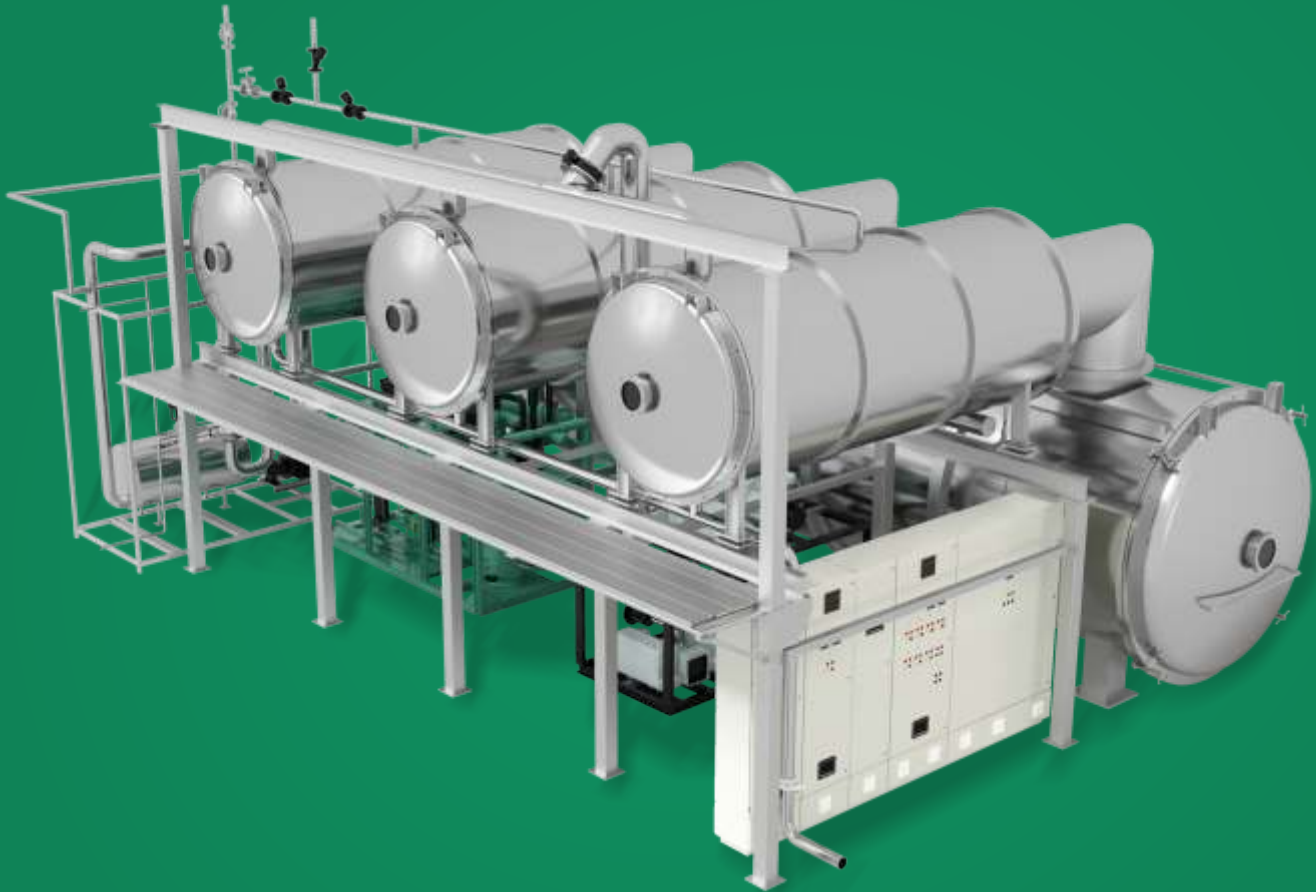
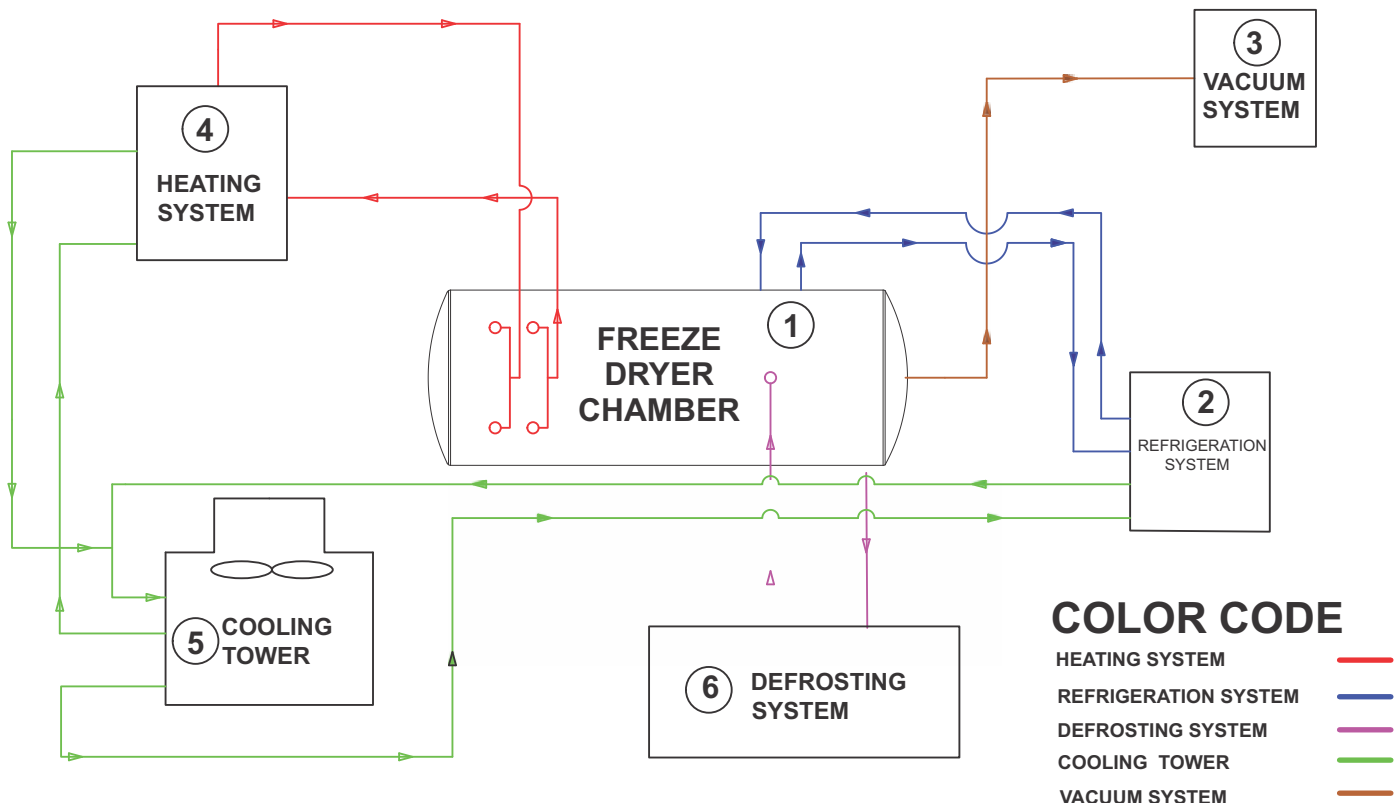


# Vacuum Freeze Dryer



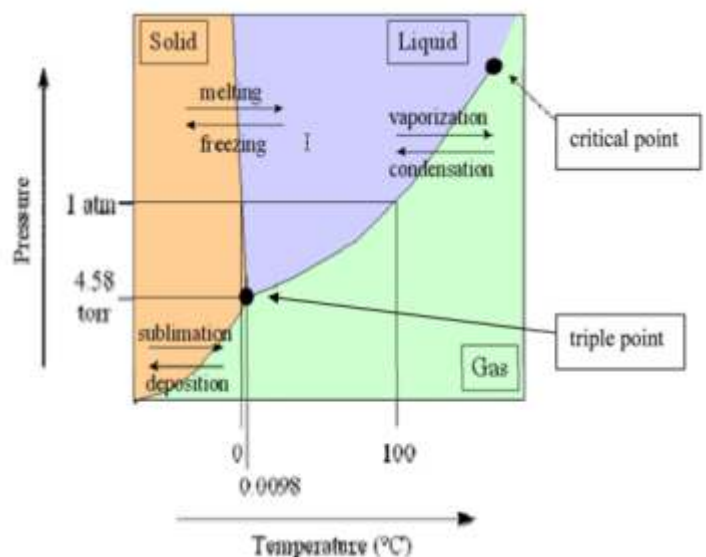
## ➤ Introduction to freeze drying (Lyophilisation)

- Freeze-drying is a low temperature dehydration process that involves freezing the product, lowering pressure, removing of ice (moisture) by sublimation, transitions of the substance from solid state to vapor without passing through the intermediate liquid phase.
- Freeze drying results in a high qualitative product because the entire process is performed at low temperature and pressure by applying vacuum, below triple point.
- The original shape of the product is maintained and quality of the rehydrated product is excellent.



## ➤ Basic Principles

- The vapour-pressure diagram shows the phase transition of the substance in graph of pressure and temperature.
- For example, it shows the boiling point of water at precisely 100 °C at normal atmospheric pressure.
- At lower pressures, the boiling point is reduced
- If the pressure is higher than 6.11 mbar, H<sub>2</sub>O passes through all three states (solid, liquid, and gaseous) as the temperature increases or decreases.
- Below this point however, i. e. if the pressure is less than 6.11 mbar, it passes directly from the solid to the gaseous state.
- All freeze drying process occurs below 6 mbar (in regular practice it may below 1 mbar)



## Stages In Freeze Drying

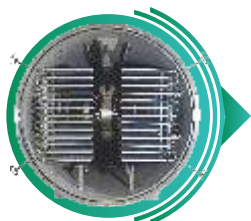
The material is fill in the tray and frozen between -20 and -45 degrees Celsius in a blast freezer, Material must be frozen below eutectic temperature to avoid liquid phase.

- Freezing Frothing when vacuum is applied.
- Freezing Shrinkage (retention of form)
- Freezing Concentration of solids

## PROCESS FLOW CHART



Material place in tray & frozen in blast freezer up to -20° to -45° temperature



Frozen material place in vacuum chamber for drying



Product dry under vacuum by sublimation process and achieve final Products moisture between 3 to 5 %



Unloading batch



Packing & Storage

**Primary Drying :** During primary drying phase, pressure is lowered and enough heat is supplied to substance by radiation for ice to sublimate, moreover vapour absorb in to ice condenser, that re-solidify on coil and formation of ice. that play important role to prevent water vapour reaching in to the vacuum pump , which degraded vacuum pump performance. condenser temperature below -40°C.

**Secondary Drying :** Aim to remove all ice by sublimation, bound moisture still present in the product In this phase, the temperature is raised higher than primary drying phase, to break any physic-chemical interactions that have formed between the water molecules and the frozen material , pressure is also lowered in this stage to encourage desorption.

**Packaging:** After drying, food is sealed / store in an airtight container that is impermeable to oxygen and prevent them from moisture absorbing.

**Rehydrated:** Simply add lukewarm water, it will regain its original fresh taste, aroma, and appearance

## Technical Parameters

| Model   | Input fresh capacity                        | Tray area     | Installed power                                       | Shelf working temp. | Cold Trap temp. | Ice capacity (kg/batch) | Compressor                              | Working pressure | MOC                                     |
|---------|---------------------------------------------|---------------|-------------------------------------------------------|---------------------|-----------------|-------------------------|-----------------------------------------|------------------|-----------------------------------------|
| IFD021  | 5 to 7 kg per batch (21 Kg per day)         | 1.2 Sq. Meter | 10 kW (Max) < 3.5 kw running                          | Max 80 °C           | -35 to -45 °C   | 12                      | Reciprocating Cascade System            | Up to 0.2 mbar   | Shell : SS304<br>Tray : SS304/SS316     |
| IFD060  | 20 to 40 kg per batch (60 kg per day)       | 3.6 Sq. Meter | 18 kW (Max) < 10 kw running                           | Max 90 °C           | -50 to -75 °C   | 30                      | Two stage Semi Hermetic compressor      | Up to 0.2 mbar   | Shell : SS304<br>Tray : SS304/SS316     |
| IFD085  | 28 to 56 kg per batch (85 kg per day)       | 5.6 Sq. Meter | 20 kW (Max) < 15 kw running                           | Max 90 °C           | -50 to -75 °C   | 40                      | Two stage Semi Hermetic compressor      | Up to 0.2 mbar   | Shell : SS304<br>Tray : SS304/SS316     |
| IFD120  | 40 to 75 kg per batch                       | 7 Sq. Meter   | 35 kW (Max) < 20 kw running                           | Max 90 °C           | -50 to -75 °C   | 75                      | Two stage Semi Hermetic compressor      | Up to 0.2 mbar   | Shell : SS304<br>Tray : SS304/SS316     |
| IFD180  | 60 to 110 kg per batch (180 kg per day)     | 11 Sq. Meter  | 50 kW (Actual power is 60% of total installed Power)  | Max 90 °C           | -50 to -75 °C   | 110                     | Two stage Semi Hermetic compressor      | Up to 0.2 mbar   | Shell : SS304<br>Tray : SS304/SS316     |
| IFD350  | 116 to 210 kg per batch (350 kg per day)    | 21 Sq. Meter  | 75 kW (Actual power is 60% of total installed Power)  | Max 90 °C           | -50 to -75 °C   | 210                     | Two stage Semi Hermetic compressor      | Up to 0.2 mbar   | Shell : SS304 /MS<br>Tray : SS304/SS316 |
| IFD400  | 133 to 280 kg per batch (400 kg per day)    | 28 Sq. Meter  | 80 kW (Actual power is 60% of total installed Power)  | Max 90 °C           | -50 to -75 °C   | 280                     | Two stage Semi Hermetic compressor      | Up to 0.2 mbar   | Shell : SS304 /MS<br>Tray : SS304/SS316 |
| IFD500  | 166 to 310 kg per batch (500 kg per day)    | 31 Sq. Meter  | 95 kW (Actual power is 60% of total installed Power)  | Max 90 °C           | -40 to -50 °C   | 310                     | Semi hermetic screw compressor with VFD | Up to 0.2 mbar   | Shell : SS304 /MS<br>Tray : SS304/SS316 |
| IFD700  | 232 to 400 kg per batch (700 kg per day)    | 40 Sq. Meter  | 100 kW (Actual power is 60% of total installed Power) | Max 90 °C           | -40 to -50 °C   | 400                     | Semi hermetic screw compressor with VFD | Up to 0.2 mbar   | Shell : SS304 /MS<br>Tray : SS304/SS316 |
| IFD1100 | 365 to 650 kg per batch (1100 kg per day)   | 65 Sq. Meter  | 150 kW (Actual power is 60% of total installed Power) | Max 90 °C           | -40 to -50 °C   | 650                     | Semi hermetic screw compressor with VFD | Up to 0.2 mbar   | Shell : SS304 /MS<br>Tray : SS304/SS316 |
| IFD1500 | 500 to 930 kg per batch (1500 kg per day)   | 93 Sq. Meter  | 185 kW (Actual power is 60% of total installed Power) | Max 90 °C           | -40 to -50 °C   | 930                     | Semi hermetic screw compressor with VFD | Up to 0.2 mbar   | Shell : SS304 /MS<br>Tray : SS304/SS316 |
| IFD2100 | 700 to 1320 kg per batch (2100 kg per day ) | 132 Sq. Meter | 260 kW (Actual power is 60% of total installed Power) | Max 90 °C           | -40 to -50 °C   | 1350                    | Semi hermetic screw compressor with VFD | Up to 0.2 mbar   | Shell : SS304 /MS<br>Tray : SS304/SS316 |
| IFD3000 | 1000 to 2100 kg per batch (3000 kg per day) | 208 Sq. Meter | 400 kW (Actual power is 60% of total installed Power) | Max 90 °C           | -40 to -50 °C   | 2100                    | Semi hermetic screw compressor with VFD | Up to 0.2 mbar   | Shell : SS304 /MS<br>Tray : SS304/SS316 |

## ► Construction and main components of the whole system

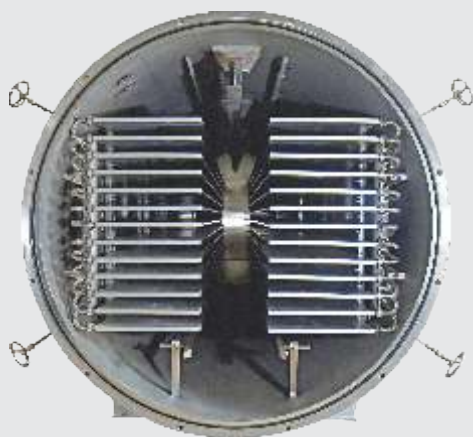
### Drying chamber

- The drying chamber is in cylindrical shape for high strength and good performance.
- In drying chamber doors are constructed with SS304 stainless steel or coated MS.
- Drying chamber incorporated with both product heating plate and the ice condenser.
- The Valve of vacuum line connection, drainage, hot water connection line, water defrost, vacuum, release valve is fitted with drying chamber.
- The doors and chambers are sealed by silicon rubber to avoid any vacuum leakage.
- FD50 To FD150 hinges will be either left or right hand side.
- FD300 to FD3000 door will be sliding, to be specified by the customer.
- Each door has viewing port, frame of viewing ports is made of 304 stainless steel and glass.



### Heating plate and trolley & tray

- A particular number of shelves are available for product loading, where radiant heat apply.
- The product is filled in trays, which are loaded between the heating-plates (shelves) in the freeze dryer.
- Heating plates are fabricated by extruded aluminum alloy with surface anodizing.
- The trolleys fitted with wheels that moving in a track which is located above the chamber.
- Embossed Ss304 product trays are designed for freeze dryer.



## ► Construction and main components of the whole system

### Ice-condenser

- Is constructed with SS304/SS316.
- Refrigeration of the condenser is by direct expansion type.
- During the defrosting mode, the condenser's accumulated, ice is melting by hot water or Steam
- Steam is preferred then hot water because it has a shorter defrosting duration.



### Vacuum system

- Process vacuum is typically achieved in less than 12 to 15 minutes depending on FD model, If Customer have a product with special requirement then this time can be reduced.
- Ice Make offer various range of vacuum pump manufacture as per customer demand : BUSH , Leybold etc .



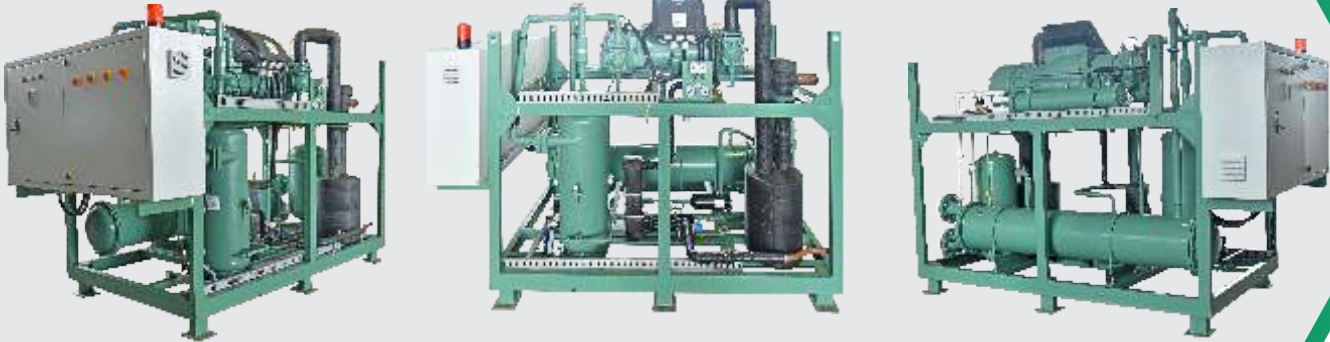
### Heating system

- Material included : Heating THE, Cooling THE, Hot recirculating pump, controlling valve accessory
- Exact temperature control with automatic steam regulating valve
- THE and tank material : SS-304



## Refrigeration system

- Ice Make Provide a refrigeration system having a temperature range of -25 to -70°C, as per the requirement.
- The screw compressor / two stage compressor rack system is adopted on large scaled freeze drying machine, while two stage / single stage is used on small scaled freeze dryer, with freon, Ammonia as a refrigerant.



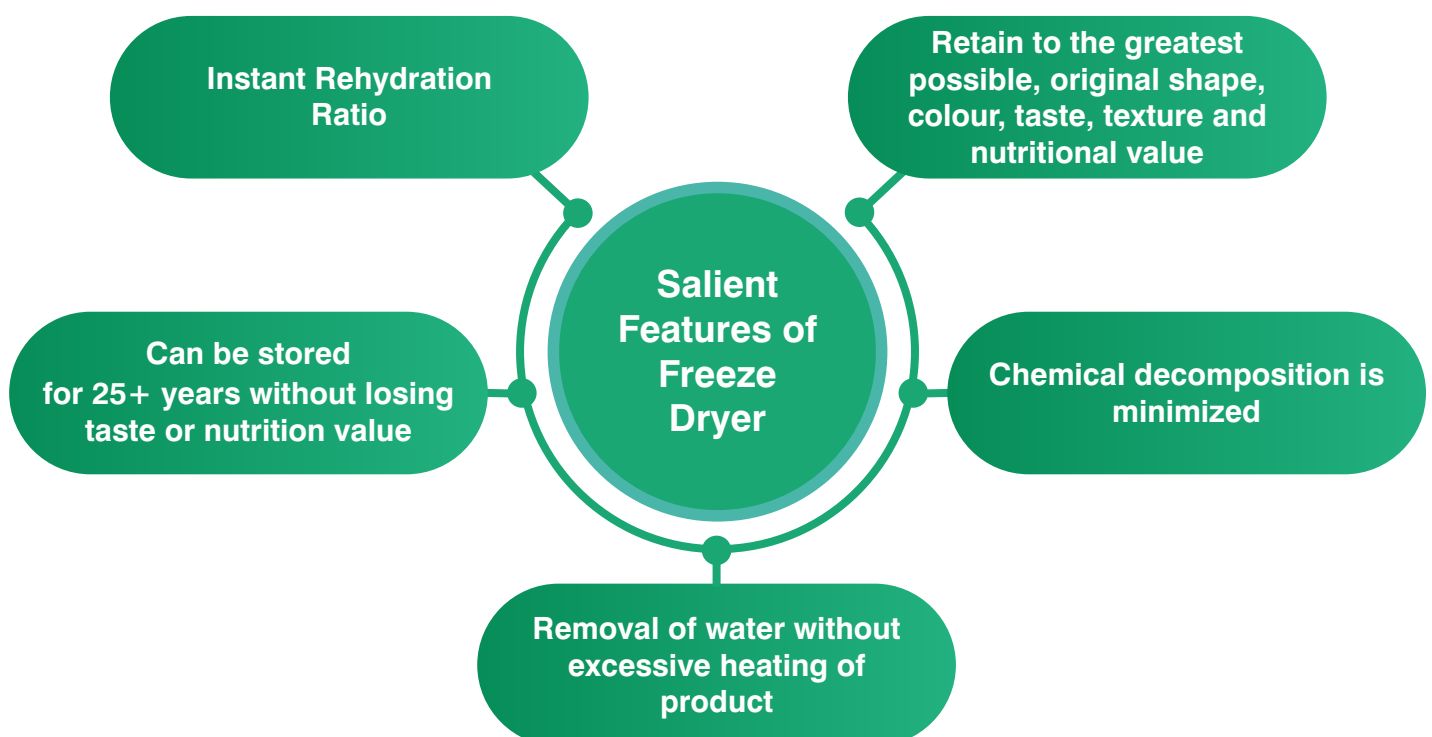
## Construction and main components of the whole system

### Control system

- PLC base control with touch screen HMI
- Easy to operate and screen may be customize as per requirement
- Remote monitoring and Controlling option available



## Salient Features Freeze Dryer



## ➤ Remarkable Advantages of a Freeze Dryer

- The process at low temperature and low pressure makes freeze drying an effective way to minimum damage to heat sensitive material and keep colour, smell, flavour nutritional content remain unchanged .
- Creation of porous structures to instant rehydrate or dissolve.
- Freeze dried material remains the same colour, flavour and appearance as it was firstly harvested. the volume of freeze dried material has no change, It is the real high quality preserved food.
- Since freeze dried food contains very low moisture, it has relatively small density and is easy to be transported.
- The freeze dried substance may be stored at room temperature for a long time without refrigeration , protected against spoilage for many years, Freeze dried food material has a longer preservation time than frozen food, canned food.
- It would greatly reduce water content that help to inhibit the action of microorganisms and enzymes that normally spoil or degrade the substance.
- No additives are added into the food during freeze drying process.
- Enhance product stability in dry state.

## ➤ Freeze Dryer Applications

**Pharmaceutical & Biotechnology | Research center | Fruits & vegetables | Floral industry**  
**Ready to eat and cook food | Airlines and railway food | Offices & Hospitals | Dairy**



### Seasonal Vegetables:

Green Peas, Sweet Corn, Mushroom, Lemon, Lady Finger, Exotic vegetable



### Tropical Fruit:

Banana, Apple, Mango, Pineapple, Jackfruit, Orange, Guava, Berries, Sapota, Avacado, Passion Fruit.



### Cooked Meals:

Instant Soups, Gravies, RTE product.

### Spices & Herb:

Garlic, Ginger, Coriander, Mint, Exotic Leafy Vegetables.



### Dairy Products

Milk, Paneer, Tofu, Cheese, Milk Based Beverages.

### Tea & Coffee:

Instant Tea & Instant Coffee

### Pharmaceutical Products:

Formulations, Enzymes, Vaccines, Hormones, Algae, Yeast, Bacterial Culture etc.



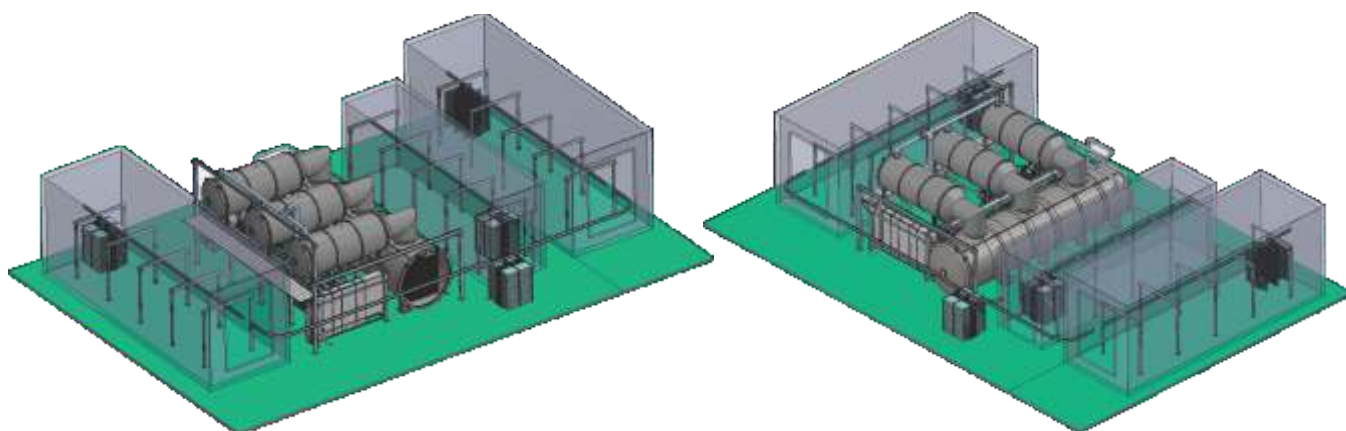
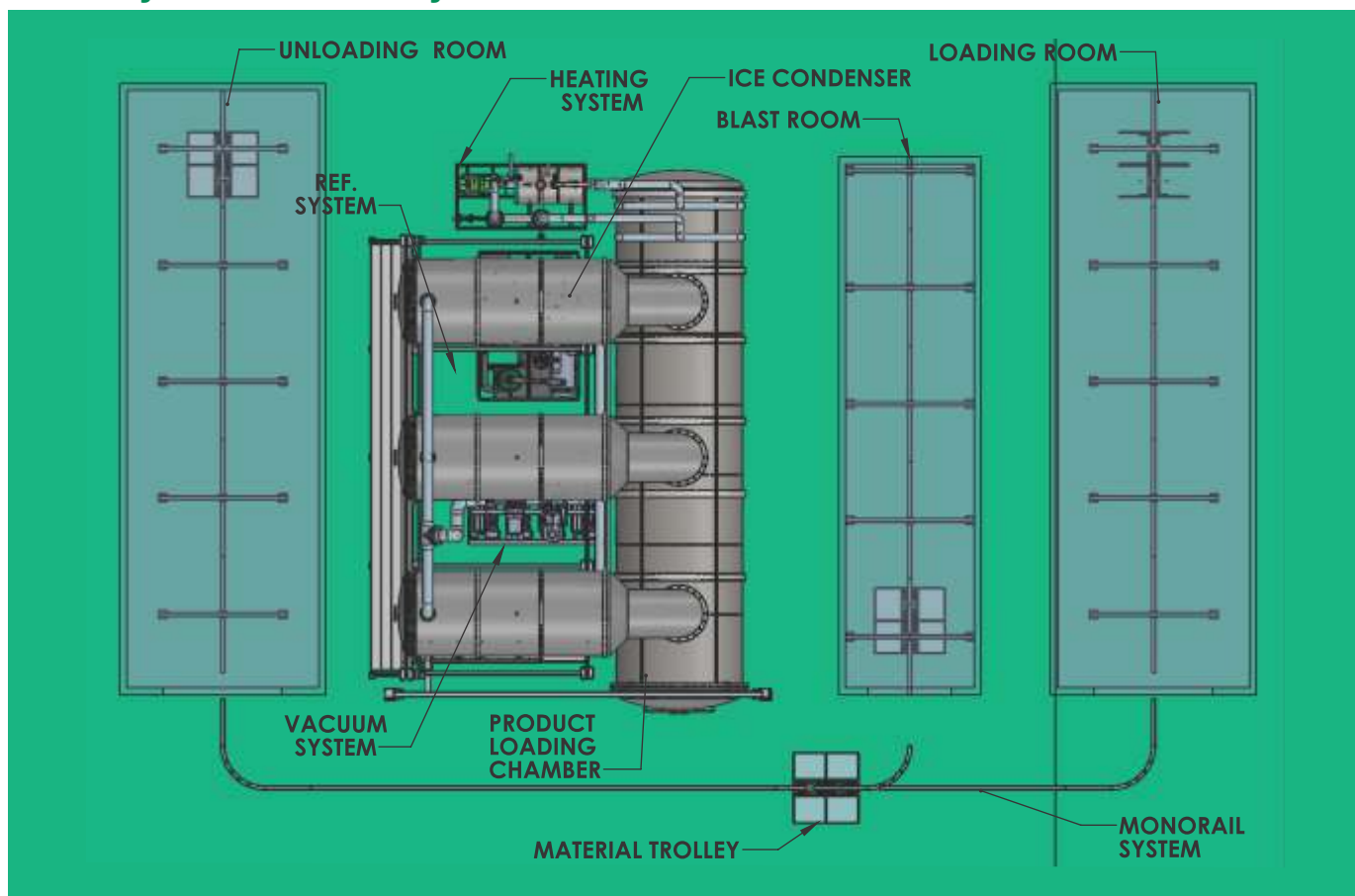
### Food For Astronauts and Expeditions

### Sea Food / Meat:

Shrimps, Fish, Chicken, Meat, Beaf, Egg Yolk etc.



## ► Plan Layout of Freeze Dryer



A Trusted Drying Partner



WEBSITE



CATALOGUE

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