Doc.No.7522-Y12042 Rev.0

INSTRUCTION MANUAL

MULTI-STAGE DRY VACUUM PUMP

MODEL EV-X100N
MODEL EV-X200N
MODEL EV-X300N

CE/SEMI/NRTL Model
200/200-220V(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, operating this equipment.

“Model OOO” in this INSTRUCTION MANUAL is Ebara model code

ISSUED BY PRECISION MACHINERY COMPANY

EBARA CORPORATION

PM40U

The Products described herein fall under “the goods listed in row 16 of the appended table 1 of the Export Trade Control Order of Japan” ,so in case of such Products, you need to confirm “use” and ”Purchaser and/or end-user” and, as case may be, obtain the approval of the Minister of Economy, Trade and Industry. (Please confirm these conditions on your own.) Furthermore, some of the Products fall under row 1-15 of the appended table 1(listed items). In case of export of these listed items, you are required to obtain the export license from the Minister of Economy, Trade and Industry. For more information, please contact our sales office located near you.

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

Environmental Basic Policies

It is our responsibility to protect irreplaceable treasure of the nature and to hand it over to our 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 the Ebara position on the environment clear to society in general.

Safety Information

Personnel operating this pump must have the knowledge to identify and avoid hazardous Conditions associated with the pump.
Inappropriate actions or improper operation may cause dangerous accidents and serious injuries.
Before installation and operation, the operator should first have a thorough knowledge of the pump's construction, operating procedure, and hazards.
The operator should read through this instruction manual and other documents issued by EBARA.
If you have any queries regarding the pump operation, safety, or maintenance, please contact EBARA directly. Please refer to Global network for contact address.

Three terms in this manual designate the different hazard level.

DANGER	Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.

WARNING	Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION	Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. This term may also be used as a warning for situations liable to damage equipment

Important Prior Warnings

DANGER 	Keep out from under the pump when lifted. Only qualified personnel shall unload and lift the pump. Keep pump at horizontal position when lifted. Do not lift the pump without eyebolt spacer.
WARNING	Be careful not to overturn the pump when pushing and pulling it sideways, because the pump is narrow in comparison to its height.
WARNING 	Only a qualified electrician, observing all national and local regulations, should perform electrical work.
WARNING 	Cut and lock out electrical power before beginning wiring or maintenance work. Do not switch on the power supply to the pump until work is completed and pump and piping are returned to safe operating condition.
WARNING 	Supply N_2 gas to the exhaust piping when necessary to dilute the flammable or toxic gas down to a safe concentration..
WARNING 	Purge system with sufficient N2 gas before removing and cleaning the vacuum lines and exhaust piping. Prevent dispersal of flammable, toxic or dangerous materials and guard against their contact with the human body. Work only in locations with an emergency escape route.
WARNING	Do not convert the pump from one process to another without an intervening overhaul. Gases or reaction products remaining in the pump may react and lead to accidents or to the formation of large amounts of byproduct.

WARNING 	Pump oil may be contaminated with process byproducts. Treat it as a hazardous waste. See Table 3.1 for oil quantities.

WARNING 	Many process gases are toxic, flammable and/or explosive. To avoid hazards, operate all process tools according to the safety guidelines provided by the tool suppliers. Appendix 6 lists typical process gases used in a Semiconductor processing. However, consult your tool supplier for details about the tool, the gases in use and other concerns specific to that tool and process.

WARNING 	Check for gas leaks after initial installation of the piping and after reassembly following maintenance Gas leaks will result in the discharge of harmful and dangerous substances and in abnormal reactions due to the admission of air into the pump. When conducting gas leak check by pressurization, do not exceed 0.05Mpa as supply pressure. Replace O-rings as required to correct leaks (Appendix 5).

WARNING	Do not modify the pump or any of its parts without EBARA's approval.

WARNING 	The pump casing and exhaust piping become extremely hot during operation and remain hot for some time after stopping. Keep pump and exhaust piping away from contact with personnel and flammable substances. Do not remove pump enclosure panels during operation.

WARNING	Check Safety Interlock functions periodically (every 6 months) to confirm correct operation.

WARNING	Disposal of process byproducts must be in strict accord with all local and national environmental and safety regulations.

CAUTION	Dispose of printed circuit boards containing lithium batteries in strict accordance with all applicable local and national environmental regulations.

WARNING	The process tool supplier and end user must avoid concurrent pumping of gases that may react in the pump. EBARA does not assume risks caused by hazardous chemical reactions resulting from simultaneous injection or mixture of multiple process gases in the pump. The pump has no protection features against the dangers from such usage.

WARNING	Do not perform a withstand voltage test. Testing error could result in damage in the sensitive devices.

CAUTION	Do not operate the pump without pump cover.

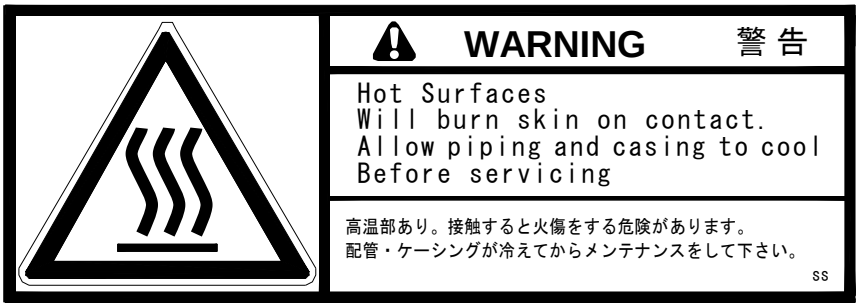
The following safety warning labels are attached to pump covers.

1. High temperature warning
2. Hazardous voltage warning1
3. Hazardous voltage warning2
4. Hazardous materials 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 1

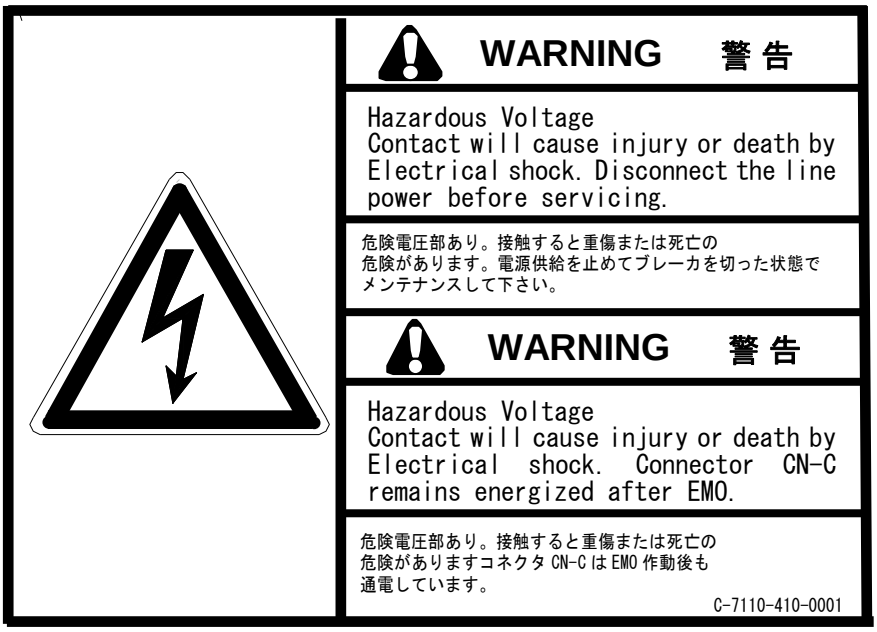
Hazardous Voltage may cause shock, burn, or cause death.

Turn power off and lockout before servicing.

3. Hazardous voltage warning 2

Hazardous Voltage may shock, burn, or cause death.

Turn power off and lockout before servicing.

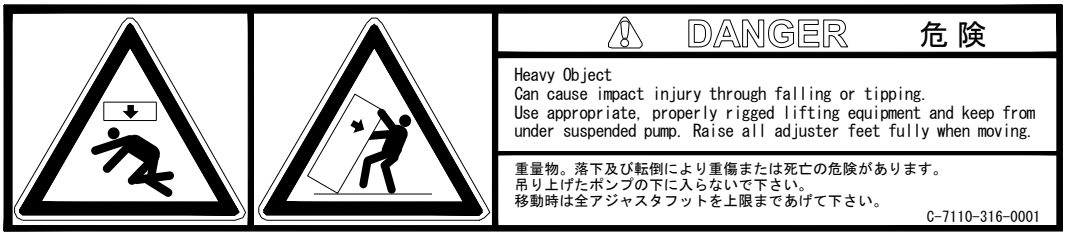


4. Hazardous materials warning

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

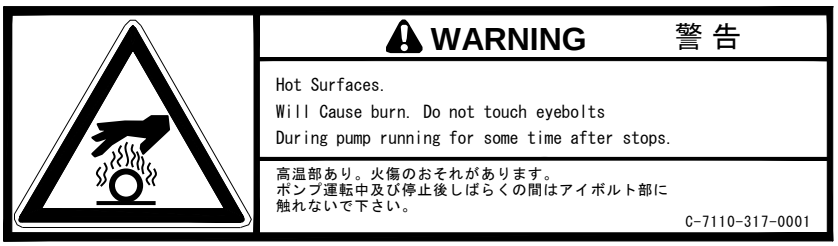
5. Hazardous weight danger

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.



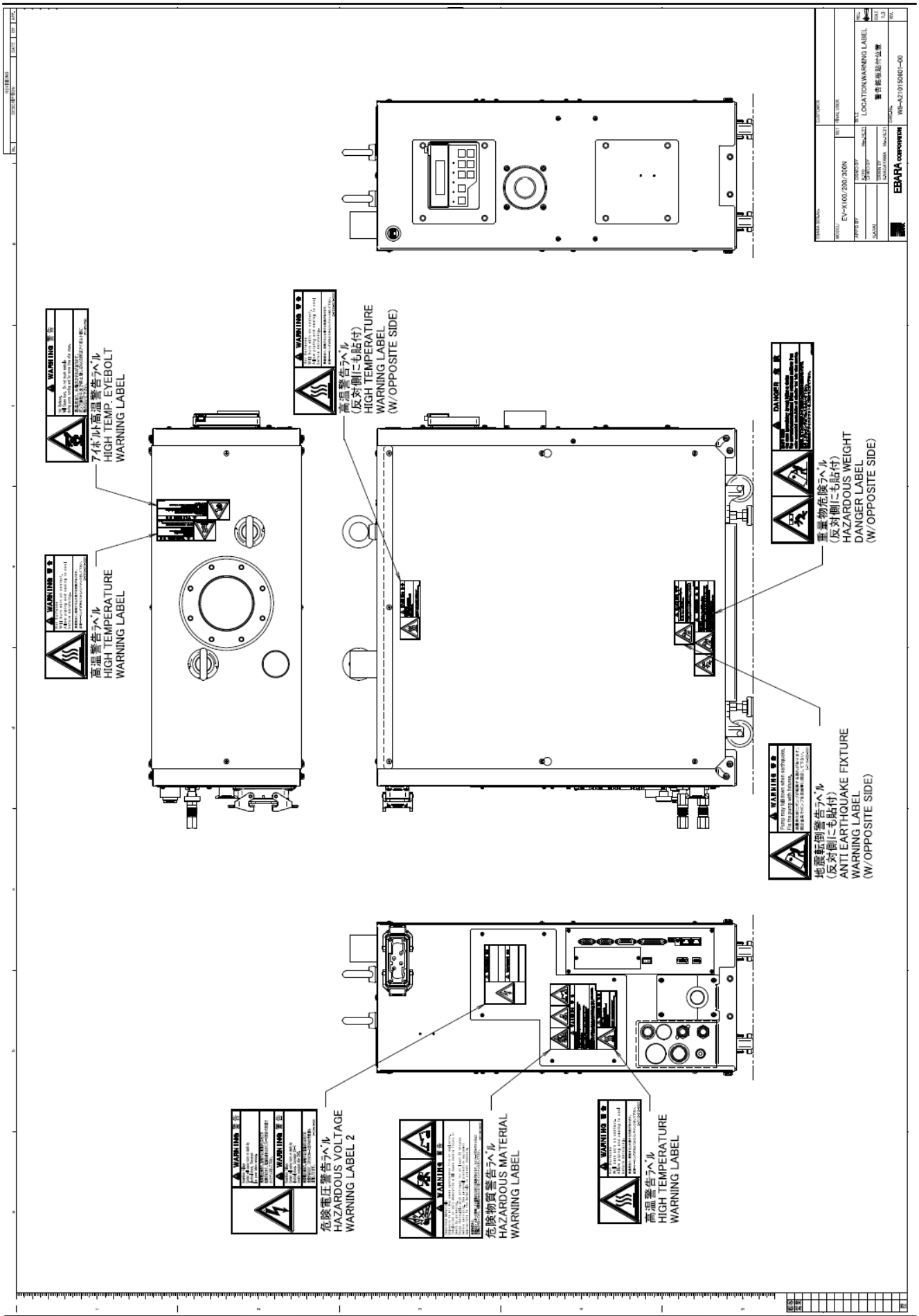
6. High temperature eyebolt warning

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 fixtures.


アイボルト高温警告ラベル
HIGH TEMP. EYEBOLT
WARNING LABEL
高温警告ラベル
HIGH TEMPERATURE
WARNING LABEL
高温警告ラベル
(反対側にも貼付)
HIGH TEMPERATURE
WARNING LABEL
(W/OPPOSITE SIDE)
重量物危険ラベル
(反対側にも貼付)
HAZARDOUS WEIGHT
DANGER LABEL
(W/OPPOSITE SIDE)
地震転倒警告ラベル
(反対側にも貼付)
ANTI EARTHQUAKE FIXTURE
WARNING LABEL
(W/OPPOSITE SIDE)
危険電圧警告ラベル
HAZARDOUS VOLTAGE
WARNING LABEL 2
危険物質警告ラベル
HAZARDOUS MATERIAL
WARNING LABEL
高温警告ラベル
HIGH TEMPERATURE
WARNING LABEL
EBARA corporation
EV-X100/200/300N
LOCATION WARNING LABEL

Safety Interlocks

WARNING	Check Safety Interlock functions periodically (every 6 months) to confirm the propsser working status of the interlocks.

1. Emergency Stop

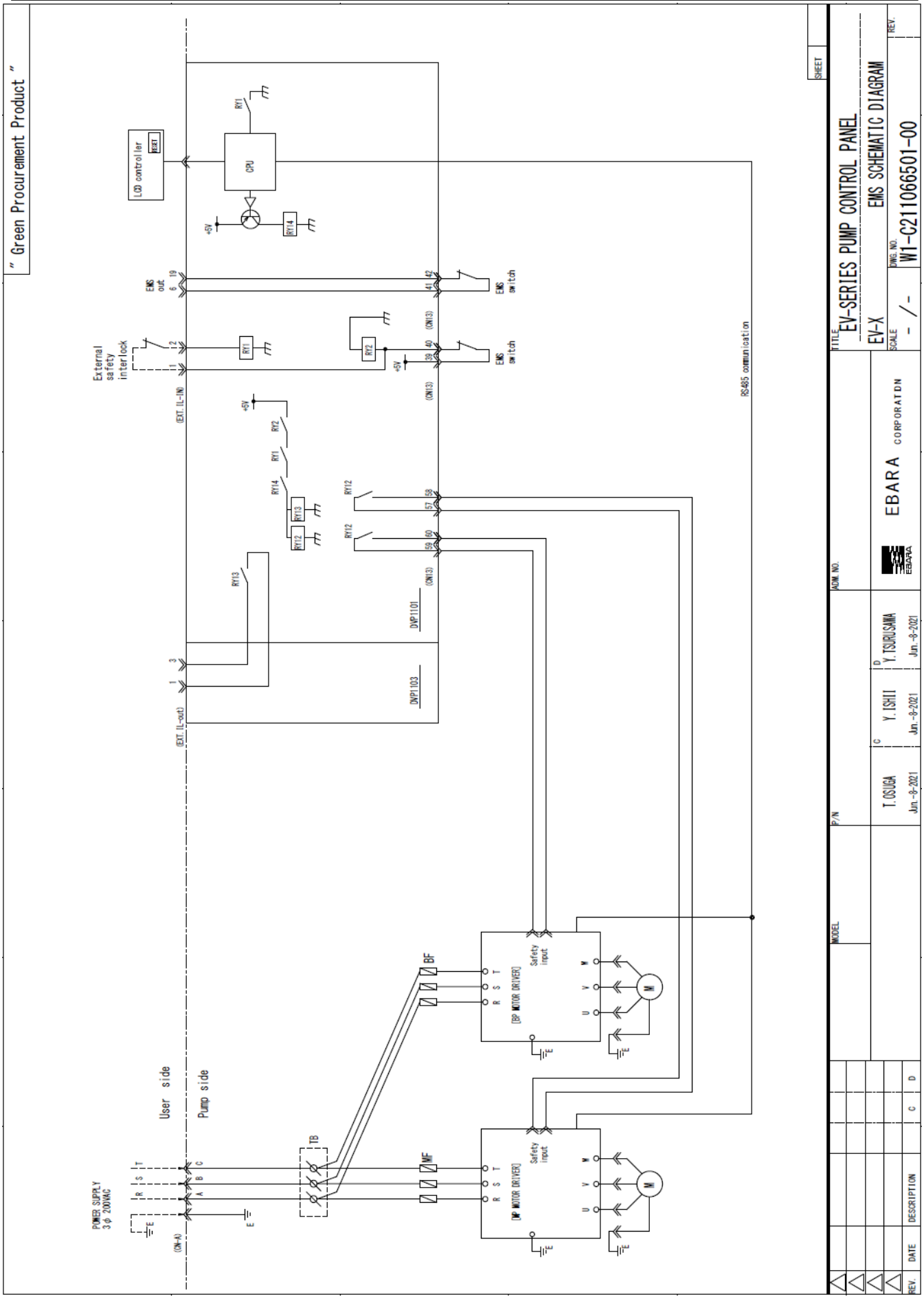
The emergency stop button stops the power supply to the electromagnetic switch coil, external power supply, and control circuit.
To reset the emergency stop state, twist the emergency stop button clockwise and press the reset button on the LCD controller or reset by external input.

2. N2 flow rate Low Warning

If the N2 supply to the pump is decreasing below the low flow rate warning setting, the pump will not be able to start. Therefore make sure that the n2 supply is sufficient, and then restart the pump.

3. Overcurrent Protection

If a short circuit occurs, the fuse inside the panel will burn. If it burns, the fuse will need to be replaced. After replacing the fuse, restart it.


" Green Procurement Product "
LCD controller
RESET
CPU
RY1
RY14
+5V
EMS out
6 19
41 42
EMS switch
External safety interlock
1 2
(EXT. IL-IN)
RY1
RY2
(CN13)
39 40
EMS switch
RS485 communication
RY12
RY13
RY14
57 58
59 60
DVP1101
DVP1103
(CN13)
(EXT. IL-out)
1 3
User side
Pump side
POWER SUPPLY
3 φ 200VAC
R S T
A B C
(CN-A)
TB
BF
MF
[BF MOTOR DRIVER]
[MF MOTOR DRIVER]
Safety input
R S T
U V W
M
TITLE
EV-SERIES PUMP CONTROL PANEL
EV-X
EMS SCHEMATIC DIAGRAM
SCALE
- / -
DWG. NO.
W1-C2110665O1-00
REV.
ADM. NO.
EBARA CORPORATION
MODEL
P/N
T. OSUGA Jun.-8-2021
C Y. ISHII Jun.-8-2021
D Y. TSURUSAWA Jun.-8-2021
REV. DATE DESCRIPTION C D
SHEET

Standard Limited Warranty

The terms of this Warranty limit the liability of EBARA CORPORATION. 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 Model EV-X pump from failure due to defects in materials or workmanship. For such failures, EBARA will, at its option, either replace or repair the pump free of charge

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

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

Exclusions and Limitations

This Warranty does not cover the following:

1. Failure due to operating the pump in a manner or under conditions other than as described in the instruction manual.

2. Failure due to corrosion, byproducts or foreign material entering the pump.

3. Failure due to fire, flood, earthquake, Acts of God, Acts of War or other circumstances beyond EBARA's control.

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

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

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

Contents

1. Foreword

We appreciate your selection of Model EV-X Series dry vacuum pump. EBARA has manufactured this pump with great care and attention to ensure safe and satisfactory operation.
Incorrect operation will result in lack of performance and may cause accidents and injuries to personnel.

[NOTE] This instruction manual contains all necessary information on the Operation and maintenance of the pump. 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 arrived.
(2) Check whether damage has occurred or screws/bolts have worked themselves loose in transit.

CAUTION 	Notify EBARA immediately, when damage is discovered or when components are missing. Do not use when a leak is present, as this might result in the accident

(3) Store the pump in a dry and clean place until installation.

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

(4) Do not stack the pump. Place it in an upright position.

2.2 Environmental Concerns

Handling or operating the unit other than specified function may induce adverse impacts on the environment. Follow the instructions mentioned 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) Maintenance failure of the pump (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, contact EBARA immediately. If the product with a leak 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 product, Model EV-X Series dry vacuum pump, is used to create low pressure, vacuuming the process gas.

The compact design of the Model EV-X Series dry vacuum pump includes various sensors and controls to enhance reliability and operation.

3.1.1 Pump Module

All Model EV-X Series dry pumps have a Multi-stage Roots-type main pump. High capacity units have a roots Booster Pump (BP) connected in series with the Main Pump (MP).

Both types of module pump include a pair of non-contact rotors synchronized by timing gears.

A compartment, isolated from the pump casing, encloses the timing gears and bearings, which are lubricated with Perfluoro-Polyether (PFPE) oil.

The pumps of this series are factory-filled with lubricating oil. Replenish or replace only with the recommended oil grades shown in Specification Table 3.1.

3.1.2 Nitrogen (N_2) Gas

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 cases where process gas concentration in the exhaust line may become higher than a specified safe level, inject nitrogen into the exhaust line. The tool user must provide this exhaust purge port.

N2 gas is supplied to seal the shaft section, enabling the pump to draw a clean Vacuum without admitting lubricant oil to the pump casing.

Additional N2 gas, injected in various pump stages for dilution, reduces corrosion due to process gas and retards the accumulation of reaction byproducts.

Adjust N2 regulator to specified pressure to ensure correct amount of nitrogen for these two types of purge operation.

Model EV-X Series include a N2 gas control valve for injection of additional N2 to dilute process gases. Adjust the N2 gas supply to the appropriate level after consulting EBARA when the dilution N2 flow rate is to be increased in accordance with the conditions of use. Maximum pump dilution N2 flow rate is 84 Pam3/s (50SLM).

3.1.3 Cooling Water

Since the Model EV-X compresses gas from a vacuum to atmospheric pressure, compression heat is generated. Therefore, cooling water is required to dissipate the heat generated. Quick-connect cooling water couplers make connection and disconnection easy.

3.1.4 Exhaust

A check valve is supplied as an optional component as per user's preference to prevent reverse flow of gas from the exhaust through the pump to the vacuum chamber when pump is stopped.

3.2 Control System

Model EV-X Series dry vacuum pumps has a built-in fuse, control power supply and a control circuit.

To improve reliability and safety, sensors monitor the condition of utilities and pump parameters.

During pump operation the pump's central processing unit monitors all the operating conditions, including power supply, cooling water flow, N2 gas flow, casing and motor coil temperature, motor speed, and motor current and back pressure (optional).

Pump operation "rides through" a transient power outage up to one second long. (Two-second ride through is available as an option.)

3.2.1 Warning and Alarm

To improve the reliability of the vacuum exhaust system, the pump control system generates two levels of trouble advisory: WARNING and ALARM.

WARNING;

The pump generates a WARNING signal when an operating parameter value exceeds the normal range. Therefore, it only draws attention to a deviation from the normal operating values but does not signify that the pump shut down is imminent. The pump will continue to operate in this condition, which enables the operator to complete one process cycle before checking the pump.

ALARM;

The pump will stop automatically and generate an ALARM signal output if a parameter approaches a mechanical safety limit.

Contact EBARA Corporation for details on checking the WARNING and ALARM setting conditions.

• The advisory indications of the Model EV-X series are different from those of previous EBARA pump series (UERR, A, AA, AAS series), based on SEMI standard E73.)

	Model UERR, A, AA, AAS series	Model EV-X series
Advisory 1:Light Fault (Pump operation continues)	ALARM	WARNING
Advisory 2:Heavy Fault (Pump stops)	TRIP	ALARM

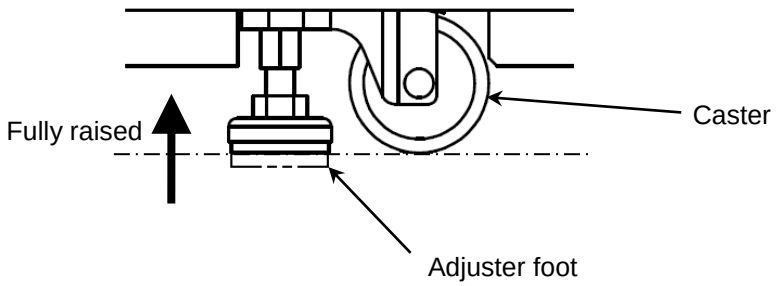
3.2.2 Operation Status Control

The LCD controller displays the sensor data to facilitate operation status control and daily inspection. The LCD controller displays all WARNING and ALARM signals. WARNING and ALARM collective signals are available for remote monitoring. Some Sensor signals have individual outputs.

3.3 Movement

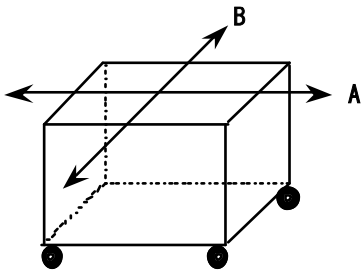
3.3.1 Preparation

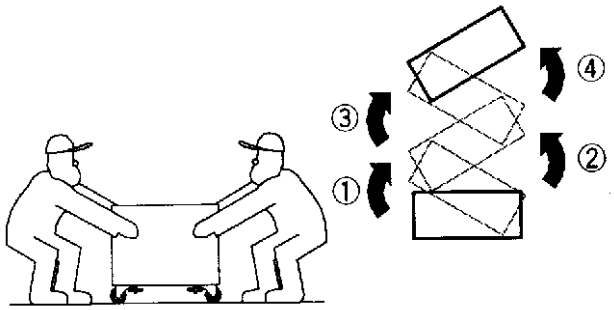
Raise all four adjuster feet fully before moving the pump; otherwise, an obstacle on the floor may cause the moving pump to tip over.



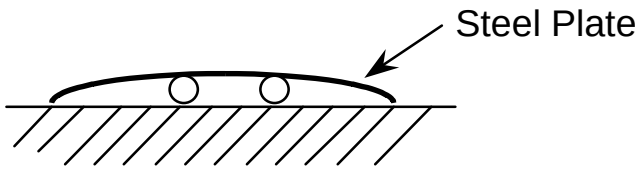
3.3.2 Moving Method

Move pump slowly by pushing at eyebolts along the long axis of the pump (Direction A). Keep toes and fingers away from moving wheels. If placing the pump in a corner or narrow space requires moving it along the short axis (Direction B), two persons should “walk” the pump over by alternately pushing the ends as shown below.





To move the pump across steps, cracks or joints in the floor, spread a steel plate or similar device, which can sustain the pump weight over the discontinuity. At least two persons, using great caution should move the pump.



If a moving pump loses balance and start to tip over, do not attempt to stop it. Get away from the pump immediately.

3.4 Release and Shut-off Residual Internal Energy

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 Tag out

Follow the procedure mentioned below to turn off the power before performing maintenance or inspection. Also, lock out the breaker switch during work so that the breaker is in OFF state.

The lockout and tag out labels should be prepared by the user. Lockout and tag out procedures and equipment should comply with OSHA 29 CFR 1910.147 and 1910.331-335.

1. Switch off the power breaker on the primary side of the pump.
2. Use a padlock to lock out the breaker switch and attach the tag-out label.
3. Make sure that the LCD display is off.

3.4.2 Cooling Water

1. Close [Facility] water supply valve to stop supply water to the pump, then close the [Facility] water return valve. Follow 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 valves from the hoses and redo the quick-connects to drain the pump lines. Have a vessel and absorbent clothes at hand before removing the couplings.

3. Make sure that the water outflow stops from both the facility lines and the pump. Then close RC1/4 thread hole of coupling by plugging with hardware plug.

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 the utility 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 the knob counterclockwise until pressure gauge reads 0 MPa. (Both N2 regulator knob and nitrogen pressure gauge are located on the utility 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 valve and nitrogen valve.
2. Remove handle stop bracket and switch ON the circuit breaker.
   Restart the pump and open foreline valve only after appropriate leak checks and safety verifications are completed.

3.5 Detailed Specifications

Specification

Table 3.1 shows the specification of the basic model of EV-X Series.

Table 3.1 Specification

Model			Model EV-X100N	Model EV-X200N	Model EV-X300N
Pumping Speed			10000 L/min	20000 L/min	30000 L/min
Ultimate Pressure*			0.5 Pa		
Connection		Gas Inlet	ISO100 (Bolted)		ISO160 (Bolted)
		Gas Outlet	NW25		NW40
Approx. power at ultimate Pressure (Max Power) **			0.9 kW (4.9 kW)	1.0 kW (4.9 kW)	1.5 kW (5.7 kW)
Utility	Cooling Water	Connection	Coupler (Rc 1/4)		
		Supply Pressure [Gauge Press.]	Max. 0.4 MPa		
		Differential Pressure [Gauge Press.]	Min. 0.1 MPa		Min. 0.15 MPa
		Flow rate	2-4 L/min		
		Temperature	Max. 30 ℃		
	N_2 Gas	Connection	1/4” Tube Fitting (Swagelok)		
		Pressure [Gauge Press.]	Supply : 0.15-0.7MPa [Setting : 0.09-0.12MPa]		
		Approx. Flow rate***	22-29 Pa m^3/s		
	Duct Ventilation ****	Connection	d50 mm x L50 mm		
		Pressure	-196 Pa		
		Approx. Flow rate	0.5 m^3/min		
Lubrication Oil		Brand	BARRIERTA J100ES (NOK)		
		Quantity	0.15 L		0.45 L
Approx. Weight			235 kg		315 kg
Power Supply		Phase/Volt/Freq.	3 Phase/200V/50Hz , 3 Phase/200-220V/60 Hz		
		Current Rating	21.3A		24.5 A
		Power capacity	6.5 kVA		7.6 kVA
		Connection*****	ILME CXM4/0		
SCCR			200 kA		
Control Signal			D-sub 15Pin + D-sub 25Pin		

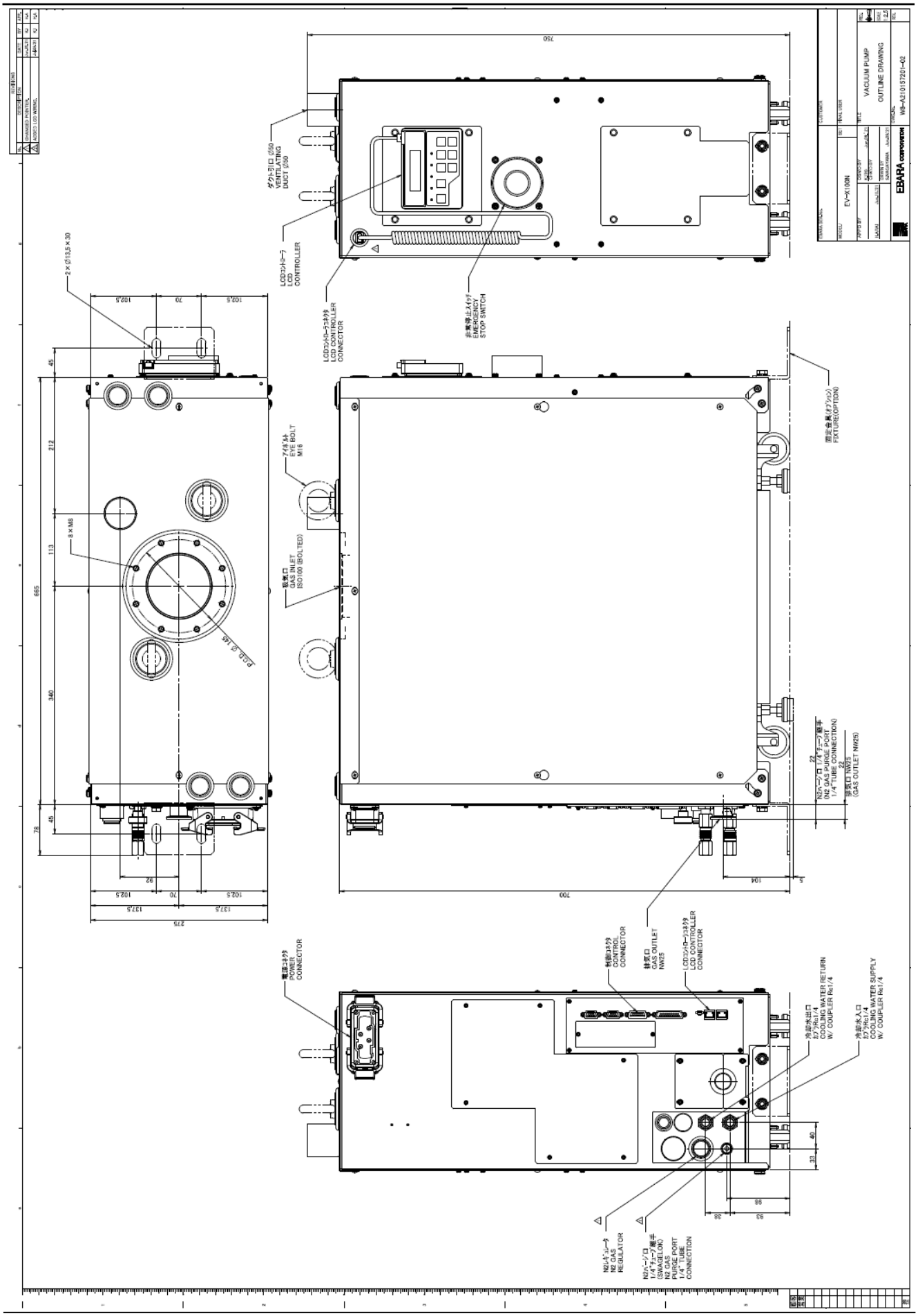
* Value is at the standard purge N2 flow rate.

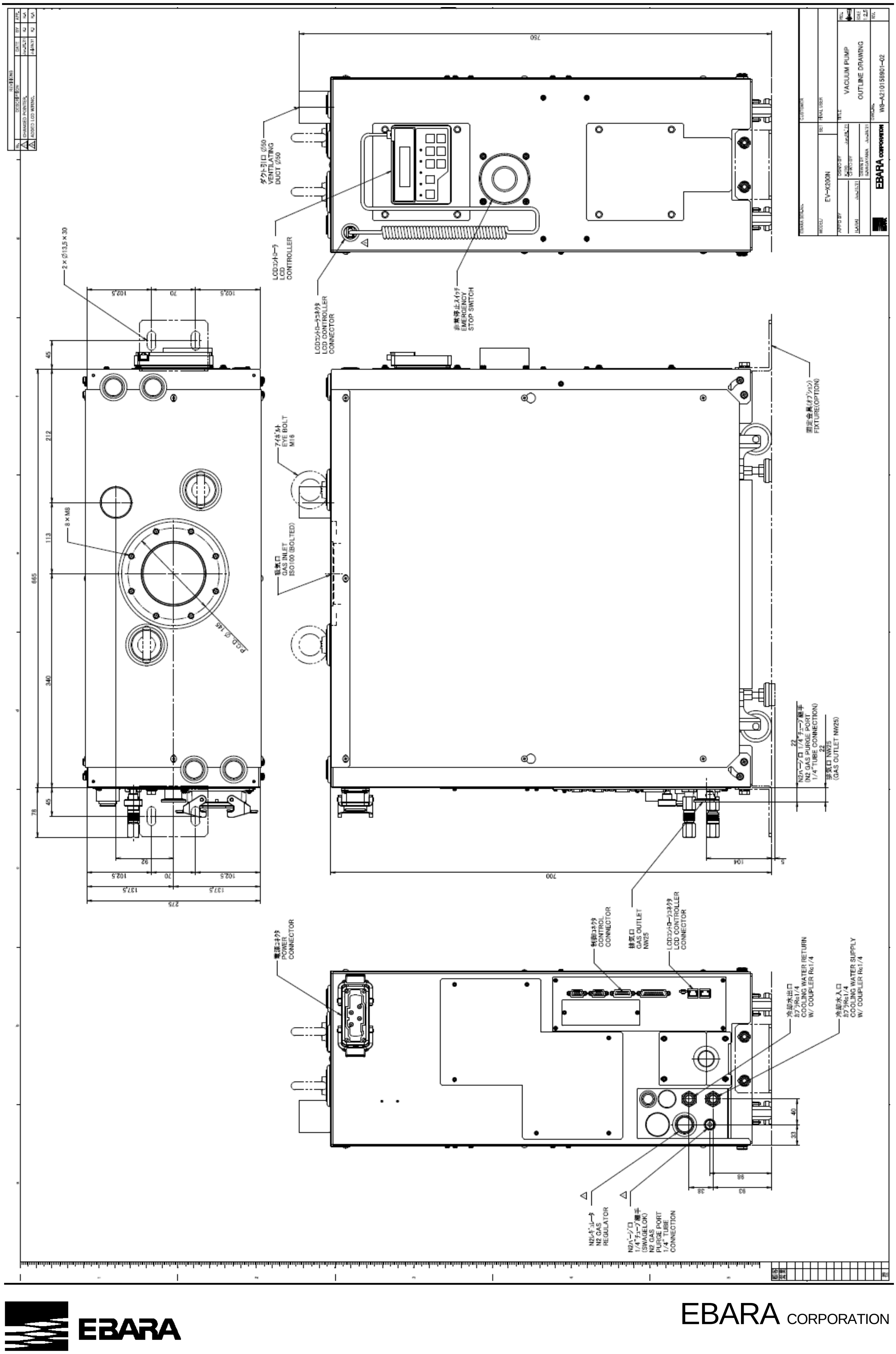
** Power does not include heater power consumption.

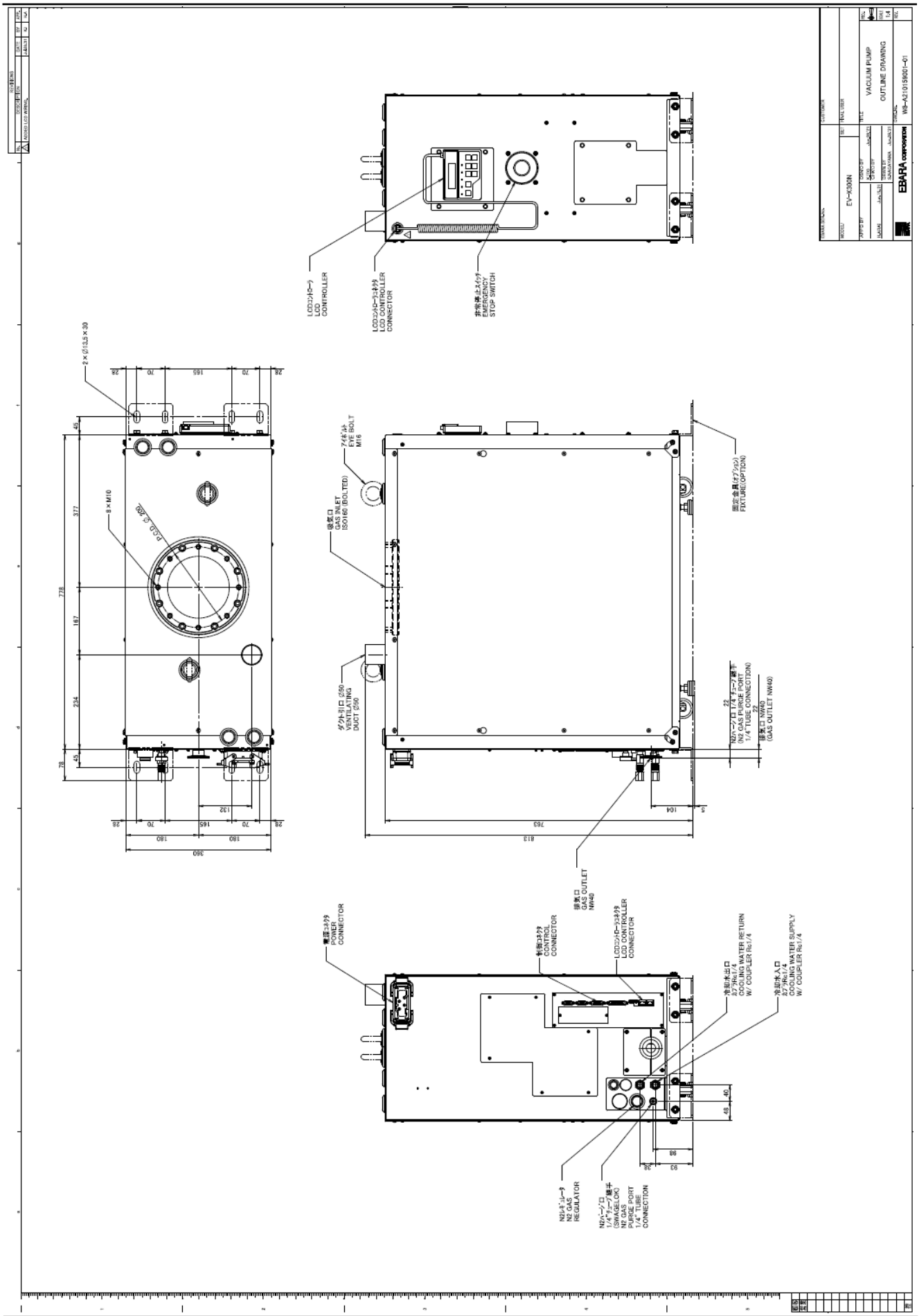
*** The pump purge N2 flow rate can be increased above the standard flow rate with control valve. (Max. pump purge N2 flow rate: 84 Pam3/s)

**** Install the pump in a location where maximum ambient temperature does not exceed 30degC.

***** ILME CXM 4/0 is compatible with HARTING HAN K4/0 09380062611..


750
ダクト用口 Ø50
VENTILATING
DUCT Ø50
LCDコントローラ
LCD
CONTROLLER
LCDコントローラ用
LCD CONTROLLER
CONNECTOR
非常停止スイッチ
EMERGENCY
STOP SWITCH
2 × Ø13.5 × 30
102.5
70
102.5
45
212
113
665
340
78
45
8 × M8
P.C.D Ø 145
92
70
102.5
137.5
275
アイボルト
EYE BOLT
M16
吸気口
GAS INLET
ISO100 (BOLTED)
700
104
5
22
N2パージ口 1/4"チューブ継手
N2 GAS PURGE PORT
1/4"TUBE CONNECTION
22
排気口 NW25
(GAS OUTLET NW25)
電源コネクタ
POWER
CONNECTOR
制御コネクタ
CONTROL
CONNECTOR
排気口
GAS OUTLET
NW25
LCDコントローラ用
LCD CONTROLLER
CONNECTOR
冷却水出口
1/4"Rc1/4
COOLING WATER RETURN
W/ COUPLER Rc1/4
冷却水入口
1/4"Rc1/4
COOLING WATER SUPPLY
W/ COUPLER Rc1/4
40
33
98
93
98
N2パージ口
1/4"チューブ継手
(SWAGELOK)
N2 GAS
PURGE PORT
1/4"TUBE
CONNECTION
N2レギュレータ
N2 GAS
REGULATOR
EV-K100N
VACUUM PUMP
OUTLINE DRAWING
WS-A2/0157201-02
EBARA CORPORATION


VENTILATING DUCT Ø50
LCD CONTROLLER
LCD CONTROLLER CONNECTOR
EMERGENCY STOP SWITCH
EYE BOLT M16
GAS INLET ISO100 (BOLTED)
FIXTURE(OPTION)
GAS OUTLET NW25
POWER CONNECTOR
CONTROL CONNECTOR
COOLING WATER RETURN
COOLING WATER SUPPLY
N2 GAS REGULATOR
VACUUM PUMP
OUTLINE DRAWING
EV-X200N


LCDコントローラ
LCD CONTROLLER
LCDコントローラコネクタ
LCD CONTROLLER CONNECTOR
非常停止スイッチ
EMERGENCY STOP SWITCH
EJ-K30N
VACUUM PUMP
OUTLINE DRAWING
WB-A21015800I-01
EBARA CORPORATION
2×Ø13.5×30
8×M10
アイボルト
EYE BOLT M16
吸気口
GAS INLET ISO160 (BOLTED)
ダクト引口 Ø50
VENTILATING DUCT Ø50
固定金具(オプション)
FIXTURE(OPTION)
排気口
GAS OUTLET NW40
動力コネクタ
POWER CONNECTOR
制御コネクタ
CONTROL CONNECTOR
LCDコントローラコネクタ
LCD CONTROLLER CONNECTOR
冷却水出口
CLOSED WATER RETURN W/ COUPLER Rc1/4
冷却水入口
COOLING WATER SUPPLY W/ COUPLER Rc1/4
N2ガスレギュレータ
N2 GAS REGULATOR
N2パージ口
PURGE PORT 1/4" TUBE CONNECTION

Performance Curve

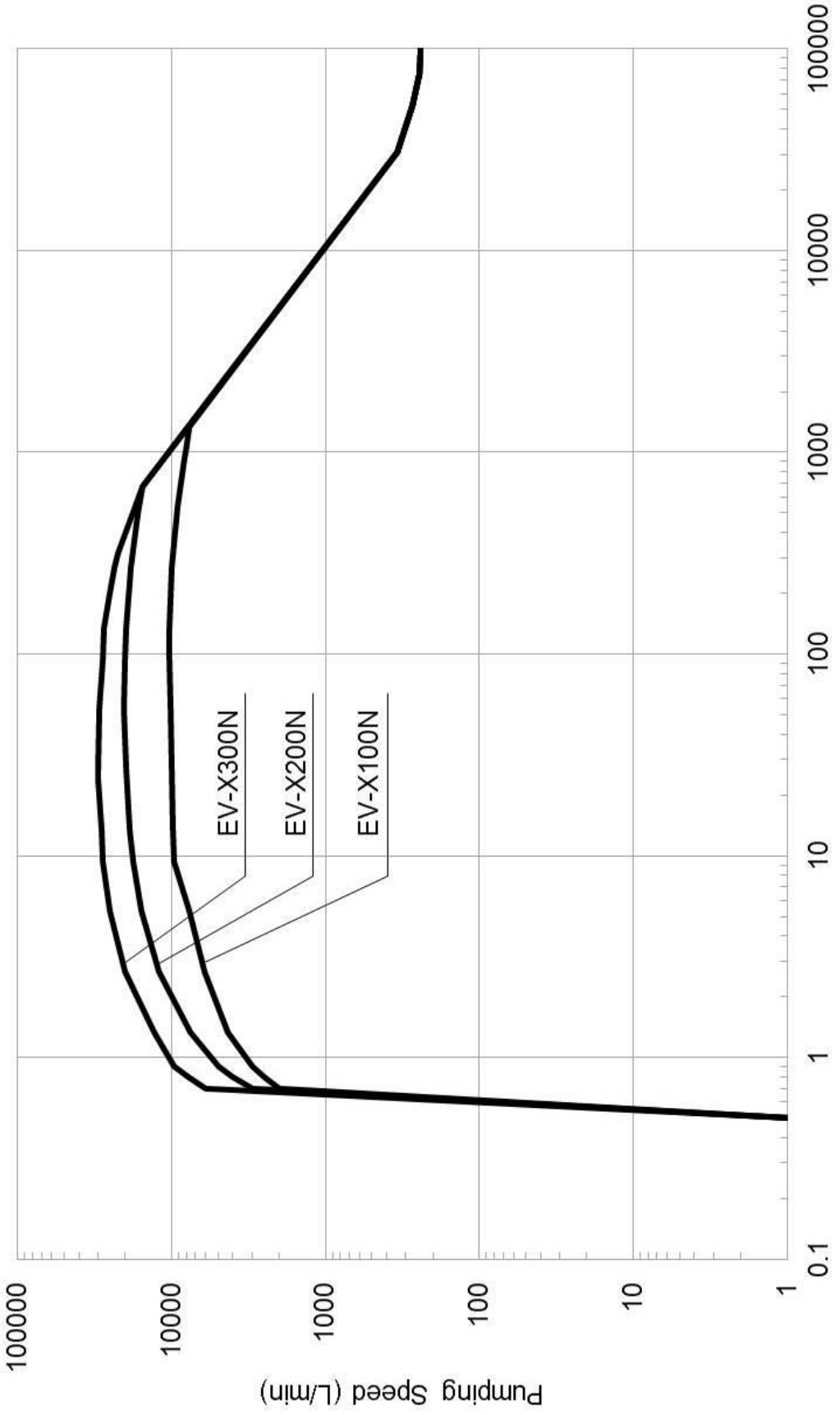


Fig.3.1 Model EV-X Series Performance curves

System Flow

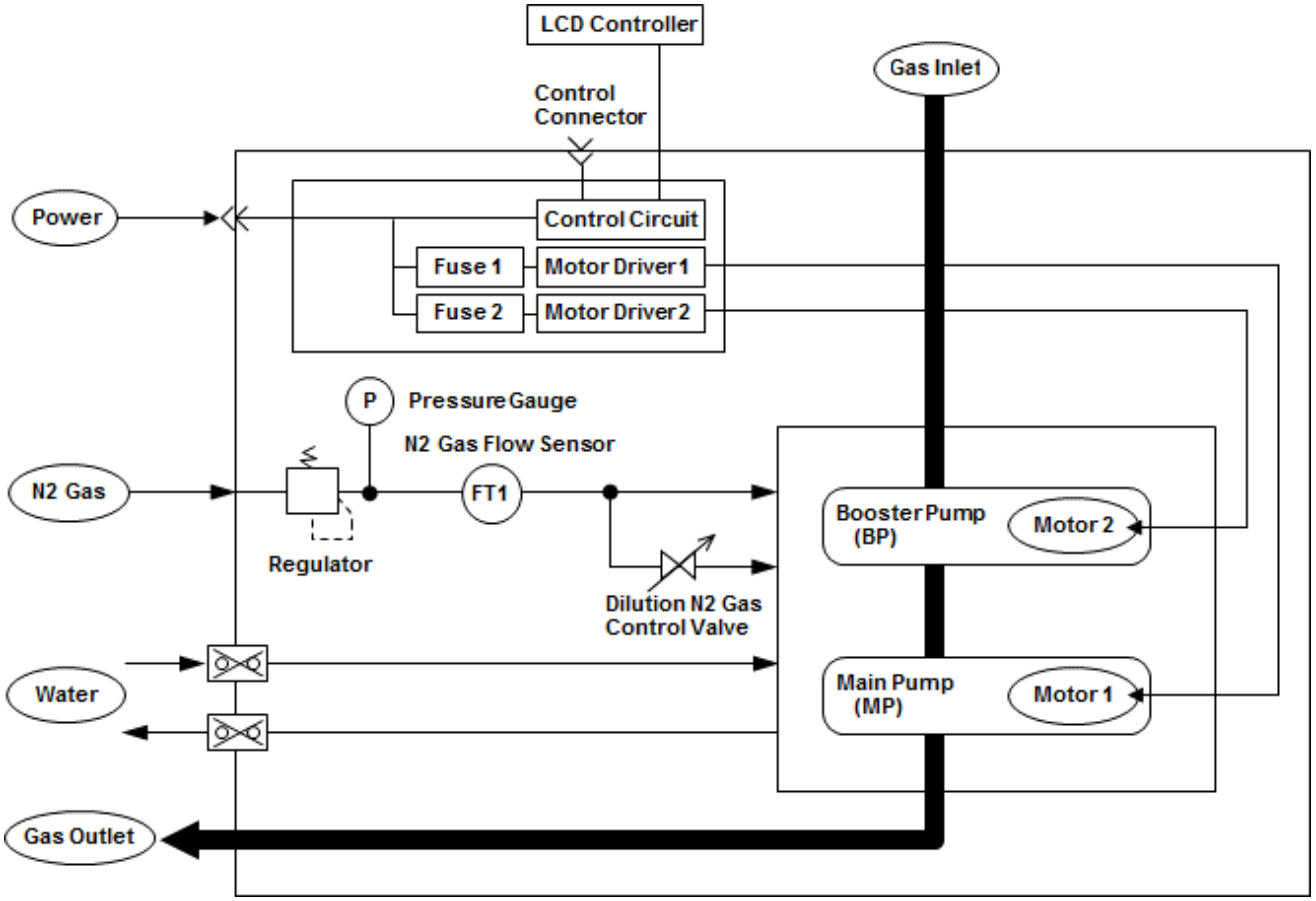


Fig. 3.2 System Flow

4. Installation

Observe the following cautions and instructions 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. Provide a sufficient space for pump installation and maintenance.
Locate any remote interface panel within 3m of the pump.

⚠ **CAUTION**	Do not install pump in a location where ambient temperature ever exceeds 30degC. Use particular caution when installing the pump in an enclosed room.

⚠ **CAUTION**	Leave a ventilation gap of at least 50mm between the pump enclosure and any adjacent equipment.

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.

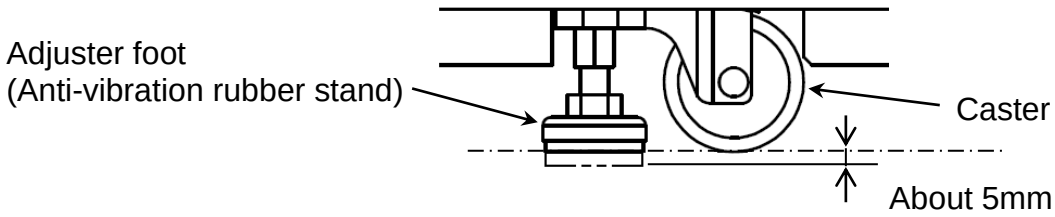


Fig. 4.1 Caster with adjuster foot

WARNING 	Be careful not to overturn the pump when pushing and pulling it sideways. The pump is narrow in comparison to its height.

CAUTION	The neck portion of the casters will vibrate when the caster is moving. Keep fingers and feet away.

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

(1) Turn the holding nuts clockwise (looking down) to lower the height-adjustment feet and secure the pump.
(2) Adjust the height of the feet evenly to ensure that the pump base is level.
(3) The difference in height between the two sides of the pump base shall not exceed 1mm.

CAUTION	Oil level low warning may occur when the pump is not level.

[NOTE] If the pump is not leveled, it may cause the shortage of lubrication oil supply to the bearings.

[NOTE] Floor vibrations and airborne noise will increase unless the adjustment feet are fixed properly.

4.1.2 Pump Anchoring

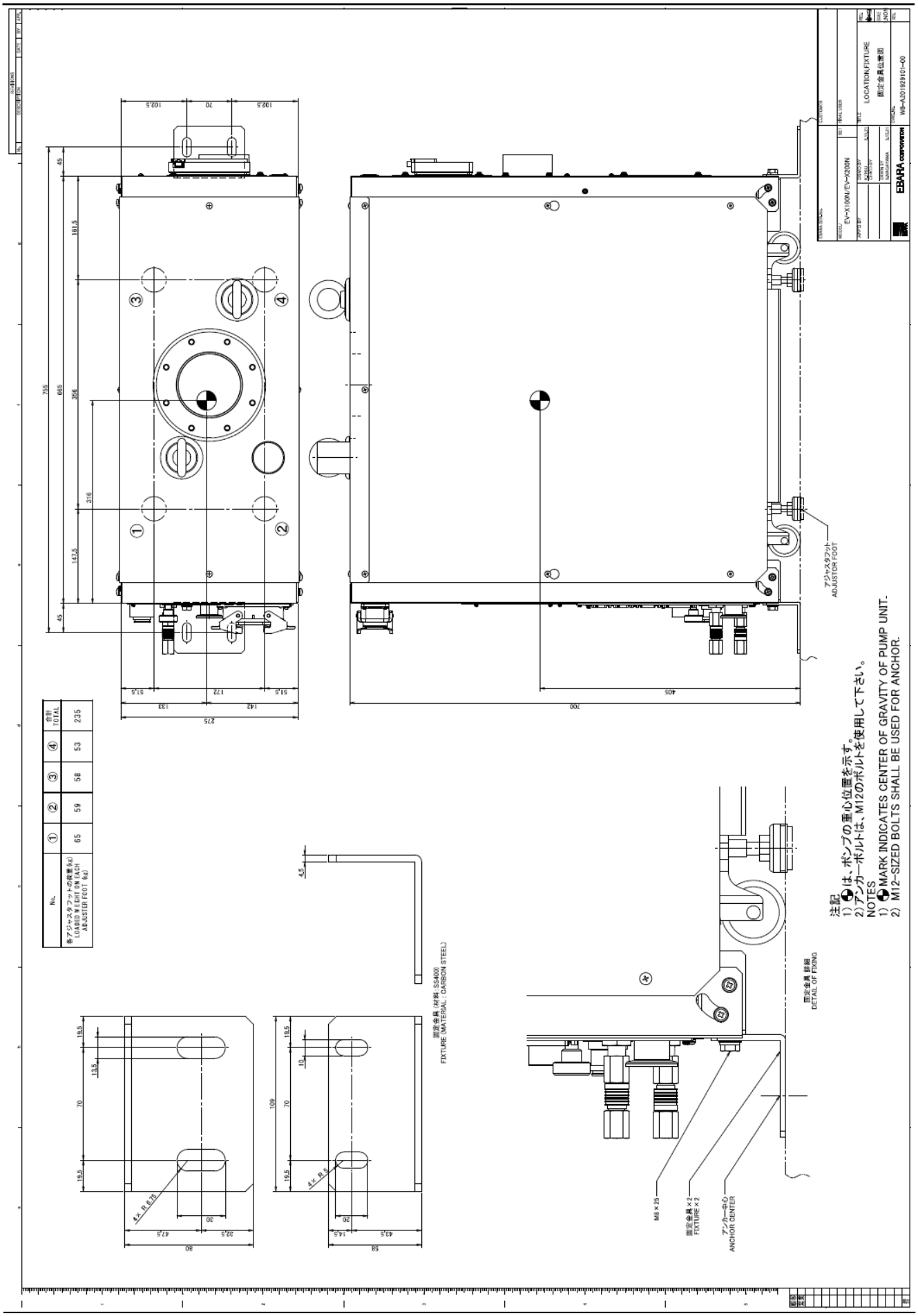
Pumps include casters for short distance movement and adjuster-feet to set height and stop the pump from rolling as described in Section 4.1.1.

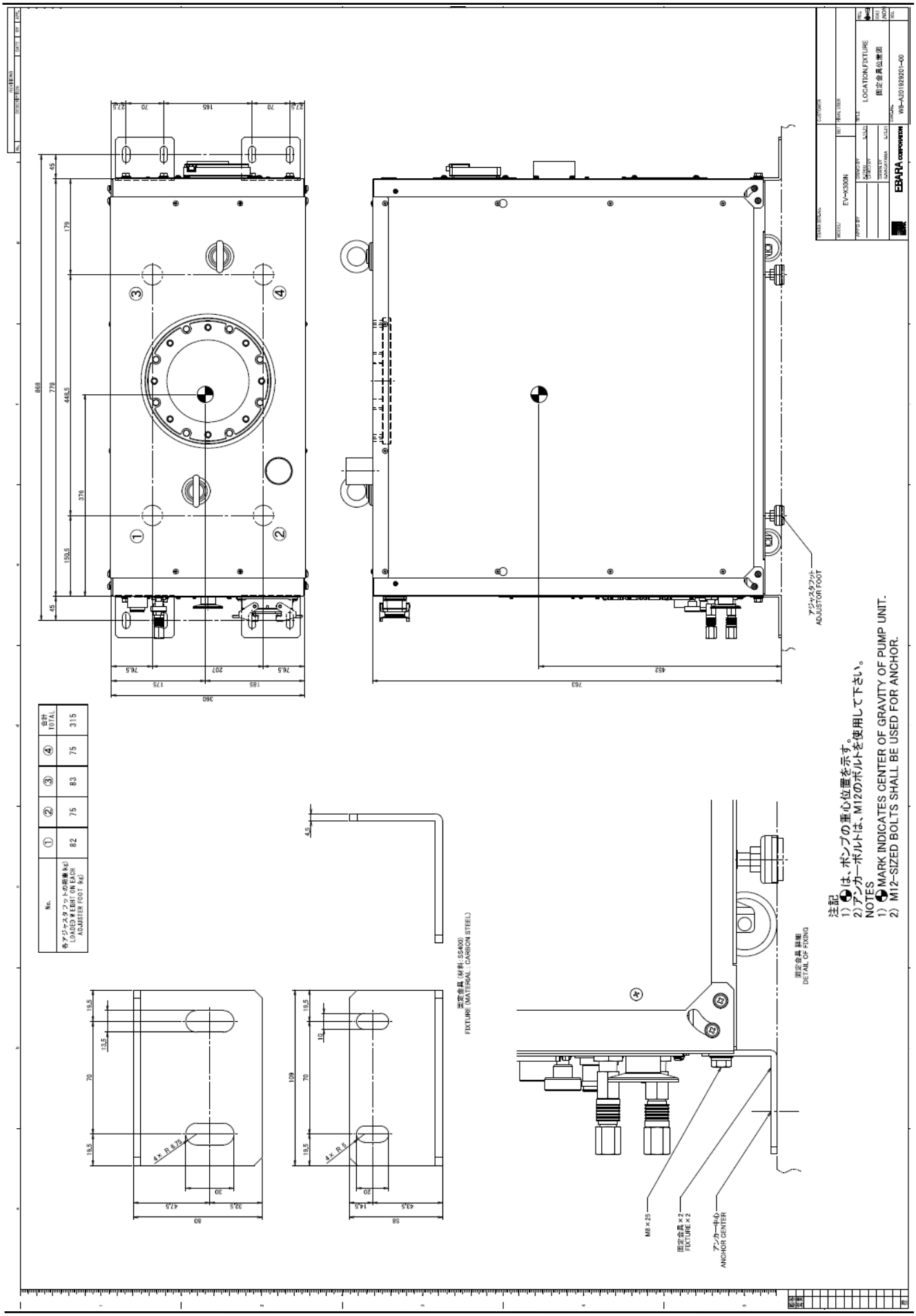
However, an earthquake may cause the pump to move or fall.

To secure the pump, EBARA provides [optional] anchor brackets as per CE/SEMI for Model EV-X dry pumps to fasten the pump body to the floor. Anchor the pump to the floor or other firm surface with these brackets.

For bracket dimensions and locations, see the accompanying drawings.

Select anchor bolts that are appropriate for the weight of the pump and the anchoring surface; install them as per the manufacturer's recommendations.


EV-X(60N)/EV-X(80N
LOCATION/FIXTURE
固定金具位置図
EBARA corporation
WS-A20192910-00
ADJUSTOR FOOT
アジャスタフット
注記
1) ◒は、ポンプの重心位置を示す。
2) アンカーボルトは、M12のボルトを使用して下さい。
NOTES
1) ◒ MARK INDICATES CENTER OF GRAVITY OF PUMP UNIT.
2) M12-SIZED BOLTS SHALL BE USED FOR ANCHOR.
No.
各アジャスタフットの荷重 (kg)
LOADED WEIGHT ON EACH ADJUSTER FOOT (kg)
①
②
③
④
合計 TOTAL
65
59
58
53
235
固定金具 (材料: SS400)
FIXTURE (MATERIAL: CARBON STEEL)
固定金具 詳細
DETAIL OF FIXING
M8 × 25
固定金具 × 2
FIXTURE × 2
アンカー中心
ANCHOR CENTER



No.	①	②	③	④	合計 TOTAL
各アジャスタフットの荷重 (kg) LOADED WEIGHT ON EACH ADJUSTER FOOT (kg)	82	75	83	75	315

4.2 Piping

4.2.1 Vacuum and Exhaust Piping

Connect the vacuum and exhaust pipes to the suction and exhaust flanges respectively.

Because of the narrow clearance between pump rotors, ingestion of foreign objects will prevent the pump from operating.
Observe the following cautions when making the flange connections:

a) Remove all foreign matter from inside the piping.

b) When connecting flanges, ensure that no dirt or dust particles adhere to the flange surfaces and that the flange surfaces are undamaged.
Prevent the ingestion of wafer fragments and of reaction byproducts that may adhere to the Automatic Pressure Control (APC) valve. For this purpose, a filter or screen is advisable.

c) The weight of the pipes attached to the pump can cause misalignment and leaks from the flange connections.
Support the piping properly and do not apply excessive force to align flange faces.
EBARA recommends the insertion of a flexible bellows between the piping and the suction and exhaust flanges of the pump. Length of the flexible bellows on the suction side will vary according to the vacuum drawn. Connect without applying undue force to the flexible bellows.

WARNING 	After installing the pump check for leaks. A leak may lead to the dangerous discharge of hazardous substances or to unpredictable reactions from admitting air into the pump. When conducting gas leak check by pressurization, do not exceed 0.05Mpa as supply pressure.

4.2.2 Cooling Water Piping

Connect the cooling water pipes to the correct inlet and outlet ports.
The water ports are quick-connect couplers. Seat the plug firmly in the socket. The socket sleeve will return to the front.

Do not connect the supply/return plugs in reverse. The diameters are slightly different, and there are In/Out markings on the plugs.

Disconnection automatically blocks water flow.
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

CAUTION	Even if the cooling water flow rate drops, the pump will continue to operate until the pump part reach a temperature corresponding to the ALARM limit. Select facility water piping rated for at least 70ºC at the operating pressure.

CAUTION	When Multiple pumps are used, do not connect the pump cooling water loops in series. Connect the cooling water to each pump in parallel. The flowability depends on the pump model and facility water piping. Select proper piping to ensure sufficient flow through each pump.

CAUTION	Connect supply and return couplers correctly to avoid reverse flow. Reverse flow will read incorrectly on the LCD and will not cool the pump properly and may lead to an accident.

CAUTION	In humid locations, allowing the cooling water to run after the pump cools down will lead to condensation on parts of the pump. If droplets appear on the outside of the water tubes when the pump is not running, cut off water flow.

4.2.3 Nitrogen (N_2) Gas Piping

Cut the tube at right angles and make the end-face perfectly smooth. Then connect the tube to the tube fitting assembly of the N_2 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 reconnect the tube again after subsequent removal, install the tube already fitted to the ferrule and retighten the retaining nut slightly (about ¼ turn) beyond hand tight.

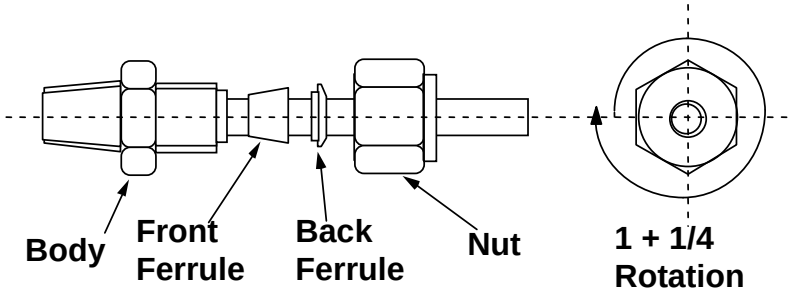


Fig. 4.2 Tube Fitting Assembly

CAUTION	Use N2 gas with purity more than 99.999%, for safety purpose. Impurities of N2 gas may cause an accident, when the pump is used for exhausting toxic and/or inflammable gases.

4.2.4 Ventilation Duct

While EBARA tests for leaks, for all the new and rebuilt pumps after assembly, but hazardous gas leaks are still possible—either from the field-connected inlet and exhaust flanges or from degradation of factory connections.

EBARA Model EV-X Series Dry Pumps (CE/SEMI) incorporate features to prevent leakage of process gases to the environment, at levels harmful to humans, if the pump enclosure is exhausted properly. Results of Tracer Gas Testing, as defined in SEMI Standard F15-93, demonstrate this fact.

In addition to preventing hazardous gas emissions from leaking to room atmosphere cabinet, exhaust also convects the heat from the pump. Without proper ventilation, Temperature rise inside the enclosure may lead to an ALARM and may result in serious problems.

Connect the ventilation port, locating on the top of the pump to a facility duct that meets the exhaust requirements shown in Table 3.1. Do not connect the cabinet exhaust duct to the pump discharge piping. Use an exhaust duct material that resists corrosion from the gases pumped.

The pump does not have a gas leak detector. For hazardous gases, EBARA recommends installing the gas leak detector or exhaust flow detector, interlocked to gas flow, in the [facility] ventilation duct piping.

The interlock on this gas leak detector should stop the gas introduced into the process tool and the pump. EBARA strongly recommends wiring the control circuit so that the pump stops immediately upon detection of a leak by connecting the leak detector output to the EMO external signal input of the pump.
Refer to Section 4.3.5 in this manual for connecting the leak detector or exhaust flow sensor output to the pump’s external interlock circuit.

CAUTION 	For safety, ventilate through the enclosure exhaust duct while using the pump for toxic and/or flammable gases. Do not combine the ventilation duct with the pump exhaust piping.

CAUTION	While pumping the process gases that are not toxic or flammable also, do not combine the ventilation duct with the pump exhaust piping. The exhaust noise of the pump may cause acoustic resonance inside the pump unit and result in abnormal noise.

CAUTION	Never operate the pump without pump cover for safety.

4.3 Electrical Wiring

WARNING 	Never supply power to the pump until wiring work and connector connection are complete. In addition, make sure to turn off the breaker on the primary side of the pump until the connections are completed.

WARNING 	Only a qualified electrician, using appropriate materials and workmanship, should perform the electrical wiring.

CAUTION	Applying power from the inside of pump to any other equipment may cause a malfunction of the control units and pump failure

4.3.1 Grounding

This product must be grounded. In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing a direct path to “earth” for the electrical current.

EBARA supplies this product either with a cord including a grounding wire or with a receptacle having an appropriate grounding path. Connect the pump to a supply or an outlet that is properly installed and grounded in accordance with all local codes and regulations.

DANGER	Improper installation of the grounding plug can result in an electric shock. If repair or replacement of the cord or plug is necessary, do not connect the grounding wire to a power phase terminal. The wire with insulation having an outer surface that is green or green-with yellow- striping is the grounding wire.

If the grounding instructions are not clear or have any queries regarding the proper grounding of the product, consult a qualified electrician or service technician. Do not modify the plug, if it does not fit the outlet, consult a qualified electrician to install the proper outlet.

4.3.2 Power Supply Wiring

Fig 4.3 shows the power supply connector and a control signal connector position On the control panel.

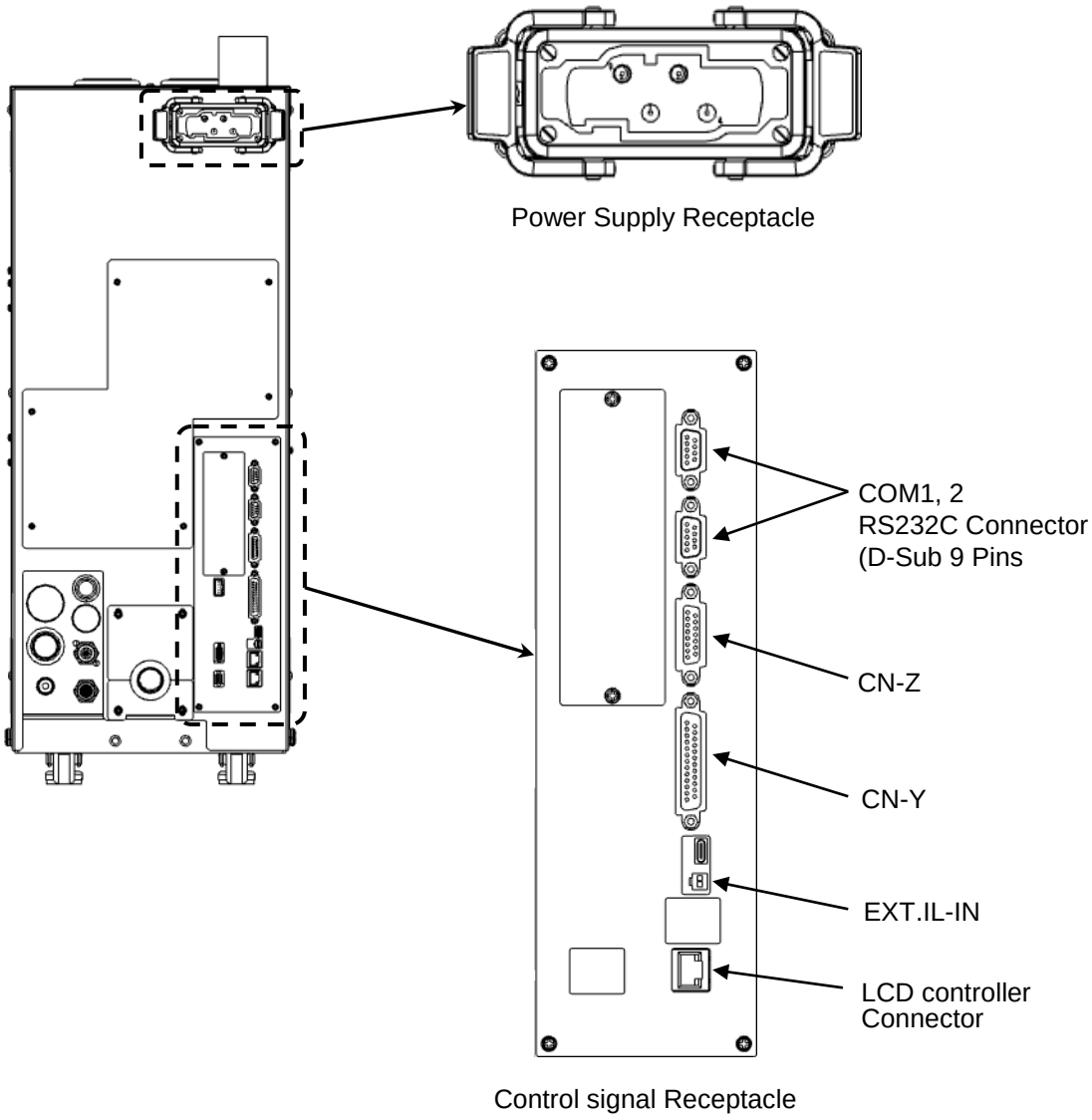


Fig. 4.3 Power Supply and Control Signal Connector positions

WARNING	Match the wire size and insulation to the pump's rated current and the ambient air temperature.

CAUTION	Ensure that the grounding wire is connected. Connect this product to a grounded, metallic, permanent wiring system.

CAUTION	Use the power connector provided with the pump. At the power source side, connect direct to distribution panel wiring terminals or use a twist-lock, Hubble-type connector.

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

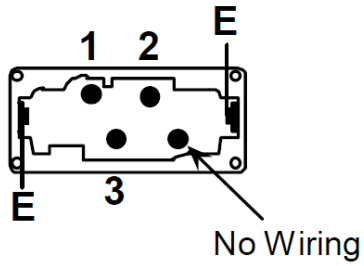


Fig 4.4 Power Supply Receptacle
(As seen from connecting side)

Table 4.2 Pin Assignment of Power Supply Receptacle

No.	Phase
1	R
2	S
3	T
E	GND

Table 4.3 Receptacle Specification

Pump model	Model EV-X100N	Model EV-X200N	Model EV-X300N
Receptacle type	CXM4/0		
Recap. Manufacturer	ILME *		
Adapted plug type	CXF4/0 *		
Suitable wire	AWG #6		
Power capacity kVA	6.5		7.6

[Note]* Adapted Plug is compatible with HARING HAN K4/0 9380062711

4.3.3 Control Signal Wiring

Signal input and output connectors on Model EV-X dry pumps enable 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 and 4.6 and Figures 4.5, 4.6 and 4.7 describe the connectors and pin assignments.

Table 4.4 Receptacle Specification

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

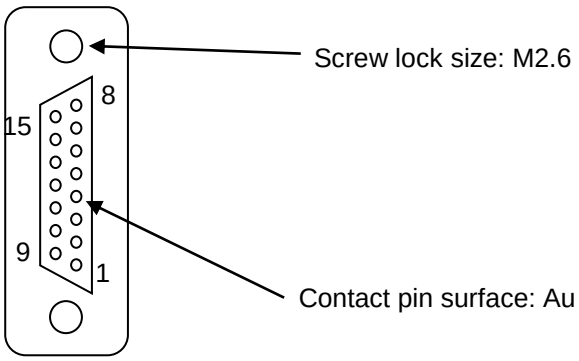


Fig. 4.5 15 Pin D Sub-Miniature Female Receptacle

(As seen from connecting side)

Table 4.5 Control Connector Pin Assignment (CN-Z)
(Applicable for SEMI E73-0299))

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

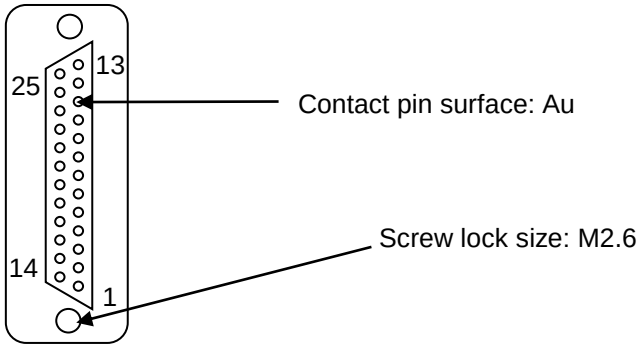


Fig. 4.6 25 Pin D Sub-Miniature Female Receptacle

(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	SAVING ENERGY CONTROL (+)	IN	SAVING ENERGY MODE: CLOSE, Alternate
3	RESERVED (+)	IN	
4	RESERVED (+)	IN	
5	RESERVED (+)	IN	
6	EMS STATUS (+)	OUT	Abnormality: OPEN, Alternate
7	PUMP N_2 WARNING STATUS (+)	OUT	Abnormality: CLOSE, Alternate*2
8	RESERVED (+)	OUT	
9	SAVING ENERGY STATUS (+)	OUT	SAVING ENERGY MODE: CLOSE, Alternate
10	BACK PRESSURE HIGH WARNING STATUS (+)*1	OUT	Abnormality: CLOSE, Alternate*2
11	RESERVED (+)	OUT	
12	RESERVED (+)	OUT	
13	−		
14	RESET (−)		
15	SAVING ENERGY CONTROL (−)		
16	RESET (−)		
17	RESET (−)		
18	RESET (−)		
19	EMS STATUS (−)		
20	PUMP N_2 WARNING STATUS (−)		
21	RESERVED (−)		
22	SAVING ENERGY STATUS (−)		
23	BACK PRESSURE HIGH WARNING STATUS (−)		
24	RESERVED (−)		
25	RESERVED (−)		

*1 Optional

*2 Logic reversible via Dipswitch

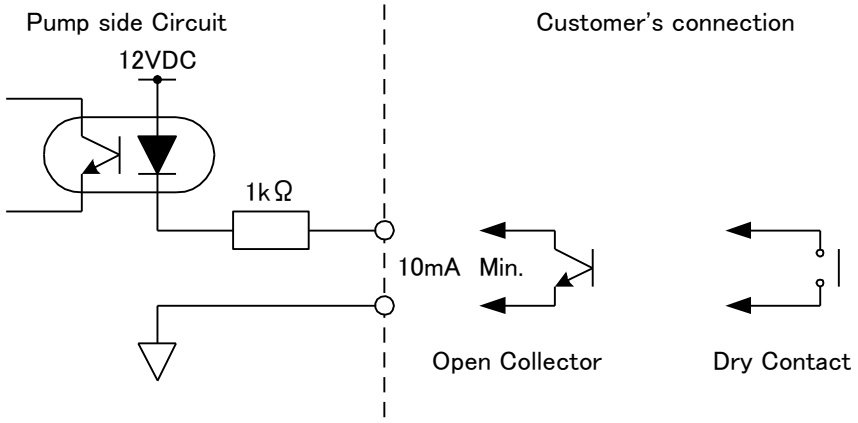
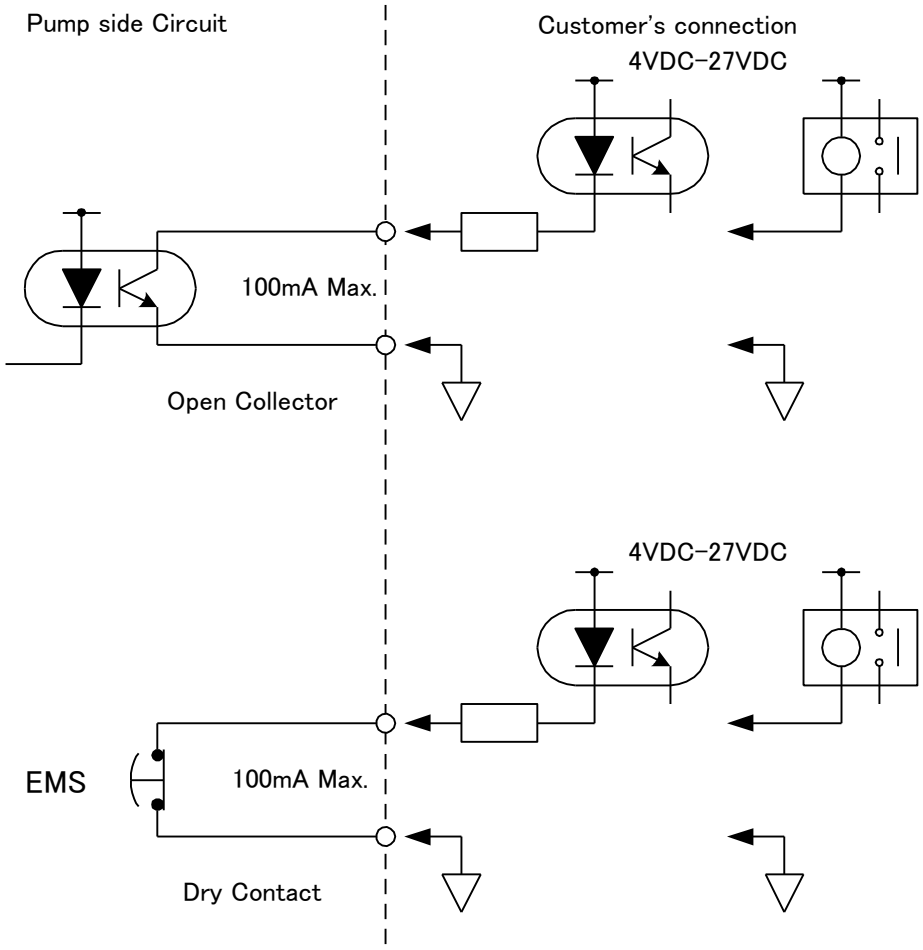
Input Signal	
Output Signal	

Fig. 4.7 CN-Z & CN-Y Signal Contacts

CAUTION	Do not wire vacant pins.

CAUTION	The pump provides 12VDC power for input signals. Do not apply voltage on the equipment side. The output signals are generated from an open collector. Apply a voltage between 4VDC and 27VDC on the equipment side.

CAUTION	Wire all signals with the correct polarity (SIG/COM.)

CAUTION	When output signals energize an inductive load, such as a relay, insert a diode (100V. 1A class) to limit the back electromotive force during de-energization.

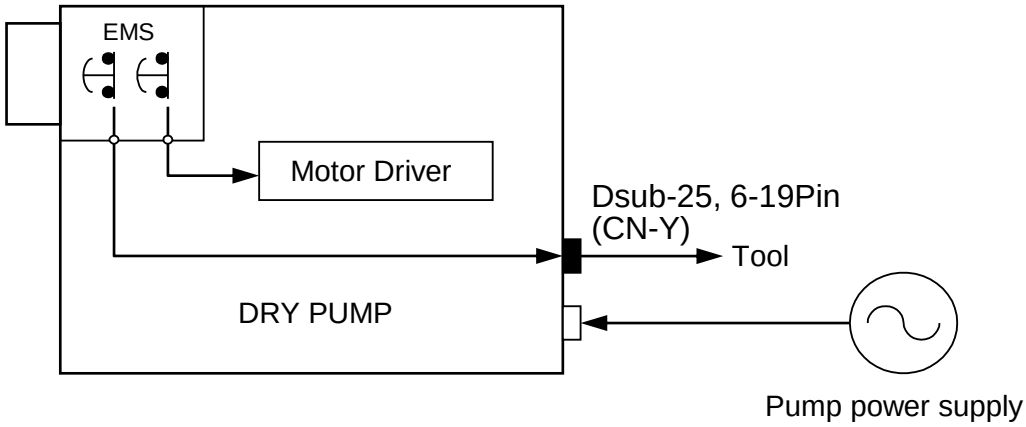
4.3.4 Emergency Stop Switch

This pump has EMS Switch. Details of EMS Switch are shown as follows.

(1) Outline / function of EMS

EMS means Emergency Stop. When EMS switch is pushed and activated for emergency, pump stops running. This EMS switch can also work as “Emergency Off” which shut down pump power supply with additional components to be prepared by users (see (4) for detail).

(2) EMS System Flow



※If the exhaust port is an optional anti-utility exhaust, EMS will be treated as an option.

Fig. 4.8 System Flow

(3) Operation control

・Push EMS Button to stop the dry pump

Push red EMS button (Alternate)
Motor Driver output is turned off and pump stops
6-19 pin at Dsub-25 pins (CN-Y) Connector: Close → Open
(See Figure 4.6 and Table 4.6)

The following alarm is shown on LCD controller.

ALARM: EMERGENCY STOP

・Release EMS

Check that pump can be operated and turn the button head to release lock.
Press the RESET button on the LCD controller, to remove the status of the ALARM.

(4) Example of System Flow diagram for EMO (Emergency OFF)

This EMS switch can also work as Emergency Off (EMO, Hardware interlock to shut off the pump power supply) and the additional components to be prepared by users.

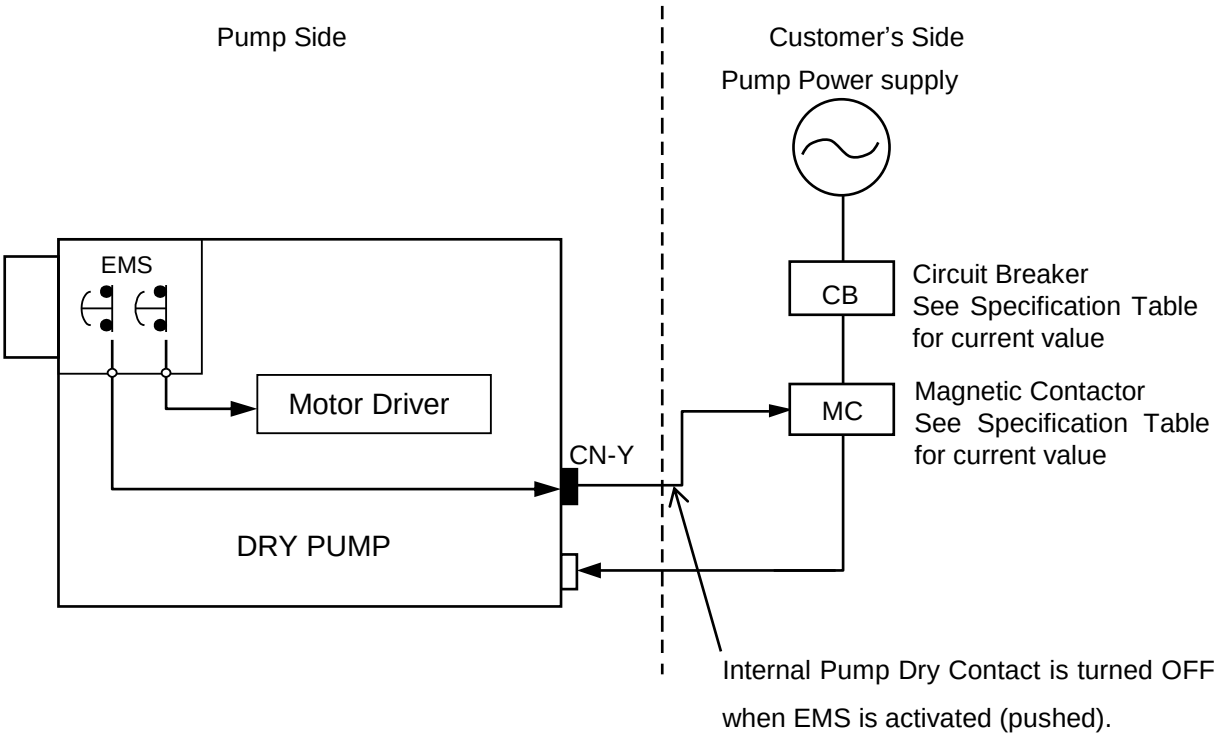


Fig. 4.9 Example for EMO System Flow

4.3.5 External interlock

In the event of an emergency on the pump, an error detector can also be connected to an additional connector for emergency signal input. For example, if a gas leak detector is connected, the pump will stop when a gas leak inside the pump is detected.

The external interlock connector "EXT.IL-IN" is located on the front panel. See Figure 4.3.

When using an external interlock, connect an error detector and slide the changeover switch shown in Figure 4.10 to enable signal input. If the LED lamp is lit when the power is on, the external interlock input is valid.

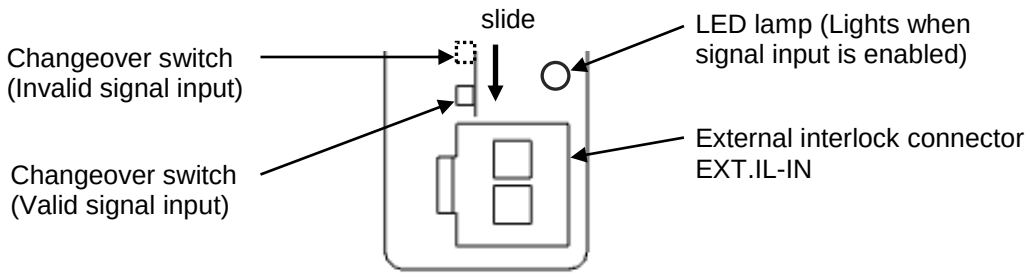


Fig. 4.10 External interlock input signal selector switch

Table 4.7 Details of external interlock connector

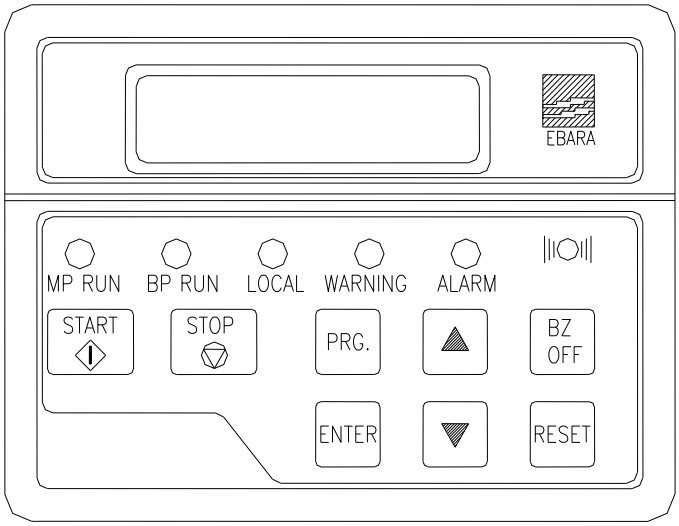
Plug	MOLEX 1053071202
Pin	MOLEX 1053001200
Suitable wire size	UL1007 AWG#24
Required capacity of user side facility	DC5V 60mA added by pump side. NO voltage required from outside
Signal input at NORMAL condition	Close
Signal input at EMERGENCY condition	Open

CAUTION	When switching the changeover switch, be sure to turn off the power breaker on the primary side of the pump.

CAUTION	DC5V is applied to the input signal on the pump side. Do not apply voltage on the device side.

5. LCD Controller

5.1 LCD Outline



Buttons	Purpose
START	Starts Main pump(MP) and Booster pump(BP)
STOP	Stops MP and BP
▲ ▼	Change LCD screen, DIP switch state, set point
RESET	Resets WARNING and ALARM
BZ. OFF	Mutes the buzzer after WARNING / ALARM
PRG.	Change pump status screen; Select Dipswitch; Change screen hierarchy (up one level)
ENTER	Select Dipswitch; Change screen hierarchy (down one level)

LED	Indicates
B.P. RUN	BP running
M.P. RUN	MP running
LOCAL	LOCAL mode
WARNING	WARNING condition
ALARM	ALARM condition

Fig 5.1 LCD controller

5.2 LCD Indication

The controller's LCD displays pump operating status. For details of this display, see Table 5.1.

Table 5.1 LCD controller indication

No	ITEM	INDICATION
1	Power	BP: ##.## kW MP: ##.## kW
2	Warning/Alarm	$$$$:$$$$$$$$ % $$$$$$$$$$$$
3	Control mode Pump running mode	CONTROL:LOCAL
4	Pump running history (Indication of history)	PUMP RUNNING HISTORY?
5	Alarm history (Indication of history)	ALARM/WARNING HISTORY?
6	Pump unit No.	UNIT NO. &&&&&&&&
7	Pump model Voltage	PUMP. TYPE @@@V EV−X@@@@
8	Total operation time	OPE. TIME #####h
9	Heater HT1~4 Temp. (option)	HT 1:### 2:### °C 3:### 4:###
10	Back pressure (option)	BACK PRESSURE ###.# kPa
11	Pump N2 gas flow	PUMP N2 FLOW ##.# Pam3/s
12	Cooling water flow (option)	WATER FLOW ##.# L/min
13	MP Casing temperature	CASING TEMP. ###°C
14	BP Casing temperature	BP CASING TEMP. ###°C
15	Motor speed	BP:#.#k min-1 MP:#.#k min-1

1. Three control modes are available: “LOCAL” (local operation), “REMOTE” (Remote operation) and “COM” (Serial communication operation).
2. " %" shows occurrence order of current WARNING/ALARM.
3. Upper row "$$$$$$" distinguishes between WARNING/ALARM and indicates the position where WARNING/ALARM has occurred.
   Lower row "$$$$$$" displays details of WARNING/ALARM.
4. Total pump operating time gives the total hours of operation after shipment from the factory.
5. After a lapse of one minute without a keystroke, the display will return to default, electrical power. (NOTE: If Dipswitch B-8 is ON, the display will not return to default.)
6. 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.
   The Display Select Switch can command a display of WARNING/ALARM history.

   See Figure 5.2 for key strokes for the pump operation status display

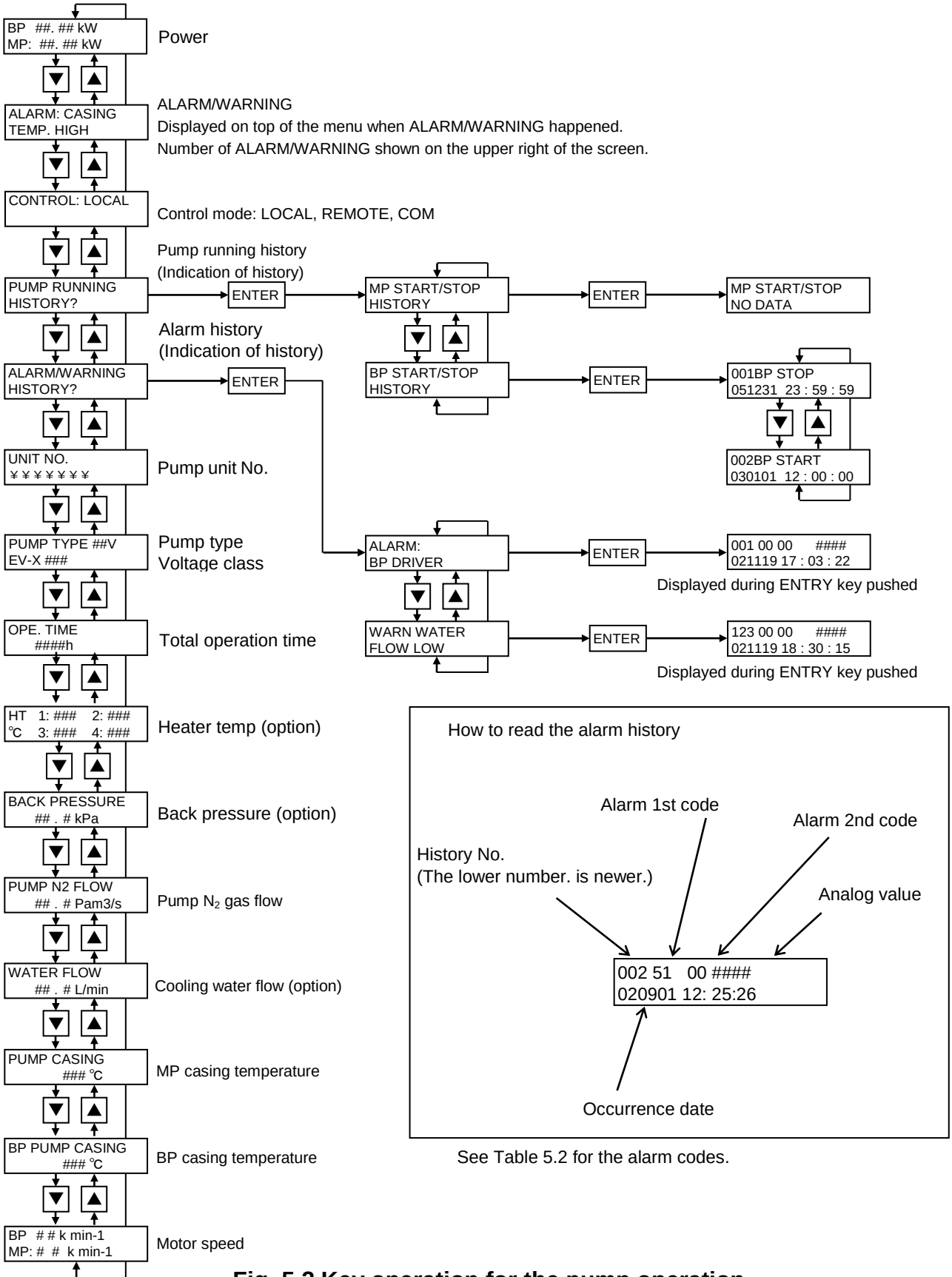


Fig. 5.2 Key operation for the pump operation
Status display screen

Table 5.2 Alarm code list

ALARM name	Code 1st code	Code 2nd code
MP casing temp high	50	01
BP casing temp high		02
MP gear temp high		10
MP motor temp high	51	00
BP motor temp high	52	00
Water leakage (▲)	53	00
Water leakage 2 (▲)		02
Emergency off (EMS)	59	00
Back press high (▲)	63	00
Power failure	64	00
MP driver protection activated (OC)	65	01
MP driver protection activated (OV)		02
MP driver protection activated (OH1)		04
MP driver protection activated (OH2)		05
MP driver protection activated (CPF)		06
MP driver protection activated (UV)		07
BP driver protection activated (OC)	66	01
BP driver protection activated (OV)		02
BP driver protection activated (OH1)		04
BP driver protection activated (OH2)		05
BP driver protection activated (CPF)		06
BP driver protection activated (UV)		07
BP motor overload 2	67	00
MP motor overload 2	68	00
BP step out	69	00
MP step out	70	00
Emergency off (EMO) (▲)	71	00
Continuous water flow low (▲)	73	00
Ext. interlock	74	00

WARNING name	Code 1st code	Code 2nd code
Water flow low (▲)	00	01
MP casing temp high	05	01
BP casing temp high		02
MP gear temp high		07
Pump N2 flow low	18	00
Back press high (▲)	21	01
Back press wire broken (▲)		02
Heater 1 error (▲)	22	01
Heater 1 wire broken (▲)		02
Heater 2 error (▲)		03
Heater 2 wire broken (▲)		04
Heater 3 error (▲)		05
Heater 3 wire broken (▲)		06
Heater 4 error (▲)		07
Heater 4 wire broken (▲)		08
Heater 1 thermostat error (▲)		42
Heater 2 thermostat error (▲)		43
Heater 3 thermostat error (▲)		44
Heater 4 thermostat error (▲)		45
BP motor temp high	23	00
MP motor temp high	24	00
MP driver case temp high	25	01
BP driver case temp high		02
Inner communication error (MP driver)	26	01
Inner communication error (BP driver)		02
Heater unit communication error (▲)	31	30
MP gear wire broken		60
MP motor wire broken		65
BP motor wire broken		66
MP casing wire broken		70

"▲" indicates Optional Items.

Detailed explanation of BP / MP driver protection

OC : Over current
OV : Overvoltage
OH1 : Base temperature rise
OH2 : Control board temperature rise
CPF : CPU error
UV : Voltage drop

5.3 Operation Mode Setting

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 5.3 below shows indications and the details of the operational mode setting.

Table 5.3 Operational mode setting indication at LCD screen

Item	Indication	Description
Pump operation setting mode	SET CONTROL MODE?	Switches the control modes: Local /Remote/Communication.
DIP switch setting	SET DIP SW?	Performs the Dipswitch Settings (see 5.4).
Pump N_2 WARNING setting	SET POINT N2 FLOW LOW?	Sets the WARNING value for N_2 flow.
WARNING value for the Back pressure setting (Option)	SET WARNING SP BACK PRES.?	Sets the WARNING value for the back pressure.
After sequence setting (Dip SW. C8:ON)	SET AFTER SEQUENCE?	Sets the value for after sequence function.

Keys work as below for the setting screen.

START	:	Invalid (No response)
STOP	:	Stop the pump.
RESET	:	Reset WARNING and /or ALARM.
BZ.OFF	:	Switch the DIP switch number
▲	:	Set the DIP switch to ON. Switches the items of the operational mode setting screen.
▼	:	Set the DIP switch to OFF. Switches the items of the operational mode setting screen.
ENTER	:	Selects the displayed setting or operation. Moves the menu down one level
PRG.		Moves the menu up one level

See Figure 5.3 for instructions on setting the operational modes.

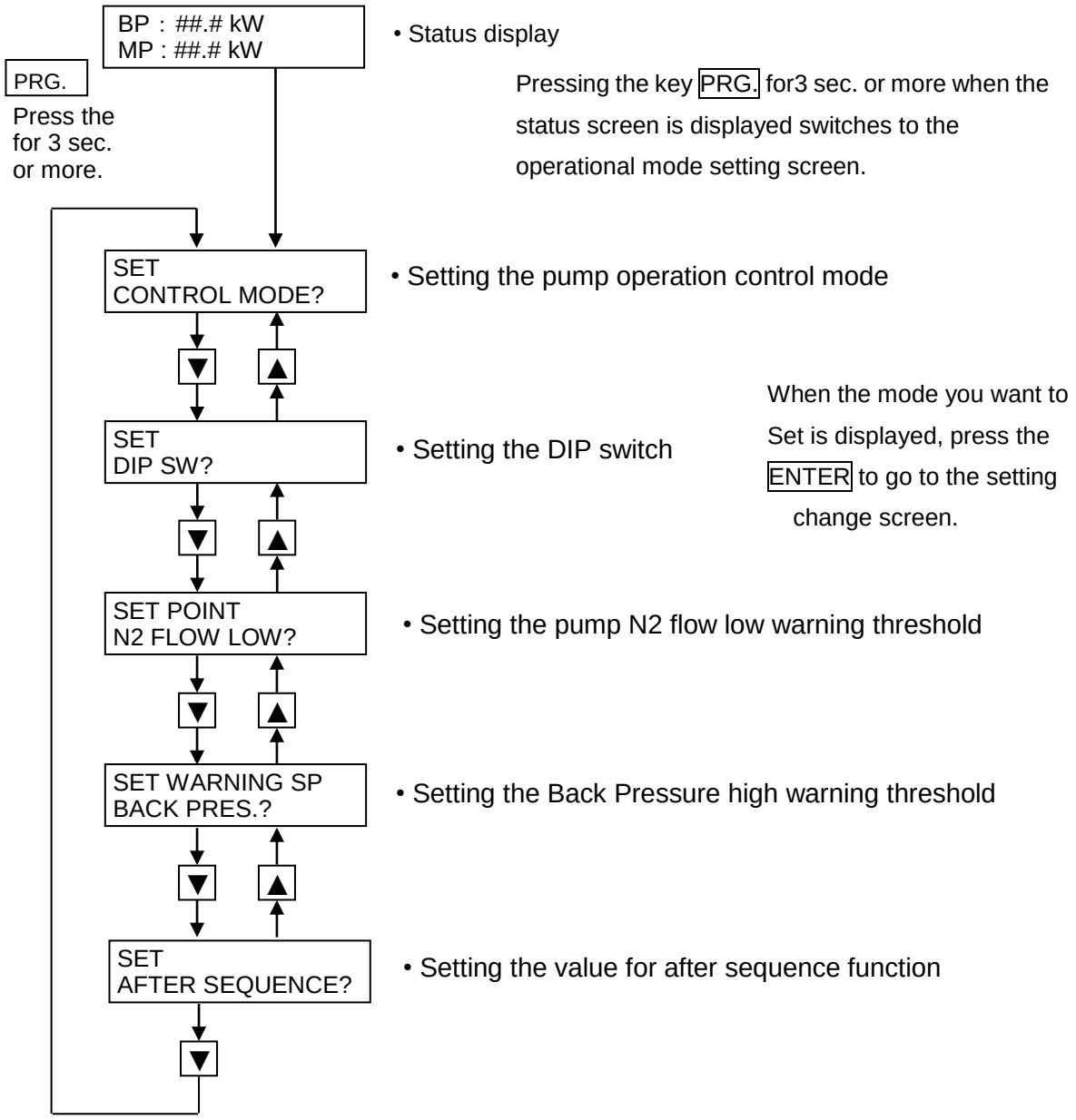
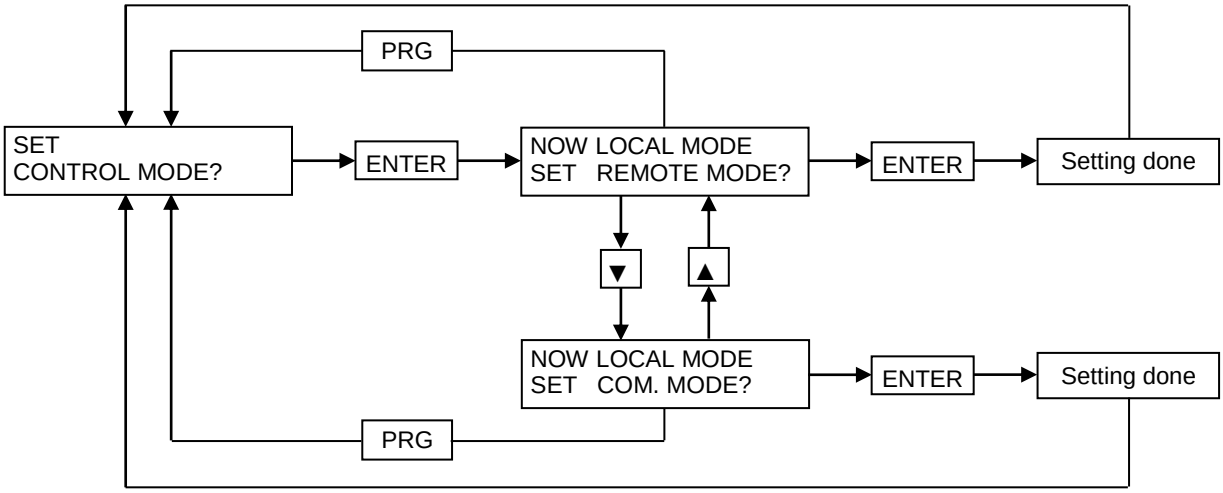


Fig. 5.3 Procedure to set the operational mode

5.3.1 Control Mode Setting

A case of display if Local mode selected.



REMOTE MODE : Enables the remote operation
(START/STOP with external signals)

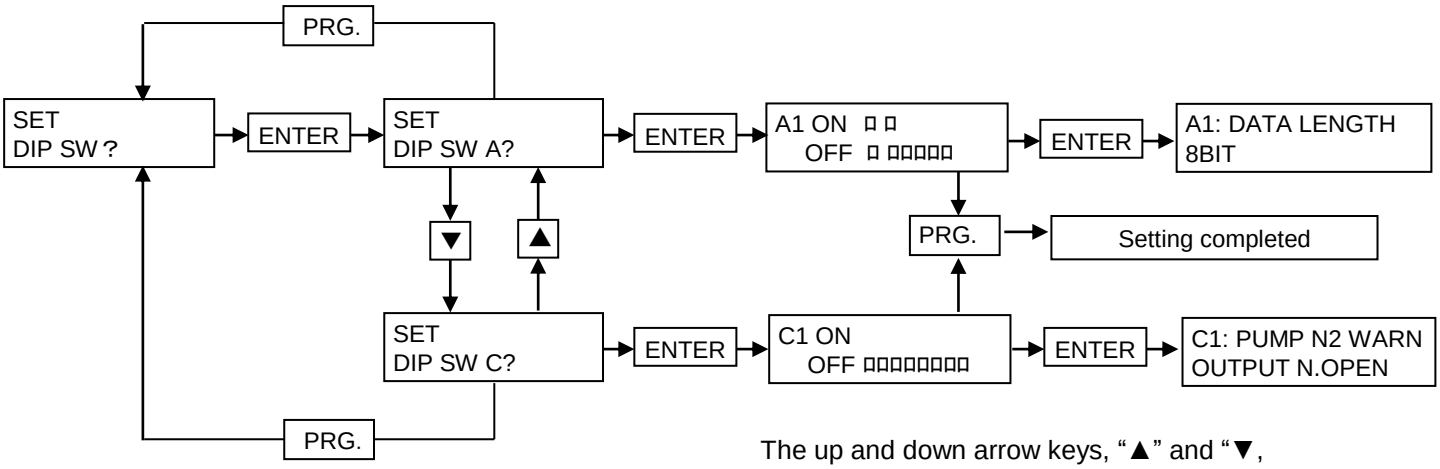
LOCAL MODE : Enables the local operation
(START/STOP with the LCD controller)

COM MODE : Enables the communication operation
(START/STOP with RS232C communication)

The LCD does not display the currently selected operational mode; rather it shows the operational mode that pressing the ENTER button would select.

If you do not wish to change the operational mode, press the PRG. key to return to the previous screen.

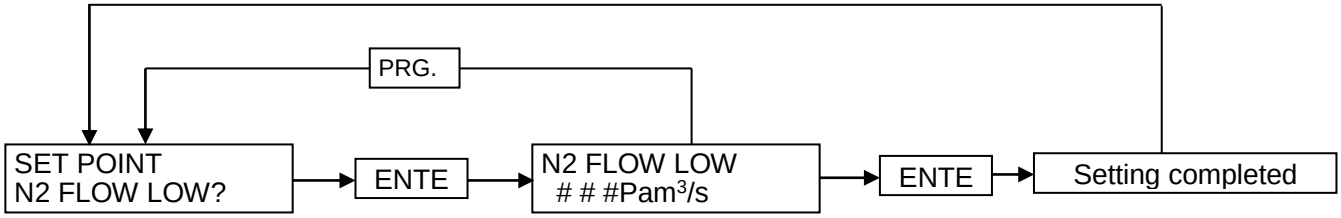
5.3.2 Dip Switch Setting



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 5.4 for details of the DIP switch.

5.3.3 N2 Flow Low WARNING Setting



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

▲Increase the setting value by 0.1 Pam^3/s

▼Decrease the setting value by 0.1 Pam^3/s

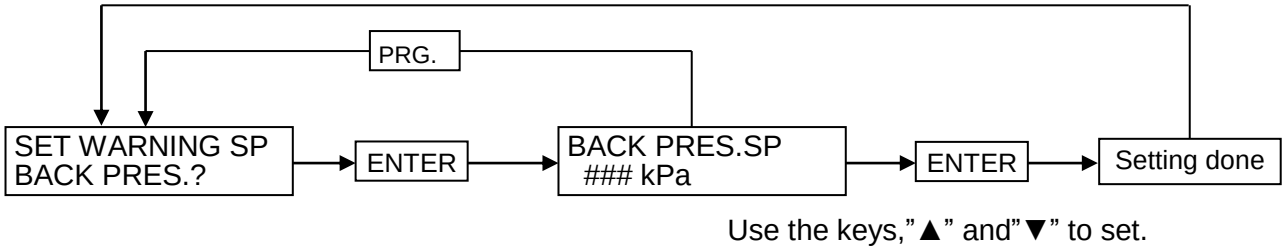
Upper limit 81.0 Pam^3/s

Lower limit 2.2 Pam^3/s

Factory setting 14.4 Pam^3/s

Reset value for WARNING set value +1.0 Pam^3/s

5.3.4 Back-Pressure High Warning



Use the keys,"▲" and"▼" to set.

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

▲ Increase the setting value by 0.5kPa.

▼ Decrease the setting value by 0.5kPa.

Upper limit ：30.0kPa

Lower limit ： 5.0kPa

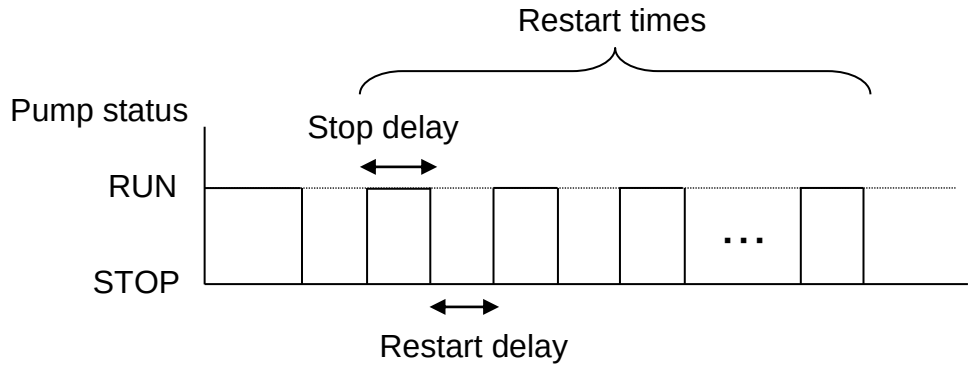
Factory setting: 20.0kPa

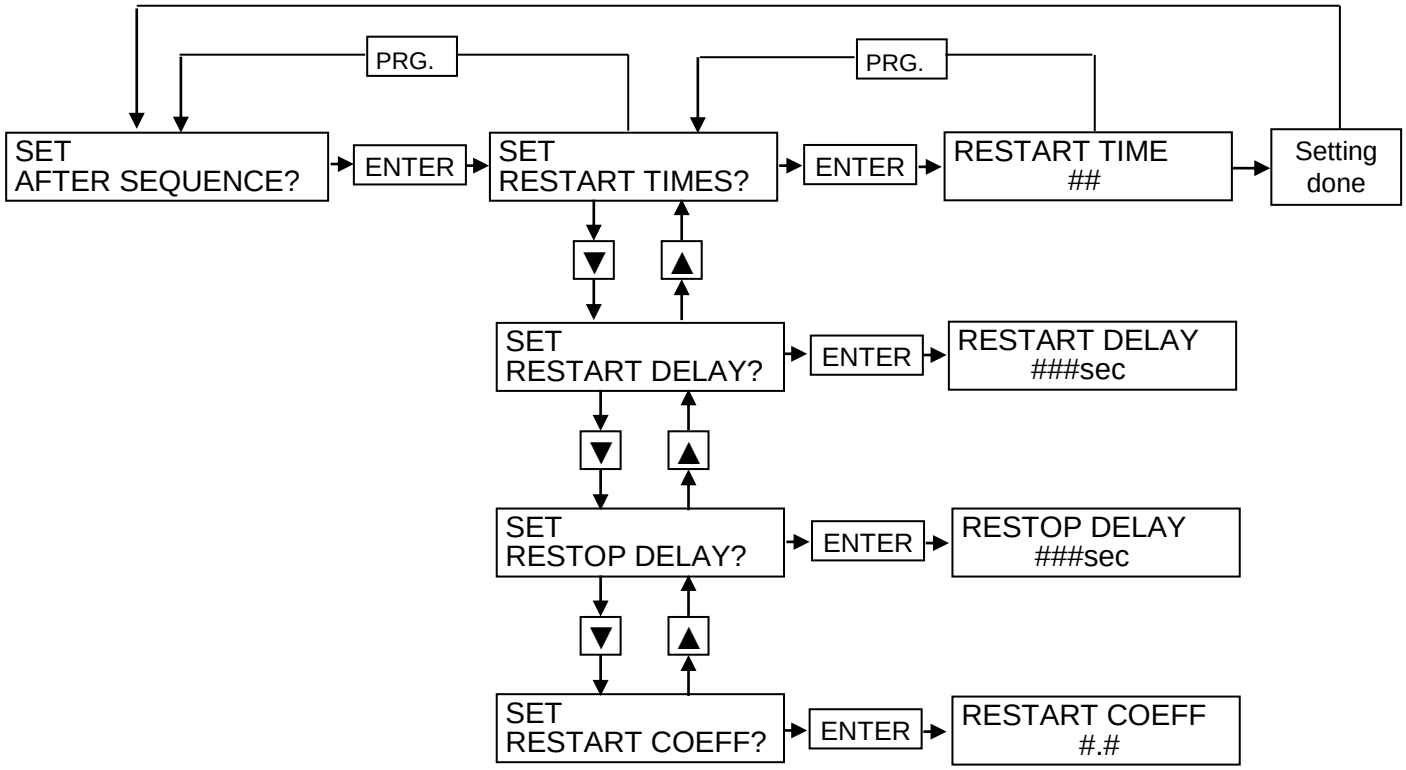
WARNING reset value: Set value –2.0kPa

5.3.5 After-Sequence Function Setting

This pump has an after sequence function. It is a control system that repeats start and stop automatically after the pump stops.

To enable the after sequence function, set Dip SW. C8: ON.





	Factory setting	Upper limit	Lower limit
Restart times	20	50	1
Restart delay	120	600	10
stop delay	120	600	10
Restart co-efficiency	0.2	1	0.1

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

5.4 Dip Switch

Set the dispatches to select the operating modes as shown in Table 5.4, 5.5 and 5.6.

Table 5.4 Dip Switch-A Settings

No.	Mode	Off	On	Factory setting
1	Data Length	7bits	8bits	ON
2	Monitor Cooling water and N_2	Always	Only during operation	OFF
3	Buzzer	Not used	Use	ON
4	Operation switched to Remote	According to signal	Automatically stop	OFF
5	-----	-----	-----	-----
6	-----	-----	-----	-----
7	-----	-----	-----	-----
8	-----	-----	-----	-----

Table 5.5 Dip Switch-B Settings

No.	Mode	Off	On	Factory setting
1	-----	-----	-----	-----
2	-----	-----	-----	-----
3	-----	-----	-----	-----
4	Pump N_2 valve control*	Disable	Enable	OFF
5	N_2 valve control for Exhaust line*	Disable	Enable	OFF
6	Remote Interface (I/F)	Exclusive special IF	No use / standard IF	ON
7	Phase error monitoring	Standard (Constant)	During power-up initialization only	ON
8	LCD screen initialize (No activity in 60seconds)	Carry out initialize	Do not initialize	OFF

* Optional

Table 5.6 Dip Switch-C Settings

No.	Mode	Off	On	Factory setting
1	Pump N_2 WARNING output	Normally Open	Normally Close	OFF
2	-----	-----	-----	-----
3	-----	-----	-----	-----
4	-----	-----	-----	-----
5	-----	-----	-----	-----
6	-----	-----	-----	-----
7	-----	-----	-----	-----
8	After sequence function	Disable	Enable	OFF

* Optional

Normally open: conducts when warning

Normally close: open during warning

DIP SW-A. No.1 Selects data length of 7 bits or 8 bits for serial output of RS232C Communication port.

DIP SW-A. No.2 Sets the monitoring mode for cooling water and N2 flow as “Always” or “Only During Operation.”
In “Only during the Operation” mode, cooling water monitoring continues for 15 minutes after the pump stops.
EBARA recommends continuing N2 flow while pump is stopped to retard byproduct accumulation and pump corrosion.

DIP SW-A. No. 3 Determines whether an audible signal (buzzer) annunciates a pump WARNING or ALARM.

DIP SW-A. No. 4 Determines whether a pump, changed from LOCAL mode to REMOTE mode, will respond immediately to a REMOTE RUN command.
Dipswitch A4 is OFF + Pump in LOCAL mode + External RUN signal present: Pump will START (or continue to RUN) when mode changes to REMOTE.
Dipswitch A4 is ON + Pump in LOCAL mode + External RUN signal present: Pump will STOP (or will not START) when mode changes to REMOTE. Starting pump requires removing and reapplying the external RUN signal.

[NOTE] Dip switch-A No.3 (BUZZER, Dip switch-B No.8 and Dip switch-C No.8) and select Local / Remote switch can change anytime.
After resetting dip switches, other than Dipswitch A-3 (BUZZER), the LCD controller initializes (counts down 10 seconds), just as it does at initial power up, right after the completion of the parameter setting.

DIP SW-A. No. 8 For a pump operating in REMOTE operation control mode, A8=ON permits operation of the booster pump with a separate external signal. A pump with Dipswitch A-8 OFF will start the booster pump automatically following a main pump start signal.

DIP SW-B. No.4 Permits use of an external valve to interrupt pump nitrogen flow (optional)

DIP SW-B. No.5 Permits control of a valve for nitrogen dilution flow to the exhaust line downstream from the pump (optional)

DIP SW-B. No.6	Selects a custom interface option. Standard position (ON) permits signal I/O at the D Subminiature control connectors (CN-Y and CN-Z). Set Dipswitch B-6 OFF only to prevent signal I/O from these connectors and to use a custom, factory-installed, on-board interface with a separate I/O connector (optional)
DIP SW-B. No.7	Selects phase error detection—either at all times or only during initialization.
DIP SW-B. No.8	During pump operation, directs the LCD to continue displaying the user-selected parameter. A pump with Dipswitch B-8 OFF will return to the default LCD display (POWER) after 60 seconds of inactivity.
DIP SW-C No.1	Select contact logic of Pump N_2 WARNING. Normally open/Normally close.
DIP SW-C No.8	Enable/Disable the after sequence mode (See 5.3.5)

5.5 Dip Switch Setting Display

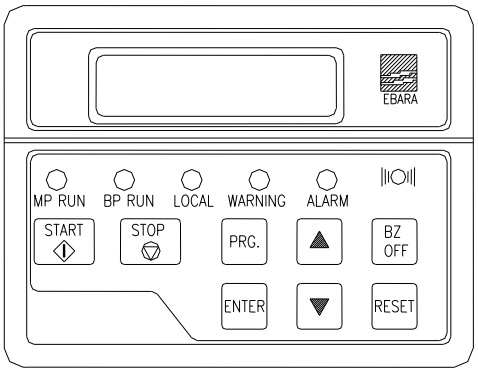


Fig 5.4 LCD Controller

Key functions will be as follows on the setting display.

START	:	Invalid (No Response)
STOP		Stops pump operation.
RESET		Resets warning and alarm.
BZ.OFF		Switches the dip switch numbers.
▲		Sets the selected dip switch ON.
▼		Sets the selected dip switch OFF.
ENTER		Scrolls the next page of the display.

DIP Switch-A

A＊	**ON**	
	OFF	□□□□□□□□

DIP Switch-B

B＊	**ON**	
	OFF	□□□□□□□□

LCD Indicates the Dipswitch number (1 to 8) currently being set.

Fig 5.5 DIP Switch

[NOTE] DIP Switch setting except for A-3(BUZZER) can NOT be changed during pump run.

[NOTE] After resetting dip switches, other than Dipswitch A-3 (BUZZER), the LCD controller initializes (counts down 10 seconds), just as it does at initial power up, right after the completion of the parameter setting.

[NOTE] Any warning or alarm during parameter setting will abort the programming session. The display will change to the warning & alarm screen.

5.6 Start/Stop Pump by LCD Controller

The user may connect either one or two LCD controllers to a pump.
If only one controller is connected, it will START and STOP a pump in LOCAL mode.
When two LCD's are connected, the one with "LOCAL" LED lit can START and STOP the pump; the other merely displays the pump operational status.

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

The first LCD controller connected controls, the other LCD controller merely displays.
To switch control to the other LCD controller, disconnect and reconnect the currently active LCD controller. The other LCD will take control.

6. Operation

6.1 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, which may cause rotor contact or other problems.

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

(2) Turn on the N_2 gas supply.

Check that the regulator attached to the pump is closed i.e. The pressure adjustment knob is fully counterclockwise.
Open the main valve and check that there are no N_2 gas leaks from the pipe connections.

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

WARNING 	Failure to maintain a sufficient supply of N2 gas will cause oil back flow, pump corrosion, accretion of reaction byproducts or other serious problems.

WARNING 	Purge N_2 gas in order to prevent corrosion and reduce the formation/deposition of reaction by-products in the pump. When diluting toxic or flammable gases down to an acceptable concentration with N2, maintain a separate supply of N2 to the pump exhaust line.

CAUTION	Abrupt rotation of the pressure adjustment knob will cause the pressure indicator needle of the regulator to wobble and display pressure inaccurately.

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

WARNING	The pump is not equipped with a breaker. Installation is required based on the laws and standards of the installation area.

[NOTE] The pump will not start during a ten-second instrument warm up after placing the CB in the ON position.

(4) Re-check on the PUMP N_2 FLOW display of the LCD Controller that the pump N_2 gas flow rate. (See flow late in section 3.5.)
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.

[NOTE] For corrosive processes and processes leading to the formation of large amounts of reaction by-products, pump purge N_2 can be increased.
Use “Dilution N_2 gas control valve” for boost up, with checking the "PUMP N_2 FLOW" display on the LCD controller. (Max. N_2 flowrate: 84Pam^3/s)
See outline drawing for the location of the Dilution N2 gas control valve.
The "dilution N_2 gas control valve" is closed when the pump is shipped.

(5) When the WARNING/ALARM display appears on the LCD controller or when any abnormal symptoms occur, take action in accordance with Chapter 10, "Troubleshooting."
After the cause of the WARNING/ALARM display is cleared, the display persists until the RESET signal is entered. Either press the RESET button or enter an external RESET signal through the control signal connector. In the BUZZER Enabled mode, pressing the BZ.OFF button suppresses the buzzer tone

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

CAUTION 	Operating with the closed valve on the exhaust will pressurize the exhaust and cause problems for the pump.

6.2 Start/Stop

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 5.3, “Setting the Operational Mode”)

The operator can change control mode (REMOTE/LOCAL) and Dipswitch A-3 (BUZZER) at any time. Set in accordance with the operating conditions.
(See 5.3, “Setting the Operational Mode”)
When Dipswitch A-4 is ON, changing the operating mode from LOCAL to REMOTE setting will stop the pump even if the external RUN signal is present.

WARNING 	The pump will remain at a very high temperature even after it has stopped. Leave the cooling water running for about one (1) hour after shutdown. Shutting off cooling water immediately after the pump stops causes a pressure rise in the cooling water piping, which may lead to a water leak.

WARNING 	The pump and exhaust piping will remain at a high temperature during operation and for a short time after the pump has stopped. Avoid contact and keep flammable substances out of reach. Do not remove the outer covers during operation.

CAUTION	When the production process leads to reaction byproducts in the pump or when the process handles corrosive gases, do not stop the pump until after at least 30 minutes after stopping the flow of process gases.

CAUTION 	Process gases will remain in the vacuum piping and in the pump even after the pump has stopped. Purge for at least one (1) hour after stopping the pump. Do not discontinue the N2 purge when the pump is stopped only for a short time.

[NOTE] Do not pump process gases until the pump has run for at least three (3) hours. If possible, wait four (4) hours for the pump casing temperature to stabilize before pumping process gases.

When Dipswitch A No. 4 is ON, changing the operating mode from LOCAL to REMOTE setting will stop the pump even if the external RUN signal is present.

When Dipswitch A No. 2 is set to “Constant Monitoring”, cooling water and N_2 flow is monitored “Always”., even after the pump stops.

6.2.1 LOCAL (Pump Side) Start/Stop

a) START

Place the pump in local mode.
Press the START button on the controller.
The Main Pump (MP) will start and the M.P. RUN LED on the controller will light.
After the MP reaches speed, the Booster Pump (BP) will start automatically, and the B.P. RUN LED on the controller will light.
The default LCD display during pump operation is BP and MP power.
For other status display indications, refer to Table 5.1.

[NOTE] Until RESET, the pump will not start after it generates a WARNING or ALARM. Pressing START BUTTON will cause "STARTFAIL" to appear on the display.

b) STOP

Press the STOP button on the controller. The MP and BP will stop simultaneously.
The RUN LED goes out and the display gives a power reading of 0.0kW.

6.2.2 REMOTE Start/Stop

a) START

Enter the external MP RUN signal input through the control connector. The MP starts. After the MP rotation reaches 3000min^{-1}, BP will start automatically.

The default LCD display during pump operation is BP and MP power.
For other status display indications, refer to Table 5.1.

[NOTE] Until RESET, the pump will not start after it generates a WARNING or ALARM. Entering a START signal will cause "STARTFAIL" to appear on the display.

b) STOP

Interrupting the external maintained MP RUN signal will stop the pump.

6.2.3 Communication Start/Stop

a) START

Start the MP by external MP RUN command input through the control connector.
After the MP rotation reaches 3000min^{-1}, BP will start automatically.

The default LCD display during pump operation is BP and MP power.
For other status display indications, refer to Table 5.1.

[NOTE] Until RESET, the pump will not start after it generates a WARNING or ALARM. Entering a START signal will cause "STARTFAIL" to appear on the display.

b) STOP

Interrupting the external BP STOP command will stop the BP.
Interrupting the external MP STOP command will stop the MP and BP.

[NOTE] Please refer to the communication specifications for details.

7. Maintenance and Inspection

7.1 Routine Inspection

Periodically, check that neither the LCD nor any remote output is displaying a WARNING signal.

Table 7.1Typical check items

No.	Item	Sensor	Recommended Interval
1	Motor Power	Motor Driver	Every 1 week
2	N_2 Gas Flow	N_2 Flow sensor	
3	Vibration / Noise	-----	
4	Cooling water flow(option)	Water Flow sensor	
5	Pump casing Temp.	Thermo-Couple	
6	Color / Level of lubricant oil	-----	Every 1 month

When the ALARM/WARNING display appears, take action in accordance with Section 10 about "Troubleshooting."
If the lubrication oil level is lower than the lower limit line of the oil level gauge, replenish the lubrication oil. See Section 7.3 “Lubrication Oil” when adding the oil.

WARNING 	Turn off the power supply to the pump before maintenance work. Be sure to turn off the power breaker on the primary side of the pump.

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

Even after correction of the root cause of the WARNING/ALARM, the signal will persist until the RESET signal is entered. After you have taken remedial action, press the RESET button on the controller or enter the RESET signal from the control signal connector to clear the WARNING/ALARM condition.

CAUTION	A WARNING signal will not stop the pump. However, continuing pump operation in this condition may lead to an ALARM signal or a serious breakdown. After the process plant has completed 1 cycle, check the pump in accordance with the instructions of Section 10 “Troubleshooting”.

CAUTION	In the REMOTE operating mode, when an ALARM signal has occurred, interrupt the external start signal before beginning maintenance. If the external MAINTAINED start signal is present, the pump will start as soon as the ALARM conditioned is cleared and the pump 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" Pressing the BZ.OFF button in the BUZZER Enabled mode, will silence the buzzer regardless of ALARM/WARNING status.

7.2 Vacuum and Exhaust Piping

WARNING 	When maintaining the vacuum or exhaust piping, avoid dispersing flammable, toxic and/or hazardous substances. Also, avoid physical contact 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. Avoid contact and keep flammable substances out of reach. Do not remove the outer covers during operation.

WARNING 	Check for gas leaks after you have finished pipe maintenance work. Leaks may be dangerous due to the discharge of harmful and hazardous substances and to unpredictable reactions associated with the admission of air into the pump.

Byproducts in the pump or piping may exude toxic gases that leak to atmosphere when any flange or other connection is unmade to repair or remove the pump. Obtain all relevant information about the process gases and byproducts from your process tool suppliers. Ensure that the gas concentrations in work areas are below acceptable levels using appropriate measurement equipment.
Instruct workers who might be exposed to toxic gases to wear proper personnel protective equipment to protect them from gas hazards. The minimum personnel protective equipment must include gloves, safety goggles and a cartridge respirator designed to abate the relevant gas species.
Follow 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, purge with a sufficient volume of N2 gas.
2. On systems with an exhaust gas scrubber unit, interrupt N2 purge and close the inlet valve of the exhaust gas scrubber before removing the piping.
3. Switch off and lockout the power supply.
4. After cleaning the piping, do not reconnect until it has dried completely.

7.3 Lubricant Oil

CAUTION	Do not start filling oil until the pump interior reaches atmospheric pressure. During pump operation, the chamber containing the oil is under vacuum. Removing the oil fill plug while the pump is running will cause oil carryover and damage the pump.

CAUTION	A licensed industrial waste disposal dealer should dispose of waste oil in accordance with Material Safety Data Sheet (Appendix 2).

If daily inspection reveals an oil level below the lower limit line of the oil level gauge, Replenish the oil using the following procedure:

(1) Stop the pump operation and remove the closure plate of the pump utility. (See Figure 7.1)

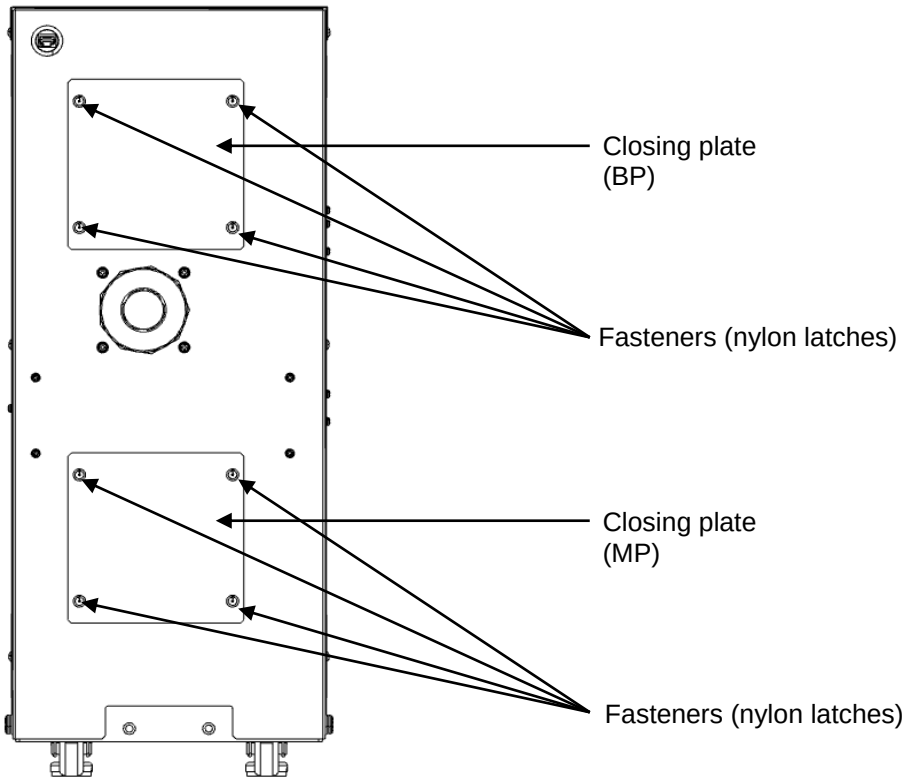


Fig. 7.1 Removing the closing plate

(2) Wait until the internal pump pressure returns to atmospheric (normal) pressure, then remove the plug from the oil-filler inlet. (See Figure 8.2.)

(3) Check the oil level from the sight-glass of the oil level gauge and fill lubricant oil until its level reaches the top line. (See Figures 8.2. and 8.3.)
(4) Check the plug O-ring for deposits and fragments; then close the oil-filler inlet.
(5) Check the air leak after supplying lubricating oil.

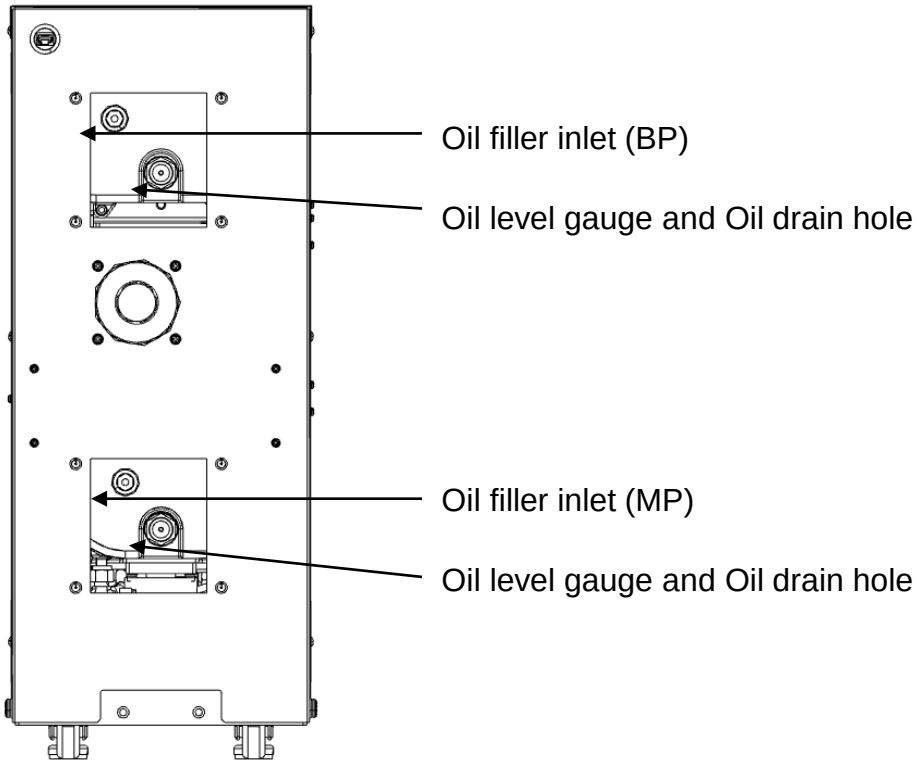


Fig. 8.2 Oil filler port, oil level gauge, and oil drain port positions

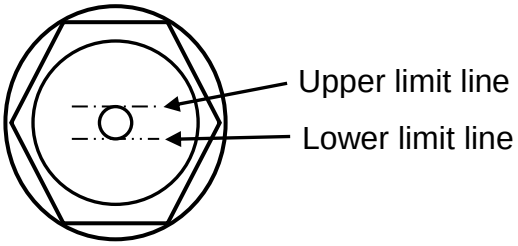


Fig. 8.2 Oil Level Gauge

CAUTION	Use the lubricant listed in specification Table 3.1.

CAUTION	If the oil level exceeds the upper limit, oil may leak into to the vapor Stream. Do not exceed the upper limit line when adding oil.

CAUTION	Low oil level can cause pump failure. If level is below lower limit line, add oil immediately.

7.4 Spare (Maintenance) Parts List

Following parts are needed for maintenance in customers' site.

Table. 7.2 Spare parts lists

1. Standard Consumable Part.

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

2. Recommended Spare Parts

Parts Name	Type	Ebara Part No.
N_2 flow sensor	84.4Pam^3/s	C-5300-014-1200
Thermocouple sensor bolt	K TYPE, M8	C-1019-165-0001
N_2 regulator	RC31886	C-2300-004-6800
Fuse	KTK-R-30	C-5500-004-4000

6 fuses are used per 1 pump.

The following labels are attached to the pump covers. Should a label peel off or become difficult to read or discolored, replace it.

Table. 7.3 Labels

Label Name		Part No.
[DANGER]	HAZARDOUS WEIGHT DANGER LABEL	C-7110-316-0001
[WARNING]	HAZARDOUS VOLTAGE WARNING LABEL1	C-7110-155-0001
[WARNING]	HAZARDOUS VOLTAGE WARNING LABEL2	C-7110-410-0001
[WARNING]	HIGH TEMPERATURE WARNING LABEL	C-7110-312-0001
[WARNING]	HAZARDOUS MATERIAL WARNING LABEL	C-7110-314-0001
[WARNING]	HIGH TEMPERATURE EYEBOLT WARNING LABEL	C-7110-317-0001
[WARNING]	ANTI EARTHQUAKE FIXTURE WARNING LABEL	C-7110-322-0001

7.5 List of Wastes during Maintenance

Table 7.4 lists wastes from general user maintenance. Dispose of the wastes according to the local waste disposal regulations in your jurisdiction.

Table 7.4 List of wastes during maintenance

Part	Equipped on	Remarks
Lubricant oil	Inside of pump module. See section 7.3.	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	Standard industrial waste.

7.6 Overhaul

Model EV-X dry pumps contain consumable parts. Overhauls, including periodic component inspection and replacement, ensure safe, high-performance pump operation.

Rebuilding pumps requires well-trained personnel with up-to-date knowledge of the pumps' design and familiarity with hazardous chemicals and safe work practices. Factories performing overhauls must have special tools and facilities as well as exhaust air handlers to protect employees from toxic gas hazards.

At EBARA-designated Rebuild Centers, well-trained personnel, working in suitable facilities, supported by an established supply system of up-to-date pump information and genuine brand-name parts, provide overhaul services.

All EBARA-designated Rebuild Centers have appropriate systems for waste disposal and tracking. Because the waste creator [pump user] is ultimately responsible for waste disposal, these systems protect EBARA Rebuild Center customers from long-term liability for toxic wastes.

EBARA recommends that users send pumps for periodic overhaul to an EBARA designated facility. These Rebuild Centers have the parts, tools, and equipment to provide superior rebuilds for the pumps regardless of condition.

Contact EBARA Sales office or service center for details.

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) Complete all necessary items in the 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 in order to avoid associated risks.

(2) When you send the pump to a service center in the United States, contact EBARA Service Center first to obtain an RMA number for identification. Enter this RMA number in the Environmental Health & Safety Clearance Form shown in Appendix 5.

Contact EBARA Service Center for latest form. Fax the completed form, in advance, to EBARA Service Center; attach the original completed form to the pump you send. Unless you take these prior actions, EBARA cannot accept your pump for rebuild because of the risks and liabilities.

8. Dismantle and Transportation

WARNING 	When the pump has exhausted highly toxic gases such as arsenic and mercury compounds, be sure to contact EBARA Corporation before you return the pump. Refer to Appendix 4 or 5 for 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, take note of the gases that it has pumped.

Byproducts in the pump or piping may exude toxic gases that leak to atmosphere when any flange or other connection is unmade to repair or remove the pump. Obtain all relevant information about the process gases and byproducts from your process tool suppliers. Ensure that the gas concentrations in work areas are below acceptable levels using appropriate measurement equipment.
Instruct workers who might be exposed to toxic gases to wear proper personnel protective equipment to protect them from gas hazards. The minimum personnel protective equipment must include gloves, safety goggles and a cartridge respirator designed to abate the relevant gas species.

To disconnect and transport the pump, proceed as follows

(1) Stop the pump.
Close the pump inlet valve or tool chamber valve and follow facility procedures for locking this valve in the closed position. All gases inside the pump by purging with N_2.

(2) Switch off the power supply to the pump and remove the power and signal wires.

(3) Close N2 supply valve, fully close the N2 regulator before removing the N2 tube, and cap the N2 purge port with a blank plug.

(4) Remove the cooling water lines.

(5) Remove the vacuum and exhaust pipes. Completely seal off the suction and exhaust ports of the pump with blind flanges. Cap any other process gas connections, such as the differential port (option), with a blind flange.

(6) Put LCD controller (with LCD controller stand (optional))on the pump top cover (LCD faces the cover) and secure it with adhesive tape.

(7) Wrap the pump in a vinyl sheet.

(8) Use the eyebolts provided on the pump for slinging the pump to load and unload. Fasten eyebolts completely; turn in until flush with the seating surface. For sling, use a strap rated to lift the pump's weight, with a length so that the slinging angle (that is, the angled subtended by the strap) is 60° or less.

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

WARNING 	Only qualified personnel should lift the pump. Ensure 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 with symmetrically centered slinging angle.

CAUTION	During sling and transportation, do NOT remain leaning more than 10 deg against a horizontal for 5 minutes. Otherwise, oil leakage will occur.

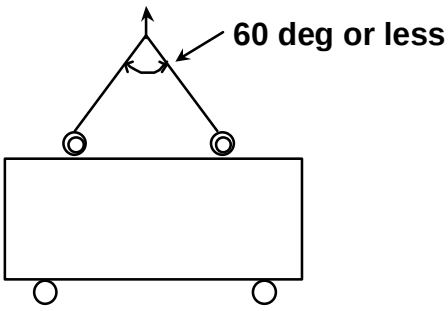


Fig. 9.1 Slinging the Pump

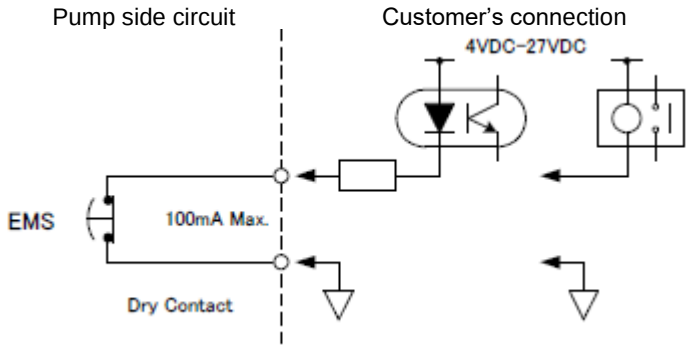
(9) When options such as an interface box are attached to the pump, be careful to avoid damage due to contact with the lifting sling.
For transportation, secure the pump by lowering the adjustment feet. Place a protective cloth around the pump to avoid shock. Position protective members between the outer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

To avoid dangers potentially encountered during pump overhauls, follow instructions shown in Section 7.6, Appendix 4 and Appendix 5 to send your pump to an EBARA designated Service Center for overhaul or repair.

9. For SEMI S2 standard

Additional electrical parts required for SEMI application are shown in Table 9.1. The process tool panel may provide these items or they may appear in an auxiliary control panel mounted on the pump or remotely.

Table 9.1 Necessary parts for SEMI S2 standard

Parts name	Conditions
CB (Circuit breaker)	Please use CB of 10 kA or more in the breaking current capacity. (UL489 corresponding)
EMO (Emergency Off)	Please select it based on the law and the standard of installation features. Please intercept the power supply of the pump when EMO operates.
Safety Interlock	Hard interlock signal (Dry contact, Open at abnormal) is output as the final safety protection by CN-Y connector (6-19pin). Please intercept the power supply of the pump when Hard interlock signal is open. 
Pump Fixation	Please fix the pump to the floor or other firm ground with the brackets at the installation.

10. Troubleshooting

10.1 Troubleshooting (1) Basic Trouble

WARNING 	Make sure to turn off the power breaker on the primary side of the pump for wiring and maintenance work. Never supply power to the pump until the specified work is completed.

WARNING 	The pump casing and exhaust piping become extremely hot during operation and remain hot for some time after stopping. Keep pump and exhaust piping away from contact with personnel and flammable substances. Do not remove pump covers 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 admission of air into the pump. When conducting gas leak check by pressurization, do not exceed 0.05Mpa as supply pressure.

Abnormal symptom	Check Item	Corrective Action
The breaker on the primary side of the pump is unable to turn on (Leakage detector is on.)	Incorrect wiring	Check wiring.
	Short circuit	Replace or overhaul pump.
Power LED not on	No power supply to pump.	Check power supply.
	Power connector disconnected	Connect power connector.
	CB is not ON.	Place CB to ON.
No display on LCD	CB is not ON.	Place CB to ON.
	LCD cable disconnected	Connect LCD
	Instrument failure	Replace instruments.
Pressing START button does not start MP.	“Remote Mode” or ”Com Mode” selected	Set to “LOCAL mode”
	Start-up conditions are not satisfied. (“Start fail” is displayed.)	Satisfy all start-up conditions.
	Instrument failure	Replace instrument.
External MP RUN signal does not start MP.	“Local Mode” or “Com Mode” selected	Set to “REMOTE mode”
	Start-up conditions are not satisfied. (“Start fail” is displayed.)	Satisfy all start-up conditions.
	Instrument failure	Replace instrument.
BP does not start.	No BP signal (in Remote Mode)	Enter the start signal.
	Instrument failure	Replace instruments.
Abnormal noise Excessive vibration	Adjustment feet are not lowered	Lower adjustment feet (Level pump).
	Object contacting outer cover	Remove the object.
	Loose enclosure screw(s)	Tighten screw(s)
	Pump parts damaged	Replace or overhaul pump.
Vacuum pressure increase.	Byproduct accumulation in piping	Clean piping.
	High N_2 pressure setting	Set pressure for correct value.
	Vacuum piping leak	Leak check piping
	Byproduct accumulation in pump	Replace or overhaul pump.
	Excessive dilution N_2 gas flow rate.	Adjust the N_2 flow rate
MEMORY ERROR is displayed on LCD after activating CB or changing the dip switch setting	None	Need “Countermeasure against electric Noise” to pump.

10.2 Troubleshooting (2) WARNING

WARNING 	Make sure to turn off the power breaker on the primary side of the pump for wiring and maintenance work. Never supply power to the pump until the specified work is completed.

WARNING 	The pump casing and exhaust piping become extremely hot during operation and remain hot for some time after stopping. Keep the pump and exhaust piping away from contact with personnel and flammable substances. Do not remove pump covers 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 admission of air into the pump. When conducting gas leak check by pressurization, do not exceed 0.05Mpa as supply pressure.

Display	Symptom	Check Item	Corrective Action
WARNING: PUMP N2 FLOW LOW ###	PUMP N_2 flow is reduced.	N_2 port is not connected.	Connect N_2 pipe fitting.
		Insufficient primary pressure	Apply sufficient pressure.
		Regulator setting value LOW.	Increase pressure setting.
		Clogged N_2 pipe	Replace N_2 piping.
		Leaks on N_2 pipe.	Check the fittings.
		Instrument failure	Replace instrument.
WARNING: BP MOTOR TEMP HIGH ### WARNING: MP MOTOR TEMP HIGH ###	Booster Pump (BP) motor coil temperature rises. Main pump (MP) motor coil temperature rises.	Reduced cooling water	Restore water flow, cool pump thoroughly and reset
WARNING: BP CASING TEMP HIGH ### WARNING: MP CASING TEMP HIGH ###	Booster Pump (BP) Casing temperature rises. Main pump (MP) Casing temperature rises.	Duct ventilation insufficient	Ventilate sufficiently.
		Pump back pressure rises.	Check exhaust pipe & trap.
		Byproduct accumulation	Replace or overhaul pump.
		Cooling water flow is reduced.	Restore water flow, cool pump thoroughly and reset
WARNING: BP DRIVER TEMP HIGH ##### WARNING: MP DRIVER TEMP HIGH #####	Booster Pump (BP) driver temp. rises. Main pump (MP) driver temp. rises.	Duct ventilation insufficient	Ventilate sufficiently.
		Reduced cooling water.	Increase cooling water flow.
WARNING: ## COMM.ERROR	Communication is not established.	Connection error of the instrumented units	Check the connection of the instrumented unit.
		Instrument failure	Replace instrument.

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 	Make sure to turn off the power breaker on the primary side of the pump for wiring and maintenance work. Never supply power to the pump until the work is completed.

WARNING 	The pump casing and exhaust piping become extremely hot during operation and remain hot for some time after stopping. Keep pump and exhaust piping away from contact with personnel and flammable substances. Do not remove pump covers 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 admission of air into the pump. When conducting gas leak check by pressurization, do not exceed 0.05Mpa as supply pressure.

Display	Symptom	Check Item	Corrective Action
ALARM: BP CASING TEMP H.HIGH ALARM: MP CASING TEMP H.HIGH	Booster Pump (BP) casing temp.rises. Main Pump (MP) casing temp.rises.	Duct ventilation insufficient	Ventilate sufficiently.
		Pump back pressure rises.	Check exhaust pipe & trap.
		Byproduct accumulation	Replace or overhaul pump.
		Cooling water flow is reduced.	Restore water flow, cool pump thoroughly and reset
ALARM: BP MOTOR TEMP HIGH ALARM: MP MOTOR TEMP HIGH	Booster Pump (BP) motor coil temp.rises. Main Pump (MP) motor coil temp.rises.	Reduced cooling water	Restore water flow, cool pump thoroughly and reset
		Motor failure	Replace or overhaul pump.
		Accumulation of by-products	Replace or overhaul pump.
		Instrument failure	Replace instrument.
ALARM: BP MOTOR OVERLOAD 2 ALARM: MP MOTOR OVERLOAD 2	Booster Pump (BP) motor Overload. Main Pump (MP) motor Overload.	Pump back pressure rises.	Check exhaust pipe & trap.
		Increase of the gas load.	Reduce the gas flow late.
		Rotor makes contact. (Byproduct accumulation) (Substance plunge)	Replace or overhaul pump.
		Instrument failure	Replace instrument.
ALARM: BP DRIVER ### ALARM: MP DRIVER ###	Booster Pump (BP) motor driver protection Main Pump (MP) motor driver protection can not Restart	Insufficient ventilation	Ventilate sufficiently.
		Pump back pressure rises.	Check exhaust pipe & trap.
		Reduced cooling water	Restore water flow, cool pump thoroughly and reset
		Broken motor driver	Replace motor driver.
		Instrument failure	Replace instrument.
ALARM: PHASE ERROR	Open phase	Instrument failure	Replace instrument.
		Incorrect wiring	Check power supply
ALARM: STARTFAIL ALARM/WARNING EXIST	Start fault	Starting during ALARM/WARNING status	Make sure that all starting conditions are met.
		Instrument failure	Replace instrument.
ALARM: ## COMM.ERROR	Communication is not established.	Connection error of the instrumented units	Check the connection of the instrumented unit.
		Instrument failure	Replace instrument.
CONTINUOUS ALARM OCCURRED!!	ALARM generates 5 times into 10 minutes.	Checks the contents of ALARM display on LCD.	Above-mentioned disposal is carried out and reset.

After you have taken the remedial actions above, RESET the pump. If the problem that has caused the ALARM signal persists, the ALARM display will appear again even after pressing 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 MAINTAINED mode, the pump will start immediately when the RESET signal is applied.

10.4 Troubleshooting (4) Option

WARNING 	Be sure to turn off the power breaker on the primary side of the pump for wiring and maintenance work. Never supply power to the pump until the work is completed.

WARNING 	The pump casing and exhaust piping become extremely hot during operation and remain hot for some time after stopping. Keep pump and exhaust piping away from contact with personnel and flammable substances. Do not remove pump covers 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 admission of air into the pump. When conducting gas leak check by pressurization, do not exceed 0.05Mpa as supply pressure.

Display	Symptom	Check Item	Corrective Action
WARNING: WATER FLOW LOW ###	Water flow is reduced.	Coupler disconnected	Connect coupler.
		Insufficient pressure	Apply sufficient pressure.
		Facility valve closed.	Open valve.
		Clogged water line	Clean or replace piping.
		Tube fittings are loosened.	Re-tighten.
		Instrument failure	Replace instrument.
		Outlet & inlet pipes are reverse. (flow rate 0 L/min)	Connect pipes correctly.
ALARM: WATER FLOW LOW	Continuous water flow low.	Coupler disconnected	Connect coupler.
		Insufficient pressure	Apply sufficient pressure.
		Facility valve closed.	Open valve.
		Clogged water line	Clean or replace piping.
		Tube fittings are loosened.	Re-tighten.
		Instrument failure	Replace instrument.
		Outlet & inlet pipes are reverse. (flow rate 0 L/min)	Connect pipes correctly.
WARNING: BACK PRESS.HIGH###	Exhaust pressure rises.	Byproduct accumulation in the exhaust pipe	Check exhaust pipe.
		Instrument failure.	Replace instrument.
WARNING: BACK PRESS. WIRE BROKE	Back pressure sensor wires are broken.	Connection error of the back pressure sensor.	Connect back pressure sensor connector.
		Instrument failure.	Replace instrument.
		Back pressure sensor wires broken.	Replace back pressure sensor.
ALARM: BACK PRESS. HIGH	Exhaust pressure rises.	Closed Exhaust valve	Open exhaust valve
		Byproduct accumulation in exhaust pipe	Clean exhaust pipe.
ALARM: WATER LEAKAGE	Water leakage	Tube fittings are loosened.	Tighten the tube fitting
		Instrument failure	Replace instrument.
WARNING: HEATER ERROR	Heater temperature low.	Slack of a heater jacket.	Fasten jacket heater
		Blown fuse	Replace fuse.
		Broken heater wires The heater wires are broken.	Replace heater.
		Heater connector disconnected	Connect heater connector.
		Instrument failure	Replace instrument.
WARNING: HEATER WIRE BROKE	Thermocouple wires are broken.	Thermocouple wires broken	Replace thermocouple.
		Thermocouple connector disconnected	Connect thermocouple connector.
		Instrument failure	Replace instrument.
WARNING:HEATER TS ERROR	Thermostat open. Heater temp. rises	Instrument failure	Replace instrument.
		Thermostat failure	Replace thermostat
		Thermocouple connector disconnected	Connect thermostat connector.
		Check whether the temperature near thermostat is abnormally high.	Address the roots cause of abnormally high temperature.

After you have taken the remedial actions above, reset the pump. If the problem that has caused the ALARM signal still remains, the ALARM display will appear again even after you have reset.
During REMOTE operation carry out the above procedures after you have turned off the external start signal. When the external start signal remains on in the ALTERNATE mode, the pump will start immediately when the RESET signal is applied.

Global Network (ENG)

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JAPAN

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製品安全データシート

作成日　2002 年 08 月 27 日
MSDS No.　1863　　改定日　2009 年 10 月 01 日

１．製品及び会社情報

製品名　：　BARRIERTA J100ES

会 社 名：　ＮＯＫクリューバー株式会社
住　　所：　東京都港区芝大門１－１２－１５　正和ビル
担当部署：　品質管理部　品質管理課
TEL:0293-43-0426　FAX:0293-43-3817

２．組成、成分情報

単一製品・混合物の区別　：　混合物

化学名　：　フッ素系潤滑油

成　分	ＣＡＳ番号	官報公示整理番号	含有量
ﾊﾟｰﾌﾙｵﾛﾎﾟﾘｴｰﾃﾙ	企業秘密により開示不可	企業秘密により開示不可	>95wt%
添加剤	企業秘密により開示不可	企業秘密により開示不可	<5wt%

危険有害成分　：　非該当

３．危険有害性の要約

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

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

触媒となる金属等が共存する場合には、280℃以下でも分解することがある。

長時間における皮膚との接触により炎症を起こすことがある。

物理的及び化学的危険性　：　特になし

４．応急措置

吸入した場合　：　大量に吸入した場合は、直ちに新鮮な空気の場所に移し、保温して安静に保つ。
必要なら医師の診断を受ける。

皮膚に付着した場合：　付着物を拭き取り、水と石けんでよく洗う。
かゆみや炎症などの症状がある場合は、速やかに医師の診断を受ける。

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

飲み込んだ場合　：　無理に吐かせようとせず、直ちに医師の診断を受ける。

５．火災時の措置

消火剤 : 本製品は不燃性。
霧状の強化液、泡、二酸化炭素、粉末が有効。

特定の消火方法 : 付近の着火源を断ち、保護具を着用して消火する。

消火を行う者の保護 : 消火作業の際には有害なガスを吸い込まないように呼吸用保護具を着用し、風上から消火作業を行う。

６．漏出時の措置

人体に対する注意事項 : 暴露防止のため、保護具を着用して作業を行い、蒸気の吸入や皮膚への接触を防止する。必要であれば、十分に換気を行う。
漏出した場所の周辺への関係者以外の立ち入りを禁止する。
付近の着火源、高温体、可燃物を取り除き、消火機材を準備する。

環境に対する注意事項 : 本製品を含む廃水の公共用水域への排出又は地下浸透を防止するため、本製品がこぼれた床面などを水で洗い流してはならない。

除去方法 : 少量の場合はヘラ、スコップ等を使うか、土砂などに吸着させて蓋付きの空容器に回収し、ウエス等できれいに拭き取る。
火花を発生しない安全な器具等を使用する。
多量の場合は、土砂などで流れを止めた後で回収する。

７．取り扱い及び保管上の注意

取り扱い

技術的対策 : 接触の恐れがある時は適切な保護具を使用する。

280℃以上に加熱したり、製品の付着した手で喫煙しないこと。

注意事項 : 原則として常温で取り扱い、その際、水分、夾雑物等の混入に注意すること。

安全取り扱い注意事項 : 暴露防止のため、保護具を使用して作業を行う。皮膚への接触を避ける。

保管

適切な保管条件 : 適切な換気のある乾燥した冷暗所に密栓して保管する。

その他、消防法、労働安全衛生法等の法令に定めることに従う。

８．暴露防止措置及び保護措置

設備対策 : 屋内作業には適切な局所排気装置を使用することが望ましい。

管理濃度 : 規定なし

許容濃度 : 日本産業衛生学会(1993 年版) 勧告値なし

保護具

呼吸器の保護具 : 有機ガス用防毒マスク

手の保護具 : 耐油性の保護手袋

目の保護具 : 側板付き普通眼鏡型またはゴーグル型保護眼鏡

皮膚及び身体の保護具 : 作業衣、安全靴

適切な衛生対策 : 作業中は飲食、喫煙をしない。

９．物理的及び化学的性質

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

１０．安定性及び反応性

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

１１．有害性情報

急性毒性　：　現在のところ知見なし

局所効果　：　長時間における皮膚との接触により炎症を起こすことがある。

変異原性　：　現在のところ知見なし

１２．環境影響情報

現在のところ知見なし

１３．廃棄上の注意

（１）知事等の許可を受けた産業廃棄物処理業者に処理を委託すること。

（２）空容器を廃棄する時は、内容物を完全に除去しておくこと。

（３）廃棄は法令に従い、適切に処理すること。

１４．輸送上の注意

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

国内規制

陸上輸送 : 消防法、労働安全衛生法等に定められている運送方法に従う。

海上輸送 : 船舶安全法に定められている運送方法に従う。

航空輸送 : 航空法に定められている運送方法に従う。

国連分類 : 非該当

国連番号 : 非該当

１５．適用法令

労働安全衛生法

表示対象物質 : 非該当

通知対象物質 : 非該当

その他 :

ＰＲＴＲ法

第一種指定化学物質 : 非該当

第二種指定化学物質 : 非該当

毒物及び劇物取締法 : 非該当

消防法 : 非該当

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

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

１６．その他の情報

（１）引用文献 ＪＩＳ Ｚ ７２５０：２０００ 日本工業標準調査会

Material Safety Data Sheet

Product name: BARRIERTA J100ES **Date:** September 10, 2002

Revision Date: February 20, 2009

MSDS No. 1863

1. Product and company identification

Product name: **BARRIERTA J100ES**

Company: NOK KLÜBER CO.,LTD

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

Telephone: +81-293-42-5365

Fax: +81-293-43-3817

2. Composition/information on ingredients

Chemical names and synonyms: Fluorinated lubricating oil

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

Hazardous ingredients:

3. Hazardous identification

>280 C traces of fluorinated products

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

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

4. First aid measures

After inhalation

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

After contact with skin

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

After contact with eyes

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

After ingestion

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

5. Fire-fighting measures

Suitable extinguishing media

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

Special hazards

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

Special protective equipment for firefighters

Standard procedure for chemical fires.

Additional information

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

6. Accidental release measures

Personal precautions

Risk of slipping due to leakage/spillage of product.

Environmental precautions

Do not flush into surface water or sanitary sewer system.

Methods for cleaning up/taking up

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

7. Handling and storage

Handling

Advice on safe handling

No special handling advice required.

Advice on protection against fire and explosion

No special precautions required.

Storage

Requirements on storage conditions

Store at room temperature in the original container.

Incompatible materials

Do not store together with food.

8. Exposure controls/personal protection

Additional advice on system design

not applicable

Ingredients and specific control parameters

None

Personal protective equipment

Respiratory protection

No special protective equipment required.

Hand protection

Wear chemical-resistant gloves.

Eye protection

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

Body protection

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

General protection and hygiene measures

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

9. Physical and chemical properties

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

10. Stability and reactivity

Stability

Stable

Conditions to avoid

None

Materials to avoid

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

Hazardous decomposition products

>280 C traces of fluorinated products

Additional information

None

11. Toxicological information

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

Acute toxicity: No data

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

12. Ecological information

Information on elimination (persistence and degradability)

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

Behavior in environmental compartments

Ecological injuries are not known or expected under normal use.

Ecotoxic effects

Aquatic toxicity is unlikely due to low solubility.

Additional information

Should not be released into the environment.

13. Disposal considerations

This product can be incinerated when in compliance with local, state and federal regulations.
This product contains halogen.
Offer rinsed packaging material to local recycling facilities.

14. Transport information

UN class : not applicable

UN No.: not applicable

Advice on transportation

Not classified as dangerous in the meaning of transport regulations.

15. Regulatory information

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

16. Other information

No information

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

Product Safety Data Sheet

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

Section 1 - Product and Company Identification

Product Name	Sizes:	Date of preparation:
Lithium Thionyl Chloride Batteries (ER)	All	March 1, 2008

Company:	Telephone:
Hitachi Maxell, Ltd. Ono Works	81-(0)794-63-8054
Address (Number, Street, City, State, and ZIP Code):	Fax:
5, Takumidai, Ono-shi, Hyogo 675-1322, Japan	81-(0)794-63-8058

Section 2 - Composition/Information on Ingredients

Ingredient	CAS#	Content (wt%)
Thionyl Chloride (SOCl2)	7719-09-7	20 to 45
Aluminum Chloride (AlCl3)	7446-70-0	2 to 6
Lithium Chloride (LiCl)	7447-41-8	0 to 2
Lithium (Li)	7439-93-2	2 to 6
Carbon (C)	1333-86-4	2 to 8

Section 3 - Hazards Identification

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

Section 4 - First Aid Measures

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

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

Section 5 - Fire Fighting Measures

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

Section 6 - Accidental Release Measures

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

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

Section 7 - Handling and Storage

1) Handling

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

2) Storage

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

Section 8 - Exposure Controls, Personal Protection

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

Section 9 - Physical/Chemical Characteristics

N/A

Section 10 - Stability and Reactivity

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

Section 11 - Toxicological Information

N/A

Section 12 - Ecological Information

N/A

Section 13 - Disposal condition

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

Section 14 - Transportation Information

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

Organizations governing the transport of lithium batteries

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

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

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

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

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

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

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

2) Cells and batteries must meet the requirements of the UN T1–T8 tests.

3) Each package containing more than 24 cells or 12 batteries shall:

a) Be marked to indicate that it contains lithium batteries, and that special procedures are to be followed in the event that the package is damaged.

b) Be accompanied by a shipping paper explaining that the cells and batteries are exempt from regulations.

c) Weigh no more than 30 kg (gross weight).

d) Be capable of withstanding a 1.2m drop test in any orientation without any shifting of the contents that would allow short-circuiting, and without release of package contents.

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

Section 15 - Regulatory Information

NA

Section 16 - Other Information

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

For further information, please contact a Maxell sales representative.

エバラドライ真空ポンプ　オーバーホール依頼書

宛先：

行

貴社名：
部署名：
御氏名：
御住所：
TEL　：
FAX　：
E-mail：

TEL No.
FAX No.
＊当社営業担当宛にFAX後、御返却下さい。

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

貴社注文書番号、整理番号など：

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

Appendix 5　Overhaul/Repair Request form(ENG)

Overhaul Request form (USA)

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

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

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

ENVIRONMENTAL HALTH & SAFETY CLEARANCE SHEET

TO

TEL No.

FAX No.

Please FAX or mail a completed copu of this form to Ebara service center prior to shipping equipment.

COMPANY NAME:
SITE NAME:
ADRESS:

PHONE:
FAX:
E-mail:

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

PO number or RMA number:

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

Appendix 6 Information of typical hazardous materials

Information of typical hazardous gas

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

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

APPENDIX 5 Typical Hazardous Gas Information

1. Etching process

Gas	Combustion Support	Flammable	Toxic	Corrosive	Global Warming	Allowable Level*
NF_3	○		○	○		10ppm
HF			○	○		3ppm
Cl_2	○		○	○		0.5ppm
BCl_3			○	○		5ppm as HCl
HBr			○	○		3ppm
Br_2			○	○		0.1ppm
CF_4					○	N/A
CHF_3					○	N/A
C_2F_6					○	N/A

*Allowable level is specified as TLV of ACGIH.

2. LP-CVD

Gas	Combustion Support	Flammable	Toxic	Corrosive	Global Warming	Allowable Level
SiH_2Cl_2		○	○	○		5ppm as HCl
SiH_4		○	○			5ppm
Si_2H_6		○	○			5ppm
$Si(OC_2H_5)_4$ (TEOS)		○				10ppm
$As(OC_2H_5)_4$ (TEOA)		○	○			0.01mg/m3 as As
NH_3		○	○	○		25ppm
H_2		○				4% LEL*
NF_3	○		○	○		10ppm
ClF_3	○		○	○		0.1ppm

*LEL : Lower Explosion Level

3. Ion-implant

Gas	Combustion Support	Flammable	Toxic	Corrosive	Global Warming	Allowable Level
AsH_3		○	○			0.05ppm
B_2H_6		○	○			0.1ppm
PH_3		○	○	○		0.3ppm
BF_3			○	○		1ppm

Appendix 7 Leak Check procedure

Typical Leak Check Procedure

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

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

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

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

Realign joints, tighten fittings, replace seals, etc.

Repeat as necessary to eliminate all leaks.

Disconnect helium supply and place system in operating condition.