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Varian, Inc.
Vacuum Technologies

VS Series Leak Detectors
for Vacuum Furnaces

Inspiring Excellence

NOTICE: This document contains references to Varian. Please note that Varian, Inc. is now part of Agilent Technologies. For more information, go to www.agilent.com/chem.



Rate of rise and vacuum decay tests will not locate leaks, they will only indicate the relative magnitude of all leaks combined.

Helium Leak Detection

Helium Leak Detection Benefits

Helium leak detection is truly the perfect solution to guarantee the tightness of a vacuum furnace.

Major advantages of helium leak detection technology:

- Ability to pinpoint the location(s) of the leak(s).
Benefit: Spend less time making repairs.
- Allows quantifiable measurements.
Benefit: Understand which leaks will cause problems.
- Outgassing issues do not affect the method.
Benefit: Can test regardless of chamber condition.
- Can be performed quickly and can be a routine operation at the start of each production run.
Benefit: Saves time and reduces scrap.

Why helium as a tracer gas?

Helium is present in only small amounts in the ambient air. This results in low background noise and makes helium a very attractive gas for leak detection applications. It is also:

- Readily available worldwide
- Non-toxic
- Non-flammable
- Totally inert

General Principle of Helium Leak Detection

Helium leak detection works as follows: Helium is applied to one side of a containing wall. Any helium that leaks through the wall is detected by a helium-tuned mass spectrometer.

While this is straightforward, test results can vary widely depending on where the leak detector is connected to the system. Hooking up the leak detector in the wrong location can significantly reduce its response time, sensitivity and ability to clean up a helium signal; even to the point of rendering it "blind" to leaks. To explain we'll define response time, sensitivity and clean up, then show how the location of the leak detector is affected by each parameter.

Response Time

Response time is the time required for a leak detector to yield a signal output equal to 63 percent of the maximum

signal attained when helium is applied indefinitely to a leak location. Mathematically this is stated as:

$$t_{63} = \frac{V}{S}$$

Where: t = Time (seconds)
 V = Volume (liters)
 S = Helium pumping speed (liters/second)

Larger volumes will have a longer response time than smaller volumes and systems with higher pumping speed will have faster response times than systems with lower pumping speed.

Clean up Time

Once a leak is found, the helium that leaked into the system must be pumped away in order to continue testing. As with response time, clean up is a function of volume and helium pumping speed of the system and leak detector pumps.

Sensitivity

Clearly response time and clean up will benefit if the rough and high vacuum pumps are operating during the helium leak test. However, their high pumping speed means that a good portion of the helium signal will be pumped away since the pumping speed of the leak detector is considerably less. So sensitivity is lost when large pumps are used.

Situating the leak detector in the Vacuum System

For a discussion on the three common locations to attach a leak detector to a vacuum furnace, refer to Figure 3.

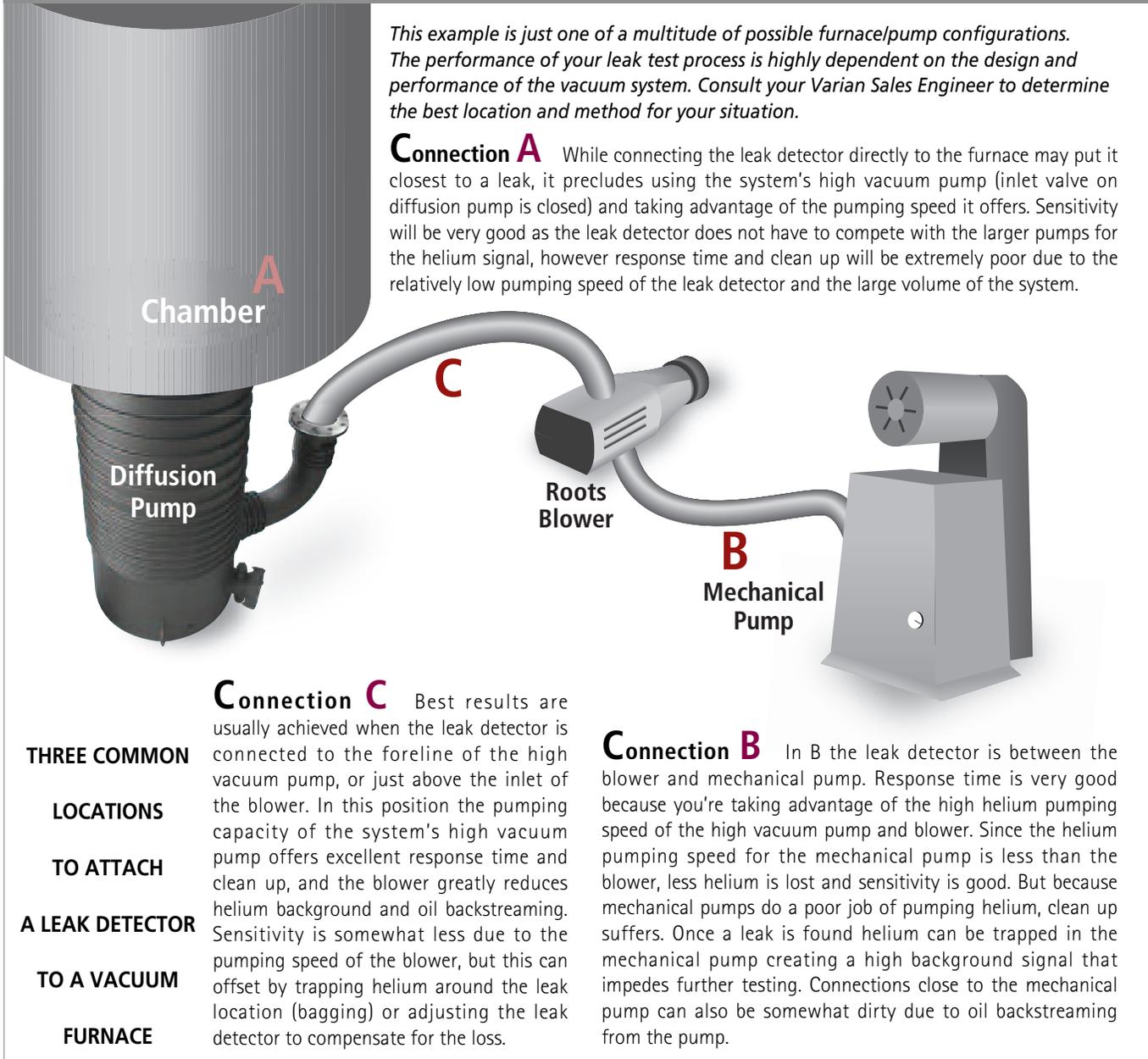
The Varian Solution

Leaks found in vacuum furnaces typically fall in the mid-range of a helium leak detector's sensitivity and therefore are not particularly challenging from a detection standpoint. However, Varian's VS series leak detectors possess unique capabilities that can save money, and simplify and speed up the leak testing process.

Finding Large Leaks

Occasionally a very large leak will prevent a furnace from reaching the vacuum level necessary for the leak detector to begin testing (typically less than 10 Torr). The result is time wasted tightening fittings, cleaning seals, re-checking valves, etc. Some manufacturers address this by adding auxiliary pumps that add to expense and bulk. A VS leak detector offers a special large leak indicator that operates at pressures as high as 150 Torr taking the guesswork out of finding the leak.

Figure 3. Example leak detector/furnace configuration



Sensitivity Compensation

To compensate for the helium lost to high speed pumps Varian offers a Split Flow adjustment on its leak detectors. This capability means that leaks can still be read accurately even when the leak detector is coupled to a system with large pumps.

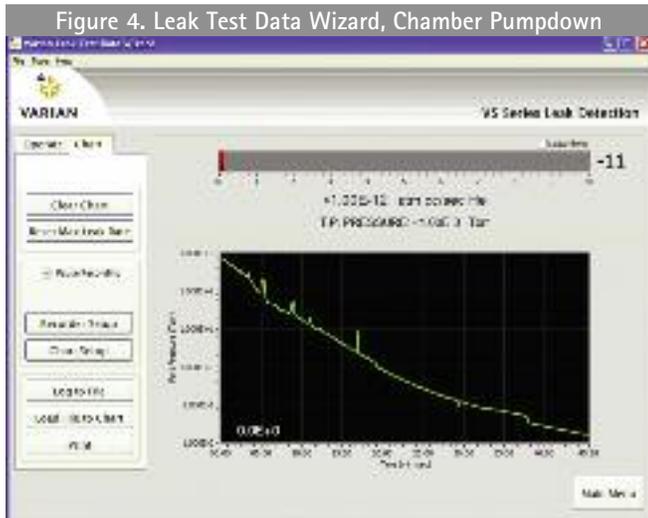
Data Analysis & Storage

Varian also offers PC-based Leak Test Data Wizard software. This easy to use program gives the user the ability to control the leak test process and log the results.

Software features:

- Pump down data (Figure 4)
- Rate of Rise plots
- Store test results and maintain product traceability
- Perform statistical analysis (Figure 5)
- Export data to Excel for further analysis

VS Series Leak Detectors for Vacuum Furnaces



Wireless Hand-held Remote

Given the size and configuration of many vacuum furnaces, the operator may be spraying Helium a considerable distance from the leak detector and is therefore unable to see or hear the instrument respond to Helium. Wired remote controls have sought to address this problem, but impedance and the cumbersome nature of long cables are often limiting factors. The VS' wireless hand-held remote control allows leak testing up to 100 meters from the base unit, Figure 6. All the major functions of the leak detector are at your fingertips, the display has a bar graph of the leak rate, and a speaker provides a variable tone



indicating the trend and relative size of the leak. Large systems, in which two technicians were previously required, can now be tested by one technician, thereby reducing labor costs.

Support & Service Organization

Finally, the proper selection of a detector, the connection of the detector to the furnace and the appropriate use of helium tracer gas are fundamental to the overall performance and success of the helium leak test process on a vacuum furnace. Our highly trained and experienced sales and service team will be pleased to guide you through the selection process and all operational issues.

With offices worldwide, Varian can easily support manufacturing and customer sites around the globe. This level of support is reflected in the VS interface which can be displayed in seven different languages.

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