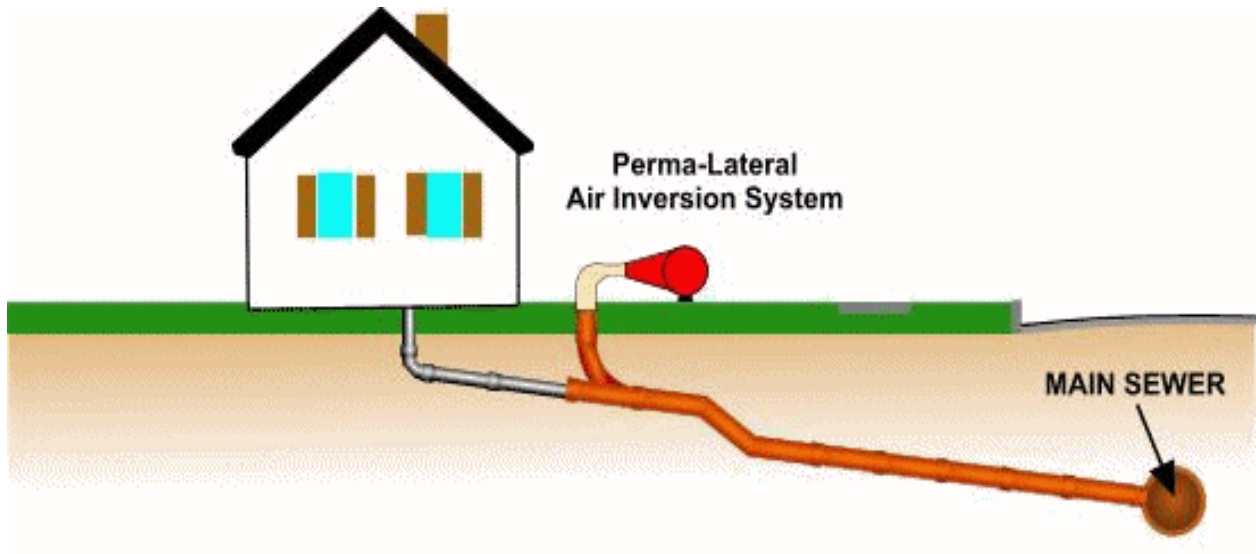




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CURED-IN-PLACE-PIPE PERMA-LATERAL AIR INVERSION SYSTEM



**THE STATE OF THE ART PERMA-VERTER IS DESIGNED TO
REHABILITATE THE HOUSE LATERAL AND OTHER SMALL
DIAMETER PIPES FROM 3" IN DIAMETER.**

PERMA-LINER INDUSTRIES, INC.

PERMA-LATERAL AIR INVERSION is a “Trenchless Technology” technique for rehabilitation of deteriorated or damaged pipelines using material based on resin and polyester reinforcements.

These materials have been used for more than 25 years for restoring pipelines and are well proven.

PERMA-LINER INDUSTRIES, INC. is committed to provide trenchless solutions for the repair of underground utilities. The PERMA-LATERAL AIR INVERSION SYSTEM can provide rehabilitation of laterals in the following situations:

- 1. Straight Runs from pit to pit.**
- 2. From sweeping cleanout to main sewer.**
- 3. Basement access through open-end pipe or cleanout opening to main sewer.**
- 4. Vertical rain water pipes from roof to ground.**
- 5. Re-lining of partial lateral.**

The PERMA-VERTER can line through multiple bends with no wrinkling. Depending on the structural damage, liner thickness can be increased to suit individual applications based on design specifications.

PERMA-LATERAL AIR INVERSION SYSTEM utilizes a combination of patented resin and reinforced polyester. The inverted liner allows the resin to migrate into cracks and bond the liner material with the existing host pipe. This full liner bonding process eliminates future water infiltration and root intrusion.

“TRENCHLESS SOLUTIONS OF TOMORROW HERE TODAY”



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PERMA-LATERAL AIR INVERTED SYSTEM **TECHNICAL SPECIFICATIONS**

PART 1 GENERAL

1.01 SCOPE

The work specified in this section includes all labor, materials, accessories, equipment, and tools necessary to install cured-in-place lateral pipelining.

1.02 QUALIFICATIONS OF BIDDER

At time of submission of bid, Bidder must possess, and be able to provide, a certificate of competency and licensing agreement from the liner manufacturer. The Bidder must also have experience installing the product and provide documentation that the Bidding Contractor has performed similar repairs.

1.03 PRODUCT QUALIFICATIONS

- a) Must be able to cure within 4.5 hours without introduction of heat, steam, or electricity (ambient Cure).
- b) Must be able to stop live infiltration without pre-grout application or other water stop products.
- c) The liner material must have outer PVC or equal coating able to stop live infiltration.
- d) Liner material must be of circular form with heat-bonded seam.
- e) Lining manufacturer must have lateral repairs installed with documentation.
- f) The lateral system must be able to line through bends and sweeping cleanouts.
- g) Must provide proof of right to use the product and/or license agreement.
- h) Must be able to bridge missing or broken pipe
- i) Must have open end after liner is cured without need for reinstatement cutter.

1.04 DESCRIPTION

A cured-in-place liner containing polyester needled felt with a PVC coating. The liner is impregnated with water resistant ambient cure resin. The liner is impregnated with the pre-measured amount of resin and the loaded into an air inverter unit. The air inverter must be capable of pressurizing up to 30 psi. The impregnated composite liner is inverted into the existing host pipe and pressed against the pipe forming a chemical bond with the internal circumference of the existing host pipe. The length of the liner to be installed is determined by the pre-television inspection video and report.

PART 2 PRODUCTS

2.01 GENERAL

The finished liner shall incorporate resin materials that will resist the corrosive effects of the raw sewage effluent and hydrogen sulfide gas. The liner must adhere to the host pipe and be able stop infiltration without grout under normal repair conditions. The cured-in-place-pipe shall be the Perma-Lateral Pipe Lining System as manufactured by Perma-Liner Industries, Inc. or a pre-approved equal.

2.02 LINER SIZING

The liner shall be fabricated to a size that will neatly fit the internal circumference of the conduit to be repaired as specified by the engineer.

2.03 LINER LENGTH

The length and number of liners shall be that deemed necessary by the Engineer to effectively carry out the repairs. The contractor shall verify the lengths in the field before installing the liners. In general, the length shall extend from the entry point to the main sewer connection.

2.04 REINFORCED LINER MATERIAL

Polyester stitch felt composite liner with a PVC corrosion resistant coating. The liner shall have a welded, filleted and taped seam that will withstand up to 45 PSI.

2.05 RESIN

A patented formulation consisting of a two component thermosetting resin having a gel time of approximately 4 hours at 24°F (-4°C) and 2 hours at 75°F with a cure time of approximately four and a half (4.5) hours without the need of external sources of heat. The patented resin contains fluid additives, matrix formers and other components to insure complete wet out of the reinforcement liner, and assuring that the liner will achieve superior bond strength to the substrate under both dry and wet conditions as well as warm and cold climates.

2.06 ALTERNATIVE MATERIALS

No alternative materials shall be employed without pre-qualification and written approval from Perma-Liner Industries, Inc.

PART 3 PRODUCT RESISTANCES TO CHEMICALS

3.1 CHEMICALS AND CORROSION RESISTANCE

The system (Resin and Liner) must meet the standards for domestic sewage resistance in accordance with testing as outlined by American Society of Testing and Materials ASTM D 543 (Table 1)

3.02 MECHANICAL & PHYSICAL PROPERTIES

The cured impregnated resin liner must meet the minimum mechanical & physical properties in accordance with testing as out lined by American Society of Testing and Materials, ASTM D 638 Tensile Properties of Plastics, ASTM D 695 Compressive Properties of Rigid Plastics, ASTM D 790 Flexural Properties of Un-reinforced and Reinforced Plastics, ASTM D 1876 Peel Resistance of Adhesives (T-Peel Test) ASTM D 2583 Indentation Hardness of Rigid Plastics by means of a Brachial Impresser ASTM D 648 Deflection Temperature of Plastics Under Flexural Load. (Table 2)

PART 4 INSTALLER

4.01 CONTRACTOR

All contractors bidding rehabilitation projects using the Perma-Lateral Repair System must show proof of successfully completing Perma-Liner's training program.

PART 5 MATERIALS

5.01 MATERIAL USAGE

The materials required for the rehabilitation project must be delivered to the site in undamaged, unopened containers bearing Perma-Liner's original label and stored in an area that will insure the materials maintain a temperature not to exceed 75°F. The material must be mixed at a temperature of 75°F or less depending on outside climate conditions. The mixing is to take place in one container, reducing the workers exposure to direct contact with the product. Always apply product directly from the container. **Do Not Alter** in any way.

PART 6 PRODUCT SAFETY

6.01 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.

6.02 SAFETY

Prior to entering access areas an evaluation of the atmosphere to determine the presence of toxic or flammable vapor or lack of oxygen must be undertaken in accordance with local, state, or federal safety regulations. Safety will be in strict accordance with all applicable OSHA standards. The Perma-Liner Point Repair System kit provides protective clothing, safety glasses, and gloves to reduce contact with resin materials while working on site.

PART 7 CLEANING AND INSPECTION

7.01 CLEANING

The intent of this procedure is the removal of all internal foreign materials and debris from the host pipe. This procedure is critical for the successful rehabilitation of the pipe. The procedure is accomplished with the use of a hydraulically propelled high velocity jet spray.

7.02 PRE INSTALLATION TELEVISION INSPECTION

Closed circuit television inspection is to be carried out immediately after cleaning to document sewer line conditions. The pipeline documentation shall be carried out using a lateral push camera, capable of viewing the complete circumference of the pipe. The camera lens is an auto-iris type. The documentation of the pipe's condition is recorded on color VHS videotape, along with reports that accompany the VHS videotape.

7.03 FLOW CONTROL

As a result of the use of an ambient cure resin, the lateral will not need to be bypassed. Bypass pumping is normally not necessary. However if excessive flow exists within the line and bypass is required, it shall be made by plugging the line at a point upstream of the pipe to be rehabilitated and pumping the flow to a downstream point or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle the flow specified in the job specifications.

7.04 INSTALLATION PROCEDURE

The Perma-Lateral Air Inversion liner bag material is measured on site unless a prior field inspection has been performed. In this case the liner would be brought to site pre measured. The Patented Perma-Lateral Resin is measured and mixed on site. The resin is then introduced into the liner bag and pinch rolled at the correct thickness of the liner bag utilized. Once the liner bag is wet out, the liner is loaded into the Perma-Verter. The Perma-Verter is then sealed airtight. The unit is pressurized to 30 psi. This pressure allows the liner bag to invert evenly through the pipe without wrinkling. The liner is inverted until the end is open. A calibration hose is then inverted through the liner bag. The liner is then held in place until cured. After curing, the calibration hose is removed and the lateral is post inspected for final approval.

7.05 FINAL PRODUCT

The cured-in-place Perma-Lateral shall extend the entire length of the area being repaired while providing a smooth transition from the host pipe to the repair. The remaining portion of each liner shall be free of any defects that would affect the integrity or strength of the repair and be both smooth and continuous.

PART 8 MANUFACTURER

8.01 PERMA-LINER INDUSTRIES, INC.

Perma-Liners' staff provides full technical support and assistance during normal working hours, unless otherwise agreed upon.

“THE INDUSTRY LEADER IN INFRASTRUCTURE REPAIR SYSTEMS”

TABLE 1
CHEMICAL RESISTANCE RESINS

The following is a partial list of chemicals to which our PATENTED RESINS have exhibited resistance:

AMMONIUM NITRATE (50%)
HYDROCHLORIC ACID (50%)
SODIUM HYDROXIDE (40%)
SULFURIC ACID (50%)
NITRIC ACID (50%)
CONCENTRATED ACETIC ACID (100%)
SODIUM CHLORIDE (100%)
CARBON TETRACHLORIDE (100%)
ACETONE (100%)
CYCLO-HEXANONE (100%)
GASOLINE, KAROSENE (100%)
CAUSTICS (100%)
SEWAGE (100%)

Note: Resin samples tested without fillers for three months at 68°F (20°C). Complete test results are available.

TABLE 2
MECHANICAL AND PHYSICAL PROPERTIES 3P RESINS

TENSILE STRENGTH	5,330 PSI
FLEXURAL STRENGTH	9,416 PSI
COMPRESSIVE STRENGTH	6,864 PSI
TENSILE MODULUS	165,800 PSI
FLEXURAL MODULUS	818,711 PSI
COMPRESSIVE MODULUS	640,800 PSI

PRODUCT PROPERTIES 3P RESINS

	COMPONENT A	COMPONENT B
SPECIFIC GRAVITY	1.55 – 1.60	1.20 – 1.27
VISCOSITY (cps)	300 – 1200	150 – 600
pH	12.5 – 12.8	-
COLOR	TRANSPARENT	DARK BROWN
FLASH POINT	N/A	>390°F (>200°C)
IGNITION TEMPERATURE	N/A	>750°F (>400°C)

MIXED RESIN

MIX RATIO	TYPICALLY 1:2 BY VOLUME
WORKING TIME	20 MINUTES
CURE TIME	3.0 HOURS

PERMA-LATERAL AIR INVERSION REPAIR SYSTEM ADVANTAGES

- SEALS INFILTRATION
- SEALS EXFILTRATION
- BRIDGES MISSING AND/OR BROKEN PIPE
 - CORRECTS OFFSET JOINTS
- SEAL OFF DISCONTINUED SERVICE CONNECTIONS
 - PERMANENT REPAIR
 - NO EXCAVATION IN MOST CASES
- COST EFFECTIVE LOWER OVER CONVENTIONAL METHODS
 - AMBIENT CURE (NO HEAT OR STEAM NEEDED)
 - ENVIRONMENTALLY FRIENDLY
 - MINIMAL INCONVENIENCE TO THE TRAFFIC
- AVAILABLE VARIETY OF LENGTHS AND DIAMETERS
- SYSTEM INTEGRITY A RESULT OF RESEARCH & DEVELOPMENT
 - EASE OF INSTALLATION
 - HIGH PERFORMANCE CORROSION STRENGTH
 - HIGH PERFORMANCE TENSILE STRENGTH
 - HIGH PERFORMANCE COMPRESSION STRENGTH
 - HIGH PERFORMANCE DURABILITY
 - BONDS TO DRY AND WET SUBSTRATES
 - RESISTS MICRO CRACKING
 - ON SITE FIELD TRAINING
- INDUSTRY AND FIELD EXPERIENCED TECHNICAL SUPORT