

SECTION 03930

CONCRETE REHABILITATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all protective coatings for concrete Work.
2. Where not otherwise shown, the extent of the protective coating shall be applied to all interior surfaces of pump station structures (and manholes if applicable) to be protected as defined on the drawings.
3. Types of protective coating for concrete Work required include, but are not necessarily limited to, the following:
  - a. Trowelable, fast setting, high-early strength underlayment.
  - b. Epoxy formulation filler compound
  - c. Corrosion-resistant, spray-applied, polymer, monolithic protective lining.
  - c. Miscellaneous materials.

B. Coordination:

1. Coordinate abrasive blasting of substrates to avoid later difficulty or delay in performing the Work of this Section.
2. Review installation procedures under other Sections and coordinate the installation of items that must be installed prior to application of the protective coating.
3. Coordinate the setting of wall and floor penetrations, and installation of piping and equipment or other items interfacing with the recommended execution procedures of the protective coating manufacturer.
4. Remove all chemicals, films, laitance, sealing compounds and other materials from substrates to receive the Work of this Section, as may be required by the protective coating manufacturer at no additional expense to OWNER.
5. All substrate surface preparation and coating application to be completed by manufacturer's approved Applicator.

C. Related Sections:

1. Section 03300, Cast-In-Place Concrete.
2. Section 09900, Painting.

1.2 QUALITY ASSURANCE

- A. Applicator Qualifications:
  - 1. Engage a single surface preparation and coating installation applicator specialist (Applicator) with specific experience and training in the application of the type of protective coating specified, and who agrees to employ only tradesmen with specific skill and experience in this type of Work. Submit name and qualifications to Manufacturer for approval.
  - 2. All Applicators shall be certified or licensed by the protective coating materials manufacturer.
  
- B. Performance Criteria: The protective coating applied to the designated surfaces shall be capable of withstanding, under constant exposure, raw wastewater including attack from hydrogen sulfide and organic acids generated by microbial sources, with no adverse effects. Products capable of only intermittent exposure resistance are not acceptable.
  
- C. Source Quality Control: Provide each component of protective coating produced by a single manufacturer, including recommended underlayment, filler compounds, base coat and top coat materials.
  
- D. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.
  - 1. As defined in Part 2 – PRODUCTS
  
- E. Statement of Application: Upon completion of the Work under this Section, submit a statement to ENGINEER, signed by CONTRACTOR and the protective coating Applicator stating that the installed protective coating complies with the requirements of the Specifications, and that the installation and materials comply with the manufacturer's printed recommendations related to the condition of installation and use.
  
- F. Protective Coatings system specified are as manufactured by Sauereisen Co., Pittsburgh, PA (412) 963-0303. Request for material substitutions shall be in accordance with requirements of the General Conditions and General Requirements, including Section 01300, Submittals, and Section 01631, Substitutions (when used).

### 1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
  - 1. After the protective coating system components have been delivered to the site submit a 12-inch by 12-inch sample of protective coating system on ¼-inch board using the materials delivered to the site and showing the installed coating system to be expected in the finished Work. Show full thickness of system with all components in place. Sample submittals will be reviewed for color, texture, and pattern only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.

- B. Shop Drawings: Submit for approval the following:
  - 1. Copies of manufacturer's technical data and installation instructions for protective coating system required.
  - 2. Maintenance Manual: Copies of manufacturer's written instructions for recommended maintenance practices. Include the following information:
    - a. Product name and number.
    - b. Name, address and telephone number of manufacturer and the local distributor.
    - c. Detailed procedures for routine maintenance and cleaning.
    - d. Detailed procedures for repairs.
- C. Certificates: Submit manufacturer's certifications that materials have been approved for the installation conditions shown on the Drawings and as specified herein. Submit manufacturer's Materials Warranty certificate.
- D. Mock Up Area: At the request of the Engineer, an on-site mock up area shall be constructed on the jobsite to provide a visible sample of the surface preparation, substrate repair, and lining for the approval by the Owner, Engineer, Contractor, Material Supplier, and the Applicator.

#### 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
  - 1. Deliver material in manufacturer's original unopened and undamaged packages.
  - 2. Clearly identify manufacturer, brand name, contents, color stock number, and order number on each package.
  - 3. Packages showing indications of damage that may affect condition of contents are not acceptable.
- B. Storage of Materials
  - 1. Store in original packaging under protective cover and protect from damage.
  - 2. Stack containers in accordance with manufacturer's recommendations.
  - 3. Store all containers, including fillers, at temperatures recommended by the manufacturer.
- C. Handling of Materials: Handle materials in such a manner as to prevent damage to products or finishes.

#### 1.5 JOB CONDITIONS

- A. Environmental Requirements: Maintain proper substrate and air temperature before, during and after installation as required by Manufacturer and detailed in Manufacturer's technical data sheets and installation instructions or in writing from

(Project Name)

Concrete Rehabilitation

the Manufacturer. Provide adequate ventilation during application and curing periods.

1.6 WARRANTY

- A. Protective Coating manufacturer shall warranty its products as free from material defects for a minimum period of one (1) year. Provide associated Warranty Certificate.
- B. CONTRACTOR shall warranty the installed protective coating system as free from material and workmanship defects for a minimum period of one (1) year.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The protective coating system shall be a complete system for substrate repair and epoxy based corrosion protection including:
  - 1. Trowelable grade underlayment when needed and recommended by the Applicator and Manufacturer to provide proper substrate for application for he epoxy lining.
  - 2. Epoxy filler compound when needed and recommended by the Applicator and Manufacturer to fill small voids and provide a properly prepared surface for the epoxy lining. (Note: New construction generally requires only the use of an approved filler compound to fill bugholes and other minor voids as approved by the Manufacturer).
  - 3. Epoxy lining to provide an abrasion resistance and chemical resistant protective coating against physical and chemical attack phenomena typically associated with municipal wastewater service conditions.
  - 4. CONTRACTOR shall provide all accessory components such as sealants, hardeners or other compounds as recommended by the manufacturer for maximum protective coating adherence to substrate, and log-term service performance.

B. Trowelable Underlayment:

1.	<u>Properties</u>	<u>Sauereisen No. F-120/F-121 Trowel Grade</u>
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Application time	
Working time at 70°F	30 minutes
Initial set at 70°F	3 hours
Color	Tan
Compressive Strength	
@ 24 hours	3500 psi
@ 5 hours	2500 psi
@ 28 days	6,000psi
Density	137 pcf

(Project Name)

Concrete Rehabilitation

Mix ratio (powder to water, by weight)	9:1
Abrasion Resistance (ASTM C-704)	
Volume Loss, cm <sup>3</sup>	5.14 cm <sup>3</sup>
Volume Loss, %	0.65%
Freeze-thaw Durability Factor (ASTM C666-A)	87.2

- Underlayment shall be a fast-setting, high early strength, Portland/Calcium Aluminate-based resurfacing material. Underlayment shall be trowelable formulation, except where Applicator recommends alternate use of sprayable, castable or gunite formulations by the same manufacturer for intended service application.

B. Epoxy Filler Compound:

1	<u>Properties</u>	<u>Sauereisen Epoxy Filler Compound No.209</u>
	Color	Off White
	Compressive Strength	10,000 psi
	Density (ASTM C-905)	87.2 pcf
	Flexural Strength (ASTM C-580)	4000 psi
	Modulus of Elasticity (ASTM C-580)	5.2 x 10 <sup>4</sup> psi
	Tensile Strength (ASTM C-307)	2200 psi
	Bond Strength to Concrete (ASTM D-4541)	Concrete Failure
	Moisture Absorption (ASTM C-413)	<0.25%
	Shrinkage (ASTM C-531)	<0.2%
	Working Time	15 min @ 70°F
	Topcoat	3 hours @ 70°F

- Filler Compound shall be an epoxy formulation specifically designed to fill voids, irregularities and air pockets in concrete surfaces. The filler compound shall provide a uniform surface for the application of epoxy monolithic protective coatings. Filler compound shall be confirmed by the Manufacturer as compatible with any underlayment materials and with the protective coating.

C. Epoxy Lining Protective Coating:

1.	<u>Properties</u>	<u>Sauereisen SewerGard No. 210S</u>
	Application time	
	Working time - 70°F (ASTM C-308 modified)	30 minutes
	Initial set time - 70°F (ASTM C-308 modified)	17 hours
	Bond strength (ASTM C-4541)	Concrete Failure
	(to dry or damp concrete)	
	Compressive strength (ASTM C-579)	6800 psi
	Flexural strength (ASTM C-580)	4600 psi
	Modulus of elasticity (ASTM C-580)	3.3 x 10 <sup>5</sup> psi

(Project Name)

Concrete Rehabilitation

Tensile strength (ASTM C-307)	2500 psi
Coefficient of thermal expansion	$38.0 \times 10^{-6}$ in/in/°F
Abrasion Resistance (ASTM D-4060)	49mg <sub>(avg)</sub>
Density (ASTM C-905)	77 pcf
Maximum Service Temperature	150°F
Moisture Absorption (ASTM C-413)	≤0.2%
Shrinkage (ASTM C-531)	≤0.11%
Elongation	1.27%
Tensile Modules	42,000 psi
Fracture Toughness	100 in-lb/cu.in.
Minimum Applied Thickness (Dry Film)	60 mils

2. Epoxy lining shall be a self priming (to concrete ), 100 % solids, fiber-filled, spray-applied epoxy polymer protective coating material specifically designed to protect concrete and steel surfaces (consult Manufacturer for primer requirements on steel surfaces) in wastewater structures subjected to municipal wastewater service conditions, including associated abrasive physical attack and chemical attack mechanisms related to hydrogen sulfide and organic acids generated by microbial sources. (Note: an alternate formulation of the identical resin and hardener system with different fillers may be applied at the specified thickness when approved in writing by the Manufacturer.)

D. Product and Manufacturer:

1. Materials specified are those that have been evaluated for the specific service. Products of Sauereisen Company (412.963.0303), Inc. are listed to establish a standard of performance and quality. Equivalent materials of other manufacturer's may be submitted on written approval of the Engineer. As part of the proof of equality, the Engineer will require at the cost of the Contractor, certified test reports from a nationally known, reputable and independent testing laboratory conducting comparative tests as directed by the Engineer between the product specified and the requested substitution.
2. Requests for substitution shall include manufacturer's literature for each product giving name, product number, generic type, descriptive information, solids by volume, recommended dry film thickness and certified lab test reports showing results to equal the performance criteria of the products specified herein. In addition, a list of five projects shall be submitted in which each product has been used and rendered satisfactory service.
3. All requests for product substitution shall be made at least 10 days prior to the bid date.
4. Any material savings shall be passed to the owner in the form of a contract dollar

reduction.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. CONTRACTOR and his Applicator shall examine the areas and conditions under which protective coating Work is to be performed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Commencement of the Work of this Section shall indicate that the substrate and other conditions of installation are acceptable to the CONTRACTOR and his Applicator, and will produce a finished product meeting the requirements of the Specifications. All defects resulting from such accepted conditions shall be corrected by CONTRACTOR at his own expense.
- C. Stopping Active Leaks: After surface cleaning, any visible leaks shall be reported to the ENGINEER. Any minor leaks not requiring other repairs by the ENGINEER must be sealed using Sauereisen InstaPlug No. F-180, No. F-370 Chemical Grout, No.F-190 H2OPRUF, or approved equal prior to proceeding with protective coatings system installation.

#### 3.2 PREPARATION

- A. Concrete surfaces to receive protective coating shall be cast with rough form finish. Surfaces shall not be rubbed, troweled or otherwise finished in any manner that will obscure or cover the firm substrate surface. All subsequent surface washing, abrasive blasting, grinding, patching, filling and preparation shall be completed by the Applicator in accordance with the protective coating Manufacturer's recommendations.
- B. Allow concrete to cure for 28 days before protective-coating system is installed, unless otherwise recommended by the Applicator or systems Manufacturer.
- C. Substrate: Concrete surfaces to be coated shall be free of curing compounds and form release agents, laitance and foreign particles that may inhibit bonding. Prior to start of protective coating systems application, broom clean, vacuum, hydroblast or abrasive blast surfaces to be covered as required, and inspect the substrate. Start of application operations shall indicate acceptance of substrate conditions and full responsibility for the completed Work. Surface preparation procedures shall be in accordance with ICRI (International Concrete Repair

- Institute) Guideline No. 03732, or comparably approved method. Surface preparation requirement is to expose aggregate and obtain a uniform surface texture resembling an ICRI CSP #4-6 comparators.
- D. Level or grind concrete substrates to manufacturer's recommended tolerances and to produce a textured but uniform installation, including removal of all sharp edges, ridges or depressions.
- E. New Concrete Application – New concrete voids and depressions shall be filled with underlayment material, re-establishing plan finished grades and surface profiles.
1. Moisture Testing
- a) Floors - New concrete should be installed over a moisture barrier to eliminate moisture transmission through the concrete floor. Prior to the application of materials, the moisture content must be determined using a suitable Moisture Detection System per ASTM F-1869 - "Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride." One such manufacturer is Sealflex Industries, 2925 College Ave. #B4, Costa Mesa, CA (714-708-0850). An average value exceeding 3.0 lbs/1000 ft<sup>2</sup>/24-hr period is unacceptable and will require additional cure time, the application of a surface penetrating vapor barrier or other corrective measures. Re-test after taking corrective measure to ensure an average value below 3.0 lbs.
- b) Moisture Testing for walls and overheads - Test new concrete pours for moisture after completing surface preparation. Utilize ASTM D-4263 "Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method." Any indication of moisture will require additional cure time, the application of a surface penetrating vapor barrier or other corrective measures. Re-test after taking corrective measure to ensure the absence of moisture.
- F. Existing Concrete Application - Existing concrete structures to receive protective coating system must be capable of withstanding imposed loads. All oil, grease and chemical contaminants must be removed from the surface of concrete by chemical cleaning. Surfaces must be firm, free of standing water, laitance, form release agents, and be structurally sound as determined by architect/engineer. Suitable surface preparation methods include Shotblasting, Abrasive Blasting, or Water Jetting. Surface preparation procedures shall be in accordance with ICRI

Guideline No. 03732. Surface preparation requirement is to expose aggregate and obtain a uniform surface texture resembling an ICRI CSP # 4-6 comparators.

- G. Brick Structures Application - All oil, grease and chemical contaminants must be removed from the brick by chemical cleaning. Hydroblast or abrasive blast to provide anchor profile on brickwork and to remove all existing paints, protective coatings, foreign particles, chemically attacked or unsound mortar. Loose brickwork and voids in the mortar joints should be re-pointed with Sauereisen Underlayment No. F-120 or F-121 Resurfacer. All active hydrostatic leaks must be stopped prior to protective epoxy coating application.
- H. Metal Application - Remove all visible oils, grease per SSPC-SP1, section 2.1 Remove contaminants from surface as per SSPC-SP1 section 3.2. Using CHLOR\*RID INTERNATIONAL "CHLOR\*TEST" test kits, or approved equivalent method, determine level of chlorides on the metal surfaces. Level of acceptable chlorides shall be no more than  $3\mu\text{g}/\text{cm}^2$  for immersion and no more than  $5\mu\text{g}/\text{cm}^2$  for atmospheric conditions. Surfaces with unacceptable levels must be washed with CHOR\*RID, or approve equal, as per manufacturer's recommendations and then re-tested.

Using SSPC-VIS 1 as a guide, abrasive blast to a NACE 1/ SSPC-SP5 White Metal Blast for immersion and a NACE 2/SSPC-SP10 for other service conditions. An anchor profile range of 2.5-3.0 mil is preferable. All welds must be continuous, free of flux and have a smooth rounded radius without any sharp edges or be ground flat and free of flux, fins and spatter.

Consult protective coatings Manufacturer for primer recommendations on metal.

### 3.3 APPLICATION

- A. Protective coating systems shall be installed when ambient air and surface temperature is between 60°F and 85°F. Store material within the 60° to 85°F range for 48 hours prior to use. Application and storage temperatures outside of this range will require written instruction from the Manufacturer.
- B. Application in direct sunlight and/or with rising surface temperatures is not recommended, as this may result in blistering of the materials due to expansion of entrapped air or moisture (out-gassing) in the concrete. In such cases, it will be necessary to postpone the application until later in the day when the temperature of the substrate is falling. Concrete surfaces that have been in direct sunlight must be shaded for at least 24 hours prior to application and remain shaded until the initial set has taken place. Consult Manufacturer for application schedule guidelines specific to temperature conditions and possible sealer application recommendations to reduce out-gassing.

C Underlayment Application – Cementitious underlayment products shall be used for surface leveling, filling voids, large bugholes, and for general concrete patching and shall be installed and cured according to Manufacturer’s written guidelines as outlined in product technical data sheets.

D. Epoxy Filler Compound Application - Epoxy filler shall be used for filling small bugholes, static cracks and joints, and for general concrete patching, and to provide a uniform, void free surface for epoxy lining application.

E. Epoxy Lining Protective Coating – Epoxy lining protective coating shall be spray applied and cured on the properly prepared surface in accordance with Manufacturer’s written guidelines as outlined in product technical data sheets.

1. Installation – Epoxy lining shall be applied to a minimum thickness of 60 mils. Application equipment shall be approved by the Applicator, in accordance with the protective coating manufacturer’s recommendations.

F. Expansion and construction joints shall be formed and filled as recommended by the protective coating Manufacturer.

G. High Voltage Spark Testing. Installed epoxy lining protective coating shall be tested for pinholes after a minimum 24-hour cure at a temperature of 70°F. Pinhole testing shall be accomplished in accordance with ASTM D4787 using a Tinker Razor Holiday Detector, San Gabriel, CA, Model AP/W, or an approved equal device. Test voltage of 100 volts/mil of coating thickness shall be applied. All pinholes shall be marked and repaired using manufacturer’s approved Patch Kit, or other approved method.

### 3.4 ADJUSTMENTS AND CLEANING

A. At the completion of the Work, CONTRACTOR shall remove all materials and debris associated with the Work of this Section.

B. Clean all surfaces not designated to receive protective coating. Restore all other work in a manner acceptable to ENGINEER.

C. All finished protective coating shall be protected from damage until Final Acceptance of the Work. Protective coating damaged in any manner shall be repaired or replaced at the discretion of ENGINEER, at no additional cost to OWNER.

(Project Name)

Concrete Rehabilitation

- D. Clean all protective coating as recommended by the manufacturer to provide finished Work acceptable to OWNER, just prior to Final Acceptance.

++ END OF SECTION ++