



I'VE GOT THE PVC BLUES

by Robert E. Reaves

It is summertime and a drought is taking hold in your area. During this heat wave the irrigation system works like it should—reliably. However, because of soil shrinkage, excess water velocity, friction from rocks in the soil and improper installation techniques, you are experiencing PVC failures throughout the property.

Since pipe is the lifeline of the irrigation system it is often taken for granted. Just like any part of the irrigation system, PVC pipe requires proper installation and maintenance. If you have one month or 15 years of experience in irrigation installation, it is essential to review PVC installation on a regular basis.

There are several major causes for the failure of PVC pipe. Many are unavoidable, but you can help prevent others with proper maintenance. Just like a doctor, an irrigation contractor needs to treat both the symptoms and the cause of the problem. Remember, when installed and maintained correctly, a PVC pipe system will have good longevity.

The following are frequent causes of pipe breaks and the methods you can use to prevent problems in the future.

Poor primer and solvent application techniques.

Most of the problems with PVC pipe joints originate with improper application techniques of cements and primers. With better training of the work crew and reading the product labels, many of the leaks and breaks would never happen.

Good primer and solvent application is a case where more is not better. When properly applied, primer softens the PVC pipe to give a better solvent weld. However, too much primer can damage the pipe.

A primer-related pipe break will show up soon after you start up the system. Usually, you will detect a bubble where the pipe burst. Excess solvent can also bring problems, but breaks from too much solvent take a long time to materialize.

Besides too little or too much solvent, problems can originate from the solvent itself. "Solvent cements are considered unstable for use if there is an appreciable change in viscosity. If they become jellied or string-like, they should be discarded. Do not mix different solvents, old and new. Solvent cements cannot be reactivated with primers or other solvents," says Tom Christy, T. Christy Enterprises, Orange, California.

Always read and follow directions for the primer and solvent cement you are using. Apply one coat of primer. Do not let the primer run down the pipe or puddle in the fitting. Then apply solvent to both ends. When you push the ends together there should be a thin bead of excess solvent. Wipe this off with a rag. If you notice a lot of excess solvent, you are applying too much. "Most joint failures are caused by improper application of solvents. If you have a pipe break, leak or the pipe pulls apart, do not attempt to use the same fitting in the repair. Cut away the fitting and the other end of the pipe and start with a brand new fitting," says George Blanco, vice president of technical services and quality control, IPS Corporation, Gardena, California. "Most of the PVC fittings and pipe failures could have been avoided simply by following the proper instructions on the label. As the PVC solvents evolve, it is very important to keep up with the changes. We don't want irrigation contractors getting a poor reputation because of their solvent application techniques," says Pete Seaman, product sales manager, Oatey Company, Newark, California.

The changes in PVC solvent formulations have been brought about by mandates from the EPA. The entire industry must regulate its emissions of volatile organic compounds (VOC) from the use of PVC solvents. It looks like the industry will meet its 1998 deadline for 250 grams per liter for VOC emissions without sacrificing performance.

All of the manufacturers of PVC solvents provide technical training for their customers. Many provide video training tapes, printed educational material, on-site technical service and customer service centers. Take advantage of them.

Too much sunlight exposure.

Never allow PVC to be exposed to the sun for any long period of time. If pipe must be stored outside, use some type of opaque covering. Ultraviolet rays weaken the structure of the pipe, making it brittle over time. If you must run pipe above ground, look for pipe that can tolerate exposure to ultraviolet light.

It's a wise idea to purchase PVC pipe from a reliable supplier who stores PVC pipe in an indoor or covered warehouse. Good air circulation is also important since it prevents overheating. Why inherit problems before you even place the pipe in the ground?

Rough handling of the PVC pipe.

Because of the light weight of PVC, there is a temptation to handle it roughly. Care should be taken to avoid dropping pipe or fittings since undetected fractures could result. This causes future problems. Physical damage to the pipe or fittings like scratches or gouges may significantly shorten the long-term strength of the PVC pipe, especially under cyclic surge conditions.

Debris below the ground.

Rocks and other sharp debris left in the soil during construction may eventually cause friction against the irrigation pipe. Over the years, constant rubbing may cause unwanted pipe leaks. To avoid this headache, remove as many rocks and as much construction debris as possible. For extremely rocky soils, use a chain trencher that can pulverize rocks up to the size of a baseball. Many contractors completely remove all the native soil from the trench and replace it with clean soil or sand. Unfortunately, if you are pulling pipe you don't have this luxury.

Movement of the soil.

Just like water, soil expands and contracts under the influence of freezing, thawing and moisture fluctuations. As an example, the heavy clay soils of central Alabama can swell and then contract so much that you can even stick your hand in the cracks!

In areas of the country like southern Ohio, a winter with several freeze-and-thaw cycles can mean substantial soil movement. Although PVC pipe can tolerate a reasonable amount of soil contraction and expansion, it can only take so much. The best precaution against damage from cold weather and freeze-and-thaw cycles is to bury the pipe at least 12 to 24 inches beneath the surface. This additional depth should provide enough protection from the freeze cycles.

Improper repair techniques.

The key to leak-free pipe repair is to dig a large enough hole that allows you to lift the pipe up and out. It is important to have the pipe ends level when you cement them together.

A common repair "shortcut" is to force pipe together at an angle because the hole is too small to lift up the pipe. When sections come together at an angle, one end scrapes off solvent, which leaves a glob inside the pipe.

The next surge of water will take the solvent into the next valve, causing a clog. In addition, the missing portion of solvent may result in a leaking pipe. This "shortcut" leaves you with two problems instead of one.

There are several types of repair kits available from your local distributor that allow you to fix pipe leaks in a small space. Compression couplings screw into either side of the pipe you

remove. Be sure to completely tighten down the coupling on both ends of the pipe to ensure a leak-free repair.

Compression couplings that are used too close to a tee or elbow may result in the pipe blowing out of the coupling. If it is necessary to use one near a tee or elbow, be sure the fitting is properly thrust blocked. Poured concrete or cinder blocks are commonly used. Thrust blocking helps keep the tee from moving.

Water in the pipe during freezes.

Water expands when it freezes. Consequently, when water freezes inside PVC pipe it can break the pipe. In areas subject to freezing, thoroughly drain the irrigation system in the fall as part of the winterization process. Removal of all water in the pipes is the key to avoiding freeze breaks. For more information on winterization see the article entitled "Freeze Damage: Preventing Big Problems," *Landscape & Irrigation*, November 1995.

Damage from high-traffic areas.

Sprinklers located next to driveways, curbs, sidewalks and other high-traffic areas are more susceptible to damage from pedestrians and vehicles. Sprinklers, tees and elbows can break from downward pressure.

When you repair the damage, look for the cause of the problem. Sprinklers mounted on rigid risers take most of the force of traffic at the tee—which can snap easily. Install sprinklers in these high-traffic areas on either flexible polyethylene pipe or swing joints. Both fittings give when subjected to downward pressure, which limits breakage.

Take care when you backfill around sprinklers. Firmly tamped soil will absorb more shock than a loose mixture.

Valve boxes on pipe.

Are the pipes breaking at certain fittings even though they have been joined correctly? Check and see how the valve box sits in relationship to the pipe. If it is sitting on top of the pipe, a mower running over the pipe can cause the pipe to break at its weakest point—almost always at solvent welded or threaded fittings.

Raise the valve box so there are at least a couple of inches of clearance between the pipe and the valve box. Most installation experts recommend setting the valve box on top of gravel. You can also raise the box with drain pipe extensions, blocks or valve box extensions.

Excess velocity.

Surge pressure and water hammer are the result of excess velocity in the irrigation system. Water hammer can destroy irrigation pipe. Therefore, make sure you specify the correct pipe size for the volume of water you want to move through the system.

Flow velocity in pipe varies to the square of the pipe diameter. For example, consider a system in which you plan to send a given quantity of water through a one-inch diameter PVC pipe. If you decide to use 1/2-inch diameter pipe instead, the velocity would be four times as high in the smaller pipe.

During normal system operation, valves regularly open and close. When valves close, surge pressures can reach 50 to 60 times the normal operating velocity. Water moving at nine feet per second can reach pressures as high as 540 pounds per square inch (psi). Class 200 pipe is rated to handle up to 200 psi. If your system has surges of 540 psi, you are in for big problems. Make certain the pipe you select can tolerate the system pressures. As a rule, design irrigation systems for no more than five to 7 feet per second. Whenever possible, design on the low end of the scale to avoid future problems.

There are a couple of options to repair a system that suffers from excess velocity. As an example, consider a system that sends 30 gallons per minute (GPM) through Class 200, one-inch diameter PVC pipe. You want to lower the demand to 15 GPM, which will move at 4.34 feet per second.

One option is to double the number of irrigation zones to lower the demand. However, be aware when you double the zones you also double your watering time. Make certain there are enough available watering hours in the day to handle the extra zones. With the additional zones, you may need to upgrade to a controller with more stations. These extra stations may also require you to run additional field wire.

Another option is to replace the existing sprinklers with nozzles that have less demand. However, be sure the area coverage and precipitation rate still provide uniform coverage. You can prevent most pipe problems by proper installation and maintenance of the irrigation system. When you install irrigation pipe or repair a pipe break, always assess the cause of the problem. By treating the cause as well as the symptom, you'll be on your way to an irrigation system with few problems.