LEAK TESTING OF COMPONENTS

Injection Engines

Engines are usually leak tested 100% inline. Faulty engines are typically sent to a rework area where the leak is located and repaired.

DESCRIPTION OF TECHNICAL CHALLENGE

The need for lower fuel consumption drives the need for new engine technologies. Over time fuel injection engines have almost completely replaced engines with carburetors. And even with injection engines, the trend is towards direct injection technologies and higher and higher injection pressures. Fuel leaks can negatively influence fuel consumption and could cause a fire in the engine compartment. With increasing fuel injection pressures, larger leak rates will be generated by the same size leak hole. Therefore, more stringent leak testing is required with increasing injection pressures. Leaks in the oil circuit will jeopardize good lubrication of the engine and may result in complete destruction of the engine during operation. Leaks in the water circuit may lead to insufficient cooling of the engine resulting in overheating that can cause irreparable damage to the engine.

Typical leak rate requirements for injection engines testing today are:

	Gasoline engines		Diesel engines	
	Multi-point fuel injection	**GDI (gasoline direct injection)**	**Unit injector**	**Common rail injection (Diesel)**
Fuel circuit	~ 10^{-4} mbarl/s	10^{-5}-10^{-4}mbarl/s	~ 10^{-4} mbarl/s	10^{-5}-10^{-4}mbarl/s
Oil circuit	~ 10 sccm	~ 10 sccm	~ 10 sccm	~ 10 sccm
Water circuit	~ 5 sccm (10^{-2} mbarl/s)	~ 5 sccm (10^{-2} mbarl/s)	~ 5 sccm (10^{-2} mbarl/s)	~ 5 sccm (10^{-2} mbarl/s)

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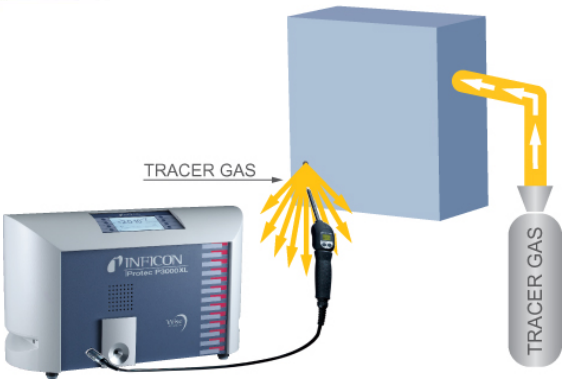
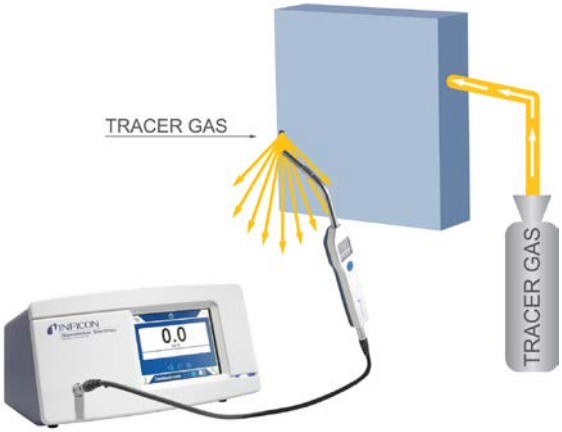
LEAK TESTING SOLUTIONS

The following testing methods are used for leak checking injection engines today:

	Fuel circuit	**Oil circuit**	**Water circuit**
Production line testing	Helium sniffing	Pressure decay (air) testing	Pressure decay (air) testing
Leak testing in rework area	Not needed to locate the leak, verification of repair via helium sniffing	Hydrogen sniffing	Hydrogen sniffing



The fuel circuit of injection engines is tested via helium sniffing in production.



Leaks in the water and oil circuit of an engine are located in the rework area via hydrogen sniffing.

Leak testing injection engines in production

After all remaining openings of the fuel circuit have been sealed, the fuel circuit of the engine is filled with helium. Typically the testing itself is conducted by robotic sniffing. For this, a robot moves the sniffer tip of the Protec P3000(XL) Helium Sniffer Leak Detector to the connections to be tested. Through the flow into the sniffer line, helium escaping from a leak is carried inside the leak detector and the leak rate is measured. For even better results a small clamp is mounted to the sniffer tip, surrounding the connectors.

Video demonstrating robotic sniffing of injection engines with the Protec P3000(XL).

Leak testing engines in rework

After the leak(s) has been detected, it must to be located and repaired. The location of a leak in the fuel circuit is already known from the helium sniffing process during production. The leak is repaired and the success of the repair is verified by manual helium sniffing the respective area using the Protec P3000(XL) leak detector.

To locate a leak in the water or oil circuit, the respective engine circuit is filled with forming gas (a 5% hydrogen in 95% nitrogen mixture). The use of the Tracer Gas Filling Unit TGF11 is recommended for well controlled charging with forming gas. The sniffer tip of the Sensistor Sentrac Hydrogen Leak Detector is then moved along the connections of the engine circuit and the leak is located where the highest leak rate of forming gas is detected. After the leak has been repaired, the repair can be verified by sniffing with the Sensistor Sentrac leak detector as well.

Video demonstrating leak location on engines with the Sensistor Sentrac hydrogen leak detector.

MAN UTILITY VEHICLES GROUP

Mr. Uwe Kestner,
Assembly planning GE engines:
“By the use of the hydrogen method we achieved time savings of factor 5 to 10 and significantly increased the efficiency of our production process. Before, we sometimes spent hours in rework to locate a leak—sometimes we were simply unable to locate it. Today locating a leak takes us only 10 to 20 min.”

BENEFITS OF TRACER GAS TESTING:

- Time saving - dry method with no further effort for drying or cleaning
- Money saving - no rust or liquid damage
- Maximum reliability – accurate and consistent test results
- Time saving - quick response time for fast pin-pointing of leaks
- Increased confidence - easy to verify if repair is successful

For more information on automotive testing applications, please visit www.inficonautomotive.com

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