



AN ERGONARMOR COMPANY

**TECHNICAL INFORMATION**

**CES-302**

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## ***CORROSION ENGINEERING SPECIFICATION FOR INSTALLATION***

### ***CHEMICAL RESISTANT BRICK FLOORING USING THE BRICKLAYERS METHOD OF CONSTRUCTION AND DIRECT BOND TECHNIQUE***

#### **1. SCOPE**

- 1.1 The following specification governs the selection and preparation of materials, concrete, and chemical resistant brick floor using the “Bricklayers Direct Bond Method”.
- 1.2 Chemical resistant brick flooring is broadly used in the chemical process and food/beverage processing industries as a durable and aesthetically pleasing floor to provide protection to concrete from organic acids, salts, detergents, alkali cleaning agents, oils, solvents, and organic foodstuffs. The brick flooring functions as a mechanical and thermal barrier. The mortar functions as a chemical resistant virtually impermeable joint barrier, and the setting bed functions as a protective membrane barrier over the concrete.
- 1.3 The chemical-resistant brick flooring system utilizes a red shale brick conforming to ASTM C-279 (latest edition) Chemical Resistant Masonry, bonded directly to a well prepared concrete slab, using a 100% solids epoxy setting bed material. A chemical-resistant mortar is troweled onto the brick edges to form full non-permeable side joints which will prevent corrosive fluids to contact the underlying epoxy bed. The bricklayers method of construction involves troweling a mortar onto the sides of the brick and then setting the brick in the uncured epoxy setting bed material which has been troweled onto the prepared concrete substrate.

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**2. MATERIALS OF CONSTRUCTION**

2.1 Brick Pavers

2.1.1 Brick are normally 8" x 3 7/8" x 1 3/16" or 1 3/8", but can also be 8" x 3 3/4" x 2 1/4". Brick shall conform to ASTM C-279, Type II or Type III, and ASTM C-410 - latest revisions. Brick color and surface texture shall be as specified by owner or owners representative. Brick in thickness from 1" to 1 3/8" may be referred to as "Pavers", "Dairy Brick", or "Packinghouse Tile". The brick surface shall be pre-waxed with a petroleum based wax suitable to prevent adhesion of mortar to brick surface. Wax should not carry onto edges, sides, and bottoms of brick. Brick should have side and bottom bonding surfaces suitable for resinous cements. All brick cuts shall be made with a masonry saw. No hammer cuts are permitted. No brick pieces of less than 1/2 length shall be used.

2.2 Epoxy Setting Bed

2.2.1 The setting bed material shall be THINSET® Adhesive, a 100% reactive epoxy adhesive composed of an epoxy resin, chemically curing hardener, and silica filler. The adhesion of the epoxy setting bed shall be greater than the tensile strength of the concrete slab and also the brick. The epoxy setting bed shall have a minimum tensile strength of 2,500 psi, ASTM C-308. Water absorption of the setting bed shall not be greater than 0.2%, ASTM C-413.

2.3 Furan Mortar

2.3.1 Chemical resistant FURALAC® Green Panel Mortar (data sheet CE-128) shall consist of two components, a polyfurfuryl alcohol resin and carbon-filled powder.

2.3.2 The furan mortar shall be resistant to organic, as well as non-oxidizing inorganic acids, most cleaning agents and detergents, oils, solvents, and mineral salts. The furan mortar shall have a density of 92 lb/per cu. ft. It shall also have a minimum tensile strength of 700 psi ASTM 307; compressive strength 6,000 psi ASTM C-579; flexural strength 1,000 psi ASTM C-453; have excellent adhesion to wire-cut and matte brick, 500 psi. ASTM C-321; a low coefficient of thermal expansion  $20 \times 10^{-6}$ , ASTM C-531; and absorption of 0.5% or less.

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2.4. Mortar - Vinyl Ester

2.4.1 Where resistance to bleaching agents, chlorine, and strong oxidizing inorganic acids PENNCHEM® Mortar (CE-250), a vinyl ester mortar shall be used as a side joint material.

2.4.2 The vinyl ester mortar shall have a compressive strength minimum 14,000 psi, ASTM C-759; tensile strength minimum 1,700 psi, ASTM 307; shrinkage < 1.0%, thermal expansion  $20.0 \times 10^{-6}$ , ASTM C-531; and low absorption 0.25%, ASTM C-413. Mortar shall not contain asbestos fibers.

2.5. Mortar - Other

2.5.1 In certain chemical environments, the use of FURALAC® or PENNCHEM® Mortar outlined above may not be suitable to address and resist the anticipated service conditions. In these cases, it is necessary to consider other resin based mortars, such as Corrosion Engineering Phenolic Mortar (CE-254), Corrosion Engineering Vinyl Ester Carbon Mortar (CE-231), or PENNCHEM Novolac Mortar (CE-276). In other chemical service, the use of a silicate mortar may be the only mortar to resist the chemical service. Consult Corrosion Engineering to discuss specific requirements.

2.6 Expansion Joint Materials

2.6.1 Expansion joints are required to accommodate mechanical or thermal stresses in the flooring. Expansion joints are placed in intervals of 20 feet along the brick flooring, and around fixed points of construction. FLEXJOINT® (CE-133), a two component epoxy joint filler shall be used in traffic bearing areas, having Shore A Hardness of 70-80. FLEXJOINT Polysulfide (CE-241), a Polysulfide joint filler is used in all other areas, having Shore A hardness of 20-30. A 100% closed cell foam rod should be installed such that the foam rod completely covers the joint bottom.

2.6.2. Expansion joint backer rod shall be - Dow Chemical Co. "Ethafoam" or equivalent.

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**3. CONCRETE PREPARATION**

- 3.1 New concrete shall be structurally sound, homogeneously poured, clean, free of dirt or contamination, and dry. It shall have been wet cured, or cured with polyethylene film or wetted burlap, until a tensile strength of 250 psi is achieved, and moisture content is sufficiently reduced so as to allow slab to pass the ASTM D-4263 mat test. The length of cure time required to meet this requirement is a function of temperature and concrete mix design, and cannot be determined in terms of number of days of cure. Consult ready mix supplier to discuss water reducing admixtures and accelerators to meet specific construction schedules if this is a concern. The use of curing compounds of any generic composition is not recommended. Cure by alternate methods such as polyethylene sheet, burlap, or ponding. The base slab shall be wood float finished, with no low spots where puddles can form when slab is flooded with water. Prepared concrete shall be sloped to drains at 1/4" per foot.
- 3.2 Prior to commencement of any work, the flooring contractor shall thoroughly examine all new floor surfaces, and report any conditions which will adversely affect proper floor installation. Commencement of work shall be deemed as acceptance of floor finish and condition.
- 3.3 Existing concrete which is clean, dry, structurally sound, and can safely support the superimposed load shall be considered satisfactory. Contaminated concrete which otherwise meets these requirements shall be thoroughly cleaned and left clean and dry. Eroded, broken, chipped, and cracked concrete shall be repaired and cured prior to installation of tile or brick. If not provided in the existing slab, a slope of 1/4" per foot to the drains shall be established.
- 3.4. Prepared concrete surface should have surface texture similar to a medium grit of sandpaper. Floor surface may be prepared in accordance with ASTM standards D-4258, D-4259 and D-4260.

**4. APPLICATION OF EPOXY SETTING BED**

- 4.1 Mix epoxy setting bed material in accordance with manufacturers recommendations. (Read product labels and installation specifications for THINSET® Adhesive for specific mixing instructions.)
- 4.2 Mix until Resin, Hardener, and Filler are blended uniformly. Setting bed

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material which begins to cure cannot be recovered by adding more resin. Do not add water, Portland cement, or any additives or adulterants to any components or the mixed setting bed.

- 4.3 Apply the setting bed material in a continuous layer to a thickness of 1/8" directly on the concrete slab by trowel ensuring that there are no voids. Use of a notched trowel to gauge the thickness of the setting bed shall be permitted, provided the bed is continuous and void free, with no areas of underlying concrete remaining exposed.
- 4.4 If surface damp concrete is a concern, it may first be coated with PENNTROWEL® Epoxy Primer (CE-139). THINSET® Adhesive should be placed after primer has dried to touch, but no longer than 48 hours after primer has been installed..

**5. MIXING OF MORTAR & BRICK PLACEMENT**

- 5.1 Mix mortar in accordance with manufacturers recommendations. Consult Corrosion Engineering specification CES-358 for installation and mixing instructions for chemical resistant brick mortars.
- 5.2 With a clean bricklayer's trowel, completely butter the vertical side joints of the brick with 1/8" of the mortar. Set the brick directly on the wet THINSET epoxy setting material. Press and tap the brick or paver into position tight against adjacent brick so that the mortar is extruded from all vertical side joints. All joints must be completely filled; 1/8" joints shall be maintained. Installed brick floor must be uniform and smooth. Allow the mortar joints to set for a short time before striking to remove extruded mortar. High points of a sloped floor shall be a rolled surface so as not to expose the corners of the paver to potential cracking or chipping.
- 5.3. Brick shall be laid in a running or stack bond pattern - stretcher coursing may be installed around piers, perimeter of room, at high points, and at drains.
- 5.4. Brick must be clean and dry, and temperature of brick should be as close to 70°F as possible.
- 5.5 Alternate "Double-Butter" or "Back-Buttering" methods of installations; in severe chemical environments or almost constantly wet processing areas it is important to consider the installation technique known as "Back-Buttering" the bed joints of brick or tile with the epoxy setting bed material.

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- 5.6 Apply setting bed material to concrete slab in a continuous layer to a thickness of 1/16". Apply 1/16" of same bed material to the "Back" or bed face of the brick or tile.
- 5.7 Place the brick or tile onto the "wet" or "soft" setting bed material and continue installation in accordance with the previous section.
- 5.8 Use a separate trowel to apply epoxy setting bed material and side jointing mortar. Do not mix epoxy setting bed material and mortar together. Take care in avoiding contamination of wet epoxy setting bed material with mortar in side joints.

**6 EXPANSION JOINTS**

- 6.1 Expansion joints shall be installed with a minimum width of ½". When installing surface primers, apply to clean and dry joints.
- 6.2 The number of joints shall be kept to a minimum, yet obeying the joint location suggestions and design rules as follows:
  - 6.2.1 Expansion joints shall be installed around all fixed objects, except drains.
  - 6.2.2 Expansion joints shall be installed around the periphery of all rooms.
  - 6.2.3 Expansion joints shall be installed over all points of movement in concrete slab at a maximum distance of 20 feet apart.
  - 6.2.4 Expansion joints shall be located near, but not on, the crown of a sloped floor.
  - 6.2.5 Drains should be located as near as possible to the midpoint between expansion joints.
  - 6.2.6 Horizontal expansion joints should utilize a pouring viscosity of joint sealant. Cove base and vertical joints should utilize a caulking viscosity.
  - 6.2.7 A cross-linked 100% closed cell polyethylene foam shall be installed as a backer rod in the construction of the expansion joint. The backer rod shall have a compressibility of 25% at a stress of

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4.7 psi, in accordance with ASTM D-1621. The uncompressed diameter of the backer rod shall be 50% greater than the width of the joint.

6.2.8 The depth of the expansion joint material shall be  $\frac{1}{2}$  the width of the joint.

6.3 FLEXJOINT® Joint Sealant is of suitable hardness and should be used in areas of frequent and heavy traffic to prevent chipping and spalling of brick.

6.4 FLEXJOINT Polysulfide Sealant should be used around the peripheries of rooms, in areas of light traffic, or in exterior applications.

6.5. Preparation of Concrete Joint

6.5.1 Brick/tile/concrete joint surfaces shall be clean; latence and all loose particles shall be removed by brushing or with air blast.

6.5.2 Joint installation - place polyethylene foam in clean and dry joint.

6.5.3 Prime joint surfaces with manufacturers suitable primer. Avoid priming polyethylene foam. Fill primed joint within twenty four (24) hours after priming.

6.5.4 Fill horizontal joints in two pours waiting 15 to 30 minutes between pours to allow for setting and air in joints to escape. Caulk vertical joints by knife or caulking gun in one application.

6.5.5 Do not apply expansion joint sealant when brick/tile flooring is less than 50°F, or when joint surfaces are wet.

## **7 INSTALLATION TEMPERATURES**

7.1 Epoxy setting bed material, side jointing mortar, and expansion joint material are formulated for installation between 50°F and 85°F.

7.2 If installation temperatures are below 50°F substitution of cold room hardeners for the materials of construction is necessary. In addition, the following should also be considered:

7.3 Store product components as close to 75°F as possible.

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- 7.4 Store brick/ tile at 75°F for at least 48 hours. Avoid frost or moisture by keeping brick or tile under cover.
- 7.5 If installation temperatures are above 85°F:
  - 7.5.1 Mix smaller batches of the epoxy setting bed material and mortar.
  - 7.5.2 Keep product components and brick/tile as close to 70°F as possible. Refrigerate resinous components 48 hours prior to use.
  - 7.5.3 Set mixing pan for mortar and/or setting bed material in a cool water or ice bath. Avoid contaminating mortar mix or setting bed mix with water.

**8. STEAM CLEANING**

- 8.1 Steam cleaning shall be performed after mortar has set hard, and as soon as possible. Remove all wax and excess material. Where necessary, repoint joints for a full, sealed, smooth, and tight installation. Under no circumstances shall any acid be used in the cleanup work without the Engineer's prior approval.

**9. DISCLAIMER**

- 9.1 The statements, technical information and recommendations contained herein are believed to be accurate as of the date hereof. Since the conditions and methods of use of the product and of the information referred to herein are beyond our control Corrosion Engineering expressly disclaims any and all liability as to any results obtained or arising from any use of the product or reliance on such information; NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, IS MADE CONCERNING THE GOODS DESCRIBED OR THE INFORMATION PROVIDED HEREIN. The information provided herein relates only to the specific product designated and may not be applicable when such product is used in combination with other materials or in any process. The user should thoroughly test any application before installation. Nothing contained herein should be taken as an inducement to infringe any patent and the user is advised to take appropriate steps to be assured that any proposed use of the product will not result in patent infringement.



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- 9.2 Please contact Corrosion Engineering for specific recommendations at +1-610-833-4000 or fax +1-610-833-3040.

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