

Foreword

This Bangladesh Standard was adopted by the Bangladesh Standards and Testing Institution on after the draft finalized by the Soap and Detergent Sectional Committee and approved by the Chemical Divisional Committee.

Epoxy enamel is a two-component self-drying paint composed of epoxy resin, pigments, additives, solvents and curing agents. The epoxy enamel paint film is hard, high gloss, high adhesion, good waterproof, mildew and corrosion resistance, good wear resistance. Epoxy enamel is widely used for interior decoration and anti-corrosion topcoats such as steel and concrete those have been coated with epoxy primer. It can also be used for structural coating of indoor equipment such as ship cabins, pipeline inner walls, and factory walls that are not exposed to sunlight.

Due to its growing demand the sectional committee decided to formulate this standard. While formulating this standard the sectional committee gave due consideration to the views of the producers, consumers and technologists and felt that it should be related to the prevailing trade and manufacturing practices followed in this field in the country.

In the preparation of this standard, assistance derived from the following publications is acknowledged with thanks:

IS 14209:1994 Epoxy Enamel, Two Component, Glossy – Specification;
Bureau of Indian Standards.

IS 101 (Part 3/Set 4):1987 (Reaffirmed 2004) Methods of sampling and test for
paints, varnishes and related products Part 3 Tests for paint film formation
Section 4 Finish; Bureau of Indian Standards.

IS 101 (Part 8/Set 6):1993 (Reaffirmed 2004) Methods of sampling and test for paints,
varnishes and related products Part 8 Tests for pigments and other solids
Section 6 Volume solids; Bureau of Indian Standards.

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 BDS 103.

Bangladesh Standard

Specification for Epoxy Enamel, Two Component, Glossy

1. Scope

1.1 This standard prescribes requirements and method of sampling and test for two component epoxy enamel.

1.2 This material is expected to have adhesion on inorganic zinc coating and epoxy-primers, high toughness and abrasion resistance. This material is used as a finish coat for the painting of steel plant equipment where protection to salt water, chemicals, mineral oils, solvents and resistance to moisture protection under **industrial and marine** conditions are required.

2. Normative references

2.1 The following Bangladesh Standards are necessary adjuncts to this Standard. For undated references the latest edition of the publication referred to applies.

BDS 103	Methods of rounding off numerical values.
BDS 833	Water for laboratory use.
BDS 1701	Glossary of terms for paints.
BDS ISO 1512	Paints and varnishes— sampling of products in liquid or paste form.
ISO 1514	Paints and varnishes — Standard panels for testing.
ISO 1516	Determination of flash/no flash — Closed cup equilibrium method.
BDS ISO 1517	Paints and varnishes - Surface-drying test - Ballotini method.
ISO 1518 Part 1	Paints and varnishes — Determination of scratch resistance — Part 1: Constant-loading method.
ISO 1518 Part 2	Paints and varnishes — Determination of scratch resistance — Part 2: Variable-loading method.
BDS ISO 2808	Paints and varnishes — Determination of film thickness
BDS ISO 2811 Part 1	Paints and varnishes — Determination of density — Part 1: Pycnometer method.
BDS ISO 2813	Paints and varnishes— Determination of specular gloss of NonMetallic paints films at 20 degree, 60 degree and 85 degree.
BDS ISO 2884 Part 1	Paints and varnishes — Determination of viscosity using rotational viscometers — Part 1: Absolute viscosity measurement with cone-plate measuring geometry at high shear rates
BDS ISO 2884 Part 2	Paints and varnishes — Determination of viscosity using rotational viscometers — Part 2: Relative measurement of viscosity using disc or ball spindles at specified speeds
ISO 3668	Paints and varnishes — Visual comparison of colour of paints.
ISO 17132	Paints and varnishes — T-bend test.

3. Terms and Definitions

For the purposes of this Standard, the definitions given in BDS 1701 shall apply.

4. Requirements

4.1 Composition - Paints complying with this standard shall comprise of epoxy resin as the principal binder. The manufacturer shall specify that the principal type of binder used in the paint has epoxy equivalent in the range of 350 to 600. The composition shall be such that it satisfies the requirements of this standard.

4.1.1 The paint shall consist essentially of two components base and hardener or catalyst solution to be mixed in the appropriate ratio by volume as specified by paint supplier to satisfy all the requirements of this standard.

4.2 Keeping Properties - The material shall conform all the requirements as mentioned in Table 1 for a minimum period of one year from the date of manufacture when stored in original sealed containers under normal atmospheric condition.

4.3 The material shall conform to the requirements given in Table 1.

Table 1 Requirement for Epoxy Enamel, Two Component, Glossy
(Clause 4.3)

SI No. (1)	Characteristic (2)	Requirement (3)	Method of Test (4)
A) Wet Paint			
i.	Mass in kg per 10 litre, Min.	9	BDS ISO 2811Part 1
ii.	Consistency	Smooth and uniform	BDS ISO 2884 Part 1 & 2
iii.	Flash point	Above 20°C	ISO 1516
iv.	Drying time, hours, Max. a) Surface dry b) Hard dry	3 24	BDS ISO 1517
v.	Percent volume, solids, Min.	40	A
vi.	Pot life, hours, Min	6	B
vii.	Total lead content, ppm, Max.	90	BDS ISO 6503
B) Dry Coat			
i.	Dry film thickness per coat, microns, Min.	30	BDS ISO 2808
ii.	Colour	Close match to an agreed colour	ISO 3668
iii.	Finish	Smooth and glossy	C
iv.	Gloss, 60°, Min	61	BDS ISO 2813
v.	Scratch hardness test (1500 g)	To pass the test	ISO 1518 Part 1 & 2
vi.	Flexibility and adhesion	To pass the test	ISO 17132
vii.	Acid/alkali resistance (10 percent Nitric acid at 27±2°C — 24 hours, 20 percent sulphuric acid at 27±2°C — 16 hours, 25 percent, caustic soda at 27±2°C —24 hours, 10 percent hydrochloric acid at 27±2°C – 48hours)	The film shall not show signs of disintegration or change of colour to a greater extent. The loss of gloss shall not be more than 50 percent of the original gloss	D
NOTE - 1. Tests from SI No. (i) to (vi) are for mixed paint.			
2. Tests mentioned at SI No. (B) vi) and (vii) shall be carried out for the full system that is 1 coat of primer, 1 coat of intermediate and 1 coat of finishing paint or 1 coat of primer and 1 coat of finishing paint supplied by the same firm after 168 hours curing at 30°C.			

5. Tests

5.1 Unless specified otherwise, tests shall be conducted as prescribed in column 4 of Table 1.

5.2 The preparation of metal panels shall be according to ISO 1514.

5.3 Quality of Reagents

Unless specified otherwise, pure chemicals and distilled water (see BDS 833) shall be employed.

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

6. Packing and Marking

6.1 Packing

The material shall be packed in dual container. It shall ensure that the quality does not deteriorate during storage and shall be as agreed to between purchaser and supplier.

6.2 Marking

Each container shall be marked with the following information:

- a) Indication of the source of manufacture,
- b) Batch No. or lot No. and month and year of manufacture,
- c) Date of expiry, and
- d) Mass of the material.
- e) An indication of flammability;
- f) A cautionary note as below:
 - i. Avoid contact with eyes and skin. Wear suitable protective clothing such as overalls, goggles, dust mask and gloves.
 - ii. Do not use in poorly ventilated areas, do not breathe in vapor or spray mist.
 - iii. This product is flammable. Keep away from sources of ignition.
 - iv. Do not smoke. Take precautionary measures against static discharge. In case of fire, use carbon dioxide, normal foam or dry agent.
 - v. This product may be harmful if swallowed or inhaled.
 - vi. **First Aid:**

Eyes	Wash off in flowing water or shower.
Skin	Wash off in flowing water or shower.
Inhalation	Remove to fresh air, loosen collar and keep patient rested.
Ingestion	If swallowed, seek medical attention. Do not induce vomiting unless directed to do so by medical personnel.
- g) Any other information required by statutory authorities.

7.2.1 The product(s) may also be marked with the BSTI Certification mark.

NOTE – The use of the BSTI Certification Mark is governed by the provisions of the Bangladesh Standards and Testing Institution Act 2018 and the Rules and Regulations made thereunder. Details of the conditions under which license for the use of the BSTI Certification Mark may be granted to manufacturers or Processors may be obtained from the Bangladesh Standards and Testing Institution.

7. Sampling

7.1 Representative samples of the material shall be drawn according to BDS ISO 1512.

Annex A

[Table 1, SI No. A(v)]

Determination of Percent volume, solids

A-1 Outline of the Method

This method is intended to provide a measure of the volume of dry coating obtainable from a given volume of liquid coating. This volume is considered to be the most equitable means of comparing the coverage and the wet film thickness of the given paint.

A-2 Apparatus

A-2.1 Analytical Balance - Sensitive to 0.1 mg.

A-2.2 Stainless Steel Disc

60 mm diameter and 0.70 mm thickness with a small hole 2 to 3 mm from the edge. A fine wire such as chromel is attached through the hole for suspending the disc in a liquid.

A-2.3 Weight Box

A-2.4 Beaker - 1 litre.

A-2.5 Mass per Litre Cup

A-2.6 Hot Air Oven - capable to maintain $105 \pm 2^\circ\text{C}$.

A-3 Procedure

A-3.1 Dry the disc in an oven at 105°C for 10 minutes and cool. Weigh the disc in air. Let it be W_1 grams.

A-3.2 Suspend the disc in water and weigh again. Let it be W_2 grams.

A-3.3 Calculate the volume of the disc V as follows:

$$V = \frac{W_1 - W_2}{d}$$

Where, d = is the density of the water at room temperature.

A-3.4 Determine the weight of non-volatile content of the liquid coating material by drying a known amount of paint at 105°C for 3 hours. Let it be W grams.

A-3.5 Determine the specific gravity of the paint to the nearest 0.001 g/mL by using mass per litre cup. Let it be P .

A-3.6 Dip the disc in the paint sample for 10 minutes and take out the disc. Allow the excess coating material to drain off. Blot the coating material off the bottom edge of the disc, so that beads or drops do not dry on the bottom edge of the disc. Dry the disc at 105°C for 3 hours and cool. Weigh the coated disc in air. Let it be W_3 grams.

A-3.7 Suspend the coated disc in water and weigh again. Let it be W_4 grams. .

A-4 Calculations

A-4.1 Calculate the volume of the coated disc V_1 as follows:

$$V_1 = \frac{W_3 - W_4}{d}$$

Where, d = is the density of the water at room temperature

A-4.2 Calculate the volume of the dried coating as follows:

$$\text{Volume of dried coating, } (V_d) = V_1 - V$$

A-4.3 Calculate the volume of wet coating as follows:

$$V_w = \frac{W_3 - W_1}{W \times P}$$

Where, W = grams of non-volatile matter in 1 g of wet coating.

A-4.4 Calculate the percent volume solids of the paints as follows:

$$\frac{V_1 - V}{V_w} \times 100 \text{ or } \frac{V_d}{V_w} \times 100$$

A-4.5 The percent volume solids of a paint is related to the covering capacity and wet film thickness in the following manner:

$$\text{a) Theoretical coverage (m}^2\text{/l) = } \frac{\text{Percent Volume Solids}}{\text{Dry film thickness (micron)}} \times 10$$

$$\text{b) Wet film thickness (microns) = } \frac{\text{Dry film thickness (micron)}}{\text{Percent Volume Solids}} \times 100$$

Annex B

[Table 1, SI No. A(vi)]

Determination of Pot Life

B-1 General

B-1.1 The time taken to double the viscosity from the original value shall be considered as the pot life of the material.

B-2 Procedure

B-2.1 Thoroughly mix component parts in the ratio specified by the paint manufacturer to give a sample of 200 mL by volume.

B-2.2 Within 10 minutes of mixing (B-2.1) determine the viscosity as prescribed in BDS ISO 2884 Part 1 and 2.

B-2.3 Allow the mixed sample of paint to stand in a suitable air-tight container and determine the viscosity at the end of the specified time.

Annex C

[Table 1, SI No. B(iii)]

Finish Test

C-1 Procedure

C-1.1 The material when applied on a mild steel panel, concrete panel or wooden panel by brushing or spraying, whichever is specified to give a dry film mass commensurate with the mass per 10 litres of the material as given in table 2 and allowed to dry for 48 hours in a vertical position under specified conditions in dust free atmosphere, shall dry to hard, firmly adherent, flexible and smooth film, free from sagging and wrinkling, with a matt semiglossy or glossy surface in accordance with requirements of the material specification.

Table 2 Relationship between dry film mass of single coat of paint material and mass per 10 litres of the paint material
(Clause C-1.1)

Mass of the paint material in Kg/10 litres (1)	Dry film mass, g/m (2)
Up to and including 10	17 to 22
Above 10 to 11	22 to 27
Above 11 to 12	27 to 34
Above 12 to 14	34 to 44
Above 14 to 16	44 to 54
Above 16 to 18	54 to 68
Above 18	68 to 80

C-1.2 The film so produced shall be of normal opacity and in no way inferior to a film prepared in the same manner and at the same time from the approved sample, when examined not earlier than 48 hours and not later than 100 hours after application. In case of failure, the test shall be repeated by keeping the painted panels under standard atmospheric condition.

Annex D

[Table 1, SI No. B(vii)]

Acid/Alkali Resistance Test

D-1 Procedure

Mild steel rods be prepared as described in the foot-note of the table, are immersed in the liquids at the temperature of $27 \pm 2^\circ\text{C}$ for a period of 4 weeks, and checked for loss of gloss and colour. It shall not be less than mentioned in column 3 of Table 1.