

SECTION XXXXXX – TECHNICAL SPECIFICATIONS FOR INSTALLATION OF
PROTECTIVE AND RESTORATION COATINGS FOR MANHOLES, WETWELLS,
AND OTHER SANITARY SEWER STRUCTURES

1.00 PART 1 -- GENERAL

1.01 SCOPE

- A. It is the intent of this contract to install a high quality protective or restoration coating system to the interior surfaces of all manholes, wetwells, or other structures. This specification covers work, materials, equipment, and tools including specially developed application equipment as required for installation of a field applied interior surfacing system. The use of specialized equipment combined with rigorous surface preparation requirements shall be used to apply the products without the use of solvents. Product application requirements and procedures described herein include surface preparation, mixing application, material handling and storage, qualification of the applicator, and application quality control.

- B. The condition of the structures to receive the protective coating will be classified in accordance with the following criteria:

Condition	Description
New	New structures or structures that have not been exposed to sanitary sewer. No evidence of infiltration.
A	Minimal damage. Minimal evidence of exposure to sanitary sewer gases. No evidence of infiltration.
B	Moderate damage such as missing mortar between bricks in brick manholes, some exposed aggregates in concrete structures. Moderate evidence of exposure to sanitary sewer gases. Evidence of minimal infiltration.
C	Severe damage such as missing bricks in brick manholes, severe exposed aggregates or exposed reinforcing steel in concrete structures. Severe evidence of exposure to sewer gases. Evidence of moderate infiltration.

- C. The minimum coating system type shall be as described in the following table:

SECTION XXXXXX – TECHNICAL SPECIFICATIONS FOR INSTALLATION OF
PROTECTIVE AND RESTORATION COATINGS FOR MANHOLES, WETWELLS,
AND OTHER SANITARY SEWER STRUCTURES

Structure Condition	Structure Material	Non-Structural Structural	System Type
New	Precast	Non-Structural	1
New	Brick	Non-Structural	2
A	Precast	Non-Structural	2
A	Brick	Non-Structural	3
B	Precast	Structural	4
B	Brick	Structural	5
C	Precast	Structural	6
C	Brick	Structural	7

1.02 DESCRIPTION OF SYSTEMS

- A. The following systems have been designated as the minimum acceptable requirements for the conditions listed in the above table.
1. System 1
 - a. Polyurea System
 - i. Minimum 80 mils DFT of approved polyurea coating
 - b. Epoxy System
 - i. Minimum 80 mils DFT of approved epoxy coating
 2. System 2
 - a. Polyurea System
 - i. Minimum ½” DFT of approved closed cell foam surfacer
 - ii. Minimum 60 mils DFT of approved polyurea coating
 - b. Epoxy System
 - i. Minimum 125 mils DFT of approved epoxy coating
 3. System 3
 - a. Polyurea System
 - i. Minimum ½” DFT of approved closed cell foam surfacer
 - ii. Minimum 60 mils DFT of approved polyurea Coating
 - b. Epoxy System
 - i. Minimum 180 mils DFT of approved epoxy coating
 4. System 4
 - a. Epoxy System
 - i. Minimum 180 mils DFT of approved epoxy coating
 - b. CIPM System
 - i. Minimum 0.099 in. thickness of approved CIPM liner
 5. System 5
 - a. Epoxy System
 - i. Minimum 200 mils DFT of approved epoxy coating

SECTION XXXXXX – TECHNICAL SPECIFICATIONS FOR INSTALLATION OF PROTECTIVE AND RESTORATION COATINGS FOR MANHOLES, WETWELLS, AND OTHER SANITARY SEWER STRUCTURES

- b. CIPM System
 - i. Minimum 0.117 in. thickness of approved CIPM liner
- 6. System 6
 - a. Epoxy System
 - i. Minimum 250 mils DFT of approved epoxy coating
 - b. CIPM System
 - i. Minimum 0.122 in. thickness of approved CIPM liner
- 7. System 7
 - a. Epoxy System
 - i. Minimum 350 mils DFT of approved epoxy coating
 - b. CIPM System
 - i. Minimum 0.158 in. thickness of approved CIPM liner

1.03 REFERENCES AND STANDARDS

- A. All references and standards listed shall be the latest revisions
- B. References
 - 1. American Society for Testing and Materials (ASTM)
 - 2. International standard Organisation (ISO)
 - 3. National Association of Corrosion Engineers (NACE)
 - 4. SSPC
 - 5. International Concrete Repair Institute (ICRI)
 - 6. American Concrete Institute
- C. ASTM Standards
 - 1. ASTM D638: Tensile Properties of Plastics
 - 2. ASTM D790: Flexural Properties of Un-reinforced and Reinforced Plastics
 - 3. ASTM D695: Compressive Strength of Rigid Plastics
 - 4. ASTM D4541: Pull-off Strength of Coatings Using a Portable Adhesion Tester
 - 5. ASTM D2584: Volatile Matter Content
 - 6. ASTM D2240: Durometer Hardness, Type D
 - 7. ASTM D1653: Water Vapor Transmission of Organic Coating Films
 - 8. ASTM D543: Resistance of Plastics to Chemical Reagents
 - 9. ASTM C297: Flatwise Tensile Strength of Sandwich Constructions.
 - 10. ASTM E-1907: Calcium Chloride Test for Moisture Vapor Transmission.
 - 11. ASTM D-4263: Test Method for Indicating Moisture in concrete by Plastic Sheet Method.
 - 12. ASTM E-337: Test Method for Measuring Humidity with a Psychomotor.
 - 13. ASTM D-6132: Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an Ultrasonic Gauge.
 - 14. ASTM D-4138: Test Method for Measurement of Dry film Thickness of Protective Coating Systems by Destructive Means.

SECTION XXXXXX – TECHNICAL SPECIFICATIONS FOR INSTALLATION OF PROTECTIVE AND RESTORATION COATINGS FOR MANHOLES, WETWELLS, AND OTHER SANITARY SEWER STRUCTURES

15. ASTM D-4787: Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates.
- D. SSPC Standards
1. SSPC Publication No. 91-08: Surface Preparation Specifications
 2. SSPC TU-13: Surface Preparation of Concrete
 3. SSPC TU-2: Design, Installation and Maintenance of Coating Systems for Concrete
- E. NACE Standards
1. NACE Standard SP 0188: discontinuity (Holiday) Testing for Protective Coatings
 2. NACE Standard SP 0892: Linings Over Concrete for Immersion Service
 3. NACE No. 6: Surface Preparation of Concrete
 4. NACE 6/SSPC 13: A Joint Standard for Surface Preparation of Concrete
- F. Other Standards
1. ICRI Technical Guidelines 03730: Surface Preparation Guidelines for the Repair of Deteriorated Concrete Resulting from Reinforced Steel Corrosion
 2. ICRI Technical Guidelines 03731: Guide for Selecting Application Methods for the Repair of Concrete Surfaces
 3. ICRI Technical Guidelines 03732: Guide for Selecting and Specifying Surface Preparation for Sealers, Coatings and Membranes

1.04 SUBMITTALS

- A. All submittals shall be submitted in accordance with the applicable portions of these specifications.
- B. The Contractor shall submit the following information to the Engineer for approval prior to beginning the installation of the protective coating.
1. Manufactures data sheets for the coating materials
 2. Third party test results verifying the physical properties of the coating materials meet or exceed the requirements of these specifications.
 3. Applicator's procedures for preparing the surface of the structure and installing the coating system.
 4. Documentation that the Applicator of the coating has been trained and certified by the Manufacturer.

2.00 PART 2 -- PRODUCTS

- 2.01 The Products and Manufacturers listed below are pre-approved for use on this Project. Other manufactures or products seeking pre-approval must submit the following documentation to the Engineer a minimum of two weeks prior to bid date. This time frame allows the Engineer ample time to determine if the proposed product is an acceptable alternative.

SECTION XXXXXX – TECHNICAL SPECIFICATIONS FOR INSTALLATION OF PROTECTIVE AND RESTORATION COATINGS FOR MANHOLES, WETWELLS, AND OTHER SANITARY SEWER STRUCTURES

- A. Manufactures data sheets for the coating materials
- B. Applicator’s procedures for preparing the surface of the structure and installing the coating system.
- C. Documentation that the Applicator of the coating has been trained and certified by the Manufacturer.
- D. Documentation that the proposed Product meets the specified minimum physical characteristics including results of testing performed by a bonded, third party testing company.
- E. An affidavit attesting to the successful use of the Product as a protective coating for concrete or masonry structures for a minimum continuous period of five (5) years in wastewater conditions recognized as corrosive or otherwise detrimental to concrete and masonry.
- F. A verifiable list of references that document the successful installation and use of the Product in a minimum of 250,000 square feet of sanitary sewer structures.

2.02 All additional products that are pre-approved by the Engineer shall be identified in an addendum issued prior to the bid date.

2.03 100% POLYUREA PRODUCTS

- A. All products to be used on this project must be pre-approved by the Engineer prior to the bid date. The following products have been pre-approved for use on this project.
 - 1. SpectraShield by CCI Spectrum, Inc.
 - 2. Nukote Aegis™ System by Nukote Coating Systems International, LLC
- B. Polyurea Coating
 - 1. Modified polymer shall be sprayable, solvent free, two-component polymeric, moisture/chemical barrier specifically developed for the corrosive wastewater environment.
 - 2. Typical Chemical Analysis
 - a. “A” Component
 - i. Viscosity, at 77°F, cps. 450
 - ii. Physical State Liquid
 - iii. Hygroscopicity Reacts with water
 - b. “B” Component
 - i. Viscosity at 77°F, cps 500
 - ii. Physical State, Liquid
 - iii. Hygroscopicity Reacts with water
 - iv. Non-Volatile 100%
 - c. Reaction Profile (100 grams, 175°F sample)
 - i. Gel Time, seconds 10
 - ii. Tack Free Time, seconds 20
 - iii. Cure Time, seconds 90
 - d. Processing
 - e. A System/B System, volume ratio: 1.00 / 1.00

SECTION XXXXXX – TECHNICAL SPECIFICATIONS FOR INSTALLATION OF PROTECTIVE AND RESTORATION COATINGS FOR MANHOLES, WETWELLS, AND OTHER SANITARY SEWER STRUCTURES

3. Typical Physical Properties
 - a. Tensile Strength, PSI >2400
 - b. Elongation, % 200-300
 - c. Tear Strength, PLI >450
 - d. Shore D Hardness 50
- C. Polyurethane Foam
 1. Polyurethane Rigid Structure Foam, low viscosity two-component, containing flame retardants.
 2. TYPICAL CHEMICAL ANALYSIS
 - a. "A" Component
 - i. Viscosity, 77° F, cps. 200
 - ii. Physical State Liquid
 - iii. Color Dark Brown
 - iv. Hygroscopicity Reacts with water and evolves CO2 gas
 - b. "B" Component
 - i. Viscosity, 77° F, cps. 660
 - ii. Physical State Liquid
 - iii. Color Transparent Dark
 - iv. Hygroscopicity Absorbs water rapidly changing ratio
 - c. Reaction Profile (100 grams, 77°F sample)
 - i. Cream Time, seconds 1-4
 - ii. Tack Free time, seconds 5-8
 - iii. Rise Time, seconds 6-10
 - d. Processing
 - i. A System / B System, volume ratio 1.00 / 1.00
 3. Typical Physical Properties
 - a. Density, nominal, core, lbs/ft³ ASTM D-1622 @ 74° F 3-10
 - b. Closed Cell Content, % @ 74° F 90-95

2.04 100% SOLIDS EPOXY PRODUCTS

- A. All products to be used on this project must be pre-approved by the Engineer prior to the bid date. The following products have been pre-approved for use on this project.
 1. S-301 by Warren Environmental, Inc
 2. ARC S1HB by A. W. Chesterton Company
- B. Epoxy Coating
 1. The coating system shall be a spray-applied 100% solids epoxy monolithic surfacing system for use in coating new or existing manholes, wetwells, lift stations, treatment plants, and other structures.
- C. Typical Physical Properties.
 1. Minimum Compressive Strength 12,000 psi
 2. Minimum Tensile Strength 5,600 psi
 3. Minimum Flexural Strength 8,300 psi

SECTION XXXXXX – TECHNICAL SPECIFICATIONS FOR INSTALLATION OF PROTECTIVE AND RESTORATION COATINGS FOR MANHOLES, WETWELLS, AND OTHER SANITARY SEWER STRUCTURES

4. Minimum corrosion resistance suitable for environments pH of 0.5 or higher.

2.05 CURED IN PLACE MANHOLE (CIPM) LINER PRODUCTS

- A. All products to be used on this project must be pre-approved by the Engineer prior to the bid date. The following products have been pre-approved for use on this project.
 1. AltLiner by Alternative Lining Technologies
 2. Triplex™ Liner System by McNeil Technologies
- B. Cured-in-Place Lining System
 1. The lining system shall be a cured-in-place liner method for use in new or existing manholes, wetwells, liftstations, treatment plants, and other structures.
- C. Materials
 1. Liner shall be of the type that allows rehabilitation of a concentric, eccentric, or flat top round structure without removing the access hatch frame, top section or corbel.
 2. As a minimum the structural liner systems shall be composed of a multiple layered composite. The primary layer shall be manufactured from 20 mils PVC with 10 ounce per square yard polyester fleece. The surface hairs of the fleece must be embedded in the molten PVC during the manufacturing process of the PVCP laminate. Glued laminates are not allowed.
 3. The anticipated hydrostatic head, “h” in feet above the bottom of the invert and the radius, “r” in feet of the structure shall determine the necessary liner thickness. “t” in mils.
 4. The fibrous body will be impregnated with a modified epoxy resin. For additional liner thickness, additional layers of resin and fiberglass will be incorporated.

3.00 PART 3 -- EXECUTION

3.01 INSTALLER QUALIFICATIONS

- A. All products must be installed by an Installer that has been trained and certified by the manufacturer.
- B. The Installer must provide verifiable documentation of the above certification and the successful installation of 250,000 square feet of the pre approved products in sanitary sewer structures.

3.02 QUALITY ASSURANCE

- A. Applicator shall initiate and enforce quality control procedures consistent with applicable ASTM standards.

SECTION XXXXXX – TECHNICAL SPECIFICATIONS FOR INSTALLATION OF PROTECTIVE AND RESTORATION COATINGS FOR MANHOLES, WETWELLS, AND OTHER SANITARY SEWER STRUCTURES

- B. Applicator shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts. These workmen shall be completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- C. Applicator shall use approved specialty equipment adequate in size, capacity and number sufficient to accomplish the work of this Section in a timely manner.

3.03 SAFETY

- A. Applicator shall perform his work in a manner to protect the health and safety of all workmen and the public.
- B. All work shall be in accordance with standard industry safety practices.
- C. All work, including entry into confined spaces shall be performed in strict compliance with current OSHA regulations.

3.04 PRE-COAT INSPECTION

- A. The applicator's vehicles and equipment must be able to access the structures to be coated under their own power.
- B. Active flows shall be dammed, plugged or diverted as required to ensure that the liquid flow is maintained below the surfaces to be coated.
- C. Installation of the protective coating shall not commence on any surfaces containing freshly poured concrete until the concrete substrate has properly cured, and in no case less than 28 days.

3.05 SURFACE PREPARATION

- A. Applicator shall inspect all surfaces specified to receive the surfacing system prior to surface preparation. Applicator shall promptly notify Owner of any noticeable disparity in the surfaces that may interfere with the proper preparation or application of the surfacing system.
- B. All concrete that is not sound or has been damaged by chemical exposure shall be restored to a sound concrete surface. All contaminants including all oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall be removed.
- C. Surfaces to receive protective coating shall be cleaned to produce a sound concrete or masonry surface with adequate profile and porosity to provide a strong bond between the surfacing system and the substrate. Surface preparation methods shall be based upon the conditions of the substrate and the requirements of the surfacing system to be applied, but as a minimum, shall be in accordance with the manufacturer's guidelines.

3.06 APPLICATION

- A. The interior surfacing system shall be applied to the specified surfaces of all other structures.
- B. The interior surfacing system shall be continuously bonded to all brick, mortar, concrete, chemical sealant, grout, pipe and other surfaces inside the

SECTION XXXXXX – TECHNICAL SPECIFICATIONS FOR INSTALLATION OF PROTECTIVE AND RESTORATION COATINGS FOR MANHOLES, WETWELLS, AND OTHER SANITARY SEWER STRUCTURES

manhole according to ASTM C882 testing and therefore shall be designed for hydrostatic loading.

- C. The cured surfacing shall have proper sealing connections to all un-surfaced areas and shall be placed and cured in conformance with the recommendations of the system manufacturer.
- D. When cured, the system shall form a continuous, tight-fitting, hard, impermeable surfacing that is suitable for sewer system service and chemically resistant to any chemicals, bacteria or vapors normally found in domestic sewage.
- E. The system shall effectively seal the interior surfaces of the structure and prevent any penetration or leakage of groundwater infiltration.
- F. The system shall be compatible with the thermal conditions of the existing sewer structure surfaces.
- G. Application procedures shall conform to the recommendations of the interior surfacing system manufacturer, including material handling, mixing, and environmental controls during application, safety, and equipment.
- H. The equipment shall be specially designated to accurately ratio and apply the specified materials and shall be regularly maintained and in proper working order.
- I. The specified materials must be applied by an approved installer of the surfacing system.
- J. The walls of the structure shall be lined with the surfacing system to provide a thickness as previously specified based on the condition of the existing structure. The cured surfacing shall have proper sealing connections to all un-surfaced areas and shall be placed and cured in accordance with the recommendations of the system manufacturer.

4.00 PART 4 -- QUALITY ASSURANCE

- 4.01 Applicator shall initiate and enforce quality control procedures consistent with applicable ASTM standards.
- 4.02 Applicator shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts. These workmen shall be completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- 4.03 Applicator shall use approved specialty equipment adequate in size, capacity and number sufficient to accomplish the work of this Section in a timely manner.

4.04 TESTING AND INSPECTION

- A. Thickness of coatings should be measured using non-destructive methods as recommended by the system manufacturer to ensure a uniform thickness during application.
- B. The Engineer and Applicator shall make a final visual inspection. Any deficiencies in the finished system shall be marked and repaired according to the procedures set forth herein by Applicator.

SECTION XXXXXX – TECHNICAL SPECIFICATIONS FOR INSTALLATION OF
PROTECTIVE AND RESTORATION COATINGS FOR MANHOLES, WETWELLS,
AND OTHER SANITARY SEWER STRUCTURES

5.00 PART 5 -- MEASUREMENT AND PAYMENT

5.01 MEASUREMENT

- A. Measurement for new and rehabilitated structures shall be per square foot and shall be measured as the total area that receives the protective coating.

5.02 PAYMENT

- A. Payment will be made under the following pay items:

- | | | |
|----|--------------------------------------|----------|
| 1. | Coating of Structure (New) | - per SF |
| 2. | Rehabilitation of Structure (Type A) | - per SF |
| 3. | Rehabilitation of Structure (Type B) | - per SF |
| 4. | Rehabilitation of Structure (Type C) | - per SF |