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MADE IN ITALY

# Food Processing Machinery


**FREEZE DRYING**

***Lyophilisation***

# EASY Freeze DRYER

## Lyophilizer

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## PIGO EASY Freeze DRYER - EFD

PIGO srl has established itself as a world-class leader in the design and manufacture of high technology freezing equipment and freeze dryers, as well as fruit and vegetable processing equipment.
PIGO srl designs, fabricates and assembles sophisticated pilot and production freeze dryers – lyophilizers, product line which includes a broad range of standard and custom units.

**FREEZE DRYING**

The freeze drying - dehydration technology allows to save delicate aromas while drying the frozen product under vacuum, producing a premium quality product. The ice contained in the product is sublimated, hence transformed from solid to gas and then trapped inside the condensation system. The sensorial properties of the finished product are absolutely superimposable to those of the fresh product.

**FREEZE DRYING PROCESS**

Freeze drying is the drying of a frozen product in a vacuum below the “triple point” (6.2 mbar = 4.6 torr). The water will only be present in two phases: ice and vapour. The vacuum allows the ice to turn directly into vapour without passing through the water stage, in a sublimation process.
Freeze drying is applied to dry a vast number of food products like fruit / berries / vegetables, meat / seafood, soup blocks, rice dishes, etc. and this preserves the product’s original shape, colour, taste, aroma and nutrients, and at the same time make them easy to store (no need for a cold chain) and serve.
You can roughly estimate sublimated water amount by determining 90-95% of product weight intended as a typical batch. For example, if the product weight is 100 kilograms wet, you will need to condense capacity of 90-95 kg or liters to process the batch.

**Description of the Operation**

Generally, the Freeze Drying, or Lyophilization cycle is divided in three phases:

An initial IQF freezing process, carried out in such a way that:

- The product exhibits the desired crystalline structure.
- The product is frozen below its eutectic temperature.

A primary drying (sublimation) phase during which:

- The partial pressure of the vapor surrounding the product must be lower than the pressure of the vapor from the ice, at the same temperature.
- The energy supplied in the form of heat must remain lower than the product’s eutectic temperature (the highest allowable product temperature during the conditions of sublimation.)

A secondary drying aimed at eliminating the final traces of water which remain due to absorption, and where:

- The partial pressure of the vapor rising from the product will be at its lowest levels.

At the completion of the process, the treated product will have retained its form, volume and original structure, as well as all its physical, chemical and biological properties. It can then be stored (provided packaging is effective to the reduction of moisture migration) for an almost indefinite period of time. As the product is porous, it can be re-dissolved by the simple addition of a proper solvent.

## MACHINE EXECUTION

**Material**

- Standard drying chamber shape is horizontal cylinder, all entirely made in stainless steel (Chamber, doors, hinges, shelf modules, trays etc…).

**Chamber**

- Shelf modules and vapour condenser are contained inside chamber.
- Viewing ports are provided in the doors, allowing observation of both the vapour condenser and product trays during the drying cycle.

**Modular Shelf Heating Plates**

- Plates are fabricated from stainless steel or optionally Alluminium. Number of modules/plates depends of the model size.
- Each shelf module is removable from the chamber for maintenance or cleaning, and is done by rolling onto a trolley, enabling only one person manipulation.

**Trays**

- Two sets of trays are provided as standard.





### Heating System

- Ellectronicaly controlled electric boiler, connected in series with the heating plates.
- Heating fluid is glycol based and is circulated by a pump, allowing heated or cooled fluid to be circulated through the plates on demand of the electronic load controller.

**Vacuum System**

- Heavy duty vacuum pump mounted near housing of the freeze dryer.

**Refrigeration**

- Each unit is equipped with complete refrigeration plant of corresponding size, including also refrigeration condensing unit is purpose-built with capacity control to allow economical use of refrigerant. Includes condenser unit.

**Vapour Condenser (PIGO design and execution)**

- Execution in stainless steel tube available, depending of refrigerant.
- Defrosting ice after a product cycle is by water or optional hot gas defrosting.

**Low Temperature Option**

- A lower temperature option can be quoted if required, giving –55°C vapour condenser temperature, and –35°C/+70°C shelf freezing/heating.

**Control System**

- MITSUBISHI/OMRON/SIEMENS/ABB PLC interfaced with touchscreen control panel. Screen includes graphic overview of freeze drying system. Automated system will ramp/reduce energy to govern sublimation pressure to pre-set parameters.
- recipe programming capacity built-in, and software for data retrieval and analysis.

*All machinery parts (chambers, shelves, door closing systems, stoppering system, condensers and all interconnections) are manufactured and controlled in-house.*

Please note our dryers are a batch style system and the capacity is demonstrated by on site test by drying the model designation in kg's of ice in a BATCH DRYING PERIOD (usually 14-16 h) i.e. EFD500 = 500kg of ice, EFD 1000 = 1000kg of ice. The model designation is the capacity of the ice condenser and this is the maximum this trap will carry. Actual loadings of product will depend on the bulk density of the product. If considered for 24 h, captured ice quantity is higher

## Basic technical data for few most common units:

| EASY Freeze Drying model | EFD 600 | EFD 900 | EFD 1200 | EFD2300 | EFD 3500 | EFD 5500 |
|---|---|---|---|---|---|---|
| Evaporated water capacity (batch/24h) | 600 | 900 | 1200 | 2300 | 3500 | 5500 |
| Chamber measures (mm) | 2100x5000 | 2300x7500 | 2300x9500 | 3000x12000 | 3500x11800 | 4500x9500 |
| Area of the heat shelf ($m^2$) | 115 | 160 | 210 | 420 | 620 | 990 |
| Number of the heat shelf | 22x2 | 25x2 | 25x2 | 31x2 | 35x2 | 43x2 |
| Tray Area ($m^2$) | 100 | 135 | 180 | 350 | 550 | 880 |
| Tray size (mm) | 1250x500x20 | 1150x800x30 | 1150x600x30 | 1400x980x30 | 1000x1000x30 | 1300x990x30 |
| Number of trays | 84 (21x4) | 144 (24x3x2) | 192 (24x4x2) | 240 | 544(34x2x8) | 672 (42x2x8) |
| System lowest preasure | < 5-13 Pa | < 5-13 Pa | < 5-13 Pa | < 5-13 Pa | < 5-13 Pa | < 5-13 Pa |
| Standard condenser temperature ($^oC$) | -40 | -40 | -40 | -40 | -40 | -40 |
| Shelves temperature ($^oC$) | +25 to +80 | +25 to +80 | +25 to +80 | -25 to +70 | +25 to +80 | -25 to +70 |
| Refrigeration capacity (kW) | 62 | 84 | 110 | 198 | 328 | 485 |
| Installed el. power (kW) (without boiler) | 98 | 105 | 133 | 228 | 290 | 440 |
| Weight (kg) | 8800 | 10900 | 13600 | 17600 | 19900 | 22600 |

***Your future is our future, and we are addressing it today with product-based design and high-technology applied.***

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# PIGO provides complete, turn-key freezing and processing solutions:

- Fluidized bed freezers
- Freeze Drying
- Spiral Freezers
- Spiral Coolers
- Spiral Pasteurizers
- Spiral Dryers
- Spiral Proofing
- Pitting systems
- Infused dried fruit plants
- Fresh-cut preservation systems
- Vegetables processing solutions
- Complete processing lines for washing, separating, blanching, peeling, sorting, cutting and more.


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