

Concrete Protective Liners in Piping Systems

CONCRETE PROTECTION SOLUTIONS



Piping systems continue to be one of the most essential components in modern infrastructure. Our understanding of corrosion and flow capacity as well as infiltration and exfiltration has enabled the creation of innovative solutions. To help businesses create more effective piping systems, AGRU has leaned on its experience as the Plastics Experts to develop concrete protective solutions using geosynthetics.

The AGRU success story has been unfolding for seven decades. Founded in 1948 by Alois Gruber, who set the company on the course for plastic manufacturing, AGRU has become one of the world's most important single-source suppliers for piping systems, semi-finished products, concrete protective liners and lining systems made from engineered plastics. AGRU uses only the finest grade thermoplastic polymers as raw materials. When it comes to application-technical consulting, AGRU is your best partner in the field.



Quality

The AGRU quality assurance system is compliant with multiple international standards and AGRU's procedures help ensure that products meet or exceed these international standards, on an ongoing basis. The start-to-finish attention to quality ensures that the products meet and beat the strictest technical specifications, providing safe operation even in challenging conditions.



Concrete piping and tunnel systems form the backbone of many municipalities, but their widespread use has unveiled numerous challenges that can affect the system in the long-term.

First, concrete be affected by exposure to **microbial-induced corrosion (MIC)**, which can corrode the inner walls of the concrete and potentially cause leaks and eventual failure. MIC has seen a surge in recent years due to water conservation methods such as low-flow fixtures. Therefore, the concentration of waste has increased, resulting in greater corrosive attack and further damage to tunnels and pipes.

Second, there is the problem of **infiltration and exfiltration**—the spread of water through leaks into or out of the system. Infiltration is generally associated with higher wastewater management costs, while exfiltration can cause environmental and infrastructure damage as well as significant cost in water loss. Ultimately, infiltration and exfiltration can lead to a total system collapse as the cracks propagate and voids are created due to flow through the cracks.

Finally, sedimentation and abrasion can lead to changes to the inner surfaces of pipes and tunnels, leading to negative changes to hydraulic performance such as decreased flow and flow capacity of the pipe.

To address all of these issues, the concrete can be protected by installing concrete protective liners (CPL). CPL leverages the strengths of polyethylene-based materials to create a barrier between pipe/ tunnel contents and the concrete pipe. CPL made with polyethylene (PE) is highly resistant to MIC, has very low permeability, does not react to most acids and bases, and helps inhibit biological growth. Polyethylene also has elongation values, allowing it to effectively bridge over cracks which may occur in the concrete. These factors enable CPL to protect concrete structures from infiltration, exfiltration, MIC, and changes to flow capacity as a result of changes to the inner surfaces of pipes/tunnels.



AGRU has developed **Concrete Protection Solutions** to meet the needs of engineers, municipalities, and precasters for applications ranging from **wastewater systems** to **stormwater systems**.





AGRU Concrete Protection Solutions

At the heart of AGRU's concrete protection solutions is AGRU-Ultra Grip®, a concrete protective liner designed to seal and protect a wide range of concrete structures. The solution incorporates Ultra Grip as well as a variety of accessories such as profiles, semi-finished products, fabric-backed liners, and welding rods.

AGRU differentiates Ultra Grip from other concrete protective products by manufacturing its liners using a continuous extrusion process, allowing the liner and studs to be formed in a single step. AGRU's manufacturing techniques produces the highest quality liner with unparalleled performance and consistency.

Ultra Grip can be manufactured using two thermoplastics: high density polyethylene (HDPE) or polypropylene (PP). These materials ensure concrete protection against chemical attack, abrasion, and leakage. See the **Products** section for more information about the products that make up AGRU's concrete protection solutions.

On the following pages, we present how AGRU concrete protection solutions can affect a project from the perspective of engineers, municipalities, and concrete precasters. AGRU routinely works with each of these partners to ensure that their goals are met.



Municipalities

AGRU offers easy-to-implement solutions for municipalities seeking long-lasting protection for their tunnel or piping systems. Municipalities and owners of sewage systems are tasked to ensure the longevity of the systems they are entrusted to manage. Often, there is a delicate balance between the best solution and one that is affordable. These decisions can go on to affect many generations. As the Plastic Experts, AGRU can help ensure municipalities choose approved installers, who help increase the service life and success of projects.

Engineers

For engineers, AGRU manages detailed specifications, data sheets, and drawings that can be quickly referenced to fit many scenarios. AGRU is always willing to discuss the needs of the project to develop the appropriate project-based solution. AGRU strives to help engineers achieve client's goals through costeffective solutions that meet the appropriate risk tolerance. Drop-in specifications are also available on the AGRU website, with detailed drawings available upon request.

Precasters

For precasters, AGRU offers streamlined means of incorporating CPL on precast concrete structures. AGRU offers a variety of product configurations, roll width, and sheet sizes to help make fabrication easier and increase yield by minimizing loss of materials. When combined with CPL, precasters will be able to produce concrete products with enhanced durability and longevity.











AGRU Concrete Protection Applications

AGRU CPL offers the ability to benefit from the strength of concrete while also being able to add the chemical and corrosive resistance of thermoplastics as well as their low permeability. For this reason, AGRU concrete protection solutions can be utilized in numerous applications.

In general, CPL can form effective solutions in wastewater systems, manholes, and stormwater systems.

Municipal Wastewater Systems

CPL can help address common issues in municipal wastewater systems including infiltration, exfiltration, and flow capacity reduction caused by internal build up. With CPL, municipalities are able to maintain a smooth pipe for higher efficiencies.

Another common problem with municipal water systems, especially for conduit sections, is MIC. These concrete tunnels and pipes are under constant threat of severe corrosion from sulfuric acid that results from the biological process of MIC, which can have long-term impact on flow characteristics as well as overall structural integrity of the pipe. AGRU CPL can be used to protect concrete pipes from corrosion-based attacks for long-term protection.





Stormwater Systems

While stormwater systems and combined sewer overflows (CSOs) with their diluted wastewater are not typically overly concerned with MIC, in some cases CPL may be considered as a way of adding abrasion resistance. Stormwater systems can also benefit from CPL should designers like to incorporate self-cleaning for the pipes.



Manholes, Access Ways, and Shafts

Addressing leakage at pipe joints is an essential step against infiltration and exfiltration within piping systems. Preventing leaks around manholes is just as important. Another common issue for these structures is biologically induced corrosion caused by gaseous hydrogen sulfide, which is a result of gas generation from turbulent flow. Nearby pumping stations can also promote excess gas generation. Unprotected concrete portions of manholes, access ways, and shafts can corrode over time, leading to leakage, loss of structural integrity, and other issues. AGRU also offers unique products such as anchors, which allow structures like stairways to be installed without disrupting the liner's ability to provide a leak-free solution.





AGRU CPL Supported Installation Methods

AGRU concrete protection solutions can be incorporated in a variety of tunneling methods and types including reinforced concrete pipes (RCP), concrete jacking pipes, and concrete tunnels using the single- or double-pass system.

When precast concrete segments are used, in a single-pass system for example, the CPL is fabricated and installed in each segment prior to tunneling. This method can mean a lot of welding for the CPL during the tunneling process. An alternative is the double-pass system, which uses concrete segments in addition to poured concrete and CPL during the tunneling process.



AGRU-ULTRA GRIP®

Overview

Ultra Grip is produced from either HDPE or PP and is available in thicknesses ranging from 2 mm (80 mil) to 5 mm (200 mil). Ultra Grip is available in a variety of colors and configurations for both rolls and sheets and is among the widest CPL produced in the United States at 10 feet. But Ultra Grip's impressive backpressure resistance is what sets it apart from its competitors. If a corrosion protection system cannot sustain the required backpressure long-term then its failure is imminent. Failure leads to concrete corrosion with high costs associated with replacement, traffic control measures, and bypass pumping systems.

Ultra Grip's superior backpressure resistance is the result of its innovative anchor design, which promotes high backpressure and pullout resistance in concrete structures. Ultra Grip is especially useful for structures installed in groundwater and resists pressures of up to 1.75 bar (at 20°C or 68°F) in long-term testing and applications. Finally, Ultra Grip's high tensile strength and elongation allow it to stretch and bridge cracks should concrete structures develop breakage, preventing groundwater from entering the system.

Should special circumstances require, AGRU can leverage its manufacturing capacity in Austria to produce liners up to 5 m (16.4 feet) in width and 12 mm in thickness. Additionally, by using a wider sheet, partners can improve installation times by reducing welding requirements.

Summary of Features

- Comes standard with 13 mm stud height and a pullout resistance of up to 820 kN/m2 with PE 80 at 20°C.
- Manufactured with HDPE or PP, depending on project requirements.
- Features a secure mechanical anchoring design applicable for a variety of concrete structures
- The innovative anchor offers long-term sustained backpressure resistance of up to 1.75 bar (at 20°C or 68°F)
- Corrosion resistant, making Ultra Grip suitable for protecting concrete against aggressive media
- Applicable within a wide temperature range
- Long life expectancy and low maintenance
- Available in UV-resistant materials.

For more information about Ultra Grip, visit: https://agruamerica.com/products/ultra-grip/.

Supporting Products

AGRU strives to be a one-stop shop by having all required products available for a successful project, including:

- Weld Rods
- Cap Strips and Conductive Cap Strips
- End Profiles
- Tear-Off Profiles
- Anchors

Configuration Options

Ultra Grip can be coextruded with additional layers for additional features:

Signal Layer

- Damage and wear detection
- Comes in a variety of color options
- Can also use a light-reflective white color.

Bionic

- A self-cleaning layer to help reduce sediment buildup
- Uses ridge and other interior physical characteristics to subtly alter fluid dynamics to promote cleaning.

ANTI-Skid

- Added step security for large structures with internal access
- Light reflective colors are also available.

Fabric-Backed

- The fabric is installed on the smooth side of the liner
- Offers a suitable option for dual-laminate applications as well as a transition point to dissimilar materials.

Blue NSF-61 Rated CPL

- Specialized CPL for potable water supply
- Comes with chlorine resistance of up to 3 mg/L for increased service life.









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