

Engine Testing



Engine parts to test

Leak testing on engines becomes more and more important. Even more so now as manufacturers are moving towards so-called cold testing. Not only the cylinders must be leak tight but also the fuel system, the water cooling system and the oil system. There are plenty of valves, injectors, joints, tubing, sensors, etc. that can leak and thereby negatively affect the performance of the engine. The cause of leakage can be material pores, contaminated or damaged seals, misalignments in joints, assembly faults, etc.

The overall leakage rate of each of the different fluid systems (fuel, water, oil) is usually measured by connecting to the engine, pressurizing each system with air and measuring pressure drop during a certain number of seconds. Air pressure decay is relatively simple but limited in sensitivity which is always a trade-off against available cycle time for the test. Enough time must be allowed before a measurable pressure drop can be detected for a certain leak specification.



Traditional leak locating methods

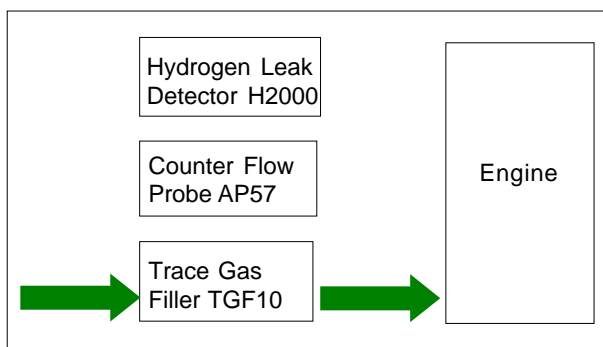
Locating leaks on engines is a problem in most engine factories. The only workable method available up till recently was soap water or soap spray. This is not regarded as very satisfactory because of the difficulties to find leaks. Some leaks are too small to create bubbles or foam and others are so big that they blow away the soap film. Moreover, the operator needs to see the leak which can be on the back of pipes, concealed by other components or located in a recess.

Sensistor provides the perfect solution to all these problems: using Hydrogen Trace Gas instead of air and locating the leaks with Hydrogen Leak Detector H2000.

Leak Testing with Hydrogen Trace Gas

The system - overview

The system comprises a leak detector, a trace gas filler and a counter flow probe. These parts are all controlled by the leak detector. The operator can easily adjust the settings for different situations and applications. The Counter Flow Probe is the recommended option when your test may involve very large leaks possibly screening out the smaller leaks.



AN-ET-ENG-200604

Injecting the hydrogen trace gas

The simplest way is to connect to the engines exactly as you do when you use compressed air. The drawback is that it may take a while before the gas has reached the leak. Injecting gas at one end of a narrow tube means that the air in the tube is compressed at the other end of the tube. If a leak is located at the far end, then this volume of air needs to pass through the leak before the gas appears at the leak (in a wider tube or channel the gas will mix with the air and reach the leak quicker).

These problems can be overcome by using the Trace Gas Filler TGF10 which evacuates the air prior to injecting the trace gas. A quick evacuation down to half an atmosphere simply halves the waiting time. The TGF10 also evacuates the air after the test to ensure it does not disturb the following test.

Searching for leaks

Simply switch on the leak detector and leave it in Detection Mode. Move the hand probe over suspected areas. Set a relatively high sensitivity (or use the Auto Range function) to quickly find escaping gas, and reduce the sensitivity to exactly pin-point the leak. When doing so, keep moving the probe constantly and listen for when the sound pitch increases and decreases. Listen for the change rather than the absolute frequency. Staying at one place does not give you the location because the gas concentration may vary. You are after the point where the concentration is highest, irrespective of how high it is.

If the engine has major leaks you may want to reduce the pressure, but that is usually not needed. You should also have good ventilation around the workplace to avoid building up too much background if you have massive leaks. Background problems with hydrogen trace gas are minimal compared to other trace gases but should still not be underestimated. A fan is an inexpensive way

to simplify the leak locating work.

When you have a large leak there is a risk that some of that gas collects in a nearby recess on the engine and gives the impression that there is a leak in the recess. The simple way to handle that is to have a simple blower handy. If you find gas in a recess, give a quick blow and check again. If there is a leak inside the recess gas will build up quickly again.

By using the Counter Flow Probe AP57 you have the possibility to ignore a build-up of hydrogen background coming from large leaks but still being able to pin-point even the smallest leaks.

Benefits

- Dry test method - no stains, no drying
- Locates leaks - even in difficult locations
- Can quantify leaks
- Quicker procedure

Leak Specifications			
	water system	oil system	fuel system
mbarl/sec	$1-8 \times 10^{-2}$	0,13-0,25	$1 \times 10^{-3}-1 \times 10^{-2}$
cc/sec	$1-8 \times 10^{-2}$	0,13-0,25	$1 \times 10^{-3}-1 \times 10^{-2}$
cc/min	0,6-4,8	8-15	0,06-0,6
Pa m3/sec	$1-8 \times 10^{-3}$	0,013-0,025	$1 \times 10^{-4}-1 \times 10^{-3}$
mm3/sec	10-80	130-250	1-10

Instruments

Hydrogen Leak Detector H2000

This unit fulfils your basic needs. The benchtop model is equipped with a so-called passive hand probe. Passive, because it does not "sniff" for gas. Instead, the hydrogen sensor is located in the tip of the probe and simply measures the local concentration of hydrogen. The signal processing in the detector, giving a frequency depending on the gas concentration, is optimised to help the operator pinpointing leaks quickly and reliably.

In noisy environments the operator can use earphones or look at a moving bar on the display. It is also possible to set an alarm level to indicate to the operator whether an identified leak is big enough to worry about.

Tracer gas Filler TGF10

The trace gas filler ensures that you actually have filled your engine system with trace gas before you start your leak search. It evacuates the air and fills the system to be tested with trace gas. After the test it also evacuates the trace gas away from the test station to avoid disturbing the following test. After evacuation it refills the tested system with air to atmospheric pressure. The Trace Gas Filler is controlled by settings in the leak detector.

Counter Flow Probe AP57

Engine leaks can be very big. The main reason why other trace gas methods have failed has been the large amounts of gas being spilled around the work place. This is much less of a problem with hydrogen trace gas, and the H2000 handles a wide range of gas concentrations. To improve the process even further Sensistor has developed Counter Flow Probe AP57 which is a unique novel tool in leak detection. This unit provides a low, controlled flow of fresh air passing the hydrogen sensor located at the tip of the probe. The air flow constantly purges the probe tip and makes the sensor insensitive to hydrogen in the surrounding air. When the probe comes near a leak the hydrogen concentration is so much higher that hydrogen molecules actually diffuse against the air flow and reaches the sensor. Hence the name Counter Flow Probe. The flow can be adjusted to two different settings between which the operator can switch by pressing a button on the handle. The probe can also be used in the passive mode.

The normal procedure would be to probe without the flow to pick up any escaping gas and switch on the counter flow if the background is building up too severely. Setting the counter flow correctly allows you to calibrate the probe to be insensitive to small leaks.

Facts about Hydrogen Tracer Gas

Pure Hydrogen is never used as a tracer gas because it is highly inflammable. A gas mixture comprising 5% Hydrogen gas and 95% Nitrogen-gas is used instead. This gas mixture is not inflammable (see ISO 10156) and is not toxic or corrosive, nor dangerous to the environment. Both hydrogen gas and nitrogen gas are present in all biological systems. Some gas suppliers have their own trade name for this gas mixture.



Sensistor Technologies AB
Box 76
SE-581 02 Linköping, Sweden
Tel: +46-(0) 13 35 59 00
Fax: +46 - (0) 13 25 59 01
e-mail: mail@sensistor.se
www.sensistor.com

Sensistor Technologies GmbH
Friedensstrasse 116-118
D-63165 Mühlheim a.M. Germany
Tel: +49-(0)6108 79 66 33
Fax: +49-(0)6108 79 66 55
e-mail: info@sensistor.de
www.sensistor.de

Sensistor Technologies Inc
2 Survey Circle # 2A
N Billerica, MA 01862, USA
Tel: +1-(978) 439 9200
Fax: 1 (978) 439 5533
e-mail: mail@sensistor.com
www.sensistor.com