MICHIGAN

DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

FOR

**CURED-IN-PLACE SANITARY MANHOLE LINING**

GND:TCS 1 of 6 APPR:DMG:RPB:09-21-23

**a. Description.** This work consists of installing a full depth cured-in-place liner for sanitary manholes. Furnish materials in accordance with section 403 of the Standard Specifications for Construction, or as modified herein.

1. References.

A. *ASTM D638 Standard Test Method for Tensile Properties of Plastics*

B. *ASTM D695 Standard Test Method for Compressive Properties of Rigid Plastics*

*C. ASTM D790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials*

D. *ASTM D2240 Standard Test Method for Rubber Property – Durometer Hardness*

E. *ASTM D2344/D2344M Standard Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates*

*F. ASTM D3039/D3039M Standard Test Method for Tensile Properties of Polymer Matrix Composite Materials*

*G. NACE RPO-188 Discontinuity (Holiday) Testing of New Protective Coating on Conductive Substrates*

*H. ASTM D4787 Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates.*

*I. ASTM F1216 Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.*

**b. Materials**. Furnish materials in accordance with section 403 of the Standard Specifications for Construction and as specified herein.

1. Manhole interior surfaces must have all defects such as leaks, holes, mortar joints, bug holes, etc. patched with compatible cementitious patching/plugging compounds. Ensure all materials are fast setting and specifically designed for leak control, to be applied directly to active leaks under hydrostatic pressure in manholes or related structures, in accordance with the manufacturer’s recommendations. Select one of the rapid setting cementitious materials: Speed Plug by Euclid, Quick Plug by Parson Environmental Services Inc., Standard Plug Plus by Standard Cement Materials, or approved equal.

2. Excessive infiltration which cannot be controlled by cementitious means may be repaired by means of hydrophilic polyurethane resins or polyurethane grouts. Furnish a solution that reacts freely with water to form a gel, film, or foam. Select one of the polyurethane products: AV-290 Fast Set by Avanti, AV-202-LV Multigrout by Avanti, Perma Seal by Parson Environmental Products Inc., or approved equal.

3. Manhole Lining Systems.

A. Composite Liner (Fiberglass Reinforced Epoxy Composite).

(1) Ensure the protective liner is a multilayered composite comprised of layers of epoxy and fiberglass/carbon fiber cloth, hand crafted, constructed in place and cured at ambient temperature. Ensure liners are custom made, monolithic, and accommodate the manhole shape.

(2) Ensure as a minimum the manhole liner system is composed of a multiple layered composite consisting of felt, an impervious membrane, and fiberglass as required. The fibrous layer will be impregnated with a polymer resin. Add fiberglass and resin for additional liner thickness.

(3) Use Altliner by Alternative Lining Technologies or approved equal.

B. Cured-in-Place (Inverted Resin Impregnated Tube Pipe Liner).

(1) Ensure the protective liner is a multilayered composite comprised of one or more layers of absorbent, non-woven felt fabric, felt/cloth, or fiberglass. Ensure liners are custom made, monolithic, and accommodate the manhole shape.

(2) Ensure as a minimum the manhole liner system is composed of a multiple layered composite consisting of felt and an impervious membrane. The fibrous layer will be impregnated with a polyester or vinyl ester resin.

(3) Use Triplex by McNeil Technologies or approved equal.

**c. Construction.**

1. Manhole Lining Systems.

A. Submit engineering design calculations used for determining the properties of each lining system to the Engineer for approval at least 21 days prior to conducting the work. Ensure these calculations are in accordance with applicable *ASTM* standards identified herein and the manufacturer’s proprietary cured-in-place manhole lining system standards for each structural design component/system to be installed. Ensure these calculations are performed and certified by a Professional Engineer licensed in the State of Michigan.

B. Maintain or bypass flow from existing active inlet and outlet pipes entering the manhole if the flow will affect installation of the liner system.

C. Remove all manhole steps prior to a coating or lining application. Do not reinstall steps after work is completed.

D. Manhole interior surfaces must have all defects such as leaks, holes, mortar joints, bug holes, etc. patched with cementitious patching/plugging compounds as specified herein.

E. Reconstruct manhole invert channels with concrete as required and specified herein.

F. Ensure manhole corbel and joints are surface prepped and resurfaced to an even and nearly smooth profile with cement grout as required and specified herein.

G. Cleanup, restore existing surface conditions and structures, and repair any part of the cured-in-place manhole liner installed and determined to be defective at no cost to the contract.

H. No infiltration or inflow is acceptable in the newly lined manhole. Ensure visible leaks are corrected at no cost to the contract.

2. Surface Preparation.

A. Remove all contaminants, including oil, grease, unsound or incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants. Remove contaminants with a degreaser or other solvents as needed to remove any film residue on the surface and then pressure wash the structure with water.

B. Clean surfaces with high pressure water using equipment capable of at least 5,000 psi at 5 gallons per mimute using a zero degree rotating nozzle.

C. Utilize a solution of muriatic acid (hydrochloric acid) at a ratio of 1 part acid to 10 parts water if the initial power washing with water cannot be utilized due to structural conditions in the manhole or it does not remove all deposits. After the acid solution is applied, wash it off completely, and allow the manhole to dry. Perform the mixing, application, and removal of the acid solution in strict accordance with the manufacturer’s specifications and safety procedures. Remove and properly dispose of all waste materials resulting from the cleaning operation.

D. Stop infiltration by using a material which is compatible with the specified liner manufacturer’s guidelines.

E. Test prepared surfaces after cleaning but prior to application of the epoxy coating to determine if a specific pH or moisture content of the concrete is required in accordance with the manufacturer's recommendations.

3. Testing and Acceptance.

A. Visual Inspection. Ensure manhole lining is visually inspected for water tightness upon completion and at any time during the warranty period. Repair any visible leaks or defects, at no additional cost to the contract.

B. Conduct Holiday Detection Test (Spark Testing) to identify pinholes, thin material, and any defects that may have a negative effect on the life of the installed system.

(1) After the epoxy coating product has cured in accordance with manufacturer’s instructions, inspect all surfaces for holidays with high-voltage holiday detection equipment. Reference *NACE RPO188* and *ASTM D4787* when performing holiday detection.

(2) Perform all testing in the presence of the Engineer.

(3) Submit test results to the Engineer for approval and acceptance.

(4) Mark all detected holidays and repair in accordance with liner manufacturer’s recommendations.

(5) Provide documentation to the Engineer on areas tested, results, and repairs made.

C. Leakage Testing. Conduct vacuum testing of sanitary manholes as shown on the plans or directed by the Engineer, in accordance with *ASTM C1244/C1244M* and this special provision.

(1) Preparation.

(a) Connect and backfill above all pipes to the manhole prior to testing.

(b) Maintain the trench in a dewatered condition such that no standing water is above any joint to be tested. Furnish a method to measure the groundwater elevation adjacent to the manhole to be inspected.

(c) Prior to air testing the manhole structure, permanently plug all lift holes. Temporarily plug all pipes entering the manholes with the plug placed inside the pipe so that the connection between the boot and the manhole is tested.

(2) Testing Procedure.

(a) Place the test head at the top of the manhole in accordance with manufacturer’s recommendations.

(b) Draw a vacuum of 10 inches of mercury on the manhole, close the valve on the vacuum line of the test head and the vacuum pump shut off. Measure the time for the vacuum to drop to 9 inches of mercury.

(c) The manhole will pass if the time for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury meets or exceeds the time as shown on Table 1. Measure time using a digital or analog stopwatch.

(d) If the manhole fails the air test, make all repairs by methods approved by the Engineer. Re-test the manhole until a satisfactory test is obtained.

(e) The Engineer may require the reconstruction of any manhole that does not pass acceptance test at no additional cost to the contract.

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| **Table 1****Sanitary Manhole Air Test Table****Minimum Time Required for 1.0 inch Mercury Pressure Drop** |
| **Depth, feet** | **Diameter, inches** |
|  | **30** | **33** | **36** | **42** | **48** | **54** | **60** | **66** | **72** |
| **8** | 11 | 12 | 14 | 17 | 20 | 23 | 26 | 29 | 33 |
| **10** | 14 | 15 | 18 | 21 | 25 | 29 | 33 | 36 | 41 |
| **12** | 17 | 18 | 21 | 25 | 30 | 35 | 39 | 43 | 49 |
| **14** | 20 | 21 | 25 | 30 | 35 | 41 | 46 | 51 | 57 |
| **16** | 22 | 24 | 29 | 34 | 40 | 46 | 52 | 58 | 67 |
| **18** | 25 | 27 | 32 | 38 | 45 | 52 | 59 | 65 | 73 |
| **20** | 28 | 30 | 35 | 42 | 50 | 53 | 65 | 72 | 81 |
| **22** | 31 | 33 | 39 | 46 | 55 | 64 | 72 | 79 | 89 |
| **24** | 33 | 36 | 42 | 51 | 59 | 64 | 78 | 87 | 97 |
| **26** | 36 | 39 | 46 | 55 | 64 | 75 | 85 | 94 | 105 |
| **28** | 39 | 42 | 49 | 59 | 69 | 81 | 91 | 101 | 113 |
| **30** | 42 | 45 | 53 | 63 | 74 | 87 | 98 | 108 | 121 |
| Times shown in seconds |
| The depth of the manhole is measured from the top of the manhole cover to the floor of the manhole. If the depth of the manhole is not listed, the next higher value will be used. |
| The largest diameter section of the manhole must be used to determine time required.  |

4. Submittals. Furnish submittals to the Engineer at least 21 calendar days prior to scheduling the work. Product data submittals required for the cured-in-place manhole liner must include:

A. Material type and manufacturer to be used including catalog data sheets, *ASTM* references, material composition, manufacturer’s recommended specifications, component physical properties, and chemical resistance.

B. Manufacturer’s detailed description of the recommended procedures for handling and storing materials.

C. Manufacturer’s detailed description of the recommended material installation/application process including mixing, additives, set time, cure time (return to service), and all equipment required for quality product delivery.

D. Technical data sheets describing each rehabilitation component to be applied/installed.

E. Manufacturer’s detailed description of all required field-testing processes and procedures.

F. By-pass pumping plan, if applicable.

G. Certified statement, from the manufacturer, that the Contractor is an approved installer of the product.

H. Furnish evidence to the satisfaction of the Engineer that the Contractor has at least 5 years of experience and five projects of similar size and complexity doing this type of specialty work. Furnish contact names from past projects as requested by the Engineer.

I. At the completion of the project, the Contractor must provide a 5-year warranty for every structure where a liner system was installed. The warranty must cover all material and labor costs associated with the repair or replacement of a defective lining system.

**d. Measurement and Payment**. The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

**Pay Item Pay Unit**

Cured-in-Place Sanitary Mh Lining Foot

**Cured-in-Place Sanitary Mh Lining** includes payment for each measured vertical foot lined within the manhole, bypass pumping and/or diversion of sewage flows, cleaning equipment, product installation, all quality controls, testing and samples for performance of required material tests, and final inspection at locations shown on the plans and as specified herein.