



Instruction Manual

Compound Molecular Pump EBT1400F Series

**Before using the pump, read carefully and understand thoroughly the caution in this instruction manual.
Save this instruction manual for future use and reference.**

EBARA Corporation



Safety




This section provides important safety information. Be sure to read this section thoroughly before using the compound molecular pump EBT1400F, and follow all instructions.


Note that the scope of the cautions and warnings in this manual are limited to the range of our expectation. For your safety, follow all general rules (laws and regulations) in addition to the instructions provided herein.


EBARA Corporation reserves the right to make changes to the product specifications without notice, so as to maintain and improve the quality of the product. For this reason, the contents of this manual may not match exactly with the actual product.

Definitions and Symbols








In this instruction manual, “Warning” and “Caution” are defined as follows:

 Warning	<p>Important information for preventing serious bodily injuries. Failure to follow instructions labeled with this symbol may result in death or serious injury.</p>
 Caution	<p>Important information for safe use of the pump. Failure to follow instructions labeled with this symbol may result in injury and/or property damage.</p>
 Information	<p>Information that may be useful when using the pump.</p>

 Warning	Installation
	<p>Use a truck or a lift in transportation and installation. Secure the pump to a mount or floor and use the pump. Do not hang the pump above a walkway. If the pump is to be mounted to equipment, read this manual thoroughly before designing the equipment and design the equipment appropriately.</p>

 Warning	Inspection
	<p>Do not place your hands or foreign matters inside the pump.</p>



 Warning	Process gas
	Do not use the pump to exhaust gallium, mercury, their compounds, or corrosive gas. Doing so may result in pump failure.
 Warning	Overhaul
	If you could not help using the pump to exhaust toxic or reactive or flammable gas, construct the system that avoids the dangers of suction or explosion, etc. And purge the pump with inert gas before removing it from the equipment. Wear protective equipment to prevent exposure to the gas. When transporting the pump, seal the inlet, purge port, vent port, and outlet.
 Warning	Disassembly and modification
	Do not disassemble or modify the pump. It may result in serious accidents, causing death, serious injury, and/or property damage.
 Warning	Temporary inlet flange
	The temporary inlet flange is only for shipping. Do not use it for any other purpose.
 Warning	Air inrush
	Do not make air inrush into the pump when operating the pump. It may result in injury and/or pump damage.
 Warning	Heat emission
	The pump generates heat in operation. Do not touch the pump in operation, or you may get burned.
 Warning	Pump detaching
	Purge the pump with the inert gas and return it to the atmospheric pressure. Detach the pump when the rotor has stopped completely.



⚠ Caution

- 1) Compatibility of the pump and the power supply**
A proper combination between the pump model and the power supply model is required.
Use the same model of power supply as specified on the caution plate attached at the connectors of the pump.
- 2) Start and Stop**
To start/stop the pump, use the START/STOP button on the front panel of the power supply, or send Start/Stop signal through the REMOTE connector on rear panel of the power supply.
Do NOT turn the input power ON/OFF to start/stop the pump operation.
Do NOT disconnect the cable while the pump is in operation.
- 3) Gas purge**
Purge the pump in operation with inert gas when evacuating dust.
- 4) Backing pump**
Always connect the backing pump to the pump before using the pump.
- 5) Maximum throughput**
Maximum throughput of this pump is approximately as follows. It depends on backing pressure and ambient temperature.
Standard model:
 Nitrogen: 830 Pa-L/s (450 sccm)
 Argon: 460 Pa-L/s (250 sccm)
Before using the pump with a higher throughput than the above, consult with EBARA Corporation.



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1. Preface

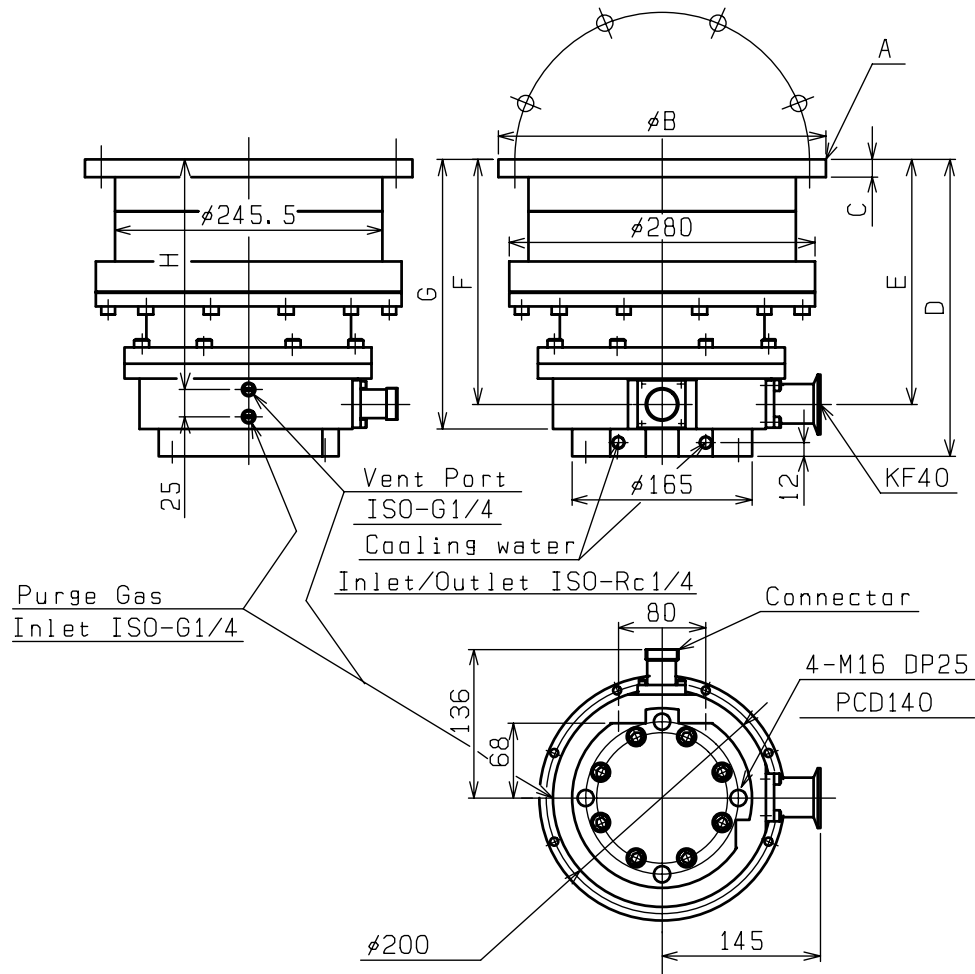
1-1. Warranty

The warranty on the pump and the peripherals is specified in the attached document, "Standard Warranty Conditions" published by EBARA Corporation.

1-2. Dimensions

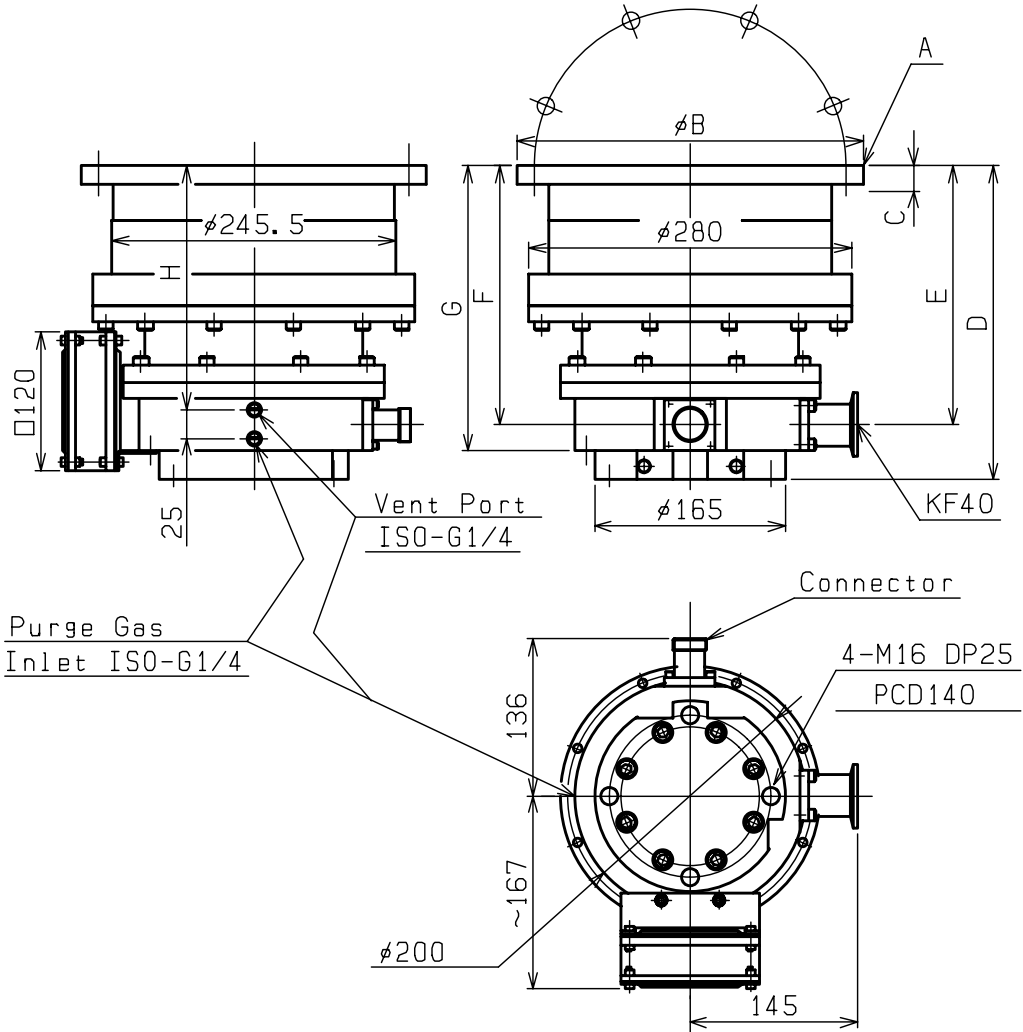
	A	B	C	D	E	F	G	H
EBT 1400F	ISO-B200	285	16	300	252.5	252.5	275	239
	CF200	253	25	319	271.5	271.5	294	258
	VG200	300	16	272	224.5	224.5	247	211

(Water-cooling Type)





(Air-cooling Type)



1-3. Name of pump parts

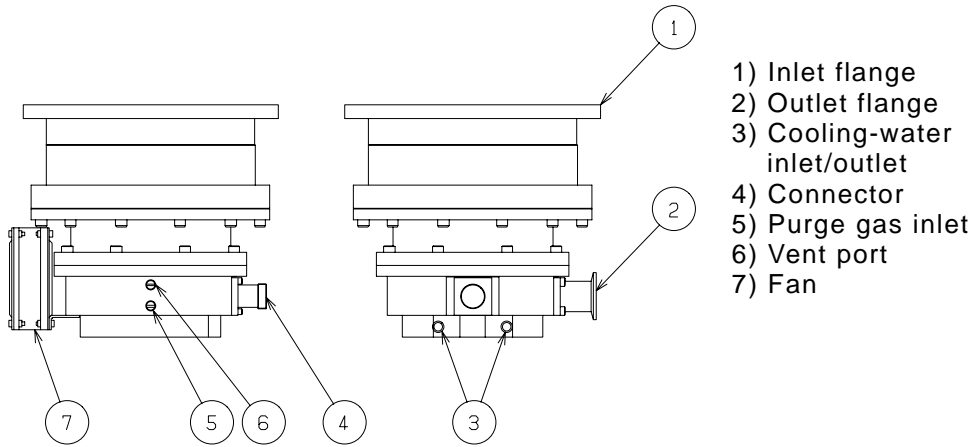


Figure 1. Name of pump parts

1-4. Nameplates

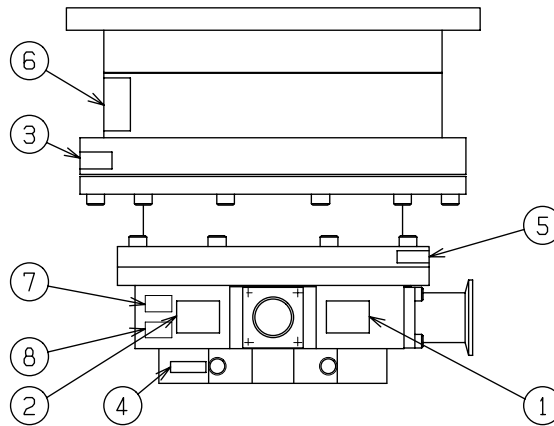
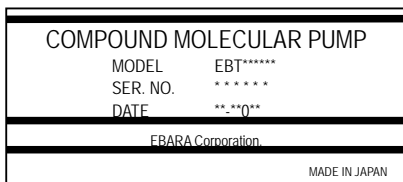


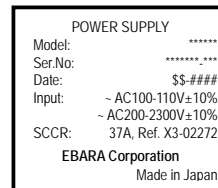
Figure 2. Nameplates

1) Main nameplate
Specifies pump type, manufacturing used number, and manufacturing date

2) Power Supply model plate
Specifies the type of power supply to be



3) Caution plate



4) Caution plate

Specifies the weight of pump



- 5) Caution plate
Connect to the backing pump



Connect the cooling-water line



- 6) Caution plate
During operation, the pump is hot.
Do NOT touch the pump



- 7) Caution plate
Connect to the venting line



- 8) Caution plate
Connect to the purge gas line



2. Opening the crate

Confirm the following items when opening the crate.

- A: Opening the crate

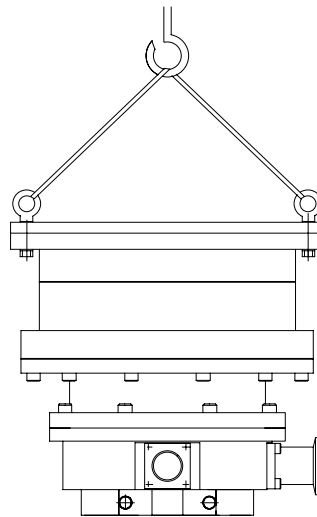


Figure 3. Example of lifting a pump

Table 1 shows the pump weight. Lift up the pump with lift etc. to put out from the crate according to figure 3.

Table 1. Pump weight

Pump	Inlet flange	Weight
EBT1400F	ISO-B200	29kg (64 lb)
	CF200	30kg (67 lb)
	VG250	29kg (64 lb)



B: Damage to the contents

If any damage to the contents is found, notify EBARA Corporation of the damage before use.

C: Components

Standard components are as follows.

- (1) Inlet flange gasket (O-ring) 1 pc.
- (2) Inlet protective screen 1 pc.
- (3) Temporary inlet blank flange with bolts & nuts 1 set
- (4) Outlet port blank flange with clamp and centering ring 1 set
- (5) Instruction manual 1 set

3. Preparation

3-1. Transportation

Use a truck or a lift etc. in transportation, installation to or removal from system. Protect the pump from impact.

3-2. Compatibility of the pump and power supply

Confirm both the pump model and the power supply model before installation. The caution plate at the pump connector on the pump shows the power supply model to be used.

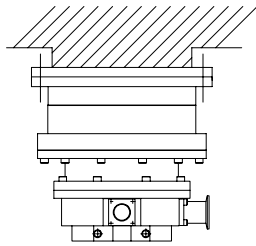
⚠ Caution	
The compatibility of the pump model and the power supply model is as follows.	
Pump model	Power supply model
EBT1400F	----- ETC1103

3-3. Pump installation

⚠ Caution
Be careful not to contaminate and/or scratch the inlet flange and do not touch inside the pump, because the pump may not be able to get sufficient performance by leak and/or contamination.

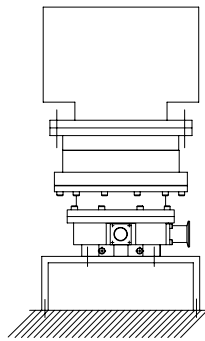
Secure the pump to the system or the frame not only at the inlet flange but also at the bottom utilizing the threaded holes prepared for securing the pump. Do not use the legs for shipping (if any) to secure the pump.

Be sure to use the bolts listed in table 3 to secure the pump.



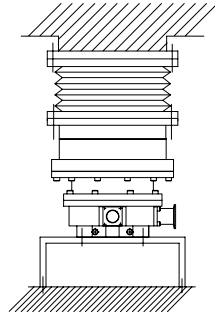
Securing method A

When the inlet flange of the pump installs to the rigid system, firmly secure the pump with the bolts listed in Table 3.



Securing method B

When the chamber installs to the inlet flange of the pump, secure the pump to the pump stand with the bolts listed in Table 3 and also secure the pump stand to the rigid floor or the frame firmly.



Securing method C

When the inlet flange of the pump installs to soft system such as bellows, secure the pump to the pump stand with the bolts listed in Table 3 and also secure the pump stand to the rigid floor or the frame firmly.

Figure 4. Example of pump installation



⚠ Warning

If an accident happens to the rotor during the pump operation, damage to the rotor will generate a large torque. This torque will try to make the entire pump rotate. Be sure to secure the pump to the frame firmly, in order to avoid any danger caused by this torque.

Use the securing bolts listed in Table 3 to secure the pump. If you could not prepare the securing bolts listed in Table 3, consult to EBARA Corporation before installation.

Do not use the legs for shipping (if any) to secure the pump.

Use metal flexible tubing or bellows to isolate the vibration of the backing pump that conducts to the pump. Also, install the backing pump separately from the pump or use a vibration absorber if the pump and the backing pump are installed in the same frame.



When planning how to secure the pump to the system, the frame or the floor, take into consideration the rotation torque listed in Table 2. Make sure the pump is secured strong enough to withstand the torque.

Table 2. Torque that can be generated when the pump is damaged

Pump model	Rotation torque (N·m)
EBT1400F	18500

Table 3 shows the size and the quantity of securing bolts of the pump at the bottom of the pump and the inlet flange. Be sure to tighten all the bolts equally and firmly.

Table 3. Securing bolts of the pump

Securing bolts location		Securing bolts (qty & size)	P.C.D.	Bolt material (property class)
EBT1400F				
Inlet flange	ISO-B200	12 x M10	260	SUS304 (70 or higher) or SCM435 (8.8 or higher)
	CF200	24 x M8	231.8	
	VG200	8 x M12	270	
Bottom of the pump		4 x M16	140	SCM435 (8.8 or higher)

3-4. Maintenance space

Keep an adequate space around the pump.

3-5. External effect on the pump

1) Ambient temperature

Ambient temperature of the water-cooling (air-cooling) pump in operation must not exceed 40°C (105°F) (32°C (90°F)). If the temperature rises, the maximum throughput will decrease.

⚠ Caution
The pump generates heat in operation. If the ambient temperature exceeds 40°C (104°F) in water-cooling type (32°C (90°F) in air-cooling type), it will cause a failure.

2) Magnetic field

Do not operate the pump in magnetic field. The permissible magnetic field of the pump is 3mT (30 Gauss) for horizontal direction and 25mT (250 Gauss) for vertical direction. When the pump will operate in stronger magnetic field than the limit, prepare magnetic shield or special pump. Consult with EBARA Corporation before operation.

⚠ Caution
The temperature of the rotor rises when the pump operates in magnetic field, and it will cause damage of the rotor.

3) External shock and vibration

Do not give an external shock or a vibration to the pump during operation.



3-6. Cooling of pump

The pump should be cooled during operation.

For water-cooling type:

- 1) Set the power supply for water-cooling type. See the instruction manual of the power supply.
- 2) Connect the cooling water pipes to the cooling water inlet and outlet ports (ISO Rc 1/4 female screw). There are two openings and either can be applied as inlet/outlet.
- 3) Make sure that cooling water supply pressure is 0.6 MPa (5kgf/cm²G, 72.5psiG) or lower. The minimum required flow rate of cooling water is 1.5 L/min. Use as clean water as possible.
- 4) Control the temperature of cooling water in the range of 10°C (50°F) to 35°C (95°F) at inlet.
- 5) Be careful that cooling water does not freeze in cold temperatures
- 6) The pump can be stopped when the cooling water is interrupted by application of flow switch to the cooling water outlet. Connect the contact (normally closed) of the flow switch to the protection terminal of the control connector of the power supply. Refer to the instruction manual of the power supply.

For air-cooling type:

- 1) Set the power supply for air-cooling type. See the instruction manual of the power supply.
- 2) Connect the fan cable to the fan.

4. Vacuum piping

4-1. Inlet port piping

- 1) Use materials for the piping with a small out gassing rate such as stainless steel or aluminum alloy.
- 2) Take the piping conductance into consideration when designing the piping.
- 3) Minimize the leak rate at the piping and the system. Degrease the wall surface of the vacuum piping in order to minimize the out gas.
- 4) When the pump is installed in a system, do not remove the protective screen at the inlet. The protective screen prevents foreign objects from falling into the pump.

⚠ Caution

Even with a protective screen, foreign objects may fall into the pump. It may cause an issue or damage to the pump.

4-2. Selection of backing pump

- 1) The performance of the pump depends on the capacity of the backing pump. Refer to Table 4 for the backing pump selection. Recommended backing pump capacity is shown in the table. Use a backing pump that has a capacity at this level or higher.

Table 4. Recommended backing pump capacity

Pump model	Recommended backing pump capacity
EBT1400F series	250L/min (8.8 CFM) or higher

⚠ Caution

If the performance of the backing pump deteriorates, the performance of the pump also deteriorates.

4-3. Foreline piping

- 1) Use stainless steel, aluminum or metal flexible tubing etc. for piping to connect the pump to the backing pump.
- 2) The length and diameter of the piping will affect the pump performance. Minimize the piping length and maximize the diameter for a larger conductance.
- 3) Use metal flexible tubing or bellows to isolate the vibration of the backing pump that conducts to the pump. Also, install the backing pump separately from the pump or use a vibration absorber if the pump and backing pump are installed in the same frame.

4-4. Purge gas line piping

When pumping a dust, purge the inside of the pump from the purge gas inlet. Refer to Figure 5.

Nitrogen is commonly used as purge gas. Set the flow rate to 9.2 Pa·L/min (5sccm). When the pump is not being purged, shut the purge gas inlet with a blank plug.

⚠ Caution

Excessive or insufficient purge gas flow rate causes failure or deterioration of the pump performance.

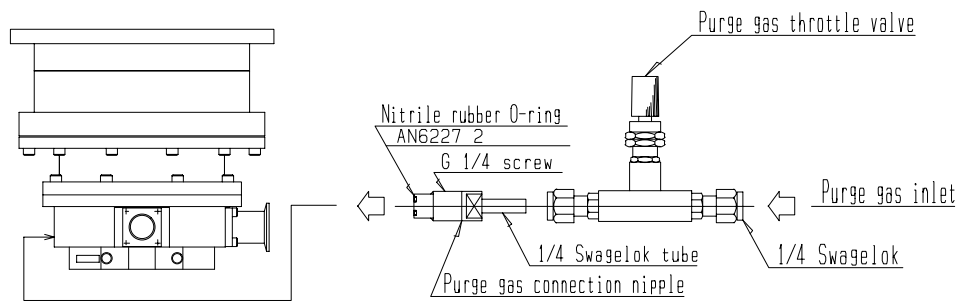


Figure 5. An example of purge gas line piping

5. Cable connection

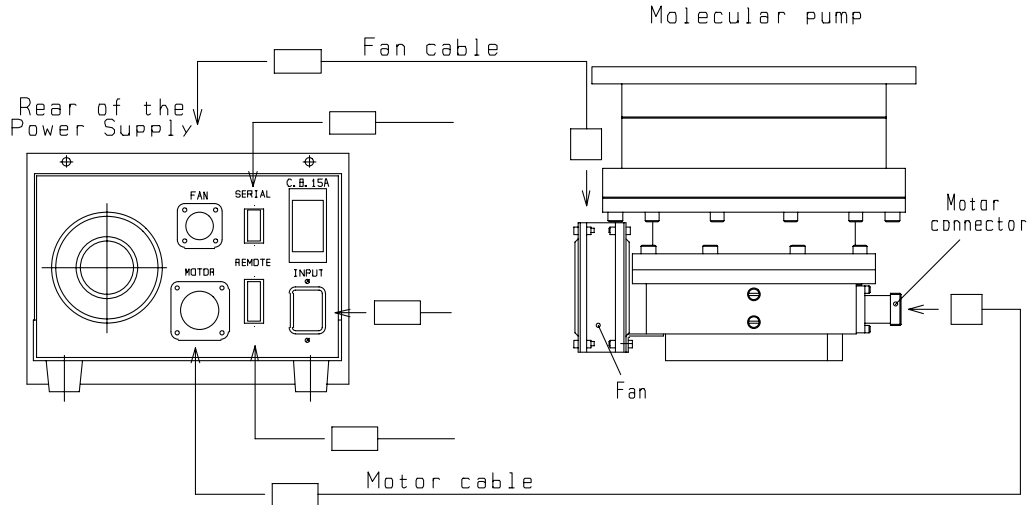


Figure 6. Connection of ETC1103

⚠ Warning

Be sure to shut the input power off to the power supply before connecting the cables. Otherwise, you may get an electric shock.

Be sure to confirm the combination between the pump model and power supply model. Connect the connector on the pump and “MOTOR” connector or “OUTPUT” connector on the rear panel of the power supply with motor cable. Connect the connector on the fan and “FAN” connector on the rear panel of the power supply with fan cable.

⚠ Caution

When connecting the motor cable, set the pins to correct position, plug in the connector at a straight angle and fasten the coupling nut to the end.



6. Operation

6-1. Precautions before operation

- 1) Be sure to confirm the combination of the pump model and the power supply model.
- 2) Make electrical connection of the pump and the power supply. Refer to the instruction manual of the power supply.
- 3) The pump needs to be cooled during operation. See also section 3-6.

For water-cooling type:

Connect the cooling water line to the cooling water inlet/outlet at the pump. Use as clean water as possible. Be sure that the interlock is operating so that the pump will stop automatically if the cooling water flow stops or the flow rate becomes too low. The minimum required flow rate of cooling water is 1.5 L/min (0.3 gpm), and acceptable temperature range is 10 - 35°C (50 - 95°F) and water pressure is below 0.6 MPa (5kgf/cm²G, 72.5psiG).

For air-cooling type:

Connect the fan cable to the fan.

⚠ Caution

If cooling is insufficient, it may cause pump failure
--

- 4) The pump and backing pump can be started up together. However, the pump may have a failure of "oL1" which means acceleration time over during acceleration and the pump may stop, if the volume of the chamber is very large. In this case, follow the next procedure.
If the chamber pressure does not reach 330 Pa (2.5 Torr) within 7 minutes only with the backing pump, continue to pump the chamber only with the backing pump. Once the chamber pressure reaches 330 Pa (2.5 Torr), then start the pump.
- 5) When pumping dust, purge the inside of the pump from the purge gas inlet. Set the purge gas flow rate 9.2 Pa·L/min (5sccm).

⚠ Caution

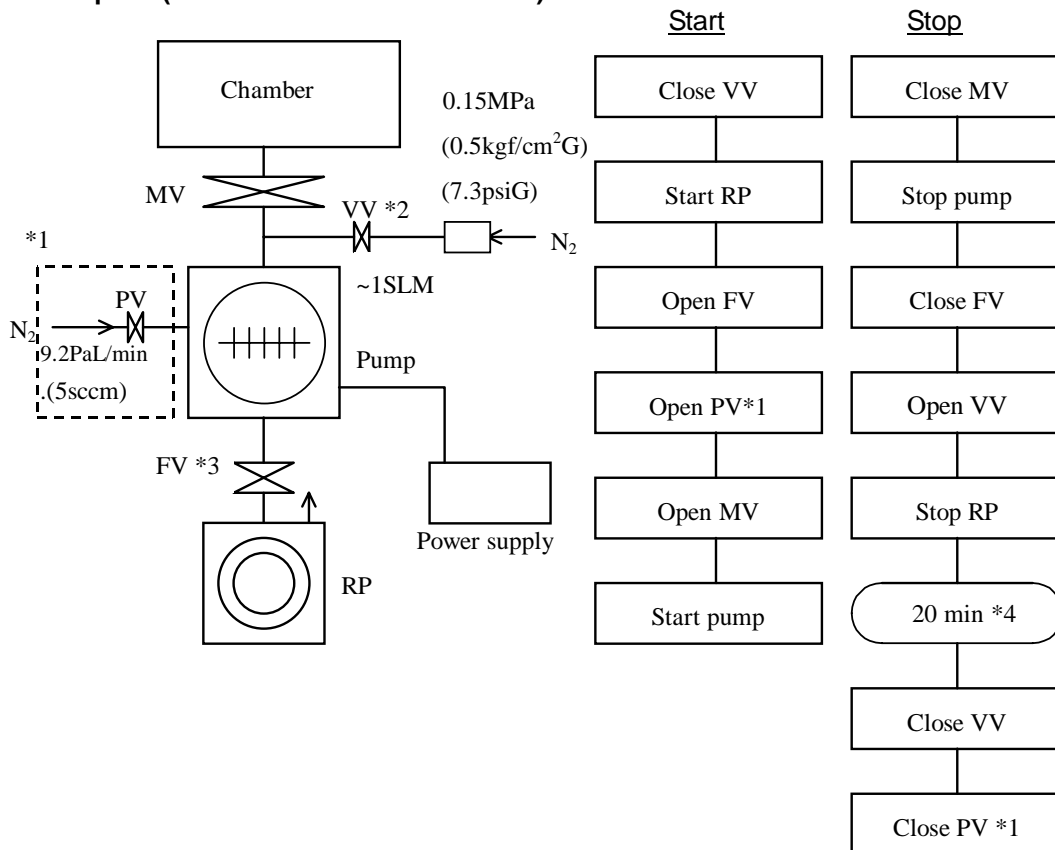
Excessive or insufficient purge gas flow may cause deterioration or failure of the pump.

6-2. Starting / Stopping the pump

The pump can be operated with signal from the START/STOP button on the front panel of the power supply for LOCAL operation or can be controlled remotely with signals from the system for REMOTE operation. Refer to the instruction manual of the power supply for operation in detail.

Refer to the following two examples of start/stop procedure.

a. Example 1 (with main and foreline valves)



Pump: EBT1400F series
 RP: Rotary pump
 MV: Main valve
 VV: Vent valve
 FV: Fore valve
 PV: Purge valve *1

- *1 In case the pump is gas-purged.
- *2 Install VV between FV and Pump on some system.
- *3 It is possible to remove FV if RP has shut-off valve.
- *4 Venting time to avoid the back streaming from lubricant.

Figure 9. Example 1 of start/stop procedure

b. Example2 (without main valve or foreline valve)

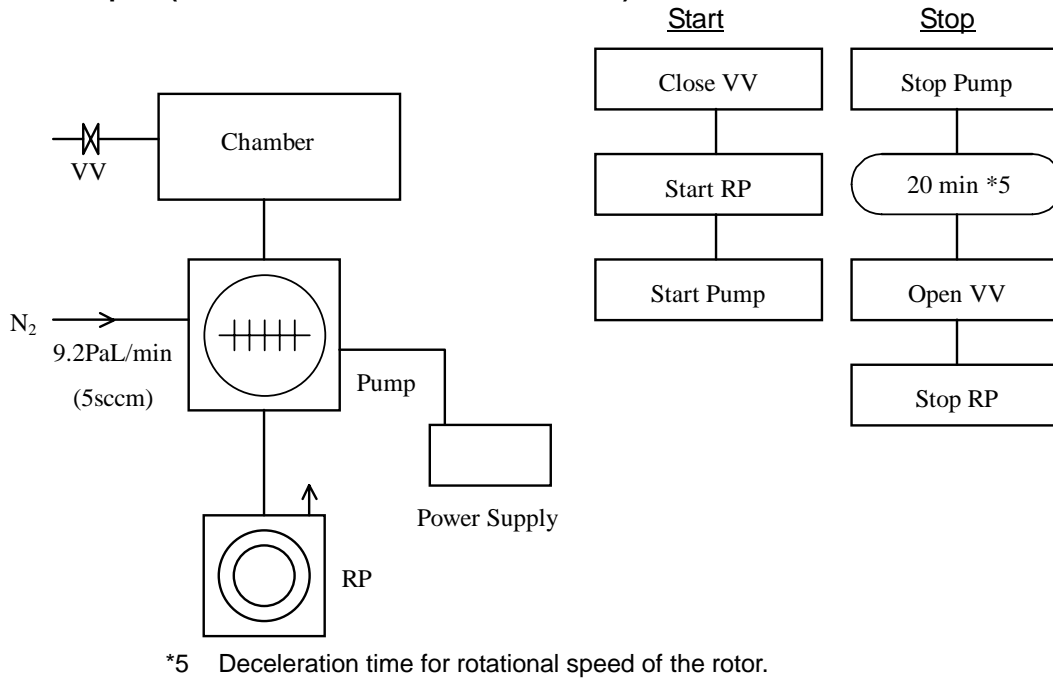


Figure 10. Example 2 of start/stop procedure

⚠ Warning

Vent the inside of the pump to atmosphere when the pump stops completely. Oil vapor may flow back to whole inside of the pump if the pump is kept in vacuum. Backflow like this case may cause deterioration. Do not exceed pressure inside the pump to 0.17 MPa (0.7 kgf/cm²G, 10.2psiG). Otherwise, the pump may damage.

6-3. Starting / Stopping the pump during operation

The pump can be stopped during acceleration or can be re-accelerated during deceleration.

7. Baking

Baking the chamber will improve the ultimate pressure. Mount a baking heater on top of the pump casing for baking of the pump as shown below:

Keep baking temperature below 120 °C (248 °F). The baking heater is provided as the option.

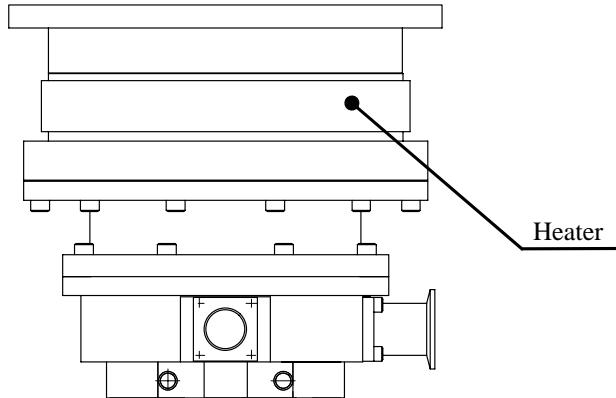


Figure 11. Position of the heater

⚠ Caution

A wrong position of a baking heater or an excessive baking temperature may result in the pump failure. Do not exceed 120°C (248 °F) of the baking temperature at inlet flange.

8. Maintenance

8-1. Vibration

If the level of pump vibration increases abnormally during normal operation, which you can feel by hand or measured full amplitude of the vibration is 1 μm or more with vibration meter, contact EBARA Corporation.

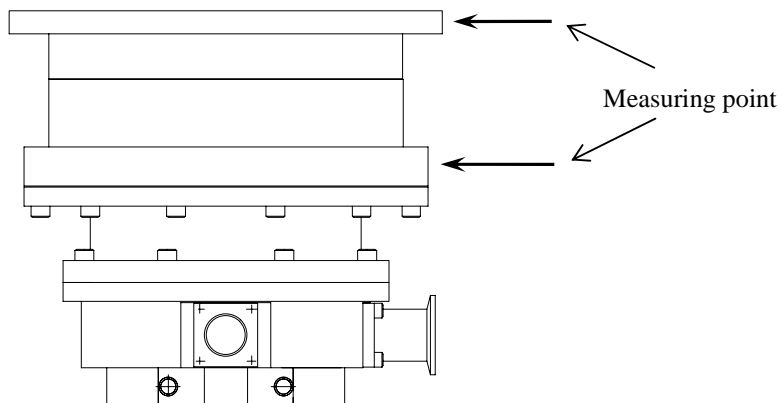


Figure 12. Measurement of vibration at inlet flange and/or bottom of casing



8-2. Reactive products

If a lot of reactive products deposits on inside the pump, it will make the pump unable to start or will cause a more serious problem. Overhaul the pump periodically.

⚠ Caution

If reactive products are left inside the pump, the parts will be corroded, and the pump will be unable to be overhauled.

8-3. Replacement of bearings

The lifetime of the bearing varies with process. Periodical overhaul is recommended to replace the bearings, every 30,000 hours with non-reactive gas. Consult with EBARA Corporation about replacement of the bearing if the pump needs to evacuate dust.

8-4. Air inrush

The pump can be restarted easily after an accidental air inrush. Contact EBARA Corporation if you experience any difficulties.

8-5. Precaution of operation in low temperatures

Be careful not to freeze the cooling water in cold weather
It is possible that the pump gets failure of "oL1", acceleration time over, during acceleration when operating the pump in winter. Because the viscosity of the lubricant rises by low temperature and it requires larger torque. In this case, re-start the pump after resetting the failure.

9. Storing the pump

Cover the inlet flange, the outlet flange and the purge gas inlet with blank flanges and plugs before storing the pump for a long time.

Purge the pump with an inert gas such as nitrogen, so as not to leave any reactive or corrosive gas in the pump.

If the reactive products deposits inside the pump, overhaul the pump before storing.

Do not store the pump in the following environments:

- 1) High temperature and/or high humidity
- 2) In strong electric and/or magnetic field
- 3) Near reactive and/or corrosive gas
- 4) Near radioactive substance
- 5) Under dripping water
- 6) Near strong vibrations
- 7) Dusty area
- 8) Sea Breeze area

It is possible to get failure caused by bad lubrication when the pump is stored more than 6 months. If the pump had any problem, contact with EBARA Corporation

It is available for operation check of the pump at EBARA Corporation service center. Or, operate the pump every 6 months for lubrication of the bearing.



10. Recommended Overhaul and service

The mean time of overhaul of the pump varies in applications and natures of gases pumping.

Be sure to overhaul the pump before 30,000 hours operation, which is lifetime of bearing when the pump evacuates non-reactive gas only. The pump has to be overhauled, even if the pump is not experiencing any issues, when operation time reaches 30,000 hours. Consult with EBARA Corporation about replacement of the bearings when the pump needs to evacuate corrosive gas, reactive gas or dust.

Contact EBARA Corporation or a service agent contracted with EBARA Corporation when the pump needs overhaul or repair.

Be sure to disclose all the evacuated gases that are harmful and/or reactive, and even non-harmful and non-reactive gases before shipping back to EBARA Corporation or service agent. Otherwise, the pump cannot be overhauled or repaired.

Purge inside the pump with non-reactive gas before sending back. Cover the inlet flange, the outlet flange, the vent port and the purge gas inlet firmly to avoid leaking the reactive products from the pump.

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⚠ Warning

Purge the pump with inert gas before dismounting it from the system if the pump has evacuated harmful or reactive gas. Take protective measures not to expose the human body to the harmful gas, reactive gas or reactive products. Be sure to disclose all the evacuated gases that are harmful and/or reactive, and even non-harmful or non-reactive gases before shipping back to EBARA Corporation or service agent. Otherwise, the pump cannot be overhauled or repaired.

Purge inside the pump with non-reactive gas before sending back. Cover the inlet flange, the outlet flange, the vent port and the purge gas inlet firmly to avoid leaking the reactive products from the pump.

11. Discarding

When the pump is disabled (to use), discard it as industrial waste.

12. Specifications

EBT1400F

Volume flow rate	for nitrogen	1400 L/s
	for nitrogen with protective screen	1300 L/s
	for hydrogen	750 L/s
Maximum compression ratio	for nitrogen	1×10^8
	for hydrogen	4300
Ultimate pressure ¹⁾	< 1×10^{-6} Pa (7.5×10^{-9} Torr)	
Maximum backing pressure	330 Pa (2.5 Torr)	
Recommended backing pump	≥ 250 L/min (8.8 cfm)	
Startup time	5.5 – 7 min	
Shutdown time	15 – 18 min	
Permissible bake-out temperature at inlet flange	≤ 120 °C (248 °F)	
Rated rotational speed	33600 min ⁻¹	
Installation position ²⁾	Any	
Cooling water	Required flow rate	≥ 1.5 L/min (0.39 gpm)
	Temperature at inlet	10 – 35 °C (50 – 95 °F)
Permissible ambient temperature	Water-cooling type	10 – 40 °C (50 – 104 °F)
	Air-cooling type	10 – 32 °C (50 – 90 °F)
Weight	Inlet flange: ISO-B200, VG200	29 kg (64 lbs)
	Inlet flange: CF200	30 kg (670 lbs)
Pollution degree	2	
IP rating	IP10 (service areas)	
Maximum noise level	90dB (A)	

1) Pressure attained after 48 hours of bake-out

2) Pump must be firmly secured to your system



Contacting EBARA

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