

LEAK TESTING OF COMPONENTS

Airbag inflators



DESCRIPTION OF TECHNICAL CHALLENGE

Airbag inflators need to be functional for usually more than ten years. Therefore, every airbag inflator needs to be thoroughly tested during production. Reliability and high throughput are key airbag-inflator testing requirements. One defective airbag inflator can cost millions of dollars as a result of personal injury or a fatality.

Cold gas inflators are filled with a mixture of argon and a significant ratio of helium, and most hold their charge for the anticipated lifetime. Pyrotechnical inflators must be protected against the intake of moisture. They contain only a small percentage of helium. Only vacuum leak testing with helium can fulfill these requirements. Any other method is not sensitive or fast enough. The size of the chamber should be adapted to the inflator. Leaky airbag generators are usually not repaired; therefore leak location after detecting a leak is not common.



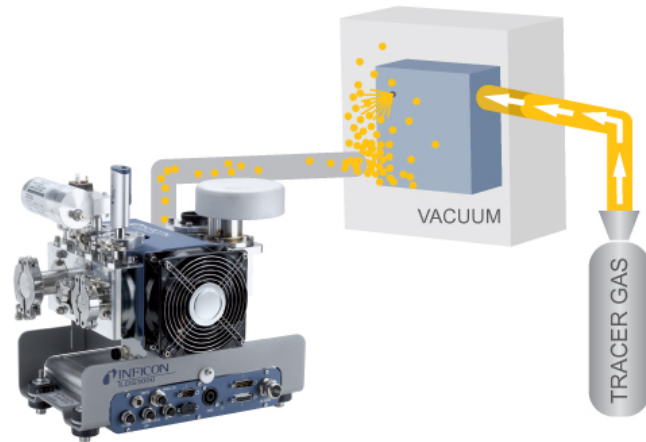
Example calculation of leak rate threshold:

Net volume	50 cm ³
Filling pressure	400 - 700 bar (7,000 ... 10,000 psi)
Acceptable loss	5%
Lifetime	15 years
Results in a leak rate of	2.65×10^{-6} mbar l/s.
When filled with 3% helium:	7.95×10^{-8} mbar l/s
Safety factor of 3:	2.65×10^{-8} mbar l/s.

Practically, big inflators are tested to 10^{-6} mbar l/s, smaller ones in the 10^{-7} ... 10^{-8} mbarl/s range. Due to the high throughput of airbag production lines, airbag gas generators usually need to be tested within seconds. Achieving the short cycle times of the airbag industry poses a challenge to the leak testing process. The uptime of the leak testing station is another critical measure for airbag manufacturers. Additionally, measurement certainty is mandatory as the airbag is a life safety device of any car.

THE INFICON SOLUTION

After purging the chamber with nitrogen, the inflator to be tested is positioned in the chamber. The chamber is closed and the purging with nitrogen is stopped. The chamber is then pumped down to ~ 0.2 mbar and a valve is opened to connect the leak detector to the chamber and to measure the leak rate. The leak detector is disconnected from the chamber afterwards and the chamber is vented and purged with nitrogen again. The inflator is removed from the chamber.



The use of the INFICON [LDS3000](#) or [Modul1000](#) Helium Leak Detector ensures the high reliability and repeatability of the testing results needed by the airbag industry. Both leak detectors allow for fast testing cycles and require minimal maintenance to ensure high uptime of the leak testing stations.



BENEFITS

- Time and cost savings due to fast and very repeatable process
- High reliability of testing due to quantifiable results
- Cost savings due to low maintenance system (24,000 hours of operation or more without adjustment or recalibration)
- High throughput due to long intervals between calibrations (sometimes even exceeding one year)
- Quick calibration process



Autoliv began using INFICON leak-detection equipment to test airbag igniters at its Tremonton, Utah facilities in 2006. The program was so successful that Autoliv later expanded its use of INFICON test equipment to quality check complete stored-gas and pyrotechnic inflators at its plant in Brigham City. Based on mass spectrometer technology, the LDS3000 equipment at Autoliv operates in a demanding, high-speed process that generates more than three million tests per year.

For more information on automotive testing applications, please visit

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