RAM Liners

Structural Fiberglass & Epoxy Resin

A Cured-In-Place Product (CIP)

#### S T A N D A R D S P E C I F I C A T I O N S

Designed for Structural Rehabilitation and Preventive Maintenance of Wastewater and Stormwater Collection Systems

for municipal and industrial applications

* Structural Collection System Rehabilitation
* Prevents In-filtration & Ex-filtration
* Eliminates Sewer Gas & Chemical Corrosion
* Preventive Maintenance in New Structures

Specifically designed for use in Sewer Manholes,

Pump Stations, Wet Wells, & Vaults, and for

Storm Water Culverts, Catch Basins & Pipes

#### RAM Liners

#### S T A N D A R D S P E C I F I C A T I O N S

1. **PRODUCTS**

**RAM-1200 Series** Liner – Five structural fiberglass layers with a dry fabric weight of 120 oz. per square yard, saturated with 100% solids epoxy, cured-in-place, and bonded to the existing structure. This liner is designed to meet D.O.T. load bearing requirements for culverts, and for the most severely deteriorated vertical or horizontal structures.

**RAM-720** **Series** Liner – Three structural fiberglass layers with a dry fabric weight of 72 oz. per square yard, saturated with 100% solids epoxy, cured-in-place, and bonded to the existing structure. This liner is for structural rehabilitation of deep and severely deteriorated manholes, pipes, catch basins, vaults and pump stations.

**RAM-540** **Series** Liner – Three structural fiberglass layers with a dry fabric weight of 54 oz. per square yard, saturated with 100% solids epoxy, cured-in-place, and bonded to the existing structure. This liner is the primary design for the standard structural rehabilitation of sewage manholes and storm-water catch basins.

**RAM-340 Series** Liner – Two layers of structural fiberglass layers with a dry fabric weight of 34 oz. per square yard, saturated with 100% solids epoxy, cured-in-place, and bonded to the existing structure. This liner is the standard manhole rehabilitation liner and is superior in strength and sewer gas resistance to spray-on and plaster-on products.

1. **MANUFACTURER/DISTRIBUTOR/INSTALLER**

**Manufacturer**: McNeil Technologies, Inc.

 Phone: (850) 687-9696 • Fax: (850) 424-3822

**Distributor/Installer:** Please contact Manufacturer for the certified distributor/installer in your area.

SERVICE AREA: USA and Canada

**3. PRODUCT DESCRIPTION**

**Usage:** The RAM Liner System is a cured-in-place structural liner designed for use as a multi-layer structural system for rehabilitation for structures such as manholes, pump stations, wet wells, vaults, storage tanks, large diameter pipe and corrugated culvert pipe. It provides impervious water and sewer gas resistance with epoxy-saturated layers of structural fiberglass. The liner system is ideal for protection against H2S gas deterioration, infiltration and exfiltration problems—and provides structural rehabilitation in structures of most any shape or size.

This waterproof liner system completely seals off infiltration and exfiltration. The epoxy resins used in conjunction with the fiberglass liner fabric are resistant to gases and chemicals typically encountered in domestic sewer systems. The liner permanently adheres to wet or dry surfaces of brick, concrete, PVC and ductile iron. It prevents further deterioration, infiltration, and exfiltration, while providing structural reinforcement to the existing structure. It provides a chemical and sewer gas resistant protective lining system. Other epoxy or vinyl-ester resins may also be used in conjunction with the RAM Liner for special chemical and industrial applications.

The RAM Liner System is manufactured in four (4) standard liner weights that are designed for varying structural conditions for both vertical and horizontal structures. These four liner designs provide the end-user with the most economical choice for permanent rehabilitation needs ranging from preventive maintenance to very serious structural problems with infiltration and/or ex-filtration. Deterioration prevention on new structures where future sewer gas is likely to be a problem is also a specialty with the RAM Liner system.

Each liner is a type that allows rehabilitation of concentric, eccentric or flat top structures without removing the ring top section or corbel. This minimizes traffic disruption and eliminates the need for road repairs. All liner material and components are custom fabricated at the McNeil Technologies manufacturing facility to fit the size and shape of each individual structure. Structure measurements are taken and liners are manufactured prior to commencement of the liner installation to minimize the on-site field time required for the liner installation.

**Materials and Liner Installation System:** Each typical RAM Liner series is made of structural fiberglass and saturated with epoxy resin. The standard impregnating resin for typical domestic wastewater sewer system liners is a modified Polyamide Bisphenol “A” Epichlorodhydrin system that is field applied. After the resin is applied, the liner is lowered into the manhole where, in most cases, it is cured in place with a temperature inversion system of air pressure and steam heat injection.

Most liners are cured within two hours and become a structural monolithic wall bonded to the host structure.

Other chemical and industrial applications may require alternate resin system depending on the site conditions and chemicals present in the structures. In these cases the Owner shall supply an analytical report of chemicals present to McNeil Technologies, Inc. The resin system used in these cases is determined on a case-by-case basis.

**Sizes:** Host structure size and conditions dictate the preferred recommended liner to be installed. Each liner is custom fabricated to fit the individual structure. There is no standard configuration in manholes and in many other types of structures; therefore, exact measurements must be completed and submitted prior to manufacturing each liner. McNeil Technologies provides diagrams for location, configuration, measurements, site & structure conditions, notes and observations.

**4. INSTALLATION PROCESS**

**Cleaning:** All surfaces of the host structure are to be cleaned with a high-pressure hydro-jet sprayer with an operating pressure of at least 4,000-psi. After pressure cleaning, the surface may be cleaned with degreaser or other solvents, as needed, in order to remove any film or residue on the surface. The structure shall then be pressure rinsed with water. The structure may be damp from prep work, but all surfaces must be clean.

**Final Preparation:** All incoming laterals and main truck line openings shall be properly trimmed and grouted with hydraulic or Portland Type II Cement, forming a filet between the structure wall and each pipe. All inlet and outlet pipes located above the invert channel should be trimmed so they do not extend into the structure more than two inches. Such application of grout shall extend at least six inches from the outlet onto the wall area. Manhole steps shall be removed flush to within ½” of the structure wall. Any remaining protrusion shall be grouted over to provide smooth surface for the liner. Surfaces may be damp, but all active infiltration must be eliminated prior to installing the product.

In manhole and pump station lining, benches, filets, walls, and floors shall be repaired or refinished as appropriate, using chemical grout, hydraulic cement or Portland type II cement. Bench areas and floors shall be lined with liner materials saturated with the epoxy resin and placed in the bottom to overlap with the liner wall section when it is lowered into place. This bottom disk is made of the same materials as the main cylinder liner and will be overlapped for monolithic, simultaneous curing with the main cylinder liner.

**Manhole Liner Installation:** Once the liner is fully saturated with resin at the job site, it shall be lowered into the structure to the pre-marked position at the cover seat of the structure entrance. The liner shall form a monolithic structure permanently connecting the ring & cover seat to the chimney, corbel, walls and benches. Unless otherwise required, the liner will end at, but include, the bench. In cases where invert channel lining is required, the sewage flow must be stopped for a minimum period of 3 hours and is normally a separate cost item.

Typical installation procedures do not require the restricting or bypassing of the main trunk line in manholes where the sewage flow is contained within the invert channel(s) and channel lining is not required.

In cases where channel is required to be lined, the same process is used, as on the bench area however, the sewage flow must be stopped for up to three hours. Channels may also be lined with a hand lay-up method using RAM Mastic and fiberglass. Using the hand lay-up method, the channel shall be dry and free of infiltration of groundwater. The channel will receive not less than 1 24-oz structural fiberglass layer along with structural fiber reinforced epoxy mastic. Once the channel lining is cured, additional layers may be applied as needed. If channel lining is required it shall be specifically noted in the liner proposal or the client’s quotation request.

The RAMLiner for manholes shall be pressurized with air or water, and cured with steam, ambient or heated air, or ambient or heated water. Most typical RAM Liner installations for manholes will be pressurized at a pressure depending on the condition of the structure and the amount of pressure required. This is typically several hundred lbs. per square foot to enable the liner to conform to the curvatures of the structure.

**Pump Station, Wet Well and Vault Installation:** All pumps, pipes and switches shall beand switches shall be removed from the structure, providing the RAMLiner installer an empty structure. Unless otherwise specified by the owner, the liner will include walls, the floor, and the underside of top slab. The underside of the top slab may be lined in conjunction with the walls and floor, or it may be coated with RAM-1000 Mastic. The underside of the top slab may also be lined. First, remove and invert the top slab (bottom side up). For installation of the liner, apply RAM liner materials or RAM-1000 Mastic, to the bottom side of the slab and then allow it to cure at ambient temperature. Removal of the top slab method will allow the top slab to be removed in the future.

Once the liner is fully saturated with resin, it shall be lowered into the structure to the appropriate pre-marked position at structure entrance. In the case of large or non-cylindrical structures, the liner may be installed in sections with multiple cure times. The liner shall form a monolithic structure permanently connecting the walls and floor of the structure (and top slab where applicable).

Pump stations and larger structures are typically pressurized with all infiltration being stopped prior to installation. The liner may also be pressurized and cured-in-place at ambient temperature by filling the structure with water to approximately one foot above the surface area to be lined. Depending upon specific site conditions, the water method is preferred for structures such as square or rectangular manholes, or vaults and large pump stations. In structures without present infiltration, the liner may be suctioned to the wall with a sacrificial bladder and cured in ambient temperature for 10-12 hours. Where steam heat may be added, the liner cure will be accomplished in 2-3 hours. The epoxy resin used in conjunction with RAM Liners is strictly a time/temperature cure instead of a “flash” type cure of some resins.

**Culvert/Pipeline Installations**: RAM Liners are designed for pipes from 18” to 96” in diameter. Once the liner is saturated with resin, it is lowered into the pipe and then pulled through the section to be lined. A dual inflation canister system will be attached to the liner on each end. Air pressure and steam heat will be injected from one end and the other end will be equipped with an exhaust valve to control the amount of pressure within the structure. The liner will cover the entire circumference of the pipe or the section of pipe.

Point repairs may be necessary to provide a smooth surface that will allow the insertion of the liner through the pipe. Sewage flow control will be required during the installation process. Bypass pumping will be required for pipes to receive liner to entire circumference of the structure. Structures must be free of active infiltration at the time of product installation.

**Curing Process:** Once positioned in place, the liner is pressurized with air or water, and then cured with steam, ambient or heated air, or ambient or heated water. Most typical installations are heated by a temperature inversion system of pressurization with steam injection and a high velocity hot air column. This creates a steam/convection oven atmosphere, which brings the liner temperature to approximately 150° to 190° F. The liner is heated for approximately one to three hours—according to the size and condition of the structure. Regardless of curing process, the RAM Liners will be fully covered under the manufacturers warranty.

Upon completion of the liner curing process, the inflation bladder shall be removed, all lines reopened and the excess liner cut off at the manhole cover seat or structure openings.

**5. AVAILABILITY AND COST**

**Availability:** The RAM Lining System is available in all major marketing areas in the United States and Canada.

**Cost:** The RAM Liner System requires custom manufacturing and installation procedures tailored for each structure. The end result is a long-term solution to infiltration and H2S gas deterioration, with exceptional “value engineering” cost per year spread over the life of the liner. This liner provides a 50-100 year solution for sewer and storm water structures. RAM Liners provide the most strength and durability of any products used in sewer and storm water rehabilitation—a truly permanent solution.

**6. WARRANTY**

McNeil Technologies, Inc., and yourAuthorized Licensed Installer, jointly provides their Ten (10) Year Materials and Five (5) Year Labor non-prorated warranty for all RAM Liner Systems. RAM Liner fabrics and resins are warranted to be free of defects in materials and workmanship and provide a surface coating resistant to sewer gases and chemicals typically found in domestic sewer collection systems. This warranty is for the repair or replacement of the liner as needed.

McNeil Technologies LLC does not certify the structural integrity of existing structure or substructure, but the liner system will eliminate further deterioration due to sewer gases and significantly increase the life of the existing structure. In the case of industrial or chemical applications, warranty will be provided on a case-by-case basis.

**7. MAINTENANCE**

Although no maintenance is anticipated for decades, the RAM Liner System is easily repaired. Small holes or cracks can be repaired with RAM-1000 Mastic. Larger areas may be repaired using fiberglass material coated on both sides with RAM-1000 Mastic for greater structural integrity. The liner may be core drilled through for the addition of incoming lateral lines. RAM-1000 Mastic is a non-shrink 100% solids grout and is recommended for use as a seal between any incoming new line and the manhole or pump station’s lined wall.

**8. TECHNICAL SERVICE**

**Manufacturer:**

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