



Uhde India Limited

**SECTION-13
TECHNICAL SPECIFICATIONS
CHEMICAL RESISTANT LINING**

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13.1 **SCOPE**

This section covers the specification for lining/coating to be provided over concrete and steel surfaces to protect them from the corrosive attack of chemicals in the form of leakages, spillages, overflows, washings etc. The scope of application is limited only to the external surfaces such as floors, pits, foundation sides & tops, encasing/coating to structural steel column, equipment supports such as skirts, legs, etc. and does not cover the lining to be provided inside the process equipment.

13.1.1 **Applicable Codes & Standards**

The following specifications, standards and codes are made a part of this specification. All standards, tentative specifications, specifications, codes of practices referred to herein shall be the latest edition including all applicable official amendments and revisions. In case of discrepancy between this specification and those referred to herein, this specification shall govern.

| | | |
|---------|---|---|
| IS 4832 | : | Chemical Resistant Mortar (Parts I to III) |
| IS 4441 | : | Chemical Resistant Mortar - Silicate type |
| IS 4442 | : | Chemical Resistant Mortar - Sulphur type |
| IS 4443 | : | Chemical Resistant Mortar - Resin type |
| IS 4456 | : | Testing of Mortar |
| IS 9510 | : | Bitumen Mastic - AR Grade |
| IS 1580 | : | Bitumen Compound |

13.2 **Types of Lining and Coating**

- 13.2.1 Chemical Resistant Brick-lining / Mandana Stone Lining.
- 13.2.2 Chemical Resistant Tile-lining
- 13.2.3 Chemical Resistant Brushable applications
- 13.2.4 Chemical Resistant Monolithic screed without reinforcement.

13.2.5 Chemical Resistant Monolithic screed with fibre glass reinforcement.

13.2.6 Chemical Resistant Bituminous coatings.

13.3 MATERIALS SPECIFICATIONS

13.3.1 Bituminous Primer Coat

This shall be of Acid Resistant Grade conforming to IS:3384. The material may be suitable for either cold or hot applications over concrete and/or steel surfaces.

13.3.2 Mastic Layer

The mastic for hot application over the primer coat shall be of Acid Resistant grade conforming to IS:9510. The thickness of the layer shall be minimum 10 mm or as specified in the drgs. whichever is higher. The general purpose A.R. mastic shall be used for floors and drain/trenches of depth not more than 800 to 1000mm. For pits containing liquid, SPECIAL MASTIC of approved make shall be used for horizontal & vertical surfaces and minimum thickness shall be 10mm. The mastic layer shall be used only as an inner layer, before application of bricks/tiles.

13.3.3 Flexivynyl Lining in Place of Mastic Layer

This material shall be used only as inner layer before the application of brick and tile lining. Minimum thickness of flexi-Vinyl application shall be 6 mm. The material to be used shall be from one of the approved manufacturers (Refer to Data Sheet 'B').

A coat of emulsified Bituminous primer shall be applied over Flexivynyl lining to make it compatible with the brick-lining bedding cement and to achieve the proper bond between flexivynyl lining and brick lining.

13.3.4 Chemical Resistant Bricks/Tiles/Mandana Stone13.3.4.1 Bricks

These shall be of Acid resistant quality, conforming to IS:4860 and of approved make. The size shall be 230 x 115 mm. and thickness shall be one of the standard thicknesses namely 38,50,65,75 mm. as specified in the drg. and schedule item description. The surfaces shall be even and free from undulations, cracks, holes, pits etc. The dimensional tolerance shall be $\pm 2\%$.

13.3.4.2 Tiles

Tiles shall be of Ceramic material with vitrified surface conforming to IS:4457, having thickness not less than 20 mm x 200 mm.

13.3.4.3 Mandana Stone

This shall be from natural sand stone commercially known as Mandana stone. The size shall be 600 mm x 600 mm or any other suitable size that can be easily handled. The thickness shall be 25 mm to 30 mm. These shall be resistant to Acidic / Alkaline spillage upto 98% concentration and temperature upto 50°C.

13.3.5 Cementing materials for bedding, jointing and pointing.

The cementing materials to be used shall be of chemical resistant quality & conforming to respective IS-Specifications. The material shall be one of the following cements and as specified in the drawing and schedule item description. The shelf life of the various materials shall be carefully observed as indicated by the manufacturer.

13.3.5.1 Potassium Silicate Cement

This shall be used only as a bedding material and not for pointing work. The application for jointing on sides shall be only to such an extent as to leave a minimum depth of 20 mm for pointing with other types of cements not soluble in water. Minimum thickness of bedding shall be 10 mm and for jointing 6 mm. Mixing, application shall be as per manufacturers specifications.

Silicate cement to be supplied and used, shall be from one of the approved manufacturers.

13.3.5.2 Phenolic Resin Based Cement

This shall be used as bedding and jointing material or pointing material. Minimum thickness shall be 6mm for bedding and 3mm for jointing. The material to be used shall be from one of the approved manufacturers.

13.3.5.3 Furane Resin Based Cement

This shall be used as bedding and jointing or pointing material. Minimum thickness shall be 6 mm for bedding and 3 mm for jointing. The material to be used shall be from one of the approved manufacturers.

13.3.5.4 Cashew-nut oil resin based cement

This shall be used for bedding and jointing or pointing material. Minimum thickness shall be 6 mm for bedding and 3mm for jointing. The material to be used shall be from one of the approved manufacturers.

13.3.5.5 Vinyl-Ester Resin based cement

This shall be used as bedding and jointing or pointing materials. Minimum thickness shall be 6mm for bedding and 3mm for jointing. Materials to be used shall be from one of the approved manufacturers.

13.3.5.6 Epoxy based cements

These shall be used as bedding and jointing or pointing or screeding/coating materials as specified in schedule items and construction drawings. All ingredients of Epoxy formulations to be used shall be of approved make. Minimum thickness to be used for different applications shall be as follows:

(A) Primer coat - Minimum 50 micros of dry-film or as manufacturer,s specifications, whichever is more.

(B) Unreinforced brushable application with Silica or carbon powder as filler materials - Min. thickness per coat 150 microns.

(C) Unreinforced monolithic screed - Minimum thickness shall be 3 mm per layer and number of layers shall be as per construction drawings, to achieve the required total thickness.

(D) Reinforced Brushable Application

Brushable Epoxy application, reinforced with Fiberglass tissue fabric shall have a minimum thickness of 200 microns for a single layer consisting of 2 flood coats of epoxy with Fibre-glass tissue fabric, sandwiched in between. Number of such layers shall be decided as per schedule item specifications and construction Drawings

(E) Reinforced Monolithic Epoxy Screed

Minimum thickness of one layer consisting of two sub-layers of monolithic epoxy mortar application with fiberglass tissue fabric reinforcement sandwiched between the two, shall be 4mm and number of such layers shall be decided as per schedule item specifications and construction drawings.

(F) Material specifications for Fillers and Reinf-Fabric

F/1 Silica or Carbon/graphite powder.

The powder particle size shall be passing through BS-sieve 100 for Quartz silica powder and carbon/graphite powder and shall be clean and free from impurities and moisture. The proportion of filler material by weight, to be added to resin shall be as per manufacturer's specification and shall be different for different applications as in A to E above.

F/2 Fibre Glass Tissue Fabric

This shall be of approved make. The grade to be used shall have minimum unit weight of 450 gms per.sq.mtr of the fabric.

13.4 Method of Application**13.4.1** Surface Cleaning & Preparation

The concrete or steel surface to be protected shall be carefully examined to ensure evenness, freedom from cracks/holes/undulations and shall be thoroughly cleaned of all loose particles, dust and preferably by using dry compressed air. In underground pits and trenches, the leak test shall be insisted upon and shall be examined for dampness, seepage etc. on the bottom or walls. Any defects in concrete or pits and damp proofness shall be got rectified from civil contractor through the supervising Engineer. The surface shall be made dry before application of primer coat. If the surface is not levelled to the required slopes and grade, the same shall be got done through civil contractor by using cement mortar screed, properly set and cured.

13.4.2 One coat of Bitumen primer as specified shall be applied on the clean dry surface of the screed, after ensuring the quality acceptance of the surface to be protected and obtaining approval thereof.

13.4.3 After the application of Bituminous Primer a layer of acid resistant mastic shall be laid over it. The mastic layer shall conform to IS:9510 and be of acid resistant grade. The thickness of this layer shall be 20 mm for floors and 12 mm for vertical surfaces. In HF-conditions carbon filler material shall be used in place of Quartz powder. If Special Mastic is specified, the thickness shall be limited to 10 mm.

13.4.4 The bricks are set in full mortar bed and jointing is done as specified in the following paragraphs. The bricks shall be coated with the mortar on side forming bed & joints and then placed in position, by properly pressing and squeezing out the excess mortar to ensure 100% application over brick surfaces. The brick laying shall be done in one of the ways specified in following five alternatives; with respect to type of cement used in bedding and jointing.

Alternative 1:

The mortar bed shall consist of Potassium silicate cement and prepared conforming to IS:4832 (Part 1) and IS:4456 (Part-1). Bricks shall be set in position after application of mortar of appropriate consistency, over bottom and sides, of the brick and then properly pressed in to its place ensuring minimum thickness of 10 mm for bedding and 5 mm for jointing leaving 20mm deep joint, open from top for pointing work. All the loose particles and impurities from the joints shall be removed and pointing shall be done using selected Resin-based cement. The joints shall be arranged in such a way that there is a continuous joint in the longitudinal direction of bricks and in the direction of slope. They should be staggered in the perpendicular direction of slope and in the cross direction of longer side of bricks.

Alternative 2:

The mortar bed conforming to IS:4832 (part II) shall consist of Phenolic resin based cement [see para 13.3.5.2] and filler of quartz silica powder [see para 13.3.5.6(F)]. Thickness of mortar shall be 6 mm and bricks shall be laid with 3 mm wide joints filled with Phenolic resin cement completely including flush pointing with the same cement. Arrangement of joints shall be as described under Alternative 1 above. The mortar shall be applied with trowel over bottom and sides of the brick before placing it in position.

Alternative 3:

All specifications shall be as per Alternative-2 except for the cement, which shall be Furane resin based in place of phenolic resin based.

Alternative 4:

All specifications shall be same as for Alt-2 except for the cement which shall be Cashewnut Oil resin based in place of phenolic resin based.

Alternative 5:

All specifications shall be same as for Alt-2 except for the cement which shall be Vinyl Ester based resin.

13.5 Procedure for Laying Tile-Lining

Procedure for tile lining shall be exactly the same as for brick laying except that the thickness of tile shall be generally limited to max. 20mm or as specified in drawings whichever is lower. Alternative No.1 shall not be applicable in case of tile lining. Alternatives 2 to 5 shall be applicable to tile lining.

13.6 Kerbs and Wall Connections

The lining and the mastic shall be taken and terminated horizontally to cover the top of kerbs and walls. Further continuation of lining over outside surfaces of kerbs and walls shall be as per construction drawings.

13.7 Lining Over Equipment Foundations

When lining is laid over equipment foundations the portion of bolt holes within the thickness of tile lining shall be filled with the same cement as is used in the lining. Pockets, if left for bolts, shall be grouted upto unfinished top of concrete with cement grout, prior to the lining work. This shall be in scope of others.

13.8 Wherever a pipe nozzle is penetrating through wall the lining shall be laid to ensure that there are no crevices, gaps around the nozzles by properly filling up the cement in the annular gap around the nozzles and puddle flanges.

13.9 Procedure for Application of Epoxy Based Lining

The following specification covers the requirements for application of epoxy based lining.

13.9.1 All materials described here are products of HINDUSTAN CIBA GEIGY. They shall be received and stored as per manufacturer's instructions. Equivalent make materials may be used with Engineer's prior approval in writing.

13.9.2 Use of these materials shall be limited to areas where maximum temperatures are below 90°C or as specified by the respective manufacturer, whichever is less.

13.9.3 In all applications, the manufacturer's instructions shall be strictly followed, since epoxy resin materials require great care in handling and application.

13.9.4 Materials (CIBA GEIGY MAKE)

ARALDITE GY - 257

ARALDITE GY - 250

HARDENER HY - 840

HARDENER HY - 830

HARDENER HY - 850

QUARTZ SILICA POWDER - Passing through BS Sieve 100 mesh or 3 mm chips as required by the thickness of lining.

13.9.5 Method of Application and Types of Lining

This is specified as given below for following four alternatives 1 to 4 :

Alternative 1 - Brushable Application without Fibre Glass Reinforcement

(a) Primer Coat

One coat of primer shall be applied over the surface ready for lining, with a clean brush using a mixture of 100 parts by weight of Araldite GY-257 and 50 parts by weight of Hardener HY-840 mixed and prepared and having pot-life as per manufacturers' specification.

(b) Finish Coats

A mixture shall be prepared to the brushable consistency using following proportion of ingredients:

- 100 parts by weight of Araldite GY 250,
- 45 parts by weight of Hardener HY 830,
- 15 parts by weight of hardener Hy 850, and

- Min. 100 parts by weight of Quartz silica powder.

Weight of Quartz powder in a batch shall be adjusted so as to get a proper brushable consistency. Minimum two coats shall be applied with drying and curing time interval between the two coats as specified by the manufacturer.

Alternative 2 - Brushable Application with Fibre Glass Tissue Fabric Reinforcement

All specs. shall be the same as for Alternative No.1, except that fibre glass tissue reinforcement shall be laid after 2 flood coats of epoxy formulation. The fabric shall be so laid and pressed in position as to remove all air pockets, waviness, folding, wrinkles etc. in the fabric layer. Number of such sandwiched layers shall be as per construction drawing.

Alternative 3 - Monolithic screed without reinforcement

(a) One coat of primer shall be applied over the prepared screed with a clean brush using a mixture of 100 parts by weight of Araldite GY 257 and 50 parts by weight of Hardener HY 840 prepared as per manufacturer's instructions.

(b) Screed coat

A mixture shall be prepared with following ingredients:

- 100 parts by weight of Araldite GY 250,
- 45 parts by weight of Hardener HY 830,
- 15 parts by weight of Hardener HY 850,
- 800 parts by weight of Quartz silica powder passing through 100 mesh B.S. sieve. This mixture shall be applied with a trowel over the primed surface to the required level and allowed to set. The thickness of this layer shall be 3 to 4 mm or as specified in the construction drawings.

Alternative 4 - Monolithic screed with fibre glass reinforcement

Wherever reinforced screed lining is specified, it shall be applied with following specifications:

- (a) One primer coat is applied with a clean brush using a mixture of 100 parts by weight of Araldite GY 257 and 50 parts by weight of Hardener HY 840.
- (b) First layer of the following mixture shall be applied with trowel.
- 100 parts by weight of Araldite Gy 250,
 - 45 parts by weight of Hardener HY 830,
 - 15 parts by weight of Hardener HY 850, and
 - 400 parts by weight of Quartz silica powder passing through 100 mesh B.S. sieve.
- (c) Intermediate layer of fiberglass tissue cloth shall be laid over the first coat ensuring no air pockets and with a lap of 100 mm between two adjacent parts of fibreglass cloth of standard width and length. A flood coat as in Alternative No.2 shall be applied for proper lap joining.
- (d) Second layer of screed shall be applied as described in (b) above. Min. thickness and number of layers shall be as per construction drawings.

13.10 For temperatures of 100° C to 150° C the following specifications shall be used. All materials shall be of Dr.Beck & Co. make or equivalent approved.

13.10.1 Material

DOBECKOT 520 F
HARDENER EH 408
HARDENER 758
GLASS FIBER TISSUE MATT (30 gms)
CHOPPED STRAND MAT (CSM)

The above products are from Dr. BECK & CO, PUNE. Equivalent make materials may be used with Engineer's prior approval in writing.

13.10.2

Application ProcedureA) Surface preparation

Surface preparation shall be as described in para 13.14.1. Care shall be taken to see that the surface is free from moisture. The slab is tested for moisture content and a slab with less than 12 percent moisture is considered suitable for application of the epoxy lining. Testing shall be carried out by covering an area of one sq.metre with a polythene sheet with edges sealed against external moisture for a minimum period of seven days. If moisture collects on the under surface of the sheet then the slab is not considered suitable for application of the epoxy coating. It should be ensured that moisture does not enter the under side of polyethylene sheet through sources other than evaporation.

When the time available for testing is short then the following two methods are used.

- (a) The surface shall be covered with a nonporous rubber mat for twelve hours. If moisture collects on the under surface of the mat then the coating shall not be applied.
- (b) A few granules of calcium are placed over a small area and covered with a dry glass plate and the edges are sealed to prevent the entry of moisture from outside. If the granules are dry after 2 or 3 hours then the slab is suitable to receive the coating.

Alternatively, an approved Moisture meter may be used for measurement of moisture percentage.

B) Mixing proportion shall be as follows:

- | | | | |
|--------------------|---|----------------------|-----------------------------------|
| (a) Dobeckot 530 F | : | 100 parts by weight: | } for brushable application |
| Hardener EH 408 | : | 25 parts by weight: | |
| Hardener 758 | : | 5 parts by weight: | |
| Thinner 21 | : | as required: | |

| | | | |
|--------------------|---|---|---|
| (b) Dobeckot 530 F | : | 100 parts by weight: | } for screed applied with trowel |
| Hardener EH 408 | : | 25 parts by weight: | |
| Hardener 758 | : | 5 parts by weight: | |
| Sand 0.1 to 1 mm | : | 400 to 600 parts by weight with a Silica powder (90size) | |
| | : | 60 to 80 parts by weight: | |

13.10.3 Chemical resistant coating (Brushable application) using Dr. Beck & Co. products

The mixture as described in 13.10.2B/(a) shall be applied over the prepared surface with a clean brush as a primer coat. A second coat of the same mixture shall be applied as a finishing coat if required by manufacturer's specs.

13.10.4 Chemical resistant laminated reinforced coating

The mixture as described in 13.10.2-B/(a) shall be applied over the prepared surface. Reinforcement such as fibreglass tissue cloth or surface tissue mat or chopped strand mat is placed and wetted with the same mixture. On this, a finishing coat of the same mixture as in 13.10.2-B(a) is applied.

13.10.5 Monolithic screed

Over a coat of primer with the mixture given in 13.10.2-B/(a) a screed made out of the mixture as given in 13.10.2-B/(b) is applied as per manufacturer's specifications.

13.10.6 The specifications under 13.10 shall be followed in conjunction with those of Dr.BECK & Co, Pune or approved equivalent.

13.11 The recommended Corrosion resistance to different duty conditions shall be as per Table 1,2 and 3.

13.12 The dry heat limit of various resins shall be as per Table 4.



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LINING TYPE DESIGNATIONS AND CORRESPONDING SPECIFICATIONS

13.13.1

LEGEND

| | | |
|-----|---|---|
| MA | - | MASTIC |
| FX | - | FLEXIVINYL |
| BR | - | BRICKS |
| CT | - | CERAMIC TILES |
| KS | - | SILICATE CEMENT |
| PH | - | PHENOLIC RESIN CEMENT |
| F | - | FURANE RESIN CEMENT |
| VE | - | VINYL ESTER CEMENT |
| CN | - | CASHEW NUT OIL RESIN CEMENT |
| EP | - | EPOXY BASED LINING |
| BRU | - | BRUSHABLE APPLICATION |
| SCR | - | EPOXY SCREED |
| FG | - | FIBREGLASS REINFORCEMENT |
| DRB | - | DR. BECK & CO. PRODUCT |
| GVE | - | GLASS REINFORCED VINYL ESTER BASED LINING |
| MT | - | MANDANA TILES |



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| Type | Sub Type | Description | Spec. Ref. |
|------|-------------|--|-------------------------------|
| MA | MA/15 | 15mm Thick Mastic Lining | 13.3.1 / |
| | MA/20 | 20mm Thick Mastic Lining | 13.3.2 |
| FX | FX 6 | 6mm Thick Flexivinyll Lining | 13.3.3 |
| | FX 8 | 8mm Thick Flexivinyll Lining | |
| BR | BR/38/KS/PH | Brick Lining 38 Thick. with 10mm Thick Silicate cement bedding & 6mm Thick Phenolic cement pointing. | 13.3.4 / |
| | | | 13.3.5.2/ 13.4 |
| | BR/38/KS/F | Same as above but pointing with furane cement. | 13.3.4/ 13.3.5.3/ 13.4 |
| | BR/38/KS/VE | Same as above but pointing with vinyl ester based cement. | 13.3.4 / 13.4/ 13.3.5.5 |
| | BR/38/KS/CN | Same as above but pointing with cashew nut oil resin cement. | 13.3.4 / 13.3.5.4/ 13.4 |
| | BR/38/PH | Brick lining in 6mm Thick cement bedding and 3mm Thick Phenolic cement jointing. | 13.3.4/ 13.4/ 13.3.5.2 |
| | BR/38/F | Same as above but with furane cement. | 13.3.4 13.3.5.3 13.4 |
| | BR/38/VE | Same as above but with vinyl resin. | 13.3.4 13.3.5.5 13.4 |
| | BR/38/CN | Same as above but with cashew nut resin based cement. | 13.3.4 13.3.5.4 13.4 |

The Sub-type 'BR' designation shall change according to recommended brick thickness. For example, if 75 mm brick is used with silicate bedding and phenolic cement pointing, the sub-type shall be BR/75/KS/PH.

13.14 Specification for Cast Iron Gratings

The overall dimensions of C.I. gratings shall be as detailed in drawings. The material shall be grey Cast Iron not inferior to FG 150 grade as per IS:120. The minimum tensile strength shall be 150 N/mm² and Brinell hardness of 130 to 180. The gratings shall be cast smooth true to dimensions as detailed in working drawings and properly levelled.

13.15 RECOMMENDED TYPE OF LINING FOR DIFFERENT DUTY CONDITIONS

| | Duty Cond. | Exposure | Temp. | Recommended Lining |
|---|---|-----------------------|------------------------|-------------------------|
| 1 | Upto 98% H ₂ SO ₄ | Within OR Outside | 25 Deg. C to 80 Deg. C | BR/38/KS/PH OR BR/38/PH |
| 2 | 5% TO 50% NaOH | ---do--- | ---do--- | ---do--- |
| 3 | 30% Hcl | ---do--- | ---do--- | ---do--- |
| 4 | 5% TO 50% NaOH & Electrical resistance of 50K Ohm | INSIDE | 50 Deg. C | EP/SCR/5 OR EP/SCR/3 |
| 5 | 50% Alkaline with no Silica pick-up. | INSIDE SATURATOR PITS | 50 Deg. C | GVB |

13.16 Mode of Measurement

The payment shall be on square metre basis of finished area. The rates quoted shall be all inclusive of materials, labour, supervision, transport, taxes/duties, octroi, wastage, guarantees, profits and all other incidental expenses.

TABLE 1 : CHEMICAL RESISTANCE OF RESIN TYPE MORTARS

| Sr. No. | Substance | Epoxy | Polyester | Phenolic | Furane | Cashew Nut Shell Liquid |
|---------|---------------------------------------|-------|-----------|----------|--------|-------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | Acids:- | | | | | |
| I) | Acetic Acid 10% | R | R | R | R | R |
| ii) | Cromic Acid 10% | N | R | L | N | L |
| iii) | Hydrochloric Acid (conc) | R | R | R | R | R |
| iv) | Hydrochloric Acid 40% (see Note 2) | N | N | R | R | R |
| v) | Lactic Acid 2% | R | R | R | R | R |
| vi) | Nitric Acid 10% | L | N | L | N | L |
| vii) | Nitric Acid (conc) | N | N | N | N | N |
| viii) | Phosphoric Acid 10% | R | R | R | R | R |
| ix) | Sulphuric Acid 10% | R | R | R | R | R |
| x) | Sulphuric Acid 40% | R | R | R | R | R |
| xi) | Sulphuric Acid (conc.) | N | N | L | N | N |
| | Alkalies: | | | | | |
| I) | Ammonia 0.880 | R | N | L | R | R |
| ii) | Sodium Hydroxide 40% | 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 (oxidising) | N | N | N | N | N |
| | Wet Gases (reducing) | R | R | R | R | R |
| | Mineral Oils | R | R | R | R | L |
| | Vegetable Oils and Fats | R | R | R | R | L |



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Note 1 - R = Generally recommended
L = Limited use (occasional spillage)
N = Not recommended

Note 2 - Carbon and graphite filters should be used for hydrofluoric acid service

TABLE 2 : CHEMICAL RESISTANCE OF SILICATE TYPE MORTARS (from IS:4441-1980)

| Sr.No. | Substance | CHEMICAL RESISTANCE | |
|--------|--|-------------------------|----------------------------|
| | | Sodium Silicate Type | Potassium Silicate Type |
| 1 | 2 | 3 | 4 |
| | Acids: | | |
| I) | Hydrochloric Acid (concentrated) | R | R |
| I) | Sulphuric Acid 10% | R | R |
| iii) | Sulphuric Acid (10 to 50%) | L | R |
| iv) | Sulphuric Acid (above 50%) (see Note) | N | R |
| v) | Nitric Acid (concentrated) | R | R |
| vi) | Organic Acids (conc.) | R | R |
| vii) | Hydrofluoric Acid (any strength) | N | N |
| | Alkalies: | | |
| I) | Sodium Hydroxide (any strength) | N | N |
| ii) | Sodium Carbonate (any strength) | N | N |
| | Salt Solutions: | | |
| I) | Acidic (pH value less than 4) | R | R |
| ii) | Alkaline | N | N |
| iii) | Neutral | L | L |
| | Solvents: | | |
| I) | Aliphatic hydrocarbons | R | R |
| ii) | Aromatic hydrocarbons | R | R |
| iii) | Alcohols | R | R |
| iv) | Ketones | R | R |
| v) | Chlorinated hydrocarbons | R | R |
| | Fats and Oils | R | R |

- R = Generally recommended
L = Limited use (occasional spillage)
N = Not recommended

Note - Potassium Silicate mortar used for resistance of sulphuric acid (above 90 percent), for a prolonged period, may cause crystal formation with subsequent growth within the pores and can disintegrate these mortars.

TABLE 3 : CHEMICAL RESISTANCE OF SULPHUR TYPE MORTARS (From IS:4442-1980)

| Sr.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 |
| | Alkalies: | |
| 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 hydrocarbons | L |
| iii) | Alcohols | R |
| iv) | Ketones | L |
| v) | Chlorinated hydrocarbons | L |
| | Fats and Oils | L |

R = Generally recommended

L = Limited use

N = Not recommended

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

TABLE 4 - DRY HEAT LIMITS IN AIR OF RESIN TYPE MORTARS (From IS:4443-1980)

| Sr.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) | Cashewnut Shell Liquid Resin | 170-180 |