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FOREWORD

Thank you very much for your kind patronage of EYELA. Get to know your EYELA products, but before using, to be sure to read this manual well. EYELA cannot be held responsible for the malfunction resulting from the use of EYELA products other than as specified in this manual.

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Liability Disclaimer

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EYELA**Freeze Dryer****FDU-1000
FDU-2000**

Instruction Manual

**Important**

This manual is designed to use this unit safely with the best performance.

Read carefully the chapter [For safety operation] before operating this unit.

Keep this instruction manual beside the unit.

Precautions for your safety

1. Warning signal words

This unit uses ignitable or flammable solution as its refrigerant. The incorrect operation causes the unexpected injuries or accident. On account of the function and characteristic, the operation at higher circumstance temperature deteriorates the function or causes the trouble of this unit.

This manual shows precautions for your safety to prevent careless injuries. They are classified and defined according to their risk, and indicated with an alert mark and a signal word. Please follow these instructions.

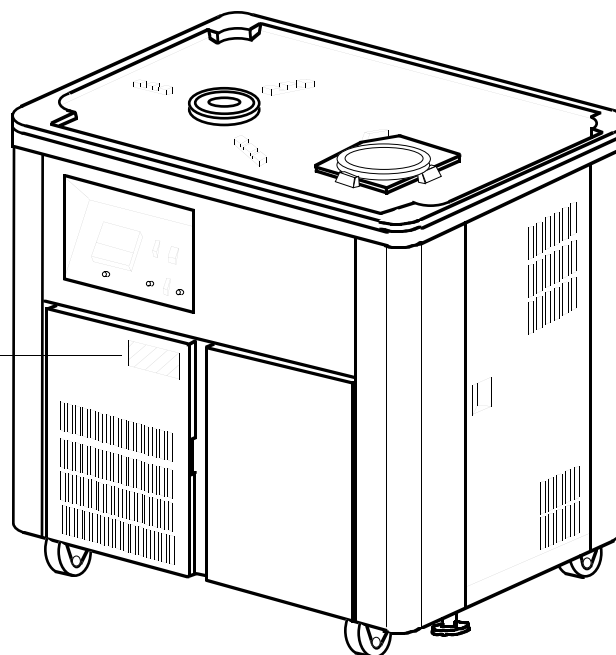
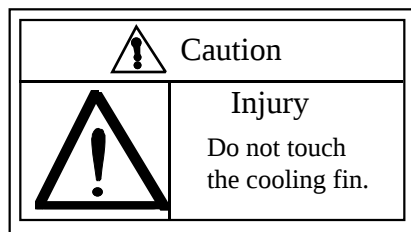
Alert Mark Signal word	Definition
 Warning	Indicates a potentially hazardous situation which, if you use incorrectly, could result in death or serious injury.
 Caution	Indicates a potentially hazardous situation which, if you use incorrectly, may result in injury or physical damage.

We investigate enough possible hazards during the operation, however it is very difficult for us to find every hazardous occasions. Therefore this manual cannot describe all hazardous operations. Please follow this manual and be careful to operate the unit, to prevent injuries or physical damages.

2. Warning label

A warning label is attached to the unit to refer the most important clause.
The attached position is shown as below.
Be careful to use the unit referring warning messages.

* When the warning label is worn and hardly show the message, change it with a new one.
Please order us a new label.



Thank you for choosing **EVELA** products.

Introduction

This instruction manual describes the procedure of installation, operation, trouble shooting, maintenance / check-up, and disposal for Freeze Dryer model FDU-1000 and FDU-2000.

Read this manual carefully before operation.

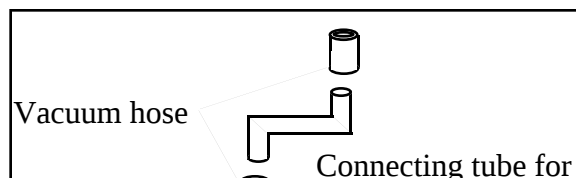
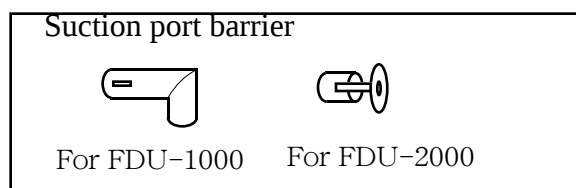
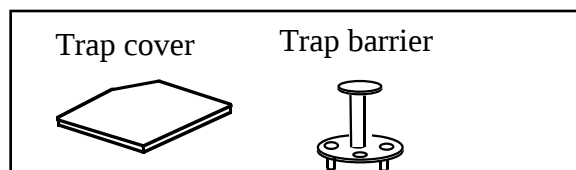
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Packing

Check quantities referring to the below table.

		Q'tity
1	Main unit	1
2	Trap cover	1
3	Trap barrier	1
4	Suction port barrier	1
5	Connecting tube for vacuum	1
6	Vacuum hose (ID18)	2
7	Fuse	1
8	Instruction manual	1



1

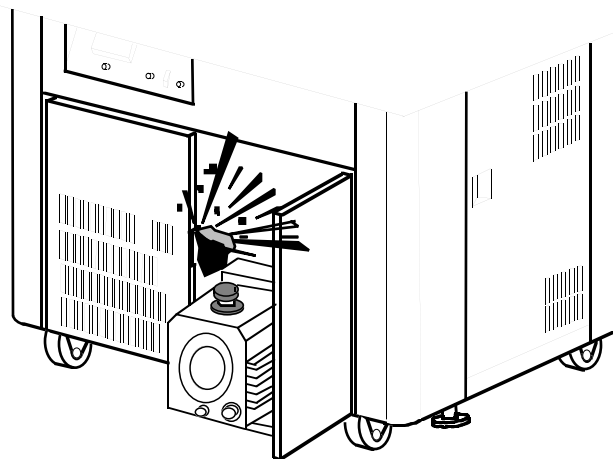
For safety operation

This unit is not an explosion-proof structure. Be careful to handle safely.

**Warning****Be careful for drying samples which contains organic solvent or ignitable materials.**

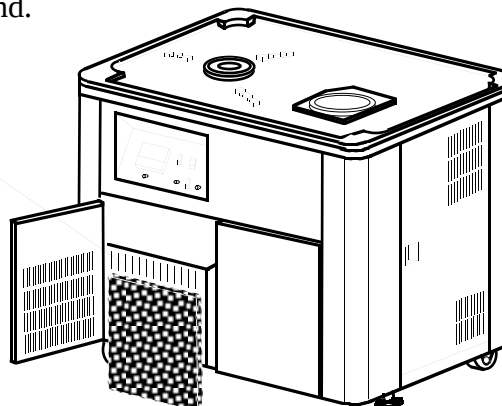
Be careful for drying samples which contains organic solvent or ignitable materials. There is a possibility to ignite or explode by solvent which is sucked by a vacuum pump.

- Freeze the sample before drying.
- Attach the sample bottle or flask after the inside wall in the cold trap cools down and the vacuum reaches 10Pa.
- If you dry the sample containing organic solvent, change the oil of vacuum pump periodically.

**Caution****Do not touch the cooling fin with a hand.**

Do not touch!
As the cooling fin is very sharp, you may cut your hand.

Fin



2	Outline
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2-1 Application

 Warning
Do not remodel. Do not use out of applications. Remodeling or use out of applications may occur electric shock hazard and mechanical troubles.

This unit is designed to concentrate or freeze dry the diluted solution of protein or enzyme, extracted solution of living thing sample, urine, serum, etc.

2-2 Specifications

Products	Freeze Dryer	
Model	FDU-1000	FDU-2000
Cooling method	Drum cooling	
Trap temperatue 1	-45°C	-80°C
Ice hold capacity	4 liter/batch	3 liter/batch
Trap desfroster	By hot gas defrosting	
Refrigeration unit (output)	600W	500W x 2
Refrigerant gas	R404A	R404A, R23
Vacuum pump 4	100/120liter/min. or more (50/60Hz) (optional accessory)	
Trap dimensions (mm)	ID200 x 300Hmm	
Vacuum gauge	Pirani vacuum gauge 0.4 ~ 533 Pa.	
Service AC outlet	AC 100V, Max. 3A 3	
Environmental temperature	5 ~ 35°C	
Overall dimensions (mm)	700W x550D x 930Hmm	
Net weight 2	100 kg	140 kg
Power source inlet 3	15A, 1.5kVA	12A, 2.4kVA
Rated power source	AC115V,or 220V 50/60Hz 1Ø	AC200 or 220V 50/60Hz, 1Ø

1 Room temperature : 20°C, rated power source voltage 50Hz, without load.

2 The net weight is for FDU-1000 only.

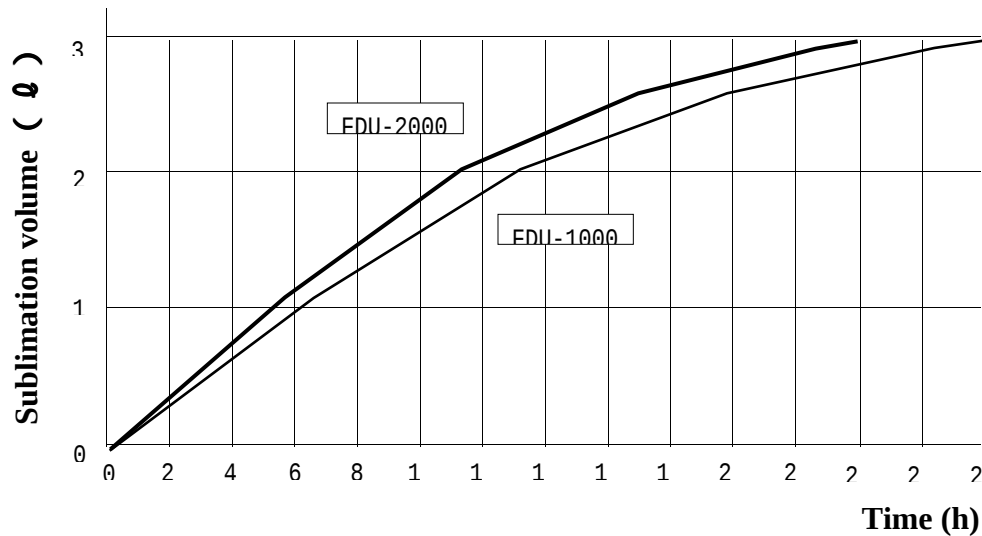
3 The value includes the vacuum pump GLD-136.

4 The service AC outlet supplies AC 100V in spite of the specifications of FDU-2000.

5 For AC 115V unit or AC220V unit, the vacuum pump must be placed outside of the cabinet.

2-3 Sublimation data (Reference)

FDU-1000/2000



Conditions

FDU-1000

Sample flask 1L contains 500g water x 6 pcs.

Frozen in pre-freeze bath.

Calculate the sublimation volume from the remaining sample against the time.

AC 100V 50Hz at room temperature 20°C

FDU-2000

Sample flask 1L contains 375g water x 8 pcs.

Frozen in pre-freeze bath.

Calculate the sublimation volume from the remaining sample against the time.

AC 200V 50Hz at room temperature 20°C

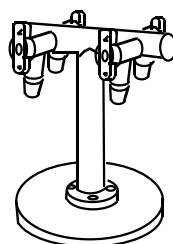
The sublimation speed depends on the environmental temperature, volume or shape of sample container (sample flask or flat bottom flask), material of sample or volume and the pre-freeze condition.

2-4 Optional accessories

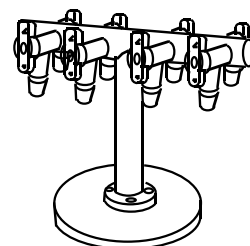
■ T-shape manifold for sample flask

Stainless steel T-shape manifold having 4 ports (PMH-4) and 8 ports (PMH-8)

Model	Cat. No.
PMH-4	119820
PMH-8	119830



PMH-4

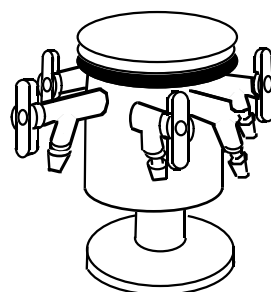


PMH-8

■ Cylindrical manifold for sample flask

Stainless steel cylindrical manifold (PMH-1000) having 9 sample ports. You can clean the inside of this manifold.

Model	Cat. No.
PMH-1000	197440



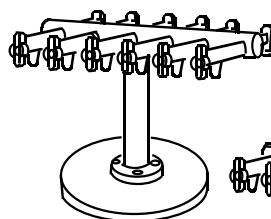
PMH-1000

■ T-shape manifold for test tube, ampule or vial

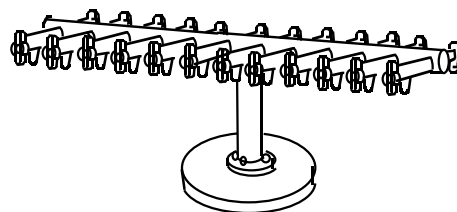
Stainless steel T-shape manifold having 12 ports (PMH-12) and 24 ports (PMH-24)

Model	Cat. No.
PMH-12	119840
PMH-24	119860

If you use test tubes or ampules, the suitable adaptors are required.



PMH-12

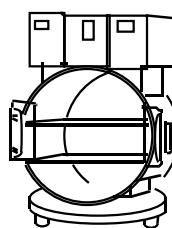


PMH-24

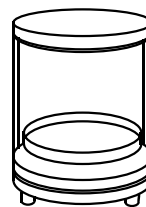
■ Round-shape tray dryer

For drying vials or petri dish

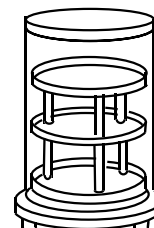
Model	Cat. No.
DRC-1N	119730
DRC-2	119740
DRC-3	119760



Base foot
DRC-1N



Base foot
DRC-2



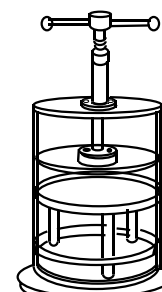
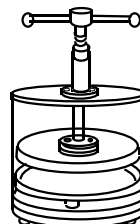
Base foot
DRC-3

If you use this with FDU-2000, remove the base feet.

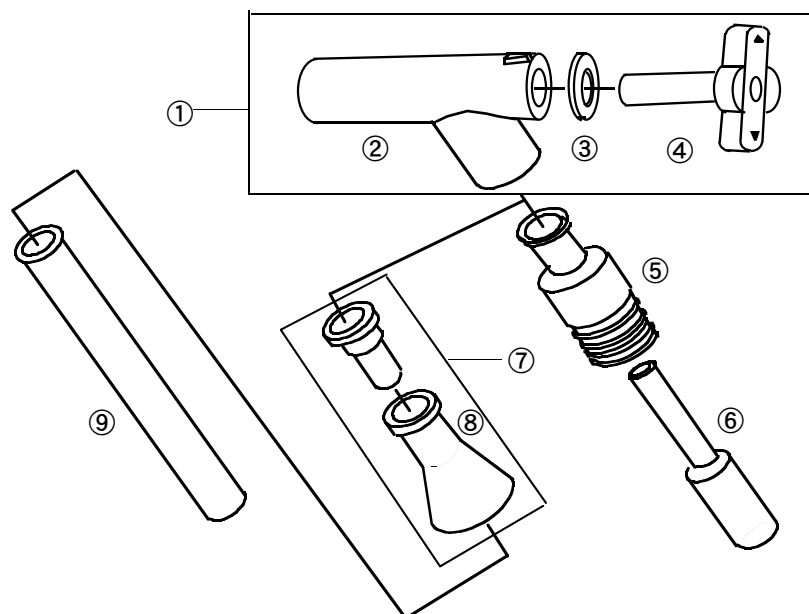
■ Sealing tray dryer

For sealing vial after freeze drying. (Upper shelf)

Model	Cat. No.
BSC-2	119780
BSC-3	119800

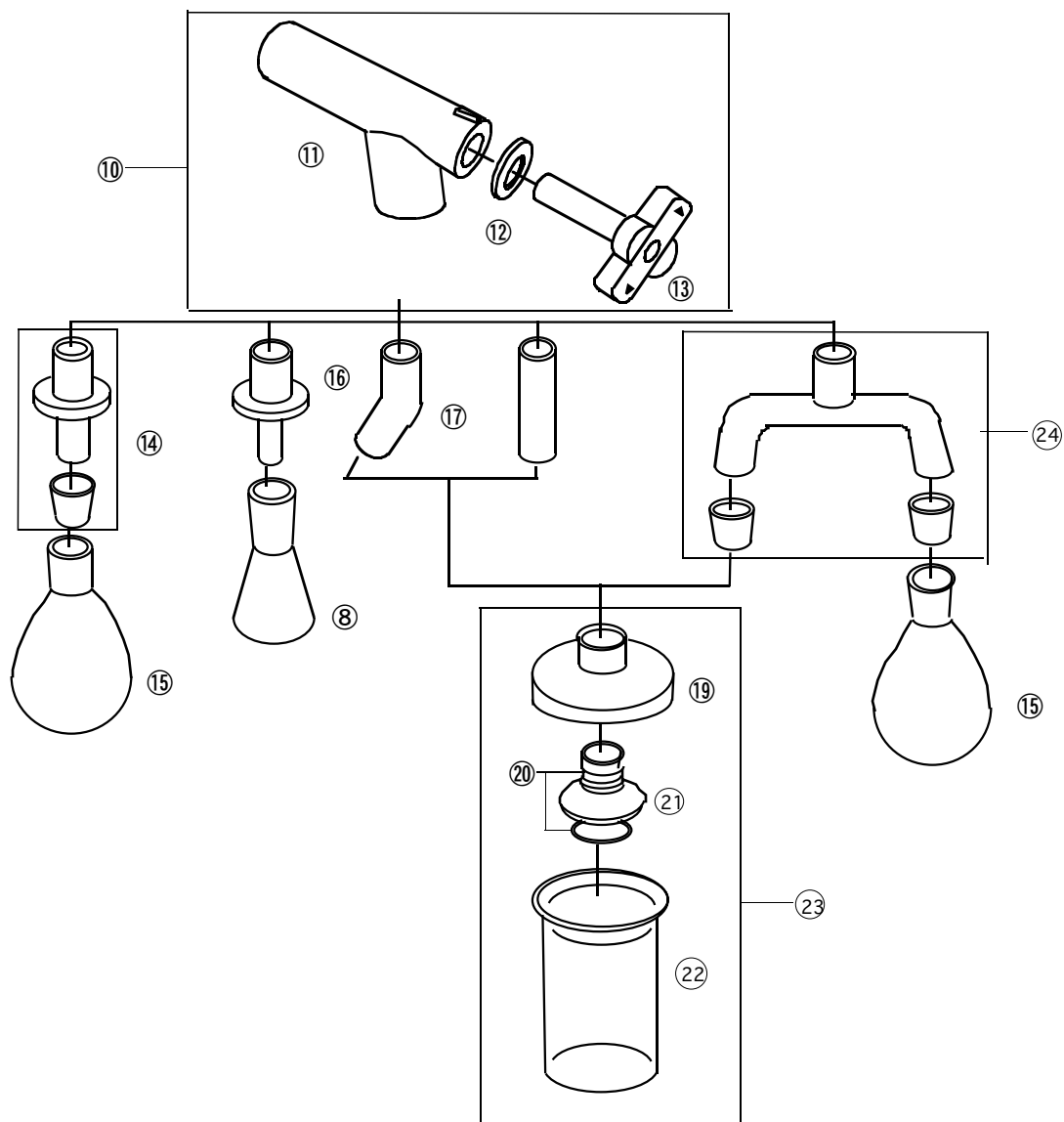


■ Quick fit valve B, test tube, ampule and others



No.	Items	Size	No.	Cat. No.
1	Quick fit valve B		1	119930
2	Quick fit valve body B		1	144480
3	Liner B		10	143960
4	Quick fit valve cock B		5	144490
5	Adaptor for ampule	for $\phi 8$	1	120520
		for $\phi 6$	1	120530
6	Ampule	Pear shape (1m ϕ)	20	120210
		Pencil shape round (1m ϕ)	20	120220
		Pencil shape flat (1m ϕ)	20	120221
		Flat (2m ϕ)	20	120230
		Flat (5m ϕ)	20	120240
		Flat (10m ϕ)	10	120250
		Round (2m ϕ)	20	120260
		Round (5m ϕ)	20	120270
		Round (10m ϕ)	10	120280
7	Test tube adaptor B		1	120510
8	Sealing		1	145610
9	Test tube with lip	$\phi 10 \times 75$ (3m ϕ)	100	143970
		$\phi 12 \times 75$ (4m ϕ)	100	143980
		$\phi 12 \times 90$ (5m ϕ)	100	143990
		$\phi 12 \times 105$ (6m ϕ)	100	144000
		$\phi 12 \times 120$ (7m ϕ)	100	144010
		$\phi 13 \times 75$ (5m ϕ)	100	144020
		$\phi 13 \times 90$ (6m ϕ)	100	144030
		$\phi 13 \times 100$ (7m ϕ)	100	144040
		$\phi 15 \times 85$ (8m ϕ)	100	144050
		$\phi 15 \times 105$ (10m ϕ)	100	144060
		$\phi 15 \times 150$ (15m ϕ)	50	144070
		$\phi 16.5 \times 105$ (12m ϕ)	100	144080
		$\phi 16.5 \times 165$ (20m ϕ)	50	144090
		$\phi 18 \times 165$ (24m ϕ)	50	144100

- Quick fit valve A, flat bottom flask, sample flask and others



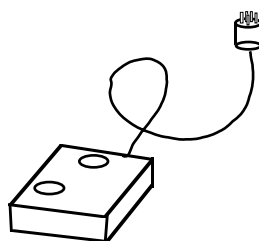
No.	Items	Size	No.	Cat. No.
10	Quick fit valve A		1	119920
11	Quick fit valve body A		1	144460
12	Liner A		10	143950
13	Quick fit valve cock A		1	144470
14	Adaptor for sample flask	Φ 29	1	120470
		Φ 24	1	144500
15	Sample flask	50m l Φ 29	1	116140
		100m l Φ 29	1	116150
		200m l Φ 29	1	116160
		300m l Φ 29	1	116170
		500m l Φ 29	1	116180
		1000m l Φ 29	1	116190

No.	Item	Size	No.	Cat. No.
15	Sample flask	50m $\varnothing$ F 24	1	116220
		100m $\varnothing$ F 24	1	116230
		200m $\varnothing$ F 24	1	116240
		300m $\varnothing$ F 24	1	116250
		500m $\varnothing$ F 24	1	116260
		1000m $\varnothing$ F 24	1	116270
16	Test tube adaptor A		1	120500
17	Adaptor for flat bottom flask		2	120460
18			3	120450
19	Cap for flat bottom flask	for $\varnothing$ 45 40 • 80m $\varnothing$	1	120020
		for $\varnothing$ 70 120 • 150 • 300m $\varnothing$	1	120030
		for $\varnothing$ 105 600 • 900 • 1200m $\varnothing$	1	120040
20	Filter holder		1	120100
21	Filter	100pcs./1 box	1	120110
22	Flat bottom flask only	40m $\varnothing$ OD $\varnothing$ 45	1	120050
		80m $\varnothing$ OD $\varnothing$ 45	1	120060
		120m $\varnothing$ OD $\varnothing$ 70	1	120120
		150m $\varnothing$ OD $\varnothing$ 70	1	120130
		300m $\varnothing$ OD $\varnothing$ 70	1	120140
		600m $\varnothing$ OD $\varnothing$ 105	1	120070
		900m $\varnothing$ OD $\varnothing$ 105	1	120080
		1200m $\varnothing$ OD $\varnothing$ 105	1	120090
23	Flat bottom flask with cap	40m $\varnothing$	1	119940
		80m $\varnothing$	1	119950
		120m $\varnothing$	1	119960
		150m $\varnothing$	1	119970
		300m $\varnothing$	1	119980
		600m $\varnothing$	1	119990
		900m $\varnothing$	1	120000
		1200m $\varnothing$	1	120010
24	Adaptor for dual flasks		1	120490

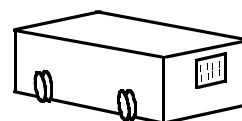
■ Trap monitor

When it detects the trapped ice volume (3 ± 0.5 liter), the neon for trap monitor blinks.

Cat.No.
197480

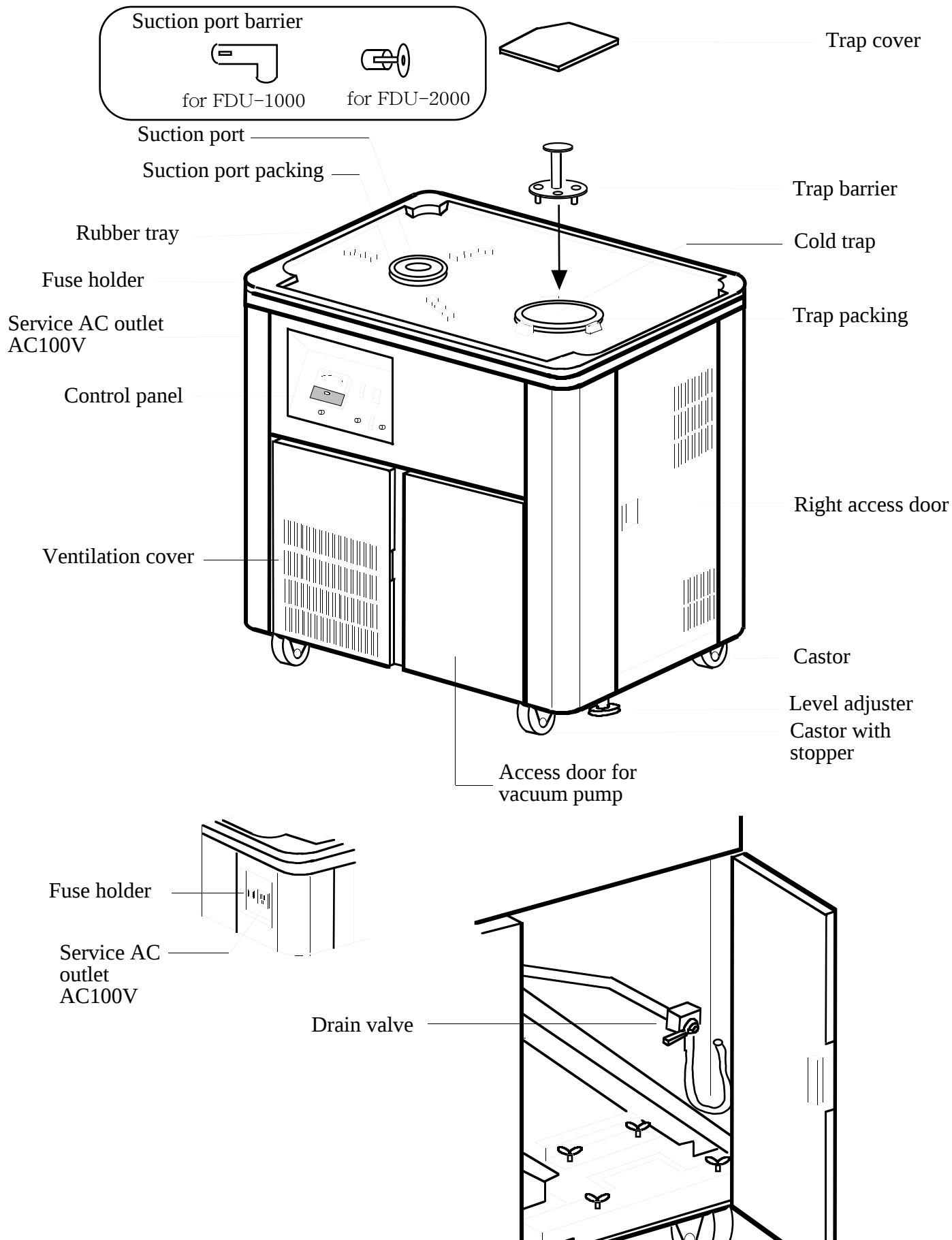


Sensor for trap monitor

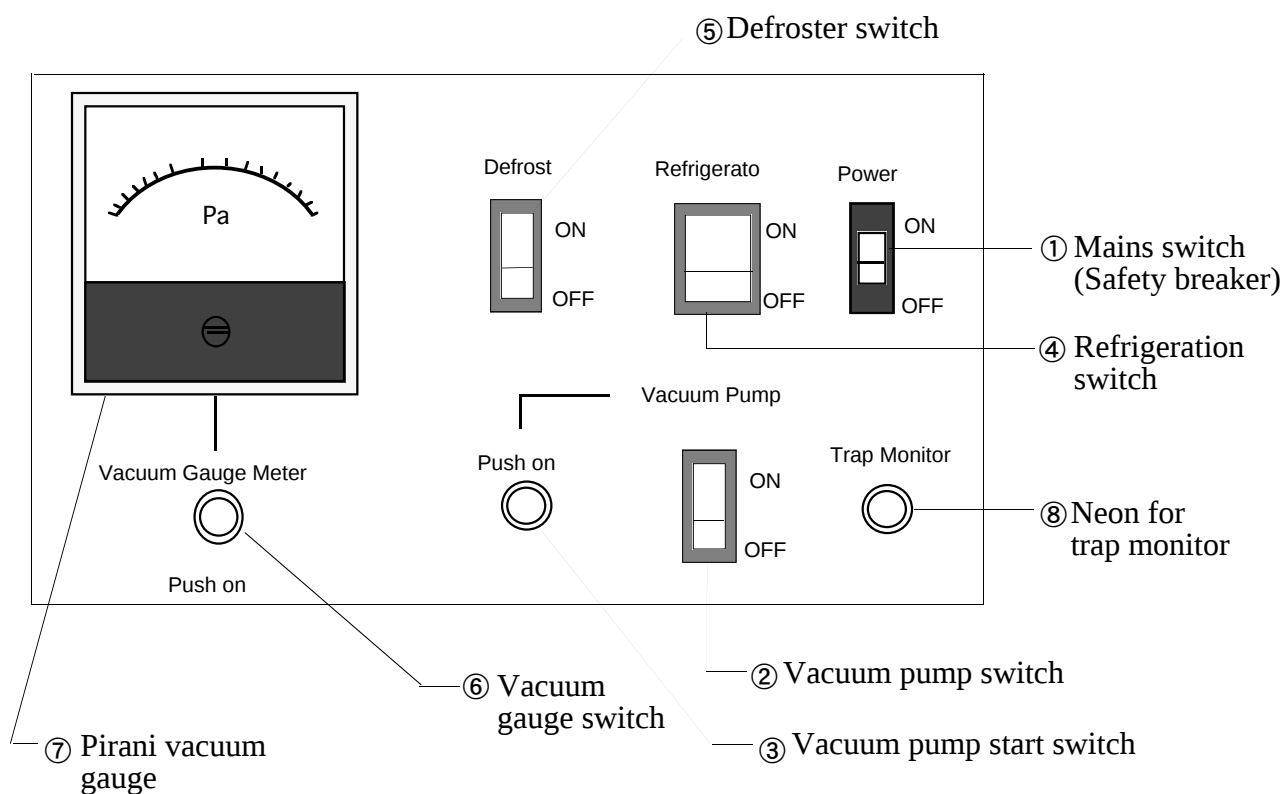


Box for circuit board
for trap monitor

2-5 Descriptions



3-1 Operation panel



No.	Description	Function
1	Mains switch	It turns on and off power. (safety breaker)
2	Vacuum pump switch	It activates the vacuum pump start switch.
3	Vacuum pump start switch	After turning on the vacuum pump switch, push this switch to start vacuum pump. It restarts the vacuum pump operation after power failure or turning off the mains switch
4	Refrigeration switch	It turns on the refrigeration unit for cooling cold trap.
5	Defroster switch	After freeze drying, turn off the vacuum pump switch and defrost
6	Vacuum gauge switch	Push this switch to measure the vacuum.
7	Pirani vacuum gauge	It indicates the vacuum in the cold trap.
8	Neon for trap monitor	It illuminates at the trap capacity 3 ± 0.5 liter. (The trap monitor is an optional accessory.)

3-2 Safety Feature

This has safety features as shown below.
When an abnormal operation occurs, solve it referring to [Trouble shooting] on P.24.

Safety feature

Safety devise	Phenomenon	Cause
Safety breaker	It turns off to shut down the power.	Electric leakage or excess current.
Safety valve (leak valve)	It opens to release the vacuum to atmospheric pressure and avoid the reverse flow of oil from vacuum pump.	• It functions when the power failure or trouble occurs during operation and stops the vacuum pump. • It functions when turning off the vacuum pump after freeze drying.
Over-load relay for refrigeration unit	Refrigeration unit is over-loaded (over-heated) and stops. The illumination of refrigeration switch and defroster switch go out. The power of service AC outlet is shut down.	• The circumstance temperature exceeds 35°C and the refrigeration unit is overloaded. • The filter for refrigeration is clogged. • Too much sample are applied at the same time. • The refrigeration unit is overloaded. • The fan for refrigeration unit does not work. • The power source voltage is low.
High pressure limit switch for refrigeration unit	Refrigeration unit is over-loaded (over-heated) and stops. The illumination of refrigeration switch and defroster switch go out. The power of service AC outlet is shut down.	• The circumstance temperature exceeds 35°C and the refrigeration unit is overloaded. • The filter for refrigeration is clogged. • Too much sample are applied at the same time. • The refrigeration unit is overloaded. • The fan for refrigeration unit does not work.
Fuse for service AC outlet	The fuse (3.15A) blows to shut down the power to service AC outlet	• The apparatus which uses 3.15A or more is connected to service AC outlet.

* After the overload relay functions and the refrigeration unit is cooled (the overload relay recovers), turn off the mains switch and turn it on to restart the refrigeration unit. It takes 3 ~ 30 min. before the overload relay recovers depending on the operating conditions.

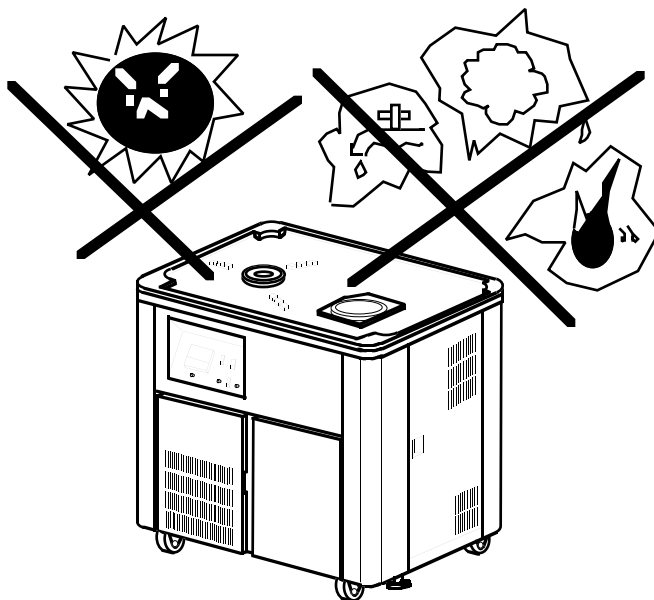
4-1 Place to be installed

**Caution****Be careful to keep good conditions of installed place.**

This unit exhausts heated air from the air cooled refrigeration unit.
Use this unit at well-ventilated place or air-conditioned place to prevent the rise of room temperature.
If the room temperature becomes high, the cooling efficiency is reduced. It may cause some mechanical troubles as the refrigeration unit is operated under high pressure and high temperature.

Place to be installed.

- **Away from direct sun light.**
- **Ambient temperature between 5 ~ 35°C.**
- **Good ventilation.**
- Away from flammable solid, liquid or gas.
- No condensation.
- Low humidity and away from drops of water .
- Less dust
- Flat and stable



4-2 Environmental conditions

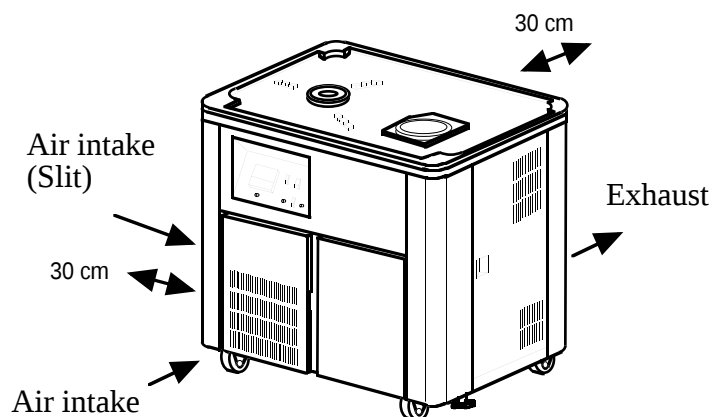
**Caution****Keep good ventilation space.**

The minimum space is required as shown right to maintain excellent performance of the unit.

**Caution****Be careful to transport unit.**

FDU-1000 (100 kg)

FDU-2000 (140)



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