

DRY VACUUM PUMP

APPLICABLE TYPE

MU300

INSTRUCTION MANUAL

Date	Record
'03.11	Prepared
'04.07	Revised
'05.08	Revised

KASHIYAMA IND., LTD.

HANDLING OF MANUAL

This instruction manual describes installation, operation, and maintenance about the MuDry Series Dry Vacuum Pump.

Be sure to read this instruction manual to correctly operation before installing and operating it. In particular, take care about the precautions for safety to following warning words.



DANGER

This indicates the existence of imminent hazard, which if the equipment is operated without respect to its contents, will result in death or a serious injury of the operator.



WARNING

This indicates the existence of potential hazard, which if the equipment is operated without respect to its contents, will result in death or a serious injury of the operator.

CAUTION

This indicates the existence of potential hazard, which if the equipment is operated without respect to its contents, may result in slight injury or less serious injury of the operator.

CONFIRMATION

This indicates the existence of possibility, which if the equipment is operated without respect to its contents, may result in equipment damage.

<STORAGE OF THIS INSTRUCTION MANUAL>

This instruction manual describes important matters related to pump operation. Keep the manual in an easy-to-see place so that it may be available whenever required.

WARRANTY OF THE DRY PUMP

Any failure attributable to our responsibility which is due to a defect of design, material, manufacturing, and occurs within one year after acceptance shall be repaired or replaced free of charge.

This warranty shall be applicable only to the case where the equipment has been correctly operated in accordance with this instruction manual and other instructions.

The execution of repair and modification by any party other than our company and our approved dealers shall be prohibited.

Moreover, this warranty shall not be applicable to the following failures.

- * Failure due to improper handling, operation or storage
- * Failure due to negligence of necessary maintenance
- * Failure due to use of maintenance/replacement parts other than those made by us
- * Failure due to fire, flood, earthquake, lightning and other force majeure

In addition, this warranty shall not be applicable to a failure or maintenance that will be necessarily caused by using the equipment for special gas exhaust such as acid, alkali, corrosive gas, and combustible gas, and inclusion of lots of solids or condensable materials.

The range of our responsibility for warranty on this warranty shall be limited to repairs or replacement of defective portions, excluding any loss generated by secondary cause. This warranty shall not be applicable to wearing and maintenance parts.

In case any failure or fault occurs, please inform our business office or Shinshu Plant, CS Section of it at once.

APPLICATION OF THE VACUUM PUMP

* This vacuum pump is intended to get a vacuum source for vacuum exhaust, maintenance of vacuum condition, exhaust of reactive gas and produced gas, and cleanliness in the process room and preliminary room in the manufacturing process for semiconductor devices and liquid crystal display units.

However, the above is not applicable to the case where using this vacuum pump has been judged to be usable for a use other than these by a previous arrangement with the user before purchase.

- * Please consult us when this pump is used for other processes than the above
- * Please use MU300 after often reading notes in this book when exhausting condensable gas such as water vapor.
- * When the use is going to change the process for using this vacuum pump or divert this pump to another use, please consult our business office or Shinshu Plant, Technical Section. It may be necessary to change the specifications of the pump and peripheral units.
- * Using this vacuum pump to uses adopting radiation is prohibited.

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< Attachment >
Return Notice Sheet

1. ITEMS RELATED TO SAFETY

1.1 Safety

This instruction manual describes the following items related to safety.



DANGER

Before completion of electric wiring work, don't supply power in any case; otherwise an electric shock may be caused.

Disconnect power connector before starting maintenance work; otherwise an electric shock may be caused.



WARNING

When lifting the pump, secure safety by a worker qualified for operating the forklift truck or crane.

Don't stand under the lifted pump in any case; otherwise injury may be caused by falling.

If any leak exists in the suction/exhaust pipe when toxic gas, corrosive gas or combustible gas is exhausted or sucked, a man-caused accident, fire, or explosion may be caused.

Because the temperatures of the suction and exhaust pipes of the pump become high, arrange them so that they may not come in contact with the human body and combustible materials.

The execution of wiring work is limited to qualified workers.

Be sure to perform grounding, otherwise an electric shock may be caused by electric leak.

While the pump is in operation or for a while after it is stopped, the temperature of the pump is high. Don't bring the human body or combustible materials into contact with the pump; otherwise a burn may be caused.

When opening the inside of the pump or piping facilities to check if the pump exhaust port is clogged with reaction products, take the following measures as required to secure the safety for workers in consideration of the toxicity or septicity of exhaust gas.

- * Purge N₂ gas completely before removing the pump or piping facilities.
- * Put on protective clothes, protective gloves, protective glasses, protective mask, etc. as required.
- * Perform ventilation enough for the workshop.
- * Collect residual materials such as waste oil and dispose of it in a proper way.

The pump keeps high temperature for a while after it stopped. Don't bring the human body or combustible materials into contact with the pump; otherwise a burn may be caused. Confirm the temperature of the pump adequately came down before the work is started.

When inspection and repair by removing the pump package are necessary, please contact us or the designated company by us.

CAUTION

Don't get on the pump or put a thing on it; otherwise falling or turnover may be caused.

When exhausting corrosive gas, combustible gas, etc., adopt high corrosion-resistant materials for pipes and parts used on both suction port and exhaust port sides.

Be sure to close the N₂ gas supply port by a blank plug when N₂ gas is not supplied; otherwise leakage may be caused.

For diluting toxic gas to the safe concentration by means of N₂ gas purging, connect an N₂ gas purge pipe to the exhaust side separately.

CONFIRMATION

Don't pile packed pumps and don't lay each pump on its side in any case; otherwise the damage may be caused to the pumps.

Use a cooling water pipe with a sufficient thickness. If the pipe diameter is small, the required cooling water volume cannot be secured. The pipe diameter should have an allowance in consideration of pressure loss in the piping system. Furthermore, secure a differential pressure of 0.2 MPa or more between the water supply port and drain port in the supply/drain facilities.

Don't use poor-quality water or hard water as cooling water, otherwise clogging may be caused in the cooling water system, leading to an alarm stop due to abnormal heat generation of the pump. Use water that contains "less impurity".

Don't supply the power to other instruments from the pump package and the controller, because that may cause malfunction of the control systems or failure of the pump.

For Input signals (Pin No. 1, 2, 4), apply a voltage of 24V DC on the pump controller side. Don't apply a voltage on the equipment side, otherwise the controller may go wrong.

When the inductive load is opened or closed by output signal, please connect a surge-absorbing element such as diode at the both sides of the load. There is a possibility that the internal relay contact may go wrong or noise may be caused.

The pump does not stop upon occurrence of an error of WARNING level. However, if the pump operation is continued in this condition, the pump may stop or go wrong on a sudden.

When draining the cooling water, make sure to introduce the compressed air into the cooling water outlet in order to drain water from the inlet. If the compressed air is introduced into the cooling water inlet, the flow meter may be damaged.

When condensable gas such as water vapor was exhausted by MU300, please keep it running with N₂ purge for about one hour after completion of the process. There is a possibility of pump failure arising from corrosion or other factors when condensed moisture, etc. remains inside the pump.

When there is a possibility of freezing while the pump is stopping, admit compressed air into the cooling water outlet and drain the cooling water from the inlet, otherwise that may cause the damage on the pipes for cooling water and the water leakage may occur.

<REQUEST>

A pump that used toxic gas has a danger to be invited by residual gas at an overhaul. When returning the pump, substitute N₂ gas for the inside of the pump completely. And describe necessary items including applied gas in the Return Notice Sheet attached to the end of this manual. Then, sent this sheet to us before returning the pump units.

The items related to safety are also described in the relevant items in this document. Please be sure to read the whole instruction manual.

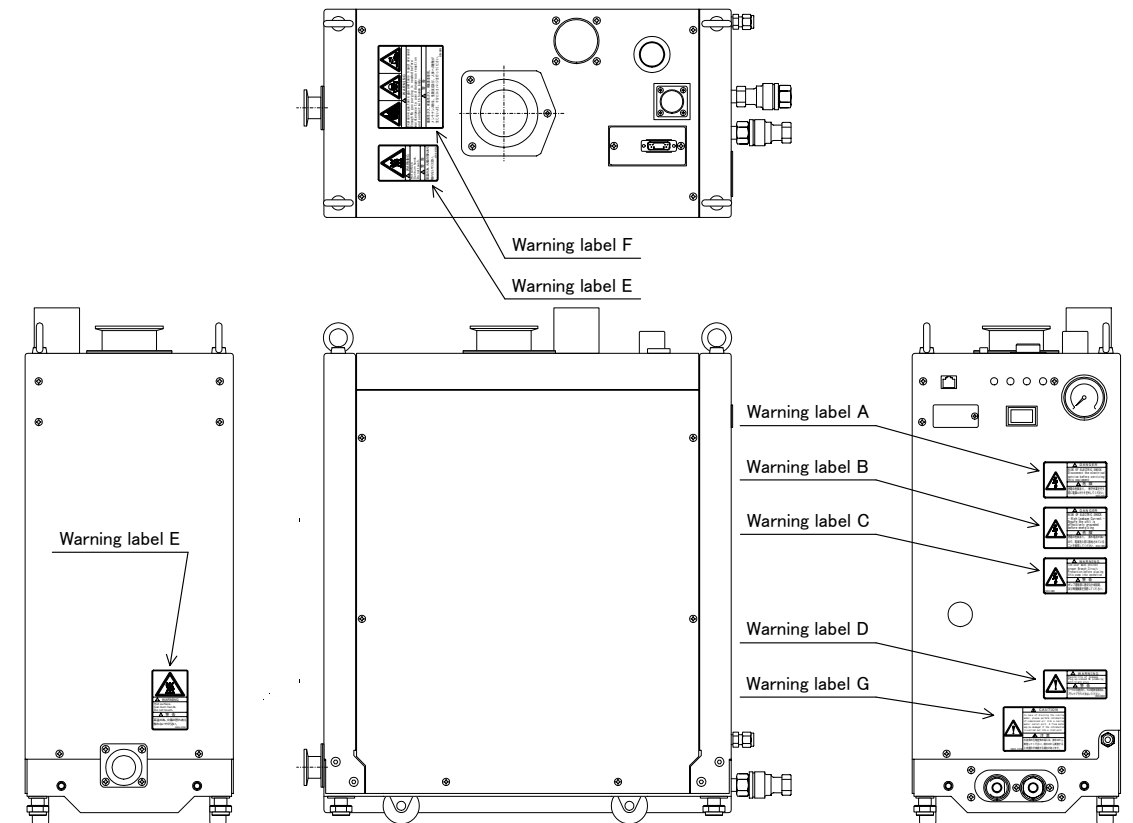
1.2 Types of Warning Label

The following warning labels are stuck on the main body of the dry vacuum pump to provoke cautions on use. The warning label sticking positions are shown on the next page.

List of Warning Labels Stuck on the Dry Vacuum Pump

Warning Label A	Warning Label B								
 <table border="1" data-bbox="475 533 738 763"> <tr> <td>⚠ DANGER</td> </tr> <tr> <td>RISK OF ELECTRIC SHOCK Disconnect the electrical service before servicing this equipment</td> </tr> <tr> <td>⚠ 危険</td> </tr> <tr> <td>感電の危険あり。保守作業を行う前に電源コネクタを外してください。 03919-10960</td> </tr> </table>	⚠ DANGER	RISK OF ELECTRIC SHOCK Disconnect the electrical service before servicing this equipment	⚠ 危険	感電の危険あり。保守作業を行う前に電源コネクタを外してください。 03919-10960	 <table border="1" data-bbox="1078 510 1342 779"> <tr> <td>⚠ DANGER</td> </tr> <tr> <td>RISK OF ELECTRIC SHOCK - High Leakage Current - Ensure the unit is effectively grounded before energizing</td> </tr> <tr> <td>⚠ 危険</td> </tr> <tr> <td>感電の危険あり。漏れ電流が高いため、電源投入前に接地されていることを確認してください。03919-10950</td> </tr> </table>	⚠ DANGER	RISK OF ELECTRIC SHOCK - High Leakage Current - Ensure the unit is effectively grounded before energizing	⚠ 危険	感電の危険あり。漏れ電流が高いため、電源投入前に接地されていることを確認してください。03919-10950
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1.3 Warning Label Sticking Positions



2. PRODUCT CONFIRMATION

This dry vacuum pump is delivered after it is strictly inspected and packed. When the user receives the package, open it and confirm the following points.

- * Check if its components parts are all included. Check if the pump specifications comply with those of your order.
- * Check if any damage has not occurred during transportation. If any fault is found, please inform our business office of it at once.
- * Regarding pump accessories, check them according to the packing list separately dispatched.

<Storage of the Pump>

- * In case the pump is not installed immediately after it is received, store it in a clean environment in the following conditions:

Temperature	5 to 40 deg. C
Humidity	80 % or less

CONFIRMATION

Do not pile packed pumps and do not lay each pump on its side in any case, otherwise the damage may be caused to the pumps.

3. PRODUCT OVERVIEW

Pumps basically consist of a pumping mechanism, a motor, a N₂ module and a cooling water module that are mounted on the base and covered with a package, and a handheld controller.

3.1 Pumping System

The pumping system consists of a roots vacuum pump (MB) and a dry vacuum pump (DP).
< MB / DP pump body >

- * A pair of hybrid roots rotors synchronously rotates, keeping a given clearance, and transfers the gas from inlet port to exhaust port.
- * Bearings and gears are installed and lubricated with oil.
- * Synchronous motor.
- * They are heat up by the compressed gas, the friction at the bearing and at the seals makes pump temperature high, under which the pump is cooled with cooling water.

3.2 Cooling Water System

- * The coupler is provided at each of the water supply and drain ports.
- * The cooling water supplied from the inlet port travels through DP oil cooler, DP casing, DP motor, MB motor, MB oil cooler and flow meter to drain port.
- * Any valve for flow rate control is not built in. Accordingly, it is necessary to install one externally.

3.3 N₂ Gas Purge System

- * It is a unit for carrying out a N₂ gas purge.
- * In this unit, it is branched into an atmosphere side spindle and a vacuum side spindle.
- * N₂ flow rate of the vacuum side spindle is fixed by orifice.
However, the flow rate can be adjusted by changing supply pressure with the regulator.
- * N₂ flow rate of the atmosphere side spindle can be adjusted by the attached control valve.
- * To suck condensative gas or corrosive gas, N₂ gas purge is necessary.
To exhaust light gas such as helium, purging is required with the object of performance improvement.

3.4 Electric System

- * Fuse, noise filter, power source for control and control board are housed in the electric panel in the pump package.
- * To secure safety, the pump is operated while cooling water value, pump casing temperature, and motor coil temperature are monitored.

3.5 Product Specifications

Specification Table

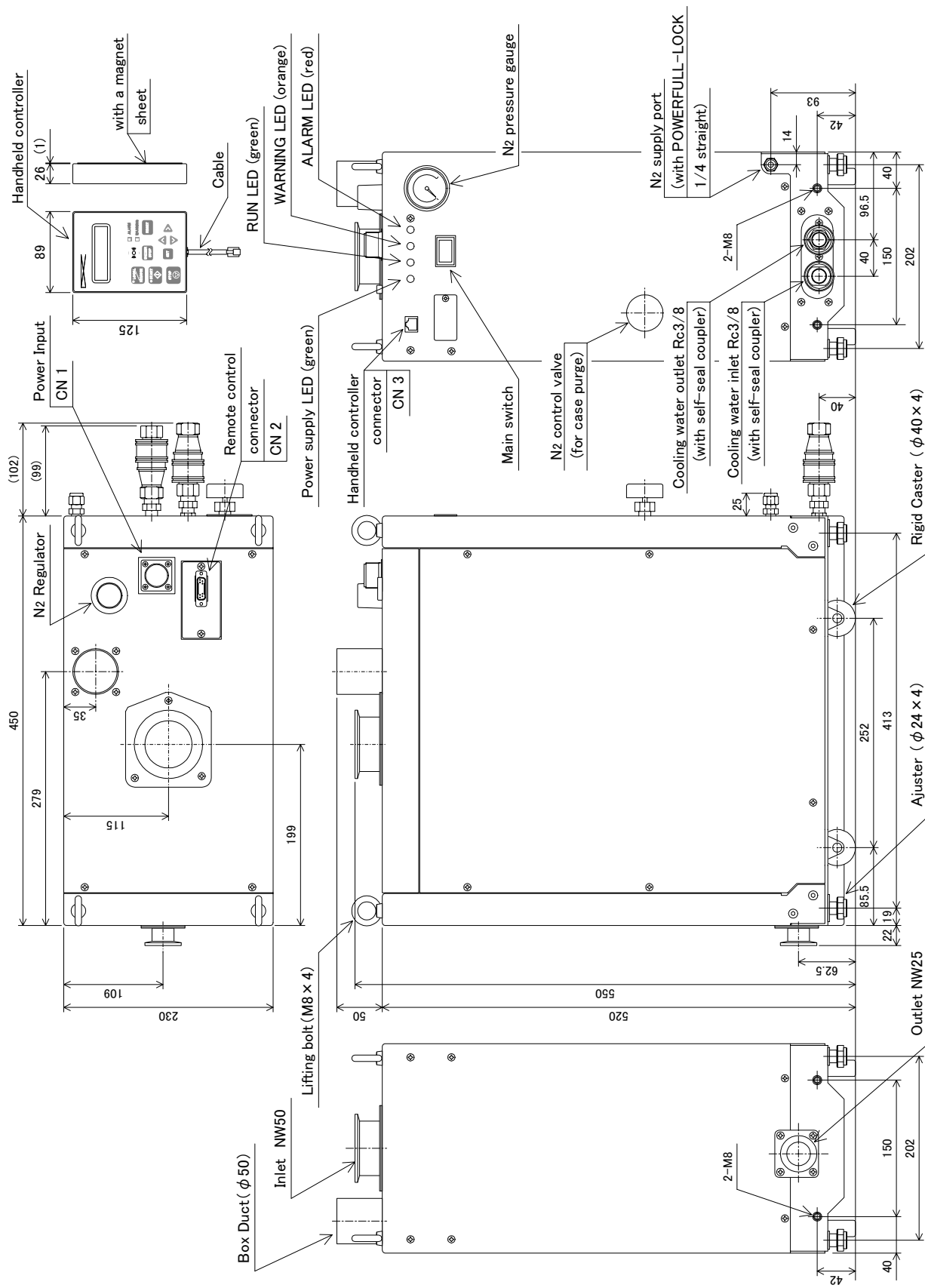
Item		Model	MU300
Maximum Pumping Speed			5000 L/min
Ultimate Pressure (Note1)			0.5 Pa
Rotor Acceleration Time			Approx. 10 sec
Rotor Deceleration Time			Approx. 5 sec
Maximum Inlet Pressure			Atmospheric pressure
Maximum Backing Pressure			3 kPa or less
Motor Rating Output			2.2 + 2.2 kW
Flange Size	Inlet		NW50
	Outlet		NW25
Publication Oil			0.1 + 0.1 litter (Fluoride oil)
Weight			Approx. 100 kg
Utility Requirements			
Power Supply	Voltage	3 Phase, 200 to 220 V, 50/60 Hz Input voltage fluctuation must be $\pm 10\%$ range (Note 2)	
	Capacity	7.0 kVA	
	Operating Current	6 to 15 A	
	Leakage Current	Approx. 3.0 mA	
Cooling Water	Maximum Supply pressure	0.5 MPa G (gauge pressure)	
	Required Minimum Differential Pressure (supply pressure - drain pressure)	0.2 MPa G (gauge pressure)	
	Flow Rate	2 to 3 L/min	
	Temperature	5 to 30 deg. C	
	Heat Exchange	Approx. 3000 kJ/h	
Purge N ₂ (Note3)	Supply Pressure	0.1 to 0.7 MPa G	
	Setting Pressure	0.04 to 0.07 MPa G	
	Flow Rate	0 to 10 SLM (depending on use)	
Box Duct	Connection	PY 50 mm x L 50 mm	
	Pressure	Atmospheric pressure – 196 Pa	
	Flow Rate	Approx. 30 m ³ /h	

Note 1) This is a value without purging.

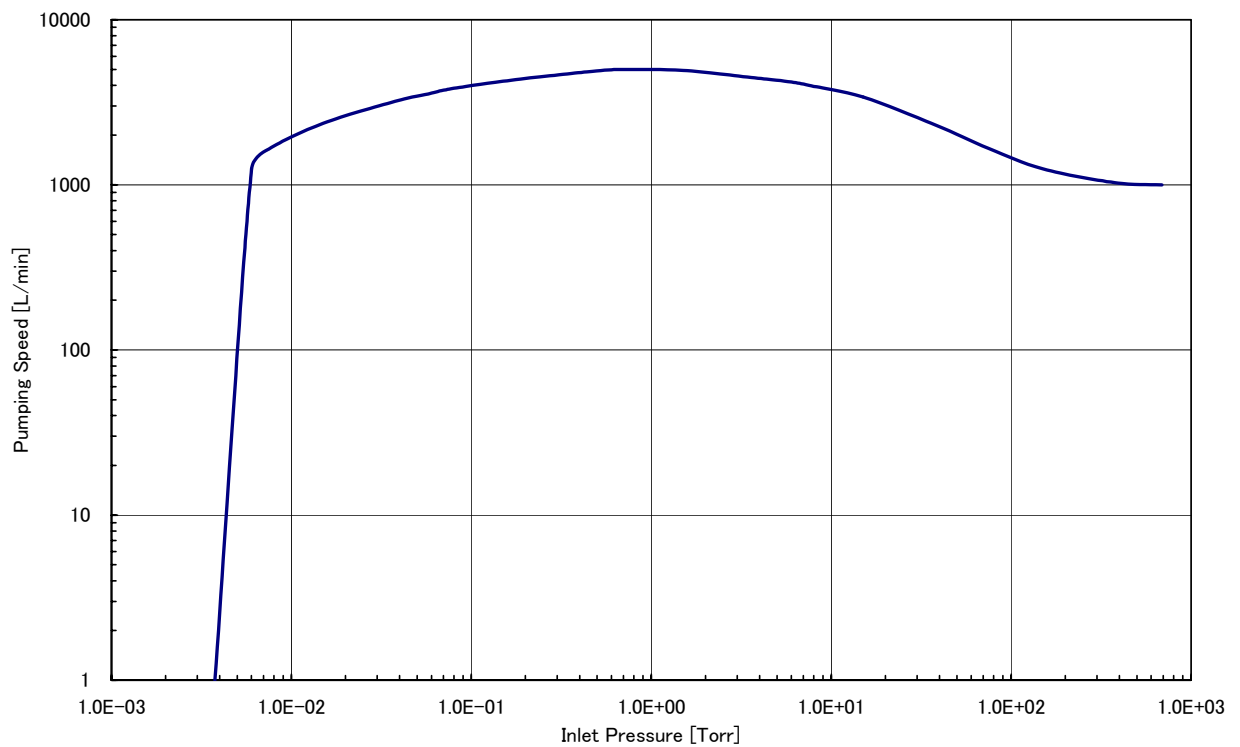
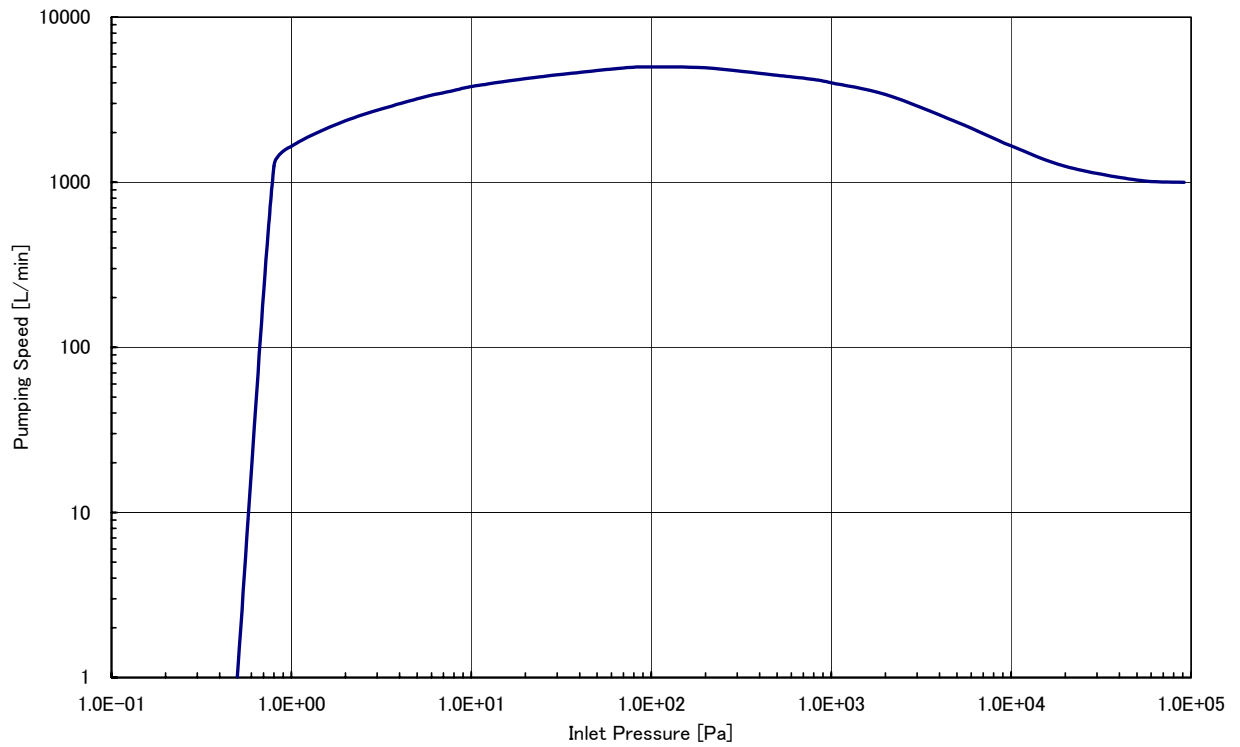
Note 2) This does not denote an allowable value of steady voltage, but not an allowable value of variation.

Note 3) N₂ gas purge is required to suck corrosive gas.

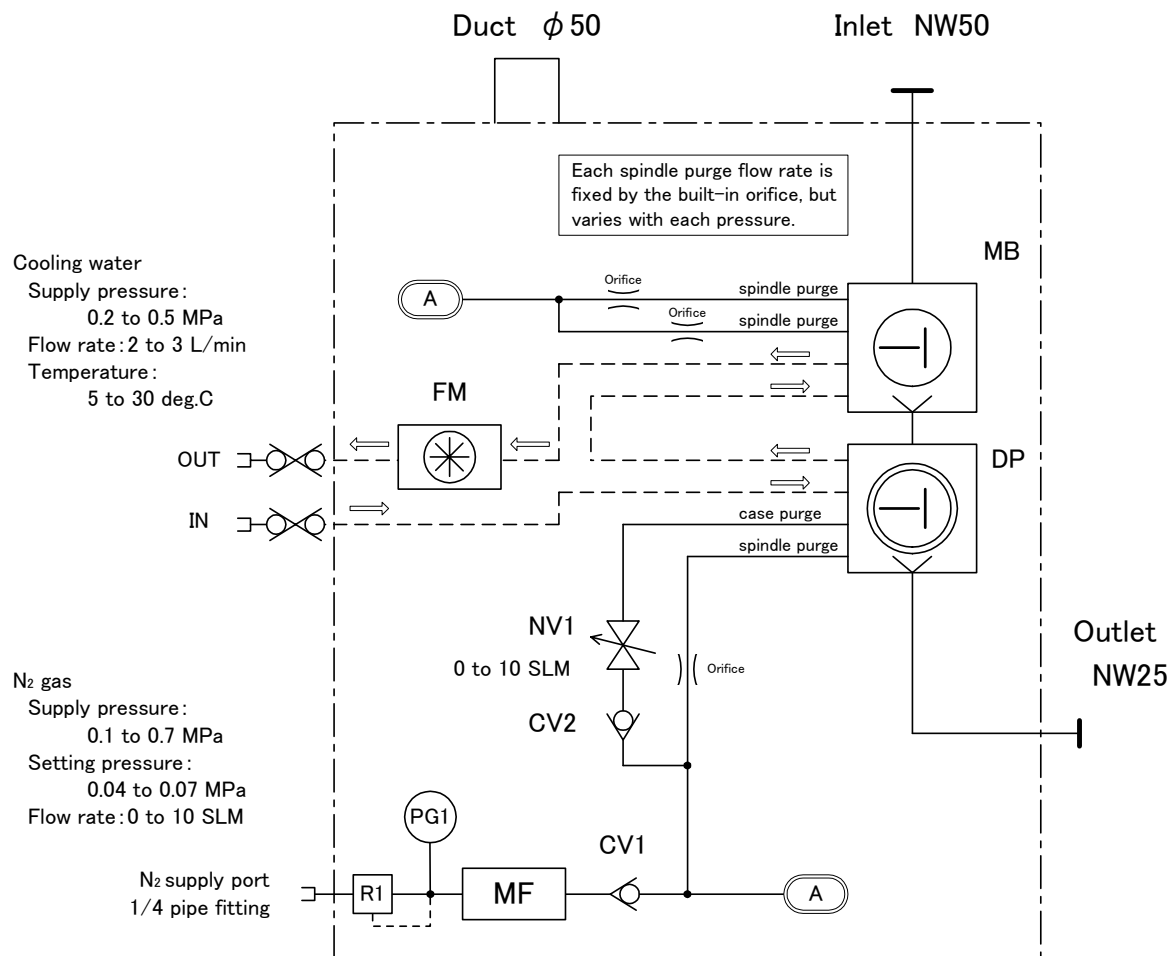
3.6 External View



3.7 Pumping Performance



3.8 System Flow Diagram



No.	Symbol	Name	Quantity
1	MB	Roots vacuum pump	1
2	DP	Dry vacuum pump	1
3	NV1	N ₂ control valve	1
4	FM	Cooling water flow meter	1
5	MF	N ₂ mass flow meter	1
6	R1	Regulator	1 set
7	PG1	Pressure Gauge	
8	CV1	Check valve	1
9	CV2	Check valve	1

4. INSTALLATION OF THE PUMP

The exhaust performance of the dry vacuum pump is affected by the opening diameter and length of the suction/exhaust pipe and the performance of the installed peripheral units. Moreover, when corrosive gas is exhausted, proper maintenance for each use is required to operate the pump normally for a long time. When the pump is installed, valves and pipes required for maintenance should be installed beforehand to secure higher maintenance efficiency. Adopt pipes and sealing parts in consideration of corrosion resistance.

4.1 Installation

WARNING

When lifting the pump, secure safety by a worker qualified for operating the forklift truck or crane.

WARNING

Don't stand under the lifted pump in any case; otherwise injury may be cause by falling.

Use proper wires (lifting by four points) and a proper crane for lifting the pump, which are suitable for the weight of the pump.

When lifting the pump, make the lifting angles of four wires equal so that the load may not be one-sided. (Fig. 4.1)

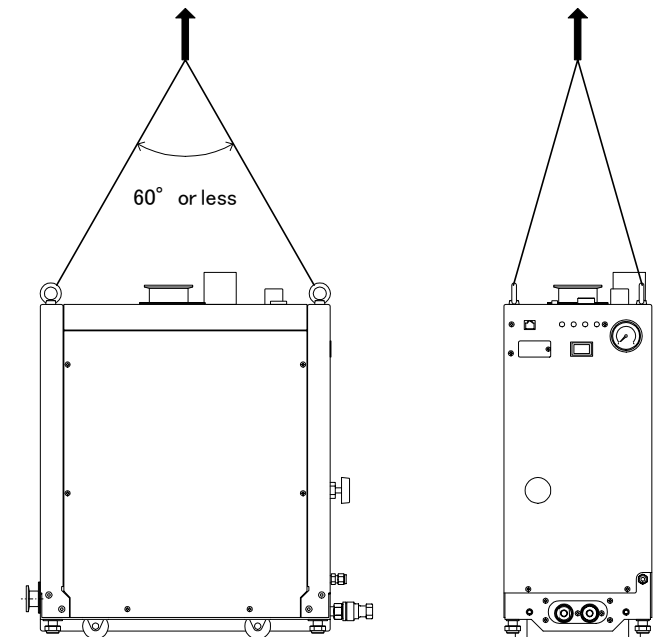


Fig.4.1 How to Lift the Pump

CAUTION

Don't get on the pump or put a thing on it; otherwise falling or turnover may be caused.

- * Install the pump indoors.
- * Install the pump on a solid and level surface of the floor.
- * Allow a proper space around the pump so that the pump may be installed and maintained smoothly.
- * Be careful not to make the temperature exceed 30 deg. C and not to make the humidity exceed 80% around the pump while it is operating, especially in closed place, because that may cause dew condensation inside the pump.
- * Fix the N₂ and cooling water pipes and cables securely.
- * Avoid installing the pump in the following places:
 - a) Outdoors, a place that may be splashed with water, and a place of extremely high humidity. (A place of 80% or higher humidity is not proper.)
 - b) A place where a toxic gas such as acid and alkali gases exists.
 - c) A place where an explosive or combustible gas exists.
 - d) A dusty place.
- * When moving the pump, use the caster provided on the base.
For preventing the pump from moving and for leveling, use the adjuster provided on the base.
- * When fixing the pump, adjust the adjuster so that the 4 casters may float above the floor (approx. 5mm or 10 mm max.) (Fig. 4.2)

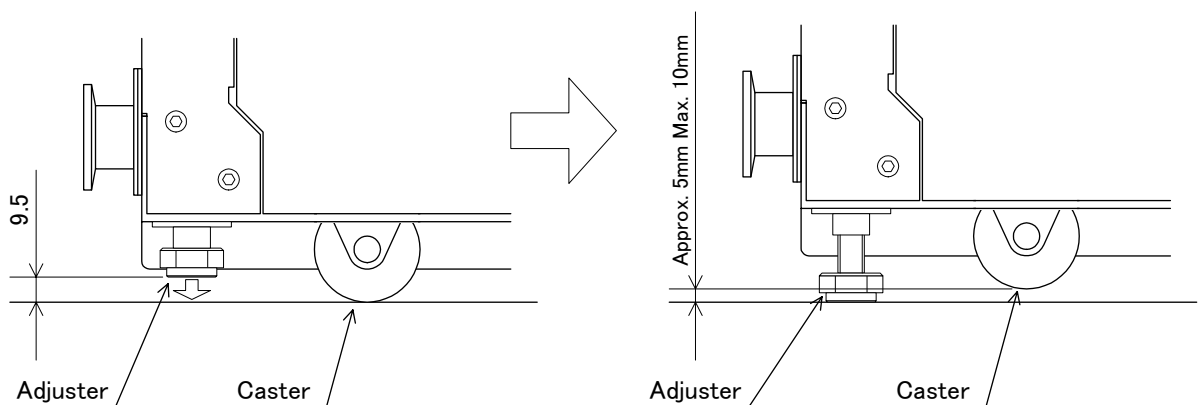


Fig.4.2 Procedure for Adjusting Adjuster

- * The pump is a heavy material (MU300: 100 kg). To facilitate the maintenance work, install the pump on the floor.
- * When moving the pump by pushing it, push it in the longitudinal direction. If the pump is pushed in the transverse direction, it may be overturned.
- * When moving pump on the uneven place, please put the pump on the carriage.
- * Removing the lifting bolts is possible after installing the pump. Please keep the removed bolts carefully.

4.2 Piping

4.2.1 Vacuum and exhaust piping

Connect a vacuum pipe and an exhaust pipe to the suction port and the exhaust port, respectively. The suction port of the dry pump is an NW50 quick flange, while the exhaust port of this pump is an NW25 quick flange. Perform piping or make connections to different parts by using these flanges.

WARNING

If any leak exists in the suction/exhaust pipe when toxic gas, corrosive gas or combustible gas is exhausted or sucked, a man-caused accident, fire, or explosion may be caused.

WARNING

Because the temperatures of the suction and exhaust pipes of the pump become high, arrange them so that they may not come in contact with the human body and combustible materials.

CAUTION

When exhausting corrosive gas, combustible gas, etc., adopt high corrosion-resistant materials for pipes and parts used on both suction port and exhaust port sides.

- * Use clean pipes without any foreign material for piping.
- * Don't install a heavy material directly at the suction port and the exhaust port; otherwise a leak or damage will be caused to the connecting portions.
- * It is recommended to use a stainless flexible joint between the pump and a pipe.
- * Don't stick any dust or foreign material on the flange seal surface or don't give damage to the flange seal surface.
- * To keep the exhausted system in a vacuum condition when the pump is stopped, install a vacuum shut-off valve between the pump and the exhausted system.
- * If there is a possibility that dust may be absorbed, install a proper scale trap at the first stage of the pump.
- * Take it into consideration to allow enough conductance for piping and exhaust gas processing facilities so that the pressure on the exhaust port side (back pressure) of this pump may be 3 kPa or less.

4.2.2 Cooling water piping

- * Before operating this pump, be sure to cause cooling water to flow. For connecting the cooling water pipe, use the self-seal type one-touch couplers provided at 2 positions in the lower part of the front side of the pump.
The connecting screw size of the self-seal type one-touch coupler is Rc3/8.
- * Install a flow rate control valve outside the pump.
(This control valve is not attached inside the pump.)

Supply pressure	0.2 to 0.5 MPa
Temperature	5 to 30 deg. C
Flow rate	2 to 3 L/min

CONFIRMATION

Use a cooling water pipe with a sufficient thickness. If the pipe diameter is small, the required cooling water volume cannot be secured. The pipe diameter should have an allowance in consideration of pressure loss in the piping system. Furthermore, secure a differential pressure of 0.2 MPa or more between the water supply port and drain port in the supply/drain facilities.

CONFIRMATION

Don't use poor-quality water or hard water as cooling water, otherwise clogging will be caused in the cooling water system, leading to an alarm stop due to abnormal heat generation of the pump. Use water that does not contain lots of impurities according to the following table.

Standard Water Quality for Industrial Water Supply
(Japan Industrial Water Works Association, Industrial Water Quality Standardization Committee)

Pollution	(ppm)	20
pH		6.5 to 8.0
Alkalinity (CaCO ₃)	(ppm)	75
Hardness (CaCO ₃)	(ppm)	120
Evaporation residue	(ppm)	250
Chlorine ion	(ppm)	80
Iron content	(ppm)	0.3
Manganese	(ppm)	0.2

4.2.3 N₂gas purge piping

N₂gas purging is always necessary with the exception of clean gas exhaust. Especially, make sure to purge N₂ when exhausting condensable gas such as water vapor. For connecting a N₂gas purge pipe, use the connecting port provided in the lower part of the front side of the pump.

Supply pressure	0.1 to 0.7 MPa
Setting pressure	0.04 to 0.07 MPa
Flow rate	0 to 16.7 Pa·m ³ /s (0 to 10 SLM)*

* The N₂gas purge flow rate depends on each process. (Refer to page 30 and 31.)

CAUTION

Be sure to close the N₂ gas supply port with a blank plug when N₂ gas is not supplied; otherwise leakage may be caused.

1) Piping procedure

- a) Applicable tube size : 1/4 in.
- b) Cut the tube in perpendicular form and eliminate burrs at the end. Take extreme care not to give damage to the external diameter portion.
- c) Stop turning for the hexagonal portion on the main body side of the joint with a wrench and remove the existing lock plug with a wrench.
- d) Insert the nut and ferrules into the tube until the end of the tube comes to the main body of the joint, and screw the nut by hand until it is locked. (Fig. 4.3)
- e) Stop turning for the hexagonal portion of the main body side of the joint and tighten the nut by 1+1/4 turns with a wrench. For retightening the nut which was tightened once, tighten it by 1/4 turn with a wrench from the lock status provided by hand-tightening.

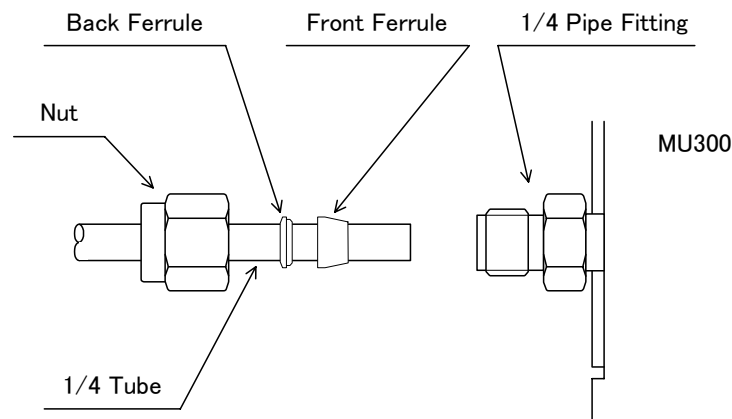


Fig. 4.3 Piping procedure

- 2) If a pipe is not connected, don't loosen the existing lock plug.

The flow control valve attached to the pump is for a case purge, it cannot intercept spindle purge lines.

4.2.4 Box exhaust piping

Hot air is exhausted from the pump package.
If box exhaust is not executed, troubles may occur owing to the inside temperature rise.

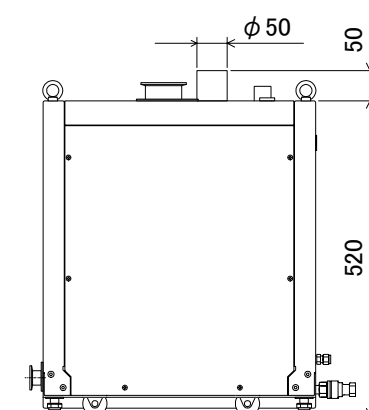


Fig. 4.4 Box exhaust connecting port dimensions

4.3 Electric Wiring

The earth leakage breaker is not installed on this pump.
Be sure to supply power from a power source, which is protected by an earth leakage breaker suitable for the following specifications.

Rated Voltage	AC 250 V
Rated Current	20 A
Rated Sensitivity Current	15 mA

DANGER

Before completion of electric wiring work, don't supply power in any case; otherwise an electric shock may be caused.

WARNING

The execution of wiring work is limited to qualified workers.

CONFIRMATION

Don't supply power from the inside of the pump package or the controller to other apparatus; otherwise a malfunction will be caused to the control system or a failure may be caused to the pump.

4.3.1 Power wiring (Connector symbol : CN1, power supply)

WARNING

Be sure to perform grounding, otherwise an electric shock may be caused by electric leak.

Use wiring materials suitable for the pump power.

Table 4.1 Power Supply and Built-in Fuse Specifications

		MU300
Power supply		3 Phase, AC 200 to 220 V, 50/60 Hz
Fuse	Rated Voltage	AC 250 V
	Rated Current	20 A
	Ampere Interrupt Capacity	10,000 A / AC 250 V
	Size	O.D. 10.3 x 38.1 (Length)

For pin connections of the power connector, refer to Fig.4.5, Table 4.2, and Table 4.3.

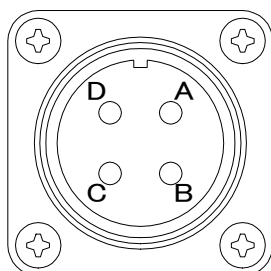


Fig.4.5 CN1 Pump-side Receptacle

Table 4.2 CN1 Receptacle Pin assignment

Pin No.	Phase
A	R
B	S
C	T
D	PE

Table 4.3 CN1 Receptacle Specifications

Receptacle model	CE05-2A18-10PD-B
Connector maker	Daiichi-Denshi Kogyo K.K.
Applicable plug (Note 1)	CE05-6A18-10SD-B-BSS
Cable-cramp (Note 1)	CE3057-10A-1
Applicable wire size	AWG #12 (3.5 mm ²)

Note 1) Applicable plug and cable-cramp are standard accessories.

4.3.2 Control wiring (Connector symbol : CN2, remote control input/output)

To perform remote operation or monitoring, perform wiring to CN2.
For pin connections, refer to Fig.4.6, Fig.4.7, and Table 4.4.

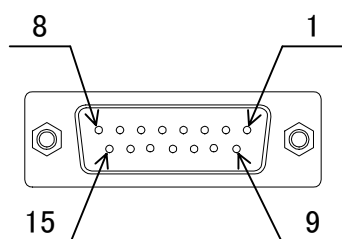


Fig.4.6 CN2 Pump-side Receptacle

Table 4.4 CN2 D-sub Receptacle Specifications

	CN2
D-sub model	DA-15SF-N
Fixed screw	M 2.6
Connector maker	Japan Aviation Electronics Ind., Ltd.
Applicable plug (Note)	DA-15PF-N
Clamp hood (Note)	DA-C8-J10-F1-1
Applicable wire size	AWG #24-20 (0.2-0.5mm ²)

Note) Applicable plug and clamp hood are standard accessories.

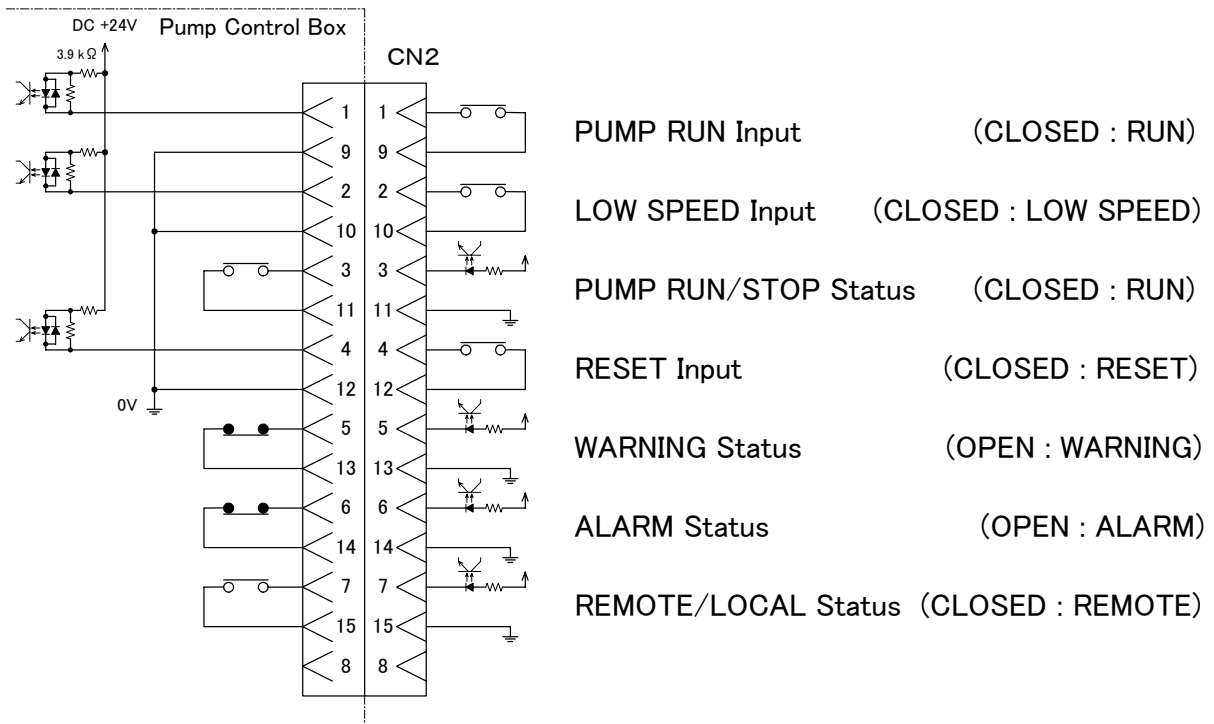


Fig.4.7 CN2 D-sub Connector Pin connections

The Output signal of the control circuit is as follows.

Output	Contact capacity	DC24V / 1A
	Minimum applicable load	DC5V / 1mA

CONFIRMATION

For Input signals (Pin No. 1, 2, 4), apply a voltage of 24V DC on the pump controller side. Don't apply a voltage on the equipment side, otherwise the controller may go wrong.

The output signals (pin No. 3-11, 5-13, 6-14, 7-15) are no-voltage relay contact outputs. Apply a voltage of 24 V DC, 1A or less on the equipment side.

CONFIRMATION

When the inductive load is opened or closed by output signal, please connect a surge-absorbing element such as diode at the both sides of the load. There is a possibility that the internal relay contact may go wrong or noise may be caused.

5. LCD CONTROLLER

The handheld controller is used to operate and stop the pump in the local mode (the local operation). Connect the handheld controller attachment cable with the connector (CN3) of the rear panel of the pump.

The pump operating status and pump data are indicated on the LCD (Liquid Crystal Display) of the handheld controller. The pump operating status can be confirmed by LEDs on the rear panel of the pump body when the handheld controller is removed.

5.1 Controller Functions

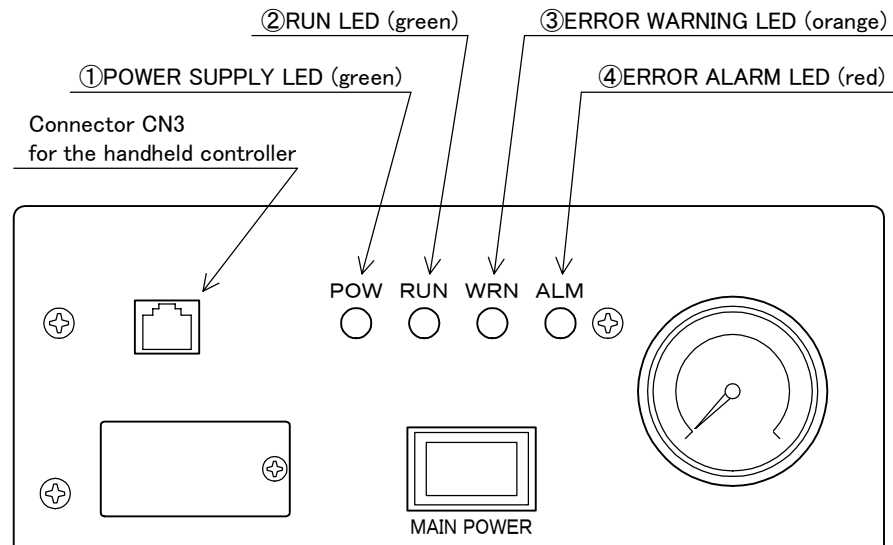


Fig. 5.1 LED on the front panel of the pump body

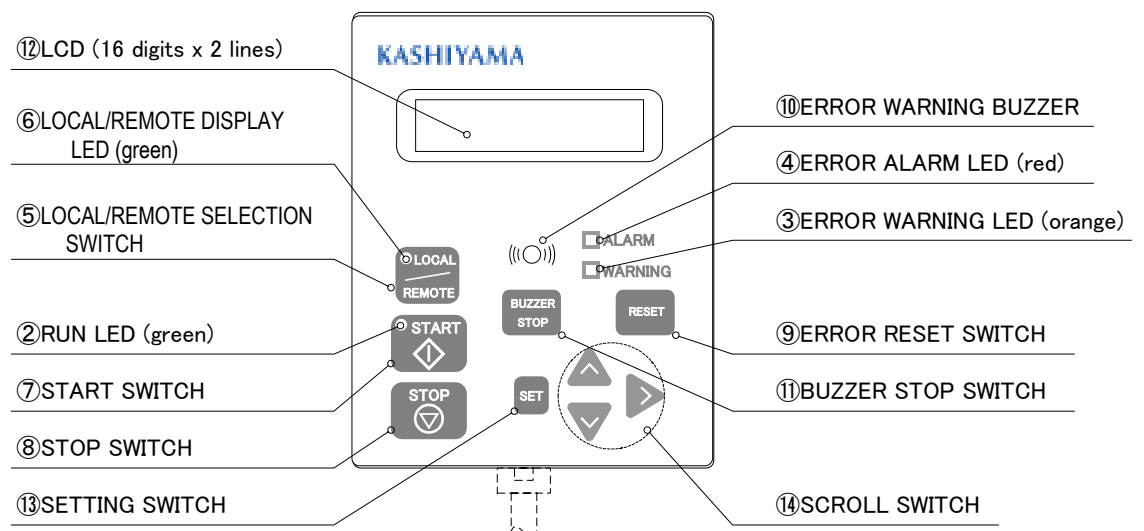


Fig. 5.2 Appearance of the handheld controller

- 1) POWER SUPPLY LED (green)
This LED comes on when the power is supplied to the pump and the main switch is on, and goes out when the switch is off.
- 2) RUN LED (green)
This LED comes on when the dry pump runs and goes out when stops.
(Regardless of the LOCAL/REMOTE status)
- 3) ERROR WARNING LED (orange)
This LED comes on in the ERROR WARNING status. When the WARNING status is cleared and a rest operation is normally performed, the LED will go out.
(Regardless of the LOCAL/REMOTE status)
- 4) ERROR ALARM LED (red)
This LED comes on in the ERROR ALARM status. When the ALARM status is cleared and a rest operation is normally performed, the LED will go out.
(Regardless of the LOCAL/REMOTE status)
- 5) LOCAL/REMOTE (local control/remote control) SELECTION SWITCH
This switch is used to select LOCAL (local control) or REMOTE (remote control). Each time this switch is pressed, one of them is selected. When changing REMOTE over to LOCAL, if the pump is in operation, the operation will be continued. If the pump is at a stop, the pump will remain in the stop status. Changing from LOCAL over to REMOTE is attained in the REMOTE input status
- 6) LOCAL/REMOTE (local control/remote control) DISPLAY LED (green)
This LED comes on in the LOCAL (local control) status.
- 7) START SWITCH
This switch is used to start the pump in the LOCAL (local control) status.
* Press the switch continuously for 0.5 sec or more.
(If the switch is pressed for less than 0.5 sec, the RUN command will be canceled.)
- 8) STOP SWITCH
This switch is used to stop the pump in the LOCAL (local control) status.
- 9) ERROR RESET SWITCH
This switch is used to reset the ERROR WARNING or ALARM status. In the LOCAL (local control) mode, the abnormal status can be reset by this switch if the cause of the abnormal status has been removed. In the REMOTE (remote control) mode, the function of this switch becomes ineffective. Accordingly, for resetting, this switch must be operated in the REMOTE input mode.
- 10) ERROR WARNING/ALARM BUZZER
This buzzer sounds intermittently in the Warning status and continuously in the Alarm status.
(Regardless of the LOCAL/REMOTE status)
It sounds briefly only once for confirmation when a switch of the handheld controller is pushed, independently of the error status.

11) BUZZER STOP SWITCH

This switch is used to stop the buzzer sounding in the error status. But the error status can not be reset by this switch.

(Regardless of the LOCAL/REMOTE status)

12) LCD (16 digits x 2 lines)

This display indicates
PRESENT DATA
WARNING LEVEL
ALARM LEVEL
PUMP DATA
ERROR LIST
SET MB/SPEED

13) SETTING SWITCH

This switch is used to change the preset value of the ERROR WARNING and the date and time.

14) SCROLL SWITCH

This switch is used to scroll the title indication (▷) and to check its details(▽, △).

It is also used to change the numerical value and the digit when the preset value of the ERROR WARNING and the date and time are changed.

5.2 Error Levels

In this controller, two levels (ALARM, WARNING) of error mode are set depending on the level of error. Refer to the following Table 5.1.

Table 5.1 Pump Interlock Levels

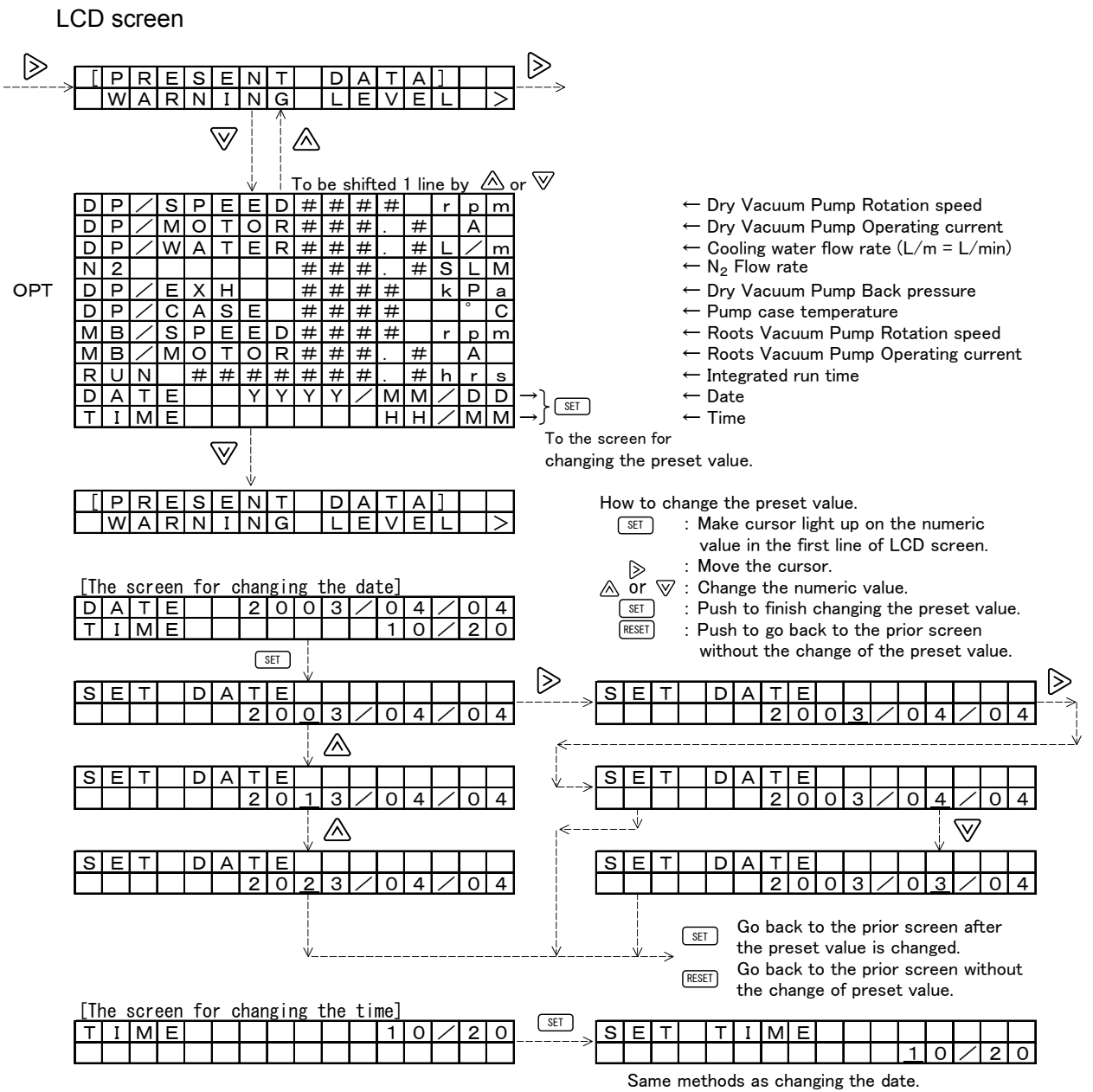
ERROR LEVEL	Pump/Controller operation on detection of error			
	Detect before running and on starting	Detect on running	LED indication Buzzer operation	Note
ALARM	Impossible to start	Stop	ALARM LED: Lighting BUZZER: Continuously	
WARNING	Impossible to start	Continuation of running	WARNING LED: Lighting BUZZER: Intermittently	Possible to start only in N ₂ purge error status.

CONFIRMATION

The pump does not stop upon occurrence of an error of WARNING level. However, if the pump operation is continued in this condition, the pump may stop or go wrong on a sudden.

5.3.1 PRESENT DATA

The present pump data, the date and total operating hours can be indicated.



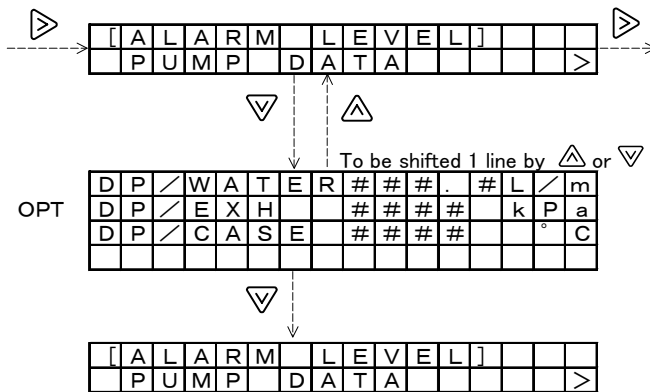
Note) "#" Indicates the present pump data.

Note) "OPT" is optional setting. It is not indicated when the option is not being installed.

5.3.3. ALARM LEVEL

The preset value for ALARM can be indicated.
In case of Alarm, pump stops with the alarm sign.

LCD screen



The factory preset value

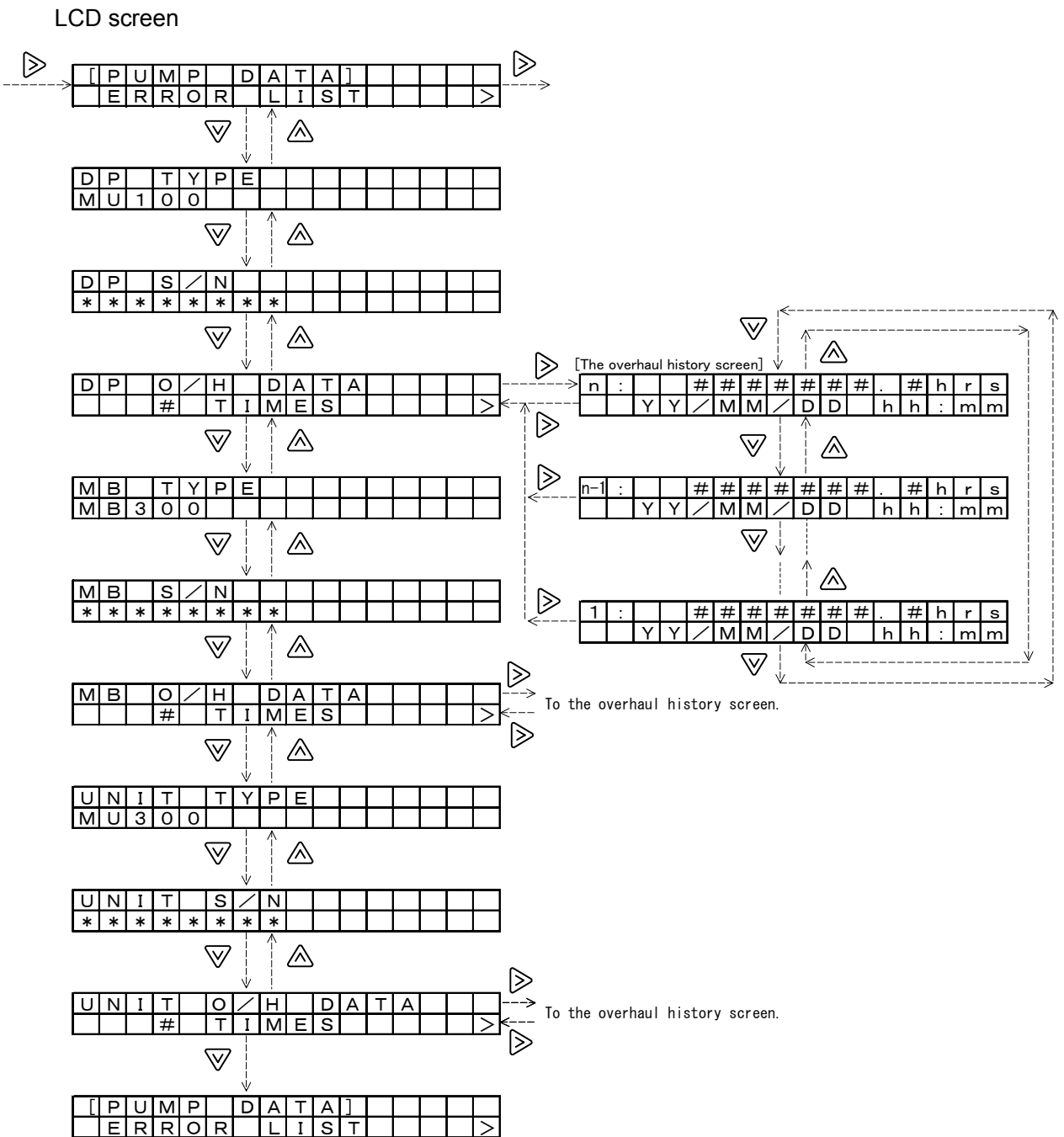
	MU300
DP / WATER	1.0 L / m
DP / EXH	30 kPa
DP / CASE	110 deg. C

Note 1) The preset value for the error of Alarm can not be changed.

Note 2) "OPT" is optional setting. It is not indicated when the option is not being installed.

5.3.4. PUMP DATA

Pump type, serial No. and overhaul history can be indicated.

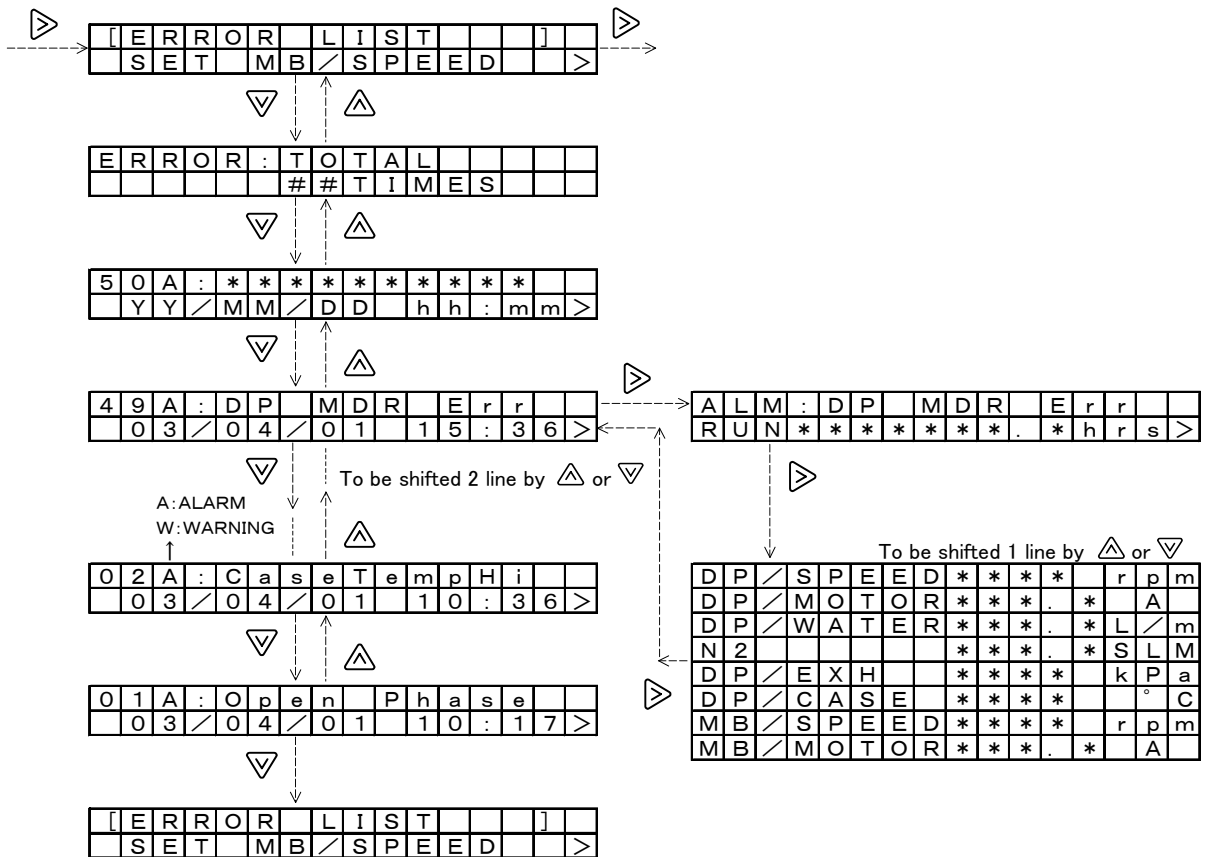


Note) Each overhaul history of MB, DP and unit can be indicated up to the past 9 times at the maximum.

5.3.5. ERROR LIST

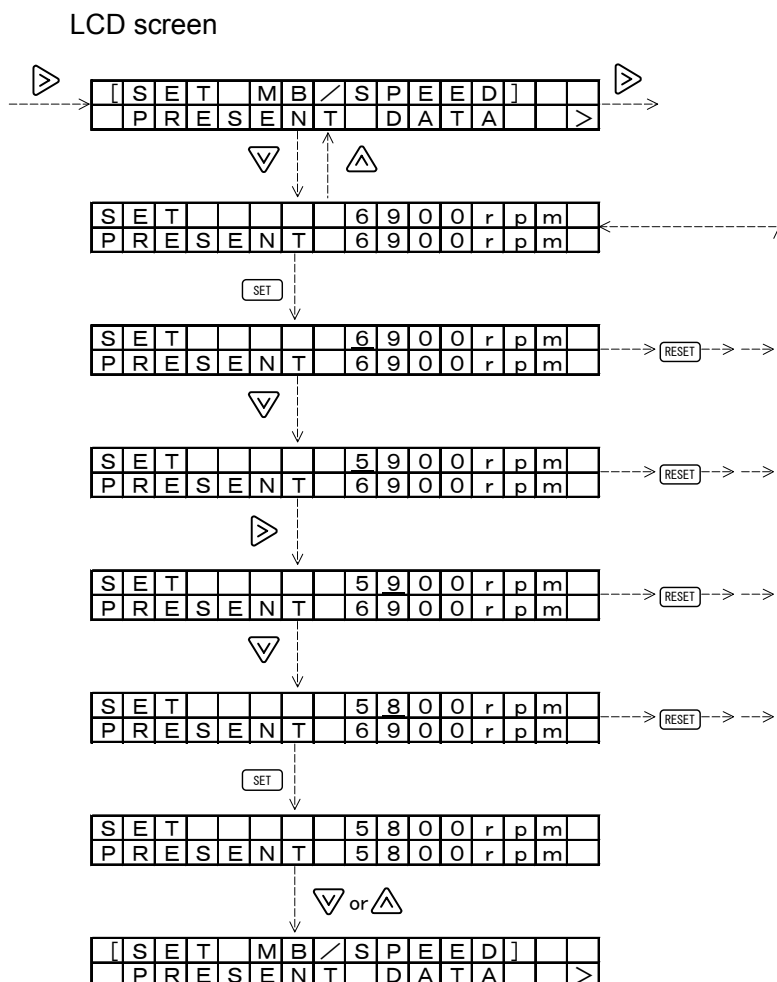
The error records of WARNING/ALARM occurred in the past can be indicated. 50 errors can be memorized at the maximum and older records would be deleted if exceed 50.
 Pump data, date and time when the error occurred can be memorized as well.

LCD screen



5.3.6. SET MB/SPEED

The rated rotation speed of MB can be adjusted. Although this setting value is effective while the power is on, if a power is off, the setting value will be eliminated and will return to the initial-setting value.



Setting Range for MB rotation speed.

	MU300	Application
The rated rotation speed	6900 rpm	The factory preset rotation speed
Maximum rotation speed	6900 rpm	
Minimum rotation speed	2000 rpm	

- Note 1) Change of rotation speed cannot be performed in "REMOTE" mode. Please carry out after changed into "LOCAL" mode.
- Note 2) The character of "TuningSPD" blinks to the LCD display part when the pump rotation speed is changed.
- Note 3) The performance of the pump will change if the rotation speed is changed. Please contact us about the pump performance in the case of changing the rotation speed.
- Note 4) Please contact us if the changed rotation speed is requested to be memorized and become effective when the power is turned on again.

6. OPERATION AND STOP

6.1 Preparations for Operation

- 1) Check if electric wiring is correctly and securely performed.
- 2) Check if the suction pipe and the exhaust pipe are securely connected. When a valve is installed on the exhaust side, open the valve securely before starting the pump.
- 3) Cause cooling water to flow at a flow rate of 2 to 3 L/min.
Check if any water leak does not occur.
- 4) Adjuster and operate the N₂ gas purge flow rate according to the following method.

CAUTION

For diluting toxic gas to the safe concentration by means of N₂ purging, connect an N₂ purge pipe to the exhaust side separately.

CAUTION

Be sure to close the N₂ gas supply port by a blank plug when N₂ gas is not supplied; otherwise leakage may be caused.

a. N₂ purge mode

The standard N₂ purge flow rate is shown in the following table. Note that the N₂ purge flow rate depends on each applied process.

Mode of N ₂ purge	Operation		N ₂ flow rate Pa*m ³ /s (SLM)	Caution
	Supply port	Valve for case		
Mode of no-purge	Seal with a blank plug	Close	0	At the mode of no-purge, be sure to seal the N ₂ supply port with a blank plug.
Mode of spindle purge	N ₂ supply (Setting pressure: 0.04 to 0.07 MPa)	Close	0.8 (fixed) (Approx. 0.05)	The flow rate for the spindle purge is fixed by the built-in orifice, but varies with each pressure. (Approx. 0.8 Pa*m ³ /s (approx. 0.5 SLM) at 0.05 MPa)
Mode of case purge		Open (Flow rate control)	0.8 to 16.7 (Approx. 0.5 to 10)	Refer to the following table and set.

b. Suggested N₂ purge flow rates

The standard N₂ purge flow rate is shown in the following table.
Set up the N₂ purge flow rate depends on each applied process.

	Process		
	Exhaust to the air	Spattering	Light process (Note 1)
Mode of N ₂ purge	No-purge	Spindle purge (Note 2)	Spindle purge (Note 2) + case purge
Setting pressure	Seal with a blank plug	0.04 to 0.07 MPa	
N ₂ flow rate	0	0.8 Pa*m ³ /s (Approx. 0.5 SLM)	0.8 to 16.7 Pa*m ³ /s (Approx. 0.5 to 10 SLM)

Note 1) Light process : Light Etching, etc.

Note 2) The flow rate for the spindle purge is fixed by the built-in orifice, but varies with each pressure.

N₂ purge flow rate is approx. 0.8 Pa*m³/s (approx. 0.5 SLM) at 0.05 MPa.

When flow rate is 0.3SLM or less, the handheld controller displays as "0.0".

6.2 Operation

6.2.1 Local (local control) operation

- 1) Supply power to the pump.
- 2) Switch on the MAIN POWER switch of the pump. At the time, POW LED on the pump will come on.
- 3) Select "LOCAL" by the REMOTE/LOCAL selection switch on the controller.
(The LOCAL LED on the handheld controller will come on.)
- 4) Push the START switch on the controller continuously for 0.5 seconds or more.
- 5) The pump will be started and the START LED on the handheld controller and the RUN LED on the pump will come on.
At the time, the PUMP RUN/STOP Status signal will be put into a make state.
(Closing Pin 3-11)

* When the pump is operated by cold starting, the performance at steady operation cannot be obtained at the ultimate pressure and the exhaust speed for about one hour after it is started. When causing condensative gas or corrosive gas to flow, operate the pump for about one hour after starting it, and then exhaust the corresponding gas after the pump temperature rises.

6.2.2 Remote (remote control) operation

- 1) Check the power is supplied to the pump and the MAIN POWER switch of the pump is ON.
- 2) Select "REMOTE" by the REMOTE/LOCAL selection switch on the handheld controller.
(The LOCAL LED on the handheld controller will go out.)
- 3) Input the PUMP RUN signal from the remote control connector (CN2). (Closing PIN 1-9)
(For the details of input/output signals, refer to 4.3.2 Control wiring. (Page 17))
- 4) The pump will be started and the START LED on the handheld controller and the RUN LED on the pump will come on.
At the time, the PUMP RUN/STOP Status signal will be put into a make state.
(Closing Pin 3-11)

6.2.3 Low Speed operation (Effective only in remote operation)

- 1) Check the power is supplied to the pump and the MAIN POWER switch of the pump is ON.
- 2) Input the PUMP RUN signal from the remote control connector (CN2) in REMOTE mode to start the pump. (Closing PIN 1-9)
- 3) Input a LOW SPEED signal from the remote control connector (CN2). (Closing PIN 2-10)
(Note 1)
- 4) The pumps (MB and DP) will operate at the preset rotation speed for LOW SPEED. (Note 2)

(Note 1) The status of LOW SPEED operation continues even if REMOTE mode is changed to LOCAL mode. If LOW SPEED operation is requested to be cancelled in LOCAL mode, please stop the pump and start it again, and the pump can run at the rated rotation speed.

(Note 2) The preset rotation speed of MB and DP for LOW SPEED is 66.7 Hz (4000rpm) when being shipped from our plant. The rotation speed of MB can be changed from 33.3 Hz to 115 Hz (2000 to 6900 rpm) and the rotation speed of DP can be changed from 33.3 Hz to 113.3 Hz (2000 to 6800 rpm). However, please consult us when changing the preset rotation speed for LOW SPEED is necessary. (Refer page (ii) for where to call)

6.3 Stop

WARNING

While the pump is in operation or for a while after it is stopped, the temperature of the pump is high. Don't bring the human body or combustible materials into contact with the pump, otherwise a burn may be caused.

CONFIRMATION

When condensable gas such as water vapor was exhausted by MU300, please keep it running with N₂ purge for about one hour after completion of the process. There is a possibility of pump failure arising from corrosion or other factors when condensed moisture, etc. remains inside the pump.

When there is a possibility of freezing while the pump is stopping, admit compressed air into the cooling water outlet and drain the cooling water from the inlet, otherwise that may cause the damage on the pipes for cooling water and the water leakage may occur.
(Refer to Page 34 7-3 Section 4 about how to drain the cooling water.)

- * Close the cut-off valve on the suction port side of the pump as required.
(To keep the inside of the exhausted system in a vacuum in the pump stop status, it is necessary install a vacuum shut-off valve between the exhausted system and the pump and then close this valve before the pump is stopped.)
- * When condensable gas such as water vapor or process gas has been exhausted, operate the pump continuing N₂ gas purge for about one hour after completion of the process, and then stop the pump. Continue this N₂ gas purge for several minutes in this condition and then stop the supply. This is intended to prevent exhausted different types of gas from staying in the pump by substituting N₂ gas for the inside of the pump with the object of avoiding corroding the inside. As the quantity of exhausted gas and products produced by reaction increases, perform N₂ gas purging for a longer time.
- * If there is an open/close valve on the exhaust port side of the pump, close this valve. If such a valve is not available, continue N₂ gas purging even when the pump stops, or performing sealing with a blank flange to prevent air or process gas from entering from the exhaust port.
- * After the pump stops, cause cooling water to flow continuously for about one hour.

6.3.1 Local (local control) stop

- 1) Push the STOP switch on the handheld controller.
- 2) The pump operation will stop and the START LED on the handheld controller and the RUN LED on the pump will go out.
The PUMP RUN/STOP Status signal will be put into an open state. (Opening Pin 3-11)

6.3.2 Remote (remote control) stop

- 1) Put the PUMP RUN contact of the remote control connector (CN2) into an open state.
(Opening PIN 1-9)
- 2) The pump operation will stop and the START LED on the handheld controller and the RUN LED on the pump will go out.
The PUMP RUN/STOP Status signal will be put into an open state. (Opening Pin 3-11)

6.4 Operation upon Occurrence of Momentary Power Interruption

When momentary electronic power failure occurs while the pump is running, power supply will stop. However, the control system holds the status before the momentary electronic power failure for a while.

The system holds the status before the power failure for about 0.4 seconds.

Reaction after the power recovery

- In case that power failure is less than 0.4 seconds : Continuation of operation
 In case that power failure is over 0.4 seconds : Go back to the state which have supplied power. (Standby status)

7. MAINTENANCE

7.1 Maintenance Method

WARNING

When opening the inside of the pump or piping facilities to check if the pump exhaust port is clogged with reaction products, take the following measures as required to secure the safety for workers in consideration of the toxicity or septicity of exhaust gas.

- * Purge N₂ gas completely before removing the pump or piping facilities.
- * Put on protective clothes, protective gloves, protective glasses, protective mask, etc. as required.
- * Perform ventilation enough for the workshop.
- * Collect residual materials such as waste oil and dispose of it in a proper way.

In order to the safe operation of this pump and maintain its performance for a long time, take the following points into consideration.

- a) Operate the pump within the range described in the catalog and the instruction manual.
- b) Perform inspection as specified in the maintenance standard.
- c) For disassembly and inspection or overhaul, return your product to Kashiya Industry Co., Ltd. or a dealer approved by us.
Please consult with our business office or Shinshu Plant, CS Section beforehand.
Perform an overhaul once every year. However, when the gas to be absorbed is very reactive or corrosive, it may be necessary to perform an overhaul within one year.

<REQUEST>

A pump that used toxic gas has a danger to be invited by residual gas at an overhaul. When returning the pump, substitute N₂ gas for the inside of the pump completely and seal the suction port and exhaust port with blank flanges. Also, describe necessary items including applied gas in the Return Notice Sheet attached to the end of this manual. Then, sent this sheet to us before returning the pump units.

We may not undertake an overhaul of pumps that absorbed arsenic gas or phosphorous gas. Please consult with our business office or Shinshu Plant, CS Section beforehand.

- d) In case of products of special specifications, the maintenance period and method may be different. Please ask us for information.
- e) When the pump must be stopped for a long time for reasons of holidays or the like, stop the pump and perform N₂ purging completely. Then, seal the suction port and exhaust port of the pump with blank flanges at once.
(This is intended to prevent process gas or air from entering the inside of the pump.)
- f) When the pump must be stopped for the sake of maintenance of exhaust gas processing facilities, check if the exhaust port of the pump is not clogged with products. If lots of products are stuck at the port, replace or clean the piping parts.

Regarding repairing service, please ask your nearest business office or Shinshu Plant for information.

7.2 Maintenance Standard

✕ Inspection
○ Replacement

Inspection and Maintenance item		Contents	To be Executed by user	Inspection and maintenance execution time			Remarks
				To be executed by Kashiwama or its approved dealer			
				Every 8000 hours or 1 year	Every 16000 hours or 2 years	5 years	
MB	Oil	Replacement		○ (O.H)			
	Gas-contact part	Disassembly, cleaning, and inspection		✕ (O.H)			
	Bearing	Replacement		○ (O.H)			
	A set of O-rings	Replacement		○ (O.H)			
	A set of spindle seals	Replacement		○ (O.H)			
	A set of gears	Replacement			✕		Replace it depending on the condition
DP	Oil	Replacement		○ (O.H)			
	Gas-contact part	Disassembly, cleaning, and inspection		✕ (O.H)			
	Bearing	Replacement		○ (O.H)			
	A set of O-rings	Replacement		○ (O.H)			
	A set of spindle seals	Replacement		○ (O.H)			
	A set of gears	Replacement			✕		Replace it depending on the condition
	A set of Ball Check-Valve	Replacement		○ (O.H)			
Battery for controller	Replacement				○		

"(O.H)" denotes an item to be executed at last at an overhaul.

Note) Perform an overhaul every year.

7.3 Removal of the Pump

DANGER

Before completion of electric wiring work, don't supply power in any case, otherwise an electric shock will be caused.

WARNING

- *The execution of wiring work is limited to qualified workers.
- *When lifting the pump, secure safety by a worker qualified for operating the forklift truck or crane.
- *Don't stand under the lifted pump in any case; otherwise injury will be caused by falling.
- *The pump is at a high temperature for a while after it is stopped. Avoid bringing the human body or combustible materials into contact with it. If not, a burn may be caused. After confirming that the pump has been cooled completely, perform the work.

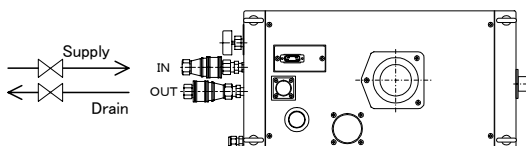
CONFIRMATION

When draining the cooling water, make sure to introduce the compressed air into the cooling water outlet in order to drain water from the inlet. If the compressed air is introduced into the cooling water inlet, the flow meter may be damaged.

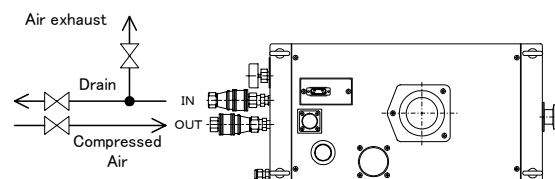
For removing the used pump, observe the following procedure.

- 1) Stop the pump and substitute N₂ gas for the inside of the pump completely.
- 2) Stop supplying power and disconnect the power connector and control connector.
- 3) Stop supplying N₂ gas and remove the pipe, and then seal the purge gas supply port.
- 4) Stop cooling water, admit compressed air into cooling water outlet and drain the cooling water from inlet, and then remove the pipe with the one-touch coupler.
(Refer to the following drawing for the piping system.)

The piping system at the time of operation



The piping system at the time of draining.



- 5) Remove the suction pipe and the exhaust pipe, and seal the suction port and the exhaust port with blank flange.
- 6) Packing
- 7) When loading the pump or unloading, lift the pump by using upper eyebolts.
(Refer to page 12)

8. TROUBLESHOOTING

 **DANGER**

Before completion of electric wiring work, don't supply power in any case; otherwise an electric shock will be caused.

 **DANGER**

Disconnect power connector before starting maintenance work; otherwise an electric shock may be caused.

 **WARNING**

The execution of wiring work is limited to qualified workers.

 **WARNING**

While the pump is in operation or for a while after it is stopped, the temperature of the pump is high. Don't bring the human body or combustible materials into contact with the pump; otherwise a burn may be caused.

 **WARNING**

When the pump needs to be overhauled or disassembled, with the pump package removed, consult with our sales department or our designated service center.

 **WARNING**

When opening the inside of the pump or piping facilities to check if the pump exhaust port is clogged with reaction products, take the following measures as required to secure the safety for workers in consideration of the toxicity or septicity of exhaust gas.

- * Purge N₂ gas completely before removing the pump or piping facilities.
- * Put on protective clothes, protective gloves, protective glasses, protective mask, etc. as required.
- * Perform ventilation enough for the workshop.
- * Collect residual materials such as waste oil and dispose of it in a proper way.

8.1 Primary trouble

Symptoms	Probable Causes	Corrective measures
POW LED does not come on after the main switch is turned on	Improper wiring to connector.	Check if correctly wired.
	The power isn't supplied to the pump.	Check the power is supplied to the pump.
	Defects of sensors	Defective sensors need to be Exchanged.
No indication at the handheld controller after the main switch is turned on.	Connector of the handheld controller is not connected.	Connect the connector to CN3 on the front panel of the pump body.
	Defects of sensors	Defective sensors need to be Exchanged.
PUMP does not start when START switch is pressed.	System is not up.	Turn on the main switch, and push START switch after about 7 seconds interval.
	Pressing time is short.	Keep on pressing more than 0.5 seconds.
	Operation mode is in REMOTE.	Select LOCAL mode on the handheld controller.
	Defects of sensors.	Defective sensors need to be Exchanged.
PUMP does not work when remote signal is input.	System is not up.	Turn on the main switch, and push START switch after about 7 seconds interval.
	Operation mode is in LOCAL.	Select REMOTE mode on the handheld controller.
	Improper wiring to connector.	Check if correctly wired.
	Defects of sensors.	Defective sensors need to be Exchanged.
Abnormal noise. Intense vibration	Some objects on the outside cover.	Take the objects away.
	Vises to fix the outside cover are loosened.	Tighten the vises.
	Resonance of flexible tubes for inlet/exhaust.	Fix the resonant part.
	Pump parts damages.	Pump exchange or overhaul is needed.
Insufficient Vacuum.	Pipe leakage in the fore line.	Check plumbing.
	Excess of N ₂ purge flow.	Adjust to the recommended flow rate.
	Right after warming-up of the pump.	Measure after one hour and more Operation.

8.2 Pump Malfunction

Reset the pump after corrective measures below have been taken. In case the cause should remain in breaker trip, the pump cannot be reset. When start signal is input while in remote operation, reset the pump after turning off the external signal as the pump runs on being reset. When the pump needs to be overhauled or disassembled, with the pump package removed, consult with our sales department or our designated service center.

Display on LCD Panel	Symptoms	Probable Causes	Corrective measures
ALM / WARN CW Flow Low	Low cooling water flow.	Cooling water coupler is disconnected.	Connect cooling water coupler properly.
		Lack of supply water.	Supply water in the range of 2 to 3 L/m.
		Insufficient supply pressure.	Supply pressure in the range of 0.2 to 0.5 MPa.
		Valve in the water supply path is closed.	Open the valve.
		Cooling water pips is clogged.	Cleaning or exchange of the pipe is needed.
		Water leakage in the water supply path.	Repair in water leakage area is needed.
		Adverse connection of cooling-water inlet/drain. (0 L/m is displayed)	Connect cooling-water inlet/drain correctly.
		Defects of sensors.	Defective sensors need to be exchanged.
ALM / WARN Case Temp Hi	Pump case temperature rise.	The temperature of cooling water is high.	Supply water in the range of 5 to 30 degrees C.
		Backing pressure rise.	Check exhaust piping.
		Pump error.	Pump exchange or overhaul is needed.
		Defects of sensors.	Defective sensors need to be exchanged.
ALM / WARN EXH Press Hi (Option)	Backing pressure rise.	Exhaust valve is closed.	Check vent-duct piping.
		Exhaust pipe is clogged.	Cleaning or exchange of the pipe is needed.
		Defects of sensors.	Defective sensors need to be exchanged.
WARNING N2 Flow Low	Low N2 flow.	N ₂ pipe is disconnected.	Connect N ₂ pipe properly.
		Insufficient supply pressure.	Supply pressure in the range of 0.1 to 0.7 MPa.
		Regulator setting pressure is low.	Supply pressure in the range of 0.04 to 0.07 MPa.
		N ₂ pipe is clogged.	Change of N ₂ pipe is required.
		Leakage from N ₂ pipe.	Repair in leakage area is needed.
		Defects of sensors.	Defective sensors need to be exchanged.
ALARM MB M Temp Hi	MB motor temperature rise.	The temperature of cooling water is high.	Supply water in the range of 5 to 30 degrees C.
		Motor failure.	Pump exchange or overhaul is needed.
ALARM DP M Temp Hi	DP motor temperature rise.	The temperature of cooling water is high.	Supply water in the range of 5 to 30 degrees C.
		Motor failure.	Pump exchange or overhaul is needed.
ALARM Open Phase	Open phase of a power supply	Improper wiring.	Check the power supply on the primary side.
		Open phase in internal wiring.	Pump exchange or overhaul is needed.
ALARM MB IPM Fail	MB IPM Failure	The temperature of cooling water is high.	Supply water in the range of 5 to 30 degrees C.
		Pump error.	Pump exchange or overhaul is needed.

Display on LCD Panel	Symptoms	Probable Causes	Corrective measures
ALARM DP IPM Fail	DP IPM Failure	The temperature of cooling water is high.	Supply water in the range of 5 to 30 degrees C.
		Pump error.	Pump exchange or overhaul is needed.
ALARM MB Over Load	MB current uprising.	Backing pressure rise.	Check exhaust pipe and silencer.
		Voltage drop.	Check voltage of power supply.
		Pump error.	Pump exchange or overhaul is needed.
ALARM DP Over Load	DP current uprising.	Backing pressure rise.	Check exhaust pipe and silencer.
		Voltage drop.	Check voltage of power supply.
		Pump error.	Pump exchange or overhaul is needed.
ALARM MB Over SPD	MB rotation speed rise.	Over compression. (Inlet pressure is higher than atmospheric pressure)	Cancel of over compression state is needed.
		Pump error.	Pump exchange or overhaul is needed.
ALARM DP Over SPD	DP rotation speed rise.	Over compression. (Inlet pressure is higher than atmospheric pressure)	Cancel of over compression state is needed.
		Pump error.	Pump exchange or overhaul is needed.
ALARM MB Low SPD	MB rotation speed fall.	Backing pressure rise.	Check exhaust pipe and silencer.
		Pump error.	Pump exchange or overhaul is needed.
ALARM DP Low SPD	DP rotation speed fall.	Backing pressure rise.	Check exhaust pipe and silencer.
		Pump error.	Pump exchange or overhaul is needed.
ALARM MB Sen Fail MB Over V MB Pwr Fail MB Lock ALM MB Ext ALM MB MDR Err MB EPRFail MB CPUFail MB OverCur MB Reverse DP Sen Fail DP Over V DP Pwr Fail DP Lock ALM DP Ext ALM DP MDR Err DP EPRFail DP CPUFail DP OverCur DP Reverse	MB/DP Motor Driver Error	Pump error.	Pump exchange or overhaul is needed.
ALARM COMMUNIC E BUTTERY LO MDR1ComErr MDR2ComErr DP RunRTN MB RunRTN	Control System Error	Controller error	Maintenance is needed.

9. SCRAPPING METHOD

The pump main body and peripheral units may have been polluted by hazardous substances depending on each applied process.

Perform scrapping in compliance with the safety control standards of the nation and each local self-governing body.

10. PRECAUTIONS ON RETURN OF PRODUCT

10.1 Special Noteworthy Matter

When returning the pump and peripheral units to us for an overhaul, repair, etc. be sure to clarify the applied gas and products. This is duty-bound by the Industrial Safety and Health Law.

Before returning a unit, fill the Return Notice Sheet attached to this manual with necessary contents and submit it by FAX or mail. The user may have to return it to the approved dealer depending on the applied gas. The above request will lead to a smooth repair or overhaul.

If this sheet is not submitted, the returned product may be regarded as a hazardous substance and be rejected.

10.2 Returning Procedure

CONFIRMATION

When draining the cooling water, make sure to introduce the compressed air into the cooling water outlet in order to drain water from the inlet. If the compressed air is introduced into the cooling water inlet, the flow meter may be damaged.

CONFIRMATION

When there is a possibility of freezing while the pump is stopping, admit compressed air into the cooling water outlet and drain the cooling water from the inlet; otherwise that may cause the damage on the pipes for cooling water and the water leakage may occur.

For a return, observe the following procedure.

- 1) Copy the Return Notice Sheet attached at the end of this manual and fill it with necessary contents.
- 2) Operate the pump while charging inert gas such as N₂ gas to remove toxic gas and corrosive gas completely from the pump. For the peripheral unit to be returned, eliminate toxic gas by charging inert gas. When solutions and lubricating oil can be disposed of properly on the user side, bleed them completely.
- 3) Admit compressed air into the cooling water line to drain the cooling water from the pump and remove all the accessories from the unit.
(Refer to Page 34 7-3 Section 4 about how to drain the cooling water.)
- 4) Seal up the suction port and exhaust port of the pump by using blank flanges.
- 5) Seal up the product to be returned if possible after putting them in a polyethylene case or polyethylene sheet.
- 6) When returning the pump or unit, put the product to be returned on a wood pallet with a size of 510 mm x 915 mm or less and fix it with bands. In case of a large product which cannot be put on such a pallet, please ask us for information.
- 7) If the product to be returned is not so large as being fixed on a pallet, pack it in a solid case.
- 8) If the product to be returned is polluted, observe the law related to the transportation of hazardous substances, and stick a label having an indication to this effect on a pallet or case.
- 9) Submit the Return Notice Sheet filled with necessary contents to us by FAX or mail. This Return Notice Sheet should reach us earlier than the product to be returned.
- 10) Hand over a copy of the Return Notice Sheet to the forwarding agent. If the product to be returned is polluted, be sure to inform the forwarding agent of this effect.
- 11) Put the original of the Return Notice Sheet into an envelope and stick it on the outside of the product to be returned.

Return Notice Sheet

Date : _____.

I. Product to be returned

- i) Model No. of the product be returned _____
- ii) Serial No. of the product to be returned _____

II. Pollution of the product to be returned

- i) Applied process name _____
- ii) Pollutant table

	Pollutant name	Chemical symbol	Precaution on Handling	Action to be taken for accidental inhalation or touch
1				
2				
3				
4				
5				
6				

III. Reason for return

- i) *Overhaul *Failure *Other ()
- ii) Contents of failure

IV. Person in charge and where to contact

Name : _____ (signature) Post : _____

Company name / plant name : _____

Address : _____

Telephone / FAX No. : TEL _____ FAX _____

Date of return : _____