
PINPOINT PLUMBING LEAKS
STEP 3: In Leak Detection
a slide show that will step you through the process
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Pipe Leak Location

Objective:

- Pinpoint exact location of buried pipe leak

Method:

- Sonic Location
- Helium Detection

Assuming the isolation pressure test identified a leaking section of pipe, it is now necessary to identify the exact location of the problem. Finding this location will facilitate a proper repair with minimal deck disturbance. Although products are advertised to seal leaks from within the pipe, these solutions are temporary at best. Most leaks exist because of some problem that can only be fixed by physically inspecting and repairing the break. The pipe leak location methods discussed in the following slides should allow pinpointing underground leaks so that an 18" x 18" hole is all that is required to make the repair.

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Pipe Leak Location

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- Sonic Location
- Helium Detection

Finding underground plumbing leaks is a challenge that exists in a number of industries. Numerous location and detection methods have been developed including video inspection, infrared thermography, ultrasonic and sonic location, and tracer gas or smoke detection. Because of the relative small pipe size, low pressure, and complexity of most swimming pool plumbing systems, many of these methods are not applicable. Sonic location and helium detection however, are two methods that are very well suited for the characteristics of swimming pool plumbing.

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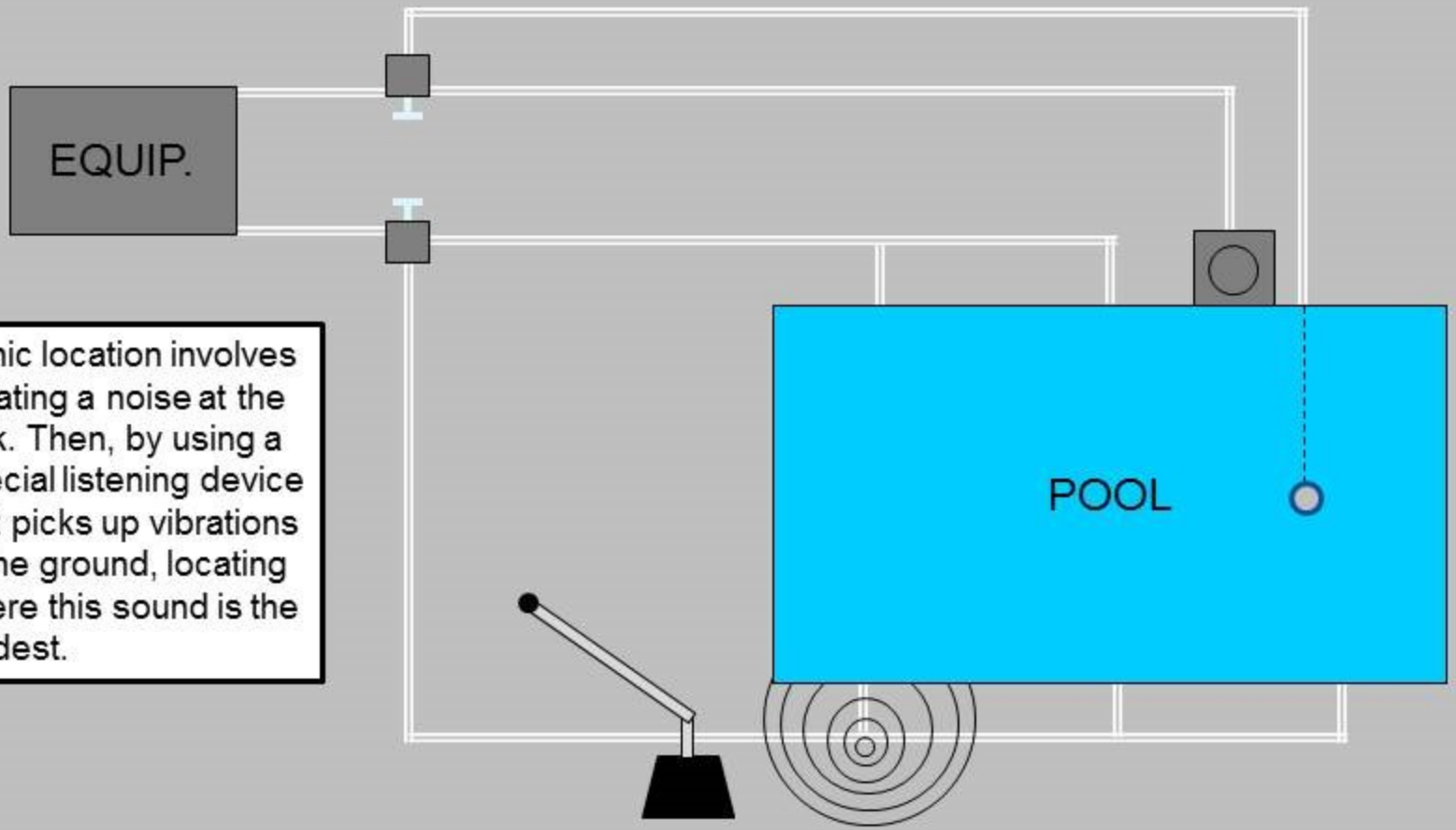
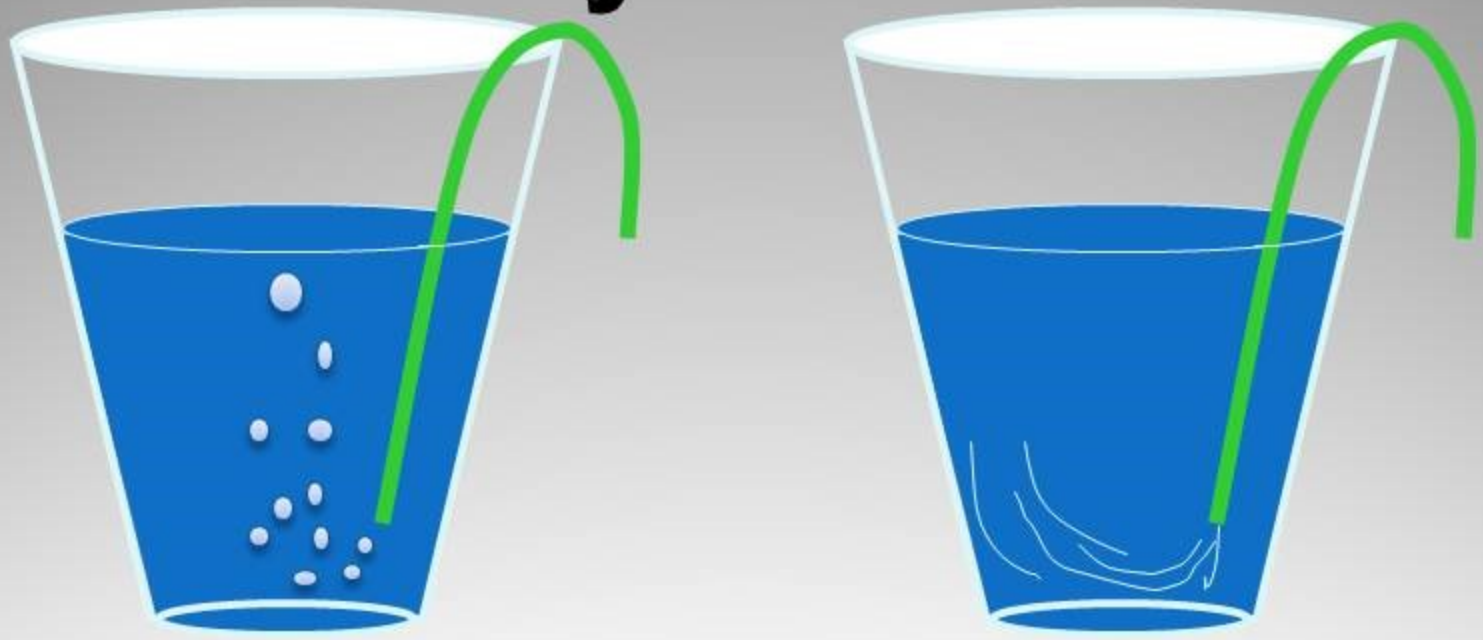
Sonic Location



Sonic location involves creating a noise at the leak. Then, by using a special listening device that picks up vibrations in the ground, locating where this sound is the loudest.

Which do you hear?



AIR

WATER

The key to effective sonic leak location is creating a distinct and audible sound at the leak. Consider the illustration above. Obviously, it is easier to hear the bucket of water that has a hose blowing air into it than it is to hear the one that has water running into it.

By creating the same sound underground that one would here when blowing air through a straw into a glass of water, an easily detected leak sound is produced.

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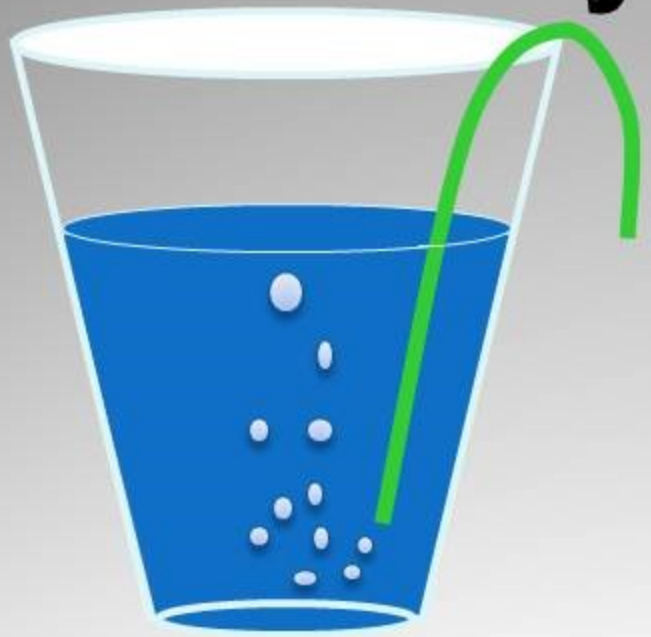
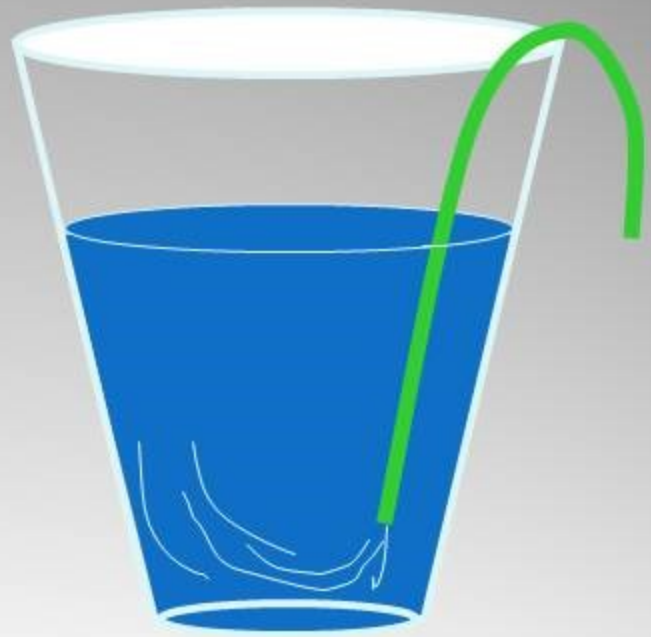
Which do you hear?



AIR



WATER

Although the term "ultrasonic" is often used by those advertising leak detection services, this is not accurate. Ultrasonic refers to sounds in a frequency above the normal human hearing range, (very high pitched sounds). Ultrasonic leak detection is used in some industries especially those which utilize very high pressure lines, but it has little use around a swimming pool. Swimming pool leak detection is primarily involved with sound in the normal hearing range of humans, thus called "Sonic" sounds.

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Sonic Location Equipment

- Pressure Testing Equipment
- Regulated Air Source
- Listening Device

To create and detect leak noises, a regulated air source (compressor or tank) and a listening device will be needed in addition to the same pressure testing equipment which was used for pressure testing.

Regulated Air Source

From
Air Source

Air will be put into the leaking section of plumbing through the same pressure testing equipment that was set up for the previous pressure test.

The air source must be able to provide a constant flow of air into the line even as the air escapes from the leak. It also must include a regulator which keeps the pressure from getting to high.

Compressor as an Air Source

A regulated ¾ horsepower compressor is adequate to provide this air flow to the line. The regulator should be set to provide no more than 20 psi of pressure. Often 5-10 psi is adequate to create the desired noise.

A small compressor like this will remain running constantly as air is put into the line. A resulting drawback is that it creates a noise that can be distracting when listening for the leak.

It is helpful to use a long air hose which allows the compressor to be placed far away from where you will be listening.

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Compressor as an Air Source

A compressor with an attached air tank offers the advantage of quiet air delivery for short periods of time.

The compressor operates while building pressure in the tank. As air is drawn from the tank however, the compressor is quiet until the tank needs to be refilled.

The downside to such a compressor is that they are bulkier and less portable than those without.

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Nitrogen Tank as Air Source

Another option for quiet air delivery is to use a high pressure gas cylinder such as a Nitrogen Tank. While rumored to make a better noise than air, nitrogen is used only because it is an inexpensive, inert gas that does not freeze up lines as CO2 does. Nitrogen does not make a different or better noise than plain air. In fact air is made up of almost 80% Nitrogen and thus the two gases have almost identical properties when used for pressure testing.

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Nitrogen Tank as Air Source

A tank such as this will never give confusing background noises, but they will need to be re-filled. If using this option it is wise to carry several tanks on the service vehicle at all times.

Nitrogen tanks are generally leased from welding supply stores or other businesses listed in the Yellow Pages under "Gas-Industrial or Gas Cylinder."

Specify the less expensive "Industrial Grade" nitrogen which has a lower purity than that which is used for medical purposes.

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Nitrogen Tank as Air Source

You will also need to purchase a "Single Stage Regulator" which attaches to the tank and indicates the pressure remaining in the tank, as well as providing a means for controlling the output pressure.

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Listening Device

A listening device picks up ground vibrations produced by the pressurized leak.

Originally developed for the water municipality industry, listening devices range in sophistication from simple stethoscopes to computerized electronic equipment.

For swimming pool purposes a good listening device must be sensitive enough to detect sounds through several feet of soil and concrete yet durable, and easy to use.

Anderson Manufacturing Company has found the following listening devices to be especially well suited for swimming pool leak detection.

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Geophones

Geophones are a completely mechanical device that pick up ground vibrations through 2 large brass sensing heads that are placed on the deck. The sounds are then transmitted to the operators ears through stethoscope type ear pieces.

This inexpensive and durable piece of equipment is also very sensitive especially in the lower frequency ranges of sounds that travel a long distance underground. While this is helpful for detecting the leak sounds it can occasionally be difficult to pinpoint the sound to a small enough area to dig a hole.

Geophones also tend to pick up lots of "outside" noises that can be confusing when listening for the leak.

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Electronic Listening Devices

XLT 17

Electronic Listening Devices offer several basic advantages over geophones. First, through electronic amplification it provides volume control and greater sensitivity. Secondly, the LED readout on the face of the unit provides a visual representation of the leak sound being detected so the operator doesn't have to depend on ears alone.

The most important feature however is the frequency filters which help to eliminate distracting "outside noises" and can be used to highlight leak sound frequencies that enable pinpoint detection.

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Electronic Listening Devices

XLT30

A "Bigfoot" microphone is used for picking up vibrations over solid substances such as the pool deck or asphalt. The actual microphone of the Bigfoot is housed inside a large rubber "muffler" that helps to eliminate outside noises .

Also included is a Ground Probe Microphone which used for detections over grass or gravel where vibrations are not well transmitted to the Bigfoot. By pushing extension rods into the ground this device picks up sounds in these areas.

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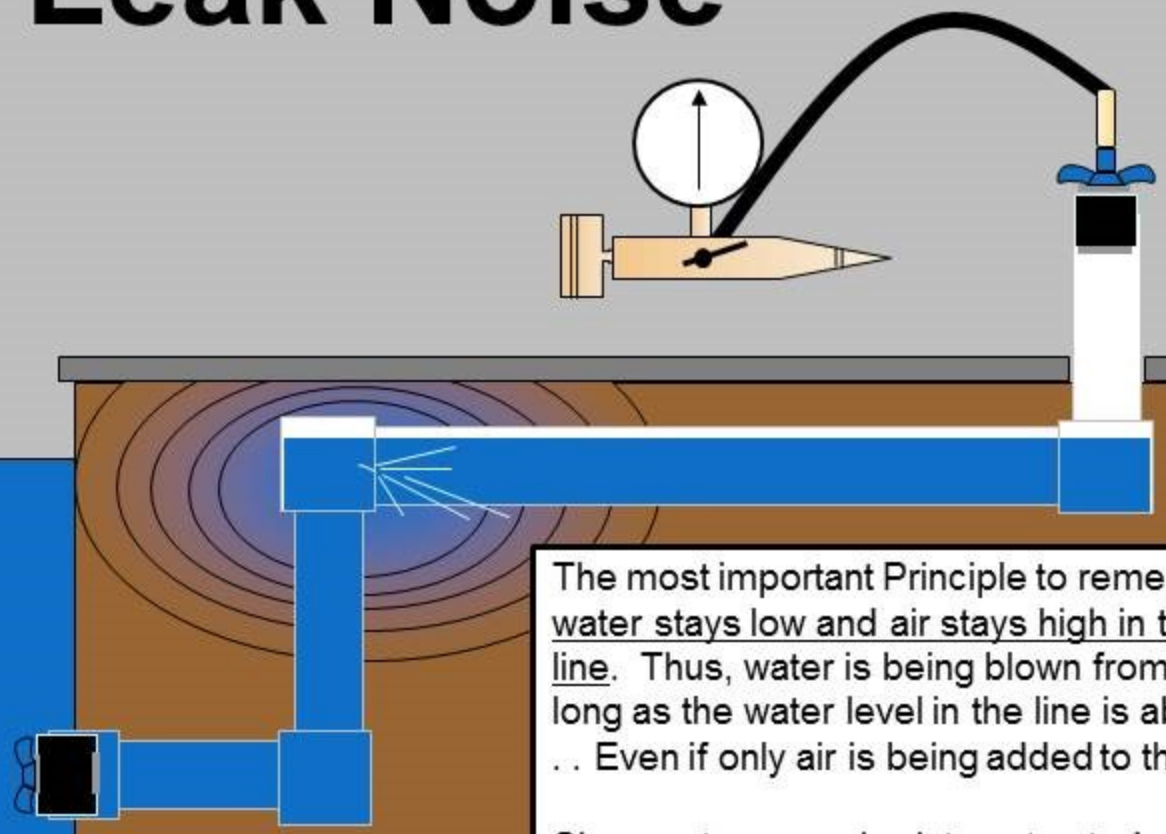
To Make a Good Leak Noise

Air must escape into saturated soil!

Regardless of what type of listening device you use the most important part of Sonic Leak Locating is making a good noise at the leak. In order to create this sound consistently one must again consider the *Pressure Testing Principles* which help us understand how air and water behave in the plumbing line being tested.

Poor Leak Noise



The most important Principle to remember is that water stays low and air stays high in the plumbing line. Thus, water is being blown from the leak as long as the water level in the line is above the leak . . . Even if only air is being added to the line!

Since water escaping into saturated soil does not create as distinct a sound as air it is important to be assured that air is reaching the leak before pulling out the listening device.

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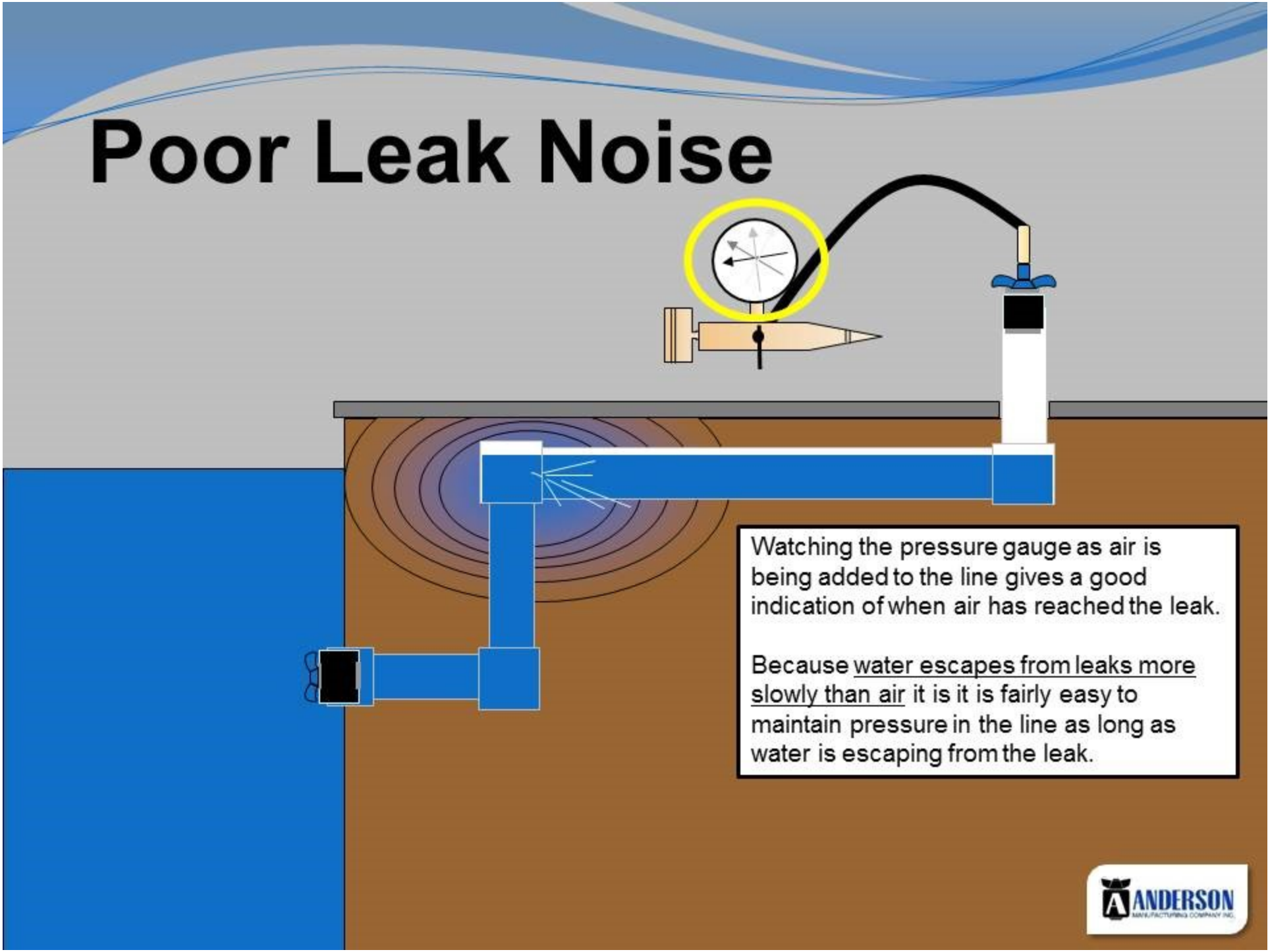
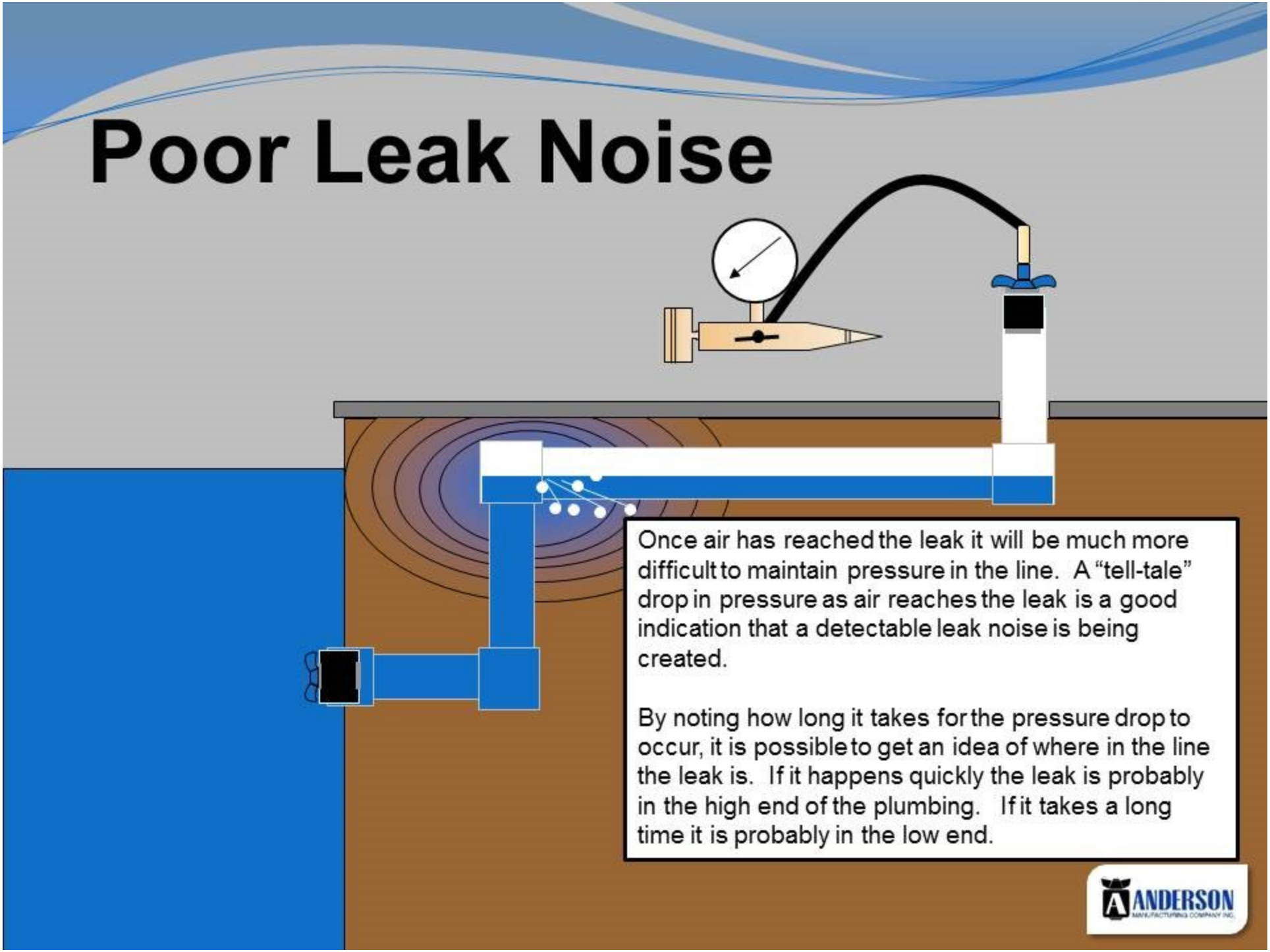
Poor Leak Noise



Watching the pressure gauge as air is being added to the line gives a good indication of when air has reached the leak.

Because water escapes from leaks more slowly than air it is it is fairly easy to maintain pressure in the line as long as water is escaping from the leak.

Poor Leak Noise



Once air has reached the leak it will be much more difficult to maintain pressure in the line. A "tell-tale" drop in pressure as air reaches the leak is a good indication that a detectable leak noise is being created.

By noting how long it takes for the pressure drop to occur, it is possible to get an idea of where in the line the leak is. If it happens quickly the leak is probably in the high end of the plumbing. If it takes a long time it is probably in the low end.

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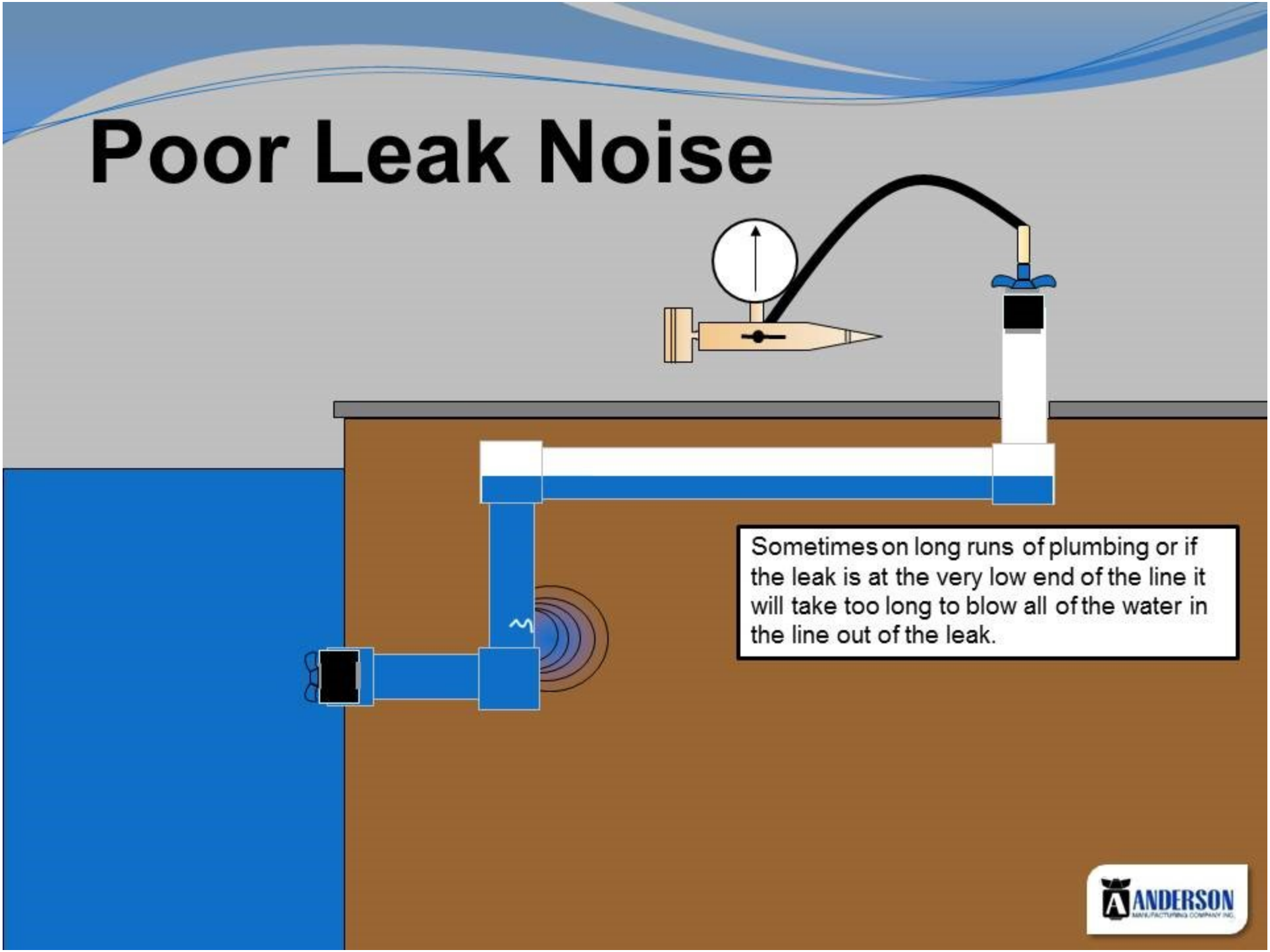
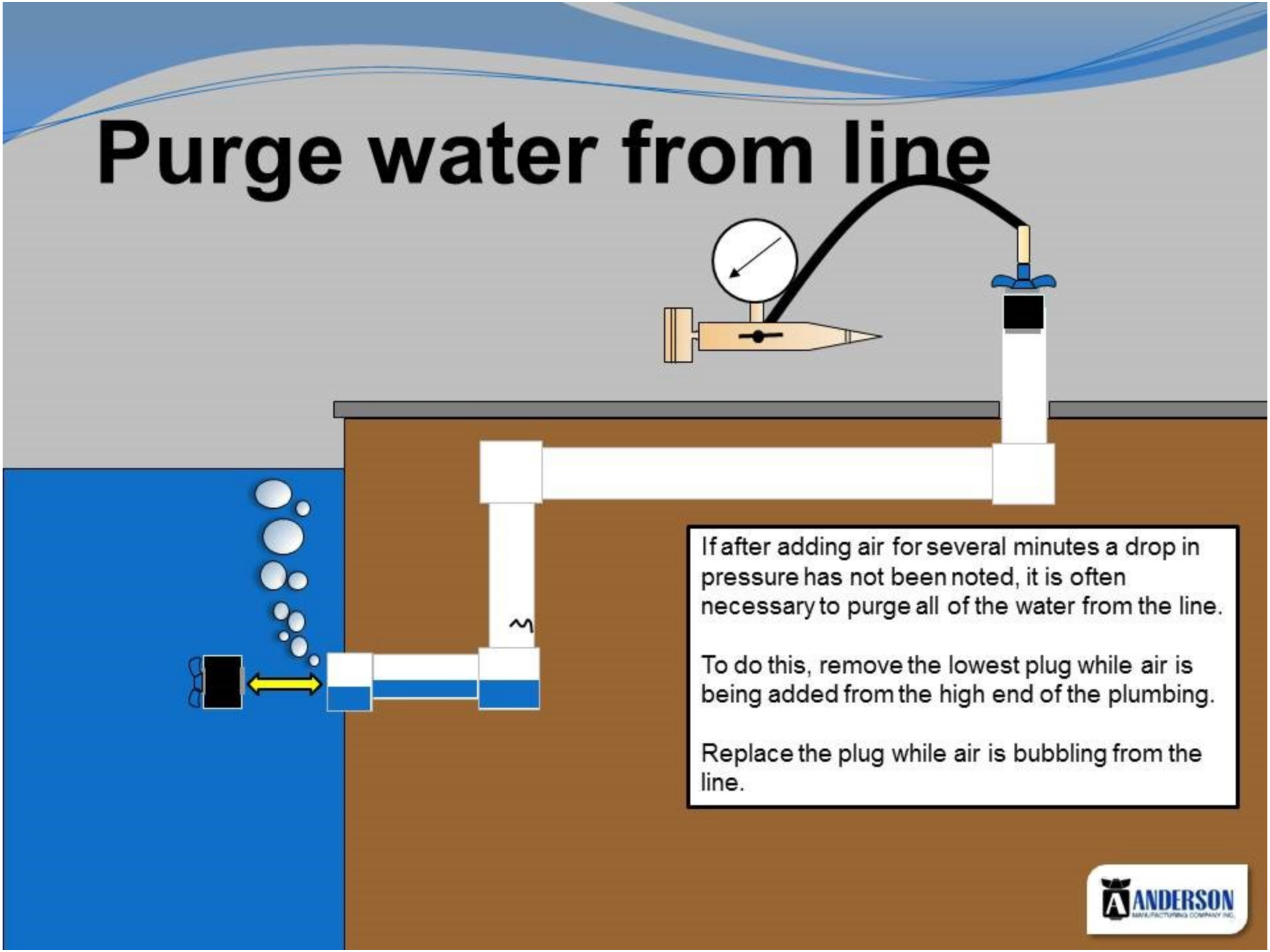
Poor Leak Noise



Sometimes on long runs of plumbing or if the leak is at the very low end of the line it will take too long to blow all of the water in the line out of the leak.

Purge water from line



If after adding air for several minutes a drop in pressure has not been noted, it is often necessary to purge all of the water from the line.

To do this, remove the lowest plug while air is being added from the high end of the plumbing.

Replace the plug while air is bubbling from the line.

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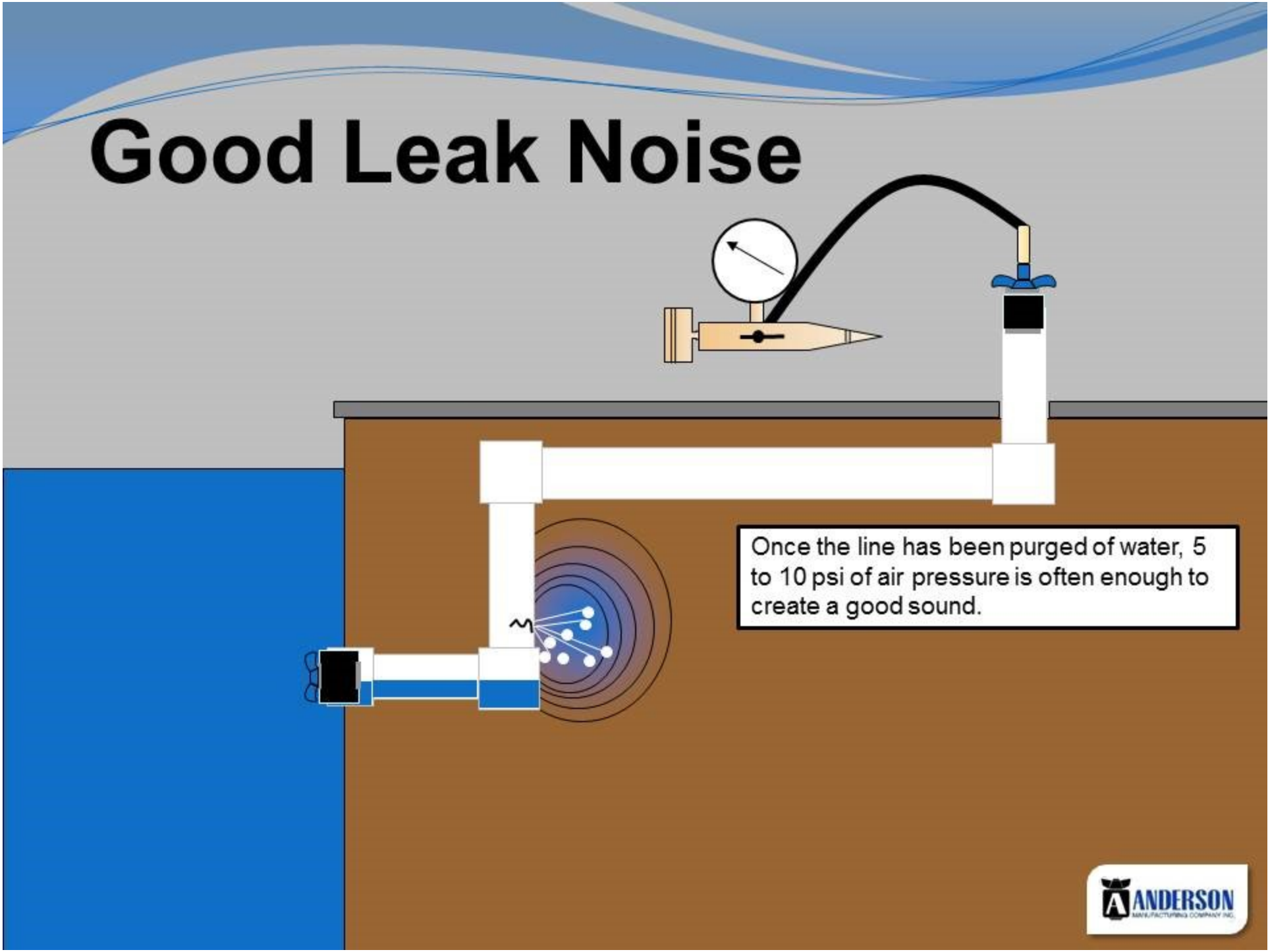
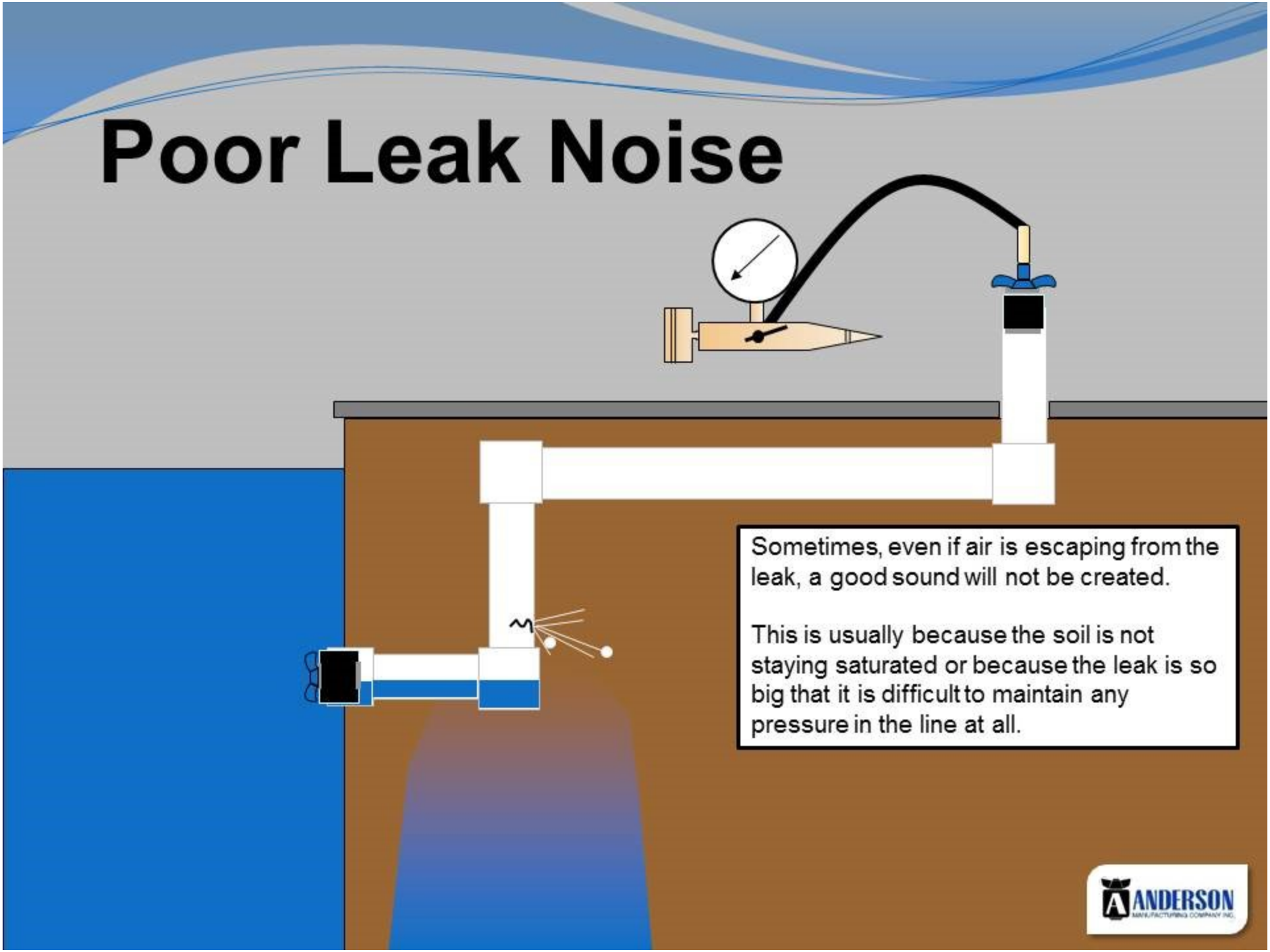
Good Leak Noise



Once the line has been purged of water, 5 to 10 psi of air pressure is often enough to create a good sound.

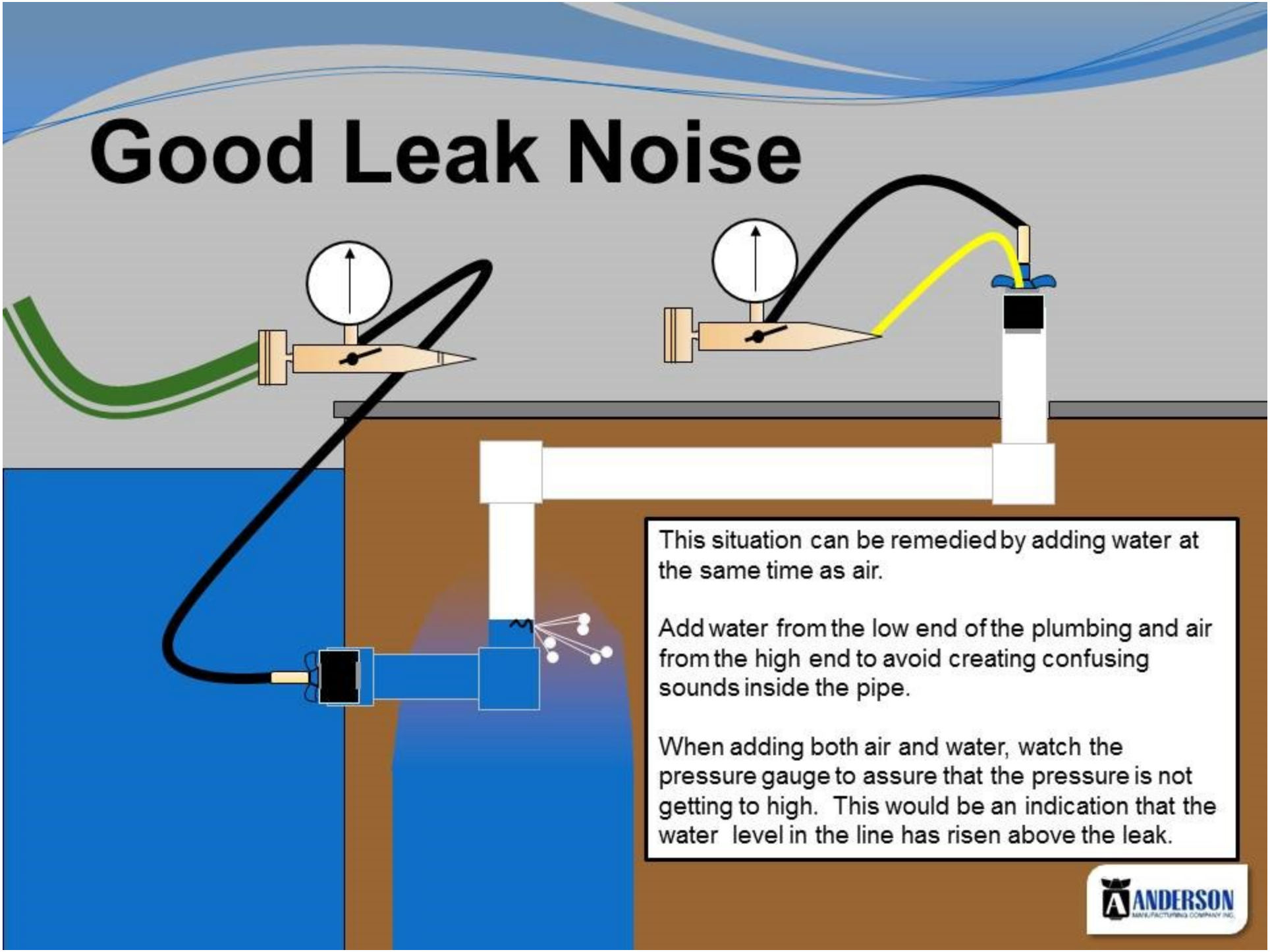
Poor Leak Noise



Sometimes, even if air is escaping from the leak, a good sound will not be created.

This is usually because the soil is not staying saturated or because the leak is so big that it is difficult to maintain any pressure in the line at all.

Good Leak Noise



This situation can be remedied by adding water at the same time as air.

Add water from the low end of the plumbing and air from the high end to avoid creating confusing sounds inside the pipe.

When adding both air and water, watch the pressure gauge to assure that the pressure is not getting to high. This would be an indication that the water level in the line has risen above the leak.

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Listen for Loudest Sound

Once assured that the leak sound is being properly created listen along the path of the buried line for the distinctive "bubbling/gurgling" sound. An initial survey of the line is usually done with the frequency filter "off" and volume on high, (if using an electronic listening device). Readings should be taken at 1 – 2 foot intervals along the line with special attention paid to locations where the line elbows or T's.

If confusing background noises exist, consider using the frequency filter to minimize these sounds. Keep in mind that a well pressurized leak will create noises in the full spectrum of sonic sounds, but that low frequency sounds travel further underground.

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Listen for Loudest Sound

Once the leak sound has been detected move the microphone around listening for the loudest, most distinct sound. By using the frequency filter to highlight high frequency sounds, which don't travel as far underground, it should be possible to pinpoint the exact location of the leak.

This leak was two feet underground in sandy soil. Note the sound of the compressor in the background. Listen to the variation in the bubbling sound as the pressure is varied between 0 and 5 psi.

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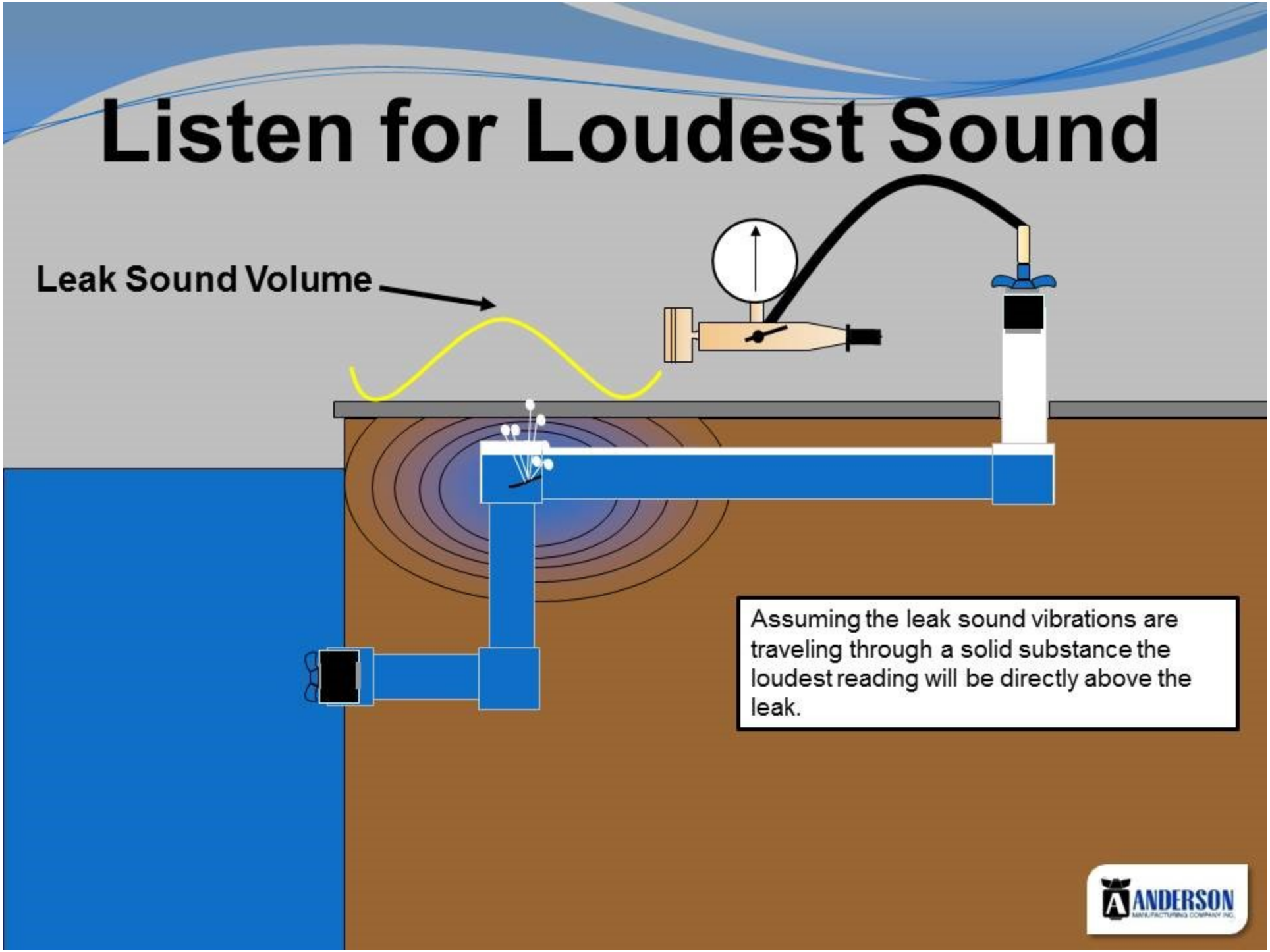
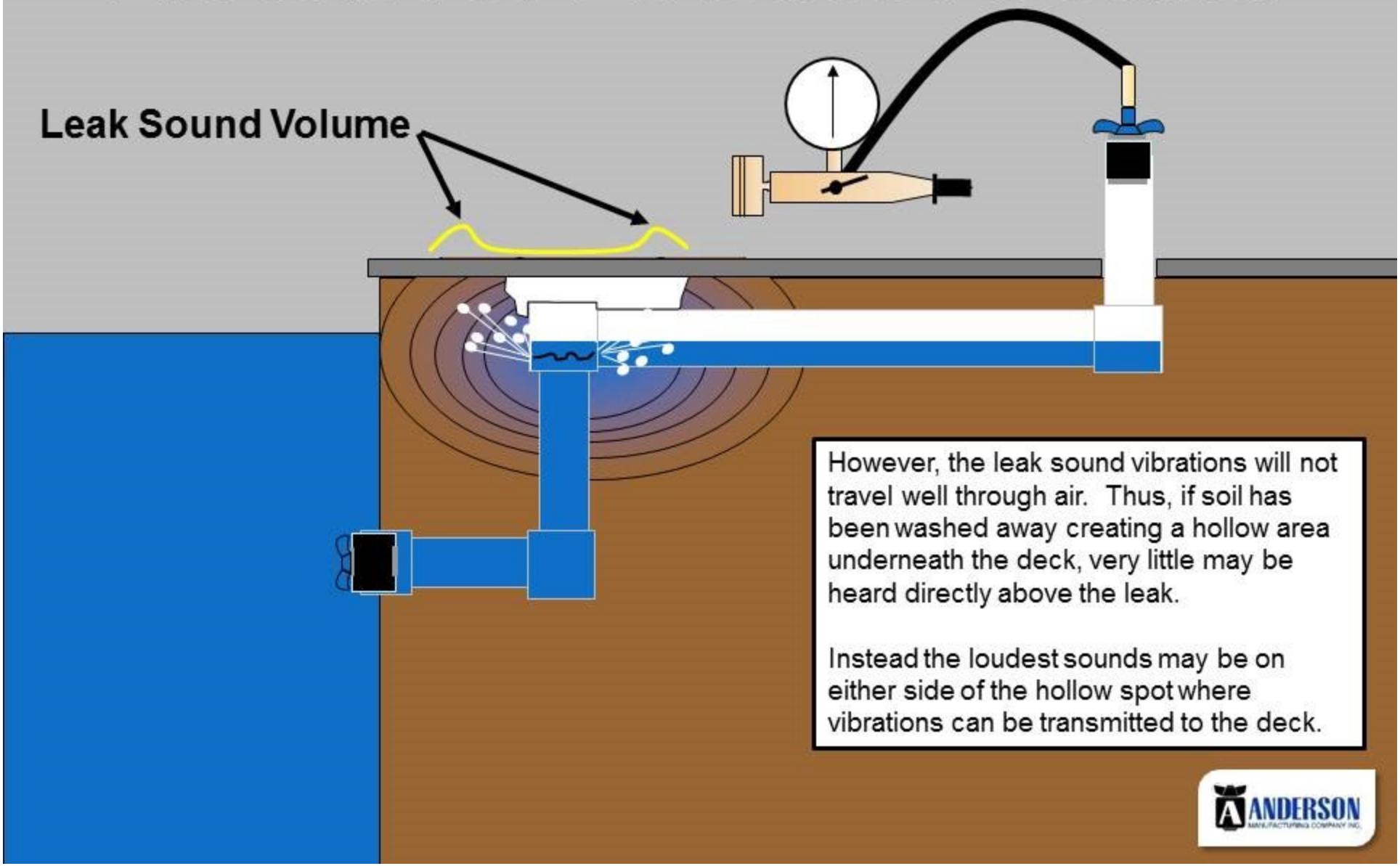
Listen for Loudest Sound



Listen for Loudest Sound



However, the leak sound vibrations will not travel well through air. Thus, if soil has been washed away creating a hollow area underneath the deck, very little may be heard directly above the leak.

Instead the loudest sounds may be on either side of the hollow spot where vibrations can be transmitted to the deck.

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Helium Detection

In rare situations where sonic location is not possible because of the inability to maintain soil saturation or line pressure. Or where the soil conditions do not provide for effective listening, Helium Detection provides valuable information.

Helium detection works by detecting the presence of a gas (helium) as it escapes from a leak. Helium is a desirable tracer gas because of its small molecular structure which allows it to rise and penetrate through most any soil.

Helium Detection

Like nitrogen, helium is purchased in a high pressure gas cylinder. It is put into the line through through the pressure tester in basically the same way that air or nitrogen is for sonic locating.

Instead of regulating the pressure of the gas as it goes into the line however, a flow regulator is used to regulate the flow of helium. This is done to avoid "flooding" the leak area with helium. Ideally just enough helium should escape from the leak to provide a reading in a small area just above the leak. Too much will cause helium to be detected in a large area.

As with sonic locating, the lines should be clear of water before adding helium to assure that gas is escaping from the leak.

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Helium Detection

A Helium Detector actually detects any gas that has a different thermal conductivity, (the rate at which temperature moves through it) from air. Helium has a very high thermal conductivity.

Air is sampled through a hose and continuously analyzed. The detector provides a readout on a series of LED lights. The higher the concentration of helium the more lights illuminate.

Helium Detection

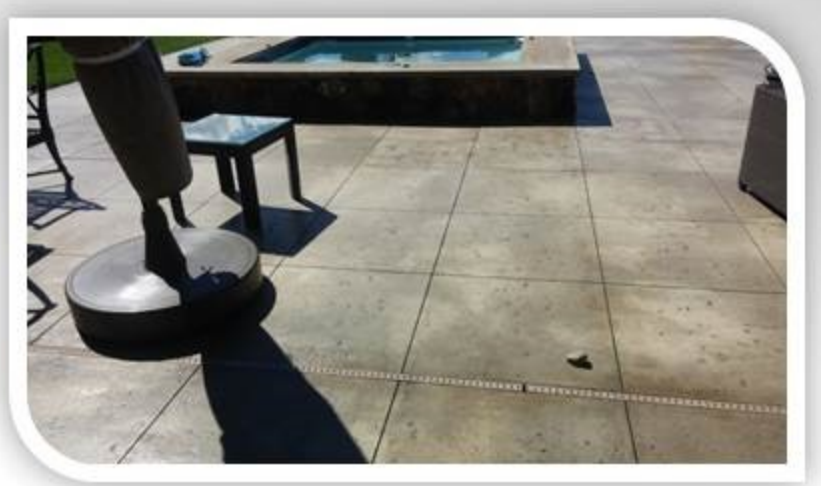
Although helium will make its way through concrete, by the time it does, it may have flooded an area underneath the deck. Check cracks, expansion joints and the edges of the deck first. On large expanses of deck with few cracks or expansion joints it may be helpful to drill small pilot holes in the deck.

Helium detection gives a good indication of the general area of the leak but on its own it is not as accurate as sonic location.

Confirm Leak Before Digging

Before digging through the deck confirm that the location you have detected through sonic and/or helium detection is consistent with all previous information collected.

If the location is based on a sonic location try listening to the same spot with pressure turned off. If the same sound is still there this is probably not the leak location.



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Confirm Leak Before Digging

If there is any uncertainty about the leak's location drill a test hole to see if there is evidence of water in the soil.

Confirm Leak Before Digging

Keep your eyes open for other clues that may help confirm the leaks location. This picture shows bubbles coming to the surface during the pressure test.

Dig

Once assured of the leaks location make a hole that will allow for an appropriate repair.