

ISOLATION

STEP 2: In Leak Detection

a slide show that will step you through the process

Isolation

Objective:

- Reduce search area
- Provide guarantee of non-leaking areas

Method:

- Pressure Test

The previously completed Information Gathering Step concluded that there is indeed a leak in the pool and provided suspicions of which part of the pool the problem is in. The Isolation Step allows confirmation these suspicions.

The objectives of this step are to reduce the search area to assure efficiency in later leak location activities, and to provide the customer and ourselves with a guarantee of non-leaking areas. Performing a pressure test on every job regardless of the suspected leak location is the only way both of these objectives can be accomplished with any certainty.

Isolation

Objective:

- Reduce search area
- Provide guarantee of non-leaking areas

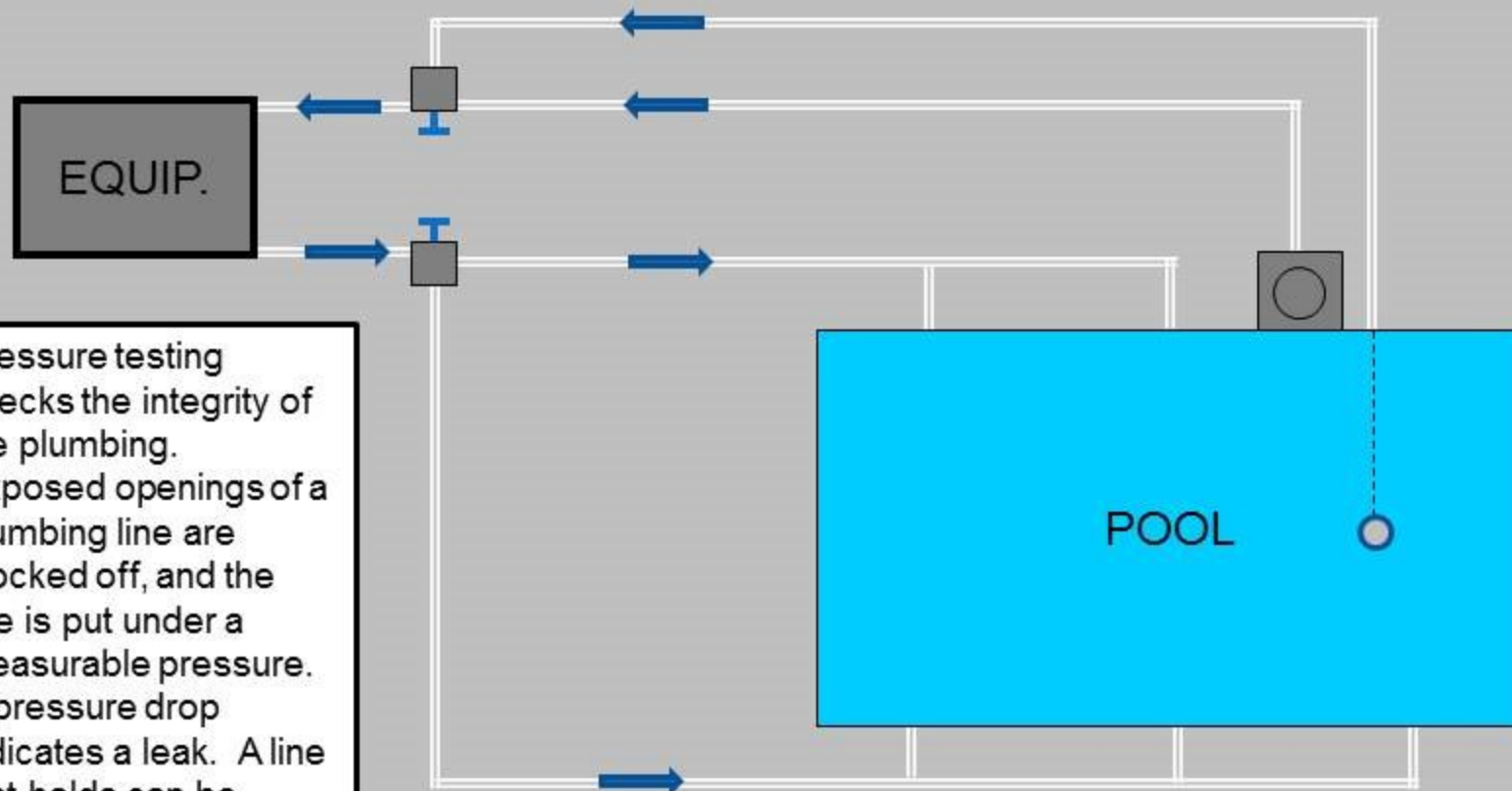
Method:

- Pressure Test

A pressure test is very valuable not only if a plumbing leak is suspected but also if the pool shell is suspect. By eliminating the entire plumbing system as a potential leak area our pool shell suspicion becomes a certainty.

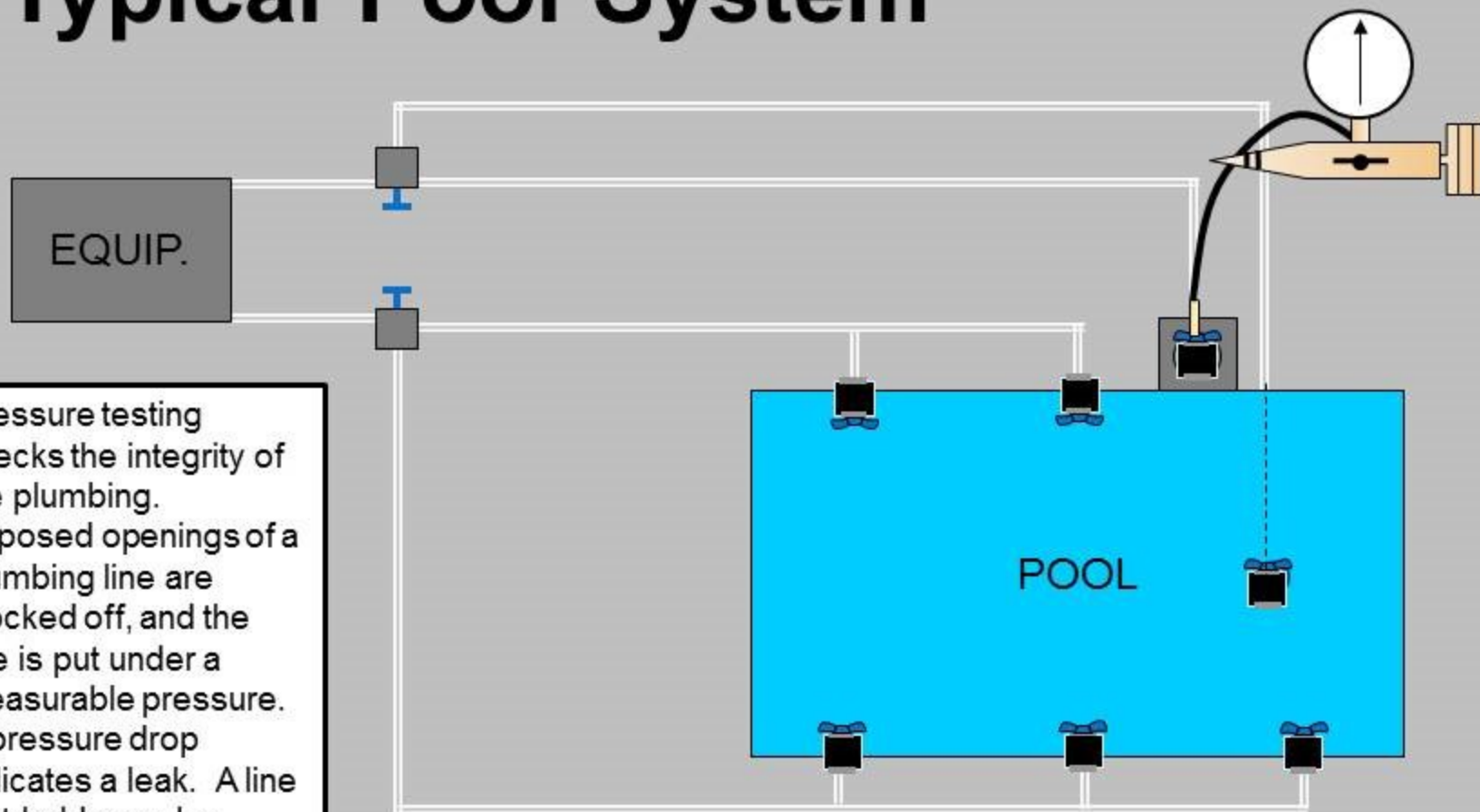
With proper equipment, and an understanding of the "pressure testing principles," pressure tests can be done in minutes and give results which assure 100% confidence.

Typical Pool System



Pressure testing checks the integrity of the plumbing. Exposed openings of a plumbing line are blocked off, and the line is put under a measurable pressure. A pressure drop indicates a leak. A line that holds can be eliminated as a potential leak location.

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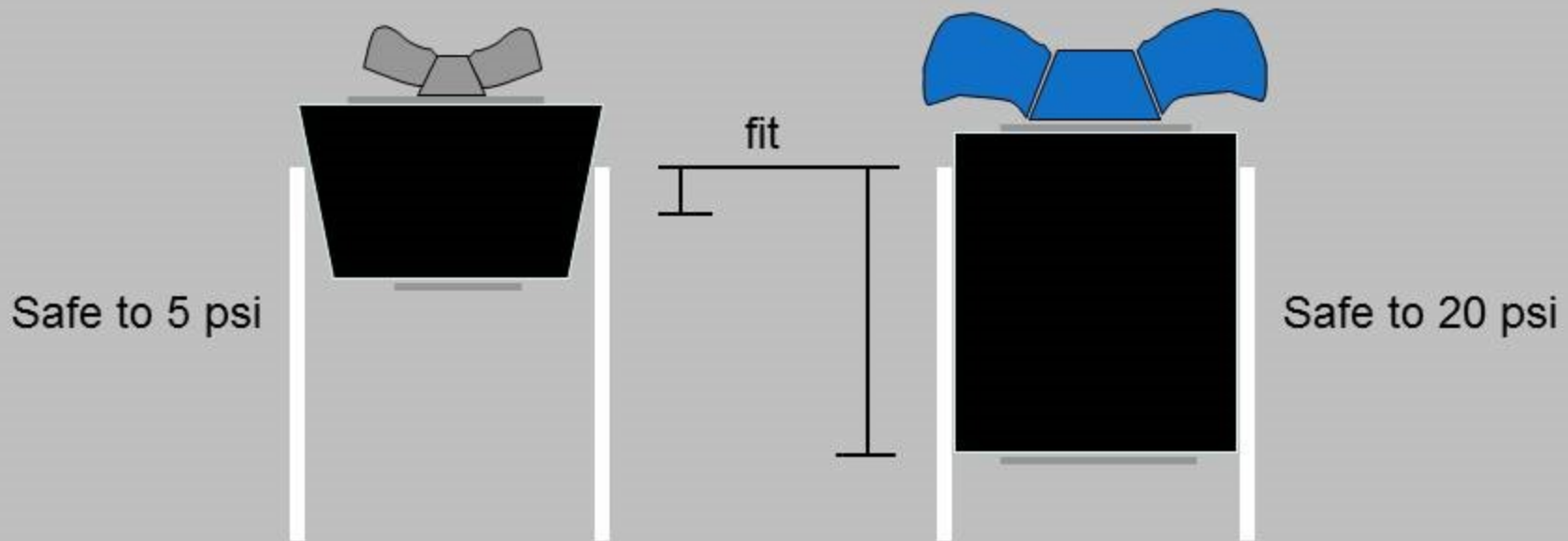
Pressure Testing Equipment

- Assorted Test Plugs
- Pressure Tester
- Garden Hose

For accurate pressure tests the following equipment will be needed: . . . assorted test plugs to block openings of the pipe to be tested, . . . a good pressure tester that allows the introduction and measurement of water pressure, . . . and a quality garden hose to hook to a water source that provides at least 20 psi of pressure.

Utilizing quality equipment assures efficient and accurate tests.

Straight-sided plugs provide a strong & safe seal!



Test plugs must provide a solid seal that will not leak or allow the plug to pop out under pressure. Any plug used for pressure testing should have straight-sided, (not tapered) rubber. Straight-sided rubber provides about 1-1/2" of seal inside the pipe. A tapered, winterizing plug only provides about 1/8" of seal . . . not enough to hold the pressure required for a pressure test. A plug that pops out under pressure wastes valuable time and puts anyone in the area at risk of injury.

Quality Test Plugs



- Straight sided solid rubber
- Complete selection of sizes and styles
- Corrosion resistant heavy duty hardware
- Large wingnuts

Test plugs are available in a wide selection of sizes and styles for plugging virtually any plumbing opening. It will be necessary to have an assortment of plugs that will seal not just common PVC pipe sizes, but also fittings, different kinds of pipe, and odd-ball situations. Choose plugs with Corrosion-resistant, heavy duty hardware and large easy to turn wingnuts. Test plugs are the main tools used by a leak detector, it is important that they function well when they are needed.

Standard Plugs



Used for:

- Cut pipe ends
- Pump inlets
- Easily accessible fittings

Standard plugs are used for any cut ends of pipe, pump inlets or other easily accessible fittings.

Standard Plugs

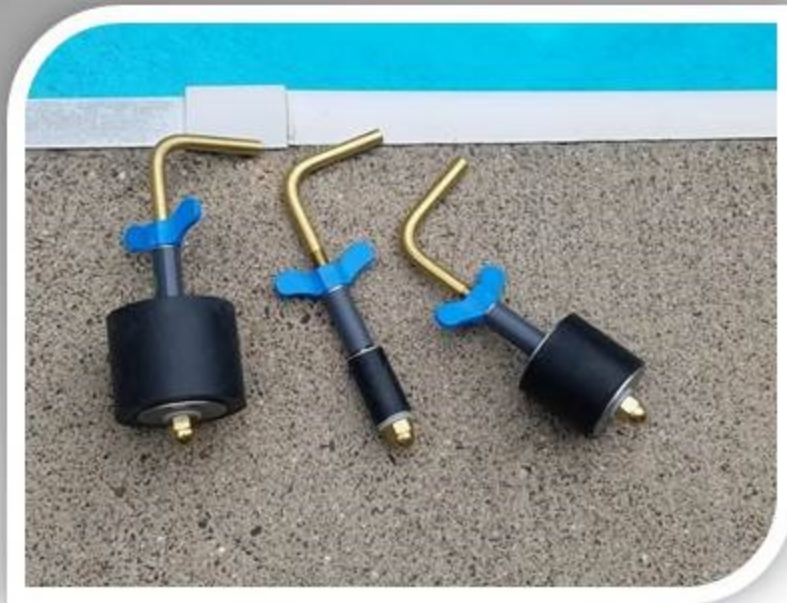


Used for:

- Cut pipe ends
- Pump inlets
- Easily accessible fittings

Standard plugs are used for any cut ends of pipe, pump inlets or other easily accessible fittings.

Hook Plugs



Used for:

- Main drains
- Return Fittings (past threads)

Hook plugs have a 1-1/2" extension between the wing nut and the rubber.

Hook Plugs



Used for:

- Main drains
- Return Fittings (past threads)

They allow a seal to be made further inside the pipe. They can be used on main drains and return fittings to get past the threads into the smooth part of the pipe.

Extender Plugs



Used for:

- Skimmers
- Therapy heads
- In-floor cleaner fittings
- “Angled” returns

Extender plugs are used in situations where a seal must be made even further inside the pipe. Common applications include skimmers, therapy heads in spas, in-floor cleaning systems, or return lines that enter the pool at an angle.

Inflatable Plugs



Used for:

- Out of round holes
- Hard to reach spots
- Main drains
- Special situations
- Large pipes

Inflatable plugs act like a balloon. They are blown up with an air compressor or pump to expand and seal inside the pipe or fitting. They cost more than mechanical plugs, and they're not quite as durable, but in some cases they're the only thing that will work. Inflatable plugs will seal out-of-round holes or hard to reach spots.

Inflatable Plugs



Used for:

- Out of round holes
- Hard to reach spots
- Main drains
- Special situations
- Large pipes

When attached to an extension hose inflatable plugs can be pushed some distance inside a pipe or even used to plug main drains from the pool deck.

Inflatable plugs are available in large sizes so they can also be used to test larger pipes found on commercial pools.

Pressure Tester



Requirements:

- Versatile means of connecting to plumbing
- Water & Air Connections
- Control valve(s)
- Pressure Gauge
- Relief Valve

A pressure tester allows the introduction of air or water into the plumbing system to be tested. Pressure testers come in a variety of “shapes and sizes” but all must have several main components or characteristics.

Pressure Tester



Requirements:

- Versatile means of connecting to plumbing
- Water & Air Connections
- Control valve(s)
- Pressure Gauge
- Relief Valve

The pressure tester must be able to access or put pressure into the plumbing system at a variety of different openings. Anderson's Pressure Tester uses different sizes and styles of open stem plugs, (plugs with a hole running through the center) to do this. This versatile system eliminates the need to cut pipe, jury rig fittings or depend on leaky threads.

Pressure Tester



Requirements:

- Versatile means of connecting to plumbing
- Water & Air Connections
- Control valve(s)
- Pressure Gauge
- Relief Valve

By quick connecting the appropriate open stem plug to the tester, pressure can be induced from return lines

Pressure Tester



Requirements:

- Versatile means of connecting to plumbing
- Water & Air Connections
- Control valve(s)
- Pressure Gauge
- Relief Valve

... or after the filter or heater on the return side.

Pressure Tester

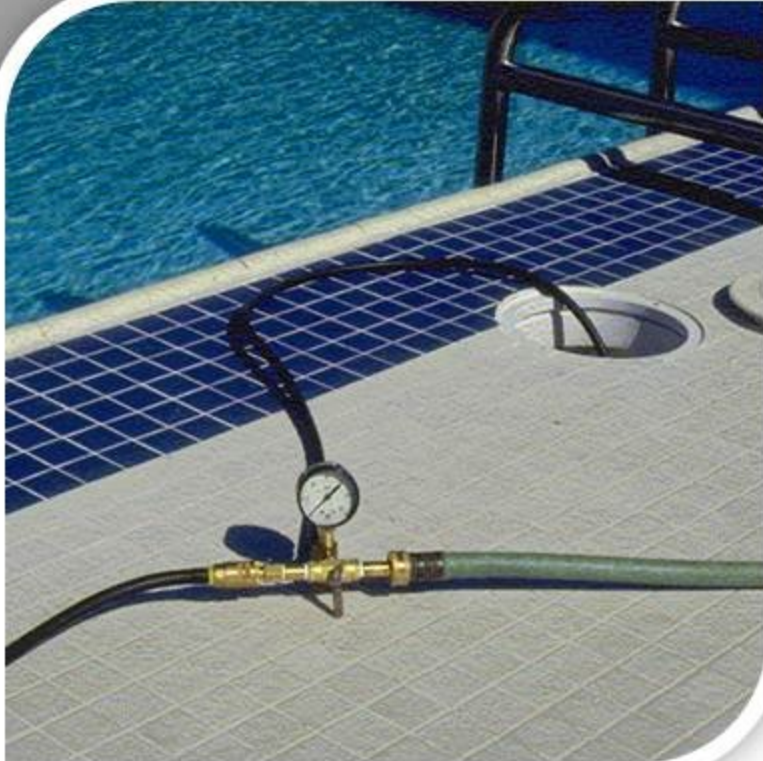
Requirements:

- Versatile means of connecting to plumbing
- Water & Air Connections
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- Pressure Gauge
- Relief Valve



On the suction side, pressure can be induced through the pump . . .

Pressure Tester



Requirements:

- Versatile means of connecting to plumbing
- Water & Air Connections
- Control valve(s)
- Pressure Gauge
- Relief Valve

... or at a skimmer.

Pressure Tester



Requirements:

- Versatile means of connecting to plumbing
- [Water & Air Connections](#)
- Control valve(s)
- Pressure Gauge
- Relief Valve

As shown in this picture, the pressure tester must have connections for both air and water. Water is used for initial testing of the lines, air is used for later leak pinpointing procedures. A regular garden hose connection works for the water side, a quick connect fitting is helpful for the air side.

Pressure Tester

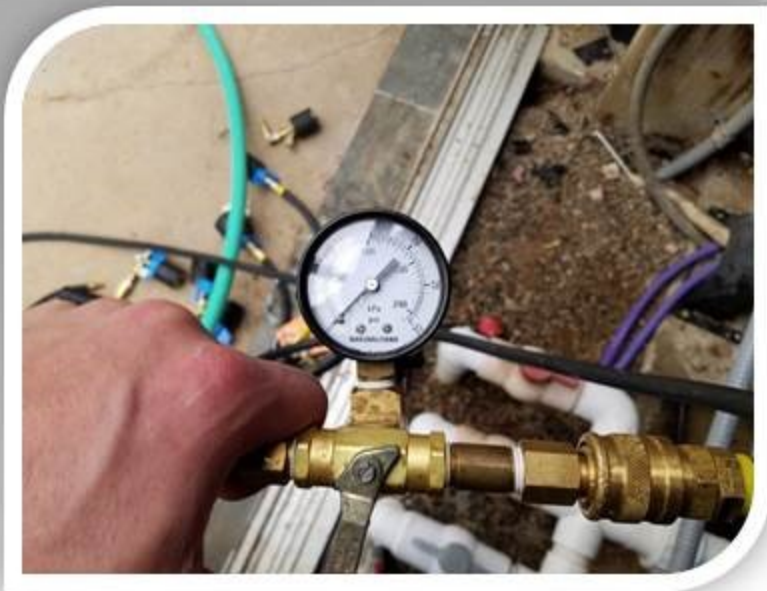


Requirements:

- Versatile means of connecting to plumbing
- Water & Air Connections
- Control valve(s)
- Pressure Gauge
- Relief Valve

Water and air pressure are turned on at the source, (at the hose spigot at the house). A valve on the pressure tester is used to control the introduction of air or water through the open stem plug into the plumbing system.

Pressure Tester



Requirements:

- Versatile means of connecting to plumbing
- Water & Air Connections
- Control valve(s)
- Pressure Gauge
- Relief Valve

For a pressure test, water is let into the line to a pressure of 20 psi and the valve is closed.

Pressure Tester



Requirements:

- Versatile means of connecting to plumbing
- Water & Air Connections
- Control valve(s)
- **Pressure Gauge**
- Relief Valve

A drop in pressure indicated on the pressure gauge is a sign of a leak in the line. To be able to identify a small drop in pressure, a 0-30 pressure gauge should be used.

Pressure Tester



Requirements:

- Versatile means of connecting to plumbing
- Water & Air Connections
- Control valve(s)
- Pressure Gauge
- [Relief Valve](#)

Pressure is released from a system that does not have a leak with a pressure relieve valve.

Pressure Testing Kit

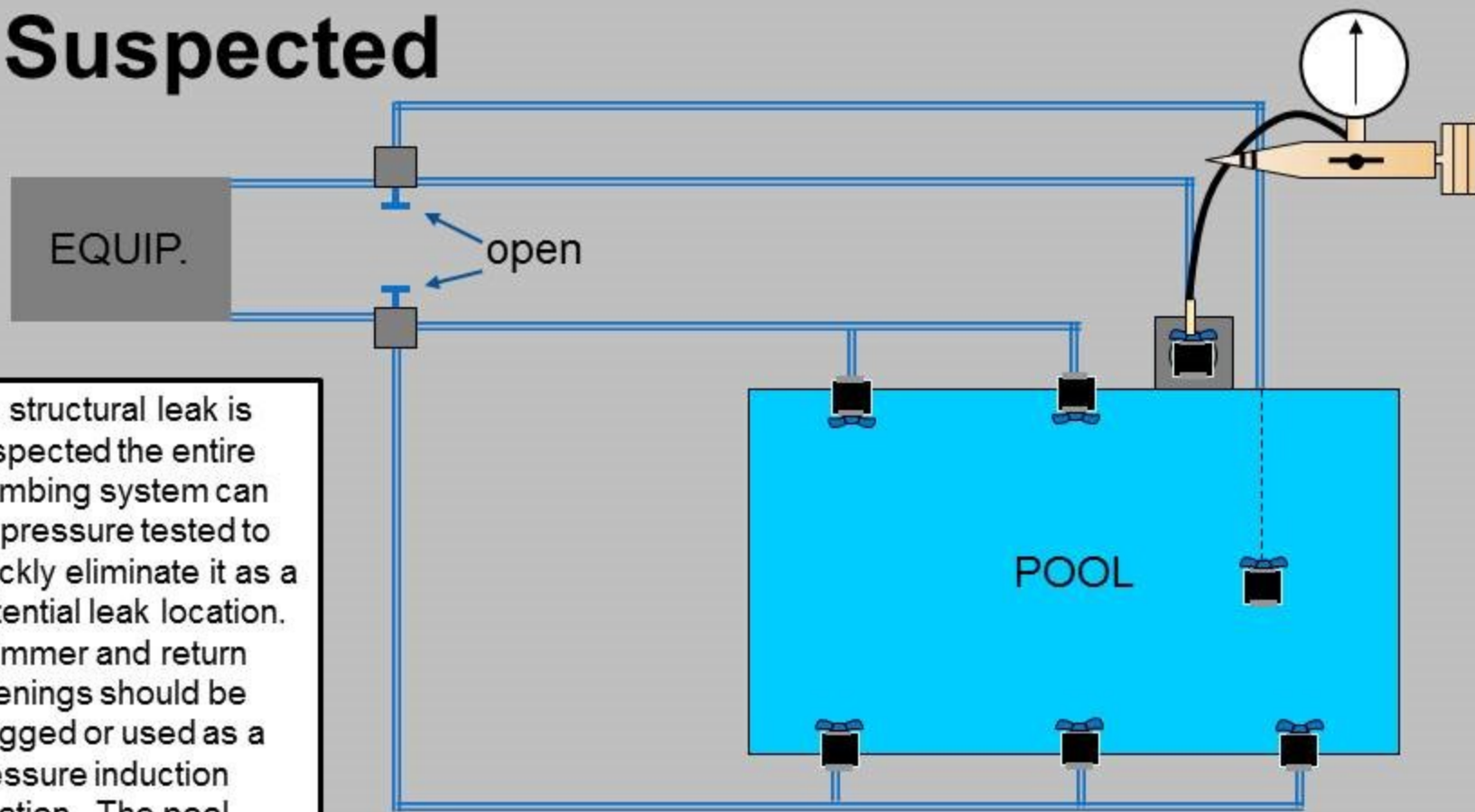


Anderson's Pressure Testing Kits combine an assortment of test plugs and pressure induction equipment that enables most swimming pool plumbing lines to be tested without cutting pipe, depending on leaky threads, or jury-rigging fittings. As your needs grow, additional plugs can be added to the durable and spacious tote box.

Includes:

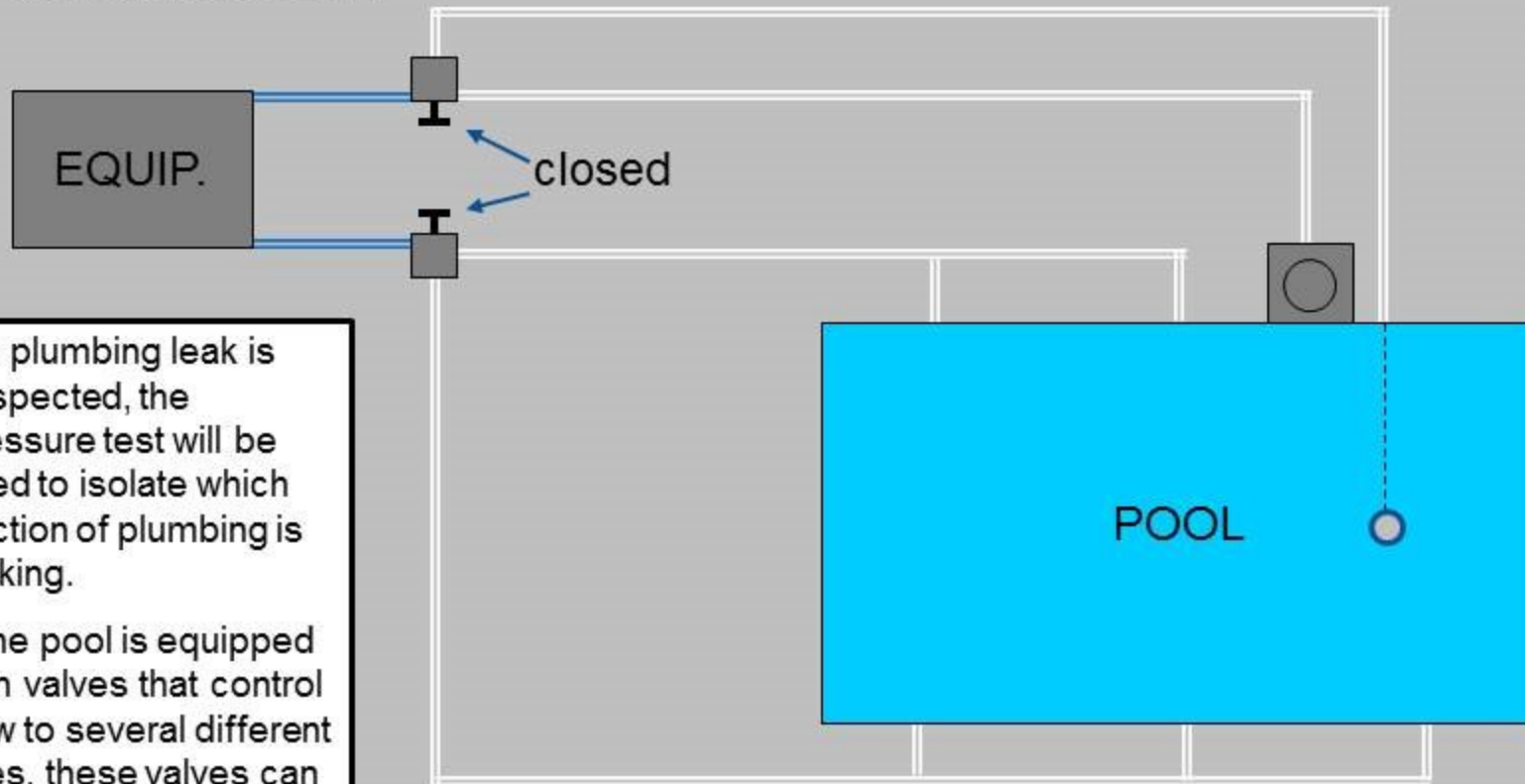
- Pressure Tester
- Open Stem Plugs
- Assorted sizes and styles of Closed Plugs
- Complete instructions
- Durable Tote with room for additional tools

Quick Test if Structural Leak is Suspected



If a structural leak is suspected the entire plumbing system can be pressure tested to quickly eliminate it as a potential leak location. Skimmer and return openings should be plugged or used as a pressure induction location. The pool equipment will be included in this pressure test.

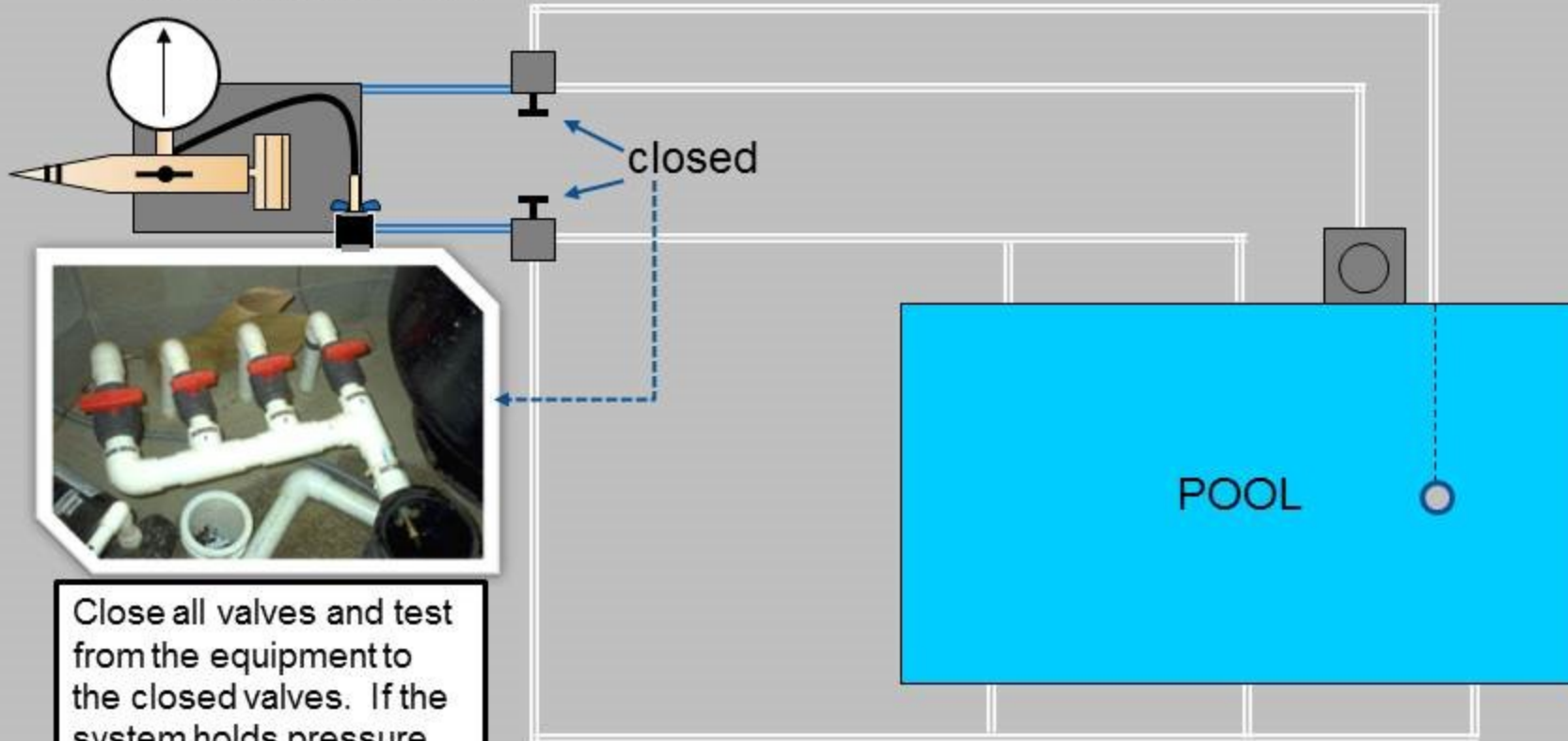
Test Valves First for Plumbing Isolation



If a plumbing leak is suspected, the pressure test will be used to isolate which section of plumbing is leaking.

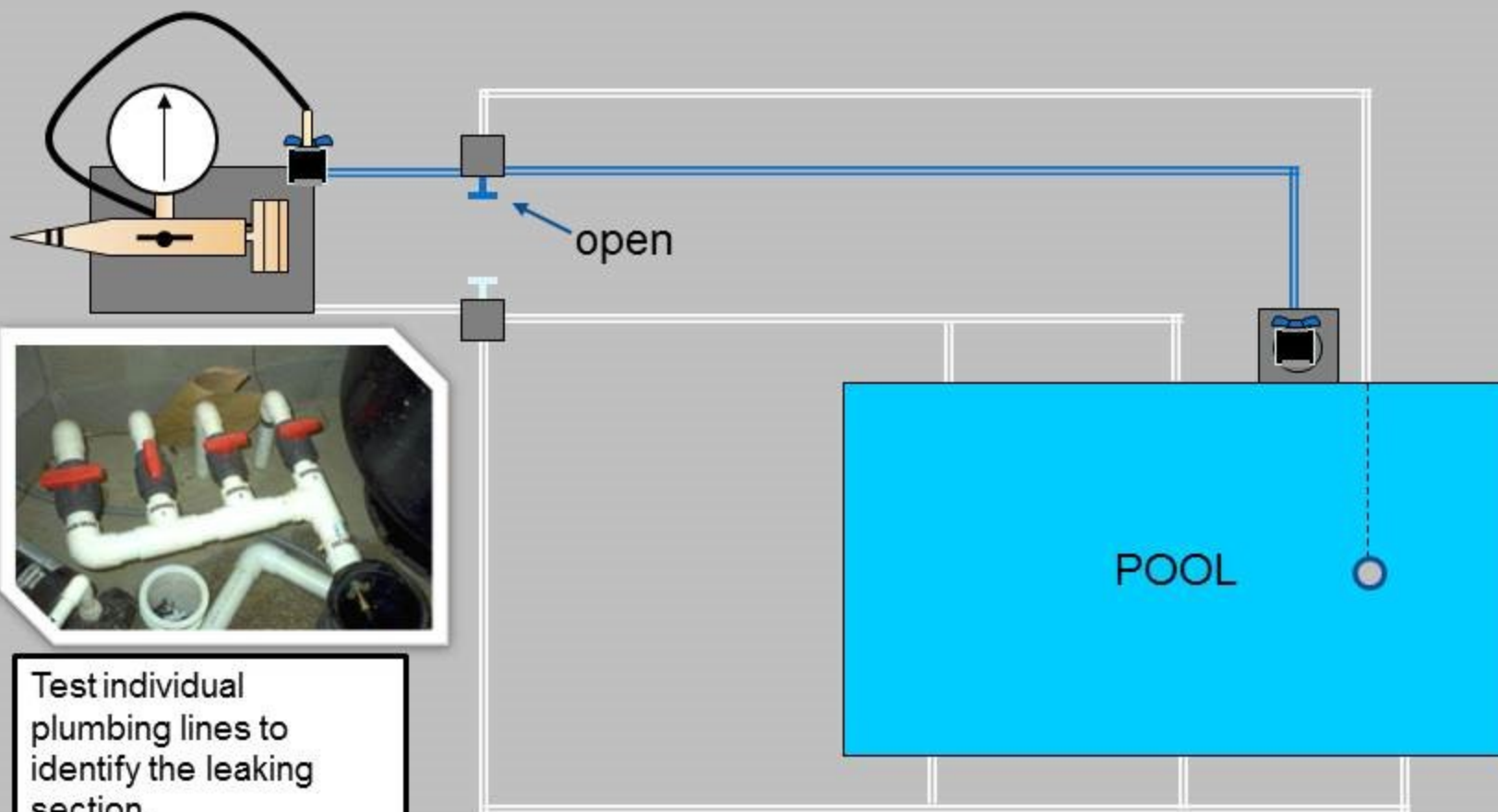
If the pool is equipped with valves that control flow to several different lines, these valves can be used to help with this isolation as long as they are tested first.

Test Valves First for Plumbing Isolation



Close all valves and test from the equipment to the closed valves. If the system holds pressure then the valves can be used to isolate individual lines.

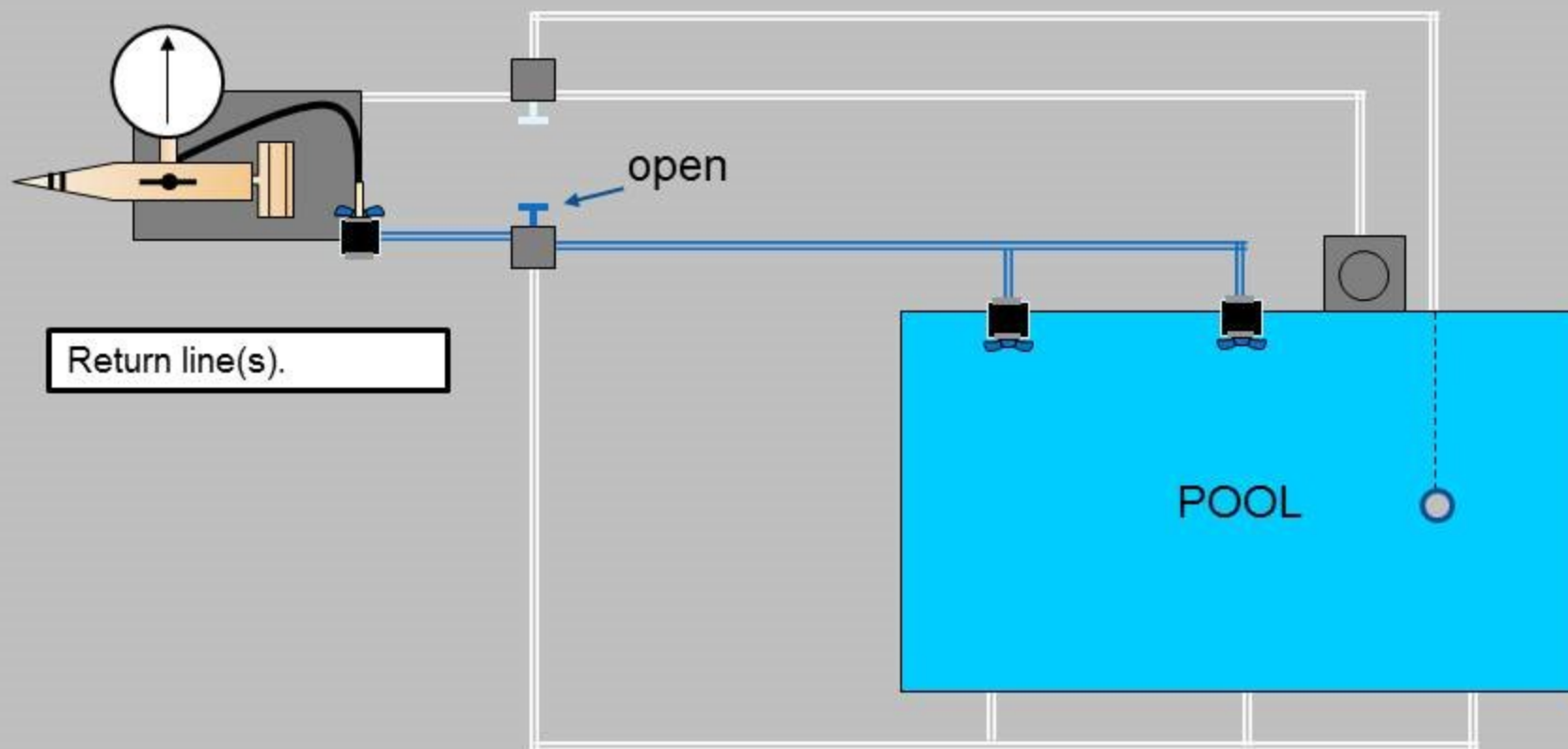
Test Individual Sections



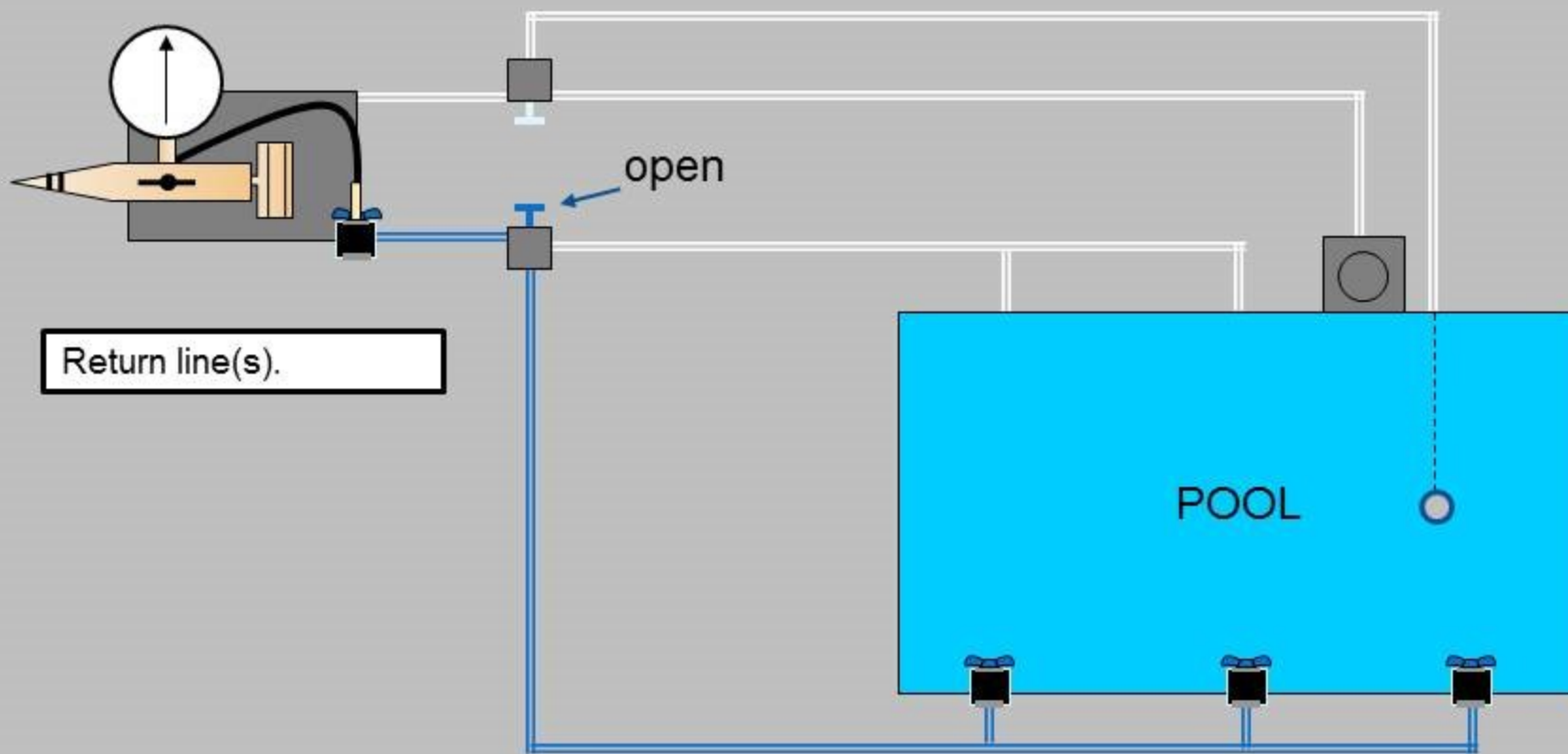
Test individual plumbing lines to identify the leaking section.

Skimmer line(s).

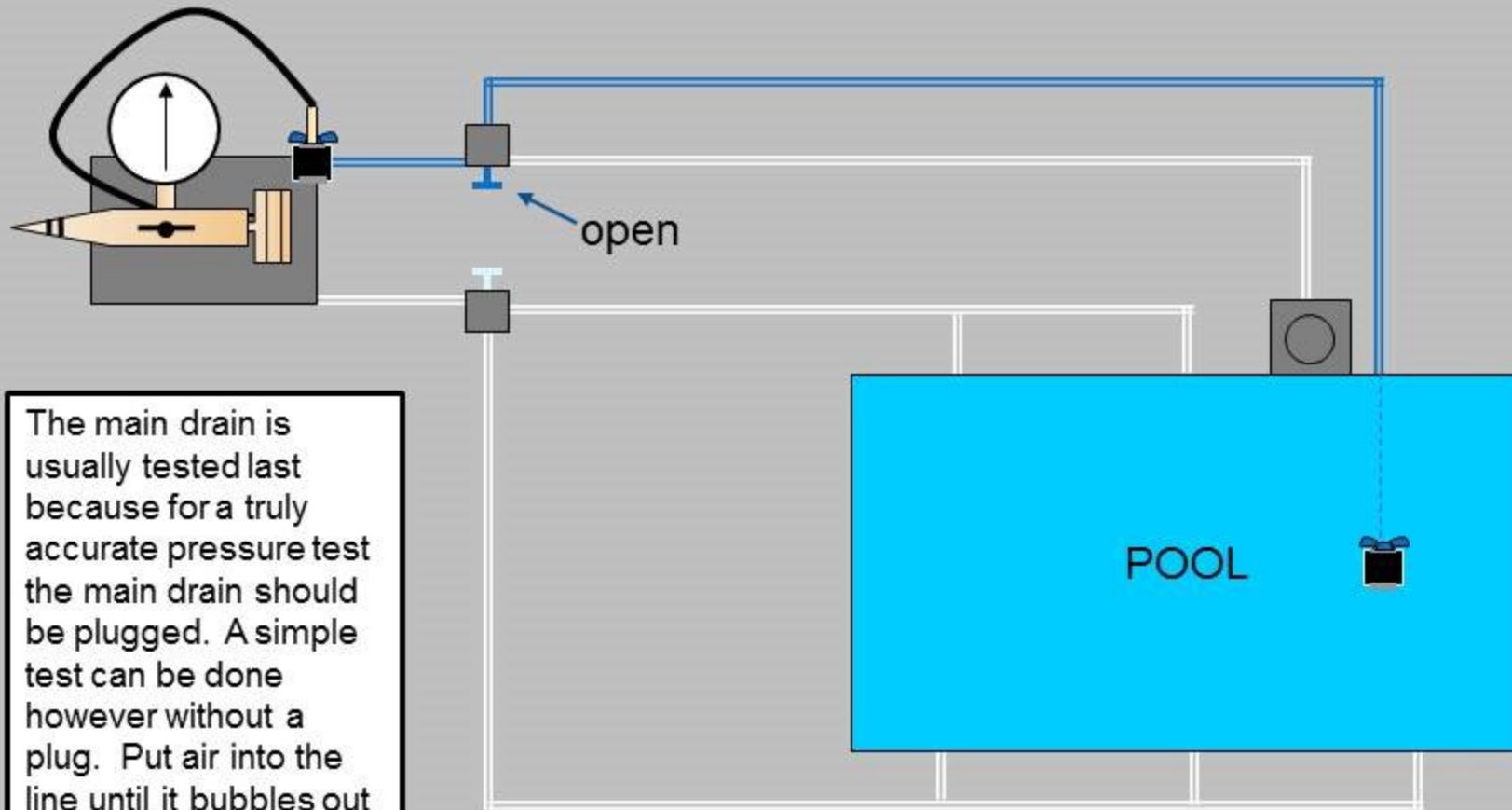
Test Individual Sections



Test Individual Sections

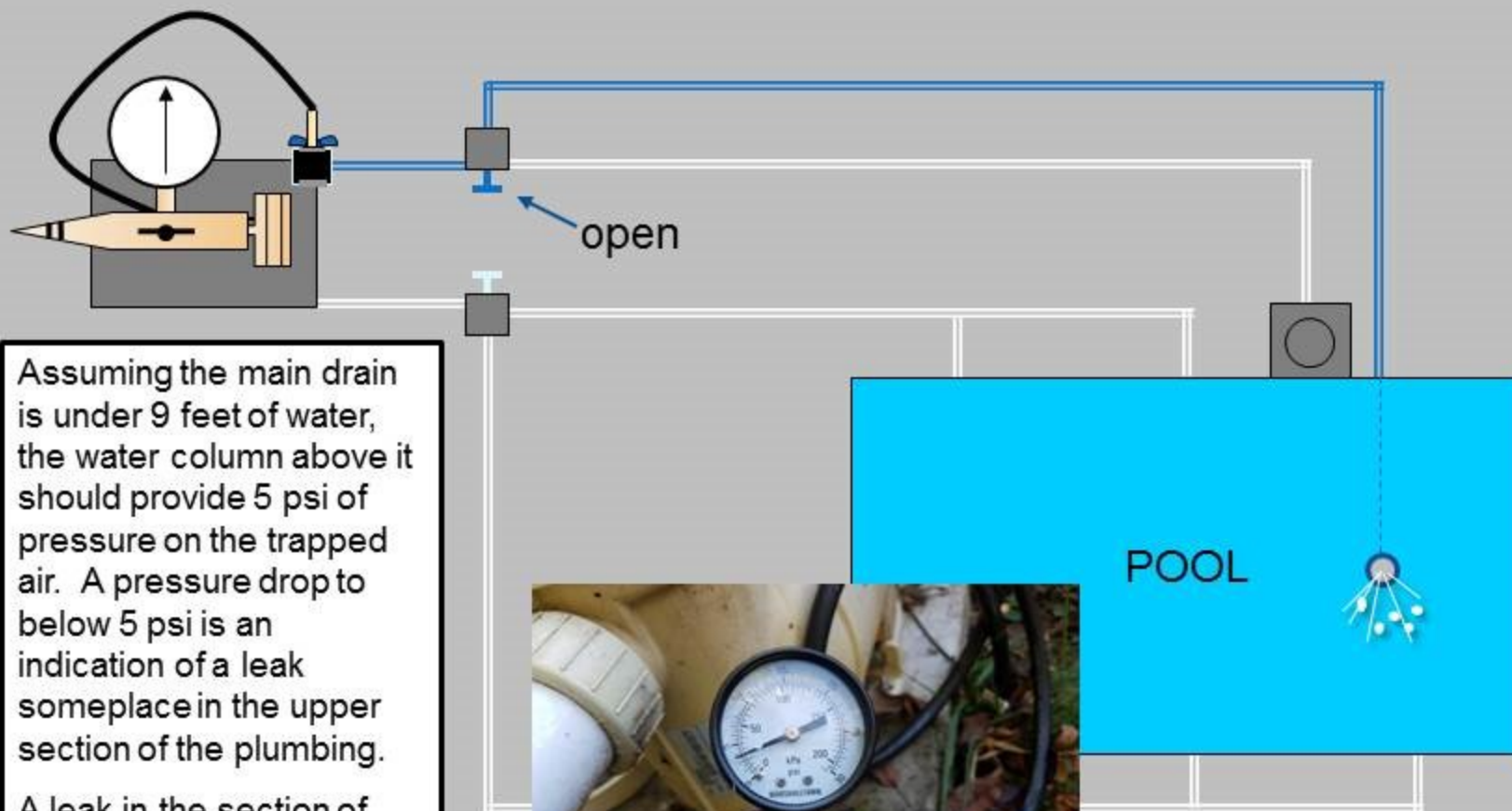


Test Individual Sections



The main drain is usually tested last because for a truly accurate pressure test the main drain should be plugged. A simple test can be done however without a plug. Put air into the line until it bubbles out of the main drain . . then close the valve on the pressure tester.

Test Individual Sections



Assuming the main drain is under 9 feet of water, the water column above it should provide 5 psi of pressure on the trapped air. A pressure drop to below 5 psi is an indication of a leak somewhere in the upper section of the plumbing.

A leak in the section of plumbing under the pool shell will not be indicated with this test.



Air or Water



There is often confusion over whether to use air or water for a pressure test.

In answering this question it is first important to understand how air and water behave differently in a plumbing system under pressure.

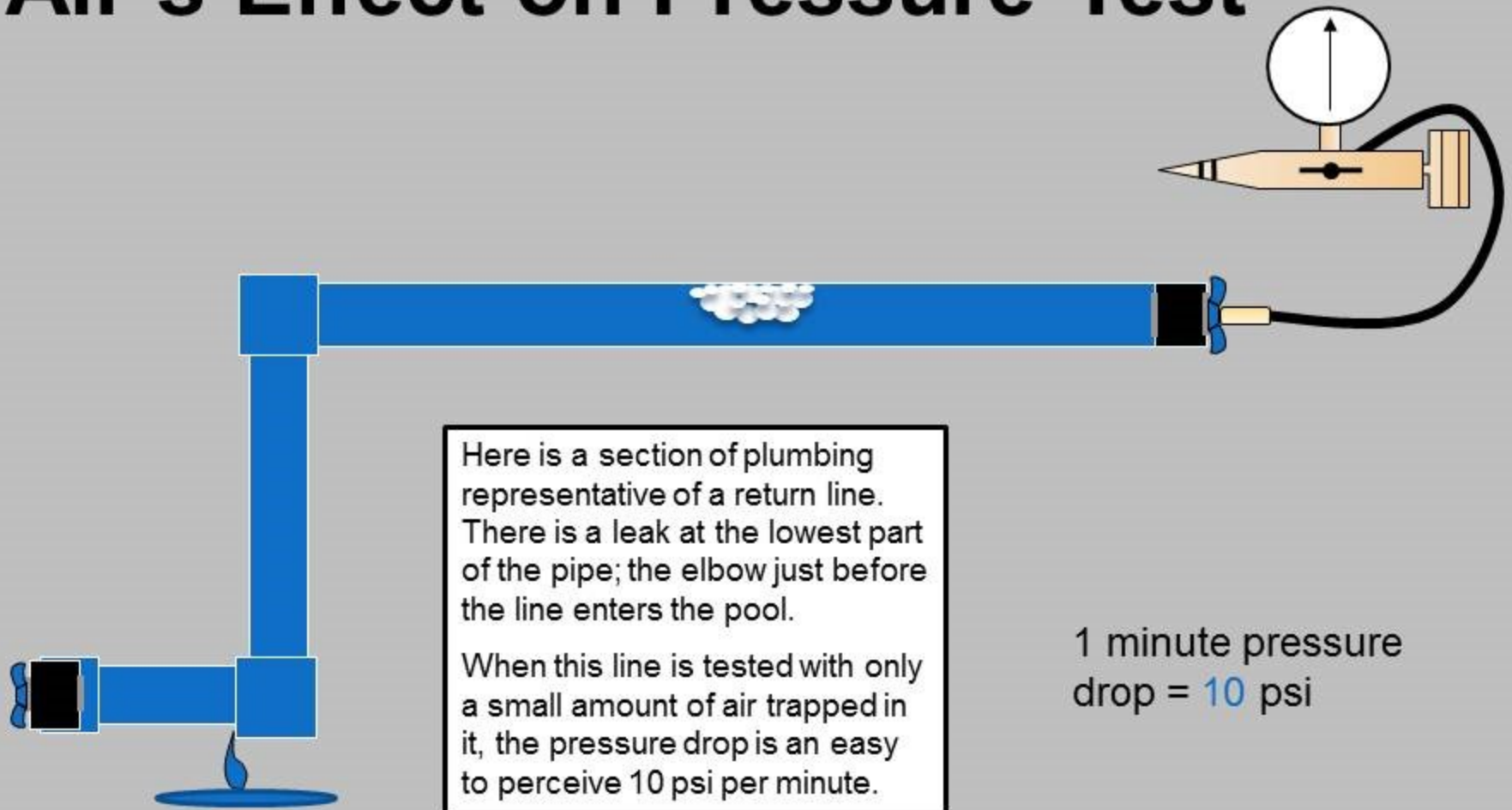
Pressure Testing Principles

- Air compresses under pressure; Water does not.
- Air stays at the top of the pipe; Water at the bottom.
- Air will escape from leaks faster than water.

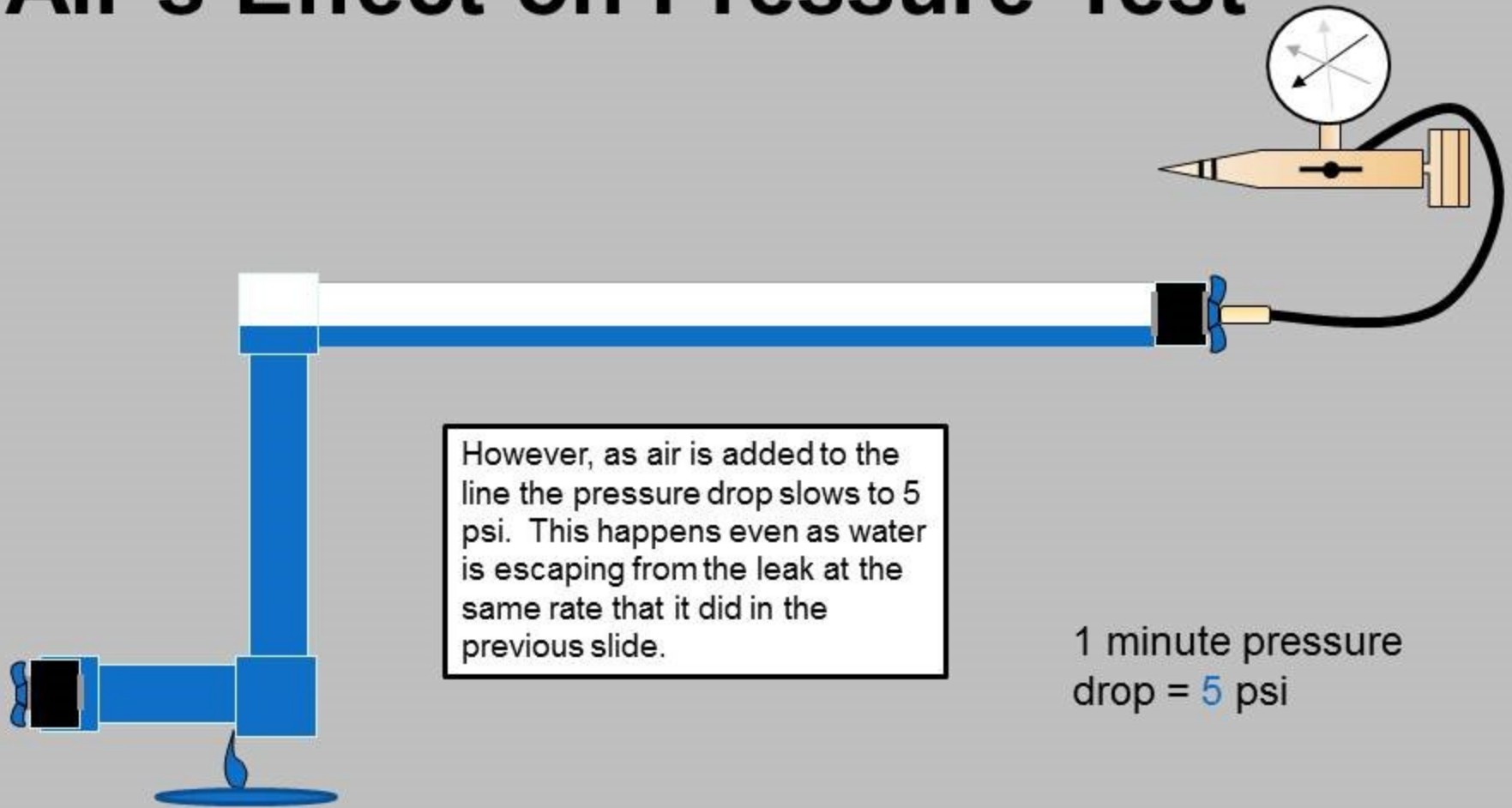
The pressure testing principles are simple laws of physics that deal with the properties of air and water when they are put under pressure. An understanding of these principles and how they effect the results of a pressure test is critical to leak detection success.

Have you ever wondered why the same sized leak, or even the same leak seems to lose pressure at different rates? The following slides illustrate how the pressure testing principles can explain this phenomenon.

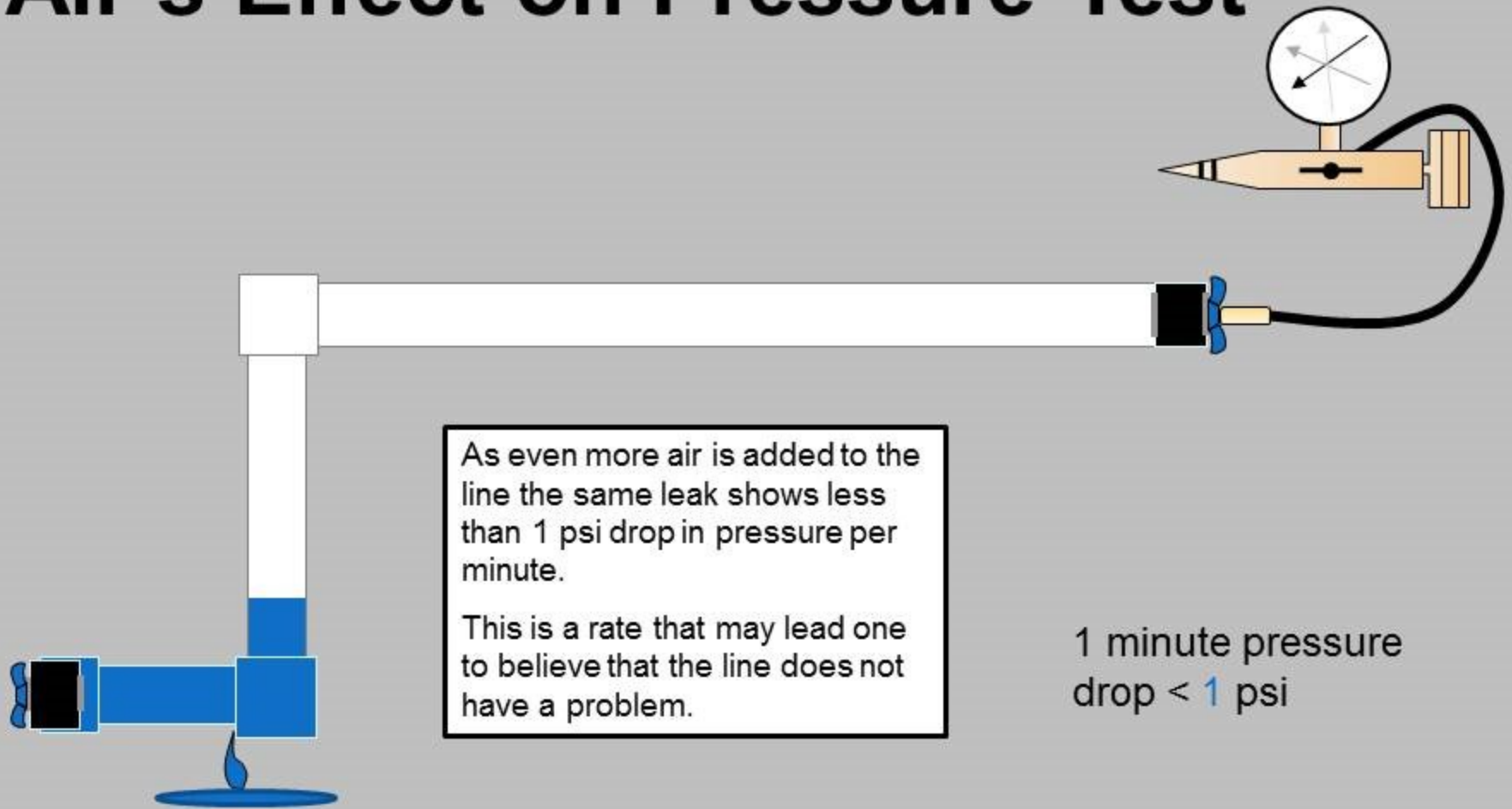
Air's Effect on Pressure Test



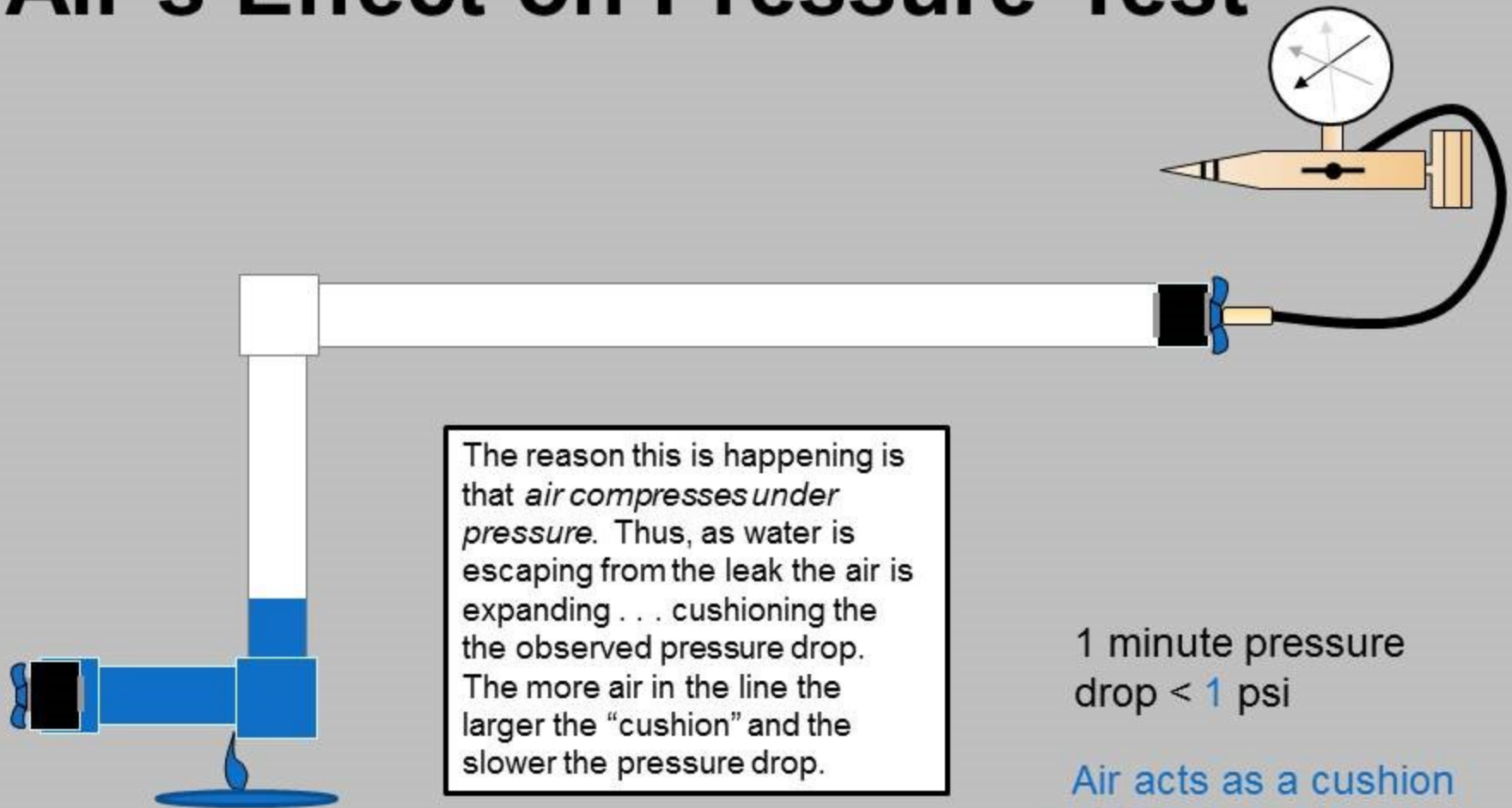
Air's Effect on Pressure Test



Air's Effect on Pressure Test



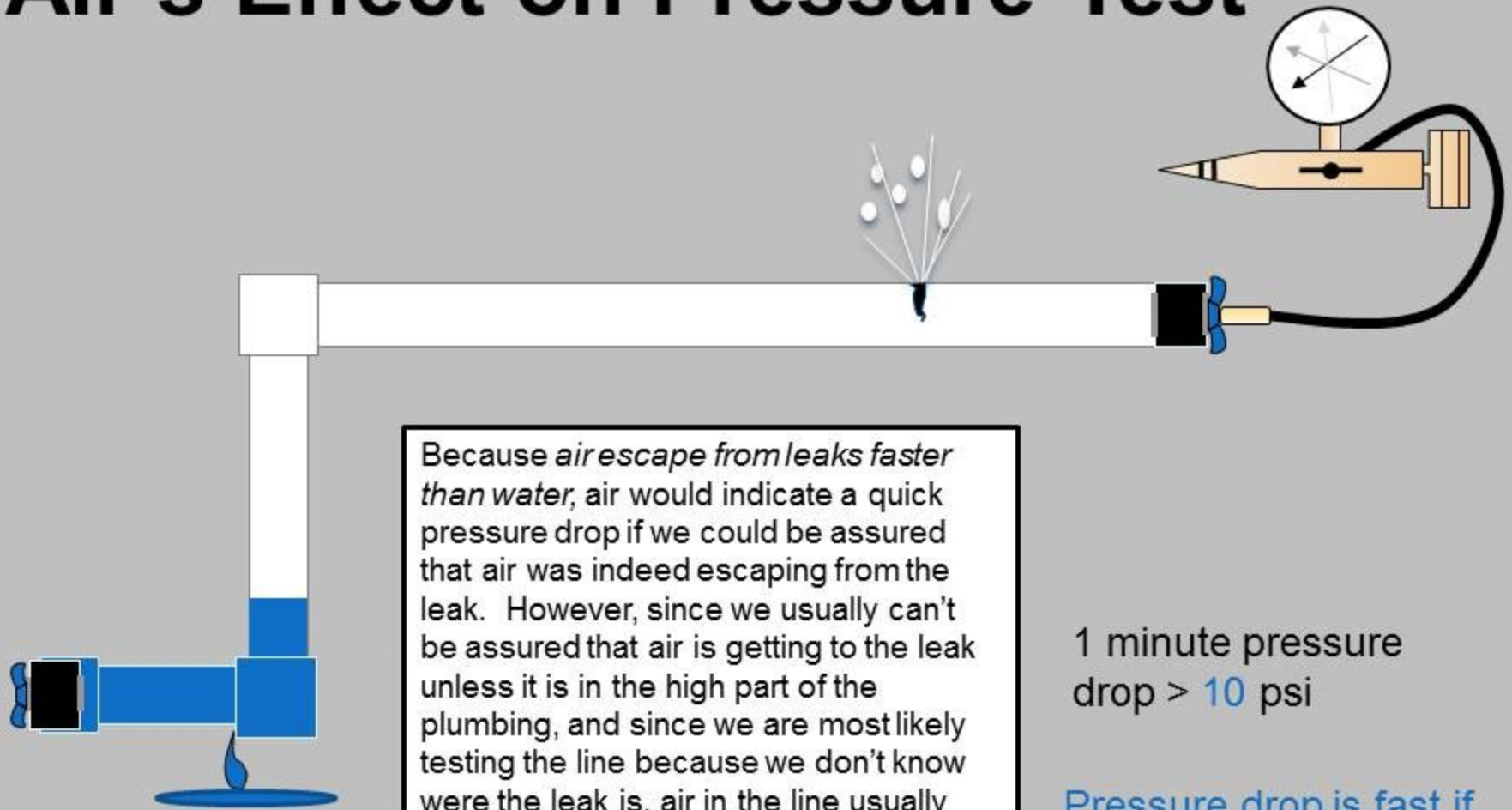
Air's Effect on Pressure Test



1 minute pressure drop < 1 psi

Air acts as a cushion which slows observed pressure drop of leaking water

Air's Effect on Pressure Test



Because *air escape from leaks faster than water*, air would indicate a quick pressure drop if we could be assured that air was indeed escaping from the leak. However, since we usually can't be assured that air is getting to the leak unless it is in the high part of the plumbing, and since we are most likely testing the line because we don't know where the leak is, air in the line usually causes problems for the isolation pressure test.

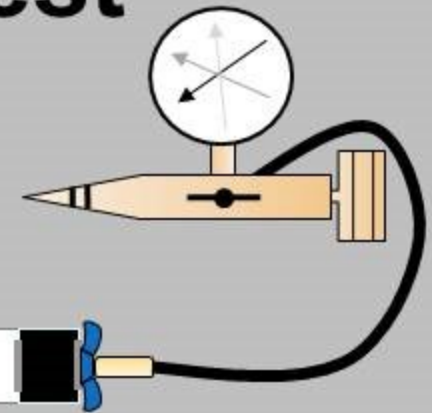
1 minute pressure
drop > 10 psi

Pressure drop is fast if
air escapes from leak

Air's Effect on Pressure Test

The fact that *air compresses under pressure* also causes problems if the pressure in the line exceeds what is safe for the plugs.

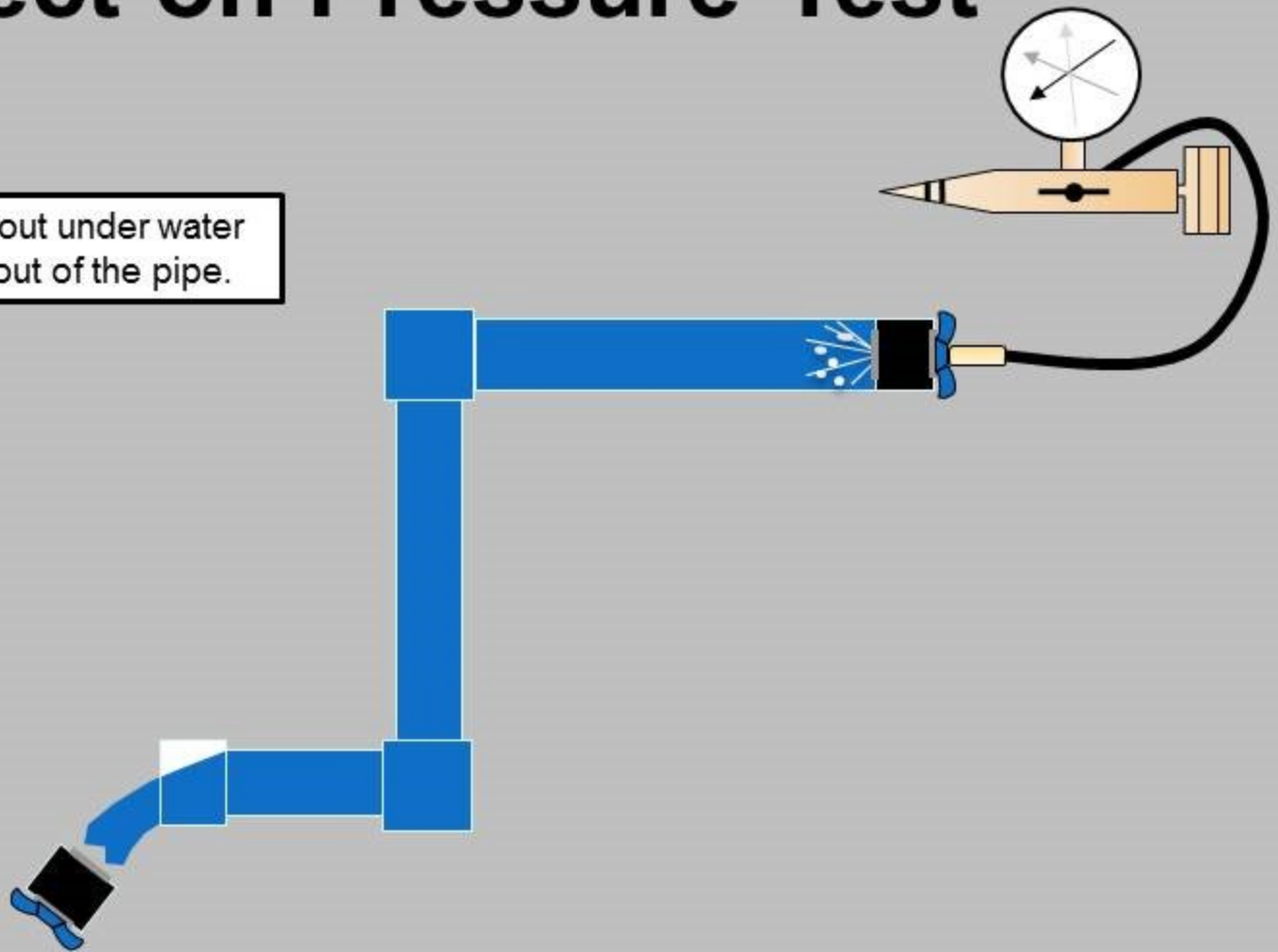
A plug that is blown out under air pressure will be shot like a cannon ball and can be very dangerous.



Risk of plug blowout is greater with air pressure

Air's Effect on Pressure Test

A plug that is blown out under water pressure will not fly out of the pipe.



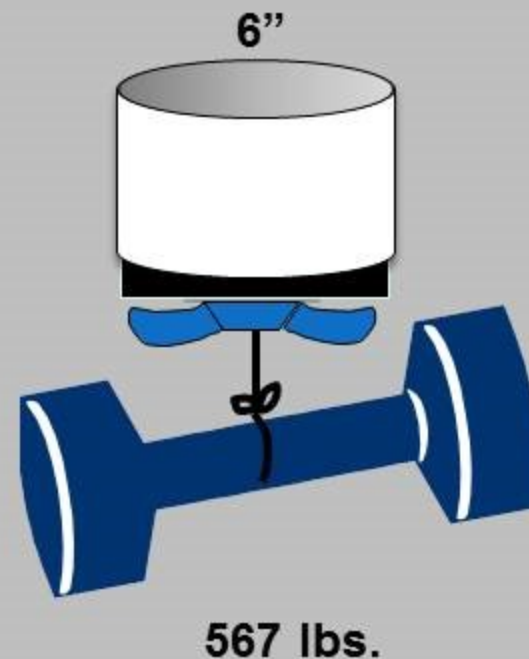
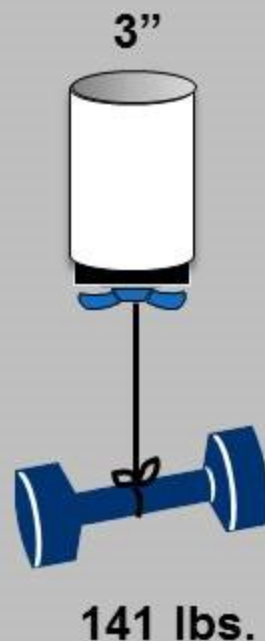
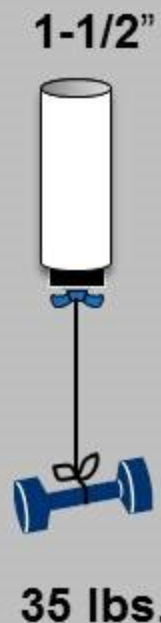
Air or Water



Use water unless the line is already filled with air (at a drained pool for instance). As a general rule avoid a mixture of air and water in the line. If using air, be extremely mindful of the risk of plug pop-outs.

How much force is on a plug under 20 psi pressure?

It is important to understand the forces a plug experiences when it is under pressure. The actual force trying to push the plug out of the line is equal to $\text{Pi (3.14)} \times \text{the radius of the pipe squared} \times \text{the psi}$. In other words, a 6" pipe under 20 psi of pressure is producing 567 lbs of force against the plug. As is demonstrated below, the amount of force increases rapidly as pipe size increases. 20 psi of pressure is too much for any line over 2" in diameter.



Pressure Testing Safety Rules

- Turn off all equipment before testing
- Use straight sided test plugs
- Do not over expand a plug to fit a larger hole
- Never exceed 20 psi pressure (5 psi maximum on openings over 2")
- Stand clear of plugged openings
- Once test is done release pressure
- Never use an unregulated air source
- Use well maintained equipment