ALTERNATIVE
LINING TECHNOLOGIES

CURED-IN-PLACE MANHOLE LINING SYSTEMS

Brief History of
Alternative Lining Technologies AltLiner™ CIPM™ Lining System

Alternative Lining Technologies started in 1998 as a division of a major pre-caster in the mid-Atlantic region, being a pre-caster they knew the environmental conditions its wastewater products faced; conditions which lead to the corrosion and sometimes failure of many underground structures. Recognizing that new materials technology in pre-cast products, there are still substantial problems in the world's aging infrastructures. *Corrosion by the acids inherent in waste-water systems deteriorate structures to weakness and failure; infiltration of groundwater into the waste-stream adds to the volume of wastewater and the cost to treat it; and exfiltration of the waste-stream into the local environments of both municipalities and industry can cause serious environmental problems*. We started looking for answers and found there were many products that offered temporary or partial solutions, historically, none offered a truly long-term solution.

We found what we recognized as a premier solution*: a pressurized cured-in-place lining system that was bounds ahead of then current solutions in the trenchless solutions marketplace. We acquired the patent rights which our first-generation liners were based upon, and in 1998 we formed the Composites Division to advance them.* ***Shortly after, we started manufacturing and installing our first Alternative Lining Technologies AltLiner™ CIPM™ lining systems****.*

The AltLiner™ CIPM™ Lining System

From the beginning our corporate credo is "No Better Solution"; we are simply not a company to rest on past achievements. We submitted our liner for testing to the Los Angeles County Sanitation District's *Evaluations of Protective Coatings for Concrete.*

We learned that like other epoxy-coated fiberglass liner types, the epoxy itself was susceptible to the acid conditions meant to mimic a time-condensed real-world exposure. Further, we noted the corrosion was arrested by our PVC membrane which was sandwiched in between layers of epoxy-coated fiberglass. We redesigned our liner to have this highly functional protective layer moved to where it was needed most: as a protective shield directly facing the acids. The results were as expected: *The PVC halted the corrosion and protected the other lining components sandwiched between it and the lined structure:* ***Thus was born our patented AltLiner™ CIPM™ liner types.***

The Continued Pursuit of Excellent Solutions

Though the performance of the AltLiner™ CIPM™ Lining System is proven, and clearly sets us apart from any competition, we questioned if we could offer an even more refined product. We decided to work towards sealing our liner seams and patented the use of fused-seam technology in the pressure-assisted, cured-in-place lining of manholes. We have developed, and currently manufacture and install, the ***AltLiner™ CIPM™ Liner Type.***

Installer Network

From liner inception to current day we search for quality trenchless company to work alongside to install our liners nationally. We pride ourselves in certifying those companies that meet or exceed our high quality of standards. By requiring our installer to these high standards we assure the end user a high quality product for years to come.

Solutions to Problems and Filling Customer Needs

We adopted the name *Alternative Lining Technologies* so as not to limit ourselves, and to cultivate an open attitude toward future growth and development of solutions that serve our customers' needs. *We work with our customers to make sure not only that they get what they need, but that they are satisfied in our joint pursuit from beginning to end to tomorrow*.

We sincerely look forward to providing a solution-based product for your .

Respectfully,

Alternative Lining Technologies

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Why the AltLiner™ CIPM™ Liner?

The AltLiner™ CIPM™ Liner is superior to other cured-in-place liners with respect to resistance to sulfuric acid, and the AltLiner™ CIPM™ Liner can be uniquely designed to withstand specific ground water pressure by means of liner thickness.

Briefly, this submittal addresses how we established what is important with respect to lining a manhole.

We selected the materials that survive over the long term in a sewer environment. *PVC has a proven life expectancy of over fifty years.* Sizing the material thickness based on structural values and failure analyses followed. Preservation of the initial assumptions is important to reach reliable performance. Therefore, we explain how to preserve these values in a corrosive environment. Our warranty conditions spell out the integrity of our liner both in legal and business terms.

The AltLiner™ CIPM™ Liner derives its durability from three principal sources.

1. Structural preservation and integrity of the liner shell, which in a circular manhole develops an arch shaped free body diagram.
2. Bonding of the resin to the host structure.
3. Chemical stability in a sewer environment because of the *PVC layer that is in direct contact with the sewer gas.*

Designed Liner Strength

In practice, it is reasonable to assume that the liner will not bond to all manhole surfaces because of trapped air or open joints in the host structure. However, the sum total of bonding is responsible for stopping virtually all infiltration through the lined surfaces.

Where the liner is not bonded, water pressure may build up between the liner and the host structure. This is where the liner will develop resistance to the water pressure because of its arch shape, thickness and material characteristics.

The key characteristics are:

- Compressive Strength in lbs/in^2
- Modulus of elasticity lbs/in^2. According to ASTM D-695, we found the values applicable to our liner.

Other values such, as tensile strength, flexural strength etc, serve no merit in defining what preserves our liner's free body diagram. For that reason we do not test for other values. We use a formula to select a necessary liner thickness at a specific diameter and hydrostatic head. The attached "*Patent002 w_illus"* sheet shows the values and correlations.

All the above is only good if the values are stable. We know that in a sewer environment the chemical stability of structural materials are at great risk because sewer gases induce the forming of sulfuric acid. *We know from the points discussed below that in the Los Angeles County Sanitation district test-environment, epoxy does not survive. Henceforth we put the PVC in direct contact with the sewer gas. This idea also received a patent for the AltLiner™ CIPM™ Liner on April 1, 2003.*

Custom-Made Liners
Every liner we supply is prefabricated to the specific dimensions of a real-world structure; that is, each is "tailor-made". We travel to specific sites to measure specific structures and to note specific site conditions.

Heat & Pressure Curing
A key application benefit comes from curing our liners under pressure and with heat. Each custom made liner is resinated and lowered into the parent structure, and aligned using factory-applied marks. Pressure is introduced with air, which forces the resin into the crevices and pores of the host structure. Heat is introduced with hot water so that the liner cures in a state of compression (into the wall. Spray applied products tend to pull away from the wall the moment after application and then cures in a state of tension (away from the wall. We believe a compression cure is better.

Skilled and Certified Installers
Alternative Lining Technologies Composites only certifies and/or licenses select installers to install our AltLiner™ CIPM™ Lining System. In total, our installers have the most cured-in-place manhole lining experience than any similar company in the country.

Acid Resistance & Protected Designed Liner Thickness
The Los Angeles County Sanitation District's "Redner tests" for the *Evaluations of Protective Coatings for Concrete* put perspective on the survivability of liners in their acid bath test. The difference between the AltLiner™ CIPM™ Liner and like liners is unmistakable.

The 2002 Update results show clearly that the AltLiner™ CIPM Liner™ (test unit C-91) preserves the epoxy and fiberglass sandwiched behind the PVC. This means the AltLiner™ CIPM™ Liner had lost nothing of its original design materials; it was 100% of what it was new. PVC has a proven life expectancy in sewer environments of over 50 years.

Page 31 of the August 1998 Update describes the performance of the epoxy-coated fiberglass test unit C-73. The inner layer of fiberglass is shown not to be a dependable layer because it actually crumbles away over the long term. Once that layer is gone, the liner is virtually 50% of what it was new.

The data also describes that the impact of sulfuric acid on the epoxy resin of our test units C-85 and C-86 (listed on page 13 of the 2002 Update matched the description of the performance of the C-73 test liner mentioned above.
For this reason, and because it is unilaterally true that PVC has better chemical stability than the epoxy tested in liners C-73, C85 and G86 we made a significant design

change: In test liner C-91, we moved our highly functional PVC from its sandwiched position (between epoxy-coated fiberglass layers to the *first-line-of-defense* position: directly facing the acid bath. **Its performance in the testing showed the PVC of the AltLiner™ CIPM™ preserved the epoxy and fiberglass components protected behind it**.

It is important not to dismiss sewer gas corrosion as less important than infiltration prevention. Imagine the effect that reduced infiltration will have on developing hydrogen sulfide gas. Absent infiltration-water, the sewage will go septic due to the higher waste concentration. The higher the acid levels, the faster you will lose the structural integrity of the epoxy / fiberglass layer that is not protected by PVC (as described above). All of the layers of our AltLiner™ CIPM™ Liner System are protected by PVC; we do not manufacture or install epoxy-coated fiberglass, PVC-sandwich style liners.

*In this way, by protecting all fiberglass and epoxy with PVC**, our patented AltLiner™ CIPM™ Liner outperforms other CIP liners** that protect only half of their epoxy and fiberglass layers.*

Non-Prorated Warranty Backed by Company History
Alternative Lining Technologies set the standard with our 10-year non-prorated warranty and we'll be here if you ever have a problem with any of our products.

Maintain Your Asset Value
Alternative Lining Technologies' 10-year, non-prorated warranty can be a great value to a utility owner, since GASB 34 (Government Accounting Standards Board requires municipalities to place asset values on their infrastructure. With a non-prorated warranty, the asset value remains fixed at least at the cost of rehabilitation for the entire warranty period. This also allows the rehabilitation costs to be amortized over the same period.