**Doc. CHD 20 (26567) C**
**IS 2932 : xxxx**
**Superseding IS 133, IS 2933, IS 8662, IS 9034, IS 14947**
**September 2024**

**DRAFT FOR COMMENTS ONLY**



*Draft Indian Standard*

# AIR DRYING ENAMEL PAINT FOR ARCHITECTURAL AND INDUSTRIAL APPLICATIONS- SPECIFICATION

(*Fifth revision* of IS 2932)

ICS 87.040

**Paints, Varnishes and Related Products Sectional Committee, CHD 20**

**Last date of comments: 17 November 2024**

Paints, Varnishes and Related Products Sectional Committee, CHD 20

FOREWORD

*(Formal clause will be added later)*

Enamel paints are a category of paints formulated with a resin-based binder that dries to form a hard, glossy, and typically opaque finish. It can be oil-based or water-based and is widely used for both interior and exterior surfaces, including walls, doors, trim, furniture, cabinetry, metallic surfaces, and wooden surfaces. Known for its durability, resistance to wear and tear, and ability to withstand various environmental conditions, enamel paint provides a smooth, glossy, and easy-to-clean finish, making it ideal for high-use items and surfaces that require a protective and aesthetically pleasing coating.

This standard was first published in 1964 by amalgamating IS 520 : 1954 ‘Specification for enamel, brushing, exterior, type I (synthetic): (1) undercoating (2) finishing, colour as required’ and IS 521 : 1954 ‘Specification for enamel, spraying, exterior, type I (synthetic): (1) undercoating (2) finishing, colour as required’ based on the available experimental data and the experience gained during that time.

In the first revision in 1974, the colour categories were rationalized by modifying it to 28 number to reduce the time and work of all concerned and give better service to the consumer. Because of non-availability of data for colour wise wet opacity requirement the same was not included.

In the second revision in 1993, based on the experience gained and availability of the technical data, the minimum requirement for phthalic anhydride content of the non-volatile vehicle was specified to assist the inspection agencies and to ensure consistent quality assurance. Changes were also made in colour categories to achieve colour correlation with shades recommended for registration of samples in terms of pigments composition and wet opacity. The number of colour categories was increased to 30. Additionally, the requirement and test for 12-month durability were incorporated to reduce the

overall testing period. Further, the requirement for minimum wet opacity for each colour category and the volume solids was also included.

In the third revision in 2003, the composition requirements were simplified to make it more performance-oriented. Additionally, the requirement for freedom from unsaponifiable synthetic hydrocarbon resin was deleted.

In the fourth revision in 2013, considering the adverse effect of lead exposure to human being the lead restriction of 90 ppm was added.

This fifth revision has been undertaken to harmonize the Indian Standards on enamel paints with the current market demand and practices. During the review of all Indian Standards on enamel paints (excluding two-component enamel paints), it was observed that the requirements and applications across these standards were largely similar. Therefore, the committee has decided to harmonize the enamel standards broadly into two categories: one for air drying enamel for architectural and industrial applications and another for stoving enamel for industrial applications.

Accordingly, the title of this standard has been modified to Air drying enamel paint for architectural and industrial applications, and the requirements of the following ISs have been merged with this standard:

- IS 2933: 2013 - Enamel, Synthetic, Exterior: (a) Undercoating (b) Finishing – Specification
- IS 133: 2023 - Enamel, Interior - Undercoating and Finishing - Specification
- IS 8662: 2004 - Enamel, synthetic, exterior (a) undercoating (b) finishing for exterior of railway coaches- Specification
- IS 14947: 2001 – Enamel Synthetic, oil resistant, air drying-Specification
- IS 9034: 2018 - Enamel, synthetic, exterior, air drying, for use on primed surfaces of motor vehicles and other equipment - Specification

Additionally, the following major changes have been made;

a) The scope of the standard has been updated to include the scopes of all aforementioned ISs.

b) The product has been categorized into types based on application (interior and exterior) and classes based on undercoating and finishing.

c) Recognizing the time constraints associated with the 12-month outdoor exposure test for durability requirements, and considering the availability of advanced simulation technologies like QUV and Xenon Arc accelerated test methods, the need for the extended outdoor exposure has been withdrawn. Additionally, test methods for evaluating the degradation of coatings have been prescribed.

d) To make the standard performance-oriented, the requirement for synthetic resin has been removed, along with the synthetic terminology from the title.

e) New requirements have been incorporated, including specifications for volatile organic compounds (VOC), water resistance, and ratings for coating degradation after exposure to QUV and Xenon Arc tests.

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 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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# AIR DRYING ENAMEL PAINT FOR ARCHITECTURAL AND INDUSTRIAL APPLICATIONS — SPECIFICATION

## 1 SCOPE

This standard prescribes the requirements, methods of sampling, and tests for air-drying enamel paint used for architectural and industrial applications, colour as required. The material is typically used for the protection and decoration of household walls, doors, trim, furniture, cabinetry, metallic surfaces, wooden surfaces, and similar purposes. It is normally applied as a painting system over the appropriate primer. Additionally, it is used for painting system for protection and decoration of railway coaches.

This standard does not apply to stoving enamel, which is primarily used for industrial applications. For stoving enamel paint, refer to IS 6125.

## 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 in Annex A.

## 3 TERMINOLOGY

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

## 4 TYPES AND CLASSES

**4.1** The product shall be following types:

a) Type I — Interior
b) Type II — Exterior

**4.2** The product shall be following classes:

a) Class A — Undercoating
b) Class B— Finishing

## 5 COLOUR CATEGORIES

For the purpose of registration of the samples of the material, the colour categories given in Table 1 shall be employed. For determining wet opacity Pfund cryptometer method shall be followed as specified in IS 101 (Part 4/Sec 1).

**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 litre |
|---|---|---|---|---|

| (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|
| 1 | White ( L) | — | White | 130 |
| 2 | Black ( D) | — | Black | 250 |
| 3 | Dark violet (D) | 796 | Dark violet | 80 |
| 4 | i) Sky blue (L) | 101 | | |
| | ii) Turquoise blue ( D) | 102 | | |
| | iii) Oriental blue ( D) | 174 | Turquoise blue | 160 |
| | iv) Light admiral grey ( L) | 697 | | |
| | v) Phirozi (D) | 176 | | |
| | vi) Satin blue (L) | 177 | | |
| 5 | i) Eau-de-nil (L) | 216 | | |
| | ii) Opaline green (L) | 275 | | |
| | iii) Apple green (D) | 281 | Apple green | 210 |
| | iv) Bus green (D) | 299 | | |
| 6 | i) Peacock blue (D) | 103 | | |
| | ii) Azure blue (D) | 104 | Traffic blue | 200 |
| | iii) Traffic blue (D) | 169 | | |
| 7 | i) Oxford blue (D) | 105 | Oxford blue | 100 |
| | ii) Navy blue (D) | 106 | | |
| 8 | Aircraft blue (D) | 108 | Aircraft blue | 170 |
| 9 | French blue (D) | 166 | French blue | 150 |
| 10 | i) Sea green (L) | 217 | Sea green | 170 |
| | ii) Verdigris green (D) | 280 | | |
| 11 | i) Sage green (D) | 219 | Sage green | 160 |
| | ii) Light olive green (D) | 278 | | |
| | iii) Aircraft grey green (D) | 283 | | |
| 12 | i) Grass green (D) | 218 | | |
| | ii) Traffic green (D) | 267 | Traffic green or Grass green | 150 |
| | iii) India green (D) | 284 | | |
| | iv) Brilliant green (D) | 221 | | |
| 13 | i) Light brunswick green(D) | 225 | | |
| | ii) Middle Brunswick green(D) | 226 | Middle Brunswick | 220 |

| | | | | |
|---|---|---|---|---|
| | iii) Deep Brunswick green (D) | 227 | | |
| | iv) Lincoln green (D) | 276 | | |
| | v) Cypress green (D) | 277 | | |
| | vi) Forest green (D) | 282 | | |
| 14 | i) Olive green (D) | 220 | | |
| | ii) Light bronze green (D) | 222 | | |
| | iii) Middle bronze green (D) | 223 | | |
| | iv) Deep bronze green (D) | 224 | Olive green | 220 |
| | v) Steel furniture green (D) | 279 | | |
| | vi) Scamic (D) | 294 | | |
| | vii) Olive drab (D) | 298 | | |
| 15 | Canary yellow (L) | 309 | Canary yellow | 100 |
| 16 | i) Lemon (D) | 355 | Golden yellow | 100 |
| | ii) Golden yellow (D) | 356 | | |
| 17 | i) Pale cream (L) | 352 | | |
| | ii) Deep cream (L) | 353 | | |
| | iii) Light stone (D) | 361 | | |
| | iv) Portland stone (L) | 364 | | |
| | v) Vellum (L) | 365 | Pale cream | 110 |
| | vi) Light straw (L) | 384 | or Deep cream | |
| | vii) Light biscuit (L) | 385 | | |
| | viii) Champagne (L) | 386 | | |
| | ix) Sunshine (D) | 387 | | |
| | x) Beige (D) | 388 | | |
| | xi) Jasmine yellow (L) | 397 | | |
| | xii) Light salmon pink (L) | 442 | | |
| | xiii) Salmon pink (D) | 443 | | |
| 18 | Primrose (D) | 354 | Primrose | 100 |
| 19 | Light buff (L) | 358 | Light buff | 160 |
| 20 | i) Middle buff (D) | 359 | | |
| | ii) Deep buff (D) | 360 | Deep buff | 200 |
| | iii) Middle stone (D) | 362 | | |

| | | | | |
|---|---|---|---|---|
| 21 | i) Dark stone (D) | 363 | | |
| | ii) Light brown (D) | 410 | | |
| | iii) Middle brown (D) | 411 | Light brown | 140 |
| | iv) Golden brown (D) | 414 | | |
| | v) India brown (D) | 415 | | |
| | vi) Leaf brown (D) | 489 | | |
| 22 | i) Dark brown (D) | 412 | | |
| | ii) Orange brown (D) | 439 | | |
| | iii) Venetian red (D) | 445 | | |
| | iv) Red oxide (D) | 446 | Gulf red | 200 |
| | v) Deep Indian red (D) | 448 | | |
| | vi) Light purple brown (D) | 449 | | |
| | vii) Gulf red (D) | 473 | | |
| | viii) Beech brown (D) | 490 | | |
| 23 | i) Nut brown (D) | 413 | | |
| | ii) Chocolate (D) | 451 | Nut brown | 220 |
| | iii) Service brown (D) | 499 | | |
| 24 | Terra cotta (D) | 444 | Terra cotta | 160 |
| 25 | i) Fire red (D) | 536 | | |
| | ii) Signal red (D) | 537 | | |
| | iii) Post office red (D) | 538 | Post office red | 60 |
| | iv) Crimson (D) | 540 | or Signal red | |
| | v) International orange (D) | 592 | | |
| 26 | Maroon (D) | 541 | Maroon | 130 |
| 27 | i) Traffic yellow (D) | 368 | | |
| | ii) Light orange (D) | 557 | Deep orange | 120 |
| | iii) Traffic red (D) | 570 | | |
| | iv) Deep orange (D) | 591 | | |
| 28 | India saffron (D) | 574 | India saffron | 120 |
| 29 | i) Silver grey (L) | 628 | | |
| | ii) Quaker grey (D) | 629 | | |
| | iii) French grey (D) | 630 | | |
| | iv) Light grey (D) | 631 | | |
| | v) Dark admiral grey (D) | 632 | Light grey and | 200 |

| | | | | |
|---|---|---|---|---|
| | vi) Smoke grey (D) | 692 | Aircraft grey | |
| | vii) Aircraft grey (D) | 693 | | |
| | viii) Dove grey (D) | 694 | | |
| 30 | i) RAF blue grey (D) | 633 | | |
| | ii) Slate (D) | 634 | | |
| | iii) Lead (D) | 635 | AF blue grey | 230 |
| | iv) Middle graphite (D) | 671 | | |
| | v) Dark blue grey (D) | 695 | | |

**NOTE**

* The colour shades have been categorised as Light (L) and Dark (D) based on the amount of pigments being used to achieve that particular shade. All pastels and white shade have been included in Light shades (L) and the shades with higher amounts of dark or black pigment have been included in Dark (D) shades category.

## 6 REQUIREMENTS

### 6.1 Composition

**6.1.1** *General*

The material shall be based on alkyd resin or suitable polymer hybrids to ensure that the delivered product satisfies the requirements of this standard.

**6.1.2** *Total Non-Volatile Content*

The total non-volatile matter including pigments, extenders and vehicles, when tested as per IS 101 (Part 8/Sec 2) shall not deviate by more than ±2 units by mass from the manufacturer's declared value or agreed between parties. This applies to both undercoating and finishing enamels.

### 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 (0) zero, when tested as per IS 101 (Part 6/Sec 2).

### 6.3 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 l/Sec 2).

### 6.4 Skin Formation

The paint shall show no skin formation, when tested as per IS 101(Part 1/Sec 2).

### 6.5 Thinning Properties

The paint shall be capable of being readily mixed with the petroleum hydrocarbon, solvent grade (see IS 1745) or with a suitable thinner as agreed to between the purchaser and the supplier, without showing any precipitation.

### 6.6 Application Properties

The paint shall normally be supplied in a condition suitable for application by brushing, either as supplied or when thinned with not more than 5 percent by volume of petroleum hydrocarbon solvent (see IS 1745) or with another suitable thinner as agreed to between the purchaser and the supplier. The paint may also be supplied in a condition suitable for spraying when thinned with not more than 20 percent by volume of the aforementioned thinner.

### 6.7 Durability

**6.7.1** A film of the sample shall be prepared and tested in any of the accelerated weathering apparatus xenon arc or quick weatherometer (QUV- A) as prescribed under **F-5**. It shall be examined every 25 hr for a period of 100 h (for Class B of Type 1) and every 72 h for a period of 500 h (for Class B of Type 2) and a complete record of its performance maintained and qualified as per requirement given in Table 2.

NOTE — As a precaution against inadvertent accidents, it is recommended that the accelerated weathering test (*see* **F-5**) is carried out in duplicate.

**6.7.2** *Optional Durability Requirements*

For colour Air craft Blue (ISC 108 ) and Satin Blue (ISC 177) the sample shall be tested upto 1000 h in QUV-A accelerated weathering apparatus and shall satisfy the requirements as given in Annex **F-6**.

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

### 6.9 Optional Requirements

Material may be tested for optional requirements given in Table 3 whenever required by purchaser.

**Table 2 Requirements For Air Drying Enamel Paint**

**For Architectural and Industrial Applications**

(*Clause* 6.8)

| **Sl. No.** | **Characteristics** | **Requirements** | | | | **Methods of test, Annex to this standard/ Ref to IS 101** |
|---|---|---|---|---|---|---|
| | | **Type I** | | **Type II** | | |
| | | **Class A** | **Class B** | **Class A** | **Class B** | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| i) | a) Consistency | Smooth, uniform and suitable for brushing without appreciable drag on the brush shall also be suitable | | | | B |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | for air/airless spraying | | | | |
| | b) Viscosity by ford cup No. 4 or 5 at (27 ± 2) °C, s (*See* Note 1) | ← 80-120 → | | | | (Part 1/Sec 5) |
| ii) | Mass, in kg/10 litre, *Min* | 12 | 8.5 | 11.5 | 9 | (Part 1/Sec 7) |
| iii) | Drying time, h, *Max* | | | | | (Part 3/Sec 1) |
| | a) Surface dry | 2 | 8 | 2 | 8 | |
| | b) Hard dry (also known as recoating time) | 8 | 18 | 8 | 18 | |
| | c) Tack free | 24 | 24 | 24 | 24 | |
| iv) | a) Finish | Smooth and matt to egg shell gloss | Smooth and glossy | Smooth and matt to egg shell gloss | Smooth and glossy | (Part 3/Sec 4) |
| | b) Gloss 60° | 0-25 | Above 70 | 0-25 | Above 70 | (Part 4/Sec 4) |
| v) | Fineness of grind, microns, *Max (by Hegmann gauge, Min scale 0 to 8)* | 50 (4) | 15 (6.5) | 50 (4) | 15 (6.5) | (Part 3/Sec 5) |
| vi) | Colour | Close match to the specified IS colour as per IS 5 or to an agreed colour where IS colour is not specified | Close match to the specified IS colour as per IS 5 or to an agreed colour where IS colour is not specified | Close match to the specified IS colour as per IS 5 or to an agreed colour where IS colour is not specified | Close match to the specified IS colour as per IS 5 or to an agreed colour where IS colour is not specified | (Part 4/Sec 2) |
| vii) | Flexibility and adhesion: | | | | | |
| | a) Scratch hardness after 96 hrs of air drying at 750 g | No such scratch as to show the bare metal | | | | (Part 5/Sec 2) |
| | b) Bend test after 96 hrs of air drying with 6.25 mm in type 1 apparatus | No visible damage or detachment | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| viii) | Flash point | ← Not below 30°C → | | | | (Part 1/Sec 6) |
| ix) | Volume solids percent, *Min* | 35 | 30 | 35 | 30 | (Part 8/Sec 6) |
| x) | Resistance to acid (Only for Class B of Type II) | - | - | - | To pass the test | C |
| xi) | Resistance to alkali (Only for Class B of Type II) | - | - | - | To pass the test | D |
| xii) | Accelerated storage stability test | ← Shall pass the test → | | | | E |
| xiii) | Durability using accelerated weathering equipment's, ratings after exposing stipulated time given in **6.7** (Only for Class B of Type I and II) | | | | | F |
| | Degree of Blistering, less than equal to | - | 2(S2) | - | 2(S2) | |
| | Degree of Rusting, less than equal to | - | Ri 3 | - | Ri 3 | |
| | Degree of Cracking less than equal to | - | 2(S2) with crack penetration of type (a) | - | 2(S2) with crack penetration of type (a) | |
| | Degree of Flaking less than equal to | - | 2(S1) | - | 2(S1) | |
| | Degree of Chalking less than equal to | - | 1 | - | 1 | |
| | Degree of colour Change, ΔE, *Max.* | - | 3.0 for light (L) colours and 5.0 for dark (D) colours (*See* Table 1) | - | 3.0 for light (L) colours and 5.0 for dark (D) colours (*See* Table 1) | |
| | Gloss retention 60°, percentage of original, *Min.* | - | 50 | - | 50 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| xiv) | Resistance to water for duration of 48 h, percentage of gloss retention in comparison with original, *Min* | - | 60 | - | 60 | G |
| xv) | Lead (including compounds of lead), *Max* | 90 ppm | 90 ppm | 90 ppm | 90 ppm | ICP-OES or AAS method of (Part 8/Sec 5) |
| xvi) | Volatile organic compound (VOC) gm/ltr, *Max* (*See* Note 2, 3 and 4) | 400 | 500 | 400 | 500 | (Part 2/Sec 3) |
| xvii) | Keeping properties | Not less than one year from date of manufacture | | | | H |

**NOTES**

1 Ford cup No. as agreed between supplier and users.

2 It is in-can VOC as supplied by manufacturer, without including any thinner. Since the amount of thinner used on-site can vary depending on the application method (brushing, spraying, etc.), it can be challenging to precisely track the extent of thinning during application.

3 VOCs of colorant added at Point of Sale. The VOC content of product including the colorant added at the point-of-sale shall not exceed 50 grams per litre over and above the allowed VOC limit of product without colorant.

4 For the calculation of the VOC content, for solvent and water-based paints, Method 2 and Method 3 may be employed respectively as given in the IS 101 (Part 2/Sec 3) and IS 101 (Part 2/Sec 4).

**Table 3 Optional Performance Requirements For Air Drying Enamel**
(*Clause* 6.9)

| **Sl. No.** | **Characteristics** | **Requirements** | | | | **Methods of test, Annex to this standard/ Ref to IS 101** |
|---|---|---|---|---|---|---|
| | | **Type I** | | **Type II** | | |
| | | **Class A** | **Class B** | **Class A** | **Class B** | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| i) | Resistance to Humidity, test cycle for 7 days | the panel shall not show any sign of deterioration and the metal surface shows no sign of corrosion. | | | | (Part 6/Sec 1) |

| | | | | | | |
|---|---|---|---|---|---|---|
| ii) | Resistance to transformer oil (*See* IS 335) at 90 °C for 48 h | The film shall neither soften nor there shall be any change in the colour. The increase in acidity and sludge content shall not be more than 0.1 mg KOH/gm and 0.05 g respectively | | | | (Part 7/Sec 2) |
| iii) | Drying time, h, *Max*<br>a) Hard dry at 70°C with 15 min flash off time | - | - | 1 | 1 | (Part 3/Sec 1) |
| iv) | Gloss 60°, *Min.* | - | - | - | 86 | (Part 4/sec 4) |
| v) | Scratch hardness (at load 1.2 kg), after 48 h air drying | - | - | No such scratch as to show the bare metal | | (Part 5/Sec 2) |
| vi) | Composition:<br>a) Pigment content, percent by mass, *Min*, (except Azure Blue, Oxford Blue, Golf Red, Post office Red, and black colours) | - | - | 6 | 6 | (Part 8/Sec 2) |
| | b) Non-volatile vehicle, percent by mass, *Min* | - | - | 20 | 40 | (Part 8/Sec 2) |
| | c) Phthalic anhydride content of non-volatile vehicle, percent by mass, *Min* | - | - | 22 | 22 | (Part 8/Sec 4) |
| vii) | Wet abrasion test | - | - | Shall pass the test | | J |

## 7 PACKING AND MARKING

### 7.1 Packing

Unless otherwise agreed to between the purchaser and the supplier, the material shall be packed in metal containers conforming to IS 1407 and IS 2552. The packing is subject to the provisions of the law in force in the country at that time.

**7.1.1** Each component as delivered shall be free of gel, coarse particles, skins, foreign matter and sediments. Any sediment formed in the container shall be mixed thoroughly, preferably with power driven stirrer to form homogeneous paint.

**7.2 Marking**

**7.2.1** Each container shall be marked with the following:

a) Types and classes of the material;

b) Indication of the source of manufacture;

c) Lead Content (Maximum);

d) Volume of the material;

e) Batch number or Lot number in code or otherwise;

f) Month and year of manufacture;

g) Shelf life of paint /material in container and temperature to be stored at

h) Other instructions for safe handling and use of the material; and

i) A cautionary note as below:

1) Keep out of reach of children.

2) Dried film of this paint may be harmful if eaten or chewed.

3) This product may be harmful if swallowed or inhaled.

**7.2.1.1** The material when intended for defence purposes, shall be marked in accordance with IS 5661.

**7.3** BIS Certification Marking

The container may also be marked with the Standard Mark.

**7.3.1** The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

**8 SAMPLING**

**8.1** Representative samples of the material shall be drawn as per IS 101 (Part 1/Sec 1).

**8.2 Preparation of Test Samples**

**8.2.1** *For Drying Time*

Prepare mild steel panel of size 150 mm × 100 mm × 1.25 mm as prescribed in IS 101 (Part 1/Sec 3). Apply the paint uniformly on one side of the panel by brushing to give a dry film mass commensurate with the mass per 10 litre as specified in IS 101(Part 3/Sec 4). Prepared test panel then subjected to the test as specified in IS 101(Part 3/Sec 1) as soon as possible.

**8.2.2** *For Flexibility and Adhesion Test*

For both bend test and scratch hardness test prepare separate burnished tin plate panels, rectangular, of sizes 100 mm × 50 mm × 0.3 mm as prescribed in IS 101 (Part 1/Sec 3). Apply one coat of material uniformly by brushing on the panels to give a dry film mass commensurate with the mass per 10 litre as specified in IS 101(Part 3/Sec 4). The coated test panels shall be dried for the time specified in (iii) (b) Table 2. Prepared test panels then subjected to the test as prescribed in IS 101 (Part 5/Sec 2) for bend test and scratch hardness test respectively.

### 8.3 Criteria for Conformity

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

## 9 TEST METHODS

**9.1** Tests shall be conducted as prescribed in **6.1** to **6.9** and the test methods referred to in column **7** of Table 2.

### 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.

## ANNEX A

(Clause 2)

## LIST OF REFERRED INDIAN STANDARDS

| *IS No.* | *Title* |
|---|---|
| IS 5 : 1994 | Colours for ready mixed paints and enamels (fourth revision) |
| IS 101 | Methods of sampling and test for paints, varnish and related products: |
| (Part l) | Test on liquid paints (general and physical), |
| (Sec 1) : 2023 | Sampling (fourth revision) |
| (Sec 2) : 2023 | Preliminary examination and preparation of samples for testing (fourth revision) |
| (Sec 3) : 1986 | Preparation of panels (third revision) |
| (Sec 5) : 2024 | Consistency (fourth revision) |
| (Sec 6) : 1987 | Flash point (third revision) |
| (Sec 7) : 2020 | Mass per 10 litre – determination of density – pycnometer method (fourth revision) |
| (Part 2) | Test on liquid paints (chemical examination), |
| (Part 3) | Tests on paint film formation |
| (Sec 1) : 1986 | Drying time (third revision) |
| Sec 4) : 1987 | Finish (third revision) |
| (Sec 5) : 2022 | Determination of fineness of grind (fifth revision) |
| (Part 4) | Optical tests on paint films |
| (Sec 1) : 1988 | Opacity (third revision) |
| (Sec 2) : 2021 | Colour-visual comparison of colour of paints (fourth revision) |
| (Sec 4) : 2020 | Gloss – determination of gloss value at 20° , 60° , 85° (fourth revision) |
| (Part 5) | Mechanical tests on paint films |
| (Sec 2) : 1988 | Flexibility and adhesion (third revision) |
| (Part 6) | Durability tests on paint films |
| (Sec 2) : 1989 | Keeping properties (third revision) |
| (Part 8) | Tests for pigments and other solids |
| (Sec 2) : 1990 | Pigments and non-volatile matter (third revision) |
| (Sec 5) : 2022 | Lead Restriction test (fourth revision) |
| (Sec 6) : 1993 | Volume solids (third revision) |
| IS 266 : 1993 | Sulphuric acid (second revision) |
| IS 285 : 2021 | Laundry soaps (fourth revision) |
| IS 296 : 2023 | Sodium carbonate, anhydrous (fourth revision) |

| | |
|---|---|
| IS 1017 : 1983 | Chamois leather (second revision) |
| IS 1070 : 2023 | Reagent grade water (fourth revision) |
| IS 1303 : 1983 | Glossary of terms relating to paints (second revision) |
| IS 1407 : 1980 | Round paint tins (second revision) |
| IS 1745 : 2018 | Petroleum hydrocarbon solvents (second revision) |
| IS 2552 : 1989 | Steel drums (galvanized and ungalvanized) (third revision) |
| IS 5661 : 2023 | Packing and marking of packages of paints, enamels, varnishes and allied products - Code of practice (First Revision) |
| IS 12744 (Part 1) : 2013 | Ready mixed paint, air drying, red oxide-zinc phosphate, priming — specification (first revision) |

## ANNEX B

[*Table* 2, *Sl No*. (i) (a) ]

## CONSISTENCY

### B-1 APPARATUS

**B-1.1** Palette Knife or Metal Rod

**B-1.2 Panels**

B-1.2.1 Unless specified otherwise, mild steel panels of size 150 mm × 50 mm × 1.25 mm shall be prepared as prescribed in IS 101 (Part 1/Sec 3).

### B-2 PROCEDURE

**B-2.1** Insert a clean metal rod or palette knife into the original container and examine the nature of settling.

**B-2.2 Observations**

The material shall not cake hard inside the container and shall be in such a condition that stirring easily produces a smooth uniform paint suitable for brushing on steel panels.

## ANNEX C

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

## TEST FOR RESISTANCE TO ACID

### C-1 GENERAL

**C-1.1 Outline of the Method**

An air-dried test panel coated with the material is immersed in solution of acid for a specific period and examined for any deterioration.

## C-2 PREPARATION OF TEST PANELS

The preparation of glass panels shall generally be in accordance with IS 101 (Part 1/Sec 3).

**C-2.1** Apply a coat of the finishing enamel given uniformly by the method, as prescribed in 1S 101 (Part 6/Sec 1) on a 150 mm × 100 mm clean glass panel to give a dry film mass commensurate with the mass in kg/10 litre of the material as specified in 101 (Part 3/Sec 4). 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 room temperature in the laboratory conditions. Unless otherwise agreed, the panel shall then be conditioned at a temperature of (27 ± 2) °C and a relative humidity of (65 ± 5) percent for a minimum of 16 h. The test shall then be carried out as soon as possible.

## C-3 REAGENT

### C-3.1 Sulphuric Acid

2 percent (m/v) solution of concentrated sulphuric acid (relative density 1.84) (*see* IS 266).

## C-4 PROCEDURE

Place sufficient amount of acid in a suitable vessel to completely or partially immerse the test panel. Immerse 3/4th of the test panel in the acid solution in an approximately vertical position using suitable supports, if necessary. Cover the container for the duration of the test to minimize the loss of reagent by evaporation or splashing. Keep the panel in this position in for 24 h at room temperature. Remove the panel, wash in running fresh water and allow to dry for 1 h.

## C-5 RESULTS

The tested panel shall not show any signs of disintegration, blistering, wrinkling and lifting. The loss of gloss shall not be more than 50 percent of the original gloss.

# ANNEX D

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

# TEST FOR RESISTANCE TO ALKALI

## D-1 GENERAL

### D-1.1 Outline of the Method

An air-dried test panel coated with the material is immersed in solution of alkalis for a specific period and examined for any deterioration.

## D-2 PREPARATION OF TEST PANELS

The preparation of glass panels shall be as prescribed in **C-1** and **C-1.1**.

## D-3 REAGENTS

**D-3.1 Laundry Soap** — 1 percent (m/v) solution of laundry soap (*see* Type 1 of IS 285).

**D-3.2 Sodium Carbonate, Analytical Reagent** —

Grade — 2 percent (m/v) solution of sodium carbonate (*see* IS 296).

**D-4 PROCEDURE**

**D-4.1** Place sufficient amount of solution of laundry soap in a suitable vessel to completely or partially immerse the test panel. Immerse 3/4th of the test panel in the soap solution in an approximately vertical position using suitable supports, if necessary. Cover the container for the duration of the test to minimize the loss of reagent by evaporation or splashing. Keep the panel in this position in for 30 mm at a temperature of (27 ± 2) °C. Remove the panel, wash in running fresh water and allow to dry for 1 h and examine the film and then subject the tested portion to further test as prescribed under **D-4.2**.

**D-4.2** Place sufficient amount of solution of sodium carbonate in a suitable vessel to completely or partially immerse the test panel. Immerse the tested portion of the test panel (see **D-4.1**) in the sodium carbonate solution in an approximately vertical position using suitable supports, if necessary. Cover the container for the duration of the test to minimize the loss of reagent by evaporation or splashing. Keep the panel in this position in for 30 mm at a temperature of (27 ± 2) °C. Remove the panel, wash in running fresh water and allow to dry for 1 h and examine the film.

**D-5 RESULTS**

The tested panel shall not show any signs of disintegration, blistering, wrinkling and lifting. The loss of gloss shall not be more than 50 percent of the original gloss.

## ANNEX E

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

## ACCELERATED STORAGE STABILITY TEST

**E-1 OUTLINE OF THE METHOD**

The material is subjected to higher temperature and then tested for thinning and application properties.

**E-2 PROCEDURE**

**E-2.1** Completely fill a clean, dry 500 ml metal container (*see* IS 1407) with the paint leaving the usual spillage and seal the lid tightly to avoid leakage of volatile paint thinners. Keep the container at (60 ± 2) °C for 96 h in an electrically heated oven. Take out the sample container and keep it at room temperature for 24 h thereafter. subsequently examine the material in the container. The sample is then stirred well and tested for drying time, viscosity and gloss value.

**E-3 OBSERVATIONS**

After the test, paint shall not gel, liver, curdle or increase in viscosity by more than 20 percent of the original value and there shall be no evidence of seeding. The paint shall meet the drying requirements and produce a film 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 60°C.

## ANNEX F

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

## TEST METHOD FOR DURABILITY

## F-1 GENERAL

Accelerated weatherometer test on paints being done to simulate and predict the effects of long-term exposure to various environmental conditions such as sunlight, moisture, temperature fluctuations, and other atmospheric elements.

## F-2 TEST PANELS

**F-2.1** The panels shall be mild steel plate and shall be prepared as prescribed in IS 101(Part l/Sec 3). The back and edges of the panels shall be protected with two coats of a suitable paint.

Panels shall be preferably of sizes 60 mm × 40 mm × 1.25 mm for Xenon arc type, 130 mm × 40 mm × 1.25 mm for UV condensation type. However, panels may be of any other sizes suitable for accommodating in those apparatus.

## F-3 PREPARATION OF TEST PANELS

**F-3.1** In the painting procedure outlined under **F-3.2**, the air drying of the films shall be done at room temperature and at a relative humidity of not more than 70 percent.

**F-3.2** The surface of the test panels to be exposed shall be prepared as follows, taking care that total dry film thickness of the complete system shall be between 75 and 100 microns:

a) Apply uniformly one coat of ready mixed paint, air drying, red oxide-zinc phosphate, priming [conforming to IS 12744] by appropriate method (brushing/spraying) and allow to air-dry for 24 h.

b) Rub down lightly with waterproof emery paper No. 320/400, wipe off the surface using a piece of clean and dry soft cloth and then apply uniformly by brushing/spraying one coat of the undercoating enamel conforming to this standard and allow to air-dry for 24 h;

c) Rub down, wet, with waterproof emery paper No. 320/400 wipe off the surface using a piece of clean and dry soft cloth and then apply uniformly by brushing/spraying one coat of the finishing enamel conforming to this standard and allow to air-dry for 24 h; and

d) Rub down, wet, with waterproof emery paper No. 400, wipe off water and, when the surface is dry, apply uniformly spraying, brushing a second coat of the finishing enamel and allow to air dry for 7 days before subjecting to exposure test.

NOTE — The primer, undercoat and the finishing enamels be preferably from the same source.

## F-4 ACCELERATED WEATHERING TEST

Testing can be conducted using any of the two accelerated weathering apparatus, namely QUV-A or Xenon arc, with exposure times 100 h for Class B of Type 1 and every 500 h for Class B of Type 2. Both side of the panels for these tests shall be prepared as described under **F-3.** Duplicate samples are to be tested in an appropriate accelerated weathering apparatus, as detailed in **F-4.1** and **F-4.2**. For details of method of tests for both xenon arc and QUV-A apparatus, refer to IS 101 (Part 6/ Sec 5).

**F-4.1 Xenon arc—** An artificial weathering apparatus of the xenon arc type for uniform and controlled exposure to the effects of heat, light and water.

**F- 4.1.1** Commonly used cycles and test conditions for Xenon arc apparatus are given below:

a) Black panel temperature (63 ± 3) °C

b) Continuous exposure in light for 17 minutes and intermittent exposure to water

spray for 3 minutes light and spray.

c) Irradiance 0.55 W/$m^2$/nm

d) Total exposure time is 500 h.

However, any other cycle may be used if mutually agreed upon between the purchaser and the supplier.

**F-4.2 QUV-A—**An artificial weathering apparatus of the QUV A type for uniform and controlled exposure to the effects of UV and condensation. Commonly used cycles and test conditions for QUV-A arc apparatus are given below:

| | | |
|---|---|---|
| 1) | Lamp type | UVA 340 |
| 2) | Test cycle | UV – (4 h at 60 ± 3°C)<br>Condensation – (4 h at 50 ± 3°C) |
| 3) | Irradiance | 0.67 W/m2/nm |
| 4) | UV-A wavelength (approx.) | 340 nm |
| 5) | Total exposure time | 1 000 h |

However, any other cycle may be used if mutually agreed upon between the purchaser and the supplier.

**F-5 EVALUATION AND RATING OF FILM CHARACTERISTICS OF TEST PANEL**

The test panels before and after the specified periods of exposure tests shall be assessed for the various film characteristics as prescribed in **F-5.1** to **F-5.8.**

**F-5.1 Degree of blistering**

The exposed panel shall be examined for the degree of blistering after 100 h for Class B of Type 1 and at interval of every 72 h up to 500 h for Class B of Type 2. The rating for the quantity (density) and size of the blister shall be provided by matching with the figures given in the IS 101 (Part 11/Sec 2) (ISO 4628 Part 2).

**F-5.2 Freedom from Rusting**

After exposure of the film is discontinued, examine for corrosion of the metal surface of the panel underneath by removing film. 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. The rating for the

degree of rusting shall be provided by matching with the figures given in the IS 101 (Part 11/Sec 3) (ISO 4628 Part 3).

**F-5.3 Freedom from Cracking**

The exposed panel shall be examined for the degree of after 100 h for Class B of Type 1 and at interval of every 72 h up to 500 h for Class B of Type 2. The rating for the quantity, size and depth of cracking shall be provided by matching with the figures given in the IS 101 (Part 11/Sec 4) (ISO 4628 Part 4).

**F-5.4 Freedom from Flaking**

The exposed panel shall be examined for the degree of flaking after 100 h for Class B of Type 1 and at interval of every 72 h up to 500 h for Class B of Type 2. The rating for the degree of flaking shall be provided by matching with the figures given in the IS 101 (Part 11/Sec 5) (ISO 4628 Part 5).

**F-5.5 Freedom from Chalking**

The exposed panel shall be examined for the degree of flaking after 100 h for Class B of Type 1 and at interval of every 72 h up to 500 h for Class B of Type 2**.** The rating for the degree of chalking shall be provided by matching with the figures given in the IS 101 (Part 11/Sec 7) (ISO 4628 Part 7).

**F-5.6 Degree of Colour Change**

**F-5.6.1** The colour of the test panel shall be compared against the stipulated shade as given in IS 5 or any agreed standard sample between purchaser and supplier. The colour difference between a pair of painted panels shall be calculated in terms of ΔE (Delta E) by using CMC (2:1) colour difference equation. From spectral measurement, QC program calculate CIE colour specifications- L* a* b* C* h* based on daylight illumination, as described in **F-5.6.2**. For passing the sample the ΔE shall not be more than 3.0 for Light colours (L) and not more than 5.0 for Dark colours (D) during the exposure period and after completing the stipulated time in the respective accelerated weatherometers.

**F-5.6.2** A reflectance spectrophotometer is used for reflectance measurement. Like Visual Assessment requirement, the sample should be sufficiently large enough to measure using Large Area of View (LAV). Small sized samples measured using Small Area of View (SAV) may not have high repeatability. Sample size should be minimum 2x2". The spectral measurement should be carried out using a reflectance spectrophotometer having following features:

| | |
|---|---|
| Repeatability – Short-Term | : Better than 0.15 $\Delta E_{CIELAB}$ |
| Inter-Instrument Agreement | : Better than 0.25 $\Delta E_{CIELAB}$ |
| Wavelength Range | : 400-700 nm (360-780 nm preferable) |
| Wavelength Increment | : 10 nm |

**F-5.7 Gloss loss at 60°**

The exposed panel shall be examined for the loss of gloss after 100 h for Class B of Type 1 and at interval of every 72 h up to 500 h for Class B of Type 2. The percentage of gloss loss shall be calculated with the initial taken gloss value, for measurement of gloss IS 101 (Part 4/Sec 4) may be referred. For passing the sample loss of gloss shall not be more 50 percent (that is gloss retention more than 50 percent) both during the exposure period and after completing the stipulated time in the respective accelerated weatherometers.

## F-6 OPTIONAL QUV REQUIREMENTS

**F-6.1** The accelerated weathering testing of Satin blue and Aircraft blue shall be according to Table 4. The percentage of gloss retention shall be calculated with the initial taken gloss value, for measurement of gloss IS 101 (Part 4/Sec 4) may be referred. The colour ratings shall be assigned according to **F-6.2**.

**Table 4 QUV Requirements For Satin Blue And Air Craft Blue Colours**

(Clause **6.7.2** and **F-6.2**)

| | **Gloss retention, percent, *Min*, after** | | | | **Colour rating, after** | | | | **Defect Rating** |
|---|---|---|---|---|---|---|---|---|---|
| | 360 Hrs/ 15 Days | 500 Hrs/ 21 Days | 672 Hrs/ 28 Days | 1000 Hrs/ 42 Days | 360 Hrs/ 15 Days | 500 Hrs/ 21 Days | 672 Hrs/ 28 Days | 1000 Hrs/ 42 Days | After 1000 Hrs |
| A) Satin Blue | 90.0 | 50.0 | 45.0 | 30.0 | 8-7 | 6-5 | 4-3 | 3-2 | The film should have minimum defect rating of 8 |
| B) Air Craft Blue | 95.0 | 90.0 | 75.0 | 60.0 | 10-9 | 8-7 | 6-5 | 4-3 | The film should have minimum defect rating of 8 |

**F-6.2** The colour of the test panel shall be compared against the stipulated shade as given in IS 5 or any agreed standard sample between purchaser and supplier. 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 Table 5. For passing the sample the rating shall not be less than 7 for both during the exposure period and after completing the stipulated time in the accelerated weatherometer.

**Table 5 Numerical rating for degree of colour change**

(Clause F-6.2**)**

| **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 | |

## ANNEX G

## TEST FOR RESISTANCE TO WATER

(*Table* 2 (xiv))

### G-1 GENERAL

#### G-1.1 Outline of the Method

This method gives an indication of the results likely to be obtained when painted articles are stored under conditions where prolonged condensation may be produced but not an extremely corrosive atmosphere.

### G-2 MATERIALS

**G-2.1** Test Panels Glass panel of size 150 mm × 50 mm. Prepare the panel as prescribed in IS 101(Part 1/Sec 3).

### G-3 PROCEDURE

**G-3.1** Apply a coat of material on glass panels as prescribed in IS 101 (Part 1/Sec 3) to give a dry film mass commensurate with the mass per 10 litre as specified in IS 101 (Part 3/ Sec 4). Allow the panel to air dry in a horizontal position for 48 h. Then follow the procedure as prescribed in IS 101 (Part 7/ Sec 1). Immerse the panel in the tank at room temperature for 48 h. Remove the panels from water and examine it after 4 h.

### G-4 OBSERVATIONS

The paint shall be deemed to have passed the test, if the painted panel shall be free from blisters, peeling or flaking and undue change in colour. Gloss retention shall not be less than 60 percent of the gloss of un-immersed portion.

## ANNEX H

**KEEPING PROPERTIES**

(*Table* 2 (xvii))

**H-1** When stored under cover in a dry place in the original sealed containers under normal temperature conditions, the material shall meet the requirement as specified in **6** for the specified period after the date of manufacture. Slight changes in viscosity may be allowed provided the material satisfies the other requirements prescribed in the material specification.

## ANNEX J

## WET ABRASION TEST

[ *Table* 3 (vii) ]

### J-1 OUTLINE OF THE METHOD

The painted panels are subjected to wet rubbing in the abrasion test apparatus at a specified speed and load of the brush. The panels are examined at the end of the stipulated oscillations for gloss retention and colour fading.

### J-2 WET ABRASION TESTER

#### J-2.1 Washing Unit

Shall be such a construction as to hold the brush in a box or holder which moves backwards and forwards in a straight line across the test panels at the rate of (38 ± 2) strokes per minute.

**J-2.2 Tray unit**: Water tight to hold the panels

**J-2.3 Brush:**

i) Size: (115 ± 10) mm x (40 ± 2) mm.

ii) Soft bristles of (22 ± 2) mm length, made of synthetic / natural origin.

iii) Weight of the brush including connecting rod shall be (400 ± 100) g.

iv) Fractional horse power motor: Of suitable speed to regulate the oscillation of the brush.

### J-3 REAGENTS

The solution used for cleaning shall be as follows;

Class A : Regular cleaning agents commercially available laundry soaps, detergents having foaming power and demulsifying capacity, and pH of 6.5 to 8.0, when diluted with water of any hardness in the ratio of 1:10 can be used for effectively clean hard stains over rexine cover, sun mica panels, aluminium strips, and vinyl sheets with no adverse effect of original substrates.

Class B : Heavy duty cleaning agents commercially available laundry soaps, detergents having foaming power and demulsifying capacity and having pH of 2.5 to 5.0 when diluted with water of any hardness in the ratio of 1:10 can be used for effectively clean hard stains over rexine cover, sun mica panels, aluminium strips and vinyl sheets with no adverse effect on original substrates.

### J-3 PROCEDURE

Take clean glass panels of size (115 ± 5) mm x (220 ± 5) mm, in duplicate for each test. Apply first coat of primer to give minimum dry film thickness of 25 µm and allow it to dry for 12 h. Apply second coat of undercoat enamel paint to give minimum thickness of 25 µm, and allow it to dry for 8 h. Then apply third and fourth coat of finishing, enamel to give minimum thickness of 30 µm, giving

time interval of 12 h between successive coat. Allow the panels to air dry for 7 days. Record the initial gloss value and colour rating on 1 - 10 scale (initially colour rating shall be recorded as 10) before commencement of the test.

Fix the painted test panel in the tray I position with painted surface upwards. Fill the tray with cleaning solution Class A. Fix the brush in its holder. Adjust the strokes in such a way that not less than 10 mm of the paint film is left free on both ends. Start the oscillations of the brush. At the end of every 1000 oscillations, stop the brush and remove the panel. Decant the cleaning composition solution completely from the tray and fill the tray with fresh cleaning composition solution and restart the oscillation of the brush. At the end of 5000 oscillations, stop the brush and remove the panel. Decant the cleaning composition solution completely from the tray. Remove the panel from the tray after completion of the test, clean in running water and allow it to dry for 1 hour. Record the gloss value and colour rating of the rubbed portion (leaving 5 mm wide surface area from the edges) of the tested panel.

Similarly, the test shall be carried out with Class B cleaning solution.

**J-4 OBSERVATION**

**a) Gloss Retention:**

**i) For Air Craft Blue**:

The requirement of this test on a sample from bulk supply shall be taken to have been satisfied if the gloss retention shall be minimum 75 percent and 60 percent of the original against Class A and Class B cleaning solutions.

**ii) For Satin Blue:**

The requirement of this test on a sample from bulk supply shall be taken to have been satisfied if the gloss retention shall be minimum 70 percent and 55 percent of the original, against Class A and Class B cleaning solution.

**b) Colour Rating:**

**i) For Air Craft Blue:**

The requirement of this test on a sample from bulk supply shall be taken to have been satisfied if the film have a minimum colour rating of 8 and 7, against Class A and Class B cleaning solutions.

**ii) For Satin Blue:**

The requirement of this test on a sample from bulk supply shall be taken to have been satisfied if the films have a minimum colour rating of 8 and 7, against Class A and Class B cleaning solutions.