# Divining the drips

By Eric Herman

**The suspicion that a pool has sprung a leak grows with time, as refillings become more frequent and voluminous. Here's a guide to leak-detection techniques available to route technicians who want to get the drop on the dripping before *real* problems break through.**

It doesn't take much for a leaking pool or spa to move from the category of *annoyance* to *emergency*.

At first, it's a nuisance because you end up filling the vessel with greater and greater frequency and larger and larger quantities of water. Left unattended, however, the leak can grow to a point where damage to the equipment, decking and the structure itself becomes a legitimate — and urgent — concern for the service technician and the customer alike.

The holes that start the problem are typically small, but even a gap of one-sixteenth-inch diameter can leak up to 500 gallons per day — and almost every hole will get bigger with time. Complicating matters is the fact that a leak can start anywhere: The array of plumbing and structural components found in most pool/spa installations can serve as a substantial haystack concealing an elusive needle.

This service challenge has given rise to a nationwide industry segment devoted strictly to leak detection, but it has also led a number of route technicians to develop their own tactics for finding and repairing leaks. For those who simply must do it themselves, here's a guide to the ins and outs of finding a leak.

## What's up, Sherlock?

The first step in finding a leak, say the experts, is determining that one actually exists.

In many cases, a pool that *appears* to be leaking may simply be subject to a high degree of evaporation. "If you're losing more than a half inch per day, though, you can be fairly certain in most parts of the country that you have a leak," says Lance Anderson, president of Anderson Manufacturing Co., a manufacturer of pressure-test accessories in St. Paul, Minn. "If it's less than that, the loss could easily be due to evaporation."

Anderson, who advises service techs throughout the country on leak-locating techniques, recommends a simple bucket test for borderline situations: Simply fill the pail with water and either float it in the pool anchored to the side or place it on a step.

This way, the water in the bucket is subject to the same environmental factors of wind, temperature and humidity as the pool water. "Leaving the bucket on the deck messes up the results," he says, because the water temperature will be different enough on the deck to skew the results.

To conduct the test, mark the waterline in the pool and in the bucket. If, after a day, the pool shows greater water loss than the bucket, then you can be fairly certain the pool is leaking.

"Once you know you have a leak," says Anderson, "you have the challenge of pinpointing its location. You need to be kind of like Sherlock Holmes, following a set of clues until you find the culprit. The first step is determining if the leak is in the structure of the pool or somewhere in the circulation system."

One dependable way to find out is to do some water-loss comparisons: First, with the pump off, measure the loss over a 24-hour period. Then, with the pump on, measure the loss and compare the two figures:

• If the loss is the same, the leak is probably in the pool shell; in other words, a structural leak likely will be unaffected by the circulation system.

• If the water loss is greater with the pump *on*, then the leak is probably located in the pressure side of the plumbing. As water is pushed downstream of the pump, it's being forced out of the leak.

• Finally, if the loss is greater with the pump *off*, the leak is probably on the suction side of the plumbing. If the pump is running, it is unlikely that water being sucked down the line will leak. In fact, the suction action may draw small amounts of air through the leak — which may reveal itself through air in the pump, loss of prime or bubbles being blown from the return line.

"I've found this pump-test method to be extremely reliable," says Chuck Girard, owner of Superior Pool Service in Lilburn, Ga. "It can be amazing the difference you'll find with the pump on. There are going to be some rare exceptions to this rule, and occassionally this test can fool you, but most of the time you're going to have a good idea of where to look."

## Checking the shell

Given identical water loss with the pump on or off, you start checking the structure for leaks.

In one sense, say the experts, the job is easy because you can locate the leak visually. In another, however, the size of some pools results in a wide variety of potential leaky sites — and perhaps more than one. As a result, the leak-hunting process can take several hours or even *days* in large commercial pools.

The method most commonly used to find structural leaks is known as a *dye test*. With the circulation system off and using a syringe, the technician injects a thin ribbon of a dye so-

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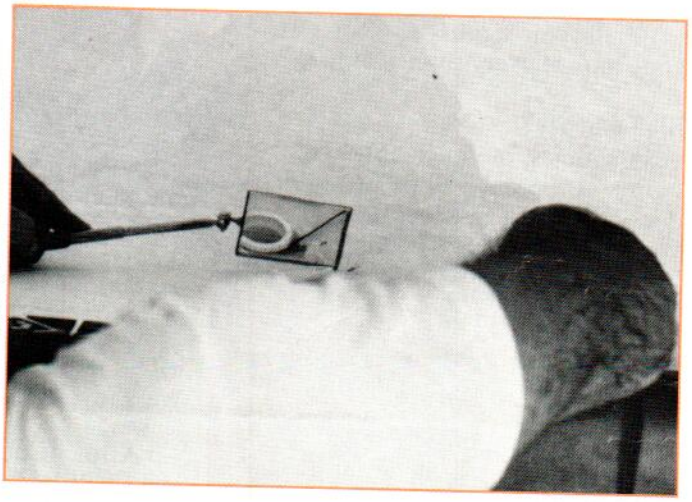
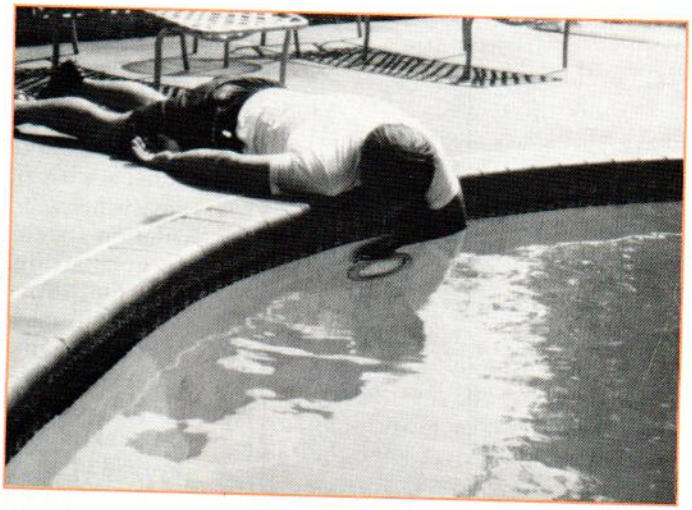
Photos courtesy Anderson Mfg. Co., St. Paul, Minn.

***HAVING THE PROPER** gear is crucial for effective and safe leak finding. The equipment shown here includes a variety of open-stemmed plugs, air and water connection fittings, and a regulated air-pressure supply.*



***A SMALL MIRROR** attached to the end of a wand can be a big help in spotting dye test results on the underside of inlets and other protruding pool-wall fittings.*



***MANY PROBABLE LEAK** locations can be reached from poolside. The skimmer and displaced or cracked tile are always prime suspects as leaky spots.*

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lution toward a suspected fissure. If those suspicions are valid, the dye will be quickly sucked out of the shell through the leak.

Most leak finders employ a diluted fabric dye solution for the test — a dark dye for white-plaster pools and a white, milky dye for colored-plaster pools. Some techs, however, use food coloring or some other mixture instead. (Just about any colored fluid will do, say technicians. Coming up with a useable formula requires only the simplest trial and error in a sink or basin.)

If you have an idea where the leak is, the dye test is quick and easy; if you're uncertain or suspect multiple leaks, however, it can be quite laborious. Indeed, when you don't know what you're up against, you need to reach down into the water from the deck and squirt dye at about three-foot intervals around the pool's full perimeter.

Because the leaks may be located on the undersides of fittings that protrude from the walls, it helps to have a small mirror handy at poolside; this will help you stay dry as you get a good look at every suspect area.

### High and dry?

Sometimes, of course, the leakage occurs at the main drain or another deeply submerged location. Here, you usually can't avoid diving in with dye and syringe for a careful tour of the floor and hopper.

Fortunately, however, the spots most likely to leak are accessible from the deck. "You should start out with the skimmer," explains Girard. "That's No. 1, then you should try the returns and the tile grout. If you don't find it there, then you should get in the pool and check the light niches, the hydrostatic valves, the main drain and so on.

"I enjoy getting in the pool and looking for leaks," he adds. "When it's hot, it's a great way to spend the day."

Not everyone, however, is as anxious as Girard is to get wet. "We'd prefer not to have to get into the pool at all, so we've developed tools that let us dye test outside the pool," says Vince Balogna, owner of A-1 Pool Service in Wayne, N.J. "We use a big syringe that we bought in a pet store and rigged up with some fish-tank tubing. We send the dye down the tube

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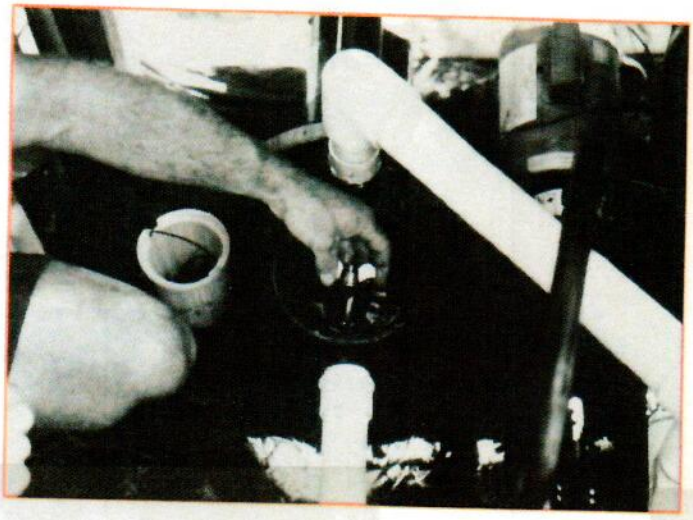


***THE UNDER-DRAIN in the pump pot is often used as an access point for pressure testing of plumbing runs. Sometimes, however, other locations are used, such as the skimmer; in those cases, the pump needs to be sealed off with a sturdy, straight-sided expansion plug.***

## The better part of valor

Taking on a leak detection task yourself is not always the best solution.

Indeed, say some technicians, calling in a leak-detection specialist with high-tech sonar equipment — and his or her guarantees that the leak will be found — are strong incentives to subcontract the work.

"It runs about 50/50 for me," reports Steve Swanson, owner of The Pool Co. in Concord, Calif. "It really depends on the nature of the leak and whether or not I can really help out the customer by finding it myself."

Swanson says that he usually takes the first couple of steps in the leak-hunting process. "If I can't find it quickly with a pressure test, then I'll sub it out," he says.

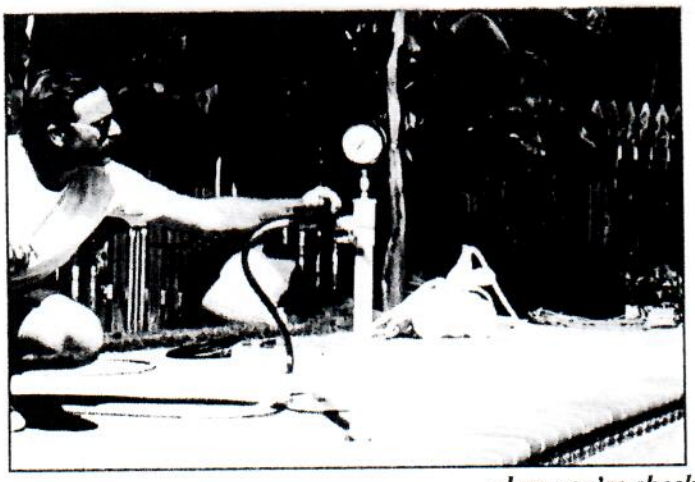
"I do have a lot of the equipment; I probably have as many plugs as the specialists do, and I have a stethoscope and a geophone. But rather than spend a lot of time searching for the leak," he says, "it's often better for me and the customer to go with the service."

Part of the challenge, according to Swanson, is background noise that disrupts his non-electronic listening devices. "There are those situations where airplanes are going overhead or there is traffic nearby and I just can't pick up where the leak is. The electronic listening devices that these companies use are far better suited to locating leaks in those circumstances."

Still, knowing how to find leaks is a strong benefit to almost any service business, whether you hire a professional leak finder or not.

"It's like anything else that you sub out," explains Swanson. "It really helps if you speak the language and are familiar with the process so you can understand what they're doing. It's helpful in protecting you *and* your customer."

**— E.H.**



***THE SKIMMER** is a good point for hooking up pressure-testing gear, especially when you're checking main drains and suction side lines.*

"Sometimes you'll have to take apart a valve and access the line that way, or you can hook up to some models of pumps. I carry a variety of plugs so I can close off just about any type of opening. And with the open-stem plugs I carry," he says, "I can access the plumbing at a variety of locations."

Anderson agrees with Girard and recommends interfacing the pressure induction system to the plumbing using an open-stem plug. That way, he says, a good seal is guaranteed.

"Once you have the system hooked up," he says, "you apply water pressure. Water doesn't compress nearly as much as air, so any pressure loss within the system is going to be due to a leak. You raise the pressure to 20 psi and wait a couple of minutes to see if you have a pressure drop."

If you see the pressure going down, then you can be sure the leak is in that line. "If you have the plumbing properly sealed, you will notice the decrease in pressure very quickly, usually within two minutes," Anderson says.

If there is no loss within a few minutes, it's time to move on to another line. Be careful in so doing that you release the pressure before removing the plugs!

## Airing the problem

If you *do* discover a leak with the water test, however, your attention should turn immediately to the air test.

The testing procedures themselves are quite similar: The plugs you used for the water pressure test are quite adequate for air testing and can be left in place. Unlike the water test, however, the air test does not yield any clues with a pressure gauge: Air compresses too readily to provide an accurate measure of loss in the line. Rather, the purpose is to create the sound of air escaping from the lines, giving the leak finder something to listen for.

Thus, using a regulated air source, you apply pressure to the line. The regulator must be adjusted to maintain a constant pressure of 20 psi — even as air escapes from the leak. A note of caution: Raising the pressure above that level, says Anderson, can cause a leak where there was none before!

"I like to use a combination of air and water," notes Balogna. "The mixture makes a definite noise you can hear easily — if you know what to listen for."

Anderson explains that the listening part of the process is where personal preference comes into play. "A lot of people, for example, don't like to use compressors because the background noise confuses them. Instead," he says, "they'll use a nitrogen bottle, which is very quiet.

"As for the type of listening device, there are several options," he says. "Some people like stethoscopes, while others like geophones, which are non-electronic devices designed to pick up the slightest vibration in the ground."

The key to effective leak detection, of course, is finding the very spot where the water is leaving the system. Anderson notes, however, that finding the faulty pipe is sometimes all that's needed. If, say, you're involved in troubleshooting a pool prior to a major renovation in which decking and plumbing will be reworked, the whole line most probably will be replaced.

Another strategy some technicians use is to find the leaking pipe themselves to narrow down the time and costs involved in bringing in an outside leak-detection service to pinpoint the problem.

## Ear to the ground

Once you've heard the sound a leaker makes, you never forget it. "I don't really know how to describe the sound," says Balogna. "I guess it's what you would think water and air escaping from a pipe sounds like.

"When you hear it, though, you know that you've hit the spot. Nothing else in the ground sounds like that," he reports.

One of the challenges in listening for leaks is isolating what is often a faint noise through a variety of background noises. In fact, the primary drawback to stethoscopes and geophones is the sound of traffic, airplanes, wind and even the compressor being used to fill the pipe with air.

Electronic listening devices available from leak-detection manufacturers are the gadget of choice for companies that move into leak detection as a specialty. More so than geophones and stethoscopes, these are specifically designed with features — mostly sonic filters — that make hearing the leak much easier.

The problem is that these devices, as well as the plugs and the pressure induction systems, represent a sizeable investment for technicians. If you won't be doing much work of this sort, electronic listening devices are indeed way out of most price ranges.

"Because of the amount of work we do, the investment we've made in equipment is worth it," says Balogna. "For other companies, it might be better to call in a specialist."

Still, techs who have made the jump into leak detecting say it's a strong specialty that can lead to profitable fix-it jobs. "We've made some good money at it," says Girard. "It's really not hard to do at all if you try it a few times and get the right equipment.

"It's nice to make the money for yourself that would've gone to somebody else," he concludes. ■

# LEAK DETECTION

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and just move the syringe around the pool until we find the leak."

"The nice thing about dye testing," explains Girard, "is that you know right away when you've found the leak. Any leak will take the dye right out of the pool. Sometimes you even see a steady stream going straight from the syringe into the leak."

Once you've isolated the structural gap, you face the task of repairing the damage. (For details on plaster-patching techniques, see "A patch in time," *P/SN*, Dec. 9, 1991, p. 42 and "Patching with a full palette," *P/SN*, Feb. 24, 1992, p. 54.)

## Down the pipes

Testing a pool/spa system's plumbing for leaks gets a bit more involved than checking out the structure, say the experts, but the procedures pick up right where structural testing leaves off.

Indeed, says Anderson, some plumbing elements can also be tested using a dye test. "If, for instance, the dye is sucked down into the main drain with the system off, then the main drain line is leaking," he explains. If you suspect such a leak, he adds, "you may need to decrease the size of the opening by using an open-stem plug. This will increase the velocity of the water moving toward the leak, making it easier to see dye movement."

Dye tests also come in handy for testing a spa's air channel. This test has its limits, however, because even if the dye is sucked down the air holes, it is very difficult to pinpoint exactly the leak's location.

In general, however, technicians looking for a leak in the plumbing set aside their dyes and syringes and turn to *pressure tests*. These tests involve lots of patience as you move as systematically as possible through the system to eliminate doubts. The important thing, say technicians, is that the testing *works*.

As a first step, you need to acquire the proper tools. "Depending upon your anticipated level of involvement with leak detection, an investment of anywhere from $100 for several test plugs and a pressure induction system to *thousands* of dollars for a full assortment of plugs and electronic-listening/pipe-locating equipment is required," says Anderson.

Here's a shopping list:

- A proper set of plugs, which typically means acquiring a variety of sizes in both closed- and open-stem varieties. Plugs, says Anderson, can range from a low cost of $2 apiece all the way up to $30 apiece for certain specialized types.
- An air- and water-pressure induction system, which is needed to fill lines with a precise amount of pressure and then monitor pressure drops. These systems can be purchased from pressure test-kit manufacturers or rigged at the shop. An induction system basically consists of four main components: a plumbing attachment, a pressure gauge, a connection for an air and water source, and valving to control the flow of air and/or water entering the system.
- An air compressor or a SCUBA-style tank of compressed air, which is required to deliver air to the system. A nitrogen tank will also do the trick.
- A listening device to enable you to hear pressure leaks. Doctor's stethoscopes are a popular choice, but there are many devices available in the industry designed specifically for leak-detecting applications.

Anderson urges technicians to be careful to use plugs designed specifically for pressure testing. "A lot of people have tried to pressure test using winterizing plugs, which have tapered sides. These aren't designed to hold the pressure required for a pressure test. And threaded plugs, while they won't pop out, have a tendency to leak around the threads."

He also urges technicians never to exceed 20 psi during testing; to keep the system under pressure only while testing; and never use an unregulated air source. "Any time you're dealing with pressure, you've got to keep safety in mind at all times," he says.

## Performance under pressure

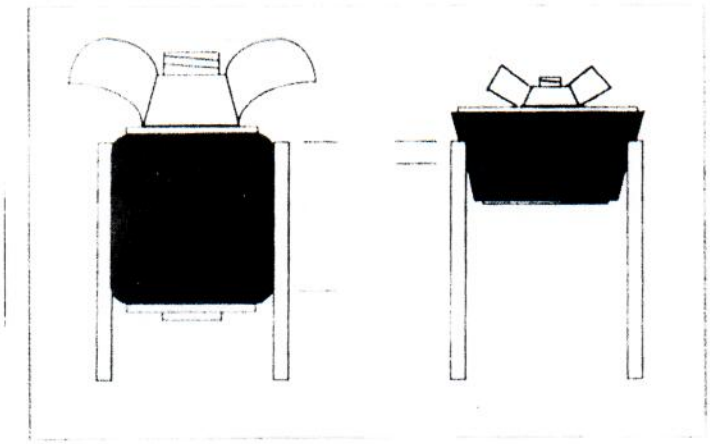
Those purchases made and caveats in mind, you can begin the test, which is usually a two-step affair: The first, a water-pressure test, is used to identify the leaking pipe; the second, an air-pressure test, is performed to pinpoint the leak along the plumbing run.

Begin the test with a simple process of elimination, moving from the most likely leak sources to the least. You know from the results of the preliminary leak testing described earlier in this article, for instance, whether you should be looking at the suction or pressure side of the system.

To begin this round of testing, you isolate a suspected plumbing run. Most experts recommend closing off all of the appropriate fittings in the pool and skimmer with test plugs and picking up the plumbing run at the pump or at a valve back at the equipment pad.

"There is really no best opening to induce pressure from," says Anderson. "Each job may require a different way of setting up than the one before." Just the same, he says, "Most experts find it's better to plug multiport valves and induce pressure from the pump, skimmer, or return lines."

"Sometimes you have to be creative in the way you isolate the plumbing," adds Girard. "I don't like to have to cut plumbing to perform a test, so I'll try every way possible to plug the system and set up the pressure tester without breaking out a saw.



***DO YOU KNOW the difference between a straight-sided, pressure-test plug and a tapered winterizing plug***