

ENGINEERING BULLETIN #133

Leak Testing for Cryogenic Hoses

When it comes to testing hose assemblies for leaks, Penflex will use one or both of the following methods.

1. A submersion bubble leak test—also known as an air-underwater test—places dry air inside the hose which is then held under water for at least one minute while testers look for bubbles.
2. A hydrostatic test uses water at a higher pressure inside the hose to verify the structural integrity of the end weld connections.

In the case of hoses designed to transfer gas made from molecules smaller than air, a testing method capable of detecting much smaller leaks must be used. Hoses which have an application in the cryogenic industry fit into this category.

Capable of detecting leaks as small as $10E-9$ cubic centimeters per second (scc/sec)—whereby it would take a year and a half for one bubble to escape under water—a mass spectrometer test using helium gas is a common requirement for such hoses. Mass spectrometer testing is the most accurate way to identify leakage.

In comparison, and in accordance with international standard ISO 10380 for corrugated hose, the leak rate that air-underwater and hydrostatic testing will capture is .001 scc/sec.

HELIUM MASS SPECTROMETER TESTING

First developed as part of the Manhattan Project during World War II, mass spectrometer testing relies on a sealed vacuum chamber filled with helium. As helium leaks out of the chamber, the mass spectrometer machine detects the leak rate.

Before Penflex tests a cryogenic hose, the testing system must be properly vented and calibrated. We'll then load the hose assembly into the chamber, connecting it with the inlet of the mass spectrometer machine. Once we have a good seal, we'll begin the testing process.

Through a series of pumps, vacuum is pulled on the inside of the hose. Once the displayed leak rate reduces to the required testing level, using the hood or the outside-in method, we spray the helium inside the chamber for a couple of seconds until helium saturates the outer dimension of the hose.

Helium is used as the tracer gas because its atoms are among the smallest and can thus penetrate small leaks quickly. We record the fluctuation in leak rate to determine whether any

potential leakage is present. As a policy, we sustain the hose in a helium rich environment for five minutes.

With the recorded values, we draw up a certificate for Penflex customers showing that the hose assembly passes the mass spectrometer test.

If you have any questions about helium mass spectrometer testing or about how Penflex hose assemblies are used in cryogenic applications, please [contact us](#).



Figure 1: Mass spectrometer machine pulling vacuum on chamber containing hose assembly.