Time for Science: Lyovapor™ L-250

Eco-Efficiency Redefined

L-250: Eco-Innovation

Indroducing EcoStream™ innovation
The greenest freeze drying option for your laboratory. The L-250 embodies BUCHI's commitment to enhancing the sustainability of laboratory processes worldwide.

- Achieve a condenser temperature of -85 °C with our ground-breaking compressor design.
- Low global warming potential (GWP) of 4 with natural coolants reducing the environmental impact.
- Lower the amount of heat output and noise emissions in your lab.

Freeze drying phases

Freezing

Freezing is critical since the frozen state of the sample directly impacts the quality of dry products.

Aqueous samples require a temperature between -25 °C and -40 °C.

For mixtures containing organic solvents, if the required temperature is too low, diluting the solvent may be required to ensure it freezes.

Primary Drying*

Pressure below vapor pressure of frozen sample with water e.g. 0,7 – 0,03 mbar.

Secondary Drying*

Water removal via desorption. Pressure below vapor pressure of frozen sample e.g. 0,5 – 0,03 mbar.

Substances that freeze at very low temperatures require a pressure below 0.05 mbar to remain solid; using an ultimate vacuum is advisable. For substances with higher freezing points, like DMSO at 18.5 °C, the pressure can be set higher.

*Standard settings.

Use of Solvents

To determine if a solvent can be freeze-dried, it is necessary to know the temperature and pressure at its triple point.

Solvent	T_{triple} [°C]	P_{triple} [mbar]
Water	0	6.1
Acetonitrile	-43.9	1.67
Acetone	-94.7	$2.33\ 10^{-2}$
Methanol	-97.7	$1.86\ 10^{-3}$
Ethanol	-123.15	$4.3\ 10^{-6}$

The table below provides an overview of solvents commonly mixed with water, indicating whether the L-250 can remove large volumes (up to 4 L) in a single batch.

Solvent	100 %	< 60 %	30 %	10 %	<= 5 %
Acetic acid					
Acetone					
Acetonitrile					
DMSO					
Ethanol					
Isopropanol					
Methanol					
TFA					
tert Butanol					
Formic acid					
DMF					

The sample can be freeze-dried properly. Sublimation occurs.

High pressure in the drying chamber partially melts samples, leading to solvent removal via evaporation and sublimation, yielding satisfactory drying for certain manifold applications.

Not working.

Vacuum Pump

- Oil and scroll vacuum pumps are available.
- Monthly oil changes might be required for solvents that frequently bypass the ice condenser.
- The maintenance interval for the scroll pump is longer.

The Lyovapor™ L-250 will remind the user when an oil change is due. To avoid damaging the pump, it is recommended to use a dry vacuum pump when solvents of high concentration are used. BUCHI recommends using the Edwards nXDS 6ic with the L-250.

Ice condenser

Solvent mixtures can be effectively dried by keeping a temperature difference of 15 – 20 °C between the ice condenser and the sample's frozen temperature.

Avoid overloading the instrument!
Overloading instruments beyond capacity increases temperature and pressure in the ice condenser, causing sample issues and inefficient solvent collection.

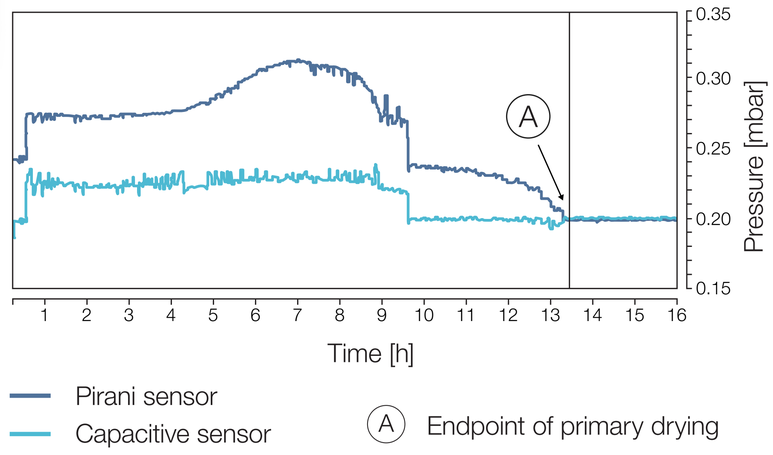
Endpoint determination

To optimize efficiency, it is advantageous to reduce the duration of the primary drying phase, which is typically the longest part of the process, while also ensuring that drying is not prematurely concluded when processing a batch of the same sample.

Temperature difference test

- The endpoint is reached when the shelf and sample temperatures are similar (delta of 1 – 2 °C).
- This is applicable for instruments with heatable shelves and the Pro instrument.

Pressure difference test



Pressure measured by pirani and capacitive sensor for manifold application with round bottom flasks containing 5 wt% mannitol.

- The endpoint is reached when the attached Pirani and capacitive sensors show similar results (delta of 0,025 – 0,05 mbar).
- This is applicable for Basic and Pro instruments and drying chambers with connections for external sensors such as manifold, normal, and stoppering.

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