100% AMERICAN MADE 100% TRENCHLESS 100% SUPPORTED

PERMA-LINER™ INDUSTRIES, LLC.

PERMA-LATERAL™ INSTALLATION MANUAL - AMBIENT SYSTEM

The Perma-Lateral™ Ambient System is a Cured-In-Place-Pipe Lining inversion system developed by Perma-Liner™ Industries. Patented technology allows installation from one access point and the ability to line thru multiple bends with ease.

Call **1-866-336-2568** Visit **www.perma-liner.com**

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OVERVIEW

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1910 E Wright Circle

Anaheim, CA 92806

1-866-336-2568

1-714-744-8446

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10220 Bode Street, Unit D3

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4060 North Dupont Highway, Unit 7

New Castle, DE 19720

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Safety

Before working on CIPP pipe rehabilitation is installed, a risk assessment must be performed to properly identify potential hazards and means for addressing them at the site.

As part of the risk assessment, tripping and falling hazards should be identified and addressed. Chemical, heat, and environmental exposure concerns should be identified and addressed, and requirements for Personal Protective Equipment (PPE) and other safety concerns should be addressed.

When working with CIPP materials and on installation, **always** ensure proper PPE is being worn which includes, **at a minimum**, protective clothing, close-toed shoes, safety glasses, a hard hat, hearing protection, gloves, and respiration equipment when there is risk of chemical and/or bacterial exposure.

Never bypass or override the safety relief valves of the Perma-Liner inversion units. Do not modify or alter the air intake to the Perma-Liner inversion units.

When working in confined spaces such as manholes there are several major risks involved, which include asphyxiation/suffocation dangers from gases and poor ventilation, explosion hazards from gases and particulates, entrapment by converging walls or a sloped floor, engulfment from surge flow and flooding conditions, and exposure to hazardous bacteria. When entering confined spaces such as manholes, it is necessary to first obtain a permit for confined space entry. In accordance with OSHA requirements, a competent person must evaluate the worksite to identify means of entry and exit, proper ventilation methods, and elimination or control of potential hazards in the space. Atmospheric monitoring must first take place before entry into a manhole, and in order to permit safe entry testing results must be under specified limits as shown in Table 1.

If the air does not test safe, forced ventilation or other means must be taken to bring the air in the workspace to safe levels and allow for entry. When the space is determined safe for entry, an above-ground monitoring attendant must be present at all times upon entry by a worker. The entering worker should have proper PPE, such as eye protection, a hard hat, gloves, respiration equipment, and coveralls. The worker must also have a gas detector with an audible alarm on their person while in the confined space.

Also make sure to provide proper protection for workers and equipment from factors such as shade from the sun, covering from rain and thunderstorms, and adequate cooling and heat protection when working in a hot environment. Ensure first aid gear is readily available. Contaminated clothing should not be allowed out of the workplace.

Never eat, drink, or smoke near the worksite, and wash hands and face properly before eating, drinking, or smoking.

If exposed to chemicals on the skin or in the eyes, wash thoroughly with water. Please refer to material SDS pages in the Appendix for more detailed information on hazards and exposure protocol.

Gases	**Testing Limits**
Oxygen (O_2)	19.5%-23.5%
Hydrogen Sulfide (H_2S)	10 ppm
Carbon Monoxide (CO)	35 ppm
Flammable Gases/Vapors	<10% LFL

Table 1

General

Perma-Liner Industries, LLC is located in Clearwater, Florida and is a manufacturer of trenchless rehabilitation products for sewer pipes, manholes and other conduit structures. Perma-Liner Industries, LLC originated in 1998.

Since then, Perma-Liner has grown its product line and installation systems to rehabilitate service laterals, manholes, sewer mains, lateral to main connections and vertical pipes.

Perma-Liner was the first company to receive ANSI/NSF Standard – 14 Certification for Cured-In-Place-Pipe (CIPP) used in sewer plumbing pipes. The certification covers small diameter pipes such as house laterals and other small pipelines. Our Lateral Lining System also bears the IAPMO Classified Marking.

Each company installing the Perma-Liner systems is trained individually by a certified trainer of Perma-Liner Industries, Inc. The installer is provided ongoing training classes to ensure each installation meets the manufacturer's requirements.

At Perma-Liner, we stand for vision, value and customer commitment; vision in anticipating our customers' needs for rehabilitation system products, value in producing and delivering the highest quality products consistently and at a fair price, and with customer commitment in everything we do. This has been our history. It is our vision for the future.

We demonstrate our commitment to the customer through service. Everything we do is directed toward meeting and exceeding customer needs.

We serve customers by manufacturing quality products for the pipe rehabilitation industry. By establishing and maintaining high standards in design, manufacturing and quality assurance, we know that our products will perform and last.

As a leader in trenchless technology, Perma-Liner is committed to providing our installers with superior products and unmatched support.

CIPP Systems Offered By Perma-Liner™

Perma-Lateral™ Inversion System

Perma-Main™ System

Perma-Liner™ Sectional Point Repair System

Perma-Liner™ Pull-In-Place System

Perma-Coatings™ Manhole Rehabilitation System

InnerSeal™ Connection Lining System

Perma-Liner™ Vac-A-Tee™ System

Top Gun™ Inversion System

Stinger™ Steam Cure System

Maverick™ Hot Water Cure System

Perma-Lateral™ Lining Through-A-Cleanout System

Perma-Liner™ Manufacturing Campus

65,000 Square Feet Facility

Clearwater, Florida

International Intellectual Property

11 Trade Marks

23 Pending and Issued Patents

Perma-Liner™ Corporate Offices and Manufacturing

Clearwater, Florida

U.S. Distribution Locations

Orange County, California

Seattle, Washington

Plainfield, Illinois

Newcastle, Delaware

Clearwater, Florida

International Distribution Locations

Singapore

Belgium

Brazil

Australia

Canada

Mexico

South Africa

Perma-Liner™ Certified Installer Base

1,600+ Certified PLI Installation Companies Worldwide

Certifications, Code Approvals, Quality Control and Quality Assurance

NSF Standard – 14 Compliant and Listed

ASTM F1216 Compliant

ASTM F1743 Compliant

ASTM 2561 Compliant

IAPMO Compliant and Listed

ICC (International Code Council) Approved

RPC (Residential Code Council) Approved

UPC (Uniform Plumbing Code) Approved

NASSCO (National Association of Sewer Service Companies) Member

NASTT (North America Association for Trenchless Technology) Member

WEF (Water Environment Federation) Member

ASTM (American Society for Testing and Materials) Committee Voting Member

PRE-INSTALLATION/SETUP

System Overview

Cured-In-Place-Pipe (CIPP) is a trenchless rehabilitation method for the repair of existing pipelines. CIPP is a jointless, seamless, pipe within a pipe repair that can span a wide range of pipe diameters and uses.

This specification details the material requirements, installation practices, and test methods for the rehabilitation of a sewer service lateral pipe by means of air inversion, by accessing one portion of the lateral without the need for excavating the entire existing pipeline.

The existing pipe reconstruction will be accomplished using a scrim reinforced textile liner tube of particular measured length and a thermo-set resin with physical and chemical properties appropriate for the application. The scrim reinforced liner will be impregnated with resin and then loaded into an approved inversion drum.

The liner will then be aligned to the open end of the existing lateral pipe, and once aligned, the launching system will invert the resin-impregnated liner with air pressure into the lateral pipe. The inversion process is completed once the liner has fully inverted its entire length along the walls of the host pipe.

The liner end will be open to allow a calibration tube to invert beyond the liner end, and a calibration tube is then inverted into the liner to hold the liner in place during the approximately three hour resin curing process. The calibration tube will be sealed at the end, holding air pressure to secure the liner against the existing host pipe until the liner is fully cured.

After the resin-impregnated liner is fully cured, the calibration tube is removed. The sewer lateral collection pipe will be immediately televised for the inspector's approval, and a copy of the televised inspection must be recorded for future reference.

Equipment/Materials Needed

Perma-Lateral Ambient System - Equipment		
Perma-Liner 30” Inverter and Inversion Heads	Lateral Inversion drum used to invert resin-impregnated liner for CIPP rehabilitation. Lateral Inversion heads used to which liner and calibration tubes are affixed. Sized according to pipe diameter, come in 0˚, 45˚, and 90˚ angles.	
Perma-Liner Delivery Hoses	Reinforced hoses designed to allow for the precise placement of the inversion heads in a pit-shot configuration.	
Perma-Liner Air Compressor	Air compressor used to supply air to inversion drum and calibration tubing.	
Vacuum Pump	Vacuum pump used to draw air from liner prior to wet-out. Facilities wet-out and increased final product quality.	
Perma-Liner Lateral Trailer	Turn-key CIPP lining trailer. Contains necessary equipment for lateral lining.	

Perma-Lateral Ambient System - Materials		
Perma-Lateral Liner	Scrim-reinforced, PVC coated, needle punched felt used in to CIPP rehabilitate sewer lines.	
Perma-Lateral Epoxy	100% Solids epoxy resins. Resins come in 3 standard recipes for various ambient conditions; hot, warm, and cold.	
Perma-Liner Calibration Tube	Reinforced polymer tube used to hold liner against the host pipe and also prevent over expansion.	
Perma-Liner Pull Strap	2” wide strap used for inversion and retraction of the Perma-Liner Calibration tube.	
Personal Protection Equipment (PPE)		
Safety Glasses	General Recommendation. Used whenever handling or mixing resin and when using equipment or tools.	
Steel Toe Boots	General worksite recommendation. Long pants also recommended	
Hard Hats	General worksite recommendation	

Disposable Gloves	Impermeable gloves to prevent contact with resin and/or curing agents.	
Hearing Protection	General worksite recommendation	
Reinstatement Cutters		
IMS, Picote, Or Dancutter Robotic Cutters	Depending on CIPP needs, may be used to reinstate services.	
Other		
Accessory Tools and Equipment	Various Measuring, Marking, And Cutting Tools	
Air Hoses	Used for connection components in the Perma-Lateral Inversion System.	

Prework/Cleaning Needs

Perform pre-conditioning of the pipe section, which includes preparatory cleaning such as corrosion removal, removal of grease buildup, and removal of any other obstruction that may interfere with lining operations. This can be done by utilizing a high-pressure jet unit, and an electric rod machine with cutting attachments, or a cleaning/cutting robot.

Utilize CCTV to inspect the line after the cleaning is complete, and again immediately prior to lining to ensure that the pipe is ready for lining.

Site Layout and Installation Examples

Figure 1 - Lateral To be Lined from Basement Towards Main

Figure 2 - Lateral Installation from Cleanout

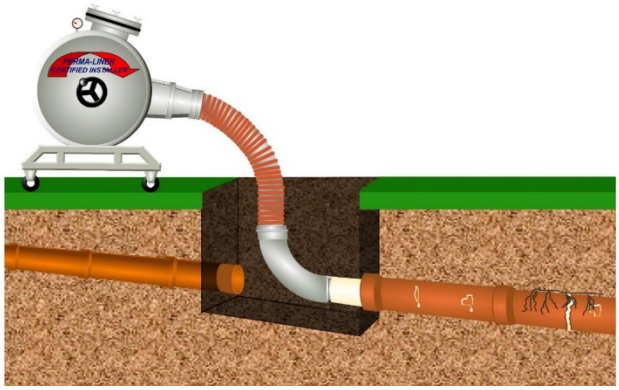


Figure 3 - Lateral Installation from Open Pit

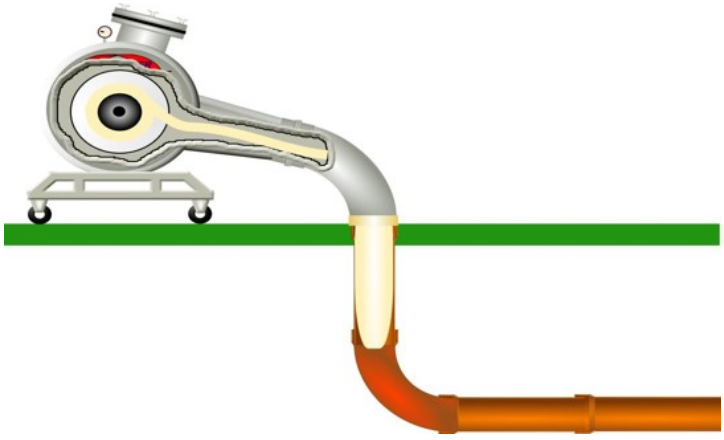


Figure 4 - Lateral Installation through Sweeping 90

Measuring of Pipe and Lining Materials

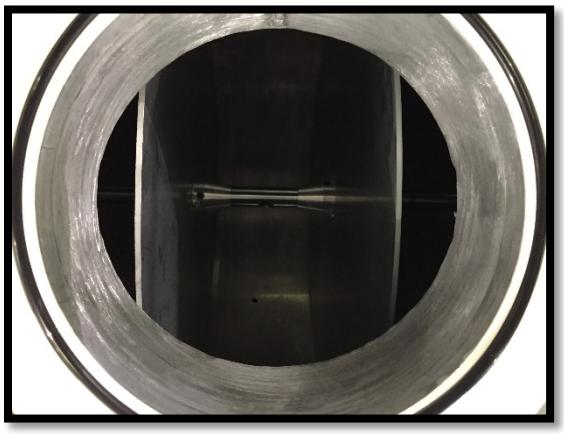
NOTE: FILL OUT THE INSTALLATION WORKSHEET TO CALCULATE THE PROPER MEASUREMENTS OF LINER, CALIBRATION TUBE, PULL TAPE, AND RESIN THAT YOU WILL NEED. KEEP FOR YOUR RECORDS AND WARRANTY PURPOSES.

1. Push the mini camera through the pipeline to the desired end location. Holding the camera in place at the desired end location, mark the camera push cable at the edge of the pipe opening by using a piece of colored tape. Also make sure to take note of and mark any laterals coming into the pipe to be lined with the colored tape. Check all equipment gauges for functionality.
2. Remove inspection camera the out of the pipe and lay the cable straight across the ground for proper measuring. Measure the distance from the tape mark to the front of the camera head. This is your "Length of Pipe to be Lined" measurement on your installation worksheet. If there were any laterals coming into the pipe to be lined, measure their distance in the same fashion. Always remove the tape after measurements are taken.
3. Position the inversion head and inversion drum being utilized for the pipe to be lined and find the best position for shooting the liner. Measure the distance from the tip of the inversion head to the edge of the host pipe. This is your “Length of Dry Material” on your installation worksheet.
4. On a clean flat surface, lay out plastic tarp for ground and material protection. Unroll the Perma-Lateral Liner Material. Measure 4” from the end of the liner and use a marker to draw a line across the liner. This will be for making a cuff in the later steps. Now from the 4” cuff line, measure and mark your “Length of Dry Material” measurement. Next from the “Length of Dry Material” line, measure and mark your “Length of Pipe to be Lined” measurement. This will be the final line. Cut the liner at the final line and put away the rest of the liner material.
5. Lay the Calibration Tube on top of the liner material with its end even with one end of the liner material. Roll out the calibration tube over top of the rest of the liner. Measure 2' past the other end of your liner and mark the calibration tube at this point. Cut the calibration tube at this mark; you should now have a calibration tube that is 2’ longer than your liner material. While the calibration tube is out, measure and cut the Introductory Tube, which will be the “Length of Dry Material” plus 4”. You can now put away the rest of the calibration tube material.

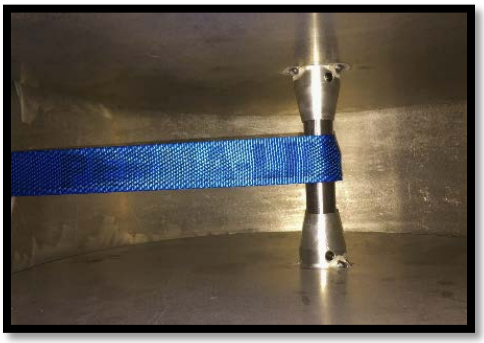
6. Lay out the pull tape on top of the calibration tube with one end even with the end of the calibration tube. Your length of pull tape depends on how much delivery hose you are using. If you are using a 5' delivery hose then you would measure 12’ of pull tape past the end of your calibration tube (5’ of delivery hose + 7’ for the inverter length). Refer to your installation worksheet for the calculations. Mark the pull tape at this point and you should have a pull tape that is 11' longer than your calibration tube and 13' longer than your liner material. Cut your pull tape at this mark (at an angle for ease of threading onto the spindle in the inverter).

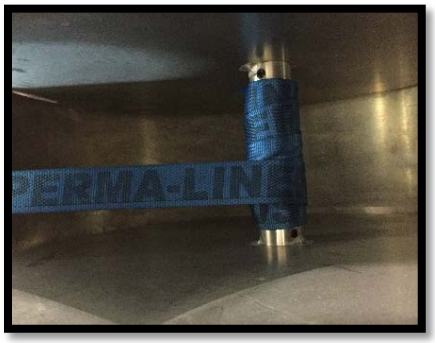
Assembly of Liner

1. Measure the lay flat width of the calibration tube. Example: the lay flat width of 4" calibration tube is approximately 5 1/4″. Set the side plates inside the inversion drum to 3/4" wider than your lay flat width.



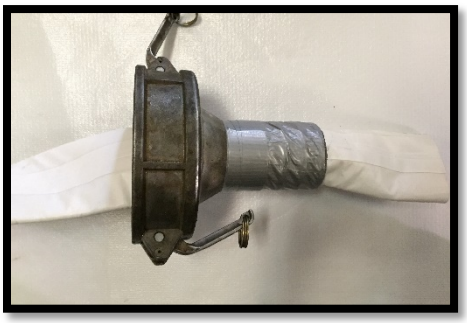
2. Open the viewing window on the inversion drum. Place the pull tape through into the inversion drum. Push 2" of pull tape through the hole located in the center of the spindle inside the unit. With tension, roll the pull tape on the shaft evenly in a side-to-side fashion until approximately 2' is hanging out of the inversion head/delivery hose. Make sure the pull tape is wrapped tightly and evenly on the shaft





3. Wrap the end your inversion head with duct tape (3 to 4 wraps). This will allow the clamps to squeeze into the duct tape. Push the material through the inversion head and (like a shirt sleeve) cuff back the liner material 4".



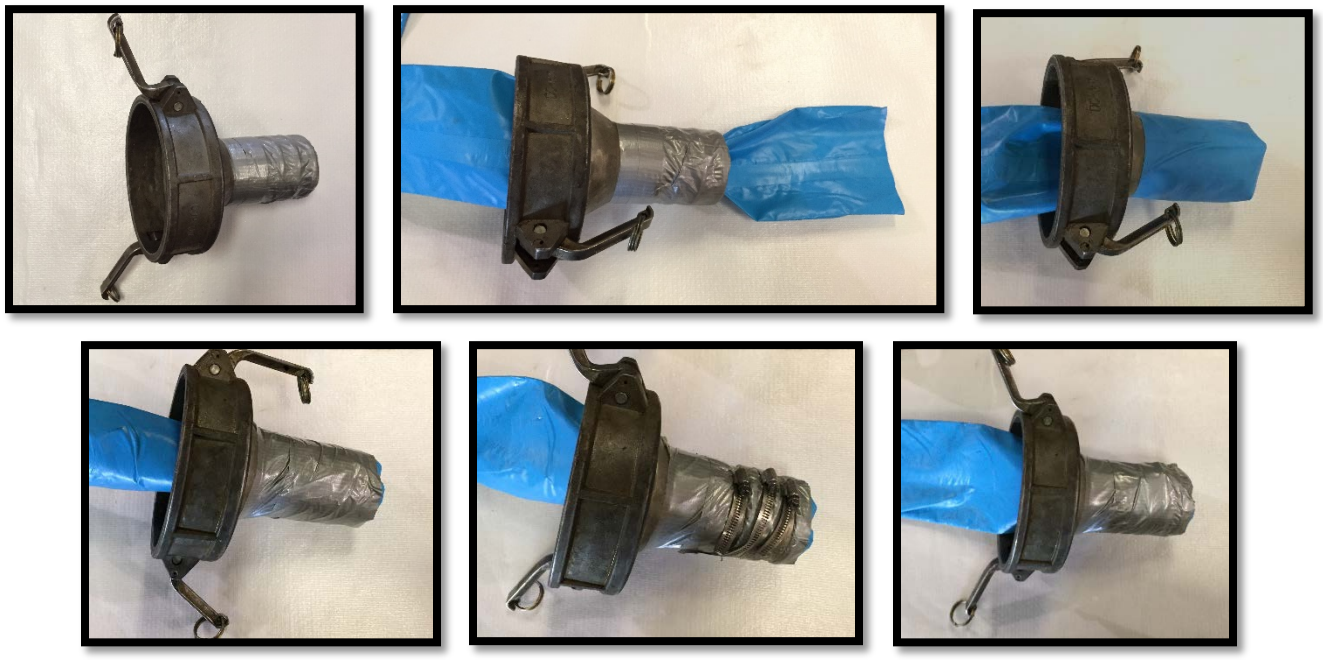


4. Pull the cuff over the head and duct tape the liner material to the inversion head.


5. Place two Hose Clamps over the liner material and inversion head in the second and third groove from the top and tighten. Duct tape over the clamps to prevent sharp edges from coming in contact with the liner material.


Assembly of Calibration Tube

1. Pull the calibration tube through the inversion head and then cuff back the calibration tube 4”. Pull the cuff over the head and duct tape the calibration tube to the inversion head. Place three clamps over the calibration tube and inversion head, then tighten. Duct tape over the clamps to prevent sharp edges from coming in contact with the calibration tube.



2. Tie a knot in the opposite end of the calibration tube approximately 5" from the end. Now take the longer piece of pull tape and tie one end thru the knot you just made in the calibration tube. Wrap both knots with duct tape to protect them. Wrap up the calibration tube and put it off to the side in a safe place that is out of the sun.

Measuring Resin

Take your "Pipe to be lined" measurement and multiply by the correct pounds per linear foot.

For Scrim Liner:

3" = .65 lbs. per linear foot

4" = .85 lbs. per linear foot

5" = 1 lbs. per linear foot

6" = 1.25 lbs. per linear foot

8" = 2.05 lbs. per linear foot

10" = 2.6 lbs. per linear foot

12" = 3.4 lbs. per linear foot

For 2mm Flex Liner:

2” = .25 lbs. per linear foot

3” = .45 lbs. per linear foot

4” = .60 lbs. per linear foot

5” = .70 lbs. per linear foot

6” = .85 lbs. per linear foot

8” = 1.4 lbs. per linear foot

10” = 1.75 lbs. per linear foot

12” = 2.3 lbs. per linear foot

Example: 100 feet of 4" diameter pipe

1. Multiply Pipe To Be Lined Length by Respective lbs/ft to calculate Total Resin Needed

$$100\ ft * .85 \frac{lbs\ resin}{ft} = \mathbf{85\ lbs\ Resin_{Total}}$$

2. Divide the Total Resin Needed by 3 to calculate the amount of Part-B resin

$$\frac{85\ lbs\ Resin_{Total}}{3} = \mathbf{28.333\ lbs\ Resin_B}$$

3. Multiply the amount of Part-B resin by 2 to calculate the amount of Part-A resin

$$28.333\ lbs\ Resin_B * 2 = \mathbf{56.666\ lbs\ Resin_A}$$

INSTALLATION OF PERMA-LATERAL CIPP LINER

Vacuum Down Liner

1. Attach appropriate vacuum cup to the liner inversion head. Use duct tape to seal the cup to the head

NOTE: MAKE SURE YOUR SYSTEM IS SEALED CORRECTLY TO ENSURE A THOROUGH VACUUM AND TO FACILITATE THE RESIN IMPREGNATION PROCESS

2. Listen for any leaks and retape if necessary.
3. Wait for vaccum pump to remove air from liner. This can be visually inspection by folding the liner into a U-shape. A properly vacuumed liner will hold the shape.

Impregnating the liner material

NOTE: ALWAYS DOUBLE-CHECK ALL MEASUREMENTS AND EQUIPMENT AT THIS TIME.

1. Pour premeasured amounts of Part-B into Part-A resin and mix the two components together approximately 1-2 minutes until they become a milky clear/white color.
2. At the open end (the end not attached to the inversion head/vacuum) open the liner material and insert a funnel. Pour all of the resin into the liner material.
3. Remove the funnel then duct tape the end of the liner closed. Introduce this taped end into the wet-out rollers.

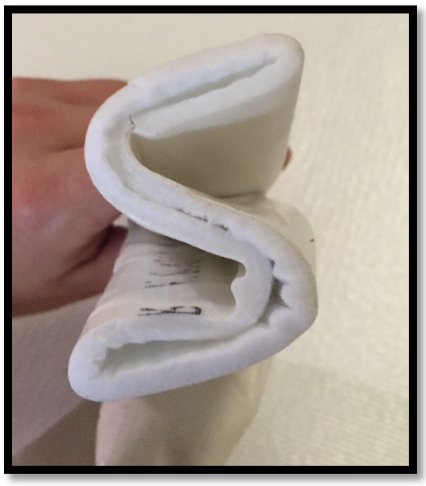
4. Roll the resin slug towards the vaccum-sealed inversion head. Keep the resin slug elevated and under pressure in the liner to ensure proper impregnation. The liner material will become more translucent when it is wet out.

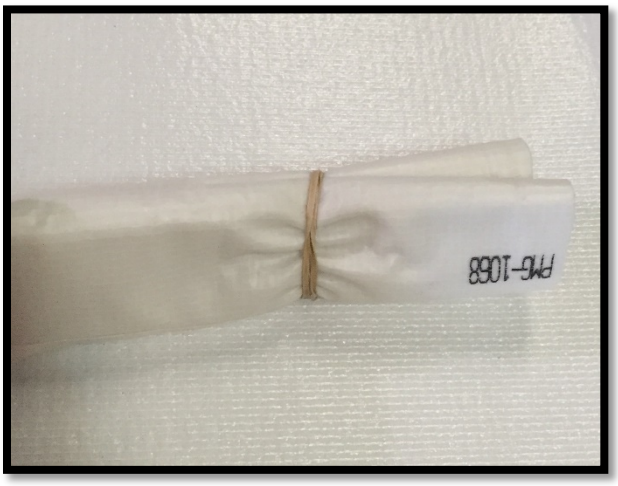

WARNING: DO NOT GET RESIN ON THE OUTSIDE OF THE LINER. THIS CAN CAUSE THE CALIBRATION TUBE TO BOND TO LINER DURING CURING PROCESS AND MAKE REMOVAL OF THE CALIBRATION TUBE DIFFICULT.

5. Make sure to wet out the liner 2" past your "Pipe to be Lined Mark". If there is excess resin left in the liner remove it by rolling it out the open end of the liner into a bucket.
6. Keep the resin slug elevated and under pressure in the liner to ensure proper impregnation. Be sure to wet out 2" past the dry material.

Shooting Liner

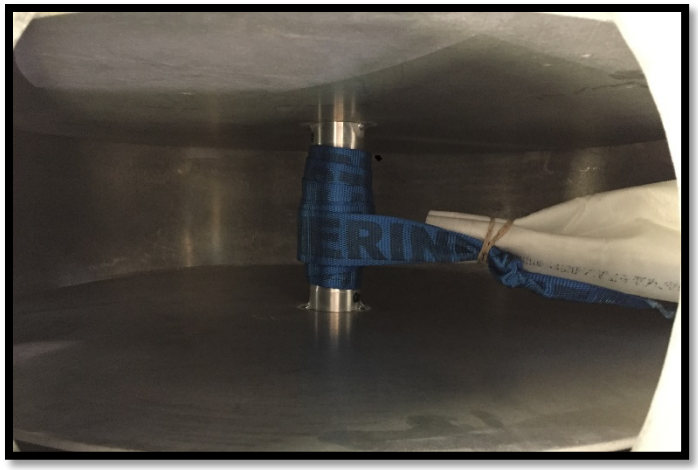
1. After the liner is completely wet out, remove the duct tape from the end of the liner. Fold the end of it into an "S" shape and wrap a medium sized rubber band around it.





2. Take 4" of pull tape with the knot in the end and attach it to the liner using another rubber band. The rubber band should be placed 2-3" from the end of the liner. You should then have 3" of pull tape left on the liner.

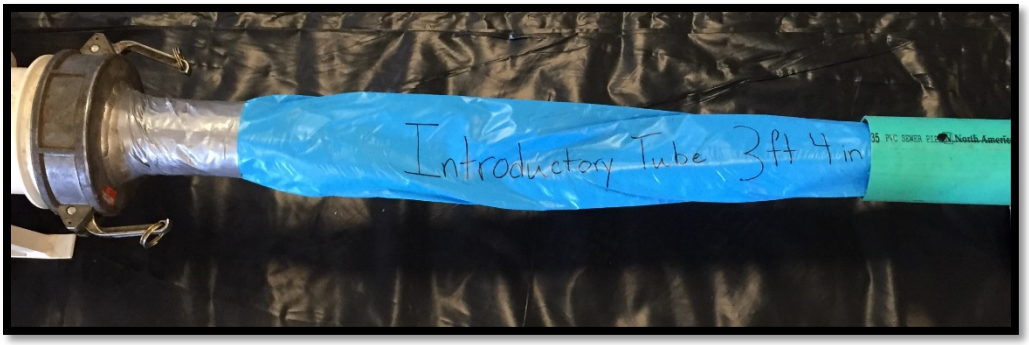
7. Slowly wind the pull tape evenly on the shaft, which will pull the liner material into the inversion drum. Fold the liner material into a U-shape and push it into the inversion drum to eliminate the pull strap from coming off the liner material. Once the liner material gets to the sight window, use your hand to wrap the liner material around the shaft a couple of times. At this point, the operator can wind up the remaining liner material. Spray vegetable oil over the entire length of the liner material while pulling into the inversion drum. Attach the inversion head to the inversion drum and position the inversion head towards the direction of the pipe.



3. Now attach the introductory tube that has been made from calibration tube onto the inversion head, by pulling the tube onto the inversion head up to the 4” mark and duct taping it into place on the head. This introductory tube will ensure proper alignment for shooting. Place the viewing window on the inversion drum and tighten it with the rubber mallet.

4. Attach the air hose to the inversion drum. Have a crew member position the inversion head by using the introductory tube and lining it up with the end of the pipe to be lined. Add air pressure to the inversion drum until the liner material starts to invert slowly. You may need to work the wheel back and forth to start the inversion, increase the pressure slowly, or both.

5. Guide the liner into the pipe as it is inverting. Stop inverting the liner after it is a couple of inches inside the pipe so that you can make sure the introductory tube is at the edge of the pipe.



6. Resume inversion while watching through the sight window. The liner material will exit the inversion drum quickly. Keep tension on the liner and maintain your pressure. You want to make sure you use enough air pressure, usually between 4 to 10 psi, to keep the liner inverting continuously. When you see where the liner is attached to the pull strap with rubber bands, stop the wheel and spin it back slightly, and at this point the liner will pop the rubber bands off. To ensure the liner is fully inverted, turn the air valve to its full open position and watch the pressure gauge. The gauge should read zero. Turn off the air valve.

WARNING: PRESSURE IN THE INVERSION DRUM SHOULD NOT EXCEDE 25 PSI AT ANY TIME DURING THE INVERSION PROCESS.

7. Cut the liner material at the inversion head; do not cut the pull tape. Remove the inversion head from the delivery hose and cut a 4" slit in the end of the liner material to allow the next inversion head to be inserted.

Shooting Calibration Tube

1. Unroll the calibration tube. Spray vegetable oil on the calibration tube and into the inversion head.
2. Begin winding the pull tape and calibration tube into the inversion drum and position the inversion head correctly for inversion.
3. Place the inversion head inside of the liner material and wrap with duct tape.
4. Pressurize the inversion drum to the appropriate inversion pressure and release slowly.
5. Invert all of the calibration tube and pull tape. Keep the gauge on the inverter at the correct inversion pressure at all times. Once the calibration tube is fully inverted, the pull tape which was pushed through the spindle will sag as a result of the end of the shot. This will ensure the calibration tube is inverted 100%.

WARNING: INSPECT THE SPINDLE TO ENSURE THAT ONLY A FEW WRAPS OF THE PULL TAPE REMAIN. IF A LARGE AMOUNT REMAINS WRAPPED AROUND THE SPINDLE, THE CALIBRATION TUBE MAY NOT HAVE INVERTED FULLY. THIS MAY REQUIRE BUMPING THE CALIBRATION TUBE AND/OR DEFLATING THEN REINFLATING THE CALIBRATION TUBE. CONTACT PERMA-LINER'S TECHNICAL SUPPORT WITH ANY QUESTIONS.

6. Use the pinch clamp on the introduction area to maintain pressure in the calibration tube before using the inversion head cap assembly.

7. Drop air and disconnect the inversion head from the delivery hose or inversion drum and remove the pull tape from the inversion drum. Push the end of the pull tape through the eyehole inside of the inversion cap and tie a knot. Push the remaining pull tape inside the inversion head and cap the inversion head.

8. Connect the pressure regulator to the inversion drum or cap and reapply air from the compressor or 13 gallon air tank.

Curing

1. Attach pressure regulator to inversion drum or inversion head cap and increase to the appropriate holding pressure.

Example:

3" hold at 8-10 psi

4" hold at 8-10 psi

6" hold at 6-8 psi

8" hold at 5-7 psi

NOTE: HOLDING PRESSURE WILL DEPEND ON SEVERAL FACTORS, INCLUDING INVERSION DEPTH, PIPE CONDITION, AND THE PRESENCE OF GROUNDWATER. CONTACT THE PERMA-LINER TECHNICAL DEPARTMENT FOR MORE INFORMATION.

WARNING: MAINTAIN PRESSURE IN THE CALIBRATION TUBE DURING CURING.

2. Maintain pressure for a minimum of 3 hours. Check the liner material to see if it is fully cured, if not maintain pressure until the liner is fully cured.

POST INSTALLATION

Removal of Calibration Tube

1. After the liner is cured, decrease pressure to 3 psi. Wind the pull tape into inversion drum, removing slack and begin the re-inversion of the calibration tube. Holding 3 psi will make sure the knotted end of the calibration tube begins to reinvert correctly. After the reinversion of the calibration tube has started, pressure may be reduced to facilitate the process. Continue to reinvert the calibration tube until full length is in the inversion drum.

WARNING: FAILURE TO MAINTAIN POSITIVE PRESSURE IN THE CALIBRATION TUBE CAN CAUSE THE CALIBRATION TUBE TO "ACCORDIAN" OR BUNCH UP. THIS MAKES IT VERY DIFFICULT TO REMOVE. PLEASE CONTACT A PERMA-LINER TECHNICIAN IN THE EVENT THIS OCCURS.

2. Once the calibration tube is removed from the liner, cut the liner approximately 1/4" from the end of the host pipe using a reciprocating saw.

Final Inspection

1. Re-televise the pipeline for final inspection, ensuring the finished pipe is continuous over the length of the run, fully cured, free from major defects, any service lines have been reinstated, and there is no visible leakage through the liner.
2. If a problem or defect persists, take necessary corrective action, and re-televise the pipeline a final time, ensuring that the final pipeline is ready to be reinstated.
3. Record a copy of the final inspection for future reference.

Reinstatement of Tie-Ins

Using a robotic cutter, all services are to be reinstated before lines are ready for use. Training on the correct use of cutters is provided by Perma-Liner and is details in the respective cutter manuals.

Cleanup/Equipment Storage

1. When the pipeline is successfully rehabilitated, remove all materials from the access point, and seal the pipe and its access point. Turn off and begin cleaning all equipment, ensuring grease, vegetable oil, dirt, etc. is thoroughly washed off before storage.
2. Properly dispose of any unusable excess materials, such as scrap liner, used calibration tube, extra unusable resin, duct tape, etc.
3. Clean the worksite, throwing away any trash generated, removing drop cloths and tents, and packing all equipment and materials away. Finally, restore any manhole covers and/or other access points that were removed.

TROUBLESHOOTING/FAQ'S

Liner/Calibration Tube is not inverting easily/takes a lot of pressure.

The material hasn't been lubricated properly; liberally apply vegetable oil when winding into the inversion drum.

Resin is hardening before the liner is able to be installed.

Check the calculation sheets to make sure the correct amount of resin is being used for the length of liner being wet out. If so, the resin can be kept refrigerated prior to wet out to bring it to a lower starting temperature. After wet out, the liner can be kept in an ice bath until being wound into the inversion drum immediately prior to shooting into the pipe. Also make sure to wet out under shade and keep the wet out liner under shade at all times.

Resin is not hardening in the correct amount of time.

First check to ensure the proper ambient cure resin was used for wet out. Also check the calculation sheets to ensure the correct amount of resin was used for the length of liner that was wet out. Video the line to see if there are signs of major sources of infiltration, as this can cause cold spots in the liner where it can't properly cure. Dependent upon geographic location, groundwater temperature should be assessed, as colder groundwater could lead to a longer curing time.

What to do when the inversion drum doesn't reach/cannot be positioned near the pipe opening?

This problem can be solved with the use of delivery hoses attached to the inversion drum. When using delivery hoses, ensure to account for their length in the "Length of Dry Material" measurement on the calculation sheet.

How to navigate and line a complicated system?

There are several different approaches that can be taken when lining complicated piping systems. If there are ever any questions or concerns relating to lining complicated systems, please contact Perma-Liner directly at (727) 507-9749.

For any other questions or concerns, please contact Perma-Liner at (727) 507-9749 for assistance.

GLOSSARY OF TERMS

ASTM – American Society of Testing Materials

Ambient Cure – Time controlled cure of resin without the assistance of steam or hot water

Bladder – An impervious layer of material that is applied inside of the resin-impregnated liner and then inflated to maintain the curing water/steam separate from the resin-impregnated liner

Bypass Pumping – Re-routing existing pipeline flow around the section of pipe to be rehabilitated

Calibration Tube – A tube inverted or pulled into a positioned liner that is inflated and used to hold the resin-impregnated liner against the host pipe until the resin is cured

Catalyst – The component of the two-part resin system that induces the exothermic reaction that begins curing the liner

CCTV – Closed Circuit Television; used to inspect pipelines

Confined Space Permit – An OSHA required permit for entry of confined spaces such as manholes that could have hazard atmospheres, potential for a person to be engulfed by material, a configuration that could cause engulfment, or other health and safety hazards

Cured-In-Place-Pipe (CIPP) – A pipeline rehabilitation method in which a resin-impregnated liner is inserted into an existing host pipe and cured into a hard pipe within a pipe

Cure Time – The time necessary for a resin-impregnated liner to finish reacting and form a hard CIPP liner

Epoxy Resin – Resin formed by reaction of bisphenol-A and epichlorohydrin; mixed with the catalyst to begin the resin curing process

Exothermic – A reaction characterization type that emits heat as the reaction proceeds, such as the reaction between epoxy resin and the catalyst

Felt – A material designed to soak up and transport catalyzed epoxy resin in place to produce a hard CIPP repair

Flex Liner – A layered liner with a felt inner layer and a TPU outer layer, designed to fill in complex host pipe configurations

Gel Time – The length of time in which the catalyzed epoxy resin takes to thicken, or “Gel” after heat generation has begun

Heat Cure – The application of steam or hot water within a bladder to cure a resin-impregnated liner

Homogeneous Resin – Resin that is visually consistent in color and consistency

Host Pipe – The original degraded pipe that the CIPP is cured inside of for the purpose of rehabilitation

Inversion – The process of turning a resin-impregnated liner, calibration tube, or bladder inside-out with water or air pressure to install the CIPP

Lateral – A service line that connects buildings to a sewer mainline

Liner – A fabric tube that is used to hold resin for curing inside of a host pipe

Mainline – A large principal pipe that collects from lateral lines to transport material to its destination

NASSCO – National Association of Sewer Service Companies

Needled Felt – Highly absorbent felt material that is designed to absorb resin

Obstructions – Material in the existing pipeline that requires removal prior to CIPP lining

Pot Life – The length of time a catalyzed resin will remain liquid before it begins to gel

Pull-In-Place – A CIPP method where the resin-impregnated liner, calibration tube, or bladder are pulled into the host pipe

Resin-Impregnated Liner – Liner that has been evenly and thoroughly filled with catalyzed epoxy resin during the wet out process

Roller – Device used to saturate the liner with resin and control the thickness of the resin-impregnated liner during wet out process

Robotic Cutter – A device used to remove debris prior to lining, and to re-instate connections after installation of a CIPP liner

Personal Protective Equipment (PPE) – Any wearable or monitoring equipment designed to keep the user safe during the preparation and installation of CIPP liners

Point Repair – A repair on a pipe that is less than the length between two access points

Safety Data Sheets (SDS) – Reference documents with chemical property information, toxicity, and guidelines for safe handling and exposure protocols; sometimes referred to as Materials Safety Data Sheets (MSDS)

Scrim Reinforced Liner – Three part liner consisting of a felt inner layer, woven fabric, and a TPU outer coating, design to inflate to a certain designed size and then stay rigid

Thermocouple – A device used to measure temperature of a resin-impregnated liner during the installation and curing process

Thermoset Resin – Material such as epoxy that undergoes an exothermic chemical reaction with the addition of a catalyst

Transition Liner – A liner that is designed to accommodate pipe size changes within a sewer line

Trenchless – Technology used for rehabilitation and renewal of existing pipeline with minimal or no excavation required

Vac-A-Tee – A system that allows for the quick addition of a viable cleanout to a lateral pipe from above ground

Vacuum – Used to remove air from the felt to facilitate the wet-out of resin evenly and thoroughly into the liner during the wet out process.

Wet Out – The process of injecting catalyzed resin into a liner and evenly and thoroughly distributing it throughout the liner prior to installation

APPENDICES

Appendix A – Lateral Ambient Installation Sheet

PERMA-LATERAL LINING SYSTEM – AMBIENT INSTALLATION SHEET

Date: _____Technicians: _____Project Address: _____
Pipe Material Type: _____ Pipe Diameter: _____ Water Infiltration? Yes No
90º Connections _____ 45ºConnections_____

Length of Pipe-To-Be-Lined _____Ft_____In

Liner Material Needed:

Pipe-To-Be-Lined = _____Ft_____In
(Variable) Intro Length + _____Ft_____In
4 Inches for Cuff + _____Ft__4__In
Total Liner Material Length = _____Ft ____In

Calibration Tube Needed:

Total Liner Material Length = _____Ft _____In
Two feet for Knot + __2__ Ft __0__ In
Total Calibration Tube Length = _____Ft_____In

Pull Tape Needed:

Calibration Tube = _____Ft_____In
Delivery Hose (no delivery hose, short hose, long hose, or both hoses) + _____Ft_____In
Inverter Length + __7__Ft__0__In
Total Pull Tape Length = _____Ft____In

Resin Needed

3mm Scrim Liner Resin Factors -	**3" = .65 lbs/FT**	**4" = .85 lbs/FT**	**5" = 1.0 lbs/FT**	**6" = 1.25 lbs/FT**	**8" = 2.05 lbs/FT**
2mm Flex Liner Resin Factors -	**3" = .40 lbs/FT**	**4" = .50 lbs/FT**	**5" = .60 lbs/FT**	**6" = 0.75 lbs/FT**	**8" = 1.00 lbs/FT**

(Multiply 'Pipe to be lined' by the appropriate Resin Factor listed above) **Total Resin Needed** = _____Lbs.

(Take Total Resin Needed and divide by 3 for B-Resin amount. Multiply the result by 2 for the A-Resin amount)

Part-A Resin _____Lbs **Part-B Resin _____Lbs**

Part-B resin type used (circle one) - Cold Warm Hot Heat Assist

Introductory tube

***Cut an additional piece of cal tube *based on the dry material length + 4 inches* to act as an
Introductory Tube* ____Ft ____In**

Liner Stretch

Cut Expected Stretch from the end of liner after wet-out
(4" = ¾" per 10 LF 6" = ½" per 10 LF) **Expected Stretch of Liner – _____Ft_____In**

Liner Strap

Cut an additional piece of Pull Tape for loading liner into Inversion Drum **__7__Ft__0__In**

Liner Roll ID_____ Resin Batch ID_____ Calibration Tube Roll ID_____

Weather: _____ Temperature: _____ Start Cure Time: _____ Time Calibration Tube Pulled: _____

Appendix B – Lateral Ambient Lining Outline

Perma-Lateral™ Lining Outline

1) **Preparation**
   - **a.** Clean pipe thoroughly
   - **b.** Pre televise line (record)
   - **c.** Take accurate measurement
   - **d.** Fill out worksheet
   - **e.** Make sure the resin is at the proper starting temperature

2) **Materials**
   - **a.** Lay out ground protection
   - **b.** Measure liner material
   - **c.** Measure calibration tube
   - **d.** Measure pull tape

3) Inverter
   - **a.** Set side plates (guides)
   - **b.** Hook up delivery hose
   - **c.** Wrap pull tape into inverter

4) **Inversion Heads**
   - **a.** Pre-tape clamp area
   - **b.** Fasten calibration tube to Inversion Head
   - **c.** Fasten liner to inversion head

5) **Resin**
   - **a.** Calculate resin amounts
   - **b.** Mix

6) Wet-Out
   - **a.** Introduce resin to liner
   - **b.** Seal end
   - **c.** Roll out (wet-out)
   - **d.** Remove excess resin
   - **e.** Fasten liner to pull tape
   - **f.** Oil
   - **g.** Wind into inverter

7) Inversion (Liner)
   - **a.** Align with host pipe
   - **b.** Pressurize inverter
   - **c.** Invert liner entirely
   - **d.** Cut and remove inversion head

8) Calibration Tube
   - **a.** Fasten pull tape to cal tube
   - **b.** Oil
   - **c.** Wind into inverter

9) Inversion (Calibration Tube)
   - **a.** Insert into liner
   - **b.** Pressurize Inverter
   - **c.** Invert cal tube entirely

10) Pressurize
   - a. Increase pressure to proper psi
   - b. Clamp
   - c. Release air pressure from inverter
   - d. Remove inversion head
   - e. Fasten clamp
   - f. Monitor to proper psi
   - g. Maintain pressure 2-3 hours

11) Depressurize
   - **a.** Reduce pressure to zero psi
   - **b.** Remove inversion cap
   - **c.** Quickly tug on pull tape
   - **d.** Re-invert calibration tube entirely

12) Re-televise
   - **a.** Cut at ¼" from host pipe
   - **b.** Record post tv inspection

Appendix C - Installation Qualifications

Cured-In-Place-Pipe (CIPP) was developed in the 1970s as a means of repairing old and deteriorated pipelines without the need for major excavation work. It was initially used by private construction companies, but once the cost and time benefits of the non-disruptive nature of CIPP were realized, the

industry quickly grew. Through expansion, faster methods of product fabrication were introduced, along with the integration of improved methods and equipment for installation.

CIPP is a thermo-set polyester, vinyl, or epoxy resin system that is delivered into an existing host pipe by a resin-impregnated felt or fiberglass tube of desired design thickness. Then it is cured in place, becoming a new hardened, smooth pipe within the pipe. First, the host pipe to be lined is cleaned thoroughly and inspected, then used as a mold for the resin-impregnated liner, which is installed either by means of air- or water-inversion, or by being pulled into place. Once the liner is in place, it is inflated against the host pipe directly or by using a calibration tube and is held in place until the resin cures, resulting in the finished pipe within a pipe product. CIPP technology was initially developed to service sewer pipelines, but has expanded to service almost any pipeline that needs rehabilitated.

There are many conditions in which CIPP can utilized as a means of pipe rehabilitation, and described below are recommendations on these methods for a variety of structural defects found in pipelines, based on the NASSCO Instructor Training and Certification Program. Structural defects can be described as the type of condition where the pipe material has been damaged, and can include cracks, fractures, broken pipe, holes, deformed pipe, collapsed pipe, joint defects, surface damage, missing walls, point repairs, and brick pipe defects.

As per ASTM F-1216 Recommendations:

X1.1.1 - The pipe may have longitudinal cracks and up to 10% distortion of the diameter. If distortion of the pipe diameter is greater than 10% alternative design methods will be required.

X1.1.2 - The original pipeline should be clear of obstructions such as solids, dropped joints, protruding service connections, crushed or collapsed pipe, and reductions in the cross-sectional area of more than 25% that will prevent the insertion of the resin-impregnated liner.

Cracks - Visible in the pipe with no distortion of the pipe wall. Ideal time to renew a pipe, with lining resulting in a well-shaped, round pipe within the existing pipe

Fractures - Visibly open cracks through sections of the pipe wall, with pipe wall still in place. Still an ideal time to renew old pipeline.

Broken Pipe - A pipe where pieces are noticeably displaced and have moved from their original position. Liner can be installed with up to 10% of the pipe having broken sections. Displaced pipe sections will reflect in the final installed product. Sharp protrusions should be ground smooth prior to liner installation.

Holes - A pipe with a visible unintentional hole in the pipe wall, where the pipe has broken away and is missing. The liner can be installed with a hole in the pipe. The hole will reflect in the final installed product, much like a service connection dimple. A preliner is recommended to reduce over expansion and to protect the liner from contaminants. Stabilization of the surrounding soil structure should be evaluated and specified.

Deformed Pipe - The pipe is damaged to the point that the original cross-section of the pipe is noticeably altered. The liner can be installed, but the deformation will reflect in the final installed

product. If the crown of the pipe has developed a reverse curvature (heart shape) the proposed CIPP design must be evaluated by a qualified engineer.

Collapsed Pipe - When pipe deformation is great enough for a complete loss of integrity with more than 25% of the cross-sectional area lost. The liner should not be installed when existing pipe area reduction is greater than 25%, or distortion in diameter is more than 10%. The CIPP design should be evaluated by an engineer, or a point excavation should be made to correct the defective section.

Joint Defects - Joints in need of repair can be offset, separated, or angled. Over time, the joint material can deteriorate and cause the pipe spigot to drop into the pipe bell. The joint has failed when more than the spigot thickness is visible, with an elliptical area of pipe where the spigot has settled being about 25% less than the round pipe. The liner can be installed when the pipe is offset, separated, or angled less than 25% of the cross-sectional area, however, the existing condition will reflect in the final installed product.

Surface Damage - Surface damage can appear in several ways, such as being rough, having aggregate missing or projecting, steel reinforcement visible and projecting, and more. Most surface damage will not prevent installation of CIPP. Surface damage will cause variations in the internal diameter of the pipeline, and some wrinkling can occur where the inside pipe diameter changes size. It is recommended to use the same diameter liner, but with a thicker mil. Missing concrete, however, can add to the diameter.

Missing Walls - A section of pipe that has collapsed and is missing, with much of the soil from above having fallen into the pipe and washed downstream over time. In this case excavation and replacement of the missing section is recommended. If excavation is not possible, install a preliner before installing CIPP. After curing, grouting and stabilization of the surrounding area is recommended.

Point Repairs - Point repairs such as replaced pipe, mechanical repair sections, and resin short liners can be encountered in existing pipeline. A liner can be installed over most thin wall repairs. If the pipe has previously been repaired with a smaller section of pipe, installation of a liner can result in significant wrinkling through the pipe section. In this case it is recommended to replace the smaller pipe with the correct size, then install the CIPP.

Brick Pipe Defects - This includes missing bricks, missing mortar, loss of crown key, and dropped invert. A liner can be installed into defective brick pipe, but it will take the shape of the old brick pipe. It is recommended to partially repair the old pipe to restore its shape and then install the CIPP.

When installation of CIPP is possible, removal of deposits, roots, and grease must be undergone before installing the liner. A small amount of residual grease may still be along the wall after cleaning without any adverse effects, but large amounts need to be removed. Any infiltration gushers should also be sealed prior to lining. Any obstructions need to be removed, and utility companies should be contacted prior to utility obstruction removal. Intruding joint seals also need to be removed. In cases where the pipe changes size, a custom designed transition liner should be utilized.

Appendix D – Specifications for Installation

Specifications for Installing CIPP Lateral Lining Inversion Method for Rehabilitation of Existing Pipelines

1.00 Scope

The intent of this cured-in-place lateral lining specification is to provide reconstruction of sewer collection laterals without excavating the entire existing pipeline.

2.00 General

The existing pipe reconstruction will be accomplished using a scrim reinforced liner tube measured to exact length and inside diameter utilizing a thermosetting resin that meets required physical and chemical resistance properties. The scrim reinforced liner will be impregnated with resin then loaded into an approved air pressured launching system. The liner will be aligned to the open end of the existing lateral pipe. Once the liner is aligned, the launching system will invert the resin-impregnated liner with air pressure. The inversion process is completed once the liner has fully inverted to the sewer main collection pipe, stopping at the connection. The liner will be open to allow the calibration tube to invert beyond the liner end at the sewer main connection. A calibration tube is then inverted into the liner holding the liner in place during the curing process. At no time will the calibration tube lose air pressure and be re-pressurized during the inversion process. The calibration tube will be sealed at the sewer main, holding air pressure to secure the liner against the existing host pipe until the liner is fully cured. After the resin-impregnated liner is fully cured, the calibration tube is removed. The sewer lateral collection pipe will be immediately televised for the inspector's approval. A copy of the televised inspection must be recorded on VHS format for future reference.

3.00 Materials

The liner tube will consist of scrim reinforcement and needled felt. The liner tube will be fabricated together using a butt-stitched seam sealing process with a heat welded sealing tape to ensure airtight seal. The liner tube is to be manufactured in the United States by Perma-Liner Industries, Inc. The liner tube will be capable of carrying resin and withstanding installation pressures and curing temperatures. The liner tube will be lined on one side with a translucent impermeable chemically resistant polyvinylchloride (PVC) waterproof coating. This coating will be on the inner lateral collection lined pipe after curing is completed. The coating will provide a smooth and seamless inner wall.

The resin will be a two-part, 100% solids epoxy containing no styrene. The epoxy resin shall be formulated to have a gel (pot) life of approximately 30 minutes with a set cure time of three (3) hours. The epoxy shall ambient cure by internal exothermic chemical reaction.

The scrim reinforced / seam stitched / heat welded seam tape / felt liner tube and resin will upon installation meet and/or exceed minimum testing standards as required by ICC, ASTM, IAPMO and ANSI/NSF International. All materials must have 3rd party testing provided by independent laboratory. The materials must be ANSI/NSF Standard-14 approved, IAPMO Certified for small diameter pipe lining in Sewer Pipes and Vents, and must be certified by the International Code Council for the International Plumbing Code and the International Residential Code. The scrim reinforced / seam stitched / heat welded seam tape / felt liner tube and resin must have NSF Standard 14, and ICC-ES denoted on the tube.

3.01 **Required Cured-In-Place Lateral Lining Standards**	**Minimum**
Flexural Strength (ASTM D-790)	4,500 PSI
Flexural Modulus (ASTM D-790)	250,000 PSI
Tensile Strength (ASTM D-638)	3,000 PSI
Compressive Strength (ASTM D-695)	4,000 PSI
Tensile Elongation (ASTM D-638)	5 PSI
Chemical Resistance (ASTM D-543)	< 20% loss
Leakage Test* (NSF Standard 14)	0/gal/in/day

* Leakage test performed by ANSI/NSF International

4.00Process

Inversion Process (ASTM F 1216)

Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube

4.01 The owner shall be notified 24 hours in advance of project start time. No building utilities, such as toilets, sinks, dishwasher, laundry washer, bath tubs or sump pumps will be used during the installation and curing process. Generally no by-pass pumping is needed.

4.02 Lateral Sewer Collection Pipe must be cleaned thoroughly prior to installation of liner.

All sand, rocks, gravel, grease, mud, sludge, and other debris must be removed from the invert to permit proper installation. Roots will need to be removed to the extent necessary to effectively line the entire pipe.

4.03 The existing Lateral Sewer Collection Pipe will be inspected using a mini-televising color camera system capable of viewing the interior condition of the host pipe. The TV inspection must be performed within 5 hours prior to installation of liner tube.

4.04 The resin-impregnated liner tube will be kept clean and loaded directly into the air pressured launching system. The launching system will be aligned to the existing host pipe for proper installation.

4.05 The resin will not be contaminated and/or diluted prior to installation.

4.06 The liner tube will be inverted using air pressure, inverting the liner inside-out until the liner tube reaches the sewer main collection pipeline. The liner tube will be open and not sealed off. The liner tube will be designed to fit tightly against the host pipe annular space and gaps. A calibration tube will be inverted inside the liner tube to ensure the liner is tight against the host pipe until fully cured. The resin-impregnated liner tube will cure within 4 hours without external heat sources.

4.07 Once the curing process is finished, the calibration tube is removed and the lateral sewer collection pipe is immediately inspected for final acceptance. The new lined pipe will be free of any foreign objects providing a smooth, seamless and continuous lined pipe from entry point to main sewer connection pipe.

4.08 Any liner tube protruding from the lateral sewer collection pipe into the main sewer pipeline will be removed by remote robotic cutting equipment.

4.09 A final TV Inspection of the lined lateral collection sewer pipe will be recorded and provided to the owner for final approval.

5.00 Final Acceptance

In addition to any specific acceptance criteria specified in the contract, the following standards shall be satisfied before final acceptance of the liner installation:

5.01 **Finish**

The finished pipe shall be continuous over the length of a run and be free from defects.

5.02 **Defects**

Any defects, which will affect the integrity of the installed pipe, will be repaired as directed by the owner.

5.03 **Leakage**

No visible leakage through the liner will be allowed.

6.00 Payment

Payment for the work included in this section will be in accordance with the prices set forth in the contract for the quantity of work performed. Progress payments will be made monthly based on the work performed during that month.

Appendix E – Technical Data Sheets

Perma-Lateral Scrim-Reinforced Liner

PERMA-LINER SCRIM LINING PRODUCT DATA SHEET

MATERIAL

- Scrim Reinforced Lining CIPP (Cured-In-Place-Pipe)

DESCRIPTION

- PVC transfer coating on Polyester knitted Fabric w/ Scrim reinforcement

GENERAL PROPERTIES

- Polyester fabric
- Coating protected against fungi and bacteria
- Styrene and hydrolysis resistant
- Good coating transparency

PHYSICAL PROPERTIES

- Color: Unpigmented
- Substrate: PET Felt
- Overall Weight: 28 ounces per sq yard
- Fabric Weight: 18 ounces per sq yard
- Coating Weight: 10 ounces per sq yard (PVC)
- Trapezoid Tear: W: 150 lbs F: 170 lbs
- Grab Tensile: W: 402 lbs/in F: 455 lbs/in
- Adhesion: W: stronger than fiber
- F: stronger than fiber

EXAMINATION

- All fabric is 100% examined to mutually agreed examination standards.
- Any faults found are marked or cut out.

TUBED MATERIAL

- Materials formed into tubular sharp using a stitched – butt seamed – tube. The stitched area is then coated with a PVC seam tape to create an air tight seal.

MATERIAL THICKNESS

- General thickness is provided from 3mm + in greater mm thickness. Greater thickness can be ordered based on customer requirements.

Appendix F – Certifications

IAPMO RESEARCH AND TESTING, INC.

5001 East Philadelphia Street, Ontario, California 91761-2816 – USA • 909-472-4100 • 909-472-4244 • www.iapmort.org

ANSI ACCREDITED ISO/IEC 17065 Product Certification Body #0202

IAPMO R&T

SCC Accredited CB-P/S OCPS Accrédité CCN

UPC ®

CERTIFICATE OF LISTING

IAPMO Research and Testing, Inc. is a product certification body which tests and inspects samples taken from the supplier's stock or from the market or a combination of both to verify compliance to the requirements of applicable codes and standards. This activity is coupled with periodic surveillance of the supplier's factory and warehouses as well as the assessment of the supplier's Quality Assurance System. This listing is subject to the conditions set forth in the characteristics below and is not to be construed as any recommendation, assurance or guarantee by IAPMO Research and Testing, Inc. of the product acceptance by Authorities Having Jurisdiction.

The most updated information on this Certificate of Listing is available online at pld.iapmo.org

Effective Date: November 2018 Void After: November 2019

Product: Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe File No. 11497

Issued To: Perma-liner Industries
13000 Automobile Blvd.
Suite 300
Clearwater, FL 33762

Identification: Product shall bear the manufacturer's name or trademark and the UPC® certification mark

Characteristics: Material and associated thermosetting resin manufactured for reconstruction of pipelines and conduits (3" to 96") by the pulled-in-place installation of a resin impregnated flexible fabric tube into an existing conduit, and secondly inflated through the inversion of calibration hose by the use of hydrostatic head or air pressure. For replacement of existing sewers only. Manufactured in accordance with the requirements of the Uniform Plumbing Code. To be installed in accordance with the requirements of the manufacturer's installation instructions

Products listed on this certificate have been tested by an IAPMO R&T recognized laboratory. This recognition has been granted based upon the laboratory's compliance to the applicable requirements of ISO/IEC 17025.

Chairman, Product Certification Committee

CEO, The IAPMO Group

IAPMO RESEARCH AND TESTING, INC. NON-PROFIT OCTOBER 20 1964 CORPORATION CALIFORNIA

This listing period is based upon the last date of the month indicated on the Effective Date and Void After Date shown above. Any change in material, manufacturing process, marking or design without having first obtained the approval of the Product Certification Committee, or any evidence of non-compliance with applicable codes and standards or of inferior workmanship, may be deemed sufficient cause for revocation of this listing. Production of or reference to this form for advertising purposes may be made only by specific written permission of IAPMO Research and Testing, Inc. Any alteration of this certificate could be grounds for revocation of the listing. This document shall be reproduced in its entirety.

IAPMO RESEARCH AND TESTING, INC.

CERTIFICATE OF LISTING

Void After: November 2019

Product: Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe

File No. 11497

Issued To: Perma-liner Industries

Products are in compliance with the following code(s):

Uniform Plumbing Code (UPC®)

Products are in compliance with the following standard(s):

ASTM F1743-2017

IAPMO RESEARCH AND TESTING, INC.
CERTIFICATE OF LISTING

Void After: November 2019

Product: Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe

File No. 11497

Issued To: Perma-liner Industries

MODELS:

Model No.
PL-PIP

IAPMO RESEARCH AND TESTING, INC.

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CERTIFICATE OF LISTING

IAPMO Research and Testing, Inc. is a product certification body which tests and inspects samples taken from the supplier's stock or from the market or a combination of both to verify compliance to the requirements of applicable codes and standards. This activity is coupled with periodic surveillance of the supplier's factory and warehouses as well as the assessment of the supplier's Quality Assurance System. This listing is subject to the conditions set forth in the characteristics below and is not to be construed as any recommendation, assurance or guarantee by IAPMO Research and Testing, Inc. of the product acceptance by Authorities Having Jurisdiction.

This certificate is not evidence of current listing. To verify listing status, visit the IAPMO R&T Product Listing Directory at pld.iapmo.org

Effective Date: April 2019 Void After: April 2024

Product: Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube File No. 4397

Issued To: PERMA-LINER INDUSTRIES LLC
13000 Automobile Blvd #300
Clearwater, FL 33762

Identification: Manufacturer's name or trademark, model description of woven or nonwoven material and associated thermosetting resin, shall bear the UPC® certification mark.

Characteristics: Materials for the reconstruction of pipeline and conduits (3" to 108") by the installation of a resin impregnated flexible tube which is inserted into the existing conduit by use of a hydrostatic head of air pressure. For replacement of existing sewers only. To be installed in accordance with the requirements of the manufacturer's installation instructions.

Products listed on this certificate have been tested by an IAPMO R&T recognized laboratory. This recognition has been granted based upon the laboratory's compliance to the applicable requirements of ISO/IEC 17025.

Products are in compliance with the following code(s):
Uniform Plumbing Code (UPC®)

Chairman, Product Certification Committee

CEO, The IAPMO Group

This listing period is based upon the last date of the month indicated on the Effective Date and Void After Date shown above. Any change in material, manufacturing process, marking or design without having first obtained the approval of the Product Certification Committee, or any evidence of non-compliance with applicable codes and standards or of inferior workmanship, may be deemed sufficient cause for revocation of this listing. Production of or reference to this form for advertising purposes may be made only by specific written permission of IAPMO Research and Testing, Inc. Any alteration of this certificate could be grounds for revocation of the listing. This document shall be reproduced in its entirety.

IAPMO RESEARCH AND TESTING, INC.

CERTIFICATE OF LISTING

Void After: April 2024

Product: Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube

File No. 4397

Issued To: PERMA-LINER INDUSTRIES LLC

Products are in compliance with the following standard(s):

ASTM F1216-2016

IAPMO RESEARCH AND TESTING, INC.

CERTIFICATE OF LISTING

This certificate is not evidence of current listing. To verify listing status, visit the IAPMO R&T Product Listing Directory at pld.iapmo.org

Void After: April 2024

Product: Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube

File No. 4397

Issued To: PERMA-LINER INDUSTRIES LLC

MODELS:

Model No.
#PL

ICC EVALUATION SERVICE
In Cooperation with Innovation RESEARCH LABS

Most Widely Accepted and Trusted

ICC-ES Report

ICC-ES | (800) 423-6587 | (562) 699-0543 | www.icc-es.org

PMG-1068

Reissued 09/2018
This report is subject to renewal 09/2019

EVALUATION SUBJECT:

PERMA-LATERAL™ INVERTED CURED-IN-PLACE PIPE LINING SYSTEM

DIVISION:
22 00 00—PLUMBING
SECTION:
22 13 16—SANITARY WASTE AND VENT PIPING

Report Holder:

PERMA- LINER INDUSTRIES, LLC

Look for the ICC-ES marks of Conformity!

ICC-ES PMG Product Certificate

PMG-1068

Effective Date: September 2018
This listing is subject to re-examination in one year.

www.icc-es-pmg.org | (800) 423-6587 | (562) 699-0543 *A Subsidiary of the International Code Council®*

CSI: DIVISION: 22 00 00—PLUMBING
Section: 22 13 16—Sanitary Waste and Vent Piping

Product certification system:

The ICC-ES product certification system includes testing samples taken from the market or supplier's stock, or a combination of both, to verify compliance with applicable codes and standards. The system also involves factory inspections, and assessment and surveillance of the supplier's quality system.

Products: Perma-Lateral™ Inverted Cured-in-place Pipe Lining System

Listee: Perma-Liner Industries, LLC
13000 Automobile Blvd.
Suite 300
Clearwater, FL 33762
www.perma-liner.com

Compliance with the following codes:

2018, 2015, 2012, 2009 *International Plumbing Code*® (IPC)
2018, 2015, 2012, 2009 *International Residential Code*® (IRC)

Compliance with the following standards:

ICC-ES LC1011 (October 2010), ICC-ES PMG Listing Criteria for the Rehabilitation of Existing Building Drains and Building Sewers by the Inversion and Curing of Resin-impregnated Tube
ASTM F1216-2016, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of Resin-Impregnated Tube
NSF 14-2017, Plastic Piping System Components and Related Materials
NSF SE 13004-2013, Rehabilitation of Small Diameter Pipelines

Code Alternate:

LC1011 was approved by the ICC-ES PMG listing committee based on several factors which include the following: (1) ASTM F 1216 is a consensus standard but not referenced in the code; (2) the code prohibits drainage line size reduction in the direction of flow. Perma-Liner's installation does not constitute a reduction to a smaller nominal pipe size, further the resulting surface affords less friction loss which provides equivalent flow capacity despite the small reduction in diameter; (3) the use of this system restores the treated pipe capacity to minimum requirements in the code. Note this analysis only applies to systems evaluated by ICC-ES in accordance with LC1011.

Identification:

The Perma-Lateral™ and Flex-Liner™ Cured-in-place Pipe Lining materials are stamped indicating the product name (Perma-Lateral™ or Flex-Liner™), the ASTM designation (ASTM F 1216), the words ICC-ES PMG listing mark, repeating the mark continuously over the entire length of the

material (See Figure 1). A label must be attached, located at a maximum of 20 feet (6096 mm) apart along the length of the lined pipe or tube and at each fixture connection, indicating the listing holder's name, the ICC-ES PMG listing mark and the words "Caution: CIPP Epoxy Lined Pipe." The label must include a warning against using flame or heat when repairing any part of the system.

Perma-Lateral™ Lining Resin (A) and Hardener (B): Each container bears a label with the product name, the manufacturer's name (Perma-Liner Industries, LLC), the ICC-ES PMG listing mark. The ICC-ES PMG listing number (PMG-1068) is optional. (See Figure 2)

Installation:

Installation must comply with the manufacturer's published installation instructions and the applicable codes.

The Perma-Lateral™ and Flex-Liner Cured-in-place Pipe (CIPP) Lining Systems must be applied by installers trained and certified by Perma-Liner Industries, LLC.

The Perma-Lateral™ Scrim reinforced liner and Flex liner Cured-in-place Pipe (CIPP) Lining System may be used to repair vertical and horizontal pipelines.

Inspection and Cleaning: The pipe must be clean of all debris, roots and other obstructions that would block proper inversion of the CIPP. The cleaning must be done with a high-pressure jet unit or with mechanically powered cleaning equipment such as an electric rod machine with cutting attachments.

Inspection of the pipe must be done using a closed circuit television (CCTV) camera and performed by experienced personnel trained in locating breaks, obstacles and service connections. The interior of the pipe must be carefully inspected to determine the location of any conditions that may prevent proper installation of the CIPP liner into the pipe. Conditions such as protruding service taps, collapsed or crushed pipe, reductions in the cross-sectional area of more than 40 percent, or other obstructions must be corrected.

If inspection reveals a condition that cannot be removed by conventional sewer cleaning equipment, then a point repair excavation should be made to uncover and remove or repair the obstruction.

Preparation, Installation and Curing of the Liner: The quantity of the specified Perma-Lateral Lining Resin and Hardener required must be calculated in accordance with the manufacturer's formula based on pipe diameter, length and liner thickness.

Perma-Lateral Lining Resin and Hardener must be mixed in accordance with the manufacturer's recommendations.

The installer must remove all air from the liner tube, using equipment approved by the manufacturer, prior to filling the liner with the epoxy mix.

Once the liner tube has been "wetted out" with the epoxy mix, the installer must evenly distribute the mix in the liner tube using roller equipment approved by the manufacturer to ensure thorough saturation. The "wetted out" liner tube must be inverted into the pipe. Inversion is the process of installing the resin-impregnated liner into the pipe to be renovated by turning the liner inside out by the use of water or air pressure. The epoxy must be cured using the following method:

Circulation of hot water or steam. A bladder, referred to as a calibration hose, is installed the length of the liner. The bladder is filled with water or steam pressurized to between 5 and 7 PSI. The bladder is connected to a heater and circulation pump which circulates the water in the bladder and raises the water temperature between 125-135°F. This water temperature and pressure are maintained for a minimum of 1 hour. This forces the liner against the inside diameter of the piping during curing. The bladder is then removed.

Cured piping is then inspected in accordance with the manufacturer's published installation instructions using equipment approved by the manufacturer. A final CCTV inspection is performed and recorded in accordance with Item 5 of the Conditions of Listing section.

Models:

Perma-Lateral™ Cured-in-place Pipe Lining System: The system consists of components tested and listed to NSF 14 and ASTM F 1216. The liner tube is 3 mm thick with a reinforced scrim and is intended to be used for most standard installations.

Flex-Liner™ Cured-in-place Pipe Lining System: The system consists of components tested and listed to NSF 14 and ASTM F 1216. The liner tube is 2 mm thick and does not have the reinforced scrim, making it more flexible. It is intended to be used where multiple bends are involved in the installation.

Conditions of Listing:

1. Installation must be performed by installers trained and certified by Perma-Liner Industries.
2. The Perma-Liner™ CIPP System may be used to line pipe with a minimum diameter of 2 inches (102 mm) up to a maximum diameter of 10 inches (254 mm).
3. The minimum thickness of the liner must meet the design parameters of each individual application using the ASTM F 1216 Appendix X1 Design Method.
4. The pipe must be inspected and cleaned in accordance with the Inspection and Cleaning section of this listing and the manufacturer's published installation instructions.
5. Final video inspection in accordance with ASTM F 1216 must be performed and witnessed by the code official or his designated representative. The final inspection must verify that the liner is continuous over the entire length of the inversion and is free of dry spots, lifts, and delaminations.
6. Perma-Liner™ CIPP System materials are under a quality control program with an annual inspection by ICC-ES.

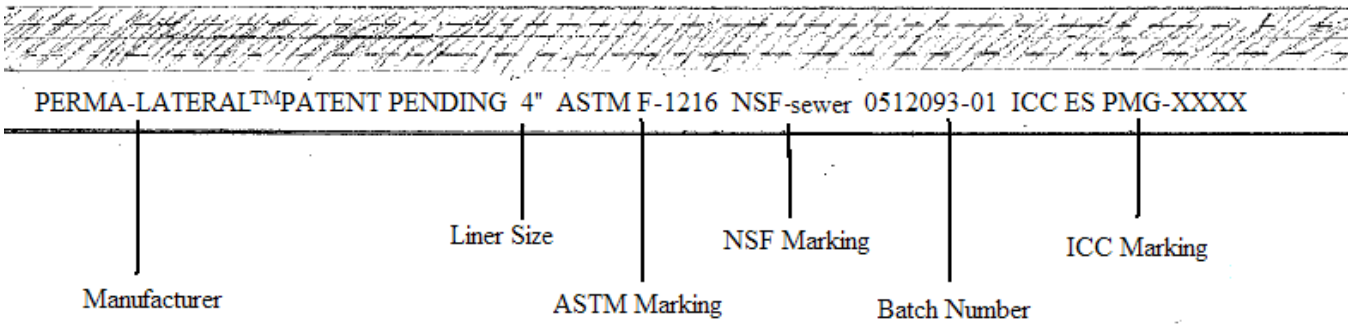


FIGURE 1—LINER MATERIAL LABEL

FIGURE 2—RESIN B

ICC EVALUATION SERVICE
In Cooperation with Innovation RESEARCH LABS

Most Widely Accepted and Trusted

ICC-ES Report

ICC-ES | (800) 423-6587 | (562) 699-0543 | www.icc-es.org

PMG-1074

Reissued 11/2018
This report is subject to renewal 11/2019

EVALUATION SUBJECT:

PERMA-LATERAL™ PULLED-IN-PLACE CURED-IN-PLACE PIPE LINING SYSTEM

DIVISION:
22 00 00—PLUMBING
SECTION:
22 13 16—SANITARY WASTE AND VENT PIPING

Report Holder:

PERMA-LINER INDUSTRIES, LLC.

Look for the ICC-ES marks of Conformity!

ICC-ES PMG Product Certificate

PMG-1074

Effective Date: November 2018
This listing is subject to re-examination in one year.

CSI: DIVISION: 22 00 00—PLUMBING
Section: 22 13 16—Sanitary Waste and Vent Piping

Product certification system:

The ICC-ES product certification system includes testing samples taken from the market or supplier's stock, or a combination of both, to verify compliance with applicable codes and standards. The system also involves factory inspections, and assessment and surveillance of the supplier's quality system.

Products: Perma-Lateral™ Pulled-in-Place Cured-in-Place Pipe Lining System

Listee: Perma-Liner Industries, LLC.
13000 Automobile Boulevard, Suite 300
Clearwater, Florida 33762
www.perma-liner.com

Compliance with the following codes:

2018, 2015, 2012 and 2009 *International Plumbing Code*® (IPC)
2018, 2015, 2012 and 2009 *International Residential Code*® (IRC)
2018, 2015, 2012 and 2009 *Uniform Plumbing Code** (UPC)
2011 *Uniform Plumbing Code – India** (UPC-I)

**Uniform Plumbing Code*® is a registered trademark of IAPMO

Compliance with the following standards:

ASTM F 1743-2017, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)
NSF 14-2017, Plastic Piping System Components and Related Materials
LC1011-2010, ICC-ES PMG Listing Criteria for the Rehabilitation of Existing Building Drains and Building Sewers by the Inversion and Curing of Resin-impregnated Tube.

Code Alternate:

LC1011 was approved by the ICC-ES PMG Listing Committee based on several factors, which include the following: (1) ASTM F 1743 is a consensus standard but not referenced in the code. (2) The code prohibits drainage line size reduction in the direction of flow. Perma-Liner's installation does not constitute a reduction to a smaller nominal pipe size. Further, the resulting surface affords less friction loss, which provides equivalent flow capacity despite the small reduction in diameter. (3) The use of this system restores the treated pipe capacity to minimum requirements in the code. Note that this analysis only applies to systems evaluated by ICC-ES in accordance with LC1011.

Identification:

The Perma-Lateral™ Pull in Place Navi-Liner™ Cured-in-place Pipe Lining materials are stamped with the product name (Perma-Lateral™ or Navi-Liner), the ASTM designation (ASTM F 1743), and

the ICC-ES PMG listing mark, with the mark repeated continuously over the entire length of the material. (See Figure 1.) Labels must be attached, at a maximum of 20 feet (6096 mm) apart along the length of the lined pipe or tube and at each fixture connection, indicating the listing holder's name, and carrying the ICC-ES PMG listing mark and the words "Caution: CIPP Epoxy Lined Pipe." The label must include a warning against using flame or heat when repairing any part of the system.

Perma-Lateral™ Lining Resin (A) and Hardener (B): Each container bears a label with the product name, the manufacturer's name (Perma-Liner Industries, LLC.), and the ICC-ES PMG listing mark. (See Figure 2).

Installation:

Installation must comply with the manufacturer's published installation instructions and the applicable codes.

The Perma-Lateral™ and Navi-Liner Cured-in-place Pipe (CIPP) Lining Systems must be applied by installers trained and certified by Perma-Liner Industries, LLC.

The Navi-Liner™ Pull in Place Cured-in-place Pipe (CIPP) Lining System may be used to repair vertical and horizontal pipelines.

Inspection and Cleaning: The pipe must be clean of all debris, roots and other obstructions that would block proper inversion of the CIPP. The cleaning must be done with a high-pressure jet unit or with mechanically powered cleaning equipment such as an electric rod machine with cutting attachments.

Inspection of the pipe must be done using a closed circuit television (CCTV) camera. The inspection must be performed by experienced personnel trained in locating breaks, obstacles and service connections. The interior of the pipe must be carefully inspected to determine the location of any conditions that may prevent proper installation of the CIPP liner into the pipe. Conditions such as protruding service taps, collapsed or crushed pipe, reductions in the cross-sectional area of more than 40 percent, or other obstructions must be corrected.

If inspection reveals a condition that cannot be removed by conventional sewer cleaning equipment, then a point repair excavation should be made to uncover and remove or repair the obstruction.

Preparation, Installation and Curing of the Liner: The quantity of the specified Perma-Lateral Lining Resin and Hardener required must be calculated in accordance with the manufacturer's formula based on pipe diameter, length and liner thickness.

Perma-Lateral Lining Resin and Hardener must be mixed in accordance with the manufacturer's recommendations.

The installer must remove all air from the liner tube, using equipment approved by the manufacturer, prior to filling the liner with the epoxy mix.

Once the liner tube has been "wetted out" with the epoxy mix, the installer must evenly distribute the mix in the liner tube using roller equipment approved by the manufacturer, to ensure thorough saturation. The "wetted out" liner tube must be pulled into the pipe by means of a power winch in accordance with ASTM F 1743. The epoxy must be cured using one of the following methods:

Circulation of hot water or steam. A bladder, referred to as a calibration hose, is installed the length of the liner. The bladder is filled with water or steam pressurized to between 5 and 7 psi. The bladder is connected to a heater and circulation pump which circulates the water in the bladder and raises the water temperature to between 125°F and 135°F. This water temperature and pressure are maintained for a minimum of one hour. This forces the liner against the inside diameter of the piping during curing. The bladder is then removed.

Ambient air curing. Depending on the air and ground temperatures, the appropriate mixture of Part B hardener is mixed with Part A to "wet out" the liner, which is pulled into the pipe. There are different formulations of Part B depending on the temperature (hot weather, warm weather and cold weather mixtures). Once the liner is installed in the pipe, the epoxy can be cured by exposing the liner to ambient air.

Cured piping is then inspected in accordance with the manufacturer's published installation instructions, using equipment approved by the manufacturer. A final CCTV inspection is performed and recorded in accordance with Item 5 of the Conditions of Listing (below).

Models:

Perma-Lateral™ Cured-in-Place Pipe Lining System: The system consists of components tested and listed to NSF 14 and ASTM F 1743. The liner tube is 3 millimeters thick with a reinforced scrim, and is intended to be used for most standard installations.

Navi-Liner Cured-in-Place Pipe Lining System: The system consists of components tested and listed to NSF 14 and ASTM F 1743. The liner tube is 2 millimeters thick and does not have the reinforced scrim, making it more flexible. It is intended to be used where multiple bends are involved in the installation.

Conditions of Listing:

1. Installation must be performed by installers trained and certified by Perma-Liner Industries, LLC.
2. The Perma-Liner™ CIPP System may be used to line pipe with a minimum diameter of 2 inches (102 mm) up to a maximum diameter of 10 inches (254 mm).
3. The minimum thickness of the liner must meet the design parameters of each individual application using the ASTM F 1216-09 Appendix X1 Design Method.
4. The pipe must be inspected and cleaned in accordance with the Inspection and Cleaning section of this listing and the manufacturer's published installation instructions.
5. Subsequent to curing in accordance with the manufacturers' instructions, a final video inspection in accordance with ASTM F 1743 must be performed and witnessed by the code official or his designated representative. The final inspection must verify that the liner is continuous over the entire length of the inversion and is free of dry spots, lifts, and delaminations.
6. Perma-Liner™ CIPP System materials are manufactured by Perma-Liner Industries, LLC., located in Clearwater, Florida, under a quality control program with yearly inspections done by ICC-ES.

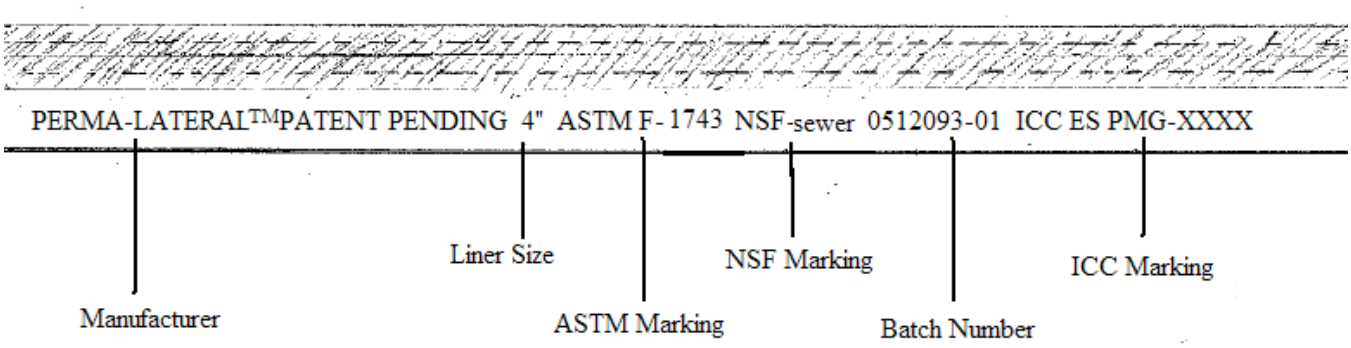


FIGURE 1—LINER MATERIAL LABEL

FIGURE 2—RESIN BUCKET LABEL

NSF International

789 N. Dixboro Road, Ann Arbor, MI 48105 USA

RECOGNIZES

Perma-Liner Industries, LLC

Clearwater, FL

AS COMPLYING WITH NSF/ANSI 14 AND ALL APPLICABLE REQUIREMENTS.
PRODUCTS APPEARING IN THE NSF OFFICIAL LISTING ARE
AUTHORIZED TO BEAR THE NSF MARK.

ANSI Accredited Program
PRODUCT CERTIFICATION
#0216
Certification Program
Accredited by the
American National
Standards Institute

Certification Program
Accredited by the
Standards Council
of Canada

This certificate is the property of NSF International and must be returned upon request. This certificate remains valid as long as this client has products in Listing for the referenced standards. For the most current and complete Listing information, please access NSF's website (www.nsf.org).

June 22, 2016
Certificate# 0D470 - 04

David Purkiss
General Manager, Plumbing

Appendix G – 3rd Party Testing

HTS Pipe Consultants, Inc.
420 Pickering Street, Houston, TX 77091
www.htspipeconsultants.com

Phone 713-692-8373
Fax 713-692-8502
Toll Free 1-800-692-TEST

August 11, 2016

HTS Report #:	**PLIF618.004B.doc**	
Mr. Skyler Biek	Customer Project Name:	Scrim Testing July 2016
Perma-Liner Industries	Customer Project No.:	
13000 Automobile Boulevard, Suite 300	Date Sample Received:	8/02/16
Clearwater, FL 33762	Date Sample Tested:	8/06/16

One (1) sample of cured-in-place pipe was delivered to HTS' laboratory for testing. The sample was tested in accordance with ASTM D638 Type II, and ASTM D790 Method I Procedure A. A Support Span-to-Depth Ratio of 16 to 1 was used as specified in the test standard ASTM D790. Thickness measurements, compressive strength, tensile strength, flexural stress and flexural modulus of elasticity tests were performed on the sample. Five (5) specimens were cut and tested from the sample. The results summarized and reported below are averages of the five (5) specimens. A test report for the sample is attached.

SAMPLE ID	TENSILE STRENGTH (psi) ASTM D 638	TENSILE ELONGATION (%) ASTM D 638	FLEXURAL STRENGTH (psi) ASTM D 790	FLEXURAL MODULUS (psi) ASTM D 790
PLI 3mm Scrim	4648	4.7	10,984	349,253

The following table contains the thickness measurements for each individual specimen tested.

MEASUREMENT OF THICKNESS FOR CURED IN PLACE PIPE LINER ASTM D 2122										
									Combined Total Average/Specimen	
Sample ID	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	in	mm
PLI 3mm Scrim	.171	.173	.171	.168	.169	.176	.165	.168	0.170	4.3

Technician	E. Carrillo
Time	2 hrs

Sincerely,

Rick Eastwood
Vice President

This test report relates only to the items tested and shall not be reproduced except in full without approval of HTS, Inc.

SUMMARY OF TEST DATA
RESISTANCE OF CIPP TO CHEMICAL REAGENTS

Sample ID: 6" diameter pvc pipe containing Perma-Liner Industries Lateral Rehabilitation sample

Chemical Reagent (Concentration)	Mechanical Property	Test Method ASTM D	Unit	Control Sample	30 Days	
					Value	% Change
Tap water - pH 6-9 (100%)	Observation	543		N/A	No Change	
	Weight	543	g	73.15	73.53	0.52
	Thickness	2122	in.	0.197	0.197	0.00
			mm.	5.0	5.0	0.00
	Max. Flexural	790	psi	9657.9	9739.0	0.84
	Modulus	790	psi	359523	364460	1.37
Nitric Acid (5%)	Observation	543		N/A	Plastic coating changed yellow	
	Weight	543	g	68.2	68.77	0.84
	Thickness	2122	in.	0.187	0.187	0.00
			mm.	4.7	4.7	0.00
	Max. Flexural	790	psi	9657.9	9849.0	1.98
	Modulus	790	psi	359523	360723	0.33
Phosphoric Acid (10%)	Observation	543		N/A	No Change	
	Weight	543	g	62.07	62.61	0.87
	Thickness	2122	in.	0.162	0.162	0.00
			mm.	4.1	4.1	0.00
	Max. Flexural	790	psi	9657.9	8709.2	-9.82
	Modulus	790	psi	359523	299127	-16.80
Sulfuric Acid (10%)	Observation	543		N/A	No Change	
	Weight	543	g	66.32	66.98	1.00
	Thickness	2122	in.	0.180	0.180	0.00
			mm.	4.6	4.6	0.00
	Max. Flexural	790	psi	9657.9	9540.9	-1.21
	Modulus	790	psi	359523	336277	-6.47

HTS, INC. Consultants

SUMMARY OF TEST DATA
RESISTANCE OF CIPP TO CHEMICAL REAGENTS

Sample ID: 6" diameter pvc pipe containing Perma-Liner Industries Lateral Rehabilitation sample

Chemical Reagent (Concentration)	Mechanical Property	Test Method ASTM D	Unit	Control Sample	30 Days	
					Value	% Change
Gasoline (100%)	Observation	543		N/A	Plastic coating bubbled & changed yellow	
	Weight	543	g	60.7	61.7	1.65
	Thickness	2122	in.	0.170	0.170	0.00
			mm.	4.3	4.3	0.00
	Max. Flexural	790	psi	9657.9	10402.5	7.71
	Modulus	790	psi	359523	353321	-1.73
Vegetable Oil (100%)	Observation	543		N/A	No Change	
	Weight	543	g	66.27	66.39	0.18
	Thickness	2122	in.	0.179	0.179	0.00
			mm.	4.6	4.6	0.00
	Max. Flexural	790	psi	9657.9	10213.7	5.75
	Modulus	790	psi	359523	360899	0.38
Detergent (0.1%)	Observation	543		N/A	No Change	
	Weight	543	g	63.16	63.57	0.65
	Thickness	2122	in.	0.174	0.174	0.00
			mm.	4.4	4.4	0.00
	Max. Flexural	790	psi	9657.9	9219.0	-4.54
	Modulus	790	psi	359523	338517	-5.84
Soap (0.1%)	Observation	543		N/A	No Change	
	Weight	543	g	53.64	54.15	0.95
	Thickness	2122	in.	0.150	0.150	0.00
			mm.	3.8	3.8	0.00
	Max. Flexural	790	psi	9657.9	7984.7	-17.32
	Modulus	790	psi	359523	311111	-13.47

HTS, INC. Consultants

SUMMARY OF TEST DATA
RESISTANCE OF CIPP TO CHEMICAL REAGENTS

SAMPLE ID: **Duration:** 30 Days **Date Tested:** 10/18/2012

Chemical Reagent (Concentration)	Mechanical Property	Test Method ASTM D	Unit	Control Sample	30 Days	
					Value	% Change
Chlorine (2%)	Observation	543		Olive	Yellowish Brown	
	Weight	543	g	67.47	67.89	0.62
	Thickness	2122	in.	0.208	0.208	0.00
			mm.	5.3	5.3	0.00
	Max. Flexural	790	psi	11287	11122	-1.46
	Modulus	790	psi	410656	411465	0.20
Chlorine (75%)	Observation	543		Olive	Light Brown	
	Weight	543	g	69.51	69.72	0.30
	Thickness	2122	in.	0.207	0.207	0.00
			mm.	5.3	5.3	0.00
	Max. Flexural	790	psi	11287	11336	0.43
	Modulus	790	psi	410656	402251	-2.05

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

199 Henlow Bay
Winnipeg, MB R3Y 1G4
Phone (204) 488-6999
Fax (204) 488-6947
Email info@nationaltestlabs.com
www.nationaltestlabs.com

CELEBRATING 90 Years 1923 - 2013

Mr. Rooter Plumbing
4 – 1955 Logan Ave.
Winnipeg, MB
R2R 0H6

July 30, 2013

Project: 2013 Lateral Liner Testing

Attention: Julio Silvestri

One sample of lateral liner manufactured by Permaliner was submitted to our laboratory on July 26, 2013 for analysis. It was requested that the liner sample to be tested to confirm the flexural strength and flexural modulus in accordance with ASTM D5813 and ASTM D790. It was also requested that the liner thickness be measured in accordance with ASTM D5813 and ASTM D3567. The testing was conducted in accordance with these standards and the test data obtained for the samples is shown in Tables 1 and 2. A summary of the flexural properties and thickness for the liner sample is provided below.

Property	Sample Test Data	ASTM F1216 Requirement
flexural strength (MPa)	60.2	31 minimum
flexural modulus (MPa)	2342	1724 minimum
flexural strain (%)	3.56	not specified
Thickness (mm)	3.91	not specified

Based upon the test results obtained, the liner sample complies with the minimum flexural strength and flexural modulus requirements.

We appreciate the opportunity to assist you in this assignment. Please contact the undersigned if you have any questions or require additional information.

Jason Thompson. C.E.T.
Manager, Materials Testing Services

TABLE 1
FLEXURAL PROPERTIES OF LATERAL LINER

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

Sample No.	NTL Sample No.	Sample Identification	Inversion Date	Sample Type	Flexural Strength (MPa)		Flexural Modulus (MPa)		Flexural Strain (%)	
					Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation
1	2321	100 mm diam. x 270 mm long x 4 mm thick	n/a	pipe	60.2	8.8	2342	358	3.56	0.16
ASTM F1216 Requirements					31 min.		1724 min.			

Notes

1. Flexural properties of CIPP liners samples were determined in accordance with ASTM D790-10, procedure A.
2. Five specimens were tested for each sample submitted to our laboratory.

30/07/2013

TABLE 2
THICKNESS OF LATERAL LINER

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

Sample No.	NTL Sample No.	Sample Identification	Inversion Date	Sample Type	Design Thickness (mm)	Nominal Tube Thickness (mm)	Measured Thickness (mm)	
							Range	Average
1	2321	100 mm diam. x 270 mm long x 4 mm thick	n/a	pipe	not provided	4.0	3.57 to 4.14	3.91

Notes

1. Thickness of liner samples determined in accordance with ASTM D3567-03(2009).
2. Eight measurements were taken on each sample at evenly spaced intervals.
3. The requirements for thickness as outlined in ASTM D5813-04(2008) are the average wall thickness shall not be less than the design thickness and the minimum wall thickness at any point shall not be less than 87.5% of the design thickness.

HTS Pipe Consultants, Inc.
420 Pickering Street, Houston, TX 77091
www.htspipeconsultants.com

Phone 713-692-8373
Fax 713-692-8502
Toll Free 1-800-692-TEST

July 1, 2013

Perma-Liner Industries, Inc.
13000 Automobile Boulevard, Suite 300
Clearwater, FL 33762

Attn: Mr. Cole Perkins

Re: **10,000 Hour Final Report**
ASTM D 2990 Flexural Creep Test
HTS Report No. PLF219.004

Dear Mr. Perkins:

Please find attached the final 10,000 hour Flexural Creep test report for the sample labeled "Perma-Liner Epoxy Resin".

I have also attached our invoice for performing this service. We appreciate the opportunity to work with you. If you have any questions or comments, please call. Thank you very much.

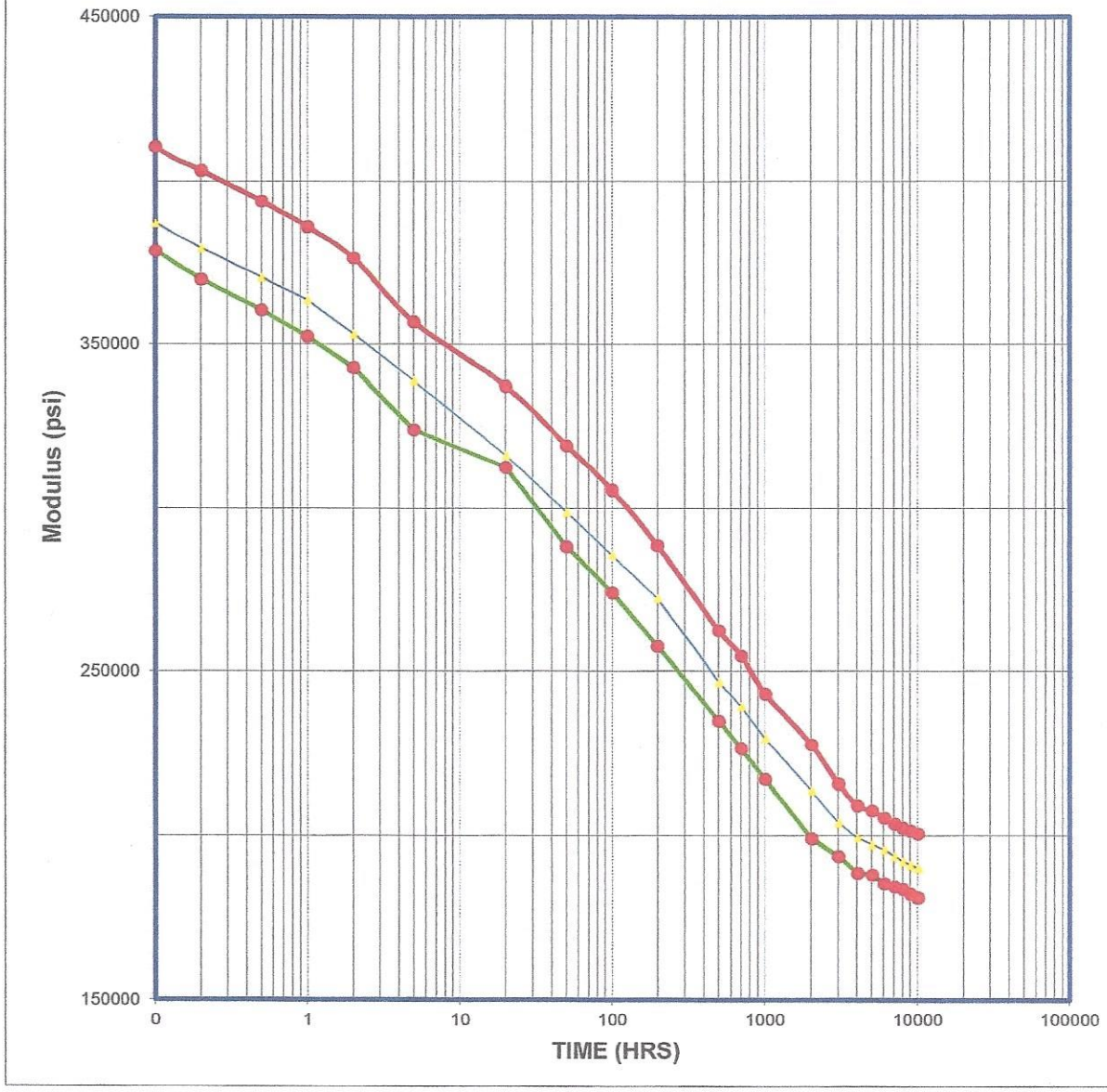
Sincerely,
HTS Pipe Consultants, Inc.

Rick Eastwood
Vice President

HTS Pipe Consultants, Inc.

420 Pickering, Houston, Texas 77091
Tel: (713) 692-8373 Fax: (713) 692-8502

FLEXURAL CREEP
ASTM D2990



Project Name:
Project No.:

Sample ID No.: *Perma-Liner Epoxy Resin*

HTS Report#: *PLF219.004*

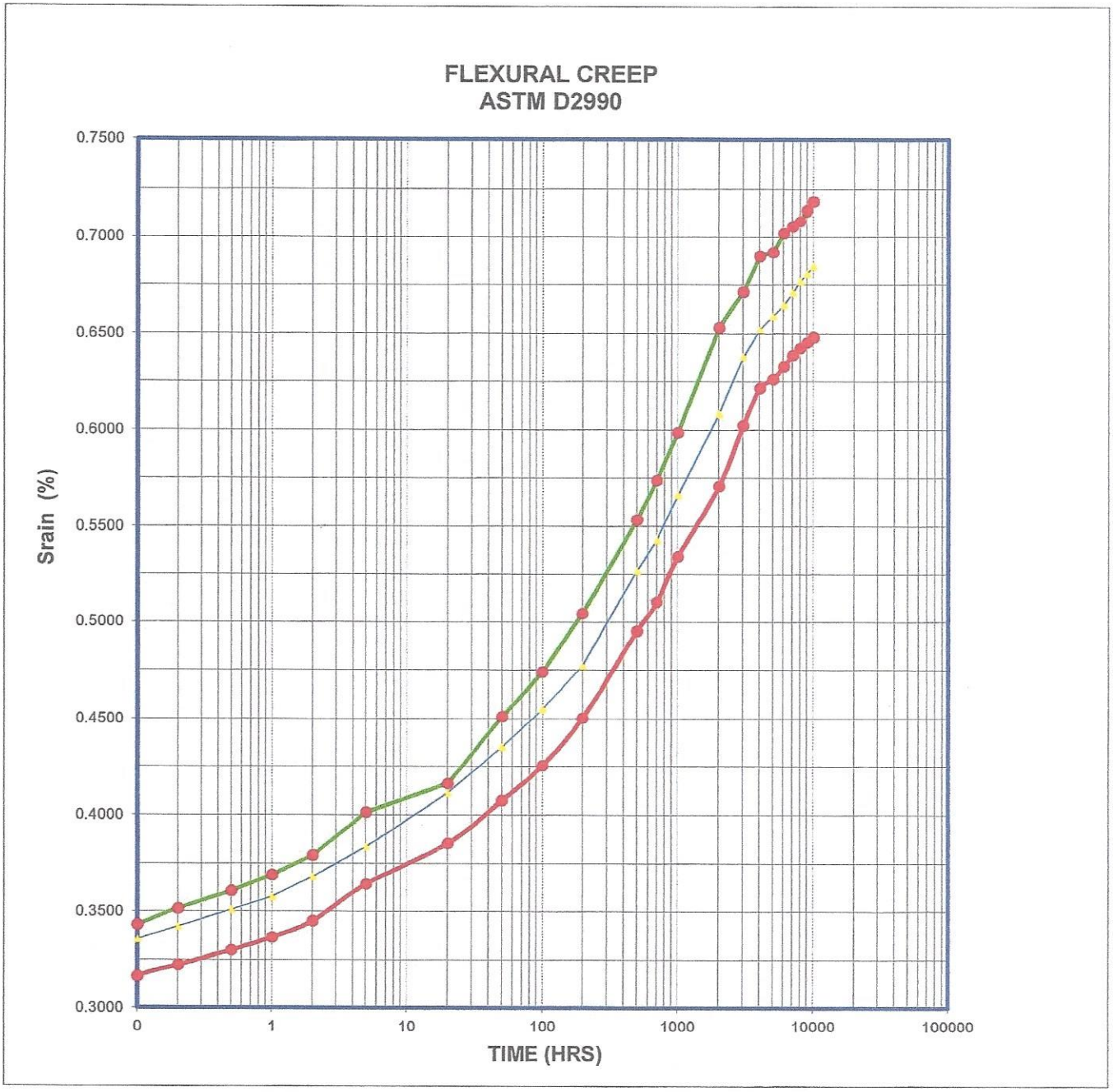
Tested Temperature: 71°F
Lab Humidity: *50%*
Specimen Gage Length: 4.0"
Stress: 1300 psi

HTS Report# PLF219.004

Sample ID:

Spec# 1		Spec# 2		Spec# 3	
Thickness: 0.246"	Width: 0.531"	Thickness: 0.255"	Width: 0.528"	Thickness: 0.255"	Width: 0.529"
TIME (HRS)	**Modulus (psi)**	**TIME (HRS)**	**Modulus (psi)**	**TIME (HRS)**	**Modulus (psi)**
0.02	406114	0.02	437131	0.02	402212
0.10	378821	0.10	410718	0.10	387315
0.20	369872	0.20	403406	0.20	379742
0.50	360413	0.50	394051	0.50	370430
1	352304	1	386215	1	363497
2	342874	2	376586	2	353111
5	323957	5	356818	5	339022
20	312464	20	337339	20	316157
50	288183	50	319126	50	298786
100	274166	100	305500	100	285604
198	257626	198	288636	198	272440
500	234869	500	262447	500	246729
700	226562	700	254584	700	239345
1004	217136	1004	243198	1004	229641
2012	199042	2012	227718	2012	213754
3020	193573	3020	215790	3020	203820
4028	188398	4028	209150	4028	199337
5036	187895	5036	207554	5036	197312
6044	185179	6044	205359	6044	195608
7052	184211	7052	203515	7052	193658
8000	183491	8000	202303	8000	192017
9000	182069	9000	201404	9000	190938
10005	180900	10005	200513	10005	189871

HTS Pipe Consultants, Inc.
420 Pickering, Houston, Texas 77091
Tel: (713) 692-8373 Fax: (713) 692-8502



Project Name:
Project No.:

Sample ID No.: *Perma-Liner EpoxyResin*

HTS Report#: *PLF219.004*

Tested Temperature: 71°F
Lab Humidity: *50%*
Specimen Gage Length: 4.0"
Stress: 1300 psi

HTS Report PLF219.004

Sample ID:

Spec# 1		Spec# 2		Spec# 3	
Thickness: 0.246"	Width: 0.531"	Thickness: 0.255"	Width: 0.528"	Thickness: 0.255"	Width: 0.529"
TIME (HRS)	**Strain (%)**	**TIME (HRS)**	**Strain (%)**	**TIME (HRS)**	**Strain (%)**
0.02	0.3201	0.02	0.2974	0.02	0.3232
0.10	0.3432	0.10	0.3165	0.10	0.3356
0.20	0.3515	0.20	0.3223	0.20	0.3423
0.50	0.3607	0.50	0.3299	0.50	0.3509
1	0.3690	1	0.3366	1	0.3576
2	0.3791	2	0.3452	2	0.3682
5	0.4013	5	0.3643	5	0.3835
20	0.4160	20	0.3854	20	0.4112
50	0.4511	50	0.4074	50	0.4351
100	0.4742	100	0.4255	100	0.4552
198	0.5046	198	0.4504	198	0.4772
500	0.5535	500	0.4953	500	0.5269
700	0.5738	700	0.5106	700	0.5432
1004	0.5987	1004	0.5345	1004	0.5661
2012	0.6531	2012	0.5709	2012	0.6082
3020	0.6716	3020	0.6024	3020	0.6378
4028	0.6900	4028	0.6216	4028	0.6522
5036	0.6919	5036	0.6263	5036	0.6589
6044	0.7020	6044	0.6330	6044	0.6646
7052	0.7057	7052	0.6388	7052	0.6713
8000	0.7085	8000	0.6426	8000	0.6770
9000	0.7140	9000	0.6455	9000	0.6809
10005	0.7186	10005	0.6483	10005	0.6847

Appendix H – Safety Data Sheets

SAFETY DATA SHEET

PERMA-LINER EPOXY RESIN PART A

Section 1. Product and company identification

GHS product identifier : PERMA-LINER EPOXY RESIN PART A
Product type : Epoxy Resin

Manufacturer/Supplier/Importer : Perma-Liner Industries, LLC
13000 Automobile BLVD Suite #300
Clearwater, FL 33762

Contact person : info@perma-liner.com

Telephone : For additional health and safety or regulatory information, call 727-507-9749

Emergency telephone number : For Emergency Medical Assistance
Call Health & Safety Information Services
1-866-303-6949

For Emergency Transportation Information
CHEMTREC US Domestic (800) 424-9300
CHEMTREC International (703) 527-3887
CANUTEC CA Domestic (613) 996-6666

Section 2. Hazards identification

Classification of the substance or mixture : SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2A
SKIN SENSITIZATION - Category 1
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) [Respiratory tract irritation] - Category 3

GHS label elements

Hazard pictograms :

Signal word : Warning
Hazard statements : H315 Causes skin irritation.
H319 Causes serious eye irritation.
H317 May cause an allergic skin reaction.
H335 May cause respiratory irritation.

Precautionary statements

General : Not applicable.

Prevention : Wear protective gloves.
Wear eye or face protection.
Use only outdoors or in a well-ventilated area.
Avoid breathing vapor.
Wash hands thoroughly after handling.
Contaminated work clothing should not be allowed out of the workplace.

Response : **IF INHALED:**
Remove victim to fresh air and keep at rest in a position comfortable for breathing.
Call a POISON CENTER or physician if you feel unwell.
IF ON SKIN:
Wash with plenty of soap and water.
Take off contaminated clothing.
Wash contaminated clothing before reuse.
If skin irritation or rash occurs:
Get medical attention.
IF IN EYES:
Rinse cautiously with water for several minutes.
Remove contact lenses, if present and easy to do. Continue rinsing.
If eye irritation persists:
Get medical attention.

Storage : Store locked up.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Other hazards which do not result in classification : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Ingredient name	% by weight	CAS number
4,4'-Isopropylidenediphenol-Epichlorohydrin Copolymer	90 - 100	25068-38-6

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.
Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If necessary, call a poison center or physician. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention if adverse health effects persist or are severe. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first aid personnel : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal : Decomposition products may include the following materials:

decomposition products		carbon dioxide carbon monoxide halogenated compounds
Special protective actions for fire-fighters	:	Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.
Special protective equipment for fire-fighters	:	Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel	:	No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.
For emergency responders	:	If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".
Environmental precautions	:	Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill	:	Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.
Large spill	:	Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13 of SDS). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 of SDS for emergency contact information and section 13 of SDS for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures	:	Put on appropriate personal protective equipment (see section 8 of SDS). Persons with a history of skin sensitization problems should not

be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10 of SDS) and food and drink. Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

None.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to

liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Skin protection

Hand protection	:	Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.
Body protection	:	Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Other skin protection	:	Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Respiratory protection	:	Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state	:	Viscous liquid.
Color	:	Clear.
Odor	:	Not available
Odor threshold	:	Not available
pH	:	Not available
Melting point/ Freezing point	:	Not available
Boiling point	:	260 °C (500.00 °F)
Flash point	:	Pensky-Martens Closed Cup: 249 °C (480.20 °F) (ASTM D 93)
Burning time	:	Not available
Burning rate	:	Not available
Evaporation rate	:	Not available
Flammability (solid, gas)	:	Not available
Lower and upper explosive (flammable) limits	:	**Lower:** Not available **Upper:** Not available
Vapor pressure	:	0.04 mbar @ 77 °C (170.60 °F)
Vapor density	:	Not available
Relative density	:	1.17
Solubility	:	Not available

Solubility in water : Negligible

Partition coefficient: n-octanol/water : Not available

Auto-ignition temperature : Not available

Decomposition temperature : Not available

SADT : Not available

Viscosity : **Dynamic:** Not available
Kinematic: Not available

Other information

No additional information.

Section 10. Stability and reactivity

Reactivity : Stable under normal conditions.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Strong oxidizer, Extremes of temperature and direct sunlight.

Incompatible materials : Reactive or incompatible with the following materials:
strong oxidizing agents,
strong acids,
strong alkalis,

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Other hazards Reacts with considerable heat release with some curing agents.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
4,4'-Isopropylidenediphenol-Epichlorohydrin Copolymer				
	LD50 Oral	Rat	11,400 mg/kg	-
	LD50 Dermal	Rat	2,000 mg/kg	-

Conclusion/Summary : Not available

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
4,4'-Isopropylidenediphenol-Epichlorohydrin Copolymer	Skin - Erythema/Eschar 404 Acute	Rabbit	1.5 - 2		-

	Dermal Irritation/Corrosion				
	Skin - Edema 404 Acute Dermal Irritation/Corrosion	Rabbit	1.0 - 1.5		-
	eyes - - 405 Acute Eye Irritation/Corrosion	Rabbit	0		-
	eyes - Redness of the conjunctivae	Rabbit	0.7		-
	Skin - Moderate irritant	Rabbit		24 hrs	-
	Skin - Severe irritant	Rabbit		24 hrs	-
	eyes - Mild irritant	Rabbit			-

Conclusion/Summary

Skin : Not available

eyes : Not available

Respiratory : Not available

Sensitization

Conclusion/Summary

Skin : Not available

Respiratory : Not available

Mutagenicity

Conclusion/Summary : Not available

Carcinogenicity

Conclusion/Summary : Not available

Reproductive toxicity

Product/ingredient name	Maternal toxicity	Fertility	Development toxin	Species	Dose	Exposure
4,4'-Isopropylidenediphenol-Epichlorohydrin Copolymer	-	-	-	-	-	-
Remarks:	No adverse reproductive effects were observed in an O.E.C.D. Test Guideline no. 416 GLP two-generation rat oral gavage study conducted up to a high dose level of 750 mg/kg/day that resulted in adult body weight decrements.					

Conclusion/Summary : Not available

Teratogenicity

Conclusion/Summary : Not available

Specific target organ toxicity (single exposure)

Product/ingredient name	Category	Route of exposure	Target organs
4,4'-Isopropylidenediphenol-Epichlorohydrin Copolymer	Category 3		Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Not available

Aspiration hazard

Not available

Information on the likely routes of exposure : Not available

Potential acute health effects

Eye contact : Causes serious eye irritation.
Inhalation : May cause respiratory irritation.
Skin contact : Causes skin irritation. May cause an allergic skin reaction.
Ingestion : Irritating to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
respiratory tract irritation
coughing

Skin contact : Adverse symptoms may include the following:
irritation
redness

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available
Potential delayed effects : Not available

Long term exposure

Potential immediate effects : Not available
Potential delayed effects : Not available

Potential chronic health effects

Conclusion/Summary : Not available

General : Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.
Carcinogenicity : No known significant effects or critical hazards.
Mutagenicity : No known significant effects or critical hazards.
Teratogenicity : No known significant effects or critical hazards.
Developmental effects : No known significant effects or critical hazards.
Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
reaction product: bisphenol-A-(epichlorhydrin); epoxy resin (number average molecular weight ≤ 700)			
	Acute LC50 1.3 mg/l - 203 Fish, Acute Toxicity Test	Fish - Fish	96 h
	Acute EC50 2.1 mg/l - 202 Daphnia sp. Acute Immobilization Test and Reproduction Test	Aquatic invertebrates. Water flea	48 h
	Acute NOEC 0.3 mg/l - 211 Daphnia Magna Reproduction Test	Aquatic invertebrates. Water flea	21 d
	Acute LC50 > 11 mg/l -	Aquatic plants - Algae	72 h

Conclusion/Summary : Not available

Persistence/degradability

Conclusion/Summary : Not available

Bioaccumulative potential

Product/ingredient name	LogPow	BCF	Potential
4,4'-Isopropylidenediphenol-Epichlorohydrin Copolymer	2.64 - 3.78	3 - 31 31.00	low

Mobility in soil

Soil/water partition coefficient (KOC) : Not available
Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

The data provided in this section is for information only and may not be specific to your package size or mode of transport. You will need to apply the appropriate regulations to properly classify your shipment for transportation.

International transport regulations

Regulatory information	UN/NA number	Proper shipping name	Classes/*PG	Reportable Quantity (RQ)
CFR		Non-regulated		
TDG		Non-regulated		
IMO/IMDG		Non-regulated		
IATA (Cargo)		Non-regulated		

*PG : Packing group

Special precautions for user : Transport within user's premises: always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.'

Section 15. Regulatory information

United States

U.S. Federal regulations : **United States - TSCA 12(b) - Chemical export notification:** None required.
United States - TSCA 5(a)2 - Final significant new use rules: Not listed
United States - TSCA 5(a)2 - Proposed significant new use rules: Not listed
United States - TSCA 5(e) - Substances consent order: Not listed

California Prop. 65: : WARNING: This product contains less than 0.1% of a chemical known to the State of California to cause cancer.

Ingredient name	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
Oxirane, 2-(phenoxymethyl)-	Yes.	No.	5 µg/day	No.

United States inventory (TSCA 8b) : All components are listed or exempted.

Canada

WHMIS (Canada) : Class D-2B: Material causing other toxic effects (Toxic).

Canadian lists

Canadian NPRI : None required.

CEPA Toxic substances : None required.

International regulations

International lists :
Australia inventory (AICS): All components are listed or exempted.
Canada inventory: All components are listed or exempted.
Japan inventory: All components are listed or exempted.
China inventory (IECSC): All components are listed or exempted.
Korea inventory: All components are listed or exempted.
New Zealand Inventory (NZIoC): All components are listed or exempted.
Philippines inventory (PICCS): All components are listed or exempted.
United States inventory (TSCA 8b): All components are listed or exempted.
Taiwan inventory (CSNN): All components are listed or exempted.

Section 16. Other information

Hazardous Material Information System III (U.S.A.) :

Health	*	2
Flammability		1
Physical hazards		0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA).
HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.
The customer is responsible for determining the PPE code for this material.

Full text of abbreviated H statements : Not applicable.

History

Date of printing	:	08/17/2015
Date of issue/Date of revision	:	02/04/2015
Date of previous issue	:	03/08/2012
Version	:	14.0
Prepared by	:	Product Safety Stewardship
Key to abbreviations	:	ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = Intermediate Bulk Container IMDG = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) RID = The Regulations concerning the International Carriage of Dangerous Goods by Rail UN = United Nations
References	:	Not available

Notice to reader

The information provided herein was believed by Perma-Liner Industries to be accurate at the time of preparation or prepared from sources believed to be reliable, but it is the responsibility of the user to investigate and understand other pertinent sources of information, to comply with all laws and procedures applicable to the safe handling and use of the product and to determine the suitability of the product for its intended use. All products supplied by Perma-Liner are subject to Perma-Liner's terms and conditions of sale. PERMA-LINER MAKES NO WARRANTY, EXPRESSED OR IMPLIED, CONCERNING THE PRODUCT OR THE MERCHANTABILITY OR FITNESS THEREOF FOR ANY PURPOSE OR CONCERNING THE ACCURACY OF ANY INFORMATION PROVIDED BY PERMA-LINER, except that the product shall conform to Perma-Liner's specifications. Nothing contained herein constitutes an offer for the sale of any product.

SAFETY DATA SHEET

PERMA-LINER EPOXY RESIN PART B1

Section 1. Product and company identification

GHS product identifier : PERMA-LINER EPOXY RESIN PART B1
Product type : Curing Agent

Manufacturer/Supplier/Importer : Perma-Liner Industries, LLC
13000 Automobile
BLVD Suite #300
Clearwater, FL 33762

Contact person : info@perma-liner.com

Telephone : For additional health and safety or regulatory information, call 727-507-9749

Emergency telephone number : For Emergency Medical Assistance
Call Health & Safety Information Services
1-866-303-6949

For Emergency Transportation Information
CHEMTREC US Domestic (800) 424-9300
CHEMTREC International (703) 527-3887
CANUTEC CA Domestic (613) 996-6666

Section 2. Hazards identification

Classification of the substance or mixture :
SKIN CORROSION/IRRITATION - Category 1B
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 1
SKIN SENSITIZATION - Category 1
TOXIC TO REPRODUCTION - Category 2
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) [central nervous system (CNS)] - Category 2
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) [bladder, kidneys, liver] - Category 2

GHS label elements

Hazard pictograms :

Signal word : Danger
Hazard statements :
H314 Causes severe skin burns and eye damage.
H318 Causes serious eye damage.
H317 May cause an allergic skin reaction.

H361f Suspected of damaging fertility.
H371 May cause damage to organs (central nervous system (CNS))
H373 May cause damage to organs through prolonged or repeated exposure (bladder, kidneys, liver)

Precautionary statements

General : Not applicable.

Prevention :
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Use personal protective equipment as required.
Wear protective gloves.
Wear eye or face protection.
Wear protective clothing.
Do not breathe vapor.
Do not eat, drink or smoke when using this product.
Wash hands thoroughly after handling.
Contaminated work clothing should not be allowed out of the workplace.

Response :
Get medical attention if you feel unwell.
IF exposed or if you feel unwell:
Call a POISON CENTER or physician.
IF INHALED:
Remove victim to fresh air and keep at rest in a position comfortable for breathing.
Immediately call a POISON CENTER or physician.
IF SWALLOWED:
Immediately call a POISON CENTER or physician.
Rinse mouth.
Do NOT induce vomiting.
IF ON SKIN (or hair):
Take off immediately all contaminated clothing.
Rinse skin with water or shower.
Wash contaminated clothing before reuse.
Immediately call a POISON CENTER or physician.
IF ON SKIN:
Wash with plenty of soap and water.
If skin irritation or rash occurs:
Get medical attention.
IF IN EYES:
Rinse cautiously with water for several minutes.
Remove contact lenses, if present and easy to do. Continue rinsing.
Immediately call a POISON CENTER or physician.

Storage : Store locked up.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Other hazards which do not result in classification : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Ingredient name	% by weight	CAS number
1,3-Propanediamine, N1-[3-(tridecyloxy)propyl]-, branched	35 - 50	68479-04-9
4,4'-Isopropylidenediphenol	25 - 35	80-05-7
Poly(oxypropylene) diamine	25 - 35	9046-10-0

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.
Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician.

Inhalation : Get medical attention immediately. Call a poison center or physician. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Get medical attention immediately. Call a poison center or physician. Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Get medical attention immediately. Call a poison center or physician. Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Chemical burns must

be treated promptly by a physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician	:	In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.
Specific treatments	:	No specific treatment.
Protection of first aid personnel	:	No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media	:	Use an extinguishing agent suitable for the surrounding fire.
Unsuitable extinguishing media	:	None known.
Specific hazards arising from the chemical	:	In a fire or if heated, a pressure increase will occur and the container may burst.
Hazardous thermal decomposition products	:	Decomposition products may include the following materials: carbon oxides nitrogen oxides other organic compounds
Special protective actions for fire-fighters	:	Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.
Special protective equipment for fire-fighters	:	Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel	:	No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Do not breathe vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.
For emergency responders	:	If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13 of SDS). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 of SDS for emergency contact information and section 13 of SDS for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see section 8 of SDS). Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Avoid exposure - obtain special instructions before use. Avoid exposure during pregnancy. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10 of SDS) and food and drink. Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
4,4'-Isopropylidenediphenol	**ACGIH TLV ()** Time Weighted Average (TWA) 5 mg/m3 **OSHA PEL ()** Time Weighted Average (TWA) 5 mg/m3 Form: respirable particulate **Time Weighted Average (TWA)** 15 mg/m3 Form: total dust

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. Reference should be made to appropriate monitoring standards. Reference to national guidance documents for methods for the determination of hazardous substances will also be required.

Appropriate engineering controls : If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles and/or face shield. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be

		noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.
Body protection	:	Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Other skin protection	:	Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Respiratory protection	:	Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state	:	Viscous liquid.
Color	:	Light
Odor	:	amine.
Odor threshold	:	Not available
pH	:	Not available
Melting point/ Freezing point	:	Not available
Boiling point	:	Not available
Flash point	:	Setaflash Closed Cup: 93.4 °C (200.12 °F) (ASTM D 3828)
Burning time	:	Not available
Burning rate	:	Not available
Evaporation rate	:	1 ((n-Butyl acetate=1))
Flammability (solid, gas)	:	Not available
Lower and upper explosive (flammable) limits	:	**Lower:** Not available **Upper:** Not available
Vapor pressure	:	1.33 mbar @ 20 °C (68.00 °F)
Vapor density	:	1 [Air = 1]
Relative density	:	0.96
Solubility	:	Not available
Solubility in water	:	Partial
Partition coefficient: n-octanol/water	:	Not available
Auto-ignition temperature	:	Not available

Decomposition temperature : Not available
SADT : Not available
Viscosity : **Dynamic:** Not available

Kinematic: Not available

Other information
No additional information.

Section 10. Stability and reactivity

Reactivity : Stable under normal conditions.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Strong oxidizer, Keep away from heat, sparks, flame and other ignition sources.

Incompatible materials : No specific data.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Other hazards

Heating this substance above 300 deg. F in the presence of air may cause slow oxidative decomposition; above 500 deg. F polymerization may occur.
Some combinations of resins and curing agents can produce exothermic reactions which in large masses can cause runaway polymerization and charring of the reactants
Fumes and vapors from the thermal and chemical decompositions vary widely in composition and toxicity.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
4,4'-Isopropylidenediphenol				
	LD50 Oral	Rat	3,250 mg/kg	-
	LD50 Dermal	Rabbit	3,000 mg/kg	-
Poly(oxypropylene) diamine				
	LD50 Oral	Rat	1,100 mg/kg	-
	LD50 Dermal	Rabbit	1,550 mg/kg	-

Conclusion/Summary : Not available

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation

4,4'-Isopropylidenediphenol	Skin - Erythema/Eschar 404 Acute Dermal Irritation/Corrosion	Rabbit	0	4 hrs	1 - 72 hrs
	Skin - Edema 404 Acute Dermal Irritation/Corrosion	Rabbit	0	4 hrs	1 - 72 hrs
	eyes - Cornea opacity 405 Acute Eye Irritation/Corrosion	Rabbit	1		-
	eyes - Iris lesion 405 Acute Eye Irritation/Corrosion	Rabbit	1		-
	eyes - Redness of the conjunctivae 405 Acute Eye Irritation/Corrosion	Rabbit	1		-
	eyes - Edema of the conjunctivae 405 Acute Eye Irritation/Corrosion	Rabbit	1 - 2		-
Poly(oxypropylene) diamine	eyes - Severe irritant	Rabbit			-

Conclusion/Summary

Skin : Not available
eyes : Not available
Respiratory : Not available

Sensitization

Conclusion/Summary

Skin : Not available
Respiratory : Not available

Mutagenicity

Conclusion/Summary : Not available

Carcinogenicity

Conclusion/Summary : Not available

Reproductive toxicity

Conclusion/Summary : See below for potential chronic health effects

Teratogenicity

Conclusion/Summary : Not available

Specific target organ toxicity (single exposure)

Product/ingredient name	Category	Route of exposure	Target organs
4,4'-Isopropylidenediphenol	Category 3 Category 2 Category 3 Category 2		Respiratory tract irritation central nervous system (CNS) Respiratory tract irritation central nervous system (CNS)

Specific target organ toxicity (repeated exposure)

Product/ingredient name	Category	Route of exposure	Target organs
4,4'-Isopropylidenediphenol	Category 2		bladder kidneys liver bladder kidneys liver

Aspiration hazard

Not available

Information on the likely routes of exposure : Not available

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : May give off gas, vapor or dust that is very irritating or corrosive to the respiratory system. Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure.

Skin contact : Causes severe burns. May cause an allergic skin reaction.

Ingestion : May cause burns to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain
watering
redness

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:
pain or irritation
redness
blistering may occur

Ingestion : Adverse symptoms may include the following:
stomach pains

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available

Potential delayed effects : Not available

Long term exposure

Potential immediate effects : Not available

Potential delayed effects : Not available

Potential chronic health effects

Product/ingredient name	Result	Species	Dose	Exposure
4,4'-Isopropylidenediphenol	- -	-		-
Remarks:	Bisphenol A (BPA) has been extensively tested in a wide variety of toxicological and biological tests, and has undergone many reviews internationally by a variety of governmental agencies. Many of these studies have focused on reproductive, developmental and endocrine endpoints. However, the human data is limited and insufficient to evaluate reproductive toxicity. While some studies show, or claim to show, target organ toxicity, fertility, or reproductive effects in humans; these studies lack internal and external validity as a result of flawed study design, multiple sources of bias, and lack of control for confounding factors. Numerous animal studies have been conducted and report a range of potential reproductive effects from BPA exposure. Although some studies report reproductive effects, many of these studies suffer from design flaws and reported observations have not been confirmed in larger, more robust studies. Comprehensive reviews of the scientific literature on BPA have focused on several well designed animal studies as a robust foundation for assessing BPA reproductive toxicity (e.g., NTP 1985; Ema et al. 2001; Tyl et al. 2002a, 2002b; Tyl et al. 2008; Delclos et al. 2014). In these studies, BPA was administered to rats and/or mice by the oral route of exposure including doses that far exceed those potentially experienced by humans, including workers. In these studies, either no reproductive toxicity was reported, or treatment-related reproductive effects were reported only at doses where maternal toxicity was observed. Maternal toxicity was manifest as liver toxicity, kidney toxicity, and overall depressions in body weight or body weight gains. The presence of these clear toxic effects was consistent with the role of stress and general systemic toxicity in the development of the reproductive effects at these high doses of BPA. The authors of these studies all concluded that systemic toxicity played a role in the observation of the reproductive effects. By letter dated April 6, 2015, the U.S. Food and Drug Administration ("FDA") of the U.S. Department of Health & Human Services reported that FDA's National Center of Toxicological Research ("NCTR") "recently completed a large scale rodent toxicity study designed to characterize potential effects of BPA in a wide range of endpoints, including reproductive toxicity…. The results from the large			

	extent of reproductive, sperm and hormone parameters evaluated in the NCTR study do not support BPA as a reproductive toxicant." Based on the total weight of evidence of the experimental animal data, including the lack of robust epidemiological data for reproductive effects, well-established pharmacokinetic data and the results of FDA's recent large scale toxicity study and using expert judgment, there is insufficient scientific support to associate reproductive toxicity with BPA exposure in the absence of systemic toxicity. Because experimental animal studies have indicated potential for reproductive effects in association with maternal toxicity at high doses, BPA has been classified as a Category 2 suspected human reproductive toxicant as required by OSHA.

Conclusion/Summary : Not available

General : May cause damage to organs through prolonged or repeated exposure
Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : Suspected of damaging fertility.

Numerical measures of toxicity

Acute toxicity estimates

Route	**ATE value**
Oral	2,739.5 mg/kg
Route	**ATE value**
Dermal	3,406.6 mg/kg

Section 12. Ecological information

Toxicity

Product/ingredient name	**Result**	**Species**	**Exposure**
bisphenol A			
	Acute LC50 4.6 mg/l Fresh water	Fish - Fathead minnow	96 h
	Acute NOEC 0.016 mg/l Fresh water Chronic ecotoxicity	Fish - Fathead minnow	444 d
	Acute EC50 1 - 16 mg/l Fresh water	Aquatic invertebrates. Water flea	48 h
	Acute NOEC 1.8 mg/l Fresh water	Aquatic invertebrates. Water flea	48 h
	Acute EC50 2.73 mg/l Fresh water	Aquatic plants - Microalgae	96 h
	Chronic NOEC 0.016 mg/l Fresh water	Fish - Fathead minnow	444 d
	Chronic NOEC 1.8 mg/l Fresh water	Aquatic invertebrates. Water flea	-

Conclusion/Summary : Not available

Persistence/degradability

Conclusion/Summary : Not available

Bioaccumulative potential

Product/ingredient name	LogPow	BCF	Potential
4,4'-Isopropylidenediphenol	3.4	73	low
Poly(oxypropylene) diamine	1.34	-	low

Mobility in soil

Soil/water partition coefficient (KOC) : Not available

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

The data provided in this section is for information only and may not be specific to your package size or mode of transport. You will need to apply the appropriate regulations to properly classify your shipment for transportation.

International transport regulations

Regulatory information	UN/NA number	Proper shipping name	Classes/*PG	Reportable Quantity (RQ)
CFR	2735	POLYAMINES, LIQUID, CORROSIVE, N.O.S. (TRIDECYLOXYPROPYL-1,3-PROPANEDIAMINE, BRANCHED**,** POLYOXYPROPYLENEDIAMINE)	Class 8 III	

TDG	2735	POLYAMINES, LIQUID, CORROSIVE, N.O.S. (TRIDECYLOXYPROPYL-1,3-PROPANEDIAMINE, BRANCHED**,** POLYOXYPROPYLENEDIAMINE)	Class 8 III
IMO/IMDG	2735	POLYAMINES, LIQUID, CORROSIVE, N.O.S. (TRIDECYLOXYPROPYL-1,3-PROPANEDIAMINE, BRANCHED**,** POLYOXYPROPYLENEDIAMINE)	Class 8 III
IATA (Cargo)	2735	POLYAMINES, LIQUID, CORROSIVE, N.O.S. (TRIDECYLOXYPROPYL-1,3-PROPANEDIAMINE, BRANCHED**,** POLYOXYPROPYLENEDIAMINE)	Class 8 III

*PG : Packing group

Special precautions for user : Transport within user's premises: always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.'

Section 15. Regulatory information

United States

U.S. Federal regulations : **United States - TSCA 12(b) - Chemical export notification:** None required.
United States - TSCA 5(a)2 - Final significant new use rules: Not listed
United States - TSCA 5(a)2 - Proposed significant new use rules: Not listed
United States - TSCA 5(e) - Substances consent order: Not listed

SARA 313

		Product name	CAS number
Form R - Reporting requirements	:	Phenol, 4,4'-(1-methylethylidene)bis-	80-05-7
Supplier notification	:	Phenol, 4,4'-(1-methylethylidene)bis-	80-05-7

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS

shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

California Prop. 65: : WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

Ingredient name	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
Phenol, 4,4'-(1-methylethylidene)bis-	No.	Yes.	No.	No.

United States inventory (TSCA 8b) : All components are listed or exempted.

Canada

WHMIS (Canada) : Class D-1B: Material causing immediate and serious toxic effects (Toxic).
Class D-2B: Material causing other toxic effects (Toxic).
Class E: Corrosive material

Canadian lists

Canadian NPRI : The following components are listed: Phenol, 4,4'-(1-methylethylidene)bis-

CEPA Toxic substances : None required.

International regulations

International lists : **Australia inventory (AICS):** All components are listed or exempted.
Canada inventory: All components are listed or exempted.
Japan inventory: Not determined.
China inventory (IECSC): All components are listed or exempted.
Korea inventory: All components are listed or exempted.
New Zealand Inventory (NZIoC): All components are listed or exempted.
Philippines inventory (PICCS): All components are listed or exempted.
United States inventory (TSCA 8b): All components are listed or exempted.
Taiwan inventory (CSNN): All components are listed or exempted.

Section 16. Other information

Hazardous Material Information System III (U.S.A.) :

Health	*	3
Flammability		1
Physical hazards		0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.
The customer is responsible for determining the PPE code for this material.

Full text of abbreviated H : Not applicable.

statements

History

Date of printing	**:**	08/17/2015
Date of issue/Date of revision	**:**	05/31/2015
Date of previous issue	**:**	03/08/2012
Version	**:**	9.0
Prepared by	**:**	Product Safety Stewardship
Key to abbreviations	**:**	ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = Intermediate Bulk Container IMDG = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) RID = The Regulations concerning the International Carriage of Dangerous Goods by Rail UN = United Nations
References	**:**	Not available

Notice to reader

The information provided herein was believed by Perma-Liner Industries to be accurate at the time of preparation or prepared from sources believed to be reliable, but it is the responsibility of the user to investigate and understand other pertinent sources of information, to comply with all laws and procedures applicable to the safe handling and use of the product and to determine the suitability of the product for its intended use. All products supplied by Perma-Liner are subject to Perma-Liner's terms and conditions of sale. PERMA-LINER MAKES NO WARRANTY, EXPRESSED OR IMPLIED, CONCERNING THE PRODUCT OR THE MERCHANTABILITY OR FITNESS THEREOF FOR ANY PURPOSE OR CONCERNING THE ACCURACY OF ANY INFORMATION PROVIDED BY PERMA-LINER, except that the product shall conform to Perma-Liner's specifications. Nothing contained herein constitutes an offer for the sale of any product.

Appendix I – Warrenty Information

LIMITED CURED-IN PLACE PIPE MATERIALS WARRANTY

Perma-Liner Industries, LLC ("PLI") warrants that the cured-in-place pipe materials (the "Materials"), when properly maintained and installed, will be free from defects in material and workmanship for ten (10) years from the date of delivery to PLI's customer ("Customer") or delivery to such other party as PLI's Customer may direct. PLI warrants to Customer that, when installed in accordance with applicable PLI standard operating procedures, the Materials are manufactured and supplied to the requirements of ASTMF1216, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube. THE FOREGOING WARRANTIES ARE THE SOLE AND EXCLUSIVE WARRANTIES GIVEN BY PLI WITH RESPECT TO THE MATERIALS AND ARE IN LIEU OF AND EXCLUDE ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, ARISING BY OPERATION OF LAW OR OTHERWISE, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WHETHER OR NOT THE PURPOSE OR USE HAS BEEN DISCLOSED TO PLI, AND WHETHER OR NOT THE MATERIALS ARE SPECIFICALLY DESIGNED AND/OR MANUFACTURED BY PLI FOR CUSTOMER'S USE OR PURPOSE. Customer assumes all other responsibility and liability for any loss, damage, or injury to persons or property arising out of, connected with, or resulting from the use of the Materials, either alone or in combination with other products/components. PLI neither assumes nor authorizes any person to assume for it any other liability in connection with the sale or use of the Materials, and there are no oral agreements or warranties collateral to or affecting this warranty statement or the contract to which this warranty statement is incorporated. No claim by Customer alleging defects with respect to the Materials provided hereunder shall be valid unless reasonably verified by PLI to have resulted from a defect covered hereunder.

The warranties contained herein do not extend to any losses or damages due to acts of God, misuse, accident, abuse, neglect, normal wear and tear, corrosion, abrasion, use of unsuitable lubricants, negligence (other than PLI's), modification or alteration not performed by PLI, improper installation, improper repair, improper handling, or improper application, improper or insufficient maintenance, storage outside of the recommended temperature range, infringement of a third party's intellectual property rights, or PLI's reliance on the drawings, specifications, samples, descriptions and/or other requirements, including performance specifications, provided to PLI by Customer or at Customer's direction or on Customer's behalf, or any other cause not the fault of PLI (collectively, the "Warranty Exclusions"). Without limiting any installation requirements, the Materials must only be installed in gravity fed pipes no deeper than the depth approved by a certified engineer licensed to make such determinations (or such greater depth as may be approved in advance by PLI); the pipe must consist of normal, standard sanitary sewer flows; and the installation and operation of the Materials must be consistent with the techniques required by PLI and, when not in conflict, consistent with industry practice. The occurrence of any of the Warranty Exclusions shall render the warranties provided hereunder null and void. Customer understands and agrees that the Materials shall be used only as directed and that Customer shall not modify the Materials in any way or use the Materials in any manner other than as intended by PLI. Further, Customer understands and agrees that any modification of the Materials or of any part or portion thereof presents a serious risk of personal and property damage. If Customer has any questions regarding this provision, Customer should contact PLI.

PLI shall, at its sole option and as Customer's exclusive remedy for breach of any warranty provided hereunder, repair or replace the defective Materials, or refund the purchase price received by PLI for the defective Materials. The correction of such defects by repair or replacement, or the refund of purchase price for the defective Materials, shall constitute the complete fulfillment of PLI obligations to Customer under the warranties provided herein. The term of the warranties for any Materials repaired or replaced pursuant to these Standard Terms shall continue for the remainder, if any, of the original, defective Material's warranty period.

Notwithstanding the exclusive remedies provided hereunder, if it is ultimately determined that such remedies fails in their essential purpose, then any action which may be brought against PLI subject to this Limited Cured-in-Place Pipe Materials Warranty will be limited to 100% of the purchase price received by PLI for such portion of the Materials for which the exclusive remedy has so failed. PLI assumes no responsibility and shall have no liability for any repairs or replacements by Customer without PLI's prior written authorization (including, without limitation, the costs of removing or segregating any defective Materials so that the repairs or replacements can be made).

LIMITED GOODS AND EQUIPMENT WARRANTY (NON-CIPP)

Perma-Liner Industries, LLC ("PLI") warrants that the goods and equipment (the "Products"), when properly maintained and installed, will be free from defects in material and workmanship for one (1) year from the date of delivery to PLI's customer ("Customer") or delivery to such other party as PLI's Customer may direct. THE FOREGOING WARRANTIES ARE THE SOLE AND EXCLUSIVE WARRANTIES GIVEN BY PLI WITH RESPECT TO THE PRODUCTS AND ARE IN LIEU OF AND EXCLUDE ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, ARISING BY OPERATION OF LAW OR OTHERWISE, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WHETHER OR NOT THE PURPOSE OR USE HAS BEEN DISCLOSED TO PLI, AND WHETHER OR NOT THE PRODUCTS ARE SPECIFICALLY DESIGNED AND/OR MANUFACTURED BY PLI FOR CUSTOMER'S USE OR PURPOSE. Customer assumes all other responsibility and liability for any loss, damage, or injury to persons or property arising out of, connected with, or resulting from the use of the Products, either alone or in combination with other products/components. PLI neither assumes nor authorizes any person to assume for it any other liability in connection with the sale or use of the Products, and there are no oral agreements or warranties collateral to or affecting this warranty statement or the contract to which this warranty statement is incorporated. No claim by Customer alleging defects with respect to the Products provided hereunder shall be valid unless reasonably verified by PLI to have resulted from a defect covered hereunder.

The warranties contained herein do not extend to any losses or damages due to acts of God, misuse, accident, abuse, neglect, normal wear and tear, corrosion, abrasion, use of unsuitable lubricants, negligence (other than PLI's), modification or alteration not performed by PLI, improper installation, improper repair, improper handling, improper application or improper operation or use, improper or insufficient maintenance, storage outside of the recommended temperature range, infringement of a third party's intellectual property rights, or PLI's reliance on the drawings, specifications, samples, descriptions and/or other requirements, including performance specifications, provided to PLI by Customer or at Customer's direction or on Customer's behalf, or any other cause not the fault of PLI (collectively, the "Warranty Exclusions"). The occurrence of any of the Warranty Exclusions shall render the warranties provided hereunder null and void. Customer understands and agrees that the Products shall be used only as directed and that Customer shall not modify the Products in any way or use the Products in any manner other than as intended by PLI. Further, Customer understands and agrees that any modification of the Products or of any part or portion thereof presents a serious risk of personal and property damage. If Customer has any questions regarding this provision, Customer should contact PLI.

PLI shall, at its sole option and as Customer's exclusive remedy for breach of any warranty provided hereunder, repair or replace the defective Products, or refund the purchase price received by PLI for the defective Products. The correction of such defects by repair or replacement, or the refund of purchase price for the defective Products, shall constitute the complete fulfillment of PLI obligations to Customer under the warranties provided herein. The term of the warranties for any Products repaired or replaced pursuant to these Standard Terms shall continue for the remainder, if any, of the original, defective Material's warranty period. Notwithstanding the exclusive remedies provided hereunder, if it is ultimately determined that such remedies fails in their essential purpose, then any action which may be brought against PLI subject to this Limited Goods and Equipment Warranty (Non-CIPP) will be limited to 100% of the purchase price received by PLI for such portion of the Products for which the exclusive remedy has so failed. PLI assumes no responsibility and shall have no liability for any repairs or replacements by Customer without PLI's prior written authorization.

Perma-Liner Industries, LLC
STANDARD TERMS & CONDITIONS OF SALE

1. **Agreement.** These Standard Terms & Conditions of Sale (these "Standard Terms") are the only terms and conditions pursuant to which PLI sells PLI Products to its Customers and these Standard Terms are incorporated in all Contracts entered into by PLI. If Customer objects to any of the provisions of these Standard Terms, Customer must bring such objection to the attention of PLI in a writing separate from any purchase order or other printed form of Customer, which shall be deemed to be proposals for different terms and conditions that may be accepted only in writing signed by an authorized representative of PLI. All orders are subject to the approval of PLI's credit department.
2. **Acceptance.** If Customer has not otherwise agreed to these Standard Terms, then Customer's acceptance of these Standard Terms shall take place at the earlier of delivery of Customer's written confirmation, Customer's order and delivery of PLI Products at Customer's worksite or location, or payment to PLI for PLI Products.
3. **Proposals.** Unless otherwise noted in PLI's Proposal, the Proposal shall lapse automatically upon the expiration of a thirty (30) day period after the date of its issue unless it has been previously accepted by Customer or revoked in writing by PLI.
4. **Plans, Drawing and Illustrations.** Proposal pages, catalogue illustrations and preliminary drawings are submitted only to show the general style, arrangement, approximate dimensions and weight of PLI Products. PLI reserves the right to make such changes of design, specification construction or arrangement as it deems necessary or appropriate without prior notice to Customer. PLI shall have no obligation to install or make such change in any PLI Products manufactured prior to the date of such change.
5. **Proprietary and Confidential Information.** The Proposal and all drawings, notebooks, operating data, specifications, and other information, data and material (whether orally disclosed, printed, handwritten, typed, numerically or computer generated, computer stored, or otherwise) furnished to Customer by either PLI or any of its subcontractors or sub-suppliers shall remain the proprietary and confidential property of PLI or the subcontractor or sub-supplier, respectively, and shall be used by Customer only with respect to the work covered by the Contract and shall not be used by Customer in connection with any other project. Such proprietary and confidential information and data shall not be shown or otherwise made available to any third party at any time without PLI's prior written consent. Neither Customer itself shall, nor shall Customer permit any third party to, reverse engineer, measure or otherwise technically examine or test PLI Products without PLI's prior written consent. Any such proprietary and confidential information which Customer determines must be disclosed to its employees shall only be disclosed to them on a need-to-know basis for the operation, maintenance, and repair of PLI Products provided under the Contract. Intellectual property (including, without limitation, patent) rights which may be obtained on the basis of the information given or made available to Customer under the Contract or with respect to PLI or PLI Products shall remain the exclusive property of PLI or its subcontractor and/or sub-supplier, respectively.
6. **Procedures.** Customer shall use, and shall train and require its employees to use and shall cause any end user to use, all safety devices, guards, and proper safe operating and maintenance procedures as prescribed by all applicable laws, rules, regulations, codes and standards and as set forth in operating and maintenance manuals and instruction sheets furnished by PLI in respect of PLI Products; provided, however, PLI shall have no obligation to so provide such procedures. Customer shall not, and shall cause any end user not to, (i) remove or modify any safety device, guard or warning sign; (ii) use PLI Products for any use or application not provided by the operating and maintenance manuals and instruction sheets furnished by PLI; or (iii) utilize any non-original replacement parts not specifically authorized in writing by PLI or make other changes in PLI Products without PLI's specific written authorization.
7. **Price and Payment.** The purchase price shall be paid in accordance with the Proposal. Any right to retain due payments or to set-off counterclaims shall be excluded unless any such claim or counterclaim of Customer is undisputed by PLI or has been determined by a final judgment of the competent court or arbitration panel. Any tax or other governmental charge now or thereafter levied upon the production, sale, use or shipment of PLI Products ordered or sold will be charged to and paid for by Customer. Such taxes are not included in PLI's price(s) unless expressly so stated in the Proposal. Whatever the means of payment used, payment shall not be deemed to have been effected before PLI's account has been fully and irrevocably credited. If Customer fails to pay the stipulated amount on the due date thereof, PLI shall be entitled to interest from the day on which payment was due. The rate of interest shall be one and one-half percent (1-½%) per month until the payment is made in full or, in the event such rate exceeds that permitted by applicable law, the maximum rate permitted by applicable law. Additionally, if PLI is required to expend costs and expenses in collecting any payments, Customer shall reimburse PLI for such costs of collection (including reasonable attorneys' fees). In case of late payment, PLI may suspend its performance of the Contract until it receives payment in full or may terminate the Contract upon the giving of notice required by the Contract documentation, if any. PLI's claim for compensation for the losses and damages it has incurred shall survive any such termination.
8. **Transportation.** Unless otherwise agreed to by PLI and Customer, all PLI Products shipped to domestic US locations are F.O.B. PLI's location. International shipments are FCA PLI location (INCOTERMS 2000). Carrier routing instructions shall be provided to PLI by Customer at least 48 hours prior to shipment. Shipments without Customer-specified routings shall be shipped by PLI's selected carriers. PLI Products on which manufacture or delivery is delayed due to any cause within Customer's control may be placed in storage by PLI, for Customer's account and risk, and regular charges and expenses in connection therewith shall be paid by Customer; provided, if, in PLI's sole opinion, it is unable to obtain or continue such storage, Customer will, on request, provide or arrange for suitable storage facilities and assume all costs and risks in connection therewith. When such delay is due to causes beyond control of either party, the matter of storage and the payment of charges therefore shall be negotiated in good faith.
9. **PLI's Remedies.** Without limiting any of PLI's rights or remedies pursuant to the Contract, in the event of a material deterioration of Customer's financial situation or in the event of the insolvency of Customer, PLI reserves the right to

terminate the Contract as well as the right to stop delivery of any PLI Products and to resell the same. Such a right shall not restrict or otherwise impair PLI's remedies for damages in the event of Customer's breach. Should Customer fail to comply with the terms and conditions set forth herein, or if any writ or execution be levied on any of Customer's property, or a receiver be appointed, or if a petition in bankruptcy be filed by or against Customer, PLI may, upon election, demand the entire purchase price stated in any then-pending or open orders or purchases for PLI Products not yet paid in full by Customer or may, without notice or demand by process of law or otherwise, take possession of all or any of the PLI Products, wherever located, and retain all monies theretofore paid as compensation for the reasonable use of such PLI Products. If the Contract is breached and is placed in the hands of an attorney or collection agency for collection of any balance due or enforcement of any other of PLI's remedies, Customer agrees to pay all reasonable attorneys' fees and other fees and expenses involved therein paid or incurred by PLI. Customer hereby waives any and all claims, damages and demands against PLI arising out of the repossession, retention and repair as aforesaid. All rights and remedies contained herein are cumulative and not alternative. PLI reserves all other rights and remedies at law or equity available to it in the event of Customer's breach.

10. **Limited Warranty.** Those certain PLI limited warranties as in effect on the date hereof and applicable to the PLI Purchased by Customer are incorporated herein as if fully set forth herein. To the extent products or materials are not warranted by PLI, PLI shall cooperate in good faith with Customer to enable Customer the benefit of any manufacturer's warranty applicable to such products and materials, if any.
11. **PLI's Liability; Force Majeure.** Without limiting any other provision in these Standard Terms, PLI shall not be liable for delay or loss or damage of any kind resulting from: (i) Customer failing to supply any necessary technical data, as required; (ii) Customer failing to supply the apparatus, materials and services required; (iii) any changes in designs or specifications made subsequent to acceptance of the Proposal; (iv) failure of suppliers to furnish purchased material or goods within scheduled dates; (v) by any other reason beyond PLI's control; or (vi) any delay caused by late payments by Customer. Further, PLI shall not be liable for any loss or damage from delay in completion or delivery of any PLI Products as a result of causes of any kind beyond the reasonable control of PLI, including, but not limited to, strikes or other labor difficulties, war, riots, changes in laws and regulations and other acts of governmental authorities, inclement weather, fire, flood or unavoidable casualties, any delays in transportation of materials, or PLI's inability to obtain timely delivery of materials from suppliers. In the event of any such delay, PLI will notify Customer within a reasonable time after PLI becomes aware of such cause of delay and it is agreed that the time for delivery or completion shall be extended for a period of time at least equal to the time lost by reason of the delay.
12. **Standards and Tolerances.** All PLI Product dimensions and published information are subject to change without notice. All PLI Products furnished to Customer shall also be subject to tolerances and variations consistent with usages of the trade concerning dimensions, composition and mechanical properties and normal variations in performance characteristics and quality.
13. **General Provisions.** Customer may not assign the Contract or its rights or delegate its duties pursuant to the Contract (including these Standard Terms) without the prior written consent of PLI. Any such assignment by Customer, without such consent, shall be void. These Standard Terms shall inure to the benefit of PLI and its successors and assigns. These Standard Terms supersede all other communications, negotiations and prior oral or written statements regarding the subject matter of these Standard Terms. No change, modification, rescission, discharge, abandonment, or waiver of these Standard Terms shall be binding upon PLI unless made in writing and signed on its behalf by a duly authorized representative of PLI. No conditions, usage of trade, course of dealing or performance, understanding or agreement purporting to modify, vary, explain, or supplement these Standard Terms shall be binding unless hereafter made in writing and signed by the party to be bound, and no modification or additional terms shall be applicable to the Contract by PLI's receipt, acknowledgment, or acceptance of purchase orders, shipping instruction forms, or other documentation containing terms at variance with or in addition to those set forth herein. Any such modifications or additional terms are specifically rejected and deemed a material alteration hereof. If this document shall be deemed an acceptance of a prior offer by Customer, such acceptance is expressly conditional upon Customer's assent to any additional or different terms set forth herein. No waiver by either party with respect to any breach or default or of any right or remedy, and no course of dealing, shall be deemed to constitute a continuing waiver of any other breach or default or of any other right or remedy, unless such waiver be expressed in writing and signed by the party to be bound. All typographical or clerical errors made by PLI in any quotation, acknowledgment or publication are subject to correction.
14. **Dispute Resolution; Governing Law.** Any determination, agreement or performance which is disputed or cannot be made, resolved or agreed within fourteen (14) days of the date requested by either Customer or PLI or such longer period for resolution as may be mutually agreed shall be submitted for resolution by the chief executive officers of Customer and PLI. It shall be a condition precedent to any subsequent proceeding that the dispute shall be submitted for resolution by such chief executive officers, but if those officers shall not reach a resolution within twenty-one (21) days of submittal to them, then the matter shall be finally settled by arbitration under the Rules of the American Arbitration Association by one or more arbitrators appointed in accordance with such Rules. The place of arbitration will be Clearwater, Florida. The contract between PLI and Customer and their respective performances shall be construed under and governed by the laws of the State of Illinois; provided, however, no action, regardless of form or dispute resolution mechanism, arising out of transactions relating to the Contract, may be brought by either party more than two (2) years after the cause of action has accrued. The U.N. Convention on Contracts for the International Sales of Goods shall not apply to this agreement.
15. **Definitions.** In these Standard Terms:
    A. "Contract" means the contract between PLI and Customer for the supply of PLI Products which will comprise these Standard Terms, the limited warranties applicable to each PLI Product purchased by Customer, PLI's Proposal, any documents referred to in the Proposal as forming part of the contract, Customer's order and PLI's confirmation of that order (or Customer's unqualified acceptance of the Proposal);

B. “PLI Products” means the products and materials to be supplied to Customer by PLI under the Contract;
C. “Proposal” means PLI’s written proposal or quotation to Customer for the supply of PLI Products;
D. “Customer” means the person identified as the purchaser of PLI Products in the Proposal and the Contract; and
E. “PLI” means Perma-Liner Industries, LLC.