



# Efficient Leak Testing with Tracer Gas Methods

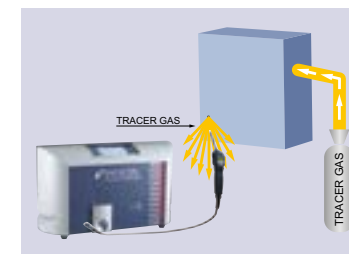
All over the world governments are releasing new regulations to lower emissions and fuel consumption and to increase the safety of cars. Hence, many vehicle components must be tested to lower and lower leak rates and sometimes even new components are added to the vehicle design for this purpose. Tracer gas leak testing offers very efficient methods to test for small leak rates with high reliability and independent of temperature or humidity. Also many new technologies like electric drive trains and fuel cell propulsion generate new applications for efficient leak testing ideally met by tracer gas methods.

Method	10 <sup>0</sup>	10 <sup>-1</sup>	10 <sup>-2</sup>	10 <sup>-3</sup>	10 <sup>-4</sup>	10 <sup>-5</sup>	10 <sup>-6</sup>	10 <sup>-7</sup>	10 <sup>-8</sup>	10 <sup>-9</sup>	10 <sup>-10</sup>	10 <sup>-11</sup>	10 <sup>-12</sup>
Helium Vacuum													
Helium Sniffing													
Hydrogen (5%) Sniffing													
Helium Accumulation													
Hydrogen (5%) Accumulation													
Pressure Decay Testing													
Water Bath Testing													
Values in mbar/s	10 <sup>0</sup>	10 <sup>-1</sup>	10 <sup>-2</sup>	10 <sup>-3</sup>	10 <sup>-4</sup>	10 <sup>-5</sup>	10 <sup>-6</sup>	10 <sup>-7</sup>	10 <sup>-8</sup>	10 <sup>-9</sup>	10 <sup>-10</sup>	10 <sup>-11</sup>	10 <sup>-12</sup>
Values in sccm	100	10	1	0.1	0.01	0.001	10 <sup>-4</sup>	10 <sup>-5</sup>	10 <sup>-6</sup>	10 <sup>-7</sup>	10 <sup>-8</sup>	10 <sup>-9</sup>	10 <sup>-10</sup>
Bubbling rate under best conditions	1000 bubbles/second	100 bubbles/second	10 bubbles/second	1 bubble/second	20 seconds/bubble	no bubbles	no bubbles	no bubbles	no bubbles	no bubbles	no bubbles	no bubbles	no bubbles

■ Theoretical Range  
■ Practical Range

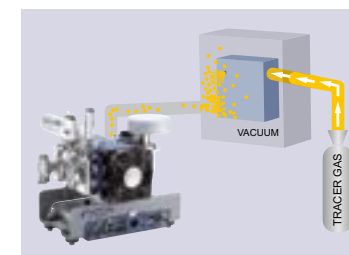
## Leak Testing in the Automotive Industry

Applications for Component Manufacturing and Final Assembly Testing



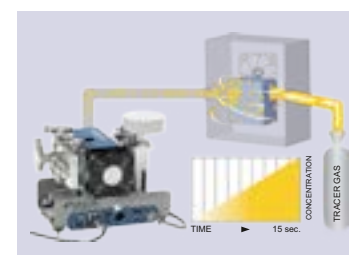
### SNIFFER METHOD

The test component is filled with tracer gas or the operating medium. In case of leaks the tracer gas escapes through the leakage channel and is detected by a sniffer probe. Probe can be moved manually or automatically via a robot. This method is ideally suited when you need to know the exact location of the leakage.



### VACUUM METHOD

The test component is filled with tracer gas in an evacuated vacuum chamber when using the vacuum method. In case of a leak, the tracer gas escapes through the leak path and is measured by a leak detector which is connected to the vacuum chamber. Leak detection systems in accordance with the vacuum method are characterized by exceptional measuring sensitivity and extremely short measuring times.



### ACCUMULATION METHOD

The test component is filled with tracer gas and placed in an accumulation chamber. Tracer gas which escapes through leaks in the chamber is equally distributed throughout the chamber via fans. The leak detector measures the total leakage rate of the test component regardless of the position of the leak. As the test takes place under atmospheric conditions, simple and cost-effective chamber systems can be used.

## Drivetrain



Automotive Component	Transmission	Torque converter	Dual fly wheel	EGR cooler	Charge-air intercooler
Testing method	Sniffing / Accumulation	Accumulation / Vacuum	Vacuum	Accumulation / Vacuum	Accumulation / Vacuum
Typical leak rates	10 <sup>-2</sup> – ...1 mbarl/s 1 sccm	10 <sup>-4</sup> ... 10 <sup>-5</sup> mbarl/s	10 <sup>-4</sup> ... 10 <sup>-5</sup> mbarl/s	~ 10 <sup>-4</sup> mbarl/s ~ 0.01 sccm	~ 10 <sup>-3</sup> mbarl/s
Recommended INFICON products	<b>XL3000flex</b> <b>Protec P3000(XL)</b> <b>LDS3000 AQ</b> <b>Sensistor Sentrac</b>	<b>LDS3000 AQ</b> <b>LDS3000</b>	<b>Modul1000</b> <b>LDS3000</b>	<b>LDS3000 AQ</b> <b>LDS3000</b>	<b>LDS3000 AQ</b> <b>LDS3000</b>

## E-Drivetrain



Automotive Component	Cell cap	Battery case	Assembled battery pack	Hoses for electric battery cooling	Electric motor	Inter-cell cooler
Testing method	Vacuum / Bombing	Vacuum / Accumulation	(Robotic) Sniffing / Accumulation	Sniffing	(Robotic) Sniffing / Accumulation	Vacuum / Accumulation
Typical leak rates	10 <sup>-6</sup> mbarl/s	10 <sup>-2</sup> ... 10 <sup>-4</sup> mbarl/s	10 <sup>-2</sup> ... 10 <sup>-4</sup> mbarl/s	10 <sup>-4</sup> ... 10 <sup>-5</sup> mbarl/s	10 <sup>-3</sup> ... 10 <sup>-5</sup> mbarl/s	10 <sup>-3</sup> ... 10 <sup>-5</sup> mbarl/s
Recommended INFICON products	<b>Modul1000</b> <b>LDS3000</b>	<b>LDS3000</b> <b>LDS3000 AQ</b>	<b>LDS3000 AQ</b> <b>XL3000flex</b> <b>Protec P3000(XL)</b>	<b>XL3000flex</b> <b>Protec P3000(XL)</b>	<b>LDS3000 AQ</b> <b>XL3000flex</b> <b>Protec P3000(XL)</b>	<b>LDS3000</b> <b>LDS3000 AQ</b>



Automotive Component	Battery module cold plate	Sub-cooled loop radiator	Chiller	Cooling pipeline	Lithium-ion battery cells
Testing method	Accumulation / Vacuum	Accumulation / Vacuum	Accumulation / Vacuum	Accumulation / Sniffing	Vacuum / Bombing
Typical leak rates	10 <sup>-3</sup> – 10 <sup>-5</sup> mbarl/s	10 <sup>-4</sup> – 10 <sup>-5</sup> mbarl/s	10 <sup>-4</sup> – 10 <sup>-5</sup> mbarl/s	10 <sup>-4</sup> – 10 <sup>-5</sup> mbarl/s	~ 10 <sup>-6</sup> mbarl/s
Recommended INFICON products	<b>LDS3000 AQ</b> <b>LDS3000</b> <b>Modul1000</b>	<b>LDS3000 AQ</b> <b>LDS3000</b> <b>Modul1000</b>	<b>LDS3000 AQ</b> <b>LDS3000</b> <b>Modul1000</b>	<b>LDS3000 AQ</b> <b>XL3000flex</b> <b>Protec P3000(XL)</b> <b>Sensistor Sentrac</b>	<b>Modul1000</b> <b>LDS3000</b>

## CNG / LNG



Automotive Component	Natural gas engine	Natural gas tank
Testing method	Sniffing	Sniffing
Typical leak rates	10 <sup>-4</sup> ... 10 <sup>-5</sup> mbarl/s	~ 10 <sup>-4</sup> mbarl/s ~ 0.01 sccm
Recommended INFICON products	<b>XL3000flex</b> <b>Protec P3000(XL)</b>	<b>XL3000flex</b> <b>Protec P3000(XL)</b>

## Fuel Cell Drive



Automotive Component	Fuel cell plate	Fuel cell housing	Fuel cell stack (assembled)	FC pressure sensor	Hydrogen gas line	Hydrogen fuel tank
Testing method	Vacuum	Vacuum / Accumulation	(Robotic) Sniffing / Accumulation	Vacuum / Accumulation	Vacuum	Sniffing / Accumulation
Typical leak rates	10 <sup>-4</sup> ... 10 <sup>-5</sup> mbarl/s	10 <sup>-2</sup> ... 10 <sup>-4</sup> mbarl/s	10 <sup>-2</sup> ... 10 <sup>-4</sup> mbarl/s	10 <sup>-4</sup> ... 10 <sup>-5</sup> mbarl/s	10 <sup>-4</sup> ... 10 <sup>-5</sup> mbarl/s	10 <sup>-4</sup> ... 10 <sup>-5</sup> mbarl/s
Recommended INFICON products	<b>Modul1000</b> <b>LDS3000</b>	<b>LDS3000</b> <b>LDS3000 AQ</b>	<b>LDS3000 AQ</b> <b>XL3000flex</b> <b>Protec P3000(XL)</b>	<b>LDS3000</b> <b>LDS3000 AQ</b>	<b>Modul1000</b> <b>LDS3000</b>	<b>LDS3000 AQ</b> <b>XL3000flex</b> <b>Protec P3000(XL)</b>

## Fuel System



Automotive Component	Fuel tank	Tank filler neck	Tank filler cap	Carbon canister	Fuel pump	Fuel tank sending unit
Testing method	Sniffing / Accumulation	Accumulation / Vacuum	Vacuum	Accumulation / Vacuum	Accumulation / Vacuum	Accumulation / Vacuum
Typical leak rates	10 <sup>-1</sup> – ...1 mbarl/s 5 ... 100 sccm	10 <sup>-3</sup> ... 10 <sup>-4</sup> mbarl/s	10 <sup>-4</sup> ... 10 <sup>-5</sup> mbarl/s	~ 10 <sup>-4</sup> mbarl/s ~ 0.01 sccm	~ 10 <sup>-3</sup> mbarl/s	~ 10 <sup>-4</sup> mbarl/s ~ 0.01 sccm
Recommended INFICON products	<b>LDS3000</b> <b>Modul1000</b> <b>Protec P3000(XL)</b>	<b>LDS3000 AQ</b> <b>LDS3000</b>	<b>Modul1000</b> <b>LDS3000</b>	<b>LDS3000 AQ</b> <b>LDS3000</b>	<b>LDS3000 AQ</b> <b>LDS3000</b>	<b>Modul1000</b> <b>LDS3000</b>



Automotive Component	Fuel injector	High pressure fuel pump	High pressure fuel rail	High pressure fuel line	Fuel filter	Fuel pressure sensor
Testing method	Accumulation	Accumulation / Vacuum	Vacuum	Accumulation / Vacuum	Accumulation / Vacuum	Accumulation / Vacuum
Typical leak rates	~ 10 <sup>-4</sup> mbarl/s	10 <sup>-4</sup> ... 10 <sup>-5</sup> mbarl/s	~ 10 <sup>-5</sup> mbarl/s	10 <sup>-4</sup> ... 10 <sup>-5</sup> mbarl/s	~ 10 <sup>-2</sup> mbarl/s	10 <sup>-4</sup> ... 10 <sup>-5</sup> mbarl/s
Recommended INFICON products	<b>LDS3000 AQ</b>	<b>LDS3000 AQ</b> <b>LDS3000</b>	<b>LDS3000 AQ</b> <b>LDS3000</b>	<b>LDS3000 AQ</b> <b>LDS3000</b>	<b>LDS3000 AQ</b>	<b>Modul1000</b> <b>LDS3000</b>



Automotive Component	Swirl pot (Diesel)	DEF ("AdBlue") tank	Power steering housing	Servo oil reservoir	Brake fluid reservoir
Testing method	Accumulation	Accumulation / Vacuum	Accumulation	Accumulation	Accumulation
Typical leak rates	10 <sup>-2</sup> ... 10 <sup>-4</sup> mbarl/s	~ 10 <sup>-4</sup> mbarl/s	10 <sup>-2</sup> ... 10 <sup>-4</sup> mbarl/s	10 <sup>-2</sup> ... 10 <sup>-4</sup> mbarl/s	10 <sup>-3</sup> ... 10 <sup>-4</sup> mbarl/s
Recommended INFICON products	<b>LDS3000 AQ</b>	<b>LDS3000 AQ</b> <b>LDS3000</b>	<b>LDS3000 AQ</b>	<b>LDS3000 AQ</b>	<b>LDS3000 AQ</b>

### Safety Features



Automotive Component	Vacuum brake pump	Brake hoses	Brake calipers	Air brakes	Air brake tank	Air suspension valve
Testing method	Accumulation	Accumulation	Vacuum / Accumulation	Vacuum	Vacuum	Vacuum
Typical leak rates	~ 10 <sup>-1</sup> mbarl/s 5...20 sccm	10 <sup>-3</sup> ...10 <sup>-4</sup> mbarl/s	10 <sup>-3</sup> ...10 <sup>-4</sup> mbarl/s	10 <sup>-4</sup> ... 10 <sup>-5</sup> mbarl/s 0.03 to 0.0006 sccm	10 <sup>-4</sup> ... 10 <sup>-5</sup> mbarl/s 0.03 to 0.0006 sccm	~ 10 <sup>-5</sup> mbarl/s
Recommended INFICON products	<b>LDS3000 AQ</b>	<b>LDS3000 AQ</b>	<b>Modul1000 LDS3000 LDS3000 AQ</b>	<b>Modul1000 LDS3000</b>	<b>Modul1000 LDS3000</b>	<b>Modul1000 LDS3000</b>



Automotive Component	Air suspension cylinder	Shock absorber	Seat belt pretensioner	Airbag ignitor caps	Airbag generator	Power brake booster
Testing method	Vacuum	Vacuum	Accumulation	Bombing	Vacuum	Accumulation
Typical leak rates	~ 10 <sup>-5</sup> mbarl/s	~ 10 <sup>-4</sup> mbarl/s	10 <sup>-3</sup> ...10 <sup>-4</sup> mbarl/s	~ 10 <sup>-4</sup> mbarl/s	Cold gas: 10 <sup>-6</sup> ... 10 <sup>-8</sup> mbarl/s Hot gas: 10 <sup>-3</sup> ...10 <sup>-4</sup> mbarl/s	10 <sup>-3</sup> ... 10 <sup>-4</sup> mbarl/s
Recommended INFICON products	<b>Modul1000 LDS3000</b>	<b>Modul1000 LDS3000</b>	<b>LDS3000 AQ</b>	<b>Modul1000 LDS3000</b>	<b>LDS3000 AQ LDS3000</b>	<b>LDS3000 AQ</b>

### AC System



Automotive Component	Evaporator	Condenser	Filling valve	Expansion valve	AC Hoses	Compressor
Testing method	Vacuum / Accumulation	Vacuum / Accumulation	Vacuum / Accumulation	Vacuum / Accumulation	Accumulation	Vacuum / Accumulation
Typical leak rates	~ 10 <sup>-5</sup> mbarl/s	~ 10 <sup>-5</sup> mbarl/s	~ 10 <sup>-5</sup> mbarl/s	~ 10 <sup>-5</sup> mbarl/s	~ 10 <sup>-5</sup> mbarl/s	~ 10 <sup>-5</sup> mbarl/s
Recommended INFICON products	<b>LDS3000 LDS3000 AQ Modul1000</b>	<b>LDS3000 LDS3000 AQ Modul1000</b>	<b>LDS3000 LDS3000 AQ Modul1000</b>	<b>LDS3000 LDS3000 AQ Modul1000</b>	<b>LDS3000 AQ</b>	<b>LDS3000 LDS3000 AQ Modul1000</b>

### Oil & Water Circuit



Automotive Component	Plastic oil tank	Oil cooler	Oil pump	Water cooler	Coolant expansion tank
Testing method	Accumulation	Vacuum / Accumulation	Vacuum / Accumulation	Accumulation / Sniffing	Accumulation
Typical leak rates	~ 10 <sup>-1</sup> mbarl/s	10 <sup>-2</sup> mbarl/s	10 <sup>-2</sup> ... 10 <sup>-1</sup> mbarl/s 1 ... 10 sccm	~ 10 <sup>-1</sup> mbarl/s	10 <sup>-2</sup> mbarl/s 1 sccm
Recommended INFICON products	<b>LDS3000 AQ</b>	<b>Modul1000 LDS3000 LDS3000 AQ</b>	<b>LDS3000 AQ</b>	<b>Sensistor Sentrac LDS3000 AQ (LDS3000)</b>	<b>LDS3000 AQ</b>

Product names and components in bold are linked for further information.

### Various



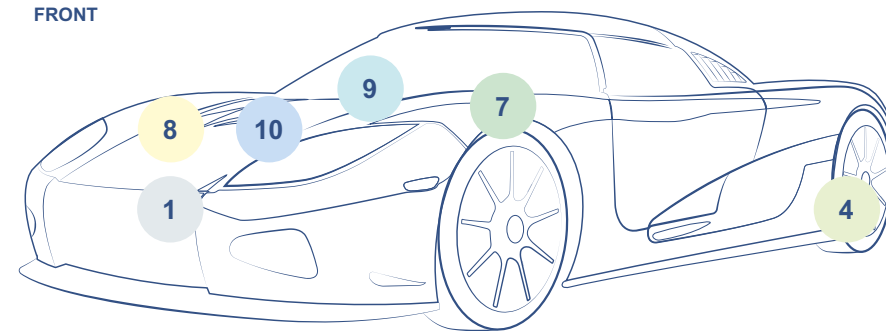
Automotive Component	Windshield wiper fluid container	Wheel rims	Xenon light bulbs	Starter battery
Testing method	Accumulation	Vacuum	Sniffing	Accumulation
Typical leak rates	~ 10 <sup>-2</sup> mbarl/s	~ 10 <sup>-4</sup> mbarl/s	~ 10 <sup>-6</sup> mbarl/s	~ 10 <sup>-3</sup> mbarl/s
Recommended INFICON products	<b>LDS3000 AQ</b>	<b>Modul1000 LDS3000</b>	<b>Ecotec E3000</b>	<b>LDS3000 AQ Sensistor Sentrac</b>

### Final Assembly

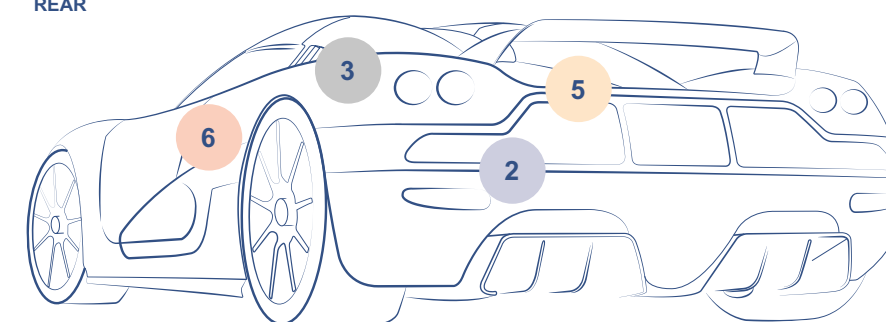


Automotive Component	Air conditioning systems	Engine fuel circuit	Cooling circuit for drive battery	Fuel rail connections
Testing method	5 g/a of refrigerant per joint	10 <sup>-3</sup> ...10 <sup>-5</sup> mbarl/s	5 g/a of refrigerant per joint	~ 10 <sup>-4</sup> mbarl/s
Typical leak rates	5 g/a of refrigerant per joint	10 <sup>-3</sup> ...10 <sup>-5</sup> mbarl/s	5 g/a of refrigerant per joint	~ 10 <sup>-4</sup> mbarl/s
Recommended INFICON products	<b>Ecotec E3000</b>	<b>Sensistor Sentrac XL3000flex Protec P3000(XL) Ecotec E3000</b>	<b>HLD6000 Ecotec E3000</b>	<b>HLD6000 Ecotec E3000</b>

FRONT



REAR



AREAS:

- 1 Drivetrain
- 2 E-Drivetrain
- 3 CNG / LNG
- 4 Fuel Cell Drive
- 5 Fuel System
- 6 Safety Features
- 7 AC System
- 8 Oil & Water
- 9 Various
- 10 Final Assembly

Product names and components in bold are linked for further information.

# Leak Detectors for Component Pretesting

## Integral, Automated Testing



**LDS3000 SYSTEM LEAK DETECTOR**  
LDS3000 is a modular leak detector used in integrated leak detection chamber systems. Its compact design and variety of interfaces and protocols allows for easy integration into automated testing systems. An optional touch screen display enables easy operation.



**LDS3000 AQ ACCUMULATION LEAK DETECTOR**  
LDS3000 AQ is the first leak detector to use helium or cost efficient forming gas (5% hydrogen in 95% nitrogen) for simple accumulation leak detection. The LDS3000 AQ is very sensitive and can detect leaks down to the 10<sup>-5</sup> mbar·l/s range.



**MODUL1000 VACUUM LEAK DETECTOR**  
Modul1000 is a plug and play leak detector for universal integration into industrial leak testing systems (vacuum or sniffer mode). With flexible vacuum architecture, the Modul1000 provides the adaptability to accommodate changes in production specifications.



## Manual and Robotic Sniffing for Leak Localization



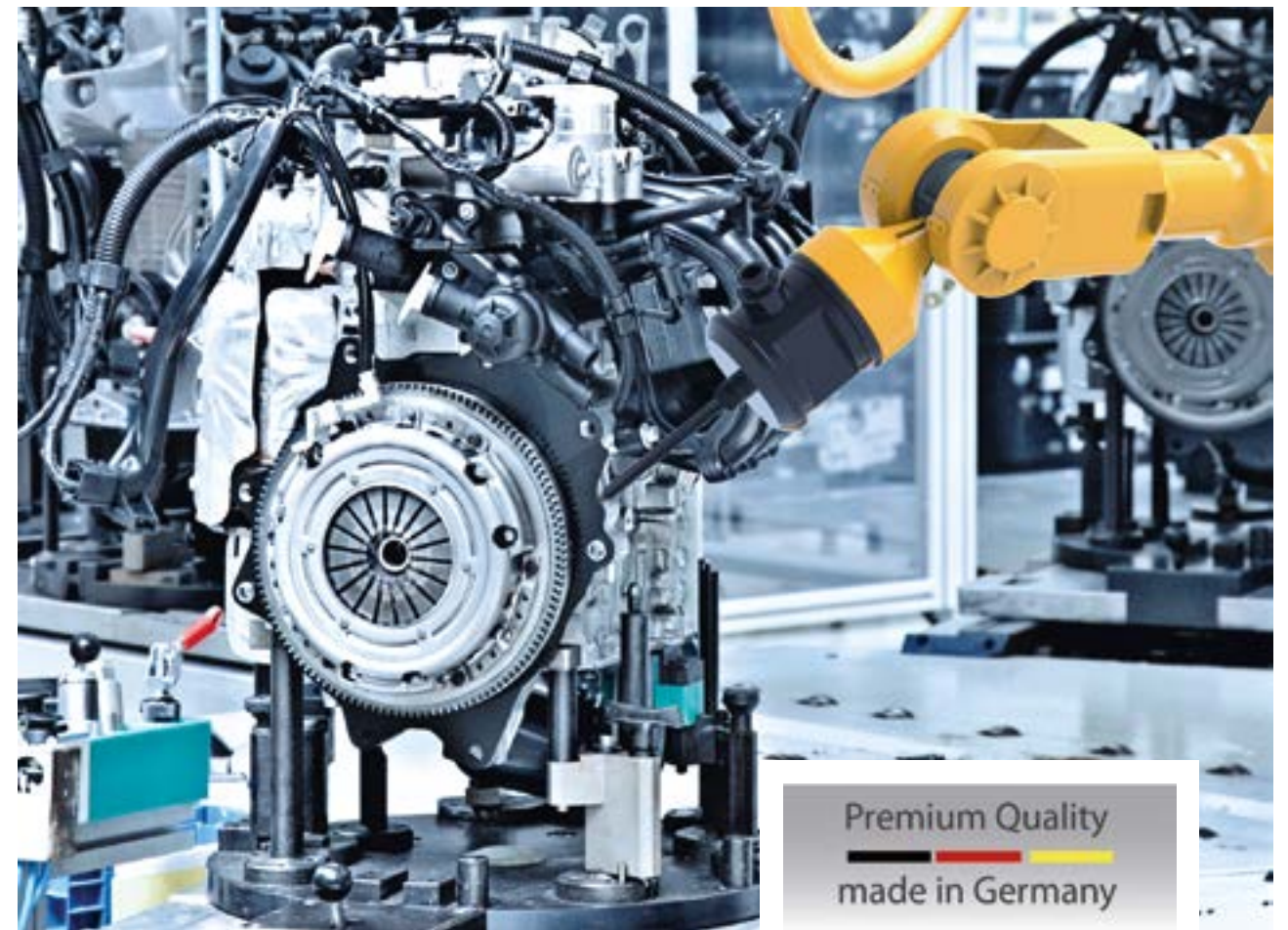
**PROTEC P3000(XL) LEAK DETECTOR**  
Protec P3000(XL) is specifically designed for full-time sniffing applications in industrial production environments. The unit allows the operator to detect gaseous leaks in even difficult to reach locations and is designed to prevent operator errors.



**SENSISTOR SENTRAC™ LEAK DETECTOR**  
Sensistor Sentrac is a dedicated sniffer leak detector for locating leaks in a variety of situations. High selectivity, wide dynamic range and short recovery time make this detector – which uses forming gas as a tracer gas – highly adaptable.



**XL3000FLEX LEAK DETECTOR**  
The XL3000flex High Flow Technology Leak Detector guarantees the highest measuring sensitivity, even at longer distances. Leaks can be detected reliably regardless of imprecise handling and in hard to reach places. The XL3000flex is also ideal for robotic applications.



Premium Quality  
— — —  
made in Germany

# Leak Detectors for Final Fluid Testing



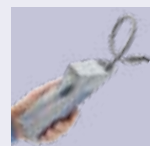
**HLD6000 REFRIGERANT LEAK DETECTOR**  
HLD6000 is a sniffer leak detector for testing air conditioning assemblies. It is available for hydrocarbons as well as for CO<sub>2</sub>. Its dual inlet technology guarantees high reliability and repeatability of results, even in environments with an increased concentration of refrigerant.



**ECOTEC E3000 MULTI-GAS LEAK DETECTOR**  
Ecotec E3000 allows the operator to detect leaks by sniffing for the escape of a final medium like fuel or refrigerant. The unit can detect four gases selectively at any time. Ecotec E3000 is designed to minimize operator error and to maximize reliability of testing.



# Leak Detectors for Automotive Service



**SERVICE LEAK DETECTORS**  
D-TEK® Select, D-TEK® Stratus and Gas-Mate® are battery operated leak detectors for vehicle air conditioning service. The Whisper™ ultrasonic leak detector is a versatile tool useful in detecting worn pistons and bearings as well as door seal leaks.



### SUITABILITY FOR GASES:



Helium



Hydrogen (Forming gas)



Refrigerant



Fuel

## Stop Leaking Profits

INFICON products support both complete part testing and leak location methods so you can stop leaking profits. Select from a wide range of test gases and leak testing products to assure you are using the best leak testing technology for your particular application. Our leak detectors provide the highest quality and increased process safety.

### Your Reliable Partner from Applications Support to Service

A specially assigned contact person who knows the requirements of your industry will work with you to define the desired specifications. After installation of your new leak detector, we support you with world-class service and troubleshooting expertise, if needed, to get the most out of your leak detector. An INFICON leak detector is optimized for its specific leak testing application. Products and services are continuously improved in close cooperation with our experts in development. This also includes the evaluation of new leak testing products at the customer's site. INFICON leak detectors not only are at the forefront of technology and offer the highest performance, but are also very easy to operate. With an INFICON leak detector, long training periods or errors in handling are simply a thing of the past.



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