INSTRUCTION MANUAL

MULTI-STAGE DRY VACUUM PUMP

MODEL ESA200W
CE / SEMI / NRTL 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

ISSUED BY PRECISION MACHINERY COMPANY

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

Environmental Basic Policies

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

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

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

Safety Information

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

Inadequate or rash operation may cause dangerous and serious accidents.

Before installation and operation, the operator should first have a good knowledge of the pump construction, operation procedure, and its hazards.
The operator should read through this instruction manual and other documents issued by EBARA in detail.

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

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

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

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

⚠ **CAUTION** indicates an imminently hazardous situation which, if not avoided, may result in minor or moderate injury.
This term may also be used as a warning for situations liable to damage to equipment.

Important Prior Warnings

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

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

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

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

WARNING Supply N2 gas to the exhaust piping when necessary to dilute the inflammable or toxic gas up to a safe concentration.

WARNING Purge with sufficient N2 gas before removing and washing the vacuum and exhaust piping.
Do not let inflammable, toxic or dangerous materials disperse and guard against contact with the human body.
Always work in a location with an escape route in an emergency.

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

WARNING To avoid any hazard induced by toxicity, flammability and explosiveness of the process gases used in the tool, be sure to operate the tool according to the operations safety guidelines supplied by tool suppliers.
Appendix 6 lists typical process gases used in a semiconductor-processing tool. However, details concerning the tool gases and other concerns specific to your tool should be directed to the respective tool suppliers.

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

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

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

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

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

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

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

WARNING Do not perform a withstand voltage test.
Failure to comply could result in damage to the sensitive devices.

CAUTION Never operate the pump without pump cover for safety.

Following safety warning labels are attached to pump covers.

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

1. High temperature warning

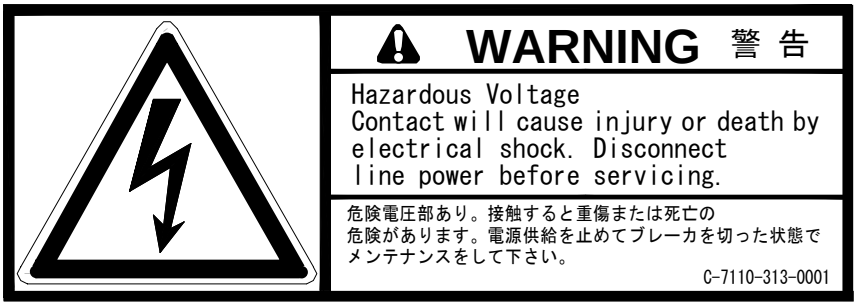
Hot surface may burn or cause injury.

Allow the piping and casing to cool before servicing.

2. Hazardous voltage warning

Hazardous Voltage may shock, burn, or cause death.

Turn power off and lockout before servicing.



3. Hazardous materials warning

In case of hazardous materials are handled. Run the pump only with N2 gas purge before servicing. Take adequate measures against dangerous reaction and contact with human body.

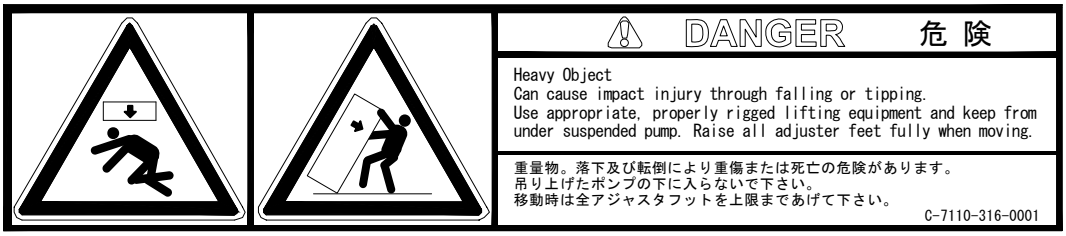
4. Hazardous voltage after EMO warning

Contact will cause injury or death by electrical shock.

Connector CN-C remains energized after EMO.

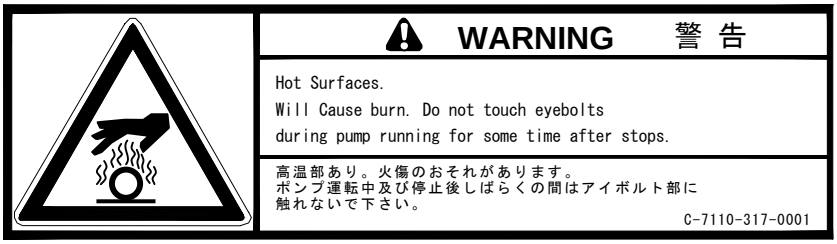
5. Hazardous weight danger

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.



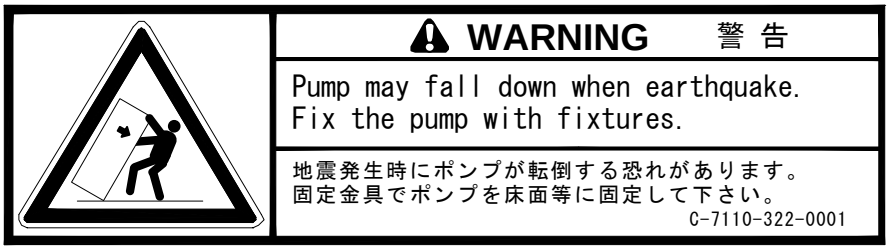
6. High temperature eyebolt warning

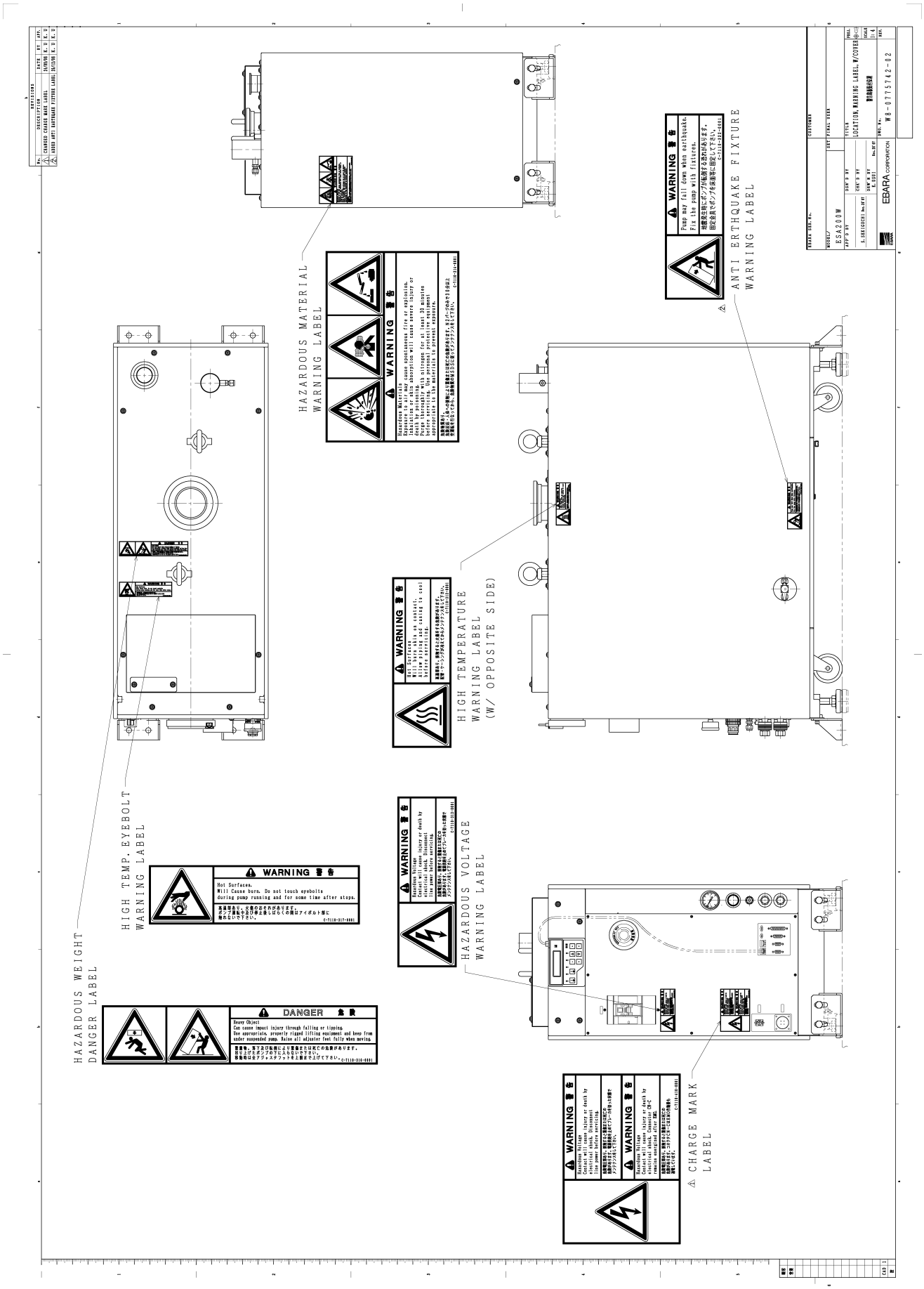
Hot surface may burn or cause injury.
Allow the eyebolt to cool before servicing.



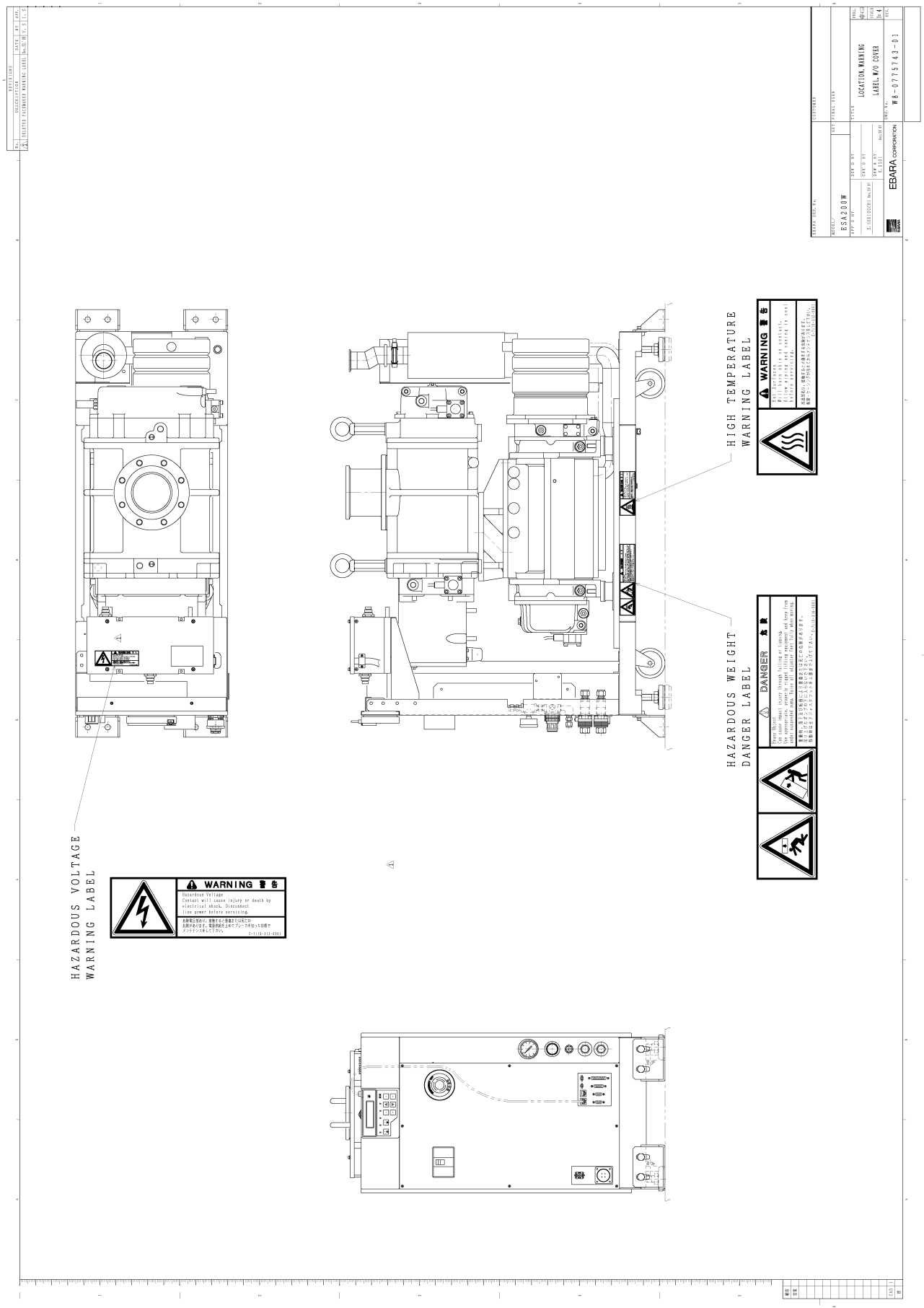
7. Anti earthquake fixture warning

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




HAZARDOUS MATERIAL WARNING LABEL
ANTI ERTHQUAKE FIXTURE WARNING LABEL
HIGH TEMPERATURE WARNING LABEL (W/ OPPOSITE SIDE)
HIGH TEMP. EYEBOLT WARNING LABEL
HAZARDOUS VOLTAGE WARNING LABEL
HAZARDOUS WEIGHT DANGER LABEL
CHARGE MARK LABEL
WARNING 警告
DANGER 危険
EBARA CORPORATION

(X)


HIGH TEMPERATURE
WARNING LABEL
HAZARDOUS WEIGHT
DANGER LABEL
HAZARDOUS VOLTAGE
WARNING LABEL
WARNING 警告
DANGER 危険
ESA200W
EBARA CORPORATION
LOCATION, MARKING
LABEL, W/O COVER
MB-07757743-01

Safety Interlocks

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

EMERGENCY OFF (EMO)

A manually activated button breaks a low-voltage control circuit that, in turn, interrupts line power. Restarting the pump(s) requires a manual reset of the twist-lock button.

NITROGEN FLOW LOW

A normally open flow switch breaks when nitrogen supply to the pump (oil bearing(s) and inter stage injection) drops below its factory set point, opening the motor starter relay(s) and shutting down the pump. Restoration of sufficient nitrogen flow permits restarting the pump.

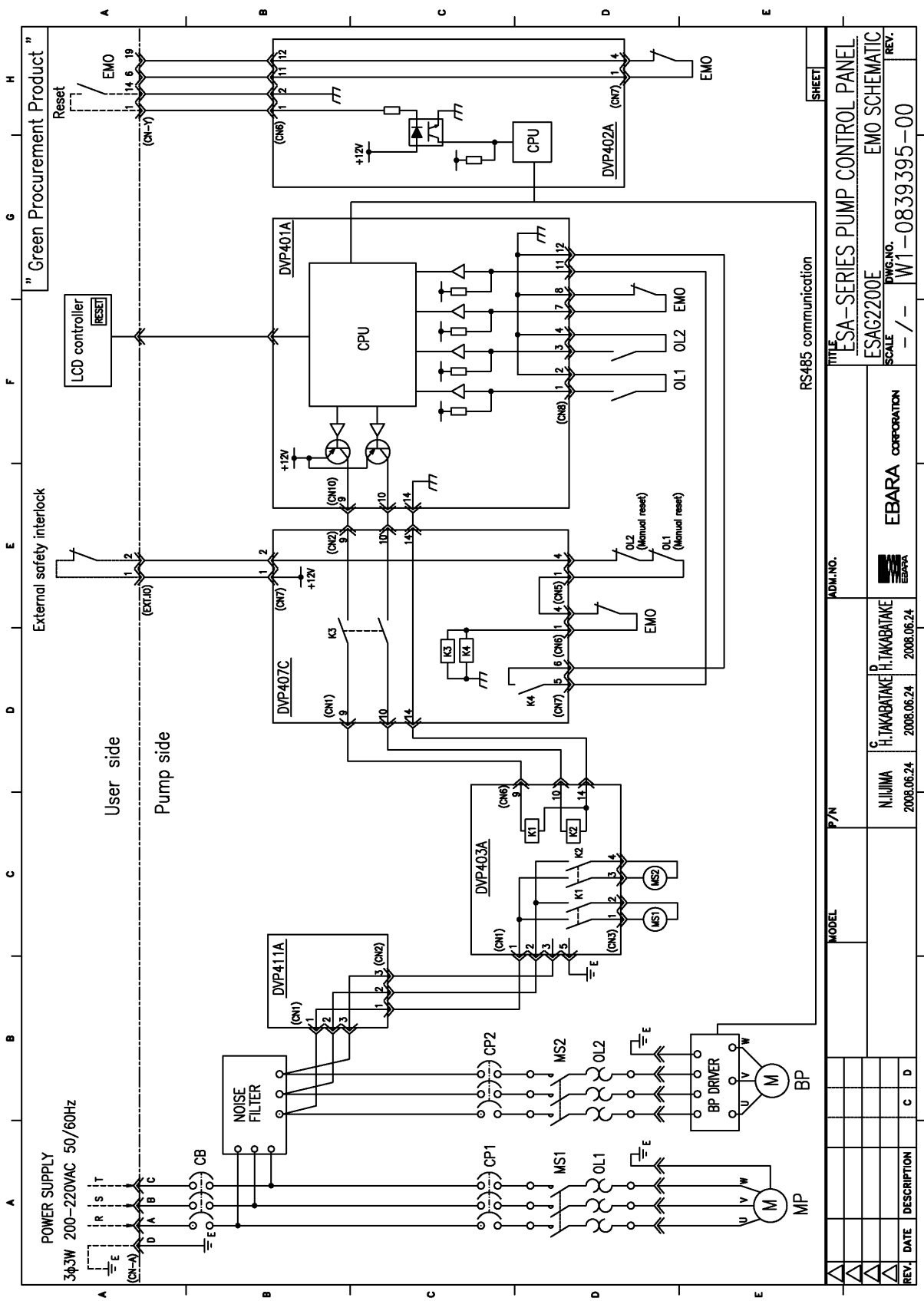
MOTOR OVERLOAD

Motor overload relays protect the pump motor(s) from overheating due to extended current draws in excess of the motor rating without tripping due to current transients such as start up inrush current. Current (for each phase of line power) passing through a coil heats a bimetallic element simulating motor heating under load. Under a persistent overload condition, differential expansion of the bimetallic element opens a contact, which interrupts the motor run circuit. A brief cool down interval permits restarting the pump.

OVER CURRENT PROTECTION

The nearly instantaneous current rise from a line-to-line or line-to-ground short very rapidly heats a thermal element in the circuit breaker, opening of a snap action switch and interrupting all power to the electrical panel. Manual reset, which requires clearing the fault condition, is necessary before restarting the pump. The circuit breaker also serves as a lockable interrupt device for servicing the pump system.

Interlock Schematic for ESA200W



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 merchanability, beyond statuatory requirements, or of fitness for a specific purpose.

EC DECLARATION OF CONFORMITY

Manufacturer: EBARA CORPORATION

Address of manufacturer: 11-1, Haneda Asahi-cho Ota-ku Tokyo 144-8510, Japan

Herewith declares that:

Type of product : Dry Vacuum Pump

Model : ESA Series

Serial Number : _____

- does comply with the provisions of the "Low Voltage Directive 2006/95/EC".
- does comply with the provisions of the "EMC Directive 2004/108/EC".
- does comply with the provisions of the "Machine Directive 2006/42/EC".

- And declares that following (parts/clauses of) harmonized standards have been applied:

EN 1012-2:1996	Compressors and vacuum pumps - Safety requirements - Part 2: Vacuum Pumps
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN 6100-6-2:2005	Electromagnetic compatibility (EMC) -- Part 6-2: Generic standards - Immunity for industrial environments
EN 6100-6-4:2007	Electromagnetic compatibility (EMC) -- Part 6-4: Generic standards - Emission standard for industrial

The Technical Construction File for this machinery is retaining at the following address:

EBARA Corporation, Precision Machinery Company

4-2-1 Honfujisawa, Fujisawa, Kanagawa Pref., 251-8502, Japan

Date of Issue : Jan. 5 '10

Signature : Y. Niimura

Yasuhiro Niimura

General Manager, Components Engineering Department, Components Division

EBARA CORPORATION, Precision Machinery Company

Contents

1. Foreword

We appreciate that you have selected an EBARA dry vacuum pump ESA200W. This pump has been manufactured with much care and attention so that it can be operated safely and satisfactorily.
Incorrect operation will result in lack of performance and cause accidents and injuries to personnel.

[NOTE] This instruction manual contains all necessary information on operation and maintenance of the pump.
Be sure to operate the pump correctly in accordance with these instructions to ensure a long service life.
Keep this instruction manual in a suitable place for immediate reference whenever needed.

2. Introduction

2.1 Introduction

Check the following items on receipt of the pump package.

(1) Check that the nameplate affixed to the outer cover of the pump to confirm that the pump supplied agrees with your order.
Check the accessories against the packing list and the previously submitted drawings and documents to confirm that the all ordered accessories have been supplied.
(2) Check whether damage has occurred or screws/bolts have worked themselves loose in transit.

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

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

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

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

2.2 Environmental Concerns

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

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

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

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

3. Product Description

3.1 Outline

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

3.1.1 Pump Module

The pump is a Roots type vacuum pump which rotates a pair of non-contact multi-stage rotors synchronized by timing gears. In the unit, a Booster Pump (BP) and the Main Pump (MP) are connected in series for ventilation.
The timing gears and bearings are enclosed in a compartment that is independent of the casing. For lubrication Perfluoro-Polyether (PFPE) oil and grease are used.
The pump is filled with lubricating oil at the factory. Use only the recommended lubrication oil grades shown in specification Table 3.1 for replenishing or replacing.

3.1.2 N2 Gas

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

N2 gas is also required to supply to seal the shaft section. This protects the penetration to bearing section, such as corrosive gas.
To reduce pump corrosion due to process gas or accumulation of reaction by-products, N2 gas is supplied to each pump component as dilution purge gas.
Stopping the dilution N2 with a selector valve can save N2 gas, when process does not produce corrosion and reaction by-products.
The correct amount of N2 gas is supplied for those two types of purge operation, by adjusting the regulation pressure to the specified value.
The nitrogen gas selector is locating on the right side of the unit, facing the LCD controller and other utility connectors. It is under the outer cover.

3.1.3 Cooling Water

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

3.1.4 Exhaust

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

3.2 Control System

This pump has a built-in measuring unit consisting of a Circuit Breaker (CB), an electro-magnetic switch and a control circuit.
To improve reliability and safety, the condition of each utility and pump section is monitored by a sensor.
During pump operation all operating conditions are monitored, including power supply, cooling water flow, N2 gas flow, casing and motor coil temperature, motor speed, and electric power for motor.
Continuous operation is possible when there is a momentarily power failure of 1 sec or less.

3.2.1 Warning

To assure the reliability of the pump as a vacuum exhaust system, the pump protection system generates two levels of alarm: WARNING and ALARM.
A WARNING signal is generated when pump operation exceeds the normal range. It therefore only draws attention that the normal operating values are not adhered to but does not signify that danger is imminent. The pump will continue to operate in this condition.
An ALARM signal output is generated and the pump will stop automatically when the upper mechanical safety limit is reached during pump operation.
When an ALARM output is suddenly generated, while the plant unit is operational, a WARNING signal will be generated to ensure that the plant operation is not discontinued. This enables the operator to check the pump after the equivalent of one cycle has been completed.
Be sure to contact EBARA Corporation for details on checking the WARNING and ALARM setting conditions.

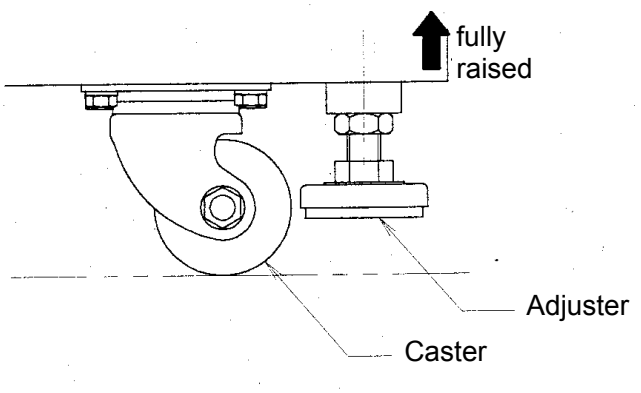
3.2.2 Operation Status Control

The sensor data are displayed on the LCD display provided on the controller to facilitate operation status control and daily inspection.
All WARNING and ALARM signals are displayed on the LCD display. For remote operation and monitoring, the signals are available as individual and group outputs.

3.3 The way of pump moving

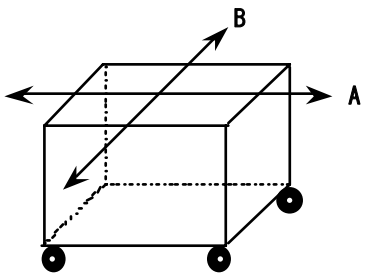
3.3.1 Preparation

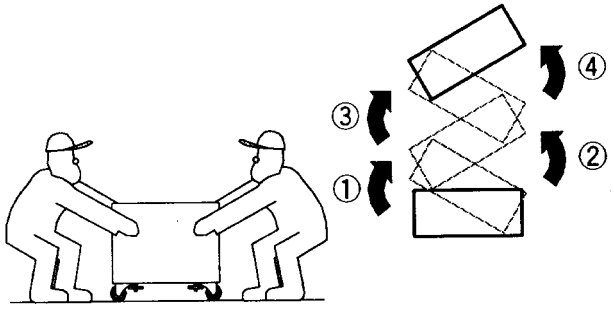
Before pump moving, all adjuster feet shall be raised fully at four places.
In case of being not raised fully, pump may be tripped over by obstacle on floor.



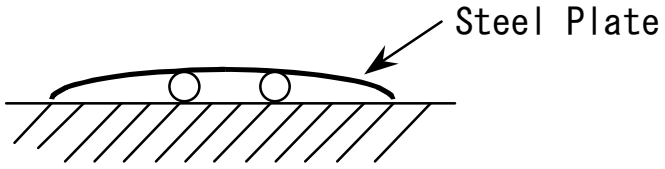
3.3.2 Moving method

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





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



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

3.4 Utility Disconnection

WARNING To avoid dangers potentially encountered during maintenance, transportation or storage, follow instructions below to shut off power.

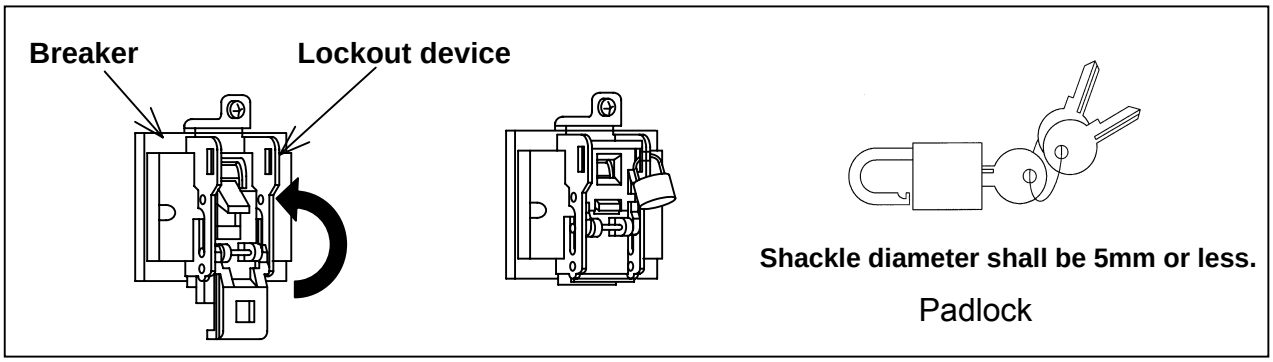
WARNING Capacitors within the control panel retain residual energy after interruption of power supply. Wait five (5) minutes after shutting off breaker before opening the control panel. Carefully check that bleed circuits have discharged the residual energy before servicing the control panel.

WARNING To comply with SEMI S2, install lockable shutoff devices on electrical, nitrogen and cooling water supplies. These devices should be adjacent to and within sight of the pump.

3.4.1 Electrical Power - Circuit Breaker Lockout and Tagout

Lock the breaker in the OFF position and tag it out to perform maintenance or troubleshooting.

1. Verify that the LCD display is lit (confirming that pump is powered).
2. Turn the handle of circuit breaker off and fix the lock lever of locking device.
3. Insert padlock through holes provided on locking device. Close padlock and attach tag.
4. Keep the key with you while working. Prepare the tagout label per factory procedures.
5. Verify that LCD display is unlit (confirming that pump is un powered).
6. If unable to confirm interruption of power via LCD display, use a voltmeter to probe contacts at Connector CN-C. Potential between any two pins indicates that electrical power to the pump is not interrupted.
7. The Lockout/Tagout procedures must comply with OSHA 29 CFR 1910.147 and 1910.331-335



3.4.2 Cooling water

1. Close [facility] water supply to stop water supply to the pump, then close water return valve. Follow [facility] procedures for locking these valves in the off position.
2. Push the knurled outer ring of the quick-connect couplers toward the pump to disconnect the water hoses. Carefully remove the male coupling halves from the hoses and remake the quick-connects to drain the pump lines. Have a catchments vessel and absorbent cloths at hand before removing the couplings.
3. Make sure water outflow stops from both the facility lines and the pump.

3.4.3 Nitrogen (N_2)

1. Close [facility] nitrogen supply valve and follow facility procedures for locking this valve in the off position.
2. Verify that the nitrogen pressure gauge (on front panel of the pump) drops to 0 MPa, confirming that no pressurized gas energy is stored in the pump.
3. Pull out the red detent ring on the N2 regulator.
4. Turn knob counterclockwise until pressure gauge reads 0 MPa. (Both N2 regulator knob and nitrogen pressure gauge are located on front panel of the pump.)
5. Disconnect tube connection of N2 supply line by turning tube nut counterclockwise.
6. Plug (cap) ¼" tube connector on the pump with a tube fitting cap.

3.4.4 Returning to Service

1. Unlock and open water and nitrogen valves.
2. Remove handle stop bracket and switch circuit breaker on.
3. Restart pump and open foreline valve only after appropriate leak checks and safety verifications.

3.5 Detailed Specifications

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

Table 3.1 Specification

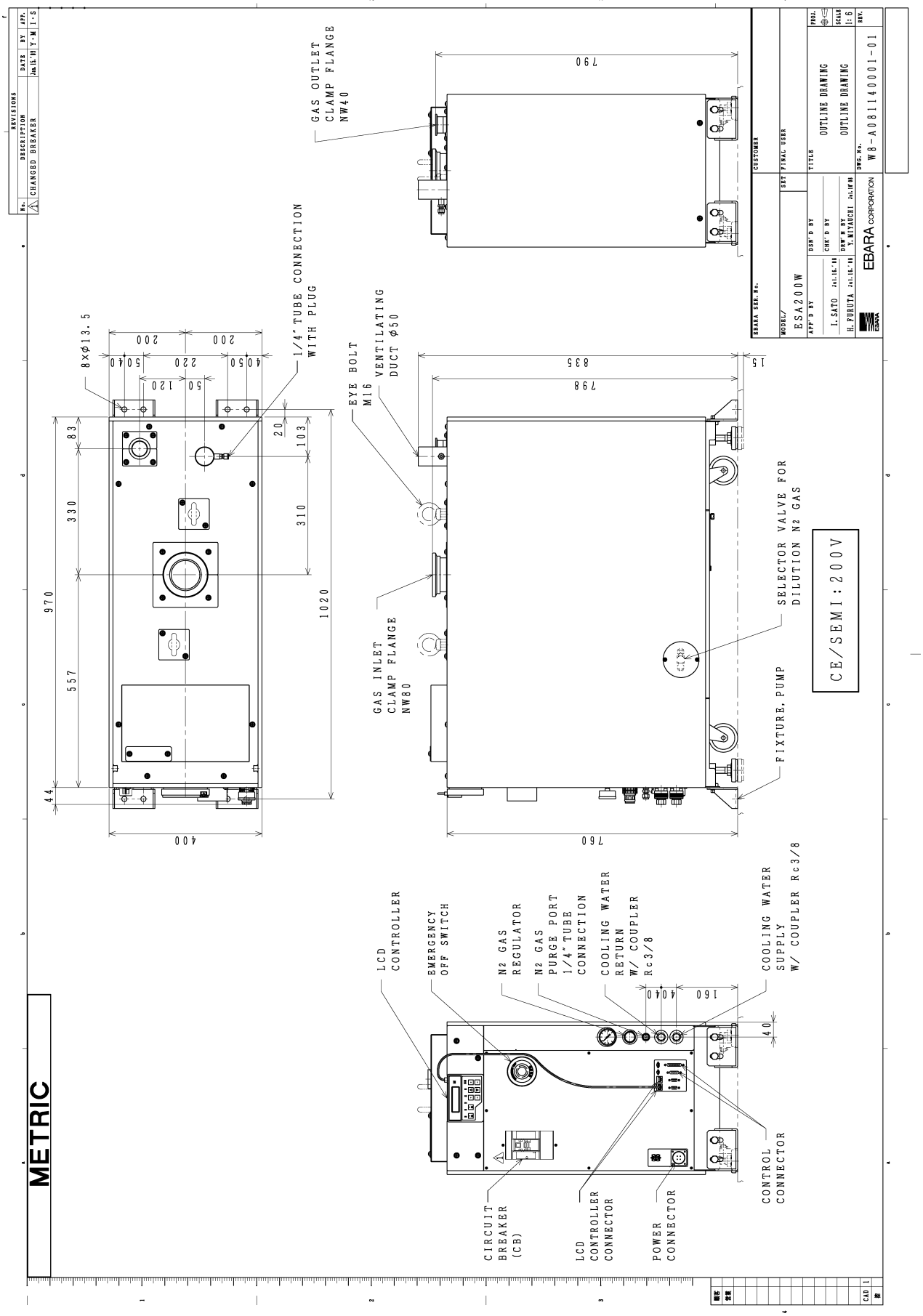
Model			Model ESA200W
Pumping Speed			20000 L/min
Ultimate Pressure			0.53 Pa
Connection		Gas Inlet	NW80
		Gas Outlet	NW40
Approx. Power at Ultimate Pressure (Motor Power)			3.2kW ; 50Hz / 3.4kW ; 60Hz (3.7kW(2P) + 4.0kW)
Uti-li ty	Cooling Water	Connection	Coupler(Rc3/8)
		Pressure [Gauge Press.]	Supply: Max. 0.4MPa Differential Press. : Min. 0.1MPa
		Flow rate	3.5 - 8 L/min
		Temperature	10 - 30 deg C
	N2 Gas	Connection	1/4” Tube Fitting(Same as Swagelok)
		Pressure [Gauge Press.]	Supply : 0.15 - 0.7MPa [Setting : 0.09 - 0.12MPa]
		Approx. Flow rate [N2-0 Mode]	17 - 20 Pa m^3/s [3.8 Pa m^3/s]
	Duct Venti- Lation *	Connection	d 50 mm x L 50 mm
		Pressure	-196 Pa
		Approx. Flow rate	0.5 m^3/min
Lubrication Oil		Brand	BARRIERTA J100ES (NOK)
		Quantity	0.6 L
Approx. Weight			410 kg
Power Supply		Phase/Volt/Freq.	3 Phase , 200-220V at 50 / 60Hz
		Power capacity	12.0 kVA (50 / 60Hz)
		Connection	Japan Aviation Electronics Industry
			JL04HV-2E22-22PE-B
Control Signal			D-sub 15 Pin + D-sub 25 Pin
Circuit Breaker			50A
Short Circuit Current Rating (SCCR)			2.5k A
Airborne noise test data [dB (A)] **			64

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

** Test condition

(1) Pump is operating under ultimate pressure.

(2) Measured at 1m distance from cover and 1.6m height from floor.


GAS OUTLET CLAMP FLANGE NW40
790
1/4" TUBE CONNECTION WITH PLUG
8×φ13.5
200
200
405
50
40
220
50
120
EYE BOLT M16
VENTILATING DUCT φ50
835
798
15
83
330
557
970
44
400
20
103
310
1020
760
GAS INLET CLAMP FLANGE NW80
SELECTOR VALVE FOR DILUTION N2 GAS
FIXTURE, PUMP
CE/SEMI:200V
LCD CONTROLLER
EMERGENCY OFF SWITCH
N2 GAS REGULATOR
N2 GAS PURGE PORT 1/4" TUBE CONNECTION
COOLING WATER RETURN W/ COUPLER Rc3/8
COOLING WATER SUPPLY W/ COUPLER Rc3/8
160
40
40
CONTROL CONNECTOR
CIRCUIT BREAKER (CB)
LCD CONTROLLER CONNECTOR
POWER CONNECTOR
METRIC
REVISIONS
No. DESCRIPTION DATE BY APP.
CHANGED BREAKER Jan.15.'01 Y-W I-S
CUSTOMER
EBARA SER.No.
SET FINAL USER
MODEL/ ESA200W
APP'D BY I.SATO Jul.15.'98
DSN'D BY
CHK'D BY
DRW'N BY Y.MITAUCHI Jul.15.'98
H.FURUTA Jul.15.'98
TITLE OUTLINE DRAWING
OUTLINE DRAWING
PROJ.
SCALE 1:6
REV.
DWG.No. W8-A08114000I-01
EBARA CORPORATION

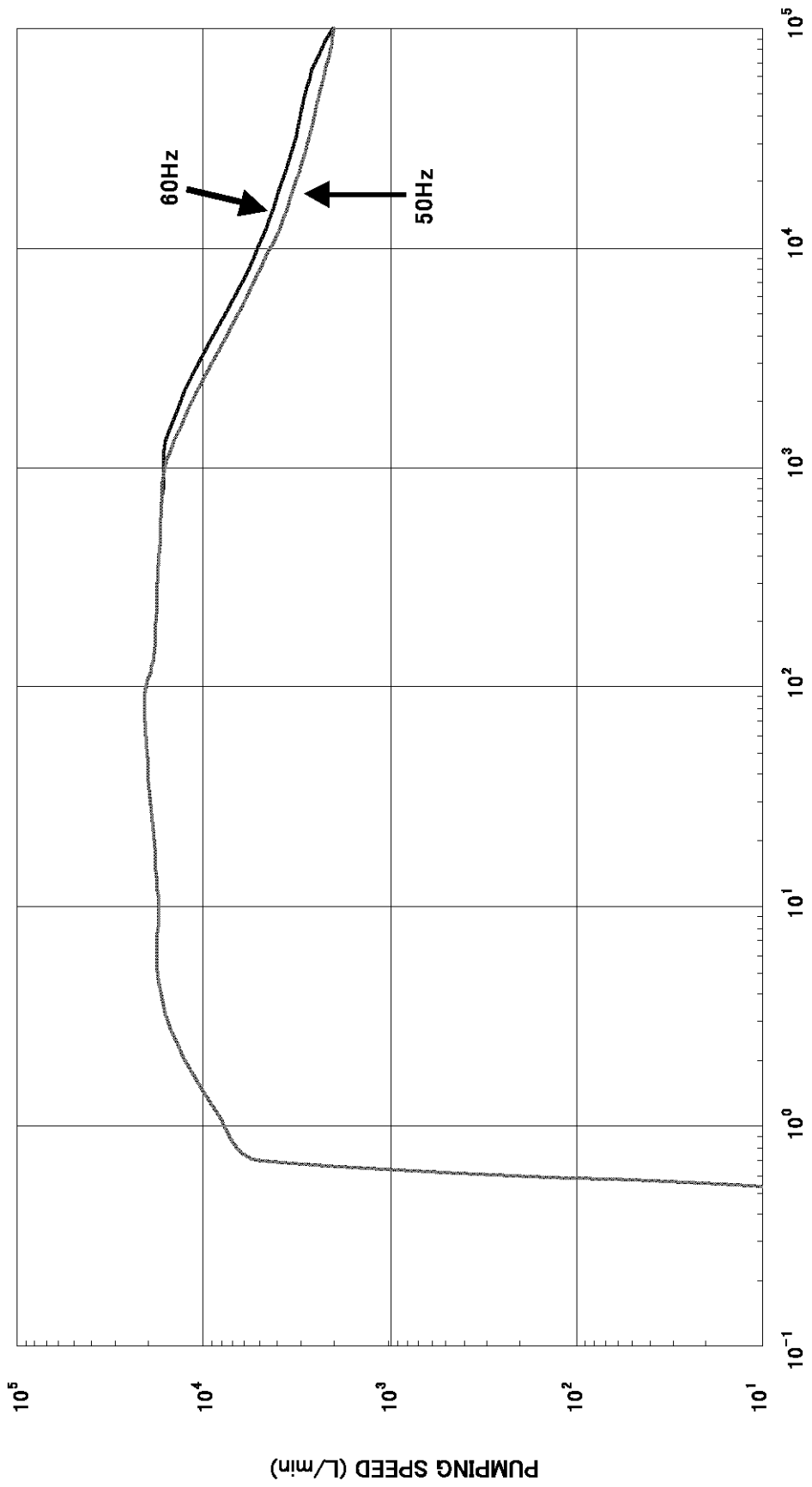


Fig.3.1 Model ESA200W Performance Curve

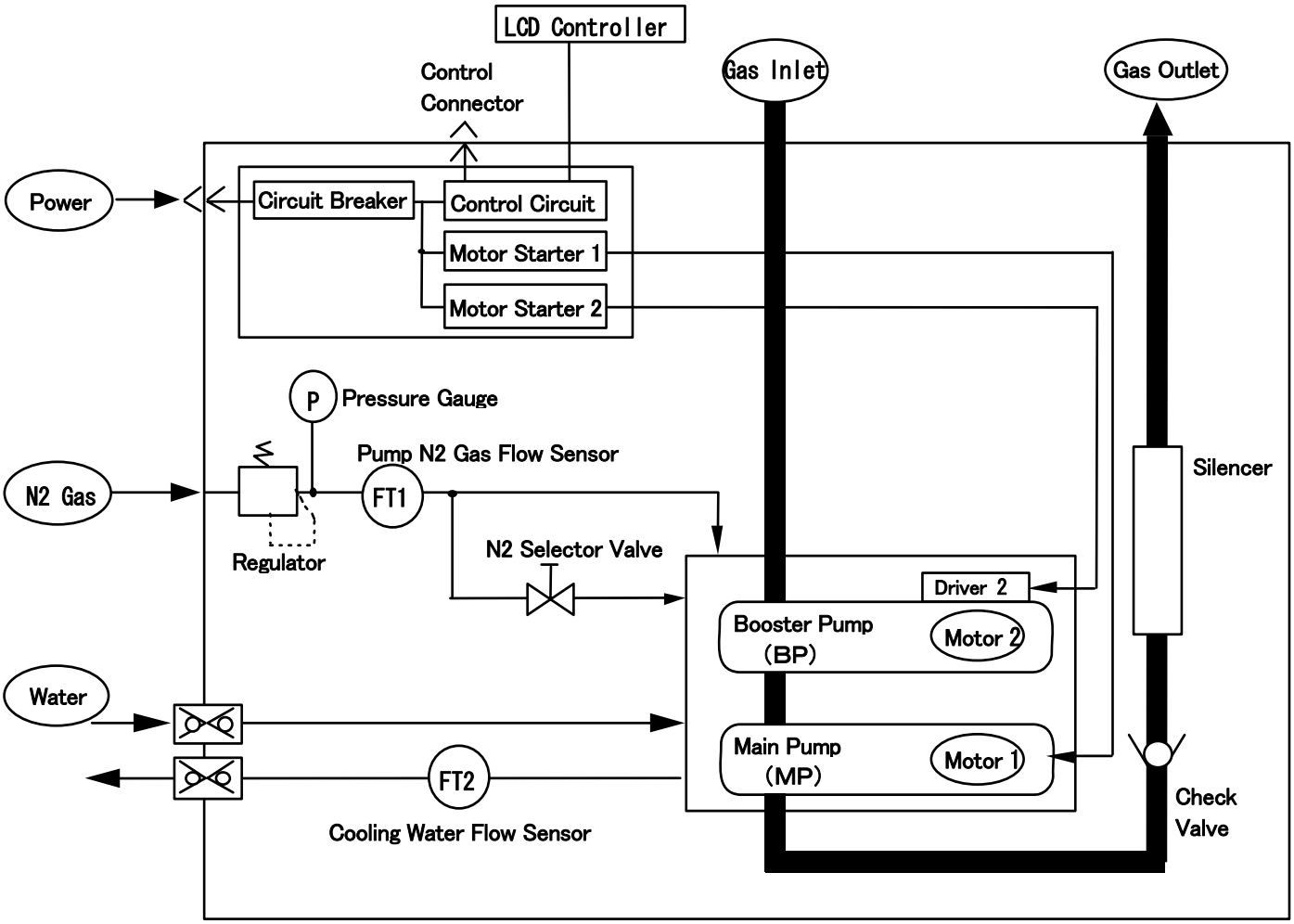


Fig. 3.2 System Flow

4. Installation

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

4.1 Movement and Fixation

4.1.1 Location

This pump is designed for indoor installation. To install the pump, select a place with little exposure to dust and humidity and not subject to dew condensation. Also allow for sufficient space to ensure easy pump installation and disassembly for maintenance.
In case of installing interface box to the pump, the distance between pump and interface box shall be 3m or less.

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

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

4.1.2 Caster and adjustment foot

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

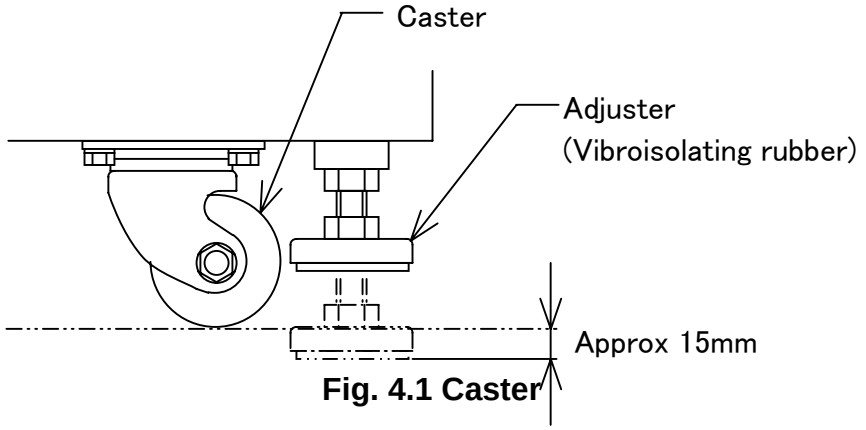


Fig. 4.1 Caster

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

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

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

(1) To fix the pump, turn the adjusters to the right to lower them.
(2) Level the pump by adjusting adjusters. Check the levelness by a put level on the inlet flange. If you cannot check the level, you should keep a difference of height between the both sides of the pump base less than 1mm.
The adjustment allowance is approximately 15 mm.

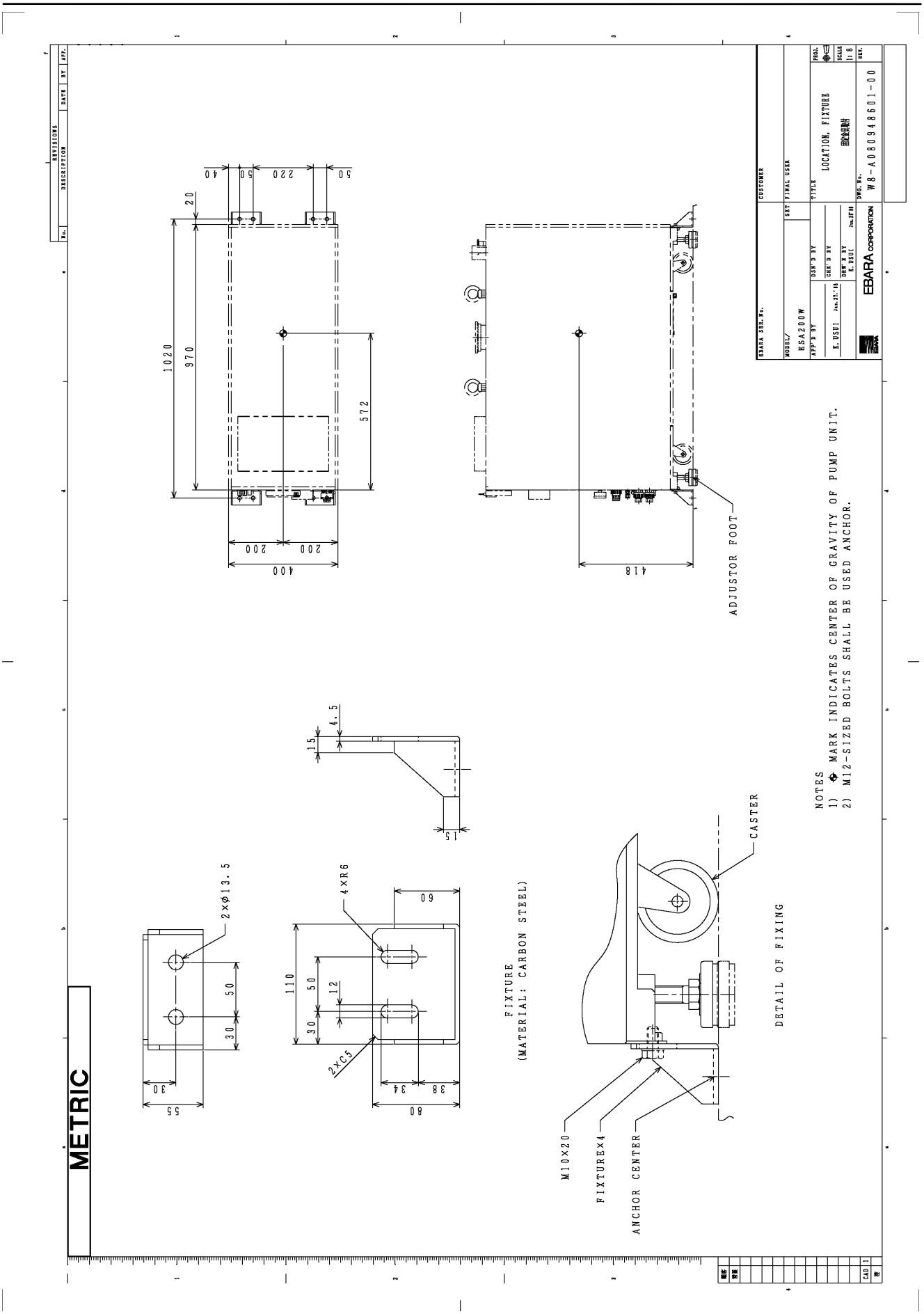
[NOTE] If the pump is not leveled, shortage of the lubrication oil supply to the bearing may be caused.

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

4.1.3 Pump Fixation

The pumps are provided with casters for easy transportation and foot adjustments for anchoring and height adjusting, as described in Section 4.1.2. The pump, however, may unexpectedly move or fall down when an earthquake occurs. To prevent such events, this model can be equipped with the anchor plate to secure the pump body to the floor. Fix the pump to the floor or other firm ground with the anchor plate at the installation.
Anchor plate is a standard part of the SEMI model. It's optional in other models.

For dimensions of the anchor plate, see the accompanying drawing.
Anchor bolts should be fit for conditions of the floor where the pump is anchored.


METRIC
NOTES
1) ◆ MARK INDICATES CENTER OF GRAVITY OF PUMP UNIT.
2) M12-SIZED BOLTS SHALL BE USED ANCHOR.
ADJUSTOR FOOT
FIXTURE
(MATERIAL: CARBON STEEL)
DETAIL OF FIXING
CASTER
M10×20
FIXTURE×4
ANCHOR CENTER
LOCATION, FIXTURE
EBARA CORPORATION
W8-A0809486 01-00

4.2 Piping

4.2.1 Vacuum and Exhaust Piping

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

a) Remove all foreign matter from inside the piping.

b) When connecting be sure that no dirt or dust particles adhere to the flange surfaces and/or that the flange surfaces are not damaged.
Provide a suitable means of preventing the ingress of reaction by-products adhering to the APC valve and wafer fragments. For this purpose, equip with a filter may be recommended.

c) The weight of the pipes attached to the pump can cause misalignment and leaks from the flange connections. Be sure that therefore to support the piping properly and not to apply undue force when aligning the flange faces.
It is recommended to insert flexible bellows when connecting the pipes to the suction and exhaust flanges of the pump.
The length of the flexible bellows on the vacuum (suction) side will vary according to the vacuum drawn. Be sure to connect so that no undue force can be applied to the flexible bellows.

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

4.2.2 Cooling Water Piping

Be sure to connect the cooling water pipes to the correct inlet and outlet ports.
The connector ports are provided with couplers. Push in the plug till the end of socket. Socket sleeve returns to front. (Fig. 4.2)
Be sure that the supply/return plugs are not connected in reverse. The diameters are slightly different. In/Out markings are provided on each plugs.
When the coupler is pulled out the water pipe will be automatically blocked. Use cooling water corresponding to the specifications of Table 4.1 below.

Table 4.1 Industrial Water Supply Quality Specification
(Japan Industrial Water Association, Industrial Water Quality Standards Committee)

Turbidity	(ppm)	20
pH		6.5-8.0
Alkalinity(CaCO3)	(ppm)	75
Hardness(CaCO3)	(ppm)	120
Evaporation residue	(ppm)	250
Chlorine ion	(ppm)	80
Iron	(ppm)	0.3
Manganese	(ppm)	0.2

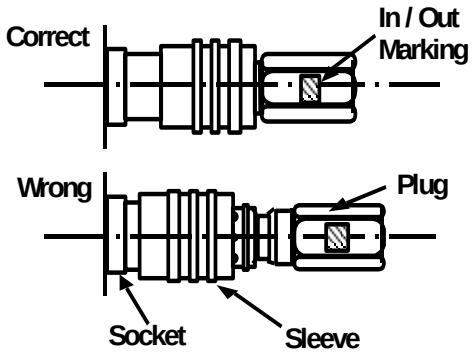


Fig. 4.2 Coupler

CAUTION Even when the cooling water flow rate drops, the pump will continue to operate until the pump part reach a temperature corresponding to the safety limit.
The material selected for the water piping of facility side should have a heat resistance so that it can withstand a maximum temperature of at least 70℃ at the operating pressure.

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

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

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

4.2.3 N2 Gas Piping

Cut tube at right angles and make the end-face perfectly smooth. Then connect the tube to the tube fitting assembly of the N2 gas purge port. The tube is a push-fit onto the shoulder of the tube fitting assembly.
Secure the tube fitting assembly properly and tighten the retaining nut by hand. After this, use a tool to tighten the nut further by 1 + 1/4 turns.
To connect the tube again after this, install the tube already fitted to the ferrule and re-tighten the retaining nut slightly after the initial tightening (generally, tighten by a further quarter turn after tightening by hand).

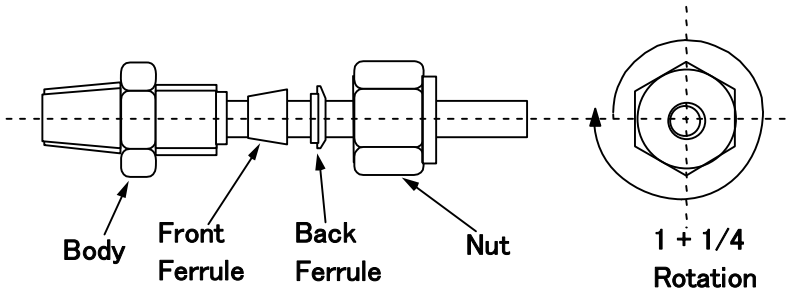


Fig. 4.3 Tube Fitting Assembly

CAUTION For safety, be sure to use N2 gas which purity is more than 99.999%. Impurities of N2 gas may cause an accident when the pump is used for exhausting toxic and/or inflamable gases.

4.2.4 Ventilation Duct

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

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

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

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

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

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. Leak detector shall be NRTL approved or equivalent.

In case of find gas leakage, stop the gas introduced into the equipment and pump. It is strongly recommended to wire the control circuit such that the pump immediately stops its operation upon leak detection by connecting the leak detector output to the EMO external signal input of the pump. Refer to Section 4.3.4 in this manual for connecting the leak detector output.

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

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

CAUTION Never operate the pump without pump cover for safety.

4.3 Electrical Wiring

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

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

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

4.3.1 Grounding

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

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

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

4.3.2 Power Supply Wiring

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

CAUTION Be sure to connect the grounding wire.

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

Wire the connector for the main power supply (3-phase, 200-220V and 50Hz/60Hz). Fig. 4.4 and Tables 4.2 and 4.3 show the connector pin assignment.

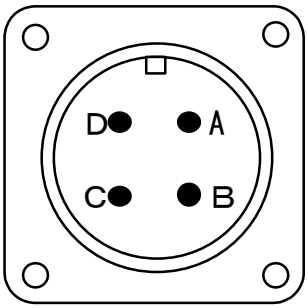


Fig. 4.4 Power Supply Receptacle
(As seen from outside,just unplugged)

Table 4.2 Pin Assignment of Power Supply Receptacle

No.	Phase
A	R
B	S
C	T
D	GND

Table 4.3 Receptacle Specification

Pump model	Model ESA200W
Receptacle type	JL04HV-2E22-22PE-B
Recep. Manufacturer	Japan Aviation Electronics Industry Co., Ltd.
Adapted plug type	JL04V-6A22-22SE-EB
Suitable wire	AWG #8 (UL1283)
Power capacity kVA	12.0

4.3.3 Control Signal Wiring

This pump is equipped with signal input and output connectors, which allow external tools and control devices to remotely operate and monitor the pumps.

Connect wires to the control connector for remote operation and remote monitoring. Tables 4.4 , 4.5 , 4.6 and 4.7 and Figs. 4.5 and 4.6 show the pin assignment.

The pumps also have an Emergency Off (EMO) input connector for user error monitoring device, such as a gas leak sensor to monitor the in-box gas leakage, to receive its error detection output for pump emergency stop. Refer to section 4.3.4 of this manual for EMO input.

Table 4.4 Receptacle Specification

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

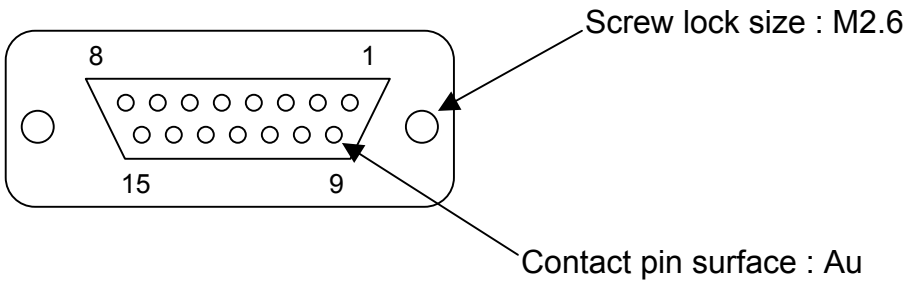


Fig. 4.5
15 Pin D Sub-Miniature Female Receptacle
(As seen from connecting side)

Table 4.5 Control Connector Pin Assignment(CN-Z)

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

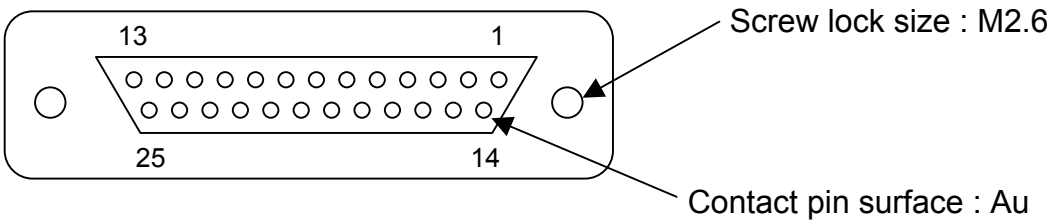


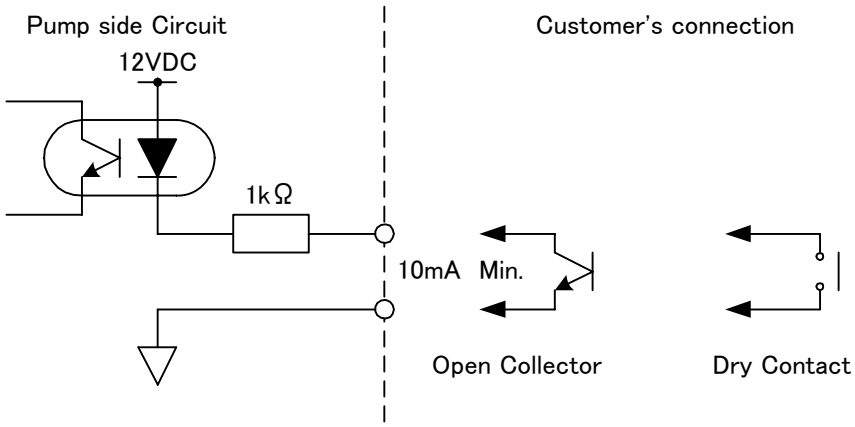
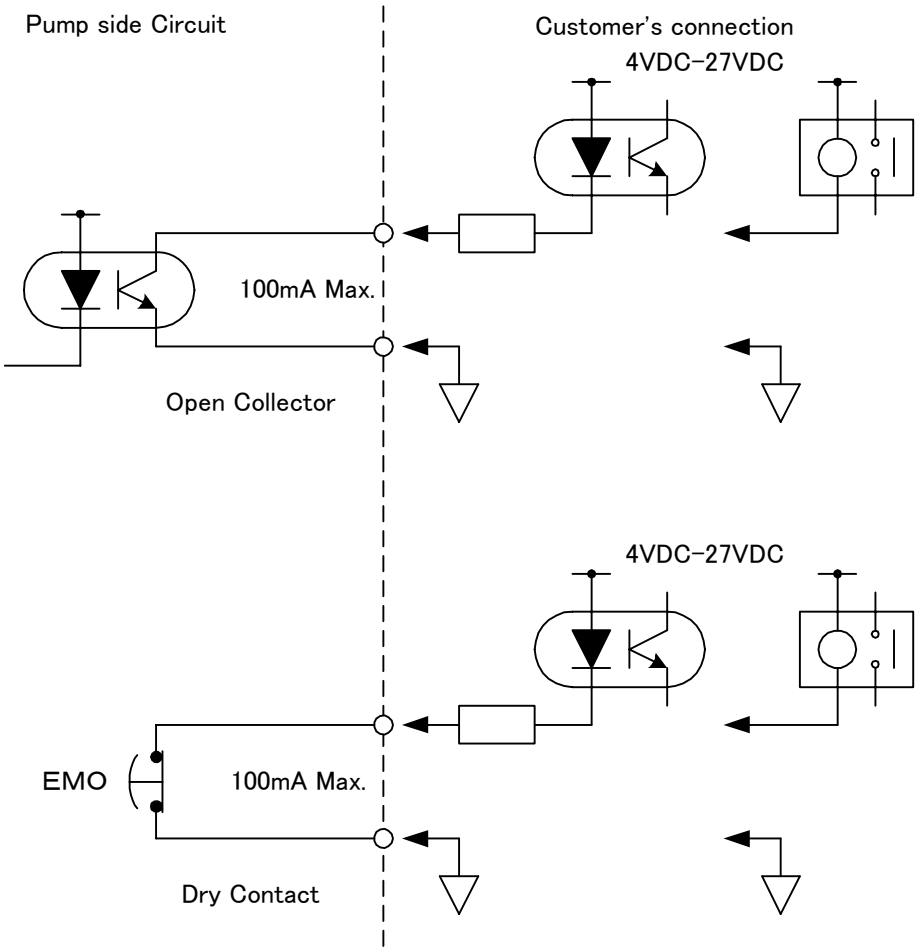
Fig. 4.6
25 Pin D Sub-Miniature Female Receptacle
(As seen from connecting side)

Table 4.6 Control Connector Pin Assignment(CN-Y)

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

※1 It can change to “Abnormality : OPEN, Alternate“ by DIP SW. setting.

Table 4.7 CN-Z & CN-Y Signal Contacts

Input Signal	
Output Signal	

CAUTION Do not wire vacant pins.

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

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

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

4.3.4 Additional Emergency Off (EMO) input

In addition to the emergency off button, which stops the pump and interrupts all primary voltage outside the main control panel, pump has a connector for an “emergency” signal input. The user may place this connector in any external interlock circuit (e.g. scrubber failure, gas leak detection, EMO “daisy chain”). Any break in this external circuit will shut down the pump.

Additional EMO input connector “EXT. IO” is located on front panel. Refer to outline drawing shown in section 3.5. (Near signal connector port.)

CAUTION Dummy plug should be connected on “EXT.IO” receptacle during operation. Pump does not run without dummy plug, because it means same as EMO signal was input.

Table 4.8 Additional EMO input Specification

Plug	HIROSE DF1B-2EP-2.5RC
Pin	HIROSE DF1-PD2428SCB
Suitable wire size	UL1007 AWG#24
Required capacity of user side facility	DC12V 20mA added by pump side. NO voltage required from outside
Signal input at **NORMAL** condition	**Close** between two pins of the plug
Signal input at **EMERGENCY** condition	**Open** between two pins of the plug

5. Power Supply for accessories

Power supply connector for accessory is equipped beside main power supply connector. This power supply is used for standard option that is listed below. (Shall not be used for other purposes.)

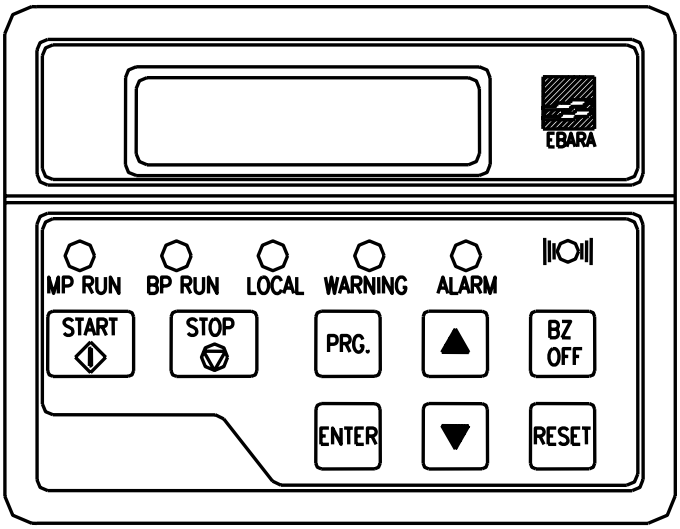
ADAPTER for Central Monitoring System
Interface Controller

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

WARNING Do not use the power supply for other purposes.

6. LCD Controller

6.1 LCD Outline



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

Fig. 6.1 LCD controller

6.2 LCD Indication

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

Table 6.1 LCD controller indication

No	ITEM	INDICATION
1	Current	BP: ##.# A MP: ##.# A
2	Control mode Pump running mode	CONTROL: LOCAL MODE: NORMAL
3	Running history (Indication of history)	PUMP RUNNING HISTORY ?
4	Alarm history (Indication of history)	ALARM/ WARNING HISTORY ?
5	Pump unit No.	UNIT NO &&&&&&&&
6	Pump type Voltage	PUMP TYPE ***V ESA&&&
7	Total operation time	OPE. TIME #####h
8	Heater temperature (option)	HT 1:### 2:### °C 3:### 4:###
9	Back pressure (option)	BACK PRESSURE ##.# kPa
10	Pump N2 gas flow	PUMP N2 FLOW ##.# Pam³/s
11	Cooling water flow	WATER FLOW ##.# L/min
12	Pump casing temperature	PUMP CASING ### °C
13	Motor speed	BP SPEED #.#k min-1
14	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.

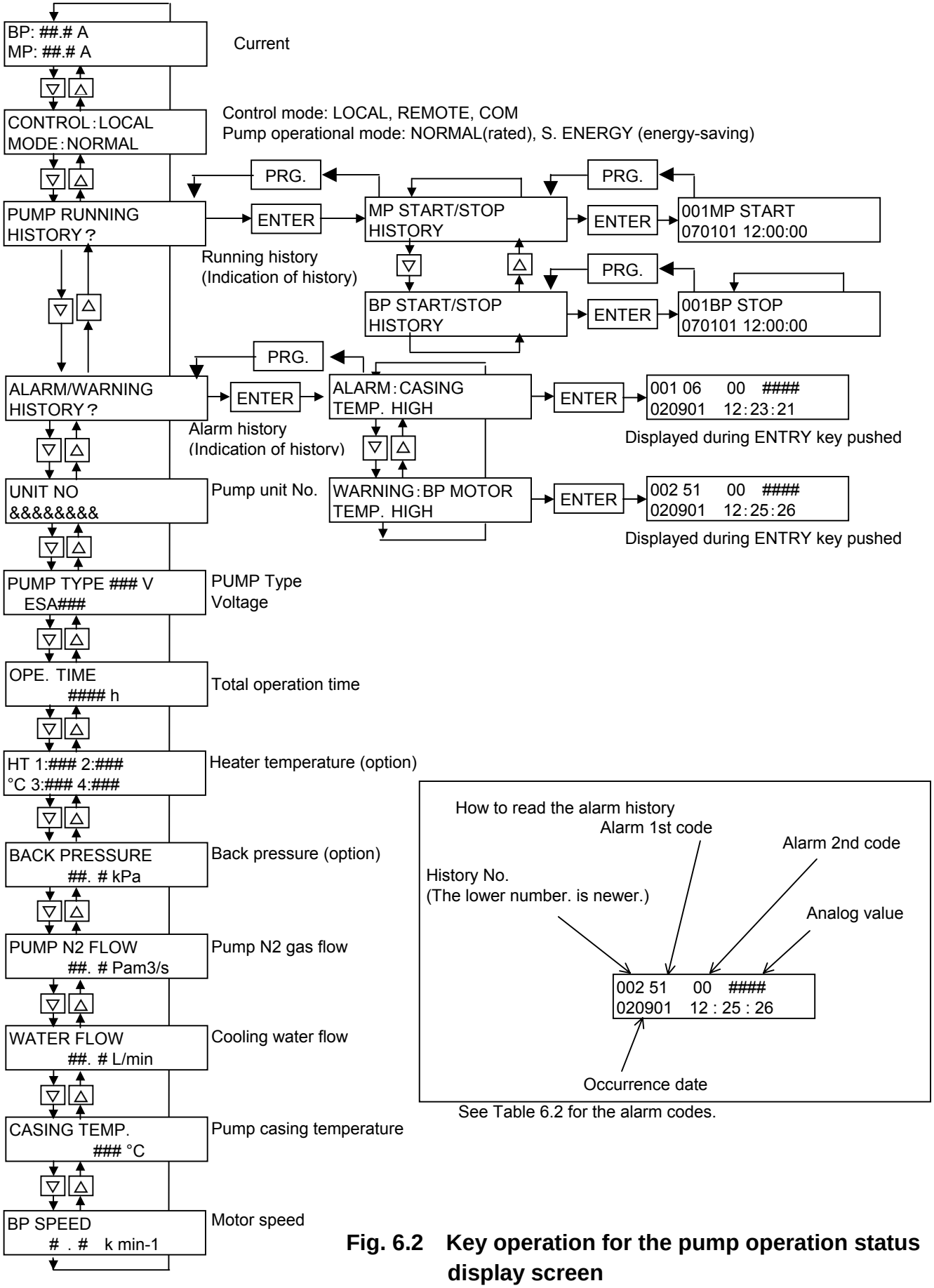


Fig. 6.2 Key operation for the pump operation status display screen

Table 6.2 Alarm code list

ALARM name	Code 1st code	Code 2nd code
MP casing temp.	50	01
BP motor temp.	51	00
MP motor temp.	52	00
BP overload 1(Thermal)	54	00
MP overload 1(Thermal)	55	00
MP Current 0	60	00
BP Current 0	61	00
Power failure	64	00
BP driver protection activated (OC)	66	01
BP driver protection activated (OV)	66	02
BP driver protection activated (OH1)	66	04
BP driver protection activated (OH2)	66	05
BP driver protection activated (CPF)	66	06
BP driver protection activated (UV)	66	07
BP driver protection activated (DRE)	66	09
BP overload 2	67	00
BP step out	69	00
Low cooling water	73	90
Inner communication error (IO)	81	01
Inner communication error (BP driver)	81	02
BP current high	81	03
Exhaust temp.	81	20
BP casing temp. (▲)	50	02
Water leakage (▲)	53	00
High back pressure (▲)	63	00
Emergency stop (EMO) (▲)	71	00
External interlock (▲)	74	00

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

"▲" indicates that the item is optional.

6.3 Setting the operational mode

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

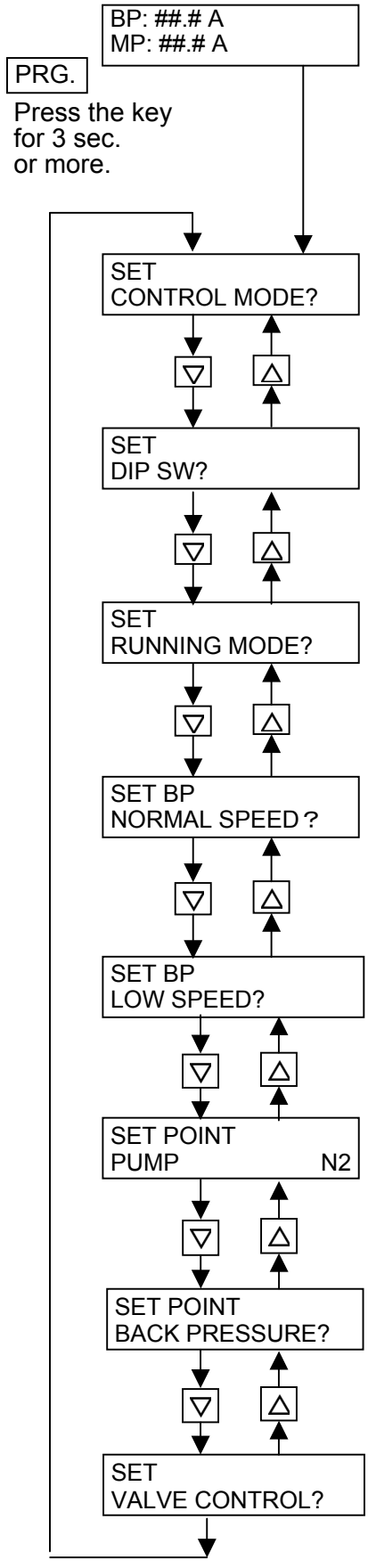
Table 6.3 Operational mode setting screen

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

Keys work as below for the setting screen.

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

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



• Status display

Pressing the key PRG. for 3 sec. or more when the status screen is displayed switches to the operational mode setting screen.

• Setting the pump operation control mode

• Setting the DIP switch

When the mode you want to set is displayed, press the ENTER to go to the setting change screen.

• Setting the pump running mode

• Setting the BP Normal rotational speed

• Setting the rotational speed in the LOW SPEED mode

• Setting the pump N2 flow low warning threshold

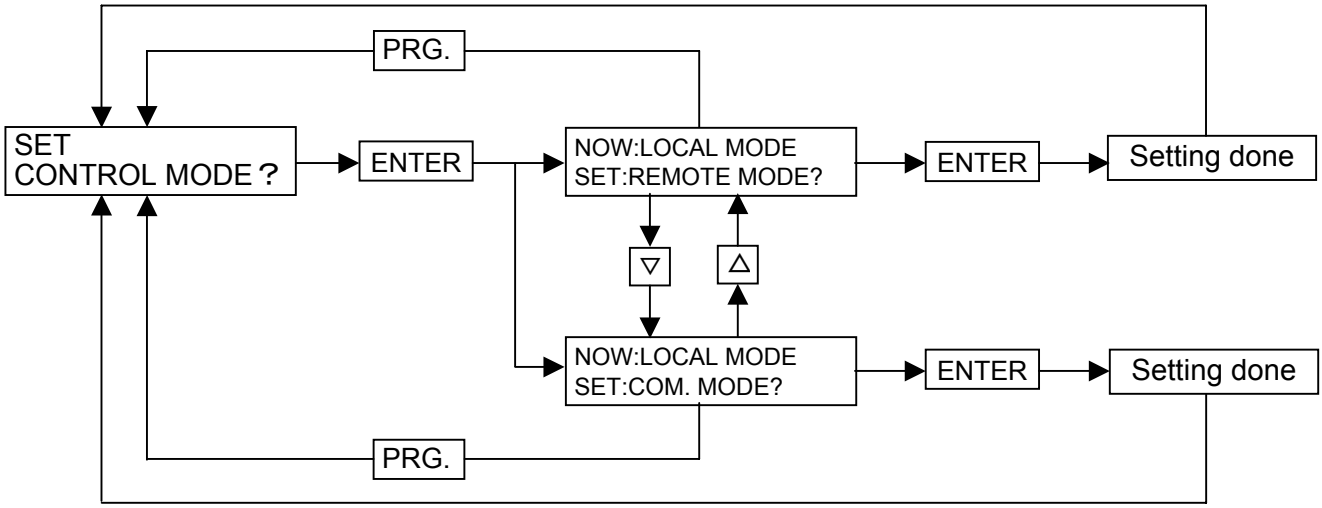
• Setting the Back Pressure high warning threshold (option)

• Pump Valve Control (option)

Fig. 6.3 How to set the operational mode

6.3.1 Setting the pump operation control mode

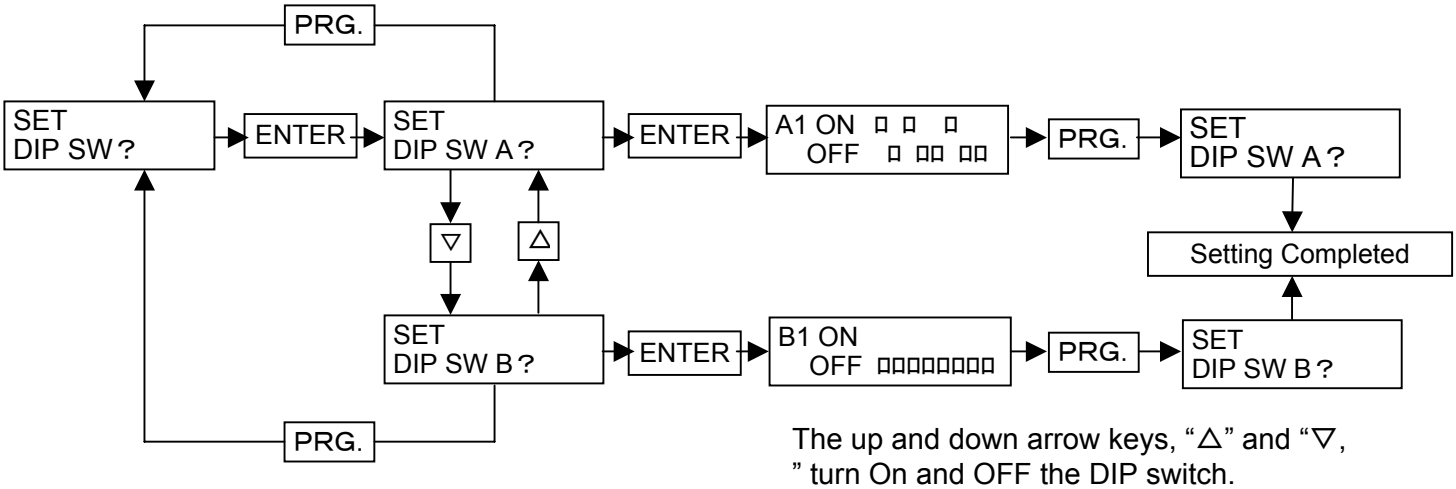
A case of display if Local mode selected.



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

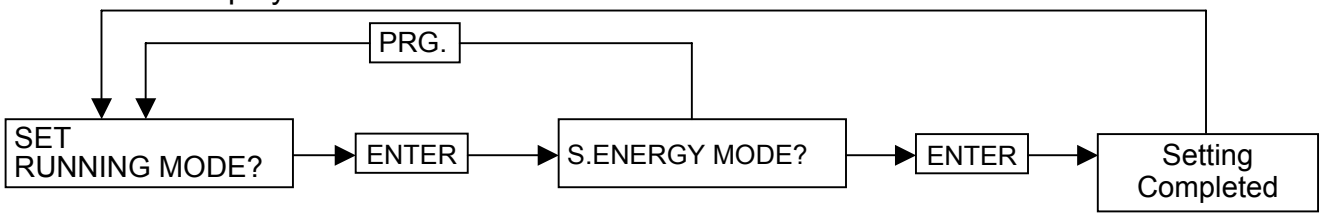


The up and down arrow keys, "△" and "▽, " turn On and OFF the DIP switch.
The key BZ.OFF switches the selection from 1 to 8.

See Section 6.4 for details of the DIP switch.

6.3.3 Setting the pump running mode

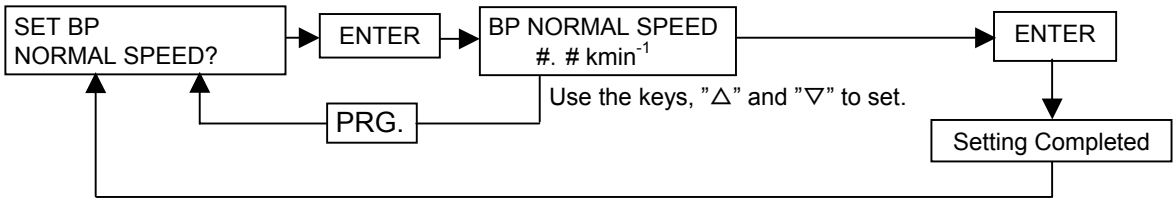
A case of display if Normal mode selected.



S.ENERGY MODE : Enables the energy-saving operation
NORMAL MODE : Enables the rated operation.

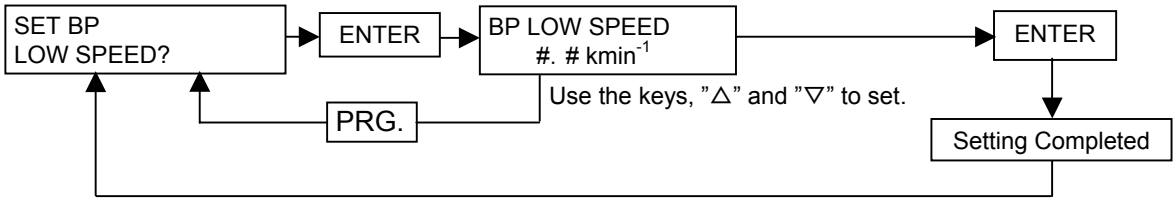
The mode that is currently not set is displayed.
If you do not need to set, press PRG. key to go back to the previous screen.

6.3.4 Setting the BP normal rotational speed



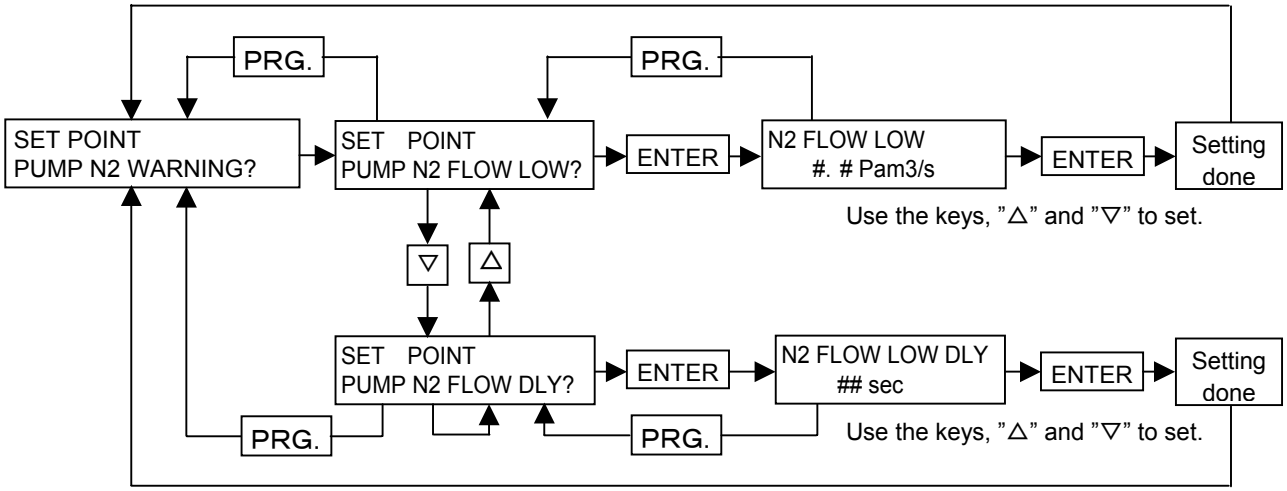
△ ▽ :Use the up and down arrow keys to change the setting value.
△ : Increase the setting speed by 0.1 $kmin^{-1}$.
▽ : Decrease the setting speed by 0.1 $kmin^{-1}$
Upper limit BP : 5.0 $kmin^{-1}$
Lower limit BP : 3.0 $kmin^{-1}$

6.3.5 Setting the rotational speed in the LOW SPEED mode



△ ▽ Use the up and down arrow keys to change the setting value.
△ : Increase the setting speed by 0.1 $kmin^{-1}$.
▽ : Decrease the setting speed by 0.1 $kmin^{-1}$
Upper limit BP : The value lower than the set value for the normal speed
Lower limit BP : 1.0 $kmin^{-1}$

6.3.6 Setting the pump N2 flow low warning threshold



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

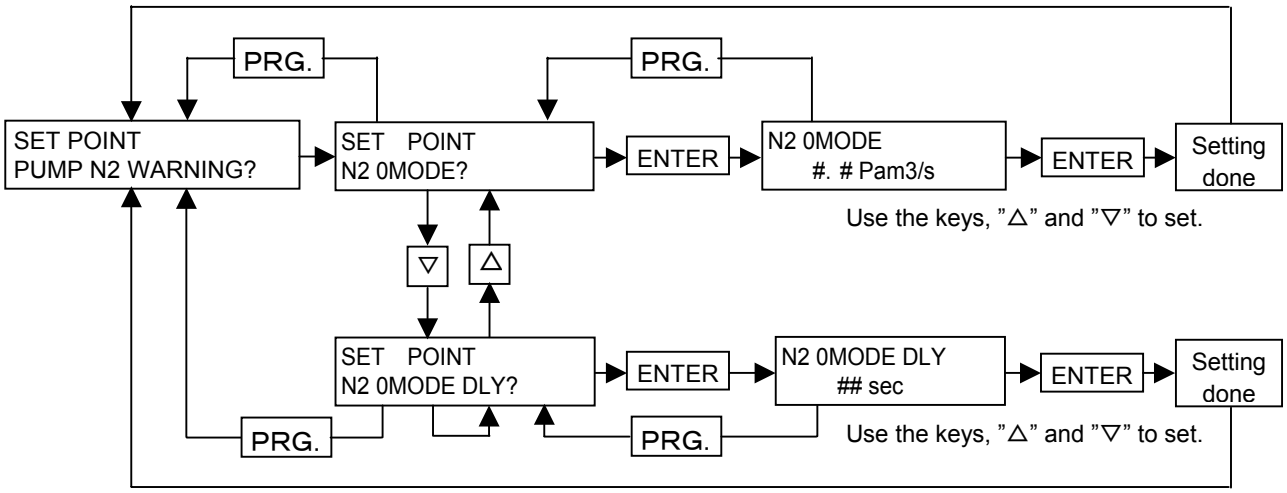
△ : Increase the setting speed by 0.1 Pam^3/s (Delay time : 1 sec)

▽ : Decrease the setting speed by 0.1 Pam^3/s (Delay time : 1 sec)

Upper limit 81.0 Pam^3/s (Delay time : 60 sec)

Lower limit 2.0 Pam^3/s (Delay time : 5 sec)

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



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

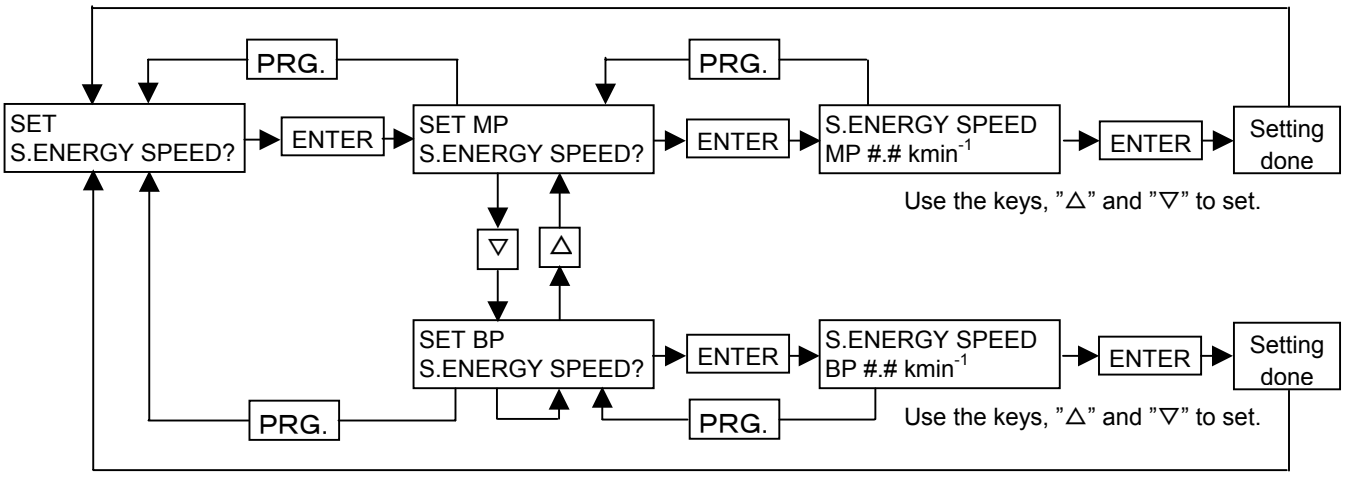
△ : Increase the setting speed by 0.1 Pam^3/s (Delay time : 1 sec)

▽ : Decrease the setting speed by 0.1 Pam^3/s (Delay time : 1 sec)

Upper limit 81.0 Pam^3/s (Delay time : 60 sec)

Lower limit 7.4 Pam^3/s (Delay time : 5 sec)

6.3.8 Setting the rotational speed in the SAVE ENERGY mode (S.ENERGY)



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

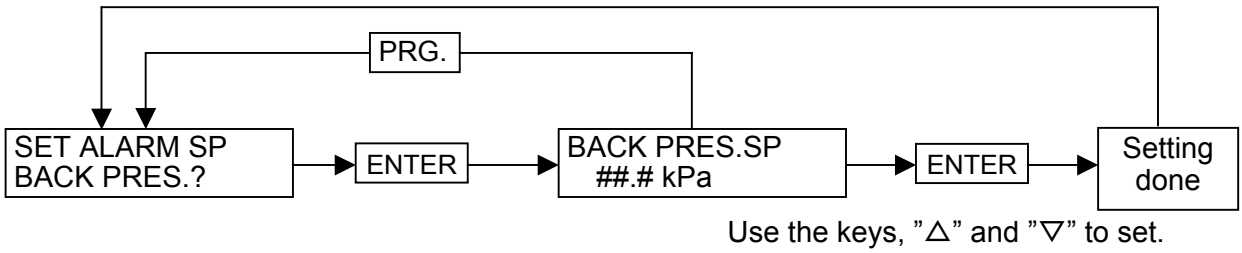
△ : Increase the setting speed by 0.1 $kmin^{-1}$.

▽ : Decrease the setting speed by 0.1 $kmin^{-1}$

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

Lower limit MP : 1.0 $kmin^{-1}$, BP : 1.0 $kmin^{-1}$

6.3.9 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.

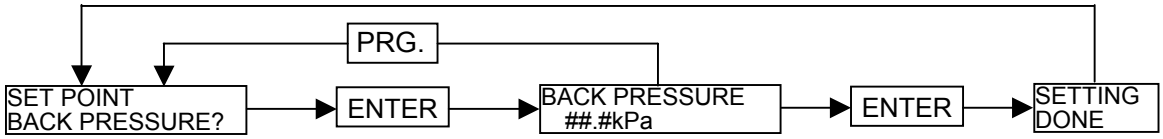
Upper limit : 30.0 kPa

Lower limit : 5.0 kPa

Factory setting : 20.0 kPa

WARNING reset value : Set value –2.0 kPa

6.3.10 Setting the Back Pressure high warning threshold (option)



Use the keys, "△" and "▽" to set.

△ ▽ 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.

Upper limit : 20.0 kPa

Lower limit : 5.0 kPa

Factory setting : 20.0 kPa

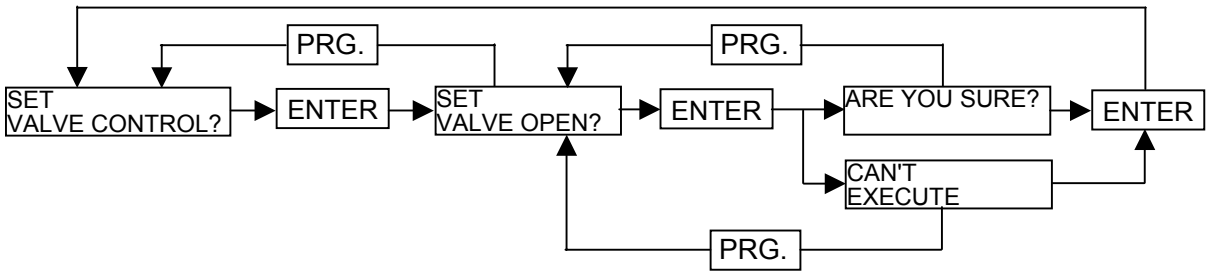
WARNING reset value : Set value –2.0 kPa

6.3.11 Pump Valve control (option)

1. Pump Valve control

・A valve follows operation from a LCD controller.

・An additional indication of the valve control screen is given at Customer operation mode.



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

B.In the case of under pump operation, ARE YOU SURE? is displayed.
Valve operation is possible.
In the case of under pump stop, CAN'T EXECUTE! is displayed.
Valve operation is impossible.

C.If it is made to decide by the ENTER key, a valve will open/close.
It returns to SET VALVE CONTROL? screen.

2.Valve operation

・Valve is made to CLOSE compulsorily at the time of a pump stop and Alarm generating.

・A valve is made to CLOSE at the time of a power supply injection.
（The last valve state is not memorized.）

3.Display on LCD

・In the case of under pump operation, and in the case of Valve CLOSE,
INLET VALVE CLOSED is displayed on a Normal display mode.

6.4 Dip Switch

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

Table 6.4 Dip Switch-A Settings

No.	Mode	Off	On	Factory setting
1	Data Length	7bits	8bits	ON
2	Monitor Cooling water and N2	Always	Only during operation	OFF
3	Buzzer	Not used	Use	ON
4	Operation switched to Remote	According to signal	Automatically stop	OFF
5	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

Table 6.5 Dip Switch-B Settings

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

* Optional

Table 6.6 Dip Switch-C Settings

No.	Mode	Off	On	Default
1	Outputs the pump N2 warning.	Normal Open	Normal Close	Off
2	-------	-------	-------	-------
3	Outputs backpress. warning. *	Normal Open	Normal Close	Off
4	-------	-------	-------	-------
5	-------	-------	-------	-------
6	Valve ON/OFF control *	Not used	Used	Off
7	The output of a valve state *	Not used	Used	Off
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 N2: “Always” or “During operation only.”
In the mode “During operation only” for the cooling water, the monitoring continues for 15 minutes after operation stop for cooling the pump.
It is recommended that N2 purge should be continuously active during operation stoppage to reduce by-product accumulation and corrosion in the pump.

DIP SW-A. No. 3 Dip switch-A No. 3 lets you select whether an acoustic alarm (buzzer) should be sounded or not when a WARNING/ALARM signal has been generated.

DIP SW-A. No. 4 When the toggle switch is moved from the LOCAL to the REMOTE position, dip switch-A No.4 lets you select "PUMP START/STOP in Response to External Start Signal (According to Signal)" or "PUMP STOP Regardless of External Signal (PUMP STOP)".

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

DIP SW-A. No. 5 Dip switch-A No. 5 lets you select "ALTERNATE Signal (START Signal ON/OFF)" or "MOMENTARY Signal (2 types of signal: ON or OFF)" for pump start and stop under external signal control.

DIP SW-A. No. 7 Dip switch-A No. 7 lets you select whether dilution N2 gas is used or not. Set dip switch-A No. 7 to ON when the production process does not lead to the formation of reaction by-products in the pump or when the process uses non-corrosive gases. Then close the N2 gas selector valve to save N2 gas. Be sure always to use the N2 gas selector valve and dip switch-A No. 7 in combination.

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

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

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

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

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

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

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

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

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

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

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

6.5 DIP Switch setting display

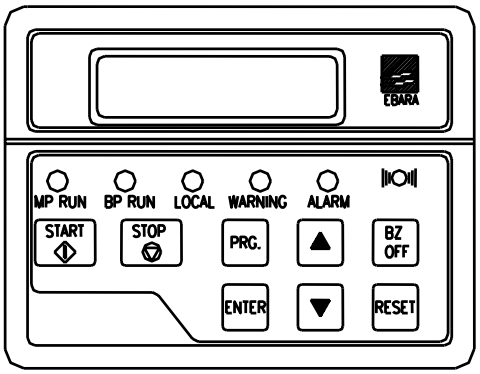


Fig 6.4 LCD controller

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	□	□	□	□	□	□	□	□

DIP Switch-B

B*	**ON**							
	OFF	□	□	□	□	□	□	□	□

DIP Switch-C

C*	**ON**							
	OFF	□	□	□	□	□	□	□	□

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

Fig 6.5 DIP Switch

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

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

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

6.6 Starting/stopping the pump with the LCD controller

Maximum two LCD controllers can be connected. Note only one of them can start and stop the pump (the other shows the pump operational statuses). The controller of which LED “LOCAL” is lit on has precedence over the other to control the start and stop operation.
If only one controller is connected, the controller starts and stops the pump.

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

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

7. Operation

7.1 Before Starting

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

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

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

(2) Turn on the N2 gas supply.
Check that the regulator attached to the pump is closed. (It is closed when the pressure adjustment knob is fully turned in the counterclockwise direction.) Open the main valve and check that there are no N2 gas leaks from the pipe connections.
Slowly turn the pressure adjustment knob clockwise to set the pressure (gauge pressure) to 0.1 MPa first. Then press the red stopper to lock the knob in position.

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

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

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

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

If DIP Switch is set to OFF Open Valve.
If DIP Switch is set to ON Close Valve.

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

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

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

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

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

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

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

(6) Re-check on the PUMP N2 FLOW display of the LCD Controller that the dilution N2 gas flow rate is within the 17 - 20Pam^3/s range. Also check that the pressure gauge shows a reading of 0.09 - 0.12MPa.
After setting the pressure, press the red stopper to lock the knob in position.
In this condition, the shaft sealing N2 flow rate is 4.6 - 6Pam^3/s.
(The shaft sealing N2 flow rate is contained in pump N2 flow rate currently displayed on the LCD controller.)

(7) When the WARNING/ALARM display appears on the LCD controller or when any abnormal symptoms are found other than the display, take action in accordance with 10. "Troubleshooting."
Even when the cause of the WARNING/ALARM display has been removed, it is maintained until the RESET signal is entered. Either press the RESET button or enter an external RESET signal from the control signal connector. In the BUZZER Enabled mode using DIP switches, it is possible to stop the buzzer by pressing the "BZ.OFF" button when the alarm is being generated.

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

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

7.2 START/STOP

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

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

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

CAUTION Process gases will remain in the vacuum pipes and the pump even after the pump has been stopped.
Be sure that therefore to purge for at least 1 hour after the pumps has been stopped.
Do not discontinue the N2 purge when the pump is stopped only for a short time.

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

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

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

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

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

7.2.1 LOCAL Start/Stop

a) START

Press the START button on the controller.

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

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

The power is indicated on the display during pump operation.

For other status display indications, refer to Table 6.1.

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

b) STOP

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

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

7.2.2 REMOTE Start/Stop

a) START

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

The MP starts.

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

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

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

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

b) STOP

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

7.2.3 COMMUNICATION Start/Stop

a) START

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

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

In the case of DIP SW A-8 ⇒ ON : After “MP” rotation reaches 3000 rpm, input the “BP” start-up command. BP will start.

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

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

b) STOP

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

Please refer to Communicating Specifications

8. Maintenance and Inspection

8.1 Internal energies

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

8.1.1 Power source

This pump is 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

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

8.1.3 Nitrogen gas

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

8.2 Routine Inspection

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

Table 8.1 Typical check items

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

When the WARNING/ALARM display appears, take action in accordance with Section 10. "Troubleshooting."
If the lubrication oil amount is lower than the lower limit line of the oil level gauge, supply the lubrication oil. See the Section 8.3 “Lubrication oil“ when adding the oil.

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

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

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

CAUTION The pump will not stop when an WARNING signal is generated. When pump operation is continued in this condition a ALARM signal will be generated or a serious breakdown will occur. Be sure therefore to check the pump in accordance with the instructions of Section 10. "Troubleshooting" after the process plant has completed 1 cycle.

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

If any abnormal symptoms other than those displayed on the LCD controller appear, take action in accordance with the instruction of Section 10. "Troubleshooting".
When the "BZ.OFF" button is pressed in the BUZZER Enable mode, the buzzer will stop even during an warning status.

8.3 Vacuum and Exhaust Piping

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

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

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

Toxic gases may be generated from by-products in the piping or pump in pump disconnection from the tool piping for repair and replacement or flange removal for maintenance. Gain relevant information about the process gases from your tool suppliers, and be sure that the gas concentrations in the work areas are at quarter or under the acceptable values specified using appropriate measurement equipment.
Without assurance of gas safety, instruct the workers to wear proper personnel protective equipment if necessary to protect them from gas hazards. The personnel protective equipment must include at least gloves, safety goggles, and a gas mask.
Be sure to following the instructions below when carrying out maintenance work on the vacuum and exhaust piping of the pump.

(1) Before you remove and wash the piping be sure to purge with a sufficient volume of N2 gas.

(2) When an exhaust gas scrubber unit is used, close the inlet valve of the exhaust gas scrubber after the N2 gas purge has been discontinued and then remove the piping.
(3) Be sure to switch off the power supply.
(4) After you have washed the piping do not reconnect until it has dried completely.

8.4 Lubricant Oil

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

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

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

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

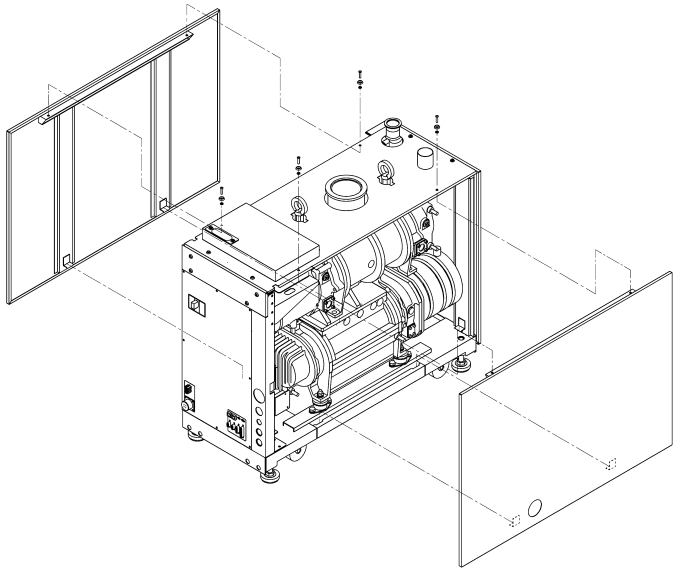


Fig. 8.1 How to remove pump covers

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

(3) Check the level through the window of the gauge. Then, add the oil so that the level is upper limit line (see Fig. 8.2 and 8.3).
In case of a booster pump gear side, oil should be filled to the upper limit line at the time of rated speed (5000kmin-1) operation.
(Target level is 2mm upper than the upper limit line at stop mode.)

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

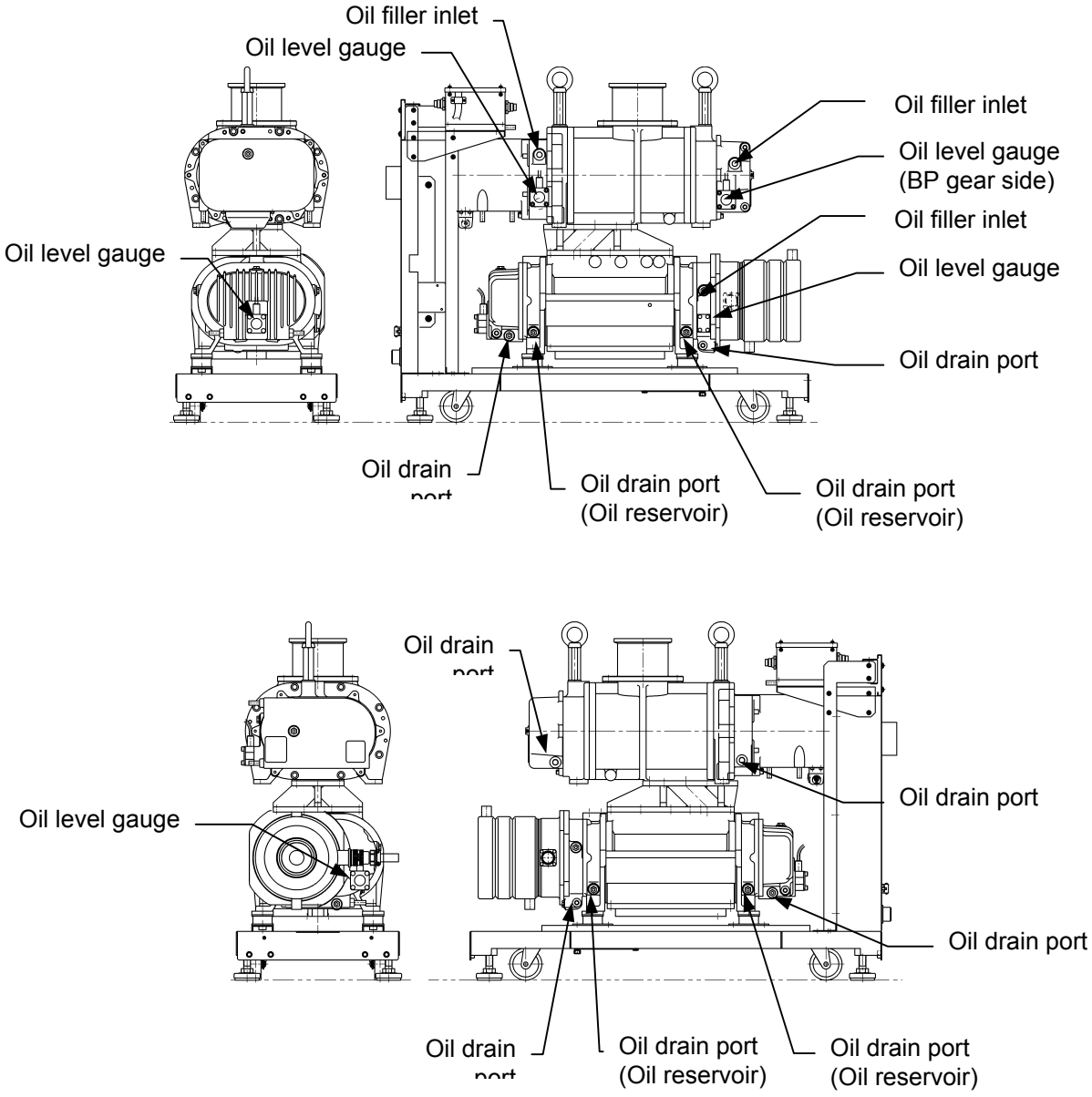


Fig. 8.2 Oil filler inlet, oil level gauge, and oil drain port positions

(5) Fit a waste oil container (PVC bag) to the bottom of the oil drain hole of the secondary reservoir and remove the drain plug. (See Fig.8.2)

(6) When you have drained off the waste oil close the drain hole after you have checked that there are no depositions and fragments adhering to the O ring attached to the plug.

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

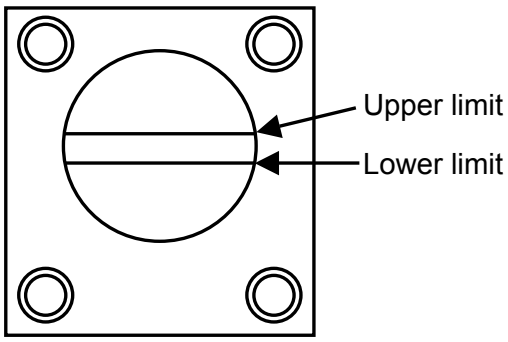


Fig. 8.3 Oil Level Gauge

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

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

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

8.5 Spare (Maintenance) Parts List

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

Table. 8.2 Spare (Maintenance) Parts List

1. Standard consumption Part.

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

2. Recommendable Part for Safe Operation.

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

3. Recommendable Parts for Quick Maintenance.

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

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

Parts' Name	Type	Order No.
Water flow sensor	10 L/min	C-5137-008-0001
N_2 flow sensor	84.4 Pa m^3/s	C-5138-062-0111
Thermo couple sensor bolt	T TYPE, M8	C-1019-121-0001
N_2 gas pressure regulator	R31-200-C121	C-2250-101-0001
Motor driver for BP	-	A-2017-224-0001

5. Electric Spare Parts.

Parts' Name	Type	Order No.
Control Panel	ESAG2200E	—
BP Motor Driver	IMDGA200	A-2017-224-0001
LCD Controller	REMG4	C-5114-317-0001

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

Table. 8.3 Labels

Label's Name		Parts No.
[DANGER]	HAZARDOUS WEIGHT DANGER LABEL	C-7110-316-0001
[WARNING]	HAZARDOUS VOLTAGE WARNING LABEL	C-7110-313-0001
[WARNING]	HAZARDOUS VOLTAGE AFTER EMO WARNING LABEL	C-7110-410-0001
[WARNING]	HIGH TEMPERATURE WARNING LABEL	C-7110-312-0001
[WARNING]	HAZARDOUS MATERIAL WARNING LABEL	C-7110-314-0001
[WARNING]	ANTI EARTHQUAKE FIXTURE WARNING LABEL	C-7110-322-0001

8.6 List of wastes during maintenance

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

Table 8.4 List of wastes during maintenance

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

8.7 Overhaul

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

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

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

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

Contact EBARA Sales office or Overhaul service center for detail.

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

(1) Fill all necessary items in a form shown in Appendix 5 and fax it in advance to Ebara Service Center or one of the agents listed in Global network for contact address. Ask Ebara service center for latest form. The original copy must accompany the pump you send. Failure to meet these requirements may restrict Ebara from providing any overhaul services to avoid associated risks.

(2) When you send back the pump to service center in the United States, contact Ebara Service Center first to obtain a RMA number for identification. Enter this RMA number to an Environmental Health & Safety Clearance Form shown in Appendix 5. Ask Ebara Service Center for latest form. Then, fax it in advance to Ebara Service Center and attach its original copy to the pump you send. Be sure to take these prior actions; otherwise Ebara refuses any overhaul services to avoid associated risks.

9. Disconnection and Transportation

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

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

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

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

To disconnect and transport the pump, proceed as follows.

(1) Stop the pump and replace all gases inside the pump by purging them with N2 gas.

(2) Turn off the power supply to the pump and unplug the power and signal cables.

(3) After you have fully closed the N2 regulator, remove the N2 pipe, seal off the N2 purge port with a sealing flange.

(4) Remove the cooling water pipes.

(5) Remove the vacuum and exhaust pipes and completely seal off the inlet and exhaust ports of the pump with a blind flange or similar seal. Seal off all process gas discharge points such as the differential port by using a blind flange.

(6) Attach the LCD controller on the front panel of the control board. Fix it with the tape.

(7) Wrap the pump in a vinyl sheet.

(8) Use the eyebolts provided on the pump for slinging the pump to load and unload. Fasten eyebolts completely and push in until flush with the seating surface. For sling, use a wire with a length so that the slinging angle (that is, the angled subtended by the two wires) is within 60 degrees.

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

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

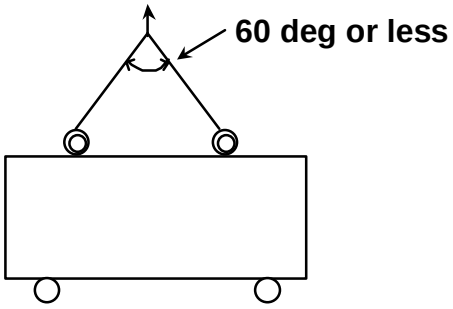


Fig. 9.1 Slinging the Pump

(9) When options such as an interface box are attached to the pump, be careful to avoid damage due to contact by the wire rope.

(10) For transportation, secure the pump by lowering the adjustment feet. Place a protective cloth around the pump to avoid shock and position protective members between the outer cover and the wires in order to distribute the load of the fastening wires.

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

10. Troubleshooting

10.1 Troubleshooting (1) Basic trouble

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

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

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

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

10.2 Troubleshooting (2) WARNING

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

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

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

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

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

10.3 Troubleshooting (3) ALARM

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

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

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

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

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

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

During REMOTE operation carry out the above procedures after you have turned off the external start signal.
When the external start signal remains on in the ALTERNATE mode, the pump will start immediately when the RESET signal is applied.

10.4 Troubleshooting (4) Option

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

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

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

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

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

During REMOTE operation carry out the above procedures after you have turned off the external start signal.
When the external start signal remains on in the ALTERNATE mode, the pump will start immediately when the RESET signal is applied.