STANDARD SPECIFICATION FOR ACID PROOF LINING

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.

2. 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.

3. Types of Lining and Coating
Acid Resistant Brick-lining
Acid Resistant Tile-lining
Acid Resistant Epoxy-lining

4. Material specifications
4.1. 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.

4.2. Mastic Layer
The mastic for hot application over the primer coat shall be of Acid Resistant grade conforming to IS: 9510. The general purpose Acid Resistant Mastic shall be used for floors and drain/trenches of depth not more than 800 to 1000 mm. The mastic layer shall be used only as an inner layer, before application of bricks/tiles.

4.3. Flexi vinyl 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. A coat of emulsified bituminous primer shall be applied over Flexi vinyl lining to make it compatible with the brick-lining bedding cement and to achieve the proper bond between flexi vinyl lining and brick lining.

4.4. Chemical Resistant Bricks/Tiles
4.4.1. 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 following standard thickness viz. 38,50,65,75 mm. as specified in the drg. and schedule of item description. The surfaces shall be even and free from undulations, cracks, holes, pits ,etc. The dimensional tolerance shall be 2%.

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

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

4.5.1. 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.

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

4.5.3. 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.

4.5.4. 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 3 mm for jointing. The material to be used shall be from one of the approved manufacturers.

4.5.5. Vinyl-Ester Resin based cement
This shall be used as bedding and jointing or pointing materials. Minimum thickness shall be 6 mm for bedding and 3 mm for jointing. Materials to be used shall be from one of the approved manufacturers.

4.6. Epoxy based cements
These shall be used as bedding and jointing or pointing or screening/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 DFT of 50 microns or as per the manufacturer’s specifications, whichever is more.
(B) Unreinforced brushable application with Silica or carbon powder as filler materials. Min. thickness per coat shall be 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
Brush able Epoxy application, reinforced with Fiberglas tissue fabric shall have a min. thickness of 200 microns for a single layer consisting of two flood coats of epoxy with Fiberglas tissue fabric, sandwiched in between. Number of such layers shall be decided as per schedule of item specifications and construction drawings.
(E) Reinforced Monolithic Epoxy Screed
Min. thickness of one layer consisting of two sub-layers of monolithic epoxy mortar application with fibreglass tissue fabric reinforcement sandwiched between the two shall be 4mm and number of such layers shall be decided as per schedule of item specifications and construction drawings.

4.7. Fillers and Reinf-Fabric

4.7.1. 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.

4.7.2. Fiber Glass Tissue Fabric
This shall be of approved make. The grade to be used shall have min. unit weight of 450 gm / sqm. of the fabric.

5. Methodology for Acid Resistant Brick-lining

5.1. 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 dampness 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.

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.

After the application of Bituminous Primer a layer of acid resistant mastic shall be laid over it. The mastic layer shall confirm to IS: 9510 and shall 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. For pits containing liquid, SPECIAL MASTIC of approved make shall be used for horizontal & vertical surfaces and minimum thickness shall be 10 mm.

5.2. Application
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 as follows with respect to type of cement used in bedding and jointing.

(a) Potassium Silicate Cement
This shall be used only as a bedding material and not for pointing work. The mortar bed shall consist of approved 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 10mm
for bedding and 5mm for jointing having 20mm deep joint, open from top of pointing work. All the loose particle 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.

(b) Phenolic Resin Based Cement
This shall be used as bedding and jointing material or pointing material. The mortar conforming to IS: 4832 (Part-2) shall consist of approved phenolic resin based cement and filler of quartz silica powder. Thickness of mortar shall be 6mm and bricks shall be laid with 3mm 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.

(c) Furane Resin based Cement
All specifications shall be as per Alternative 2 except for the cement, which shall be approved Furane resin based in place of phenolic resin based.

(d) Cashew-nut oil resin based cement
All specifications shall be as per Alternative 2 except for the cement, which shall be approved cashew nut oil resin based in place of phenolic resin based.

(e) Vinyl-Ester Resin based cement
All specifications shall be as per Alternative 2 except for the cement, which shall be approved vinyl ester based resin

6. Method of Application for Acid Resistant Tile Lining
Procedure for tile lining shall be exactly the same as for brick laying except that the thickness of the tile shall be generally limited to max. 20mm or as specified in drawings whichever is lesser. Cement used for brick lining are applicable for tile laying except for Potassium Silicate Cement which is not applicable in case of tile lining.

6.1. On kerbs and wall connections
The lining and 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 drawing.

6.2. Lining over equipment foundations
When lining is done over equipment foundations the portion of bolt holes within the thickness of tile lining shall be filled with the same cement as is issued 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. Wherever a pipe nozzle is penetrating through wall lining shall be laid to ensure that there are no crevices, gaps around the nozzle by properly filling up the cement in the annular gap around the nozzle and puddle flanges.

7. Method of Application for Acid Resistant Epoxy linings
The following specification covers the requirements for the application of epoxy-based lining.

7.1. For materials that shall be limited to areas where maximum temperatures are below 90° C or as specified by the manufacturer, whichever is less. Procedure for epoxy lining shall be exactly the same as for brick laying. All material described here are products of Hindustan Ciba Geigy. They shall be received and stored as per manufacturer’s instructions. Equivalent make can be used with Engineer’s prior approval in writing. In all applications, the manufacturer’s instructions shall be strictly followed, since epoxy resin materials require great care in handling and application.
Materials (Ciba Geigy Make)

- Araldite GY-257
- Araldite GY-250
- Hardener HY-840
- Hardener HY-850
- QUARTZ SILICA POWDER – Passing through BS sieve 100mesh or 3mm chips as required by the thickness of lining.

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

7.1.1. Brush able application without fibreglass 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 wt. Of araldite GY-257 and 50 parts by wt. of Hardener HY-840 mixed and prepared and having pot-life as per manufacturer’s specification.

   (b) Finish Coats
   A mixture shall be prepared to the brushable consistency using following portion of ingredients:
   - 100 parts by wt. Of araldite GY 250
   - 45 parts by wt. Of Hardener HY 830
   - 15 parts by wt. Of Hardener HY 850 and
   - Min. 100 parts by wt. Of Quartz silica powder
   Weight of quartz powder in a batch shall be adjusted so as to get a proper brushable Consistency. Min. 2 coats shall be applied with drying and curing time interval between the two coats as specified by the manufacturer.

7.1.2. Reinforced Brush able Application
Brushable application with fibreglass tissue fabric reinforcement all specs. Shall be the same as per Alternative-1 except the fibreglass tissue Reinforcement shall be laid after 2 flood coats of epoxy formulation. The fabric shall be laid and pressed in position as to remove all air pockets, waviness, folding, wrinkles, etc. in the fabric layer. Nos of such sandwich layers shall be as per construction drawings.

7.1.3. Unreinforced monolithic screed.
   (a) Primer Coat
   One coat of primer shall be applied over the prepared screed with a clean brush using a mixture of 100 parts by wt. Of Araldite GY 257 and 50 parts by wt. Of hardener HY-840 prepared as per manufacturer’s instructions.

   (b) Screed coat
   A mixture shall be prepared with following ingredients: -
   - 100 parts by wt. Of araldite GY 250
   - 45 parts by wt. Of Hardener HY 830
   - 15 parts by wt. Of Hardener HY 850
   - 800 parts by wt. Of Quartz silica powder passing through 100 mesh

B.S. Sieve. This mixture shall be applied with a trowel over the primed surfaces to the required level and allowed to set. The thickness of the level shall be 3 to 4 mm or as specified in the construction drawing.
7.1.4. Reinforced Monolithic Epoxy Screed
Whenever reinforced screed lining is specified it shall be applied with Following Specifications:

(a) Primer Coat
One coat of primer is applied with a clean brush using a mixture of 100 parts by wt. of Araldite GY 257 and 50 parts by wt. of hardener HY-840 prepared as per manufacturer’s instructions.

(b) First layer of the following mixture shall be applied with trowel.
- 100 parts by wt. Of araldite GY 250
- 45 parts by wt. Of Hardener HY 830
- 15 parts by wt. Of Hardener HY 850 and
- 400 parts by wt. Of Quartz silica powder passing through 100 mesh

(b) Intermediate layer of fibreglass tissue cloth shall be laid over the first coat ensuring no air pockets and with a lap of 100mm between two adjacent part of fibre glass cloth of standard width and length. A flood coat as per Annexure –2 shall be applied for proper lap joining.

(c) Second layer of screed shall be applied as described in (b) above. The minimum thickness and no. of layer shall be as specified in the construction drawing.

7.2. For temperatures of 100 deg C to 150 deg C the following specifications shall be used. All materials shall be of approved make.

7.2.1. Material
- Dobeckot 520F
- Hardener EH 408
- Hardener 758
- Glass fibre tissue matt (30gms)
- Chopped Strand matt (CSM)

7.2.2. Surface preparation
Surface preparation shall be described in Para 5.1. 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% moisture is considered suitable for application of the epoxy lining. Testing shall be carried out by covering an area of 1 sq. mtr. With a polythene sheet with edges sealed against external moisture for a min. period of 7 days. If moisture collects on under surface of the sheet then the slab is not considered suitable for the application of epoxy coating. It should be ensured that moisture does not enter the underside of polythene 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 hrs. 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 to 3 hrs. then the slab is suitable to receive the coating. Alternatively, an approved moisture meter may be used for measurement of moisture percentage.
7.2.3. Application procedure
7.2.3.1. Mixing proportion shall be as follows

(a) For brushable application
- Dobeckot 530 F: 100 parts by wt.
- Hardener EH 408: 25 parts by wt.
- Hardener 758: 5 parts by wt.
- Thinner 21: as required

(b) For screed applied with trowel
- Dobeckot 530 F: 100 parts by wt.
- Hardener EH 408: 25 parts by wt.
- Hardener 758: 5 parts by wt.
- Sans 0.1 to 1mm: 400 to 600 by wt with a silica powder
  (90 size) 60 to 80 parts by wt.

7.2.3.2. Chemical resistant coating with brushable application The mixture is described in 1.10.2B/(a) shall be applied over the prepared surfaces with a clean brush as primer coat. A second coat of the same mixture shall be applied as a finishing coat if required by manufacturer’s specifications.

7.2.3.3. Chemical resistant laminated reinforced coating The mixture is described in 1.10.2B/(a) shall be applied over the prepared surfaces with a clean brush as primer coat. 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 1.10.2B/(a) is applied.

7.2.3.4. Monolithic screed
Over a coat of primer with the mixture given in 1.10.2B/(a) a screed made out of the mixture as given in 1.10.2B/(b) is applied as per manufacturer’s specifications.

The dry heat limit of various resins shall be as per Table 1

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Type of Resin</th>
<th>Dry Heat Max deg C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Phenolic 150</td>
<td>150</td>
</tr>
<tr>
<td>2</td>
<td>Furane 150</td>
<td>150</td>
</tr>
<tr>
<td>3</td>
<td>Epoxy: 3.1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Ambient temp. system 90</td>
<td>90</td>
</tr>
<tr>
<td>5</td>
<td>Heat cured system 200</td>
<td>200</td>
</tr>
<tr>
<td>6</td>
<td>Polyester 110-120</td>
<td>110-120</td>
</tr>
<tr>
<td>7</td>
<td>Cashew nut shell liquid system 170-180</td>
<td>170-180</td>
</tr>
</tbody>
</table>

The recommended corrosion resistance to different duty conditions shall be as per Table 2, 3 and 4.

TABLE 2: CHEMICAL RESISTANCE OF RESIN TYPE MORTARS

Sr. No. Substance Epoxy Polyester Phenolic Furane Cashew Nut Shell Liquid
1 Acids: Acetic acid 10% R R R R R
Chromic acid 10% N R L N L
HCl (Con) R R R R R
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Substance</th>
<th>Sodium Silicate Type</th>
<th>Potassium Silicate Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acids:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>HCl (Con)</td>
<td>R R</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Sulphuric acid 10%</td>
<td>R R</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Sulphuric acid 10-50%</td>
<td>L R</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>Sulphuric acid (above50%)</td>
<td>N R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nitric acid</td>
<td>R R</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Alkalies:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>NaOH 40%</td>
<td>N N</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Salt Solutions:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Solution (acidic)</td>
<td>R R</td>
<td></td>
</tr>
<tr>
<td>3.2</td>
<td>Salt solution (alkaline)</td>
<td>L L</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Solvents:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Aliphatic hydrocarbons</td>
<td>R R</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>Aromatic hydrocarbons</td>
<td>L N</td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>Alcohols</td>
<td>R R</td>
<td></td>
</tr>
<tr>
<td>4.4</td>
<td>Ketones</td>
<td>L N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chlorinated hydrocarbons</td>
<td>L L</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wet gases (oxidizing)</td>
<td>R R</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wet gases (reducing)</td>
<td>R R</td>
<td>L</td>
</tr>
<tr>
<td></td>
<td>Mineral oils, Vegetable oil and fats</td>
<td>R R</td>
<td>L</td>
</tr>
</tbody>
</table>
R-Generally recommended, L-Limited use (occasional spillage), N-Not recommended

Note: Potassium silicate mortar used for resistance of H2SO4 (above 90%), for a prolonged period, may cause crystal formation with subsequent growth within the pores and can disintegrate these mortars.

**TABLE 4: CHEMICAL RESISTANCE OF SULPHUR TYPE MORTARS (IS 4442-1980)**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Substance</th>
<th>Sulphur type Mortars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acids: HCL (Con)</td>
<td>R</td>
</tr>
<tr>
<td>1.a)</td>
<td>Sulphuric acid 70%</td>
<td>R</td>
</tr>
<tr>
<td>1.b)</td>
<td>Sulphuric acid above 70%</td>
<td>L</td>
</tr>
<tr>
<td>1.c)</td>
<td>Nitric acid (40%)</td>
<td>R</td>
</tr>
<tr>
<td>Nitric acid (above 40%)</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Organic Acids (con)</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>HF (40%)</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Alkalies:</td>
<td>-</td>
</tr>
<tr>
<td>NaOH 1%</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>Sodium Carbonate above 1%</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Sodium Carbonate (con)</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>Salt Solution (acidic)</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>Salt solution (alkaline)</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>3 Solvents:</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Aliphatic hydrocarbons</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Aromatic hydrocarbons</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Alcohols</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>Ketones</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Chlorinated hydrocarbons</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Vegetable oil and fats</td>
<td>L</td>
<td></td>
</tr>
</tbody>
</table>

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

Note: Graphite & carbon filter should be used for HF service

8. LEGENDS

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA</td>
<td>MASTIC</td>
</tr>
<tr>
<td>FX</td>
<td>FLEXIVINYL</td>
</tr>
<tr>
<td>BR</td>
<td>BRICKS</td>
</tr>
<tr>
<td>CT</td>
<td>CERAMIC TILES</td>
</tr>
<tr>
<td>KS</td>
<td>SILICATE CEMENT</td>
</tr>
<tr>
<td>PH</td>
<td>PHENOLIC RESIN CEMENT</td>
</tr>
<tr>
<td>FVE</td>
<td>FURANE RESIN CEMENT VINYL ESTER CEMENT</td>
</tr>
<tr>
<td>CN</td>
<td>CASHEW NUT OIL RESIN CEMENT</td>
</tr>
<tr>
<td>EP</td>
<td>EPOXY BASED LINING</td>
</tr>
<tr>
<td>BRU</td>
<td>BRUSHABLE APPLICATION</td>
</tr>
<tr>
<td>SCR</td>
<td>EPOXY SCREED</td>
</tr>
<tr>
<td>FG</td>
<td>FIBREGLASS REINFORCEMENT</td>
</tr>
<tr>
<td>DRB</td>
<td>DR. BECK &amp; CO. PRODUCT</td>
</tr>
<tr>
<td>GVE</td>
<td>GLASS REINFORCED VINYL ESTER BASED LINING</td>
</tr>
</tbody>
</table>

Type Sub Type Description

MA MA/15
MA/20
15mm thk Mastic lining
20mm thk Mastic lining
FX FX6
FX8
6mm thk Flexivinyle lining
8mm thk Flexivinyle lining
BR BR/38/KS/PH Brick lining 38 thk. With 10mm thk silicate cement bedding and
6mm thk Phenolic cement pointing
BR/38/KS/F Same as above but pointing with furane cement
BR/38/KS/VE Same as above but pointing with vinyl ester based cement
BR/38/KS/CN Same as above but pointing with cashew nut oil resin cement
BR/38/PH Brick lining in 6mm thk cement bedding and 3mm thk phenolic
cement jointing
BR/38/F Same as above with furane cement
BR/38/VE Same as above with vinyl resin
BR/38/CN Same as above but pointing with cashew nut oil resin cement

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

Recommended Type of Lining for Different Duty Conditions

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Duty Conditions</th>
<th>Exposure Temp</th>
<th>Recommended Lining</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Upto 98% H2SO4</td>
<td>Within or ide</td>
<td>25 deg C to 80 deg C</td>
</tr>
<tr>
<td>2</td>
<td>5% to 50% NaOH</td>
<td>-do-</td>
<td>do3</td>
</tr>
<tr>
<td>3</td>
<td>30%HCl</td>
<td>-do-</td>
<td>do4</td>
</tr>
<tr>
<td>4</td>
<td>5% to 50% NaOH &amp; Electrical Resistance of 50K Ohm</td>
<td>Inside 50 deg C</td>
<td>EP/SCR/5 &amp; EP/SCR/3</td>
</tr>
<tr>
<td>5</td>
<td>50% Alkaline with no Silica Pick-up</td>
<td>Inside 50 deg C</td>
<td>GVB</td>
</tr>
</tbody>
</table>

9. Mode of Measurement
Payment shall be on sq. mtr. basis of finished area. The rates quoted shall be all inclusive of materials, labor, supervision, transport, taxes/duties, octroi, wastage, guarantees, profits and all other incidental expenses.