



Leak Testing for Underground Storage
of Hazardous Materials



PHD-4 PORTABLE LEAK DETECTOR FOR TESTING UNDERGROUND STORAGE TANKS

The Measure of Confidence



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Introduction

Leaks in underground gasoline and fuel oil tanks are a danger to the environment especially if leaking fuel enters local water supplies. To avoid environmental damage, countries worldwide are instituting legislation restricting the level of leaks allowed to emanate from underground tanks.

To protect the environment and to avoid the liability costs associated with non-compliance with environmental legislation, it is very important to find and repair leaks quickly.

The average cost to clean up a simple tank leak is very high and increases with the size of the leak. One way to minimize the danger and expense of leaks is to find them when they are very small. This

requires a high degree of sensitivity and reliability in the leak detection method, one that both identifies and locates leaks precisely. The PHD-4 does both. This eliminates the need to excavate the area around an entire tank to fix a leak that may only be in the piping, for example.

What Is PHD-4?

The PHD-4 is a self-contained, ready-to-use portable leak detector capable of detecting helium concentration as small as 2 parts-per-million. This user-friendly leak detector is particularly suitable for on-site leak detection for the following reasons:

- Helium as a tracer gas is advantageous because it is non-toxic, non-flammable, inexpensive, and quickly diffuses through small leaks.
- Helium is non-reactive with other chemicals and easily permeates earth and asphalt. Furthermore, due to the low concentration of helium in the atmosphere (only 5 ppm), very small leaks can be detected.

Locating Leaks

There are two main applications with

respect to leak detection of USTs:

- *Initial installation* – Leak detection of the tank top and all associated underground piping during initial installation.
- *Post installation* – Leak detection of any or all components of an installed UST in order to meet new regulations or isolate a suspected leak.

Leak Detection At Initial Installation

Leak detection during initial installation is usually easier to accomplish because most or all components of the UST are readily accessible. Today, most new installations consist of primary and secondary containment systems. Tanks are typically double-walled and piping runs consist of an inner primary pipe and outer secondary pipe. Product leaking from the primary pipe is caught by the secondary pipe. Since piping runs are pitched back toward the sump area, any captured product flows in that direction to help insure containment.

Generally, testing of the tank top and piping in a new installation proceeds as follows:

- Adequately seal all tank and piping penetrations.
- Apply helium flow to one end of the system and monitor helium flow at the opposite and farthest end of the system to insure flushing of the ambient air within and to make sure that helium has reached all components.
- Seal the downstream penetration and pressurize the system with welding grade helium.

Although higher total pressures will increase the flow rate at leak sites and make smaller leaks easier to detect, one hundred percent helium is not necessarily required. Once the system is flushed and helium is added, the total pressure can be increased with air or nitrogen. Diluting

Regulations on Underground Storage of Hazardous Materials

Laws regulating underground storage of hazardous materials are becoming more stringent worldwide. In the United States, California was one of the first states to regulate the construction, permitting, and monitoring of USTs. In recent years, however, these regulations have been modified and now require tanks and all associated underground piping to be “product tight”. “Product tight” is defined as impervious, not only to the liquid, but also to the vapor phase of the product contained in the UST.

Enhanced leak detection methods are required before the UST can be placed into use. These regulations require leak testing of the tank and piping down to a leak rate of approximately 0.005 gallons, or 0.02 liters per hour. Additional restrictions are placed on installations located within 1000 feet or 300 meters of public drinking water wells. It is expected that similar regulations will soon be passed in other areas of the United States and around the world. This has resulted in an increased need for more reliable and accurate leak detection equipment in this industry.

on-site makes helium substantially more economical than pre-mixed tracer gases such as Forming gas (5% hydrogen, 95% nitrogen).

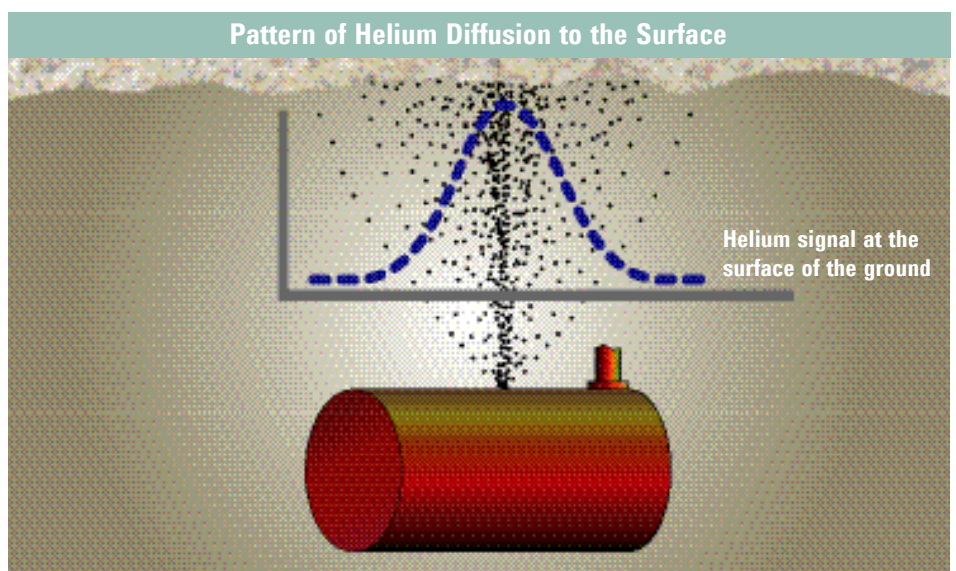
When testing the primary piping using the PHD-4 helium “sniffer”, the secondary piping can often be used to help contain any leaking helium. An accumulation effect occurs, making detection easier. In these cases, once the primary system is found to be leak free, the secondary piping can be sealed. Then, using a similar process, this secondary containment area, the interstitial space between pipes, can be flushed, pressurized with helium, and checked for potential leaks.

Post Installation Leak Detection

Leak detection of a previously installed UST can be much more challenging since the tank and most of the piping are less accessible. These sites also typically have a layer of concrete or asphalt at the surface. The system must be flushed of air and pressurized with helium as described earlier, and leak detection must be performed through the layers of dirt, sand, gravel, concrete, etc.

Helium will pass through all substrates but will not always follow a straight-line path to the surface. To aid in finding the precise location of the leak site, holes may be drilled through the concrete at regular intervals along and directly over the piping runs. Once pressurization and a short dwell time are accomplished, the PHD-4 probe is placed at each of these holes to determine the approximate location of the leak.

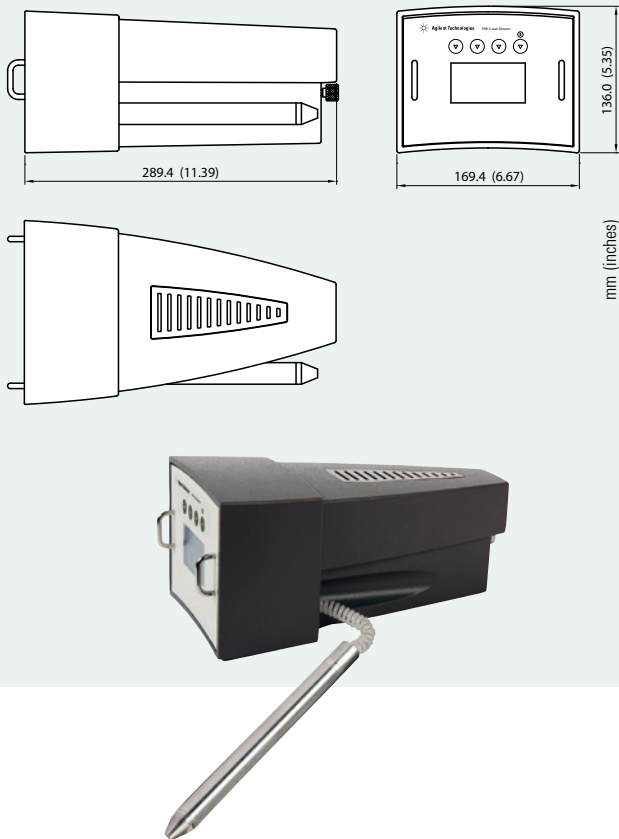
Tape or some other material is placed over the hole during the dwell period to permit an accumulation effect and make the detection method more sensitive. Proper execution of this method can significantly reduce the amount of excavation required to repair leaks at an existing UST site.



AGILENT PHD-4 - FEATURES AND BENEFITS

High Selectivity	PHD-4 is sensitive only to helium. There are no false signals due to the presence of any other gases.
High Sensitivity	PHD-4 is nearly as sensitive to small leaks as a more expensive mass spectrometer leak detector used in the sniffing mode. This allows precise location of the leak which helps minimize excavation costs.
Battery Operated	PHD-4 can be operated without a main power supply or power generator. Up to 4 hours on a single charge.
Simple Operation	PHD-4 is very easy to use and does not require any special operator training. All the active menus of the PHD-4 are available in four languages. Specifically designed for underground testing (see sampling probe in photo on page 3).
Very Low Maintenance	Replacement of sampling line filters is straightforward and requires only a screwdriver.
Portable	PHD-4 is lightweight, portable and easy to carry, even to the most difficult leak check locations. It weighs only 2.6 kg.

OUTLINE DRAWING



AGILENT PHD-4 - TECHNICAL SPECIFICATION

Lowest Detectable Helium Concentration:	2 ppm (parts per million)
Lowest Detectable Helium leak:	5 x 10 ⁻⁶ atm cc/s 5 x 10 ⁻⁶ mbar l/s 5 x 10 ⁻⁷ pa m ³ /s
Response Time:	< 2 sec
Recovery Time:	<10 sec (from 50 ppm to 0 ppm)
Start up time, including self check-up:	3 min approx.
Electrical Supply:	Rechargeable Battery included Power Supply included 110-240 V 50-60 Hz
Battery operation Time:	4 hours
Maximum Signal Drift:	10 ppm/10 min
Operating Conditions	Temperature: +5°C to +35°C Humidity: 90% maximum relative humidity
Storage Conditions	Temperature: -20°C to +60°C Weight: 2,6 Kg (5.7 lbs)
Compliance to Norms:	CE, CSA/UL approved

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