

**UTILITIES COMMISSION**  
**CITY OF NEW SMYRNA BEACH, FLORIDA**

ITB# 01-18  
SANITARY SEWER REHABILITATION – SYSTEMS 1, 2 & 10

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**SECTION 02750 – MANHOLE LINER SPECIFICATION**

**PART 1 – GENERAL**

**A. DESCRIPTION OF WORK**

- 1) This specification covers all work necessary for sanitary sewer manhole rehabilitation. The Contractor shall provide all labor, materials and equipment necessary for sanitary sewer manhole rehabilitation, to include but not limited to, cleaning, surface preparation/repair and final coat/liner.
- 2) The Contractor shall install a continuous, jointless and structurally sound liner specialty coating or lining for the interior surfaces of sanitary sewer manholes.
- 3) The Contractor shall provide necessary maintenance of traffic and by-pass pumping per the Contract Bid Tabulation.
- 4) The Contractor shall provide necessary warranty and documentation of required experience per the Contract Bid Submittal Requirements and as specified herein.
- 5) The **COMMISSION** requires all Customers to be notified a minimum of 5 calendar days of any anticipated flow interruptions. It is the Contractor's responsibility to make said Customer notifications.
- 6) The **COMMISSION** will pay for installed materials only per the Contract Bid Tabulation Bid Item Unit Cost.
- 7) All work shall adhere to Occupational Health and Safety Administration (OSHA) standards, current edition.
- 8) Maintenance of Traffic shall adhere to FDOT Design Standards, Index 600, current edition.

**B. REFERENCE SPECIFICATIONS AND STANDARDS**

- 1) The Contractor shall furnish, install, and test the structures coatings as specified herein. All references to Industry Standards (ASTM, ANSI, etc.) shall be the latest revision unless otherwise stated.
  - American Society for Testing and Materials (ASTM)
  - C78, Standard Test Method for Flexural Strength of Concrete
  - C109, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
  - C157, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
  - C307, Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing
  - C580, Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes

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- C596, Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement
- C882, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete By Slant Shear
- D638, Standard Test Method for Tensile Properties of Plastics
- D792, Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- D4787, Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates
- D4833, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
- F2414, Standard Practice for Sealing Sewer Manholes Using Chemical Grouting

**C. PERFORMANCE WORK STATEMENT (PWS)**

- 1) The Contractor shall submit, to the **COMMISSION**, a Performance Work Statement (PWS) at the pre-construction meeting, which clearly defines the Manhole Liner product delivery in conformance with the requirements of these contract documents. Unless otherwise directed by the **COMMISSION**, the PWS shall at a minimum contain the following:
  - a. Clearly indicate that the Manhole Liner will conform to the project requirements as outlined in the Description of Work and as delineated in these specifications.
  - b. Where the scope of work is specifically delineated in the contract documents, a detailed installation plan describing all preparation work, cleaning operations, pre-video inspections, by-pass pumping, maintenance of traffic, installation procedure, method of curing, quality control, testing to be performed, final video inspection, warranties furnished and all else necessary and appropriate for a complete the Manhole Liner installation. A detailed installation schedule shall be prepared, submitted and conform to the requirements of this contract.
  - c. Contractor's description of the proposed Manhole Liner technology, including a detailed plan for maintaining all wastewater service to **COMMISSION** Customers during installation.
  - d. A description of the Manhole Liner materials to be furnished for the project. Materials shall be fully detailed in the submittals and conform to these specifications and/or shall conform to the pre-approved product submission.
  - e. The name and experience of each lead individual performing work on this Contract shall be submitted with the PWS.

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- f. Proposed manufacturers technology data shall be submitted for all Manhole Liner products and all associated technologies to be furnished.
- g. A detailed description of the Contractor's proposed procedures to patch/repair manhole from Infiltration/Inflow in the manhole that may be encountered during the cleaning process.
- h. A detailed public notification plan shall be prepared and submitted including detailed staged notification to Customers affected by the Manhole Liner installation.

**PART 2 – PRODUCTS**

**A. GENERAL**

- 1) The materials to be utilized in the lining of concrete structures shall be designed and manufactured to withstand the severe effects of hydrogen sulfide in a wastewater environment.
- 2) The Manhole Liner must meet the chemical resistance requirements of these contract documents. All materials, shipped to the project site, shall be accompanied by test reports certifying that the material conforms to the ASTM standards listed herein. Materials shall be shipped, stored, and handled accordance with the Manhole Liner manufacturer's recommendations to avoid damage. Damage includes, but is not limited to, gouging, abrasion, flattening, cutting, puncturing, or ultra-violet (UV) degradation. On site storage locations, shall be approved by the **COMMISSION**. All damaged materials shall be promptly removed from the project site at the Contractor's expense and disposed of in accordance with all current applicable agency regulations.

**B. ACRYLIC OR ACRYLATE BASE GROUT**

- Follow ASTM F2414 and as specified herein.
- Two-part chemical grout mixed at point of injection.
- Minimum 25% acrylic or acrylate base material by volume.
- To increase strength or offset dilution during injection period, use higher concentration of base material as directed by the Manufacturer.
- Controllable reaction time: 30 seconds to 1 hour.
- Viscosity: 1.5 centipoises water.
  - May be increased maximum of 2.5 centipoises water if approved by the **COMMISSION**
  - Remain constant throughout injection period.
- Tolerates dilution and reacts in moving water.

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- Final reaction:
  - Continuous irreversible, impermeable, non-porous still gel in pure form.
  - Stabilized soil in ground that will not become brittle or rigid.
- Gel does not bleed water under stress.
- Dehydrated gel returns to 90% of its original volume and form after prolonged period of low ground water.
- Do not use catalyst containing dimethyl amino propionitrile (DMAPM).
- Use root inhibitor (50% active dichlobenil) when roots are present in manholes.
- Use latex additive for increased tensile strength.
- Tinted to allow detection of grout in drill holes or at leakage locations.

**C. URETHANE BASE GROUT**

- Follow ASTM F2414 and as specified herein.
- Ratio: One part urethane prepolymer to 1 to 10 parts water by volume (10% to 50% prepolymer).
- Liquid prepolymer:
  - Solids content: 77% to 83%
  - Specific Gravity: 1.04
  - Flash Point: 20 degrees F.
  - Viscosity: 200 to 1,200 centipoises water at 70 degrees F.
- Water for reacting prepolymer: pH of 5 to 9.
- Use manufacturer recommended gel control agent to control cure time as required.
- Final Reaction:
  - Chemically stable, non-biodegradable, flexible gel, impermeable to water at pressures up to 15psi.
- Dehydrated gel returns to 90 % of its original volume and form after prolonged period of low ground water.
- Use root inhibitor (50% active dichlobenil) when roots are present in manholes.
- Use latex additive for increased tensile strength.
- Tinted to allow detection of grout in drill holes or at leakage locations.

**D. CEMENTITIOUS RECONSTRUCTION FOR MANHOLE RESTORATION**

- Quick setting (under 20 minutes), high strength, sulfide resistant, calcium aluminate-based or portland cement material.
- Suitable for troweling or rotary spray application to inside of manhole.
- Use additives to increase corrosion resistance or bond strength at manufacturer's direction and with **COMMISSION** approval.
- Initial set time per manufacturer's recommendation and per project conditions.
- Density when applied: 135 lb/cf +/- 5 lb/cf.

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- Compressive strength (ASTM C109) at 1 day.
  - Per manufacturer’s recommendation.
  - Minimum acceptable: 2,000 psi.
- Compressive strength (ASTM C109) at 28 days.
  - Per manufacturer’s recommendation.
  - Minimum acceptable: 5,500 psi.
- Bond Strength (ASTM C882) at 28 days.
  - Per manufacturer’s recommendation.
  - Minimum acceptable: 1,640 psi.
- Flexural Strength (ASTM C78) at 28 days.
  - Per manufacturer’s recommendation.
  - Minimum acceptable: 1,500 psi.
- Shrinkage (ASTM C596) at 28 days: 0 %.

**E. HYDRAULIC WATER PLUGS**

- Rapid setting to plug active leaks prior to other rehabilitation work.
- Initial Set Time at 70 degrees F: 60 to 90 seconds.
- Final Set Time at 70 degrees F: One hour.
- Compressive Strength (ASTM C109) at 28 days:
  - Per manufacturer’s recommendation.
  - Minimum acceptable: 4,000 psi.
- Length Change (ASTM C157): 0 %.

**F. SPRAY ON EPOXY LINER**

- Two or three part epoxy coating to protect mason or concrete from chemical attack.
- Minimum Thickness: 125 mils
- Minimum Tensile Strength (ASTM C307): 2,500 psi.
- Minimum Flexural Strength (ASTM C580): 4,600 psi.
- Working Time at 70 degrees F: 30 minutes.
- Initial Set time at 70 degrees F: 17 hours.

**G. STRUCTURAL REQUIREMENTS**

- 1) The physical properties and characteristics of the finished liner will vary considerably, depending on the types and mixing proportions of the materials used, and the degree of cure executed. It shall be the responsibility of the Contractor to control these variables and to provide a Manhole Liner which meets or exceeds the minimum properties specified herein.

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- 2) The required structural Manhole Liner total thickness shall be based, as a minimum, on the physical properties of the cured composite and per the design of the Professional Engineer and in accordance with the Design Equations contained in the appendix of the ASTM standards.
- 3) The Contractor shall submit, prior to installation of the Manhole Liner, certification of compliance with these specifications and/or the requirements of the pre-approved Manhole Liner. Certified material test results shall be included that confirm that all materials conform to these specification and/or the pre-approved system. Materials not complying with these requirements will be rejected.

**H. PRODUCT SUBMITTALS**

- 1) The Contractor shall submit the following information:
  - Manufacturer’s certification that the materials to be used meet the referenced standards and these specifications.
  - License or certificate verifying Manufacturer’s/Licensors’ approval of the installer.
  - Proposed equipment and procedures for accomplishing the work.
  - A complete description and manufacturer’s recommended cure method. The PWS shall contain a detailed curing procedure detailing the curing medium and the method of application.

**PART 3 – LINER INSTALLATION**

**A. GENERAL**

- 1) Neither the Liner material, nor its installation, shall cause adverse effects to any of the **COMMISSION**’s processes or facilities. The use of the product shall not result in the formation or production of any detrimental compounds or by-products at the wastewater treatment plant. The Contractor shall notify the **COMMISSION** and identify any by-products produced as a result of the installation operations, test and monitor the levels, and comply with any and all local waste discharge requirements.
- 2) Manhole Liner installation shall not commence until the Cured-In-Place Pipe liner is installed and fully cured.
- 3) Product shall be spray applied using specialty application equipment.
- 4) When applying the coating to a manhole interior with small voids, pits or surface abnormalities present, use a resurfacing 10-20 mil application of the specified coating and then a back trowel method to fill and level the surface. Once the resurfacing application has been applied the application of the remaining amount

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of the specified minimum coating mil thickness can continue.

- 5) For manhole interiors that have undergone mild surface deterioration use a resurfacing application of 20%-25% of the specified coatings required minimum mil thickness and then a back trowel method to fill and level the surface. Once the resurfacing application has reached a tack-free state the application of the full amount of the specified minimum coating mil thickness can be applied.
- 6) For manhole interiors that have undergone severe surface deterioration, the Contractor shall resurface/rebuild the structure with polymer modified cement or cementitious products suggested by the Liner manufacturer.

**B. PREPARATION AND CLEANING**

- 1) Contractor shall perform a pre-video inspection of all sewer manholes to be lined. The Contractor shall provide the **COMMISSION** a copy of the video in digital format for review and approval.
- 2) The pre-video shall be after the manhole is cleaned.
- 3) The Contractor is responsible to clear the manhole of obstructions that will interfere with the installation and long-term performance of the Manhole Liner.
- 4) If the pre-video inspection reveals a deteriorated manhole not identified as part of the original scope of work which will prohibit proper installation of the Manhole Liner, the Contractor may be directed by the **COMMISSION** to correct the problem(s) prior to lining. The Contractor shall be compensated for this work under a Contract Bid Alternate Bid Item.
- 5) The Contractor shall be responsible for confirming the locations of all inverts prior to installing and curing the Manhole Liner.
- 6) Abrasive blasting, shot blasting, high pressure water cleaning, water jetting, or a combination of methods and equipment shall remove all loose mortar, unsound concrete, brick, hard contaminants, localized micro-organisms and gas contaminants from the interior manhole walls, floor and ceiling. Final product shall be cleaned and exposed ready for rehabilitation material.
- 7) Prior to coating, the manhole must be prepared in a manner that provides a uniform, clean, sound, neutralized surface suitable for the specified coating. The manhole must be free of all contaminants, such as oil, grease, rust, scale or deposits. In general, coating performance is proportional to the degree of surface preparation.
- 8) Concrete and masonry surfaces must be sound and contaminant-free.



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- 9) After surface preparation is completed, Contractor and the **COMMISSION** must perform an inspection to identify any manhole deficiencies, if any, for the items listed below:
  - Leaks
  - Cracks
  - Holes
  - Missing Bricks
  - Exposed Rebar
  - Ring and Cover Condition
  - Bench/Channel Condition
  - Invert Condition
- 10) If any defects are identified, repairs to correct all found deficiencies shall be approved by the **COMMISSION**.
- 11) Repair all leaks with a chemical or hydraulic sealant per the Manhole Liner manufacturer's recommendation.
- 12) Repair all leaks with non-shrink grout designed for use in field sealing of ground water.
- 13) Severe cracks shall be repaired using urethane based chemical sealant.
- 14) Grout and Sealant product to be utilized shall be approved by the **COMMISSION** prior to installation.
- 15) Equipment for installation of lining materials shall be high quality grade as recommended by the manufacturer.
- 16) Re-blasting may be required to remove all abrasive materials after repairs are completed.
- 17) The Contractor is responsible for construction water. The **COMMISSION** can supply the Contractor with a Temporary Construction Water Meter (with proper backflow prevention) provided an account is applied and paid for by the Contractor with the **COMMISSION**'s Billing Department.

**C. BY-PASS PUMPING**

- 1) See Specification 02730.

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**D. GROUT**

- 1) Do not block pipes entering/exiting manhole with grout.
- 2) Prevent material from entering gravity sanitary sewer collection system.

**E. CEMENTITIOUS RECONSTRUCTION**

- 1) Following approved submittals and as specified herein.
- 2) Mix and handle materials.
- 3) Apply materials using rotary spray equipment or spray gun.
- 4) Seal around pipe connections.
- 5) Prevent material from entering gravity sanitary sewer collection system.
- 6) Apply material a minimum of ½ inch thick.
- 7) Trowel and brush for smooth finish.
- 8) Cure using curing compound when recommended by manufacturer.
- 9) Do not allow flow in manhole or traffic over manhole, until manufacturer's minimum cure times have been achieved.

**F. EPOXY LINER**

- 1) Mix and apply material.
- 2) Sagging of material is not permitted.
- 3) Seal around pipe connections.
- 4) Cure.
- 7) The final Manhole Liner shall be a continuous, jointless and structurally sound and shall be completely free of pinholes or voids.
- 8) Total thickness of the liner shall be a minimum of 125 mils.
- 9) All defects identified such as pinholes, low film millage, etc. shall be repaired with same material and to same thickness as required of original installation.
- 10) A permanent identification number and date of work performed shall be affixed to the structure in a readily visible location.
- 11) Provide final written report to **COMMISSION** detailing the location, date of report, and description of each Manhole Liner installed.
- 12) The Contractor shall clean-up, restore existing surface conditions and structures, and repair any of the Manhole Liner determined to be defective. The Contractor shall conduct installation operations and schedule clean-up in a manner to cause the least possible obstruction and inconvenience to Customers, traffic, pedestrians, businesses, etc.

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**G. MANHOLE INVERT RECONSTRUCTION**

- 1) The Contractor shall be compensated for this work under a Contract Bid Alternate Bid Item.

**H. MANHOLE BENCH / CHANNEL REHABILITATION**

- 1) The Contractor shall be compensated for this work under a Contract Bid Alternate Bid Item.

**I. MANHOLE LINER REPAIR/REPLACEMENT**

- 1) Occasionally installation of will result in the need to repair or replace a defective Manhole Liner. The Contractor shall outline specific repair or replacement procedures for potential defects that may occur in the Manhole Liner. Repair/replacement procedures shall be accordance with the Manhole Liner manufacturer’s recommendations and shall be submitted as part of the PWS.
- 2) Defects in the installed Manhole Liner that will not affect the operation and long term life of the product shall be identified and defined.
- 3) Repairable defects that may occur in the installed Manhole Liner shall be specifically defined by the Contractor based on manufacturer’s recommendations, including a detailed step-by-step repair procedure, resulting in a finished product meeting the requirements of these contract specifications.
- 4) Un-repairable defects that may occur to the Manhole Liner shall be clearly defined by the Contractor based on the manufacturer’s recommendations, including a recommended procedure for the removal and replacement of the Manhole Liner.

**PART 4 – FINAL COMPLETION**

**A. TESTING**

- 1) The Contractor shall supply the COMMISSION with certification that the installed Manhole Liner material has been sampled and tested by the manufacturer in accordance with the provisions of this specifications.
- 2) If properties tested do not meet minimum requirements, the liner shall be repaired or replaced by the Contractor, at no cost to the **COMMISSION**.

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- 3) The installed liner thickness shall be measured for manhole liner installed. If the liner thickness does not meet these specifications then the liner shall be repaired or removed by the Contractor at no cost to the **COMMISSION**. The liner thickness shall have tolerance of minus 5% plus 10%. The Contractor may use industry proven, non-destructive methods for confirming the thickness of the installed liner.
- 4) The Contractor shall furnish liner samples, when applicable.
- 5) All testing and repairs shall be completed before Final Completion and Final Payment to the Contractor.

**B. INSPECTIONS**

- 1) Contractor shall perform a post-video inspection of each lined manhole. The Contractor shall provide the **COMMISSION** a copy of the video in digital format for review and approval.
- 2) Immediately prior to conducting the post-video, the Contractor shall thoroughly clean the newly installed liner removing all debris and buildup that may have accumulated.
- 3) The post-video will visual inspect the finished liner as follows:
  - a. Shall be continuous over the entire length of the installation and shall be free of significant visual defects, damage, deflection, holes, leaks and other defects.
  - a. Shall maintain the overall hydraulic capacity of the original manhole. In those cases where full capacity cannot be achieved after liner installation, the Contractor shall submit a request to waive this requirement, together with the reasons for the waiver request. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition.
- 2) The post-video shall be submitted to the **COMMISSION** within ten (10) working days of the liner installation. The data shall note the inspection date, location of all reconnected side sewers, debris, as well as any other defects in the liner, including, but not limited to, gouges, cracks, bumps, or bulges.
- 3) If post installation inspection documentation is not submitted within Ten (10) working days of the liner installation, the **COMMISSION** may at its discretion suspend any further installation of CIPP until the post-installation documentation is submitted. As a result of this suspension, no additional working days will be added to the contract, nor will any adjustment be made for increase in cost.
- 4) Bypass pumping or plugging from the upstream manhole shall be utilized to minimize sewer from entering the pipe during the post-video inspection.
- 5) Where leakage is observed, the Contractor shall institute additional testing

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including but not limited to air testing, localized testing and any other testing that will verify the leak-proof integrity of the installed liner to the satisfaction of the **COMMISSION**.

**C. AS-BUILTS**

- 1) As-Built drawings/reports and pre & post inspection videos shall be submitted to the **COMMISSION** for review and approval for Final Completion contract date. As-Built drawings will include the identification of the work completed by the Contractor and shall be prepared on one set of Contract Drawings provide to the Contractor at the onset of the project.
- 2) As-Built drawings shall be kept on the project site at all times, shall include all necessary information as outlined in the PWS or as agreed to by the **COMMISSION** and the Contractor at the start of the Contract and shall be updated as the work is being completed, and shall be clearly legible.

**D. WARRANTY**

- 1) The Contractor shall provide necessary warranty and documentation of required experience per the Contract Bid Submittal Requirements and as specified herein.
- 2) The Manhole Liner manufacturer shall warrant the liner to be free from defects in raw materials for a minimum of one (1) year, or as specified in the Contract Bid Submittal Requirements, from the date of installation and Final Completion by the **COMMISSION**.
- 3) The Contractor shall warrant the Manhole Liner installation for a minimum of one (1) year, or as specified in the Contract Bid Submittal Requirements, from the date of installation and Final Completion by the **COMMISSION**.
- 4) During the Manhole Liner manufacturer and Contractor warranty period, any defect found that may materially affect the integrity, strength, function and/or operation of the manhole shall be repaired at the Contractor's expense in accordance with procedures included in Part 3, I. Manhole Liner Repair/Replacement at no cost to the **COMMISSION**.
- 5) The **COMMISSION** may inspect all or portions of the lined manholes during the warranty period and if found that any of the liners have developed abnormalities since the time of Final Completion, the abnormalities shall be repaired and/or replaced as defined in Part 3, I. Manhole Liner Repair/Replacement at no cost to the **COMMISSION**.

**END OF SECTION**