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IS 9197 (1979): epoxy resin, hardeners and epoxy resin compositions for floor topping [CED 5: Flooring, Wall Finishing and Roofing]



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IS : 9197 - 1979

Indian Standard

SPECIFICATION FOR
EPOXY RESIN, HARDENERS AND EPOXY
RESIN COMPOSITIONS FOR FLOOR TOPPING

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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Indian Standard

**SPECIFICATION FOR
EPOXY RESIN, HARDENERS AND EPOXY
RESIN COMPOSITIONS FOR FLOOR TOPPING**

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Indian Standard

SPECIFICATION FOR EPOXY RESIN, HARDENERS AND EPOXY RESIN COMPOSITIONS FOR FLOOR TOPPING

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 April 1979, after the draft finalized by the Flooring and Plastering Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Epoxy resin and hardener systems for floor toppings are gaining wide popularity due to varied properties in cured composition, like high chemical resistance against acid, alkali, solvents and fertilizers; less abrasion and low shrinkage; high compressive, flexural and tensile strength; high bonding strength with dissimilar materials, etc. Although the ultimate performance will depend upon the selection of formulation, however they should satisfy certain minimum requirements for durability under service conditions, and this standard lays down their minimum requirements. The procedure for laying the epoxy resin floor topping has been covered in IS : 4631-1968*.

0.3 This standard contains clauses 3.1, 3.2, 3.4 and 3.6 which permit the purchaser to use his option for selection to suit his requirements.

0.4 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

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 lays down the requirements for epoxy resin, hardeners and other constituent materials to be used in the formulation of floor toppings.

*Code of practice for laying of epoxy resin floor toppings.

†Rules for rounding off numerical values (revised).

2. TERMINOLOGY

2.1 For the purpose of this standard the definitions given in IS : 4631-1968* shall apply.

3. MATERIALS

3.0 An epoxy resin floor topping shall consist essentially of the materials given in 3.1 to 3.5.

3.1 **Epoxy Resin** — This shall be liquid epoxy resin containing no hardeners. It shall be of the following two grades:

- a) *Grade 1* — Resins containing no diluents. These shall conform to the requirements laid down in Table 1.
- b) *Grade 2* — Resins modified with a reactive diluent. These shall conform to the requirements laid down in Table 2. Each class of Grade 2 resin can be made with Grade 1 resin.

NOTE — Other grades of epoxy resins may be used where so agreed to between the purchaser and the supplier.

TABLE 1 REQUIREMENTS FOR GRADE 1 EPOXY RESIN

CLASS	EPOXY CONTENT		VISCOSITY AT 27°C Pa.s	SPECIFIC GRAVITY AT 27°C	HYDROLYZ- ABLE CHLORINE CONTENT, PERCENT, <i>Max</i>
	Equivalent/ 1 000 g	Weight per Epoxy Equivalent			
(1)	(2)	(3)	(4)	(5)	(6)
I	5.0 to 5.88	200 to 170	3 to 20	1.05 <i>Min</i> 1.20 <i>Max</i>	0.6

TABLE 2 REQUIREMENTS FOR GRADE 2 EPOXY RESIN

CLASS	EPOXY CONTENT EQUIVALENT/ 1 000 g, <i>Min</i>	VISCOSITY AT 27°C Pa.s	SPECIFIC GRAVITY AT 27°C	HYDROLYZABLE CHLORINE CONTENT, PERCENT, <i>Max</i>
(1)	(2)	(3)	(4)	(5)
I	5	0.5 to 0.9	1.05 <i>Min</i> } 1.20 <i>Max</i> }	0.6
II	5	0.9 to 4	do	0.6
III	5	4 to 10	do	0.6

*Code of practice for laying of epoxy resin floor toppings.

3.2 Hardeners — This shall be liquid type, such as an aliphatic amine, an aliphatic or aromatic amine adduct, a polyamide or amido polyamine as specified in Table 3. It shall react with epoxy resin at normal ambient temperature above 5°C.

NOTE — Other types of hardeners may be used where so agreed to between the supplier and the purchaser. Additional type of hardeners will be included in Table 3 as and when information for the specification becomes available.

3.3 Accelerator — These are liquids which may be added to accelerate the rate of curing of epoxy resin hardener system. Tertiary amines are generally recommended as accelerators.

3.4 Plasticizers and Non-reactive Diluents — Plasticizers and non-reactive diluents may be incorporated not only in the resins but in the hardeners also, provided the total quantity of these ingredients does not exceed 25 parts per hundred parts by weight of the resin, in the resin—hardener mixture. Diluents or plasticizers may be incorporated to the extent that they should not affect the requirements of pot life, curing time and strength as specified in the standard. However, the total percentage of these materials added to the resin hardener system shall be specified by the suppliers.

3.5 Liquid Coal Tar — It may be incorporated either in the resin or the hardener or both if desired by the purchaser, provided the quantity added shall not exceed 1 : 1 by weight of the epoxy resin hardener mixture and that the pot life, curing time and other physical and chemical properties of the mixture shall conform to those specified in the standard. The general specification for liquid coal tar is given in Table 4.

3.6 Aggregates — Aggregates shall be free from any reactive or deleterious substances. Fine aggregate shall conform to grading Zone III or Zone IV of IS : 383-1970*. Coarse aggregate shall also conform to IS : 383-1970*. However, the grading of the aggregate and the ratio of the binder to filler should be so chosen as to ensure minimum values of the requirements of the composition listed in Table 5. Any other specific grade of the filler or aggregate shall be as agreed upon by the purchaser and the supplier.

4. PROPERTIES OF EPOXY RESIN COMPOSITIONS

4.1 Pot Life — The pot life of the mixture containing all the ingredients in the prescribed proportions shall be at least 45 minutes at $27 \pm 2^\circ\text{C}$ and at 65 ± 5 percent relative humidity, when tested according to IS : 9162-1979†.

*Specification for coarse and fine aggregates from natural sources for concrete (second revision).

†Methods of test for epoxy resin hardeners and epoxy resin composition for floor toppings.

TABLE 3 HARDENERS FOR EPOXY RESIN

(Clause 3.2)

Sl No.	TYPE	VISCOSITY AT 25°C MPa. s	AMINE VALUE mg KOH/g	SPECIFIC GRAVITY AT 25°C	AMOUNT RECOMMENDED PER EQUIVALENT EPOXY IN RESIN g	REMARKS
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(a) Aliphatic Amine						
i)	A	10 to 20	1 300 to 1 700	0.97 to 0.99	16 to 25	High rate of reaction with strong exotherm. Curing sensitive to humidity
ii)	B	20 to 40	450 to 500	—	50 to 55	Slow rate of curing with long pot-life and low exotherm
iii)	C	3 000 to 6 000	830 to 910	—	50 to 55	High rate of reaction and high exotherm
(b) Aromatic Amine Adduct						
i)	A	3 800 to 6 000	260 to 290	1.11 to 1.12	110 to 130	Permits curing at high atmospheric humidity and low temperature, medium rate of curing
ii)	B	14 000 to 22 000	250 to 280	1.125 to 1.135	110 to 130	Permits curing at high atmospheric humidity and low temperature. Fast rate of curing
(c) Polyaminoamide						
i)	A	12 500 to 17 500	350 to 410	0.96 to 0.98	110 to 190	Slow rate of curing with low exotherm
ii)	B	14 000 to 15 000	190 to 210	1.05 to 1.07	100 to 110	do
iii)	C	9 000 to 13 000	280 to 300	0.96 to 0.98	160 to 180	do
(d) Amino resin compound						
i)	A	17 000 to 23 000	300 to 360	—	100 to 110	Possibility of adjusting pot-life and exotherm

TABLE 4 GENERAL SPECIFICATION FOR LIQUID COAL TAR
(Clause 3.5)

Sl. No.	CHARACTERISTIC	REQUIREMENT	METHOD OF TEST, REF TO IS:
(1)	(2)	(3)	(4)
i)	Viscosity at 40°C, Pa.s	14 to 16	1206-1958*
ii)	Specific gravity at 27°C	1.15 to 1.21	1202-1958†
iii)	Residue (pitch), percent	60 to 70	1204-1958‡
iv)	Softening point of residual pitch	67°C	1205-1958§
v)	Fractional distillation, percent by mass		
	170°-270°C	7.85	1213-1958
	270°-300°C	5.46	
	300°-350°C	19.06	
vi)	Phenol, cresolos, etc, percent, <i>Max</i>	3	1218-1959¶
vii)	Naphthalene, percent, <i>Max</i>	2	1219-1958**

*Method of testing tar and bitumen: Determination of viscosity.

†Method of testing tar and bitumen: Determination of specific gravity.

‡Method of testing tar and bitumen: Determination of residue of specified penetration.

§Method of testing tar and bitumen: Determination of softening point.

||Method of testing tar and bitumen: Distillation test.

¶Method of testing tar and bitumen: Determination of phenols,

**Method of testing tar and bitumen: Determination of naphthalene.

4.2 Chemical Resistance — Chemical resistance of cured epoxy resin composition shall conform to the requirements of Table 1 of IS : 4631-1968* when tested according to IS : 9162-1979†.

4.3 Resistance to Wear — When tested according to IS : 9162-1979† permissible average wear and individual wear of specimen shall be as given in Table 5. Not less than six specimens shall be tested for determining the resistance to wear of epoxy resin floor toppings.

4.4 Other Requirements — The cured samples of epoxy resin-hardener-filler (including aggregate) when tested after 7 days of curing shall conform to the requirements specified in Table 5.

*Code of practice for laying of epoxy resin floor toppings.

†Methods of test for epoxy resin hardeners and epoxy resin composition for floor toppings.

TABLE 5 REQUIREMENTS OF EPOXY RESIN COMPOSITION FOR FLOOR TOPPING

(Clauses 3.6, 4.3, 4.4, A-3.1 and A-3.3)

Sl. No.	CHARACTERISTIC	REQUIREMENT	METHOD OF TEST (REF TO CL OF IS : 9162-1979*)
(1)	(2)	(3)	(4)
i)	Compressive strength, N/mm ²	80 <i>Min</i>	8
ii)	Bond strength, N/mm ²	2 <i>Min</i>	11
iii)	Flexural strength, N/mm ²	20 <i>Min</i>	9
iv)	Tensile strength, N/mm ²	15 <i>Min</i>	10
v)	Modulus of elasticity, N/mm ²	35 × 10 ⁻⁸ <i>Min</i>	9
vi)	Coefficient of linear thermal expansion, mm/mm°C	45 × 10 ⁻⁶ <i>Max</i>	12
vii)	Thermal conductivity (optional) W/mk	1 <i>Max</i>	16
viii)	Linear shrinkage, percent	0.10 <i>Max</i>	12
ix)	Water absorption, percent	0.50 <i>Max</i>	13
x)	Resistance to wear, mm	Average wear 2 <i>Max</i> Individual wear 2.5 <i>Max</i>	15
xi)	Shear strength N/mm ²	3.2 <i>Min</i>	17

*Methods of test for epoxy resin hardeners and epoxy resin compositions for floor toppings.

5. SAMPLING AND CRITERIA FOR ACCEPTANCE

5.1 The method of drawing representative samples of the material and the criteria for conformity shall be as given in Appendix A.

6. PACKING AND MARKING

6.1 Resins and hardeners shall be packed separately in suitable sealed airtight containers. Filler shall be supplied in separate packing.

6.1.1 The following information shall be marked legibly on each package:

- a) Name of manufacturer,
- b) Name of product,
- c) Net weight,
- d) Date of manufacture/batch No.,

- e) Storage requirements,
- f) Storage life, and
- g) Date of expiry.

6.2 BIS Certification Marking

The product may also be marked with Standard Mark.

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

A P P E N D I X A

(Clause 5.1)

SAMPLING PROCEDURE

A-1. LOT

A-1.1 The quantity of resin, hardener and filler material from the same manufacturing unit offered for inspection in one lot shall be such as to give not less than 1000 g of the mortar when mixed well by suitable means.

A-1.2 Samples shall be selected and tested from each lot separately for ascertaining its conformity to the requirements of the specification.

A-2. SELECTION

A-2.1 Since the mortar is obtained by intimately mixing the resin, hardener and filler material which are packed separately, as a first step, suitable number of containers of resin, hardener and filler material shall be selected from the lot. The number of containers shall not be less than 10 percent of the total number of containers in the lot. Equal quantities of material shall be taken from each container selected and the resin, hardener and filler material shall be mixed well to give the sample of mortar for the lot.

A-3. CRITERIA FOR CONFORMITY

A-3.1 Specimens shall be taken from the mortar sample and tested for all the requirements given in Table 5.

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A-3.2 A lot shall be considered as having satisfied the requirements of this specification if the results for all the tests satisfy the relevant requirements of this specification.

A-3.3 Re-test — If the sample when tested, does not comply with the requirements specified in Table 5, another set of sample shall be prepared from the same lot and subjected to the tests. If the second sample also fails to comply with the requirements of Table 5, then the lot represented by the samples shall be rejected.

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