

## LEAK DETECTION ON PLATE HEAT EXCHANGERS

# How to detect leaks on plate heat exchangers with tracer gas

Heat exchangers are used in a wide range of industries and applications to transfer heat between two or more gases, liquids or a combination of both. By implementing thorough leak testing procedures, manufacturers can ensure the reliability, safety and performance of their heat exchangers, in order to prevent costly repairs and downtime.

## Application

From power generation and manufacturing to healthcare and data centres, heat exchangers improve the efficiency, safety and energy savings of thermal processes. Heat exchangers can range from small units for domestic applications to large industrial units used in power stations, chemical plants and oil refineries. Their size and volume vary greatly depending on the type, application and amount of heat to be transferred. This document describes leak detection on plate heat exchangers using tracer gas leak detectors from INFICON.

## Traditional Methods

A common method of detecting leaks is **pressure decay**, which involves filling the heat exchanger, or its components, with air, pressurising the part and then checking the pressure drop over time. This method is affected by changes in temperature and has a limited sensitivity. The pressure drop gives an indication of the tightness of the system, but not the exact location of the leak. After pressurising the heat exchanger with air, a **soap** or detergent solution can be applied to potential leak areas. If there is a leak, bubbles generally form at the leak point. Commonly used to detect small leaks in flanges, joints, gaskets and seals, this technique is simple and inexpensive, but the limited sensitivity makes it impossible to detect very small leaks. The same argument applies to **water dunk testing**, where the plate heat exchanger is immersed in a tank of water after being pressurised with air or gas. Bubbles appearing at the leak point typically indicate the location of the leak. However, a large number of bubbles makes it difficult to identify leaks with accuracy. Water bath requires visual access to all surfaces of the component, including those that are hidden from the operator's eye. These techniques are not suitable for large components or heat exchangers used in an operating system or process, and require shutdown and drying afterwards.



A plate heat exchanger in automotive application

## How we do it

Testing a plate heat exchanger with tracer gas is an effective method in cases where small leaks are difficult to detect using conventional methods. The process typically uses helium or a nitrogen-hydrogen mixture as the tracer gas.

### Drain any liquids and evacuate gases from the heat exchanger

This allows correct tracer gas filling and ensures accurate test results

### Pressurize the heat exchanger

with tracer gas at operating pressure

### Detect leaks

Measure the tracer gas concentration in the chamber and use the sniffer probe to locate leaks

## The solution from INFICON

A non-destructive and more sensitive method is leak detection with a tracer gas. This method involves using forming gas (5% hydrogen in nitrogen) or helium as the tracer gas. Depending on the size of the heat exchanger, the required throughput and the leak rate requirements, the accumulation test and the vacuum test are suitable alternatives.

	ACCUMULATION LEAK TEST	VACUUM LEAK TEST
Leak rate requirements	Water-tight, oil-tight	Refrigerant-tight
Throughput	Low to medium	Medium to high
Part size	Small to medium	Medium

### Accumulation Test with Leak Location

For small to medium sized heat exchangers that need to be tested for water/oil leaks with low to medium throughput, leak detection with forming gas in an accumulation chamber under normal pressure (accumulation test) provides a cost efficient leak testing solution.

The test starts by evacuating and pressurizing the component with hydrogen tracer gas and placing it in a chamber where the air is circulated by a fan.

Any hydrogen leaking from the heat exchanger will remain within the chamber and the concentration will build up in proportion to the leak size. The solution from INFICON consists of the [Sentrac Hydrogen Leak Detector](#), with dual probe connection as standard, and the [AP29ECO Sampling Probe](#). Controlled by the Sentrac leak detector, the AP29ECO allows a certain time (accumulation time) before taking a sample from the chamber and analyzing the gas concentration. The AP29ECO has an automatic purge function which can be activated before and after sampling, and when the gas concentration exceeds a set limit. It can therefore detect gross leaks and still be cleared within seconds. If the concentration exceeds the set reject level, the Sentrac leak detector gives an alarm signal. The sniffer hand probe, which is simultaneously connected to the Sentrac leak detector, is then used to locate leaks immediately after the integral test, while the part is still pressurised.

### Accumulation Test with Highest Sensitivity

For very rapid leak tests, when extremely small leaks are expected or in all circumstances where a leak detector for both helium and forming gas is preferred, the [LDS3000 AQ Leak Detector](#) is the right choice.

The unit works with both gases and detects leaks down to the  $10^{-5}$  mbarl/s range. The part to be tested is filled with tracer gas and placed in the accumulation chamber. Any tracer gas escaping from potential leaks accumulates in the chamber. The LDS3000 AQ measures the speed of increase of the tracer gas level in the chamber. If



Controlled by the Sentrac leak detector, the AP29ECO draws a sample from the chamber and analyzes the gas concentration. If this exceeds the set reject level, an alarm signal is triggered

this rises too quickly, it indicates that the leak is too large.

### Vacuum Leak Test

For larger heat exchangers that need to be tested at medium to high throughput, or parts that need to be tested for refrigerant leaks, leak testing with helium in a vacuum chamber is the preferred solution. In this testing process, the heat exchanger is evacuated and filled with helium before vacuum pumps create a vacuum in the chamber. If there is a leak, the [LDS3000 Helium Leak Detector](#) from INFICON detects the helium atoms as they exit from the heat exchanger and gives an alarm signal.

### Advantages of leak detection with tracer gas

- Significantly improved leak test quality - detects even the smallest leaks
- Easy leak location - pinpoints the exact location of the leak
- Rapid leak detection - faster results, minimal downtime
- Clean, non-destructive method - no need to disassemble nor dry the part
- Temperature and humidity independent method - reliable test results with high repeatability

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