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CODE OF PRACTICE FOR LAYING OF EPOXY RESIN FLOOR TOPPINGS

(First Revision)

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Indian Standard

CODE OF PRACTICE FOR LAYING OF EPOXY RESIN FLOOR TOPPINGS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 31 January 1986, after the draft finalized by the Flooring and Plastering Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Epoxy resins are steadily finding increased use in the building industry on account of their qualities of adhesion and chemical resistance. They are suitable for use on industrial floors, such as in chemical plants manufacturing fertilizers, pharmaceuticals, acids and solvents, in dairies, tanneries, breweries, garages, service stations, warehouses, metal plating and pickling areas. The use of epoxy resin for industrial floor topping is characterized by its exceptional physical and chemical properties, such as chemical resistance, hardness, abrasion resistance, compressive, impact and flexural strengths, negligible shrinkage, dimensional stability and adhesion to cured concrete, metals and other surfaces.

0.3 As the mechanical and the chemical properties of the epoxy resin floor topping mix depends on the composition of the mix, it is essential that the formulator should be consulted for details concerning the material. This standard first published in 1968, was intended to give detailed guidance to the user, engineer, and architect in the method of laying an epoxy resin floor topping and the precautions that are to be taken in handling this material. In this revision, the specification for epoxy resins and epoxy resin compositions for floor topping have been given in accordance with IS : 9197-1979*. Where a heavily filled travelling compound is applied, recommendations for applying seal coat of unfinished resin have been included.

0.4 Methods of tests in epoxy resins compositions shall be done in accordance with IS : 9162-1979†.

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*Specification for epoxy resin, hardners and epoxy resin compositions for floor topping.

†Methods of tests for epoxy resins, hardners and epoxy resin compositions for floor topping.

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

1. SCOPE

1.1 This standard deals with the method of laying epoxy resin of jointless floor toppings and the precautions to be taken in laying them.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Plasticizer — A compound which, when added to an epoxy resin hardener mixture, will not enter into the curing reaction, but at the same time will improve the resilience and toughness of the cured resin and thereby also its thermal shock resistance, impact resistance, peel strength and flexibility.

2.2 Flexibilizer — A compound which will take part in the curing reaction of an epoxy resin and improve the resilience and toughness of the cured resin thereby also its thermal shock resistance, impact resistance, peel strength and flexibility.

2.3 Amine-Adduct — An addition product of an amine with an epoxy compound which is used as a curing agent for epoxy resins.

2.4 Pot-Life — The time taken after addition of the hardener for a resin to reach an unusable state and is greatly influenced by prevailing temperature.

3. MATERIALS

3.0 An epoxy resin floor topping shall consist essentially of the materials given in **3.1** to **3.6.**

3.1 Epoxy Resin — Epoxy resin shall conform to IS : 9197-1979†.

3.2 Hardeners — Hardeners shall conform to IS : 9197-1979†.

3.3 Accelerator — Accelerator shall conform to IS : 9197-1979†.

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

†Specification for epoxy resins, hardeners and epoxy resin composition for floor topping.

3.4 Plasticizers and Non-Reactive Diluents — Plasticizers and non-reactive diluents shall conform to IS : 9197-1979*.

3.5 Liquid Coal Tar — Liquid coal tar shall conform to IS : 9197-1979*.

3.6 Aggregates — Aggregates shall conform to IS : 9197-1979*.

4. PROPERTIES OF EPOXY RESIN COMPOSITION

4.1 The properties of epoxy resin composition shall conform to IS : 9197-1979*.

5. TYPES OF EPOXY RESIN TOPPINGS

5.0 There are basically two types of epoxy resin floor toppings commonly available in addition to special finishes, each of which is designed for a specific class of floor requirements.

5.1 Trowel Type — This is usually heavily filled with sand or other suitable aggregate and the compound is applied by trowel. Such compounds are often referred to as mortars or screeds.

5.2 Flow Type — This is usually a solventless compound containing filler and pigment and the mixture is poured directly on to the surface when the blend will flow and level itself often with little assistance to form a smooth continuous coating.

5.3 Terrazzo Floors — The portland cement in the conventional terrazzo floors is replaced by epoxy resin binder. Such flooring formulations serve the dual purpose of providing a good appearance and chemical resistance.

5.4 Non-Skid Floors — This type of floor may be prepared by sprinkling a suitable grit on an epoxy resin floor topping when the latter is still in a tacky state.

6. RECOMMENDED THICKNESS

6.1 The following minimum thicknesses of epoxy resin floor toppings are recommended to obtain satisfactory performance:

a) *Trowel Type* — 4 mm for normal use and 6·5 mm in areas of thermal shock and heavy traffic on horizontal surfaces,

b) *Flow Type* — 2 mm, and

c) *Terrazzo Floors* — 10 mm.

*Specification for epoxy resins, hardeners and epoxy resin composition for floor topping.

7. EQUIPMENT

7.1 Mixing — The resin and the hardener constituents shall be blended just before use by suitable means. Power mixing with good shearing action may be adopted. For small jobs, hand mixing may be done with trowels taking special care that the resin does not come into contact with the skin of the workman. In the case of flow-type floor mix, the use of a continuous mixing equipment with predetermined ratios for the constituents may be permitted.

7.2 Spreading — Conventional types of spreading equipment, including trowels, notched spreaders and screed levelling devices, may be used. Water or detergent solutions to wet the trowel for easier trowelling shall not be used. As epoxy resins are sensitive to moisture due care shall be taken that equipment for mixing and application shall not be in wet condition when brought in contact with the resin.

8. PREPARATION OF FLOOR SURFACE

8.1 To ensure proper adhesion of the epoxy resin mix, the substrate shall be clean, free from grease and oil, dry and rough.

8.2 Concrete Surface — Before application of the epoxy resin topping, the base concrete floor shall be properly cured and dried and kept rough at the time of application of the epoxy resin topping. Laitance shall be removed from the concrete surface by washing the floor with dilute hydrochloric acid. Sand blasting or hacking may be adopted for roughening the concrete surface. In the case of an already existing concrete floor, the structural soundness of the concrete surface shall be examined before the epoxy resin topping is applied. All the cracks and broken areas on an existing concrete base shall be sealed, fresh concrete shall be laid and the portion shall be completely cured before the application of epoxy resin topping. Heavy contamination on an existing concrete floor shall be removed by scarification or wire brushing if required. Grease and oil shall be removed by washing the surface with solvents, such as acetone or a suitable detergent. For cleaning of the base concrete surface, a dilute hydrochloric acid solution (10 to 15 percent) shall be poured and allowed to react with the concrete surface for about 15 minutes till no more bubbling is visible on the surface. The resulting slush shall be thoroughly rinsed with plenty of water or dilute ammonia solution and tested with litmus paper. The surface shall then be allowed to dry.

8.2.1 An even concrete surface is very essential as otherwise excess quantity of costly epoxy materials would be consumed in filling the surface.

8.3 Mild Steel or Cast Iron Surfaces — The surface shall be washed with a suitable solvent or detergent solution to remove any grease or oil. The surface shall then be sand-blasted or abraided with emery cloth, abrasive disc or with wire brushes.

9. LAYING

9.1 Mixing of Epoxy Resin Blend — The mixing shall be carried out at the site as follows:

a) The constituents required for the particular epoxy resin topping shall be mixed in the correct proportions specified by the formulator.

b) In mixing the blend, unless otherwise specified by the formulator, the order of addition of the components to the equipment shall be resin, hardener and aggregate (where separate or additional aggregate is required for the blend).

c) Aggregates, where used, shall be added to the blend in the mixer in a dry condition. Supplies of aggregate should, therefore, be delivered and stored to maintain suitable dry conditions.

d) The duration of mixing of the separate components of the epoxy resin blend shall be adequate to ensure thorough mixing and the quantity of resin mixed at any one time shall be such that the mix can be applied and spread within the known pot-life.

9.2 Application — Application of the epoxy resin topping shall be done in accordance with the procedure laid down in **9.2.1** and **9.2.2**.

9.2.1 The blended epoxy resin mix shall be applied and uniformly spread over the prepared area to give the required thickness. It is recommended that the floor area be laid out in sections so that a uniform thickness of epoxy resin topping may be applied over the whole floor.

9.2.2 For some areas where a heavily filled trowelling compound is to be applied, the prepared area shall be first covered with a tack coat of the unfilled resin-hardener mix applied by brush and this shall be allowed to cure partly to a tacky stage before the actual topping is applied.

9.2.2.1 Where a heavily filled trowelling compound is used, it is advisable to apply a seal coat of unfinished resin to ensure that pores, if any, are sealed adequately.

9.2.3 *Tools* — As mild steel tools are liable to cause stains on light coloured surfaces, it is recommended that stainless steel, chromium plated steel or rigid PVC tools should be used for laying of epoxy resin floor toppings.

9.3 Setting of Floor Topping Before Use — After application of the epoxy resin topping, the floor shall be allowed to set without disturbance for a minimum period of 24 hours. The floor can be brought to normal use after a minimum period of 7 days at temperature of 20°C and above, though light traffic may be permitted after 24 hours of laying the floor topping. Below 20°C special hardeners may be used as recommended by the formulator in order to obtain proper setting of the floor topping.

9.4 Expansion Joints — The expansion joints to coincide with the expansion joints in the base concrete should be provided in epoxy toppings. The expansion joints for the epoxy topping should be filled with a flexible putty that shows appropriate water and chemical resistance. The formulators should be consulted for a suitable material.

10. SAFETY PRECAUTIONS

10.1 Epoxy resins may cause irritation to persons having sensitive skin. Providing good ventilation of the work rooms and storage rooms, maintaining cleanliness at work and in work-clothing, and taking maximum care when processing resins and hardeners are recommended to minimize these hazards. The most effective precaution is the use of rubber or polyethylene gloves. It is preferable to wear thin cotton gloves underneath for comfort covered by rubber or polyethylene. Other measures recommended for individual workers are regular washing of hands, arms and face with soap and lukewarm water, followed by thorough drying with a clean towel, and the use of a good barrier cream. Splashes on the skin should be removed immediately by washing with soap and lukewarm water. On no account should a solvent be used for the purpose. In mild cases of skin irritation the symptoms generally disappear within a few days and in doubtful cases, a doctor should be consulted.

11. CHEMICAL RESISTANCE

11.1 A general guide for chemical resistance of epoxy resin flooring mixes to various substances is given in Table 1. Table 1 shows that systems cured with amines exhibit higher chemical resistance. Polyamide hardeners should be used where floors are exposed to frequent impact stress and fluctuations in temperature. The performance of floor will, however, depend on whether it is exposed to different chemicals, chemicals of different concentrations and whether chemical and mechanical stresses occur simultaneously. Variations in temperature would also affect the performance of the floor topping.

12. MAINTENANCE

12.1 Very little maintenance is required for epoxy resin floor toppings. However, the following precautions would prolong the service life of the topping.

TABLE 1 CHEMICAL RESISTANCE OF EPOXY RESIN FLOORING MIXES

(*Clause* 11.1)

SUBSTANCE	CHEMICAL RESISTANCE AT 20°C							
	Compounds Cured with Amine or Amine-Adduct Hardeners				Compounds Cured with Polyamide Hardeners			
	E	G	S	P	E	G	S	P
Acetic acid, 5 percent	—	—	×	—	—	—	—	×
Acetic acid, 10 percent	—	—	—	×	—	—	—	×
Acetic acid, 50 percent	—	—	—	×	—	—	—	×
Acetic acid, anhydride	—	—	—	×	—	—	—	×
Ammonium hydroxide, 10 percent	×	—	—	—	—	×	—	—
Ammonium hydroxide, 30 percent	—	×	—	—	—	—	×	—
Alchols (ethyl alchols)	—	×	—	—	—	×	—	—
Aliphatic hydrocarbons (naphtha)	×	—	—	—	×	—	—	—
Aromatic hydrocarbons (toluene)	—	—	×	—	—	—	×	—
Beer	×	—	—	—	×	—	—	—
Blood	×	—	—	—	×	—	—	—
Boric acid	×	—	—	—	×	—	—	—
Calcium chloride, 50 percent solution	×	—	—	—	×	—	—	—
Caustic soda, 10 percent	×	—	—	—	—	×	—	—
Caustic soda, 50 percent	×	—	—	—	—	×	—	—
Chlorinated hydrocarbons (carbon tetrachloride)	—	—	×	—	—	—	×	—
Citric acid, 10 percent	—	×	—	—	—	—	×	—
Cooking fats and oils	×	—	—	—	×	—	—	—
Ester	—	×	—	—	—	×	—	—
Ether (ethyl ether)	—	×	—	—	—	—	×	—
Fats and oils	×	—	—	—	×	—	—	—
Formaldehyde, 37 percent	×	—	—	—	—	×	—	—
Glycerine	×	—	—	—	—	×	—	—
Hydrochloric acid, 10 percent	—	×	—	—	—	—	×	—
Hydrochloric acid, 37 percent	—	—	×	—	—	—	—	×
Javel water	—	—	×	—	—	—	—	×
Ketone (acetone)	—	—	×	—	—	—	×	—
Lactic acid, 10 percent	—	—	×	—	—	—	×	—
Liquid fuel (petrol or oil)	×	—	—	—	×	—	—	—
Milk, sour or fresh	—	×	—	—	—	—	×	—
Nitric acid, 10 percent	—	—	×	—	—	—	—	×
Nitric acid, 50 percent	—	—	—	×	—	—	—	×
Soaps and detergents	×	—	—	—	×	—	—	—
Sugar (saturated solution)	×	—	—	—	×	—	—	—
Sulphuric acid, 10 percent	—	—	×	—	—	—	—	×
Sulphuric acid, 50 percent	—	—	—	×	—	—	—	×
Tap water	×	—	—	—	×	—	—	—
Urine	×	—	—	—	×	—	—	—
Vegetable oils	×	—	—	—	×	—	—	—
Water (distilled)	×	—	—	—	×	—	—	—

NOTE — E = excellent, G = good, S = satisfactory, and P = poor.

12.1.1 For cleaning of the floor, usual household detergents, soap and warm water (up to 60°C) may be used in conjunction with mopping, but stubborn dirt marks may require scrubbing. Use of powerful oxidizing agents should, however, be avoided.

12.1.2 Epoxy resin floor toppings tend to develop cracks when subjected to quick thermal cycles. Hence frequent alternate quick hot and cold water hosing should be avoided.

12.1.3 Dragging of heavy sharp edged loads should be avoided since the flooring would be liable to scoring.

12.1.4 Spillages of powerful solvents like acetone and trichloroethylene should be drained away as quickly as possible.

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