

SECTION 02607

SANITARY SEWER LINING SYSTEM

PART 1 - GENERAL

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Project Name

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1.1 SCOPE OF WORK

A. The Contractor shall perform lining of concrete or brick manholes to protect against corrosion at the various locations indicated by the Contract Documents.

1. Install Microbiologically Influenced Corrosion (MIC) protective coating system where shown on the drawings.

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- B. The Contractor shall provide all material, equipment, and labor as required to complete the work in accordance with the specifications.

1.2 RELATED SECTIONS

- A. Section 02606, Sanitary and Storm Structures

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B. Section 02610, Piping and Fittings

1.3 SUBMITTALS

A. Shop Drawings including the following items shall be submitted in accordance with

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Section 01340.

1. Manufacturer's product data and material safety data sheets for each coating product provided.

2. Manufacturer's installation instructions and recommendations specific to environmental conditions, minimum and maximum temperatures, surface preparation, substrate conditions, testing and application procedures.

3. Complete shop drawings including location and details for all terminations and transitions.

4. Certifications:
 - a. Furnish affidavits from the manufacturer certifying that materials

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furnished conform to the requirements specified.

- b. Certify concrete repair and coating products have been checked for compatibility.

 - c. Certification from manufacturer stating the applicator and applicator's assigned personnel have received specific training for the application of the MIC coating system under similar conditions.

 - d. Certificate from applicator stating the assigned personnel have received specific training for the application of the MIC protective coating system under similar conditions.

 - e. Submit manufacturer's representative and independent inspector/tester NACE or SSPC certification and contact information.
5. Submit name, company name and telephone number of person(s) applicator.

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6. Provide list of at least 10 applications in high H₂S environments in Midwest States including contact names, address, phone numbers and date of installation for both the coating system and the applicator.

7. Field Data Records and Installation Reports.

8. Product Warranty.

9. Closeout Submittals:
 - a. As-built drawings which include coating application limits, transitions, and terminations.

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- b. Photos with dates of photos taken

- c. Quality assurance records, field data records and installation reports

- d. Certificate of Surface Preparation

- e. Test and evaluation reports including pull-off strength (adhesion) and spark testing.

- f. Final Report

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g. Final Certified Warranty

1.4 QUALIFICATIONS

- A. Products shall be manufactured by company specializing in manufacturing the products specified in this section with a minimum of five continuous years of experience for performance in similar applications in wastewater treatment plants and wastewater collection systems.

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1.5 QUALITY ASSURANCE

- A. The Contractor shall be responsible for the provisions of all test requirements specified in the referenced ASTM Standards as applicable. The Contractor shall also bear the cost of all tests specified in Paragraph 3.9, Quality Assurance and Testing. In addition, all coating products to be installed under this Contract may be inspected at the plant for compliance with these specifications by an independent testing laboratory provided by SD1. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of plant inspection of all products and materials approved for this Contract shall be borne by SD1. The cost of field testing as specified in Paragraph 3.9 shall be included in the Bid Item for protective coating.

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B. Inspections of the coating products and materials may also be made by the Engineer or other representatives of SD1 after delivery. The products and materials shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though samples may have been accepted as satisfactory at the place of manufacture. Materials rejected after delivery shall be marked for identification and shall be removed from the job at once.

1. Provide adequate time and access for inspections for the following major activities:

a. Pre-surface preparation

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- b. Monitoring of surface preparation

- c. Post-surface preparation

- d. Monitoring of repair and resurfacing product application

- e. Post repair and resurfacing products

- f. Monitoring of coating application

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g. Post application inspection and testing

h. Corrective actions and final inspection

C. Pre-installation Meeting

1. At least two weeks prior to beginning work, the Contractor shall conduct a Pre-installation Meeting to discuss coating procedures and submittals. Attendees shall include the Coating Applicator, SD1, Engineer, Manufacturer's Technical Representative, Testing and Inspection Agencies (if

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f. Testing procedures to determine moisture content of concrete

g. Proper procedures to fill substrate

h. Application equipment

i. Proper application of primer

j. Proper application of coating system

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k. Proper termination and transition details

l. Inspection of coating during and after application

m. Testing of coating

n. Repair methods

o. Documentation requirements

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p. Approval Procedures

D. Field Data Records

1. Maintain daily Quality Assurance Records including the following:

a. Date

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b. Atmospheric Temperature and Humidity

c. Substrate pH

d. Substrate Temperature

e. Dew Point

f. Product Batch Numbers

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g. Mixing Time for Each Part and the Combined Parts of a Coating System

h. Pot Life

i. Curing Time of Primer and Finish Layers

j. Holiday Test Results and Repair Data

k. Foreman or Supervisor's Signature

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1.6 SERVICES OF MANUFACTURER'S TECHNICAL REPRESENTATIVE

- A. Manufacturer's technical representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

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- C. Any product showing deterioration, or which has been exposed to any other adverse storage condition that may have caused damage, even though no such damage can be seen, shall be marked as rejected and removed at once from the work site by the Contractor.

1.8 WARRANTY

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PART 2 - PRODUCTS

2.1 GENERAL

- A. The materials used shall be designed, manufactured and intended for sewer manhole rehabilitation lining and the specific application in which they are used. The materials shall be supplied in factory-labeled containers.

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- B. All patching and waterproofing materials shall be mixed and applied in accordance with the manufacturers written instructions.

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2.2 PVC LINING SYSTEMS

- A. Lining for manholes shall be PVC Duraplate 100 Liner System as manufactured by ALOK Products, or equal. Liner shall be cast integral into the concrete at the point of precast manufacture.
1. PVC Liner, Channel Joints, H-joints and Corner Joints; Manufactured from polyvinyl chloride resin. White in color to assist in providing a light reflective environment. All sheet compounds shall result in a semi-rigid material for thermoforming to the contour of the structure and shall have a minimum wall thickness of 1.7mm (0.065 inch).
 2. Lined manholes shall have a flat top that is lined with the same type of protective liner as the manhole.
 3. Rubber gasket between structures shall be provided for a watertight seal. Gasket shall be DURA-Plate-Lok-Sealant MT-320 measuring 0.5 inches by 1.5 inches to be placed on the return. When the two sections are coupled, the butyl-lok will displace over the return on the bell and tongue ends of the liner.
 4. Linings shall be installed by a certified lining manhole precaster, while constructing the manhole, in strict conformance with the manufacturer's requirements. The Precaster shall submit certification documentation from ALOK products with the manhole submittals.
 - a. Inspect the form core for sharp or jagged edges that could damage the liner during the pre-casting and shipping process.

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- b. Place Dura Plate 100 Liner panels level around the core of the form. Form release agent is not necessary.
- c. Install the vertical joints by placing the black rubber strip between the panel returns, making sure that the flap of the strip is fitted over one of the returns.
- d. Place backing plate on the inside return of panel that the flap fits over. Hold together with spring loaded clamps evenly spaced about 12" apart.
- e. Secure the panels together with fasteners placed every 3 inches, making sure that each fastener is tightened to 5 in-lbs.
Note: The fasteners must be installed from the side opposite the flap, straight thru the backing plate, parallel to the liner.
- f. Repeat for all seams.
Note: Caulk can be placed between the form core and liner returns to minimize concrete seepage during production.
- g. Install reinforcement into form with any other necessary parts needed for the structure.
- h. Pour concrete around the liner evenly to prevent shifting of the liner.
- i. Vibrate and compact the concrete in a manner that will protect the liner and produce a dense, homogenous structure.
- j. Take precaution to protect the liner from sharp or jagged objects while stripping from the form.
- k. Visually inspect the liner after production for any cuts or tears. If repairs are needed, refer to Dura Plate 100 Liner repair bulletin for proper repair procedures.

B. Steps shall be installed in each manhole at the point of manufacture. Drill all holes in liner larger than the diameter of the step. Install steps or ladder then caulk area

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around step and liner with FR500 caulking material (lap Sealant) and seal with a minimum 0.5” thickness of ThoRoc SewerGuard epoxy.

- C. All hole opening surfaces shall be coated with a minimum 0.5” thickness coverage of ThoRoc SewerGuard epoxy that overlaps the liner at least 1 ½ inches.
- D. Manhole Bench and Inverts – The benches and inverts shall be of the same material as the manhole, integral within the manhole and installed by the manhole manufacturer and as shown on the standard manhole detail drawings. The benches and inverts shall be coated with a minimum of 0.5” thickness of ThoRoc SewerGuard epoxy or approved equal. Thickness shall be tested in the field by SD1. CONTRACTOR shall patch all test holes.
- E. The procedure below shall be followed at the factory to determine the thickness of epoxy applied to the benching in manholes and structures manufactured.
 - 1. Utilizing a 40 “L x 1.5“W x 0.5“H Nylon rod:
 - a. Designate each rod with a corresponding number.
 - b. Verify each rod dimension using a caliper.
 - c. Initial and date the measurements.
 - 2. Mark the rod with a line at 1” increments.
 - 3. Cut the rod at each line to form segments of 1“L x 1.5“W x 0.5“H.
 - 4. Once the concrete is formed in the base of the manhole or structure space the segments approximately 18” apart and adhere the segments to the concrete such that the 0.5“H is the distance from top of concrete to the tip of the nylon segment.
 - a. Document the spacing of each segment on the back of the Manhole or Structure Assembly/Inspection Form.
 - b. Initial and date the measurements.
 - 5. As the benching is being applied, it should be above the segments, which are 0.5“H.
 - 6. During the final inspection of the manhole/structure, there should be no visible segments.

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- a. Document the observations on the back of the Manhole or Structure Assembly/Inspection Form.
- b. Initial and date the observations.
- c. If the difference or thickness of the ThoRoc is 0.5" – 1.0" inches at all reference points, the manhole is acceptable.
- d. If the difference or thickness of the ThoRoc is less than 0.5", the thickness is not correct. Inform proper production personnel of the problem.

2.3 PROTECTIVE COATING SYSTEM

- A. The materials to be utilized in the lining of manholes shall be designed and manufactured to withstand the severe effects of corrosion in a wastewater environment. Manufacturer of corrosion protection products shall have a minimum of five continuous years of proven experience in the production of the lining products utilized and shall have satisfactory installation record.

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B. Hydro blasting equipment shall be used to remove corroded materials from the existing concrete/brick structure.

C. Equipment for installation of lining materials shall be high quality grade and be as recommended by the manufacturer.

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D. The lining system to be utilized for manhole structures shall be a multi-component liner system consisting of a primer, as needed, and a cementitious liner as specified hereinafter with a MIC protective coating as specified herein.

E. Provided MIC protective coating system is to be applied by trained applicators. s.

F. A MIC coating shall be used to form a monolithic liner to cover and protect all interior cementitious lined manhole surfaces 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

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sources. Approved products are Sauereisen SewerGard 210-X (80 to 125 mils); Raven 405 Series (80 to 250 mils), Mainstay DS-5 (125 mils); Tnemec Series 434 Perma-Shield H₂S Mortar (125 mils); Warren Environmental S-301 (125 to 250 mils); Carbolite Plasite 5371 (125 mils); Sherwin-Williams Dura-Plate 6100 (100 to 125 mils), CCI Spectrum Spectrashield (primer, 50 mil modified polymer moisture barrier, 400 mil polyurethane/polymeric blend surfacer and 50 mil modified polymer corrosion barrier for a total thickness of 500 mils) or approved equal.

1. The thicknesses specified herein are the minimum dry film thickness required and do not include the primer thickness. The MIC Coating dry film thicknesses shall be based upon manufacturer's recommendations.
2. Provide greater thickness where recommended by the manufacturer.
3. All MIC coating products shall meet the applicable ASTM standards.

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G. Should the Contractor wish to use any brand or type of material other than as specified herein, they shall state in writing to the Engineer naming the proposed substitution and manufacturer. This statement shall be accompanied by:

1. A certificate of compliance from an approved independent testing laboratory that the proposed substitute meets or exceeds the specified requirements and has been tested in accordance with the specified test standards.

2. Documented proof that the proposed brand or type of material has a proven record of performance when used in the intended application as confirmed by actual field test or successful installations.

3. Certification that the two or more types of products identified in the specifications (which are intended to be used as part of a system) are supplied by the same manufacturer so as to insure compatibility of materials and to

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maintain single-source manufacturer responsibility.

- H. When requested, the Contractor shall submit for the approval of the Engineer samples of the material he proposes to use in ample time for a proper determination.

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manufactured by the manufacturer of the MIC Coating System. If approved by manufacturer, MIC Coating System can be self-priming.

- C. Primer shall be as recommended by the coating manufacturer to achieve a superior coating system performance. Manufacturer shall select primer based on substrate moisture, environmental conditions and humidity, substrate temperature, pH, achievement of maximum bond and other properties.

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2.5 MANHOLE INTERIOR CONCRETE SUBSTRATE REPAIR (CEMENTITIOUS LINER)

A. Materials

1. The cementitious monolithic lining shall be designed to stop water infiltration through cracks, holes, or weeping in municipal wastewater collection and treatment systems. The product shall be in accordance with the MIC protective coating system manufacturer's recommendations.

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B. Area Preparation

1. All structures to receive a cementitious monolithic lining must be properly designed and capable of withstanding imposed loads. Surfaces must be examined to see that they are free of laitance, dust, loose particles, oils, grease, chemical contaminants, and previously applied paints or protective coatings. Surfaces should be prepared in accordance with the manufacturer's recommendations.

C. Application

1. The application of the cementitious monolithic lining shall be in accordance

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with the manufacturer's requirements and recommendations.

D. Setting/Curing

1. The setting and curing time and temperature conditions shall be in accordance with the manufacturer's requirements and recommendations.

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PART 3 – EXECUTION

3.1 PROTECTION OF IN-PLACE OR EXISTING CONDITIONS

- A. Equipment, vehicles, buildings and other finished items shall be protected from damage and overspray. Sensitive equipment shall be wrapped in plastic and taped.

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3.2 COATINGS

- A. Coatings shall only be applied by an applicator who has been trained by the manufacturer in the application of the proposed lining system. . The Contractor must provide evidence that personnel assigned to the project have successfully completed the manufacturer's training.

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contractor to make sure the surface preparation meets coating manufacturer's requirements.

- C. The Contractor shall examine all surfaces to be coated and shall correct all surface defects per manufacturer's requirements before application of any coating.

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- C. All plugging, patching, and coating shall be reviewed by the Engineer or by an inspector representing SD1 for conformance with the general specifications, however, it is the responsibility of the contractor to make sure all surface preparation meets coating manufacturer's requirements.

3.5 SEWAGE FLOW AND DIVERSION

- A. Provide means, labor and equipment to divert flow from pipelines entering the manhole as necessary to prevent sewage flow from contacting surfaces to be coated.

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1. The Contractor shall maintain flow by approved means in accordance with SD1 Specifications.

2. In no case shall the Contractor allow any sewage to surcharge and backup into homes or businesses, or in any way overflow into the environment. If the bypass pumping capacity is insufficient to prevent surcharge and/or overflow at any time, the Contractor shall pull the line plugs irrespective of the status of the application or curing process, and restart the application or curing process until the coating is applied to the manufacturer's specifications.

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3.6 DEFECT REPAIR

- A. All surface defects including tie holds, any honeycombing or otherwise defective concrete or brick shall be repaired. All voids, holes, and rough or irregular surfaces shall be filled.

- B. The Contractor shall use the repair and fill material recommended by the coating manufacturer and approved by SD1 to repair or fill all defects.
 - 1. Areas to be patched shall be cleaned.

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2. Minor honeycombed or otherwise defective areas shall be removed to solid concrete.
3. The edges of the cut shall be perpendicular to the surface of the concrete.
4. Patches on exposed surfaces shall be finished to match the adjoining surfaces after they have set.
5. Finishes shall be equal in workmanship, texture, and general appearance to that of the adjacent undamaged concrete or brick.
6. Concrete with exposed reinforcing steel or with defects that affect the

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structural strength shall be repaired per SD1 specifications or an approved method shall be approved by SD1's Engineer.

3.7 SURFACE PREPARATION

- A. Surfaces to receive coating shall be clean and free of dirt, oil, grease and other foreign material. All concrete repairs shall be completed prior to coating installation.

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contaminants. Remove all fins, protrusions, and similar imperfections to allow a uniform surface after surface preparation. Under no circumstance shall surface preparation be less than manufacturer's recommendation to provide the best possible installation. Moisture levels of concrete and temperature shall be recorded, tested and documented and be within acceptable ranges prior to application of coating.

- E. Provide written certification from independent testing company or manufacturer's representative that on organization's letterhead, signed by an officer of the company that the surface preparation for each structure meets the requirements of the coating manufacturer.

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Recoat time between coats shall be documented and shall not exceed manufacturer's requirements. Where recoat times are exceeded the coating shall be prepared in strict accordance with manufacturer's recommendations including scarification to provide sufficient profile.

- F. Cure coatings in strict accordance with the manufacturer's recommendations, prior to putting in service.

3.9 QUALITY ASSURANCE AND TESTING

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A. All coated surfaces shall be inspected and tested in accordance with the following requirements:

1. Visual inspection: Coated surfaces shall be visually inspected for dry spots, blow out bubbles (Out Gas), blisters and voids in the finished coating.

2. Spark (Holiday) Testing: All coated surfaces shall be tested for pinholes and discontinuities in accordance with ASTM D4787 or NACE SP 0188. The Spark Tester used shall provide 100 volts per mil of thickness. The Contractor shall repair identified pinholes and discontinuities as recommended by the manufacturer and retest. All testing and repair work shall be at the Contractor's expense.

3. Adhesion Testing: Adhesion testing shall be performed to a minimum 200 psi in accordance with ASTM D7234. The maximum adhesion test load will not exceed manufacturer's recommendations for precast manholes that are not adequately bonded. All costs for any repair due to adhesion test failures shall be at the Contractor's expense.

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4. During application of MIC Coating, installer/applicator shall check wet film thickness in accordance with ASTM D4414.

B. There shall be no groundwater infiltration or other leakage through the structure walls after coating. If leakage is found, it shall be eliminated with an appropriate method as recommended by the coating manufacturer and approved by the Engineer at no additional cost to SD1.

C. All pipe connections shall be open and clear.

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3.10 WORK IN CONFINED SPACES

- A. The general contractor and any sub-contractors shall meet all OSHA requirements for work in confined spaces. The Contractor shall provide and maintain safe working conditions for all employees and subcontractors. Fresh air shall be supplied continuously to confined spaces through the combined use of existing openings, forced-draft fans and temporary ducts to the outside, or by direct air supply to individual workers. Fumes shall be exhausted to the outside from the lowest level of the confined space. Electrical fan motors shall be explosion-proof if in contact with fumes. No smoking or open fires shall be permitted in or near areas where volatile fumes may accumulate.

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++ END OF SECTION ++

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