

LEAK DETECTION IN AVIATION

How to locate leaks on aircraft wing tanks with the hydrogen method

Aircraft fuel leaks are often detected on the skin (outer surface) of the aircraft, in dry bays, or in other hard-to-reach areas. These locations can make pinpointing the exact origin of a leak inside the fuel system challenging. By using hydrogen tracer gas the source of the leak can be fast identified and repaired, avoiding long, expensive stops.

Application

To repair a wing tank fuel leak, the exact origin of the leak inside the tank must be identified. The entry point of a leak is often not on the opposite side of the exit point, and on large aircraft, the distance between entry and exit can exceed 10 feet. This makes it difficult to determine the correct repair location, with a high risk of the repair being made in the wrong spot. This document describes how to locate the source of leaks in aircraft fuel tanks in a maintenance situation, and the advantages with the Ex-certified [Extrima® Hydrogen Leak Detector](#) from INFICON.

Traditional Methods

Pinpointing the leak exit point is done visually by simply observing fuel spots or drops.

A common method to identify the leak entry point is guesswork. Based on experience, maintenance personnel scrape off and repair the area they think is most likely. Because this method is not based on fact, it often results in repeated repairs when the tank is refueled and still leaks.

Another method is to have an operator apply compressed air to the exit point of the leak. A second operator uses soap water on the inside of the tank to observe bubbles forming at the leak entry point. Studies show that leaks passing below 10E-5 mbarl/s of tracer gas will not leak fuel at all, and leaks below 10E-4 mbarl/s will not cause fuel dripping.



Pinpointing the leak exit point is done visually by simply observing fuel spots or drops.

Hydrogen method

Locating leaks with hydrogen tracer gas requires the use of an inexpensive gas mixture (95%N₂/5%H₂). This gas mix is environmentally friendly, non-toxic, non-flammable, non-corrosive and available at most common gas suppliers.

Prepare

Observe fuel spots on the outside of the skin. De-fuel the tank and inject tracer gas into the leak exit

Locate the leak

Enter the tank and locate the exact leak source point on the inside

Repair and verify

Leak repair before re-fuelling

Leak rates of this magnitude are difficult to detect with soap water, which means that the source of leaks giving only a fuel stain on the skin may be impossible to locate. Furthermore, this method relies on visual access to the leak, which can be severely limited, especially on small aircraft.

Pinpointing the exact source of the leak with traditional methods is time consuming. Time is a critical factor, both for venting the tank to non-Ex levels before leak detection and due

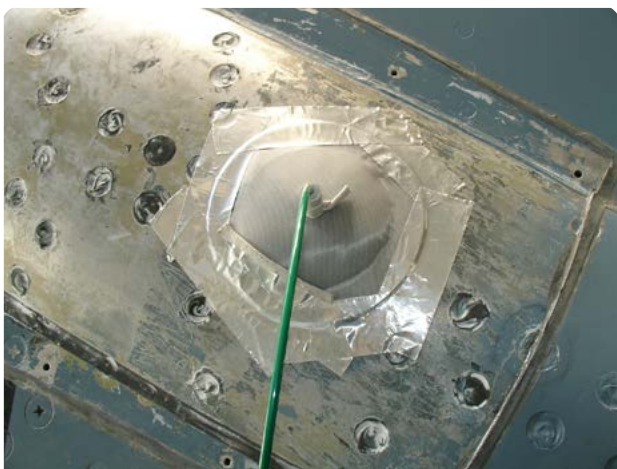
The solution from INFICON

Leaks need to be repaired where they start – inside the tank. Therefore, we use a tracer gas and trace the leak from where it exits on the outside to where it starts on the inside. The solution from INFICON involves the use of a safe tracer gas (a mix of 5% hydrogen in nitrogen), the Extrima hydrogen leak detector, and a gas injection kit to get the tracer gas into the leak. The Extrima leak detector is intrinsically safe and certified for use in hazardous locations, Class I, Division 1. This means that the detector will not be able to ignite any remaining fuel vapors or puddles, allowing technicians to save time by entering the tank earlier than would be possible with a non-certified instrument, if regulations permit. This method drastically reduces the amount of time an aircraft is on the ground with a leak and makes the repair time much more predictable.

Preparation

Pinpointing the leak exit point is done visually by simply observing fuel spots or drops on the outside of the skin. Once the leak exit point has been identified, an injection pad is fixed over the exit point. The pad needs to sit without pressure for at least 10 minutes to really stick to the surface. During this time, operators can calibrate and do function tests on the Extrima leak detector.

Using the gas injection kit ensures that tracer gas fills the entire injection system at the right pressure. The gas injection kit, connected to the injection pad, allows the tracer gas to



An injection pad will enable the user to push tracer gas back through the leak and into the tank.



Ex-certified Extrima Hydrogen Leak Detector cuts the time for leak locating in less than half.

flow backwards following the leak path. A few moments of waiting will allow the gas enough time to find its way into the fuel tank.

Leak location

Following all relevant safety procedures, the operator can now enter the tank with the Extrima leak detector and search for the leak. The audio signal and the visual indication in the hand probe will guide users to the leak origin with accurate precision. Once the leak is repaired and before the aircraft is refueled, the same leak detection equipment is used to verify that the repair has effectively stopped the leak.

Advantages of leak location with the system from INFICON

- helps precisely pin-point leaks without visual access
- is easy to apply and finds leaks with a minimum of training
- EX Zone 0-rated (DIV I) detector adding extra safety to the operation
- shortens time needed for leak locating
- needs one operator only
- allows repair verification before refueling

Locating leaks after assembly

The technology can also be used for testing the outside of a fuel tank for possible leaks after assembly, or a major overhaul.

For more information → inficon.com