

Manhole Rehabilitation Technical Specifications

1.0 Scope:

This specification defines the approved methodology and materials for the rehabilitation of concrete structures using Infrastructure Repair Systems, Inc.'s ambient cured 100% thermosetting epoxy brush or trowel on system. This includes waterproofing, sealing, structural enhancement, and corrosion protection. The structures include, but are not limited to, new and existing sewer manholes (base, walls, corbel/cone, and chimney), square and rectangular shaped wet wells. Our system will effectively recondition the manhole surface to create a high strength, high build, and corrosion resistant impermeable structural bond with the internal substrate.

2.0 General:

The rehabilitation will include four (4) phases.

- A. Cleaning: Proper cleaning is critical for the successful rehabilitation of the manhole.
- B. Patching: All holes, voids and cracks greater than 1/8" shall be filled with mastic stopping all leaks.
- C. Sealing - Priming: All surfaces shall be coated at a rate of 400 sq. per gallon.
- D. Top Coat: Applied at a dry film thickness between 100 and 125 mils.

2.1 Description:

A two component 100% solids thermosetting epoxy system that is applied from 100 to 125 mils, or as required by a qualified design engineer, to both dry and wet substrates. Many factors determine the optimum thickness such as the condition of the existing manhole, depth, groundwater pressure, and traffic loads. The total system is applied by brush or trowel to the internal substrates of a damaged or leaking manhole and can also be applied to new structures.

3.0 Significance and Use:

This specification is for use by regulatory agencies, engineers, and commissioners of public works, superintendents of public works and others who are authorized and are involved in the rehabilitation of infrastructure and sewer manholes.

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4.0 Manufacturer's Specifications:

4.1 Resin:

A two component 100% solids thermosetting epoxy containing zero grams per liter VOC'S and having a gel time of approximately 10 minutes without the need of external sources of heat. The system will achieve superior bond strength to the substrate under both dry and wet conditions in both warm and cold climates.

4.1 Materials:

The material required for the rehabilitation project must be designed for manhole rehabilitation and specific application in which they are used. The material shall be delivered to the site in undamaged, unopened containers bearing Infrastructure Repair Systems' original label and stored in an area that will insure the materials maintain a temperature not to exceed 90° F. The material must be mixed and applied in accordance with our written instructions and **not altered in any way**. All materials shall be rejected for failure to meet the requirements of this specification.

4.2 Alternative Materials:

No alternative materials shall be employed without qualification and written approval from Infrastructure Repair Systems, Inc.

5.0 Chemical and Corrosion Resistance:

The rehabilitated manhole must be chemically resistant to withstand internal exposure to domestic sewage and meet the standards for domestic sewage resistance in accordance with testing as outlined by the American Society of Testing and Materials ASTM D 543 (Table 1).

5.1 Mechanical and Physical Properties:

The cured epoxy shall be resistant to biogenetic corrosion and aggressive soil conditions and must meet the mechanical and physical properties in accordance with testing as outlined by the American Society of Testing and Materials, ASTM C 297 Tensile Strength of Flat Sandwich Constructions in Flatwise Plane, ASTM D 638 Tensile Properties of Plastics, ASTM D 790 Flexural Properties of Unreinforced and Reinforced Plastics, ASTM D 648 Deflection Temperature of Plastics Under Flexural Load and ASTM D 2240 Test Method For Rubber Property – Durometer Hardness. (Table 2)

5.2 Independent Testing:

All mechanical and physical ASTM testing must be validated by a third party qualified in these testing procedures. The chemical, structural and composite testing laboratories results shall be made part of this specification.

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6.0 Contractor:

The contractor will apply material according to specifications of Infrastructure Repair Systems, Inc.

7.0 Material Safety Data Sheet:

The MSDS will be included with each shipment and shall be kept on the job during the entire time work is in progress.

8.0 Safety:

Prior to entering access area an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen must be undertaken in accordance with local, state or federal safety regulations. Safety shall be in strict accordance with all applicable OSHA standards.

9.0 Documentation:

Documentation of the observed defects during the inspection shall be documented with the use of a digital or CCTV camera and be made available along with the inspection logs as part of the report.

10.0 Substrate Preparation:

Cleaning shall consist of the removal of all loose material and substrate contaminants and shall be accomplished by pressure washing (min. 3000 psi) or sandblasting. The use of muriatic, hydrochloric or other acids for cleaning the substrate is not recommended. Precautions must be taken to prevent debris and foreign material from entering active lines. Any large solid protrusions on the substrate, such as mortar lumps, shall be cut back flush with the existing wall, or as near as possible, using a small sledge or chipping hammer.

10.1 pH:

Using a pH meter verify that the substrate is near neutral (pH 7) prior to the application of any of the products.

10.2 Patching:

All loose or disintegrated material shall be removed from the substrate that is to be patched exposing a sound substrate. Patching, filling and repairing of holes, cracks, breaks, broken bricks and irregular surfaces will be accomplished by the application of Infrastructure Repair Systems' brush or trowel grade 100% epoxy mastic which is formulated with ingredients that will not promote corrosion of the steel of which it may be in contact.

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10.3 Sealing/Primer:

Infrastructure Repair Systems' penetrating sealer is designed to penetrate the concrete, block and brick pore structures of the manhole (base, wall, corbel/cone). The penetration depth depends on several factors including moisture content and the porosity of the substrate. In general the penetration depth will range from 1.5mm to 8.5mm. Filling the voids that have occurred over time resulting in a denser, more durable concrete and reduction of permeation by liquids and /or gases from external sources. The penetrating sealer/primer is formulated to have a coefficient of expansion and contraction similar to that of the substrate. It is evenly sprayed at a rate of 400 square feet per gallon to both dry and damp substrates using Infrastructure Repair System's approved application methods.

10.4 Coating:

Infrastructure's topcoat application must be applied with Infrastructure Repair System's approved application methods, or as required by a design engineer. Final thickness will increase in areas of major damage. The coating must be applied monolithically. The finished topcoat shall be uniform in color and exhibit superior bond strength to the substrate beneath the coating. No pinholes, blistering or other defects will be accepted.

10.5 Gel Time/Cure Time Verification:

A sample shall be taken prior to actual application of the top coat. The measured gel/cure time is used as the basis for determining the required coating/application time.

11.0 Final:

Acceptance criteria shall be based on properly completed rehabilitation of the manhole and in accordance with this specification. The continuity of the dry but uncured coating shall be checked with a nondestructive holiday detector at 100 volts per mil. Any leakage or defects in the work shall be corrected by the contractor within an agreed upon time at no additional cost to the owner. Final acceptance also involves documentation of the completed repair.

12.0 Warranty:

Infrastructure Repair Systems shall warranty that the products that are required for manhole rehabilitation are produced in conformity with its written specifications and formulas within recognized tolerances and are free of adulterations or contaminations and Infrastructure Repair System further warrants that the product will perform in accordance with its published literature and technical data sheets when properly applied in strict conformance with its written instructions and applied to a properly prepared substrate.

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ADVANTAGES

- **Ease of Installation**
- **Forms a Permanent Monolithic Repair**
- **Minimal Inconvenience to the Public and Traffic**
- **Ambient Cure**
- **Environmentally Friendly 0 VOC'S**
- **High Performance Corrosion Strength**
- **High Performance Tensile Strength**
- **High Performance Compression Strength**
- **High Performance Durability**
- **Ability to Conform to any Configuration**
- **Bonds to Dry and Wet Substrates**
- **Prevents Infiltration and Exfiltration**
- **Technical Support**

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Table 1
ASTM 543

(Minimum Chemical Resistance Requirements for Domestic Sanitary Sewer Applications)

Chemical Solution	% Of Concentration
Tap Water pH 6-9	100%
Nitric Acid	5%
Phosphoric Acid	10%
Sulfuric Acid	10%
Gasoline	100%
Vegetable Oil	100%
Detergent	0.1%
Soap	0.1%

Minimum One Month at 73.4° F (23° C)

Table 2
Mechanical and Physical Properties

Test Method	Results		
ASTM D 638	Tensile Strength	Tensile Modulus	Elongation Strength
	8,228 psi	463,516 psi	1.886%
ASTM D 695	Compressive Strength	Compressive Modulus	
	13,627 psi	542,290	
ASTM D 790	Flexural Strength	Flexural Modulus	
	16,917 psi	465,306 psi	
ASTM D 2240	Hardness Mold Side		
	84.7	Average after high & low reading discarded	

Tensile Pull Off Strength

Test Method	Substrate	Tensile Pull Off Strength
ASTM C 297	Steel	1101 psi (average 2 tests)
	Concrete	>464 psi (average 3 tests)

Visual Observations

Steel Substrate: 60% Cohesive Failure of Epoxy; 40% Adhesion Failure
Concrete Substrate: 100% Failure of Concrete Substrate