

LEAK TESTING OF COMPONENTS

Heat exchangers



DESCRIPTION OF TECHNICAL CHALLENGE

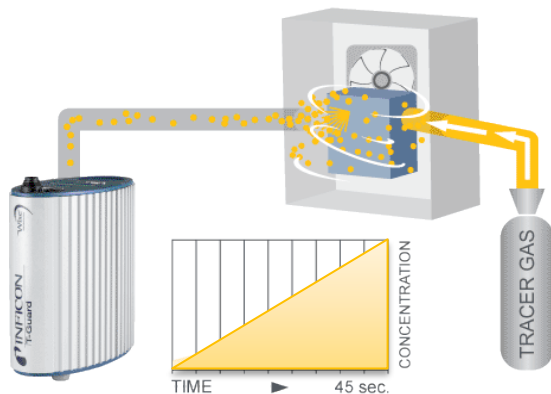
Increasing numbers of heat exchangers are used in a modern car design. Strict new governmental emissions and fuel-economy requirements drive the need for major HVAC and powertrain improvements. This, in turn, will increase the need for stricter leak testing, but also require additional high-quality heat-exchange systems. The introduction of exhaust gas recirculation adds an additional EGR cooler to each vehicle using this technology. Increased use of turbo chargers to increase gas mileage leads to increased production numbers of charge air intercoolers. For mobile air conditioners, the industry is currently switching from R134a (used as refrigerant in car air conditioners for the last decade) to the more environmentally-friendly (lower GWP), but flammable HFO-1234yf. The flammability, in particular, drives the need to test all MAC components (in this case, the evaporator and the condenser) for lower leak rates. Also, more complex designs (introduced to efficiently use the limited underhood space) restrict the use of traditional testing methods (like water bath testing).

THE INFICON SOLUTION

Integral Testing During Production

Depending on the size of the heat exchanger and the required throughput, two tracer gas solutions are available today that are not affected by temperature changes:

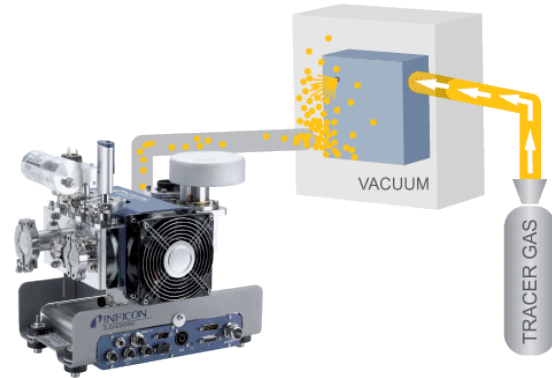
	Accumulation method	Vacuum leak testing
Leak rate requirements	Water-tight, oil-tight	Refrigerant-tight
Throughput	Low to medium	Medium to high
Part size	Small to medium	Medium to large



For small to medium parts that need to be tested for water/oil leaks with low to medium throughput, leak detection with helium or hydrogen in an accumulating chamber under normal pressure (**accumulation method**) provides an economical solution for leak testing heat exchangers.

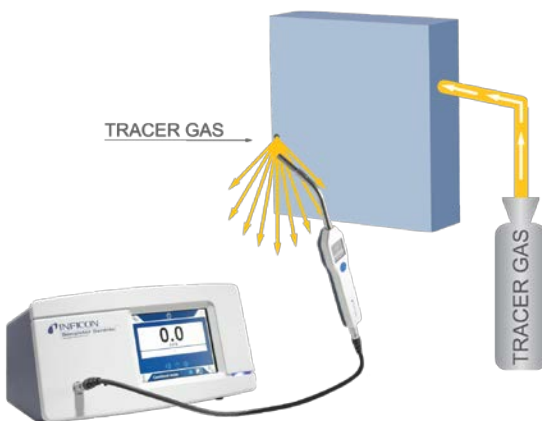
In a simple chamber, the test part is pressurized with helium or hydrogen through its test gas connection so that the test gas can escape through any leaks into the accumulating chamber. Fans then ensure an even distribution of the test gas in the chamber – so, independent of the position of the leak, precise measurement values are guaranteed. The [T-Guard Helium](#) sensor then determines the test gas content in this atmosphere and calculates the leak rate of the part from this value.

For larger parts that need to be tested with medium to high throughput, or parts that need to be tested for refrigerant leaks, leak testing with helium in a vacuum chamber is recommended. For this testing process, the heat exchanger is sealed before large vacuum pumps pull a vacuum once the chamber lid is closed. The part and chamber are evacuated simultaneously; subsequently the part is backfilled with helium. Helium then has the opportunity to migrate outwards and if a leak is present, the INFICON [LDS3000 Helium Leak Detector](#) (which is valved into the vacuum pumps after the part has been filled with helium) detects the helium atoms as they emerge from the heat exchanger.



Leak location in rework

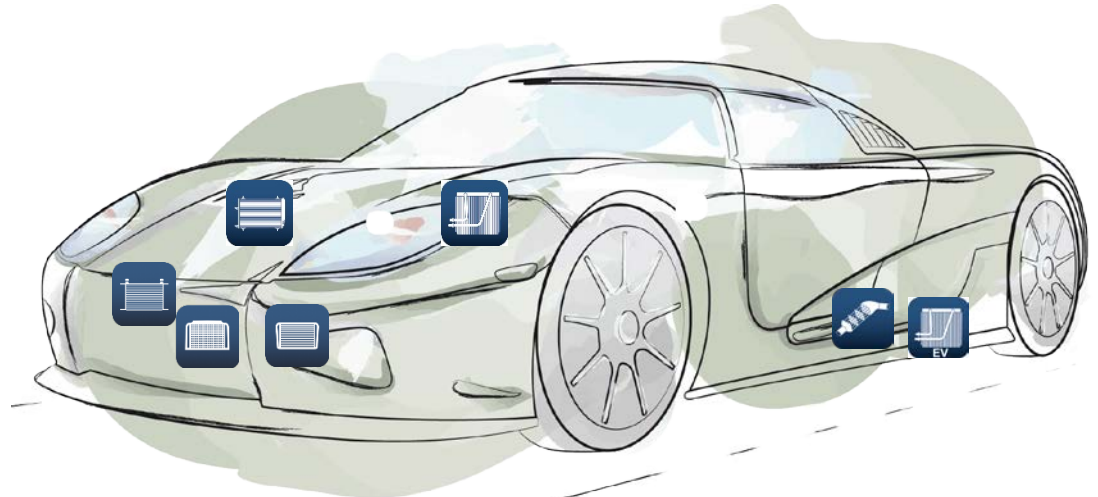
After one or more leaks have been detected, the leak needs to be located and repaired. Depending on the leak rate requirements, the heat exchanger is either filled with forming gas (a 5% hydrogen in 95% nitrogen mixture) or helium. The sniffer tip of the [Sensistor Sentrac Hydrogen Leak Detector](#) or the [Protec P3000\(XL\) Helium Sniffer Leak Detector](#) is then moved along the welds of the heat exchanger and a leak is detected, if the sniffer tip comes in contact with the tracer gas escaping from a leak in the heat exchanger. After the leak has been repaired, the repair can be verified with this same method.










BENEFITS OF HELIUM / HYDROGEN LEAK TESTING

- Accurate and repeatable measurements for reliable results of leak testing
- Test method independent of temperature and moisture
- Cost efficient leak testing
- High sensitivity

EXAMPLES OF HEAT EXCHANGERS IN A CAR DESIGN



				
Automotive Component	Evaporator	Condenser	Oil cooler	Water cooler
Typical leak rates	$10^{-4} - 10^{-5}$ mbarl/s	$10^{-4} - 10^{-5}$ mbarl/s	$10^{-2} - 10^{-4}$ mbarl/s	$\sim 10^{-2}$ mbarl/s
Recommended INFICON products	T-Guard LDS3000 Modul1000	T-Guard LDS3000 Modul1000	Modul1000 LDS3000 T-Guard Sensistor ISH2000	Sensistor Sentrac T-Guard (LDS3000)
				
Automotive Component	Charge-Air intercooler	EGR cooler	Evaporator for EV battery cooling	
Typical leak rates	$\sim 10^{-3}$ mbarl/s	$\sim 10^{-3}$ mbarl/s	$10^{-4} - 10^{-5}$ mbarl/s	
Recommended INFICON products	T-Guard LDS3000	T-Guard LDS3000	T-Guard LDS3000	

* Click on the product name to get more product information from our website

For more information, please visit us at
www.inficonautomotive.com



www.inficon.com reachus@inficon.com

Due to our continuing program of product improvements, specifications are subject to change without notice.

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