

# Fluid Systems: The Oil & Gas Insider's Guide to Operational Excellence

Chapter 2.1 - The Lowdown on Leakage

Swagelok®





# PROUD TO SERVE YOU

Swagelok has supplied the highest-quality valves, fittings, and fluid system components to oil and gas companies in Australia since 1972. Today, we continue to deliver a service that is technically sound, customer-driven, and of the highest integrity.

In fact, our capabilities go far beyond that. Whether you need a custom solution, are eager to put efficiency back in your supply chain, or require ideas for reducing the cost and complexity of systems, Swagelok provides a range of services tailored to meet those needs, from exploration and drilling to the transportation, processing, and refining of petroleum and natural gas.

Simply put, we are here to help you.

Allan Hughes



Managing Director, Swagelok Western Australia



We take pride in being a trusted partner—one known for making the best decisions for the teams and operations assigned to us. Our customers agree, Swagelok is always on the lookout for the health of their projects and, more importantly, people.

We know that improving workforce safety with training and education is amongst the greatest benefits we can bring to any organisation. Our experts can help your technicians, operators, and installers work smarter and safer, and help you grow that knowledge while you grow your business.

When you work with us, you will find our associates at all levels are experienced in the oil and gas industry. They know the trends, the applications, the local regions, and the laws and regulations that apply to your operations.

Kevin Hurrell



Managing Director, Swagelok Eastern Australia



**SWAGELOK:  
BRINGING 60+ YEARS OF EXPERIENCE  
TO THE OIL & GAS INDUSTRY**

Swagelok Australia is ready to support you.  
Challenge us to help you succeed.







# ABOUT THIS EBOOK

Australia’s oil and gas industry is pushing new boundaries. Conditions are more challenging, chemistries more corrosive, and wells are reaching greater depths, temperatures, and pressures.

There are new drilling technologies and stringent regulations and standards. At the same time, there are shorter timelines and projects that involve multiple partners in different nations.

With so much to consider, we know that you need suppliers who can deliver confidence and peace of mind above all else.

This eBook looks at simple ways to improve the safety and performance of fluid systems operating in oil and gas environments, and gives practical advice for reaching new levels of process accuracy, reliability, and efficiency.

As one organisation of many resources, local and global, Swagelok regularly consults on new construction and maintenance and repair challenges, investigates corrosion issues, and provides recommendations for part specifications, system designs, and assemblies.

The learnings presented here address many of the questions and concerns we commonly encounter from across Australia in all sectors of the oil and gas industry.

We are confident you will find this collection of expert insights beneficial to your own operations, and invite you to contact us for local assistance with any difficulties you might be facing.



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# THE LOWDOWN ON LEAKAGE

## COMMON COSTS AND CAUSES

Leakage is a serious consideration in the reliable performance of fluid systems—even the smallest leaks can cost facilities thousands of dollars a year! In fact, leakage costs industry billions annually.

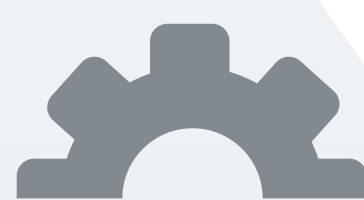
### LOST FLUID

millions of litres are wasted each year  
(1 litre of hydraulic fluid ≈ \$5 AUD)



### LOST PRODUCTION

especially important in offshore oil where laws already limit production to a specific number of days per month



### EQUIPMENT DAMAGE

loss of lubrication can lead to premature wear/machine failure



### OFF-SPECIFICATION PRODUCT

can be produced inadvertently due to improperly calibrated or operating instruments; material must be reworked, sold at reduced price, or disposed of

### DEGRADED WORK ENVIRONMENT

oil drippage can cause accidents; emissions can be expensive, dangerous—even illegal



### FINES FOR NONCOMPLIANCE

systems and equipment that violate validated processes can quickly become costly



### CLEANUP

it takes time to locate and repair leaks; some call for special teams to manage toxic chemicals; there's also the cost of shutting down a system to thoroughly clean it



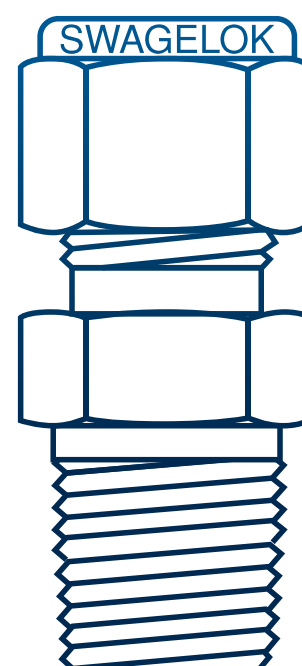
**MOST LEAKS AREN'T THE RESULT OF SUB-STANDARD PARTS BUT HUMAN ERROR. CHOOSING THE RIGHT COMPONENTS AND INSTALLING THEM CORRECTLY CAN SAVE TREMENDOUS TIME AND COST.**

## 3 COMMON CAUSES OF LEAKAGE

1. Unreliable metal-to-metal seals
2. Improperly installed tube fittings
3. Poor tubing selection/preparation

Studies show the total replacement cost of hydraulic fluid can be

**5x** THE INITIAL COST  
of filling the system



If a hydraulic fitting leaks **6 drops of fluid per minute**, each drop a half a millilitre, the fitting will leak

**half a litre**  
over 24 hours

**15 litres**  
over a month

**180 litres over a year!**

At \$5 AUD per litre, that's  
**\$900 annually**  
in make-up fluid alone—per leak!

*Consider: There can be more than 10,000 connection points—and potential leak paths—at a single site. Stopping leaks can mean significant savings.*



# KNOW YOUR LEAKS

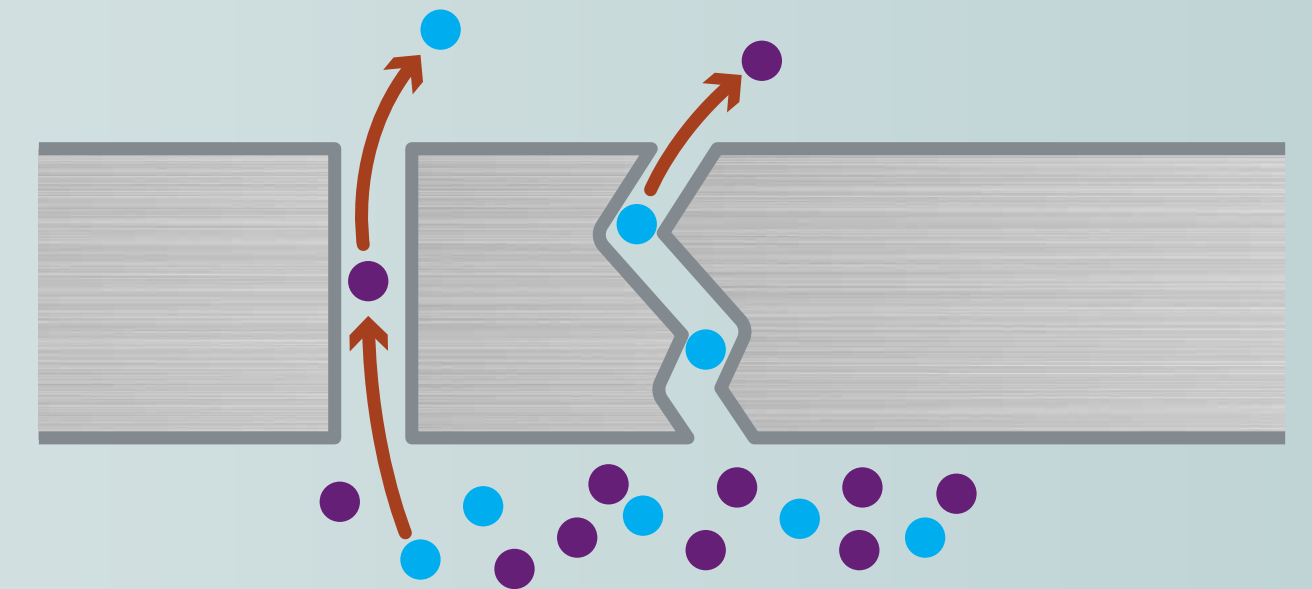
Where safety and operating costs are paramount, even one leak in a system is too many. When maintaining fluid systems, remember:

- Making highly reliable metal-to-metal seals is a difficult task—follow manufacturer guidelines precisely
- Leaks occur most often in valves and connectors because they are the most prevalent components in facilities
- A good leak detection program increases worker safety and decreases risks to your operation

## TYPES OF LEAKS

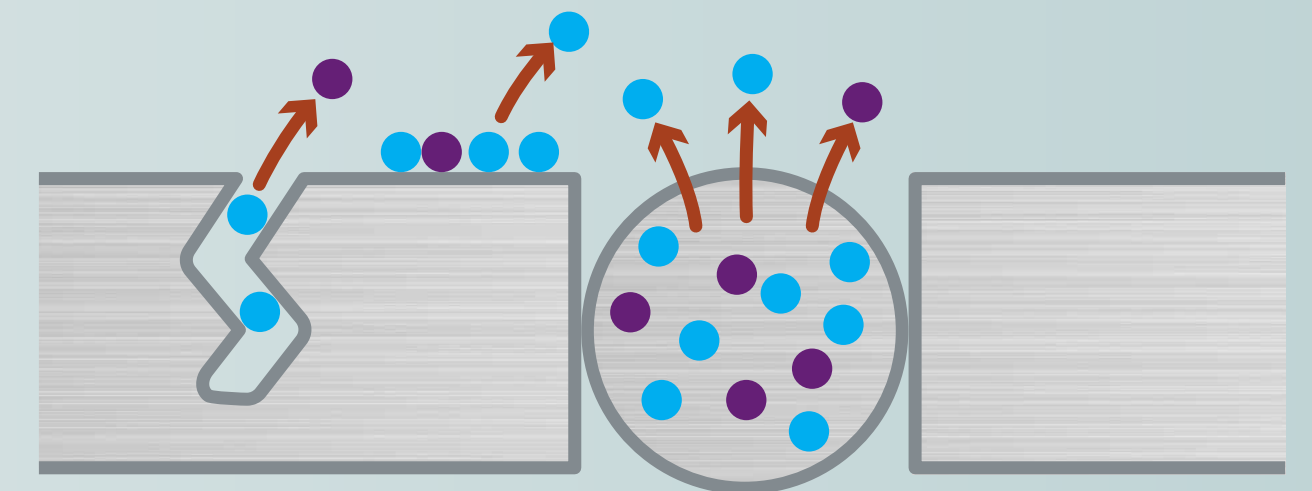
### Real leak

When a pressure barrier fails to contain or isolate a system fluid from the surrounding environment (result of cracks or gaps between sealing surfaces or permeation through seal materials).



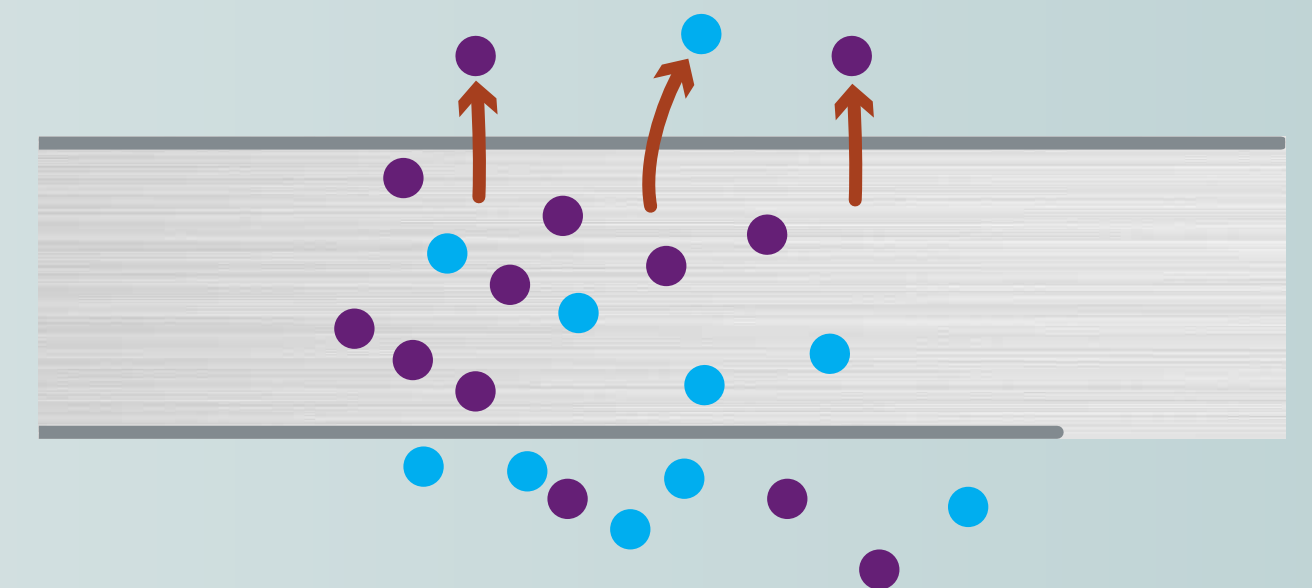
### Virtual leak

A release of internally trapped fluid into a fluid system due to material outgassing (escape of gas from a material under test in a vacuum), absorbed or adsorbed fluids, entrapment in cracks, or deadlegs.



### Permeation

The passage of fluid into, through, and out of a pressure barrier having no holes large enough to permit more than a small fraction of the molecules to pass through any one hole.





# LEARN LEAK DETECTION

When testing for leaks, there are four main nondestructive test (NDT) methods to consider.

Click each button to learn more:

Bubble Testing

Pressure Leak Testing

Pressure Change  
Measurement Testing

Mass Spectrometry Testing

## BUBBLE TESTING

### Testing Methods

Bubble Testing is a fast, simple, and inexpensive test that can be done using the immersion or film solution techniques.

### Methodology

The unit-under-test is pressurised to create a pressure differential.

### Leak Rate

As low as  $1 \times 10^{-5}$  std.cc/sec

### Advantages

- Simple, fast, inexpensive
- Fairly sensitive
- **Especially useful for leak location**
- Entire component can be evaluated at once
- Allows the observer to distinguish between real and virtual leaks

### Limitations

- **Cannot be used to provide a specific leak rate**
- Operator-dependent
- Small leaks take longer to detect
- Unit-under-test must be cleaned or dried following testing
- Restricted to tests with internal pressures 1000 PSI and below

Swagelok Australia can provide a snapshot of your facility's performance with regard to leakage, including a report that documents:

**The amount of leakage • The cost of leakage • Steps for moving forward to save money and reduce emissions**





# LEARN LEAK DETECTION

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## PRESSURE LEAK TESTING

### Testing Methods

Pressure Leak Testing is an excellent proof test that is best for leak location. The two techniques for best results are hydrostatic and pneumatic tests.

### Methodology

The unit under test is gradually pressurised with water or air to a specified mark and held for a predetermined length of time. Pressure is then reduced to design pressure and the unit is observed for leakage.

### Leak Rate

As low as  $1 \times 10^{-2}$  std.cc/sec or less, if additives to enhance leak detection are used.

### Advantages

- **Excellent proof test**
- Inexpensive, simple, clean
- Good for leak location
- Entire assembly can be evaluated at once
- Generally safe

### Limitations

- Dangerous if air is not completely evacuated
- Slow
- Water can temporarily seal small leaks
- Water is not very sensitive
- **Cannot be used to provide a specific leak rate**
- Assemblies must be cleaned and dried following testing

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Mass Spectrometry Testing

## PRESSURE CHANGE MEASUREMENT TESTING

### Testing Methods

Pressure Change Measurement Testing determines total leakage in a simple, inexpensive way. The four common techniques are pressure decay, pressure change absolute, pressure change reference, and volume or flow measurement.

### Methodology

Pressure Change Measurement Testing is based on the measurement of change across a pressure boundary caused by leakage.

### Leak Rate

A decrease in pressure indicates leakage. The leak rate can then be calculated and evaluated to ensure the amount of leakage is within acceptable limits.

Pressure decay is the most commonly used technique, but it is optimal for small systems with volumes less than 7.5 cubic feet.

### Advantages

- **Determines total leakage**
- No special tracer gas
- Inexpensive
- Simple
- Largely operator-independent
- Increased sensitivity in small-volume applications

### Limitations

- Many factors affect sensitivity (especially in larger-volume applications)
- Internal volume must be known
- **Cannot locate leaks**

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## MASS SPECTROMETRY TESTING

### Testing Methods

Mass Spectrometry Testing is a versatile, reliable method of measuring leakage and locating leaks. Five techniques of Mass Spectrometry Testing are hood, tracer probe, detector probe, accumulation, and bell jar.

### Methodology

In Mass Spectrometry Testing, a mass spectrometer is used to measure the amount of tracer gas, usually helium, present in the unit-under-test. To accomplish this, a pressure differential is created between the unit-under-test and the mass spectrometer. The presence of the tracer gas inside the mass spectrometer is indicative of a leak.

### Leak Rate

Mass Spectrometry Testing is typically used to measure specific leak rates between  $1 \times 10^{-4}$  and  $1 \times 10^{-10}$  std.cc/sec.

It is not used to detect leak rates larger than  $1 \times 10^{-4}$ .

### Advantages

- **A great degree of reliability and sensitivity can be measured**
- Ability to measure leakage and locate leaks
- Clean

### Limitations

- **High initial costs and equipment is costly to repair**
- High helium cost
- Requires a skilled operator
- Sensitive to background helium levels and outgassing
- Requires a comprehensive test plan when used on large or complex systems

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# COMPRESSED GAS LEAK DETECTION PROGRAM

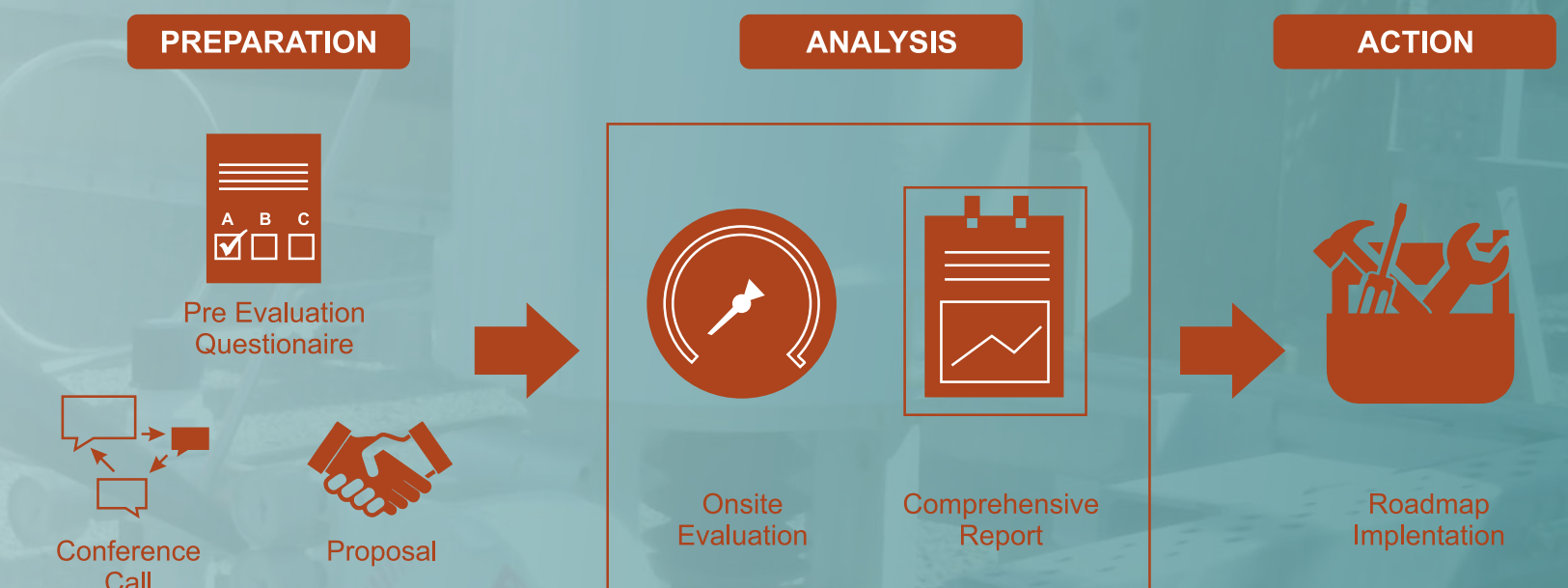
At Swagelok we have found that about two-thirds of energy costs for compressed air can be significantly reduced without large capital outlay.

## Compressed Gas Leak Detection

Leakage can be a problem for all compressed air systems. At Swagelok we have found that about two-thirds of energy costs for compressed gas can be significantly reduced without large capital outlay. The solution is our **Compressed Gas Leak Detection Program**. This is a comprehensive evaluation of your plant that utilises the innovative technology of ultrasonic leak detection and the use of Snoop Liquid Leak Detector. We will work with your team to improve system performance and reduce operational costs by our proven process:

- Initial discussion to review your unique situation
- Customised evaluation proposal
- In-plant evaluation, in consultation with your team
- Detailed report with prioritised recommendations
- Ongoing support and leak prevention training

**Leak Detection + Leak Prevention  
= More Profit**



## Develop an Ongoing Program

It is important to recognise that leak detection and repair needs to be a continuous process. As a system ages or changes, new leaks can develop and will require your attention. Having a Compressed Gas Leak Detection audit will help you reduce leaks, consistently deliver energy savings, improve plant efficiency, reduce downtime, lower overall system costs and decrease maintenance costs.

If you're ready to meet with one of our Energy Management experts, give us a call today or complete the **Evaluation Services request form.**



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Swagelok Australia is engineered to keep you up and running. We work harder because the world's toughest industry demands only the best. If the fluid systems in your oil and gas environment are becoming a source of cost and concern, we can help with the right products, the right recommendations, and the right people at the right time.

Give yourself an advantage—you can be sure it's done right with Swagelok.

**Swagelok®**