CORROSION ENGINEERING SPECIFICATION FOR INSTALLATION

PENNCOAT ® LININGS

1. SCOPE

1.1 This specification is suitable for PENNCOAT 210, 221, 227, and 321 Lining systems.

1.2 Detailed specifications covering the installation of PENNCOAT 331 and 340 (Specification CES-259), and PENNCOAT 401 and 401 MR (Specification CES-264) are also available for these individual systems, and should be consulted for additional detail.

2. SURFACE PREPARATION

2.1 Steel:

2.1.1 Steel surfaces should be abrasive blasted to a cleanliness level appropriate with the end service of the application. For immersion and vessel linings, prepare substrate in accordance with Steel Structures Painting Council Specification SSPC-SP-5, National Association of Corrosion Engineers NACE #1 or SA #3. For non immersion applications, this preparation can be relaxed to SSPC SP6, NACE #3 or SA #2. For Pacmastic 325 in immersion or non-immersion applications, prepare steel in accordance with SSPC-SP6, NACE #3, or SA #2.

2.1.2 If primer is required for the specified system, the primer's performance will be directly related to the anchor pattern profile and cleanliness of the steel. For immersion service conditions, highly corrosive environments and thermal cycling, the steel substrate should be clean, dry and have a minimum anchor profile of 3 mils. For less severe conditions, splash, spillage and no thermal cycling, a 2-3 mil anchor profile is acceptable with a SSPC-SP-5 and NACE #1 surface

cleanliness.

2.2 Concrete:

2.2.1 Concrete surfaces should exhibit a minimum surface tensile bond strength of 200 psi (1.4 MPa) when tested in accordance with ACI 503R-89 Appendix A.1. Mechanical methods such as abrasive blasting or scarifying are the preferred methods. Chemical methods such as acid etching and detergents should be utilized to remove latence, oil and grease or when mechanical methods cannot be utilized. Read and follow manufacturer's MSDS's and safety precautions when handling these chemicals.

2.2.2 Applicable ASTM Standards to be referenced for concrete surface preparation are:
D4258 - Practice for Surface Cleaning Concrete for Coating
D4259 - Practice for Abrading Concrete
D4260 - Practice for Etching Concrete
D4261 - Practice for Surface Cleaning Concrete Unit Masonry for Coating
D4262 - Test Method for pH of Chemically-Cleaned or Etched Concrete Surfaces
D4263 - Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
D4285 - Method for Indicating Oil or Water in Compressed Air

3. MIXING OF RESIN BASED SYSTEMS

3.1 Do not attempt coating application if substrate temperature is within 5 Fahrenheit degrees (2 Celsius degrees) of dew point, or if relative humidity is greater than 95%.

3.2 Since concrete expels air during the day and intakes air during the night, the best time to apply linings is late afternoon or early evening at which time concrete is least likely to expel air. Other precautions such as shading the work area from sunlight to minimize the heating of the substrate will also reduce expulsion of air.

3.3 Mix components thoroughly in the prescribed mix ratio as specified on the applicable data sheet.

3.4 Mixing: PENNTROWEL Primer Resins and PENNCOAT Lining Resins

should be stirred thoroughly prior to adding applicable Hardeners. Add Hardener to Resin portion and mix for a minimum of 3 minutes. Do not thin.

3.5 PENNCOAT Resin should be stirred thoroughly prior to adding Hardener. Add Hardener to Resin portion and mix for a minimum of 3 minutes or until uniform color and consistency is obtained. Do not thin without specific written authorization from Corrosion Engineering. Be certain to check the sides of the mixing container for uncatalyzed resin.

3.6 A Jiffy® mix blade, model PS 21, or similar paint mixing blade, should be used, along with a variable speed drill, to ensure proper mixing. Do not whip air into mixture during mixing.

4. APPLICATION OF RESIN BASED SYSTEMS

4.1 Temperature of both the substrate and the material components should be maintained between 50°F and 80°F (10-26°C) before and during lining installation. As well, surface to be lined must be maintained at least 5 Fahrenheit degrees (2 Celsius degrees) above the moisture dew point.

4.2 PENNCOAT Linings may be applied by brush, roller or spray, except for PENNCOAT 221 and PENNCOAT 321 which are designed for heavier application and are applied by flat trowel in 2 x 40 mil WFT coats).

4.3 A natural bristle brush and/or a short nap wool or mohair roller may be used to apply PENNCOAT linings.

4.4 Application: On concrete, PENNTROWEL Primers should be applied with a stiff brush and worked into the surface with a strong scrubbing action so as to emulsify the wetness at the concrete surface, and to penetrate into the concrete. Excess primer should be removed from the surface. On steel, PENNTROWEL Primer should be applied by roller and not applied too heavy.

4.5 For MR (Mat Reinforced) Linings incorporating chopped strand glass mat reinforcing, apply PENNTROWEL Primer as above at a rate of no more than 150 sf/gal (0.2 kg/sm). While primer is still wet, roll in 1.0 or 1.5 oz (300-450 gm) chopped strand glass mat reinforcing, further saturating the mat with catalyzed PENNTROWEL Primer. Smooth out wrinkles and blisters as required. Allow reinforced Primer to cure overnight.

4.6 Spray Application

4.6.1 Most PENNCOAT linings can be applied by spray to insure even uniform results. Consult manufacturer of spray equipment for specific recommendations and most current part numbers based on material viscosity and application specifics. A suggested starting point for equipment for spray application of PENNCOAT Linings is as follows:

4.6.2 Plural component - Air Atomized: Binks 18C Catalyst side injector external mix or 18NC internal nozzle mix gun. Low pressure 4:1 or 8:1 material pump. Catalyst handled by pressure injector or pump.

4.6.3 Plural Component - Air Assisted Airless: Gun and tip are designed to atomize filled materials at lower pressure through larger orifices than most standard airless guns. Fan shape is adjusted by external air. Binks Portable System 105-1168, B 5, 20:1 material pump, Model 202-755 gun, Super Slave catalyst pump. Glas-Craft 3-WP AAC Portable Spray System, LPA-11-AAC gun, 11:1 material pump, SP-85 Catalyst Slave Pump.

4.6.4 Consult directly with the manufacturer of spray equipment for specific recommendations and most current part numbers based on material viscosity and application specifics. Corrosion Engineering is not responsible for specific equipment recommendations as there are too many variables and changes from equipment manufacturer to manufacturer.

4.7 Pot Life

4.7.1 The pot life or working time of the material is mass sensitive: the larger the volume the shorter the pot life. Do not catalyze more material than can be used within the pot life. Above 90°F (30°C) ambient temperature, best results are obtained when the catalyzed material is poured into smaller containers reducing the mass. When ambient temperature exceeds 80°F the pot life can be extended by cooling the materials. The materials should be stored between 65°F and 75°F (18-24°C) for 24 hours prior to use for optimum handling properties. If plural component application equipment is used materials are not premixed and pot life is not a factor. Mixing chamber and spray tip must be kept clean and flushed with solvent.

4.7.2 PENNCOAT Linings should be topcoated within 24 hours after installation of basecoat. This time frame can vary depending upon ambient air and substrate temperature. Consult Corrosion Engineering

for further specific details.

4.7.3 In cooler temperatures, the catalyst proportion can be raised in vinyl ester based systems (PENNCOAT 321) from 1.5% by weight of resin, to 2.25% to accelerate cure. Do not exceed the 2.25% ratio - use of more than a 2.25% addition rate will not have any further acceleration effect on the cure.

5. RECOAT AND TOPCOAT LIMITATIONS

5.1 The applicator should plan the work so that the primer and lining are applied within the shortest time possible.

5.2 PENNCOAT Linings can be top-coated as soon as dry to touch is achieved. However, if applicator must walk on the basecoat to apply the topcoat this time should be extended. Exposure to direct sunlight or temperatures higher than 70°F (20° C) will shorten the time required to achieve dry to touch state.

5.3 PENNCOAT linings may be top-coated when dry to touch. In no case should the re-coat time extend beyond 48 hours.

5.4 If the PENNCOAT lining base coats are left un-coated beyond the time to complete cure, or if there is a need to re-coat cured PENNCOAT Linings, the surface must be cleaned and abrasive blasted to promote bonding of the next coat.

6. CURE TIME

6.1 The cure time is very dependent on temperature of the substrate and material at time of application and the specific PENNCOAT system being used. Consult Corrosion Engineering for specific cure questions not noted on the applicable product data sheet. The ambient air temperature may not be the temperature of the substrate, i.e. direct sunlight will heat steel to higher temperature than ambient air. In winter, steel may be colder than ambient air. The substrate temperature should be measured and dewpoint calculated prior to coating. Substrate temperatures below 50°F (10°C) will retard the curing of PENNCOAT Linings.

7. CLEAN-UP

7.1 All mixing equipment, spray equipment, rollers and brushes should be

cleaned immediately after use. Solvents recommended for clean-up are methyl ethyl ketone or lacquer thinner. When using these materials read and follow the supplier's material safety data sheets.

7.2 Do not use acetone for vinyl ester based materials such as PENNCOAT 321.

8. STORAGE AND SHELF LIFE

8.1 PENNCOAT lining components should be stored in a cool, dry, area and out of direct sunlight.

8.2 Typical Shelf Life

8.2.1 PENNCOAT 321 Lining and PENNTROWEL Vinyl Ester Primer can be stored up to 6-8 months at 50°F (10°C) , 4-6 months at 70°F (20°C) and <1 month at 80-90°F (26-30°C) .

8.2.2 PENNCOAT 221, and 227 Linings have shelf lives of up to 1 year when stored in tightly sealed containers in a cool dry location.

9. SAFETY PRECAUTIONS / DISCLAIMER

9.1 Read and follow the hazard information, precautions and first aid directions on the individual product labels and material safety data sheets before using. While all statements, technical information, and recommendations contained herein are based on information our company believes to be reliable, nothing contained herein shall constitute any warranty, express or implied, with respect to the products and/or services described herein and any such warranties are expressly disclaimed. We recommend that the prospective purchaser or user independently determine the suitability of our product(s) for their intended use. No statement, information or recommendation with respect to our products, whether contained herein or otherwise communicated, shall be legally binding upon us unless expressly set forth in a written agreement between us and the purchaser/user.

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