

# Dry Vacuum Pump

Original Instructions

## INSTRUCTION MANUAL

MODEL  
MS-Series  
MS120A, MS600A, MS1200A



ULVAC INC, Components Division

[www.ulvac.co.jp](http://www.ulvac.co.jp)



# Before Use of This Machine

Dry Pumps from ULVAC, Inc. (hereinafter referred to as "Our Company"): MS series (hereinafter referred to as "this machine")

Upon receipt of the machine, please confirm the contents included are the same as you ordered and check the machine for any damage attributed to transportation etc. just in case.

This instruction manual (hereinafter, "this manual") describes appropriate handling and maintenance procedures to safely use this pump and to maximize its performance. Read this document in advance to properly use this pump.

Install and operate this machine according to the local and national safety laws and regulations (such as fire laws and electric wiring code). It is required to take a training for general safety of the country and the local area where this machine will be used. Do not use this machine without any training.

The operator is required to have taken such trainings. In addition, the operator must have expertise, skills, qualifications in electrics, mechanics, cargo handling, vacuum, etc.

This pump has been designed to conform to the rules in place when this document was created. Conformity is not guaranteed because the applicable standards may change in the future.

Performance and safety may not be ensured if equipment connected to this pump does not conform to the same rules or if the pump is altered. In such cases, we cannot guarantee (take responsibility for) performance or safety. Product alterations made by the customer are not covered by the warranty, and we cannot take responsibility for them.

Before installing or removing this machine, separate all energy sources (including power and cooling water) from the product.

None of this pump's parts may continue to be used permanently while maintaining the performance upon delivery. Performance inevitably degrades after a certain amount of time elapses, thus increasing the likelihood of product problems even in assumed common usage scenarios. We ask that our customers perform preventive maintenance to avoid problems in accordance with their usage scenarios. By performing preventive maintenance measures, you can lower the probability of problems with this pump due to parts failures caused by parts becoming worn out as well as the probability of other risks, such as downtime caused by pump problems, fire, or effects on other processes. From the viewpoint of preventive maintenance, we also ask our customers to prepare maintenance and inspection plans and to replace parts and perform overhauls according to such plans.





If you have any questions about handling or other matters, please contact our nearest sales office or dealer.

## Safety Indications









Signal words and symbol marks are used in the warning indications contained in this document and on the product so that the user can understand the matters to be observed. Their meanings are as follows.

### ► Definition of signal words:

The terms that signify the warning level for safety are referred to as "Signal Words."

	Indicates an imminent possibility that incorrect handling may lead to the user's death or serious injury.
	Indicates a possibility that incorrect handling may lead to the user's death or serious injury.
	Indicates a possibility that incorrect handling may lead to the user suffering a medium-level injury.
	Indicates important information not related to human injury.





### ► Definition of pictograms:

	Indicates potential risks related to human injury.
	Indicates potential risks related to electrical shock.
	Indicates potential risks related to high temperature.
	Indicates the matters "Prohibited" or must not to do.
	Indicates the matters "Compulsory" or must to do.
	Indicates that a protective gloves must be worn.
	Indicates that a protective glasses must be worn.
	Indicates that the instruction manual must be referred.

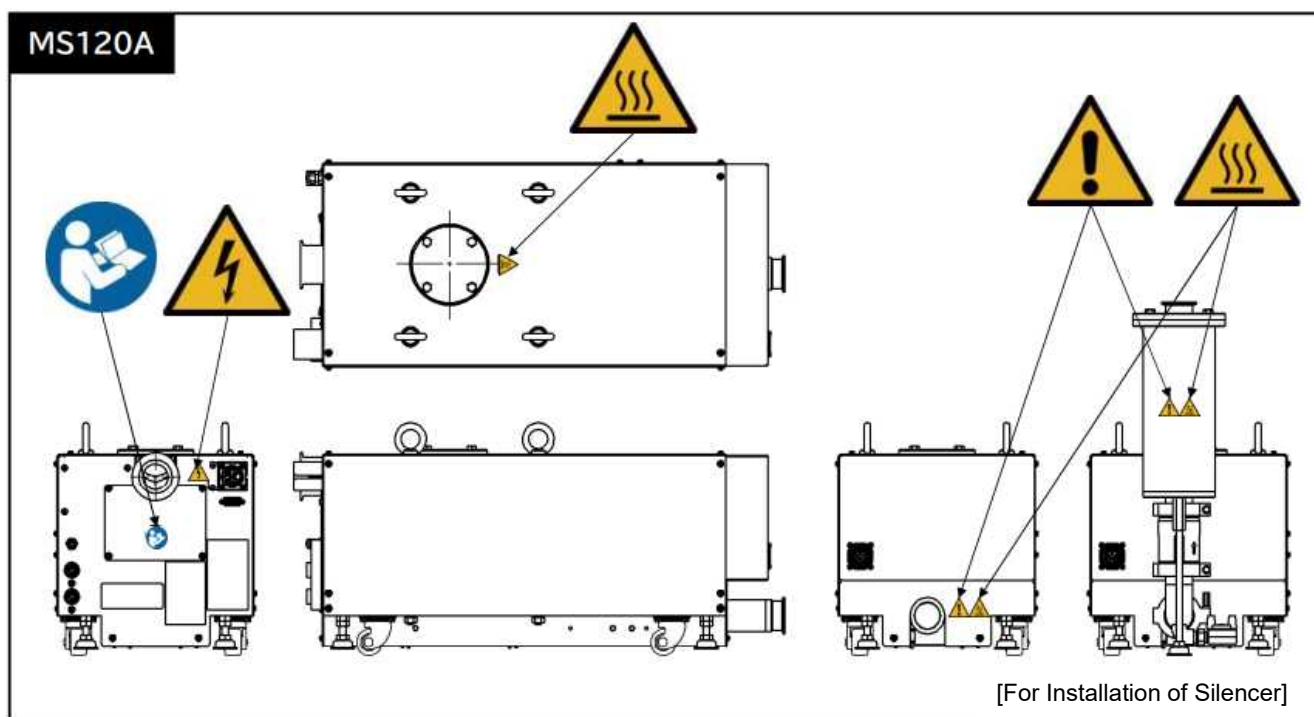
## Warning Label Types and Display Positions

A warning label is attached onto a warning location on the machine. Before operating this pump, be sure to confirm the warning contents.

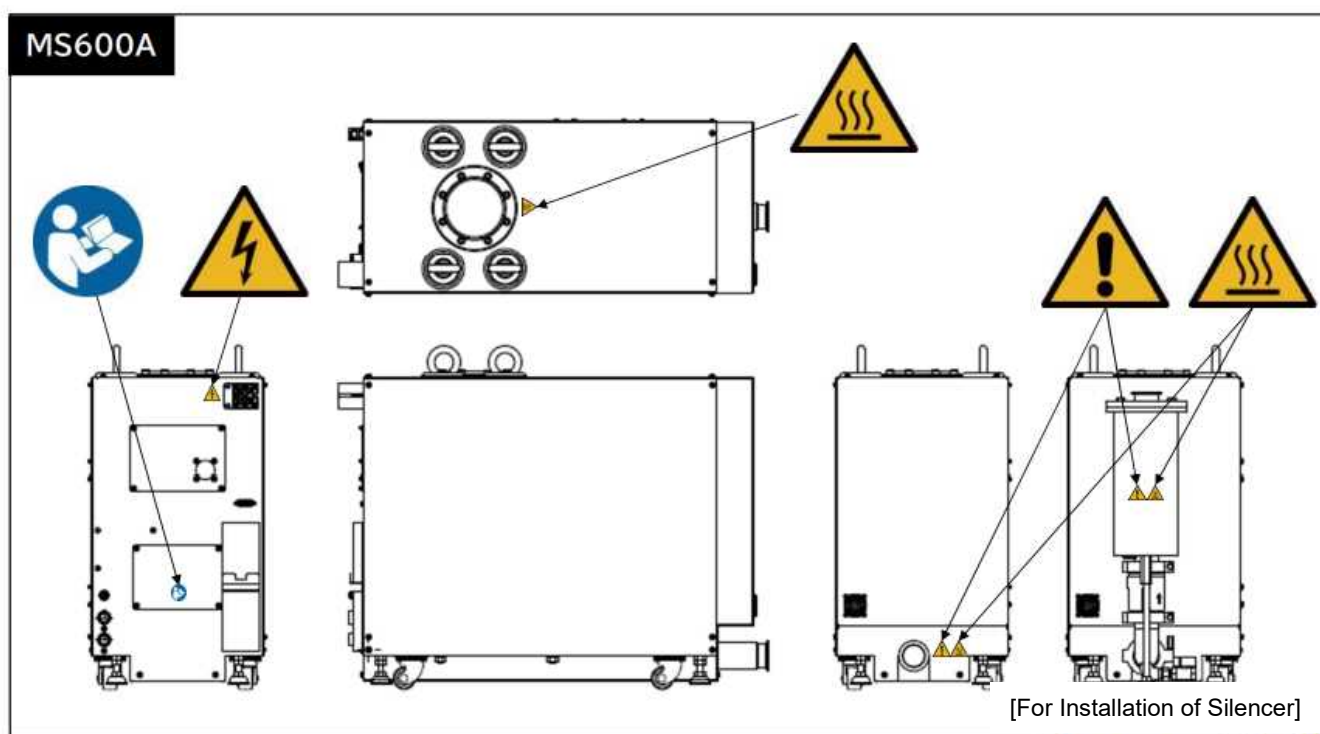
### ► Warning Label Types and Descriptions

	Parts with this warning label have a risk of electrical shock. Turn off the primary power supply before starting wiring or maintenance.
	During operation or for a while after operation stops, do not touch the unit as each portion is at a very high temperature. Touching it may cause burns.
	Do not operate this pump while equipment is attached that prevents gas from moving to the exhaust port (e.g., that blocks the exhaust port). The pump's internal pressure may rise, causing the casing or level gauge to rupture, oil leakage, or motor overload. Explosive or flammable gas, gas that increases the susceptibility of substances to fire, or other gas may ignite inside the pump, thus increasing the pump's internal pressure. Do not exhaust gas that has these characteristics. Before pumping such a gas, dilute it sufficiently to the extent that the risk of explosion and ignition is eliminated.
	Before use, read through the instruction manual and fully understand its contents.

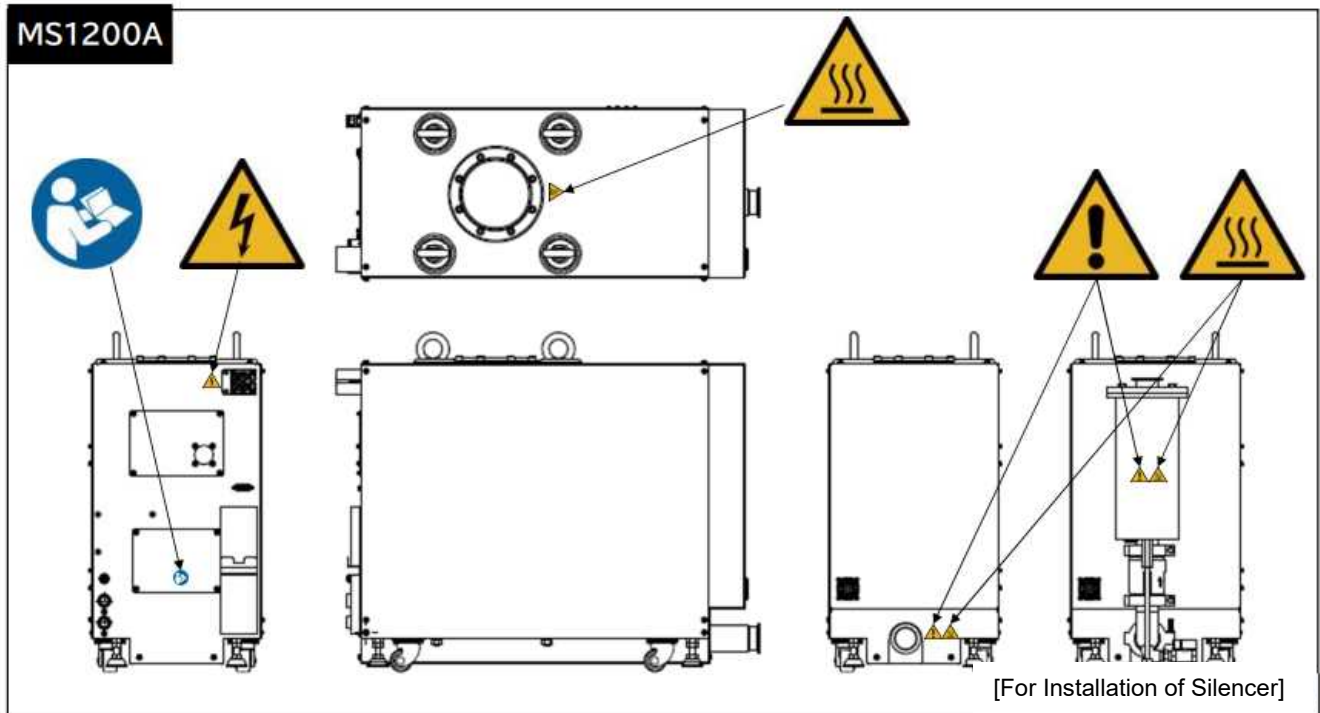
## ► Warning Label display position



**Figure 1** Warning label pasting position (MS120A)



**Figure 3** Warning label pasting position (MS600A)



**Figure 4** Warning label pasting position (MS1200A)

## Warranty Terms

Although this pump undergoes our stringent internal inspection before shipment, if there are any failures attributable to us such as a manufacturing defect or accident during shipping, contact our nearest sales office or dealer. We will repair or replace it free of charge.

### ► Warranty Product

(a) Dry pump MS-Series (MS120A/MS600A/MS1200A)

### ► Warranty Period

(a) Transactions in Japan: One year from the shipment date

(b) Direct export transactions: One year from the B/L date

### ► Warranty scope

The warranty applies only to this pump. If a failure or accident occurs during air or nitrogen exhaust due to our design or a manufacturing defect, we will repair the pump free of charge if within one year of delivery.

### ► Disclaimer

The warranty does not cover the product failures listed below or those due to one of the following causes; we will charge for such repairs even during the warranty period.

- Failures or defects due to influence of corrosion or generated gas or product that are attributed to the process environment.
- Failures or defects caused by consumables.
- When the power voltage or frequency of the power supply used differs from what was specified at the time of order.
- Failures or defects caused by natural disasters such as fires, floods, earthquakes, or lightning, or force majeure such as war.
- Failures or defects caused by handling errors or incorrect usage.
- Products modified/disassembled/repared without our permission.
- Failures or defects caused by use in an abnormal environment including strong electromagnetic fields, radioactive environments, high temperatures, high humidity, flammable gas atmospheres, corrosive gas atmospheres, and dust.
- Failures or defects due to noise.
- Secondary damage incurred by the customer caused by product defects or claims from third parties on violation of patents.
- When our engineers judge that the failures or defects are caused under the conditions of use inappropriate to this product or not satisfied.
- Products for which the warranty period has elapsed.



## ► Response

### (a) Transactions in Japan:

We will send a substitute product, or repair the product returned to us or our nearest ULVAC TECHNO office.

If on-site action is required, contact our nearest sales office or dealer separately.

### (b) Direct export transactions:

We will send a substitute product, or repair the product returned to us or our nearest service center.

## ► Others(Warranty terms)

(a) If there are individual contracts and memorandum related to specifications in addition to this document, the contents in those documents prevail.

(b) Before exporting this pump from Japan, contact us and perform the necessary procedures according to the provisions of export-related laws such as the Foreign Exchange and Foreign Trade Law.

(c) For any questions and consultation on this machine, confirm the model and manufacturing number and then contact our nearest sales office or dealer.

[https://www.ulvac.co.jp/support\\_info/](https://www.ulvac.co.jp/support_info/)

(d) Note that the contents in this document is subject to change without notice.

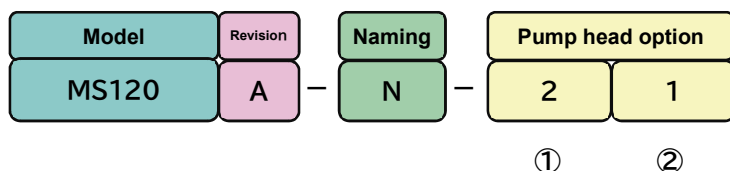
## About this Manual

- To ensure this machine remains usable for a long time, before installing, operating, inspecting, or maintaining it, be sure to read this manual and fully understand the safety notes as well as the pump's specifications and operating procedures.
- Note that the specifications, prices, and other contents in this manual are subject to change without notice for improvement or other reasons. Changes are released as a revision that updates the document number listed on the top-right corner of the instruction manual's cover.
- Be sure to give this document to the end user who uses the product.
- Copying this instruction manual in whole or in part for third parties without our permission is strictly prohibited.
- This document is intended for users whose native language is Japanese. If users whose native language is not Japanese perform work related to this machine, thoroughly provide safety training and handling instructions under your own responsibility.

## Applicable Model

This manual applies to MS120A, MS600A, and MS1200A.

Symbols and numbers used for models have the following meanings.



### Model : Design Displacement

MS120 : 120 m<sup>3</sup>/hr

MS600 : 560 m<sup>3</sup>/hr

MS1200 : 980 m<sup>3</sup>/hr

### Revision

A : Latest revision symbol

### Naming

N : Normal specifications

### ① Sealing material

2 : Fluoro-rubber

4 : Perfluoroelastomer

### ② Voltage

1 : 200V class

2 : 400V class

# Table of Contents

Before Use of This Machine .....	i
Safety Indications .....	ii
▶ Definition of signal words: .....	ii
▶ Definition of pictograms: .....	ii
Warning Label Types and Display Positions .....	iii
▶ Warning Label Types and Descriptions .....	iii
▶ Warning Label display position .....	iv
Warranty Terms .....	vi
▶ Warranty Product .....	vi
▶ Warranty Period .....	vi
▶ Warranty scope .....	vi
▶ Disclaimer .....	vi
▶ Response .....	vii
▶ Others(Warranty terms) .....	vii
About this Manual .....	viii
Applicable Model .....	viii
1. For Safety Use .....	1
1.1 Handling of this Machine .....	1
1.2 Acceptance/Transfer/Storage .....	2
1.2.1 Acceptance .....	2
1.2.2 Transfer .....	3
1.2.3 Storage .....	3
1.3 Installation/Operation .....	3
1.4 Disposal .....	4
1.5 Protective Device .....	4
1.6 Safety Measures and Waring Risk .....	4
1.6.1 Vacuum pumping and exhaust of hazardous gases or substances .....	4
1.6.2 Transfer of heavy object .....	5
1.6.3 Electrical shock .....	5
1.6.4 High temperature .....	5
1.6.5 Ruptures .....	6
1.6.6 Leakage of high-temperature cooling water .....	6
1.7 Safety Data Sheet .....	7
2. Product Overview .....	8
2.1 Application .....	8
2.2 Naming .....	8
2.3 Efforts Related to RoHS Directive and .....	8
Regulated Hazardous Substances .....	8
2.4 Performance Curve .....	9
2.4.1 Pumping speed .....	9
2.4.2 Power consumption .....	10

2.5 Name and Function of Parts.....	11
2.6 Description of Controller .....	13
2.7 System Configuration .....	16
<b>3. Installation .....</b>	<b>17</b>
3.1 Before Installation .....	17
3.1.1 Responsibility for work from shipping to startup .....	17
3.1.2 Storage environment requirements .....	18
3.1.3 Environmental requirements for installation and operation .....	18
3.2 Unpacking .....	19
3.2.1 Precautions for unpacking.....	19
3.2.2 Confirmation after unpacking.....	19
3.3 Transfer.....	20
3.3.1 How to hoist using crane .....	21
3.3.2 How to transport using pallet truck .....	22
3.4 Installation.....	23
3.4.1 Leveling.....	23
3.4.2 Earthquake countermeasures .....	23
3.5 Piping and Wiring .....	25
3.5.1 Inlet/Exhaust Port Piping .....	25
3.5.2 Dedicated silencer (Separately packed) .....	26
3.5.3 Cooling water piping.....	27
3.5.4 Purge Gas .....	29
3.5.5 Drain .....	30
3.6 Electric Wiring.....	31
3.6.1 Electric wiring.....	31
3.6.2 Wiring for remote control.....	33
<b>4. Operation.....</b>	<b>36</b>
4.1 Precautions on Operation.....	36
4.2 Preparation for Operation .....	38
4.2.1 Pre-Operation Check .....	38
4.2.2 How to switch between LOCAL (manual) and REMOTE (remote) .....	38
4.3 How to Start/Stop.....	39
4.3.1 LOCAL operation .....	39
4.3.2 REMOTE operation .....	39
4.4 Monitor Display.....	40
4.4.1 How to operate monitor display .....	40
4.5 Parameter List.....	41
4.5.1 U3: Alarm history .....	41
4.5.2 U4: Operation monitor .....	42
<b>5. Maintenance and Inspection .....</b>	<b>43</b>
5.1 Daily Inspection .....	43
5.2 Inspection after Long-Term Storage.....	43
5.3 Overhaul .....	44
5.4 Notes on Transportation .....	44
<b>6. Troubleshooting .....</b>	<b>45</b>
6.1 Trouble with Basic Operation.....	45
6.2 Alarm Status and Measures .....	46

6.3 How to Restart the Pump after an Alarm ..... 52

7. Specifications ..... 53

    7.1 Performance Specifications ..... 53

    7.2 External Dimensions ..... 54

Appendix..... 57

    Major Replacement Parts ..... 57














# 1. For Safety Use

This chapter describes how to reduce risks as well as which dangerous behaviors must be avoided for each work item.

## ▶ 1.1 Handling of this Machine

If you need an overhaul or repair or if you have a problem, contact our nearest service center.

 <b>Danger</b> 	<p>This manual assumes that this pump's interlock system or control system has been integrated into the host equipment. Connect the pump's power line to the host equipment's EMO system.</p>
 <b>Danger</b> 	<p>This pump can exhaust inert gas (air, nitrogen, or argon). If the pump exhausts other gas (toxic, combustible, corrosive, or explosive gas, or gas that increases the susceptibility of substances), such gas may leak from the pump's main unit or ignite or explode inside the pump. Therefore, do not use this pump to exhaust such gases. If to use this pump, dilute such a gases sufficiently to the extent that the risk of explosion and ignition is eliminated before pumping.</p>
 <b>Danger</b> 	<p>Install this pump in a ventilated room indoors. If nitrogen or argon leaks, the lack of oxygen may cause suffocation.</p>
 <b>Danger</b> 	<p>Before installing or removing this pump, separate all energy sources (including power and cooling water) from it.</p>
 <b>Danger</b> 	<p>When toxic gases were pumped, not only this machine but also the oil becomes toxic. Please be careful during maintenance.</p>
<b>Notice</b> 	<p>Install appropriate traps, such as filters, separators and/or condensers to prevent the ingress of liquid and solid particles to this pump.</p>

- This machine has been designed to conform to the rules in place when this manual was created. Conformity is not guaranteed because the applicable standards may change in the future.
- Performance and safety may not be ensured if equipment connected to this pump does not conform to the same rules or if the pump is altered. In such cases, we cannot guarantee (take responsibility for) performance or safety.
- Do not handle this pump if you have not undergone publicly recognized general safety training (including on electrical and loading safety) in your country. The operator must attend such training.
- Install and operate this pump according to the safety-related laws and regulations (such as fire prevention laws and electrical wiring regulations) in your country.

- If the details of dangerous substances to be used is not disclosed, or the substances difficult to undergo a detoxification processing are discharged, we may reject the maintenance and other related handlings.

If you entrust us of an overhaul, maintenance, or repair etc., enter the necessary information in the "Declaration of Contamination" attached to the end of this manual and submit it to a service center.










- Before exporting this machine from Japan, it must undergo screening according to the Foreign Exchange and Foreign Trade Law as well as government ordinances, ministerial ordinances, notices, and other orders based on said law. Contact our nearest sales office or dealer.

【List of sales offices】

[https://www.ulvac.co.jp/support\\_info/sales\\_office/](https://www.ulvac.co.jp/support_info/sales_office/)





## ▶ 1.2 Acceptance/Transfer/Storage

### 1.2.1 Acceptance


 <b>Danger</b> 	<p><b><u>Never get under this machine</u></b></p> <p>This machine may fall or topple if a forcible operation is performed or if the equipment is not sufficiently maintained. Never get under this machine.</p>
 <b>Warning</b> 	<p><b><u>Ask a specialist company to perform disassembly.</u></b></p> <p>This machine comes packaged in a wooden crate, cardboard box, or other material. Ask a specialist company to perform disassembly. Workers may cut their hands on nails or wooden chips during work. Instruct those who disassemble the machine to wear leather gloves and to use an appropriate bar or other disassembly tool.</p>
 <b>Warning</b> 	<p><b><u>Use a crane or other cargo-handling equipment</u></b></p> <p>Give instructions to hoist and transfer this machine using a crane or other cargo-handling equipment and eyebolts on the top of this machine when unpacking or hoisting it. Before using the eyebolts, confirm that there are no abnormalities.</p>
 <b>Warning</b> 	<p><b><u>Certified persons must perform loading work and operate the cargo-handling machine.</u></b></p> <p>Never perform loading work or operate the cargo-handling machine if you do not have the appropriate certifications.</p>
<p><b>Notice</b></p> 	<p><b><u>After unpacking, make sure that there are no missing items or damage</u></b></p> <p>After unpacking, make sure that there are no missing, damaged, or abnormal items. If there are any problems, do not perform installation work.</p>










## 1.2.2 Transfer

 	<p><b><u>Do not use the casters as a transportation device or a means of equipment support.</u></b></p> <p>Although this pump is equipped with casters, do not use them as a transportation device or a means of equipment support.</p>
 	<p><b><u>For transport, use cargo-handling equipment or a pallet truck.</u></b></p> <p>To transport this machine, a load higher than the safety standards is required. Therefore, manually transporting may cause lower back pain or injury. For transport, hang this machine with cargo-handling equipment (such as a mobile crane) or fix it on a pallet and then transport it by pallet truck.</p>

## 1.2.3 Storage

<p><b>Notice</b></p> 	<p><b><u>Respect the environmental conditions</u></b></p> <p>This machine has a precise clearance. Confirm the storage location and satisfies the requirements listed in "3.1.2 Storage environment requirements."</p>
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## ► 1.3 Installation/Operation

 	<p><b><u>Do not remove the face panel</u></b></p> <p>Never remove the face panel. Failure to observe this instruction may lead to burns or electrical shock.</p>
 	<p><b><u>Do not remove the casters</u></b></p> <p>Do not remove the casters, and do not install this pump directly on the ground.</p>
<p><b>Notice</b></p> 	<p><b><u>Do not apply shock to this machine or put in at an incline, position it sideways, or stand it up or reverse it.</u></b></p> <p>Do not apply shock to this machine or put in at an incline, position it sideways, or stand it up or reverse it. Doing so will degrade the pump's operation. Install this machine in a horizontal position to be leveled.</p>
<p><b>Notice</b></p> 	<p><b><u>Operate this machine after its temperature reaches the operational ambient temperature</u></b></p> <p>If this machine was stored outside the range of the operational ambient temperature, operate it after its temperature reaches the operational ambient temperature.</p>
<p><b>Notice</b></p> 	<p><b><u>Install this machine in a horizontal position to be leveled</u></b></p> <p>After moving to the installation location, adjust the four adjusters within the range of 0 to 10 mm and install this machine horizontally on the main unit. If you operate with casters, vibration may be transmitted to the floor. In addition, this machine may move itself and collide with surrounding equipment.</p>

#### Notice



#### Respect the environmental conditions

This machine has a precise clearance. Confirm the storage location and satisfies the requirements listed in "3.1.3 Environmental conditions during installation and operation."

## ► 1.4 Disposal

#### Warning



#### Ask a waste disposal specialist to dispose of this pump if you have used it to exhaust harmful gas that may endanger human health.

Ask a waste disposal specialist to dispose of this pump if you have used it to exhaust harmful gas that may endanger human health.

Dispose of this pump according to the laws and ordinances issued by your local government. Particularly if you have used this pump to exhaust harmful gas, ask a waste disposal specialist to dispose of this pump. The customer must incur any disposal-related costs.

## ► 1.5 Protective Device

#### Warning



#### Be sure to install an earth leakage circuit breaker.

If no earth leakage circuit breaker is installed, then equipment burnout, fire, or electrical shock may occur.

This pump is not equipped with a power interrupter and leak detector. When selecting a ground-fault interrupter, refer to "3.6 Electric Wiring."

## ► 1.6 Safety Measures and Waring Risk

### 1.6.1 Vacuum pumping and exhaust of hazardous gases or substances

#### Danger



#### Do not exhaust toxic gas, combustion gas, flammable gas, corrosive gas, explosive gas, or gas containing fine powder





It is extremely dangerous to exhaust toxic gas, combustion gas, flammable gas, corrosive gas, explosive gas, or gas containing fine powder. Furthermore, if these gases were pumped into the machine, it is extremely dangerous as they may ignite or explode due to residual gases or products not only during operation but also after the machine stops. Do not discharge gases with these properties. When exhausting such gas, dilute it sufficiently to the extent that the risk of explosion and ignition is eliminated, before exhausting.

#### Danger







#### Wear protective equipment










During work such as inspection, wear protective equipment suitable for toxic substances for use.

 	<p><b><u>Ask a waste disposal specialist to dispose of this pump.</u></b></p> <p>To dispose of this pump, ask a waste disposal specialist authorized by the government.</p>
 	<p><b><u>Ask for entrust to a specialized processor for detoxification processing.</u></b></p> <p>For an overhaul or disposal, entrust a processor specialized in waste disposal to do the detoxification processing.</p>


### 1.6.2 Transfer of heavy object

 	<p><b><u>Never get under this pump.</u></b></p> <p>The pump may fall or topple if a forcible operation is performed or if the equipment is not sufficiently maintained. Never get under this pump.</p>
 	<p><b><u>Certified persons must perform loading work and operate the cargo-handling machine.</u></b></p> <p>Never perform loading work or operate the cargo-handling machine if you do not have the appropriate certifications. Failure to observe this instruction may lead to accident or injury.</p>

### 1.6.3 Electrical shock

  	<p><b><u>Before connecting the power, turn off the primary power supply.</u></b></p> <p>Be sure to turn off the primary power supply before connecting the power.</p>
  	<p><b><u>Before inspection or relocation, turn off the primary power supply.</u></b></p> <p>Be sure to turn off the primary power supply before inspection or relocation.</p>
  	<p><b><u>Be sure to connect the ground terminal.</u></b></p> <p>A certified electrical worker must embed grounding or connect the ground line. Incomplete grounding incurs the risk of electrical shock.</p>

### 1.6.4 High temperature

  	<p><b><u>Do not remove the face panel.</u></b></p> <p>Never remove the face panel. This pump becomes very hot during operation and remains hot for a while after operation stops. Touching it may lead to burns.</p>
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**Warning**



**Do not touch the pump's main unit, motor, or piping during operation.**

Do not touch the pump's main unit, motor, or piping during operation because they are very hot. Failure to observe this instruction may lead to burns.

**Warning**



**Wait until the pump temperature drops.**

The pump is hot immediately after operation stops. Wait a while until the pump temperature drops and then perform inspection. Failure to observe this instruction may lead to burns.

### 1.6.5 Ruptures

**Warning**



**Do not increase the pressure on the pump's exhaust side to 0.03 MPaG or higher.**

Measure the pressure on the pump's exhaust side. If the pressure is 0.03 MPaG (0.3kg/cm<sup>2</sup>G) (gauge pressure) or higher, remove any objects that prevent gas on the exhaust port side from passing.

If the pump's internal pressure exceeds 0.03 MPaG, the pump may rupture.

### 1.6.6 Leakage of high-temperature cooling water

**Warning**



**If this machine is operated without water supply, stop immediately and keep away from it**

If this machine is operated without water supply, stop immediately and keep away from it. Hot steam may blast out of the pump's cooling water port.

**Warning**



**Install an interlock on the cooling water pathway.**

Install a flowmeter on the cooling water pathway, and install an interlock so that this pump stops if supply of cooling water stops. If you operate this pump without flowing cooling water, hot steam may blast out of the pump's cooling water port.




**Warning**



**Wait until the pump temperature drops.**

Remove and inspect after stopping this machine and confirming that the temperature has dropped.

## ▶ 1.7 Safety Data Sheet

 <b>Warning</b> 	<b><u>Thoroughly read the safety data sheet</u></b> Obtain the safety data sheet (hereinafter referred to as the "SDS") and thoroughly read it in advance. If lubricant adheres to the skin or enters the eyes, follow the first aid procedure described on the safety data sheet.
<b>Notice</b> 	<b><u>Use the specified lubricant</u></b> Use of a non-specified lubricant will affect the pump's performance and service life as well as void the pump's warranty coverage.

Do not use any chemical substance (Lubricant) that is not specified on this manual.

Lubricating oil	BARRIERTA J100FLUID, J100FLUID E (NOK KLUBER)
Bearing grease	NOXLUB, KF1920 (NOK KLUBER)

The SDS describes the chemical substances that may be used or touched to operate this pump. To understand the characteristics of hazards, carefully read the SDS. Obtain the latest version of the SDS from our nearest sales office or dealer.

The SDS provides reference information to ensure safe handling of dangerous or hazardous chemical substances.

Anyone handling lubricant must always obtain the latest SDS and understand that measures suitable for the actual handling and other situations in question must be taken under their own responsibility by referring to the SDS before using the lubricant. The SDS itself does not guarantee safety.

## 2. Product Overview

The MS series is designed to pump a general equipment which interlock system and control system are to be installed in the host device.

### ▶ 2.1 Application

- **Pumping system for electronic components and semiconductor manufacturing equipment**  
- Etching equipment, Ashing equipment, Plasma cleaning equipment, etc.
- **Pumping system for vacuum heat treatment furnace**  
- Sintering furnace, carburizing furnace, etc.
- **Pumping system for manufacturing equipment of lithium batteries**  
- Electrode drying device, defoaming device, liquid injection device, etc.
- **Pumping system for medical- and food-related equipment**  
- Freeze drying equipment, vacuum drying equipment, etc.

### ▶ 2.2 Naming

#### ■ N type: Normal type

- **Feature: General type operating by the inverter.**  
**Special surface treatment in standard.**

### ▶ 2.3 Efforts Related to RoHS Directive and Regulated Hazardous Substances

The main unit and the standard accessories including the cable assembly do not contain the following 10 specified environmentally hazardous chemical substances of more than their thresholds that are regulated by the RoHS Directive (Revised RoHS Directive 2011/65/EU and (EU) 2015/863).

**Table 1:** Applicable regulated hazardous substances and their thresholds

Regulated Hazardous Substances	Threshold
Lead (Pb) / Lead compounds	1000ppm
Mercury (Hg) / Mercury Compounds	1000ppm
Cadmium (Cd) / Cadmium compounds	100ppm
Hexavalent Chromium (Cr6+) / Hexavalent Chromium Compounds	1000ppm
Polybrominated biphenyls (PBBs)	1000ppm
Polybrominated diphenyl ethers (PBDEs)	1000ppm
Diethylhexyl phthalates (DEHPs)	1000ppm
Butyl benzyl phthalates (BBPs)	1000ppm
Dibutyl phthalates (DBPs)	1000ppm
Diisobutyl phthalate ( DIBP )	1000ppm

## 2.4 Performance Curve

### 2.4.1 Pumping speed

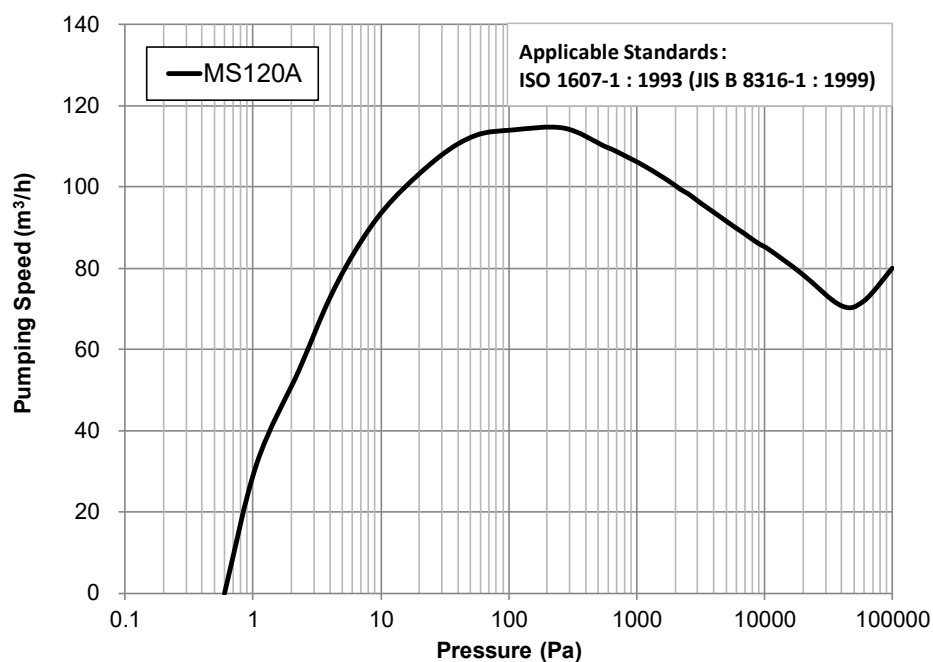


Figure 5: Pumping speed curve (MS120A)

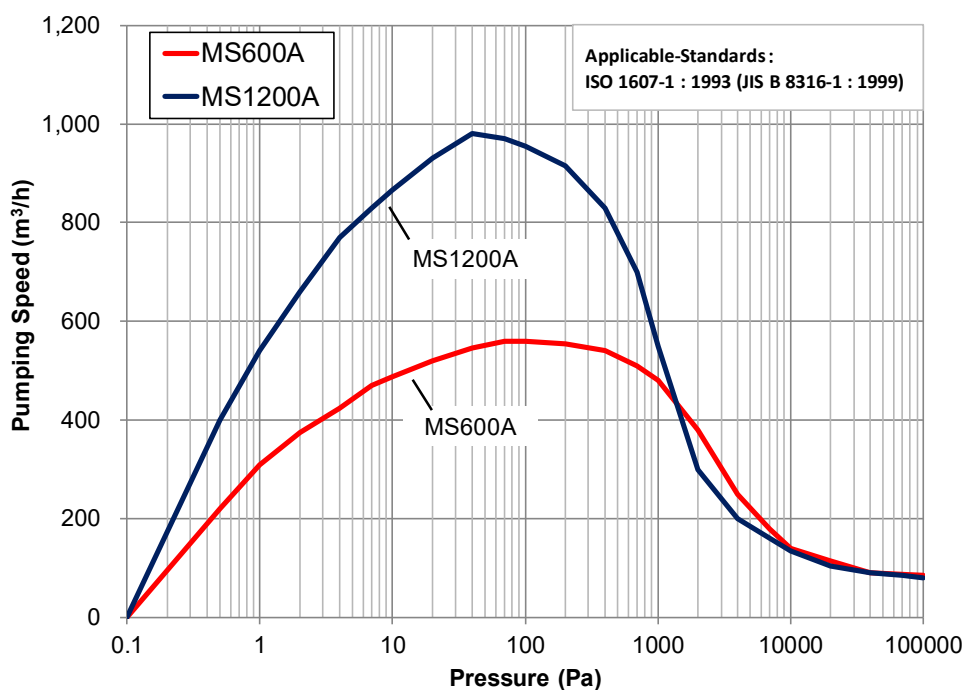


Figure 6: Pumping speed curve (MS600A, MS1200A)

### 2.4.2 Power consumption

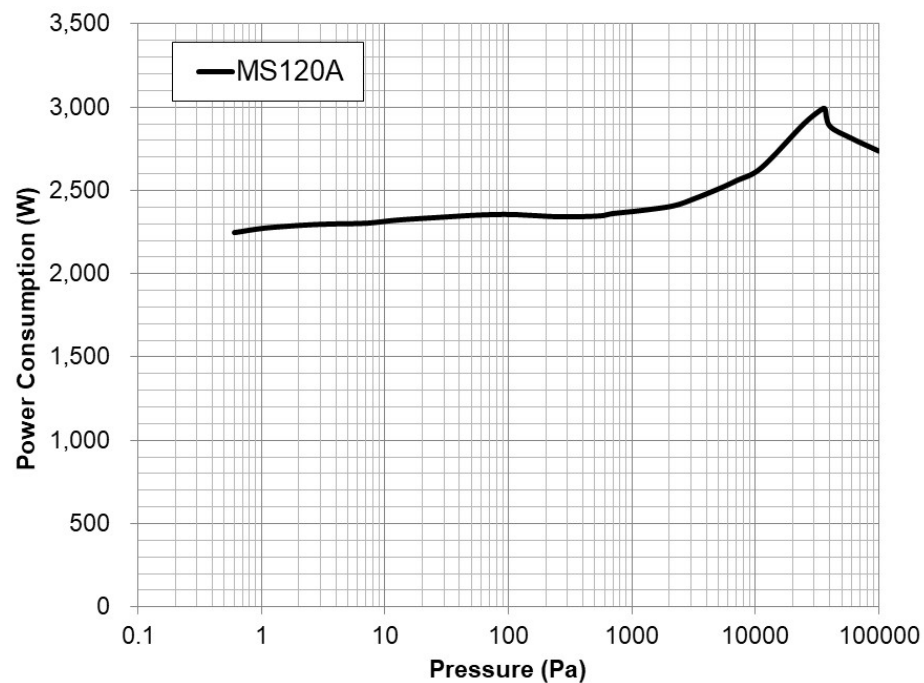


Figure 7: Power curve (MS-120A)

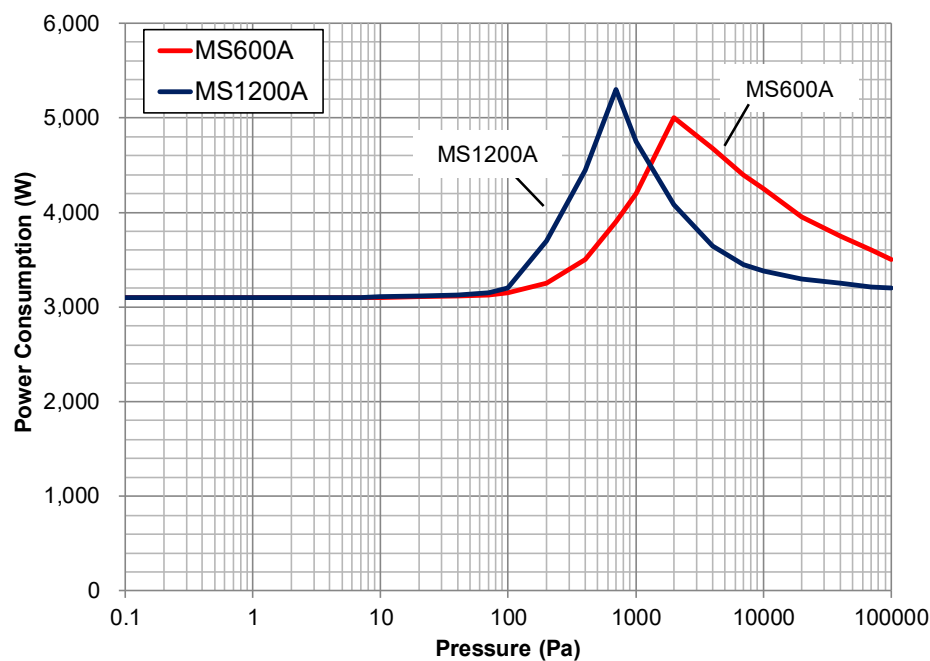
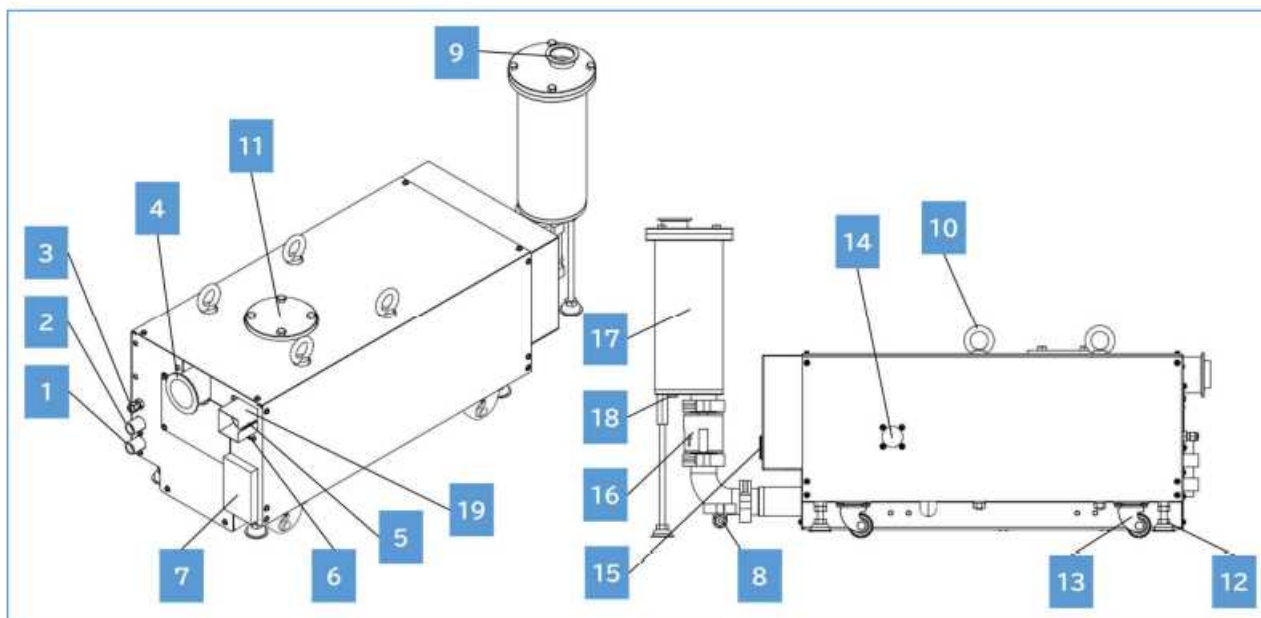


Figure 8: Power curve (MS600, MS1200A)



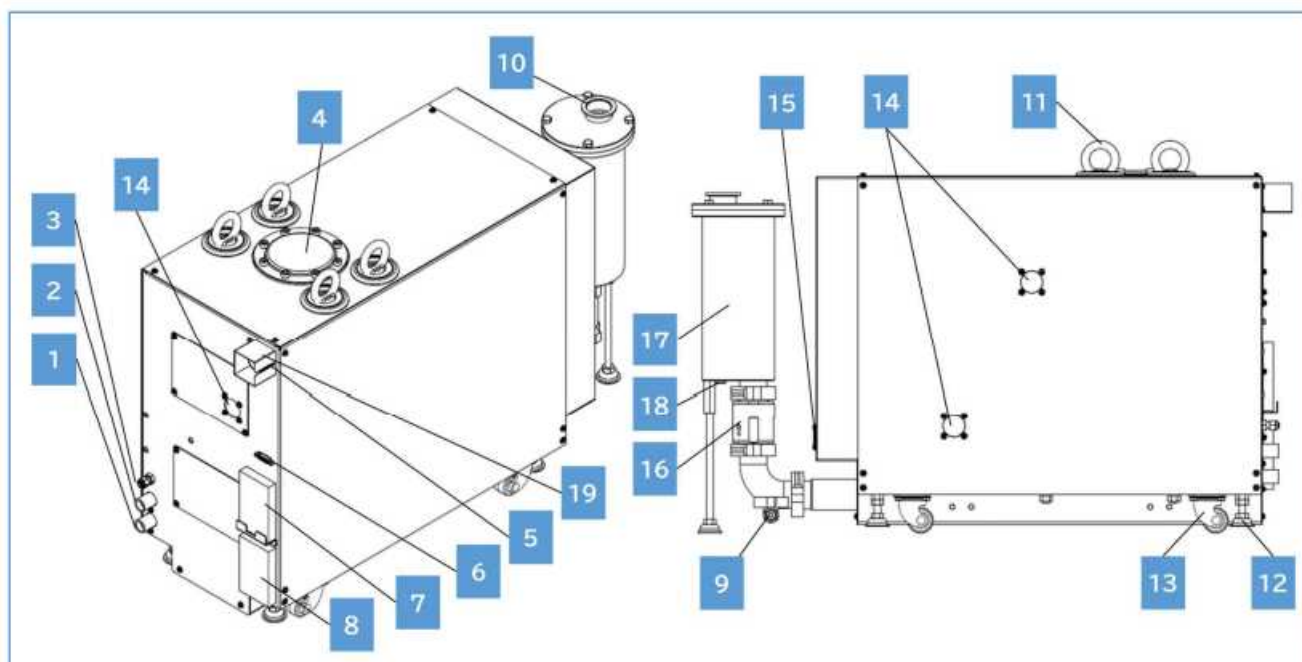
## 2.5 Name and Function of Parts



**Figure 9:** Name of parts (MS120A)

**Table 2:** Name of Parts (MS120A)

Name	Function	Reference
1	Cooling water outlet	Connects the pipe that discharges cooling water. (Rc3/8)
2	Cooling water inlet	Connects the pipe that supplies cooling water. (Rc3/8)
3	Purge gas inlet	Connects the pipe that supplies a purge gas.
4	Inlet port (horizontal): KF50	Connects the container and piping for pumping.
5	Power connector	Connects the power cable.
6	Signal connector	Connects the signal cable.
7	Controller	Displays the status of this machine, such as start, stop, and alarm modes.
8	Drain valve	Valve for drain exhaust. (Rc3/8)
9	Exhaust port: KF40	Connects the pipe that discharges the exhaust gas.
10	Eyebolt	Bolt to hoist the pump using a crane or other equipment.
11	Inlet port (vertical): VG50	Connects the container and piping for pumping.
12	Adjuster	Height adjuster of this machine.
13	Caster	Swivel type wheels.
14	Lubricant inspection window	Viewport to check the oil color.
15	Ventilation inlet	Air ventilation intake port
16	Check valve	Valve to prevent a backflow from the exhaust side when the pump stops.
17	Silencer	Dedicated exhaust silencer.
18	Service port	Port for drain exhaust. (Rc3/8)
19	Power connector guard	Safety guard for the power connector. *Power connector guard is required to be installed over the electrical wiring when the system is used with a permanently connection.

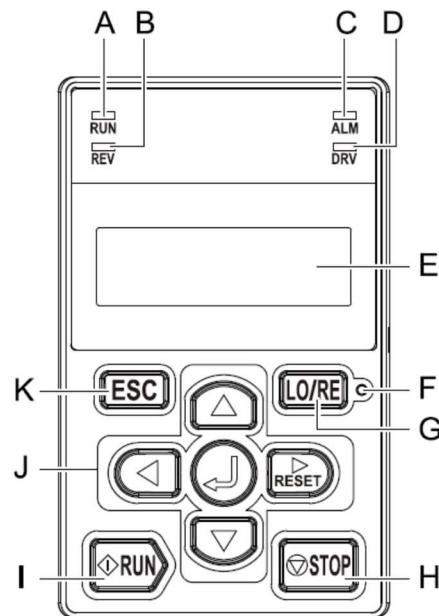


**Figure 10:** Name of parts (MS600A, MS1200A)

**Table 3:** Name of Parts (MS600A, MS1200A)









Table 3-1: Name of Parts (continued) (Rc3/8)			
Name		Function	Reference
1	Cooling water outlet	Connects the pipe that discharges cooling water. (Rc3/8)	3.5.2
2	Cooling water inlet	Connects the pipe that supplies cooling water. (Rc3/8)	3.5.2
3	Purge gas inlet	Connects the pipe that supplies a purge gas.	3.5.4
4	Inlet port	Connects the container and piping for pumping.	3.5.1
5	Power connector	Connects the power cable.	3.6.1
6	Signal connector	Connects the signal cable.	3.6.2
7	Controller for MBP	Displays the status of MBP alarms, etc.	2.6
8	Controller for DRP	Displays the status of this machine, such as start, stop, and DRP alarm modes.	
9	Drain valve	Valve for drain exhaust. (Rc3/8)	3.5.5
10	Exhaust port: KF40	Connects the pipe that discharges the exhaust gas.	3.5.1
11	Eyebolt	Bolt to hoist the pump using a crane or other equipment.	3.3.1
12	Adjuster	Height adjuster of this machine.	3.4.1
13	Caster	Swivel type wheels.	3.3
14	Lubricant inspection window	Viewport to check the oil color. (3 places)	5.1
15	Ventilation inlet	Air ventilation intake port	4.1
16	Check valve	Valve to prevent a backflow from the exhaust side when the pump stops.	
17	Silencer	Dedicated exhaust silencer.	3.5.2
18	Service port	Port for drain exhaust. (Rc3/8)	3.5.5
19	Power connector guard	Safety guard for the power connector. *Power connector guard is required to be installed over the electrical wiring when the system is used with a permanently connection.	3.6.1







## 2.6 Description of Controller









**Figure 11:** Controller

**Table 4:** Description of Controller

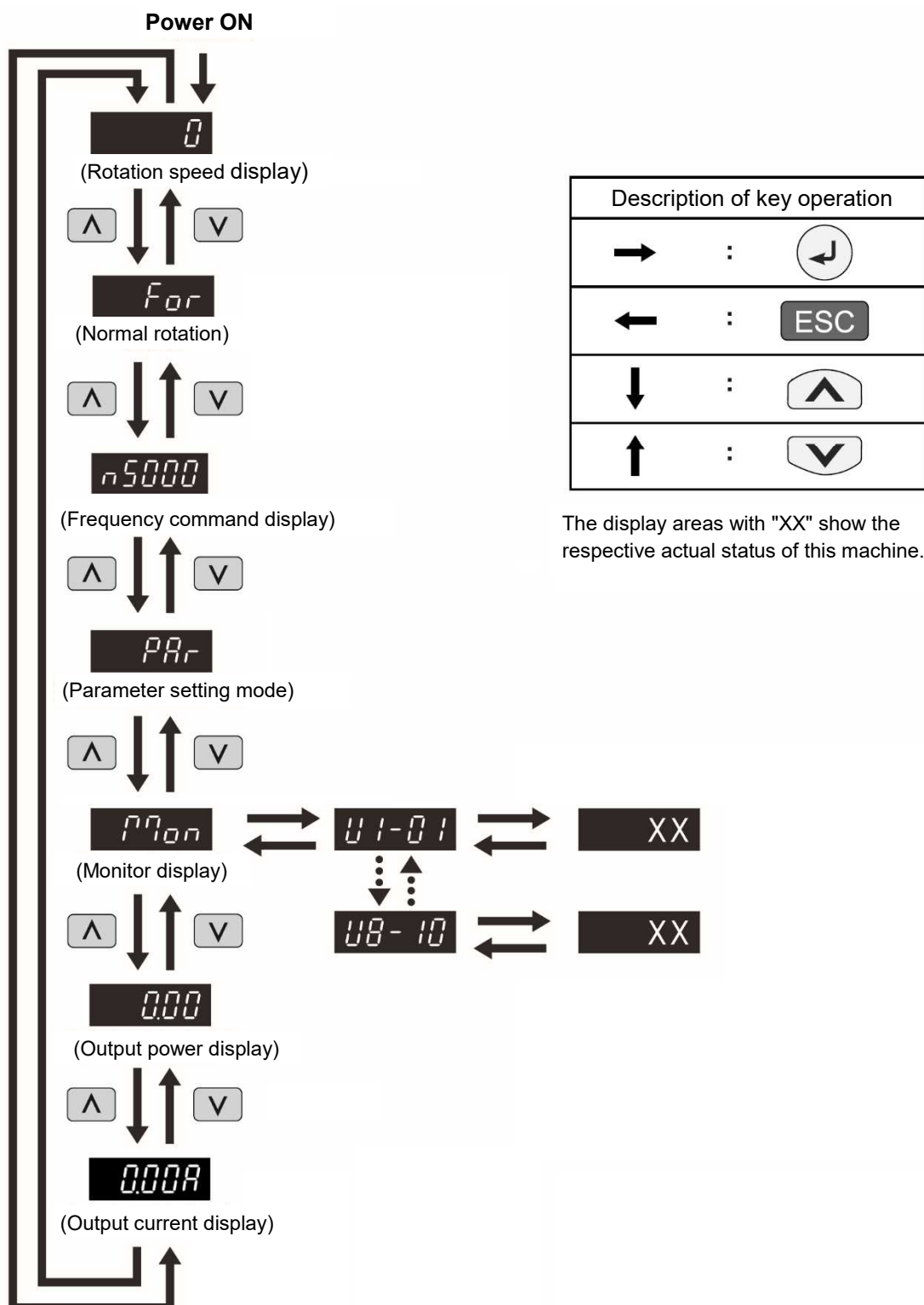
	Key/LED	Function
A	RUN indicator lamp 	Lights up during operation of this machine. Refer to "Table 5: Display and Status of Indicator Lamp."
B	REV indicator lamp 	Refer to "Table 5: Display and Status of Indicator Lamp."
C	ALM indicator lamp 	Lights up when an alarm is activated on this machine. Refer to "Table 5 Display and Status of Indicator Lamp."
D	DRV indicator lamp 	Refer to "Table 5: Display and Status of Indicator Lamp."
E	LED indicator lamp	Displays the number of revolutions and the current status.
F	LO/RE indicator lamp 	Lights up while the controller (LOCAL) is selected. Refer to "Table 5: Display and Status of Indicator Lamp."
G	LO/RE select key 	Switch using for changes of "Controller (LOCAL)" and "Remote control wiring (REMOTE)" operation. Only the controller on the DRP side (lower side) can be switched)
H	STOP key 	Switch used for stops this machine.
I	RUN key 	Switch which runs this machine while LOCAL mode is selected.

	Key/LED	Function
J	LEFT key 	Switch which moves the digit to the left in the controller operation mode.
	UP key / DOWN key  	Switch which selects the status to monitor or proceed to the next item and data.
	RIGHT key (RESET key) 	Switch which moves the digit in the controller operation mode to the right. Functions as the alarm reset key in the event of an alarm.
	ENTER key 	Switch which displays or accept the status to monitor. Used to move from one screen to the next screen.
K	ESC key 	Switch which returns to the previous status before pressing the ENTER key.

**Table 5:** Display and status of indicator lamps

Indicator lamp	Display	Status
RUN indicator lamp 	ON	Running
	Blink	Decelerating and stopping
	Short blink	<ul style="list-style-type: none"> <li>Operation command right was switched to REMOTE while the operation command was input from the outside in the LOCAL mode.</li> <li>External interlock signal was input.</li> <li>External interlock is activated and inverter has cut off.</li> <li> has pressed and operation stopped when operation command was REMOTE mode.</li> </ul>
REV indicator lamp 	ON	Normally does not light up. (A state where the reverse command is input)
	OFF	Normal state.
ALM indicator lamp 	ON	Alarm has detected.
	Blink	Warning detection before alarm activation.
	OFF	Normal status without warnings or abnormalities.
DRV indicator lamp 	ON	Drive mode.
	Blink	Internal sequence is running.
	OFF	Program mode.
LO/RE indicator lamp 	ON	Operation command right is set to the controller (LOCAL).
	OFF	Operation command right is set to an external command (REMOTE) other than the controller. (Only the controller on the DRP side (lower side) can be switched)

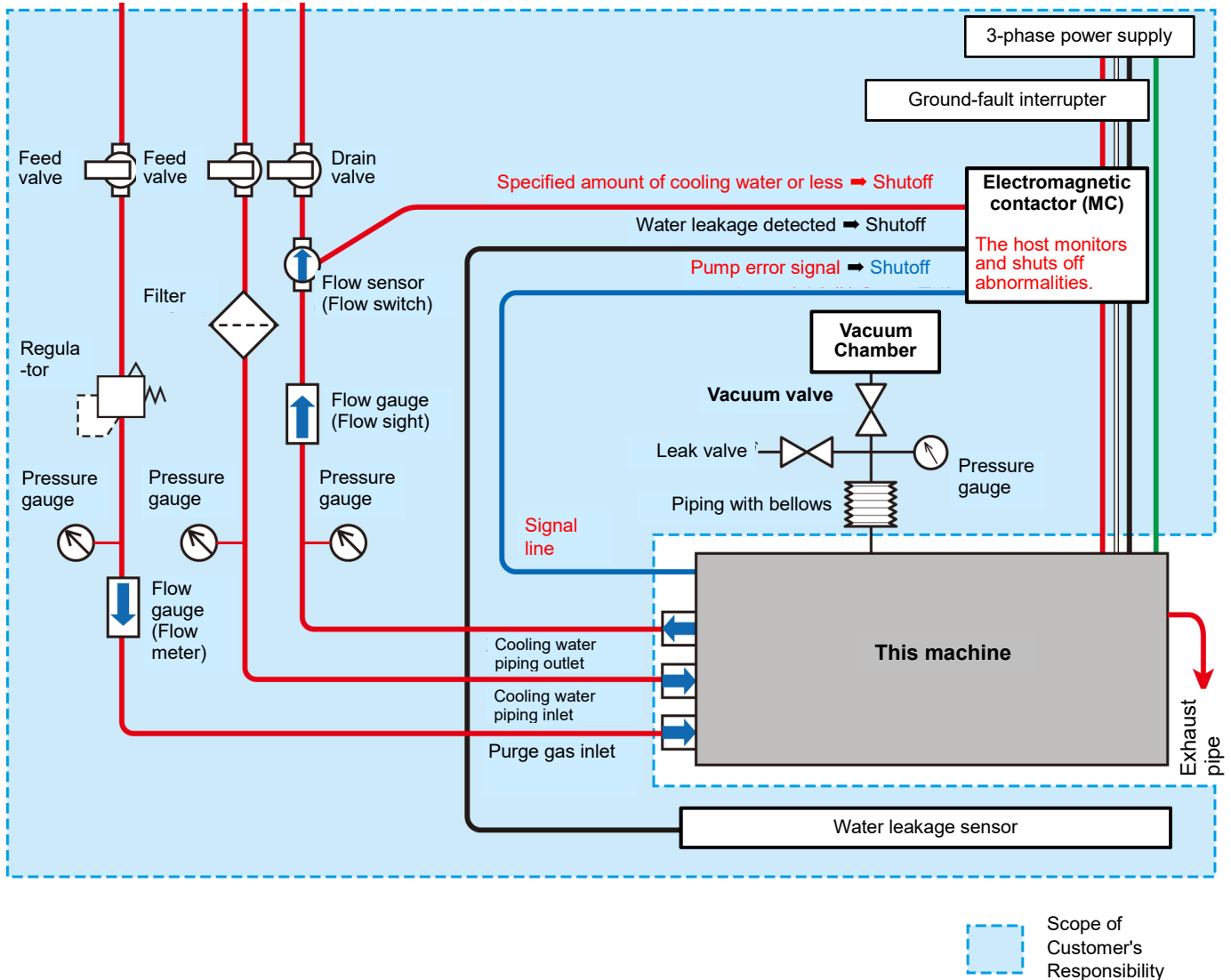
## Transition of data display



**Figure 12:** Transition diagram of data display

## 2.7 System Configuration

The area surrounded by the broken line below falls within the customer's responsibility. Customers are responsible for preparing and managing these pipes, wires, and pieces of equipment.



**Figure 13:** System connection diagram

### Notice

The warranty covers this machine only (refer to "Warranty Scope"). Note that any failures and damage due to piping, wiring, or equipment within the customer's responsibility mentioned above are not covered by the warranty.

## 3. Installation

### ▶ 3.1 Before Installation

#### 3.1.1 Responsibility for work from shipping to startup

This machine is provided on the assumption that we are in charge of the stages from packing through shipment (transport), while the customer is in charge of the stages from cargo reception through startup. However, the customer may fully or partly transport, unpack, or install this pump depending on the pump's terms and conditions.

Packing	•ULVAC
Transport	•ULVAC entrust this task to a specified carrier.
Cargo reception and unpacking	•Customer
Inspection	•Customer
Transfer to the installation location	•Customer
Installation and assembly	•Customer
Piping and wiring	•Customer
Startup check	•Customer

#### Notice

The above work from shipment to startup may not apply in your case. Check the pump's specifications document. If you have any questions, please contact us.

### 3.1.2 Storage environment requirements

Store into following conditions when this machine will be stored at warehouse or clean storage room prior to installation without use for a long period of time.

Ambient temperature	-20 to 60°C (No freezing)
Ambient humidity	95 %RH or less (No condensation)
Altitude	1,000m or less of altitude above sea level
Vibration resistance	Vibration acceleration of 0.5G (114dB) or less
Others	No dust
	The room must be ventilated.
	Do not stack this machine, position this machine sideways, or stand it up.
	Do not apply shock to this machine.
	Do not expose this machine to direct sunlight.
	Keep this machine away from heat sources.
	Be sure to release the water in the cooling water piping before storage.
	In low temperatures (0°C or less), parts may be damaged by frozen water.
	Do not incline this machine by 10 degrees or more.

### 3.1.3 Environmental requirements for installation and operation

This machine is a unit with precise clearances. Confirm that the following requirements are satisfied during installation and operation.











Ambient temperature・Inhaled gas temperature	5 to 40°C (Inhaled gas temperature is shown in terms of atmospheric pressure.)
Ambient humidity	95 %RH or less (No condensation)
Altitude	1,000m or less of altitude above sea level
Power supply	Overvoltage category II (IEC61010-1)
Others	Pollution Degree 2 or less (IEC61010-1)
	No corrosive or explosive gas.
	No dust
	The room must be ventilated.
	Do not stack this machine, position this machine sideways, or stand it up.
	Do not apply shock to this machine.
	Do not expose this machine to direct sunlight.
	Keep this machine away from heat sources.
	After moving to the installation location, adjust the four adjusters within the range of 0 to 10mm and install this machine in a horizontal position.
	Securely fix this machine in case of an earthquake.



## ▶ 3.2 Unpacking

This machine is protected by stretch film, cushioning materials, or by other means, packed in a wooden frame or cardboard, and shipped. In case the packaging is by crate, ask a specialist to dismantle. Provide following precautions and instructions to the dismantling contractor.

### 3.2.1 Precautions for unpacking

 <b>Danger</b> 	<p><b><u>Never get under this machine.</u></b></p> <p>This machine may fall or topple if a forcible operation is performed or if the equipment is not sufficiently maintained.</p>
 <b>Warning</b> 	<p><b><u>Cargo handling work and operation of cargo handling machines shall be performed only by qualified personnel.</u></b></p> <p>Cargo handling work and operation of cargo handling machines shall be performed only by qualified personnel.</p>
 <b>Warning</b> 	<p><b><u>Lift using cargo handling equipment.</u></b></p> <p>Give instructions to hoist and transfer this machine using a crane or other cargo-handling equipment with eyebolts on the top of this machine when unpacking or hoisting it.</p>
 <b>Warning</b> 	<p><b><u>Do not tilt this machine 10 degrees or more</u></b></p> <p>Falling or other accidents may cause injury or damage.</p>
 <b>Caution</b> 	<p><b><u>For crate packing, wear leather gloves and use appropriate dismantling tools.</u></b></p> <p>As you may cut your hands with a nail used to fix the crate or a piece of wood during work, give instructions to wear leather gloves and use appropriate dismantling tools, such as an appropriate crowbar.</p>

### 3.2.2 Confirmation after unpacking

After unpacking, confirm that this product matches your order and has not been damaged in transit or for another reason.

If you notify us of a packing problem after starting use, we may charge for a repair.

Although we ship with the greatest care, after unpacking, confirm the following to ensure safety









- Check if the actual content match with your order.
- Check if accessories (Quick manual, optional parts) are included.
- Check if there are any parts damaged during transportation.
- Check that there is no any screws and nuts loosened or disconnected during transportation.

In the event of any failure, contact our sales department or specified agent.




**Table 6:** List of standard accessories

Product name	Specifications	Q'ty	Remarks
Power connector	CE connector (DDK) /JL04V connector (JAE)	1	CE05-6A22-22SD-D-BSS /JL04V-6A22-22SE-EB-R
Waterproof cable clamp	CE connector (DDK) /JL04V connector (JAE)	1	CE3057-12A-1-D /JL04-2022CK(14)-R
Signal connector	D-sub 15pin	1	With a clamp hood
Quick manual	Japanese version, English version	1	—
Power connector guard	—	1	—
Nut (for purge gas)	1/4	1	VUW-6.35N
Front ring (for purge gas)	1/4	1	VUW-6.35S
Back ring (for purge gas)	1/4	1	VUW-6.35R
Dedicated silencer	For MS	1	Silencer + Check valve + Elbow piping assembly with drain valve
Outer ring	For KF40	1	MCK-2040-OU
Pressure-resistant clamp	For KF40	1	PJ0494-NW40

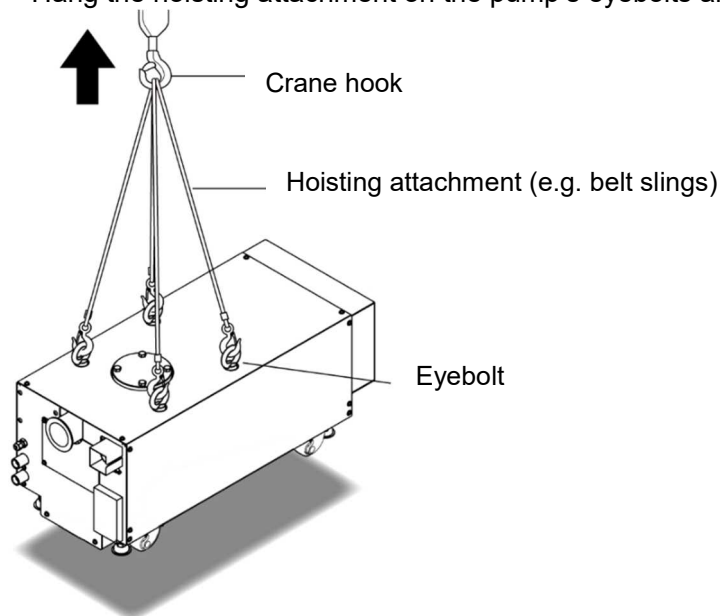
### ▶ 3.3 Transfer

 <b>Warning</b> 	<p><b><u>Do not use the casters as a transportation device or a means of equipment support.</u></b></p> <p>Although this pump is equipped with casters, do not use them as a transportation device or a means of equipment support.</p>
 <b>Warning</b> 	<p><b><u>Do not incline this pump by 10 or more.</u></b></p> <p>Otherwise, this pump may topple, causing injury or damage.</p>
 <b>Warning</b> 	<p><b><u>For transport, use cargo-handling equipment (e.g., a mobile crane) or a pallet truck.</u></b></p> <p>The weight of machine is as follows: MS120A: 139 kg, MS600A:241kg, MS1200A:264kg. To transport this pump, a load higher than the safety standards is required. Therefore, manually transporting it may cause lower back pain or injury.</p>
 <b>Warning</b> 	<p><b><u>Wear safety shoes during transportation</u></b></p> <p>Be sure to wear safety shoes before transferring this pump.</p>

### 3.3.1 How to hoist using crane

<b>Danger</b> 	<b><u>Never get under this machine</u></b> This machine may fall or topple if a forcible operation is performed or if the equipment is not sufficiently maintained. Never get under this machine.
<b>Warning</b> 	<b><u>Use a crane or other cargo-handling equipment</u></b> Give instructions to lift and transfer this machine using a crane or other cargo-handling equipment securely with the four eyebolts on the top of this machine when unpacking or lifting it. Before using eyebolts, confirm that there are no abnormalities. When hoist, make sure that hoist angle formed by the diagonal lines of the hoisting attachments with 60 degrees or less.
<b>Notice</b> 	<b><u>Make sure to hoist this machine alone</u></b> When hoisting, remove the dedicated silencer. Hoisting with the dedicated silencer mounted may damage the parts.

1. Prepare an appropriate hoisting attachment and check that the eyebolts are in normal condition (e.g., not loosened or damaged).
2. Hang the hoisting attachment on the pump's eyebolts and the crane hook.



**Figure 14:** Hoisting using Crane

3. Slowly operate the crane to hoist this machine until just before this machine leaves the ground.
4. Operate the crane again to hoist this machine until this machine leaves the ground.
5. After starting to hoist this machine, confirm that the belt sling and hoisting tool are in normal condition. Confirm that the load is not inclined.
6. When unloading the machine, make sure to lower the crane slowly not to apply shock to or damage the machine.

### 3.3.2 How to transport using pallet truck

#### **Warning**



#### **Do not transport this machine with the adjusters raised**

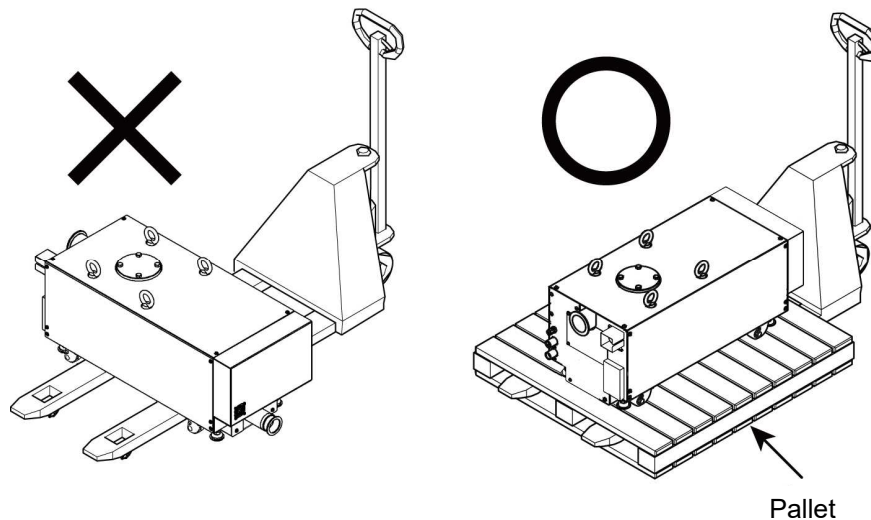
When transporting this machine via pallet truck, lower the four adjusters. If you carry this machine without the adjusters attached to the pallet, the machine may topple, causing injury or damage.

#### **Warning**



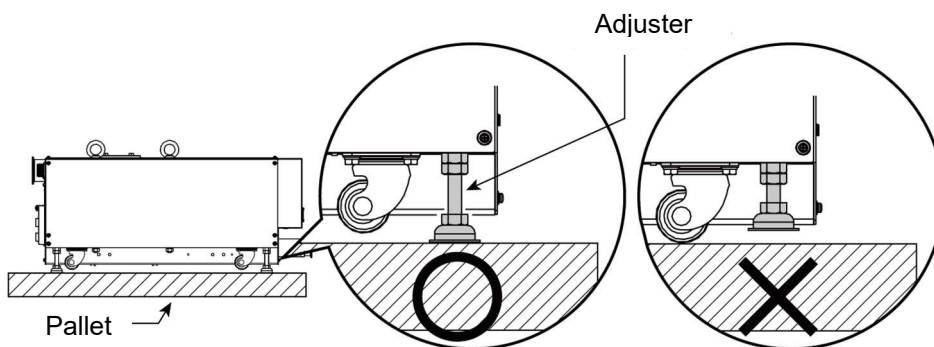
#### **Always use a pallet when transporting via a pallet truck.**

Do not transport this machine by pallet truck without placing it on a pallet. The machine may topple, causing injuries or damage.



**Figure 15:** Use of pallet

1. When putting this machine on a pallet, lower the adjusters (4 places).



**Figure 16:** Adjusters in Transportation

2. Put the pallet truck's fork through the pallet and lift the pallet slowly.
3. Transport the machine after confirming that there are no obstacles in the direction of travel.

## 3.4 Installation

### 3.4.1 Leveling

#### Notice



#### Install this machine in a horizontal position

If this machine is installed on a sloping floor or if adjustment of the adjuster is unbalanced, it may cause noise or malfunction.

After moving this machine to the installation location, use the adjuster to adjust the machine's inclination and install it. (Adjustment range is within +10mm). Use the adjustment while checking the inclination with a level if necessary.

### 3.4.2 Earthquake countermeasures

As an earthquake countermeasure, fixing brackets are available as an option.

#### Notice



#### Perform earthquake resistant fixing

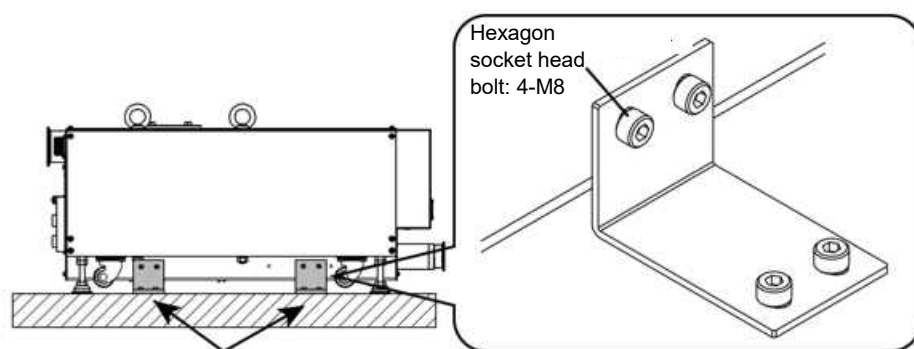
Securely fix this machine in case of an earthquake. (Fig. 17 Earthquake resistant fixing bracket). If the machine is fixed insufficiently, it may topple or move, damaging the surrounding equipment.

#### Notice



#### Piping and wiring need to be structured to absorb shaking.

Vacuum piping, cooling water piping, purge gas piping, and electric wiring need to be structured to absorb shaking. This is to prevent braking or disconnection of piping by the shaking.



Two brackets on both sides (Total of four brackets)

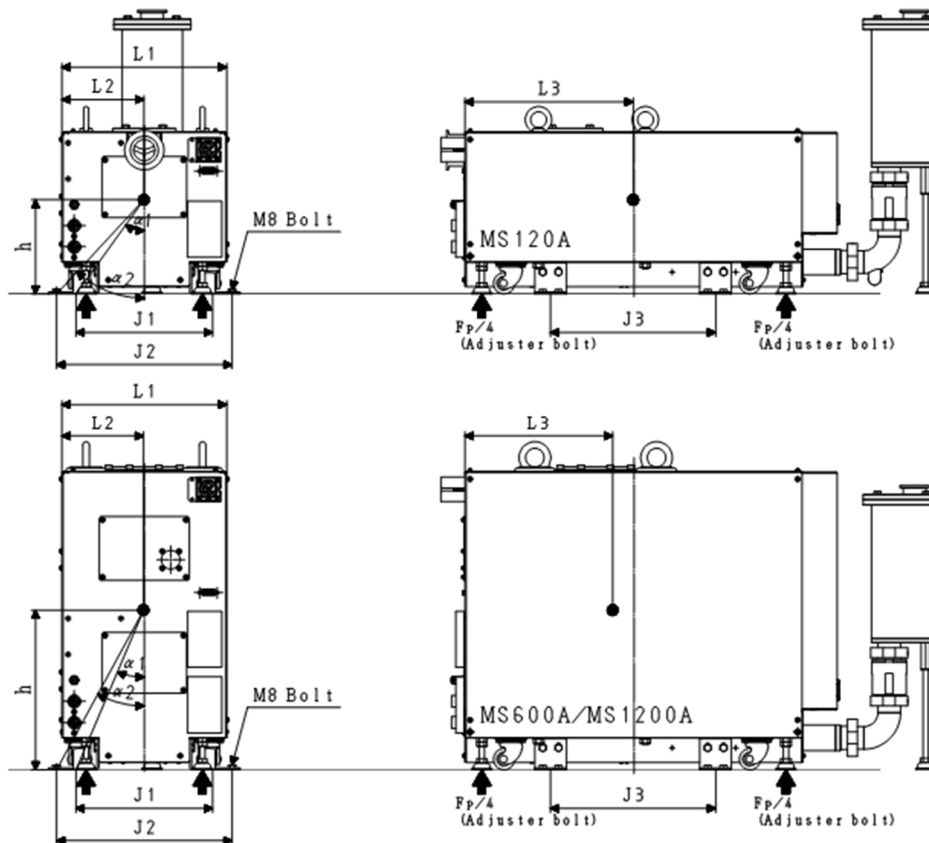
**Figure 17:** Earthquake resistant fixing bracket

Earthquake resistance has been examined based on the requirements of the 1997 Edition of the United States Union Building Code (UBC).




For the overturning moment, horizontal load and center-of-gravity position, refer to "Table 7: Earthquake resistance assessment."

**Table 7:** Earthquake resistance assessments



		Unit	MS120A	MS600A	MS1200A
Whole width of the surface of projection that falls easily	L1	mm	311	311	311
Short distance from the fulcrum on the surface of projection that falls easily to the position of the center of gravity	L2	mm	156	154	155
Distance from the rear panel to the position of the center of gravity	L3	mm	318	289	304
Height from the floor to the center of gravity	h	mm	197	301	312
Weight of equipment	Wp	kg	142	242	266
Horizontal moment (adjuster bolt) $F_p = 0.94 \times W_p$	$F_p/4$	kg	33.4	56.9	62.5
There is overturning moment R when $0.94 \times h \geq 0.85 \times L2$ .			OK	OK	OK
Overturning moment $R = (W_p \times (0.94h - 0.85L2)) / (2 \times L1)$	R	kg	12.0	59.2	69.1
Shear stress of anchor bolt (M8 × 2)	$\tau$	N	2038	2038	2038
$F_p < \tau$			OK	OK	OK
Tensile stress of anchor bolt (M8 × 2)	$\sigma$	N	3531	3531	3531
$R < \sigma$			OK	OK	OK
Interval between adjuster bolts	J1	mm	220	220	220
Interval between earthquake-resistant brackets	J3	mm	312	312	312
Tipping angle	$\alpha 1$	deg	29.2	20.1	19.4
Interval between earthquake-resistant brackets	J2	mm	332	332	332
Tipping angle	$\alpha 2$	deg	40.1	28.9	28.0
$\alpha > 15 \text{deg}$			OK	OK	OK



## 3.5 Piping and Wiring

 <b>Warning</b> 	<p><b><u>Shut off hazardous energy sources.</u></b></p> <p>Before working on piping and wiring, make sure that all hazardous energy sources are shut off referring to "1. For Safe Use" before starting work.</p>
<p><b>Notice</b></p> 	<p><b><u>Piping and wiring need to be structured to absorb shaking.</u></b></p> <p>Vacuum piping, cooling water piping, purge gas piping, and electric wiring need to be structured to absorb shaking. This is to prevent braking or disconnection of piping by the shaking.</p>



### 3.5.1 Inlet/Exhaust Port Piping

 <b>Warning</b> 	<p><b><u>Prevent the pressure on the exhaust side of this machine from increasing to 0.03 MPaG or more.</u></b></p> <p>Measure the pressure on the exhaust side of the pump. If it is 0.03 MPaG (0.3 kg/cm<sup>2</sup> G) (Gauge pressure) or more, remove those that are preventing gas from passing through on the exhaust port side.</p> <p>If the pressure in the pump increases to 0.03 MPaG or more, the pump may burst.</p>
--	--

- When connecting the pipe, remove the storage flange.  
At the time of shipment from the factory of the MS series, a storage flange, inlet port mesh, and desiccants are attached to the inlet flange section. When connecting the pipe, remove the storage flange and also the desiccants.
- For MS120A, blank either the vertical or horizontal exhaust port.  
MS120A has two inlet ports: horizontal and vertical. Be sure to attach a flange to the unused inlet port.  
\* MS120A assumes the use of a horizontal inlet port. When using a vertical inlet port, attach a blank flange to the horizontal inlet port. (The blank flange for the horizontal inlet port does not come standard.)
- Do not allow foreign matters to enter the inlet/exhaust port of this machine.  
When connecting the pipes, take care not to drop foreign matter (e.g. bolts) into the inlet/exhaust port of this machine. If foreign matters drop, it is necessary to disassemble this machine and remove them. Contact your nearest service center.
- Do not apply loads directly to the inlet/exhaust port of this machine.  
Do not apply loads, such as the connection piping, directly to the inlet/exhaust port of this machine.
- Be careful not to damage the seat surface of the O-ring  
Be careful not to damage the seat surface of the O-ring at inlet/exhaust port side. After assembling the pipes, perform a leak test for the entire system.
- Use piping with sufficient pressure resistance  
If the exhaust piping consists of thin metal pipes, such as accordion type and bellows, the piping may resonate due to exhaust pulsation, causing the noise to exceed the work environment reference value. Use piping with sufficient compressive strength.
- Secure the pipe diameter, path, and flow rate so that the exhaust piping is lower than the allowable pressure.  
In addition, the exhaust piping should be able to pass through without exceeding the allowable pressure (0.03 MPaG) on the exhaust side with respect to the maximum flow rate (80m<sup>3</sup>/hr).



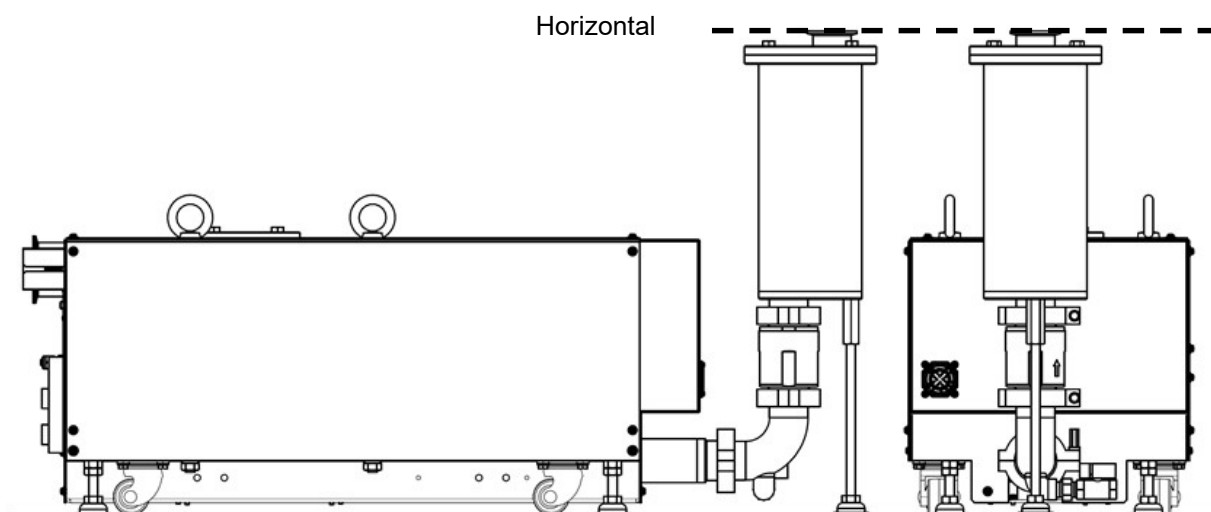
### 3.5.2 Dedicated silencer (Separately packed)

<b>Notice</b> 	<b><u>Install the dedicated silencer in a horizontal position.</u></b> If the dedicated silencer is installed on a sloping floor or if adjustment of the adjuster is unbalanced, it may cause noise or malfunction.
<b>Warning</b> 	<b><u>After assembling the pipes, perform a leak test for the entire system.</u></b> In the event of leakage, the process gas leaks from the pump, which may affect the human body. In addition, there is a danger that air enters the inside of the pump, causing abnormal reactions (ignition/explosion).

This machine comes with a dedicated silencer and KF40 pressure-resistant clamp / outer ring for mounting in a separate package.

Adjust the adjuster and install it as horizontally as possible. If necessary, adjust the adjusters while checking the level.



The recommended tightening torque of the long nuts for the pressure-resistant clamp is  $2\text{N}\cdot\text{m}$ . (8 mm in the diagonal direction)



**Figure 18:** Install of silencer



### 3.5.3 Cooling water piping

<b>Notice</b> 	<b><u>Use appropriate joints</u></b> The cooling water port of this machine is Rc 3/8. Connect appropriate joints to the cooling water piping. Do not confuse between inlet cooling water port and the outlet cooling water port.
<b>Notice</b> 	<b><u>Items to comply with in the use of cooling water piping</u></b> Comply with the items described below for cooling water and piping.

- **Be sure to supply the required amount of cooling water.**

Especially during operation at a high suction-pressure, if the amount of water falls below the specified amount, the temperature of this machine increases the pump malfunctions. It is recommended to install a flowmeter in the cooling water system and provide an interlock that stops this machine when the amount of water becomes equal to or lower than the specified value.

- **When stopping the operation in winter, drain water inside**

When operation is stopped in winter, water in the cooling water piping may freeze, causing damage to them. While operation is stopped, drain water inside by blowing compressed air from the cooling water outlet or by other means.

- **It is recommended to use water with fewer impurities (e.g. industrial water; refer to the table below) for cooling water.**

It is recommended to use water with fewer impurities (e.g. industrial water; refer to the table below) for cooling water of this machine. It is recommended to use "Table 8 [for reference]: The standard quality of water supply in the Japanese industrial water works."

In the cooling water system of this machine, water scale, such as calcium carbonate, settles on depending on the water quality, which may reduce the cooling water flow rate.

In addition, chlorine ions corrode the inner walls, which may cause leakage of cooling water. Furthermore, when pure water is used, metal is separated therefrom, which may cause leakage of cooling water.

Note that in advance that in such a case, the repair cost may be borne by you.

**Table 8 [Reference]** The standard quality of water supply in the Japanese industrial water works

Turbidity	pH	Alkalinity	Hardness	Total residue on evaporation	Chloride ion	Iron	Manganese
20mg / L or less	6.5~8.0	75mg/L or less	120mg/L or less	250mg / L or less	80mg/L or less	0.3mg/L or less	0.2mg/L or less

**Established by:** Japan Industrial Water Association (Industrial water quality standard committee)

- **Do not install electrical equipment or wiring on the floor below or near this machine**

This is designed so that no water leak occurs under the specified conditions and checked through a water leak test. However, in the event of abnormal conditions outside the specifications (e.g. an abnormal increase in water pressure), a water leak may occur. In that case, water will continue to leak unless the supply from the equipment is stopped. Do not install electrical equipment or wiring on the floor below or near this machine.

It is also recommended to place water leak sensors on the floor below and near this machine so that the power is shut off if a leak sensor is activated.

- **Install a flowmeter (e.g. flow sight) at the cooling water source**

Install a flow meter (e.g. flow sight), which allows you to visually recognize the flow, at the cooling water supply source, such as a device, to check whether or not cooling water flows.

- **When using multiple units of this type, connect the cooling water pipes in parallel.**

When using multiple units of this type, connect the cooling water pipes in parallel. A series connection is insufficient in cooling capacity, which may cause a failure.

- **Water with a lot of impurities is filtered using a filter or by other means.**

When using water with a large amount of impurities, such as scale and iron, filter them with a filter installed in the prior stage before use.

- **Secure the required flow rate**

If operation is continued with the cooling water flow rate below the specified amount, this machine may break down. Secure at least the specified flow rate. In addition, if the supply source and drain port are far apart from each other or if there is a height difference in the piping (lifting drainage to a position higher than this machine), a sufficient flow rate may not be secured. In that case, secure the flow rate by changing the piping layout, making the piping thicker, or increasing the supply pressure within the specified range.

- **Use the piping with an appropriate resistant water pressure and heatproof temperature.**

For the cooling water system, use joints and pipes with a resistant water pressure of 0.9 MPa or more and a heatproof temperature of 70°C or more.

- **Do not use metal pipes other than SUS pipes in the cooling water system (including the equipment side)**

Do not use metal pipes other than SUS pipes in the cooling water system including in the equipment side. For example, when using metal pipes containing copper or zinc, ions may dissolve in water. The dissolved ions may precipitate and adhere to the inner wall of pipes, reducing the flow rate of the cooling water.

The cooling water piping used in this machine uses SUS pipes and PTFE tubes. Note in advance that repairs are charged for trouble caused by a blockage in a pipe due to precipitation or accumulation of impurities (scale, microorganisms, metal powder or metal ions) and deterioration of cooling efficiency.

## ■ Specifications of connection

Connection port: Rc3/8 female

## ■ Applicable piping

Joints and pipes with a resistant water pressure of 0.9MPa or more

Heatproof temperature: 70°C or more

**Table 9:** Piping specifications






Cooling water	Supply pressure (MPa)	0.1 ~ 0.3
	Differential pressure between inlet and outlet (MPa)	0.1
	Flow rate (L/min)	> 4.0
	Feed water temperature (°C)	10 ~ 30 (non-condensing)

### 3.5.4 Purge Gas

This machine has a purge gas introduction mechanism.

If the target gas contains condensable gas and moisture, liquid may collect in the final stage of the pump. Therefore, use purge gas to prevent the gas from liquefying and accumulating inside the pump body. In addition, for explosive/flammable/combustion-supporting gas, dilute it with purge gas to the extent that the danger is eliminated. Introduce purge gas to reduce the accumulation of corrosive/reactive products when pumping such a gases.

As the purge gas, introduce nitrogen or CDA (dew point: -60°C). Decide which one to use as the purge gas depending on the process. (CDA cannot be used for dangerous processes that react with oxygen). Adjust the flow rate after starting the pump.

 	<p><b><u>Use the included nuts and ferrules.</u></b></p> <p>Use the included nuts and ferrules for installing piping. Using parts other than those specified may cause a malfunction or accident.</p>
<p><b>Notice</b></p> 	<p><b><u>Perform warm-up operation before processing and degassing operation when the unit is stopped.</u></b></p> <p>When processing, be sure to perform warm-up operation before processing and degassing operation when the unit is stopped each for one hour (operation in the atmosphere relief mode). In the event of processing under the condition where the increase in temperature of the pump in early stages is insufficient or in the presence of residual gas when the pump stops, condensable gas condenses inside the pump, which may shorten the life of the pump.</p>
<p><b>Notice</b></p> 	<p><b><u>The configuration is such that the condensed gas does not return directly to the pump.</u></b></p> <p>For the configuration, bend sideways the piping on the exhaust side using an L-shaped pipe or by other means so that the condensed gas does not return directly to the pump. It is recommended to provide a mechanism to drain accumulated liquid.</p>
<p><b>Notice</b></p> 	<p><b><u>Reference of water vapor tolerance is 1.5kg/hr.</u></b></p> <p>If water vapor exceeding the processing capacity, it may condense inside the pump even if purge gas is used, shortening the life of the unit. In addition, it is recommended not to stop the unit without intermittent operation.</p>

Connect the purge gas piping according to the following specifications:

## ■ Specifications of connections

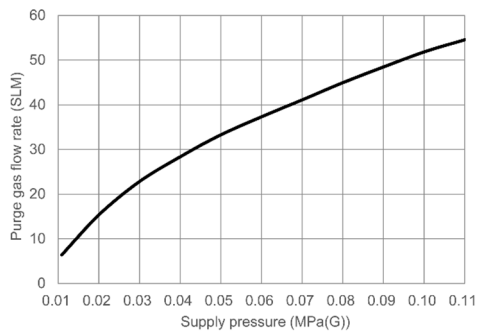
Pipe fittings of  $\phi 6.35$  mm

## ■ Applicable piping

Pressure resistance: fittings of 0.9 MPa or more and SUS piping with an outer diameter of  $\phi 6.35$  mm

Heatproof temperature: 100°C or more

Supply pressure: 0.09 to 0.11 MPaG Flow rate: 48 to 55 SLM (values as a guide)



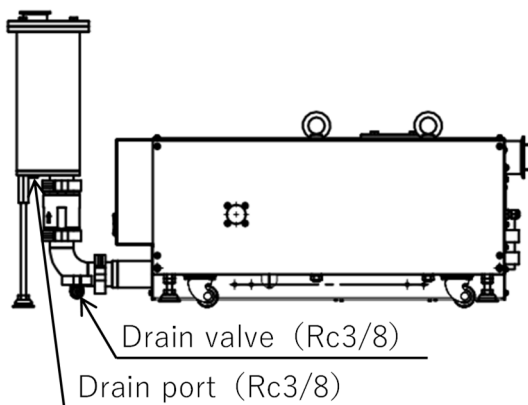
**Figure 19:** Purge gas supply pressure and flow rate (for reference)

### 3.5.5 Drain

This machine is equipped with a drain valve in the exhaust piping to prevent the liquid condensed on the exhaust side from accumulating inside the pump.

For positive liquid discharge of condensable gas connect a drain pipe to customers discharge connection area.






















Periodically, discharge the remaining liquid manually or use other pump to discharge when this machine is stopped. If to discharge during the operation is under the vacuum, provide a structure that prevents backflow. It may have a flow back if this machine is running at that point.



**Figure 20:** Drain

## 3.6 Electric Wiring

### 3.6.1 Electric wiring

 <b>Danger</b>  	<p><b><u>Electric wiring must be carried out by qualified personnel</u></b></p> <p>Electric wiring must be carried out by qualified personnel.</p>
 <b>Danger</b>  	<p><b><u>Before installing the wiring, turn off the primary ground-fault interrupter.</u></b></p> <p>Before installing the wiring, turn off the primary ground-fault interrupter. Never leave the voltage applied during the work.</p>
 <b>Warning</b>  	<p><b><u>Be sure to establish a ground for the ground terminal.</u></b></p> <p>For incomplete grounding, there is the risk of electric shock.</p>
 <b>Warning</b>  	<p><b><u>Use the included connectors</u></b></p> <p>Be sure to use the included connectors. Using other connectors may make it impossible to provide the first contact at the time of joining, resulting in an electric shock.</p>
 <b>Warning</b>  	<p><b><u>Do not use other than at the rated voltage</u></b></p> <p>Do not use other than at the rated voltage. Otherwise the ground-fault interrupter does not work properly, causing burnout or fire.</p>
 <b>Warning</b> 	<p><b><u>Comply with Rules and Laws and Regulations</u></b></p> <p>Install and operate this machine in compliance with the safety codes and laws (e.g. fire protection laws and electric codes) in the country and region where you use this machine.</p>
 <b>Warning</b> 	<p><b><u>Fix or cover the cables</u></b></p> <p>Fix the cables so that they do not come into direct contact with this machine, or prepare covers (cable racks).</p>
 <b>Warning</b> 	<p><b><u>Install the ground-fault interrupter in a readily accessible position and indicate that it is exclusively for this machine.</u></b></p> <p>In the event of a short circuit, it protects the equipment and wiring and protects against overload. In addition, it protects against an electric shock and a ground fault that can lead to fire due to electric leakage. If no ground-fault interrupter is installed or if it is installed but does not match the motor capacity, it may cause burn-damage to equipment, fire, or an electric shock. The open-circuit device of this machine is the ground-fault interrupter that is installed on the primary side by the customer. Install in a readily accessible position and indicate that it is an open-circuit device dedicated to this machine.</p>

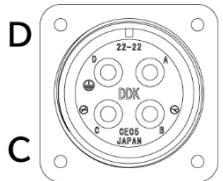
- Use electrical wires certified by the national safety standards in the country of destination (e.g. products certified by UL, TUV).
- Carry out cable wiring according to the rules of NEC Article 400.
- Prepare a power supply with the capacity to the power specifications of this machine in reference to "Table 10: List of power capacities and ratings of recommended ground-fault interrupters."

- In addition, a high-frequency leakage current occurs as an inverter is used inside. When using a ground-fault interrupter other than the specified ones with measures already taken against high frequency, use one with a sensed current of 200 mA or more.

**Table 10:** List of power capacities and ratings of recommended ground-fault interrupters

Rating List	200V			400V		
	MS120A	MS600A	MS1200A	MS120A	MS600A	MS1200A
Recommended type ( Manufactured by Mitsubishi Electric )	NV-32SV(F)	NV-63SV(F)		NV-32SV(F)	NV-63SV(F)	
Rated current ( A )	30	40	40	15	20	20
Rated sensed current ( mA )	30	30	30	30	30	30
Power capacity ( kVA )	9.5	12.5	13.0	9.5	12.5	13.0

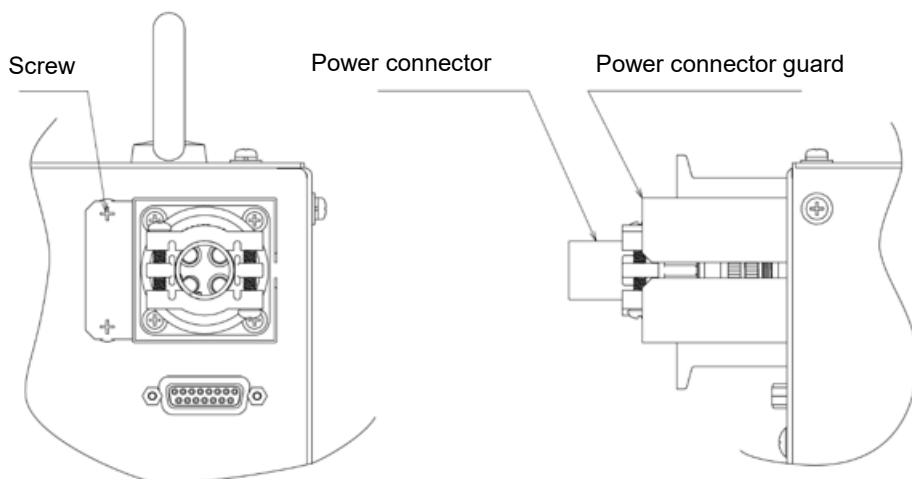
## Pin assignment of power

 <p><b>Figure 21:</b> Pin assignment</p>	Pin assignment	
	Pin No.	Specifications
	A	Phase L1/R
	B	Phase L2/S
	C	Phase L3/T
	D	PE/GND

**Table 11:** Receptacle connector specifications







Manufacturer of receptacle connector	DDK Ltd.	Japan Aviation Electronics Industry, Ltd.
Receptacle connector type	CE05-2A22-22PD-D	JL04HV-2E22-22PE-B-R
Applicable plug type (Direct type)	CE05-6A22-22SD-D-BSS	JL04V-6A22-22SE-EB-R
Applicable electric wire size	Up to 10AWG/4 ( Outer diameter of insulation coating: $\phi 4.5$ mm )	
Rated current (50/60 Hz)	46A	

- After connecting the power connector, install the guard.



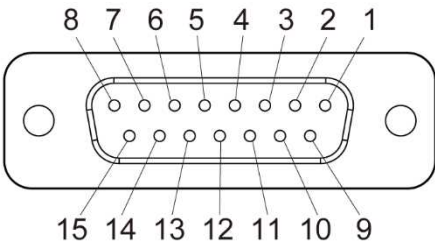
**Figure 22:** Installation diagram of power connector guard

### 3.6.2 Wiring for remote control

 <b>Danger</b>  	<p><b><u>Wiring must be installed by qualified personnel.</u></b></p> <p>Electric wiring must be carried out by qualified personnel.</p>
 <b>Danger</b>  	<p><b><u>Before installing the wiring, turn off the primary ground-fault interrupter.</u></b></p> <p>Before installing the wiring, turn off the primary ground-fault interrupter. Never leave the voltage applied during the work.</p>

- For the INPUT system, 24 VDC, 8 mA is applied on the pump side. Prepare a no-voltage contact.
- The pump side in the OUTPUT system is a no-voltage contact (Photo coupler output). Use a signal voltage of 5 to 48 VDC, 2 to 50 mA.
- When starting/stopping this machine from a distance, wire the signal line to the plug of the remote connector. The contact signal can start/stop this machine.
- When the pump is shipped, the signal connector pins from 13 to 14 are short-circuited. If it is not necessary to start/stop from a distance, use it with the signal connector plug attached.
- If the external interlock function between 13 and 14 (used when interlocking the interlock with equipment other than the device equipped with the pump) is not used, short-circuit them. If this wiring is not installed, it will be recognized as an external interlock instruction and the pump does not start. ("STo" appears on the controller.)
- MS120A "Startup Check" is output when the DRP speed is 1200 rpm or more. MS600A, MS1200A "Start Check" is output when the DRP rotation speed is 1200 rpm or more and the MBP rotation speed is 1800 rpm or more.
- If the "Pump Start" signal is input, the "Alarm Reset" signal is ignored. Be sure to set the "Pump Start" signal to OFF, before executing "Alarm Reset."
- When pins 1 and 9 and between pins 13 and 14 of the signal connector are short-circuited, it is possible to perform the start/stop operation by turning ON/OFF the MC on the power supply side. However, if it is done frequently, the inverter used inside may fail. From the viewpoint of the life of the relay contacts inside the inverter and the electrolytic capacitor, it is not recommended to start/stop by turning ON/OFF the MC on the power supply side. However, if necessary, the frequency shall be up to once every 30 minutes.
- To comply with the EMC standards, it is necessary to suppress the conduction noise from the cable. For the wiring, use shielded cables. Conduction noise changes depending on the relationship with other built-in electrical components, wiring conditions, arrangement, etc. Therefore, the customer should check the compatibility of the machine/device as a whole.
- "External Error" can be used to stop the pump by the contact signal of other equipment (e.g. flow meter).

## ■ Pin assignment of remote control wiring

				
Pin assignment				
No.	I/O	Item	Specifications	
1	IN	Pump Start	CLOSE: Operation	OPEN: Stop
2	IN	Alarm Reset	CLOSE: Reset	
3	IN	External Error	CLOSE: Error	OPEN: Normal
4	IN	Spare	Unable to use	
5		N.C		
6	OUT	Start check	CLOSE: Running	OPEN: Stopped
7		N.C		
8	OUT	Alarm	CLOSE: Normal	OPEN: Alarm
9	IN	IN COM		
10		N.C		
11		N.C		
12		N.C		
13	IN	External interlock	CLOSE: Normal	OPEN: Interlock
14	IN	External interlock Common		
15	OUT	OUT COM		

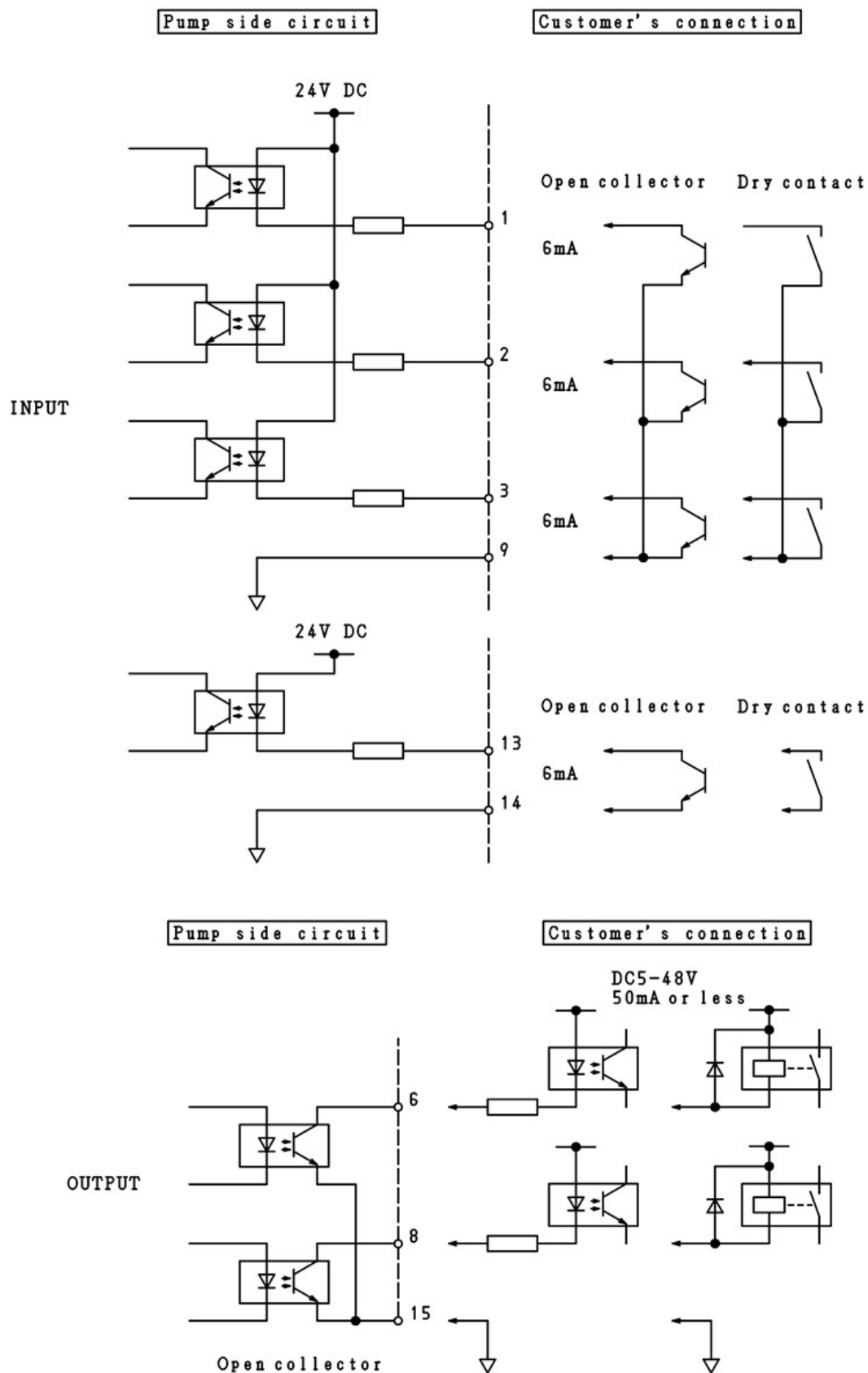
**Figure 23:** Pin assignment of remote control wiring

**Table 12:** Signal connector specifications

Connector type	D-sub 15-pin female
Applicable connector type	D-sub 15-pin male
Applicable electric wire size	AWG #22

\* The fitting screw size of the connector is M2.6.



























**Figure 24:** I/O block diagram for remote control wiring

## 4. Operation

### ▶ 4.1 Precautions on Operation

 <b>Danger</b> 	<p><b><u>Do not use any gas other than inability gas</u></b></p> <p>The pumping of toxic gas, flammable gas, combustible gas, corrosive gas, explosive gas and particle gas, may damage this machine and hazardous. Furthermore, the chemical reaction of remaining gases and/or generated particle and gases may cause the explosion, not only during operation but also after stop operation.</p>
 <b>Danger</b> 	<p><b><u>Do not use toxic gases into this machine</u></b></p> <p>When toxic gases were pumped, not only this machine but also the oil becomes toxic. Please be careful during maintenance.</p>
 <b>Warning</b> 	<p><b><u>Do not use in areas where a hazardous atmosphere may form or occur</u></b></p> <p>Do not use in areas where a hazardous atmosphere may be formed or occur due to explosive gas. Otherwise, injury or fire may occur.</p>
 <b>Warning</b> 	<p><b><u>Do not block the exhaust port</u></b></p> <p>Do not operate this machine with any equipment installed on the exhaust port side that prevents gas from passing in such a way as to block the exhaust port. Pressure in this machine may increase, which causes a rupture of or oil leakage from the casing or level gauge, or overloads the electric motor. This machine is not explosion proof structure. The guaranteed pressure value of this machine is 0.03MPaG (0.3kg / cm<sup>2</sup>G) (gauge pressure).</p>
 <b>Warning</b> 	<p><b><u>Ensure a space of at least 0.5 m in front of the ventilation inlet.</u></b></p> <p>If there are walls or obstacles within 0.5 m from the ventilation inlet, there is a risk of burn injury and fire due to abnormal overheating.</p>
 <b>Warning</b>  	<p><b><u>During operation, do not touch the pump body or piping.</u></b></p> <p>During operation, do not touch the bump body, motor, or piping as they reach extremely high temperature. If a human body touches the machine, it may get burned.</p>
 <b>Caution</b> 	<p><b><u>Confirm that the valve is open</u></b></p> <p>If the valve is installed on a pipe after the exhaust port, make sure that the valve is open.</p>
<p><b>Notice</b></p> 	<p><b><u>Be sure to supply cooling water during operation.</u></b></p> <p>Be sure to supply cooling water during operation. The required amount of cooling water is as follows:</p> <ul style="list-style-type: none"> <li>- Amount of cooling water: 4.0 L/min. or more</li> <li>- Cooling water inlet/outlet differential pressure: 0.1 to 0.3 MPaG (gauge pressure)</li> <li>- Cooling water temperature: 10 to 30°C</li> </ul>

<div>Notice</div> <div></div>	<div><b><u>Use water with fewer impurities for cooling water</u></b></div> <div>It is recommended to use water with fewer impurities (e.g. industrial water; refer to the table below) for cooling water of this machine.</div> <div>In the cooling water system of this machine, water scale, such as calcium carbonate, settles on depending on the water quality, which may reduce the cooling water flow rate.</div> <div>In addition, chlorine ions corrode the inner walls, which may cause leakage of cooling water. Furthermore, when pure water is used, metal is separated therefrom, which may cause leakage of cooling water.</div> <div>Note that in advance that in such a case, the repair cost may be borne by you.</div> <div><b>[Reference]</b> The standard quality of water supply in the Japanese industrial water works</div> <table><tr><th>Turbidity</th><th>pH</th><th>Alkalinity</th><th>Hardness</th><th>Total residue on evaporation</th><th>Chloride ion</th><th>Iron</th><th>Manganese</th></tr><tr><td>20mg / L or less</td><td>6.5~8.0</td><td>75mg/L or less</td><td>120mg/L or less</td><td>250mg / L or less</td><td>80mg/L or less</td><td>0.3mg/L or less</td><td>0.2mg/L or less</td></tr></table> <div><b>Established by:</b> Japan Industrial Water Association (Industrial water quality standard committee)</div>	Turbidity	pH	Alkalinity	Hardness	Total residue on evaporation	Chloride ion	Iron	Manganese	20mg / L or less	6.5~8.0	75mg/L or less	120mg/L or less	250mg / L or less	80mg/L or less	0.3mg/L or less	0.2mg/L or less
Turbidity	pH	Alkalinity	Hardness	Total residue on evaporation	Chloride ion	Iron	Manganese										
20mg / L or less	6.5~8.0	75mg/L or less	120mg/L or less	250mg / L or less	80mg/L or less	0.3mg/L or less	0.2mg/L or less										
<div>Notice</div> <div></div>	<div><b><u>Pay attention to a decrease in amount of cooling water</u></b></div> <div>If the amount of cooling water is reduced, it may cause failures such as rapid wear or seizing up of the components of the pump. Take care that this is highly likely to occur especially when intake pressure is high,</div>																
<div>Notice</div> <div></div>	<div><b><u>Use with the exterior panel attached.</u></b></div> <div>Operating with the exterior panel removed may lower the performance. Be sure to use with the exterior panel attached. Pumping performance may not be fully provided under the condition immediately after the startup and with the panel removed.</div>																
<div>Notice</div> <div></div>	<div><b><u>Warm up for approx. 30 minutes (recommended) after startup</u></b></div> <div>In order to make full use of the pump performance of this machine, it is recommended to warm up for approx. 30 minutes after startup.</div>																
<div>Notice</div> <div></div>	<div><b><u>Avoid any operations that place a heavy load when starting the pump.</u></b></div> <div>If it takes longer to reach the steady rotation speed from the start, the inverter protection circuit works to stop as an alarm. Apply loads after reaching the steady rotation speed.</div>																
<div>Notice</div> <div></div>	<div><b><u>Suction of chemicals such as acid</u></b></div> <div>The pumping of chemicals, such as acid, may damage the pump and becomes unable to operate. When the pump is not actively discharged from the inside residual chemical product. (Refer to 3.5.4 <u>Purge Gas</u> and 3.5.5 <u>Drain.</u>)</div>																

## ▶ 4.2 Preparation for Operation

### 4.2.1 Pre-Operation Check

Before operating this machine, reconfirm the following.

1. Make sure that the cooling water pipe, power connector, and signal connector are connected.
2. Open the cooling water valve and check that there is no cooling water leakage.
3. When supplying purge gas, connect the purge gas pipe and then supply purge gas.  
Check that there is no leakage of purge gas.
4. Supply power to the primary side.

### 4.2.2 How to switch between LOCAL (manual) and REMOTE (remote)

Entering operation commands from the controller is called LOCAL.

Entering operation commands from a sequence of higher-level devices via remote control wiring is called REMOTE.

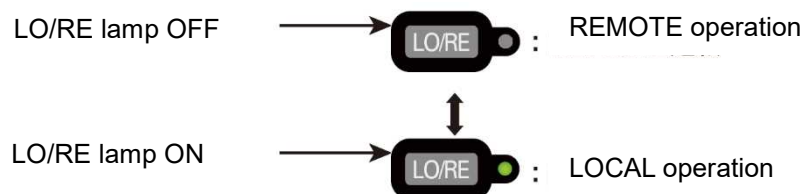
1. Turn on the power.  
The initial screen appears.

2. Press  on the DRP controller.

LOCAL/REMOTE switches.





The LO/RE lamp goes off during the "REMOTE" operation and lights up during the "LOCAL" operation.

Furthermore, when the power is cut off, it returns to the initial state (REMOTE). However, if the power is restored in a few seconds, the state before the cutoff is maintained.



\* Do not set the MBP controller to "LOCAL." If the MBP controller is switched to "LOCAL," the MBP becomes unable to start.


## 4.3 How to Start/Stop

<p><b>Notice</b></p> 	<p><b><u>Start/Stop the pump by starting/stopping the inverter as much as possible.</u></b></p> <p>When performing the start/stop operation by turning ON/OFF the MC on the power supply side, the inverter used inside may fail if it is done frequently. From the viewpoint of the life of the relay contacts inside the inverter and the electrolytic capacitor, it is not recommended to start/stop by turning ON/OFF the MC on the power supply side. However, if necessary, the frequency shall be up to once every 30 minutes.</p>
<p><b>Warning</b></p>  	<p><b><u>After the pump stops, keep supplying cooling water for a certain period of time.</u></b></p> <p>During operation or for a while after operation stops, the pump remains at very high temperatures. If a human body touches the pump, it may get burned. Supply cooling water until the temperature of the pump decreases.</p>
<p><b>Caution</b></p> 	<p><b><u>After the pump stops, supply a purge gas for a certain period of time.</u></b></p> <p>It is recommended to supply CDA as a purge gas.</p>


### 4.3.1 LOCAL operation

Use with the included signal connector plugs attached.

#### How to start

- Press  on the DRP controller.  
The unit starts and the RUN lamp on the controller lights up.  
\* For MS600A, and MS1200A, MBP starts when DRP reaches 1,200 rpm or more.

#### How to stop

- Press  on the DRP controller.  
This machine stops and the RUN lamp on the controller goes off.

### 4.3.2 REMOTE operation

Use with the included signal connector plugs wired separately.

#### How to start

- Enter the start signal from the host side.  
This machine starts.  
\* For MS600A, and MS1200A, MBP starts when DRP reaches 1,200 rpm or more.









#### How to stop

- Cut off the start signal from the host side.  
This machine stops.

## ► 4.4 Monitor Display

### 4.4.1 How to operate monitor display

To check the state of each pump, select "Monitor display" on the controller and follow the procedure below:

1. Turn on the power.  
The initial screen appears.
2. Until  (Monitor display) appears on the controller, press  or  and, Press   
The "Monitor display mode" appears.
3. Press  or  and select the parameter to display.
4. Press  and check the current state of each pump.
5. After the completion of checking, press  to return to the initial screen.

## ▶ 4.5 Parameter List

### 4.5.1 U3: Alarm history

To display the alarm history, use the U3 parameter.

**Table 13:** List of alarm history parameters

No.	Name	Function
U3-01	Details on the previous alarm	Displays details on the previous alarm.
U3-02	Details on the 2nd-to-last alarm	Displays details on the 2nd-to-last alarm.
U3-03	Details on the 3rd-to-last alarm	Displays details on the 3rd-to-last alarm.
U3-04	Details on the 4th-to-last alarm	Displays details on the 4th-to-last alarm.
U3-05	Details on the 5th-to-last alarm	Displays details on the 5th-to-last alarm.
U3-06	Details on the 6th-to-last alarm	Displays details on the 6th-to-last alarm.
U3-07	Details on the 7th-to-last alarm	Displays details on the 7th-to-last alarm.
U3-08	Details on the 8th-to-last alarm	Displays details on the 8th-to-last alarm.
U3-09	Details on the 9th-to-last alarm	Displays details on the 9th-to-last alarm.
U3-10	Details on the 10th-to-last alarm	Displays details on the 10th-to-last alarm.
U3-11	Cumulative operating time in the event of the previous alarm	Displays the cumulative operating time in the event of "previous alarm."
U3-12	Cumulative operating time in the event of the 2nd-to-last alarm	Displays the cumulative operating time in the event of "2nd-to-last alarm."
U3-13	Cumulative operating time in the event of the 3rd-to-last alarm	Displays the cumulative operating time in the event of "3rd-to-last alarm."
U3-14	Cumulative operating time in the event of the 4th-to-last alarm	Displays the cumulative operating time in the event of "4th-to-last alarm."
U3-15	Cumulative operating time in the event of the 5th-to-last alarm	Displays the cumulative operating time in the event of "5th-to-last alarm."
U3-16	Cumulative operating time in the event of the 6th-to-last alarm	Displays the cumulative operating time in the event of "6th-to-last alarm."
U3-17	Cumulative operating time in the event of the 7th-to-last alarm	Displays the cumulative operating time in the event of "7th-to-last alarm."
U3-18	Cumulative operating time in the event of the 8th-to-last alarm	Displays the cumulative operating time in the event of "8th-to-last alarm."
U3-19	Cumulative operating time in the event of the 9th-to-last alarm	Displays the cumulative operating time in the event of "9th-to-last alarm."
U3-20	Cumulative operating time in the event of the 10th-to-last alarm	Displays the cumulative operating time in the event of "10th-to-last alarm."

## 4.5.2 U4: Operation monitor

To display operating information of this machine, use the U4 parameter.

**Table 14:** Parameter list on operation monitor

No.	Name	Function
U4-01	Cumulative operating time	Displays the cumulative operating time of this machine.
U4-08	Inverter temperature	Displays the inverter temperature.



## 5. Maintenance and Inspection

Daily and regular inspection and maintenance work are required to maintain the original performance of this machine and ensure safe use.

### ► 5.1 Daily Inspection

Check the following items to prevent pump failures and extend this machine's life.

Item	Check item	Troubleshooting
Color of lubricating oil	Confirm that oil color is colorless and transparent.	If it is turbid, contact to ULVAC service center.
Cooling water	Confirm that cooling water flows at the specified flow rate.	Check the water pressure and piping.
Water leakage	Confirm that the floor is not wet.	Check the water pressure and piping.
Purge gas (In use of purge gas)	Confirm that purge gas flows at the specified flow rate.	Check the supply pressure and piping.
Abnormal noise, sound or vibration	Confirm that there are no abnormal noise, sound or vibration.	Check whether this machine, piping, etc. are fixed in place.
Power value	Confirm that overload is not applied to the pump.	Check the intake pressure. Check the exhaust side piping.

\* The oil level fluctuates depending on the operating conditions, but there is no problem when the oil surface is viewed through the inspection window for lubricating oil during operation.

### ► 5.2 Inspection after Long-Term Storage

If this pump is stored for a long period of time without being operated (at least six months), trouble may occur when the pump is operated due to rusting.

If the pump has not been used for a long period of time, request an inspection from your local ULVAC service center before using the pump.

## ► 5.3 Overhaul

Periodic overhaul perform is recommended.

Overhauls are necessary to maintain the performance (including safety) as well as to ensure the planned level of productivity.

### **Caution**



#### **Perform an overhaul once a year.**

**Perform an overhaul once a year.**

**In addition, an overhaul is recommended when this machine's performance degraded significantly or it has been contaminated by the usage, even when less than a year has passed since the previous overhaul.**

**Note that when performing an overhaul, it is necessary to replace at least the parts described in "Appendix: Major Replacement Parts."**

For overhauls, contact your local ULVAC Service center. When requesting overhaul, maintenance, repair, or other work, fill out the Declaration of Contamination attached to this document and submit it to the service center.

If details on the dangerous substances in use is not disclosed or if difficult-to-detoxify substances are exhausted, the Service center may refuse to perform maintenance or other operations.

## ► 5.4 Notes on Transportation

This product is a precision machine that incorporates precision machinery components and electronic components inside. Application of a strong impact or continuous vibration may cause a malfunction. Therefore, in transportation, please use a means of transportation which have vibration-proof function (an air suspension truck, for example).

Especially for long-distance overland transportation under poor road surface conditions, it is recommended to transport to the installation site under the same packing condition as when it was shipped from ULVAC.

If it is left in a high temperature and high humidity environment for a long time, it may cause a malfunction due to corrosion of mechanical parts or performance deterioration of electrical parts. Transport and store in an appropriate environment.

# 6. Troubleshooting

## ▶ 6.1 Trouble with Basic Operation

**Table 15:** Trouble with Basic Operation

Problem	Cause	Measures	Reference
The power cannot be turned on.	No electricity is supplied.	Supply power.	4.2.1
	Wrong connector wiring	Install wiring correctly.	3.6.1
	Electric leakage inside this machine	Contact to ULVAC service center.	Last page of this manual
Nothing appears on the controller display.	No electricity is supplied.	Supply power.	4.2.1
	Faulty instrumentation	Contact to ULVAC service center.	Last page of this manual
This machine does not start with the controller.	Not in the LOCAL operation mode.	Press the REMOTE/LOCAL switch.	4.2.2
	The external interlock is not wired ("Hbb" lights up).	Short-circuit between pins 13 and 14 of the remote control wiring.	3.6.2
	Faulty instrumentation	Contact to ULVAC service center.	Last page of this manual
This machine does not start by remote control.	The remote control wires are not connected correctly.	Connect the remote control wiring correctly.	3.6.2
	The external interlock is not wired ("Hbb" lights up).	Short-circuit between pins 13 and 14 of the remote control wiring.	3.6.2
	Faulty instrumentation	Contact to ULVAC service center.	Last page of this manual
The pump generates unusual noise.	The panel generates vibration noise.	Contact to ULVAC service center.	Last page of this manual
	Exhaust noise	Change to a thicker pipe. Even if the gas is introduced in a normal operation, resonant sound may generate by the connected pipes resonance.	
	Pump failure	Contact to ULVAC service center.	Last page of this manual
	Increase in exhaust pressure	Check the exhaust pipe.	3.5.1
	Leakage in the inlet pipe	Check the inlet pipe and stop the leak.	3.5.1
Pressure does not drop.	The mesh in the inlet port is clogged.	Check the inlet pipe.	3.5.1
	The exhaust pipe is blocked.	Check the exhaust pipe.	3.5.1
	Pump operating temperature has not reached the steady state.	After startup, warm up for about 30 minutes. The ultimate pressure shown in the specification table is the value directly over the pump.	7.1

## ▶ 6.2 Alarm Status and Measures

Indication	Alarm Name	Status
<b>CoF</b> (CoF)	Current offset error	Motor started operation during free-running.

Cause	Measures	Reference
Restarted before the pump rotation stopped completely.	After the pump stopped rotating, restart operation again.	4.3
	If the alarm persists even after restarting, contact to ULVAC service center.	Last page of this manual

Indication	Alarm Name	Status
<b>STPo</b> (STPo)	Step-out detection	Motor step-out was detected.

Cause	Measures	Reference
Occurrence of power outage	Check the electric wiring.	3.6.1
No cooling water flow	Cool this machine once and then flush it with water.	3.5.2
Pump overload	Contact to ULVAC service center.	Last page of this manual
Faulty ventilation fan	Contact to ULVAC service center.	Last page of this manual
Ambient temperature is out of the specification range	Operate at an appropriate ambient temperature.	3.1.3
Unable to rotate due to other particles.	Contact to ULVAC service center.	Last page of this manual

Indication	Alarm Name	Status
<b>LF</b> (LF)	Output open-phase	An open-phase occurred on the inverter output side.

Cause	Measures	Reference
The power supply wiring is broken.	Check the power supply wiring for breaks and miss-wiring. ➡ Install wiring correctly.	3.6.1
Motor failure	Contact to ULVAC service center.	Last page of this manual
Inverter failure	Contact to ULVAC service center.	Last page of this manual

Indication	Alarm Name	Status
<b>LF2</b> (LF2)	Output current imbalance	The three-phase balance of the output current is lost.



Cause	Measures	Reference
Motor failure	Contact to ULVAC service center.	Last page of this manual
Inverter failure	Contact to ULVAC service center.	Last page of this manual

Indication	Alarm Name	Status
<b>oC</b> (oC)	Overcurrent	Overcurrent flowed through the motor.



Cause	Measures	Reference
Motor failure	Contact to ULVAC service center.	Last page of this manual
Pump overload	Unable to rotate due to foreign matters. ➔ Contact to ULVAC service center.	Last page of this manual
	Increased back pressure. ➔ Clean and wash the piping on the exhaust side of the pump.	3.5.1
	Damage to bearing. ➔ Contact to ULVAC service center.	Last page of this manual
	High intake pressure ➔ Check the piping on the inlet side (for leakage etc.).	3.5.1
Inverter failure	Contact to ULVAC service center.	Last page of this manual

Indication	Alarm Name	Status
<b>oL 1</b> (oL1)	Motor overload	The motor overload protection is activated.



Cause	Measures	Reference
Pump overload	Unable to rotate due to foreign matters. ➔ Contact to ULVAC service center.	Last page of this manual
	Increased back pressure. ➔ Clean and wash the piping on the exhaust side of the pump.	3.5.1
	High intake pressure ➔ Check the piping on the inlet side (for leakage etc.).	3.5.1
Motor failure	Contact to ULVAC service center.	Last page of this manual
The output power is out of order due to the open-phase of the power supply wiring.	Check the power wiring.	3.6.1

Indication	Alarm Name	Status
<b>oL2</b> (oL2)	Inverter overload	The inverter overload protection is activated.



Cause	Measures	Reference
Pump overload	Unable to rotate due to foreign matters. ➡ Contact to ULVAC service center.	Last page of this manual
	Increased back pressure. ➡ Clean and wash the piping on the exhaust side of the pump.	3.5.1
	Damage to bearing. ➡ Contact to ULVAC service center.	Last page of this manual
	High intake pressure ➡ Check the piping on the inlet side (for leakage etc.).	3.5.1
Blockage in exhaust piping	Clean and wash the piping on the exhaust side of the pump.	3.5.1
Not to reach the steady rotation speed.	The load at startup is high. ➡ At startup of this machine, apply loads after reaching the steady rotation speed.	4.1
The output power is out of order due to the open-phase of the power supply wiring.	Check the power wiring.	3.6.1
Poor warm-up operation	Loads are applied without warming up. ➡ Warm up for approx. 30 minutes after startup.	

Indication	Alarm Name	Status
<b>oPr</b> (oPr)	Keypad connection failure	The cable between the inverter and the controller has been broken.



Cause	Measures	Reference
The wiring between the inverter and the controller has been broken.	Contact to ULVAC service center.	Last page of this manual

Indication	Alarm Name	Status
<b>oV</b> (ov)	Overvoltage in the main circuit	An overvoltage has been detected.



Cause	Measures	Reference
Occurrence of power outage	Check the power wiring.	3.6.1
The motor is ground fault.	Contact to ULVAC service center.	Last page of this manual
Extremely high power supply voltage	Check the supply voltage. ➡ Reduce the voltage to the power supply specifications of this machine.	7.1
Inverter failure	Contact to ULVAC service center.	Last page of this manual

Indication	Alarm Name	Status
<b>oH</b> (oH)	Inverter overheating	Inverter overheating was detected.



Cause	Measures	Reference
Excessive ambient temperature	Reduce the ambient temperature.	3.1.3
Ventilation fan failure	Contact to ULVAC service center.	Last page of this manual
Insufficient cooling water flow rate	Check the cooling water and increase the amount of supply.	3.5.2
	Insufficient differential pressure at the cooling water inlet/outlet ➡ Increase the supply pressure.	3.5.2
	The cooling water piping is clogged, or impurities are mixed in the cooling water. ➡ Clean the piping.	3.5.2
	Leakage from the cooling water piping ➡ If it is in this machine, Contact to ULVAC service center.	Last page of this manual

Indication	Alarm Name	Status
<b>PF</b> (PF)	Abnormal voltage in the main circuit	Main-circuit DC voltage fluctuates excessively more than that during regeneration.



Cause	Measures	Reference
An open-phase has occurred in the input power.	Check the input power supply wiring for breaks and miss-wiring. ➡ Install wiring for the power supply correctly.	3.6.1
Excessive fluctuations in voltage of the input power supply.	Check the power supply voltage. ➡ Take measures to stabilize the power supply.	3.6.1
Phase voltage imbalance		
Inverter failure	Contact to ULVAC service center.	Last page of this manual

Indication	Alarm Name	Status
<b>STo</b> (STo)	Inputting external interlock signals	An external interlock signal was input to the wiring for remote operation.



Cause	Measures	Reference
An external interlock signal is input.	Check the external interlock conditions. ➡ Release the external interlocks.	3.6.2
The external interlock is broken or not wired.	Check the wiring for remote control for breaks and miss-wiring. For local operation, check that pins 13 and 14 are short-circuited. ➡ Install wiring for remote control correctly.	3.6.2

Indication	Alarm Name	Status
<b>LT-2</b> (LT-2) <b>LT-3</b> (LT-3) <b>LT-4</b> (LT-4)	Expiration of maintenance period	The period that the inverter needs to be replaced has expired.



Cause	Measures	Reference
The period that the inverter needs to be replaced has expired.	It is recommended to overhaul including replacement of the inverter. ➡ Contact the ULVAC service center.	Last page of this manual



Indication	Alarm Name	Status
<b>CPFO 1</b> (CPF01)	Faulty control circuit	An error occurred in the inverters hardware.



Cause	Measures	Reference
Transmission noise is propagated from the wiring for remote control.	Use shielded cables for remote control wiring. ➡ Securely establish a ground.	
Controller wiring failure	Contact to ULVAC service center.	Last page of this manual

Indication	Alarm Name	Status
<b>EF3</b> (EF3)	External abnormality signal being input	An external abnormality signal has been input in the remote control wiring.



Cause	Measures	Reference
An external abnormal signal has been input.	Check the contact conditions of external devices. ➡ Release the contact for the external device.	3.6.2

Indication	Alarm Name	Status
<b>EF6</b> (EF6)	External abnormality signal being input	An external abnormality signal has been input in the remote control wiring.



Cause	Measures	Reference
An alarm is given to MBP. (Displayed on the controller side of DRP.)	Contact to ULVAC service center.	Last page of this manual

Indication	Alarm Name	Status
<b>dEv</b> (dEv)	Excessive speed deviation	An excessive speed deviation is detected. (Not an alarm, but a warning appears.)



Cause	Measures	Reference
Too much load	Since the chamber capacity at the time of evacuation is large, protect the MBP to reduce the number of revolutions. ➡ When the indication disappears after evacuation, there is no problem.	3.6.2
	Since the amount of gas to be sucked is large, protect MBP to reduce the number of revolutions. ➡ Adjust the pressure on the intake side to avoid several-hour operation at 3,000 rpm or less.	

## ► 6.3 How to Restart the Pump after an Alarm

### ■ Resetting an alarm

If the controller displays an alarm, restart the pump after eliminating the cause of the alarm. Upon restarting the pump, reset the alarm using any of the following methods.

Procedure after an alarm occurs	How to reset the alarm
After eliminating the cause of the alarm, reset the alarm and then restart the pump.	Press the controller's RESET key while the alarm content is displayed on the controller.*
After eliminating the cause of the alarm, turn on the alarm reset signal from the signal connector.	Short circuit the alarm reset signal pin of the remote control wiring.
Turn the power on again.	Turn the primary side power off. Turn it on again after the controller display turns off.

\* For MS600A, and MS1200A, press the RESET key on both the DRP and MBP controllers in order.

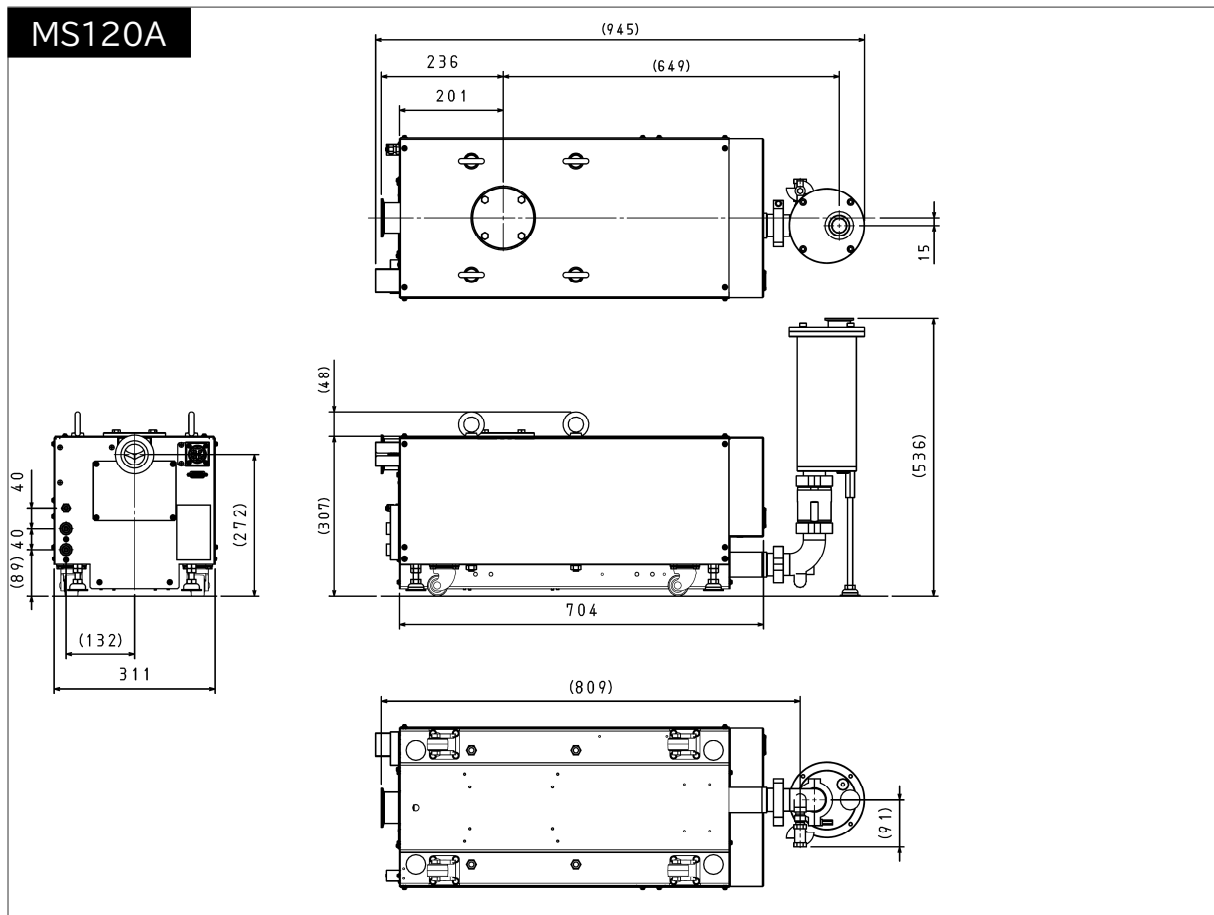
# 7. Specifications

## 7.1 Performance Specifications

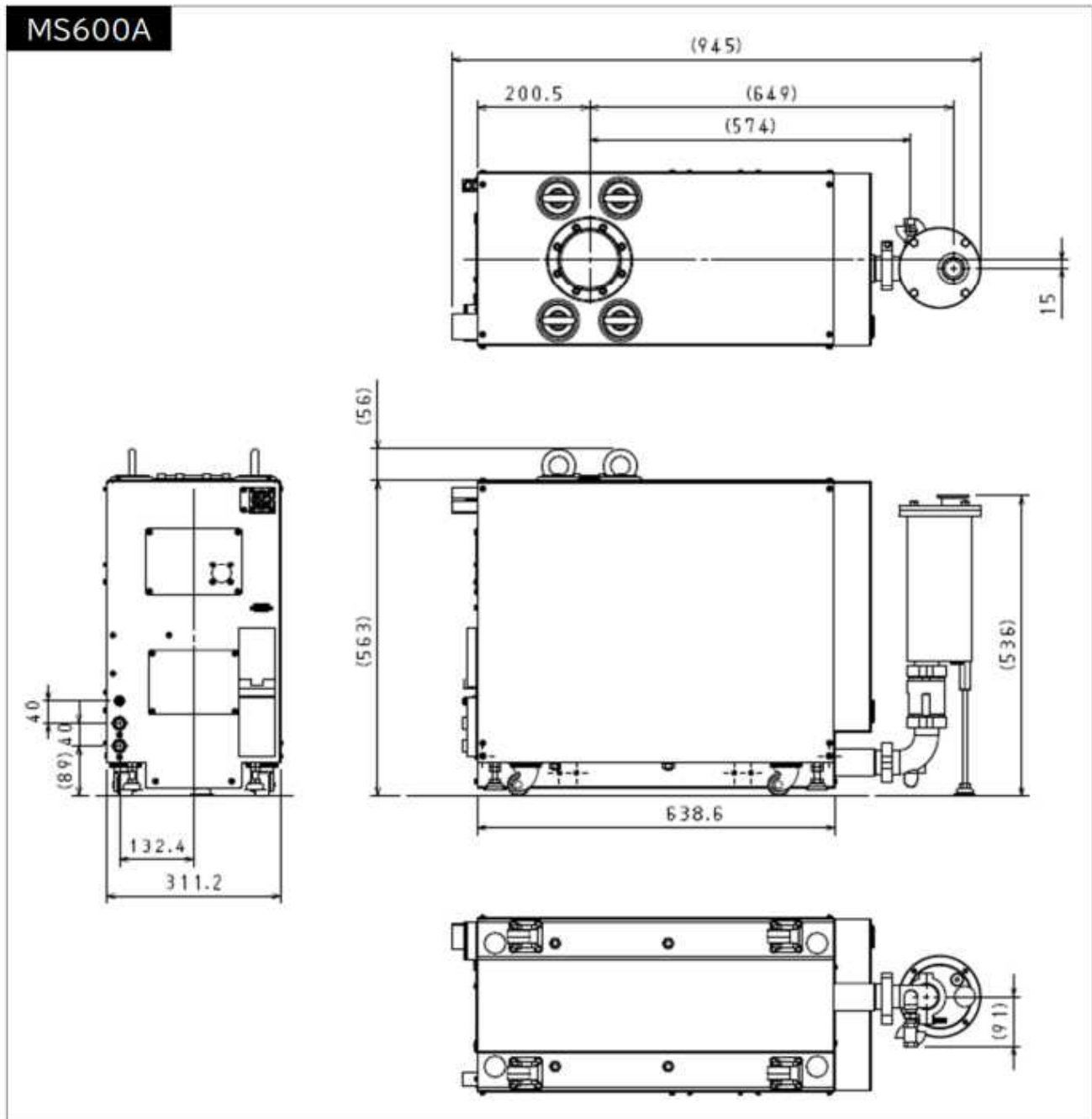
Model			MS120A	MS600A	MS1200A
Pumping speed※1	Maximum	m³ / hr	115	560	980
	Atmospheric pressure		80		
Ultimate pressure		Pa	≦0.6	≦0.1	
Power-supply voltage (Select)		VAC	3 phase 200-240±10% or 380-480±10% 50/60Hz		
Approximate power consumption	At ultimate pressure	kW	2.4	3.1	3.1
	Under maximum load		3.0	5.0	5.3
Motor capacity				3.7	5.9
Amount of cooling water		L / min	>4.0		
Amount of purge gas*1		SLM	0～50		
Maximum water vapor throughput*1		kg / hr	1.5		
Noise value	At ultimate pressure	dB(A)	61	62*1	64*1
Inlet port flange			KF50, VG50	ISO-F-80	ISO-F-100
Exhaust port flange			KF40		
Surface treatment			Special surface treatment		
Lubricating oil			BARRIERTA J100FLUID, J100FLUIDE (NOK KLUBER)		
DRP's oil level		mL	240	240	240
MBP's oil level			—	300	300
External dimensions * 2	Width	mm	311		
	Length		704(945)		
	Height		307(536)	563	563
Mass * 3		kg	132(139)	234(241)	257(264)
Overseas safety standards			CE, cTUVus		

<sup>\*1</sup>: Representative value. <sup>\*2</sup>: ( ) shows the external dimensions including a silencer. <sup>\*3</sup>: ( ) is mass including a silencer.

## 7.2 External Dimensions

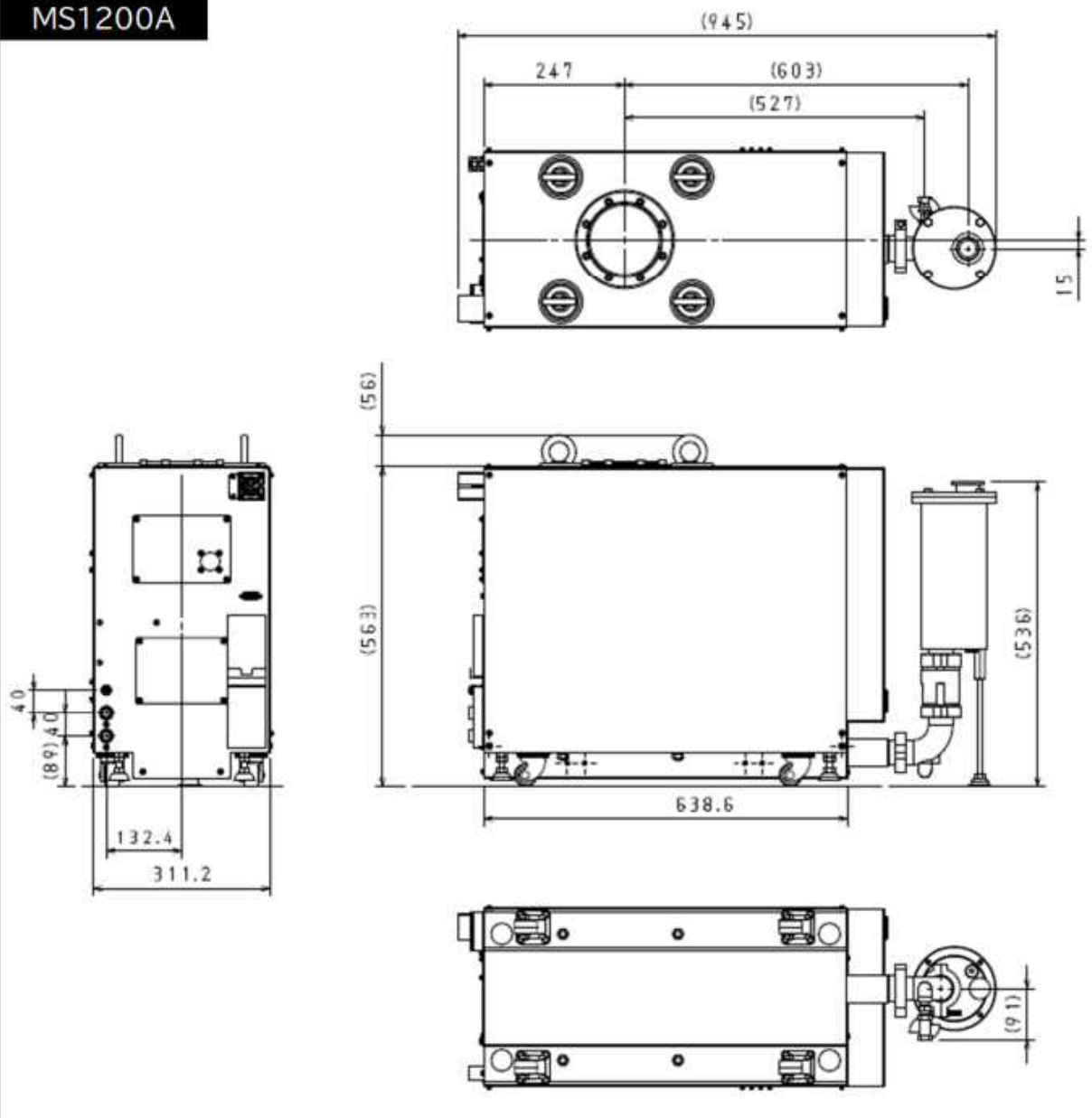


**Figure 25:** External dimensions of MS120A



**Figure 27:** External dimensions of MS600A

## MS1200A



**Figure 28:** External dimensions of MS1200A

# Appendix

## Major Replacement Parts

The list of parts to be replaced through an overhaul is shown below: The replacement period depends on the part. In addition, the recommended replacement cycle shown in the table below is given for reference only. It depends on your usage and environment.

**Table 16:** Major replacement parts

Category	Parts Name
Parts that must be replaced during an overhaul	Bearing
	Power lock
	Cooling water piping
	O-ring
	Lubricating oil
	Oil seal
	Level gauge
	Check valve
	Parallel key
	LAN cable
	Vibration-proof rubbers
Parts that must be replaced every two years	Bearing case
	Seal sleeve
	Slinger
Parts that must be replaced every three years	Inverter
	Cooling fan
Parts that must be replaced every five years	Cylinder
	Rotor shaft
	Side cover
	Motor
	Timing gear
	Controller
	Noise filter

# ULVAC Components / Certificate of Decontamination

This is a certificate of decontamination for repair and inspection request of ULVAC Components. All material must be certified as decontaminated and this certificate must be submitted to your closest local ULVAC service center or sales office prior to shipment.

Please consult with your closest local ULVAC service center or sales office if our components are used with toxic gases or contaminated with reactive products or substances produced by reaction.

Product model:

Model:

Serial No.:

Application:

Remarks:

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Contaminant (Check an applicable box.)

- ☐ I guarantee that above returned item(s) is not contaminated with harmful substances.
- ☐ Above returned item(s) is contaminated with the following harmful substances.

	Name of contaminant (molecular formula)	Characteristics
1		
2		
3		
4		
5		

To: ULVAC, Inc

Attn:

Date: / / (YYYY/MM/DD)

Your company

Division

Contact

Phone

Fax

E-mail

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Please pack returned item(s) carefully before shipment. Any accident occurred during transportation to us caused by contaminant is under your responsibility. It is also to be understood that ULVAC may decline to repair returned item(s) depending on the type of contaminant and degree of contamination, and return it to you.

To be filled in by ULVAC	Received by	
Request for MSDS: Yes/No		
ULVAC job No.		



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規格品事業部

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