

CRACK INJECTION TECHNIQUES

EPOXY OR POLYURETHANE FOAM?

A casual debate often will arise over the use of either epoxy or polyurethane foam for foundation crack repair. Both will fill the crack and stop water from entering through the crack. If stopping a leak is the only concern, then either product is fine to use.

The question remains, which one is better? That depends on the type of crack and conditions present at the time of the repair. The obvious difference between the 2 injection systems is epoxy will restore the structural integrity of the cracked wall by filling the crack with a high-strength adhesive that essentially 'welds' the cracked wall back together. Filling the crack with these high-strength epoxies eliminates the movement of the opening and closing of the crack in the wall that occurs during normal expansion and contraction of the soil during the seasonal cycles.

Polyurethane foam also fills the crack with a resin that expands in the presence of moisture and can be flexible enough to accommodate the same movement of the soil due to these freeze/thaw or wet dry cycles. Since polyurethane resin systems expand during the injection, less resin is required and can be much more economical to install especially in wider cracks or loose soil conditions. For a majority of foundation cracks the resin selection should be what the contractor is most comfortable using. Some cracks will have better repair results using one system over the other. For thin or hairline cracks, low viscosity epoxy resins will more often achieve better results because the epoxy will remain a liquid during the injection process allowing the resin the extra time that may be needed to fill tight hair line cracks when using low pressure cartridge type injection systems. For very wide cracks, the polyurethane expanding foam systems will fill the crack and do so with a fraction of the resin that would be required if epoxy was used. Wet or actively leaking cracks often will have better results being injected with polyurethane foam. There are epoxies that will work well in wet conditions as the epoxy will displace the water during the injection process, but extra care needs to be taken to "flush" out any resin that combines with the water. This is accomplished by continuing the injection of the epoxy coming out the next higher port and pushing out any resin that appears milky until clear resin flows out the port streak free.

There is a class of cracks that require expert review in terms of resin selection. Structural cracks due to movement and or settling of the home Cracks that are wider at the bottom or where the walls on either side of the crack appear deflected are often due to settling should be evaluated by a structural Engineer who can provide professional opinion on the best corrective action. .

HIGH PRESSURE OR LOW PRESSURE INJECTION?

Most foundation cracks can be successfully injected with low-pressure injection systems such as the single caulking style cartridge or the dual side-by-side cartridge systems. These manually injected systems in conjunction with the appropriate viscosity resin system will require very little pressure to fully inject most cracks. The issue of injection pressure becomes more relevant when repairing fine or hairline cracks.

The convenient and simple to use cartridge systems can generate pressures far exceeding required pressures for injecting most epoxy resin systems. A slow, low-pressure injection procedure with a low-viscosity resin will effectively fill even the thinnest of cracks.

Two component polyurethane systems such as Polyfoam LV, which is available both in the single or dual side-by-side cartridges, can be used to inject most foundation cracks whether leaking or not. Polyurethane foam systems are more commonly associated with higher injection pressure systems utilizing pumps and grease guns. Fast-reacting cut-off foams will require high pressure to maintain the 'forward' progress of the foaming resin being injected. The drilling required for installing the high-pressure injection packer-ports creates dust that can clog the crack and merely getting the resin past the spring ball valve can require up to 250 p.s.i.. Crack width and other circumstances will mandate which method or system is best but most foundation cracks can be effectively repaired with polyurethane foam and low-pressure cartridge style systems.

EPOXY INJECTION

1. Surface of the crack must be clean, free of loose material and dry (damp is ok with no surface moisture present). Old coatings should be removed by grinding or wire brushing to expose bare concrete.
2. Mix a small amount of epoxy paste according to mix ratio.
 - a) Use Polybac #1002FS for 20min. set up of injection ports and when walls are damp or wet.
 - b) Use Polybac #1004FS for 45 min. set up of injection ports when low-odor pastes are required.
 - c) Use Polybac #1183 or LCR Epoxy Repair Paste when longer pot-life is desired.
3. Apply a small bead of paste to the back of surface mount injection port and affix the port directly over the crack approximately 4" – 6" up from the floor. Repeat this procedure and place additional ports as necessary every 10" – 12" up the entire length of the crack. For horizontal cracks start at one end and work towards the other end.
4. Mix additional amounts of epoxy paste and apply the paste to the floor/wall cove area at the base of the crack to min. 6" either side of the crack. Apply the epoxy paste to the entire surface of the crack and around the entire base of each of the ports to effectively seal the entire crack. In the event the bottom part of the crack is hairline and not visible, continue to apply the paste down to the floor in the general direction of the visible part of the crack to seal any potential leaks during the injection procedure.

5. Allow the epoxy crack paste to sufficiently harden until it is plastic hard and can be scratched with a nail. Select the appropriate viscosity of epoxy injection resin based on the width of the crack. Hairline cracks will require a low viscosity resin and wider cracks will require a higher viscosity resin. Large cracks should be injected with epoxy gel resins to minimize the potential for seepage of the epoxy resin into the soil before it has set. Guidelines for resins as follows:
 - a) Polyject #1001 LV for hairline to 1/16" cracks
 - b) Polyject #1001MV for 1/16" to 1/8" cracks
 - c) Polyject #1001 HV for 1/8" to 1/4" cracks
 - d) Polyject #1001 EHV for over 1/4" cracks
6. Begin injecting the epoxy resin into the lowest port or start at one side of a horizontal crack. Continue to inject until resin appears at the next port. Release injection pressure, cap the lower port and move injector nozzle to the next higher port. Repeat the injection sequence until the entire crack has been filled.
7. It is good practice to re-inject one of the higher ports after 10 or so minutes to verify that the crack is completely full and has not lost any resin due to seepage or settling of the resin in the crack. Footings often crack at the same point as the wall and additional resin will be required to fill the footing crack.

Option 1. The epoxy surface sealer paste can removed after the injection resin has cured. Use a cold chisel to remove most of the paste and sanding will remove remaining resin. Grinding or burning of the epoxy paste is not recommended.

PROS

High strength bond of crack
 Effective long-term repair results
 Recommended for finished basements

CONS

Lower bond-strengths in actively leaking cracks
 Can cause re-cracking in walls under stress or settling
 Some materials odors can be objectionable or offensive

POLYURETHANE INJECTION

1. Follow the same general setup procedures for epoxy injection above – steps 1-4
2. After the epoxy crack paste has hardened, although it is not always necessary, pre-wet the crack by injecting a small amount of water to later activate the injected polyurethane resin.
3. Inject the polyurethane resin as outlined in step 6 of epoxy injection. Carefully monitor the resin flow at the top port so as not to over inject the resin. Too much resin will foam out the top of the crack and can overflow onto exterior surfaces such as sidewalks, driveways and decks. Cured polyurethane resin is almost impossible to remove.

PROS

Can inject actively leaking cracks
 Economical resin system
 Recommended for moving cracks

CONS

Not a structural repair
 Difficult to inject hairline cracks
 Messy and hard to clean-up resin

BASIC CRACK REPAIR WITH HYDRAULIC CEMENT

Caution! Hydraulic cements contain caustic chemicals and can cause skin irritations and chemical burns. Wear appropriate respirators, safety glasses and gloves to protect against cement dust, debris and chemicals.

1. Dampen the crack with water. Mix a slurry of the hydraulic cement and brush or hand apply over the crack and also coat 2" of surface on both sides of the crack.
2. Using as little water as possible, mix the hydraulic cement into a stiff mortar mix. Starting at the bottom trowel the mix over the entire crack and fill a cove at the bottom of the crack where the floor meets the wall for 6" either side of the crack. Mix another slurry mix and brush over the entire repair.

Option 1 - Chip out the crack 1" wide by 1½" deep, top to bottom and along the floor wall joint 6" either side of the crack. Slot should be "U" shaped or "dove tailed" for best repair results. Proceed with steps 1 and 2.

Option 2 – Substitute an epoxy gel or grout for the hydraulic cement for added durability and bond strength.

PROS

Inexpensive materials
 Quick repair
 Easy low-tech repair method

CONS

Rigid material; re-cracks easily
 Material can shrink or crack as it dries
 Not recommended for finished basements

WET OR ACTIVELY LEAKING CRACK REPAIR

WARNING! Use of power tools, lights and other electrical tools in wet work areas is extremely dangerous! Use properly functioning ground fault circuit interrupters at all times and all cords should be intact and undamaged when working in or around wet areas!

SLOW OR MINOR SEEPAGE

1. Chip out the crack 1" wide by 1½" deep, top to bottom and along the floor wall joint 6" either side of the crack. Slot should be "U" shaped or "dove tailed" for best repair results.
2. Mix a slurry of the hydraulic cement and brush or hand apply into the slot of crack and also coat 2" of surface on both sides of the crack.
3. Start at the top of the crack and work down to the point of heaviest seepage. Mix small batches of a fast-setting hydraulic cement and fill slot to surface. Fill the length of the crack except for 2"-4" of the area of seepage. Allow the installed cement to fully harden a minimum of 15 minutes and the longer the cure the better.
4. Mix a final "plug" batch of the hydraulic cement and work it with you hands until the cement just begins to stiffen. Firmly press the cement plug into the remaining slot and hold for 2-3 minutes or until the cement is rock hard. Mix another slurry mix of the hydraulic cement and brush over the entire repair.

HEAVY OR HIGH VOLUME WATER FLOW

- a. Follow steps 1 & 2 above. Locate area of heaviest water flow and mix one handful of hydraulic cement and create a stiff putty mix. Use the mix to cement a piece of tubing or pipe as a pressure relief port directly over the flow of water. Apply additional layers of mix to reinforce the tube into place. Allow the cement to harden for a few minutes.
- b. Start at the top of the crack work down toward the leak. If the leak is above the floor level or towards the middle, work also from the bottom of the crack up towards the installed pressure relief pipe until the crack is filled and the water is now flowing out of the pressure relief pipe. Allow the installed cement to sufficiently harden.
- c. Remove the pipe and mix a final "plug" batch of the hydraulic cement and work it with your hands until the cement just begins to stiffen. Firmly press the cement plug into the remaining slot and hold for 2-3 minutes or until the cement is rock hard. Mix another slurry mix of the hydraulic cement and brush over the entire repair to finish.

Note: More than 1 pressure relief pipe and or larger diameter pipes may be needed for heavy leaks. The final plugging sequence should always begin with the pipe of least seepage or pressure and progress to the heaviest. Allow the installed cement time to sufficiently harden before proceeding.

BASIC EXTERIOR CRACK REPAIR

Caution! Check with your local utility service providers before you dig to help locate any buried power or other utility service lines. Also, practice safe digging techniques to prevent collapse or cave in of the hole.

1. Locate the crack by examining the exposed top of the wall. Dig a hole large enough to expose 4 feet of length of the wall with 2 feet exposed on either side of the crack. The hole should extend out away from the wall far enough to allow for comfortable work access and prevent possible cave in or collapse of the hole. Dig down deep enough to expose the entire footing. Scrape the wall clean of all loose dirt and wire brush the entire surface.
2. Cut a strip of roofing felt, (90 lb. felt works best) 12" wide by the length of the crack plus 10 " to cover over the footing. Apply a thick heavy layer of roofing mastic tar (the thick 'peanut butter' type) over the entire piece of felt. Press the mastic side of the felt directly over the crack and down and over the top of the footing.
3. Cut a second strip of felt to match the width of the exposed wall and again to the length of the wall plus the 10 extra inches. Once again apply a very thick layer of the roofing mastic to the felt paper. Press the mastic side of the felt directly over the first piece of felt and down the wall and over the top of the footing. Firmly press the felt paper so any air pockets are eliminated and mastic squeezes out from the edges.
4. Backfill the dirt into the hole and tamp the dirt regularly to ensure good tight compaction of the dirt.

Option 1 – Before applying the tar mastic/felt layer, chip out the crack and patch with gel epoxy or hydraulic cement for added waterproof protection.

Option 2 – Substitute a high quality rubber membrane system for the tar-mastic and felt.

PROS

Inexpensive materials
Easy low-tech repair method

CONS

Digging/excavation of crack
Digging/excavation of crack

TIPS OF THE TRADE

"Tack" up injection ports with Crazy Glue Gel.

Temporarily stop actively flowing water by pounding cedar shingles or wood shims directly into the crack. The wood will swell up and stop the flow of water.

Instead of chipping out cracks which can clog up the crack, core drill holes big enough to set surface mount injection ports with hydraulic cement. Good tip for actively leaking cracks.

Chip out actively leaking cracks and pack with Oakum or lead wool to stop flowing water.

Soak absorbent rags in Polyfoam and tightly pack into cracks or around pipe penetrations to stop the flow of water.

Core drill directly into an active leak and set port with hydraulic cement. Place an empty caulking tube over the end of a shop vac hose. Put cartridge tip into the port and suction the water out of the crack while setting other injection ports with #1002FS paste.

Inject behind furnaces, hot water heaters etc. by affixing clear tubing to static mixer nozzle and injection port with hose clamps.

“Springing a Leak” during injection can be stopped by rubbing a candle over the leak, with modeling clay or plumbers putty.

Insert coffee straws, long brad nails, wire, etc. into the crack and mount injection port over nail, straw etc. This will prevent the crack from getting clogged by excess crack paste. Remove straw, nail, etc. prior to injecting.