

Using Forming Gas vs. Helium



Tracer gas leak testing is a method of leak detection that provides high sensitivity, accuracy, and repeatability.

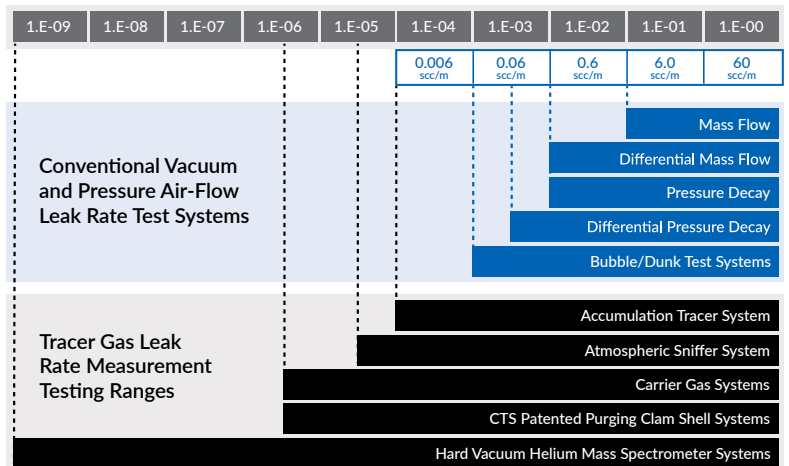
Tracer gas leak testing is typically used to test parts with very low leak rates – in the range of 1×10^{-4} scc/s to 10^{-8} scc/s (0.000000001 scc/m) – that are outside the range of conventional air-flow pressure decay and mass flow testing, or to replace bubble test methods. A tracer gas leak test can also be used to locate leaks in parts that have been identified as leaking.

A top medical manufacturer came to CTS with a problem: They needed to boost the production volume of their small fluid/solution bags (50ml-500ml) but their current leak tester couldn't go any faster without sacrificing their current detection capability and test repeatability. They thought would need to add another station and operator to meet their goals, which would be costly—until they came to CTS and discovered their other options.

Helium has long been the most common type of gas used for tracer gas leak testing, but due to factors including rising costs due to scarcity and demand, many manufacturers are moving to alternatives.

Forming gas is the most common alternative, consisting of a 95% nitrogen, 5% hydrogen mix.

While either can deliver an accurate, reliable tracer gas leak test, there are a variety of factors, including test specifications, environment, and budget which can impact which one would be best for your test. In the next sections we provide the pros and cons for helium vs. forming gas.



scc/s = standard cubic centimeters per second

What is tracer gas leak testing?

While pressure decay testing measures changes happening inside the part, tracer gas testing measures what is coming out of the part.

Different methods of tracer gas leak testing:

- [Sniff leak testing](#)
- [Nitrogen purge leak testing](#)
- [Accumulation tracer gas leak testing](#)
- [Hard vacuum helium leak testing](#)



Helium

Helium is the most common tracer gas used in leak detection. It is non-flammable, non-destructive, non-toxic, inert, and only has trace presence in our atmosphere, making it easier to control background. Helium can be used at 100% concentration or mixed with another gas, such as nitrogen or dry air, to help reduce the cost of tracer gas leak test procedures.

Pros	Cons
<ul style="list-style-type: none">▪ Helium can be used safely in high concentrations▪ Helium is inert and non-toxic▪ Helium easily flows through the smallest leaks▪ Helium has only trace presence in atmosphere (5 PPM)▪ Used for high vacuum chamber testing (Hard Vacuum Mass Spectrometer method)▪ Instrumentation available to measure leak rates as low as 10-12 scc/s	<ul style="list-style-type: none">▪ Helium may permeate through certain materials, impacting the reliability of measurements▪ Helium is more expensive than alternative tracer gasses▪ Due to its popularity in a variety of industries, helium can be vulnerable to availability issues

Reduce helium costs with a recovery system

For manufacturers that choose to use helium in their tracer gas leak testing, [helium recovery systems](#) are a popular addition to the production line. A helium recovery system can recycle up to 95% of helium, helping you boost sustainability, reduce dependency on helium suppliers, and reduce helium costs.

[Learn more](#)



Forming gas

Forming gas is a low-cost alternative to helium. It is typically a mixture of 5% hydrogen and 95% nitrogen that can be used as a safe, non-flammable (in concentrations < 5.7%), and effective tracer gas in many applications. It costs roughly 1/4 to 1/10 the cost of helium and, unlike helium, there are no availability issues to consider.

Pros	Cons
<ul style="list-style-type: none">Hydrogen is safe and non-toxic at low concentrationHydrogen has only trace background presence in atmosphere (0.5 PPM)Hydrogen is inexpensiveInstrumentation available to measure leak rates as low as 10⁻⁵ scc/s (sampling from atmosphere)	<ul style="list-style-type: none">Not suitable for measuring in a hard vacuumHydrogen is reactive (makes hydrides), must be controlledHydrogen is flammable (greater than 5%), oxidation catalysts ignite without heat, spark, or flameSensitivity reduced using 5% H₂ in Nitrogen

So, which is best for you? Helium or forming gas?

While helium remains the best option for detecting the smallest leaks, not every leak test scenario requires meeting this specification. Due to its higher cost and potential supply issues, manufacturers that don't require helium to meet their specifications will often opt for forming gas as a more cost-effective and easier-to-obtain alternative.

To determine whether your leak test requires the use of helium, you will need to consider your target cycle time and environment:

- Cycle time:** The difference in concentrations between forming gas and helium (5% hydrogen maximum versus potential 100% helium) impact the cycle times possible for your test. Forming gas takes longer to test because of the smaller concentration rate of rise. This will mean that depending on the size of your part and the relative test chamber, you may not be able to meet your target cycle time using forming gas, leaving helium as your best option.
- Environment:** As helium and hydrogen are both present in our atmosphere and can be off gassed in a plant environment, it is important to consider if there are any factors present on your plant floor that could skew your measurements. This could include certain processes happening around your leak test station, or motor machinery you have running on the plant floor, such as fork trucks. If these machines are running on natural gas, they output hydrogen into the air, which will likely mean you need to use helium for your test (dependant on target leak rate).

Controlling ambient background is key to accurate testing at lower leak rates

To test lower than 1x10⁻⁴ scc/s, you need to carefully consider how you are controlling the ambient background, as hydrogen and helium can be naturally present in that range. At these lower leak rates, nitrogen purge testing or hard vacuum helium mass spectrometer test methods can be used to ensure an accurate, reliable leak test.



TracerMate II: Flexible, automated solution for tracer gas leak

CTS' TracerMate II is a flexible solution for leak testing using helium, forming gas, or other gases (carbon dioxide, argon, VOCs, etc.). It can be used for various methods of tracer gas leak testing, including sniff leak testing, nitrogen purge, accumulation, and hard vacuum. CTS also offers portable, turnkey test solutions for quick, easy leak location on the production floor.

[Learn more](#)



Need help with tracer gas leak testing? Contact the experts at CTS!

CTS is a worldwide leader in tracer gas technology. For over 40 years, we have worked with leading manufacturers across the globe, ensuring defective assemblies are caught before they leave the plant.

Contact us to discuss your tracer gas leak test solution. We are here to answer your questions and help you find the best solution for your needs.

Contact us



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