

## SECTION 5400 - LINING EXISTING MANHOLE

### PART 1 – GENERAL

**1.01 SCOPE:** This Section covers repair of existing manhole by placement of a cementitious lining. Topics include product and installer qualifications, manhole cleaning, manhole and invert patching, lining, and exfiltration tests.

**1.02 RELATED WORK:** Refer to the following sections for related work:

Site Restoration	Section 1000-General Requirements
Traffic Control	Section 1300-Traffic Control
Bypass Pumping	Section 5100-Sanitary Sewer Main

**1.03 ACCEPTABLE VENDORS:**

- A. Coating materials for use in lining standard environment existing manholes shall be AP/M Permaform PERMACAST MS-10,000; Strong Systems, Inc. MS-2A; Master Builders, Inc. Emaco S88C; Standard Cement Materials, Reliner MSP; or Quadex QM-1s Restore.
- B. Coating materials for use in lining corrosive environment existing manholes shall be AP/M Permaform COR+GARD; Aquafin, Inc. Hydro-Pox 212 GL; De Neef Construction Chemicals, Inc. Denepox Sewergel; Raven Lining Systems AquataPoyx Systems or Raven 400 Series; or Sauereisen, Inc. Sewergard No. 210RS.

**1.04 ENVIRONMENTAL LIMITS:** Product shall not be placed on surfaces with below freezing temperature, or if surface may experience below freezing temperature within 24 hours after application. When air temperatures exceed 90° F, chill mix to maintain mix temperature below 85° F.

**1.05 COMPONENT COMPATIBILITY:** All equipment, materials, application methods, and installer training shall be approved for the application by the manufacturer of the lining material.

**1.06 SUBMITTALS:** Contractor shall submit for review including, but not limited to, the following:

- A. Lining material product data sheet and information.
- B. Manufacturer's application procedure and recommended application equipment.
- C. Certification that the coating system materials furnished comply with all requirements specified herein.

**1.07 INSTALLER QUALIFICATION:** The firm shall be certified or licensed by the manufacturer of the lining material to have equipment and training recommended to prepare the manhole and to apply the specified coatings.

### PART 2 – PRODUCTS

**2.01 PATCHING AND LEAK CONTROL MATERIALS:** Material for patching of manholes shall be a quick setting, non-shrink, material at least as strong as the liner material and produced or recommended by the lining manufacturer. Selection of actual patch product, if any, shall be based on field conditions.

**2.02 LINER MATERIAL:**

A. Material for standard environment spray-on lining shall be a pre-blended mixture of cements, chemically active aggregates, fiber reinforcements, and other additives specifically selected for their special properties and formulated for spray application. No material (other than potable water) shall be used with or added to the approved design mix without prior approval or recommendation from the lining manufacturer and Engineer. All water used in the mixture shall be clean and potable. The density of the material at placement of the coating shall not be less than 95 pounds per cubic feet. Approximate working time of the material after initial application shall be 30 minutes. Material shall meet the following requirements for the strength class required:

<u>Test</u>	<u>Normal</u>	<u>Method</u>
Compressive Strength	3000 psi, 24 hours	ASTM C109
Flexural Strength	1200 psi, 28-day	ASTM C348
Shrinkage at 90 percent relative humidity	0 percent	ASTM C596
Bond Strength	130 psi, 28-day	ASTM C952
Freeze-Thaw	No visible damage after 100 cycles	ASTM C666
Permeability	Shall not exceed 450 Coulombs	ASTM T277

B. Material for corrosive environment lining shall be a 100% solids, solventless two-component epoxy resin system suitable for spray or trowel application. Products shall be mixed and applied as recommended by manufacturer and approved by Engineer.

**2.03 INSTALLATION EQUIPMENT:** Application equipment shall be manufactured or licensed by the material supplier and designed specifically for the application of manhole liners. Minimum pumping pressure shall be 250 psi.

High-pressure water spray for surface cleaning shall reach minimum 3500 psi.

**PART 3 – EXECUTION**

**3.01 BYPASS PUMPING:** See Related Work Part 1.

**3.02 MANHOLE PREPARATION:** Invert and service lines shall be covered to prevent waste material from entering lines. Foreign material shall be removed from wall and bench by high-pressure water spray. Loose or protruding brick, mortar, or concrete shall be chipped out. Large voids and active leaks shall be patched and plugged.

**3.03 INVERT REPAIR:** Inverts with visible damage or infiltration shall be repaired. Contractor shall block flow and clean invert. Patch material shall be applied a minimum of 1/2-inch thick over the entire invert and shall extend onto the bench sufficiently to tie to subsequent liner placement.

**3.04 LINER APPLICATION:** Material shall be mixed and applied using the procedure and equipment approved and licensed by the lining manufacturer. Surface to receive lining shall be saturated but free of water drops. Liner shall be sprayed on following manufacturer's recommendations. Spray material to a minimum 1-inch uniform thickness to ensure that all voids and crevices are filled and a smooth surface remains after troweling. Trowel to compact material into voids and crevices and to "set" the bond on the manhole surface. Below 12 feet, minimum liner thickness shall be 1-1/2-inches.

Top limit of the liner shall be a minimum of 1 inch up onto the casting. Bench shall receive a single coat of a minimum 1/2-inch thickness at the invert and shall increase in thickness in the direction of the wall so as to provide the required minimum slope. The entire bench shall be coated to the edge of the invert channel. The bench/wall intersection shall receive a radiused fillet.

**3.05 CURING:** The liner shall be cured a minimum of 4 hours before being exposed to flow.

**3.06 ACCEPTANCE TESTING:** Liner shall be visually inspected for complete coverage and finish. When directed by Engineer, water tightness of the liner shall be tested as follows:

- A. When ground water is high or when cave-in adjacent to manhole allows dye to be introduced at the outer surface of the manhole, the liner shall be inspected visually for leaks. No leak shall be discernible.
- B. When water is not present or cannot be introduced at the outer surface of the manhole, an exfiltration test shall be conducted. Manhole shall be inundated to top and allowed to stand for 5 minutes. For depths of 6 feet or less, water drop shall be less than 1 inch. For every additional foot of depth, an additional loss of 1/8-inch shall be acceptable.

END OF SECTION 5400