IS 4442 (1980): Code of practice for use of sulphur type chemical resistant mortars [CED 5: Flooring, Wall Finishing and Roofing]

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IS : 4442 - 1980
(Reaffirmed 2001)

Indian Standard

CODE OF PRACTICE FOR USE OF SULPHUR TYPE CHEMICAL RESISTANT MORTARS

(First Revision)

UDC 691·53 : 666·971·019·34 : 69·001·3

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Price Rs 5·00

June 1980

Indian Standard

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Indian Standard

CODE OF PRACTICE FOR USE OF SULPHUR TYPE CHEMICAL RESISTANT MORTARS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 29 February 1980, after the draft finalized by the Flooring and Plastering Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The choice of the appropriate chemical mortar for use in construction as a bonding material requires adequate consideration. A particular type of mortar which may be suitable for a particular condition and environment may be completely unsuitable for another. So the selection of the bonding material has to be entirely based on the specific problem at hand. The sulphur mortars have good resistance against most of the acids except for concentrated oxidizing acids, but have very poor resistance to alkalis. The sulphur mortar shall always be used at less than 90°C. Where conditions are questionable, specific recommendations should be obtained from the manufacturer.

0.3 This standard was first published in 1967 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. The important changes incorporated in this revision relate to the method of application of such mortars. The application on walls and on floors has been laid down separately. Such detail has become particularly significant in view of the recent development. With regard to the joint thickness the provision has been modified.

0.4 In the formulation of this standard due weightage has been given to the 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 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)-1968†.

2. TERMINOLOGY

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

2.1 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.

3. STORAGE

3.1 Sulphur mortar shall be kept in a dry place prior to use. The mortar shall not deteriorate on storage.

4. SAFETY PRECAUTIONS

4.1 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 mortar is not burning. The blue flame shall be checked in a dark place.

4.2 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 is carried out shall be checked for flammable or explosive gases and a flame permit shall be

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

†Specification for chemical resistant mortars : Part III Sulphur type.

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 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.

5. EQUIPMENT

5.0 The equipment given at **5.1** to **5.3** may be used for handling sulphur mortar. All equipment shall be kept clean and dry.

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

5.2 Long Handle Steel Ladle — for dipping and stirring.

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

6. MELTING AND POURING

6.1 The mortar shall be melted in a clean vessel (*see* **5.1**). It shall be filled with the dry sulphur mortar to not 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.

6.1.1 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 get into the heating vessel so as to avoid foaming.

6.2 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.

7. APPLICATION

7.1 Surface Preparation — The surface on which chemically resistant bricks conforming to IS : 4860-1968* or tiles conforming to IS : 4457-1969† are to be laid shall be free from dirt and dampness and shall be properly cured and dried.

7.2 Mortar Application with Same Bedding and Jointing Materials

7.2.1 *On Floors* — Spacer chips with a surface area of about 1 cm^2 and 6 mm thick and made of sulphur mortar conforming to IS : 4832 (Part III)-1968‡ shall be made available. The chemical resistant brick or tile shall be placed on spacer chips, 3 chips being used under each tile. Between the floor and the tile or brick 6 mm space shall be provided. The molten sulphur mortar shall be poured in a maximum of two operations, in the spaces between the floor and the tile or brick avoiding air pockets till it completely fills the joints. Trim off excess mortar to make the joints smooth and plane finish using a hot trowel.

7.2.2 *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 out of sulphur mortar. The vertical and horizontal joints are 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.

7.3 Mortar Application with Different Bedding and Jointing Materials

7.3.1 *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 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 : 4441-1980§. Fill up the joints completely to its entire

*Specification for acid-resistant bricks.
†Specification for ceramic unglazed vitreous acid-resistant tiles.
‡Specification for chemical resistant mortars : Part III Sulphur type.
§Code of practice for use of silicate type chemical resistant mortars.

length with sulphur mortar as given in **6.2.** Trim off excess mortar to make the joints smooth and plane with a hot trowel.

7.3.2 *On Walls* — Spread on to the back and two adjacent sides of the tile or brick, the silicate 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 not more than 6 mm thick. Only one course of tile or brick shall be laid during 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 : 4441-1980*. 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.

7.4 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.

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

8. CHEMICAL RESISTANCE OF SULPHUR TYPE MORTARS

8.1 A general guide for chemical resistance of sulphur type mortars to various substance 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) - 1967†.

*Code of practice for use of silicate type chemical resistant mortars.
†Methods of test for chemical resistant mortars : Part II Sulphur type.

TABLE 1 CHEMICAL RESISTANCE OF SULPHUR TYPE MORTARS

(*Clause* 8.1)

Sl No.	Substance	Chemical Resistance
(1)	(2)	(3)
	Acids	
i)	Hydrochloric acid (concentrated)	R
ii)	Sulphuric acid (70%)	R
iii)	Sulphuric acid (above 70%)	L
iv)	Nitric acid (40%)	R
v)	Nitric acid (above 40%)	N
vi)	Organic acid	L
vii)	Hydrofluoric acid (40%) (*see* Note)	R
	Alkalis	
i)	Sodium hydroxide (1%)	R
ii)	Sodium hydroxide (above 1%)	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

R = Generally recommended,
L = Limited use, and
N = Not recommended.

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

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FLOORING AND PLASTERING

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653-1962 Sheet linoleum (*revised*)
657-1962 Materials for use in the manufacture of magnesium oxychloride flooring compositions (*revised*)
658-1962 Code of practice for magnesium oxychloride composition floors (*revised*)
809-1970 Rubber flooring materials for general purposes (*first revision*)
1195-1978 Bitumen mastic for flooring (*second revision*)
1196-1978 Code of practice for laying bitumen mastic flooring (*second revision*)
1197-1970 Code of practice for laying of rubber floors (*first revision*)
1198-1958 Code of practice for laying and maintenance of linoleum floors
1237-1980 Cement concrete flooring tiles (*first revision*)
1443-1972 Code of practice for laying and finishing of cement concrete flooring tiles (*first revision*)
1542-1977 Sand for plaster (*first revision*)
1630-1960 Mason's tools for plaster work and pointing work
1661-1972 Code of practice for application of cement and cement lime plaster finishes (*first revision*)
2114-1962 Code of practice for laying *in-situ* terrazzo floor finish
2394-1965 Code of practice for application of lime plaster finish
2402-1963 Code of practice for external rendered finish
2571-1970 Code of practice for laying *in-situ* cement concrete flooring (*first revision*)
3461-1966 PVC (vinyl) asbestos floor tiles
3462-1980 Flexible PVC flooring (*first revision*)
3463-1966 Polystyrene wall tiles
3464-1966 Methods of test for plastic flooring and wall tiles
4112-1967 Code of practice for fixing of polystyrene wall tiles
4441-1980 Code of practice for use of silicate type chemical resistant mortars (*first revision*)
4442-1980 Code of practice for use of sulphur type chemical resistant mortars (*first revision*)
4443-1980 Code of practic for use of resin type chemical resistant mortars (*first revision*)
4456 Methods of test for chemical resistant mortars:
(Part I)-1967 Part I Silicate type and resin type
(Part II)-1967 Part II Sulphur type
4457-1967 Ceramic unglazed vitreous acid-resistant tiles
4631-1968 Code of practice for laying of epoxy resin floor toppings
4832 Chemical resistant mortars:
(Part I)-1969 Part I Silicate type
(Part II)-1969 Part II Resin type
(Part III)-1968 Part III Sulphur type
4860-1968 Acid-resistant bricks
4971-1968 Recommendations for selection of industrial floor finishes
5317-1969 Bitumen mastic for bridge decking and roads
5318-1969 Code of practice for laying of flexible PVC sheets and tile flooring
5491-1969 Code of practice for laying *in-situ* granolithic concrete floor topping
5766-1970 Code of practice for laying burnt clay brick flooring
6278-1971 Code of practice for white-washing and colour washing
7956-1975 Recommendations for selection of dairy floor finishes
8374-1977 Bitumen mastic, anti-static and electrically conducting grade
9162-1979 Method of test for epoxy resins, hardeners and epoxy resin compositions for floor topping
9197-1979 Epoxy resin, hardeners and epoxy resin compositions for floor topping

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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Printed at New India Printing Press, Khurja, India