



## TRENCHLESS CURED-IN-PLACE PIPE

RENEWAL AND REHABILITATION SOLUTIONS FOR I & I MITIGATION

MAINLINES

LATERALS

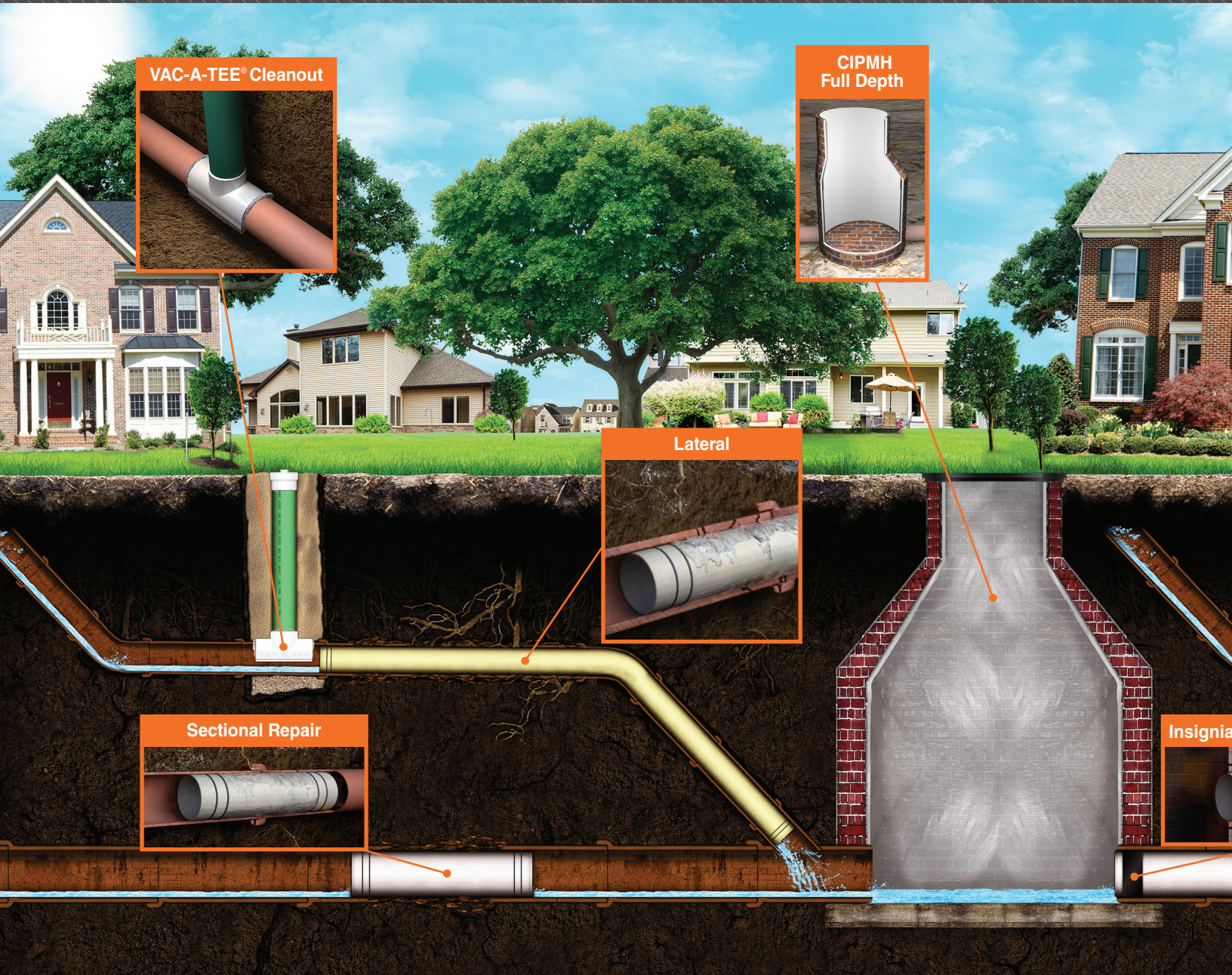
MANHOLES

GASKET SEALS

EQUIPMENT

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# LMK Solutions for Renewing Sewer System Integrity



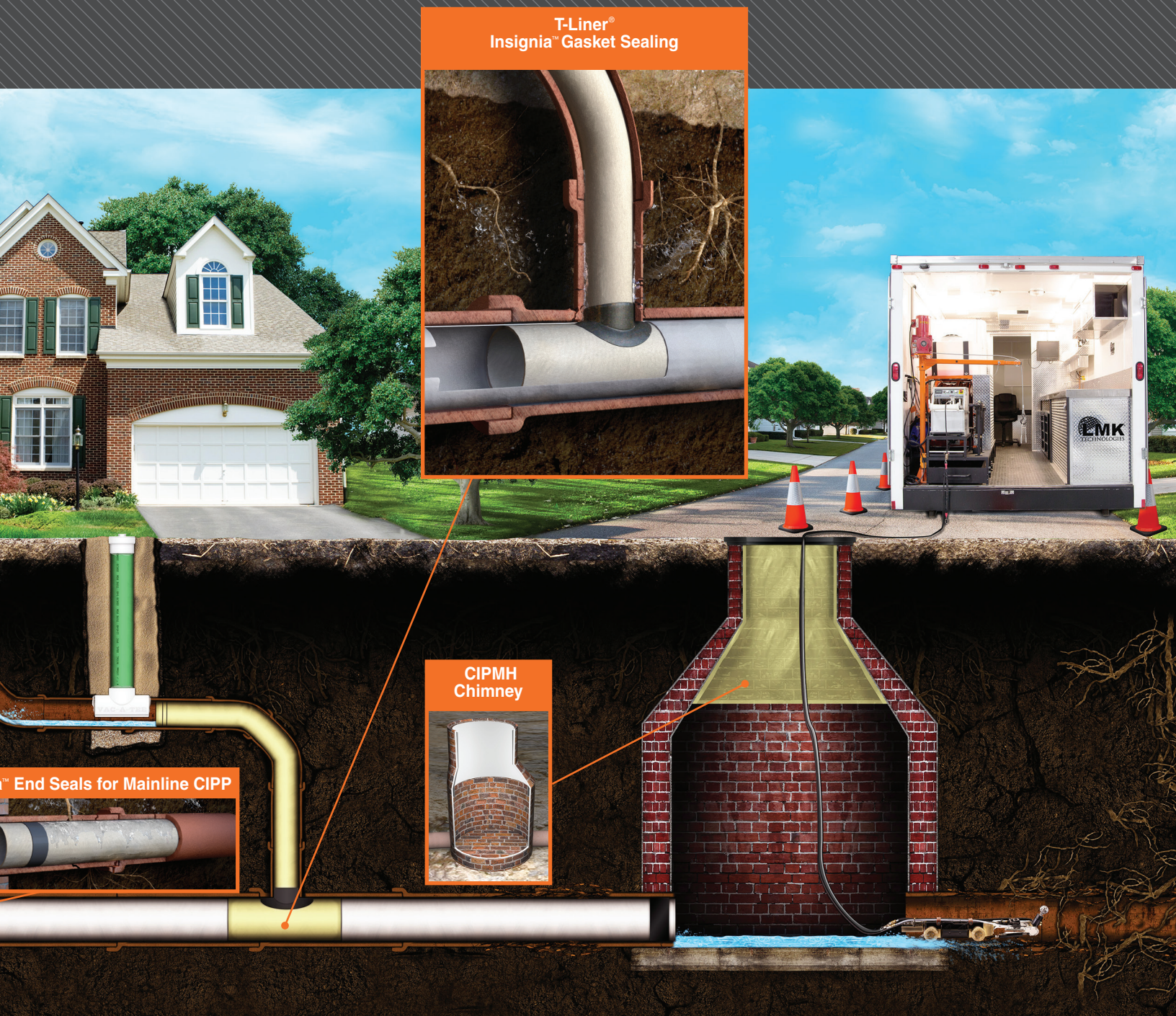
LMK Technologies has been at the forefront of virtually every significant advancement in trenchless CIPP technology, even before its formal incorporation in 1993. Founder, Larry Kiest Jr., and the LMK Technology Team have an extensive world-wide patent library covering the design, materials, application and installation equipment for trenchless sewer rehabilitation products.

LMK has been instrumental in the drafting of several governing ASTM standards: F2599, F2561, F3033, F3097 and F3240 for CIPP mainline sectional repairs, the rehabilitation of CIPP service main-to-lateral connections, manhole lining, installation of an outside cleanout by vacuum excavator and the installation of seamless molded hydrophilic gaskets, respectively.

Similarly, LMK Technologies continues to play a leading role in the advancement of CIPP technology and the development of best practices through active participation in the industry's most prominent trade associations, including:

- North American Society for Trenchless Technology (NASTT)
- International Society for Trenchless Technology (ISTT)
- National Association of Sewer Service Companies (NASSCO) and its Lateral Assessment and Certification Program (LACP)
- Water Environmental Federation (WEF)
- American Water Works Association (AWWA)
- American Society of Civil Engineers (ASCE)





**T-Liner®  
Insignia™ Gasket Sealing**

**CIPMH  
Chimney**

**™ End Seals for Mainline CIPP**

## Technology Solutions

### Main-to-Lateral Connections

- T-Liner® one-piece connection system
- Insignia™ compression gasket seals
- VAC-A-TEE® trenchless cleanout installation method

### Lateral Service Line Renewal

- Performance Liner® lateral lining

### Mainline Repair

- Performance Liner® sectional spot repair system
- Insignia End Seal compression gaskets
- Sectional Connection spot repair with lateral

### Manhole Rehabilitation

- CIPMH (cured-in-place manhole), full-depth liner
- CIPMH chimney liner

### CIPP Equipment Used to Install LMK Technologies

- Fully equipped, turnkey wet-out trailer systems and boiler steam trucks
- Picote™ cutter systems

## Materials

- Liner materials are offered in a variety of polymer-based, felt-backed textiles to best suit application specifications. Liners are assembled in LMK's state of the art factory. A variety of resin systems are available to meet application requirements.
- All LMK products and proprietary installation equipment are made in the United States.



# Main-to-Lateral Connections

## Municipal sanitary engineers face difficult challenges in sewer renewal projects -

**Root Intrusion:** According to the U.S. Environmental Protection Agency (EPA), root intrusion is "...the most destructive single element facing those maintaining a wastewater collection system."

**Faulty Joints and Fractured Pipe:** Most industry experts agree that as much as 60% of inflow results from faulty pipe joints and fractured sections within a lateral. Areas with heavy annual rainfall and high water tables only exacerbate the force of hydrostatic pressure.

**Excavation:** The adverse impacts of excavation on the roads, traffic, other utilities and adjoining property owners are expensive and are often unnecessary aggravations to be avoided, if at all possible.

## CIPP trenchless technologies address these issues, but different technical concerns must not be overlooked -

**Adhesion:** CIPP linings will not adhere to the host pipe because of improper surface preparation, incompatibility of materials and the presence of fats, oils and grease (FOG). This results in an annular space where roots and water can track.

**Annular Space:** All thermoset resins shrink during the curing cycle. This also results in an annular space between the liner and host pipe, allowing groundwater to travel behind the liner and migrate back into the collection system.

**Engineers must require solutions that address both adhesion and the annular space.**

## T-LINER® WITH INSIGNIA™ GASKET SEALING TECHNOLOGY

An engineered main-to-lateral CIPP solution that:

- Fully restores the structural integrity of the host pipe
- Provides a reliable long-term resistance to root intrusion
- Ensures a sealed watertight system with verifiable non-leaking molded compression gasket seals

LMK's T-Liner is an engineered, full-circle structural main-to-lateral connection that also renews lateral pipes in one continuous length up to 200 feet without cold joints. Fully compliant with ASTM standards, this rehabilitation system can be designed and stamped by a licensed P.E. from the installation state for both the lateral and the main-to-lateral structural connection.



**LMK T-Liner is fully compliant with the design, engineering and installation requirements of:**

- **ASTM F2561** – Standard Practice for Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One-Piece Main and Lateral Cured-In-Place Liner



## T-Liner Key Factors

- One-piece, full circle and homogenous main and lateral CIPP connection liner with a uniform wall thickness of absorbent textile material that also meets the requirements of ASTM D5813, (Sections 6 and 8), the standard specification for CIPP thermosetting resin sewer pipe.
- Compressible liner material manufactured on the mainsheet provides a smooth tapered transition to the host pipe at both the upstream and downstream ends.
- The resin system — corrosion-resistant polyester, vinyl ester, epoxy or silicate resin and catalyst — produces a CIPP that fully complies with ASTM physical and chemical requirements for a fifty plus year design life.
- The liner is impregnated with the resin system under controlled vacuum conditions and inverted through the lateral. Pipe cracks and voids are filled through resin migration, 18 inches of the mainline connection is structurally renewed, and the lateral liner can be inverted up to a maximum length of 200 feet.
- Curing is accomplished within two hours at ambient temperature or in as little as thirty minutes with steam.
- The lateral connection utilizes an engineered, molded one-piece, flexible long-term compression gasket sealing system.
- T-Liners may be installed in mainline pipe sizes from six inches to twenty-four inches in diameter. They can be manufactured in TEE or WYE designs.
- Each liner is permanently marked with a lateral identification label for future reference.

**Other LMK Main-to-Lateral Configurations:** LMK's "Shorty" and "Stubby" are designed for municipalities requiring the value and quality of a watertight connection seal without the costs or legal issues associated with cleanout installations. Each model is a one-piece, structural, stand-alone homogenous main-to-lateral CIPP connection incorporating all the performance factors and benefits of T-Liner. Both products provide 16 inches of structural mainline lining, with Shorty extending two to fifteen feet up the lateral and Stubby providing six inches of lateral lining.

## VAC-A-TEE® CLEANOUT SYSTEM

VAC-A-TEE is a trenchless outside cleanout system that allows access to the lateral pipe for cleaning, inspection and lateral lining. It consists of a patented VAC-A-TEE saddle and riser pipe affixed with adhesive.

VAC-A-TEE meets the ASTM F3097-15 Standard, a practice for installation of an outside sewer service cleanout through a minimally invasive small bore created by a vacuum excavator.



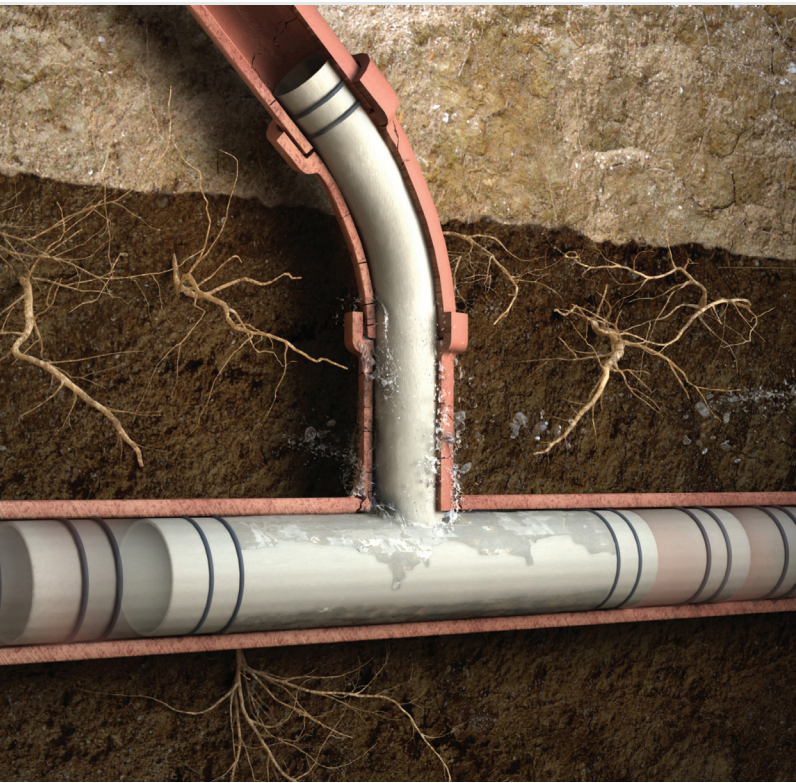
### VAC-A-TEE Key Features

- Vacuum excavation eliminates the potential hazards of digging up buried gas and water utility lines; it minimizes homeowner disruption, with no damage or restoration to landscape.
- Compatible with all pipe types, including clay, cast iron, concrete, PVC and even HDPE.
- The patented snapping design of the saddle and proprietary adhesive/sealant provides a fail-proof, high-strength bond to the host pipe.
- For lateral pipe sizes from four to 24 inches and lateral depths to 20 feet.





## Main-to-Lateral Connections, Cont.



### SECTIONAL CONNECTION LINER

Frequently in an unlined mainline a spot repair needs to be made near or adjacent to a lateral service line. Once the repair is made, the service line has to be reinstated and the repair is only structural since the reinstatement process allows infiltration to enter the collection system at the connection.

The Sectional Connection Liner combines the best of both an LMK Performance Liner® Sectional Spot Repair and a main-to-lateral connection repair. This system simultaneously renews a short section of mainline pipe and lateral pipe without the need for reinstatement.

The Sectional Connection Liner provides a watertight, structural repair. Four molded mainline O-Rings at the ends of the spot repair and two lateral O-Rings at the lateral termination, all made of hydrophilic rubber, create a verifiable watertight seal. Installed as a one-piece main-to-lateral liner through air inversion, the repair has a smooth interior finish. Both the mainline and lateral portions are designed per ASTM F1216, appendix X1.



### LARGE DIAMETER MAN ENTRY LAPEL LINER

The Lapel Liner is a trenchless solution for rehabilitating the main-to-lateral connection in lined or unlined large diameter main pipelines via man entry.

The patent pending LMK Lapel Liner does not depend upon the resin bonding to either a CIPP lining or to the host pipe. The mechanically anchored connection liner cannot fall away from the main pipe unlike competitors' "top hat or brim style" liners that do not utilize hydrophilic materials or stainless steel compression rings.

Designed for mainline diameters from 27 inches to 60 inches with lateral diameters from four inches to 24 inches with a standard lateral length of 18 inches. Each liner includes the use of a hydrophilic compression gasket at the connection which ensures a verifiable watertight seal. The liner is mechanically anchored by stainless steel fasteners and has been engineered to withstand specific hydrostatic loading.



# Verifiable Watertight Sealing



## THE INSIGNIA™ SEALING SYSTEM

It is commonly understood that CIPP liners do not bond with the host pipe. The presence of fats, oils and grease (FOGs) are major issues. Additionally, resins shrink due to polymerization, losing as much as five percent of their volume, and all thermoset liners are subject to thermal expansion/contraction and creep. This results in an annular space between the liner and host pipe, allowing groundwater to migrate behind the new lining and re-enter the collection system at lateral connections and mainline sectional repairs. LMK has developed the line of Insignia molded compression sealing gaskets as a solution to address these problems.

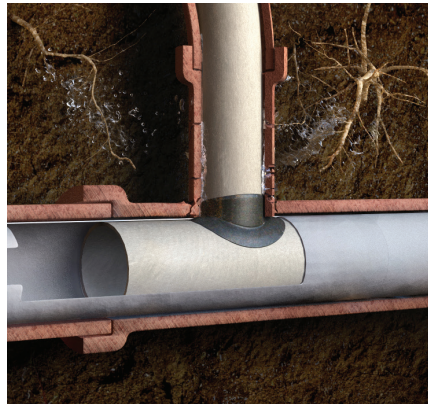
These gaskets meet the ASTM F3240 Standard, a Practice for Installation of Seamless Molded Hydrophilic Gaskets (SMHG) for Long-Term Watertightness of Cured-in-Place Rehabilitation of Main and Lateral Pipelines.

When exposed to water, engineered and molded Insignia hydrophilic Neoprene<sup>1</sup> gaskets swell to create a positive compression seal that prevents water tracking between the liner and host pipe. The cylindrical shape of Insignia gaskets generates uniform compression to form a highly effective seal with all types of piping.



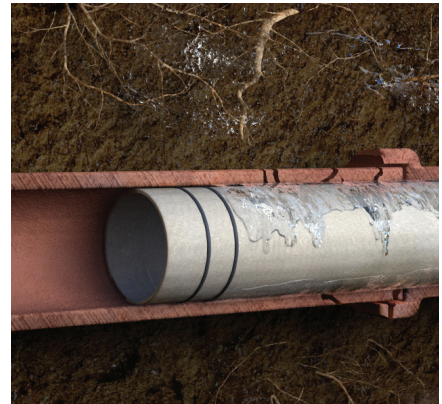
### End Seal

- This seamlessly molded end seal provides a large 360° sealing surface, guaranteeing a uniform watertight seal. Installed with mainline CIPP at the manhole penetration.



### Connection Hat

- It provides a positive 360° compression seal at the main-to-lateral pipe connection.



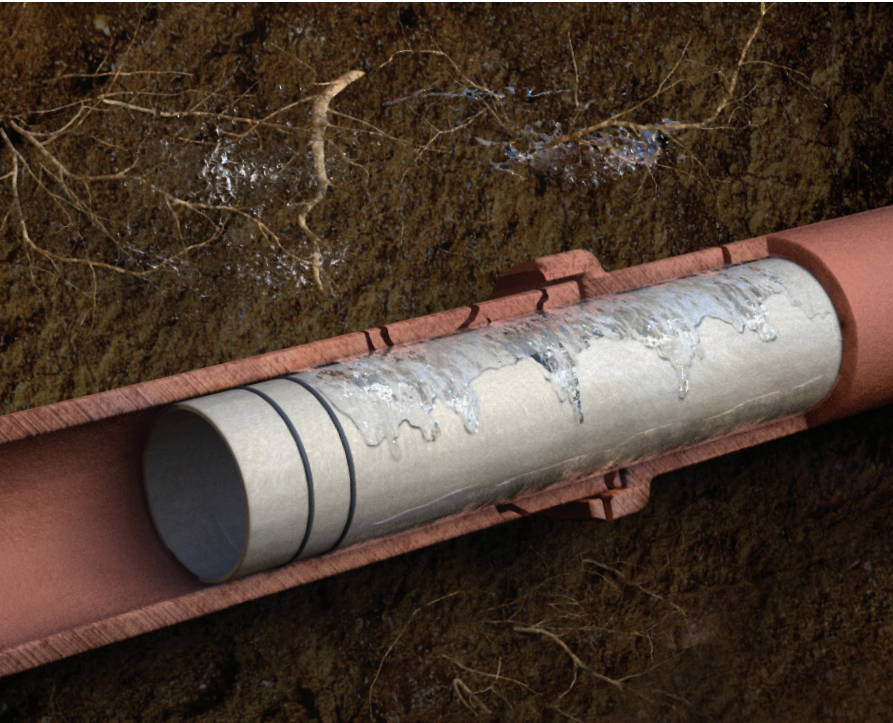
### O-Rings

- They are proven as a long-term solution for sealing lateral lining terminations, a lateral liner overlapping a connection seal and for sealing sectional liner terminations.

<sup>1</sup> LMK Insignia gaskets are manufactured of Neoprene, a synthetic rubber made from chloroprene polymers. Neoprene is an extremely durable and chemically inert material that is widely used in waterproofing applications.



## Lateral and Mainline Repair



### PERFORMANCE LINER® LATERAL LINING

The LMK lateral lining system is a unique cured in-place process that allows the installer the freedom to position the liner anywhere in the pipe by inverting it through a cleanout. The liner can be directed either upstream or downstream using LMK's patented guide shoe. LMK's Lateral System is truly a no-dig solution for renewing lateral pipes, since the entire process can be completed through an inside or outside cleanout or manhole. Gasket sealing O-rings are placed at the upstream and downstream ends of the liner, providing a verifiable, non-leaking lateral liner that is compatible with all types of piping. This process renews laterals from four to eight inches in diameter in continuous lengths up to 130 feet.



### SECTIONAL SPOT REPAIR

LMK's Performance Liner® Sectional System meets the design calculations found in ASTM F1216, Appendix XI and the standard practice of ASTM F2599, the Sectional Repair of Damaged Pipe by Means of an Inverted Cured-in-Place Liner. It is a unique, one-step, air-inversion spot repair process that prevents resin contamination and loss, which are key to a successful CIPP installation.

This system renews mainlines from six to 42 inches in diameter and from three to 100 feet in length. When installed with Insignia O-Rings at the terminating ends, the Sectional Spot Repair offers a watertight as well as structural repair.



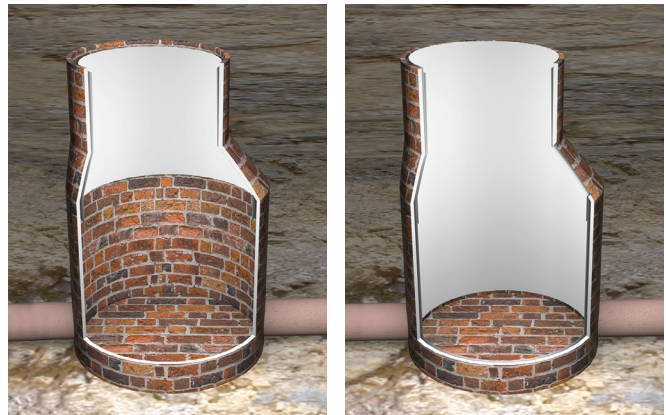
# Manhole Rehabilitation and Saddle Kits

## CIPMH LINERS

Effective manhole rehabilitation is necessary to remove I&I, enhance structural integrity and address public safety issues. Deteriorating manholes are also major contributors to sanitary sewer overflows (SSOs).

The LMK CIPMH (cured-in-place manhole) solution is a unique, one-piece, resin-saturated liner designed to reduce I&I and renew structural defects in a variety of manhole configurations and sizes, including barrel sections, eccentric and concentric cones constructed of brick and mortar, pre-cast or cinderblock. This one size fits most, reinforced and stretchable CIP liner is engineered to resist traffic loading and freeze-thaw cycles while creating a corrosion-resistant lining.

Available for chimney or full-depth manhole rehabilitation projects, the CIPMH vacuum-impregnated liner is pressed against the existing manhole by a pressurized bladder until the thermoset resins have cured ambiently, typically within two hours.



- **CIPMH Chimney:** A stretchable, non-woven textile tube (fiberglass reinforcement available) with a silicate-based thermoset resin.
- **CIPMH Full Depth:** Woven textile tube with a corrosion-resistant polyester resin system.



**Lined Main Tap (LMT™) Saddle System**



**LMK Saddle System**

## LINED MAIN TAP (LMT™) AND LMK SADDLE SYSTEMS

The LMT™ (Lined Main Tap) Saddle Installation System is engineered to connect a lateral sewer service pipe to a liner inside a rehabilitated mainline.

The LMK Saddle Installation System is designed to connect a lateral sewer service pipe directly to a mainline pipe.

- The saddle is sized to surround the liner or pipe beyond the spring line, which creates a clamping effect that draws the saddle firmly to the liner or the pipe.
- The universal LMK Adhesive bonds the saddle to the liner or host pipe, providing a flexible non-leaking main/lateral connection. A special two part adhesive is available for HDPE liners/pipes.
- The saddle is compatible with CIPP and fold and form liners.
- The saddle is also compatible with a variety of pipes including cast iron, clay, concrete, PVC and HDPE.
- A variety of saddle sizes are available - for pipes ranging from six inch to 24 inch.



# LMK Provides Innovative Engineered Solutions

## RESEARCH AND DEVELOPMENT

With an in-house Technology Team, LMK is positioned to provide industry-leading solutions. Working with municipalities, engineers and contractors, we test solutions both internally and in the field before releasing to the industry.

## TRAINING

All of LMK's independent licensed contractors complete a comprehensive training protocol that includes classroom, laboratory and in-field situations. Trainers are available 24/7 to answer questions from the field and address any issues that arise on the job site.

## EDUCATION

LMK is proud of the Interactive Technical Education Center (ITEC) located in Ottawa, Illinois. Used for company and industry training events and demonstrations, ITEC is home to NASSCO Inspector Training and Certification Program (ITCP) classes.

Regional seminars hosted by LMK earn participants PDH credits and are regularly attended by professional engineers and industry experts.

## WARRANTY

All LMK liner products are backed by a Ten-Year Limited Cured-In-Place Pipe Materials Warranty to be free from defects in material and workmanship.





# Questions to Ask When Comparing Lining Systems

## UNDERSTANDING THE SPECIFICATION

- What Technology is being used? What “generation” of main-to lateral liner is it?
- Does the main-to-lateral connection lining system comply with ASTM F2561?
- How many and which ASTM standards does the technology comply with?
- What is the longest length of the lateral than can be lined in one inversion process?
- What is the structural design of the mainline portion and lateral?
- What is the service life expectancy?

## THE BIDDING PROCESS

- How many contractors using the specified technology will be bidding on the project?

## MATERIAL QUALITY ASSURANCE

- Where are materials manufactured and where are they assembled?
- What Quality Control documentation is available?

## SYSTEM INFILTRATION SEALING ATTRIBUTES

- What is the sealing method at the connection?
- What is the sealing method at the lateral termination?
- Does the sealing system include a mechanical seal?

## INSTALLATION

- Do the crews participate in an intensive training program?
- Will there be homeowner or homeowner landscape disruption?
- How will flow from the home be mitigated?
- How long does installation take?
- How will lateral termination quality assurance be monitored?
- If they steam cure, where will they vent? Through the house?

## WARRANTY

- What is the manufacturer's and contractor's length of warranty for materials and installation?





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