

FREEZE DRYING

Giving you a clear edge

APPLICATION NOTE



Where is vacuum used?

Freeze drying is a sublimation process where the solvent, usually water, is directly vaporised from its solid phase. Water sublimation takes place at a pressure lower than 6.1 mbar, the saturation vapour pressure of ice at 0°C. However, most freeze drying applications are carried out at pressure of 0.05 to 1 mbar depending of the product to be dried.

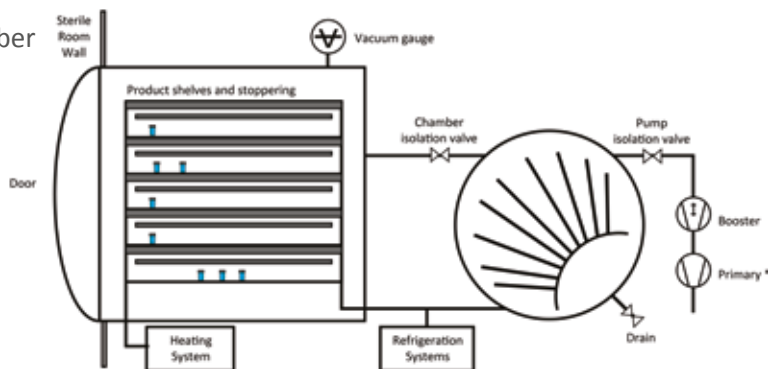
Freeze drying avoids chemical, physical and enzymatic changes associated with other forms of drying and is the optimum process of selection for unstable, heat liable products, like pharmaceutical or blood plasma derivatives. The end product is highly porous mass having the same size and shape as the originally frozen material.

Typical freeze drying system

A freeze dryer consists of a vacuum chamber accommodating refrigerated and heated shelves connected to a refrigerated condenser piped to a vacuum pumping system. Sublimed water is pumped by the refrigerated condensers at $\sim -70^{\circ}\text{C}$.

The vacuum pumping system need to meet the following major requirements:

- Ensure pump down of chamber and condenser to ~ 0.05 mbar in less than 30 minutes
- Ensure fast pump down below 1 mbar
- Ensure final vacuum of 0.01 mbar or lower in the chamber
- Ensure reliability, as loss of vacuum during sublimation process can damage the product or the entire batch
- Provide clean vacuum, especially for pharmaceutical injectable
- Avoid cross contamination between cycles
- Monitor vacuum level to ensure repeatable process performance



Solutions

Dry Pumping systems - Recommended technology

Recommended Models

GXS dry screw pumps and GMB booster combinations

- GXS160, GXS160/1750
- GXS250, GXS250/2600
- GXS450, GXS450/2600, GXS450/4200
- GXS750, GXS750/2600, GXS750/4200

iXL dry pumps

- iXL120N
- iXL1000N

Benefit: Dry pump systems substantially reduce the maintenance and operating costs

- A large tolerance to water vapour and solvents traces that may be added to increase solubility
- Clean residual vacuum
- Elimination of oil back streaming which is a source of contamination in the pharmaceutical injectable solution
- No cross contamination due to cleanable internal swept volume

Oil sealed pumping systems - Conventional technology

Conventional Models

E2M two stage oil sealed rotary vane pumps

- E2M40
- E2M80
- E2M175
- E2M275

EH Mechanical booster pumps

- EH250
- EH500
- EH1200
- EH2600
- EH4200

Benefit: Generally, oil sealed pumps have higher operating and maintenance costs. However two stage oil sealed rotary vane pumps have been the conventional technology before the introduction of dry pumping.

- High ultimate vacuum for optimum final drying
- High reliability
- Proven technology in freeze drying processes

Edwards' Benefits

GXS dry screw pumps

The GXS range featuring intelligent on-board control has been developed using new variable pitch tapered screw technology for exceptional performance and reliability. Available in pumping speed from 160 m³h⁻¹ to 750 m³h⁻¹ and when combined with GMB vacuum boosters, speeds of up to 3,450 m³h⁻¹ can be achieved.

Highly reliable

Ability to handle harsh processes

Low maintenance cost

No unplanned down-time

Increased productivity

Longer intervals between services

Safe operation, consistent output

Automated control of your process

No loss of expensive products

Reliable

Increased Productivity

Longer interval between services



iXL dry pumps

iXL is the most compact and low energy dry pump option.

It is available as the iXL120N stand-alone unit delivering pumping speed of 110 m³h⁻¹, or as the iXL1000N combination, which includes an inverter-driven booster delivering 930 m³/h⁻¹ peak pumping speed. Equipped with Intelligent on-board controller, delivers the same benefits of GXS to freeze drying process. In addition:

Perfect integration in pilot freeze dryers

Smaller foot print than similar pumping speed

Comfortable workplace

Extremely quiet running



E2M two stage oil sealed rotary vane pumps

Edwards EM two stage oil sealed rotary vane pumps represent the industry standard for two stage oil sealed rotary vane pumps, available in displacement 42 to 350 m³h⁻¹

Process performance

High ultimate vacuum than comparable technology

No loss of expensive products

Reliable

Peace of mind

Industry proven with large install base



EH Mechanical booster pumps

Edwards EH mechanical booster pumps represent the industry standard for mechanical booster pumps, available in displacement 310 to 4985 m³h⁻¹. EH range features the unique hydrokinetic drive with a fluid coupling that physically regulates transmission of power by limiting torque from motor to rotors

Increased productivity

Faster pump down time

Peace of mind

Industry proven with large install base



Global contacts

EUROPE

UK Crawley +44 1293 528844

UK (local rate) 08459 212223

Belgium Brussels +32 2 300 0730

France Paris +33 1 4121 1256

Germany Munich 0800 000 1456

Italy Milan +39 02 48 4471

USA

Niagara (toll free) +1 800 848 9800

BRAZIL

Sao Paulo +55 11 3952 5000

ISRAEL

Qiryat-Gat +972 8 681 0633

ASIA PACIFIC

China (toll free) +86 400 111 9618

India Pune +91 20 4075 2222

Japan Yachiyo +81 47 458 8831

Korea Bundang +82 31 716 7070

Singapore +65 6546 8408

Taiwan R.O.C. Jhunan Town +886 3758 1000

Publication Number: P11200895, Issue A
© Edwards Limited 2016. All rights reserved.

Edwards and the Edwards logo are trade marks of Edwards Limited.

Whilst we make every effort to ensure that we accurately describe our products and services, we give no warranty as to the accuracy or completeness of any information provided in this datasheet.

Edwards Ltd, registered in England and Wales No. 6124750, registered office: Manor Royal, Crawley, West Sussex RH10 9LW, UK