

# **INSTRUCTION MANUAL**

---

## **MULTI-STAGE DRY VACUUM PUMP**

**MODEL ESA130-CN**  
**STANDARD MODEL**  
**380-400V(50Hz)**



**Caution:**

Please read and understand this INSTRUCTION MANUAL thoroughly before using this equipment.

Be sure to keep this INSTRUCTION MANUAL on hand for future reference

To Facility and Tool Manufactures:

Be sure to distribute this INSTRUCTION MANUAL to all end-user personnel actually operation this equipment.

「Model OOO」 in this INSTRUCTION MANUAL is our model code

**ISSUED BY PRECISION MACHINERY COMPANY**

The Products described herein fall under "the goods listed in row 16 of the appended table 1 of the Export Trade Control Order of Japan", so in cases of export of such Products, you need to confirm "use" and "purchaser and/or end-user" and, as case may be, obtain the approval of the Minister of Economy, Trade and Industry. (Please confirm these conditions on your own.)

For more information, please contact our sales office located near you.

Do not reproduce or reprint any portion of this manual without permission.  
Manufacturer reserves the right to discontinue or change any specifications or designs without notice and without incurring obligations.  
Model ○○○ in this manual is our model code.

All rights reserved, copyright EBARA Corporation.

---

## Environmental Basic Policies

It is our responsibility, as people of the earth, to protect nature's irreplaceable treasures and to pass them on to future generations.

As we undertake our business activities, we will establish environmental management systems and implement ongoing improvements and reviews, while striving to promote harmony between technology and nature, prevent environmental pollution, and improve the overall results of our environmental management activities. We are aware that environmental protection and management activities are the responsibility of all managers and employees of the Corporation, and each person will demonstrate this awareness when carrying out his or her duties.

We will widely publicize these basic policies to regional societies and the general public and work to make Ebara's position on the environment clear to society in general.

## Safety Information

It is essential that those operating this pump should have the knowledge to identify and avoid hazardous conditions associated with the pump.

Inadequate or rash operation may cause dangerous and serious accidents.

Before installation and operation, the operator should first have a good knowledge of the pump construction, operation procedure, and its hazards.

The operator should read through this instruction manual and other documents issued by EBARA in detail.

If you have any questions on pump operation, safeties, and maintenance, please do not hesitate to contact EBARA directly. Refer to Global network for contact address.

Three terms designating the level of hazard are used in this manual.



### **DANGER**

indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



### **WARNING**

indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



### **CAUTION**

indicates an imminently hazardous situation which, if not avoided, may result in minor or moderate injury.

This term may also be used as a warning for situations liable to damage to equipment.

---

## Important Prior Warnings

**DANGER**

Keep out from under the pump when lifted.  
Only qualified personnel shall unload and lift the pump.

**WARNING**

Be careful not to overturn the pump when pushing and pulling it sideways, because the width of the pump is small to its height.

**WARNING**

All electrical works must be performed by only a qualified electrician.  
All national and local electrical regulations must be observed.

**WARNING**

Interrupt Circuit Breaker (CB) before starting on wiring and maintenance work.  
Do not switch on the power supply to the pump until work is completed.

**WARNING**

Supply N<sub>2</sub> gas to the exhaust piping when necessary to dilute the inflammable or toxic gas up to a safe concentration.

**WARNING**

Purge with sufficient N<sub>2</sub> gas before removing and washing the vacuum and exhaust piping.  
Do not let inflammable, toxic or dangerous materials disperse and guard against contact with the human body.  
Always work in a location with an escape route in an emergency.

**WARNING**

Do not use the pump for another process without a previous overhaul. Gases or reaction products remaining in the pump will react and lead to accidents with the formation of large amounts of products.



**WARNING** To avoid any hazard induced by toxicity, flammability and explosiveness of the process gases used in the tool, be sure to operate the tool according to the operations safety guidelines supplied by tool suppliers.

Appendix 6 lists typical process gases used in a semiconductor-processing tool. However, details concerning the tool gases and other concerns specific to your tool should be directed to the respective tool suppliers.



**WARNING** Check for gas leaks after installing and maintaining the piping. Gas leaks will result in the discharge of harmful and dangerous substances and in abnormal reactions due to the ingress of air into the pump. When checking for gas leaks by pressurization, please pressurize by less than 0.05 MPa into the purge port and do check.



**WARNING** Do not alter the pump member nor change any parts without the EBARA's consent or approval.



**WARNING** The pump casing and exhaust piping become extremely hot during operation and for some time after stopping. Be sure that pump and exhaust piping do not come in contact with humans or inflammable substances. Do not remove the pump cover during operation.



**WARNING** Check Safety Interlock functions periodically (every 6 months) to confirm the interlocks will work correctly.



**CAUTION** Disposal of process by-products shall be strictly in accordance with all local and national environmental and safety regulations.



**CAUTION** Disposal of Printed circuit board containing Lithium battery shall be strictly in accordance with all local and national environmental and applicable regulations.

**WARNING**

In designing the dry pumps, Ebara does not assume risks caused by hazardous chemical reactions resulted from simultaneous injection or mixture of multiple process gases in the pumps, and the pump is not equipped with a protection against the dangers from such pump usage. The tool suppliers and users must pay attention not to simultaneously inject or mix those gases.

**WARNING**

Do not perform a withstand voltage test.

Failure to comply could result in damage to the sensitive devices.

**CAUTION**

Never operate the pump without pump cover for safety.



Following safety warning labels are attached to pump covers.

1. High temperature warning
2. Hazardous voltage warning
3. Hazardous materials warning
4. Hazardous weight danger
5. High temperature eyebolt warning
6. Anti Earthquake fixture warning

1. High temperature warning

Hot surface may burn or cause injury.

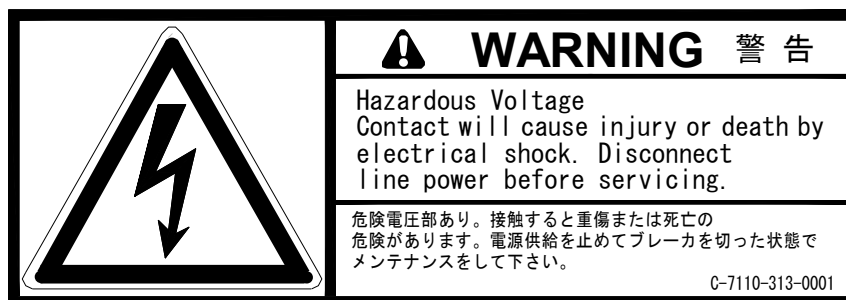
Allow the piping and casing to cool before servicing.



2. Hazardous voltage warning

Hazardous Voltage may shock, burn, or cause death.

Turn power off and lockout before servicing.





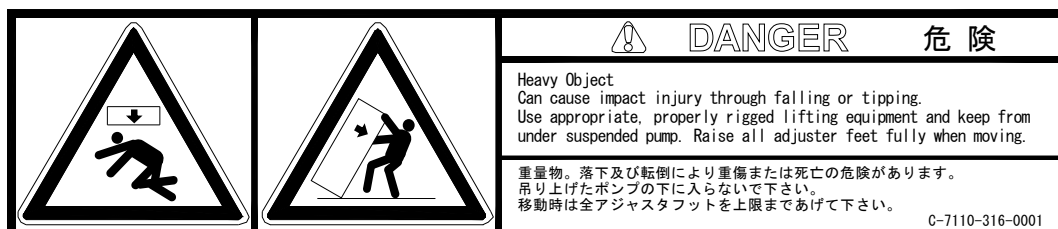
### 3. Hazardous materials warning

In case of hazardous materials are handled. Run the pump only with N<sub>2</sub> gas purge before servicing. Take adequate measures against dangerous reaction and contact with human body.



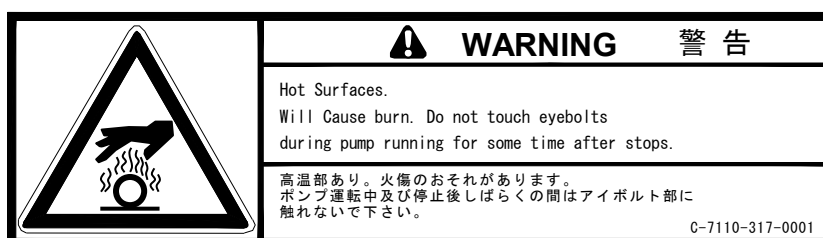
### 4. Hazardous weight danger

Heavy weight may cause severe injury or death due to overturning or falling pump. Keep out from under the lifted pump.  
 Raise all adjuster-feet fully when moving.



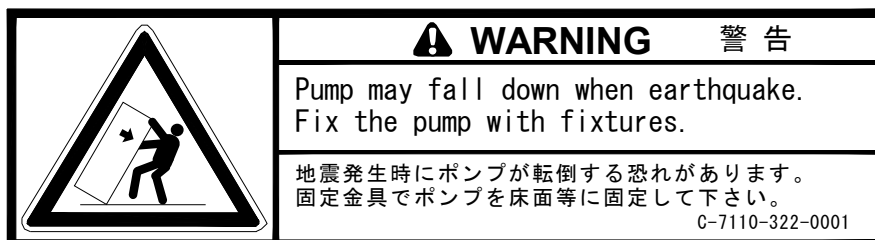
### 5. High temperature eyebolt warning

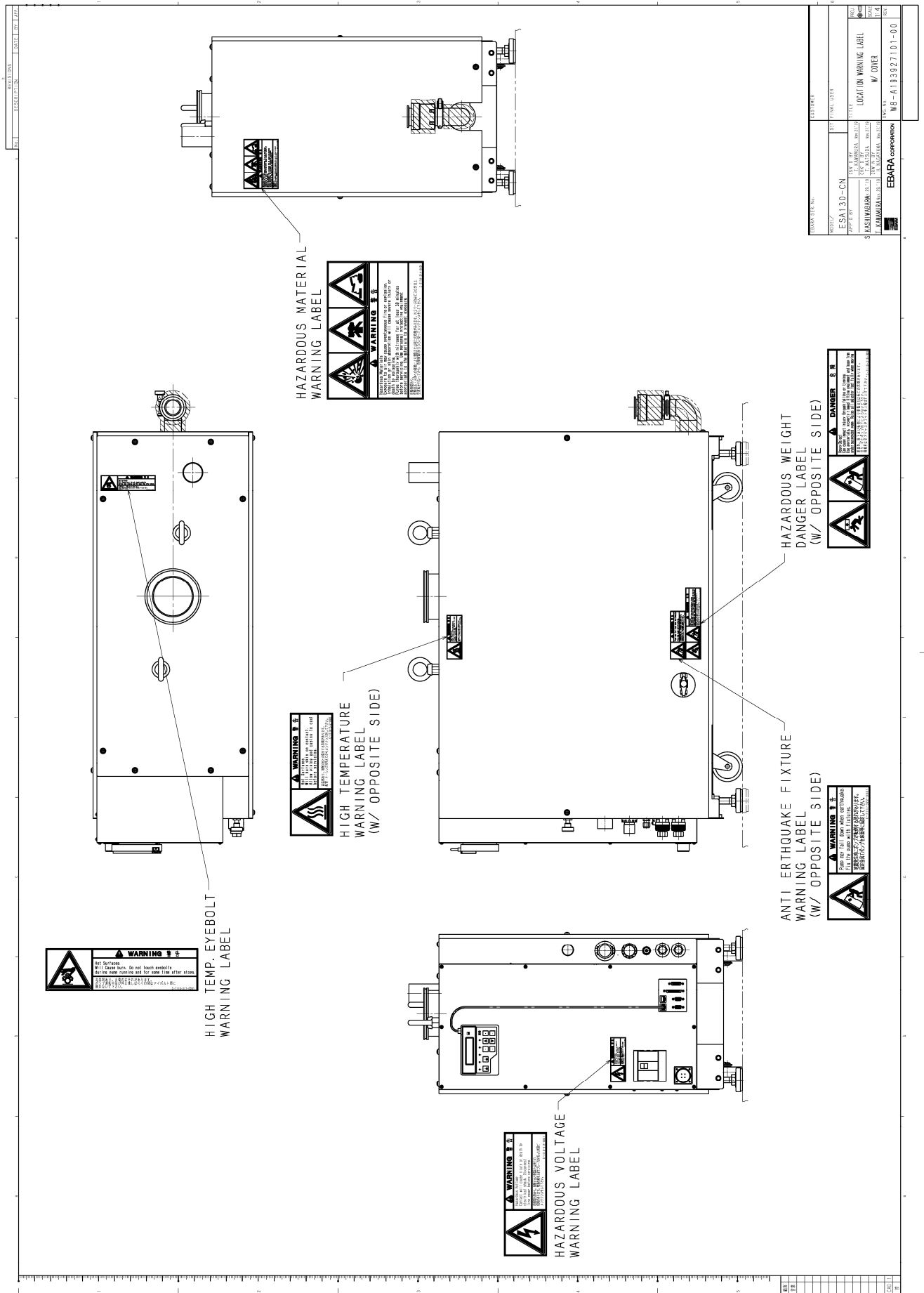
Hot surface may burn or cause injury.  
 Allow the eyebolt to cool before servicing.

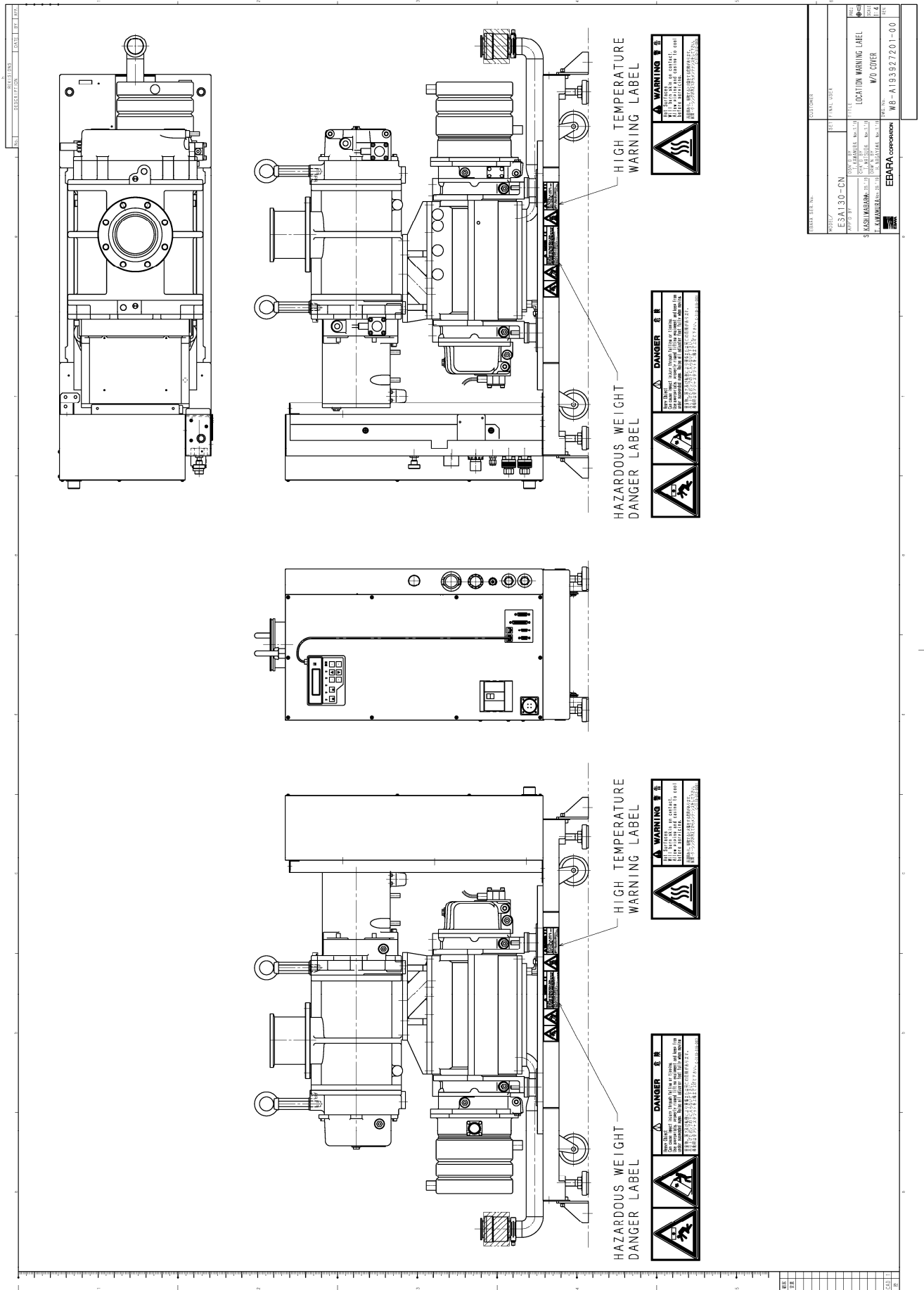


6. Anti earthquake fixture warning

To prevent fall down of the pump caused by earthquake,  
Pump must be fixed on the floor with attached fixtures.







---

## Standard Limited Warranty

The terms of this Warranty limit the liability of EBARA CORPORATION. Please read it carefully.

### Duration

For new pumps, the Warranty period shall be one (1) year from the date of commencing operation by user or 18 months from shipment by EBARA, whichever comes first. This Warranty does not apply to service beyond these time periods.

For overhauled pumps, the warranty period shall be six (6) months from shipment by EBARA.

### Coverage

For the duration of the Warranty period, EBARA warrants this ESA pump from failure due to defects in materials or workmanship. For such failures, EBARA will, at its option, either replace or repair the pump free of charge

Such repair or replacement will not extend the duration of the warranty beyond the original period.

For repairs not covered under this Warranty, EBARA will charge the customer for parts and labor.

### Exclusions and Limitations

This Warranty does not cover the following:

1. Failure due to operating the pump in a manner or under conditions other than as described in the instruction manual.
2. Failure due to corrosion, byproducts or foreign material entering the pump.
3. Failure due to fire, flood, earthquake, Acts of God, Acts of War or other circumstances beyond EBARA's control.

Disassembly or repair of the pump by parties other than EBARA or EBARA-authorized suppliers will void this Warranty.

EBARA's liability is limited to repair or replacement of the pump under Warranty. EBARA accepts no liability for consequential damages, including injury to personnel and damage to facilities, tools or product.

EBARA makes no Warranty of merchantability, beyond statutory requirements, or of fitness for a specific purpose.

## Contents

Environmental Basic Policies .....	i
Safety Information .....	ii
Important Prior Warnings .....	iii
Standard Limited Warranty .....	xi
Contents .....	xii
1. Foreword .....	1
2. Introduction .....	1
2.1 Introduction .....	1
2.2 Environmental Concerns .....	2
3. Product Description .....	3
3.1 Outline .....	3
3.1.1 Pump Module .....	3
3.1.2 N2 Gas .....	3
3.1.3 Cooling Water .....	4
3.1.4 Exhaust .....	4
3.2 Control System .....	4
3.2.1 Warning .....	4
3.2.2 Operation Status Control .....	5
3.3 The way of pump moving .....	5
3.3.1 Preparation .....	5
3.3.2 Moving method .....	5
3.4 Detailed Specifications .....	7
Table 3.1 Specification .....	7
Outline Drawing .....	8
Performance Curve .....	9
4. Installation .....	11
4.1 Movement and Fixation .....	11
4.1.1 Location .....	11
4.1.2 Caster and adjustment foot .....	11
4.2 Piping .....	13
4.2.1 Vacuum and Exhaust Piping .....	13
4.2.2 Cooling Water Piping .....	14
4.2.3 N2 Gas Piping .....	15
4.2.4 Ventilation Duct .....	16
4.3 Electrical Wiring .....	18

4.3.1	Grounding .....	18
4.3.2	Power Supply Wiring .....	19
4.3.3	Control Signal Wiring .....	20
4.4	Communication .....	24
4.4.1	Communication Specification .....	24
4.4.2	Receptacle Specification .....	24
4.4.3	Communication Commands .....	25
5.	Power Supply for accessories .....	26
6.	LCD Controller .....	27
6.1	LCD Outline .....	27
6.2	LCD Indication .....	28
6.3	Setting the operational mode .....	32
6.3.1	Setting the pump operation control mode .....	34
6.3.2	Setting the DIP switch .....	34
6.3.3	Setting the pump running mode .....	35
6.3.4	Setting the BP normal rotational speed .....	35
6.3.5	Setting the rotational speed in the LOW SPEED mode .....	35
6.3.6	Setting the pump N2 flow low warning threshold .....	36
6.3.7	Setting the dilution N2 0mode warning threshold (option) .....	36
6.3.8	Setting the Back Pressure high warning threshold (option) ..	37
6.3.9	Pump Valve control (option) .....	37
6.3.10	After-Sequence Function Setting .....	38
6.4	Dip Switch .....	39
6.5	DIP Switch setting display .....	42
6.6	Starting/stopping the pump with the LCD controller .....	44
7.	Operation .....	45
7.1	Before Starting .....	45
7.2	START/STOP .....	48
7.2.1	LOCAL Start/Stop .....	49
7.2.2	REMOTE Start/Stop .....	49
7.2.3	COMMUNICATION Start/Stop .....	50
8.	Maintenance and Inspection .....	51
8.1	Internal energies .....	51
8.1.1	Power source .....	51
8.1.2	Cooling water .....	51
8.1.3	Nitrogen gas .....	51
8.2	Routine Inspection .....	52
8.3	Vacuum and Exhaust Piping .....	53

8.4	Lubricant Oil.....	54
8.5	Spare (Maintenance) Parts List .....	58
8.6	List of wastes during maintenance .....	59
8.7	Overhaul .....	60
9.	Disconnection and Transportation.....	61
10.	Troubleshooting.....	63
10.1	Troubleshooting (1) Basic trouble .....	63
10.2	Troubleshooting (2) WARNING .....	65
10.3	Troubleshooting (3) ALARM .....	67
10.4	Troubleshooting (4) Option .....	70



## 1. Foreword

We appreciate that you have selected an EBARA dry vacuum pump ESA200W. This pump has been manufactured with much care and attention so that it can be operated safely and satisfactorily.

Incorrect operation will result in lack of performance and cause accidents and injuries to personnel.

**[ NOTE ]** This instruction manual contains all necessary information on operation and maintenance of the pump.

Be sure to operate the pump correctly in accordance with these instructions to ensure a long service life.

Keep this instruction manual in a suitable place for immediate reference whenever needed.

## 2. Introduction

### 2.1 Introduction

Check the following items on receipt of the pump package.

(1) Check that the nameplate affixed to the outer cover of the pump to confirm that the pump supplied agrees with your order.

Check the accessories against the packing list and the previously submitted drawings and documents to confirm that the all ordered accessories have been supplied.

((2) Check whether damage has occurred or screws/bolts have worked themselves loose in transit.



**CAUTION** Notify EBARA without delay when damage is discovered or when components are missing. Do not use when a leak is present as this will result in accident.

(3) Store the pump in a dry and clean place if it is not installed at once after delivery.

Temperature	: 5-40°C
Humidity	: 80% or less

(4) Do not stack the pump. Pump must be placed in an upright position.

## 2.2 Environmental Concerns

Handling or operating the unit other than specified may induce adverse impacts on the environment. Follow the descriptions below to handle, operate, and maintain the unit.

- (1) Ask an authorized waste-disposal company to dispose packing materials from uncrating according to laws and ordinances applicable to the waste.
- (2) Failure to do the unit maintenance (including overhaul) may trigger accidents causing injury or death, unit troubles, or environmental pollution. Plan the maintenance and perform it periodically to operate the unit efficiently.
- (3) To dispose the unit, follow effective laws and ordinances applicable in the area where the unit is installed.
- (4) To dispose the lubricant oil and chemicals, follow effective laws and ordinances applicable in the area where the unit is installed.



**WARNING** If the pump becomes damaged during shipment or if parts are missing, immediately contact EBARA. If a leaking or damaged product is used, an accident resulting in injury or death could occur or the product could become further damaged. Even if leakage occurs, take measures to ensure they will not be directly discharged from the site, as such leakage also wastes resources.



**CAUTION** If the product is not to be immediately installed, store it in a clean, dry location.

### 3. Product Description

#### 3.1 Outline

This pump has a compact design and includes various sensors and controls to enhance reliability and operation.

##### 3.1.1 Pump Module

The pump is a Roots type vacuum pump which rotates a pair of non-contact multi-stage rotors synchronized by timing gears. In the unit, a Booster Pump (BP) and the Main Pump (MP) are connected in series for ventilation.

The timing gears and bearings are enclosed in a compartment that is independent of the casing. For lubrication Perfluoro-Polyether (PFPE) oil is used.

The pump is filled with lubricating oil at the factory. Use only the recommended lubrication oil grades shown in specification Table 3.1 for replenishing or replacing.

##### 3.1.2 N<sub>2</sub> Gas

Introduce nitrogen gas to dilute the hazardous gases to an unarmful level. Properly connect the nitrogen gas line to the purge port provided according to the instructions in Table 3.1 and the descriptions in Section 4.2.3. In the cases the gas concentration may become higher than the specified for safe gas exhaust, introduce the nitrogen gas to lines to the exhaust outlet. The tool user shall provide the purge port for this purpose.

N<sub>2</sub> gas is also required to supply to seal the shaft section. This protects the penetration to bearing section, such as corrosive gas.

To reduce pump corrosion due to process gas or accumulation of reaction by-products, N<sub>2</sub> gas is supplied to each pump component as dilution purge gas. Stopping the dilution N<sub>2</sub> with a selector valve can save N<sub>2</sub> gas, when process does not produce corrosion and reaction by-products.

The correct amount of N<sub>2</sub> gas is supplied for those two types of purge operation, by adjusting the regulation pressure to the specified value.

The nitrogen gas selector is locating on the right side of the unit, facing the LCD controller and other utility connectors. It is under the outer cover.

### **3.1.3 Cooling Water**

Because the pump compresses gas from a vacuum to atmospheric pressure, compression heat is generated. Therefore cool the motor with cooling water. The cooling water connector takes the form of a coupler for easy connection and disconnection.

### **3.1.4 Exhaust**

A check valve is provided as a standard accessory to prevent reverse flow of gas from the exhaust through the pump to the vacuum chamber when pump is stopped.

## **3.2 Control System**

This pump has a built-in measuring unit consisting of a Circuit Breaker (CB), an electro-magnetic switch and a control circuit.

To improve reliability and safety, the condition of each utility and pump section is monitored by a sensor.

During pump operation all operating conditions are monitored, including power supply, cooling water flow, N<sub>2</sub> gas flow, casing and motor coil temperature, motor speed, and electric power for motor.

Continuous operation is possible when there is a momentarily power failure of 1 sec or less.

### **3.2.1 Warning**

To assure the reliability of the pump as a vacuum exhaust system, the pump protection system generates two levels of alarm: WARNING and ALARM.

A WARNING signal is generated when pump operation exceeds the normal range. It therefore only draws attention that the normal operating values are not adhered to but does not signify that danger is imminent. The pump will continue to operate in this condition.

An ALARM signal output is generated and the pump will stop automatically when the upper mechanical safety limit is reached during pump operation.

When an ALARM output is suddenly generated, while the plant unit is operational, a WARNING signal will be generated to ensure that the plant operation is not discontinued. This enables the operator to check the pump after the equivalent of one cycle has been completed.

Be sure to contact EBARA Corporation for details on checking the WARNING and ALARM setting conditions.

### 3.2.2 Operation Status Control

The sensor data are displayed on the LCD display provided on the controller to facilitate operation status control and daily inspection.

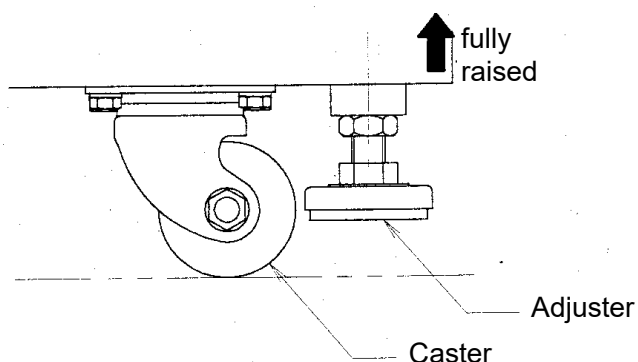
All WARNING and ALARM signals are displayed on the LCD display. For remote operation and monitoring, the signals are available as individual and group outputs.

### 3.3 The way of pump moving

#### 3.3.1 Preparation

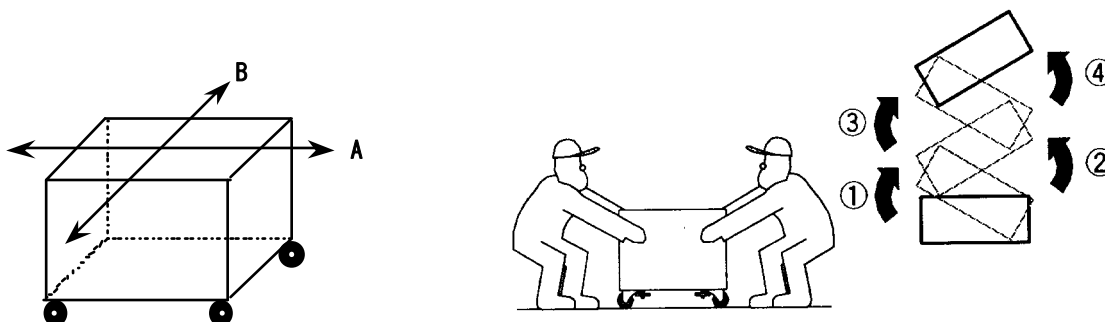
Before pump moving, all adjuster feet shall be raised fully at four places.

In case of being not raised fully, pump may be tripped over by obstacle on floor.

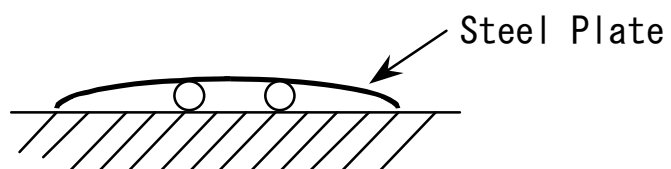


#### 3.3.2 Moving method

Move pump slowly by pushing eye bolt toward direction A. Be sure not to be caught by toes. If pump needs to be moved toward direction B in order to be set at a corner or narrow spaces, two persons shall move the pump by pushing its terminal portion alternately as directed below.



If pump needs to be moved on steps or ditches, spread steel plate or the like which can sustain the pump weight over the steps / ditches and pump shall be moved on it by two persons with care.



If pump should lose its balance when moving and start tripping over, never try to sustain the pump, get away from the pump immediately.

### 3.4 Detailed Specifications

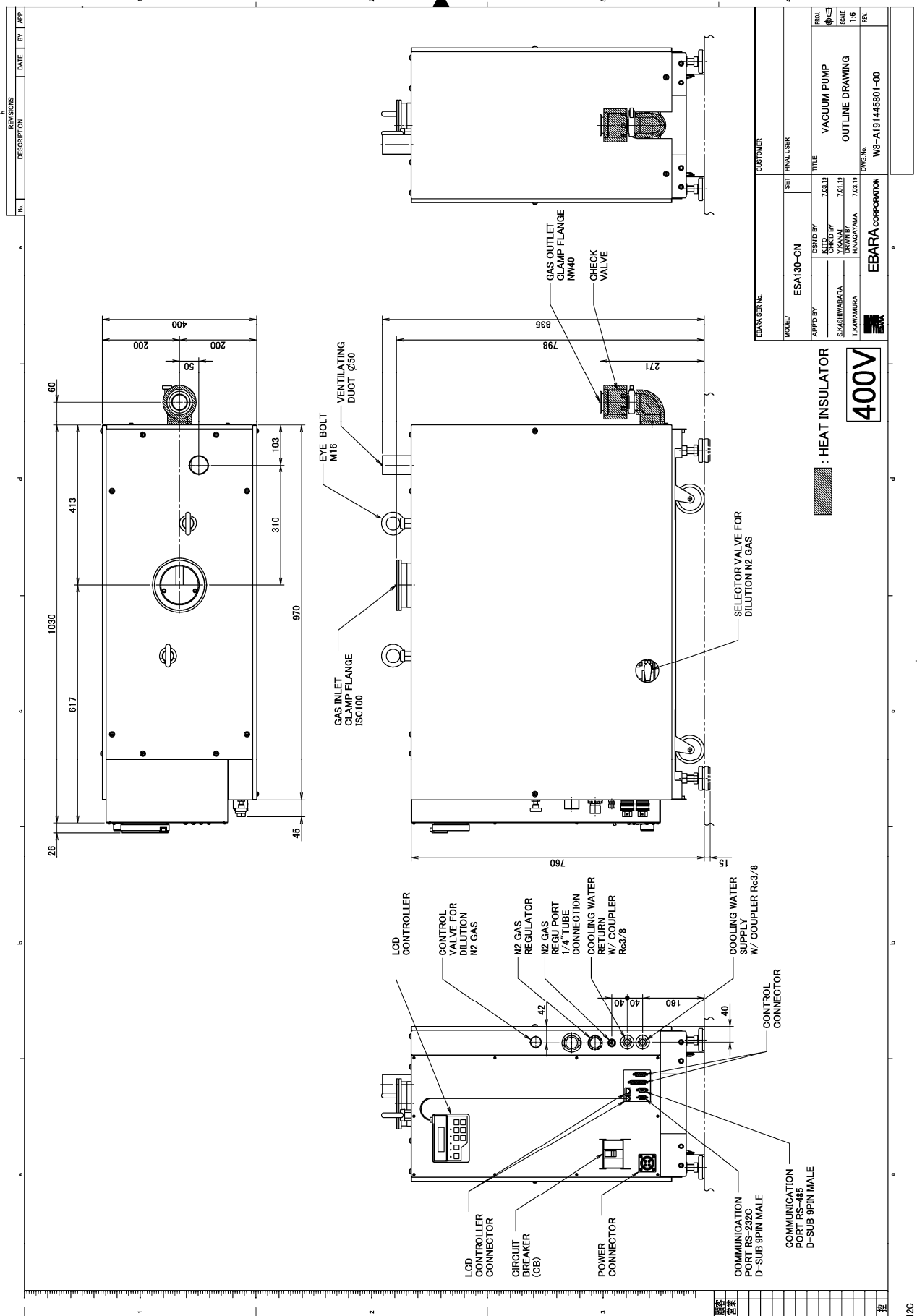
The following tables and figures should be consulted for pump specification, dimension and performance details.

**Table 3.1 Specification**

Model			Model ESA130-CN	
Pumping Speed			13000 L/min	
Ultimate Pressure			0.53 Pa	
Connection	Gas Inlet		ISO100	
	Gas Outlet		NW40	
Approx. Power at Ultimate Pressure			3.2kW	
Uti- li- ty	Cooling Water	Connection	Coupler(Rc3/8)	
		Pressure [Gauge Press.]	Supply: Max. 0.4MPa Differential Press. : Min. 0.1MPa	
		Flow rate	3.5 - 8 L/min	
		Temperature	Max. 30 deg C	
	N2 Gas	Connection	1/4" Tube Fitting(Same as Swagelok)	
		Pressure [Gauge Press.]	Supply : 0.15 - 0.7MPa [Setting : 0.09 - 0.12MPa]	
		Approx. Flow rate [N2-0 Mode]	17 - 20 Pa m³/s [3.8 Pa m³/s]	
	Duct Venti- Lation *	Connection	d 50 mm x L 50 mm	
		Pressure	-196 Pa	
		Approx. Flow rate	0.5 m³/min	
Lubrication Oil	Brand	BARRIERTA J100ES (NOK)		
	Quantity	0.6 L		
Approx. Weight			410 kg	
Power Supply	Phase/Volt/Freq.		3 Phase , 380-400V at 50Hz	
	Circuit Breaker		30A	
	Power capacity		11.0 kVA	
	Connection		Japan Aviation Electronics Industry	
JL04HV-2E22-22PE-B				
Control Signal			D-sub 15 Pin + D-sub 25 Pin	
Communication**			•RS-485 x 1 (D-sub 9pin / male) •RS232C x 1 (D-sub 9pin / male)	

[Note] \* The ambient temperature of the pump installation place shall be 30 degrees of centigrade of lower.

\*\* Please see the accompanying sheet for details. The receptacles for RS-485 and RS-232C are the same. Please confirm the label for each connector before connection.





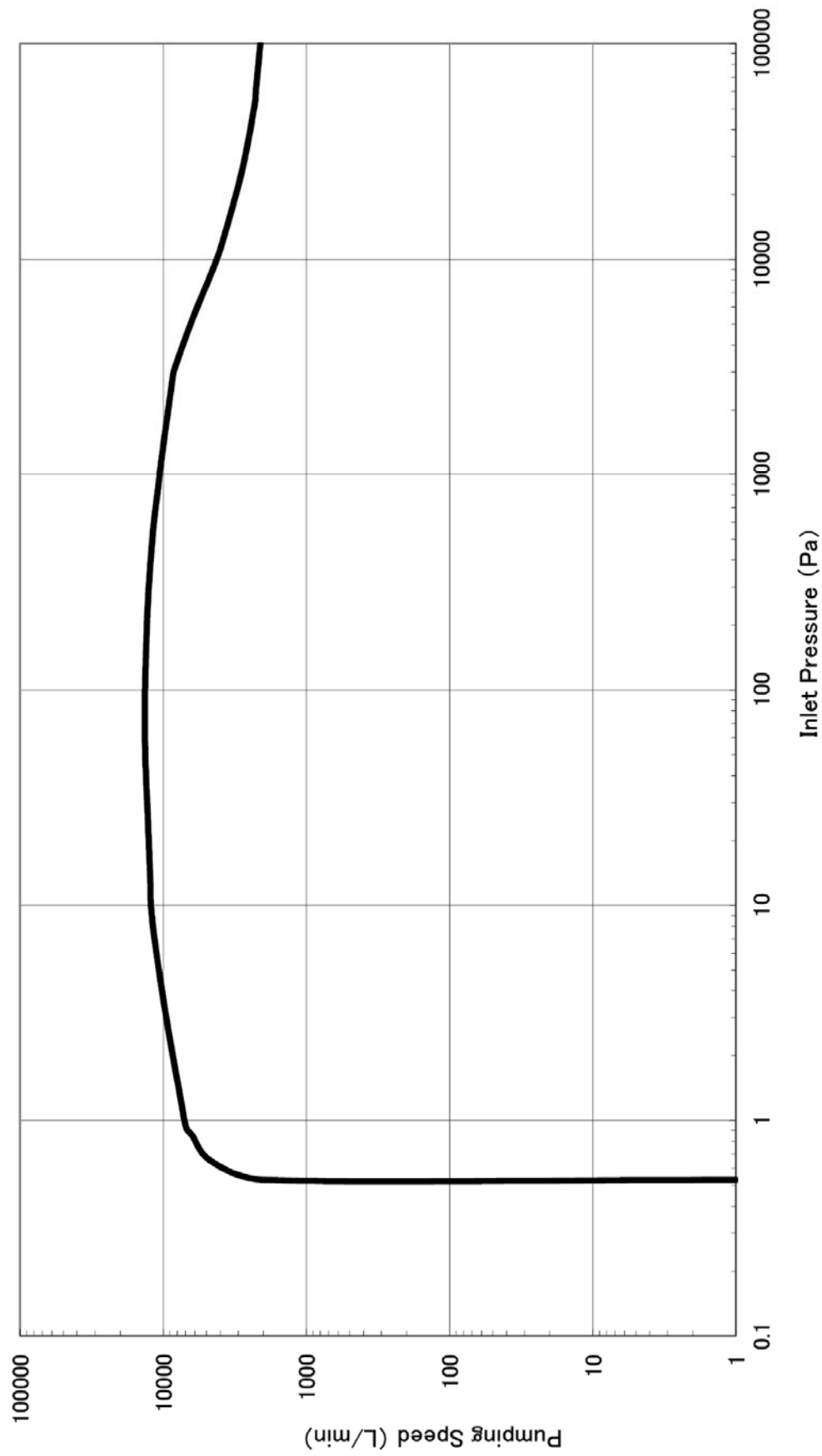


Fig.3.1 MODEL ESA130-CN Performance curve

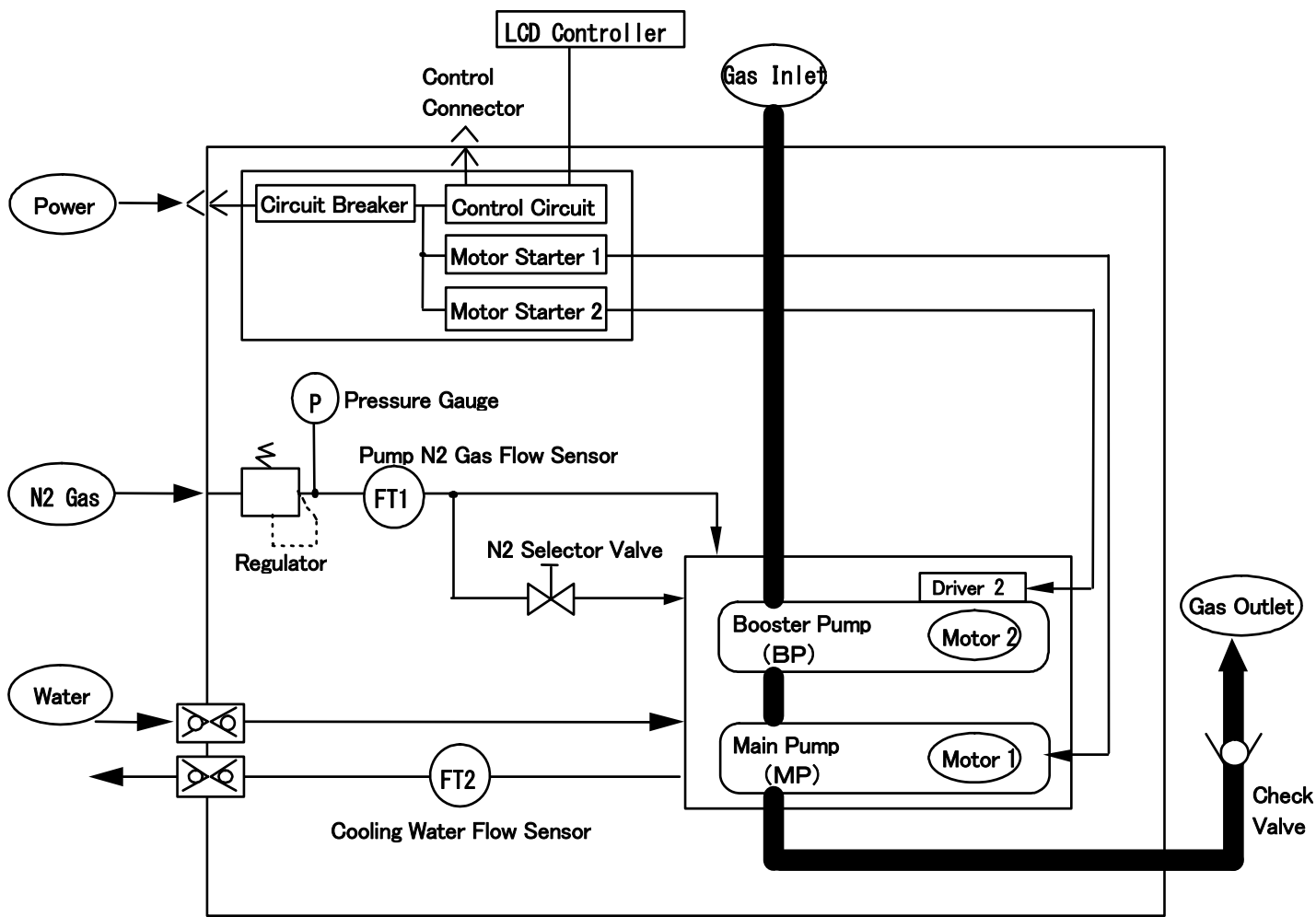


Fig. 3.2 System Flow

## 4. Installation

Be sure to take the following cautions and instructions into account when installing the pump.

### 4.1 Movement and Fixation

#### 4.1.1 Location

This pump is designed for indoor installation. To install the pump, select a place with little exposure to dust and humidity and not subject to dew condensation. Also allow for sufficient space to ensure easy pump installation and disassembly for maintenance.

In case of installing interface box to the pump, the distance between pump and interface box shall be 3m or less.



#### CAUTION

Install pump in a location at an ambient not exceeding 30°C. Particular caution is required when the pump is operated in an enclosed room.



#### CAUTION

A gap of at least 50mm should be left open for ventilation between the pump cover and the adjacent equipment.

#### 4.1.2 Caster and adjustment foot

Four integral mobile support units consisting of a caster and a height-adjustment foot each are provided underneath the pump base. To move the pump, raise the four adjustment feet by turning the holding nuts in the counterclockwise direction.

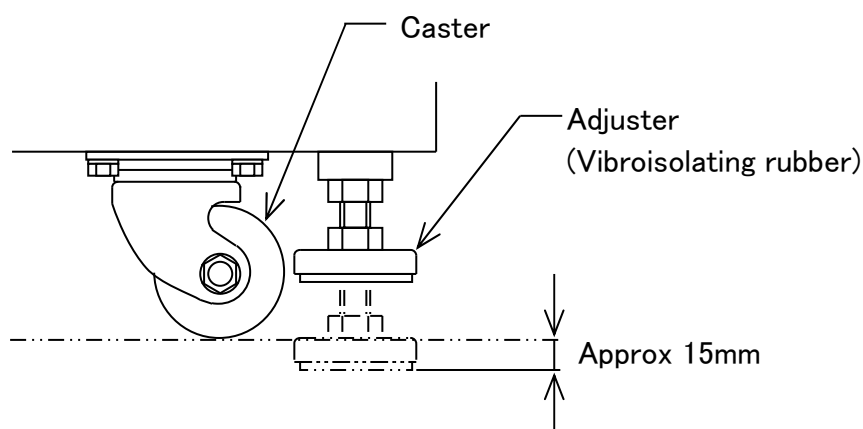


Fig. 4.1 Caster



**WARNING**

Be careful not to overturn the pump when pushing and pulling it sideways, because the width of the pump is small to its height.



**CAUTION**

The neck portion of the casters will vibrate during caster movement. Be sure to keep your fingers and feet out.



**CAUTION**

Do not step on the pump or place objects on it.

(1) To fix the pump, turn the adjusters to the right to lower them.

(2) Adjust the height of the feet evenly to ensure that the pump base is level.

The difference in height between the two sides of the pump base shall not exceed 1mm.

The adjustment allowance is approximately 15 mm.

[ **NOTE** ] If the pump is not leveled, shortage of the lubrication oil supply to the bearing may be caused.

[ **NOTE** ] To prevent vibrations and airborne noises, keep horizontal level of pump with the adjustment feet.

## 4.2 Piping

### 4.2.1 Vacuum and Exhaust Piping

Connect the vacuum and exhaust pipes to the inlet and exhaust flanges.

A narrow clearance is maintained in the pump for rotor rotation. The ingress of foreign objects into the pump interior will therefore prevent the pump from operating. Be sure that therefore to heed the following cautions when making the pipe connections.

- a) Remove all foreign matter from inside the piping.
- b) When connecting be sure that no dirt or dust particles adhere to the flange surfaces and/or that the flange surfaces are not damaged.  
Provide a suitable means of preventing the ingress of reaction by-products adhering to the APC valve and wafer fragments. For this purpose, equip with a filter may be recommended.
- c) The weight of the pipes attached to the pump can cause misalignment and leaks from the flange connections. Be sure that therefore to support the piping properly and not to apply undue force when aligning the flange faces.  
It is recommended to insert flexible bellows when connecting the pipes to the suction and exhaust flanges of the pump.  
The length of the flexible bellows on the vacuum (suction) side will vary according to the vacuum drawn. Be sure to connect so that no undue force can be applied to the flexible bellows.



#### **WARNING**

Be sure to check for leaks after you have installed the pump. Leaks will cause serious danger due to the discharge of harmful and hazardous substances and the occurrence of unpredictable reactions associated with the admission of air into the pump. When checking for gas leaks by pressurization, please pressurize by less than 0.05 MPa into the purge port and do check.

### 4.2.2 Cooling Water Piping

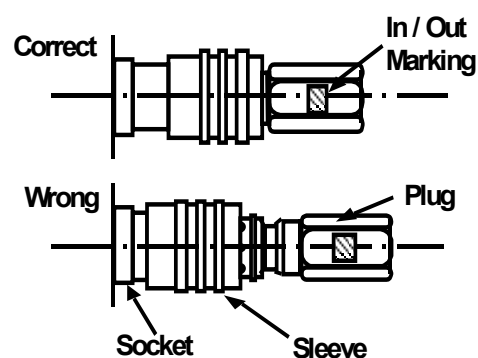
Be sure to connect the cooling water pipes to the correct inlet and outlet ports. The connector ports are provided with couplers. Push in the plug till the end of socket. Socket sleeve returns to front. (Fig. 4.2)

Be sure that the supply/return plugs are not connected in reverse. The diameters are slightly different. In/Out markings are provided on each plugs. When the coupler is pulled out the water pipe will be automatically blocked. Use cooling water corresponding to the specifications of Table 4.1 below.

**Table 4.1 Industrial Water Supply Quality Specification**

(Japan Industrial Water Association, Industrial Water Quality Standards Committee)

Turbidity	(ppm)	20
pH		6.5-8.0
Alkalinity(CaCO <sub>3</sub> )	(ppm)	75
Hardness(CaCO <sub>3</sub> )	(ppm)	120
Evaporation residue	(ppm)	250
Chlorine ion	(ppm)	80
Iron	(ppm)	0.3
Manganese	(ppm)	0.2



**Fig. 4.2 Coupler**



#### CAUTION

Even when the cooling water flow rate drops, the pump will continue to operate until the pump part reach a temperature corresponding to the safety limit.

The material selected for the water piping of facility side should have a heat resistance so that it can withstand a maximum temperature of at least 70°C at the operating pressure.



**CAUTION** When several pumps are used, be sure to connect the cooling water pipes to each pump in parallel. The cooling water will flow more or less easily according to the type of pump and the piping. Be sure to select the correct piping so as to ensure the appropriate cooling water flow rate for all pipes used.



**CAUTION** When the cooling water connections are incorrect and the flow is reversed, a flow rate different from the normal value will be displayed. Pump may not be cooled properly under this condition, and this cause serious problem.  
Be sure therefore to connect correctly to avoid problems.



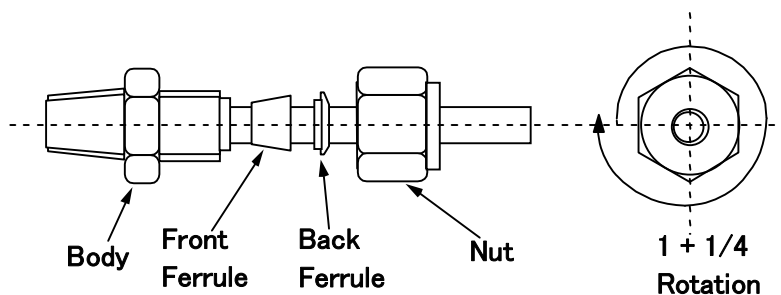
**CAUTION** When the cooling water supply is left on while the pump is stationary dew condensation will form on the water-cooled parts in locations with high humidity.  
Make it a rule therefore to stop the cooling water when water droplets can be detected on the outer surface of the pump cooling water piping as this suggests the possibility of dew condensation in the pump.

#### 4.2.3 N2 Gas Piping

Cut tube at right angles and make the end-face perfectly smooth. Then connect the tube to the tube fitting assembly of the N2 gas purge port. The tube is a push-fit onto the shoulder of the tube fitting assembly.

Secure the tube fitting assembly properly and tighten the retaining nut by hand. After this, use a tool to tighten the nut further by  $1 + 1/4$  turns.

To connect the tube again after this, install the tube already fitted to the ferrule and re-tighten the retaining nut slightly after the initial tightening (generally, tighten by a further quarter turn after tightening by hand).



**Fig. 4.3 Tube Fitting Assembly**



**CAUTION** For safety, be sure to use N<sub>2</sub> gas which purity is more than 99.999%. Impurities of N<sub>2</sub> gas may cause an accident when the pump is used for exhausting toxic and/or inflammable gases.

#### 4.2.4 Ventilation Duct

All dry pumps that Ebara supplies shall go through the leakage inspection after assembly regardless of the newly built or overhauled. Yet, in the cases where the user-supplied line connection at the pump exhaust outlet came out or the connection became loose due to long time pump operation while neglecting its maintenance may allow the hazardous gases to leak from the pump module.

This pump is designed such that the process gases will not leak to environment to the level harmful to human if the unit has been properly ventilated. This is proven under the Tracer gas test defined in F15-93 of the SEMI standard.

Proper ventilation is necessary not only to prevent the hazardous gases to leak but also release heat generated and accumulated in the pump module through the pump operation. Without proper ventilation, the temperature inside the cover will continue to rise until an ALARM is generated. This will result in serious problems.

Connect the ventilation duct, locating on the top of the pump, to a duct that the user provides. The user side duct shall have exhaust capability listed in Table 3.1 and shall be independent from the duct connected to the pump exhaust outlet.

A substance, which is not corroded with used gas, shall be used as the material of the exhaust duct.





**CAUTION** For safety, be sure to ventilate through the ventilation duct when the pump is used to exhaust toxic, inflammable, and/or other hazardous gases. Do not combine the ventilation duct with the pump exhaust piping





**CAUTION** Even when the pump is used for exhausting process gases that are not toxic and/or inflammable, do not combine the ventilation duct with the pump exhaust piping. The exhaust noise of the pump will give rise to acoustic resonance inside the pump unit and result in an abnormal noise being generated.




**CAUTION** Never operate the pump without pump cover for safety.

### 4.3 Electrical Wiring


 **WARNING** Be sure to keep the power supply to the pump turned off and lock-outed until you have finished the wiring and connecting work. Also interrupt the Circuit Breaker (CB) during this.

 **WARNING** Electrical wiring shall be carried out only by qualified electricians.

 **CAUTION** Do not apply the power supply from the pump's power pack to any other equipment as this will result in malfunctioning of the control units and in pump failure.

#### 4.3.1 Grounding

This product should be grounded. In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing an escape wire for the electric current. This product is equipped with a cord having a grounding wire with an appropriate grounding plug. The plug must be plugged into an outlet that is properly installed and grounded in accordance with all local codes and ordinances.

 **DANGER** Improper installation of the grounding plug can result in a risk of electric shock. If repair or replacement of the cord or plug is necessary, do not connect the grounding wire to either flat blade terminal. The wire with insulation having an outer surface that is green with or without yellow stripes is the grounding wire.

Check with a qualified electrician or serviceman if the grounding instructions are not completely understood, or if in doubt as to whether the product is properly grounded. Do not modify the plug provided; if it will not fit the outlet, have the proper outlet installed by a qualified electrician.

### 4.3.2 Power Supply Wiring

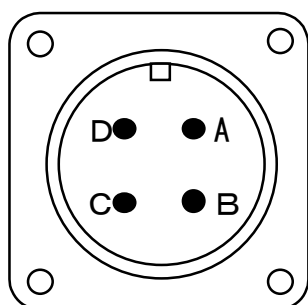
**CAUTION** Use the correct wiring materials and size to match the operating conditions in accordance with the power consumption rating and ambient air temperature of the pump.

**CAUTION** Be sure to connect the grounding wire.

**CAUTION** Wiring should be hard-wired or using twist-lock Hubbel type connector at power source side.

Wire the connector for the main power supply (380-400V AC at 3-phase and 50Hz).

Fig. 4.4 and Tables 4.2 and 4.3 show the connector pin assignment.



**Fig. 4.4 Power Supply Receptacle**  
(As seen from outside, just unplugged)

**Table 4.2 Pin Assignment of Power Supply Receptacle**

No.	Phase
A	R
B	S
C	T
D	GND

**Table 4.3 Receptacle Specification**

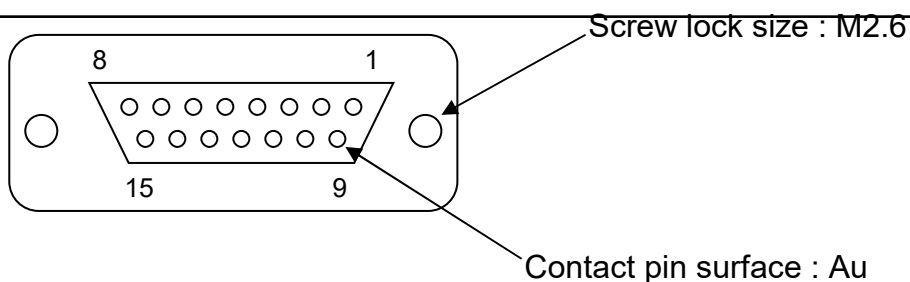
Pump model	Model ESA130-CN
Receptacle type	JL04HV-2E22-22PE-B
Recep. Manufacturer	Japan Aviation Electronics Industry Co., Ltd.
Adapted plug type	JL04V-6A22-22SE-EB-R
Suitable wire	AWG #10 (UL1015)
Power capacity kVA	11.0

### 4.3.3 Control Signal Wiring

This pump is equipped with signal input and output connectors, which allow external tools and control devices to remotely operate and monitor the pumps. Connect wires to the control connector for remote operation and remote monitoring. Tables 4.4 , 4.5 , 4.6 and 4.7 and Figs. 4.5 and 4.6 show the pin assignment.

**Table 4.4 Receptacle Specification**

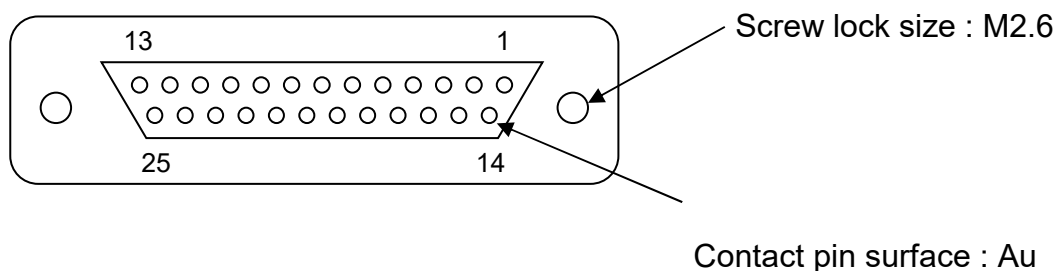
Connector No.	Connector type
CN-Z	15 pin D sub-miniature Female receptacle (In accordance with SEMI E73)
CN-Y	25 pin D sub-miniature Female receptacle



**Fig. 4.5 15 Pin D Sub-Miniature Female Receptacle**  
(As seen from connecting side)

**Table 4.5 Control Connector Pin Assignment(CN-Z)**

Pin. No.	Signal name	I/O	Signal type
1	MP START (+)	IN	Run: CLOSE, Alternate
2	BP START (+)	IN	Run: CLOSE, Alternate
3	MP START STATUS (+)	OUT	Run: CLOSE, Alternate
4	BP START STATUS (+)	OUT	Run: CLOSE, Alternate
5	WARNING STATUS (+)	OUT	WARNING: OPEN, Alternate
6	ALARM STATUS (+)	OUT	ALARM: OPEN, Alternate
7	REMOTE STATUS (+)	OUT	REMOTE: CLOSE
8	–		
9	MP START (–)		
10	BP START (–)		
11	MP START STATUS (–)		
12	BP START STATUS (–)		
13	WARNING STATUS (–)		
14	ALARM STATUS (–)		
15	REMOTE STATUS (–)		



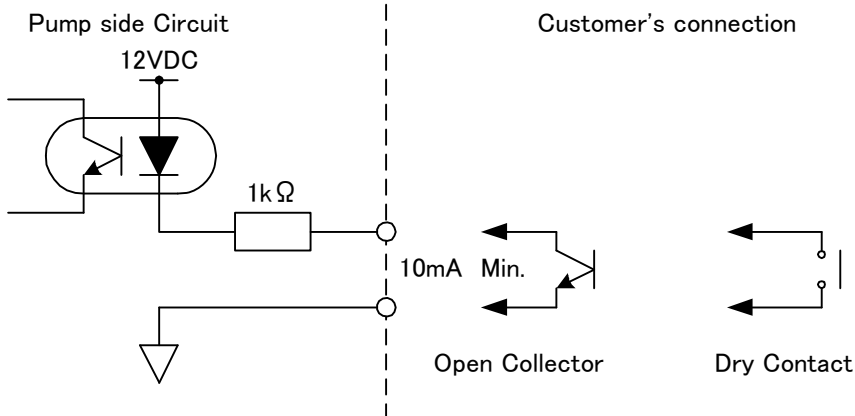
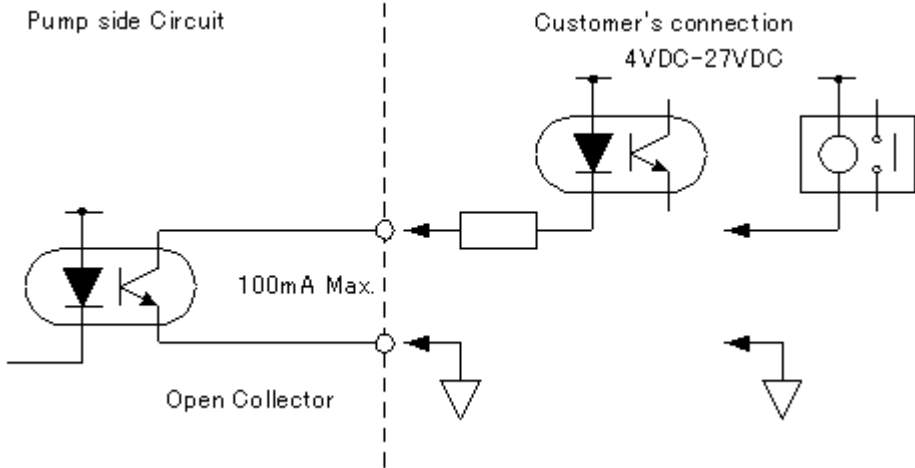
**Fig. 4.6 25 Pin D Sub-Miniature Female Receptacle**  
(As seen from connecting side)

**Table 4.6 Control Connector Pin Assignment(CN-Y)**

Pin No.	Signal name	I/O	Signal type
1	RESET (+)	IN	RESET: CLOSE
2	LOW SPEED CONTROL (+)	IN	LOW SPEED: CLOSE, Alternate
3	RESERVED (+)	IN	
4	RESERVED (+)	IN	
5	RESERVED (+)	IN	
6	RESERVED (+)	OUT	
7	PUMP N2 WARNING STATUS (+)	OUT	Abnormality: CLOSE, Alternate *1
8	RESERVED (+)	OUT	
9	LOW SPEED CONTROL (+)	OUT	LOW SPEED: CLOSE, Alternate
10	BACK PRESSURE WARNING STATUS (+)	OUT	Abnormality: CLOSE, Alternate
11	RESERVED (+)	OUT	
12	RESERVED (+)	OUT	
13	-		
14	RESET (-)		
15	LOW SPEED CONTROL (-)		
16	RESERVED (-)		
17	RESERVED (-)		
18	RESERVED (-)		
19	RESERVED (-)		
20	PUMP N2 WARNING STATUS (-)		
21	RESERVED (-)		
22	LOW SPEED CONTROL (-)		
23	BACK PRESSURE WARNING STATUS (-)		
24	RESERVED (-)		
25	RESERVED (-)		

\*1 It can change to "Abnormality: OPEN, Alternate" by DIP SW. setting.

**Table 4.7 CN-Z & CN-Y Signal Contacts**

Input Signal	
Output Signal	

**CAUTION** Do not wire vacant pins.

**CAUTION** Apply a 12V DC power for input signals on the pump side.  
Do not apply this voltage on the equipment side.  
The output signals are generated from an open collector output.  
Please use it by the equipment side, impressing the power supply of DC4V to DC27V.

**CAUTION** Be sure to wire all signals with the correct polarity(SIG./COM.)

**CAUTION** When output signals are used to energize an inductive load such as a relay, be sure to insert a diode (100V, 1A class) in order to absorb the back electromotive force due to surge currents.

## 4.4 Communication

### 4.4.1 Communication Specification

**Table 4.8 Communication Specification**

Electrical interface	RS-485	<b>RS-232C</b>
Synchronization method	Start/stop method	Start/stop method
Communication speed	9600 bps	9600 bps
Data length	8 bits	8 bits
Stop bit	1 bit	1 bit
Parity	None	None
Error control	Checksum	Checksum
Busy control	None	None
Duplex	2 Wire - Half	---

### 4.4.2 Receptacle Specification

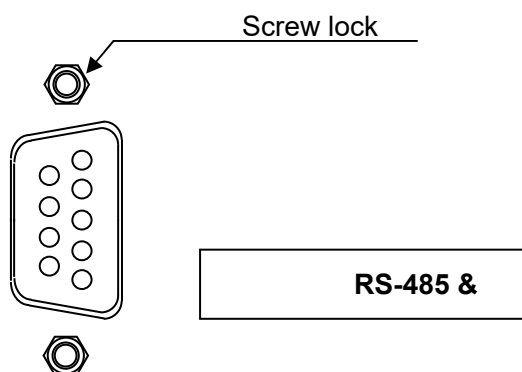
**Table 4.9 Receptacle Specification**

Electrical interface	Connector type
RS-485	9 pin D sub-miniature Male receptacle
RS-232C	9 pin D sub-miniature Male receptacle

[NOTE] 1) The receptacles for RS-485 and RS-232C are the same.

Please confirm the label for each connector before connection.

2) This RS-485 cannot set the address.



**Fig. 4.7 9 Pin D Sub-Miniature Male Receptacle  
(As seen from connecting side)**



**Table 4.10 Communication Connector Pin Assignment**

RS-485		RS-232C	
Pin No.	Signal name	Pin No.	Signal name
8	V ( - )	2	TxD
9	V( + )	3	RxD
		5	GND
		7	CTS
		8	RTS

#### 4.4.3 Communication Commands

Refer to table 4.11. Commands for RS-485 and RS-232C are common.

**Table 4.11 Details of Commands**

Command name	Command	Description	Control mode
Start	S20	Starts MP/BP.	Only in COM.
Stop	S21	Stops MP/BP.	Only in COM.
Reset	S22	Resets the pump.	All
Normal/power-saving mode switching	S23	Switches the pump operation mode.	Only in COM.
Motor speed setting for normal and power-saving modes	S24	Sets the motor speed for normal and power-saving modes.	Only in COM.
Analog data read	M20	Reads analog data selected by the user.	All
Operation status read	M21	Reads the MP/BP operation status (normal or power-saving) and Alarm/Warning data.	All

## 5. Power Supply for accessories

Power supply connector for accessory is equipped beside main power supply connector. This power supply is used for standard option that is listed below.

(Shall not be used for other purposes.)

ADAPTER for Central Monitoring System  
Interface Controller



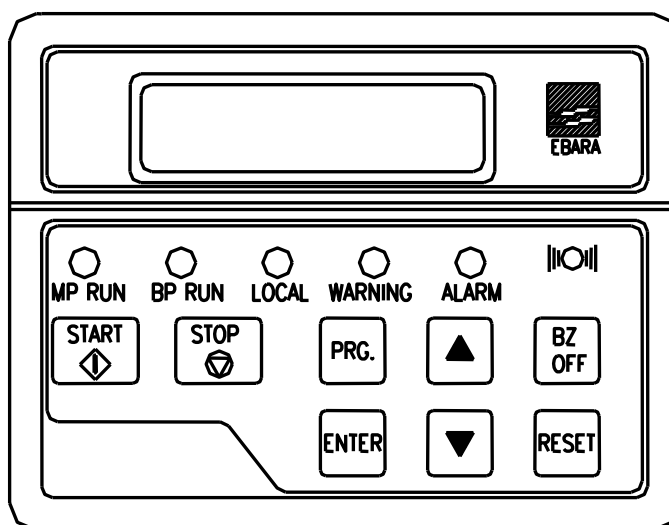
**DANGER** Power Supply for the options is kept applying voltage when Circuit Breaker (CB) turns on during the pump is supplied the power.



**WARNING** Do not use the power supply for other purposes.

## 6. LCD Controller

### 6.1 LCD Outline



[Buttons]	START	For start Main pump(MP) and Booster pump(BP)
	STOP	For stop MP and BP
	▲ ▼	For changing LCD indication
	RESET	For resetting WARNING and ALARM
	BZ. OFF	For "buzzer mute in WARNING / ALARM "
	PRG.	For changing screen of pump status and change hierarchy of screen
	ENTER	For using at DIP switch selection And change hierarchy of screen
[LED]	B.P. RUN	BP running
	M.P. RUN	MP running
	LOCAL	LOCAL mode
	WARNING	WARNING condition
	ALARM	ALARM condition

**Fig. 6.1 LCD controller**

## 6.2 LCD Indication

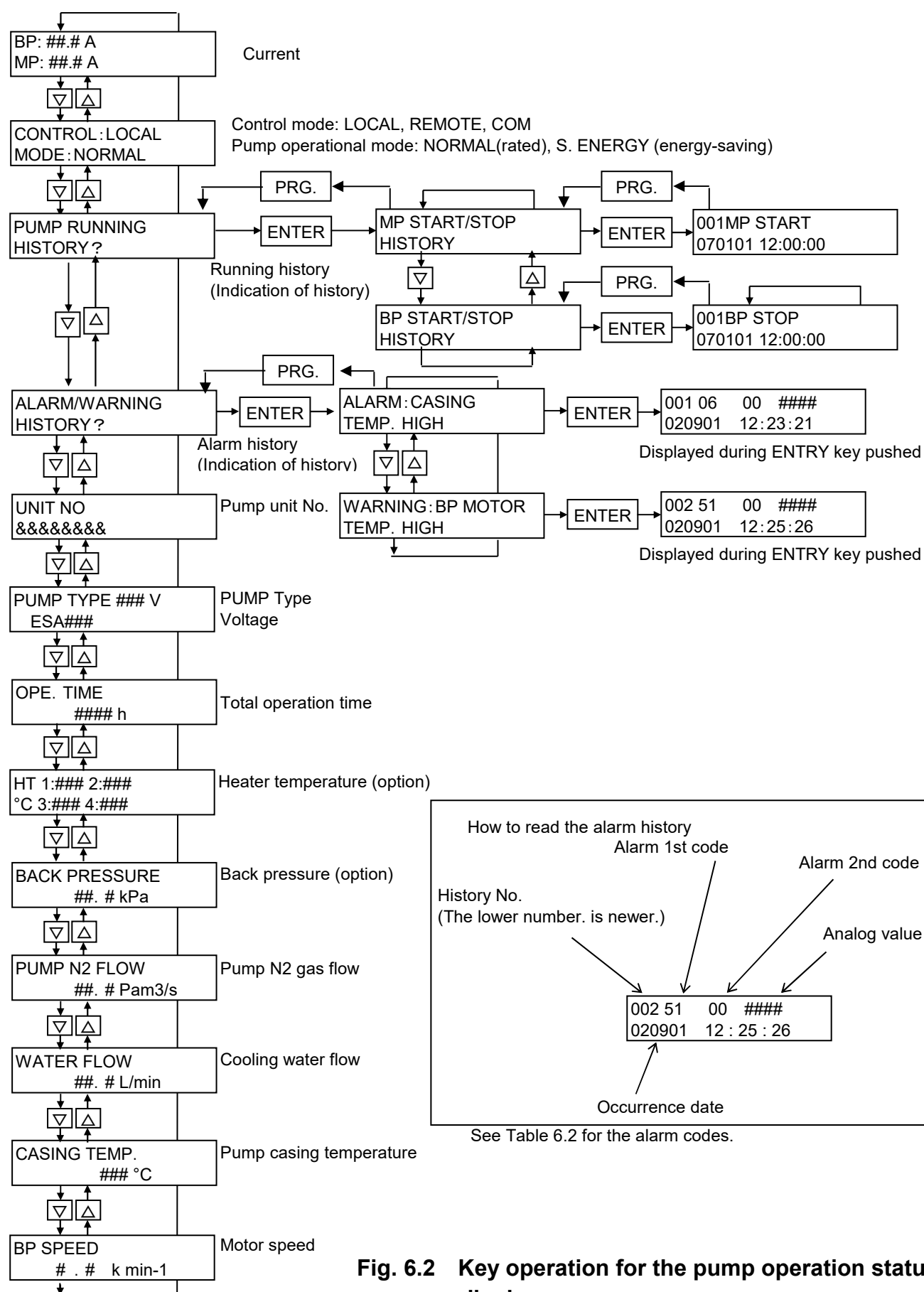
The operating status of the pump is displayed on the LCD display of the controller. For details of display, see Table 6.1.

**Table 6.1 LCD controller indication**

No	ITEM	INDICATION
1	Current	B P :    # # . #    A M P :    # # . #    A
2	WARNING/ALARM	\$ \$ \$ \$ \$ : \$ \$ \$ \$ \$ \$ \$ \$ % \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$
3	Control mode Pump running mode	C O N T R O L : L O C A L M O D E : N O R M A L
4	Running history (Indication of history)	P U M P    R U N N I N G H I S T O R Y ?
5	Alarm history (Indication of history)	A L A R M / W A R N I N G H I S T O R Y ?
6	Pump unit No.	U N I T    N O & & & & & & &
7	Pump type Voltage	P U M P    T Y P E       * * * V E S A & & &
8	Total operation time	O P E . T I M E # # # # # h
9	Heater temperature (option)	H T    1 : # # #    2 : # # # ° C    3 : # # #    4 : # # #
10	Back pressure (option)	B A C K    P R E S S U R E # # . #    k P a
11	Pump N2 gas flow	P U M P    N 2    F L O W # # . #    P a m <sup>3</sup> / s
12	Cooling water flow	W A T E R    F L O W # # . #    L / m i n
13	Pump casing temperature	P U M P    C A S I N G # # #    ° C
14	Motor speed	B P    S P E E D # . # k    m i n - 1

1. Three control modes are available : "LOCAL" (local operation) , "REMOTE" (remote operation) and "COM" (Communication operation).
2. Two running modes are available "NORMAL(rate operation)" and "S.ENERGY (energy-saving operation)"
3. " % " shows present number of WARNING/ALARM.
4. Upper row "\$\$\$\$\$\$" distinguishes between WARNING/ALARM and indicates the position where WARNING/ALARM has occurred.  
Lower row "\$\$\$\$\$\$" displays details of WARNING/ALARM.
5. Total pump operating time gives the total hours of operation after shipment from the factory.
6. The display will return to the electrical power and motor rotation speed indication when no operation takes place after the lapse of 1 minute.
7. Use the Display Select Switch ( $\Delta$   $\nabla$ ) to change the display.  
The WARNINGS/ALARMS that have currently been generated can be displayed with the Display Select Switch.

See Fig. 6.2 for the key operation of the pump operation status display.



**Fig. 6.2 Key operation for the pump operation status display screen**

**Table 6.2 Alarm code list**

ALARM name	Code	
	1st code	2nd code
MP casing temp.	50	01
BP motor temp.	51	00
MP motor temp.	52	00
BP overload 1(Thermal)	54	00
MP overload 1(Thermal)	55	00
MP Current 0	60	00
BP Current 0	61	00
Power failure	64	00
BP driver protection activated (OC)	66	01
BP driver protection activated (OV)	66	02
BP driver protection activated (OH1)	66	04
BP driver protection activated (OH2)	66	05
BP driver protection activated (CPF)	66	06
BP driver protection activated (UV)	66	07
BP driver protection activated (DRE)	66	09
BP overload 2	67	00
BP step out	69	00
Low cooling water	73	90
Inner communication error (IO)	81	01
Inner communication error (BP driver)	81	02
BP current high	81	03
Exhaust temp.	81	20
BP casing temp. (▲)	50	02
Water leakage (▲)	53	00
High back pressure (▲)	63	00
External interlock (▲)	74	00

WARNING name	Code	
	1st code	2nd code
Low cooling water	00	01
MP casing temp.	05	01
BP oil level low	06	00
MP oil level low	08	00
Control board inner temp.	13	00
Pump N2	18	00
BP motor temp.	23	00
MP motor temp.	24	00
BP driver case temp.	25	02
BP driver inner temp.	25	04
Inner communication error (BP driver)	26	02
Inner communication error (IO)	26	03
Inner communication error (A_IO)	26	04
Inner communication error (C_IO)	26	07
BP current high	31	14
MP current high	31	15
Exhaust temp.	31	20
BP casing temp. (▲)	05	02
High back pressure (▲)	21	01
Back pressure sensor damaged (▲)		
Heater1 error (▲)		
Heater1 sensor damaged (▲)		
Heater2 error (▲)		
Heater2 sensor damaged (▲)		
Heater3 error (▲)		
Heater3 sensor damaged (▲)		
Heater4 error (▲)		
Heater4 sensor damaged (▲)		
Heater thermostat (▲)		
Pump N2 Valve Error (▲)		

“▲” indicates that the item is optional.

### 6.3 Setting the operational mode

This section describes how to set the operational mode. In the normal state, the LCD controller displays pump status. To display the operational mode setting screen, press the key "**PRG.**" for three seconds or longer. Pressing the key for one second or longer again returns to the pump status display screen. Table 6.3 below shows indications and the details of the operational mode setting.

**Table 6.3 Operational mode setting screen**

Item	Indication	Description
Setting the pump operation control mode	SET CONTROL MODE?	Switches the control modes: local ,remote, communication.
Setting the DIP switch	SET DIP SW?	Performs the DIP switch settings (see 6.4).
Setting the pump running mode	SET RUNNING MODE?	Switches the running modes: NORMAL and S. ENERGY.
Setting the rotational speed in the RATED mode	SET BP NORMAL SPEED?	Sets the pump rotational speed in the RATED mode.
Setting the rotational speed in the S. ENERGY mode	SET BP LOW SPEED?	Sets the pump rotational speed in the S. ENERGY mode.
Setting the WARNING value for the back pressure (option)	SET POINT BACK PRESSURE.?	Sets the WARNING value for the backpressure.

Keys work as below for the setting screen.

- START : Valid
- STOP : Stops the pump.
- RESET : Resets WARNING and /or ALARM.
- BZ.OFF : Switches the DIP switch No.
- △ : Sets the DIP switch to ON. Switches the display of the operational mode setting screen.
- ▽ : Sets the DIP switch to OFF. Switches the display of the operational mode setting screen.
- ENTER : Determines the selected setting.

See Fig. 6.3 for how to set the operational modes.



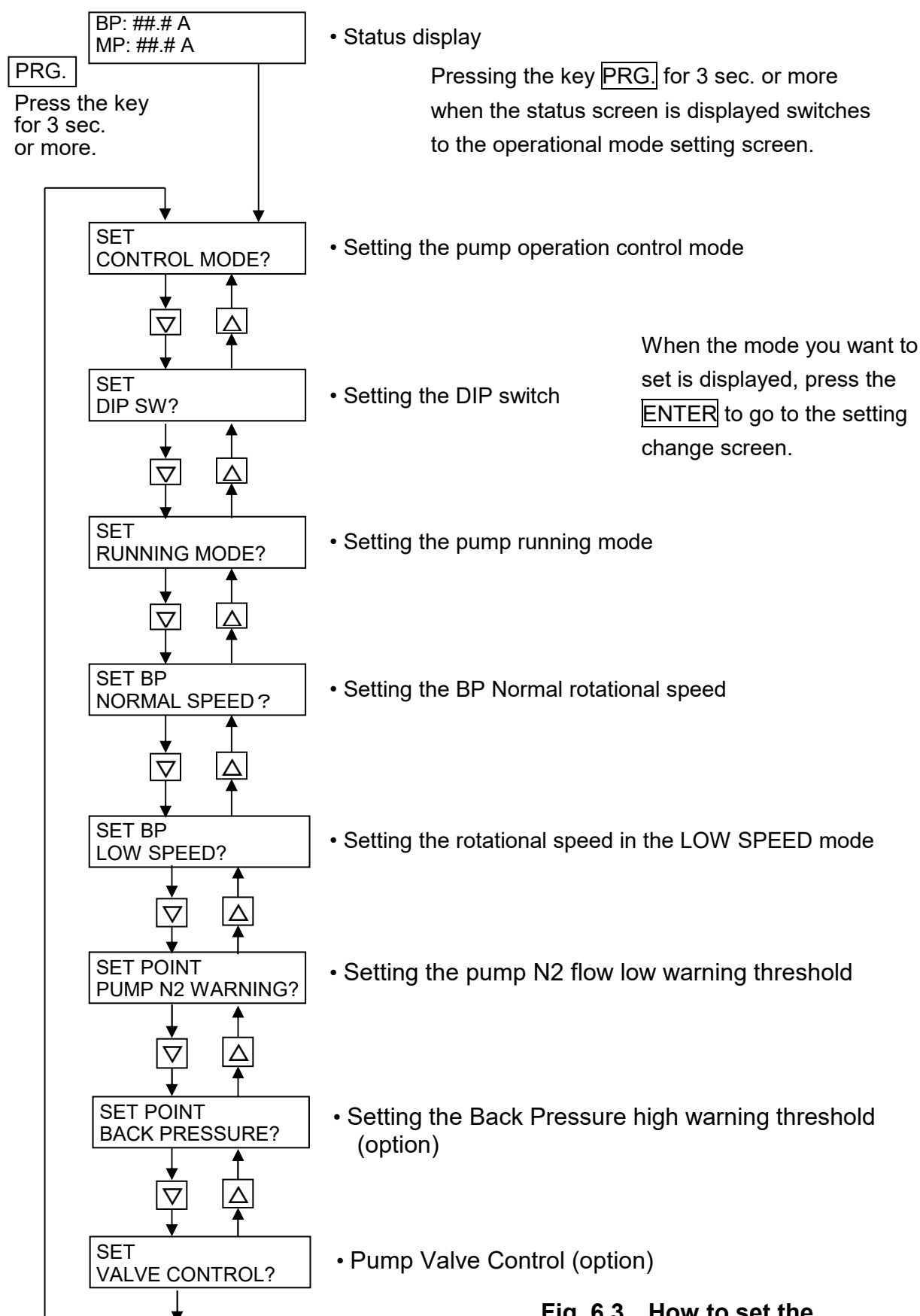
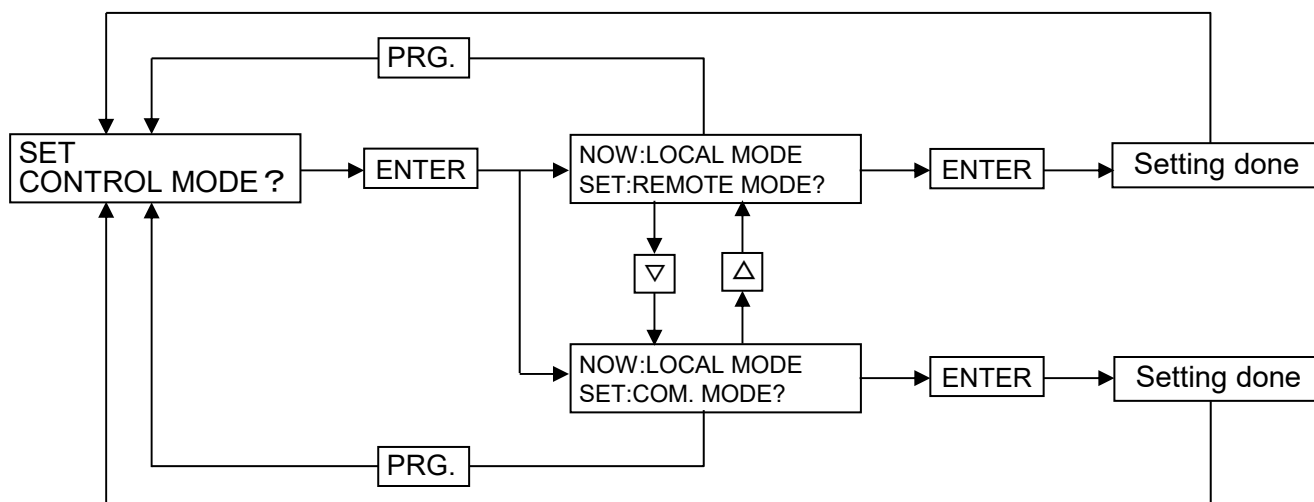


Fig. 6.3 How to set the

### 6.3.1 Setting the pump operation control mode

A case of display if Local mode selected.



REMOTE MODE : Enables the remote operation  
(start/stop with external signals)

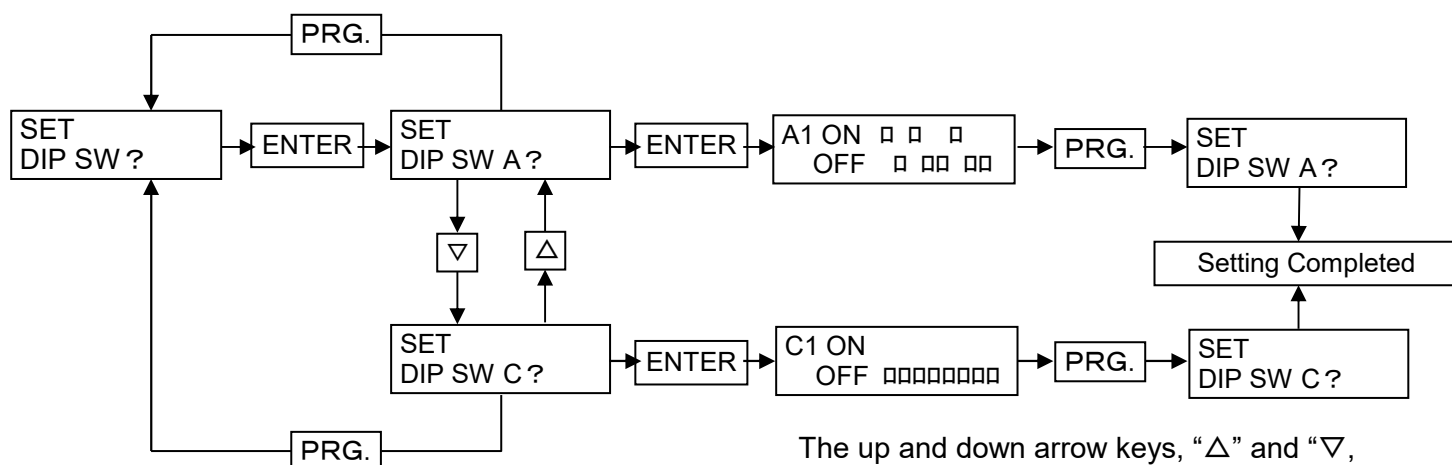
LOCAL MODE : Enables the local operation  
(start/stop with the LCD controller)

COM MODE : Enables the communication operation  
(start/stop with RS232C communication)

The mode that is currently not set is displayed.

If you do not need to set, press **PRG.** key to go back to the previous screen.

### 6.3.2 Setting the DIP switch

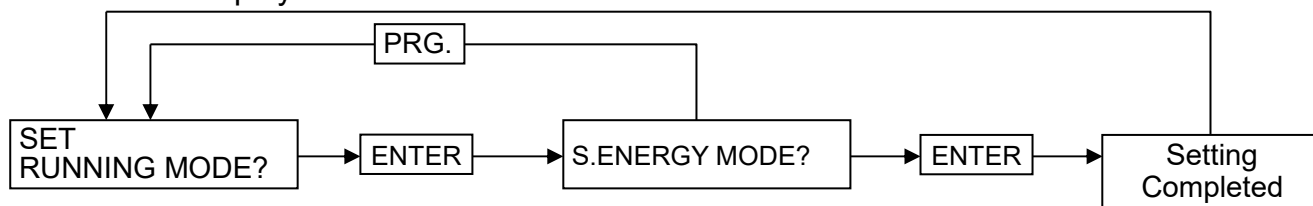


The up and down arrow keys, “△” and “▽,” turn On and OFF the DIP switch.  
The key **BZ.OFF** switches the selection from 1 to 8.

See Section 6.4 for details of the DIP switch.

### 6.3.3 Setting the pump running mode

A case of display if Normal mode selected.



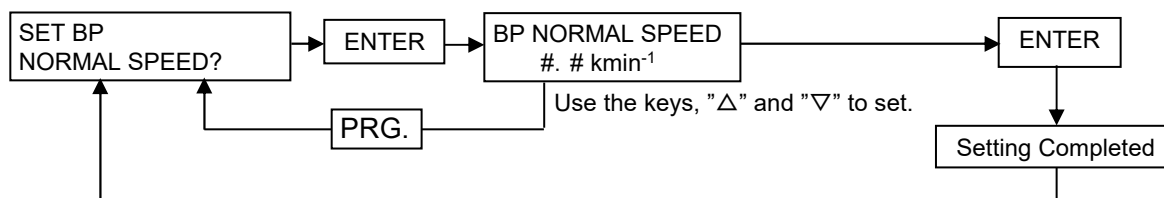
S.ENERGY MODE : Enables the energy-saving operation

NORMAL MODE : Enables the rated operation.

The mode that is currently not set is displayed.

If you do not need to set, press **PRG.** key to go back to the previous screen.

### 6.3.4 Setting the BP normal rotational speed



**Δ** **▽** : Use the up and down arrow keys to change the setting value.

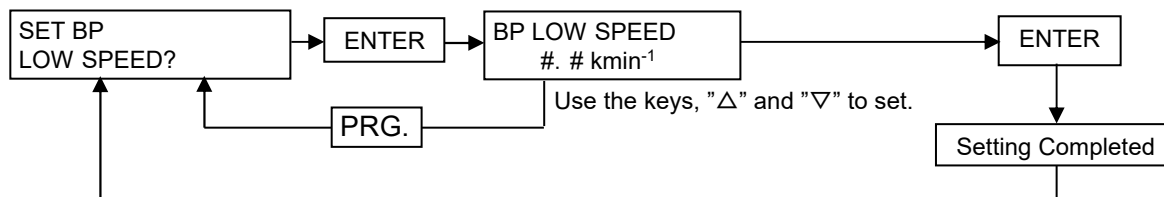
**Δ** : Increase the setting speed by 0.1 kmin<sup>-1</sup>.

**▽** : Decrease the setting speed by 0.1 kmin<sup>-1</sup>

Upper limit BP : 5.0 kmin<sup>-1</sup>

Lower limit BP : 3.0 kmin<sup>-1</sup>

### 6.3.5 Setting the rotational speed in the LOW SPEED mode



**Δ** **▽** Use the up and down arrow keys to change the setting value.

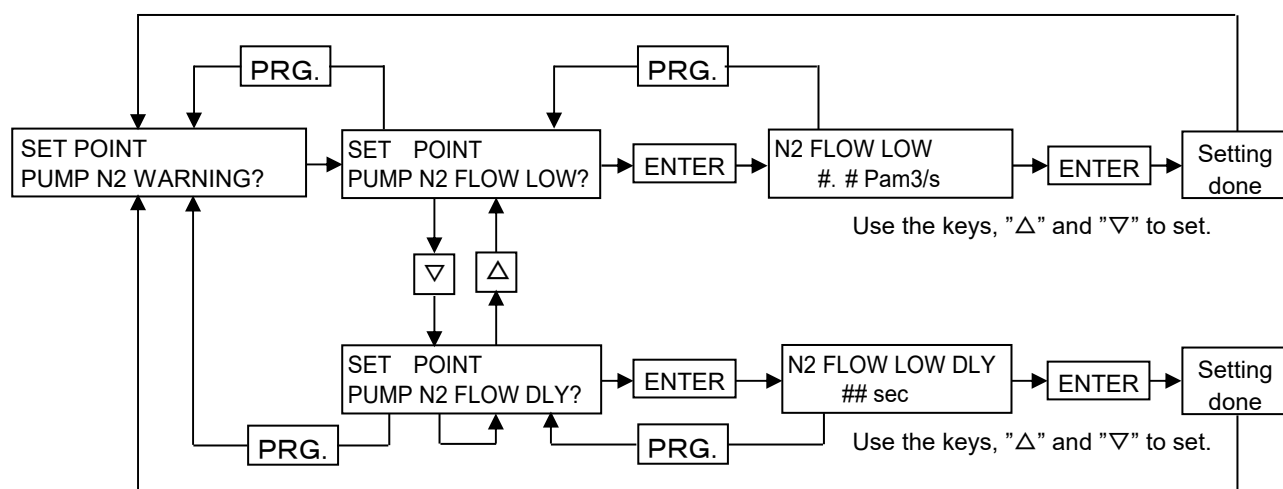
**Δ** : Increase the setting speed by 0.1 kmin<sup>-1</sup>.

**▽** : Decrease the setting speed by 0.1 kmin<sup>-1</sup>

Upper limit BP : The value lower than the set value for the normal speed

Lower limit BP : 1.0 kmin<sup>-1</sup>

### 6.3.6 Setting the pump N2 flow low warning threshold



Δ ∇ Use the up and down arrow keys to change the setting value.

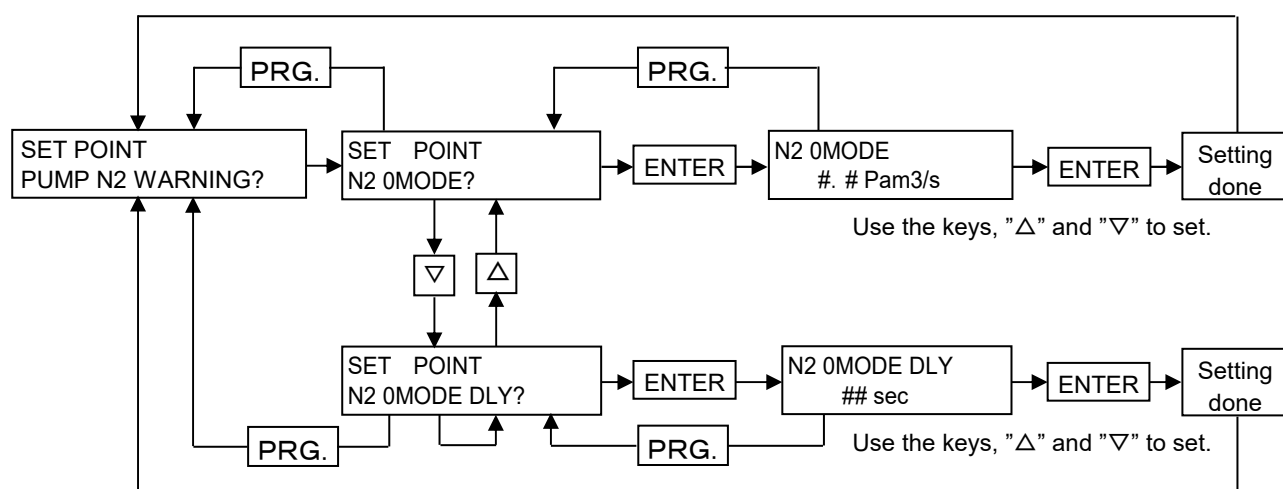
Δ : Increase the setting speed by 0.1 Pam<sup>3</sup>/s (Delay time : 1 sec)

∇ : Decrease the setting speed by 0.1 Pam<sup>3</sup>/s (Delay time : 1 sec)

Upper limit 81.0 Pam<sup>3</sup>/s (Delay time : 60 sec)

Lower limit 2.0 Pam<sup>3</sup>/s (Delay time : 5 sec)

### 6.3.7 Setting the dilution N2 0mode warning threshold (option)



Δ ∇ Use the up and down arrow keys to change the setting value.

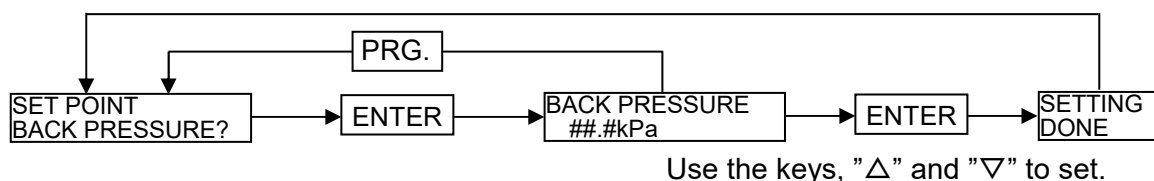
Δ : Increase the setting speed by 0.1 Pam<sup>3</sup>/s (Delay time : 1 sec)

∇ : Decrease the setting speed by 0.1 Pam<sup>3</sup>/s (Delay time : 1 sec)

Upper limit 81.0 Pam<sup>3</sup>/s (Delay time : 60 sec)

Lower limit 7.4 Pam<sup>3</sup>/s (Delay time : 5 sec)

### 6.3.8 Setting the Back Pressure high warning threshold (option)



Δ ▽ Use the up and down arrow keys to change the setting value.

Δ : Increase the setting value by 0.5 kPa.

▽ : Decrease the setting value by 0.5 kPa.

Upper limit : 20.0 kPa

Lower limit : 5.0 kPa

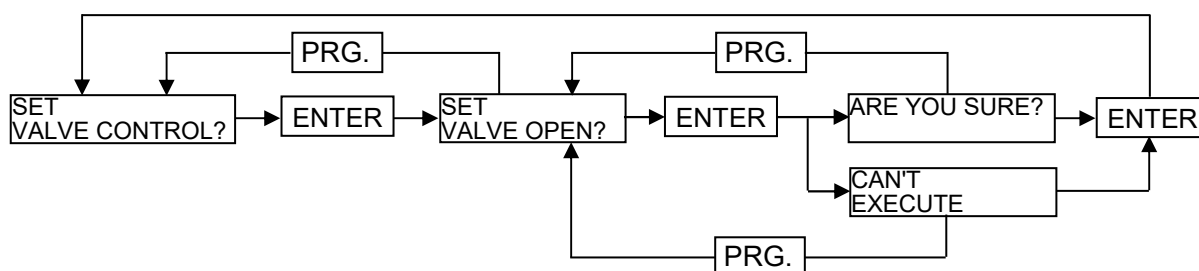
Factory setting : 20.0 kPa

WARNING reset value : Set value -2.0 kPa

### 6.3.9 Pump Valve control (option)

#### 1. Pump Valve control

- A valve follows operation from a LCD controller.
- An additional indication of the valve control screen is given at Customer operation mode.



A. **SET VALVE OPEN?** is displayed when the present valve state is CLOSE.

**SET VALVE CLOSE?** is displayed when the present valve state is OPEN

B. In the case of under pump operation, **ARE YOU SURE?** is displayed.

Valve operation is possible.

In the case of under pump stop, **CAN'T EXECUTE!** is displayed.

Valve operation is impossible.

C. If it is made to decide by the ENTER key, a valve will open/close.

It returns to **SET VALVE CONTROL?** screen.

#### 2. Valve operation

- Valve is made to CLOSE compulsorily at the time of a pump stop and Alarm generating.
- A valve is made to CLOSE at the time of a power supply injection.  
(The last valve state is not memorized.)

#### 3. Display on LCD

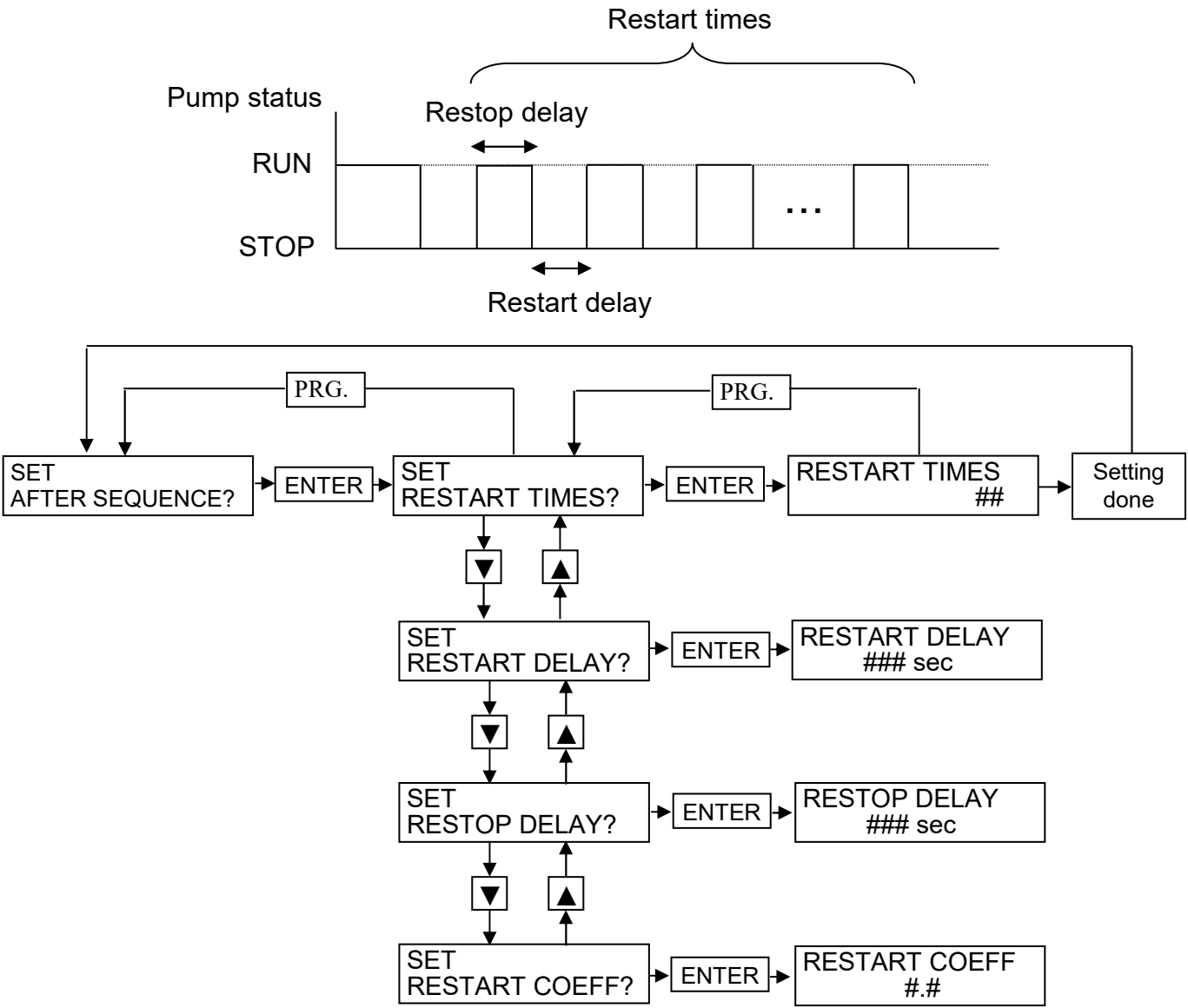
- In the case of under pump operation, and in the case of Valve CLOSE,

**INLET VALVE CLOSED** is displayed on a Normal display mode.


6.3.10 After-Sequence Function Setting

This pump has an after sequence function. It is a function that repeats restart and restop automatically after the pump stops.

If you need after sequence function, set Dip SW. C8:ON.



	Factory setting	Upper limit	Lower limit
Restart times (times)	20	50	1
Restart delay (sec)	120	600	10
Restop delay(sec)	120	600	10
Restart coefficiency (-)	0.2	1	0.1

**CAUTION**

Use caution when after sequence function is active (C8:ON), because the pump repeats start and stop for a configured time, even if press the STOP button on the LCD controller or enter the external STOP signal.

## 6.4 Dip Switch

Set the dipswitches to select the operating modes as shown in Table 6.4, 6.5 and 6.6.

**Table 6.4 Dip Switch-A Settings**

No.	Mode	Off	On	Factory setting
1	Data Length	7bits	8bits	ON
2	Monitor Cooling water and N2	Always	Only during operation	OFF
3	Buzzer	Not used	Use	ON
4	Operation switched to Remote	According to signal	Automatically stop	OFF
5	-----	-----	-----	-----
6	-----	-----	-----	-----
7	Dilution N2 mode	Standard mode	Dilution N2-0 mode	OFF
8	BP operation in Remote	Automatic operation	External signal input	OFF

**Table 6.5 Dip Switch-B Settings**

No.	Mode	Off	On	Factory setting
1	-----	-----	-----	-----
2	-----	-----	-----	-----
3	-----	-----	-----	-----
4	Pump N2 valve control*	No	Yes	OFF
5	-----	-----	-----	-----
6	Remote Interface (IF) *	Exclusive special IF	No use / standard IF	ON
7	Phase error monitoring	Standard	During starting only	OFF
8	LCD screen initialize	Carry out initialize	Do not initialize	OFF

\* Optional

**Table 6.6 Dip Switch-C Settings**

No.	Mode	Off	On	Default
1	Pump N2 warning signal	Normal Open	Normal Close	OFF
2	-----	-----	-----	-----
3	Backpress. warning signal *	Normal Open	Normal Close	OFF
4	-----	-----	-----	-----
5	-----	-----	-----	-----
6	Valve ON/OFF control *	Not used	Used	OFF
7	Valve state output *	Not used	Used	OFF
8	After sequence	Not used	Used	OFF

\* Optional

DIP SW-A. No.1      In case of observing pump running status with RS232C communication port, Data Length can be selected out of 7bits and 8bits.

- DIP SW-A. No.2      Sets the monitoring mode for the cooling water and N2: "Always" or "During operation only."  
In the mode "During operation only" for the cooling water, the monitoring continues for 15 minutes after operation stop for cooling the pump.  
It is recommended that N2 purge should be continuously active during operation stoppage to reduce by-product accumulation and corrosion in the pump.
- DIP SW-A. No. 3      Dip switch-A No. 3 lets you select whether an acoustic alarm (buzzer) should be sounded or not when a WARNING/ALARM signal has been generated.
- DIP SW-A. No. 4      When the toggle switch is moved from the LOCAL to the REMOTE position, dip switch-A No.4 lets you select "PUMP START/STOP in Response to External Start Signal (According to Signal)" or "PUMP STOP Regardless of External Signal (PUMP STOP)".
- [ NOTE ]** Dip switch-A No.3 (BUZZER) and Dip switch-B No.8 (LCD initialize) can change always. When parameter setting of the dip switches, other than dip switch-A No.3 (BUZZER), is performed, the LCD controller counts down 10 seconds, the same as at the power on state, right after the completion of the parameter setting.
- DIP SW-A. No. 5      Dip switch-A No. 5 lets you select "ALTERNATE Signal (START Signal ON/OFF)" or "MOMENTARY Signal (2 types of signal: ON or OFF)" for pump start and stop under external signal control.
- DIP SW-A. No. 7      Dip switch-A No. 7 lets you select whether dilution N2 gas is used or not. Set dip switch-A No. 7 to ON when the production process does not lead to the formation of reaction by-products in the pump or when the process uses non-corrosive gases. Then close the N2 gas selector valve to save N2 gas. Be sure always to use the N2 gas selector valve and dip switch-A No. 7 in combination.



**[ NOTE ]** The N2 gas selector valve is positioned on the front panel at the right when viewing facing the pump front panel (operating panel).

**[ NOTE ]** It takes ten odd seconds until the flow has stabilized after you have operated the N2 gas selector valve.

DIP SW-A. No. 8 When dip switch-A No. 8 has been set to the REMOTE (Remote Operation) position, it is possible to operate the Booster Pump (BP) by selecting "AUTOMATIC Operation" or "START/STOP in Response to External Signal Input."

DIP SW-B. No.4 Controls N2 supply to the pump with a valve attached to the N2 piping in the pump unit. This is optional.

DIP SW-B. No.6 Activate or inactive the special interface for ESA.  
· Set this to OFF to activate the interface (optional).  
· Set this to ON to inactivate the interface (default).

DIP SW-B. No.7 Selects the detection method for phase loss in the power source.

DIP SW-B. No.8 Locks or unlocks the currently selected operation status display, which usually returns to the power display in 60 seconds.

DIP SW-C. No.1 This switch allows you to select "NORMAL OPEN" or "NORMAL CLOSE" for PUMP N2 WARNING output.

DIP SW-C. No.3 This switch allows you to select "NORMAL OPEN" or "NORMAL CLOSE" for Backpressure WARNING output.

DIP SW-C. No.6 This switch allows you to select enable or disable the pump valve control.

DIP SW-C. No.7 This switch allows you to select enable or disable the output of pump valve control status.

DIP SW-C No.8 Enable/Disable the after sequence mode (See 6.3.10)

6.5 DIP Switch setting display

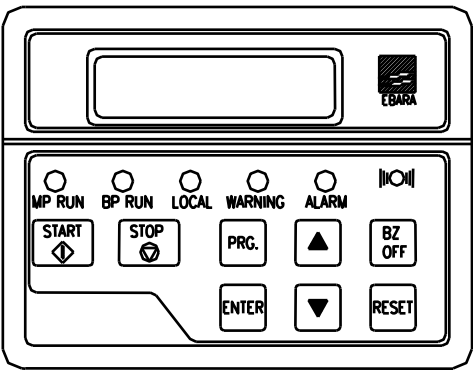


Fig 6.4 LCD controller

Key functions will be as follows on the setting display.

- START : Invalid
- STOP This stops pump operation.
- RESET This resets trip and alarm.
- BZ.OFF This switches the dip switch numbers.
- ▲ This sets the selected dip switch ON.
- ▼ This sets the selected dip switch OFF.
- ENTER Move display level. Or indicate set up conditions.

DIP Switch-A

A*	ON							
	OFF	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

DIP Switch-B

B*	ON							
	OFF	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

DIP Switch-C

C*	ON							
	OFF	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

\* indicate the dip switch number (1 to 8) currently you are setting.

Fig 6.5 DIP Switch

**[NOTE]** Duration of pump operation, dip switches, except A-3 (BUZZER) and B-8 (LCD initialize), can not be used for parameter setting.

---

**[NOTE]** When parameter setting of the dip switches, other than dip switch-A No.3 (BUZZER) and B-8 (LCD initialize), is performed, the LCD controller counts down 10 seconds, the same as at the power on state, right after the completion of the parameter setting.

**[NOTE]** If any warning or alarm occurs during the parameter setting, the setting session will be stopped automatically and the display will be changed to the warning & alarm display screen.

## 6.6 Starting/stopping the pump with the LCD controller

Maximum two LCD controllers can be connected. Note only one of them can start and stop the pump (the other shows the pump operational statuses).

The controller of which LED "LOCAL" is lit on has precedence over the other to control the start and stop operation.

If only one controller is connected, the controller starts and stops the pump.


	One controller connected	Two controller connected
START/STOP	Allowed	The one with its LED "LOCAL" lit on is allowed.

When you use two controllers, disconnect the one which you will not use for the operation from the pump once. Then, attach it again.

## 7. Operation

### 7.1 Before Starting

- (1) Turn on the cooling water supply and check that there are no leaks at the pipe connections.


 **CAUTION** Without sufficient cooling water, the pump temperature will rise and problems such as rotor contact will occur.


[ **NOTE** ] The pump unit itself has no cooling water flow adjustment valve.


- (2) Turn on the N2 gas supply.

Check that the regulator attached to the pump is closed. (It is closed when the pressure adjustment knob is fully turned in the counterclockwise direction.) Open the main valve and check that there are no N2 gas leaks from the pipe connections.

Slowly turn the pressure adjustment knob clockwise to set the pressure (gauge pressure) to 0.1 MPa first. Then press the red stopper to lock the knob in position.

 **WARNING** Be sure to purge with N2 gas in order to prevent corrosion and reduce the formation/deposition of reaction by-products in the pump. When inflammable and/or toxic gases are diluted with N2 to the safe concentration, be sure to maintain a separate supply of N2 gas to the pump exhaust pipe.

 **CAUTION** Abrupt rotation of the pressure adjustment knob will cause the pressure indicator needle of the regulator to wobble and result in an inaccurate pressure display.

 **CAUTION** Unless a sufficient supply of N2 gas is maintained, serious problems will occur such as oil back flow or pump corrosion and accretion of reaction by-products.

Operate the N2 gas selector valve in accordance with the dilution N2 mode set by DIP switch-A No. 7.

If DIP Switch is set to OFF                      Open Valve.

If DIP Switch is set to ON                      Close Valve.

**[ NOTE ]** For normal operation, open the N2 gas selector valve. To save N2 gas set close the valve when the production process does not lead to the formation of reaction by-products in the pump or when the process uses non-corrosive gases.

**[ NOTE ]** The N2 gas selector valve is positioned on the front panel at the right when viewing facing the pump front panel (operating panel).

**[ NOTE ]** It takes 10 odd seconds until the flow has stabilized after you have operated the N2 gas selector valve.

(3) Turn on the power supply to the pump.

(4) The LCD controller counts down 10 seconds after placing the Circuit Breaker (CB) into the ON position.

**[ NOTE ]** The pump cannot start while the measuring instruments are warming up for 10 seconds after the CB is placed in the ON position.

(5) Check on the WATER FLOW display of the LCD Controller that the cooling water flow rate is 3.5 L/min. or more.

(6) Re-check on the PUMP N2 FLOW display of the LCD Controller that the dilution N2 gas flow rate is within the 17 - 20Pam<sup>3</sup>/s range. Also check that the pressure gauge shows a reading of 0.09 - 0.12MPa.

After setting the pressure, press the red stopper to lock the knob in position.

In this condition, the shaft sealing N2 flow rate is 4.6 - 6Pam<sup>3</sup>/s.

(The shaft sealing N2 flow rate is contained in pump N2 flow rate currently displayed on the LCD controller.)

- (7) When the WARNING/ALARM display appears on the LCD controller or when any abnormal symptoms are found other than the display, take action in accordance with 10. "Troubleshooting."

Even when the cause of the WARNING/ALARM display has been removed, it is maintained until the RESET signal is entered. Either press the RESET button or enter an external RESET signal from the control signal connector. In the BUZZER Enabled mode using DIP switches, it is possible to stop the buzzer by pressing the "BZ.OFF" button when the alarm is being generated.

- (8) When the pump exhaust pipe is equipped with a valve, open this valve before starting the pump.



**CAUTION** Problems will occur when the pump is operated with the valve closed as the exhaust pipe will be pressurized.

## 7.2 START/STOP

The toggle and DIP switches can be set at any time to select the REMOTE/LOCAL modes and BUZZER Enabled function. Set in accordance with the operating conditions. (See 6.3. Setting the operational mode.)



### **WARNING**

The pump and exhaust piping will remain at a high temperature during operation and for a short time after the pump has stopped.  
Be sure to avoid contact and keep inflammable substances out of reach.  
Do not remove the outer cover during operation.



### **CAUTION**

When the production process leads to react by-products in the pump or when the process handles corrosive gases, be sure not to stop the pump until after at least 30 minutes of stopping the process gases.



### **CAUTION**

Process gases will remain in the vacuum pipes and the pump even after the pump has been stopped.  
Be sure that therefore to purge for at least 1 hour after the pumps has been stopped.  
Do not discontinue the N<sub>2</sub> purge when the pump is stopped only for a short time.



### **CAUTION**

The pump will remain at a very high temperature event after it has been stopped. Be sure therefore to leave the cooling water on for about 1 hour after the pump has been stopped.

[ **NOTE** ] It will take approx. 30 min. to reach the prescribed ultimate pressure when pump starts under the state of cold start.

[ **NOTE** ] Do not exhaust the process gases until at least 30 minutes after the pump has been started. The pump casing temperature will stabilize after about 4 hours and it is recommended not to start exhausting the process gases earlier than this.



**[ NOTE ]** Do not restart the pump until 30 seconds past, after the pump was stopped. The alarm(OVERLOAD2, STEP OUT, DRIVER ALARM) may generate if the pump is started during the time.

When DIP switch-A No. 4 is placed into the ON position and the toggle switch is changed from the LOCAL to the REMOTE setting the pump will stop regardless of the external signal input.

### 7.2.1 LOCAL Start/Stop

#### a) START

Press the START button on the controller.

The Main Pump (MP) will start and the M.P. RUN lamp on the controller will light.

After this, the Booster Pump (BP) will start automatically and the B.P. RUN lamp on the controller will light.

The power is indicated on the display during pump operation.

For other status display indications, refer to Table 6.1.

**[ NOTE ]** The pump will not start when an WARNING/ALARM has been generated. When the START button is pressed, "STARTFAIL" will appear on the display.

#### b) STOP

Press the STOP button on the controller. The MP and BP will stop simultaneously.

The RUN lamp goes out and the display gives a power reading of 0.0kW.

### 7.2.2 REMOTE Start/Stop

#### a) START

Enter the external "MP" start signal input from the control connector.

The MP starts.

In the automatic BP operating mode, the BP can be started/stopped automatically.

When the BP is operated under external start signal input, apply the external BP start signal to the control connector.

The power is indicated on the display during pump operation. For other status display indications, refer to Table 6.1.

**[ NOTE ]** The pump will not start when a WARNING/ALARM has been generated. When a START signal is entered, "STARTFAIL" will appear on the display.

b) STOP

Interrupt the external MP start signal and the pump will stop.

### 7.2.3 COMMUNICATION Start/Stop

a) START

Input the Main Pump "MP" start-up command from the RS232C communication connector. The MP will start.

In the case of DIP SW A-8  $\Rightarrow$  OFF : After "MP" rotation reaches 3000 rpm, "BP" will start automatically.

In the case of DIP SW A-8  $\Rightarrow$  ON : After "MP" rotation reaches 3000 rpm, input the "BP" start-up command. BP will start.

The power is indicated on the display during pump operation. For other status display indications, refer to Table 6.1.

**[ NOTE ]** The pump will not start when an WARNING/ALARM has been generated. When a START signal is entered, "STARTFAIL" will appear on the display.

b) STOP

Input the MP stop command from the RS232C communication connector. The pump will stop.

Refer to Communicating Specification

## 8. Maintenance and Inspection

### 8.1 Internal energies

Following items show internal energies that shall be considered before start service maintenance.

#### 8.1.1 Power source

This dry pump is supplied with AC400V power source. Aside from the pump, the accessory power source locating in the vicinity of the power connectors are supplied with voltage even when the pump is completely stopped. To conduct pump maintenance or service, be sure to turn off the breaker switch, lock it out and then unplug the power cable. Refer to Section 3.4 in this manual for locking out the breaker switch.

#### 8.1.2 Cooling water

This pump is supplied with cooling water at pressure of maximum 0.4 MPa. Disconnection of the cooling water resulted from improper handling may cause electrification and unit damage. For service and transportation, unplug the cooling water connection plugs on the inlet and outlet, and seal off with plastic cap. The self-sealing plug is used for the cooling water connection plug in these pumps.

#### 8.1.3 Nitrogen gas

This pump is supplied with nitrogen gas at pressure of maximum 0.7 MPa for diluting and sealing inside the pump. For service and transportation, close the supply-source valve to reduce the pressure with the regulator and detach the gas connection. Close nitrogen port with blank off plug. If the pump has already operated with process gases, purge the residual gases with nitrogen gas after stopping the pump operation. Then, conduct maintenance.

## 8.2 Routine Inspection

Check periodically that ALARM signal is not output on the LCD controller or remote output.

**Table 8.1 Typical check items**

No.	Item	Sensor	Interval (recommended)
1	Motor Current	Current Transformer	Every 1 week
2	N2 Gas Flow	Flow sensor	
3	Vibration / Noise	-----	
4	Cooling water flow	Flow sensor	
5	Pump casing Temp.	Thermo- Couple	
6	Color / level of lubricant oil	-----	Every 1 month

When the WARNING/ALARM display appears, take action in accordance with Section 10. "Troubleshooting."

If the lubrication oil amount is lower than the lower limit line of the oil level gauge, supply the lubrication oil. See the Section 8.3 "Lubrication oil" when adding the oil.



### **WARNING**

Switch off the power supply to the pump first and interrupt the Circuit Breaker (CB) and lockout before you start on maintenance.



### **WARNING**

The pump and exhaust piping will remain at a high temperature during operation and for a short time after the pump has stopped.

Be sure to avoid contact and keep inflammable substances out of reach.

Do not remove the outer cover during operation.

Even when the cause of the WARNING/ALARM signal has been removed the signal will be maintained until the "RESET" signal is entered. After you have taken the remedial action, press the "RESET" button on the controller or enter the RESET signal from the control signal connector to reset the WARNING.

**CAUTION**

The pump will not stop when an WARNING signal is generated.

When pump operation is continued in this condition a ALARM signal will be generated or a serious breakdown will occur. Be sure therefore to check the pump in accordance with the instructions of Section 10. "Troubleshooting" after the process plant has completed 1 cycle.

**CAUTION**

When a ALARM signal has been generated in the REMOTE operating mode, do not start the maintenance tasks until you have interrupted the external start signal. When the external ALTERNATE start signal input is maintained, the pump will start while the ALARM is being reset.

If any abnormal symptoms other than those displayed on the LCD controller appear, take action in accordance with the instruction of Section 10. "Troubleshooting".

When the "BZ.OFF" button is pressed in the BUZZER Enable mode, the buzzer will stop even during an warning status.

### 8.3 Vacuum and Exhaust Piping

**WARNING**

Maintenance on the vacuum and exhaust piping shall be performed by taking proper action to avoid the dispersion of inflammable, toxic and/or hazardous substances and to prevent physical contact with, and absorption of, these substances.

**WARNING**

The pump and exhaust piping will remain at a high temperature during operation and for a short time after the pump has stopped.

Be sure to avoid contact and keep inflammable substances

out of reach.

Do not remove the outer cover during operation.

**WARNING**

Be sure to check for gas leaks after you have finished pipe maintenance work. Leaks will cause serious danger due to the discharge of harmful and hazardous substances and the occurrence of unpredictable reactions associated with the admission of air into the pump. When checking for gas leaks by pressurization, please pressurize by less than 0.05 MPa into the purge port and do check.

Toxic gases may be generated from by-products in the piping or pump in pump disconnection from the tool piping for repair and replacement or flange removal for maintenance. Gain relevant information about the process gases from your tool suppliers, and be sure that the gas concentrations in the work areas are at quarter or under the acceptable values specified using appropriate measurement equipment.

Without assurance of gas safety, instruct the workers to wear proper personnel protective equipment if necessary to protect them from gas hazards. The personnel protective equipment must include at least gloves, safety goggles, and a gas mask.

Be sure to following the instructions below when carrying out maintenance work on the vacuum and exhaust piping of the pump.

- (1) Before you remove and wash the piping be sure to purge with a sufficient volume of N<sub>2</sub> gas.
- (2) When an exhaust gas scrubber unit is used, close the inlet valve of the exhaust gas scrubber after the N<sub>2</sub> gas purge has been discontinued and then remove the piping.
- (3) Be sure to switch off the power supply.
- (4) After you have washed the piping do not reconnect until it has dried completely.

## 8.4 Lubricant Oil

**CAUTION**

Do not start filling oil until the interior pump pressure has reached atmospheric pressure. The chamber containing the oil is under low pressure (vacuum) so that a significant leak

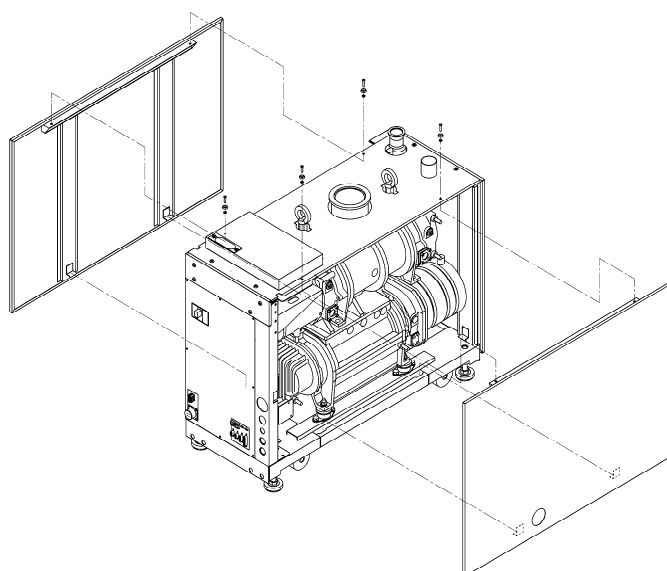
will occur causing substantial damage to the pump when the oil-filling plug is removed with the pump operating.

**CAUTION** Waste oil shall be disposed of by industrial waste disposal dealer in accordance with Material Safety Data sheets. (Appendix 2)

If the oil level is lower than the lower limit line of the oil level gauge in daily inspection and maintenance, it is necessary to supply oil.

Follow the steps below to supply oil.

(1) Stop the pump and remove the outer side cover on the pump. (See Fig. 8.1)

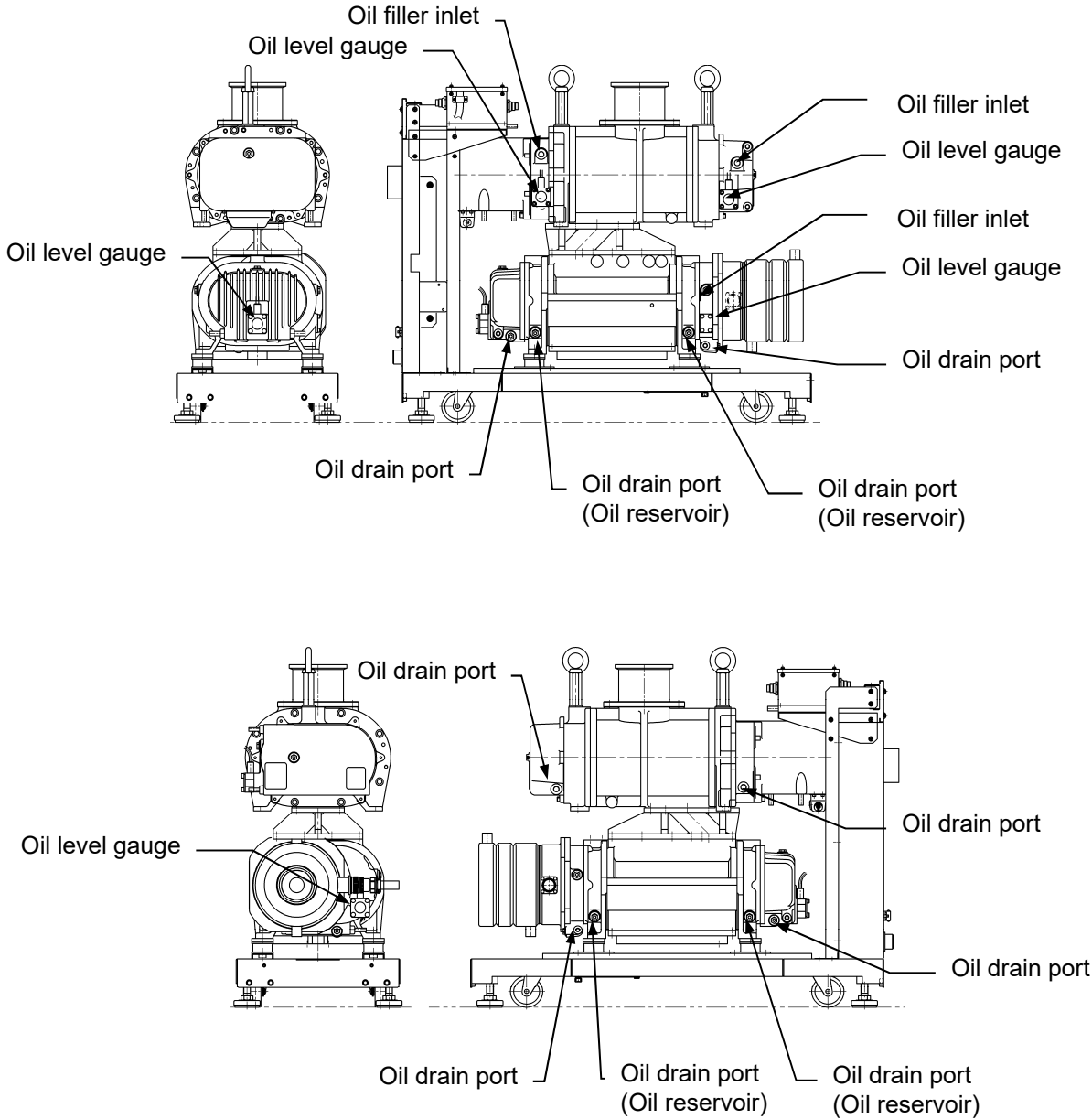


**Fig. 8.1 How to remove pump covers**

(2) After you have waited until the internal pump pressure returns to atmospheric (normal) pressure, remove the plug from the oil-filler inlet. (See Fig. 8.2)

(3) Check the level through the window of the gauge. Then, add the oil so that the level is between the upper and lower limit lines (see Fig. 8.2 and 8.3).

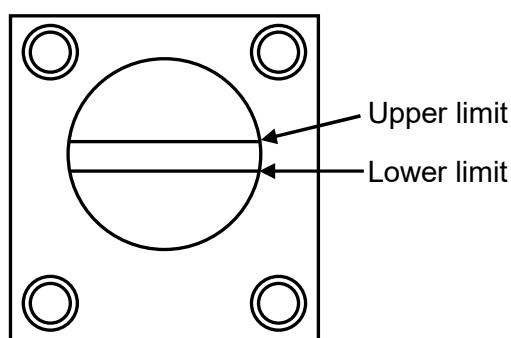
(4) After you have checked that there are no depositions and fragments adhering to the O ring attached to the plug, close the oil-filler inlet.



**Fig. 8.2 Oil filler inlet, oil level gauge, and oil drain port positions**



- (5) Fit a waste oil container (PVC bag) to the bottom of the oil drain hole of the secondary reservoir and remove the drain plug. (See Fig.8.2)
- (6) When you have drained off the waste oil close the drain hole after you have checked that there are no depositions and fragments adhering to the O ring attached to the plug.
- (7) Please check the air leak after supplying lubricant oil.



**Fig. 8.3 Oil Level Gauge**

**! CAUTION** Be sure to use the lubricant oils listed in specification table 3.1 only.

**! CAUTION** When the lubrication oil level exceeds the upper limit, the oil may leak to the pump side. Thus, be sure not to exceed the upper limit line when adding the oil. (Except Booster pump gear side.)

**! CAUTION** When the lubrication oil level is lower than the lower limit line, serious failure may be caused. If you find out the shortage, add the oil immediately.

## 8.5 Spare (Maintenance) Parts List

Following parts are needed for maintenance in customer's site.

**Table. 8.2 Spare (Maintenance) Parts List**

### 1. Standard consumption Part.

Parts' Name	Type	Order No.
Lubricant oil	BARRIERTA J100ES	C-0402-000-0111

### 2. Recommendable Part for Safe Operation.

Parts' Name	Type	Order No.
O-ring (Viton A)	For NW25 center ring	C-1210-351-0001
	For NW40 center ring	C-1210-352-0001
	G55(For Exh. check valve)	C-1210-089-0201

### 3. Recommendable Parts for Quick Maintenance.

Parts' Name	Type	Order No.
Exhaust check valve	32X80L	C-2244-031-0001

### 4. Recommendable Spare Parts. (Not needed for each pump.)

Parts' Name	Type	Order No.
Water flow sensor	10 L/min	C-5137-008-0001
N <sub>2</sub> flow sensor	84.4 Pa m <sup>3</sup> /s	C-5138-062-0111
Thermo couple sensor bolt	T TYPE, M8	C-1019-121-0001
N <sub>2</sub> gas pressure regulator	R31-200-C121	C-2250-101-0001

### 5. Electric Spare Parts.

Parts' Name	Type	Order No.
Control Panel	ESAG4200E	—
Motor driver for BP	IMDGA200-400	A-2100-007-6000
LCD Controller	REMG4	C-5114-317-0021

Following labels are attached to pump covers. When they are hard to read for discoloring or peeling off, please stick them again as directed.

**Table. 8.3 Labels**

Label's Name	Parts No.
[DANGER] HAZARDOUS WEIGHT DANGER LABEL	C-7110-316-0001
[WARNING] HAZARDOUS VOLTAGE WARNING LABEL	C-7110-313-0001
[WARNING] HIGH TEMPERATURE WARNING LABEL	C-7110-312-0001
[WARNING] HAZARDOUS MATERIAL WARNING LABEL	C-7110-314-0001
[WARNING] ANTI EARTHQUAKE FIXTURE WARNING LABEL	C-7110-322-0001

## 8.6 List of wastes during maintenance

Table 8.4 lists wastes from general user maintenance. Dispose the wastes properly according to your local waste disposal regulations in each area.

**Table 8.4 List of wastes during maintenance**

Part	Equipped on	Remarks
Lubricant oil	Inside of pump module. See section 8.4.	Refer to Appendix 2 for Material Safety Data Sheet.
Lithium battery	CPU board. (No necessary to replace at usual maintenance.)	Refer to Appendix 3 for Material Safety Data Sheet.
O-ring	Connection of vacuum line	Usual industrial waste.

## 8.7 Overhaul

Some parts used in this pump is consumables. Overhauls including periodical component replacement and inspections ensure safe and high-performance pump operations.

The overhauls require well-trained personnel who have up-to-date knowledge of the pump structure and are familiar with hazardous chemical gases and safe work procedures. Factories where the overhauls are conducted must be equipped with special tools and facilities as well as exhaust air ducts to protect against toxic gas hazards.

Ebara-designated overhaul factories provide services with well-trained personnel and relevant facilities supported by an established supply system of up-to-date pump information and genuine brand name parts. These advantages offer users superior overhaul services for the pumps in various states.

Ebara recommends the users to send the pumps for the periodical overhaul to the Ebara-designated factories. These factories equip special tools, sufficient evacuation duct

Contact EBARA Sales office or Overhaul service center for detail.

To avoid dangers potentially encountered during pump overhauls, follow instructions below to send your pump to an Ebara-designated factory for overhaul or repair.

- (1) Fill all necessary items in a form shown in Appendix 5 and fax it in advance to Ebara Service Center or one of the agents listed in Global network for contact address. Ask Ebara service center for latest form. The original copy must accompany the pump you send. Failure to meet these requirements may restrict Ebara from providing any overhaul services to avoid associated risks.
- (2) When you send back the pump to service center in the United States, contact Ebara Service Center first to obtain a RMA number for identification. Enter this RMA number to an Environmental Health & Safety Clearance Form shown in Appendix 5. Ask Ebara Service Center for latest form. Then, fax it in advance to Ebara Service Center and attach its original copy to the pump you send. Be sure to take these prior actions; otherwise Ebara refuses any overhaul services to avoid associated risks.

## 9. Disconnection and Transportation



### **WARNING**

When the pump has been used for exhausting highly toxic gases such as arsenic and mercury compounds, be sure to contact EBARA Corporation before you return the pump. Refer to Appendix 4 and 5 or the format required when customer returns their pump to Ebara service center for overhaul or rebuild



### **CAUTION**

In the interest of safety during the transportation, disassembly and cleaning of the pump, be sure to take note of the gases that have been handled.

Toxic gases may be generated from by-products in the piping or pump in pump disconnection from the tool piping for repair and replacement or flange removal for maintenance. Gain relevant information about the process gases from your tool suppliers, and be sure that the gas concentrations in the work areas are at quarter or under the acceptable values specified using appropriate measurement equipment.

Without assurance of gas safety, instruct the workers to wear proper personnel protective equipment if necessary to protect them from gas hazards. The personnel protective equipment must include at least gloves, safety goggles, and a gas mask.

To disconnect and transport the pump, proceed as follows.

- (1) Stop the pump and replace all gases inside the pump by purging them with N2 gas.
- (2) Turn off the power supply to the pump and unplug the power and signal cables.
- (3) After you have fully closed the N2 regulator, remove the N2 pipe, seal off the N2 purge port with a sealing flange.
- (4) Remove the cooling water pipes.
- (5) Remove the vacuum and exhaust pipes and completely seal off the inlet and exhaust ports of the pump with a blind flange or similar seal. Seal off all process gas discharge points such as the differential port by using a blind flange.

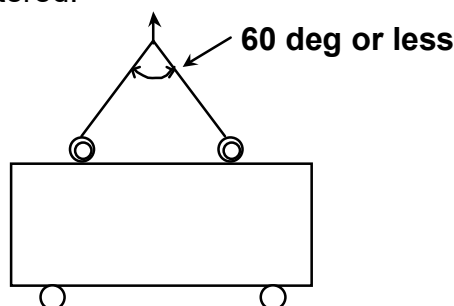
- (6) Attach the LCD controller on the front panel of the control board. Fix it with the tape.
- (7) Wrap the pump in a vinyl sheet.
- (8) Use the eyebolts provided on the pump for slinging the pump to load and unload. Fasten eyebolts completely and push in until flush with the seating surface. For sling, use a wire with a length so that the slinging angle (that is, the angled subtended by the two wires) is within 60 degrees.



**DANGER** Do not enter the zone underneath the suspended pump.



**WARNING** For lifting the pump, use only qualified operator personnel. Be sure that the wire rope and crane used for lifting the pump are in proper order and match the weight of the pump. To prevent unequal weight distribution, suspend the pump by ensuring that the slinging angle remains symmetrically centered.



**Fig. 9.1 Slinging the Pump**

- (9) When options such as an interface box are attached to the pump, be careful to avoid damage due to contact by the wire rope.
- (10) For transportation, secure the pump by lowering the adjustment feet. Place a protective cloth around the pump to avoid shock and position protective members between the outer cover and the wires in order to distribute the load of the fastening wires.

To avoid dangers potentially encountered during pump overhauls, follow instructions shown in Section 8.7, Appendix 4 or 5 to send your pump to an Ebara-designated factory for overhaul or repair.

## 10. Troubleshooting

### 10.1 Troubleshooting (1) Basic trouble

**WARNING**

Interrupt Circuit Breaker (CB) before starting on wiring and maintenance work.

Do not switch on the power supply to the pump until work is completed.

**WARNING**

The pump casing and exhaust piping become extremely hot during operation and for some time after stopping.

Be sure that pump and exhaust piping do not come in contact with humans or inflammable substances.

Do not remove the pump cover during operation.

**WARNING**

Check for gas leaks after installing and maintaining the piping. Gas leaks will result in the discharge of harmful and dangerous substances and in abnormal reactions due to the ingress of air into the pump. When checking for gas leaks by pressurization, please pressurize by less than 0.05 MPa into the purge port and do check.

Abnormal symptom	Check Item	Corrective Action
Circuit breaker is activated. (Leakage detector is on.)	Incorrect wiring	Check wiring.
	Short circuit	Replace or overhaul pump.
Power LED does not come on.	No power supply to pump.	Check power supply.
	connector is not connected.	Connect power connector.
	CB is not ON.	Place CB to ON.
Nothing appears on LCD	CB is not ON.	Place CB to ON.
	Disconnection of the LCD's connector	Connect LCD's connector
	Instrument failure	Replace instruments.
MP does not start when applying START button.	"Remote" mode has been selected.	Set switch to "Local" mode.
	Start-up conditions are not satisfied. ("Startfail" is displayed.)	Satisfy all start-up conditions.
	Instrument failure	Replace instrument.
MP does not start when entering external "MP start" signal input.	"Local" mode has been selected.	Set switch to "Remote".
	Start-up conditions are not satisfied. ("Startfail" is displayed.)	Satisfy all start-up conditions.
	Instrument failure	Replace instrument.
BP does not start.	BP start signal is not entered in REMOTE mode.	Enter the start signal.
	Instrument failure	Replace instruments.
Abnormal noise Excessive vibration	Adjustment feet are not applied.	Use the adjustment feet.
	Some object is making contact with the outer cover.	Remove the object.
	The fastening screws of the outer corer have worked themselves loose.	Tighten the fastening screws.
	Parts of the pump are damaged.	Replace or overhaul pump.
Vacuum pressure increase.	Accumulation of by-products in pipes.	Clean piping.
	N2 pressure setting is high.	Set pressure for correct value.
	Leak from vacuum piping.	Check piping.
	Accumulation of by-products in pumps.	Replace or overhaul pump.
**MEMORY ERROR** is displayed on LCD after activating ELB or changing the dip switch setting	None	Need "Countermeasure against electric Noise" to pump.



## 10.2 Troubleshooting (2) WARNING



### WARNING

Interrupt Circuit Breaker (CB) before starting on wiring and maintenance work.

Do not switch on the power supply to the pump until work is completed.



### WARNING

The pump casing and exhaust piping become extremely hot during operation and for some time after stopping.

Be sure that pump and exhaust piping do not come in contact with humans or inflammable substances.

Do not remove the pump cover during operation.



### WARNING

Check for gas leaks after installing and maintaining the piping. Gas leaks will result in the discharge of harmful and dangerous substances and in abnormal reactions due to the ingress of air into the pump. When checking for gas leaks by pressurization, please pressurize by less than 0.05 MPa into the purge port and do check.

Display	Symptom	Check Item	Corrective Action
WARN: WATER FLOW LOW ###	Water flow is reduced.	Coupler is disconnected.	Connect coupler.
		Pressure is not sufficient.	Apply sufficient pressure.
		Root valve is closed.	Open valve.
		Water pipe is clogged.	Clean or replace piping.
		Tube fittings are loosened.	Re-tighten.
		Instrument failure	Replace instrument.
		Outlet & inlet pipes are reverse. (flow value 0 L/min)	Connect pipes correctly.
WARN: PUMP N2 FLOW LOW	Pump N2 flow is reduced.	N2 port is not connected.	Connect N2 pipe fitting.
		Primary pressure is insufficient.	Apply sufficient pressure.
		Regulator setting value LOW.	Increase pressure setting.
		N2 pipe is clogged.	Replace N2 piping.
		Leaks on N2 pipe.	Check the fittings.
		Instrument failure	Replace instrument.
WARN: CASING TEMP HIGH	Casing temperature rises.	Duct ventilation insufficient	Ventilate sufficiently.
		Pump back pressure rises.	Check exhaust pipe
		Increase of the gas load.	Reduce the inflow gas amount.
		Accumulation of by-product	Replace or overhaul pump.
		Cooling water flow is reduced.	Increase cooling water flow.
WARN: BP MOTOR TEMP HIGH  WARN: MP MOTOR TEMP HIGH	Booster Pump (BP) motor coil temp. rises.  Main pump (MP) motor coil temp. rises.	Cooling water flow is reduced.	Cool pump thoroughly and reset.
WARN: BP DRIVER TEMP HIGH #####	Booster Pump (BP) driver temp. rises.	Duct ventilation insufficient	Ventilate sufficiently.
		Cooling water flow is reduced.	Increase cooling water flow.
WARN: ## COMM.ERROR	Communication is not established.	Connection error of the instrumented units	Check the connection of the instrumented unit.
		Instrument failure	Replace instrument.
ALARM: PUMP BOX TEMP HIGH	Temp. rises in pump cover.	Duct ventilation not sufficient	Ventilate sufficiently.
		Cooling water flow is reduced.	Increase cooling water flow.

After you have taken the remedial actions above, reset the pump. If the problem that has caused the WARNING signal still remains, the WARNING display will appear again even after you have reset.

### 10.3 Troubleshooting (3) ALARM



**WARNING** Interrupt Circuit Breaker (CB) before starting on wiring and maintenance work.  
Do not switch on the power supply to the pump until work is completed.



**WARNING** The pump casing and exhaust piping become extremely hot during operation and for some time after stopping.  
Be sure that pump and exhaust piping do not come in contact with humans or inflammable substances.  
Do not remove the pump cover during operation.



**WARNING** Check for gas leaks after installing and maintaining the piping. Gas leaks will result in the discharge of harmful and dangerous substances and in abnormal reactions due to the ingress of air into the pump. When checking for gas leaks by pressurization, please pressurize by less than 0.05 MPa into the purge port and do check.

Display	Symptom	Check Item	Corrective Action
ALARM: WATER FLOW LOW	Water flow is reduced.	Coupler is disconnected.	Connect coupler.
		Pressure is not sufficient.	Apply sufficient pressure.
		Root valve is closed.	Open valve.
		Water pipe is clogged.	Clean or replace piping.
		Tube fittings are loosened.	Re-tighten.
		Instrument failure	Replace instrument.
		Outlet & inlet pipes are reverse. (flow value 0 L/min)	Connect pipes correctly.
ALARM: CASING TEMP H.HIGH	Pump casing temp. rises.	Insufficient ventilation	Ventilate sufficiently
		Pump back press. rises.	Check exhaust pipe & silencer.
		Increase of the gas load.	Reduce the inflow gas amount.
		Cooling water flow is reduced.	Cool pump thoroughly and reset.
		Accumulation of by-products	Replace or overhaul pump.
ALARM:BP MOTOR TEMP H.HIGH ALARM:MP MOTOR TEMP H.HIGH	Booster Pump (BP) motor coil temp. rises. Main Pump (MP) motor coil temp. rises.	Cooling water flow is reduced.	Cool pump thoroughly and reset.
		Motor failure	Replace or overhaul pump.
ALARM:BP MOTOR OVERLOAD  ALARM:MP MOTOR OVERLOAD	BP motor current rises. (thermal relay trip)	Pump back press. rises.	Check exhaust pipe & silencer.
		Increase of the gas load.	Reduce the inflow gas amount.
	MP motor current rises. (thermal relay trip)	Rotor makes contact. (Accumulation of by-products) (Substance plunge)	Replace or overhaul pump.
		Open phase	Loss of the phase in power source
		Instrument failure	Replace instrument.
ALARM:BP MOTOR STEP OUT	Booster Pump (BP) motor step out	Pump back press. rises.	Check exhaust pipe.
		Increase of the gas load.	Reduce the inflow gas amount.
	Can not restart	Rotor makes contact. (Accumulation of by-products) (Substance plunge)	Replace or overhaul pump.
		Instrument failure	Replace instrument.
ALARM :MP MOTOR NO CURRENT	MP motor current value is 0.	Instruments are in failure.	Replace instruments.

ALARM: BP DRIVER ###	BP Motor driver protection  Can not restart	Insufficient ventilation	Ventilate sufficiently.
		Pump back press. rises.	Check exhaust pipe.
		Increase of the gas load.	Reduce the inflow gas amount.
		Rotor makes contact. (Accumulation of by-products) (Substance plunge)	Replace or overhaul pump.
		Cooling water flow rate is reduced.	Cool pump thoroughly and reset.
		Motor driver has broken down.	Replace motor driver.
ALARM: PHASE ERROR	Open phase	Instrument failure	Replace instrument.
		Incorrect wiring	Check power supply
ALARM:STARTFAIL ALARM/WARN EXIST	Start fault	Starting during WARNING/ALARM status	Make sure that all starting conditions are met.
		Instrument failure	Replace instrument.

After you have taken the remedial actions above, reset the pump. If the problem that has caused the ALARM signal still remains, the ALARM display will appear again even after you have reset.

During REMOTE operation carry out the above procedures after you have turned off the external start signal.

When the external start signal remains on in the ALTERNATE mode, the pump will start immediately when the RESET signal is applied.

## 10.4 Troubleshooting (4) Option



**WARNING** Interrupt Circuit Breaker (CB) and lockout before starting on wiring and maintenance work.

Do not switch on the power supply to the pump until work is completed.



**WARNING** The pump casing and exhaust piping become extremely hot during operation and for some time after stopping.

Be sure that pump and exhaust piping do not come in contact with humans or inflammable substances.

Do not remove the pump cover during operation.



**WARNING** Check for gas leaks after installing and maintaining the piping.

Gas leaks will result in the discharge of harmful and dangerous substances and in abnormal reactions due to the ingress of air into the pump. When checking for gas leaks by pressurization, please pressurize by less than 0.05 MPa into the purge port and do check.

Display	Symptom	Check Item	Corrective Action
ALARM: WATER LEAKAGE	Water leakage	Tube fittings are loosened.	Re-tighten.
		Instrument failure	Replace instrument.
ALARM: BACK PRESS.HIGH	Exhaust pressure rises.	Exhaust valve is closed.	Check exhaust pipe.
		Instrument failure	Replace instrument.
WARN: PRESS. HIGH ###	Exhaust pressure rises.	Exhaust valve is closed.	Check exhaust pipe.
		Instrument failure	Replace instrument.
ALARM: EMERGENCY STOP	Emergency Stop switch	Stop by emergency Stop button.	Check that pump can be operated and turn the button head to release lock.

After you have taken the remedial actions above, reset the pump. If the problem that has caused the ALARM signal still remains, the ALARM display will appear again even after you have reset.

During REMOTE operation carry out the above procedures after you have turned off the external start signal.

When the external start signal remains on in the ALTERNATE mode, the pump will start immediately when the RESET signal is applied.



# Global Network (ENG)

## USA

### EBARA TECHNOLOGIES INCORPORATED

HEADQUARTERS/FSC  
SACRAMENTO (CA)

51 MAIN AVENUE, SACRAMENTO, CA 95838  
PHONE:1-916-920-5451  
FAX:1-916-830-1900

**Service Locations:**

<http://www.ebaratech.com/index.php?target=location>

## EUROPEAN UNION

### EBARA PRECISION MACHINERY EUROPRE GMBH

HEADQUARTERS  
HANAU, GERMANY

RODENBACHER CHAUSSEE 6 D-63457 HANAU, GERMANY  
PHONE:49-6181-1876-0  
FAX:49-6181-1876-40

FSC  
LIVINGSTONE, SCOTLAND

3/4 ADAM SQUARE, BRUCEFIELD INDUSTRIAL PARK,  
LIVINGSTONE, WEST LOTHIAN, EH54 9DE, U.K.  
PHONE:44-1506-460232  
FAX:44-1506-460222

**Service Locations:**

<http://www.ebara-pm.eu/about-us/locations.html>

## KOREA

### EBARA PRECISION MACHINERY KOREA INC.

HEADQUARTERS  
U-SPACE 1B-902, DAEWANGPANGYO-RO 660,  
BUNDANG-GU, SEONGNAM-SI, GYEONGGI-DO, KOREA  
PHONE:82-2-581-6901/5  
FAX:82-31-724-2570

FSC  
MOGOK-DONG

446-4, MOGOK-DONG, SEOCHO-KU, SEOUL KOREA  
PHONE:82-31-665-0001  
FAX:82-31-665-0003

**URL (Korean):**

<http://ebara.co.kr/index.php>



### EBARA CORPORATION

PRECISION MACHINERY.FUJISAWA PLANT  
2-1, HON-FUJISAWA 4-CHOME, FUJISAWA,  
KANAGAWA, 251-8502, JAPAN  
PHONE:81-466-83-8111 FAX:81-466-82-0127

[URL:http://www.ebara.co.jp/en/business/precision/](http://www.ebara.co.jp/en/business/precision/)

## TAIWAN

### EBARA PRECISION MACHINERY TAIWAN INC.

HEADQUARTERS  
TAIPEI

ROOM 1402 CHIA HSIN BLDG.,NO.96, SECRETARY. 2,  
CHUNG SHAN N. RD.,TAIPEI TAIWAN, R.O.C. 104  
PHONE:886-2-2560-1166  
FAX:886-2-2560-1177

FSC  
HU-KOU

5, TZU-CHIANG RD.,HSIN-CHU LND.PARK. TAIWAN, R.O.C.303  
PHONE:886-3-597-3300  
FAX:886-3-597-7733

**Service Locations (Chinese):**

<http://www.ebara-tep.com.tw/service.htm>

## SINGAPORE

### EBARA ENGINEERING SINGAPORE

NO.1 TUAS LINK 2 SINGAPORE-638550  
PHONE:65-6862-3536  
FAX:65-6861-0589,6862-5937

**URL:**

[http://www.ebara.com.sg/index.php?option=com\\_frontpage&Itemid=1](http://www.ebara.com.sg/index.php?option=com_frontpage&Itemid=1)

## CHINA

### SHANGHAI EBARA PRECISION MACHINERY CO., LTD.

ZHANGJIANG HIGH-TECHNIC PARK, NO.76 LANE 887,  
ZUCHONGZHI ROAD, SHANGHAI, 201203, CHINA  
PHONE:86-21-5131-7008  
FAX:86-21-5131-7048

**URL (Chinese):**

<http://www.sepm-ebara.com/cn/index.php>

## JAPAN

### EBARA FIELD TECH CORPORATION

2-1, HON-FUJISAWA 4-CHOME, FUJISAWA,KANAGAWA,  
251-8502, JAPAN  
PHONE:81-466-83-9171  
FAX:81-0466-83-1100

**Service Locations (Japanese):**

<http://www.eft.ebara.com/company/soffice.html>



## 製品安全データシート

MSDS No. 1863

作成日 2002 年 08 月 27 日  
改定日 2009 年 10 月 01 日

## 1. 製品及び会社情報

製品名 : BARRIERTA J100ES

会社名 : NOKクリューバー株式会社

住所 : 東京都港区芝大門1-12-15 正和ビル

担当部署 : 品質管理部 品質管理課

TEL:0293-43-0426 FAX:0293-43-3817

## 2. 組成、成分情報

単一製品・混合物の区別 : 混合物

化学名 : フッ素系潤滑油

成分	CAS番号	官報公示整理番号	含有量
パーフルオロポリエーテル	企業秘密により開示不可	企業秘密により開示不可	>95wt%
添加剤	企業秘密により開示不可	企業秘密により開示不可	<5wt%

危険有害成分 : 非該当

## 3. 危険有害性の要約

最重要危険有害性 : 280℃以上に加熱すると、有害な（腐食性のある）分解ガスが発生する恐れがある。

有害性 : 280℃以上に加熱すると、有害な（腐食性のある）分解ガスが発生する恐れがある。

触媒となる金属等が共存する場合には、280℃以下でも分解することがある。

長時間における皮膚との接触により炎症を起こすことがある。

物理的及び化学的危険性 : 特になし

## 4. 応急措置

吸入した場合 : 大量に吸入した場合は、直ちに新鮮な空気のある場所に移し、保温して安静に保つ。  
必要なら医師の診断を受ける。皮膚に付着した場合 : 付着物を拭き取り、水と石けんでよく洗う。  
かゆみや炎症などの症状がある場合は、速やかに医師の診断を受ける。

目に入った場合 : 清浄な水で最低15分間洗浄した後、医師の手当てを受ける。

飲み込んだ場合 : 無理に吐かせようとせず、直ちに医師の診断を受ける。

## 5. 火災時の措置

- 消火剤 : 本製品は不燃性。  
霧状の強化液、泡、二酸化炭素、粉末が有効。
- 特定の消火方法 : 付近の着火源を断ち、保護具を着用して消火する。
- 消火を行う者の保護 : 消火作業の際には有害なガスを吸い込まないように呼吸用保護具を着用し、風上から消火作業を行う。

## 6. 漏出時の措置

- 人体に対する注意事項 : 暴露防止のため、保護具を着用して作業を行い、蒸気の吸入や皮膚への接触を防止する。必要であれば、十分に換気を行う。  
漏出した場所の周辺への関係者以外の立ち入りを禁止する。  
付近の着火源、高温体、可燃物を取り除き、消火機材を準備する。
- 環境に対する注意事項 : 本製品を含む廃水の公共用水域への排出又は地下浸透を防止するため、本製品がこぼれた床面などを水で洗い流してはならない。
- 除去方法 : 少量の場合はヘラ、スコップ等を使うか、土砂などに吸着させて蓋付きの空容器に回収し、ウエス等できれいに拭き取る。  
火花を発生しない安全な器具等を使用する。  
多量の場合は、土砂などで流れを止めた後で回収する。

## 7. 取り扱い及び保管上の注意

### 取り扱い

- 技術的対策 : 接触の恐れがある時は適切な保護具を使用する。  
280℃以上に加熱したり、製品の付着した手で喫煙しないこと。
- 注意事項 : 原則として常温で取り扱い、その際、水分、夾雑物等の混入に注意すること。
- 安全取り扱い注意事項 : 暴露防止のため、保護具を使用して作業を行う。皮膚への接触を避ける。

### 保管

- 適切な保管条件 : 適切な換気のある乾燥した冷暗所に密栓して保管する。

その他、消防法、労働安全衛生法等の法令に定めることに従う。

## 8. 暴露防止措置及び保護措置

- 設備対策 : 屋内作業には適切な局所排気装置を使用することが望ましい。
- 管理濃度 : 規定なし
- 許容濃度 : 日本産業衛生学会(1993年版) 勧告値なし

### 保護具

- 呼吸器の保護具 : 有機ガス用防毒マスク
- 手の保護具 : 耐油性の保護手袋
- 目の保護具 : 側板付き普通眼鏡型またはゴーグル型保護眼鏡
- 皮膚及び身体の保護具 : 作業衣、安全靴
- 適切な衛生対策 : 作業中は飲食、喫煙をしない。

---

## 9. 物理的及び化学的性質

形状	: 液体
色	: 無色透明
臭い	: なし
比重	: 約 1.89 (20°C)
引火点	: なし (不燃物)
発火点	: なし (不燃物)
爆発限界 (下限)	: なし
爆発限界 (上限)	: なし
溶解性	: 水に不溶
蒸気圧	: 約 6.5E-5Pa (20°C)

---

## 10. 安定性及び反応性

安定性	: 通常の条件下では安定
反応性	: 特記すべき反応性なし
避けるべき材料	: 強塩基、アルカリ金属、アルカリ土類金属、ルイス酸
危険有害な分解生成物	: 280°C以上に加熱すると、有害な（腐食性のある）分解ガス（フッ素化合物）が発生する恐れがある。

---

## 11. 有害性情報

急性毒性	: 現在のところ知見なし
局所効果	: 長時間における皮膚との接触により炎症を起こすことがある。
変異原性	: 現在のところ知見なし

---

## 12. 環境影響情報

現在のところ知見なし

---

## 13. 廃棄上の注意

- (1) 知事等の許可を受けた産業廃棄物処理業者に処理を委託すること。
  - (2) 空容器を廃棄する時は、内容物を完全に除去しておくこと。
  - (3) 廃棄は法令に従い、適切に処理すること。
-

## 14. 輸送上の注意

注意事項 : 取り扱い及び保管上の注意の項の記載に従うこと。  
容器漏れのないことを確かめ、転倒、落下、損傷のないように積み込み、荷崩れ防止を確実に行う。

### 国内規制

陸上輸送 : 消防法、労働安全衛生法等に定められている運送方法に従う。

海上輸送 : 船舶安全法に定められている運送方法に従う。

航空輸送 : 航空法に定められている運送方法に従う。

国連分類 : 非該当

国連番号 : 非該当

## 15. 適用法令

### 労働安全衛生法

表示対象物質 : 非該当

通知対象物質 : 非該当

その他 :

### P R T R法

第一種指定化学物質 : 非該当

第二種指定化学物質 : 非該当

毒物及び劇物取締法 : 非該当

消防法 : 非該当

水質汚濁防止法 : 排出基準 : フッ素及びその化合物 (海域以外 : 8mg/L、海域 : 15mg/L)

輸出貿易管理令 : 別表1の5項 (先端材料)、別表1の16項 (キャッチオール規制)

## 16. その他の情報

(1) 引用文献 J I S Z 7 2 5 0 : 2 0 0 0 日本工業標準調査会

本製品安全データシートは、化学製品の工業的用途について、安全な取り扱いを確保するための参考資料として、一般的取り扱い等を前提として作成・提供されるものです。また、危険有害性の評価では現時点で入手した資料・情報・データ等に基づいて作成しておりますが、全ての情報を網羅したわけではありません。取り扱う事業者の皆様は、これを参考として、自らの責任において個々の取り扱いの実態に応じた適切な処置を講じる必要があることをご理解の上、お使い頂きます様、お願い申し上げます。

従って、本データシートそのものは、安全の保証書ではありません。  
また、法令の改正および新しい知見に基づき改訂されることがあります。

## Material Safety Data Sheet

**Product name:** BARRIERTA J100ES**Date:** September 10, 2002**Revision Date:** February 20, 2009**MSDS No.** 1863

Page 1 of 5

### 1. Product and company identification

**Product name:** BARRIERTA J100ES**Company:** NOK KLÜBER CO.,LTD

955-4, Aza Ohishi, Isohara, Isoharamachi, Kitaibaraki city, Ibaraki 319-1541, Japan

**Telephone:** +81-293-42-5365**Fax:** +81-293-43-3817

### 2. Composition/information on ingredients

**Chemical names and synonyms:** Fluorinated lubricating oil

CAS No.	Components	Value
	Perfluoropolyether	>95wt%
	Additives	<5wt%

**Hazardous ingredients:**

### 3. Hazardous identification

&gt;280 C traces of fluorinated products

Some materials (e.g. titanium, aluminum or alloys of these materials) may cause lower decomposition temperatures.

Prolonged skin contact may cause skin irritation and/or dermatitis.

### 4. First aid measures

**After inhalation**

Remove victim to fresh air. If symptoms persist, call a physician.

**After contact with skin**

Wash off with mild cleaners and plenty of water. If symptoms persist, call a physician.

**After contact with eyes**

Rinse with plenty of water. If symptoms persist, call a physician.

**After ingestion**

If large amounts are swallowed, do not induce vomiting. Obtain medical attention.

## **5. Fire-fighting measures**

### **Suitable extinguishing media**

The product itself does not burn. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

### **Special hazards**

In case of fire the following can be released: traces of fluorinated products

### **Special protective equipment for firefighters**

Standard procedure for chemical fires.

### **Additional information**

Water mist may be used to cool closed containers.  
In the event of the fire and/or explosion do not breathe fumes.

---

## **6. Accidental release measures**

### **Personal precautions**

Risk of slipping due to leakage/spillage of product.

### **Environmental precautions**

Do not flush into surface water or sanitary sewer system.

### **Methods for cleaning up/taking up**

Use mechanical handling equipment. Dispose of absorbed material in accordance with the regulations.

---

## **7. Handling and storage**

### **Handling**

#### **Advice on safe handling**

No special handling advice required.

#### **Advice on protection against fire and explosion**

No special precautions required.

### **Storage**

#### **Requirements on storage conditions**

Store at room temperature in the original container.

#### **Incompatible materials**

Do not store together with food.

---

---

## 8. Exposure controls/personal protection

### Additional advice on system design

not applicable

### Ingredients and specific control parameters

None

### Personal protective equipment

#### Respiratory protection

No special protective equipment required.

#### Hand protection

Wear chemical-resistant gloves.

#### Eye protection

Wear safety glasses. Do not wear contact lenses when working with chemicals.

#### Body protection

Wear clean, body-covering clothing to minimize dermal exposure.

#### General protection and hygiene measures

Avoid prolonged and/or repeated contact with skin. Remove soiled or soaked clothing immediately. Clean skin thoroughly after work; apply skin cream. Keep away from tobacco products.

---

## 9. Physical and chemical properties

<b>Form:</b>	liquid
<b>Color:</b>	colorless
<b>Odor:</b>	none
<b>Density:</b>	approx. 1.89 g/cm <sup>3</sup> , 20°C
<b>Flash point:</b>	none °C
<b>Ignition temperature:</b>	not applicable °C
<b>Lower explosion limit:</b>	not applicable
<b>Upper explosion limit:</b>	not applicable
<b>Water solubility:</b>	insoluble
<b>Vapor pressure:</b>	approx. 6.5E-5Pa (20 C )

---

## **10. Stability and reactivity**

### **Stability**

Stable

### **Conditions to avoid**

None

### **Materials to avoid**

Strong bases, alkali metals, alkaline earth metals, Lewis acids

### **Hazardous decomposition products**

>280 C traces of fluorinated products

### **Additional information**

None

---

## **11. Toxicological information**

The toxicological data has been taken from products of similar composition.

**Acute toxicity:** No data

Prolonged skin contact may cause skin irritation and/or dermatitis.

---

## **12. Ecological information**

### **Information on elimination (persistence and degradability)**

Product is insoluble in water. May be separated out mechanically in purification plants.

### **Behavior in environmental compartments**

Ecological injuries are not known or expected under normal use.

### **Ecotoxic effects**

Aquatic toxicity is unlikely due to low solubility.

### **Additional information**

Should not be released into the environment.

---

## **13. Disposal considerations**

This product can be incinerated when in compliance with local, state and federal regulations.

This product contains halogen.

Offer rinsed packaging material to local recycling facilities.

---



---

## 14. Transport information

**UN class :** not applicable

**UN No.:** not applicable

### **Advice on transportation**

Not classified as dangerous in the meaning of transport regulations.

---

## 15. Regulatory information

Please refer to the law and local regulations, etc. in each country.

---

## 16. Other information

No information

---

The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid if the material is used in combination with any other materials or if it is processed, unless specified in the text.

---

# Product Safety Data Sheet

The batteries are exempt articles and are not subject to the OSHA Hazard Communication Standard Requirement. This sheet is provided as technical information only. The information and recommendations set forth are made in good faith and are believed to be accurate as of the date of preparation. **Maxell makes no warranty, expressed or implied.**

## Section 1 - Product and Company Identification

Product Name Lithium Thionyl Chloride Batteries (ER)	Sizes: All	Date of preparation: March 1, 2008
Company: Hitachi Maxell, Ltd. Ono Works	Telephone: 81-(0)794-63-8054	
Address (Number, Street, City, State, and ZIP Code): 5, Takumidai, Ono-shi, Hyogo 675-1322, Japan	Fax: 81-(0)794-63-8058	

## Section 2 - Composition/Information on Ingredients

Ingredient	CAS#	Content (wt%)
Thionyl Chloride (SOCl <sub>2</sub> )	7719-09-7	20 to 45
Aluminum Chloride (AlCl <sub>3</sub> )	7446-70-0	2 to 6
Lithium Chloride (LiCl)	7447-41-8	0 to 2
Lithium (Li)	7439-93-2	2 to 6
Carbon (C)	1333-86-4	2 to 8

## Section 3 - Hazards Identification

This is a high energy density sealed battery containing dangerous (Lithium) and deleterious (Thionyl Chloride) materials. For this reason, improper handling of the battery could lead to distortion, leakage\*, overheating, explosion, fire, or generation of irritating/corrosive gases and cause human injury or equipment trouble. Please strictly observe safety instructions.

(\*Leakage is defined as an unintended escape of liquid from a battery.)

## Section 4 - First Aid Measures

None unless exposed to internal materials. If contents leak, observe the following instructions.

Inhalation	Fumes can cause nausea or difficulty in breathing. Ensure the person has fresh air and consult a physician.
Skin	Immediately wash the skin with plenty of water. If itchiness or irritation due to chemical burns persists, consult a physician.
Eyes	Immediately rinse the eye with plenty of water and continue for at least 15 minutes. Consult a physician immediately.
Ingestion	If a battery is swallowed, consult a physician immediately. If the contents come into contact with the mouth, immediately rinse with plenty of water and consult a physician.

## Section 5 - Fire Fighting Measures

Extinguishing Media	Alkaline metal fires can be effectively extinguished. Plenty of cold water is also effective to cool the surrounding area and control the spread of fire. But hydrogen gas may be generated by the reaction of water and lithium, forming a potentially explosive mixture. Therefore, use a smothering agent if many lithium batteries are burning in a confined space.
Fire fighting procedure	Use self-contained breathing apparatus and full protective gear to avoid inhaling harmful gases.

## Section 6 - Accidental Release Measures

None under normal use conditions. If contents leak, observe the following instructions.

Protection	Use full protective equipment to avoid breathing vapors or touching liquid.
Removal procedure	Place the battery in a large container filled with water. Rinse away the leaked contents with water.
Area	Evacuate the area except for operators. After above procedures, ventilate the contaminated area.

## Section 7 - Handling and Storage

### 1) Handling

Do not: swallow, apply excessive force to the positive terminal, drop, weld the terminal or wire to the body of the battery directly, short-circuit the battery, charge, forcibly discharge, heat, expose to open flame, disassemble, reverse the positive and negative terminals when mounting, use different batteries together, touch any liquid that leaks from the battery, or hold the battery for an extended period.

### 2) Storage

Keep the battery away from water. Never store the battery in a hot or very humid place.

## Section 8 - Exposure Controls, Personal Protection

Respiratory Protection		N/A
Ventilation	Local Exhaust	N/A
	Mechanical	N/A
	Special	N/A
	Other	N/A
Eye Protection		N/A
Protective Gloves		N/A
Other protective clothing		N/A

## Section 9 - Physical/Chemical Characteristics

N/A

## Section 10 - Stability and Reactivity

Stability	Stable
Incompatibility	Water
Hazardous polymerization	N/A
Conditions to avoid	See section 7
Hazardous decomposition or byproducts	Sulfur Dioxide, Hydrogen Chloride, Hydrogen

## Section 11 - Toxicological Information

N/A

## Section 12 - Ecological Information

N/A

## Section 13 - Disposal condition

The battery may be regulated by national or local regulations. Please follow the proper regulations. Electricity remaining in a discarded battery can lead to distortion, leakage, overheating, or explosion if the battery comes into contact with other metals, so make sure to cover the (+) and (-) terminals with friction tape or some other insulator before disposal.

**Section 14 - Transportation Information**

Shipping Name	Lithium Batteries
UN Number	UN3090 (UN3091 for lithium batteries in equipment)
Hazard Classification	Class 9 (Miscellaneous)

**Organizations governing the transport of lithium batteries**

Area	Method	Organization	Special Provision
International	Air	IATA, ICAO	A45
International	Water	IMO	188
U.S.A	Air, Rail, Highway, Water	DOT	49 CFR Section 173.185

These regulations are based on the UN Recommendations. Each special provision provides specifications on exceptions and packaging for shipping lithium batteries. All Maxell's ER batteries meet all special provisions.

Ref) Summary of A45 (IATA Dangerous Goods Regulations 49th Edition)

If all of the following three requirements are satisfied, lithium batteries will not be considered as dangerous goods when transported.

**1) Lithium weight or equivalent lithium content\* must be less than the value in table.**

	Lithium Cell/Battery (Lithium weight)	Lithium ion Cell/ Battery (Equivalent lithium content)
Cell	1g or less	1.5g or less
Battery	2g or less	8g or less

\*Equivalent lithium content (g) is calculated as 0.3(g/Ah) times the rated capacity (Ah).

**2) Cells and batteries must meet the requirements of the UN T1–T8 tests.****3) Each package containing more than 24 cells or 12 batteries shall:**

- Be marked to indicate that it contains lithium batteries, and that special procedures are to be followed in the event that the package is damaged.
- Be accompanied by a shipping paper explaining that the cells and batteries are exempt from regulations.
- Weigh no more than 30 kg (gross weight).
- Be capable of withstanding a 1.2m drop test in any orientation without any shifting of the contents that would allow short-circuiting, and without release of package contents.

Because the consignor has to take responsibility, the customer has to confirm exceptional conditions when shipping.

**Section 15 - Regulatory Information**

NA

**Section 16 - Other Information**

The battery is considered to be an article for purposes of the TSCA and not a chemical. Therefore, the battery is exempt from the TSCA requirements.

For further information, please contact a Maxell sales representative.

# エバラドライ真空ポンプ オーバーホール依頼書

宛先：

貴社名：

部署名：

行 御氏名：

御住所：

TEL No.

TEL：

FAX No.

FAX：

\* 当社営業担当宛にFAX後、御返却下さい。

E-mail：

お願い： 当社における作業（分解、洗浄など）の人的安全および環境安全の確保のため、弊社の製品をご返却の際は、お  
手数ですが必ずこの用紙で弊社にご連絡頂き、製品に添付して下さい。使用ガスや想定される化学的危険性は、  
事故防止のため記載不備の無いようお願い致します。また、オーバーホールで不要となった部品は、ご連絡がない限り  
弊社にて処理させていただきます。

貴社注文書番号、整理番号など：

1. ポンプ機名	
2. ポンプシリアル番号	
3. 付属品の有無	<input type="checkbox"/> 無 <input type="checkbox"/> 有（具体的に
4. 装置名	（装置メーカー名） （装置モデル名）
5. プレート名	<input type="checkbox"/> LP-CVD <input type="checkbox"/> PE-CVD <input type="checkbox"/> EPI <input type="checkbox"/> MO-CVD <input type="checkbox"/> ALD <input type="checkbox"/> METAL-CVD <input type="checkbox"/> OXIDE-ETCH <input type="checkbox"/> POLY-ETCH <input type="checkbox"/> ASHING <input type="checkbox"/> PVD <input type="checkbox"/> ION-IMPLANTER <input type="checkbox"/> SEM/METROGY <input type="checkbox"/> L/Lなど <input type="checkbox"/> その他（ * Coppre（銅）汚染がある場合は営業にご相談ください。
6. 使用ガス名	* エッチングプロセス、L/L用途であってもAs（ヒ素）等、有毒性のガスを使用されている場合は必ず「As」 明記し、ポンプ吸排気口には閉止フランジを取付けて下さい。明記なき場合、閉止なき場合はお引取 できません。
7. 使用ガス以外で想定される化学的危険性	* 使用ガス以外でポンプ内部に存在、残留が想定される化学物質とその危険性について明記ください。 例）エッチング、アッシング等プロセスのように使用ガス以外にウエハから除去、排出される化学物質 L/L等であってもプロセスチャンバ残留物として排出される可能性のある化学物質 チャンバー洗浄、乾燥工程等により排出される化学物質、他設備から流入、排出される化学物質
8. 電圧・周波数	
9. ポンプ停止時の状況	
10. 運転期間	年 月 日～ 年 月 日
11. オーバーホール後の状態	<input type="checkbox"/> 現状仕様 <input type="checkbox"/> 改造（手直し）希望（
12. 返却日／引取希望日	年 月 日 午前 午後
13. オーバーホール御希望納期	年 月 日 午前 午後 * 予備機の有無（有、無）
14. 備考	

## Appendix 5 Overhaul/Repair Request form(ENG)

### Overhaul Request form (USA)

In the United States, returned pump shipments must conform to Department of Transportation regulations:

- Hermetically seal contaminated equipment in two heavy gauge polyethylene bags or equivalent.
- Tag or label equipment stating the possible hazardous material and/or the environment in which it was used.
- Obtain an RMA number from the EBARA Service department and post on all bags, containers, and packing list along with a copy of the Environmental Health & Safety Clearance Form. See next page for sample of the form.

Be sure to take these prior actions; otherwise Ebara refuses any overhaul services to avoid associated risks.

# ENVIRONMENTAL HALTH & SAFETY CLEARANCE SHEET

TO

COMPANY NAME:

SITE NAME:

TEL No.

ADRESS:

FAX No.

PHONE:

Please FAX or mail a completed copu of this form to

FAX:

Ebara service center prior to shipping equipment.

E-mail:

Requests: Please fill out and attach this sheet with returning equipment due to envitonmental health and safety during overhaul works. Please describe risks of used gasses and estimated chemical risks to avoid an accident. We will dispose unnecessary parts without your requests.

PO number or RMA number:

1. Model name	
2. Serial nuber	
3. Attachments	<input type="checkbox"/> Without <input type="checkbox"/> With ( )
4. Tool name	(Maker name) (Model name)
5. Process name	<input type="checkbox"/> LP-CVD <input type="checkbox"/> PE-CVD <input type="checkbox"/> EPI <input type="checkbox"/> MO-CVD <input type="checkbox"/> ALD <input type="checkbox"/> METAL-CVD <input type="checkbox"/> OXIDE-ETCH <input type="checkbox"/> POLY-ETCH <input type="checkbox"/> ASHING <input type="checkbox"/> PVD <input type="checkbox"/> ION-IMPLANTER <input type="checkbox"/> SEM/METROGY <input type="checkbox"/> L/L etc. <input type="checkbox"/> Other process ( ) Please inform if the equipment contaminated with copper.
6. Gasses	Please write clearly if the equipment is contaminated with hazardous gasses, As or so, and tighten seal even used for load lock or etching process. We would not receive it without our requests.
7. Estimated chemical risk	Please write cleary estimated chemicals and their risks from existing byprocucts or chemicals in a pump. For example, generated chemicals from wafers in etching or ashing process. Discharged chemicals from process chambers or other facility.
8. Voltage, Hz	
9. Pump condition	
10. Operating period	/ / ~ / /
11. Requested condition	<input type="checkbox"/> Same condition <input type="checkbox"/> Modification or Repair( )
12. Preferred return day	/ / / AM PM
13. Remarks	

## Appendix 6 Information of typical hazardous materials

### Information of typical hazardous gas

The table below lists the typical gases used in a semiconductor-processing tool. Personnel involving operations, maintenance and services of the process tools and pumps must fully understand properties and hazardous nature of the gases used in those devices.

Many of those processing gases are inclined to explosive reaction when contacted with other chemicals or gases. It is also well known that the mixing or exhausting combustion gases and combustion support gases results in explosive reaction while causing serious damages. The list neither encompass all explosive gases nor describe all risks and dangers those may cause. It is strongly advised to contact your tool supplier to obtain sufficient and the latest information on potential risks and hazard the process gases have as well as on the safe operation of the tool. It is the responsibility of users to conduct safety practices to avoid any potential risks.



## APPENDIX 5 Typical Hazardous Gas Information

### 1. Etching process

Gas	Combustion Support	Flammable	Toxic	Corrosive	Global Warming	Allowable Level*
NF <sub>3</sub>	○		○	○		10ppm
HF			○	○		3ppm
Cl <sub>2</sub>	○		○	○		0.5ppm
BCl <sub>3</sub>			○	○		5ppm as HCl
HBr			○	○		3ppm
Br <sub>2</sub>			○	○		0.1ppm
CF <sub>4</sub>					○	N/A
CHF <sub>3</sub>					○	N/A
C <sub>2</sub> F <sub>6</sub>					○	N/A

\*Allowable level is specified as TLV of ACGIH.

### 2. LP-CVD

Gas	Combustion Support	Flammable	Toxic	Corrosive	Global Warming	Allowable Level
SiH <sub>2</sub> Cl <sub>2</sub>		○	○	○		5ppm as HCl
SiH <sub>4</sub>		○	○			5ppm
Si <sub>2</sub> H <sub>6</sub>		○	○			5ppm
Si(OC <sub>2</sub> H <sub>5</sub> ) <sub>4</sub> (TEOS)		○				10ppm
As(OC <sub>2</sub> H <sub>5</sub> ) <sub>4</sub> (TEOA)		○	○			0.01mg/m <sup>3</sup> as As
NH <sub>3</sub>		○	○	○		25ppm
H <sub>2</sub>		○				4% LEL*
NF <sub>3</sub>	○		○	○		10ppm
ClF <sub>3</sub>	○		○	○		0.1ppm

\*LEL : Lower Explosion Level

### 3. Ion-implant

Gas	Combustion Support	Flammable	Toxic	Corrosive	Global Warming	Allowable Level
AsH <sub>3</sub>		○	○			0.05ppm
B <sub>2</sub> H <sub>6</sub>		○	○			0.1ppm
PH <sub>3</sub>		○	○	○		0.3ppm
BF <sub>3</sub>			○	○		1ppm

## Appendix 7 Leak Check procedure

### **Typical Leak Check Procedure**

NOTE: This general procedure is not a substitute for user's work instructions or leak detector operations manual. Read and follow the instructions for your leak detection apparatus.

Perform leak check after initial system assembly and after any breach of the system for maintenance.

Check pump down time (that is time to go from atmosphere to target pressure) of fore line to confirm the absence of gross leaks.

For vacuum systems and process pump exhaust lines, pressurize the system with helium and run the probe ("sniffer") of a mass spectrometer leak detector around all joints, seals and fittings.

Realign joints, tighten fittings, replace seals, etc.

Repeat as necessary to eliminate all leaks.

Disconnect helium supply and place system in operating condition.

