LACO TECHNOLOGIES

APPLICATION NOTE

NOTE #07-05

HELIUM SNIFFING LEAK DETECTION

SCOPE

This application note covers the general techniques and instructions for sniffing leak detection using a tracer gas (sometimes called the detector probe method).

BACKGROUND

The sniffer leak detection method uses a sensitive instrument which samples and is able to detect specific atmospheric gases leaking from a defect in a pressurized system. Helium is the most common tracer gas; however, hydrogen, sulfur hexafluoride (SF6), and a number of refrigerants and other gases can also be used. This application note will specifically address sniffer leak detection with helium tracer gas.

Generally, sniffer leak detection is used to locate leaks in parts or systems so that they can be identified and repaired. The part or system is first pressurized with the tracer gas or a mixture of the tracer gas with air or nitrogen. The operator then systematically scans suspect leak locations with the sniffer instrument in order to identify a leak. The skill of the operator and the technique used can dramatically affect the results of a leak test. This is why the sniffing method is often NOT considered a quantitative leak testing method. Nevertheless, with the use of calibrated instruments, calibrated leak standards, and well trained operators, quantitative measurements can be made.

This method is often used to replace air-under-water (or dunk) leak testing as well as soap and bubble testing. Depending on conditions and the sensitivity of the instrument, this method can detect leaks over 100 times smaller than what can be detected using the bubble method. There are three classifications of helium sniffer instruments that can be used in this method:

1. Helium Mass Spectrometer: Detects helium by passing the sample into a mass spectrometer analyzer cell operating in high vacuum.
2. Helium Membrane Ion Pump: Detects helium by passing the sample through a membrane into an ion pump chamber.
3. Helium Thermal Conductivity: Detects helium by comparing the thermal conductivity of the helium enriched gas sample to that of air.

All of these instruments use some type of sampling or sniffer probe which has an air pump attached to it for drawing the air sample (sniffing) into the analyzer. Each instrument will have differing sensitivity to helium, selectivity to helium, sensitivity to contamination, and response time. These factors must be well understood when selecting the proper instrument for helium sniffing

DESCRIPTION

The sniffer leak test method can be broken into three main steps:

1. Helium Charging

Prior to filling the part or system with helium the user should identify the optimum tracer gas pressure. Operator safety should be of primary importance when pressurizing any part with a gas. Never fill a part greater than its rated pressure. If the part fails catastrophically under pressure, the stored energy in the compressed gas can create a hazardous environment which can injure an operator.

Insure that the part or system has been properly sealed and that no seals are missing or valves are left open. If an attempt to fill the part is made with a massive leak or missing part the helium escaping the leak can contaminate the test area with helium making it difficult to conduct helium sniffing. Sometimes a pre-test using air to check for massive leaks prior to filling with helium is a good choice. An automated helium charge system can be employed to automatically perform this and other steps in the charging process.

When filling the part one must realize that the helium introduced into the part is mixing with the air already in the part (at atmospheric pressure) and is diluting the helium. In some cases it is desirable to evacuate the part prior to filling with helium. In order to reduce helium usage, it may be desirable to mix the helium with dry air or nitrogen. This can be done using a helium blender/mixer, purchasing pre-mixed gas, or by fill with helium and nitrogen alternately to the desired pressures to achieve the target mix percentage.

2. Scanning the Part

When scanning the part or system for leaks insure that fans or other high volume air handling equipment are not blowing on the part and removing the helium form the area too quickly (fans may be used to exhaust air from the room in case of accidental helium spillage, but shouldn't be used while sniffing). Also, when planning a procedure for sniffing a systematic scanning approach should be used. Because helium rises, it is best to start scanning near the bottom of the part or system. On large systems, if a leak is found, it is best to repair the leak if practical before continuing. This will prevent the leak from giving false readings while scanning other areas of the part. When a signal is detected always remove the probe from the area, allow signal to dissipate, then return to the suspect area and verify the signal.

3. Venting the Gas

When the sniffing is complete, vent the tracer gas through a vent line or hose to an area outside the test room, preferably outside the building. This will prevent helium from accumulating in the room and raising the natural helium concentration in the room. A high helium background in the test area can make it difficult to detect smaller leaks.

BENEFITS

The sniffer leak detection method is ideal for locating even small leaks and is much more sensitive than bubble techniques. It can be employed at a relatively low cost without the need of expensive fixtures or test chambers, and can be used on small parts as well as large complex systems. On the other hand, well trained operators are required to obtain reliable and repeatable results.