DIVISION 7 Section 14.19

_____ PROJECT

HIGH SOLIDS CHEMICAL RESISTANT EPOXY SYSTEM FOR CONCRETE CONTAINMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for furnishing and installing a liquid applied, high solids, chemical resistant, epoxy sealant system for immersion and containment of highly caustic materials designated on the drawings _____ for concrete tanks, reservoirs, pits, for containment..

B. Partially reinforced liquid high solids epoxy system for immersion and continuous containment of acid and wastewater over cold joints, cracks, and protrusions in the concrete areas described in Sec. 1.01 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. Applicator's Project References: Submit list of completed project references.

D. 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.

E. Warranty: Submit manufacturer's standard warranty.

1.03 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, and applicator.

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

D. Third Party (3rd) Required Inspections (NACE Level II Inspector) Of All Phases (Appendix A Checklist):

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

2. Visual inspection of the cured EP 990C 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.

1.03 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).

C. Concrete to receive surfacing shall have cured for at least 28 days and shall have been free of water for at least 7 days.

D. Dew Point: Substrate temperature must be minimum of 5 degrees above dew point prior to, during or up to 24 hours after application of flooring system.

E. Advise other trades of fixtures and fittings not to be installed until flooring is cured and protected.

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

G. Do not apply when substrate is in direct sunlight.

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

1.06 WARRANTY

A. Provide a 5-year material and 1-year labor warranty. Obtain material warranty from manufacturer.

PART 2 PRODUCTS

A. Primer: Ultra-Flex EP-990C Concrete Penetrating Epoxy Primer. A cycloaliphatic, 2 component, low viscosity concrete sealing epoxy.
B. Performance Coat: Ultra-Flex EP-990 HS High Solids Chemical Resistant Epoxy. A Novolac/Bis A 2 component, fast setting epoxy.

2.01 MANUFACTURER

A. Lava-Liner, Ltd., 1550 Tiburon Blvd., Suite G-418, Tiburon, CA 94920 / Ph. 415-761-9247 / Fax 415-761-9510 sales@lava-liner.com.

2.02 FLUID APPLIED HIGH SOLIDS EPOXY SYSTEM FOR CONTAINMENT

A. High-performance coating: ULTRA-FLEX EP 990 HS. Two-component, high solids, Novolac Bisphenol A Chemical Resistant Epoxy.

Solids by volume: 100 percent.

Volatile Organic Compounds (VOC): 0% EPA Method 2

Tensile Strength, ASTM D695,>7,000 pounds per square inch.

Softening Point, ASTM 036: Greater than 450 degrees F (177 degrees C).

Service Temperature: minus 20 degrees F to 220 degrees F

Hardness, ASTM D2240, Shore D, 77 degrees F (25 degrees C): >70.

Permeability to Water Vapor, ASTM E96, Method E, 100 degrees F (38 degrees C), 100-mil sheet: 0.0 perms.

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

Adhesion to Concrete, Dry, Elkometer: >2500 pounds per square inch.

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. Reinforcing Fabric and Joint Cover Sheet: use a woven or non-woven C-Glass fiberglass fabric that is chemical resistant. Recommended specs are:

1. Weight: 0.77 oz/yd (2 26 gm/m^2) ASTM D1777 (DIN 53854)

2. Thickness: 0.10 in (0.26mm) ASTM D4886 (DIN 53855/1)

3. Tensile Strength: 5.6 lb./in^2 ASTM D1682:

4. Elongation: 1 percent: ASTM D168 DIN 53857)

D. 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.

PART 3 EXECUTION

3.01 INSPECTIONS

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. Inspect in accordance with ACI 201.1R.

3.02 PROTECTION

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

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.

D. 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 with hydraulic cement and cured properly and treated with EP990C prior to application of the EP990 HS.

E. Condition Survey: If required by site Engineer, perform a condition survey of existing concrete in accordance with ACI 201.1 R. Complete Surface Condition Checklist Appendix A. Copy to GC, Owner and Lava-Liner, Ltd as a part of the Warranty Submittal.

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 D4258 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 D4259-88.

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.

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 hydraulic cement, 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 SSPC-Sp-6/NACE No.3.

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

Primer

B. Apply Ultra-Flex EP-990C (Concrete Penetrating Epoxy) as a primer to concrete surface a minimum of 10-mil WFT (wet film thickness) at the rate of 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 screed coats to subsequently blast and obtain a clean SSPC-Sp-6/NACE No.3 finish free of all bug holes, honeycombs and anomalies.

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

Reinforcing

A. Reinforce all cold joints, protrusions, penetrations and cracks. Apply a 3 to 6-inch-wide strip of fiberglass reinforcing fabric over cracks over 1/16-inch wide, nonworking cold joints, protrusions and penetration edges by imbedding fabric into a tack coat.
B. Imbed reinforcing fabric into tack coat taking care not to entrain air and to keep surface free of folds and wrinkles.
C. When the fiberglass fabric can be recoated without movement and the underlying tack coat has cured for 1-4 hours, recoat with high-performance coating to refusal.

High Solids Performance Coating

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

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

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

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

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

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

G. Apply sufficient high-performance coating to achieve a total 30-mil wet film thickness for containment.

Joint Lines:

A. Prepare for joint lines should rain or other conditions require work stoppage or extended delay.
B. Install joint lines clean and straight. Install overlap 6-inches minimum to ensure an impervious joint.
C. Severely abrade with wire brush or sandpaper and apply bonding agent to all areas where the high-performance coating has cured beyond the recoat window.

Recoating:

A. Recoat the high-performance coating system within the recoat window to obtain maximum interlayer adhesion to build specific thickness.
B. Immersion Service: Minimize areas to be recoated outside the recoat window, except at joint lines.
C. 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 72-hours to 120-hours at 60 degrees F (15 degrees C) for a 30-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. Either o the following are acceptable methods for testing prior to being placed into service.

1. 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.
2. 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 Division 22 Section 10 00 for specific flood testing procedures". A. Upon completion, the tank shall be tested to determine water tightness. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Engineer. If the pretest has not been completed prior to commissioning, the test shall be performed at the completion of the curing of the final coat of the EP 990 HS.

C. Final inspection prior to warranty release shall be made by the coating manufacturer or a NACE Level II certified inspector.

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

APPENDIX A

Checklist for Visual Inspection of Concrete Structure

Inspection Items	Description	Comments / Rating
Description of structure	1. Name, location, type, and size 2. Owner, project engineer, contractor, date of construction 3. Photographs involve general view and a detailed close-up of the condition of an area 4. Draw map-orientation showing the sunny and shady areas and the well and poorly drained regions.	
Nature of environmental and loading conditions	Exposure of the structure to various environmental and loading conditions: 1. Arid, subtropical, marine, freshwater, industrial environment. 2. Freezing and thawing, wetting and drying under a dry atmosphere. 3. Chemical corrosion and attack: sulfates, acids, bases, chloride, gases 4. Abrasion, erosion, cavitation, impact 5. Electrical conductivity 6. Deicing chemicals that contain chloride ions 7. Heat from adjacent sources	
Drainage	Flashing Joint, sealants, Weep holes, Contour Elevation of drains	
Loading conditions	1. Dead 2. Live 3. Impact 4. Vibration 5. Traffic 6. Seismic 7. Other types of loads	
Soils (foundation conditions)	1. Expansive soil 2. Compressible soil (settlement) 3. Evidence of pumping	
Distress indicators	1. Cracking 2. Staining 3. Surface deposits and exudations 4. Leaking	
Overall apparent alignment of structure	1. Settlement 2. Deflection 3. Expansion and contraction.	
General Condition of Concrete Surface	1. Good 2. Satisfactory 3. Poor	
Formed and finished concrete surfaces	1. Smoothness 2. Bugholes (surface air voids) 3. Sand streaks 4. Honeycomb 5. Soft areas 6. Cold joints 7. Staining	

Cracking	1. Location and frequency of cracks 2. Crack map 3. Crack width and pattern 4. Leaching	
Scaling of concrete	Scaling type, area, and depth	
Spalls and pop outs	Number, size, and depth type	
Stains, efflorescence	–	
Exposed reinforcement	Corrosion	
Curling and warping	–	
Erosion	Abrasion, Cavitation	
Previous patching or other repair	–	
Surface coatings/protective systems/linings/ toppings	1. Type and thickness 2. Bond to concrete 3. Condition	
Penetrating sealers	Type, Effectiveness, Discoloration	