CORROSION ENGINEERING SPECIFICATION FOR INSTALLATION

PENNCHEM ® 97 AND TUFCHEM ® II MEMBRANES ON CONCRETE

1. SCOPE

1.1 This specification governs the installation of PENNCHEM 97 Membrane and TUFCHEM II Membrane as manufactured by Corrosion Engineering for the protection of concrete structures and vessels.

1.2 This specification shall govern the application and inspection work. Where applicable, this specification shall be used in conjunction with product data sheets CE-228, CE-196, CE-293, and CE-139.

2. MATERIALS

2.1 For effective concrete sealing on concrete surfaces, PENNTROWEL Epoxy Primer, Data Sheet CE-139, shall be applied before membrane.

2.2 Membranes - Elastomeric urethane membranes shall be manufactured by Corrosion Engineering and include TUFCHEM II Membrane (CE-196), TUFCHEM II Membrane-Spray Grade (CE-228), and PENNCHEM 97 Membrane, (CE-293).

3. SURFACE PREPARATION

3.1 When forms are used in placing the concrete, the formwork should be designed so as to yield a smooth, continuous concrete surface to which the lining is applied.

3.2 A single pass troweled finish shall be given to new concrete floors with special care being taken to avoid bringing latence to the surface.

3.3 Concrete shall reach a minimum compressive strength of 2,500 psi before

the lining is applied. All concrete surfaces shall exhibit a minimum tensile bond strength of 250 psi as tested with a Dillon Dynamometer or an

Elcometer adhesion tester. Random tensile tests should be performed on each wall section and floor. Tensile bond strength values which do not meet 250 psi minimum shall be reported to owner, concrete installer, and membrane applicator for mutual resolution.

3.4 New concrete shall be cured in accordance with ACI-308 "Recommended Practice for Curing Concrete". The concrete installer shall give Corrosion Engineering a copy of the concrete installation specification, and all records regarding concrete placement and cure.

3.5 The concrete surface is to be prepared in accordance with ASTM D-4259 "Standard Practice for Abrading Concrete". Although the surface shall have a rough texture appearance, no specific reference profile is required. The intent is to remove sufficient material in order to achieve a sound concrete surface free of latence, glaze, efflorescence, and incompatible concrete curing agents or form release agents.

3.6 All form marks and protrusions such as prominent aggregate exposure, tie wires, reinforcing wires, stirrups, etc., must be cut off at a minimum ½" below the surface and shall be filled by packing with a neat sand cement mix.

3.7 All cavities, stone pockets, honeycombing, and bugholes shall be filled by packing with a neat sand cement mix. The composition of the mix shall be forwarded to Corrosion Engineering technical service representative. The surface texture of the mix after cure shall conform to Section 3.5 and ASTM D4259.

3.8 ASTM D4263 "Standard Test Methods for Indicating Moisture in Concrete by the Plastic Sheet Method" shall be followed to indicate the presence of capillary moisture in the concrete. This test shall be performed before priming with PENNTROWEL Epoxy Primer on each wall section and at least three random areas on the floor of the vessel.

4. PRIMING CONCRETE

4.1 After concrete surface has been prepared and accepted in accordance with Section 3.0 "Surface Preparation" and Section 7.0 “Inspection and Test", the concrete shall be primed.

4.2 The concrete surface shall be primed with PENNTROWEL Epoxy Primer. If ASTM Test D4263 indicates the presence of moisture, the Primer shall be

installed by a stiff brush with hard scrubbing action. If the test does not indicate the presence of moisture, the concrete shall be primed by spray by diluting 5% by volume with xylene. Follow specific application instructions on product container labels. Read and follow manufacturer's MSDS's when handling xylene.

4.3 A minimum of two spray coats of Primer shall be necessary to ensure that the surface is sealed. Primer shall be dry to touch before application of additional coats. Allow PENNTROWEL Epoxy Primer to dry hard before coating with membrane.

4.4 The adhesion of PENNTROWEL Epoxy Primer to the prepared concrete surface shall be measured with an Elcometer or suitable instrument and recorded. Testing adhesion of Primer shall be done on each wall section and at least three random areas on the floor of the vessel.

4.5 Control joints in the concrete shall not be primed with PENNTROWEL Epoxy Primer. Control joints shall be cleaned by solvent wiping with isopropyl alcohol before application of the membrane.

4.6 PENNTROWEL Epoxy Primer is dry hard in 16 hours @ 60°F, 8 hours @ 70°F, and 6-1/2 hours @ 90°F.

5. MEMBRANE STORAGE AND MIXING

5.1 Individual product data sheets shall be consulted on the mixing, storing, and application procedures for each product:
TUFCHEM II Membrane-Spray Grade - Product Data Sheet CE-228
TUFCHEM II Membrane - Product Data Sheet CE-196
PENNCHEM 97 Membrane - Product Data Sheet CE-293

5.2 Storage Materials shall be stored at a minimum of 50°F and no higher than 80°F. It is preferred for best mixing and application results that materials be stored as close to 70°F as possible.

5.3 The mixing area, whether outdoors or indoors, should be as close to 70°F as possible, shaded from the sun and the wind.

5.4 At the time of mixing and application the temperature of the components should be approximately 70°F (21°C). Remove the lid from the can: inspect for damage incurred during transit, insure that there are no leaks in the Component B container and that there is no water present on or in Component A.

5.5 Utilizing a variable speed heavy duty drill, capable of delivering shaft rotation of 400 to 600 rpm, and a Jiffy Mixer Blade, Model PS-21 or equal mix Component A by itself for a minimum of one minute.

5.6 Open Component B, continue to mix Component A at the recommended speed, begin pouring the Component B into the Component A (there will be a vigorous vortex created by the mixer). Total elapsed time for the addition of the component B should be 15 to 20 seconds while mixing.

5.7 When the material temperature is 70°F (21°C) or higher, mix for at least three (3) minutes using a good mixing technique to yield a uniform mix. When the temperature of the components is 50°F (10°C), mix for at least ten (10) minutes using a good mixing technique to yield a uniform mix.

5.8 These Membranes are thixotropes. Let mixed material sit approximately 10-15 minutes after mixing, to reach a more desirable trowelable consistency.

5.9 Never allow moisture or other contaminants to come in contact with either membrane component or the wet mix.

6. APPLICATION OF PENNCHEM 97 MEMBRANE AND TUFCHEM II MEMBRANE

6.1 When spray applying TUFCHEM II Membrane Spray Grade, it is best to apply as much as possible in a two hour period to allow for sufficient drying and strength development, and then recoat that area to achieve the proper thickness. It is recommended that a minimum number of coats required to achieve a 1/8" (125 mils) dry film thickness be applied. That is, two coats minimum shall be applied on all horizontal areas. Three coats minimum shall be applied on all vertical areas.

6.1.1 Spray application of TUFCHEM II Membrane-Spray Grade is preferred in lining large continuous areas.

6.1.2 Recommended equipment for spray application of TUFCHEM II Spray Grade is as follows:

Mastic Pump	Graco 30:1 Bulldog Hydra Spray airless, model 206-234.
Hydra-mastic Gun	Model 206-718 without diffuser tip
Gun Tip	Graco Reverse-A-Clean tip, model #205-614, orifice size, 0.033"

Material Hose	3/4" ID, working pressure - 4000 psi, 16000 psi burst pressure, or 1" ID, - working pressure 3000 psi, 12000 psi burst pressure for 150' length.
Inline Filter	Spray Quip inline Filter with 0.020" mesh screen
Air Compressor	100 cu ft/minute at 100 lb/sq. In. minimum
Air Hose	From Compressor to mastic pump - 3/4" to 1" ID

6.2 Depending on concrete and air temperature, TUFCHEM II Membrane will set in 2-4 hours. PENNCHEM 97 Membrane will set in 5-6 hours. Once membrane has set, it must be lightly abraded to break the film and remove the gloss. Then it shall be solvent wiped with isopropyl alcohol before application of additional membrane.

6.3 Overlapping PENNCHEM 97 or TUFCHEM II Membrane lining from horizontal surfaces onto vertical surfaces shall be accomplished In accordance with Section 6.2.

6.4 When overlapping new PENNCHEM 97 or TUFCHEM II Membrane onto existing membrane, it shall be done in a 2-4" wide band. Care should be taken to avoid over spray onto existing lining which has set.

7. INSPECTION AND TESTING

7.1 The concrete surface preparation shall be inspected in accordance with the previously stated ASTM procedures and verified visually with photographic records.

7.2 The air and material temperatures in the storage area shall be noted and maintained on a daily basis.

7.3 The ambient air and material temperature in the mixing and work area shall be measured and recorded every four hours. Mixing and application and curing temperatures shall be a minimum of 50°F and a maximum of 90°F. The moisture dew point shall be measured and recorded every four hours of the working period during application. It is important that the concrete surface be 5°F above the moisture dew point temperature. Work will not proceed with respect to Primer or Membrane application when the moisture dew point temperature is less than 5°F above the concrete surface temperature.

7.4 The concrete surface preparation shall be visually inspected and accepted before remedial concrete surface patching is undertaken. An initial 100 sq.

ft. representative area shall be prepared and then accepted. This area shall be the standard for the remaining work.

7.5 Remedial concrete patching shall be undertaken and be accepted in accordance with Section 3.5. A 100 sq. ft. representative area shall be prepared and then accepted. This area shall be the standard for the remaining work.

7.6 Priming of concrete shall be undertaken after the acceptance of concrete surface preparation and surface patching. Priming with PENNTROWEL Epoxy Primer shall be performed in accordance with Section 4.0. A 100 sq. ft. area shall be primed and accepted. Once accepted, this area shall be the standard for the remaining work. Visual observation of sealing shall constitute the acceptance criteria.

7.7 The mixing and application of these Membrane Systems shall be performed in accordance with Sections 5.0 and 6.0. A 100 sq. ft. representative area, preferably vertical, shall be applied. Each coat shall be wet gauged for wet film thickness every 100 sq. ft. An aggregate wet film thickness of 132 mils minimum shall be the acceptance criteria. The membrane surface shall be relatively smooth and free from runs, sags, snots, knobs, and other application imperfections.

An aggregate wet film thickness of 132 mils will yield a dry film thickness 125 mils or 1/8". PENNCHEM 97 Membrane is a 100% solids coating and will yield a dry film thickness equal to the wet film thickness.

8. REMEDIAL WORK AND REPAIRS

8.1 During the inspection by a qualified quality assurance representative, remedial actions or repairs may be necessary to bring the lining to specification. Due to the nature of the nonconformance, repair procedures can take many specific forms. In general, the following procedure applies:

8.2 Cut out the nonconforming membrane down to the primed concrete surface.

8.3 If the membrane is dry, abrade the membrane with a wire brush or power brush to roughen the surface to marry the new membrane to old.

8.4 Solvent clean the existing primed concrete surface and wire brush for preparing existing membrane. Isopropyl alcohol is recommended for solvent cleaning.

8.5 Re-apply the membrane in accordance with the product data sheets.

9. CURING

9.1 Cure of Membrane is affected by air and concrete surface temperature, relative humidity, amount of sunlight and rain.

9.2 Membrane cure schedule for foot traffic is 48 hours at 60°F, 24 hours at 75°F, and 12 hours at 90°F. Relative humidity is assumed to be 50%. For foot traffic, Membrane must be tack-free.

9.3 The membrane lining may be put into service once half its full cure is achieved and, therefore, half its physical properties have been achieved. Consult specific product data sheets for curing times.

10. SAFETY PRECAUTIONS AND DISCLAIMER

10.1 TUFCHEM II and PENNCHEM 97 membranes, and components and mixes of them present a number of hazards. Read before using and follow the hazard information, precautions, and first aid directions on the individual product labels and Material Safety Data Sheets.

10.2 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.

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