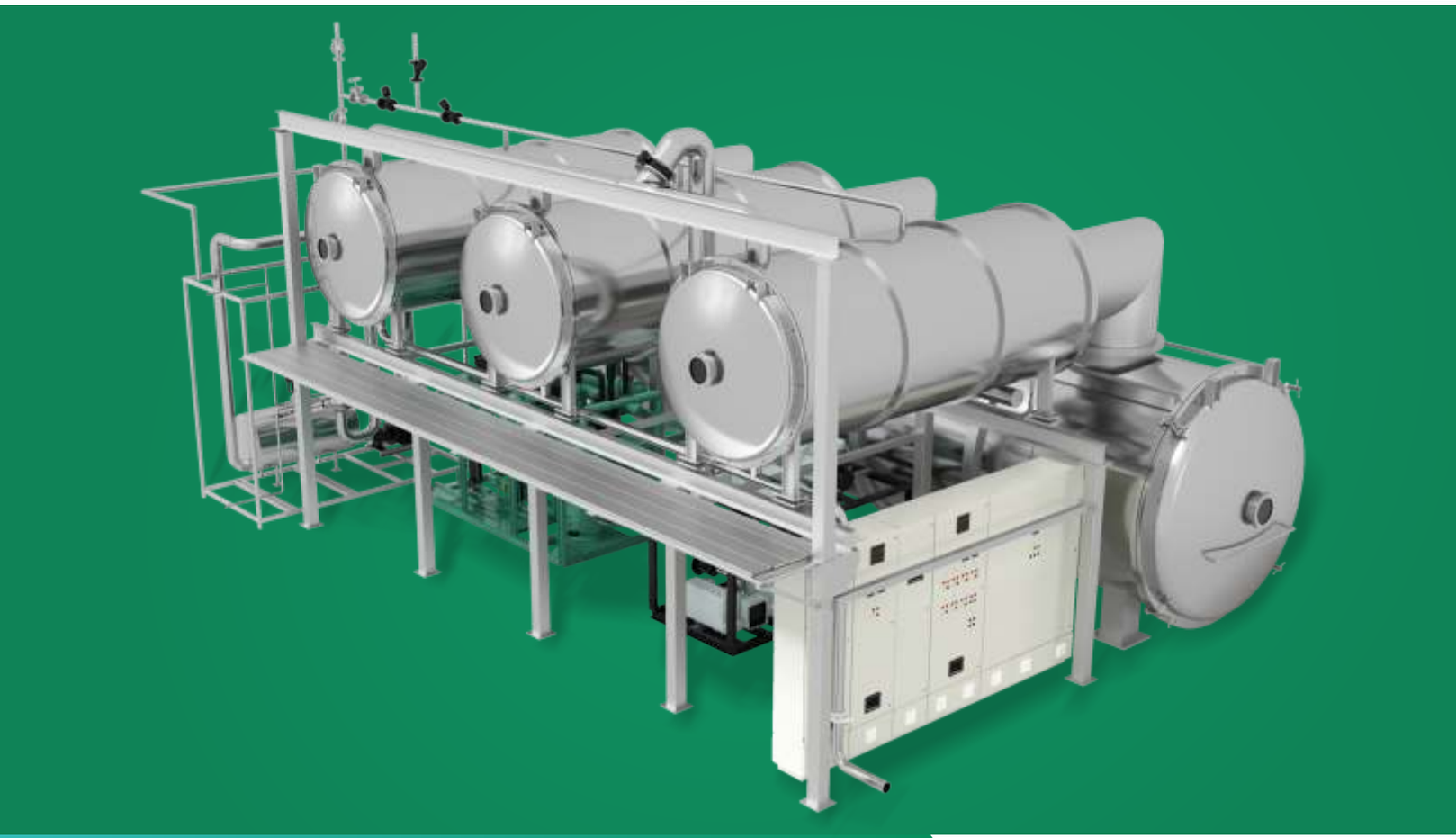
A Division of **ICE MAKE**

DRYMAKE

A Trusted Drying Partner

# Vacuum Freeze Dryer



Fresh Banana



Freeze Dried Banana

Fresh Green Peas

Freeze Dried Green Peas

Fresh Jamun



Freeze Dried Jamun

Fresh Tomatoes

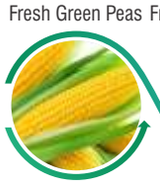


Freeze Dried Tomatoes

Fresh Pineapple

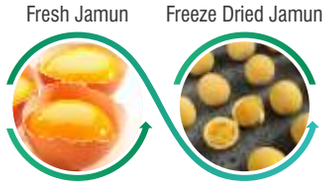


Freeze Dried Mangoi



Fresh Sweet Corn

Freeze Dried Sweet Corn



Fresh Egg Yalk



Freeze Dried Egg Yalk

Fresh Biryani



Freeze Dried Biryani

Jamun - Fresh



Freeze Dried Pineapple

Fresh Lemon

Freeze Dried Lemon

Fresh Poha



Dried Poha

Fresh Soup



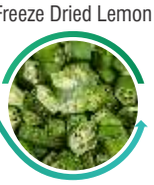
Freeze Dried Soup

Fresh Dragon Fruit



Freeze Dried Dragon Fruit

Fresh Okra

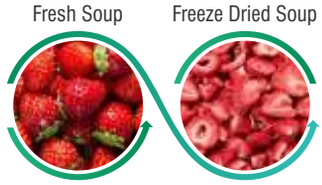


Freeze Dried Okra

Fresh Shrimps



Freeze Dried Shrimps



Fresh Strawberry



Freeze Dried Strawberry

Fresh Kiwi



Freeze Dried Kiwi

Fresh Cheese

Freeze Dried Cheese

Fresh Milk



Freeze Dried Milk

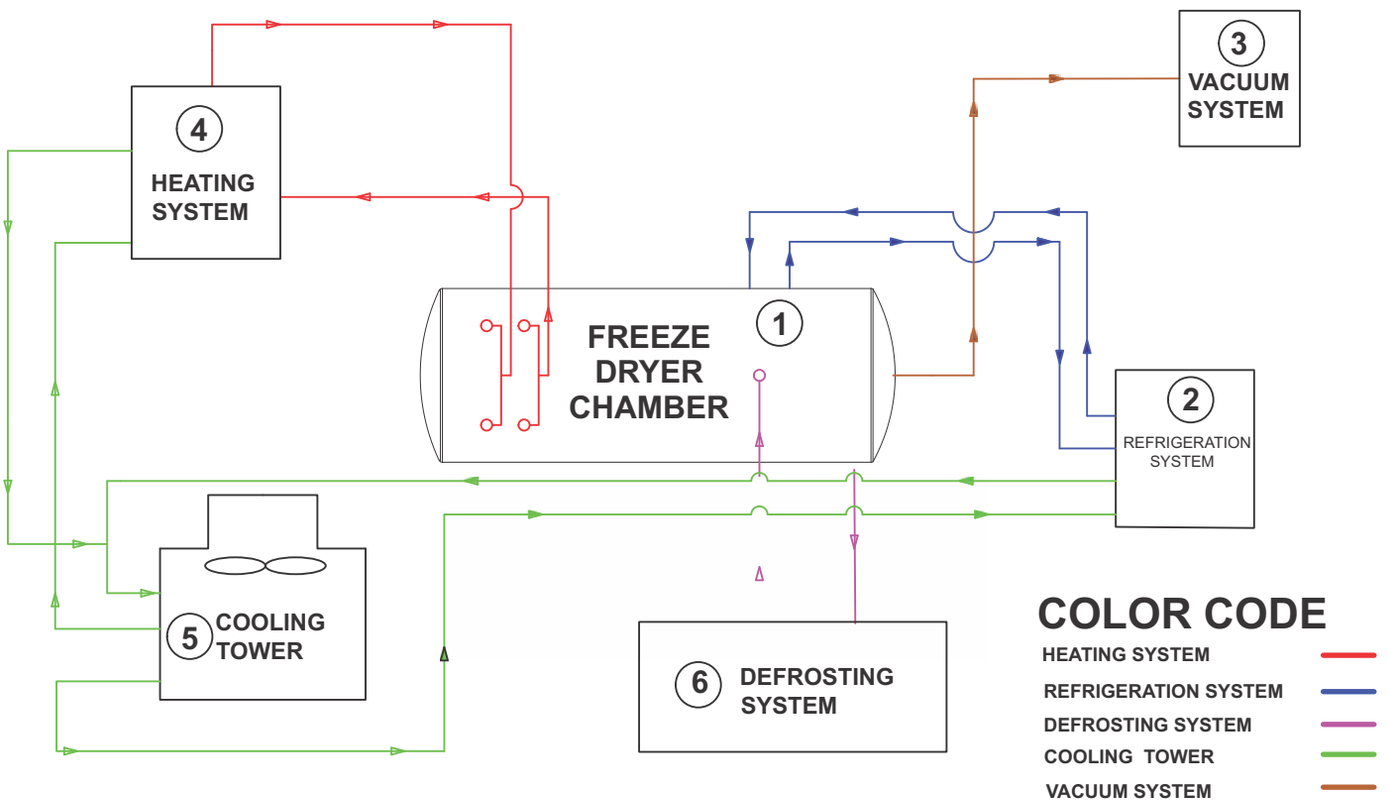
Fresh Paneer



Freeze Dried Paneer

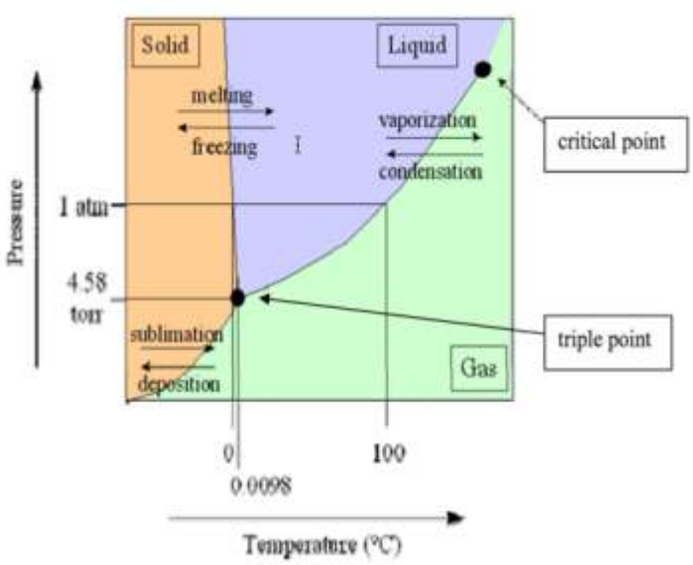
## Introduction to freeze drying (Lyophilisation)

- 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, H2O 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



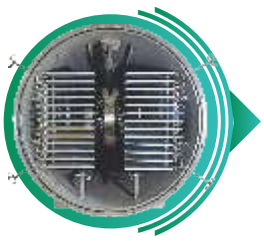
### Stages In Freeze Drying

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

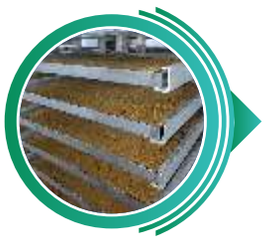
### PROCESS FLOW CHART

Material place in tray & frozen in blast freezer up to -20º to -45º temprature



Frozen material place in vaccum 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 | Drying Tray area | Installed power | Shelf working temperature | Cold Trap temperature | Ice capacity (kg/batch) | compressor | Working pressure in the Drying Cabin | MOC |
|---|---|---|---|---|---|---|---|---|---|
| IFD050 | 17 kg per batch (50 kg per day) | 3 sq. m. | 15 kW ( Max ) < 10 kw running | Max 90 Deg °C | -50 to -65 Deg °C | 30 | Two stage Semi Hermetic compressor | Up to 0.2 mbar | Shell : SS304/MS Tray : SS304 or 316 or Alu |
| IFD075 | 25 kg per batch (75 kg per day) | 5 sq. m. | 20 kW ( Max ) (< 15 kw running | Max 90 Deg °C | -40 to -50 Deg °C | 40 | Two stage Semi Hermetic compressor | Up to 0.2 mbar | Shell : SS304/MS Tray : SS304 or 316 or Alu |
| IFD180 | 60 kg per batch (180 kg per day) | 10.5 sq. m. | 35 kW (Actual power is 60% of total installed Power) | Max 90 Deg °C | -40 to -50 Deg °C | 110 | Two stage Semi Hermetic compressor | Up to 0.2 mbar | Shell : SS304/MS Tray : SS304 or 316 or Alu |
| IFD350 | 116 kg per batch (350 kg per day) | 21 sq. m. | 55 kW(Actual power is 60% of total installed Power) | Max 90 Deg °C | -40 to -50 Deg °C | 200 | Two stage Semi compressor Hermetic | Up to 0.2 mbar | Shell : SS304/MS Tray : SS304 or 316 or Alu |
| IFD700 | 232 kg per batch (700 kg per day) | 40 sq. m. | 65 kW | Max 90 Deg C | -40 to -50 Deg °C | 400 | Semi hermetic Semi hermetic screw compressor with VFD | Up to 0.2 mbar | Shell : SS304/MS Tray : SS304 or 316 or Alu |
| IFD1100 | 365 kg per batch (1100 kg per day) | 65 sq. m. | 130 kW (Actual power is 60% of total installed Power) | Max 90 Deg °C | -40 to -50 Deg °C | 520 | Semi Hermetic compressor with VFD | Up to 0.2 mbar screw | Shell : SS304/MS Tray : SS304 or 316 or Alu |
| IFD2100 | 700 kg per batch (2100 kg per day ) | 132 sq. m. | 250 kW (Actual power is 60% of total installed Power | Max 90 Deg C | -40 to -50 Deg C | 1000 | Semi Hermetic screw compressor with VFD | Up to 0.2 mbar | Shell : SS304/MS Tray : SS304 or 316 or Alu |
| IFD3000 | 1000 kg per batch (3000 kg per day) | 208 sq. m. | 400 kW (Actual power is 60% of total installed Power | Max 90 Deg C | -40 to -50 Deg C | 1000 | Semi Hermetic screw compressor with VFD | Up to 0.2 mbar | Shell : SS304/MS Tray : SS304 or 316 or Alu |

## 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 hings 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 .



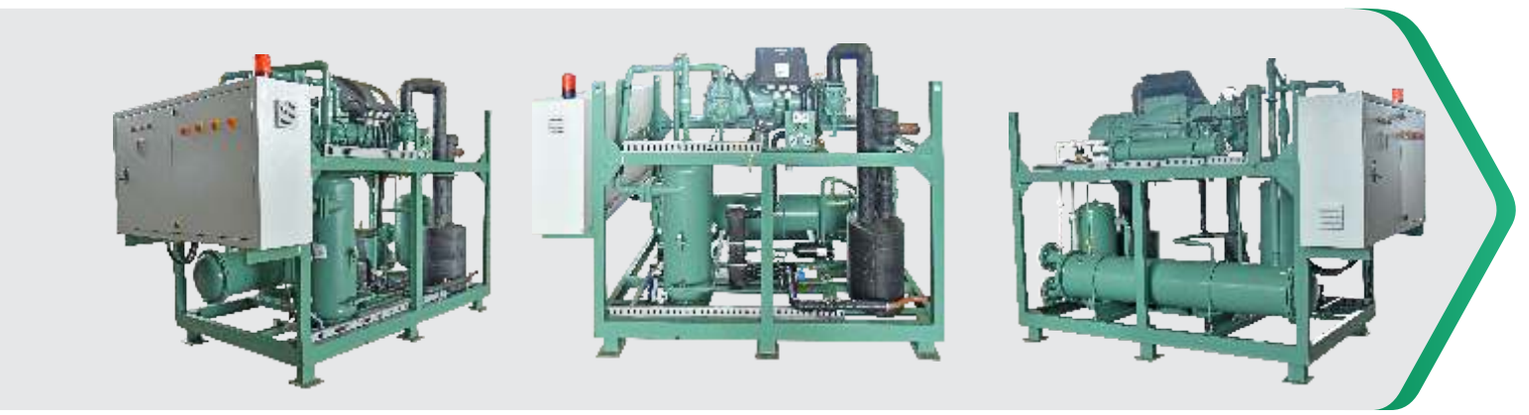
### Heating system

- 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

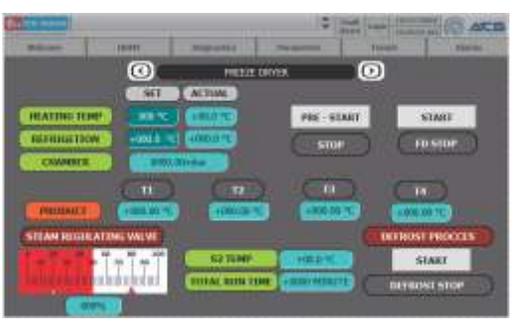
- Ice Make Provide a refrigeration system having a temperature range of -25 to -70°c, as per the requirement.
- The screw compressor / two stage compressor rack system is adopted on large scaled freeze drying machine, while two stage / single stage is used on small scaled freeze dryer, with freon, Ammonia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



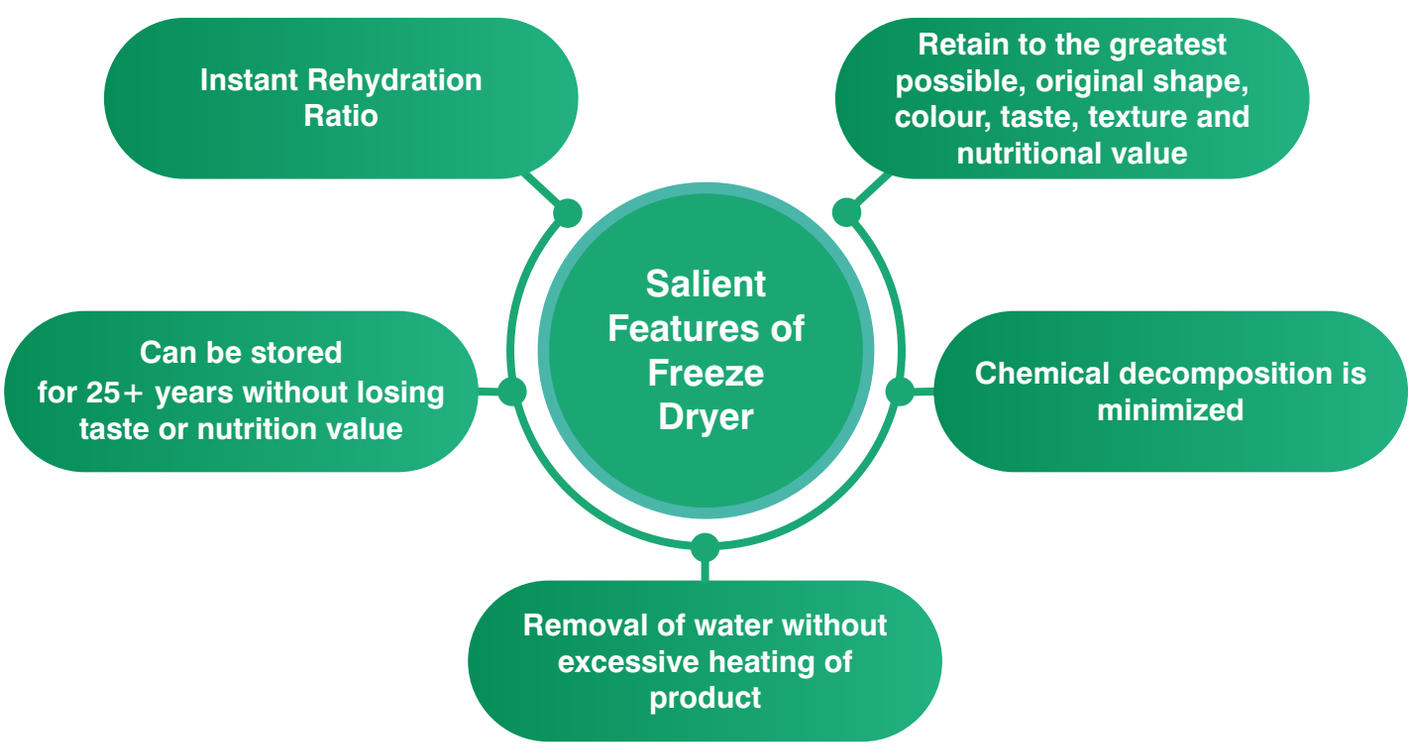
## Construction and main components of the whole system

### 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.

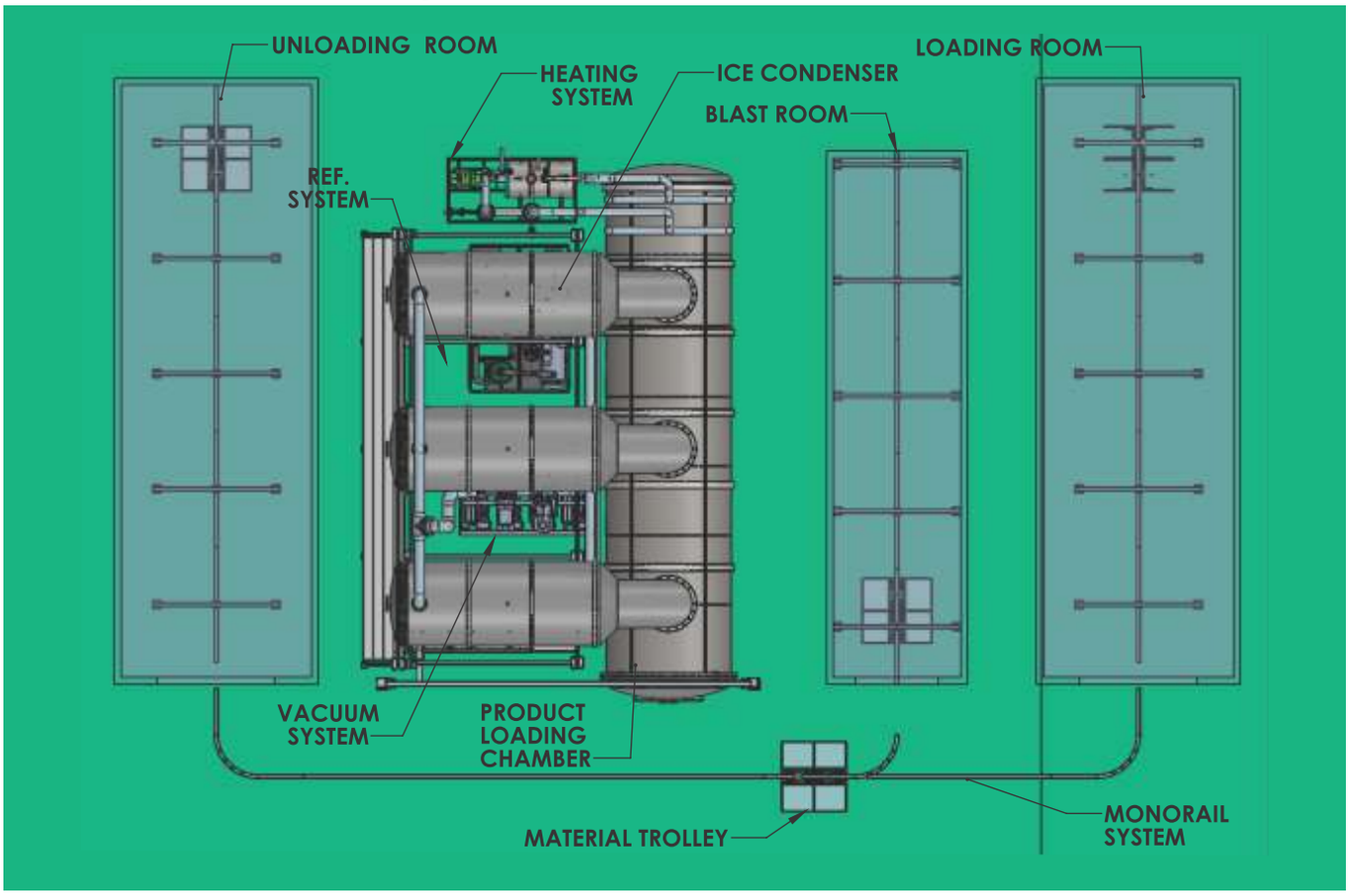
**Tea & Coffee:**
Instant Tea & Instant Coffee

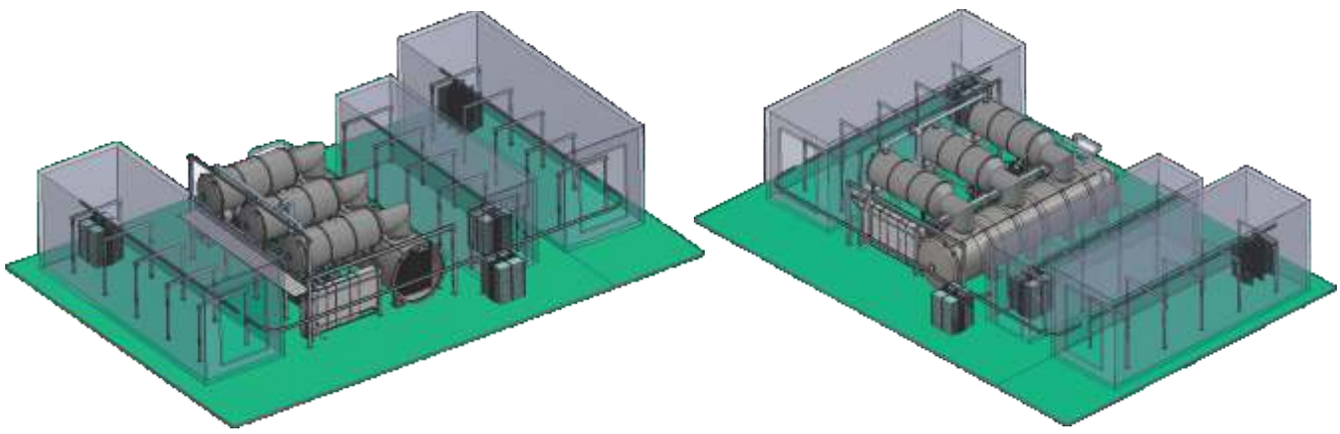
**Pharmaceutical Products:**
Formulations, Enzymes, Vaccines, Hormones, Algae, Yeast, Bacterial Culture etc.

**Food For Astronauts and Expeditions**

**Sea Food / Meat:**
Shrims, Fish, Chicken, Meat, Beaf, Egg Yolk etc.

## Plan Layout of Freeze Dryer



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**An ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018 certified Company**

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