

MANHOLE RESTORATION

Seal, Stabilize, Protect for Less & for Good

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Manhole Restoration (Non-Structural)

The term “non-structural” restoration is used here to differentiate between manholes that have definite structural problems from those that are simply leaking. Often is the case where the manhole is leaking due to failed joints or pipe seals. In these instances, chemically grouting the leaks with Prime Flex polyurethanes is all that is required. However, there are cases where the manhole is on the verge of collapsing due to true structural deterioration. If this is the case, a true structural repair may be necessary. This may entail lining the manhole with a cementitious material, epoxy, polyurea, or fiberglass liner. Even these “structural” repair methods usually require chemical grouting to stop the leaks first.

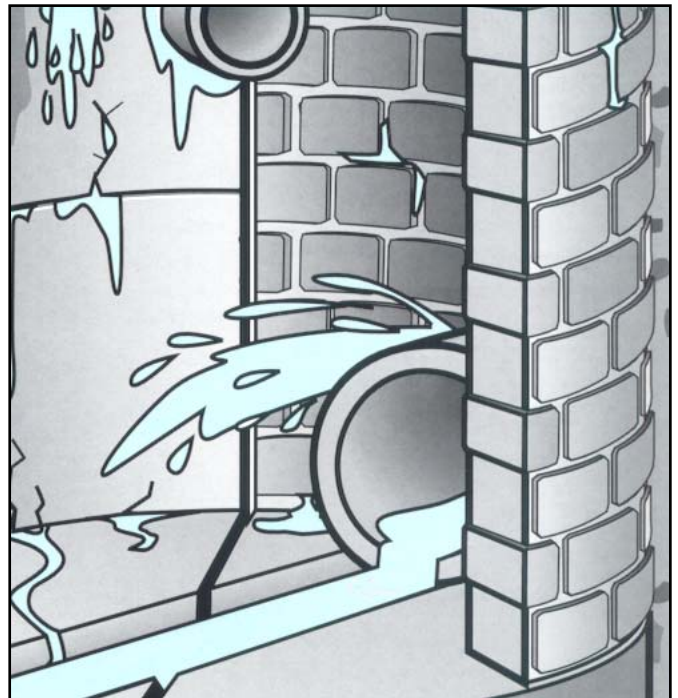
Objective: The objective of non-structural manhole restoration is simply to seal the leaks and stabilize the surrounding soil by injecting a polyurethane grout into the voids and soil outside the structure as well as into the cracks, honeycombs, joints and defects in the structure itself.

The idea is to close off all entry points that ground water may use to enter the manhole. This is accomplished by creating an external gasket that envelops the manhole. The polyurethane grout is injected through drilled holes in the manhole that extend all the way through the structure. The polyurethane fills the voids outside of the structure, penetrates into the surrounding soil, and creates the watertight grout seal necessary for waterproofing the manhole.

Base, Invert, and Mainline Pipe Penetrations

Water leaking in at the bottom of the manhole most frequently enters the manhole where the mainline pipe and the invert meet. The joint around the pipe is difficult to seal properly during construction, and settlement of the manhole itself can cause the seal to break.

This area of the manhole can be sealed using several different products. The goal is to place a grout into the void that is flexible enough to withstand some movement. Prime Resins Hydro Gel SX and Prime Flex 900XLV will all do the job effectively. There is little concern about wet / dry cycling since this area of the manhole is constantly wet.



Material Selection

Hydro Gel SX – One component, polyurethane gel

Hydro Gel SX is the first material to evaluate for this area of the manhole. It is flexible, fast setting, and relatively inexpensive. The best way to inject Hydro Gel SX is with a two-component pump that is either fixed ratio (8:1) or variable ratio. Hydro Gel SX reacts with water and absorbs up to 15 parts water during its cure. You may inject it as a single component and use the ground water to activate it. However, experience indicates that less material is used if mixed with water just prior to injection. “Twin streaming” with a two-component pump also generates a better quality gel. A two-component pump that mixes the product just before it enters the wall is needed since it only has a 45-60 second pot life.

Gel Reinforcing Agent can also be added to the water side of the mix. This is a latex additive that increases the strength and flexibility of the Hydro Gel SX. It also helps to reduce shrinkage during dry cycles. Add the Gel Reinforcing Agent at a ratio of 6 to 8 parts water to 1 part Gel Reinforcing Agent. Then use this solution to mix with the Hydro Gel at 8 parts prepared solution to 1 part Hydro Gel SX. A two-component pump is usually recommended. An accelerator may be added to reduce the reaction time if necessary.



Hydro Gel SX is available in single component cartridges for smaller jobs. These cartridges fit standard size caulk guns. The Hydro Gel SX is also packaged in a convenient “Quick Mix” cartridge system, which allows for packaging the Gel Reinforcing Agent side by side with the Hydro Gel SX.



“Single Shot” Cartridge



“Quick Mix” Cartridge

Prime Flex 900 XLV – A one component, polyurethane foam.

Prime Flex 900 XLV is probably the longest lasting of all the chemical grouts for use in this area. The drawback is that the set time is three to five minutes or longer in cold water. If the water leak can be temporarily shut-off or slowed down using dry oakum or hydraulic cement, then the Prime Flex 900 XLV polyurethane is an excellent material. Prime Flex 900 XLV uses only one part water to react. The result is excellent wet / dry cycling with very little shrinkage. For this reason, it is most often used in areas of the manhole that tend to be dry (the uppermost sections). Prime Flex Hydro Gel SX is also the material of choice for sealing pipe penetrations using the Activated Oakum Technique.

Activated Oakum Technique

Chemical grouts are used to seal active leaks in concrete or brick structures. It is necessary at times to use this method to help control ground water infiltration. By slowing the leak with the “Activated Oakum” technique you allow the chemical grout more time to react with water and seal the defect. This method can also be used to form a primary seal at the surface of wide joints or pipe penetrations in order to fill the space within the joint or around the pipe with chemical grout. The primary “Activated Oakum” seal acts to contain the expanding chemical grout within the joint or pipe penetration and promote a dense cell structure in the cured foam.

Application

It is assumed that the equipment has already been selected based on the product to be applied. First, a few steps are required to prepare the work area.

1. Check for dangerous gasses using a gas detector and follow all confined space entry requirements before entering the manhole.
2. Pressure-wash the walls of the manhole to remove debris and build-up that may be covering any defects.
3. Sanitize the walls with a disinfectant.
4. Set up all safety equipment including a blower to vent air out of the manhole.

Curtain Grouting (Brick Manholes)

Take a moment to review the diagram on the last page. The first step is to drill a hole or series of 3/8” to 5/8” holes through the **manhole wall** using a hammer drill. Electric hammer drills work best (be absolutely certain to follow all appropriate safety procedures including a ground fault switch). If there is too much water present, you may need to switch to pneumatic hammers. The quantity and spacing of holes is determined by the severity of the leaks. We have found that most grouts will travel ¼ to ½ the distance around the manhole. A typical drilling pattern is 3 holes per horizontal plane or every 120° (ten o’clock, two o’clock, and six o’clock). Start at the bottom of the manhole and drill a three-hole pattern every twelve to eighteen vertical inches.



If the **mainline pipe connection** is leaking, it will usually be at 3:00 or 9:00 (using the clock example). For these leaks, try drilling at the 12:00 position an inch or two above the pipe. Bear in mind that you may be able to seal these leaks as other parts of the manhole are injected.

If the **joint** at the base of the manhole and the **bench** is leaking, try drilling one or two holes a few inches above the joint.

If the **invert** is leaking, or if there are cracks in the bench, try drilling straight down through the bench. This may require a longer drill bit.



Box of Oakum

Now that you have drilled a few holes you are ready to start plugging the major leaks (remove the drill from the manhole, but don't put it away just yet, you may need it again). If there is not a lot of water flow, you can skip this step.

Plug the leaks in the cracks by any means available. This surface plug is only temporary to allow the grout to cure before it flows out with quick moving water. You can use dry oakum, backer rod, polyester fill, or even rags to slow the water down. A rendering cement may also be useful for a temporary seal (especially in brick manholes).

At this point, all the prep work is completed and it is time to start grouting. Grouting is something you will need to get a feel for. You will learn as you go. Real knowledge comes from doing, not reading, but here are a few hints:

1. Start grouting at the hole furthest from your worst leak. This will seal the tighter areas first. It is also the point where you will have the most resistance to flow, allowing the grout time to set up, before it washes out.
2. Keep pumping as long as grout is filling the desired area. You can conceivably grout an entire manhole from one point. However, if the material pumped in one hole is excessive with little evidence that the material is moving to the problem areas, then stop and move on to another hole. A little polyurethane in the correct place is better than a lot of polyurethane in the wrong place.
3. Once the leaks are sealed, you are done!

Point Grouting (Concrete Manholes)

Concrete manholes are usually easier to seal. Most of the time, the points of infiltration are easier to identify. There are four main points for infiltration in a concrete manhole:

1. At the intersection of the mainline pipe.
2. At the base joint.
3. At the sectional joints.
4. Defects in the concrete itself.

Each of these points are usually easy to identify. The base joints and sectional joints may need more than one hole to effectively seal them. The other points typically only need one hole correctly placed.

Sealing Leaks in Joints (Concrete Manholes)

Injecting into the joint using a Hydrophilic water activated Polyurethane resins will expand to seal off all leaks and form a impenetrable yet flexible foam seal within the joint.

Drilling at a 45 degree angle to intersect the joint and installing a port in each 3rd of the manhole joint will ensure the entire joint is sealed and will also allow you to monitor material travel. Install a zerk fitting only on the first port being injected. Couple up to the zerk using a Prime Flow Control Valve w/ Coupler. Slightly open the valve to start injecting, when material has traveled to the next port install zerk and continue injecting on 2nd port. Repeat these steps until material has traveled around the entire joint. If there is a blockage in the joint more injection port may have to be installed.

Curtain Grouting (Concrete Manholes)

A Hydrophobic Polyurethane water activated resins such as Prime Flex EXP and Prime Flex 920 shall be used for sealing gushing leaks, filling voids and stabilization soils around the manhole structure.

Injection holes shall be drilled through the manhole at 120-degree angles from each other at the same plane of elevation. Rows shall be separated no more than three vertical feet,



5 Gallon Pail

and the holes shall be staggered with the holes in the rows above and below. Provide additional injection holes near observed defects and at pipe seals. A minimum of 6 injection holes shall be provided.

Grout shall be injected through the holes under pressure with a suitable probe. Injection pressure shall not cause damage to the manhole structure or surrounding surface features. Grout shall be injected through the lowest holes first. The procedure shall be repeated until the manhole is externally sealed with grout. Grout travel shall be verified by observation of grout to defect or adjacent injection holes.

Polyurea Coatings

A high strength, cold spray applied aromatic polyurea coating is applied using a 2 component pneumatic dual cartridge gun. A spray mixer and regulator required for spray application with pneumatic gun.

The polyurea coating shall be applied to the manhole chimney or riser rings to prevent ground water inflow into the system. Polyurea coatings can also be applied to the entire manhole for added structural value, chemical and abrasion resistance.



“Quick Spray” Cartridge & Pneumatic Gun

Surface Preparation (Polyurea Coating)

The surface must be clean and free of any dust, oil, grease, curing compounds, or any other contaminants. Mechanical or blast cleaning is required to achieve a Concrete Surface Profile (CSP) of 3 for concrete or SP-2 or SP-3 for metal surfaces (reference ICRI Technical Guideline No 03732). All bug holes, spalls, cracks, chips and defects in concrete must be filled using a patching material. Moisture level of concrete must be below 5-1/2%.

Safety

Use all necessary and required confined entry equipment. Make sure you test the air quality of every manhole before entering. *Sewer gasses can be deadly.*

The easiest way to make sure that no noxious fumes from the sewer or the grout build up in the manhole is to use a blower unit that is located outside with an air duct that reaches to the bottom of the manhole (near the level of the grout technician).

Safety goggles must be worn at all times. The pump creates pressure and grout could spray or splash into eyes not protected by safety goggles.

Rubber gloves must be worn at all times. We also recommend Tyvec suits and rubber boots.

Please read the MSDS for each chemical for more information.

