DON'T LET HELIUM SHORTAGE STOP YOUR PRODUCTION

Converting from Helium to Forming Gas

Forming gas (5% H_2/95% N_2) is a proven, cost-effective alternative to helium for leak detection — when your system is set up correctly. This guide tells you exactly what to do.

The Helium Supply Situation

Global helium supply has tightened significantly over the past decade. With only a handful of production facilities worldwide, a single plant outage or geopolitical disruption can trigger months-long shortages. Forming gas — 5% hydrogen in nitrogen — is available from any industrial gas supplier, at a stable price, without import dependency.

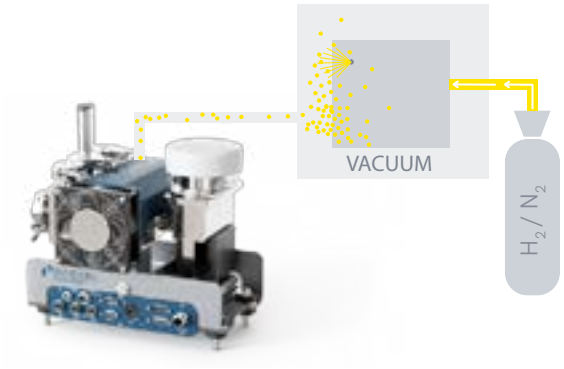
Why Switch to Forming Gas?

Helium supply is under pressure globally. Prices are volatile, availability is inconsistent, and disruptions can halt production without warning. Forming gas (5% H_2 in nitrogen) offers a reliable, locally sourced alternative that keeps your LDS3000 running — at a fraction of the cost.

The Challenge

Hydrogen (mass 2) produces a higher natural background than helium (mass 4), because water vapor dissociates in the mass spectrometer. The good news: with the right system configuration, this background is fully controllable.

The LDS3000 is fully compatible with forming gas operation. With the correct system setup, you can achieve detection sensitivities comparable to helium-based testing — without changing your leak test hardware.



What is forming gas?

It is a mixture of 5% hydrogen (H_2) in nitrogen (N_2). It is non-flammable at this concentration, making it safe to handle in industrial environments.

Originally developed as a protective atmosphere for metal processing, it is now widely used as a tracer gas for leak detection — particularly in battery and EV manufacturing, where helium supply constraints or cost pressure make an alternative necessary.

Any industrial gas supplier can provide it, at stable prices and without import dependency.

Three Non-Negotiables

Before switching, your system must meet all three requirements — no exceptions

1. The test chamber must be made of stainless steel. Aluminum is strictly prohibited — its significantly higher outgassing rate generates an unacceptable hydrogen background that will mask leak signals.
2. No plastics, elastomers, or polymer components inside the test chamber. These materials outgas moisture and hydrocarbons, both of which interfere with the mass 2 signal.
3. A sufficiently powerful backing pump is required. Weak backing pumps cannot achieve the low foreline pressure needed for stable sensor operation and low background signal.

Recommendations for Optimal Performance

The following measures are not strictly mandatory but are strongly recommended to achieve the best possible signal-to-background ratio and measurement stability:

Protect your Test Chamber from Moisture

- Electropolished stainless steel chamber: Electropolishing reduces surface roughness and outgassing rates compared to mechanically polished or standard stainless steel, further reducing the hydrogen background.
- Vent with dry air: Always vent the test chamber with dry air rather than ambient air. This minimizes adsorption of water vapor onto chamber walls, which is a primary source of hydrogen background during pump-down.
- General air dehumidification: If dry air venting is not possible, consider installing an air dryer in the facility to reduce the humidity of all air entering the chamber.

Configure the LDS3000 for Forming Gas

- **1500 Hz TMP speed:** This setting reduces the water-related hydrogen signal per H_2 molecule, effectively lowering the background of the measurement.
- **Use EcoBoost:** EcoBoost reduces the effective background, improving sensitivity. Make sure to set the H_2 vacuum time constant correctly. Its value is the chamber volume divided by the total pumping speed during measurement.
- **ULTRA inlet port:** The ULTRA inlet port provides more pumping speed and a higher sensitivity. Maximum inlet pressure with 1500 Hz is 0.4 mbar for a short time, 0.2 mbar for a longer time.

Eliminate Contamination of your Pumping System

- Dry-running (oil-free) backing pump: Oil-sealed rotary vane pumps generate hydrocarbon vapors that migrate into the mass spectrometer. These hydrocarbons fragment in the ion source and contribute to elevated hydrogen background. Dry-running scroll pumps eliminate this contamination source entirely.

What is EcoBoost?

EcoBoost is an INFICON-developed operating mode for the LDS3000 that actively reduces the hydrogen background signal during measurement.

Enabling EcoBoost can significantly improve the signal-to-noise ratio and lower the effective detection limit, making it particularly valuable in environments where humidity cannot be fully controlled. It is one of the most impactful single settings for forming gas operation and should be activated as a standard part of the system configuration.

Watch our EcoBoost video

What to Avoid

The following conditions degrade measurement quality and should be eliminated before or during the conversion:

- **High humidity:** Moisture is the primary source of hydrogen background in forming gas testing. Water vapor adsorbs on chamber walls and desorbs during pump-down, producing a sustained H2 background signal. Keep relative humidity in the test environment as low as feasible.
- **Oil-sealed (wet) backing pumps:** Hydrocarbon oil vapors from the pump migrate into the foreline and sensor area, elevating the mass 2 background. Replace with a dry-running alternative if possible.
- **Hydrocarbon contamination in chamber and foreline:** Any oil residue, grease (also vacuum-compatible), or polymer components in the gas path will outgas hydrocarbons. Clean the chamber thoroughly and regularly.

Quick Reference Summary

All requirements and recommendations at a glance.

CATEGORY	REQUIREMENT/RECOMMENDATION	TECHNICAL REASON
🟠	Stainless steel test chamber	Aluminum outgassing incompatible with mass 2 measurement
🟠	No plastics or elastomers inside chamber	Moisture and hydrocarbons interfere with mass 2 signal
🟠	Sufficient backing pump capacity	Weak pumps cannot maintain required foreline pressure
🟢	Electropolished stainless steel	Lower outgassing rate than standard stainless steel
🟢	TMP speed 1500 Hz	Reduces water signal per H_2 molecule
🟢	EcoBoost mode	Reduces effective background
🟢	Dry air venting	Prevents water vapor adsorption on chamber walls
🟢	Facility air dryer	Reduces water content in all venting cycles
🟢	Dry-running backing pump	Eliminates hydrocarbon vapors from foreline
🟢	ULTRA inlet port	Higher pumping speed and sensitivity at low pressures
🔴	High ambient humidity	H_2O desorption sustains H_2 background during pump-down
🔴	Oil-sealed backing pump	Hydrocarbon vapors directly raise mass 2 background
🔴	Hydrocarbons in chamber / foreline	Interfere with forming gas signal at mass 2

Mandatory Recommended Avoid

Your Conversion Checklist

Follow these steps in order when switching an existing LDS3000 system from helium to forming gas.

- ☐ Confirm stainless steel chamber — replace aluminum.
- ☐ Remove all plastics, rubber, and polymer parts from the chamber interior.
- ☐ Swap oil-sealed backing pump for a dry-running alternative.
- ☐ Verify pump capacity is matched to chamber volume.
- ☐ Commission dry air venting or install an air dryer.
- ☐ Set LDS3000 TMP speed to 1500 Hz.
- ☐ Enable EcoBoost — set H_2 vacuum time constant correctly.
- ☐ Select ULTRA inlet port. Observe pressure limits: 0.4 mbar short-term, 0.2 mbar sustained.
- ☐ Introduce 5% H_2/N_2. Validate with a calibrated leak standard.

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