भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG, NEW DELHI 110002

व्यापक परिचालन मसौदा

हमारा संदर्भ : सीईडी 05/टी-23 **30 सितम्बर 2024**

तकनीकी समिति : फर्श, दीवार फिनिशिंग और छत अनुभागीय समिति, सीईडी 05

प्राप्तकर्ता :

क) सिविल इंजीनियरी विभाग परिषद्, सीईडीसी के सभी सदस्य
ख) सीईडी 05 के सभी सदस्य
ग) रूचि रखने वाले अन्य निकाय

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प्रलेख संख्या	शीर्षक
सीईडी 05 (26662) WC	**रेज़िन प्रकार के रासायनिक प्रतिरोधी मोर्टार के उपयोग — रीति संहिता का भारतीय मानक मसौदा** (IS 4443 का *दूसरा पुनरीक्षण*), ICS 91.100.10

कृपया इस मसौदे का अवलोकन करें और अपनी सम्मतियाँ यह बताते हुए भेजे कि यह मसौदा भारतीय मानक के संशोधन के रूप में प्रकाशित हो तो इस पर अमल करने में आपको व्यवसाय अथवा कारोबार में क्या कठिनाइयाँ आ सकती हैं।

सम्मतियाँ भेजने की अंतिम तिथि**: 30 अक्टूबर 2024.**

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धन्यवाद।

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(सिविल अभियांत्रिकी विभाग)

संगलन : उपरिलिखित

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS

MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG, NEW DELHI 110002

DRAFT IN WIDE CIRCULATION

Our Ref: CED 05/T-23 **30 September 2024**

Technical Committee: Flooring, Wall Finishing and Roofing Sectional Committee, CED 05

ADDRESSED TO:

1) All Interested Members of Civil Engineering Division Council, CEDC
2) All Members of CED 05 and its subcommittees,
3) All other interests.

Dear Sir/Madam,

Please find enclosed the following draft:

Doc No.	Title
CED 05 (26662) WC	**Draft Indian Standard use of Resin type Chemical Resistant Mortars — Code of Practice** (*Second Revision* of IS 4443), ICS 91.100.10

Kindly examine the draft and forward your views stating any difficulties, which you are likely to experience in your business or profession, if this is finally adopted as National Standards.

Last Date for Comments: 30 October 2024.

Comments, if any, may please be made in the format as enclosed and e-mailed to the undersigned at ced5@bis.gov.in in word format. In case no comments are received or comments received are of editorial nature, kindly permit us to presume your approval for the above document as finalized. However, in case comments of technical nature are received, then this may be finalized either in consultation with the Chairman, Sectional Committee or referred to the Sectional Committee for further necessary action if so desired by the Chairman, Sectional Committee. The document is also hosted on BIS website www.bis.gov.in.

Thanking you,

Yours faithfully,

Sd/-

(Dwaipayan Bhadra)

Head (Civil Engineering)

Encl: As above

FORMAT FOR SENDING COMMENTS ON BIS DOCUMENTS (Please use A-4 size sheet of paper only and type within fields indicated. Comments on each clause/sub-clause/ table/figure, etc. be started on a fresh box. Information in column 3 should include reasons for the comments and suggestions for modified working of the clauses when the existing text is found not acceptable. Adherence to this format facilitates Secretariat's work) {Please e-mail your comments to **ced5@bis.gov.in**}

DOC. NO.:CED 05 (26662) WC

Title: Draft Indian Standard Use of Resin type Chemical Resistant Mortars — Code of practice (*Second Revision of IS 4443*)

LAST DATE OF COMMENTS: **30/10/2024**

NAME OF THE COMMENTATOR/ORGANIZATION: _____

Sl. No.	Clause/Para/Table/ Figure No. Commented	Comments/Modified Wordings	Justification of the Proposed Change

BUREAU OF INDIAN STANDARD

DRAFT FOR COMMENTS ONLY

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Draft Indian Standard

USE OF RESIN TYPE CHEMICAL RESISTANT MORTARS — CODE OF PRACTICE

(*Second* Revision of IS 4443)

ICS 91.100.10

Flooring, Wall Finishing and Roofing Sectional Committee CED 05	**Last date for Comment: 30 October 2024**

FOREWORD

(Formal clauses will be added later)

The choice of an appropriate chemical resistant mortar for use in construction activities as a bonding material requires adequate consideration. A particular type of mortar that may be able to resist a particular chemical environment may be completely unsuitable for another chemical environment. Therefore, the selection of a bonding material has to be entirely based on the specific chemical conditions.

The resin mortars have fairly good resistance to non-oxidizing mineral acids but have poor resistance to oxidizing mineral acids. They are fairly resistant to inorganic alkalies. Where conditions are questionable, specific recommendations should be obtained from the manufacturer. The requirements for resin type mortar are covered in IS 4832 (Part II).

This standard was first published in 1967 and was subsequently revised in 1980 with a view to provide guidance for the use of resin type chemical resistant mortars. The present revision has been taken up mainly to incorporate the modifications necessary as a result of experience gained by the industry in the manufacture and use of such type of mortars. In this revision, the following major changes are incorporated:

a) Recommendation on Mixing has been updated.
b) Recommendation of surface preparation has been modified to clarify that surfaces must be cured and dried until the concrete core is fully dry.
c) The recommendation on Application of membrane has been modified to incorporate the use of same resin used for manufacturing the mortar should be applied as a primer.

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

(The composition of the Committee responsible for the formulation of this standard will be added later.)

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.

Draft Indian Standard

USE OF RESIN TYPE CHEMICAL RESISTANT MORTARS — CODE OF PRACTICE

(*Second Revision of IS 4443*)

1 SCOPE

This standard lays down recommendations for the storage, mixing, method of use and safety precautions required in handling resin type chemical resistant mortars.

NOTE – The requirements of the silicate type mortar have been covered in IS 4832 (Part II).

2 REFERENCES

The standards listed in Annex A contains 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 these standards.

3 TERMINOLOGY

For the purpose of this standard, the following definition shall apply:

Resin Type Chemical Resistant Mortar – An intimate mixture of liquid resinous material and a powder composed of properly selected filler materials and usually containing the setting agent. These components are mixed at ordinary temperatures to form a trowelable mortar that subsequently hardens.

4 STORAGE

The resins shall be stored in a clean dry place away from open flame and under a roof with containers tightly closed. The resins could generally be stored without deterioration at 27 ± 2 °C for periods not exceeding the values given below. The filler or resin that has become wet shall not be used:

	Type of Resin	*Storage Period in Months*
i)	Cashew nut shell liquid	9
ii)	Epoxy	12
iii)	Furane	12
iv)	Phenolic	3
v)	Polyester	3

NOTE — The storage periods may be increased or decreased in consultation with the manufacturer.

5 SAFETY PRECAUTIONS

5.1 Both the liquid and the powder ingredients may contain materials that may affect the skin. Therefore, either gloves or barrier cream shall be used while handling these materials.

5.2 Vapours are present in most of the resin mortars and some produce gases during cure. Adequate ventilation shall be provided in the mixing and working areas. Under confined areas like vessel lining, etc, forced air draught may be used.

5.3 Resin mortars that are labelled as inflammable by the manufacturer shall be used with adequate safety precautions against fire.

5.4 Solvents used for cleaning tools are generally inflammable. Fires shall be kept away from the area in which such solvents are used and 'NO SMOKING' sign shall be pasted in these areas.

6 EQUIPMENT

6.1 All equipment shall be kept clean and dry.

6.2 Shallow basin of enamel or polyethylene may be used for hand-mixing.

6.3 As curing of resin type mortars is accompanied by exothermic reactions, cooling is often necessary in hot weather. Furane type of resins may be cooled by immersing the container in ice water. Epoxy and polyester resins may be cooled in a container immersed in water at ambient temperature to avoid condensation of moisture below dew point.

7 MIXING

7.1 For hand-mixing required quantity of the liquid resin shall be poured into the basin. The powder shall then be added gradually and the mixture shall be well stirred, working out all lumps and air bubbles. The mortar shall be mixed to the proportion as specified by the manufacturer for a particular type of job. A stainless steel spatula may be used for mixing purposes.

7.2 Mixing will be carried out by moving spatula in clockwise direction with its sharp edge placed such that it doesn't interrupt the initial setting process of the mortar during its mixing process.

7.3 Only such quantity of mortar that could be consumed within 15 to 20 minutes shall be prepared unless otherwise recommended by the manufacturer.

8 HANDLING

8.1 Resin mortars cure slowly at low temperatures. If the work is to be carried out at temperature below 15 °C, masonry units should be warmed and the area of work shall be enclosed and heated to above 15 °C by using infrared lamp, to obtain proper curing.

8.2 Mixed mortar that has become unworkable shall not be re-tempered with liquid resin, but shall be discarded.

9 APPLICATION

9.1 Surface Preparation

The surface on which chemically resistant bricks conforming to IS 4860 or tiles conforming to IS 4457 are to be laid, shall be free from dirt and dampness and shall be properly cured and dried till the core of concrete.

9.1.1 *Application of Membrane* – The surface after preparation shall be applied with a coat of bitumen primer conforming to IS 158. The primed surface shall be subsequently applied with a uniform coat of bitumen conforming to IS 9510. If the bedding material is epoxy or polyester resin, the tiles or bricks can be laid directly on to the surfaces without application of bitumen primer. The primer in these cases will be a thin coat of the same resin which is going to be used for manufacturing the mortar.

In case of furane, cashew nut shell liquid and phenolic type resin, a coat of bitumen primer conforming to IS 3384 shall be used subject to service conditions. Other membranes such as rubber, lead, polyisobutane, and fibre-reinforced plastics can also be used in place of bitumen primer.

9.2 Mortar Application with Same Bedding and Jointing Materials

9.2.1 *On Floors*

Spread the resin type mortar 6 to 8 mm thick on the back of the tile or brick. Smear two adjacent sides of the tile or brick with 4 to 6 mm thick mortar. Press the tile or brick into the bed and push against the floor and the tile or brick until the joint in each case is 2 to 3 mm thick. Trim off excess mortar and allow it to harden fully. Cure with acid as given in **9.4** except for epoxy and polyester resins

9.2.2 *On Walls*

Spread the resin type mortar 6 to 8 mm thick on the back of the tile or brick. Join two adjacent sides of the tile or brick with 4 to 6 mm thick mortar. Press the tile or brick against the wall and with the adjacent tile or brick until the joint in each case is 2 to 3 mm thick. Trim off excess mortar and allow it to harden fully. While carrying out the jointing, allow sufficient time to avoid the joints at the bottom getting disturbed and the tile or brick getting slided. Only one course of tile or brick shall be laid during the initial setting. Cure with acid as given in **9.4** except for epoxy and polyester resin. For tiles/bricks laid in epoxy and polyester based mortars, the bedding will not be more than 5 mm and joints between tiles / bricks will be 5 to 6 mm wide to allow heat of exotherm to escape.

9.3 Mortar Application with Different Bedding and Jointing Materials.

9.3.1 *On Floors*

Spread on to the back and two adjacent sides of the tile or brick the silicate type mortar 6 to 8 mm thick. Press the tile or brick on the bed and push against the floor and the tile or brick, until the joint in each case is 3 to 6 mm thick maintained by employing spacers. Before the silicate mortar sets completely, the jointing material is removed to a depth of 20 mm. The material thus removed, may be used for bedding provided it is trowelable and has not hardened. After the bedding mortar is properly set, cure the joints as given in **9.4** and fill the joints full with resin type mortar taking special care to fill up the entire length of the joint. Trim off excess mortar to make the joints smooth and plane.

9.3.2 *On Walls*

Spread on to the back and two adjacent sides of the tile or brick the silicate type mortar 6 to 8 mm thick. Press the tile or brick against the wall and with the adjacent tile or brick until the joint in each case is 3 to 6 mm thick maintained by employing spacers. Only one course of tile or brick shall be laid during the initial setting time to avoid the joints at the bottom getting disturbed and the tile or brick getting slided. Before the silicate mortar sets completely, the jointing material shall be removed to a depth of 20 mm. The material thus removed may be used for bedding provided it is trowelable and has not hardened. After the bedding mortar has properly set, cure the joints as given in **9.4** and fill the joints full with resin type mortar taking care to fill the entire length of the joint. Trim off the excess mortar to make the joints smooth and plane.

9.4 Acid Curing

Except for epoxy and polyester resins, cure the joints for a minimum period of 72 hours with 20 to 25 percent hydrochloric acid or with 30 to 40 percent sulphuric acid before applying the resin type mortars. After acid curing, wash the free acid in the joints with soap water followed by clean water and allow sufficient time for thorough drying. Resin mortars shall then be filled into the joints.

10 CLEANING

10.1 Cleaning Mortar from Brick or Tile

Various compounds are available for masking masonry units to prevent mortar from adhering to them. Such compounds may be removed by steam or water after the joints have hardened.

10.1.1 The manufacturer of the mortar should be consulted for the method of cleaning mortar from the face of the masonry unit before hardening, since the cure of certain mortars is affected by contact with water.

10.2 Cleaning the Equipment

Equipment should be cleaned frequently with solvent mixtures containing ketones, such as acetone, or with the solvent as recommended by the manufacturer. Hardened mortars may be removed from metal equipment by careful burning.

10.3 Cleaning of Hands

Resin mortar adhering to the hands or skin of the operator shall be wiped off with a cotton waste and the region washed with warm soap water or with special cleansing creams. Solvents used for cleaning equipment shall not be used for cleaning hands.

11 CURING

Resin mortars are normally self-curing and do not generally require any auxiliary curing. They should not be put to use before 48 hours in the case of furane, epoxy and polyester resin type mortars. They may be put to use after 48 hours provided the setting temperature is at least 20 °C. In the case of phenolic and cashew nut-shell liquid resin and for lower temperatures the period of curing shall be extended as recommended by the manufacturer. Without any heat treatment the phenolic resin and the cashew nut-shell liquid resin shall not be put to use for 7 to 28 days respectively. With heat treatment the phenolic and the cashew nut shell liquid resin may be put to use after 2 and 6 days respectively. The construction shall be protected from weather and water and from accidental mechanical damage until the mortar is cured.

NOTE — Heat treatment may be given with infrared lamp.

12 CHEMICAL RESISTANCE OF RESIN TYPE MORTARS

A general guide for chemical resistance of resin type mortars to various substances is given in Table 1. The ratings are for immersion service at ambient temperature and may be upgraded for spillage only. Specific recommendations should be obtained from the manufacturer where conditions are questionable.

Table 1 Chemical Resistance of Resin Type Mortars
(Clause 12)

SL No.	Substance	Epoxy	Polyester	Phenolic	Furane	Cashew nut shell liquid
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Acids:					
i)	Acetic acid 10 percent	R	R	R	R	R
ii)	Chromic acid 10 percent	N	R	L	N	L
iii)	Hydrochloric acid (concentrated)	R	R	R	R	R
iv)	Hydrofluoric acid 40 percent *(see* Note 2)	N	N	R	R	R
v)	Lactic acid 2 percent	R	R	R	R	R
vi)	Nitric acid 10 percent	L	N	L	N	L
vii)	Nitric acid (concentrated)	N	N	N	N	N
viii)	Phosphoric acid 10 percent	R	R	R	R	R
ix)	Sulphuric acid 10 percent	R	R	R	R	R
x)	Sulphuric acid 40 percent	R	R	R	R	R
xi)	Sulphuric acid (concentrated)	N	N	L	N	N
	Alkalies:					
i)	Ammonia 0.880	R	N	L	R	R
ii)	Sodium hydroxide 40 percent	R	N	L	R	L
iii)	Sodium carbonate	R	L	R	R	R
iv)	Calcium hydroxide	R	N	R	R	R
	Salt Solutions:					
i)	Salt solution (acidic)	R	R	R	R	R
ii)	Salt solution (alkaline)	R	L	R	R	R
	Solvents:					
i)	Aliphatic hydrocarbons	R	R	R	R	N
ii)	Aromatic hydrocarbons	L	N	R	R	N
iii)	Alcohols	R	R	R	R	R
iv)	Ketones	L	N	L	R	R
v)	Chlorinated hydrocarbons	L	L	R	R	N
	Wet Gases (Oxidizing)	N	N	N	N	N
	Wet Gases (Reducing)	R	R	R	R	R
	Minerals Oils	R	R	R	R	L
	Vegetable Oils and Fats	R	R	R	R	L

NOTE 1 — R = Generally recommended
L = Limited use (occasional spillage)
N = Not recommended

NOTE 2 — Carbon and graphite fillers should be used for hydroflouric acid service.

13 DRY HEAT LIMITS

A general guide for the use of resin type mortars at elevated temperatures is given at Table 2. The rating are for dry heat in air only.

Table 2 Dry Heat Limits in Air of Resin Type Mortars

(Clause 13)

SL No.	TYPE OF RESIN	DRY HEAT, *Max* °C
(1)	(2)	(3)
i)	Phenolic	150
ii)	Furane	150
iii)	Epoxy:	
	a) Ambient temperature system	90
	b) Heat-cured system	200
iv)	Polyester	110-120
v)	Cashew nut shell liquid resin	170-180

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 158 : 2015	Ready mixed paint, brushing, bituminous, black, acid, alkali and heat resisting – Specification (*fourth revision*)
IS 3384 : 1986	Specification for Bitumen primer for use in waterproofing and damp-proofing (first revision)
IS 4457 : 2007	Ceramic unglazed Vitreous Acid resisting tiles – Specification (s*econd revision*)
IS 4832 (Part 2) : 2023	Chemical Resistant Mortars: Part 2 Resin Type – Specification
IS 4860 : 1968	Acid-Resistant bricks – Specification
IS 9510 : 1980	Specification for Bitumen mastic, Acid-Resisting grade