

# **FD 150**

**STAINLESS STEEL.  
(150kgs)**

**INDUSTRIAL FREEZE DRYER.  
SPECIFICATIONS.**



## Table of Contents

<b>1. General.....</b>	<b>2</b>
<b>2. Construction</b>	<b>2</b>
2.1. Chamber and doors.....	2
2.2. Product module and heating plates.....	2
2.3. Product trays .....	3
2.4. Vapour condenser .....	3
2.5. Machinery frame.....	3
2.6. Dimensions.....	4
<b>3. System Specification .....</b>	<b>5</b>
3.1. Vacuum system .....	5
3.2. Roots blower.....	6
3.3. Heating ystem.....	6
3.4. Refrigeration system.....	7
3.5. Defrost system.....	7
<b>4. Electrical Specification .....</b>	<b>8</b>
<b>5. Standard equipment supplied .....</b>	<b>8</b>
5.1. Electrical.....	8
5.2. Chamber fittings .....	8
5.3. Pneumatic .....	9
5.4. Pumps and fluids .....	9
5.4.1. Sensors .....	10
5.5. Control.....	10
<b>6. Client Supplied Services.....</b>	<b>11</b>
<b>7. Available options.....</b>	<b>12</b>



# **1. GENERAL**

The Epsilon FD-150 Freeze Dryer has been designed after careful consideration of all the factors necessary for a wide variety of freeze drying techniques. The FD-150 General Purpose Freeze Dryer is capable of drying a variety of biologicals such as fruit and vegetables and diverse products such as blood/plasma, mushrooms to mussels. Epsilon Co.,Ltd. has been developing and manufacturing freeze dry and vacuum drying equipment for over 10 years.

## **2. CONSTRUCTION**

### **2.1. CHAMBER AND DOORS**

The cylindrical shaped chamber has product loading/ unloading doors. This doors are double hinged to assure correct alignment and sealing against the chamber. The door has one viewing ports, 400mm diameter, AISI 304 stainless steel frame and Acrylic window, to allow visual monitoring of both vapour condenser and product. The chamber contains both the product module and the vapour condenser. The chamber is fitted with electric operated valve that isolate the vacuum line connection, drain, water defrost and vacuum release. The chamber, doors and hinges are constructed in AISI 304 stainless steel. The door sealing material is rubber. The doors have an opening angle of 90° (provided enough room) or depend on space room and customer layout needed. The hinges will be either left- or right-hand side, to be specified by the customer. Closing is by means of quick acting latches.

### **2.2. PRODUCT MODULE AND HEATING PLATES**

The product is placed in trays and loaded onto the heating plates module. The machine is capable of freezing product in place on the heat-plates, which can be freeze as well as heated. Alternatively the product can be frozen in a separate chiller. The module consists of 10 heat-plates (9 available for product loading, top plate provides radiant heat for the top product plate only). The heat-plates are fabricated from AISI 304 stainless steel, and have a flat upper side and heating fluid channels on the lower side. An optional clean-sheet can be provided, this covers the bottom fluid channels and makes the lower side of the heat-plates flat for critical hygiene applications. The heating fluid is piped into headers that connect to welded in the chamber wall..

No. of modules / machine	1
No. of heat-plates / module	10
Heat-plate material	AISI 304
Heat-plate surface roughness	0.1 – 0.5 mm
Heat-plate intermediate distance	65 mm
Heat-plate thickness	18-20 mm
Heat-plate width (useful)	900 mm
Heat-plate depth	1400 mm
Shelf-flatness	<1.5 mm
Optional clean-sheet	

### 2.3. PRODUCT TRAYS

The product trays are made of AISI 304 stainless steel 1.2 mm thick, and have rounded corners for ease of cleaning. Sizes are: length 450 x 700 width x 20mm deep. Radius of corners: 2.0mm.

Two sets of trays are included with the freeze dryer. A tray trolley for ease of storing/ cleaning and loading is optional.

Tray size	450 x 700 x 20 mm
No. of trays / heat-plate	4
No. of trays total	40 x 2
Tray material	AISI 304, 1.2mm

### 2.4. VAPOUR CONDENSER

The vapour condenser is located in the lowest of the chamber, and is constructed from round coil 19mm, AISI 304. Refrigeration is by direct expansion. Defrosting the accumulated ice from round coil SUS304 is by water, hot water is recommended for a quick defrosting cycle. Heat recovery from the refrigeration system is an option that will provide an efficient and cost-effective way of achieving this.

### 2.5. MACHINERY FRAME

All the machinery involved with the operating of the freeze dryer is mounted in a separate frame or with frame. The frame is made from carbon steel sections with powder coating finish. It can be placed up to 10 meters away from the product chamber. Connections are through fixed piping and fixed electrical wiring.

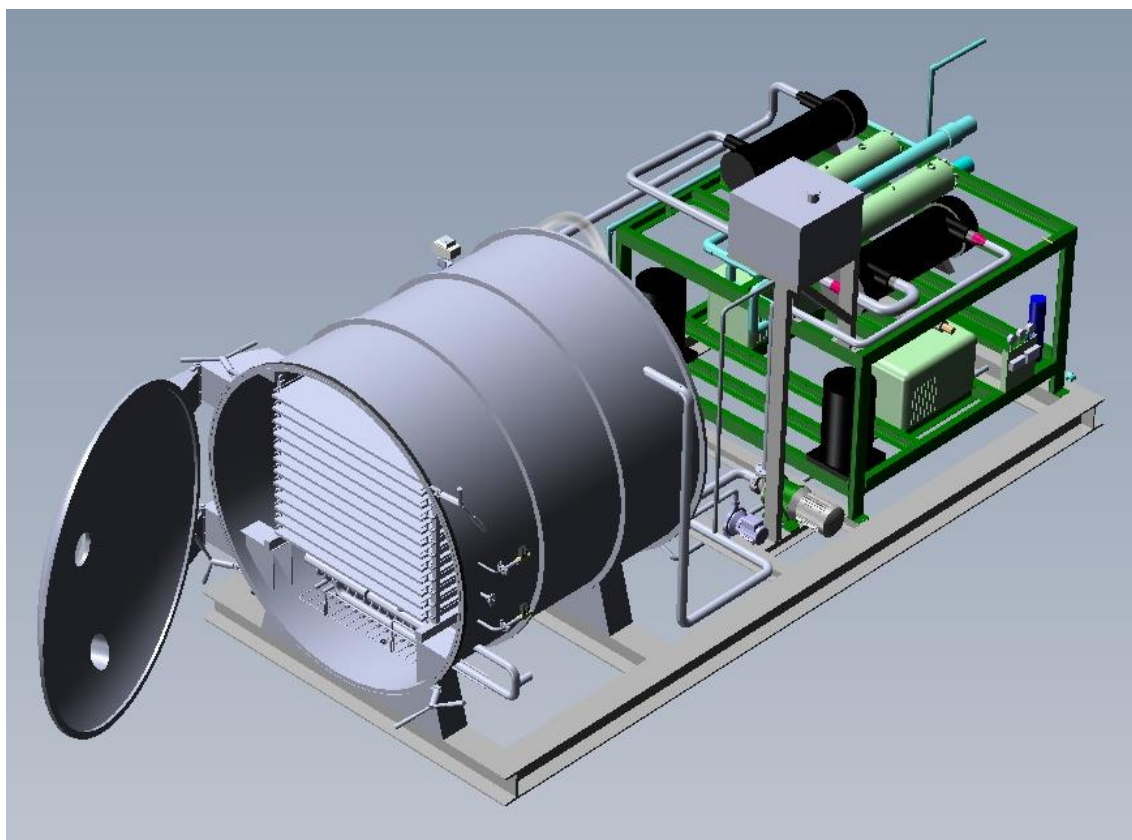


## 2.6. DIMENSIONS

The following table lists the dimensions of the complete plant.

Chamber	Diameter 1500 mm Depth : 1500 mm
Machinery Frame	length: 5000mm width:2000 mm height :2200 mm
Motor Control Cabinet	width: 800mm height :1250mm depth: 270mm
Water Cooled condenser	height: 1000mm width: 1200 mm depth: 1200 mm
Air cooled refrigeration condenser (optional)	length: -mm width: -mm height :-mm
Heat recovery water tank (optional)	height: - mm diameter:- mm

## DIMENSIONAL SKETCH



## System Specification

### 2.7. VACUUM SYSTEM

The vacuum pump is a rotary vane vacuum pump to give efficient capacity for evacuation and non-condensable vapour management. Pump control is via the integrated control system, with features such as warm-up, condition monitoring.

Technical data:

No. of Rotary vane pumps	1
Brand	Pfeiffer
Model	
Flow rate	125 m <sup>3</sup> /hr
Power requirements	
Rotation speed	1400 r.p.m.

**2.8. ROOTS BLOWER**

No of Booster pump	0
Brand	Edwards
Model	
Flow rate	0 m <sup>3</sup> /hr
Power requirements	kW
Rotation speed	2800 r.p.m.

Total vacuum system:

Pumping speed @ 2mbar	Xxx m <sup>3</sup> /h @ 2mbar
Estimated evacuation time to 1 mbar	30 minutes

**2.9. HEATING YSTEM**

The heat-plates are cooled and heated with a heat transfer fluid. This fluid can be chilled or heated to provide in-place-freezing or heating of the product during the drying cycle. The fluid used to –40°C is Silicone M50.

A centrifugal pump provides the forced circulation of the heat transfer fluid.

An electrical heater directly heats the fluid, chilling is through an intermediate heat exchanger.

Heat transfer fluid	Silicone oil M50
Total circuit capacity	0.2 m3
Circulating pump	Iwaki
Pump flow rate	5 m3/hr
Pump power requirements	1 kW
Rotation speed	1400 r.p.m.
Chilling heat exchanger capacity	4.5 kW
Heater power	7.5 kW
No of elements	1
Temperature range	-40 to +60°C
Cooling time 20°C to -40°C	2 Hour
Heating rate	10 K/hr
Temperature variance	+/- 2°C
Temperature variance / shelf	+/- 2°C

## 2.10. REFRIGERATION SYSTEM

The refrigeration system cools the heat plates during in-place-freezing, evacuation and the early stages of drying. It also cools the vapour condenser during the drying cycle.

The compressor/s are Bitzer semi-hermetic 2 stages; the refrigerant used is chlorine free.

Refrigerant	R404a
Refrigerant capacity	30 kg
Compressor	Bitzer 2 stages
Compressor Power Requirements	
Refrigeration Capacity @ -40 SST	

## 2.11. DEFROST SYSTEM

Defrosting is by means of water. Option available for 50°C hot water defrost by heat reclaim by refrigeration heat rejection system heat exchanger, .2 m<sup>3</sup> insulated storage tank, and circulation pump. This option greatly reduces defrosting times over conventional cold water.



### 3. ELECTRICAL SPECIFICATION

The Freeze Dryer is delivered with full electrical hardware that, where possible, is chosen to be totally compatible with local supplies. Wiring is complete with mains isolation, motor circuit breakers and overload protection. Electrical enclosures are purpose built and are supplied with key locks. Control circuitry is interfaced with relays to maintain PLC isolation from electrical load. Electrical cabinets are configured to suit customer layouts. Mains supply cable and connection is to the customers account.

Main Switch supplied	Yes
Motor control Cabinet supplied	Yes
Control Cabinet Supplied	Yes
Pneumatics Cabinet supplied	Yes

### 4. STANDARD EQUIPMENT SUPPLIED

#### 4.1. ELECTRICAL

EQUIPMENT	TYPE
7.5 K/w Elements	THA
Speed Drive	-
Freeze Thermostat	Pt100
Lifting Bellows	-
Pneumatics Cabinet	-
MCC Cabinet	-
Thyristor Cabinet	-
Thyristor	-
Level Control	-
Contactors	Telemecanique
Overloads	Telemecanique
Circuit Breakers	Telemecanique
Relays	Omron
PLC	ABB
Main Switch	Telemecanique

#### 4.2. CHAMBER FITTINGS

Perspex Windows	Clear acrylic
Ball Valves	NZF
RJT Fittings	NZF
S/S Fitting	NZF
Door Seal	Silicone rubber 60shoreA
Braded S/S Hose	THA



#### **4.3. PNEUMATIC**

Electric Solenoid Valves	Burkert
Pneumatics Filter	-
Air Manifold	-
Pneumatics Valves	-
Actuators	-

#### **4.4. PUMPS AND FLUIDS**

Silicone Pump	Iwaki
Heat Recovery Pump	-
Condenser Pump	-
Defrost Pump	Lowara or THA
Heat Recovery Tank	-
Flow Switch	-
Heat Transfer Fluid	Silicone oil M50

#### **4.4.1. SENSORS**

A variety of sensors support the data acquisition and control of the Freeze Dryer. Pressure transducers are fitted and both monitor and control the refrigeration system. Vacuum pressure is monitored at the product chamber. Temperature sensors measure and control the heating fluid. RTD type (PT100) sensors are provided by means of a vacuum plug to allow measurement and logging of the product temperatures inside the vacuum vessel.

Pressure Transducers	Edwards
Vacuum Sensor	Edwards
Heat fluid control sensors	PT100
Product temperature sensors	PT100

#### **4.5. CONTROL**

Control of the Freeze Dryer is by an Mitsubishi PLC interfaced with Proface Programmable Terminal (Touch Screen). The screen shows a graphical display of temperatures and pressures in a schematic representing the actual freeze dryer installation. The system is designed to control and monitor the dryer and will automatically ramp energy as required to govern sublimation pressure to pre-set parameters. All analogue data can be logged and kept in historical logs. The data can be stored in compact flash cards for display on a PC, if required.



## **5. CLIENT SUPPLIED SERVICES**

The client is required to supply all buildings for the Drying chamber and plant room equipment including foundations, structural frames and pads for tanks and cooling towers.

Access for Chamber installation.

Power to the main switch of the Motor Control Centre, lighting and plant room ventilation.

Water and air for ancillary services adjacent to necessary plant.

Drainage.

Building detail drawings (CAD preferred).

## 6. AVAILABLE OPTIONS

Every effort is made to deliver a custom machine most suitable to the clients needs. Several options are available. Some options will need engineering to suit the local conditions. Please discuss your exact requirements with Epsilon Company Limited.

Heat Recovery	BPHE, Tank, & Pump c/w level control	
Low Temperature Ice condenser	Change Specification from std -40C refrigerant SST	
Cooling Tower	Upgrade from std fibreglass Liang Chi model LBC40	
Air Cooled Refrigeration	Remote Air-cooled option subject to suitable ambient conditions: Client to supply written local climate extremes.	
Pipe cladding	Stainless steel/ aluminium Foam option	
Wall penetrations	Upgrade from PVC sleeve to Client specifications	
Shelf Clean-Sheet	Upgrade to std modular shelving to include 2mm smooth sole plate to assist cleaning	
Multi jet Cleaning System	High pressure manual cleaning system c/w Six vee jet vertical head, wand, pressure cleaner with chemical tank	
CIP System	Design and build to suit client specification NB: Clean Sheet required for this option.	
Speed Drive	Change specification of Std Speed Drive	
Documentation	Client specification table required for additional documentation over std operation and maintenance manual	
Product trays	Upgrade to 316 stainless steel	
Product trays	Change standard size or quantity	
Tray trolleys	Supply tray trolleys (design to suit customer)	
Wiring	Custom wiring Identification	
Spare Parts	Supply spares from parts list	



Add other Options as required


Epsilon Co., Ltd will quote for Options as listed above as a variation to the contracted price.

***Note: specification subject to change without notice prior to our improvement.***