

Frey-CWrap Foreva

- 50 year design life
- Waterproof liner
- Full pipe capacity restored
- Corrosion free repair material
- Detailed design assistance
- Automated and manual installation

Trenchless PCCP repair solution - Carbon FRP relining

Foreva® Frey-CWrap is a Freyssinet patented repair solution for the rehabilitation and strengthening of exposed or underground pipes with carbon fiber reinforced polymer. It is a less expensive and faster alternative to the replacement or tubing of damaged pipes sections, at risk of bursting due to severe corrosion.

Advantages

- **High quality relining:** industrialized and automated implementing system.
- **Very fast relining**, several hundred meters per day (reduced maintenance period).
- **Minimal surface disruptions**, particularly important in urban areas.
- **Design for high pressure and large diameter pipes.**
- **No hydraulic losses induced.**
- **No increase in dead weight.**
- **Applicable to potable water pipelines**, listed on the NSF/ANSI Standard 61.
- **Solvent free resin.**
- **Maintenance free repair.**

Fields of use

Foreva® Frey-CWrap is recommended for any pipeline conveying potable water with a minimum inner diameter of 60" (1.5m).

It is specifically designed for the repair of PCCP suffering from corrosion, but is applicable to all types of pressure pipes.

Foreva® Frey-CWrap is based on Freyssinet's extensive experience in the repair of bridges, water tanks and civil infrastructures. Hundreds of structures have been strengthened with the carbon fiber reinforced polymer **Foreva® TFC**.

Technical principle

Foreva® Frey-CWrap relies on an automated equipment to helically install a carbon fiber / epoxy resin composite on the pipe inner surface.

Foreva® Frey-CWrap Robot* fits with the recommendations of the trenchless profession to maintain projects within reasonable budgets and time constraints.

Once cured in place, the composite works as a new structural liner. **Foreva® Frey-CWrap B500*** is watertight, with a high bond strength to concrete. The overlapping length (thus the number of layers) is determined to resist internal fluid pressures (service pressure, burst pressure and field test pressure).

Short range repairs and localized conditions along the pipeline are treated manually (sudden variation in diameter, elbows, etc.) with the same carbon fiber composite.

Pipe joints are treated with epoxy resin prior to the application of **Foreva® Frey-CWrap**. When required, joints are waterproofed using **Foreva® PCCP Joint**.



Pipe reinforced with Foreva® Frey-CWrap Robot

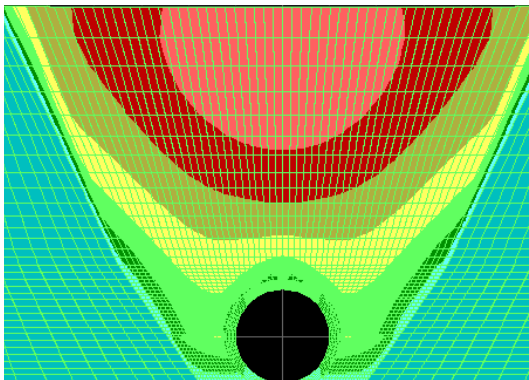
Description of the robot

Foreva® Frey-CWrap robot is made up of a body and a satellite: displacement and rotation are synchronized to apply the composite on the pipe inner surface.

The robot saturates the carbon fabric with resin prior to application to the pipe wall to ensure a perfect bonding.

Design

The type of carbon fabric (unidirectional or bidirectional) and the number of layers are determined by Freyssinet based on the specificities of the structure, its loading history, its hydraulic requirements and the degree of corrosion to achieve the expected design life. The stresses in the pipe and the carbon fiber reinforcement are monitored through a finite difference model to assess the effect of internal and external loads.



Ground displacements around the pipe

Installation

- The pipeline is dewatered.
- The pipe surface is washed with ultra high pressure water.
- Defects and delaminated concrete areas are repaired with **Foreva®** solutions.
- The robot is introduced in the pipeline as a whole or in several pieces through existing manholes (minimum diameter of 30" - 750 mm).
- It is assembled and loaded with carbon fabric rolls and resin tanks.

- A pull-off test is performed to check that a minimum bonding strength of 290 psi (2 MPa) is attained.
- At the end of a fabric roll, the robot is reloaded with material and re-started in such a position as to ensure a minimum carbon fabric overlap of 24" (600 mm).
- Rewatering is possible a few days after **Foreva® Frey-CWrap** application as per NSF approval.



Foreva® Frey-CWrap B500 wrapping with Foreva® Frey-CWrap Robot

Health & Safety Procedure

Freyssinet thoroughly addressed Health and Safety concerns to meet OSHA requirements:

- Staff trained and qualified to work in confined spaces.
- Personnel equipped with Personal Protection Equipment (PPE).
- Specific procedures (Quality Management Plan, Health and Safety Plan, Environmental Plan, etc.).

Special provisions will be taken to meet more demanding regulations.

Services

Freyssinet provides the following upstream assistance: inspection, monitoring, diagnosis and classification by priority order of the pipeline sections to be repaired.

Testing of Foreva® Frey-CWrap

Available upon request.

* Refer to technical datasheet **Foreva® Frey-CWrap Robot and Foreva® Frey-CWrap B500**.