

# **INSTRUCTION MANUAL**

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

**MODEL ESR100WN**

**STANDARD MODEL**

**200-220V (50/60Hz)**



**Caution:**

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

Be sure to keep this INSTRUCION 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

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Model OOO in this catalog is our model code.

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## **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.

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## 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, safety, 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.

 <b>DANGER</b>	Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.
 <b>WARNING</b>	Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
 <b>CAUTION</b>	Indicates an imminently hazardous situation that, if not avoided, may result in minor or moderate injury. This term may also be used as a warning for situations liable to damage equipment

## Important Prior Warnings

 <p><b>DANGER</b></p> 	<p>Keep out from under the pump when lifted. Only qualified personnel shall unload and lift the pump. Keep pump at horizontal position when lifted. Do not lift the pump without eyebolt spacer.</p>
 <p><b>WARNING</b></p>	<p>Be careful not to overturn the pump when pushing and pulling it sideways, because the pump is narrow in comparison to its height.</p>
 <p><b>WARNING</b></p> 	<p>Only a qualified electrician should perform electrical works, observing all national and local electrical regulations.</p>
 <p><b>WARNING</b></p> 	<p>Interrupt Earth Leakage Breaker (ELB) before starting on Cut and lock out power before beginning wiring and or maintenance work. Do not switch on the power supply to the pump until work is completed and pump and piping are returned to safe operating condition.</p>
 <p><b>WARNING</b></p> 	<p>Supply N2 gas to the exhaust piping when necessary to dilute the flammable or toxic gas down to a safe concentration.</p>
 <p><b>WARNING</b></p> 	<p>Purge with sufficient N2 gas before removing and cleaning 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.</p>
 <p><b>WARNING</b></p>	<p>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 byproducts.</p>

 <b>WARNING</b> 	<p>Pump oil may be contaminated with process byproducts. Treat it as a hazardous waste. See Table 3.1 for oil quantities.</p>
 <b>WARNING</b> 	<p>Exhaust from pumps handling process gases should be connected to an appropriate exhaust abatement system that is equipped with discharge quality monitors to provide warnings and shut down the process gas flow if gas concentrations exceed allowable limits.</p>
 <b>WARNING</b> 	<p>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.</p>
 <b>WARNING</b>	<p>Do not alter the pump member nor change any parts without EBARA's consent or approval.</p>
 <b>WARNING</b> 	<p>The pump casing and exhaust piping become extremely hot during operation and remain hot 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 pump enclosure panels during operation</p>
 <b>WARNING</b>	<p>Check Safety Interlock functions periodically (every 6 months) to confirm correct operation.</p>
 <b>CAUTION</b>	<p>Disposal of process by-products shall be strictly in accordance with all local and national environmental and safety regulations</p>
 <b>CAUTION</b>	<p>Disposal of Printed circuit board containing lithium battery shall be strictly in accordance with all applicable local and national environmental regulations.</p>

 <b>WARNING</b>	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.
 <b>WARNING</b>	Do not perform a withstand voltage test. Failure to comply could result in damage to the sensitive devices.
 <b>CAUTION</b>	Never operate the pump without pump cover for safety.

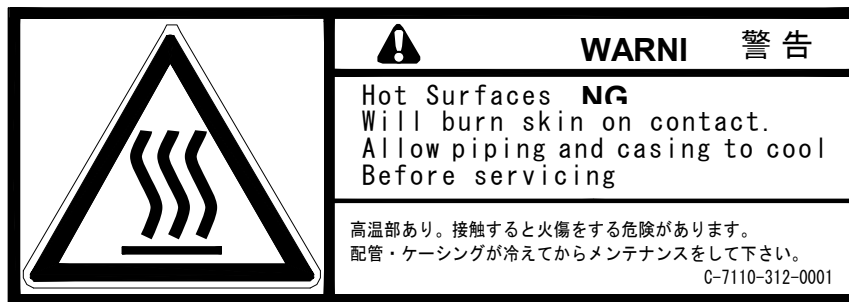
The following safety warning labels are attached to pump covers.

1. High temperature warning
2. Hazardous voltage warning
3. Hazardous materials warning
4. Electric charge mark
5. Hazardous weight danger
6. High temperature eyebolt warning

1. High temperature warning

Hot surface may burn or cause injury.

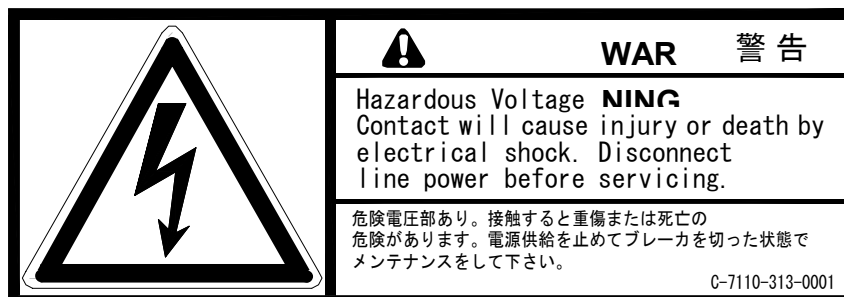
Allow the piping and casing to cool before servicing.



2. Hazardous voltage warning

Hazardous Voltage may shock, burn, or cause death.

Turn power off and lockout before servicing.



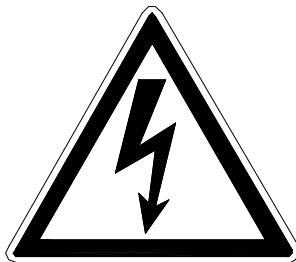


### 3. Hazardous materials warning

In case of hazardous materials are handled. Run the pump only with  $N_2$  gas purge before servicing. Take adequate measures against dangerous reaction and contact with human body.

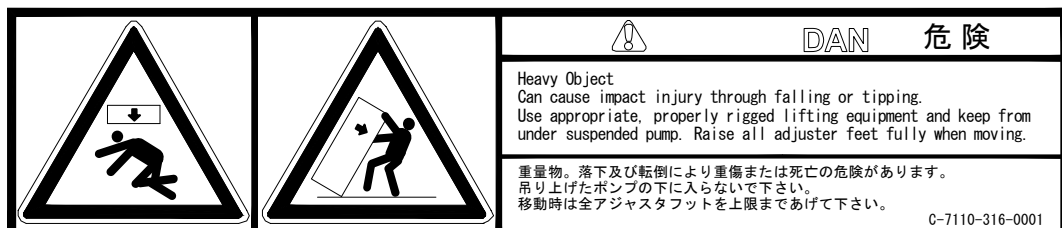


### 4. Electric charge mark

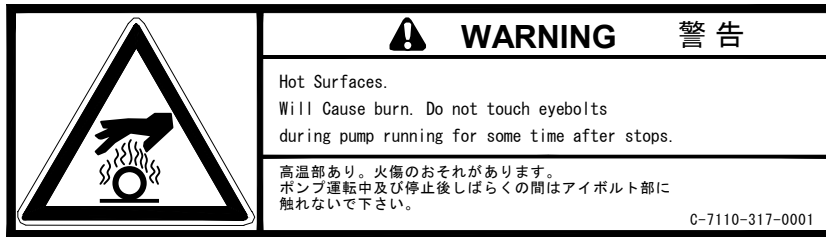


### 5. Hazardous weight danger

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.



6. High temperature eyebolt warning  
Hot surface may burn or cause injury.  
Allow the eyebolt to cool before servicing.



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## 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 or 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.

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## 1. Foreword

We appreciate that you have selected an EBARA MODEL ESR Series dry vacuum pump.

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.

 <p><b>CAUTION</b></p>	<p>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.</p>
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(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.

 <b>WARNING</b>	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.
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 <b>CAUTION</b>	If the product is not to be immediately installed, store it in a clean, dry location.
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## 3. Product Description

### 3.1 Outline

The MODEL ESR series dry vacuum pump has a compact design and includes various sensors and controls to enhance reliability and operation.

#### 3.1.1 Pump Module

The pump consists of a roots type Main Pump (MP) and roots type Booster Pump (BP) that rotates a pair of non-contact rotors synchronized by timing gears. In the units, a Booster Pump are connected in series with the Main Pump are connected in series for ventilation.

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

The pumps of MODEL ESR series are factories filled with lubrication oil. Lubrication oil grades recommendations for replenishing or replacing are shown in Tables 3.1.

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

N<sub>2</sub> gas is supplied to seal the shaft section so that a clean vacuum can be drawn without admitting lubricant oil to the pump casing.

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.

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 pumps of MODEL ESR series are equipped with a dilution N<sub>2</sub> gas control valve. Be sure

therefore to adjust the N<sub>2</sub> gas supply to the appropriate level after consulting EBARA when the dilution N<sub>2</sub> flow rate is to be increased in accordance with the conditions of use. (Maximum dilution N<sub>2</sub> flow rate; 84 Pam<sup>3</sup>/s.)



### 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

MODEL ESR series dry vacuum pumps have a built-in measuring unit consisting of an Earth Leakage Breaker (ELB), an electro-magnetic switch and a control circuit.

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

During pump operation all operating conditions are monitored, including power supply, cooling water flow, N<sub>2</sub> gas flow, lubrication oil level, casing and motor coil temperature, motor speed, and electric power for motor, back pressure.(option)

Continuous operation is possible when there is a momentarily power failure of 1 sec or less. (Two-second ride through is available as an option.)

### 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.

- Note that the warning indications of the MODEL ESR series are different from the conventional ones.

	Conventional	MODEL ESR series
Alarm 1 (Pump operation continued)	ALARM	WARNING
Alarm 2 (Pump stop)	TRIP	ALARM

### 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 Detailed Specifications

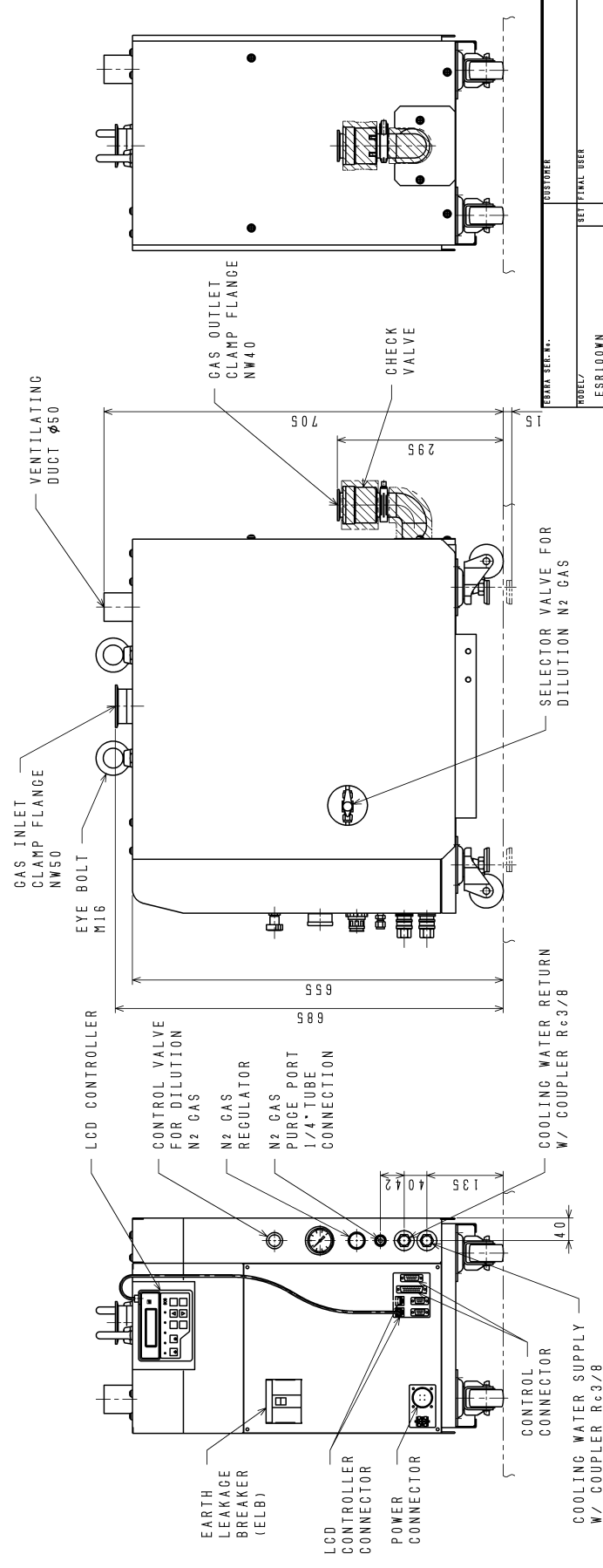
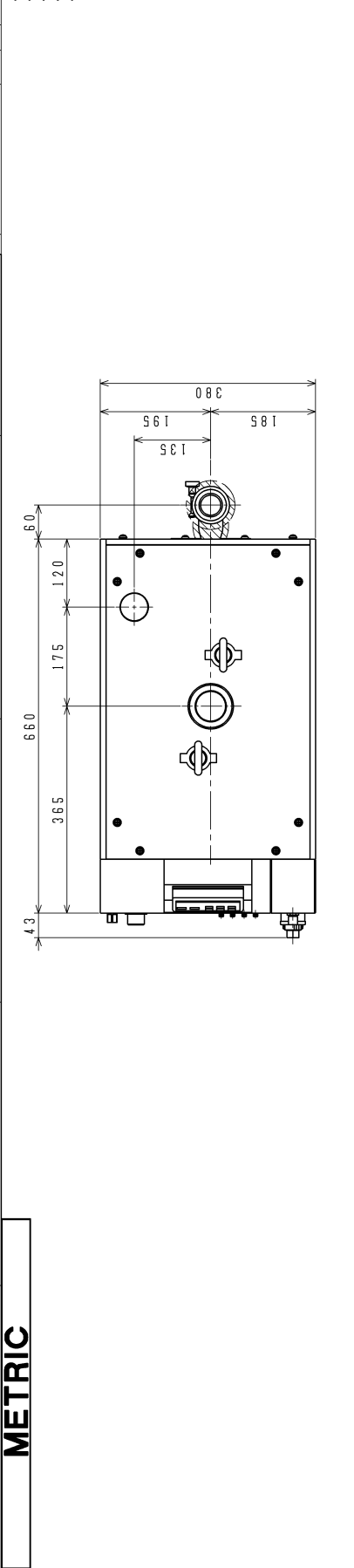
**Table 3.1 Specification**

Model		MODEL ESR100WN	
Pumping Speed		4000~10000 L/min	
Ultimate Pressure		0.2Pa	
Connection	Gas Inlet	NW50	
	Gas Outlet	NW40	
Approx. power at ultimate Pressure (Max Power)		1.0 kW (4.5 kW)	
Utility	Cooling Water	Connection	Coupler (Rc 3/8)
		Pressure [Gauge Press.]	Supply : Max. 0.4MPa Differential Press. : Min. 0.1MPa
		Flow rate	2-8 L/min
		Temperature	Max. 30°C
	N <sub>2</sub> Gas	Connection	1/4" Tube Fitting ("Swagelok" or equivalent)
		Pressure [Gauge Press.]	Supply : 0.1-0.7MPa [Setting : 0.04-0.07MPa]
		Approx. Flow rate* [N2-0 Mode]	19-22 Pa m <sup>3</sup> /s [3.4 Pa m <sup>3</sup> /s]
	Duct Ventilation**	Connection	d50 mm x L50 mm
		Pressure	-196 Pa
		Approx. Flow rate	0.5 m <sup>3</sup> /min
Lubrication Oil	Brand	BARRIERTA J100ES (NOK)	
	Quantity	300cc	
Approx. Weight		180 kg	
Power Supply	Phase/Volt/Freq.	3 Phase, 200-220V , 50 / 60Hz	
	Earth Leakage breaker	30 A trip	
	Power capacity	7.0kVA	
	Connection	Japan Aviation Electronics Industry JL04HV-2E22-22PE-B	
Control Signal		D-sub 15Pin + D-sub 25Pin	
Communication		RS-232C D-sub 9Pin × 2	
ELB Rating		30 A	

[Note] \* Approx. flow rate of N<sub>2</sub> gas shows a necessary amount of utility to total of pump purge N<sub>2</sub>. LCD controller displays the flow rate of pump purge N<sub>2</sub>. The pump purge N<sub>2</sub> flow rate can be increased above the standard flow rate with the control valve on the front (control panel) side.  
(Max. pump purge N<sub>2</sub> flow rate: 84Pa m<sup>3</sup>/s).

\*\* The ambient temperature of the pump installation place shall be 30°C of lower.

REV.	DESCRIPTION	DATE	BY



EBARA SER. NO.		CUSTOMER	
PROJECT	ESR100WN	DESIGNED BY	TEST FINAL USER
APP'D BY	J. SATOH	CHK'D BY	
DATE	Feb. 17, 1988	DATE	
S. KAWAHARA (CA. 1:10)		TITLE	
		VACUUM PUMP	
		OUTLINE DRAWING	
		SCALE	
		U.S.	
		REC.	
		DRAW. NO.	
		WB-0734875	
EBARA CORPORATION			

: HEAT INSULATOR	
SELECTOR VALVE FOR DILUTION N2 GAS	
CHECK VALVE	
GAS OUTLET CLAMP FLANGE NW40	
VENTILATING DUCT Ø50	
GAS INLET CLAMP FLANGE NW50	
EYE BOLT M16	
COOLING WATER RETURN W/ COUPLER Rc3/8	
COOLING WATER SUPPLY W/ COUPLER Rc3/8	
CONTROL CONNECTOR	
POWER CONNECTOR	
LCD CONTROLLER CONNECTOR	
EARTH LEAKAGE BREAKER (ELB)	
PURGE PORT 1/4\"/>	

**METRIC**

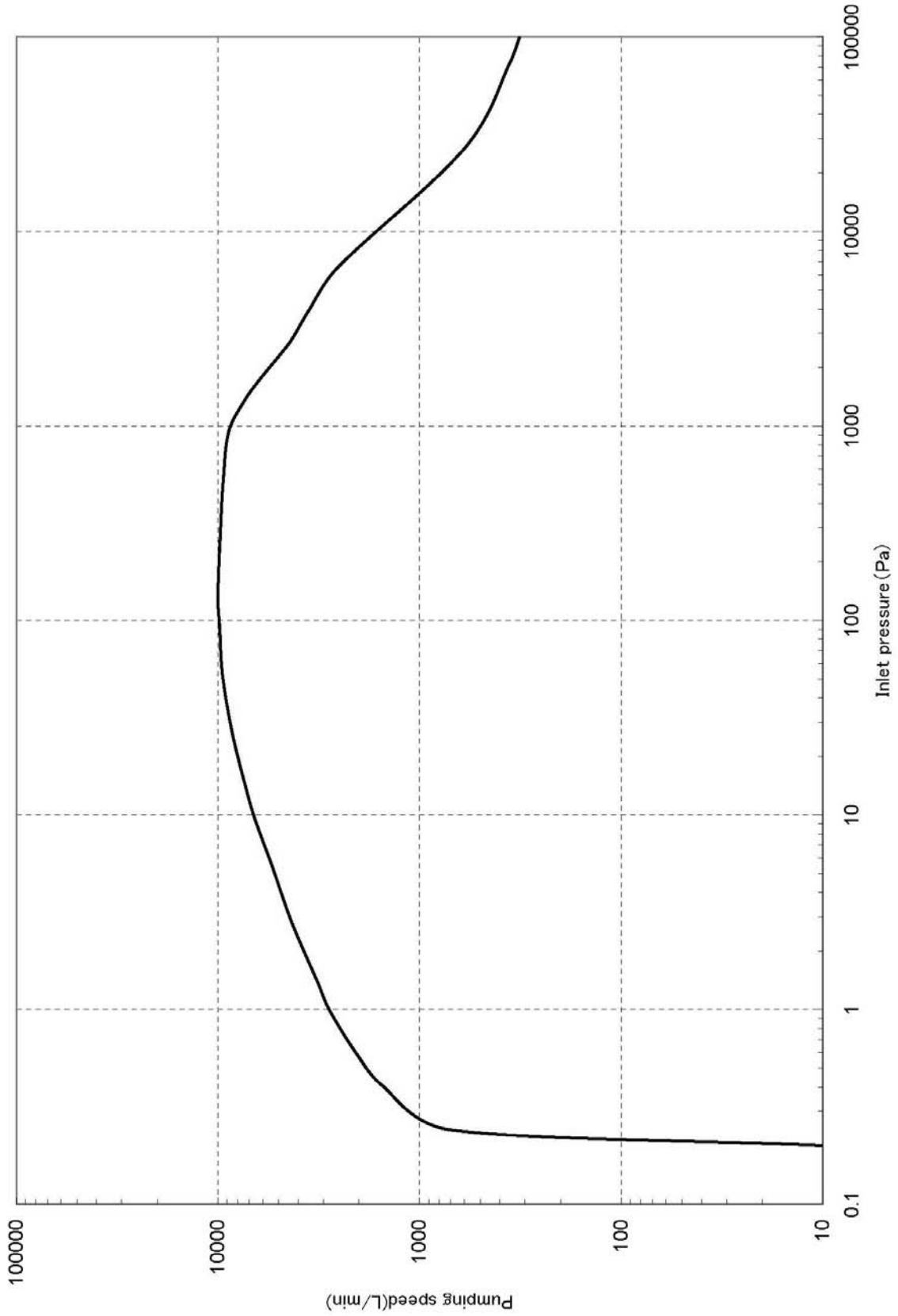


Fig 3.1 MODEL ESR100WN Performance

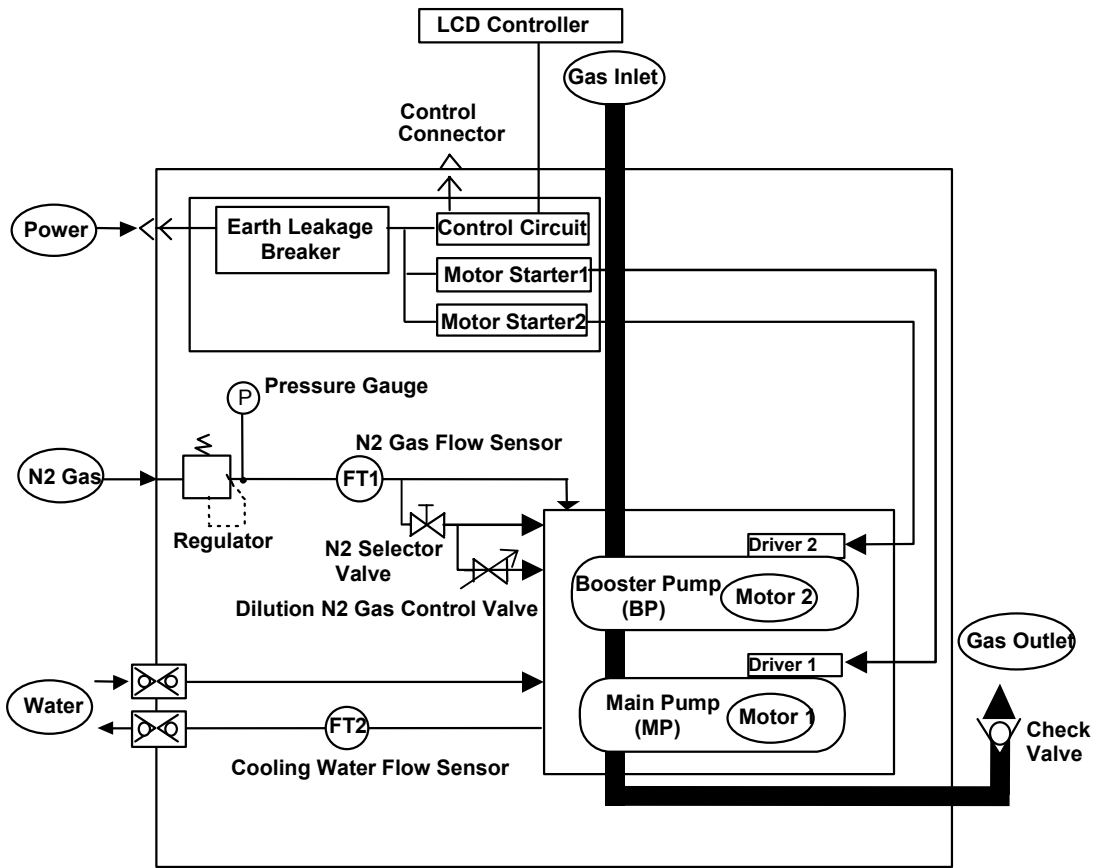


Fig 3.2 System Flow


## 4. Installation


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

### 4.1 Location

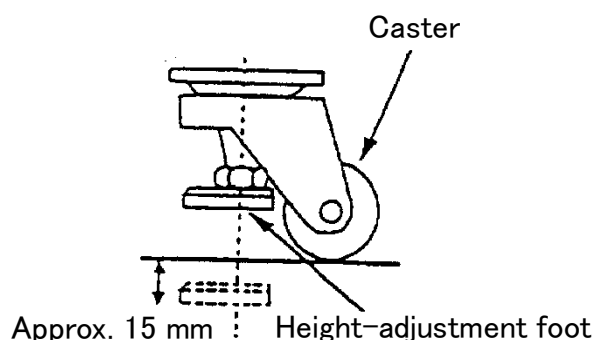
- (1) This pump is designed for indoor installation. To install the pump, select a place with little exposure to dust and humidity and not subject to dew condensation. Also allow for sufficient space to ensure easy pump installation and disassembly for maintenance.

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



 <b>CAUTION</b>	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.
--	--


 <b>CAUTION</b>	A gap of at least 50mm should be left open for ventilation between the pump cover and the adjacent equipment.
--	---


- (2) 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**

 <b>WARNING</b> 	Be careful not to overturn the pump when pushing and pulling it sideways, because the width of the pump is small to its height.
---	---

 <b>CAUTION</b>	The neck portion of the casters will vibrate during caster movement. Be sure to keep your fingers and feet out.
--	---

 <b>CAUTION</b>	Do not step on the pump or place objects on it.
--	---

- (3) To fix the pump, Turn the holding nuts in the clockwise direction to lower the height-adjustment feet and secure the pump.
- (4) 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.

<b>NOTE</b>	If the pump is not leveled, shortage of the lubrication oil supply to the bearing may be caused.
-------------	--

<b>NOTE</b>	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.

 <p><b>WARNING</b></p> 	<p>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.</p>
---	--

[ **NOTE** ] For a leak check with pressurization, apply a pressure of 0.05MPa at the N2 gas purge port.

 <p><b>CAUTION</b></p>	<p>Exhaust pipes made of materials that tend to transmit sound, such as vinyl chloride, may conduct pump exhaust sound, letting loud noise out. To solve such noise problems, attach a silencer (optional).</p>
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### 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)

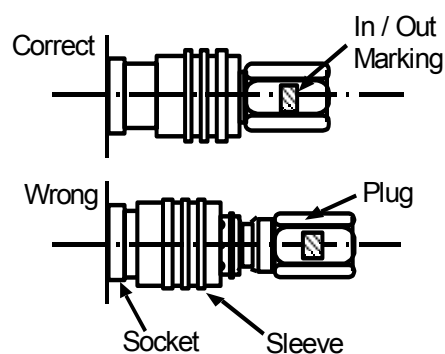
Be sure that the supply/return plugs are not connected in reverse. The diameters are slightly different. In/Out markings are provided on each plugs.

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**

 <p><b>WARNING</b></p> 	<p>In the case of removing the coupler, at first close the valve of cooling water supply line and next remove the coupler from the cooling water supply.</p> <p>In the case of connecting the coupler , connect it with the cooling water return (ret. outline drawing).</p> <p>If the above is neglected, pressure in the cooling water piping rises rapidly and there is a possibility to cause the water leak.</p>
---	---

 <p><b>CAUTION</b></p> 	<p>Even when the cooling water flow rate drops, the pump will continue to operate for 5 minutes.</p> <p>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.</p>
---	--

 <p><b>WARNING</b></p> 	<p>In the case of removing the coupler, at first close the valve of cooling water supply line and next remove the coupler from the cooling water supply.</p> <p>In the case of connecting the coupler , connect it with the cooling water return (ret. outline drawing).</p> <p>If the above is neglected, pressure in the cooling water piping rises rapidly and there is a possibility to cause the water leak.</p>
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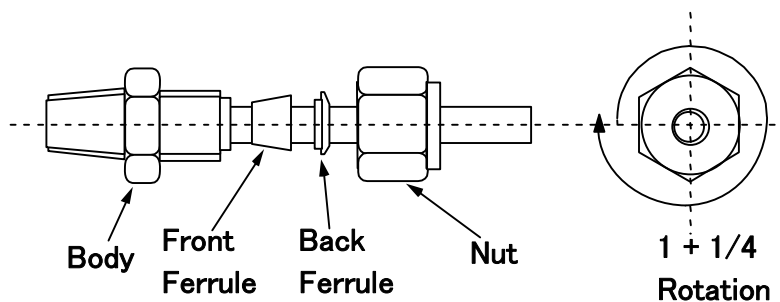
 <p><b>CAUTION</b></p> 	<p>Even when the cooling water flow rate drops, the pump will continue to operate for 5 minutes.</p> <p>The material selected for the water piping of facility side should have a heat resistance so that it can withstand a maximum temperature of at least 70°C at the operating pressure.</p>
---	--

#### 4.2.3 N<sub>2</sub> 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 N<sub>2</sub> 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**

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

#### 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.





Ebara MODEL ESR Series Dry Pumps 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.

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.


The pump does not provide protective hardware, like gas leak detector. So it is recommended to attach gas leak detector on detector port of duct piping to take exhaust flow interlock. In case of find gas leakage, stop the gas introduced into the equipment and pump.

 <b>CAUTION</b> 	For safety, be sure to ventilate through the ventilation duct when the pump is used to exhaust toxic and/or inflammable gases. Do not combine the ventilation duct with the pump exhaust piping .
 <b>CAUTION</b>	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.
 <b>CAUTION</b>	Never operate the pump without pump cover for safety.

### 4.3 Electrical Wiring


 <b>WARNING</b>	Be sure to keep the power supply to the pump turned off and locked out until you have finished the wiring and connecting work. Also interrupt Earth Leakage breaker (ELB) during this.
--	--

 <b>WARNING</b>	Only qualified electricians shall carry out electrical wiring.
--	--

 <b>CAUTION</b>	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.

 <b>DANGER</b>	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

Fig 4.4 show the power supply connector and a control signal connector position on the control panel.

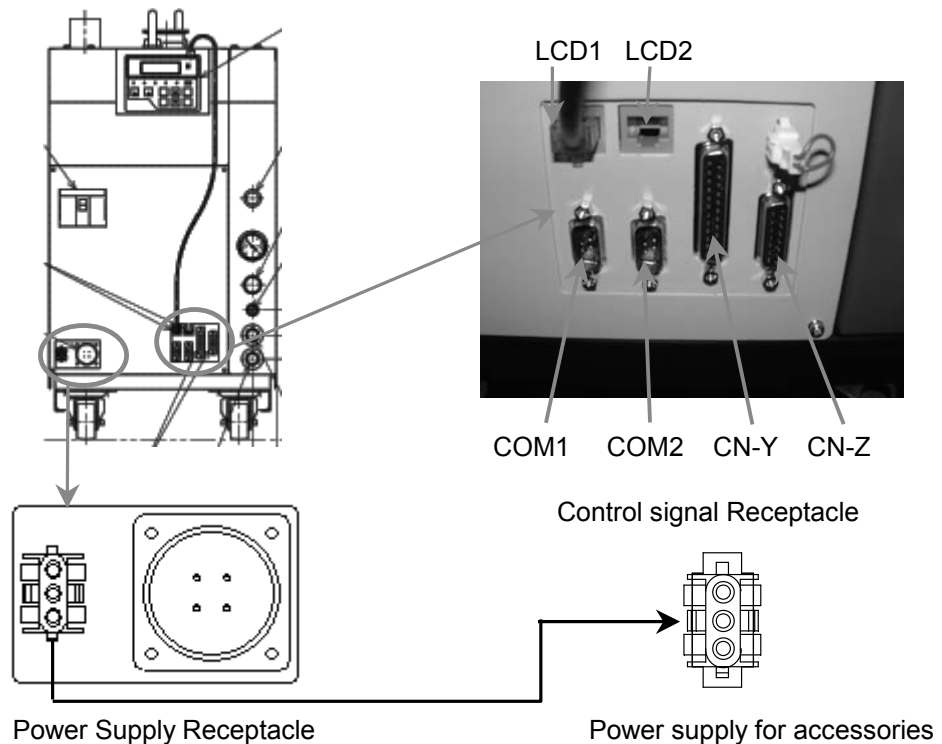



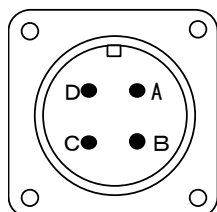


Fig 4.4 Power Supply and Control Signal connects position

<p><b>! WARNING</b></p> 	<p>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.</p>
<p><b>! CAUTION</b></p> 	<p>Be sure to connect the grounding wire.</p>
<p><b>! CAUTION</b></p> 	<p>Wiring should be hard-wired or using twist-lock Hubbel-type connector at power source side.</p>

Wire the connector for the main power supply (3-phase, 200-220V and 50Hz/60Hz).  
Fig. 4.5 and Tables 4.2 and 4.3 show the connector pin assignment.



**Fig 4.5 Power Supply Receptacle**  
(As seen from connecting side)

**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 ESR100WN
Receptacle type	JL04HV-2E22-22PE-B
Recep. Manufacturer	Japan Aviation Electronics Industry Co.,Ltd
Adapted plug type	JL04V-2E22-22SE-B
Suitable wire	AWG #10
Power capacity kVA	7.0

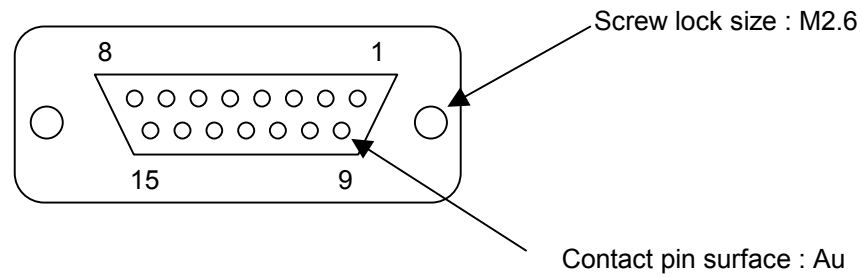
### 4.3.3 Control Signal Wiring

MODEL ESR dry pumps are 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 and 4.5 and Figs. 4.6 and 4.7 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

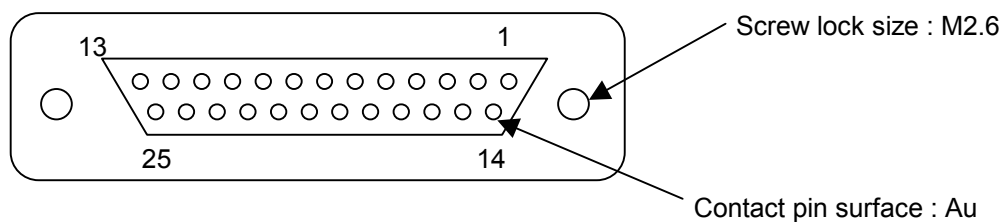




**Fig. 4.6 15 Pin D Sub-Miniature Female Receptacle**  
(As seen from connecting side)

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

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



**Fig. 4.7 25 Pin D Sub-Miniature Female Receptacle**  
(As seen from connecting side)

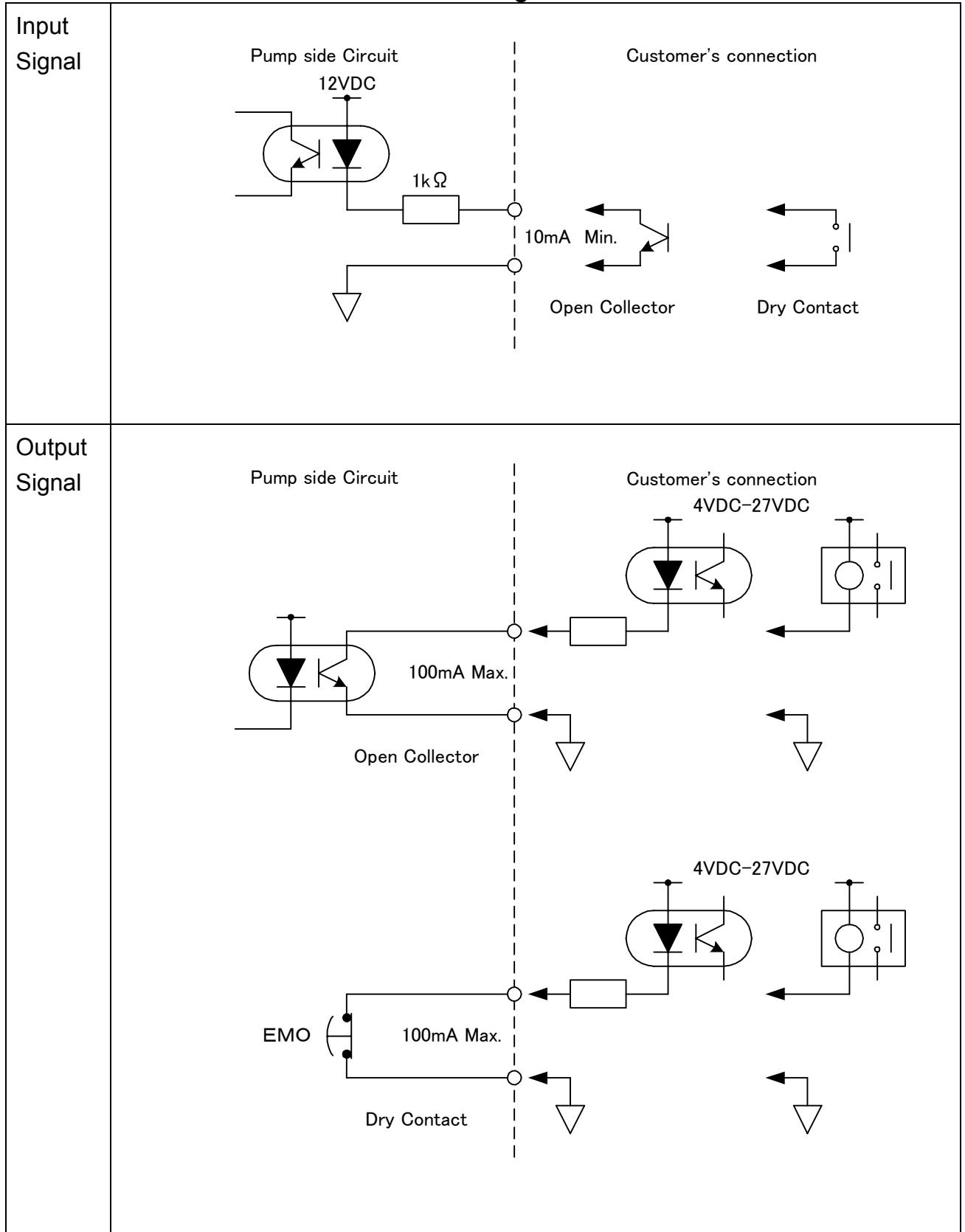
**Table 4.6 Control Connector Pin Assignment(CN-Y)**





Pin No.	Signal name	I/O	Signal type
1	RESET (+)	IN	RESET:CLOSE
2	SAVING ENERGY CONTROL(+)	IN	SAVING :ENERGY CLOSE,Alternate
3	RESERVED (+)	IN	
4	PUMP N2 VALVE CONTROL (+)*1	IN	VALVE CLOSE:CLOSE, Alternate
5	EXHAUST N2 VALVE CONTROL (+) *1	IN	VALVE CLOSE:CLOSE, Alternate
6	EMO STATUS (+)	OUT	Abnormality : OPEN,Alternate
7	PUMP N <sub>2</sub> WARNING STATUS (+)	OUT	Abnormality: CLOSE,Alternate*2
8	EXHAUST N <sub>2</sub> WARNING STATUS (+) *1	OUT	Abnormality : CLOSE,Alternate*2
9	SAVING ENERGY STATUS(+)	OUT	SAVING ENERGY:CLOSE, Alternate
10	RESERVED (+)	OUT	
11	RESERVED (+)	OUT	
12	RESERVED (+)	OUT	
13			
14	RESET (-)		
15	SAVING ENERGY CONTROL(-)		
16	RESERVED (-)		
17	PUMP N2 VALVE CONTROL (-)		
18	EXHAUST N2 VALVE CONTROL (-)		
19	EMO STATUS (-)		
20	PUMP N <sub>2</sub> WARNING STATUS (-)		
21	EXHAUST N <sub>2</sub> WARNING STATUS (-) *1		
22	SAVING ENERGY STATUS(-)		
23	RESERVED (-)		
24	RESERVED (-)		
25	RESERVED (-)		

\*1 As optional

\*2 Selectable both normal open or normal close with dip switch setting.

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



 <b>CAUTION</b>	Do not wire vacant pins.
 <b>CAUTION</b>	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. Apply a voltage not exceeding 50V DC on the equipment side.
 <b>CAUTION</b>	Be sure to wire all signals with the correct polarity (SIG./COM.)
 <b>CAUTION</b>	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.

## 5. Power Supply for the Options



Power supply connector for accessory is equipped beside main power supply connector. This Power Supply is used for the option which are listed below.


(Cannot be used for other purposes.)

ADAPTER for Central Monitoring System

Interface Controller

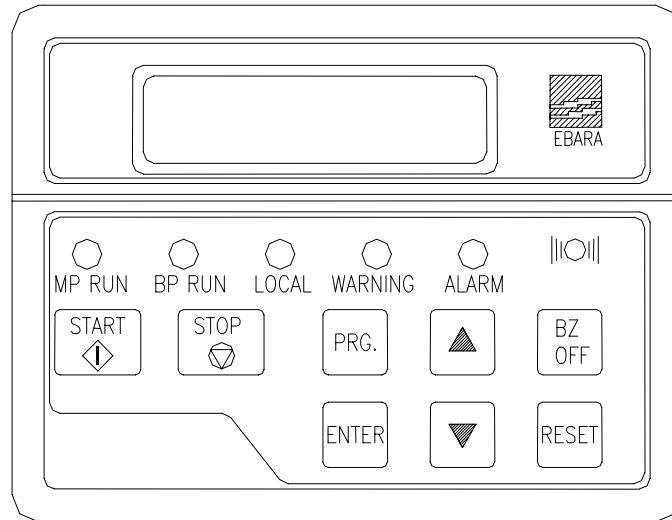
N2 Solenoid Valve

 <b>WARNING</b> 	Power Supply for the options is kept applying voltage when Earth Leakage Breaker (ELB) turns on during the pump is supplied the power.
---	--

 <b>CAUTION</b>	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 Tables 6.1.

**Table 6.1 LCD controller indication**

No	ITEM	INDICATION
1	Power	B P : # # . # # K W M P : # # . # # k W
2	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
3	Alarm history (Indication of history)	A L A R M / W A R N I N G H I S T O R Y ?
4	Pump model Pump unit No.	P U M P . T Y P E @ @ @ @ U N I T N O & & & & &
5	Total operation time	O P E . T I M E # # # # # h
6	Back pressure (option)	B A C K P R E S S U R E # # . # k P a
7	Pump N <sub>2</sub> gas flow	P U M P N 2 F L O W # # . # P a m <sup>3</sup> / s
8	Cooling water flow	W A T E R F L O W # # . # L / m i n
9	CASING Temp.	B P : # # # °C . M P : # # # °C
10	Motor speed	B P : # . # k m i n - 1 M P : # . # k m i n - 1
11	WARNING/ALARM	\$ \$ \$ \$ \$ : \$ \$ \$ \$ \$ \$ \$ \$ % \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$

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 (▲ ▼) 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.



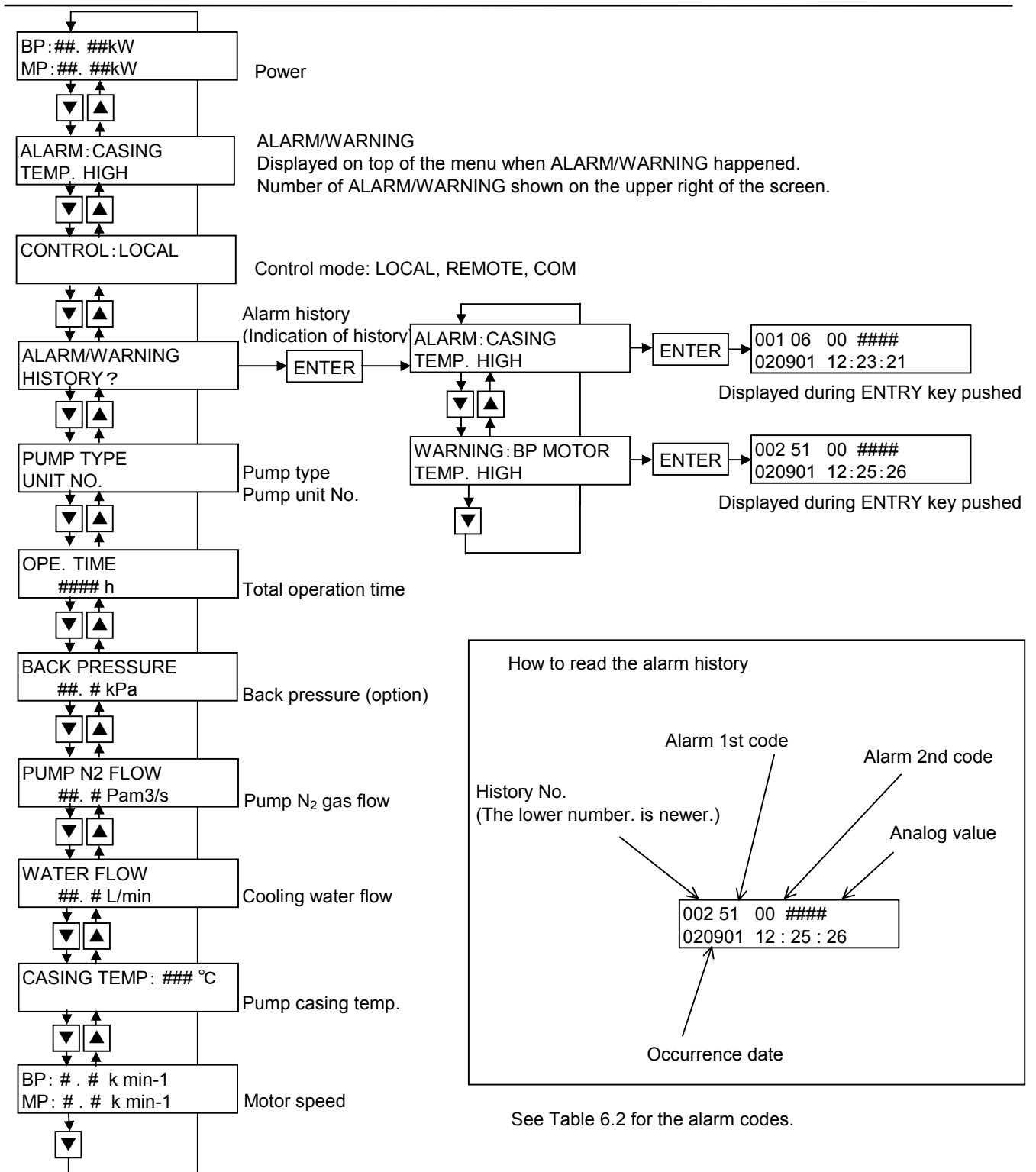


Fig. 6.2 Key operation for the pump operation status display screen

Table 6.2 Alarm code list

ALARM name	Code		WARNING name	Code	
	1st code	2nd code		1st code	2nd code
MP casing temp H.HIGH.	50	01	Water Flow Low	00	00
MP motor temp H.HIGH	51	00	MP casing temp HIGH	05	01
BP motor temp.H.HIGH	52	00	Pump Box Temp HIGH	13	01
Water Leakage (▲)	53	00	Pump N2 0mode Error	14	02
BP Motor overload(Thermal)	54	00	Pump N2 Flow Low	18	00
MP Motor overload(Thermal)	55	00	Ext.N2 Flow Low(▲)	19	00
Back pressure High	63	00	Back Pressure HIGH	21	01
Phase Error	64	00	Back Pres Wire Broke		02
MP Driver OC	65	01	BP Motor Temp HIGH	23	00
MP Driver OV		02	MP Motor Temp HIGH	24	00
MP Driver OH1		04	MP Driver Temp High Case	25	01
MP Driver OH2		05	BP Driver Temp High Case		02
MP Driver CPF		06	MP Driver Temp High Inner		03
MP Driver UV		07	BP Driver Temp High Inner		04
MP Driver DRE		09	MP Comm. Error	26	01
BP Driver OC		66	01		BP Comm. Error
BP Driver OV	02		IO Comm. Error		03
BP Driver OH1	04		AI Comm. Error	04	
BP Driver OH2	05		Water Valve Error (▲)	27	01
BP Driver CPF	06		Pump N2 Valve Error (▲)		02
BP Driver UV	07		EXT. N2 Valve Error (▲)		03
BP Driver DRE	09				
BP Motor overload2	67		00		
MP Motor overload2	68	00			
BP Motor Step Out	69	00			
MP Motor Step Out	70	00			
Emergency off (EMO) (▲)	71	00			
EXT.N2 Flow Low(▲)	72	00			
Water Flow low	73	00			
Ext. interlock	74	00			
Watch Dog Timer Error	47	00			
Continuous Alarm Occurred	48	00			
Momentary Power Failure Running	49	01			
Momentary Power Failure Stop		02			

“▲” 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.

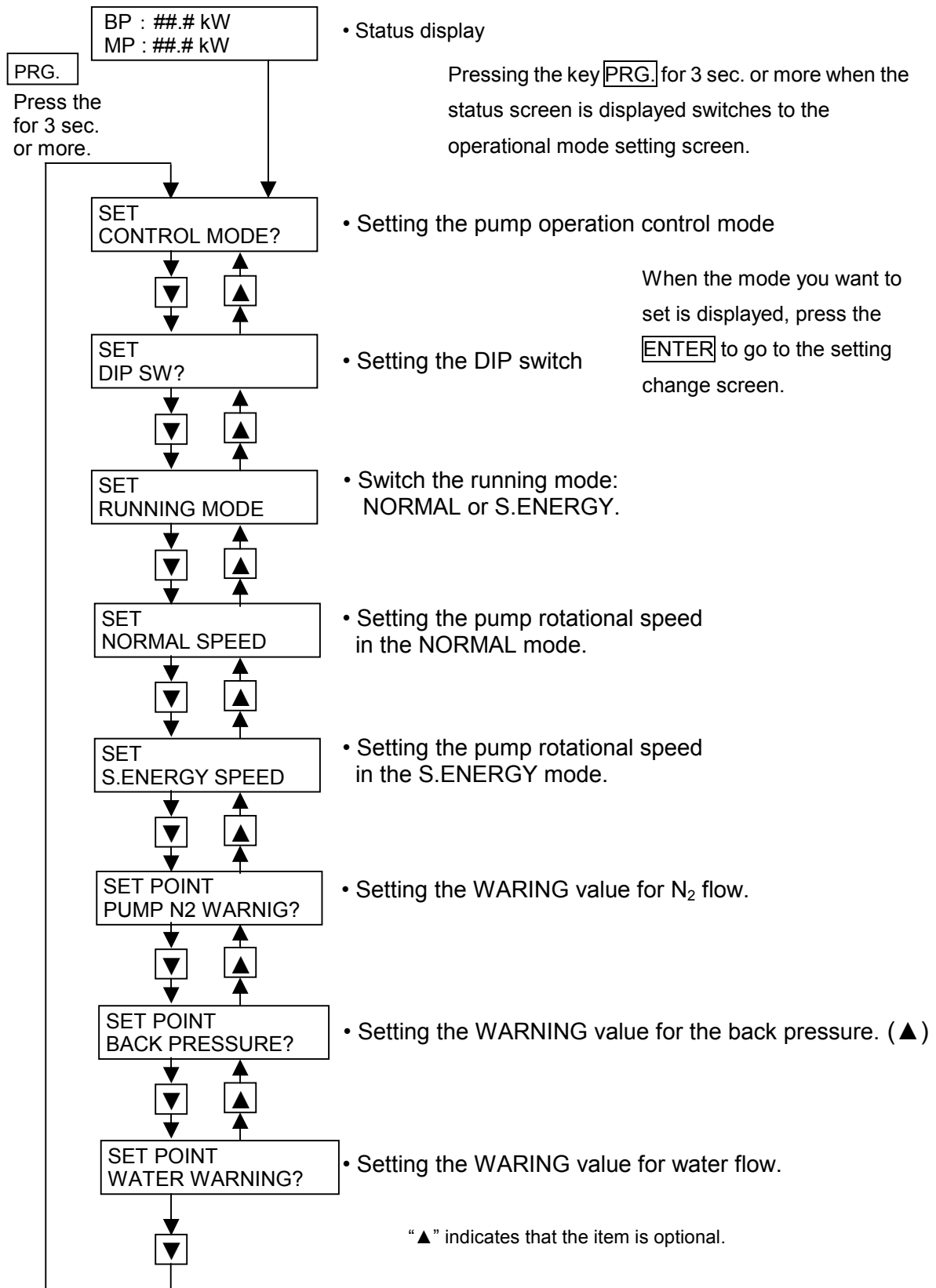
**Table 6.3 Operational mode setting indication at LCD screen**

Item	Indication	Description
Pump operation setting mode	SET CONTROL MODE?	Switches the control modes: local /remote/communication.
DIP switch setting	SET DIP SW?	To set DIP switches (see 6.4).
Setting the pump running mode	SET RUNNING MODE?	Switch the running modes: NORMAL and S.ENERGY.
Setting the rotation speed In the NORMAL mode.	SET NORMAL SPEED?	Sets the pump rotational speed In the NORMAL mode.
Setting the rotational speed In the S.ENERGY mode.	SET S.ENERGY SPEED?	Sets the pump rotational speed In the S.ENERGY mode.
WARNING value for the back pressure setting (option)	SET ALARM SP BACK PRES.?	Sets the WARNING value for the back pressure.
Pump N <sub>2</sub> WARNING setting	SET POINT N2 WARNING?	Sets the WARNING value for N <sub>2</sub> flow.
Water WARNING setting	SET POINT WATER WARNING?	Sets the WARNING value for Water flow.

Keys work as below for the setting screen.

- START : Invalid
- STOP : Stop the pump.
- RESET : Reset WARNING and /or ALARM.
- BZ.OFF : Switch the DIP switch No.
- ▲ : Set the DIP switch to ON. Switches the items of the operational mode setting screen.
- ▼ : Set the DIP switch to OFF. Switches the items of the operational mode setting screen.
- ENTER : Fix the selected setting.

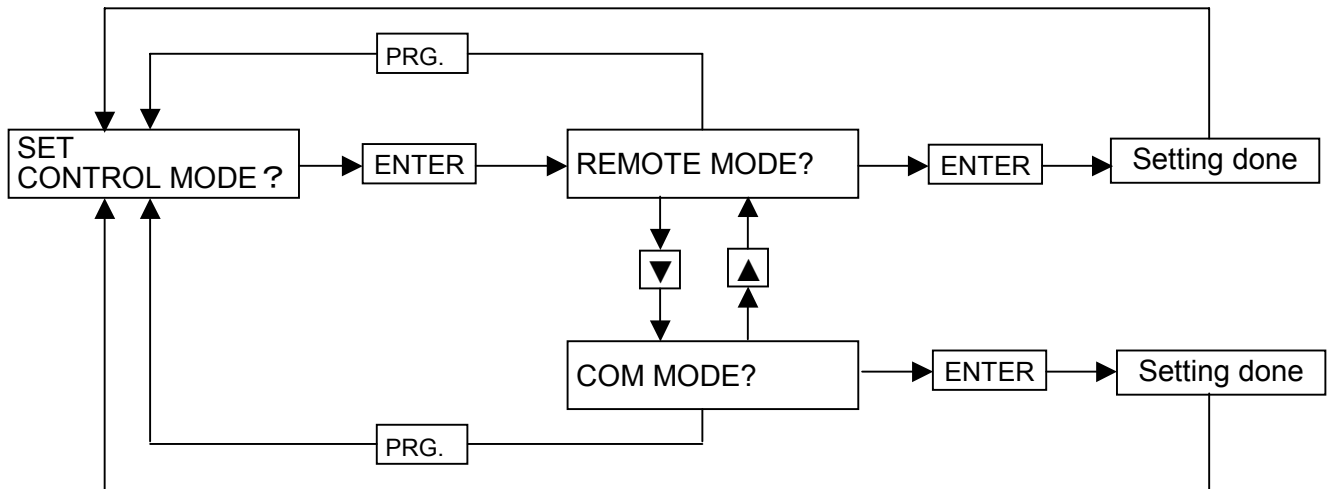
See Fig. 6.3 for how to set the operational modes.



**Fig. 6.3 How to set the operational mode**

### 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)

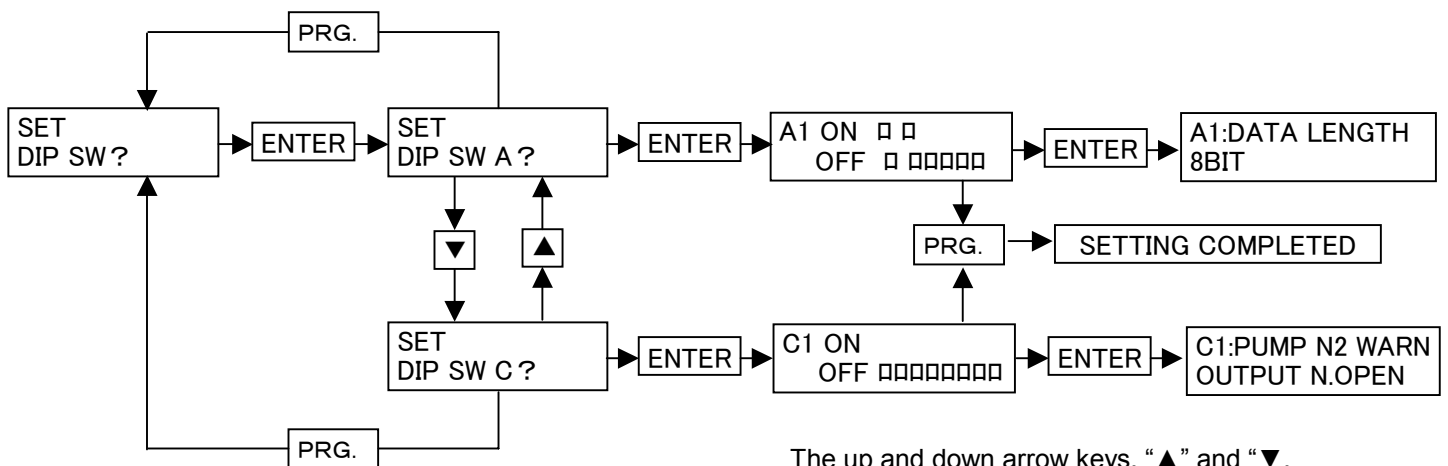
LOCAL MODE : Enables the local operation  
(start/stop with the LCD controller)

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.

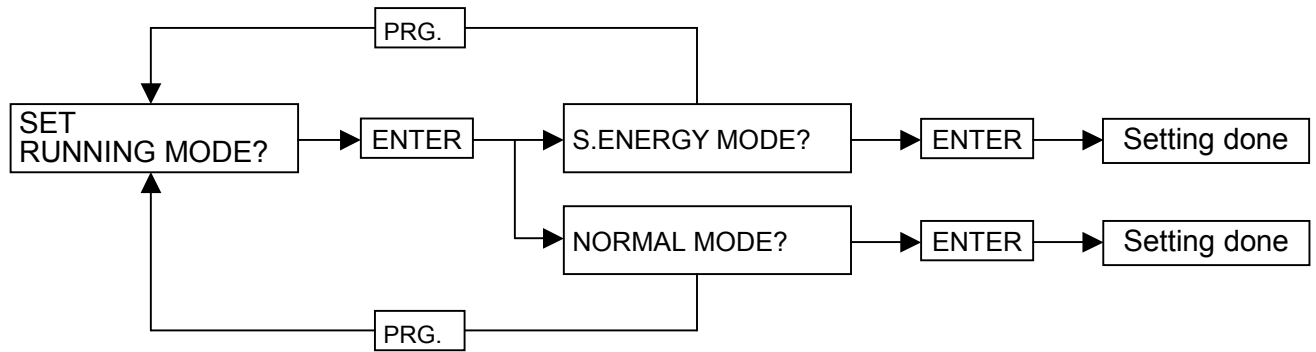
### 6.3.2 Setting the DIP switch



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 6.4 for details of the DIP switch.

### 6.3.3 Setting the pump running mode



S.ENERGY MODE: Enables the energy-saving operation

NORMAL MODE: Enables the rated operation.

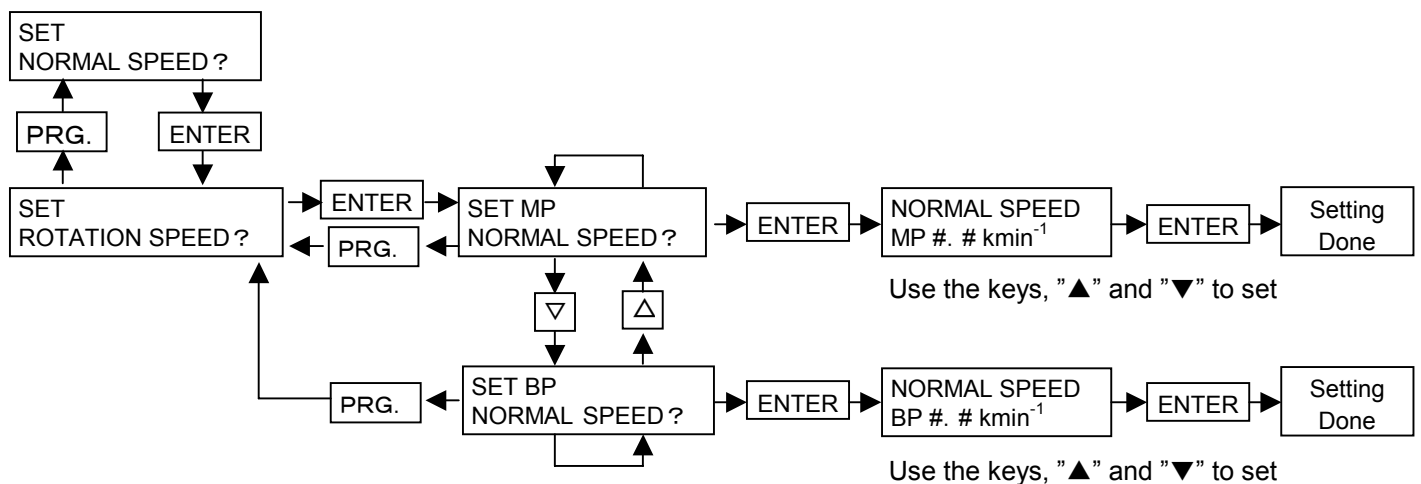
The mode which is currently not set is displayed.

If you do not need to set, press the key

**PRG.** to go back to the previous screen.

### 6.3.4 Setting the normal rotational speed

(1) Setting the normal rotational speed (BP, MP individual setup)



▲ ▼ Use the up and down arrow keys to change the setting value.

▲: Increase the setting speed by  $0.1 \text{ kmin}^{-1}$ .

▼: Decrease the setting speed by  $0.1 \text{ kmin}^{-1}$

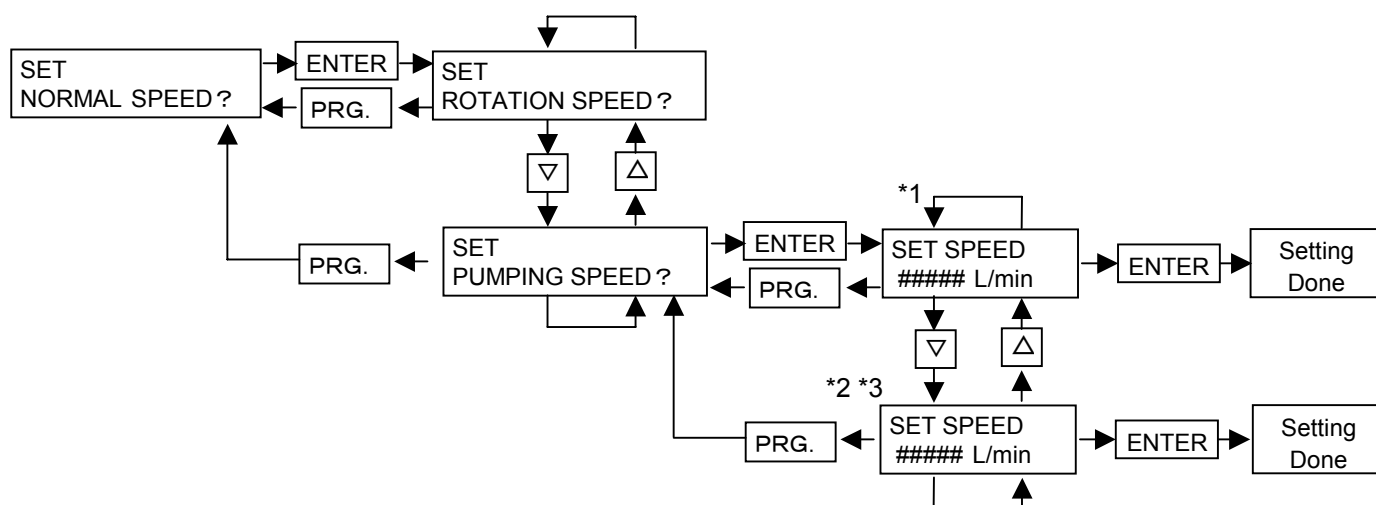
Upper limit MP:  $6.0 \text{ kmin}^{-1}$ , BP:  $7.0 \text{ kmin}^{-1}$

Lower limit MP:  $4.0 \text{ kmin}^{-1}$ , BP:  $3.0 \text{ kmin}^{-1}$

**Table 6.4 Rotational speed and pumping speed**

Model	Rotational speed (min-1)		Pumping speed (L/min)
	Booster pump	Main pump	
MODLE ESR100WN	3000	4000	4000
	3700	4500	5000
	4400	4900	6000
	5000	5400	7000
	6000	6000	8500
	7000	6000	10000

## (2) Setting the normal rotational speed (Pumping speed setup)



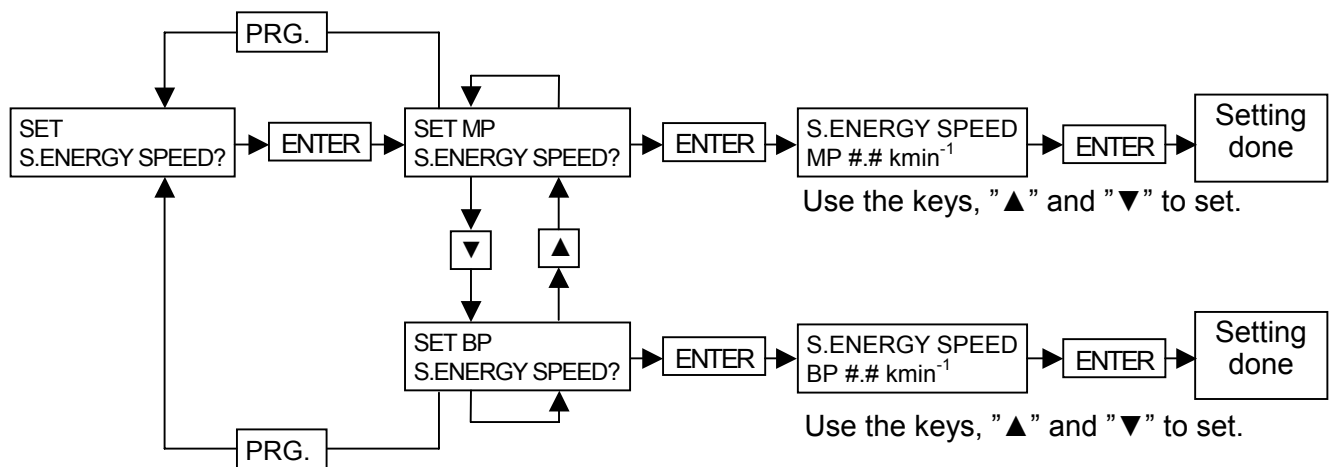
SET PUMPPING SPEED:

MP/BP rotational speed set up by choosing pumping speed.

**Table 6.5 Pumping speed according to model**

PUMP MODEL	*1	*2	*3
MODEL ESR100WN	4000 L/min	8500 L/min	10000 L/min

### 6.3.5 Setting the rotational speed in the S. ENERGY mode



▲ ▼ Use the up and down arrow keys to change the setting value.

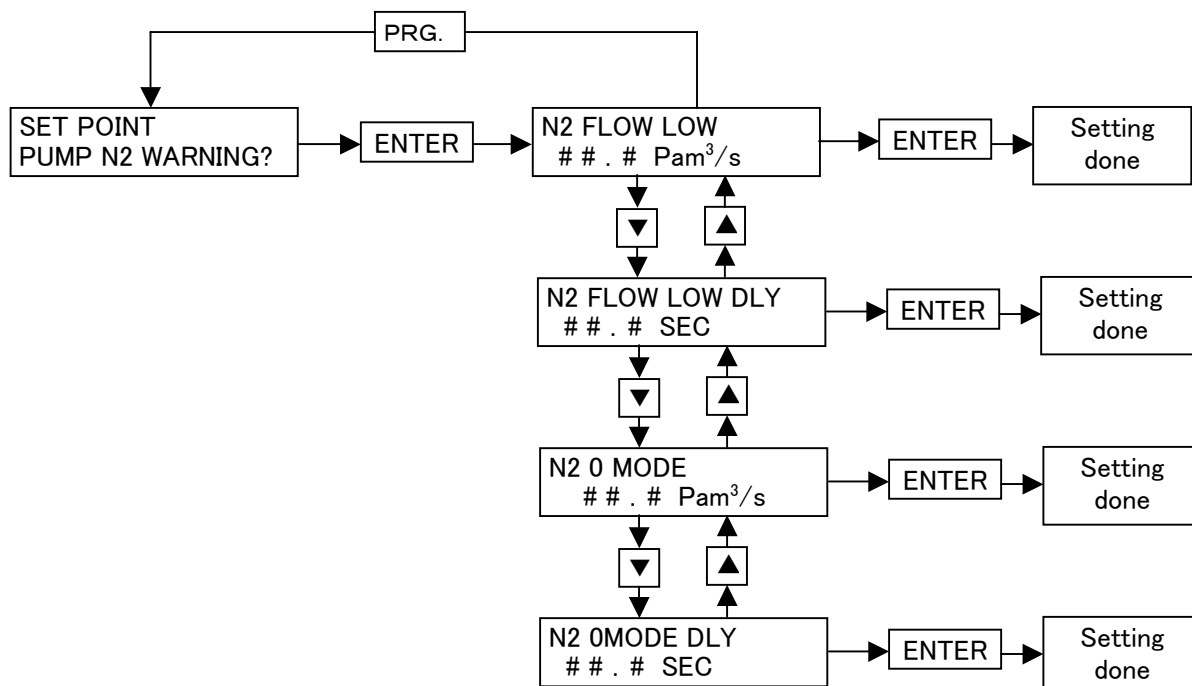
▲: Increase the setting speed by 0.1 kmin<sup>-1</sup>.

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

Upper limit MP, BP: The value lower than the set value for the rated speed

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

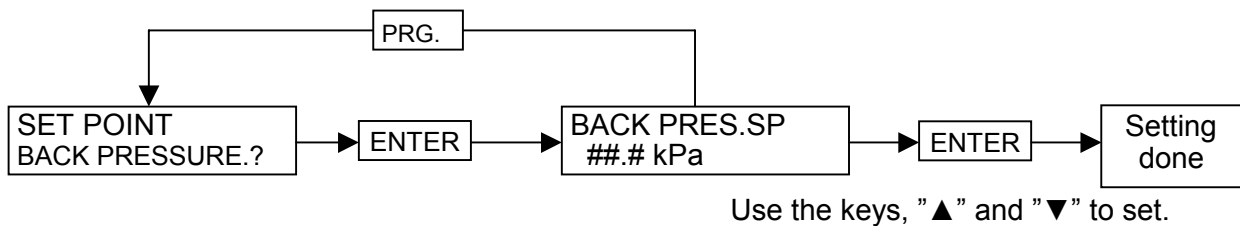
### 6.3.6 Setting the WARNING value for the pump N2 flow





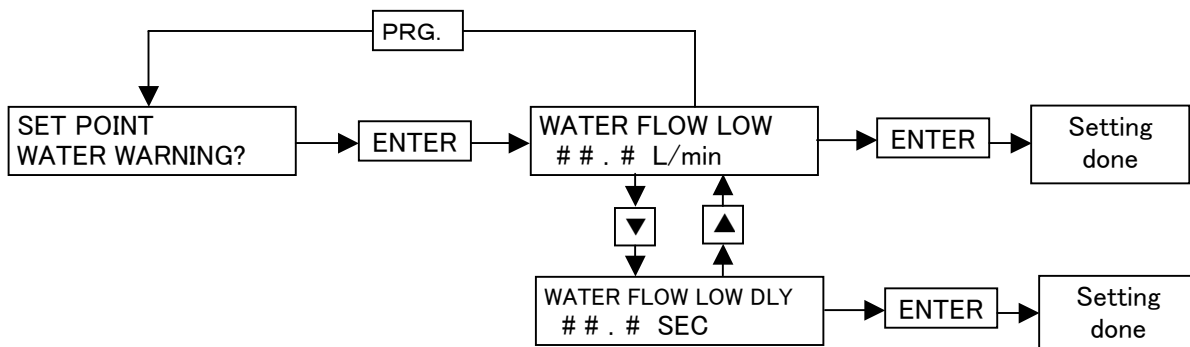
- ▲ ▼ Use the up and down arrow keys to change the setting value.
- ▲ : Increase the setting value by 0.1 Pam<sup>3</sup>/s and 1sec
  - ▼ : Decrease the setting value by 0.1 Pam<sup>3</sup>/s and 1sec
- N2 Flow Low: 2.2~81.0 Pam<sup>3</sup>/s (Factory setting 12.0 Pam<sup>3</sup>/s)  
 N2 Flow Low Delay: 5~60sec(Factory setting 60sec)  
 N2 0Mode Error: 0.5~81.0 Pam<sup>3</sup>/s (Factory setting 1.0 Pam<sup>3</sup>/s)  
 N2 0Mode Error Delay: 5~60sec(Factory setting 60sec)

### 6.3.7 Setting the WARNING value for the back pressure (option)



- ▲ ▼ Use the up and down arrow keys to change the setting value.
- ▲ : Increase the setting value by 0.5 kPa.
  - ▼ : Decrease the setting value by 0.5 kPa.
- Back Pressure High: 5.0~30.0 kPa (Factory setting 20kPa)

### 6.3.8 Setting the WARNING value for water flow



- ▲ ▼ Use the up and down arrow keys to change the setting value.
- ▲ : Increase the setting value by 0.1 L/min and 1sec.
  - ▼ : Decrease the setting value by 0.1 L/min and 1sec
- Water Flow Low: 1.8~19.9L/min (Factory setting 1.8L/min)  
 Water Flow Low Delay: 5~60sec (Factory Setting 60sec)

## 6.4 Dip Switch

Set the dispatches to select the operating modes as shown in Table 6.6 / 6.7 / 6.8.

**Table 6.6 Dip Switch-A Settings**

No.	Mode	Off	On	Factory setting
1	Data Length	7bits	8bits	ON
2	Monitor Cooling water and N <sub>2</sub>	Always	Only during operation	OFF
3	Buzzer	Not used	Use	ON
4	Operation switched to Remote	According to signal	Automatically stop	OFF
5	External start/stop signal *	Alternate(Level)	Momentary(Pulse)	OFF
6	-----	-----	-----	-----
7	Dilution N2 mode	Standard mode	Dilution N2-0 mode	OFF
8	BP operation in Remote	Automatic operation	External signal input	OFF

\* Optional

**Table 6.7 Dip Switch-B Settings**

No.	Mode	Off	On	Factory setting
1	-----	-----	-----	-----
2	-----	-----	-----	-----
3	Cooling water valve control*	Not applied	Applied	OFF
4	Pump N <sub>2</sub> valve control*	Not applied	Applied	OFF
5	N <sub>2</sub> valve control for Ex line*	Not applied	Applied	OFF
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 6.8 Dip Switch-C Settings**

No.	Mode	Off	On	Factory setting
1	Pump N <sub>2</sub> WARNING output	Normal Open	Normal Close	OFF
2	Ext. N <sub>2</sub> WARNING output*	Normal Open	Normal Close	OFF
3	-----	-----	-----	-----
4	-----	-----	-----	-----
5	-----	-----	-----	-----
6	-----	-----	-----	-----
7	-----	-----	-----	-----
8	-----	-----	-----	-----

\* 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 N<sub>2</sub>: “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 N<sub>2</sub> purge should be continuously active during operation stoppage to reduce by-product accumulation and corrosion in the pump.  
If the DIP switch-A No. 2 has been set to the "Constant Monitoring" mode it will be possible to continue monitoring the cooling water and N<sub>2</sub> gas status even after the pump has stopped.

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 dip 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 select Local / Remote switch 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      This switch allows you to select "ALTERNATE (Level)" or "Momentary (Pulse)" for starting and stopping the pump under the external signal control. The former means switching on/off of the start signal. The latter means 2 types of pulse signals: ON or OFF.

**[ NOTE ]** Momentary signal of external start/stop signal used only when you use optional interface box.

DIP SW-A. No. 7 This switch allows you to select whether the dilution N<sub>2</sub> gas is used or not. To perform a process which does not lead to the formation of reaction by-products in the pump or which uses non-corrosive gases, set this mode On. By closing the N<sub>2</sub> gas selector valve, the N<sub>2</sub> gas can be saved. This mode No. 7 must be used with the N<sub>2</sub> gas selector valve in combination.

**[ NOTE ]** The N<sub>2</sub> gas selector valve is positioned on the front panel at the right when viewing facing the pump front panel (operating panel).

**[ NOTE ]** It will take ten odd seconds will take until the flow has stabilized after you have operated the N<sub>2</sub> 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.3 This switch allows you to select whether the cooling water valve is used or not when the valve is attached on the pump cooling water inlet. It allows you to control the cooling water supply to the pump. This is an optional item.

DIP SW-B. No.4 Controls N<sub>2</sub> supply to the pump with a valve attached to the N<sub>2</sub> piping in the pump unit. This is optional item.

DIP SW-B. No.5 Controls N<sub>2</sub> supply for diluting the exhaust gas to the pump with a valve attached to the N<sub>2</sub> piping for diluting the exhaust gas downstream from the pump unit, such as a dilution N<sub>2</sub> unit. This is optional item.

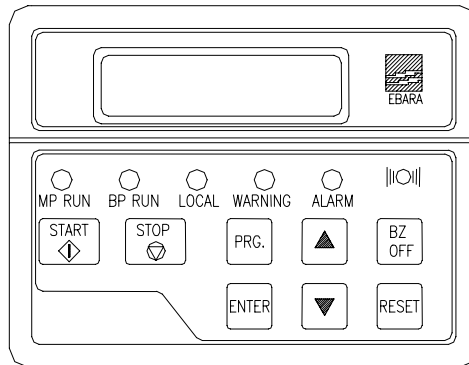
DIP SW-B. No.6 Activate or inactive the special interface for MODEL ESR.  
· Set this to OFF to activate the interface (optional).  
· Set this to ON to inactivate the interface (default).

**[ NOTE ]** With this switch set to OFF, signal output from the control signal connectors (CN-Z and CN-Y) that are directly connected to the pump is prevented although that from the MODEL ESR-dedicated interface is allowed.

- DIP SW-B. No.7      This switch allows you to select the open-phase detection mode.
- 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      Can be select Normal Open / Normal Close of Pump N<sub>2</sub> WARNING.
- DIP SW-C No.2      Can be select Normal Open / Normal Close of EXT N<sub>2</sub> WARNING. This is optional.

**[ NOTE ]** In the case of DIP switch set-up, please keep default setting of no selection DIP switch No. If you change DIP switch of no selection, it may be cause of some trouble.

## 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"/>

### DIP Switch-B

B *	ON						
	OFF	<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), can not be used for parameter setting.

**[NOTE]** 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.

**[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.

**[NOTE]** The dip switch setting at the time of shipment from the factory are as follows.

Data length	:	8bits
BUZZER	:	USE
Operation switched to Remote	:	According to signal
External START/STOP Signal	:	ALTERNATE signal
Pump N2 Mode	:	Standard Mode
dilution N2 Mode	:	Standard Mode
BP Operation in Remote	:	Automatic Operation

## 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.

 <b>CAUTION</b>	Without sufficient cooling water, the pump temperature will rise and problems such as rotor contact will occur.
--	---


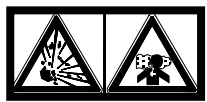
[NOTE] The pump unit itself has no cooling water flow adjustment valve.


- (2) Turn on the N<sub>2</sub> 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 N<sub>2</sub> gas leaks from the pipe connections.

Slowly turn the pressure adjustment knob clockwise to set the pressure (gauge pressure) to 0.05 MPa first. Then press the red stopper to lock the knob in position.

 <b>WARNING</b> 	Be sure to purge with N <sub>2</sub> 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 N <sub>2</sub> to the safe concentration, be sure to maintain a separate supply of N <sub>2</sub> gas to the pump exhaust pipe.
---	--

 <b>CAUTION</b>	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.
--	---

 <b>CAUTION</b> 	Unless a sufficient supply of N <sub>2</sub> gas is maintained, serious problems will occur such as oil back flow or pump corrosion and accretion of reaction by-products.
---	--

Operate the N<sub>2</sub> gas selector valve in accordance with the dilution N<sub>2</sub> 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 N<sub>2</sub> gas selector valve. To save N<sub>2</sub> 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 N<sub>2</sub> 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 N<sub>2</sub> gas selector valve.

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

(4) The LCD controller counts down 10 seconds after placing the Earth Leakage Breaker (ELB) into the ON position.



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

(5) Check on the WATER FLOW display of the LCD Controller that the cooling water flow rate is 2 L/min. or more.

(6) Re-check on the DIL. N<sub>2</sub> FLOW display of the LCD Controller that the dilution N<sub>2</sub> gas flow rate is within 19-22Pam<sup>3</sup>/s range. Also check that the pressure gauge shows a reading of 0.04-0.07Mpa After setting the pressure, press the red stopper to lock the knob in position.  
In this condition, N<sub>2</sub> flow rate is 4.6-6.0Pam<sup>3</sup>/s.  
(The shaft sealing N<sub>2</sub> flow rate is contain in pump N<sub>2</sub> flow rate currently displayed on the LCD controller.)




**[NOTE]** For corrosive processes and processes leading to the formation of large amounts of reaction by-products, it is possible to increase the volume of pump purge N<sub>2</sub>. Adjust the "dilution N<sub>2</sub> gas control valve" at the right of the pump's front panel by looking at the "PUMP N<sub>2</sub> FLOW" display on the LCD controller. (Max. dilution N<sub>2</sub> flow rate: 84Pam<sup>3</sup>/s).  
The "dilution N<sub>2</sub> gas control valve" is closed when the pump is shipped.

- (7) When the ALARM/WARNING 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 ALARM/WARNING 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.

 <b>CAUTION</b> 	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 LOCAL / REMOTE / COMMUNICAION modes and BUZZER Enabled function. Set in accordance with the operating conditions. (See 6.3 Setting the operation Mode.)

<p><b>! WARNING</b></p> 	<p>The pump will remain at a very high temperature even after it has been stopped. Be sure therefore to leave the cooling water on for about one (1) hour after the pump has been stopped.</p> <p>When the cooling water is stopped at once after the pump stops, pressure in the cooling water piping rises. And there is a possibility to cause the water leak.</p>
<p><b>! WARNING</b></p> 	<p>The pump and exhaust piping will remain at a high temperature during operation and for a short time after the pump has stopped.</p> <p>Be sure to avoid contact and keep inflammable substances out of reach. Do not remove the outer cover during operation.</p>
<p><b>! CAUTION</b></p>	<p>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.</p>
<p><b>! CAUTION</b></p> 	<p>Process gases will remain in the vacuum pipes and the pump even after the pump has been stopped.</p> <p>Be sure therefore to purge for at least 1 hour after the pumps has been stopped.</p> <p>Do not discontinue the N2 purge when the pump is stopped only for a short time.</p>

**[NOTE]** Do not exhaust the process gases until at least 1 hour 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.

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

### 7.2.1 LOCAL (Pump Side) 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 BP RUN lamp on the controller will light.

The power consumption value is indicated on the display during the pump operation.

For other status indications at display is shown in Table 6.1.

**[NOTE]** The pump will not start when an ALARM/WARNING has been generated.

When the START button is pressed during ALARM/WARNING generating, "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 is turned off and the indication of power consumption value becomes of 0.0kW.

### 7.2.2 REMOTE Start/Stop

#### a) START

Enter the external "MP" start signal input through 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.

In the case of DIP SW A-8 ⇒ OFF : "MP" rotation reaches 3000 rpm,

"BP" will start automatically.

In the case of DIP SW A-8 ⇒ ON : "MP" rotation reaches 3000 rpm,

input the external "BP" start signal. 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 ALARM/WARNING has been generated.

When a START signal is entered, "STARTFAIL" will appear on the display.

BP can be started/stopped by the external signal when the DIPswitch set accordingly.

**b) STOP**

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

**7.2.3 COMMUNICATION Start/Stop****a) START**

Enter the external "MP" start signal input through the communication connector.  
The MP starts.

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

In the case of DIP SW A-8 ⇒ ON : "MP" rotation reaches 3000 rpm,  
input the external "BP" start signal. BP will start.

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

When the BP is operated under external start command input, apply the external  
BP start command to the communication 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 an ALARM/WARNING has been generated.  
When a START signal is entered, "STARTFAIL" will appear on the display.  
BP can be started/stopped by the external signal when the DIPswitch set  
accordingly.

**b) STOP**

Enter the external "MP" stop signal input through the communication connector.  
The MP will stop.

**\*Please see the instruction manual for details.**

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## 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

MODEL ESR dry pumps are supplied with AC200V 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

MODEL ESR dry pumps are 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

MODEL ESR dry pumps are 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 WARNING signal is not output on the LCD controller or remote output.



**Table 8.1 Typical check items**

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

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


When the lubricant oil needs replenishing, take action in accordance with Section 8.4 "Lubricant Oil."


 	<p><b>WARNING</b></p> <p>Switch off the power supply to the pump first and interrupt the Earth Leakage Breaker (ELB) and lockout before you start on maintenance.</p>
--	---

 	<p><b>WARNING</b></p> <p>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.</p> <p>Do not remove the outer cover during operation.</p>
--	--

Even when the cause of the ALARM/WARNING 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.







 <b>CAUTION</b>	<p>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.</p>
--	---



 <b>CAUTION</b>	<p>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.</p>
--	--

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

 <b>WARNING</b> 	<p>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.</p>
---	---

 <b>WARNING</b> 	<p>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.</p>
---	---

 <b>WARNING</b> 	<p>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.</p>
---	---


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

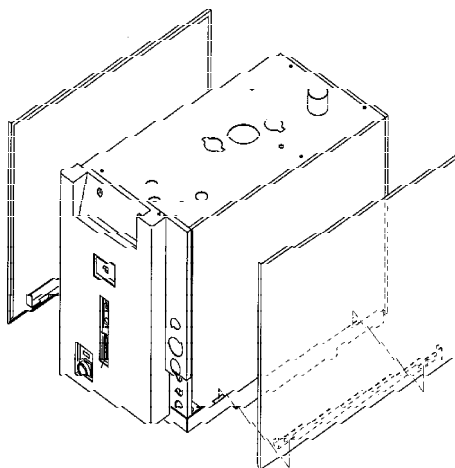
 <b>CAUTION</b>	Do not start filling oil until the interior pump pressure has reached atmospheric pressure. The chamber containing the oil is under low pressure (vacuum) so that a significant leak will occur causing substantial damage to the pump when the oil filling plug is removed with the pump operating
--	---

 <b>CAUTION</b> 	Waste oil shall be disposed of by industrial waste disposal dealer in accordance with Material Safety Data sheets. (Appendix 1)
---	---

If the oil level is low than the lower limit line of the oil level gauge in daily inspection and maintenance, supply the oil is needed.

Please refill the oil as following procedure.

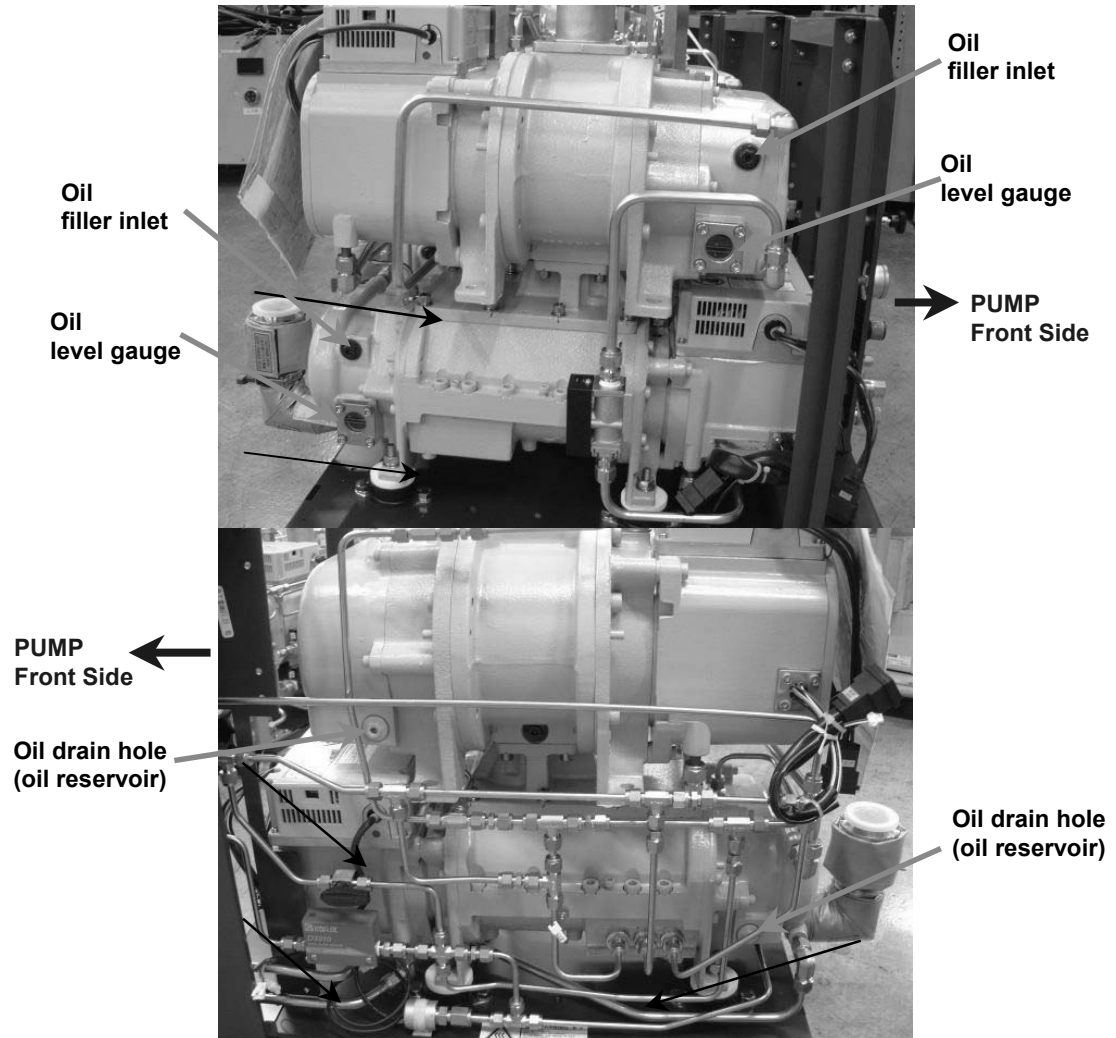
- (1) Stop the pump and remove the outer side cover on the pump. (See Fig. 8.1)



**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 oil level from the sight-glass of the oil level gauge and fill lubricant oil until its level reaches the top line. (See Figs. 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.
- (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.






- \* The oil filler port and oil level gauge are positioned on the left side when seeing from the front of pump
- \* Drain port of the secondary reservoir are provided on opposite side.

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



**Fig. 8.3 Oil Level Gauge**

 <b>CAUTION</b>	Be sure only to use the lubricant listed in specification tables 3.1
 <b>CAUTION</b>	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.
 <b>CAUTION</b>	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.

(7) Please check the air leak after supplying lubricating oil.

## 8.5 Spare (Maintenance) Parts List

Following parts are needed for maintenance in customers' site.

**Table. 8.2**

### 1. Standard consumption Part.

Parts Name	Type	EC Part No.
Lubricant oil	BARRIERTA J100ES	C-0402-000-0111

### 2. Recommendable Part for Safe Operation.

Parts Name	Type	EC Part No.
O-ring (Viton A)	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	EC Part No.
Exhaust check valve	32X80L	C-2244-031-0001

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

Parts Name	Type	EC Part No.
Oil level gauge (BP)	-----	C-3126-006-0011
Oil level gauge (MP)	-----	C-3126-005-0001
Water flow sensor	WF3010-10-FL308673	C-5138-061-0001
N <sub>2</sub> flow sensor	D3810	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
Motor driver (MODEL ESR100WN)	MP	C-5152-096-0001
	BP	C-5152-098-0001

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

**Table. 8.3 Labels**

Label Name	Part No.
[DANGER] HAZARDOUS WAIGHT 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] HIGH TEMP. EYEBOLT WARNING LABEL	C-7110-317-0001
[CAUTION] CHARGE MARK LABEL	C-7110-315-0001

### 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 1 for Material Safety Data Sheet.
Lithium battery	CPU board. (No necessary to replace at usual maintenance.)	Refer to Appendix 2 for Material Safety Data Sheet.
O-ring	Connection of vacuum line	Usual industrial waste.

### 8.7 Overhaul

Some parts used in this dry pump are 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 Section 11 of this manual. 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

 <b>WARNING</b> 	<p>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 for the format required when customer returns their pump to Ebara service center for overhaul or rebuild.</p>
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 <b>CAUTION</b> 	<p>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.</p>
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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 N<sub>2</sub> gas.
- (2) Switch off the power supply to the pump and remove the power and signal wires.
- (3) After you have fully closed the N<sub>2</sub> regulator remove the N<sub>2</sub> pipe, seal off the N<sub>2</sub> purge port with a sealing flange.
- (4) Remove the cooling water pipes.
- (5) Remove the vacuum and exhaust pipes and completely seal off the suction 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.


[ notes ] Differential port is option.

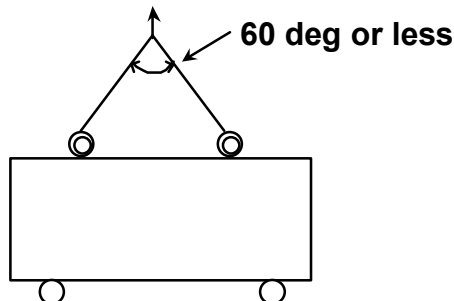
- (6) Turn the operating panel of the controller downward and attach the controller and stand to the outer pump cover with adhesive tape.
- (7) Wrap the pump in a vinyl sheet.

- (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.

 <p><b>DANGER</b></p>	Do not enter the zone underneath the suspended pump.
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 <p><b>WARNING</b></p>	<p>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.</p> <p>To prevent unequal weight distribution, suspend the pump by ensuring that the slinging angle remains symmetrically centered.</p>
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 <p><b>CAUTION</b></p>	In case of sling and transportation, be sure not to remain leaning more than 10 deg against a horizontal for 5 minutes. If not, oil leakage will occur.
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**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, send your pump to an Ebara-designated factory for overhaul or repair.







## 10. Troubleshooting

### 10.1 Troubleshooting (1) Basic trouble

 <b>WARNING</b> 	<p>Interrupt Earth Leakage Breaker (ELB) before starting on wiring and maintenance work.</p> <p>Do not switch on the power supply to the pump until work is completed.</p>
 <b>WARNING</b> 	<p>The pump casing and exhaust piping become extremely hot during operation and for some time after stopping.</p> <p>Be sure that pump and exhaust piping do not come in contact with humans or inflammable substances.</p> <p>Do not remove the pump cover during operation.</p>
 <b>WARNING</b> 	<p>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.</p>

Abnormal symptom	Check Item	Corrective Action
Earth Leakage 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.
	ELB is not ON.	Place ELB to ON.
Nothing appears on LCD	ELB is not ON.	Place ELB 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

 <b>WARNING</b> 	<p>Interrupt Earth Leakage Breaker (ELB) before starting on wiring and maintenance work.</p> <p>Do not switch on the power supply to the pump until work is completed.</p>
 <b>WARNING</b> 	<p>The pump casing and exhaust piping become extremely hot during operation and for some time after stopping.</p> <p>Be sure that pump and exhaust piping do not come in contact with humans or inflammable substances.</p> <p>Do not remove the pump cover during operation.</p>
 <b>WARNING</b> 	<p>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.</p>

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 ##### WARN: MP DRIVER TEMP HIGH #####	Booster Pump (BP) driver temp. rises. Main pump (MP) 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.
WARN: OIL LEVEL LOW	Oil level is low.	Check oil level. (See Fig.8.1)	Charge lubrication oil.
WARN:PUMP N2 VALVE ERROR	N2 valve open.	Setting is N2 0 mode	Close N2 valve. (at the side of pump)

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

 <b>WARNING</b> 	<p>Interrupt Earth Leakage Breaker (ELB) before starting on wiring and maintenance work.</p> <p>Do not switch on the power supply to the pump until work is completed.</p>
 <b>WARNING</b> 	<p>The pump casing and exhaust piping become extremely hot during operation and for some time after stopping.</p> <p>Be sure that pump and exhaust piping do not come in contact with humans or inflammable substances.</p> <p>Do not remove the pump cover during operation.</p>
 <b>WARNING</b> 	<p>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.</p>

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  ALARM:MP 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.
	Main Pump (MP) motor step out	Rotor makes contact. (Accumulation of by-products) (Substance plunge)	Replace or overhaul pump.
		Can not restart	Instrument failure





ALARM: BP DRIVER ###	BP Motor driver protection	Insufficient ventilation	Ventilate sufficiently.	
		Pump back press. rises.	Check exhaust pipe.	
		Increase of the gas load.	Reduce the inflow gas amount.	
	ALARM: MP DRIVER ###	MP Motor driver protection  Can not restart	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

 <b>WARNING</b> 	<p>Interrupt Earth Leakage Breaker (ELB) before starting on wiring and maintenance work.</p> <p>Do not switch on the power supply to the pump until work is completed.</p>
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 <b>WARNING</b> 	<p>The pump casing and exhaust piping become extremely hot during operation and for some time after stopping.</p> <p>Be sure that pump and exhaust piping do not come in contact with humans or inflammable substances.</p> <p>Do not remove the pump cover during operation.</p>
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 <b>WARNING</b> 	<p>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.</p>
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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.