LEAK TESTING DOMESTIC WATER PURIFIERS

How to detect leaks on domestic water purifiers or components thereof

Leak testing is critical in water purifier manufacturing, yet current methods risk both missed defects and the rejection of conforming units—leading to increased costs from over-quality and potential release of defective products. Implementing more precise and efficient leak detection methods allows manufacturers to ensure product integrity while reducing claims and operational inefficiencies.

Application

The water purifier unit typically consists of 3 to 5 cylindrical filters connected using quick fittings and plastic tubing. All components, including some electronics, are housed within a cabinet. This document describes leak testing the assembled water purifier, or components thereof, using tracer gas leak detectors from INFICON.

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Traditional Methods

In current industry practice, water purifiers are often leak tested using traditional methods such as **water bath** or **soap spray**. These tests typically rely on subjective criteria "no bubbles within X seconds," based on historical precedent rather than industry standards. A commonly observed benchmark is "no bubbles in 15 to 30 seconds at 4 barg," which corresponds to leak rates:

Estimated leak rates based on bubble size

BUBBLE SIZE	LEAK SIZE			
1,0 mm	1,7x10E-5	to	3,5x10E-5	mbarl/s
2,5 mm	2,7x10E-4	to	5,4x10E-4	mbarl/s

The leak limits applied to water purifiers often approach the sensitivity required for gas leaks within HVAC/R industry (1x10E-4 mbarl/s). For **soap spray** testing, the acceptance level is typically "no visible bubbles during a test time of 2-5 minutes," which remains a subjective and time con-

How we do it

Testing a water purifier for leaks with hydrogen tracer gas is an effective method to repair only parts leaking above the reject level.

Evacuate the water purifier
This allows correct tracer gas filling and ensures accurate test results

Fill the water purifier with tracer gas
ensuring a maximum concentration on the inside

Detect leaks
Use the sniffer probe to locate leaks on the joints of interest

suming method. These findings highlight the need for more standardized, objective leak testing procedures that are both fit-for-purpose and cost-effective.

Typical Procedure

Components are pressurized with water and put on pieces of paper that indcate the precence of a leak. This initial test typically takes about 15 minutes.
For assembled products, leak testing is performed by pressurizing the system with air at 4–5 barg, followed primarily by immersion in a water bath or application of soapy water.
Approximately 10–15 joints are tested. A foamed soap solution is applied to the joints and allowed to settle (de-foam) for 2 to 5 minutes. Each joint is then visually inspected. The typical inspection time per joint is 5 to 15 seconds. The drawbacks of soaping are:

- Potential for missed leaks - Large leaks can blow the soap film away from the leak site, while small leaks may produce bubbles that are difficult to detect. As a result, both large and small leaks can be overlooked during inspection.
- Over-quality and cost implications - The leak limit typically used for rejection may result in discarding units that would not actually leak water in real-world use. This leads to unnecessary production costs due to over-quality.
- Limited visual access - It is questionable whether a single operator can adequately inspect the full circumference of 10–15 joints per unit, potentially leading to undetected leaks.
- Space requirements - Because the soap needs to sit for 2–5 minutes before inspection, additional space is required to store units during this waiting period.
- Production bottlenecks - This waiting time causes a backlog of units in the testing area, which can slow down overall production and increase capital tied up in work-in-progress inventory.

The solution from INFICON

This method involves using forming gas (5% hydrogen in nitrogen) as the tracer gas. To ensure optimal tracer gas concentration inside the cabinet, it's important to evacuate air before filling or filling through one port and evacuating through another port at the far end at the same time. Simply pushing in tracer gas at 4 barg is possible, but may lead to dilution and reduced sensitivity. Not all products are fit for the push-in technique, due to complex geometries on the inside. The TGF11 Tracer Gas Filler is a well-proven tool for controlled and efficient tracer gas filling.

Once the filling is done the leak testing can start. At the core of the solution there is the Sentrac Hydrogen Leak Detector as stand alone for manual leak detection, or combined with the AP29ECO Sampling Probe for automatic or semi-automatic leak testing. Controlled by the Sentrac leak detector, the AP29ECO allows an accumulation period before sampling the cabinet air. If the tracer gas concentration exceeds the reject threshold, Sentrac triggers an alarm. The operator then uses the connected hand probe to quickly check each joint—typically requiring just one second per joint. High sensitivity and auto-range settings are recommended to ensure no leaks are missed.

Once leaks are located and repaired, tracer gas should be released in a way that prevents contamination of the test station. When testing is done on a moving conveyor, separate evacuation systems may be required. The TGF11 Tracer Gas Filler also support evacuation to manage gas release effectively.

A backlog of units in the testing area needs drying after leak detection with soapy water.

Advantages of leak detection with tracer gas

- Fast pin-pointing of the leak position
- No operator interpretation of the leak size - precise measurement obtained
- Repair only the leaks that are leaking above the reject level
- No time wasted in cleaning up or drying after testing
- All leaks detected even in hard to access areas, reduces operator dependence
- No pile-up of waiting products saves space and capital

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