

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.

The material is normally intended for protection and decoration of mild steel, aluminium, galvanized metal parts and components used in various industries, such as domestic appliances, automobile, two wheeler, light and heavy industrial, electrical segments. It covers the various compounds, for example, epoxy, epoxy polyester, polyester/TGIC and polyurethane powders. Epoxy and epoxy polyester grade powders are meant for interior use while polyester/TGIC based powders are suitable for exterior exposure conditions. For surface treatment various options like shot blasting (for thick metal parts), zinc or iron phosphating, chromating etc. shall be employed depending on the nature of parts prior to application of powder coatings.

For manufacturing powder coatings, both synthetic and naturally occurring extenders/fillers along with pigments are used as a part of the constituents. Lead containing raw materials shall not be used deliberately in such formulation except the trace amount that may come from impurities. So it is technologically feasible to formulate this product with very low level of lead. Therefore, in this standard, lead restriction up to a maximum permissible limit of 90 ppm has been stipulated keeping in view of the fact that powder coated objects and domestic appliances etc. are used in consumer homes where the possibility of lead exposure to children cannot be ruled out. Lead is a proven mental growth retardant and small children are more susceptible to the adverse impact of lead toxicity. Since common people are not aware of the long term consequences of lead exposure on human health therefore, along with lead restriction, a suitable cautionary notice has been included in the marking clause.

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 13871:2021 Powder Coating – Specification; 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 Powder Coating

1. Scope

1.1 This standard prescribes requirements, methods of sampling and test for thermosetting powder coatings.

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 11	Sodium Hydroxide
BDS 34	Nitric Acid
BDS 37	Hydrochloric Acid
BDS 38	Sulphuric Acid
BDS 103	Methods of rounding off numerical values.
BDS 833	Water for laboratory use.
ISO 787 Part 22	General methods of test for pigments and extenders Part 22: Comparison of resistance to bleeding of pigments.
BDS ISO 1512	Paints and varnishes— sampling of products in liquid or paste form.
ISO 1514	Paints and varnishes — Standard panels for testing.
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 1520	Paints and varnishes — Cupping test.
BDS ISO 2409	Paints and varnishes — Cross-cut test.
BDS ISO 2808	Paints and varnishes — Determination of film thickness.
ISO 2812 Part 1	Paints and varnishes — Determination of resistance to liquids Part 1: Immersion in liquids other than water.
BDS ISO 2812 Part 2	Paints and varnishes — Determination of resistance to liquids Part 2: Water immersion method.
BDS ISO 2813	Paints and varnishes— Determination of specular gloss of NonMetallic paints films at 20 degree, 60 degree and 85 degree.
ISO 3248	Paints and varnishes — Determination of the effect of heat.
ISO 6272 Part 1	Paints and varnishes — Rapid-deformation (impact resistance) tests Part 1: Falling-weight test, large-area indenter.
ISO 6272 Part 2	Paints and varnishes — Rapid deformation (impact resistance) tests — Part 2: Falling-weight test, small-area indenter.
BDS ISO 6860	Paints and varnishes — Bend test (conical mandrel).
ISO 7253	Paints and varnishes — Determination of resistance to neutral salt spray (fog).
BDS ISO 9227	Corrosion tests in artificial atmospheres — Salt spray tests.
ISO 13320	Particle size analysis — Laser diffraction methods.

3. Terms and Definitions - For the purpose of this standard, the definitions given in BDS 1701 and the following shall apply.

3.1 Volatile Organic Compounds (VOC) — It is defined as the total volatile matter content minus the water content.

4. Grades - The material shall be of five grades depending upon its finish as given below:

- a) Grade A — Glossy finish,
- b) Grade B — Semi-glossy finish,
- c) Grade C — Matt finish,
- d) Grade D — Structure finish, and
- e) Grade E — Texture finish.

5. Preparation of Test Panels

5.1 The type and number of test panels to be used, application dry film thickness etc. including the criteria for evaluation shall be defined and shall be mutually agreed upon by the purchaser and the seller.

5.2 Preparation of Test Panels

5.3 Powder Application Recommendations

Application voltage	60-100 KV
Stoving schedule	180°-200 °C (Effective metal temperature) for 10 to 15 minutes.

It is essential that the compressed air used completely filtered to remove contamination of oil, dust or water. Jigs should be clean in order to maintain good earthing. To avoid contamination, when using different colours, thorough cleaning of the appliance and recovery systems must be carried out between each colour change. Care should be taken in handling of different colours and types of powders for proper segregation. The total curing time of the film is dependent on several factors like material substrate, thickness and mass of the material and shape of the material. The effective curing time commences when the object has reached the recommended temperature.

No	Type	Thickness (mm)	Hardness (Rockwell B)	Roughness (μ)
1	Cold rolled steel (Matt)	0.6 to 1.0	55-65	25-55
2	Cold rolled steel (Polished)	0.6 to 1.0	55-65	15-35
3	Cold rolled steel	0.6 to 1.0	55-65	< 20
4	Aluminium	1.0	-	< 20

Metal	Process	Purpose	Recommendation
Thick parts/ casting	Degreasing	To remove oil and dust from the substrate.	Alkaline degreasing.
Aluminium	Chromating	To improve anti-corrosive performance and adhesion of paint film to aluminium substrates.	Suitable chromate conversion coating.
Steel	Phosphating	To improve anti-corrosive performance and adhesion of paint film to steel substrates.	Passivated zinc phosphate (coating wt. 1.5-2.5 gm/Sq.m).

6. Requirements

6.1 Description - The material shall be free flowing powder based on synthetic resins, hardeners, pigments, fillers and additives suitable for application by standard methods, for example, electrostatic, spraying, tribostatic spraying, fluidized bed coating, etc. It shall give a continuous, smooth and hard film when applied by one of the above methods and stoved as per schedule prescribed by the supplier. The powder application parameters will be as agreed between the supplier and the user.

6.2 Particle Size Distribution - It shall depend on the method of application, type of equipment, etc, as agreed between the supplier and the user. The particle size shall be determined as per any of the method prescribed in ISO 13320/ IS 4961/ IS 5258.

6.3 Relative Density - It shall be within ± 3 percent of the approved sample.

6.4 The reactivity of the powder shall be as per the approved sample.

6.5 Lead Restriction

6.5.1 The material shall be tested for restriction from lead in accordance with BDS ISO 6503 or by atomic absorption spectrometer or by ICP. When thus tested the material shall not contain lead or compounds of lead or mixtures of both, calculated as metallic lead exceeding 90 ppm.

6.6 The curing schedule should be followed as agreed to between the purchaser and the supplier. The cured film shall also conform to the requirements given in Table 1.

Table 1 Requirements of Powder Coatings

(Clauses 6.6 and 9.1)

Sl. No.	Characteristic	Requirement					Method of test
		Grade A	Grade B	Grade C	Grade D	Grade E	
i.	Dry film thickness, microns	50-60 unless specified otherwise			80-100		BDS ISO 2808
ii.	Finish	Smooth					A
iii.	Gloss 60°	Above 80	10-80	Below 10	-	-	BDS ISO 2813
iv.	Scratch hardness at 3000 g	No such scratches as to show bare metal					ISO 1518 Part 1 & 2
v.	Flexibility on 6.25 mm mandrel	No visible damage or detachment of film					BDS ISO 6860
vi.	Cross cut adhesion	No visible damage or detachment of film					BDS ISO 2409
vii.	Cupping test, mm	8.0	3.0-7.0 (see note)	3.0	-	-	BDS ISO 1520
viii.	Impact resistance (direct/reverse), kg/cm	250	150	150	80	40	ISO 6272 Part 1 & 2
Resistance to following under condition of condensation for 1000 hours with single coat DFT of 50-60 microns (DFT of 80-100 microns for Grade E)							
ix.	Resistance to humidity	To pass the test					BDS ISO 9227 ISO 7253
x.	Resistance to salt spray	To pass the test					
xi.	Resistance to boiling water 1/2 hours at 100 °C	No blisters, No visible damage, change in gloss and adhesion					ISO 2812 Part 2
xii.	Resistance to lubricating oil, SAE 30	To pass the test					ISO 2812 Part 1
xiii.	Resistance to petrol	To pass the test					
xiv.	Resistance to heat double bake schedule	No appreciable change of colour or deterioration in the mechanical properties					ISO 3248
xv.	Resistance to bleeding	To pass the test					ISO 787 Part 22
xvi.	Resistance to detergents	To pass the test					B
xvii.	Resistance to acid/alkali	To pass the test					C
NOTE - Exact value to be agreed to between the purchaser and the supplier.							

7. Packing and Marking

7.1 Packing

The material shall be packed in suitable containers as agreed to between the purchaser and the supplier.

7.1.1 Storage

The powder should be stored in a cool and dry place at a temperature not exceeding 25 °C and at a relative humidity not more than 65 percent. Direct exposure of the powder to heater sunlight must be avoided. The stack height should not be more than 1 + 3 carton. The storage life of powders under above conditions will not be less than 6 months. Partially used packs should be kept in original packing under tightly sealed condition.

7.2 Marking

7.2.1 The packaged material shall be marked with the following:

- a) Name of the material;
- b) Indication of the source of manufacture;
- c) Lead content (maximum);
- d) Grade and mass of the material;
- e) Batch number or lot number in code or otherwise;
- f) Month and year of manufacture; and
- g) Recommended stoving schedule;
- h) 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.

7.2.2 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.

8. Sampling

8.1 Representative samples of the material shall be drawn as prescribed in BDS ISO 1512.

8.2 Criteria of Conformity

A lot shall be described as conforming to the requirements of this standard, if the test results of the composite sample satisfy all the requirements prescribed under

9. Tests

9.1 Test shall be conducted as referred in column 8 of Table 1 and 6.1 to 6.6.

9.2 Quality of Reagents - Unless specified otherwise, pure chemicals and distilled water (see BDS 833) shall be employed in tests.

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

Annex A

[Table 1, SI No. (ii)]

Finish Test

A-1 Procedure

A-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

A-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 B

[Table 1, SI No. (xvi)]

Resistance to Detergents Test

B-1 Principle

This method prescribes for determination of the resistance of powder coating to detergent solution in an accelerated manner.

B-2 Apparatus

B-2.1 Container

A corrosion resistant container equipped with the means to control the solution temperature within 40 ± 1 °C and capable to maintain the liquid level of minimum 5 mm.

B-2.2 Cover

The container shall be provided with a cover to retard evaporation and to contain the test specimens completely.

B-3 Test Specimens

B-3.1 Unless otherwise specified, the test specimens shall be 100 mm × 300 mm × 0.9 mm in size and it shall be prepared as prescribed in ISO 1514.

B-3.2 The method of application, film thickness, curing and conditioning of the test surface shall be agreed upon by the purchaser and the supplier.

B-3.3 The backs, cut edges and those areas containing identification marks or in contact with the supports, shall be protected with suitable coating that is stable under the conditions of test.

B-4 Detergent Solution

The composition and concentration of the detergent solution shall be agreed upon by the purchaser and the supplier. The temperature normally shall be 74 ± 1 °C.

B-5 Procedure

B-5.1 Immersion Suspend the test specimens vertically in the container so that at least one half of the surface area is submerged in the detergent solution. Separate the test specimens so that they are not in contact with any metal and should not come closer than 25 mm at any point in the bath. Replace the detergent solution with fresh detergent solution after every 168 hours. If successive tests are to be correlated, use reference panels coated with a control paint.

B-5.2 Examination of Specimens

When the specimens are ready for examination, carefully remove, gently wash or dip in clean running water not warmer than the temperature of the detergent solution to remove the detergent from the surface, and then carefully dry by blowing with air or blotting with absorbent paper. During the progress of the test, examine for deterioration of the film immediately. If reimmersion is necessary, do not allow the specimen to remain out of the liquid in excess of 1/2 hours, unless otherwise specified. Examine the test coating for blisters, rust and loss of adhesion. The sample will be treated as passing if no noticeable rusting developed, no loss of adhesion and not more than 8 blisters are observed.

Annex C

[Table 1, SI No. (xvii)]

Resistance to Acid/Alkali Test**C-1 Principle**

This method prescribes for determination of the resistance of powder coatings to acid and alkali solutions in an accelerated manner for a fixed period.

C-2 Apparatus**C-2.1 Containers**

Corrosion resistant containers equipped with the means to control the solution temperature within 60 ± 1 °C and capable to maintain the liquid level of minimum 5 mm.

C-2.2 Cover

The containers shall be provided with covers to retard evaporation and to contain the test specimens completely.

C-3 Test Specimens

The test specimens shall be prepared as in B-3.1 above.

C-4 Reagents

C-4.1 Hydrochloric Acid (see BDS 37), 10 percent.

C-4.2 Nitric Acid, (see BDS 34) 10 percent.

C-4.3 Sulphuric Acid, (see BDS 38) 20 percent.

C-4.4 Sodium Hydroxide, (see BDS 11) 25 percent.

C-5 Procedure

C-5.1 Immersion Suspend the test specimens vertically in the container so that at least one half of the surface area is submerged in the solutions namely nitric acid, sulphuric acid, hydrochloric acid and sodium hydroxide for a period of 12 hours each. Separate the test specimens so that they are not in contact with any metal and are no closer together than 25 mm at any point in the bath. Replace the test solutions with fresh solutions after every 168 h. If successive tests are to be correlated, use reference panels coated with control paint.

C-5.2 Examination of Specimens

When the specimens are ready for transfer and/or examination, carefully remove, gently wash or dip in clean running water not warmer than the temperature of the test solution to remove the excess solution from the surface, and then carefully dry by blowing with air or blotting with absorbent paper. Examine the test coating for blisters, flaking and corrosion. The sample shall be treated as passing if there is no blistering, flaking and corrosion.