Distributed by: BEST MATERIALS LLC
Ph: 800-474-7570, 602-272-8128 Fax: 602-272-8014
www.BestMaterials.com Email: Sales@BestMaterials.com

CONCRETE SUMPS

AND

IMMERSED SURFACES

SOLUTIONS FOR REPAIR AND COATING

09/12/06

Table of contents

Concrete Sump and Basin Repair Manual

Preparation

There are a large number of concrete sumps, basins and surfaces that have been is service for long periods of time without having been coated to prevent deterioration. In the past, it was a common misconception that concrete was impermeable and impervious to chemical attack. Portland cement has very little tolerance for acids and caustic chemicals. We know differently now and must be able to spot problems before we approach a job so that we can intelligently address each problem and provide solutions for our customers.

Before you can apply ULTRA-FLEX 5000 or Ultra-Flex ECO 5000 liquid membranes, you must ascertain what problems exist in the substrate and how to repair them before attempting to apply ULTRA-FLEX. The structural integrity of the concrete must be in good shape or you must rehabilitate it to a point that the use of a coating will be effective and the chances of a coating failure or breach are negated. The ULTRA-FLEX Membrane System is an unparalleled coating system for waterproofing, containment and basins for cooling towers an power stations.

Preparation is the all important key to a successful application of an ULTRA-FLEX Membrane System. Not only must the substrate be clean and dry but it must also be in good shape. The following illustrations will point out a number of problems you will possibly encounter in fixing and coating a concrete basin and provide you with several ways to correct the problems before coating.

We do not intend to try to provide a solution for the systemic causes of the corrosion and deterioration problems, but only to:

1. Spot the problems that cause the corrosion and inform the customer.
2. Spot any engineering or repair issues that must be addressed before coating.
3. Repair any structural problems and concrete slab deterioration.
4. Understand how and why ULTRA-FLEX 5000 can aid in the prevention of further corrosion and deterioration.
5. Provide a long term solution to your customers.

It is important that the customer understand that the ongoing treatment of water in any cooling tower or immersed substrate requires a constant monitoring to make sure the water does not contain any chemicals that will continue to destroy the concrete or the ULTRA-FLEX coated basin. A good relationship with their water treatment company is also important.

In most instances where you are going to coat a concrete basin, you will want to have a repair kit that will provide you the materials to address almost all problems you will encounter. We will outline later a basic list of some materials that will allow you to avoid having to leave and return to the site to address problems once you are there to repair and coat the concrete basin.

Chemicals and Concrete

Many chemicals will cause premature deterioration of concrete. In the cooling tower industry, the most common problems will be related to chlorine, chlorides (salts), sulfuric other acids used to treat the water to prevent bacterial growth or to adjust the pH of the water and reduce corrosion.

ULTRA-FLEX 5000 and ECO 5000 have a very high resistance to aqueous acids and base chemicals in high concentrations. With few exceptions, ULTRA-FLEX is impervious to the chemicals used in water treatment. The physical properties of the cured ULTRA-FLEX 5000 and ECO5000 can be found in Appendix A. A list of some of the chemicals and the concentrations that will not affect ULTRA-FLEX 5000 or ECO 5000 is attached as Appendix B.

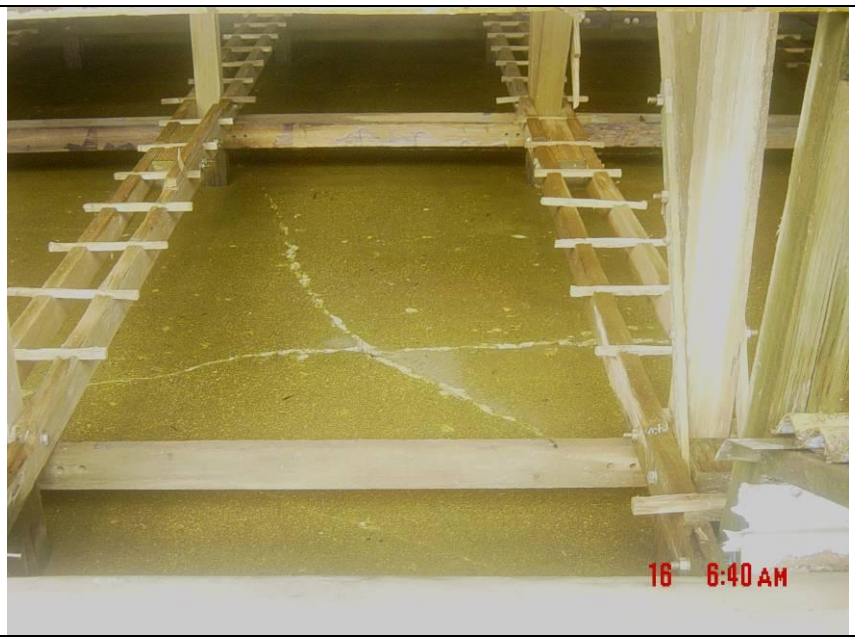
To help you understand and explain in simple terms what occurs when chemicals attack concrete for potential customers, we will give a brief example of what happens in the some of the above instances without getting into the chemistry detail.

Chlorine and Calcium

Concrete contains calcium in the form of lime. Chlorine, over time, will penetrate concrete and bind with the calcium to form calcium chloride, a salt that is very soluble in water. Once in chlorine ions are in solution with the water, they will leach the calcium from the concrete rendering it porous and eventually destroy the structural integrity of the concrete.

Sulfuric Acid and Concrete

Sulfuric acid reacts with the calcium in concrete and will form a new compound commonly known as gypsum. Another product that is formed called ettringite will lift corroded concrete away from sound concrete and cause a faster deterioration by exposing new surface to acid attack. Both of these will leave a rough and porous surfaced concrete with substantially reduced integrity. Another way to tell if sulfuric may be at issue is that the concrete will have a pale yellow color.



An illustration of deterioration and discoloration due to long term exposure to dilute sulfuric acid in the water treatment system.

Chlorides (Salts)

Because of the continuous monitoring of the water quality in a tower the formation of chlorides is a given. Simple evaporation can cause concentration of elements and the addition of chemicals will cause the formation of salts in the water. Chlorides are the enemy of structural steel used to reinforce concrete. When the concrete is penetrated by water, it will carry chloride ions with it. This will in turn attack the rebar in concrete and cause corrosion. When this occurs, oxidized metal will begin to expand and will eventually cause spalling. Spalling occurs by the separation of concrete from the metal rebar through internal forces caused by oxidation of the metal within the concrete and results in sections of concrete being split from the surface.

Other Damage

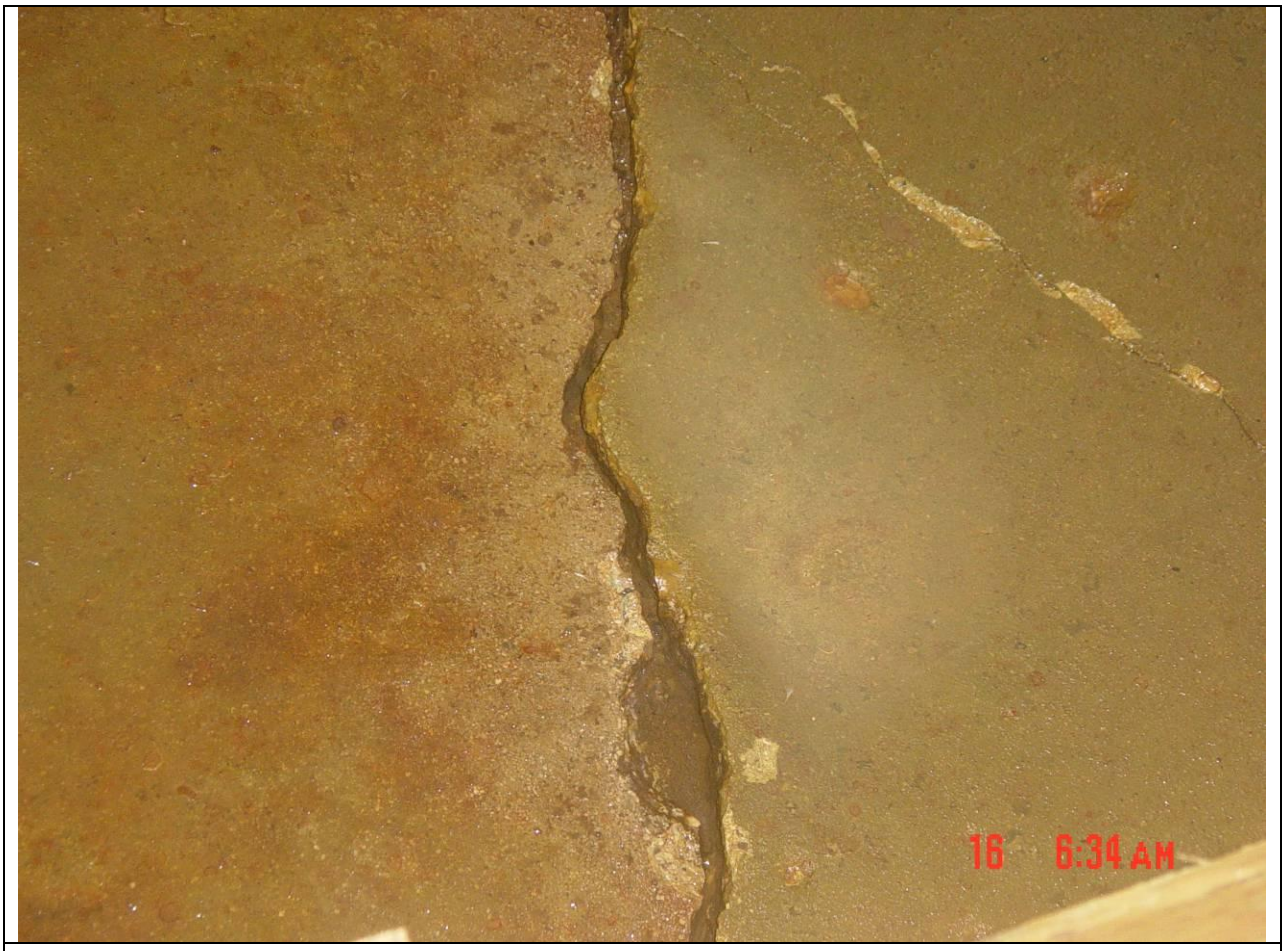
Freeze Thaw

In areas subject to harsh winter conditions, the concrete, after having absorbed water over time, may in the presence of chlorides or other chemicals begin to deteriorate and spall. Water, when frozen, increases in size. When it is encapsulated in concrete, it will slowly begin to increase in size and cause small fissures and cracks, these will in turn become filled with water and again every time it freezes, the cracks will become larger until at some point the concrete will begin to break apart.

The foregoing picture is an example of extreme spalling.

Basin Settlement

Most concrete basins are poured on grade concrete slabs and not generally poured with walls and parapets as an integral part of the structure. The walls are poured separately and leave a joint at the base that will allow water to penetrate between the slab and wall base. The foregoing illustration of extreme spalling also shows where the wall was poured separately from the floor slab and you can see the moisture along the base of the wall that has not dried. This illustration also shows how the basin has settled over time due to an erosion of the base under the slab. The slab was not coated and eventually cracked and allowed water to penetrate through the slab to the earth below and washed out the material over time. The following picture also illustrates the effects of concrete failure and cracking due to erosion of the base under the slab.



Cracking and separation due to base erosion under slab.

The following shows how the water was leaking from the slab and beginning to erode the base next to the basin which could result in substantial damage to the adjacent structure. Note the water accumulation between the tower basin and the brick building and the moisture wicking up the brick wall.

The pictures show the accumulation of water from a leaky basin.

Repair of the Basin

Structural Issues

Before the basin is coated, all structural issues such as cracks and spalling should be fixed. Your basic repair kit should include hydraulic cement that cures rapidly (usually within 3-4 hours) and forms a crystalline bond with the old concrete. Hydraulic cements that have been successfully used to repair cooling tower basins include the following:

Manufacturer	Product Name
Xypex	Patch ‘n Plug
Quikrete	Water Stop Cement
Unitex	Hydraulic Cement

The following illustration shows a spall and joint crack that have been repaired using hydraulic cement prior to coating with ULTRA-FLEX 5000.

Spall and wall joint prior to repair

Hydraulic cement repaired spall and wall joint.

Surface Preparation

Once the major spalls, cracks and joints have been repaired, the surface of the basin should be pressure washed or sand blasted to remove any biofilm and accumulated dirt or chemical residue on the surface. Rinse, blow off or vacuum all dust or dirt from the basin after it has dried. The basin should be dry enough so that the concrete surface does not contain more than 5% moisture. Please read the application specification for methods for determining the moisture in concrete if you are unsure of how dry the concrete has become.

In order to rehabilitate the concrete surface and to seal off moisture that has accumulated in the concrete from reacting with the ULTRA-FLEX 5000 application, it is important to apply a sealer coat of ULTRA-FLEX EP-990C, concrete penetrating epoxy. EP-990C was specifically designed to penetrate concrete and to seal off moisture as well as to provide increased ULTRA-FLEX 5000 adhesion to the concrete basin. EP-990C is a two component epoxy that is blended on site at the ratio of two parts A to one Part B. EP-990 C has a pot life of approximately 1-2 hours at 25°C/77°F.

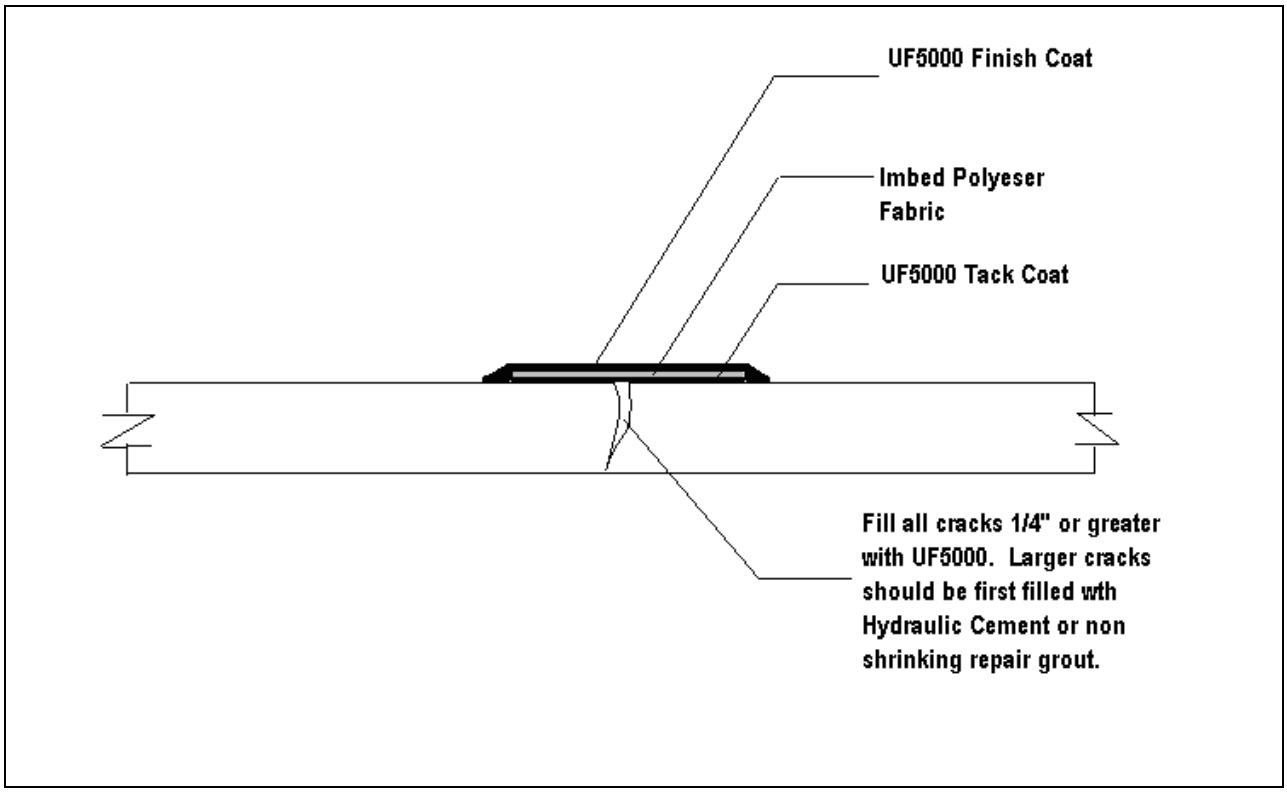
EP-990C is applied at a rate of approximately 200 square feet per gallon. It is very thin and will rapidly soak into concrete. EP-990C is easily applied using a simple garden sprayer or by roller. An example of application using a garden sprayer is pictured below. The use of airless spray equipment is NOT recommended due to the fine mist it will create and potential for inhalation by personnel. Additionally, airless equipment will not provide a sufficient amount of material in a single pass due to its fine atomization. All concrete treated with EP-990C must not have more than 5% moisture content.

	
Filling a Simple Garden Sprayer w/EP-990C	Application of EP-990C with Sprayer

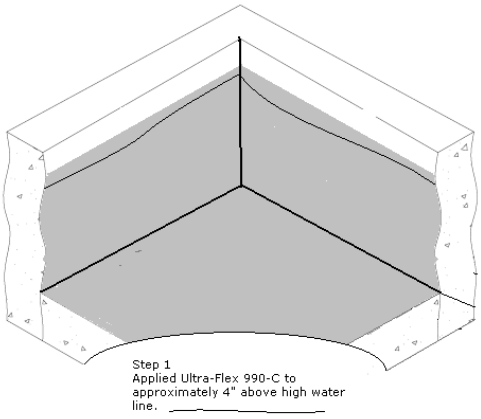
Reinforcement Fabric

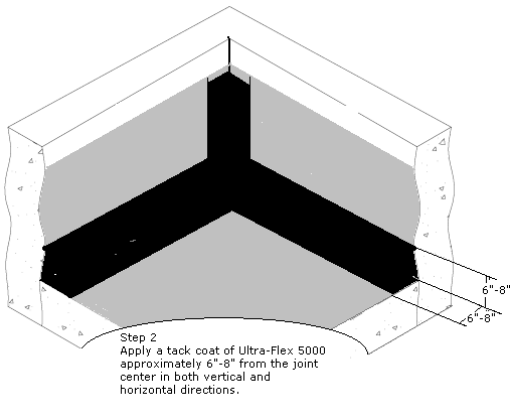
All joints and cracks over 1/8 of an inch and all areas that have been patched using hydraulic cement should be reinforced with a polyester or polypropylene fabric. The manner of coating cracks is illustrated below.

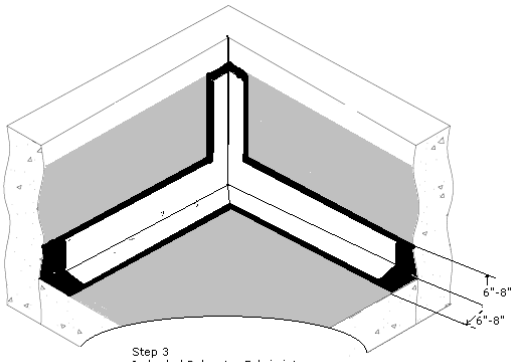
ARCHITECTURAL DRAWINGS



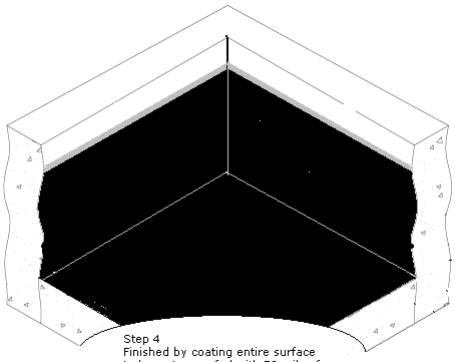
When addressing transitions from floor to wall, the procedure for preparing the joints and coating with ULTRA-FLEX 5000 using a reinforcing fabric is shown below.







Step 3
Imbeded Polyester Fabric into tack coat.



Step 4
Finished by coating entire surface to be waterproofed with 50 mils of Ultra-Flex 5000.

All concrete applications are not alike but the foregoing will help understand what difficulties might be encountered and how to address them in order to complete a professional job. The following general specification and guideline attached as Exhibit C can be used as a basis for presenting a specification for application of ULTRA-FLEX 5000 to a potential customer.

APPENDIX A

ULTRA-FLEX 5000 PHYSICAL PROPERTIES CHART

PHYSICAL PROPERTIES	TEST METHOD	RESULTS	
		5000	ECO 5000
Tensile (PSI)	ASTM D412	≥1400	≥ 3250
Elongation (%)	ASTM D412	≥245	≥ 130
Tensile, Modulus	ASTM D882	≥1320	≥ 3200
Graves Tear (Die C, pl 20” min.)	ASTM D624	≥230	≥ 250
Shore A Hardness (Inst-5sec)	ASTMD2240	≥70	
Shore D Hardness (Inst-5sec)			≥ 45
Moisture Vapor Transmission (Perm-in)	ASTM D471	≤0.02	≤0.02
Percent Solids	Calculated	92% (±2%)	96% (±2%)
VOC	ASTM D3960	≤ 98 g/l	≤ 94 g/l
Recoverable Phenols as per EPA 420.1	EPA 420.1	> 0.01	> 0.01
Abrasion Resistance (Wt. Loss)	ASTM D4060	>1.1 mg.	>.5 mg.

APPENDIX B

CHEMICAL RESISTANCE CHART

The adjacent will provide general exposure guidelines as to the resistance of ULTRA-FLEX 5000 and ECO against certain chemicals and combinations. Although this information is believed to be reliable, LAVA-LINER has no particular application, installation, or exposure experience of ULTRA-FLEX 5000 and suitable tests should be carried out by the end user.

Where concentrations of chemicals are listed, the rating applies to all concentrations up to and including the concentration indicated. Maximum temperature for continuous service in some specific atmospheres is 160^0F (71^0C). For most applications, however, maximum service temperature is much higher. Consult LAVA-LINER representative for actual use recommendations.

FOOTNOTE
R – Recommended / suitable continuous
CR - Conditionally recommended for splash/spill conditions
1 - Max service temp. limited to 100^0 F
2 - Max service temp. limited to 160^0 F.
NC - Incompatible

Acetic Acid, Glacial	CR
Acetic Acid, >15% <30%	R1
Acetic Acid, >5 % <10%	R
Ammonium Hydroxide,> 50%	NC
Ammonium Hydroxide, < 15%	R1
Biological Oxidation Ponds	R
Bromine, Saturated	R
Chromatic Acid 7%	CR
Sulfuric Acid 6%	CR
Chlorine, Saturated	R
Citric Acid, > 15%	R
Copper Sulfate (Sat.) Solution in Water	R
Crude Oil (Continuous Emersion)	NC
Deionized Water	R
Diesel Fuel	NR
Ethylene Glycol (Antifreeze)	R
Ferric Chloride, < 54%	R 2
Hydrochloric Acid (muriatic). < 15%	R
Solution in Water	R
Hydrogen Sulfide, Vapor37%	CR
H20, Fresh	R
Hydrogen Sulfide, Vapor Over Saturated Solution	CR
Methanol	CR
Nitric Acid, 10%	R
Phosphoric Acid, 10%	R
Sewage Disposal Plant	R
(Activated Sludge Sedimentation Tanks)	R
Salt	R
Sodium Dichromate 12%	R
Sodium Hydroxide 10%	R1
50% 72 hrs	R1
40% 48 hrs	R2
Sodium Hypochlorite, 5.25%	R
Soil Burial	R
Sodium Silicate, < 41 %	R
Sulfuric Acid, 5%-40%	R
Trisodium Phosphate< 10%	R
H_20	R

APPENDIX C

WATERPROOFING CONCRETE SLABS AND CONTAINMENT FOR COOLING TOWERS (General Specification)

1) GENERAL

A) This is a guide specification for the application of ULTRA-FLEX 5000 as a waterproofing and protective membrane over new or retrofitted concrete reservoirs and basins for cooling towers.

2) QUALITY ASSURANCE

A) LAVA-LINER requires that this system must be installed by a certified representative and shall be in compliance with all specifications herein and approved by LAVA-LINER or its duly authorized representative.

B) Requisite Paperwork and Submittals to LAVA-LINER or Representative.

C) To ensure that the requisite minimum standards for warranties are met, compliance with the following must be completed and forwarded to LAVA-LINER for review and approval.

i) Project specifications must be verified as complied with, signed and dated by the applicator.
ii) Work orders and change orders deviating from the specifications must be submitted and accompany the verified project specifications.
iii) LAVA-LINER and/or its authorized representative must submit request for Warranty Issuance to LAVA-LINER within 10 working days from the final inspection.

D) The following projects must obtain prior approval by LAVA-LINER before specifications are requested, contract is let or work is begun:

i) Projects where ULTRA-FLEX 5000 is to come into contact with chemicals in excess of those concentrations as set forth in the Chemical Resistance Charts for ULTRA-FLEX 5000 , petroleum distillates or chemicals not listed in the Chemical Resistance Charts.

3) DESCRIPTION

A) ULTRA-FLEX 5000 is a cold applied, two-component, liquid urethane. It cures to form a tough, durable, seamless, water impermeable barrier. ULTRA-FLEX 5000 may be brushed, rolled, spray or squeegee applied and retains its flexibility in hot or cold environments.

B) ULTRA-FLEX 5000 can be applied as a membrane over newly cured or existing, concrete surfaces. See Paragraph 6) A) below for limitations on curing requirements.

C) The system provides for a fabric reinforced membrane.

4) MATERIALS

i) ULTRA-FLEX 5000 PART "A"
ii) ULTRA-FLEX 5000 PART "B"
iii) ULTRA-FLEX 5000 AP (Adhesion Promoter)
iv) ULTRA-FLEX EP-990C Part A (Concrete Penetrating Epoxy) and ULTRA-FLEX EP-990C Part B (Concrete Penetrating Epoxy), 2:1 ratio for mixing.

5) SAFETY

A) Construction should be done with equipment and procedures designed to minimize danger to personnel and materials. It is recommended that good safety practices be followed when installing the ULTRA-FLEX 5000 membrane system.

B) All safety standards and recommendations for safety and handling hazardous materials issued by OSHA, EPA and other appropriate federal and state governmental and regulatory agencies must be followed.

C) All Material Safety Data Sheets must be complied with and maintained on site or

readily available to the personnel working the site.

D) The LAVA-LINER CONCRETE APPLICATION MANUAL shall be maintained on site and readily available to personnel working with ULTRA-FLEX 5000 products.

6) CONCRETE CURING

A) NEW CONCRETE: A curing period is necessary for all concrete surfaces to be coated with ULTRA-FLEX 5000. Portland Cement Concrete shall appear dry at the time of application of ULTRA-FLEX 5000. This curing period is needed for the concrete to attain proper hardness and for evaporation of excess water to prevent blistering, which could be caused by vapor pressure underneath the membrane film. Recommended curing of concrete varies from 28 days to six months depending upon surface conditions and coating used. Recommended procedure for new concrete is to moisture cure, using plastic film, wet burlap or water spray; pre-coat with a float finish to Class "B" tolerances and then surface with ULTRA-FLEX 5000.

B) Refer to the LAVA-LINER MANUAL for methods to determine moisture and content.

7) PREPARATION OF SUBSTRATE

A) ULTRA-FLEX 5000 is applied on a clean, dry, and structurally sound concrete base.

B) Any oil and/or grease spots must be thoroughly cleaned. If paint or a previous coating has been applied, the surface must be lightly sanded. All paint or previous coatings that are loose or flaking must be removed.

C) The following is a list of normal practices used in surface preparation:

i) Inspect and clean the surface thoroughly.
ii) Repair structural defects (i.e., cut out blisters in prior coatings and secure any loose sections, fill in voids and honeycombs).
iii) Repair or replace flashings, counter flashings, gravel stops, vents, drains, etc.
iv) All weak spots should be reinforced and repaired, checking particularly for damage at the weakest points.
v) Mask and protect surrounding structures, which are not to be covered with ULTRA-FLEX 5000.

D) If the concrete substrate is porous, a primer coat or an epoxy sealer may be required to prevent out gassing and the formation of bubbles. Formation of bubbles that can form as a result of entrapped air or moisture can be addressed through the use of EP-990C (Concrete Penetrating Epoxy) 4 hours prior to coating with ULTRA-FLEX 5000.

8) INCOMPATIBLE SUBSTRATES

A) Coal Tar products or solvent borne caulks or pastes are **not** compatible with ULTRA-FLEX 5000.

9) DETAILS AND SPECIAL CONSTRUCTION

A) All details and special construction such as vents, edges, flashings, counter flashings, parapets, curbed systems, equipment and sign supports, protrusions, drains and similar functions shall be consistent with the construction details set forth in the ULTRA-FLEX 5000 CONCRETE APPLICATION MANUAL.

B) The above sections shall be sealed in the following manner.
i) STEP-1 Apply a tack coat of ULTRA-FLEX 5000 around a protrusion, flashing, drain, etc to an area approximately 4 inches on each of the horizontal and vertical surfaces.
ii) STEP-2 Evenly imbed a 6” wide piece of polyester fabric into the tack coat.
iii) STEP-3 Coat the imbedded fabric and tack coated area with ULTRA-FLEX 5000.

10) PHASE CONSTRUCTION

A) No phase construction should take place if:

i) Material temperature is below 50^{O}F at time of application.
ii) Surface temperature is below 40^{O}F.
iii) Surface moisture is present or rain is imminent.
iv) Surface temperature drops below the dew point.
v) Other conditions are obviously unsuitable.
vi) Concrete is in a temperature rising/curing mode.

11) JOINTS

A) Treatment of major expansion joints with ULTRA-FLEX 5000 should be consistent with the ULTRA-FLEX 5000 CONCRETE APPLICATION MANUAL and Architectural Drawings included therein.

B) Hairline cracks (non-working) up to 1/8 inch may be bridged with ULTRA-FLEX 5000. If cracks exceed 1/8 inch but are less than ¼ inch and do not impair the structural integrity of the substrate, they may be in the following manner:

i) STEP 1 - Apply a tack coat of ULTRA-FLEX 5000 at the crack to 3 inches on each side of the crack.
ii) STEP 2 - Center and imbed 6 inch wide strip of polyester fabric over the crack into the wet ULTRA-FLEX 5000.
iii) STEP 3 – Coat over polyester fabric with ULTRA-FLEX 5000.
iv) STEP 4 – Recoat over tack coat and polyester fabric during final application of ULTRA-FLEX 5000

12) PROPORTIONING AND MIXING ULTRA-FLEX 5000

A) MIXING FOR BRUSH, ROLLER, SQUEEGEE OR "HOT POT" SPRAYING - Mix ULTRA-FLEX 5000 components with a "Mortar Mixer" or other similar mixer approved by LAVA-LINER for a FULL THREE MINUTES. (ULTRA-FLEX 5000 is packaged in pre-proportioned mixing containers and should not be mixed in proportions other than that specifically prepackaged by LAVA-LINER)

B) Hand mixing of the two components shall not be used except for small quantities of less than one gallon. (Components shall be proportionately reduced from original packaging.)

C) Plural component spray mixing shall be preset at a ratio or prepolymer (Part A) to activator (Part B) of 7:1 by weight or 9:1 by volume.

D) See the ULTRA-FLEX 5000 CONCRETE APPLICATION MANUAL for specific details for spraying either air-assisted or plural component spray equipment.

13) APPLICATION OF ULTRA-FLEX 5000

A) ULTRA-FLEX 5000 may be applied by brush, roller, spray or squeegee on horizontal surfaces in one pass to a minimum thickness of 50 mils dry film thickness. When spray, brush or roller applied on vertical surfaces, two or more passes are required to achieve a 50-mil dry film thickness. Squeegee application is not recommended on vertical surfaces. Wet coverage rate is approximately 3.55 gallons per 100 square feet.

14) REINFORCED MEMBRANE SYSTEM

A) Where it is desirable to reinforce the membrane system, ULTRA-FLEX 5000 may be applied in two coats using an imbedded polyester fabric. This is especially advantageous when applying a membrane system to steep embankments or walls to insure a minimum thickness and coverage. The application of ULTRA-FLEX 5000 in a reinforced system is accomplished in the following manner:
i) STEP 1 Apply a coat of ULTRA-FLEX 5000 to an area approximately 2-4 inches greater than the width of the polyester fabric roll.
ii) STEP 2 Center and imbed the polyester fabric into the wet ULTRA-FLEX 5000.
iii) STEP 3 Recoat over polyester fabric with ULTRA-FLEX 5000.
iv) STEP 4 Apply a second tack coat on the concrete surface adjacent to the prior application of reinforced ULTRA-FLEX 5000.

v) STEP 5 Center and imbed a new layer of polyester fabric into the new coat of ULTRA-FLEX 5000 insuring that the new fabric layer overlaps the previously imbedded polyester fabric by 6 inches.

vi) STEP 6 – Recoat over the new polyester fabric with ULTRA-FLEX 5000.

15) RECOATING

A) ULTRA-FLEX 5000 must be recoated within four hours to obtain maximum interlayer adhesion. If the membrane has cured for more than four hours, it must be lightly abraded with a wire brush or sandpaper and pretreated with ULTRA-FLEX AP (Adhesion Promoter).

16) JOINT OVERLAP

A) Should rain or other conditions require work stoppage, prepare for joint lines.

B) Joint lines shall be clean and straight. The overlap shall be six inches minimum to assure an impervious joint.

C) When the membrane has cured for more than four hours, all areas to be coated shall be lightly abraded with a wire brush or sandpaper. The abraded surface shall be treated with ULTRA-FLEX AP (Adhesion Promoter) at least 30 minutes and no more than four hours before applying the new ULTRA-FLEX 5000.

Division 7 Master Spec Format

SECTION 07.14.19
FLUID APPLIED REINFORCED MEMBRANE WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for furnishing and installing fully reinforced, liquid applied, membrane system designated on the drawings WP - 5 for concrete tanks, reservoirs, pits, for containment of water and wastewater.

B. Partially reinforced liquid applied membrane system for non-immersed areas. System is similar to A with reinforcing limited to cold joints, cracks and protrusions.

1.02 SUBMITTALS

A. Comply with requirements of Section 01. 33 00 - Submittal Procedures (Submittal Procedures).

B. Product Data: Submit manufacturer's product data, including surface preparation, application, and curing.

C. Samples: Submit 3-inch by i-inch samples for approval by the Engineer.

1. Cured high-performance coating, 69 mils thick.
2. Reinforcing fabric and joint cover sheet.

D. Applicator's Project References: Submit list of completed project references.

E. Certification of Applicator: Submit for applicator a certificate indicating completion of manufacture's contractor training program or 2 year history of application of equivalent 2 component systems.

F. Warranty: Submit manufacturer's standard warranty.

1.03 LEED SUBMITTALS

A. LEED Certification Product Data: Submit LEED Certification Product Data as specified in SECTION 018113 "SUSTAINABLE DESIGN REQUIREMENTS".

B. LEED Material Buyout Form: Complete and submit LEED Material Buyout Form, attached at the end of SECTION 01 81 13 "SUSTAINABLE DESIGN REQUIREMENTS" for the applicable LEED credit(s) specified hereinbefore.

C. Prohibited Content Installer Certification: Following completion of installation, complete and submit the certification form specified in SECTION 01 3329.07 "PROHIBITED CONTENT INSTALLER CERTIFICATION."

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Applicator: Use applicator experienced in the application of the specified high performance coating for a minimum of 2-years on projects of similar size and complexity.

Provide a list of completed projects including project name and location, name of engineer, name of coating manufacturer, and approximate quantity of coating applied.
2. Applicator's Supervisor: Employ a supervisor during all phases of the work that had successfully completed manufacturer's contractor training program.

3. Applicator's Personnel: Employ persons trained for the application of high-performance coating.

B. Regulatory Requirements: Comply with environmental regulations. Specific attention should be given the potential for the requirement of a Confined Space Permit.

C. Pre-Application Meeting:

1. Convene a pre-application meeting 2 weeks before the start of application of the high performance coating.

2. Require attendance of parties directly affecting work of this section, including the contractor, sub-contractor, engineer, applicator, and manufacturer's representative.

3. Review environmental requirements, materials, and protection of adjacent work, surface preparation, application, curing, field quality control, cleaning, and coordination with other work.

D. Manufacturer required inspections:

1 . Inspection of surface preparation prior to application of the concrete penetrating epoxy.

2. Inspection of the concrete penetrating epoxy prior to application of the high-performance coating

3. Final inspection of the coating after the completion of testing and warranty issuance.

E. LEED Requirements:

1. To the greatest extent practicable, furnish products containing recycled materials in compliance with requirements of LEED 2009 Rating System to achieve points for 20 percent] under MR Credit 4 Recycled Content.

2. LEED MR Credit 5 (MR 5.1 and MR 5.2) Regional Materials: Provide products that are extracted, processed, and manufactured regionally in compliance with requirements of LEED 2009 Rating System to achieve 2 points for 20 percent under MR Credit 5 Regional Materials.

3. Provide materials extracted, harvested, recovered and manufactured within 500 miles of the project site. Materials shall comply with LEED credit MR 5 to the extent possible.

4. LEED Credits: materials extracted, harvested, recovered and manufactured within 500 miles of the project site. Materials shall comply with LEED credit MR 5 to the extent possible.

5. Adhesives and sealants for use on the Interior of the Building shall be in compliance with requirements of LEED 2009 Rating System to achieve IEQ Credit 4.1 for low-emitting materials.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Deliver materials to the site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

2. Do not deliver material to site more than one month before use.

B. Storage:

1. Store the material in accordance with manufacturer's instructions.

2. Store materials indoor in an area well ventilated and protected from damage.

3. Do not store material near open flame, sparks, or hot surfaces.

4. Store materials on raised platforms and covered by waterproof covers.

5. Keep material containers closed.

C. Handling: Protect materials during handling and application to prevent damage.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not apply in wet weather or when rain is imminent.

B. Apply when the surface is a minimum 50 degrees F (10 degrees C) and a minimum of 5 degrees F (3 degrees C) above dew point. Consult manufacturer for application instructions if the ambient or surface temperature is below 50 degrees F (10 degrees F).

C. Do not apply to porous substrates when substrate or ambient temperatures are rising.

D. Do not apply to porous substrates when substrate is in direct sunlight.

E. Do not apply over substrates that are frozen or contain frost.

1.06 WARRANTY

A. Provide a 10 year material and 1-year labor warranty. Obtain material warranty from manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Lava-Liner, Ltd., 1550 Tiburon Blvd., Suite G-418, Tiburon, CA 94920 Ph. 415-435-7746 Fax 415-789-9502

2.02 FLUID APPLIED REINFORCED MEMBRANE WATERPROOFING

A. High-performance coating: ULTRA-FLEX ECO 5000. Two-component, high solids, elastomeric asphalt modified urethane. Designed for spray, squeegee, or roller application.

1. Elastomeric Waterproofing, ASTM C836 and C957: Exceeds all criteria.

2. Solids by volume: 92 percent.

3. Volatile Organic Compounds (VOC): 0.76 pounds per gallon (92 giL).·

4. Tensile Strength, ASTM 0412, 100-mil sheet: >3000 pounds per square inch.

5. Extension to Break, ASTM 0412: 130 percent.

6. Recovery from 100 Percent Extension:

a. After 5-minutes: 98 percent.

b. After 24-hours: 100 percent.

7. Coating Performance, Crack Bridging:

a. 10 Cycles at minus 15 degrees F (minus 26 degrees C): Greater than 1/8-inch.

b. After Heat Aging: Greater than 1/4-inch.

8. Coating Performance, Weathering,, ASTM 0822: 5000 hours: no cracking.

9. Softening Point, ASTM 036: Greater than 350 degrees F (177 degrees C).

10. Deflection Temperature, ASTM 0648: below minus 60 degrees (minus 50 degrees C).

11. Service Temperature: minus 60 degrees F to 220 degrees F (minus 50 degrees C to 105

degrees C).

12. Hardness, ASTM D2240, Shore D, 77 degrees F (25 degrees C): 45.

13. Permeability to Water Vapor, ASTM E96, Method E, 100 degrees F (38 degrees C), 100- mil sheet: 0.02 perms.

14. Abrasion Resistance, Weight Loss, ASTM D4060: <1.0 mg.

15. Adhesion to Concrete, Dry, Elcomeler: 350 pounds per square inch.

16. Color: Black.

B. Primer: Ultra-Flex EP-990C Two-component, medium solids, concrete penetrating epoxy primer.

1. Solids by Volume: 65 percent mixed.

2. Volatile Organic Compounds (VOC): 2.81 pounds per gallon (340170 *giL).*

C. Adhesion Promoter: Ultra-Flex AP174. Adhesion promoter: Bi-functional organosilane compound dispersed in isopropyl alcohol. Ensures a continuous and uniform bond between surfaces. Use the bonding agent over non-porous surfaces such as steel, except where primer has been installed. Do not use where solvent cleaners are prohibited.

1. Solids by Volume: Less than 1 percent.

2. Volatile Organic Compounds (VOC): 6.4 pounds per gallon (743 *g/L).* Where required, Ultra-Flex AP-174 may be blended to specifications requiring less than 100 g/l, contact your Ultra-Flex representative.

D. Patching Material: ULTRA-FLEX ECO 5000 Trowel Grade, Liquid applied, chemical and corrosion resistant urethane elastomer, chemically thickened to allow trowel application with minimum sag, Use as a crack filler and for application to vertical surfaces and cold joints,

1. Elastomeric Waterproofing, ASTM C836 and C957: Exceeds all criteria,

2. Solids by volume: 92 percent.

3. Volatile Organic Compounds (VOC): 0.74 pounds per gallon (88 *giL).*

4. Tear Strength, ASTM624, Die C: 150 pounds per inch.

5, Tensile Strength, ASTM D412, 1 ~O-mil sheet: >3000 pounds per square inch.

6. Extension to Break, ASTM D412: 130 percent.

7. Recovery from 100 Percent Extension:

a. After 5-minutes: 98 percent.

b. After 24-hours: 100 percent.

8. Coating Performance, Crack Bridging:

a. 10 Cycles at minus 15 degrees F (minus 26 degrees C): Greater than 1/8-inch.

b. After Heat Aging: Greater than 1/4-inch.

9. Coating Performance, Weathering, ASTM D 822: 5000 hours: no cracking,

10. Softening Point, ASTM D36: Greater than 325 degrees F (160 degrees C).

11. Deflection Temperature, ASTM D648: below minus 60 degrees (minus 50 degrees C).

12. Service Temperature: minus 60 degrees F to 220 degrees F (minus 50 degrees C to 105 degrees C).

13. Hardness, ASTM 02240, Shore D, 77 degrees F (25 degrees C): 45.

14. Permeability to Water Vapor, ASTM E96, Method E, 100 degrees F (38 degrees C), 100- mil sheet: 0.02 perms.

15. Abrasion Resistance, Weight Loss, ASTM 04060: >1 mg.

16. Adhesion to Concrete, Dry, Elcometer: 350 pounds per square inch.

17. Color: Black.

O. Reinforcing Fabric and Joint Cover Sheet: Tietex T272 or equivalent. Stitch bonded polyester. Compatible with coating materials.

1. Weight: 3 ounces per square yard (100 *g/m2).*

2. Tensile Strength, ASTM 01682: 57.1 pounds (30 kg).

3. Elongation, ASTM 01682: 62 percent.

4. Mullen Burst Strength, ASTM 03726: 177 pounds per square inch

5. Trapezoid Tear Strength, ASTM 01117: 16.1 pounds (7.2 kg).

E. Pipe Protrusion Cover and Sealing Gaskets: polyester fabric, waterproofed, rubber boot gaskets. Compatible with Coating materials.

1. Manufacturer: Jaeger TTC,

2. Size: Various to fit tightly around pipes and circular protrusions as required.

F. Protection Board-2 - Pro Cover Waterproofing Protection Course or equal. For use at Wetland cells only.

PART 3 EXECUTION

3.01 INSPECT

A. Inspect substrate and adjacent areas where high-performance coating will be applied. Notify the Engineer of conditions that would adversely affect the application or subsequent utilization of the high-performance coating. Do not proceed with application until unsatisfactory conditions are corrected.

3.02 PROTECTION

A. Protect adjacent work and surrounding areas from contact with high-performance coating.

3.03 SURFACE PREPARATION

A. Surface Preparation shall be in accordance with SSPC-Sp-6/NACE No.3 at a minimum.

B. Provide clean, dry, and structurally sound concrete surface.

C. New Concrete:

1. Ensure concrete has a minimum compressive strength of 3,000 psi, is dry, and is free of release agents and curing compounds before application of high-performance coating.

2. Remove surface laitance and release agents.

O. Steel Surfaces:

1. Steel surfaces shall be lightly abraded and cleaned prior to application. At concrete to steel transitions any gaps or cracks shall be filled UF ECO 5000 -Trowel Grade.

E. Condition Survey: If required by site Engineer, perform a condition survey of existing concrete in accordance with ACI 201.1 R.

F. Abrasive Blasting: (Water blasting may be used as an alternative)

1. Prepare concrete surface to receive high-performance coating by abrasive blasting.

2. Remove dirt, soil, grease, oil, paint, coatings, form release agents, curing compounds, laitance, loose material, unsound concrete, and other foreign materials that would inhibit performance of high-performance coating in accordance with ASTM 04258 and by abrasive blasting .

3. Obtain a firm, sound concrete surface in which bug holes are fully opened or repaired.

4. Remove sharp concrete edges and projections.

5. Perform abrasive blasting in accordance with ASTM 04259-88.

6. Receive approval by Engineer of blasting media.

7. Maintain air supply for abrasive blasting free of oil and water in accordance with ASTM D4285.

8. Expose aggregate to obtain a profile of ICRI CSP 4 to 6 in accordance with ICRI 03732.

G. Repair concrete surface to be free of holes. Fully open bug holes before repair. Repair defects in the concrete surface, such as bug holes, air pockets, and honeycomb by filling and smoothing off with patching material, epoxy patching compound, or grout. Abrasive blast repaired surfaces.

H. Ensure substrate is clean and dry in accordance with manufacturer's instructions. Remove surface laitance from concrete surface to expose aggregate to obtain a profile of ICRI CSP 4 to 6 in accordance with ICRI 03732.

I. Repair cracks in concrete surface with material suitable for type and width of crack, compatible with substrate and high-performance coating, and approved by the Engineer.

J. Moisture Tests: 00 no apply primer or high-performance coating to concrete surface unless one of the flowing moisture tests confirm appropriate moisture levels for properly prepared substrates:

1. Plastic Sheet Method (ASTM D4263): Pass/Fail.

2. Relative Humidity Test: Less than 75 percent relative humidity at 70 degrees F.

3. Calcium Chloride Test: Less than 5 pounds per 1,000 square feet per 24 hours.

4. Radio Frequency Test: Less than 5 percent moisture.

3.06 APPLICATION

A. Locations:

1. Reservoir, Storm water Dewatering Reservoir and the Fire Water Storage Tank, Sump Pits, the Fully Reinforced WP-5 shall be used to 1.0 feet above the maximum water level. The surfaces above that shall use the partially reinforced system.

2. For Tidal Flow and Vertical Flow Wetland Cells, Elevator Dry Pits, Permanent Dewatering Wells, Sump Pits, Sewage Ejector Pits and Sand Trap, the Fully Reinforced WP-5 shall be used to the top edge of the enclosure or as indicated in drawings.

3. Terminations on vertical surfaces shall be sealed and protected with a bead of UF ECO 5000- Trowel grade. The bead shall be tooled smooth.

B. Apply Ultra-Flex EP-990C (Concrete Penetrating Epoxy) as a primer to concrete surface a minimum of 10-mils wet thickness (200 Sq. ft/gal). A Uniform coating free of holidays or pinholes is necessary to minimize out gassing effects curing the application of the high-performance coating to porous surfaces such as concrete. Surfaces may require additional coats to obtain a pinhole free finish.

C. Allow primer to cure in accordance with manufacturer's instructions before over coating with the high-performance coating.

D. Apply high-performance coating in accordance with manufacturer's instructions for a fully reinforced elastomeric membrane system.

E. Keep material containers tightly closed until ready for use.

F. Keep equipment, air supplies, and application surfaces dry.

G. Mix and apply when high-performance coating is above 60 degrees F (15 degrees C).

H. Do not use adulterants, thinners, or cutback solutions.

I. Blend and mix 2-component materials in accordance with manufacturer's instructions. Do not hand mix components.

J. Maintain air supply for material spray application free of oil and water in accordance with ASTMD4285.

K. Apply high-performance coating directly to a clean and dry epoxy prepared surface as a tack coat of approximately 20 mils wet film thickness.

L. Imbed reinforcing fabric into tack coat taking care not to entrain air and to keep surface free of folds and wrinkles.

M. Apply a 3 to 6-inch wide strip of polyester reinforcing fabric over cracks over 1/8-inch wide, nonworking joints, and edges by imbedding into a tack coat.

N. When the polyester fabric can be recoated without movement and the underlying tack coat has 1-4 hours, recoat with high-performance coating.

O. Apply sufficient high-performance coating to achieve an additional 60-mils wet film thickness for containment.

P. Joint Lines:

1. Prepare for joint lines should rain or other conditions require work stoppage or extended delay.

2. Install joint lines clean and straight. Install overlap 6-inches minimum to ensure an impervious joint.

3. Severely abrade with wire brush or sandpaper and apply bonding agent to all areas where the high-performance coating has cured beyond its recoat window.

Q. Recoating:

1. Recoat the high-performance coating system within the recoat window to obtain maximum interlayer adhesion to build specific thickness.

2. Immersion Service: Minimize areas to be recoated outside the recoat window, except at joint lines.

3. Non-Immersion Service: Severely abrade with wire brush or surface grinder, apply bonding agent, and recoat, if high-performance coating has cured more than the recoat window. Acceptable adhesion can only be achieved through aggressive abrading.

3.07 CURING

A. Cure high-performance coating in accordance with manufacturer's instructions.

B. Curing Time:

1. Allow minimum time of 24-hours to 48-hours at 60 degrees F (15 degrees C) for a 60-wet mil coating thickness.

C. Receive approval of cured coating by Engineer.

3.08 FIELD QUALITY CONTROL

A. Provide inspection services by an independent inspection firm throughout all phases of surface preparation, application, and curing of the high-performance coating.

B. Prior to placing into service, the applicator shall test the containment areas using electric field vector mapping or an equivalent method for testing for breaches in the high-performance coating system. If breaches are identified, the coating in the affected area shall be abraded and repaired in accordance with the manufacturer's instructions.

C. Flood testing by hydrostatic means shall be used after successful testing by the foregoing electric field vector mapping to identify potential additional leak problems but shall not be used as an alternative. See Section 22 10 00 "Wastewater Treatment System for specific flood testing procedures

D. Final inspection prior to warranty release shall be made by the High-performance coating manufacturer or their representative.

3.09 CLEANING

A. Remove and dispose of all temporary materials used to protect adjacent work and surrounding areas.

B. Immediately remove and clean high-performance coating materials from surfaces not intended to receive the materials.

END OF SECTION