

## SECTION 09 96 35

## CHEMICAL-RESISTANT COATINGS

07/07

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

## ASTM INTERNATIONAL (ASTM)

ASTM D 578	(2005) Glass Fiber Strands
ASTM D 579	(2004) Standard Specification for Greige Woven Glass Fabrics
ASTM D 4263	(1983; R 2005) Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM F 2170	(2002) Determining Relative Humidity in Concrete Floor Slabs in situ Probes

## INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI)

ICRI 03732	(1997) Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays
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## THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 13	Requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

**SD-01 Preconstruction Submittals**

Submit **letter from CRC manufacturer** stating that:

1. Applicator has notified manufacturer of proposed installation.
2. Manufacturer is in agreement with the intended application.
3. Applicator is qualified to do the Work and meets the quality control minimum experience requirements.
4. Applicator's Qualifications: List of references substantiating

experience.

5. Sample of warranty, prior to starting the Work.

#### SD-02 Shop Drawings

Submit **scaled drawings of installation plan**, including configuration details for the following:

Expansion joints and structural isolation joints.  
Construction joints  
Cracks  
Wall base details  
Equipment bolts (when installed before or after CRC application).  
Metal angle frames at trenches, gratings, or hatches  
Floor drains  
Transition and termination detail at edge of CRC system  
Pipe penetrations (vertical and horizontal)  
Other details specific to the structure being coated

#### SD-03 Product Data

Submit **manufacturer's catalog data** for all specified products.

The following information shall be appended to each CRCDS:

1. Manufacturer's technical data sheets.
2. Chemical resistance test results for exposure to service conditions.
  - a) Provide specific chemical resistance data for chemicals not listed in the manufacturer's standard data sheets.
  - b) Manufacturer's application specification.

#### SD-04 Samples

Submit **4-inch square sample** proposed for use showing minimum thickness and finish of each layer and complete system.

#### SD-07 Certificates

Submit **certificates** for following items showing conformance with the referenced standards contained in this section.

Field inspection and test reports  
Manufacturer's Certificate of Proper Installation  
Special guarantee

#### 1.3 DELIVERY, HANDLING AND STORAGE

- a. Deliver materials in manufacturer's original, unopened containers.
- b. Storage: Maintain materials in clean and dry condition. Follow manufacturer's instructions for storage temperature range.

#### 1.4 FIELD TESTS

- a. Inspection: Inspect finished system for complete, uniform coverage of specified area. Evidence of defects include improper thickness, hardness, adhesion, flexibility, and appearance.

1. All finish coats, including touchup and damage-repair coats, shall be applied in a manner that will present a uniform texture and color-matched appearance.

2. All visible areas of chipped, peeled, or abraded coatings shall be hand or power sanded. Prime and finish coat these in accordance with these Specifications and the manufacturer's recommendations.

b. Holiday Testing:

1. All surfaces lined with CRC shall be electrically checked with high voltage holiday test equipment to determine the location of discontinuities:

a) Provide suitable electrical contact to reinforcing steel. Verify conductivity of electrical contact by touching the second, ungrounded, electrode to another metallic ground connected to the concrete structure.

1) Do not perform electrical inspection until the CRC is sufficiently cured, as determined by the CRC manufacturer.

b) All electrical inspection testing shall be performed in accordance with NACE RP0188.

c) Perform all electrical tests at 100 volts/mil for the minimum approved thickness of the lining material.

2. Repair all lining defects in accordance with the manufacturer's written instructions.

3. After repaired and recoated areas have dried sufficiently, retest each repaired area. Final tests may also be conducted by Engineer.

1.5 PROTECTIONS AND SAFETY PRECAUTIONS

a. Temperature: Apply coating only when substrate, ambient air, and coating material are within manufacturer's recommended range. It is the Contractor's responsibility to provide to furnish temporary facilities that may be required for proper installation of coating, such as covers, enclosures, airheating and cooling, and dehumidification.

b. Substrate: Moisture content shall be within manufacturer's recommended range for product application.

c. Ventilation: Provide during and after application to meet all applicable safety and health regulations.

d. Submit [letter from CRC Manufacturer](#).

1.6 QUALITY ASSURANCE

1.6.1 Quality Control

a. Manufacturer's Experience

1. Minimum 5 years manufacturing proposed products.

2. Manufacturer shall have a minimum of three projects where the specified products have been successfully installed.

b. Applicator's Experience: Minimum 3 years applying proposed products.

c. Applicator Quality Control Plan: Applicator shall maintain an in-house quality assurance program that monitors surface preparation, coating application, and quality control testing for coating and lining operations. Level of experience, quality assurance program, and quality control testing by the applicator shall meet the minimum requirements specified herein, the coating manufacturer's instructions, and related government regulations.

d. The Contractor is solely responsible for quality control inspection and testing. Contractor shall monitor and be responsible for all environmental, surface preparation, application and quality control testing compliance at the locations where coating work is undertaken.

e. Mockups:

1. Required for coating systems over 1,000 square feet in area or exposed to view in service.

2. Before proceeding with Work under this section, finish one complete space or item of each color scheme required showing selected colors, finish texture, materials, quality of work, and special details.

3. Procedure:

a) Prepare, prime and coat one section of concrete minimum 3 feet by 3 feet, at a location mutually agreed upon by the Contractor and Engineer. Use a "step" down mockup as follows:

1) Leave one-quarter of the surface exposed to allow observation of the surface preparation.

2) Apply primer to three-quarters of remaining surface.

3) Apply filler/surfacer to one-half of the surface, over the primer, leaving one-quarter of the surface exposed with primer.

4) Apply finish coat to filler/surfacer, leaving one-quarter of the surface exposed with surfacer/filler.

b) Mockup shall include concrete cuts for coating terminations and one example of a penetration.

c) Holiday test the portion of mockup with the complete system using the equipment and test voltages specified herein.

d) Leave mockup in place to serve as a reference and standard for the remaining work.

e) At completion of project, clean and prepare all surfaces that are not complete and finish coat the mockup area for

incorporation into the Work.

4. After Engineer review and approval, sample spaces or items shall serve as a standard for similar work throughout the Project.

#### 1.6.2 Service Conditions

a. Location: Covered, ambient temperature conditions.

b. Surface:

1. Concrete and masonry floors, walls, and vault for chemical storage and handling secondary containment areas.

2. Concrete walls and floors for continuous immersion in RO Concentrate or Process Drains.

c. Traffic: Foot, light hand truck.

d. Chemicals Stored in Containment Area and Chemical Trenches:

1. Ammonium hydroxide (aqueous ammonia), 25 percent solution.

2. Corrosion inhibitor, chemical and concentration to be determined during operation.

3. Hydrofluorosilicic acid (fluoride), 28 percent solution.

4. Sodium hypochlorite (bleach), 0.2 percent solution.

5. Sodium chloride (brine), up to 100 percent solution.

6. Sulfuric acid, 93 percent solution.

7. Sodium Bisulfite, 35 percent concentration.

#### 1.6.3 Manufacturer's Services

a. Provide manufacturer's technical representative at Site for installation assistance, inspection, and Manufacturer's Certificate of Proper Installation.

b. Manufacturer's technical representative shall provide separate site visits for each individual CRC system as specified herein.

c. Manufacturer's representative shall visit the project site at the following intervals:

1. On the first day of application of any CRC system.

2. As necessary during surface preparation and application to ensure installations are made in accordance with the manufacturer's recommendations.

3. As required to resolve field problems attributed to or associated with manufacturer's product.

4. Minimum number of site visits required for each CRC system shall be:

- a) CRC-2: Two site visits, each for a minimum of 4 hours.
- b) CRC-5: One site visit, for a minimum of 4 hours.

## PART 2 PRODUCTS

### 2.1 General

#### 2.1.1 Materials

- a. Manufacturer's highest quality products suitable for the intended service.
- b. Only compatible materials from a single manufacturer shall be used within any system.
- c. Meet federal, state, and local requirements limiting the emission of volatile organic compounds.
- d. Materials shall not contain lead or lead compounds.
- e. Joints:
  - 1. Provide joint filler material of type, size, and composition as recommended by the CRC manufacturer for the particular joint condition.
  - 2. Joint materials shall maintain a liquidtight joint for the life of the coating system.
  - 3. Chemical resistance of the joint material shall be the same or better than the coating system.
  - 4. Provide joint backing material per CRC manufacturer's recommendations.
- f. Non-slip Aggregate: Type and quantity as recommended by coating manufacture for specific application.

#### 2.1.2 Manufacturers

- a. Novolac Epoxy:
  - 1. Ceilcote.
  - 2. Dudick.
  - 3. Sherwin-Williams.
- b. Polyurethane Elastomer:
  - 1. Carboline (Polibrid 705).
  - 2. Global Eco-Technologies (Enduraflex 1988).
- c. Submit [manufacturer's catalog data](#).
- d. Submit [4-inch square sample](#).

## 2.2 EPOXY COATINGS

### a. Novolac Epoxy (CRC-2):

1. General: Multi-layer system consisting of reinforced flexible epoxy base coat with novolac epoxy finish.
2. Filler: 100 percent solids epoxy paste, to fill holes and patch the concrete surface after abrasive blasting, and to fill concrete block masonry. Quantity and thickness as required.
3. Primer: Low viscosity and moisture tolerant. Thickness 6 mils minimum DFT.
4. Base: Epoxy, 150 percent minimum elongation for bridging cracks in concrete, reinforced with fiberglass mat. Thickness 35 mils minimum DFT. Floor and wall coatings reinforced with 1-ounce fiberglass mat saturated with specified resin.
5. Finish: Novolac epoxy, flake-filled, 100 percent solids, resistant to specified chemicals, and slip-resistant where required. Colors as selected by Engineer from manufacturer's standard colors. Color selection may vary by chemical to distinguish different containment areas. Thickness 25 mils minimum DFT, in two coats. Aggregated for slip resistance in locations subject to foot traffic under normal operating conditions.
6. Lining Reinforcement: Fiberglass chopped-strand or woven-mat lining reinforcement shall meet the requirements of ASTM D 578 and ASTM D 579 standards for Class C chemical grade glass.

## 2.3 POLYURETHANE COATINGS (CRC-5)

### a. Plural-component, polyurethane elastomeric coating with successful service record in concrete basins:

1. One coat aggregated filler, application rate as required to fill and level 100-percent of the concrete surface in preparation for coating, 1/16-inch nominal thickness.
2. One coat epoxy or polyurethane primer, 2 mils MDFT.
3. One coat of polyurethane elastomer, 80 mils MDFT.

## PART 3 EXECUTION

### 3.1 EXAMINATION

#### a. Surface Preparation:

1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed directions and recommendations of the system manufacturer whose product is to be applied.
2. Provide RPR minimum 3 days' advance notice of start of surface preparation and system application Work.

3. Perform Work only in presence of RPR, unless RPR grants prior approval to perform Work in RPR's absence.

b. Schedule inspection with RPR in advance for cleaned surfaces and system application Work.

### 3.2 PREPARATION

a. Follow the manufacturer's printed directions and recommendations.

b. Fill holes and cracks with manufacturer's recommended materials to produce even surface for application of systems.

c. Concrete Surfaces:

1. Do not begin until 30 days after concrete has been placed, or longer if required for low moisture in concrete.

2. Remove grease, oil, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent, or other suitable cleaning methods.

3. Prepare surfaces according to [SSPC SP 13](#) Blast clean to remove loose concrete and provide a tooth for binding. Minimum surface profile shall meet [ICRI 03732](#) 3 to 5, or higher, if required by the coating manufacturer.

4. Secure coating manufacturer's recommendations for additional preparation if required to fill excessive voids or bugholes exposed after blasting.

5. Ensure surfaces are dry prior to coating.

a) Conduct tests to verify that concrete surfaces are sufficiently dry for coating. Test for moisture using plastic sheets in accordance with [ASTM D 4263](#).

b) If the test indicates evidence of moisture, conduct tests to determine quantity of water present in accordance with [ASTM F1869](#). Moisture content shall not exceed 3 pounds per 1,000 square feet in a 24-hour period.

c) All tests using electronic moisture meters shall conform to [ASTM F 2170](#).

### 3.3 APPLICATION

a. General:

1. Spray or trowel apply coating systems in accordance with manufacturer's printed instructions.

2. Cove corners at vertical and horizontal intersections, and reinforce as specified in paragraph Joints, this section.

3. Provide the minimum number of coats required for each coating system, regardless of application method. Do not apply succeeding coats until previous coat has cured in accordance with the coating

manufacturer's recommendations.

4. Submit [scaled drawings of installation plan](#).

b. Containment Linings:

1. Install coating systems on vertical and horizontal surfaces, including caps, within containment wall for storage tanks, pumps, and piping. Stop coating of walls in a clean line 36 inches above the floor or at the elevation indicated on the Drawings.

2. Extend surfacing completely under structures and equipment located within the containment area. Install at construction joints in substrate and floor drains, trenches, and other components within the containment area.

c. Film Thickness:

1. Provide specified thickness of material. Use screeds or wet film gauges to monitor thickness during application.

2. All coated surfaces shall be visually inspected to ensure proper and complete coverage has been obtained.

3. After repaired and recoated areas have sufficiently dried, coating thickness tests may be conducted by the Owner to verify thickness complies with the manufacturer's recommendations.

d. Provide temporary facilities and enclosures as necessary to protect work areas during the preparation, application and curing.

e. Mixing:

1. Thoroughly mix epoxy resin coatings until homogeneous following manufacturer's instructions.

2. Mix only components furnished by coating manufacturer.

f. Joints:

1. Provide continuous sealant, backing material, and joint-lining treatment recommended by the coating manufacturer at all expansion, isolation, and construction joints.

2. Provide continuous sealant bead at joints between different coating systems.

3. Provide fiberglass or synthetic fabric reinforcement at construction joints and large substrate cracks to maintain liquid-tight requirements under the specified service conditions.

g. Penetrations: Coat over or around equipment anchors, base plates, pipes, and similar items installed in areas receiving CRC to maintain continuous liquid-tight seal. Provide written instructions for treatment of penetrations.

h. Terminations:

1. Conform to manufacturer's details.

2. For coatings exposed to wastewater or vapor space above wastewater liquid levels, terminate leading edges in saw cuts  $1/4$  inch wide by  $1/4$  inch deep, or as required by the coating manufacturer. Prime and extend epoxy resin or polyurethane elastomer into the saw cut. Do not fill saw cut with epoxy surfacer filler.

### 3.4 APPLICATION SCHEDULE

a. Unless otherwise specified, apply coatings in accordance with the following application schedule and as shown on Drawings. In the event of discrepancies or omissions in the following, request clarification from Engineer before starting Work in question.

b. Coating System CRC 2: Use in the following areas:

1. Concrete surfaces of containment areas, as specified herein and as shown on the Drawings, associated with the following chemicals:

- a) Ferric chloride.
- b) Citric acid.
- c) Hydrofluorosilicic acid.
- d) Sodium hypochlorite generation.
- e) Sulfuric acid.
- f) Sodium bisulfite.

2. Concrete surfaces of trenches in RO Building, as specified and as shown on the Drawings.

3. Exposure: Immersion or splash and spill service.

4. Traffic: FT.

5. Location: Covered, ambient temperature conditions.

c. Coating System CRC-5: Use in the following areas:

1. Concrete basins and structures, as shown on the drawings. Apply coating to all submerged concrete surfaces below the elevation shown on the drawings.

- a) RO Concentrate Pump Station.
- b) Chlorine Contact Tank.

2. Exposure: Immersion service in process:

- a) RO Concentrate.
- b) Chlorine Contact Tank.

3. Traffic: Foot Traffic.

4. Location: Covered, ambient temperature conditions.

3.5 ACCEPTANCE PROVISIONS

a. If an item has an improper appearance or insufficient film thickness, the surface shall be cleaned, prepared, and top-coated as required to achieve proper appearance and/or thickness. Provide specific procedures in writing from the CRC manufacturer prior to cleaning and preparation.

b. Damaged coatings, pinholes, and holidays shall have the edges feathered and repaired in accordance with the recommendations of the coating manufacturer.

1. All finish coats, including touchup and damage-repair coats, shall be applied in a manner that will present a uniform texture and color-matched appearance.

2. All visible areas of chipped, peeled, or abraded coatings shall be hand or power sanded. Prime and finish coat these in accordance with these Specifications and the manufacturer's recommendations.

c. Submit [certificates](#).

-- End of Section --