CIPP REHABILITATION OF PRESSURIZED PIPELINES

By NASSCO Member Joanne Carroll, Subtegic Group

It is well known that CIPP has been around for over 50 years, primarily being used to rehabilitate gravity sewer pipelines. In the 1980s CIPP was introduced for low pressure sewer applications, and late in the 1990s began to emerge for water main and higher pressure force main rehabilitations. Although the evolution of materials, benefits and efficiencies of trenchless CIPP has made its way and gathered acceptance in these applications, there remain challenges for the continued success including an understanding of the requirements for CIPP in pressurized pipelines.

Four basic keys to successful rehabilitation of pressurized pipelines using CIPP include:

1. Performance-based specification
2. Product qualification
3. Installer workmanship
4. Inspection

Every project that comes about has its own nuances, necessitating a solution that meets the requirements for the overall system's safe operation while encouraging the most innovative, efficient and effective rehabilitation delivered at the best and lowest competitive price. Specifications that baseline performance specification for the rehabilitation of pressurized pipelines using CIPP are available through NASSCO's Performance Specification Guidelines (PSG) and ANSI/AWWA Standard C623 Cured-In-Place Pipe (CIPP) Rehabilitation of Pressurized Potable Water Pipelines, 4 In. (100 mm) and larger.

NASSCO's upcoming PSG for force main rehabilitation using CIPP includes guideline boxes that highlight key factors for consideration when compiling a performance specification. While AWWA's standard was developed under an ANSI consensus process it is specific to the rehabilitation of potable water mains, providing a detailed standard specification that can be modified for use in force main applications.

Product qualification includes the technical envelope of the CIPP system including limitations of diameter and length of install which are commercially available up to 72 in. diameter and 1,200 feet (diameter and existing pipeline configuration dependent). Type testing as a means of qualification of products should be performed by the CIPP system provider/ manufacturer that identifies the pressure rating and substantiates the capabilities of the CIPP system to perform in specific pipeline environments. When qualifying a CIPP product for a specific project, the capability to navigate bends during installation must also consider the effect on the pressure rating of the CIPP product. In type testing, the pressure rating is derived from short-term burst test value divided by the pressure rating factor that is generally greater than or equal to four. De-rating should be considered when intended to line through bends or when other geometric anomalies in the CIPP exist. Vinyl ester and epoxy resins are typically used in pressure pipe CIPP systems. Both resin types have beneficial capabilities as well as limitations that guide the selection for force main applications. Styrene-free formulations are commercially available. It is also worth mentioning that PFAS may be present in resin systems used in CIPP, although efforts are being made to minimize their use and mitigate potential environmental and health risks associated with their presence.

There has been a lot of discussion about structural capabilities or classification of linings for pressurized pipelines. On the AWWA website a free download of the AWWA Committee Report – ***Structural Classification of Pressure Pipe Linings*** - is available that includes type test methods and an illustration of design methodology for CIPP. Also, keep an eye out for an upcoming design appendix to AWWA C623 expected in late 2024.

Inspectors with knowledge and experience of CIPP rehabilitation in pressurized pipelines may be difficult to come by, making the writing of a specification which includes inspection, methods, and required results even more critical. Specifications for a CIPP pressure pipe rehabilitation should include clearly stated means and methods of inspection, all of which call attention to the installer of their importance during construction, including the following:

1. Clean and prepare the existing pipeline to remove debris, deposits and obstructions or repair or correct other defects or deficiencies that will interfere with the proper installation and operation of the CIPP without causing further damage to the existing pipeline.
2. Take physical measurements of existing (once cleaned) pipeline to accurately order the manufacture of the tube. The importance of proper sizing of the tube relates directly back to the performance of the finished CIPP ensuring a close fit without system imperfections that will impair or diminish the capability of the CIPP to perform within the intended (pressurized pipeline) application.
3. Follow requirements for procedures and document all aspects of resin impregnation to ensure thorough saturation of the tube using quality resins for performance within the intended environment.
4. Follow procedures to ensure controlled insertion and expansion of the liner to achieve a tight fit to the host pipe and optimize structural performance.
5. Follow procedures and document processes used to achieve full cure of the CIPP for validation of design and performance requirements.
6. Install mechanical end seals and inspect end terminations to ensure a watertight system, which can be validated through hydrostatic pressure testing of the completed CIPP installation.
7. Establish procedures to be followed for standard field sample preparation and collection. Ensure these procedures are followed including marking of samples collected to enable proper testing that is used to verify that the installed CIPP meets contractual requirements.

NASSCO AND AWWA CONTINUE TO PRODUCE RESOURCES THAT ENABLE THE USE OF TRENCHLESS TECHNOLOGIES SUCH AS CIPP FOR THE REHABILITATION OF WATER AND WASTEWATER PRESSURIZED PIPELINES. WHETHER YOU'RE AN OWNER, CONTRACTOR, ENGINEER OR INSPECTOR, THESE ORGANIZATIONS AND THE MULTITUDE OF PROFESSIONAL SUBJECT MATTER EXPERTS IN THE INDUSTRY CAN AND WILL AID YOU IN MAKING YOUR UPCOMING PRESSURE PIPE REHABILITATION PROJECT A SUCCESS.

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