

Experience of using PU Grout

(Excerpt from the article "Injecting Long Life" by Scott Kelly, Cleaner, July 2008, pp 86-87)

Chemical grouting provides simple and cost-effective repair for manhole leaks-by using right material and the right installation method.

There are many ways to repair leaks in concrete structures like sanitary and storm pipes, man-holes and basins. One of the oldest yet least understood methods uses polyurethane chemical grouts that react with water to bond with the concrete to form watertight, permanent seals, or to become rigid, filling voids and stabilizing soil.

According to the National Association of Sewer Service Companies (NASSCO), chemical grout was developed in 1955. Since then, it has been used in sewers, manholes,tanks, vaults, tunnels, and many other applications worldwide.

Recent studies and more than 40 years of experience indicate that grouting - known as the nation's first trenchless technology - is still a highly cost-effective, long-term defence against infiltration of groundwater into structurally sound sewer systems.

Grouting can be especially effective for sealing leaks in manholes, which by some estimates account for up to 40 percent of infiltration to waste water collection systems.

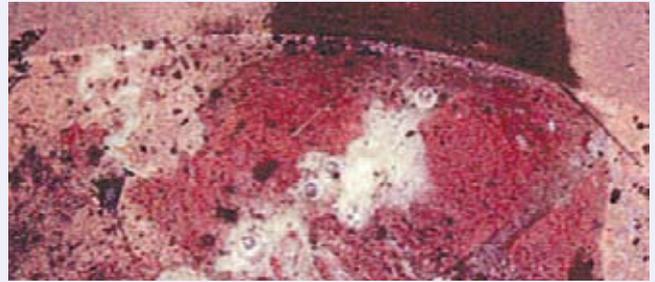
Reducing infiltration

The nation's infrastructure is aging while its population continues to grow. As a result, municipalities and contractors are under pressure to find effective repair options to reduce infiltration, which increases treatment plant loads, adds treatment cost, and increases the risk of sanitary sewer overflows (SSOs).

Groundwater leaks also carry sand, silt, and other debris into the system, increasing wear and tear on equipment. Voids often form around leaking structures that can lead to instability and settling. A properly chosen grout can stop leaks in seconds, forming a long-lasting seal and providing immediate cost-savings.



A crack at the base of a manhole allows water to infiltrate.



A hydrophilic chemical grout was used to repair the crack and stop all leaks.

(Photos courtesy Prime Resins Inc.)

Some manholes require structural rehabilitation, usually involving a sprayed, hand-applied or cured-in-place (CIP) lining. Contractors and municipal crews must realize that groundwater infiltration needs to be stopped before such linings are installed.

Too often, leaks in manholes are treated by applying a quick-set hydraulic cement over the active infiltration. This stops the leak temporarily and allows time for the lining to be installed. But water remains within the primary structure and can weaken the bond and eventually cause a lining failure.

Installation basics

Polyurethane chemical grouts are usually injected under pressure as a liquid resin into or near the leak. Once the resin contacts water, a chemical reaction occurs. Depending on the material formulation, the grout/water combination forms an expansive closed-cell foam or a gel. The foam can be flexible and resilient (hydrophilic) or rigid, meaning the cell structure of the foam crushes when compressed (hydrophobic).

In most manhole leaks, the water flow can be used to pull the grout into the structure. To accomplish this, a hole is drilled near the leak, and the chemical grout is injected through the wall into the water source. As the resin reacts with the groundwater, it is pulled back into the structure and seals the leak from the outside in, creating a seal through the entire wall.



An injection specialist uses chemical grout to repair a leaking joint

Where the leak is not strong enough to pull the grout into the structure, the grout can be injected directly into the defect. The expansion of the foam helps drive the grout through the structure to seal the gap. Hydrophilic polyurethane resins that produce gels are typically installed by running water along with the resin through a manifold that briefly mixes the two before they are injected. These gels are non-expansive but can be produced at water-to-resin ratios as high as 15 parts water to one part resin.

Knowing the material

Both hydrophilic and hydrophobic chemical grouts seal leaks in all types of concrete structures initially. The issue is how to create a permanent seal. The longevity of the repair depends on choosing the right material. No single product will repair all leaks in concrete. Many products will temporarily fix a leak, but if applied correctly, most polyurethane grouting repairs are essentially permanent.

To break down the decision process, it helps to examine the basic properties of both hydrophobic and hydrophilic grouts. The properties of each type can be used to reduce installation cost and improve the quality and life of the repair.

What to do

This basic knowledge of the two types of polyurethane grout helps in choosing the right product and the right method for a given repair.

If a leak repair involves a non-structural defect in a concrete or masonry structure, a hydrophilic chemical grout should be used, unless job conditions dictate otherwise.



Water enters the manhole due to a pipe penetration.



Hydrophilic chemical grout is injected around the area.

Gels should be used only in below-grade structures where either moisture from the interior (like in a manhole) or from groundwater is present to keep the cured gel hydrated. Gels will shrink if water becomes absent, but provide a low-cost alternative to foams.

Foams are appropriate for above-grade or below-grade installation. They are typically 85 percent air filled after cure and have excellent elongation, compression and rebound for use in expansion joints, cracks, or any other non-structural defect in concrete.

The aggressive expansion of hydrophobic chemical grouts is helpful in repairing a gushing leak that is impractical to repair with milder-expanding hydrophilic resins. In below-grade structures, this is a good way to fill voids that may be present outside the structure. Once the leak is reduced to a manageable level, hydrophilic resin should be injected into the defect to back up the hydrophobic material.

Hydrophilic gels can also be used to stop gushing leaks when injected near or with a 1:1 water-to-resin mix. In this case, it is necessary to push in as much material as possible, as fast as possible. If a high-volume pump is available, less material will be used to stop the leak, because the high flow of resin reduces the dilution.

It is wise to use activated oakum (dry oakum soaked in hydrophilic resin) to reduce the flow in gushing leaks. If the leak can be slowed, a hydrophilic resin may be used to complete the repair.

What to avoid

Users should avoid installing gels in expansion joints or cracks that are subject to movement. Gels form a solid material with little or no cellular structure to disperse tension under compression. This tension can split the gel and damage the seal.

It is also important to avoid installing hydrophobic chemical grouts for repairing minor leaks in cracks or joints. The repair will be temporary. Don't hurry when repairing tight cracks and minor leaks. These can be the most difficult to repair for the long term.

As infrastructure ages, chemical grouting will maintain its value as one of the easiest, most cost-effective and longest-lasting repair solutions available. If the right polyurethane chemical grout is chosen for a repair project, and the correct installation techniques are used, the repair will actually outlast the structure.