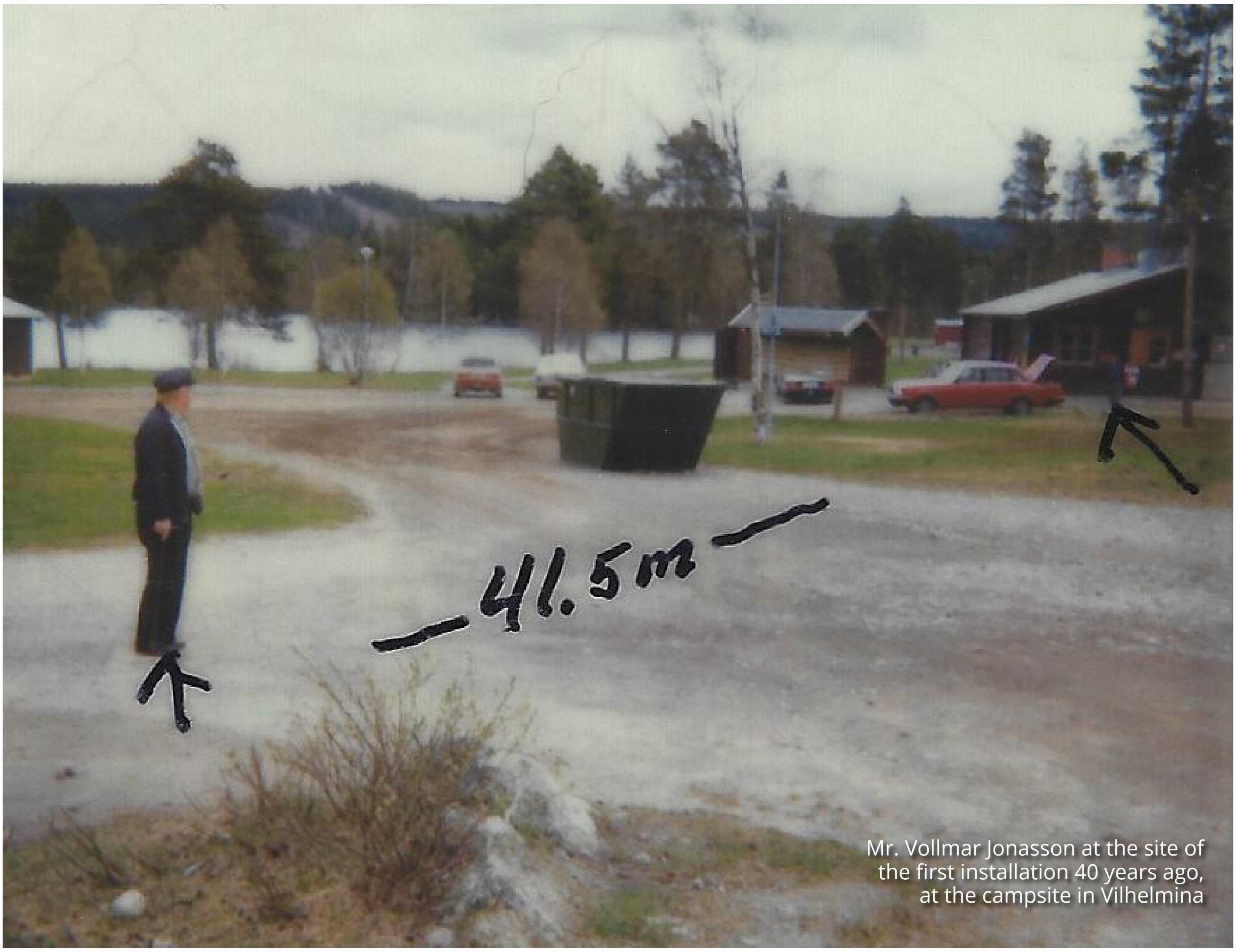
Celebrating an historic milestone in UV Light-Cured CIPP technology



Mr. Vollmar Jonasson at the site of the first installation 40 years ago, at the campsite in Vilhelmina

Cured in Place Pipes (CIPP) technology has been pivotal in pipeline rehabilitation worldwide since its inception in the 1970s. This year, we celebrate the 40th anniversary of the first commercial installation of UV Light-cured CIPP, a groundbreaking advancement in trenchless technology.

Historic installation

This historic installation took place in September 1985 at a campsite in Vilhelmina, a quaint village located 300 km south of the Arctic Circle in northern Sweden. It marked the debut of the first commercially sold Inpipe liner, installed into 42 meters of DN 150 mm gravity concrete host pipe. This feat was made possible through bespoke installation equipment designed by Jan Borje Persson, who many readers will recognise as the Managing Director of JBP Composites S.L. Reflecting on this installation, Borje recalls the close collaboration with his former boss, friend, and trenchless pioneer Mr. Vollmar Jonasson, who invented the UV light-cured “Plast Strumpan” or “Plastic Stocking.” Jonasson’s patents date back to 1977, paving the way for this innovative technology.

It’s remarkable to reflect on how this invention, which meant liner could be produced and impregnated in a factory, stored, and transported to the site without risk of “pre-curing”, only requiring protection from sunlight, has evolved into one of the fastest-growing trenchless rehabilitation techniques for pipeline networks worldwide.

During the installation, the factory-impregnated glass fibre sleeve, which was shielded both inside and outside by tubular thermoplastic foils, was inverted using air. The light trolley (yes, only one trolley) was installed and pulled to the receiving manhole manually. It was later retrieved using an electrically driven cable winch.

Evolution of liner materials

Returning to materials and liner design, the earliest CIPP systems introduced to the market utilised synthetic fibers as the resin carrier. In these designs, strength and ring stiffness were derived primarily from the resin's wall thickness and its degree of cure. With the introduction of fiberglass, the liner gained a true structural reinforcement layer, enabling a dramatic increase in the cured pipe's mechanical performance while reducing overall wall thickness, an approach commonly referred to as unisotropic design. Thus, the breakthrough lay not only in the curing technology but also in the evolution of liner materials and structural design.

The patented reinforcement concept developed in 1977–78 featured a unique fiberglass architecture consisting of 96 individually woven fiberglass tapes, each 5 mm wide, braided into a flexible tubular structure. As the liner expanded during installation, the orientation of the braided "sock" shifted, and the fibers adopted a more circumferential alignment. This transformation substantially increased the ring stiffness of the cured pipe without requiring additional wall thickness. It was, by any standard, an elegantly engineered solution.

One early drawback, however, was that the liner shortened as its diameter increased, which caused creasing in the inner layer. This issue was later resolved by adjusting the thermoplastic components and the internal reinforcement layer, while retaining the use of pure fiberglass.

Innovative installation technologies

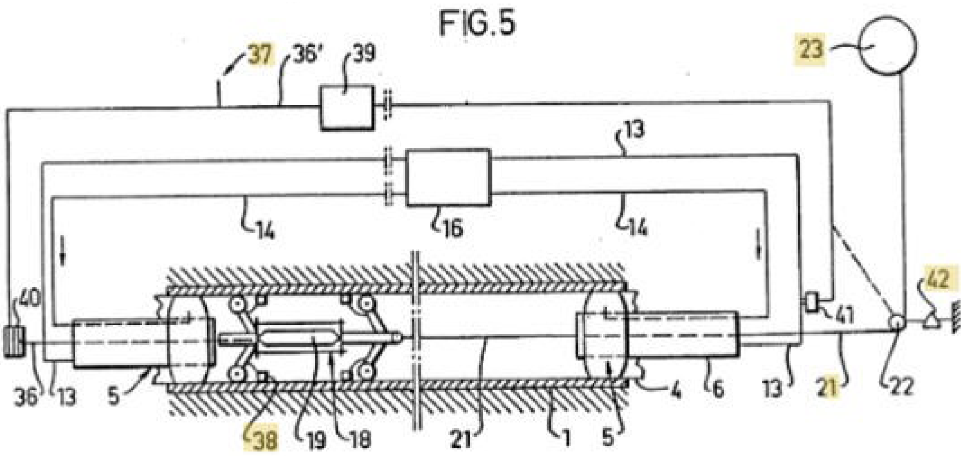
The installation utilised a cone-shaped tool anchored at the inversion side manhole with a "rubber packer." Remarkably, the rubber packer was placed inside the liner itself, leaving the first 20-30 cm uncured. This required separate curing after the light train completed its work. The liner was then pushed through the cone and secured with a leather membrane tightened by a rubber band to prevent any internal pressure from leaking out. Once inverted over the rubber packer, the liner was locked in place using compressed air, similar to a packer for short lining or pipe stoppers.

This technology necessitated the presence of a technician in the manhole throughout the entire inversion process, which could last for several hours. Keeping the liner and the inner tubing lubricated with talcum powder was essential for smooth operation. Soon after the initial installation, the original tool was upgraded: the "inrängnings dorn" was replaced by a 90-degree elbow, allowing for top-fed lining while maintaining the secure locking mechanism.

The first commercial installation of a DN 150 glass fibre liner, comprised of a braided structure of 96 woven glass fibre bands, was a significant achievement for Vollmar, Borje and prospective investors, drawing keen interest from other major industry players. Companies, such as Insituform, soon announced that they would be commencing their own projects to develop UV curing systems as a replacement for traditional hot water curing methods. >

The actual tool "invrängnings dorn" used for the ever first commercial installation 1985

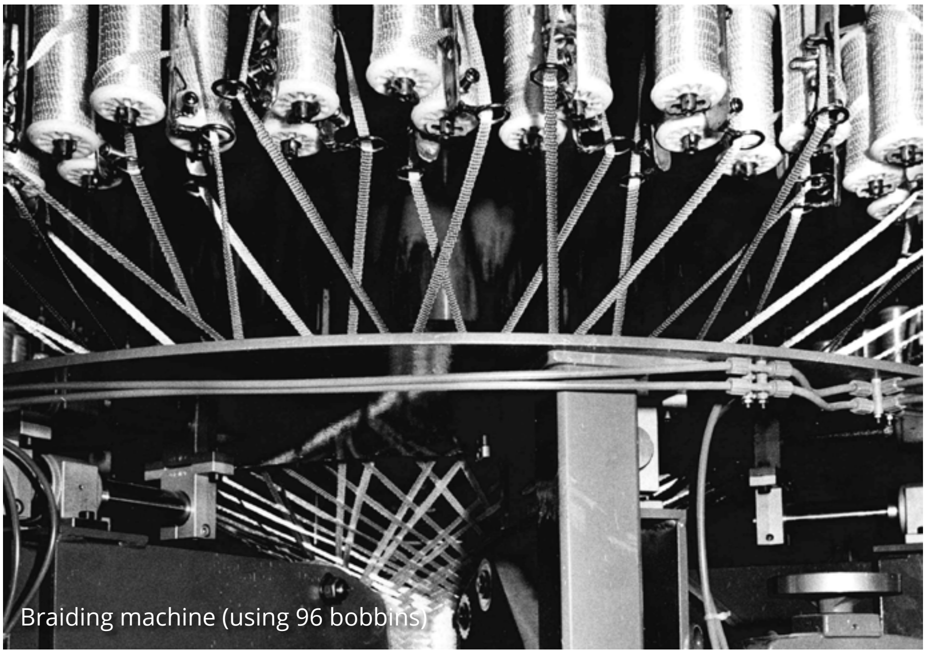
1983 Patent (ESO 0 122 246) Method and Design diagram



Research, development and cooperation

As previously noted, the first UV-curing method patent was granted with priority from 6 April 1983. Insituform had monitored the Swedish inventor's work since the 1970s, following his public announcement of the research initiative, and consequently launched its own development program focused on UV-cured liners. Insituform received its first UV method patent shortly after Mr. Vollmar, with priority established in autumn 1983.

Insituform's UV-curing patent was subsequently granted across Europe; however, their design placed the light source underwater. At Inpipe, we did not consider this configuration competitively viable at the time due to the inherent challenges of operating a high-voltage light source in a water-filled pipeline. Furthermore, water absorbs a notable share of UV radiation, significantly reducing curing efficiency.


Braiding machine (using 96 bobbins)

During the first field installation, the resin used had been developed in collaboration between the inventor and the Swedish company ASEA in Piteå (now ABB). This styrene-based polyester resin was initially formulated to be thixotropic and was later modified using magnesium oxide to further increase viscosity and enhance storage and transport stability, ensuring consistent wall thickness in the final cured pipe. The difference between relying on thixotropy versus deliberate thickening is substantial in terms of viscosity control and processing consistency.

In 1988, senior management elected to accelerate resin development and entered a joint venture with the German chemical company BASF. Comprehensive laboratory and testing programs


On site in Vilhelmina, successfully relined pipe using UV CIPP

began immediately at BASF's Ludwigshafen facility which, at that time, employed over 55,000 people. This unique environment enabled nearly a year of direct collaboration with BASF's resin and composite R&D division.

This phase marked the refinement of the light-curing isophthalic-acid-based resin "A 400," an unsaturated polyester resin modified with isophthalic acid to improve reactivity and stiffness upon curing. Palatal P 92 later emerged as an improved version of A400; its "I" variant incorporated isophthalic acid and neopentyl glycol, compliant with DIN 18820/1 Group 3, still one of the most widely used resin systems for CIPP relining today.

The development and optimization of the curing and installation equipment were carried out in close cooperation with international technical experts, establishing the foundation for modern UV-cured CIPP technology.

Key markets, major players and competition

Between 1986 and 1987, Inpipe AB was established, acquiring the assets of VJ System AB (the inventor's company) and building a factory in Vilhelmina, which evolved into a centre for research, development, and production. Through licensed installers in Sweden, Norway, Denmark, and Germany, extensive development efforts for the Inpipe Liner gained momentum.

Simultaneously, Insituform initiated its venture into the UV-cured CIPP market, aiming to improve speed and reduce water use, key selling points at the time. By mid-1988, Insituform sold its first set of ultraviolet curing equipment

Right to left: Roland Lindberg, Börje Persson (IBP CEO) Thomas Lundmark and Nicklas Björnvind (InPipe MD) back on the Vilhelmina site, inspecting the orignal liner invertor used

to its Danish partner, Per Aarsleff. The technology was promoted as a "special application alternative" to their traditional Insituform solutions, igniting competition that resembled a classic David versus Goliath scenario.

The early rivalry between Inpipe and Insituform catalysed significant advancements, shaping the market we see today. Light-cured CIPP now represents approximately 30% of the global CIPP market, exceeding 50% in Europe and China. The annual installation length is estimated at close to 8,000 km, with a liner material value in excess of €400 million and an installed value of between €1.25 and €1.4 billion – and still growing strongly, globally

Revisiting a UV-CIPP milestone

On the occasion of the 40th anniversary of the first commercial installation of UV Light-cured CIPP, I was able to revisit the original site in Vilhelmina and meet again with former colleagues who were involved in the project and early development of the UV Light-cured CIPP method and materials. It was a great opportunity to reflect on some of those early challenges and recall the perseverance to overcome them.

Special thanks go to Dr. Dec Downey, Prof. Henrik Lindberg, Thomas Lundmark, Roland Lindberg and Tom Sangster for their contributions and support in providing their reflections, recollections and important information in the revisiting this important milestone, and thanks also to the many other trenchless colleagues who have shared this journey. As we reflect on the origins of UV light-cured CIPP technology and this 40th anniversary, we recognise the collaborative spirit and innovation of those early pioneers and that their contributions continue to drive the industry forward.