

SECTION 09 96 35
CHEMICAL-RESISTANT COATINGS

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. ASTM International (ASTM):
 - a. D522, Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
 - b. D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
 - c. F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - d. F2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes.
 2. International Concrete Restoration Institute (ICRI): Guideline 03732, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymers.
 3. The Society for Protective Coatings (SSPC):
 - a. PA 10, Guide to Safety and Health Requirements for Industrial Painting Projects.
 - b. P13/NACE 6, Surface Preparation of Concrete.

1.02 ABBREVIATIONS

- A. CRC: Chemical Resistant Coating.
- B. CSP: Concrete Surface Profile.
- C. MDFT: Minimum Dry Film Thickness.
- D. Mil: One thousandth of an inch.
- E. SDS: Safety Data Sheet.
- F. SSPC SP: Surface Preparation Standard for Protective Coatings.

1.03 PREINSTALLATION MEETING

- A. Prior to beginning painting Work, schedule meeting and be prepared to discuss the following subjects, as a minimum:
1. Required schedule.
 2. Sequence of critical path work items.
 3. Use of Site, access, office and storage areas, security, and temporary facilities.
 4. Major product delivery and priorities.
 5. Safety plan.
- B. Attendees shall include:
1. Contracting Officer's representatives.
 2. Contractor's office representative.
 3. Contractor's resident superintendent.
 4. Contractor's quality control representative.
 5. Subcontractors' representatives whom Contractor may desire or Contracting Officer may request to attend.
 6. Contracting Officer's representative.
 7. Paint manufacturer's technical representative.
 8. Others as appropriate.

1.04 SUBMITTALS

- A. Action Submittals:
1. Shop Drawings:
 - a. Furnish a CRC System Data Sheet (CRCSDS) and a CRC Product Data Sheet (CRCPDS) for each CRC system. The CRCSDS and CRCPDS forms are appended to the end of this section.
 - b. Indiscriminate submittal of manufacturer's literature only is not acceptable.
 - c. The following information shall be appended to each CRCSDS:
 - 1) Manufacturer's technical data sheets.
 - 2) Manufacturer's application specification.
 - 3) Chemical-resistance test results for exposure to service conditions.
 - 4) Configuration details for the following:
 - a) Expansion joints and structural isolation joints.
 - b) Construction joints.
 - c) Cracks.
 - d) Wall base details.
 - e) Gate frames.
 - f) Equipment bolts (when installed before or after CRC application).

- g) Metal angle frames at trenches, gratings, or hatches.
 - h) Transition and termination detail at edge of CRC system.
 - i) Pipe penetrations (vertical and horizontal).
 - j) Top of wall termination.
 - k) Other details specific to the structure being coated.
2. Coordinate submittal for painting metal surfaces with Section 09 90 00, Painting and Coating.

B. Informational Submittals:

1. Letter from CRC manufacturer stating the following:
 - a. Applicator has notified manufacturer of proposed installation.
 - b. Manufacturer agrees with intended application.
 - c. Applicator is qualified to do the Work and meets quality assurance minimum experience requirements.
2. Applicator Qualifications:
 - a. List of references substantiating experience. Include projects with at least 3 years of successful service history, including project name and location, names of Owner and Engineer, and description of product used, substrates coated, and application procedures.
 - b. Certification from coating manufacturer showing current status as an approved applicator.
3. Manufacturer's Product Qualifications:
 - a. List of projects substantiating successful application and performance of the proposed products to the specific exposure and process conditions. Include project name and location, application dates, and names of Owner, Engineer, and Applicator.
4. Field inspection and test reports.
5. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers' Field Services.
6. Safety Data Sheets (SDS).

1.05 QUALITY ASSURANCE

- A. Manufacturer's Experience: Minimum 5 years manufacturing proposed products.
- B. Applicator's Experience: Minimum 3 years applying proposed products.
- C. Applicator Quality Control Plan: Applicator shall maintain 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 applicator shall meet minimum requirements specified herein, coating manufacturer's instructions, and related government regulations.
- D. Subcontractor is solely responsible for quality control inspection and testing. Subcontractor shall monitor and be responsible for all environmental, surface

preparation, application and quality control testing compliance at 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. Provide one mockup for each CRC system.
4. Mockup components will vary, depending on CRC system. All components of CRC system, including surface preparation, must be exposed in mockup.
5. Example Mockup Procedure:
 - a. Prepare, prime, and coat one section of concrete, 10 feet by 10 feet, at a location mutually agreed upon by the Sub Contractor and Contracting Officer. Use a “step” down mockup as follows:
 - 1) Leave one-quarter of the surface exposed to allow observation of surface preparation.
 - 2) Apply resurfacing mortar three-quarters of remaining surface.
 - 3) Apply filler/surfacer and primer to one-half of the surface, over resurfacing mortar, leaving one-quarter of the surface exposed with resurfacing mortar.
 - 4) Apply finish coat to filler/surfacer with primer, leaving one-quarter of surface exposed with surfacer/filler/primer.
 - b. Mockup shall include concrete cuts for coating terminations and one example of a penetration.
6. After Contracting Officer review and approval, sample spaces or items shall serve as a standard for similar work throughout Project.
7. Leave mockup in place to serve as a reference and standard for the remaining work. At completion of Project, clean and prepare all surfaces that are not complete and finish coat the mockup area for incorporation into the Work.

1.06 REGULATORY REQUIREMENTS

- A. Meet applicable federal, state, and local requirements for coating product selection, surface preparation, and painting activities.

1.07 SURFACE PREPARATION AND COATING APPLICATION

- A. Perform surface preparation and painting in accordance with recommendations of the following:
1. These Specifications.
 2. Coating manufacturer’s instructions.
 3. SSPC PA 10.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original, unopened containers.
- B. Storage:
 - 1. Maintain materials in clean and dry condition.
 - 2. Maintain storage temperatures within the manufacturer's requirements.
 - 3. Follow manufacturer's instructions.
- C. Shelf Life: Do not use any coating materials that have exceeded shelf-life limitations printed on the package.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Temporary Facilities: Provide temporary facilities that may be required for proper installation of the complete chemical resistant coating system, such as covers, enclosures, air heating or cooling, and dehumidification.
- B. Temperature: Apply surfacing materials and protective coating only when substrate, ambient air, and coating material are within the manufacturer's recommended range.
- C. Substrate: Moisture content shall be within the manufacturer's recommended range for product application.
- D. Ventilation: Provide during and after application to meet all applicable safety and health regulations.

1.10 SPECIAL GUARANTEE

- A. Furnish extended guarantee or warranty. Special guarantee shall provide for correction, or at option of the Contracting Officer, removal and replacement of Work specified in this specification section found defective during a period of 2 years after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in the General Conditions.
 - 1. 24-Month Warranty Period Inspection: Contracting Officer will conduct inspection of interior and exterior coated surfaces prior to the end of warranty period. Contracting Officer will notify Contractor in advance of inspection and Contractor may attend at its option. Contracting Officer will prepare list of coating defects and failures identified during inspection and transmit to Contractor. List shall serve as notice of repairs required under warranty.

2. Repairs:
 - a. If repairs are required, requirements of Contract shall apply including, but not limited to, requirements to remove standing water and perform repair work.
 - b. Repair defective coatings using coating materials, equipment, and methods similar to those used in original work. Materials shall be of fresh manufacture and within manufacturer's stated shelf life at time of application.
 - 1) Provide extended warranty of 1 year for repairs.
 - 2) Complete repairs within 30 calendar days of Warranty Period Inspection.

PART 2 PRODUCTS

2.01 PAINT

- A. Manufacturers:
 1. CRC-4:
 - a. Sauereisen .
 - b. Or equal.
- B. Physical Characteristics:
 1. Color: Color as Selected by Contracting Officer.
- C. Functional: Minimum of 5 years verifiable experience in manufacture of specified product.
- D. Performance: Nationally recognized manufacturers of paints and protective coating who are regularly engaged in the production of such materials for essentially identical service conditions.

2.02 MATERIALS

- A. Chemical-Resistant Coatings:
 1. Mixture of liquid resin-based material, setting agent, and filler designed to be troweled into place to cure to a hard state.
 2. As Described in Coating Systems. Provide manufacturer's highest quality products suitable for the intended service.
- B. Product Service Experience: Minimum 5 years of verifiable successful product performance in the listed exposure and process condition.
- C. Only compatible materials from a single manufacturer shall be used within any system.

- D. Meet federal, state, and local requirements limiting the emission of volatile organic compounds.
- E. Materials shall not contain lead or lead compounds.
- F. 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 liquid tight 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 recommendation.

2.03 COATING SYSTEMS

- A. CRC-4—Epoxy Polymer, Trowel or Spray Applied:
 - 1. Description: Chemical resistant barrier lining suitable for application to new and existing underground concrete hydraulic structures.
 - 2. Service Conditions:
 - a. Immersion and head space exposure to primary wastewater subject to hydrogen sulfide and dilute sulfuric acid, pH of 1 to 3.
 - b. Chemical Storage room with secondary containment for 50 percent Citric Acid and 10 percent to 15 percent Sodium Hypochlorite, 53 percent to 62 percent Magnesium Hydroxide and supplemental carbon in the form of a proprietary organic blend similar to a glycerin based strength of 1.1 kg/L COD.
 - 3. CRC Components:
 - a. Primer: One coat of manufacturer's recommended moisture-resistant epoxy primer, 2 mils MDFT. As required by CRC manufacturer.
 - b. Surfacer/Filler: One coat of 100 percent solids, trowel applied epoxy surfacer, application rate as required to fill and level 100 percent of the concrete surface in preparation for coating. 1/16-inch nominal thickness.
 - c. Corrosion Barrier Lining: One coat of trowel grade, 100 percent solids, chemical resistant amine-cured epoxy lining material, 125 MDFT.
 - d. Glaze Coat: Required for fiber-filled or aggregate-filled corrosion barrier lining products to provide a smooth surface. One coat of liquid applied, 100 percent solids, amine-cured chemical-resistant epoxy finish, 15 MDFT to 20 MDFT.

PART 3 EXECUTION

3.01 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 Contracting Officer minimum 3 days' advance notice of start of surface preparation and system application Work.
 - 3. Perform Work only in presence of Contracting Officer unless Contracting Officer grants prior approval to perform Work in Contracting Officer's absence.
- B. Schedule inspection with Contracting Officer in advance for cleaned surfaces and system application Work.

3.02 PREPARATION

- A. In accordance with Section 09 90 00, Painting and Coating, and 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 surface preparation activities until 30 days after new concrete has been placed, or longer if required to meet coating manufacturer's limit for moisture in the 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 and provide a concrete profile by abrasive blasting, SSPC SP 13, or by high-pressure water blasting, 4,000 psi minimum. Minimum surface profile shall meet ICRI CSP 3 to 5, or higher if required by coating manufacturer.
 - 4. Secure coating manufacturer's recommendations for additional preparation if required by the coating manufacturer.
 - 5. Ensure that concrete surfaces are sufficiently dry prior to coating.
 - a. Test for moisture using plastic sheets in accordance with ASTM D4263.
 - b. If the test indicates moisture is present, conduct tests to determine moisture content in accordance with ASTM F1869. If the moisture content exceeds 3 pounds per 1,000 square feet in a 24-hour period, provide the manufacturer's recommendations for mitigation of

moisture effect on lining application and long term lining performance.

- c. All tests using electronic moisture meters shall conform to ASTM F2170.

- D. Concrete Defects: Fill holes and cracks with manufacturer's recommended materials. Secure the manufacturer's recommendations for additional preparation if required for excessive bug holes exposed after blasting.

3.03 APPLICATION

A. General:

1. This specification section is intended for coating and lining concrete with special chemical resistant coatings. See Section 09 90 00, Painting and Coating, for ferrous metal painting requirements.
2. Surfacer/Filler: Apply surfacer/filler to concrete with methods recommended by the coating manufacturer as required to provide a surface that is continuous, smooth, void-free surface. Force material into voids and irregularities, and remove excess filter before the material sets.
3. Spray or trowel apply coating system components in accordance with manufacturer's written instructions.
4. Cove corners at vertical and horizontal intersections, and reinforce as specified in Part 3, Execution, Paragraph Joints.
5. Lightly backroll finish coat as recommended by CRC manufacturer to eliminate pinholes.
6. Provide 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 coating manufacturer's recommendations.
7. Observe manufacturer's published recoat windows. If recoat window is exceeded, mechanically abrade before recoating in accordance with manufacturer's directions and as approved by Contracting Officer

- B. Priming and Holiday Prevention on Concrete and Substrates: Follow manufacturer's written instructions related to application during decreasing substrate temperature conditions, adequate surface preparation and other application techniques that may be necessary to reduce the potential for outgassing and formation of pinholes during coating application and cure. If required by the coating manufacturer, apply manufacturer's recommended epoxy penetrating primer to minimize the effects of vapor transmission from the concrete.

C. Product Mixing:

1. Thoroughly mix until homogeneous following manufacturer's instructions.
2. Mix only components furnished by coating manufacturer.

- D. Film Thickness: Provide specified thickness of material. Use screeds or wet film gauges to monitor thickness during application.
- E. 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.
- F. Penetrations: Coat over or around equipment anchors, base plates, pipes, and similar items installed in areas receiving CRC to maintain continuous liquid tight seal.
- G. Terminations:
 - 1. Confirm to manufacturer's details.
 - 2. For coatings exposed to wastewater or vapor space above wastewater liquid levels, terminate leading edges in beveled saw cuts 1/4-inch wide by 1/4-inch deep, or as required by manufacturer. Prime and extend coating into the saw cut. Do not fill saw cut with epoxy surfacer. Saw cut shall be provided by CRC subcontractors.

3.04 UNSATISFACTORY APPLICATION

- 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 manufacturer prior to cleaning and preparation.

3.05 DAMAGED COATINGS

- A. Damaged coatings, pinholes, and holidays shall have the edges feathered and repaired in accordance with the recommendations of the manufacturer.
- B. 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.
- C. 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.

3.06 FIELD QUALITY CONTROL

- A. Inspection: Inspect finished system for complete, uniform coverage of specified area. Evidence of defects include improper thickness, hardness, and appearance.
- B. Holiday Testing:
 - 1. All surfaces provided with a barrier lining shall be electrically checked with high-voltage holiday test equipment to determine 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 barrier lining is sufficiently cured, as determined by the manufacturer.
 - b. All electrical inspection testing shall be performed in accordance with NACE SP0188.
 - 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.
- C. Film Thickness:
 - 1. Perform destructive dry film thickness measurements in accordance with ASTM D4138.
 - 2. Perform one film thickness measurement per 500 square feet of lined surface.
 - 3. Perform additional testing if any one measurement does not meet specified thickness requirement.
 - a. Perform an additional four measurements in the area where inadequate thickness is found. No single measurement shall be less than specified dry film thickness.
 - 4. Provide additional coats of barrier lining as required to meet specified film thickness. Abrade surface by brush blasting if manufacturer's recommended recoat window is exceeded.
- D. Repair all damaged coatings associated with film thickness testing in accordance with manufacturer's written instructions.

3.07 MANUFACTURER'S SERVICES

- A. Provide manufacturer's representative at Site in accordance with Section 01 67 00, Product Requirements, for installation assistance, inspection, and Manufacturer's Certificate of Proper Installation.
- B. Manufacturer's representative shall visit the Project Site at the following intervals:
 - 1. At preconstruction conference.
 - 2. On first day of application of any system.
 - 3. As necessary during surface preparation and application to ensure installations are made in accordance with the manufacturer's recommendations.
 - 4. As required to resolve field problems attributed to or associated with manufacturer's product.
 - 5. Minimum Number of Site Visits: Two site visits, each for a minimum of 6 hours. Travel time is not included as part of duration listed above.

3.08 APPLICATION SCHEDULE

- A. Unless otherwise shown or specified, apply coatings in accordance with the following application schedule. In the event of discrepancies or omissions in the following, request clarification from Contracting Officer before starting Work in question.
- B. Coating System CRC-4:
 - 1. Use in the following areas:
 - a. Receiving Station: Precast Concrete Vault/Septage Equalization Tank.
 - b. Headworks Channel; Apply coatings to the full height of concrete channels and water holding structures.
 - c. Process Building: Chemical Storage Room; Apply coatings on floor and 6 inches up walls
 - d. Digesters: Apply coating to the full height of concrete walls and all overhead concrete.
 - e. Plant Drain Station: Apply coating to the full height of the concrete walls in drain pump wet well.

3.09 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are a part of this specification:

1. Chemical-Resistant Coating System Data Sheet (CRCSDS).
2. Chemical-Resistant Coating Product Data Sheet (CRCPDS).

END OF SECTION

CHEMICAL-RESISTANT COATING SYSTEM DATA SHEET (CRCSDS)

Complete this CRCSDS for each coating system, include all components of the system (surface preparation, primer, intermediate coats, and finish coats). Include all components of a given coating system on a single CRCSDS.

CRC Number (from Spec.):		
CRC System Title (from Spec.):		
Coating Manufacturer:		
Representative:		
Surface Preparation:		
CRC Material (Generic)	Product Name/Number (Proprietary)	Min. Coats, Coverage

CHEMICAL-RESISTANT COATING PRODUCT DATA SHEET (CRCPDS)

Complete and attach manufacturer's Technical Data Sheet to this CRCPDS for each product submitted. Provide manufacturer's recommendations for the following parameters at temperature (F)/relative humidity.

PRODUCT: _____

Temperature/RH	50/50	70/30	90/25
Induction Time			
Pot Life			
Shelf Life			
Drying Time			
Curing Time			
Min. Recoat Time			
Max. Recoat Time			

Provide manufacturer's recommendations for the following:

Mixing Ratio: _____

Maximum Permissible Thinning: _____

Ambient Temperature Limitations: min.: _____ max.: _____

Surface Temperature Limitations: min.: _____ max.: _____

Surface Profile Requirements: min.: _____ max.: _____