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-22 **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

प्रिय महोदय/महोदया,

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प्रलेख संख्या	शीर्षक
सीईडी 05 (26661) WC	**सल्फर प्रकार के रासायनिक प्रतिरोधी मोर्टारों के उपयोग – रीति संहिता का भारतीय मानक मसौदा** (IS 4442 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-22 **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 (26661) WC	**Draft Indian Standard Use of Sulphur type Chemical Resistant Mortars — Code of practice** (*Second Revision* of IS 4442), 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 (26661) WC

Title: Use of Sulphur type Chemical Resistant Mortars — Code of practice
(*Second Revision of IS 4442*)

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 SULPHUR TYPE CHEMICAL RESISTANT MORTARS — CODE OF PRACTICE

(Second *Revision of IS 4442*)

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.

Sulphur mortars exhibit good resistance to most acids, with the exception of concentrated oxidizing acids; however, they are highly susceptible to alkalis. Additionally, sulphur mortars should always be employed at temperatures below 90°C. Where conditions are questionable, specific recommendations should be obtained from the manufacturer.

This standard was first published in 1967 and was subsequently revised in 1980 with a view to provide guidance for the use of sulphur 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 storage conditions has been updated to prevent deterioration of mortar from the sun, wind and rain.
b) The recommendation to use sulphate resistant cement in the construction of structures where sulphur mortar lining is proposed has been incorporated to ensure enhanced durability and chemical resistance.

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 SULPHUR TYPE CHEMICAL RESISTANT MORTARS – CODE OF PRACTICE

(*Second Revision of IS 4442*)

1 SCOPE

This standard lays down recommendations for the storage, melting, method of use and safety precautions to be taken in handling sulphur type chemical resistant mortars.

NOTE — The requirements of sulphur type mortar have been covered in IS 4832 (Part III).

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:

Sulphur Type Chemical Resistant Mortar — An inorganic product consisting of an intimate mixture of sulphur and inert fillers, such as carbon or silica flour. Small amounts of chemically resistant inert modifying agents may be added.

4 STORAGE

Sulphur mortar shall be kept in a dry place prior to use. The mortar shall not deteriorate during storage. The manufacturer should recommend the storage conditions. Generally, it should be in a covered area and well protected from the sun, wind and rain.

5 SAFETY PRECAUTIONS

5.1 Sulphur mortar is melted and poured between the bricks or tiles. If overheated, it ignites and burns with a low blue flame. When the blue flame is observed, heating shall be stopped and the vessel shall be covered with a tight fitting lid or wet gunny bags until the fire is extinguished. When applying sulphur mortar in a confined space, each pail of molten material shall be checked to ensure that the mortar is not burning. The blue flame shall be checked in a dark place.

5.2 All surfaces coming into contact with molten sulphur mortar shall be kept dry. Adequate safety precautions shall be taken during the melting and pouring of sulphur mortars. The operators shall be provided with leather aprons, asbestos gloves, asbestos boots, goggles and masks. The areas where melting and pouring are carried out shall be checked for flammable or explosive gases, and a flame permit shall be issued before the fires are lit or the molten sulphur mortar is carried into the area. Soda-acid type fire extinguishing equipment and wet cloth or asbestos cloth shall be made available for extinguishing fire or preventing its spread. Water shall be kept away from molten sulphur mortar in order to avoid foaming. Adequate ventilation should be provided wherever sulphur mortars are used.

6 EQUIPMENT

6.1 The equipment given at **6.2** to **6.4** should be used for handling sulphur mortar. All equipment shall be kept clean and dry.

6.2 Vessel

Vessel made of cast iron, steel, or aluminium for melting the sulphur mortar. The vessel should be fitted with a thermometer. Jacketed vessels are preferable in order to prevent overheating.

6.3 Long Handle Steel Ladle

For dipping and stirring.

6.4 Galvanized Bucket

Galvanized bucket of 2 litres capacity, made of cast iron or steel and having a sharp protruding nose for transporting and pouring the mortar.

7 MELTING AND POURING

7.1 The mortar shall be melted in a clean vessel (*see* **6.2**). It shall be filled with the dry sulphur mortar to no more than one half and heated slowly until the mortar has melted to a black, smooth liquid with a mirror-bright surface and the liquid is almost as free flowing as water, while stirring frequently with the steel ladle. The sulphur mortar must be dry at the time of use to avoid foaming. The mortar shall be heated to a temperature of about 135°C. Below 130°C some of the liquid will congeal over the top or around the sides of the vessel. If the mortar is heated much above 135°C, the viscosity increases until the mortar thickens and loses its mirror-like appearance.

7.1.1 If the mortar thickens on overheating, it should be allowed to cool and stirred until thin; then more cold mortar may be added, if necessary. Overheating for long periods may permanently damage the mortar. Care shall be taken that water or damp mortar do not enter the heating vessel to avoid foaming.

7.2 The molten sulphur mortar shall be taken in the galvanized bucket. The nose of the bucket shall be directed towards the joint, and the hot and viscous sulphur mortar is poured slowly into the joint without air entrapment. Any entrapped air should be removed while the mortar is hot by poking with a thin mild steel rod.

8 APPLICATION

8.1 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. Sulphate resistant cement should be used in construction of structure where this lining is proposed.

8.2 Mortar Application with Same Bedding and Jointing Materials

8.2.1 *On Floors*

Spacer chips with a surface area of about 1 cm^2 and 6 mm thick, made of sulphur mortar conforming to IS 4832 (Part III) shall be made available. The chemical resistant brick or tile shall be placed on spacer chips, with 3 chips being used under each tile.

Between the floor and the tile or brick, a 6 mm space shall be provided. The molten sulphur mortar shall be poured in a maximum of two operations, into the spaces between the floor and the tile or brick, avoiding air pockets until it completely fills the joints. Trim off excess mortar to make the joints smooth and plane finish using a hot trowel.

8.2.2 *On Walls*

The chemically resistant brick or tile shall be placed 6 mm away from the wall and the adjacent tile or brick using spacer chips with a surface area of 1 cm^2 and 6 mm thick and made of sulphur mortar. The vertical and horizontal joints should be sealed using gummed strip paper of 25 mm wide to prevent the flow of molten sulphur mortar from the joints. The mortar shall be filled, avoiding air entrapment, leaving a gap of 25 mm from the top. A further course of tile or brick shall be laid in the same way immediately thereafter. The gummed paper can be stripped off as soon as the sulphur mortar has hardened.

8.3 Mortar Application with Different Bedding and Jointing Materials.

8.3.1 *On Floors*

Spread silicate type mortar 6 to 8 mm thick onto the back and two adjacent sides of the tile or brick. Press the tile or brick on the bed and push against the floor and the adjacent tile or brick until the joint in each case is not more than 6 mm thick. 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 has properly set, cure the joints with acid for a minimum period of 72 hours and dry. If the bedding material is silicate type mortar, the laying and curing shall be done as per IS 4441. Fill up the joints completely to their entire length with sulphur mortar as given in **7.2**. Trim off excess mortar to make the joints smooth and plane with a hot trowel.

8.3.2 *On Walls*

Spread silicate type mortar 6 to 8 mm thick onto the back and two adjacent sides of the tile or brick. Press the tile or brick against the wall and the adjacent tile or brick until the joint in each case is not more than 6 mm thick. 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, remove the jointing material 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 set, cure the joints with resin for a minimum period of 72 hours and dry. If the bedding material is silicate type mortar the laying and curing shall be done as per IS 4441. Seal the vertical and horizontal joints with a strip of gummed paper 25 mm wide to prevent the flow of sulphur mortar from the joints. Fill up the joints completely with molten sulphur mortar, avoiding air entrapment. Strip off the gummed paper after the mortar has hardened. Trim off excess mortar with a hot trowel to make the joints smooth and plane.

8.4 Protecting the Brick or Tile from the Mortar

Various methods are available for masking the masonry units to prevent sulphur mortar from adhering to them. Paraffin wax, paper, etc may be used to cover the masonry units. The paraffin wax or paper shall be removed after use.

8.5 Floors laid with sulphur mortar shall not be put into service before 8 hours of laying.

9 CHEMICAL RESISTANCE OF SULPHUR TYPE MORTARS

9.1 A general guide for chemical resistance of sulphur type mortars to various substances is given in Table 1. The ratings are for immersion service at ambient temperature and may usually be upgraded for spillage only. Specific recommendations should be obtained from the manufacturer where conditions are questionable. The chemical resistance of sulphur mortar shall be determined in accordance with the method prescribed in IS 4456 (Part II).

Table 1 Chemical Resistance of Sulphur type Mortars
(Clause 9.1)

Sl No.	SUBSTANCE	CHEMICAL RESISTANCE
(1)	(2)	(3)
	Acids:	
i)	Hydrochloric acid (concentrated)	R
ii)	Sulphuric acid (70 percent)	R
iii)	Sulphuric acid (above 70 percent)	L
iv)	Nitric acid (40 percent)	R
v)	Nitric acid (above 40 percent)	N
vi)	Organic acid	L
vii)	Hydrofluoric acid (40 percent) (*see* Note)	R
	Alkalies:	
i)	Sodium hydroxide (1 percent)	R
ii)	Sodium hydroxide (above 1 percent)	N
iii)	Sodium carbonate (concentrated)	R
iv)	Salt solutions (acidic)	R
v)	Salt solutions (alkaline)	L
	Solvents:	
i)	Aliphatic hydrocarbons	L
ii)	Aromatic	L
iii)	Alcohols	R
iv)	Ketones	L
v)	Chlorinated hydrocarbons	L
	Fats and Oils	L

NOTES

1 R = Generally recommended.
L = Limited use (occasionsal spillage)
N = Not recommended.

2 Graphite and carbon filler should be used for hydrofluoric acid service.

ANNEX A
(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 4441 : 1980	Code of practice for use of Silicate type Chemical resistant Mortars (*first revision*)
IS 4456 (Part 2) : 1967	Methods of test for Chemical resistant Mortars Part 2 Sulphur type
IS 4457 : 2007	Ceramic unglazed Vitreous Acid resisting tiles – Specification (s*econd revision*)
IS 4832 (Part 3) : 2015	Chemical Resistant Mortars: Part 3 Sulphur Type – Specification
IS 4860 : 1968	Specification for Acid-resistant bricks