No. 1000310-2-01-14

ULVAC

Instruction Manual
For
Oil Sealed Rotary Vacuum Pump

Original Instructions

Model

GHD－031A

GHD－031B

Request to Users

Please read this manual thoroughly to ensure safe and effective use of the equipment.

Keep this manual in a place where it can be referred to at any time and look after it carefully.

The contents of this instruction manual are subject to change without prior notice due to improvements in performance and the functions of the product.

ULVAC KIKO, Inc.

Contents

0. Introduction ・・・・・・・・・・・01

0.1 Before using the vacuum pump ・・・・・・・・・・・01

0.2 Safety symbols ・・・・・・・・・・・03

1. For safe operation ・・・・・・・・・・・ 1

1.1 Hazards peculiar to the pump and safety measures ・・・・・・・・・・・ 1

1.1.1 Danger Leakage of dangerous gas and material ・・・・・・・・・・・ 1

1.1.2 Warning Electric shock ・・・・・・・・・・・ 1

1.1.3 Warning Explosion ・・・・・・・・・・・ 2

1.1.4 Caution High temperature ・・・・・・・・・・・ 3

1.2 Safety Data Sheet (SDS) ・・・・・・・・・・・ 4

2. Outline of the Pump ・・・・・・・・・・・ 5

2.1 Specification ・・・・・・・・・・・ 5

2.2 Dimensional drawing ・・・・・・・・・・・ 6

3. Measures before it starts ・・・・・・・・・・・ 7

3.1 Securing of exhaust vent ・・・・・・・・・・・ 7

3.2 Installation ・・・・・・・・・・・ 9

3.3 Vacuum piping ・・・・・・・・・・・10

3.4 Electric wiring ・・・・・・・・・・・12

a) Power cable selection standards ・・・・・・・・・・・13

b) Precautions ・・・・・・・・・・・13

b-1) Unplug-preventive hardware(Option) ・・・・・・・・・・・13

b-2) How to install unplug-preventive hardware ・・・・・・・・・・・14

3.5 Fluctuation in the power voltage and frequency ・・・・・・・・・・・15

4. Operation ・・・・・・・・・・・16
4.1 Cautions for operation ・・・・・・・・・・・16
4.2 Start of operation ・・・・・・・・・・・16
4.3 Stopping the operation ・・・・・・・・・・・17
4.4 Operation in cold climates ・・・・・・・・・・・17
4.5 Thermal protector ・・・・・・・・・・・17
4.6 Magnet coupling ・・・・・・・・・・・18
4.7 Oil mist trap (Option) ・・・・・・・・・・・18
4.8 Restriction on operation when the oil mist trap is installed ・・・・・・・・・・・18
5. Pump performance ・・・・・・・・・・・19
5.1 Ultimate pressure ・・・・・・・・・・・19
5.2 Pumping speed ・・・・・・・・・・・20
5.3 Power requirement ・・・・・・・・・・・21
6. Maintenance, Inspection and Repair ・・・・・・・・・・・22
6.1 Maintenance ・・・・・・・・・・・22
6.2 Periodic inspection ・・・・・・・・・・・22
6.3 Replacement of the pump oil ・・・・・・・・・・・25
6.4 Trouble check list ・・・・・・・・・・・28
7. Disposal ・・・・・・・・・・・31
8. Maintenance parts ・・・・・・・・・・・32
8.1 Maintenance parts list ・・・・・・・・・・・32
8.2 Disassembly drawing ・・・・・・・・・・・33
Warranty
Safety Data Sheet (SDS) for Vacuum Pump Oil R-2
Pump usage check sheet (Use this sheet for requesting an overhaul.)
Sales, service agency, and the where to make contact

Figures and Tables

Figure1. Dimensional drawing of GHD-031 oil sealed rotary vacuum pump・・・・・・・・・・ 6

Figure2. Basic piping diagram to the vacuum chamber ・・・・・・・・・・・・10

Figure3. Electric wiring diagram ・・・・・・・・・・・・12

Figure4. Inlet (EN60320-1) ・・・・・・・・・・・・12

Figure5. Change region of the voltage and frequency ・・・・・・・・・・・・15

Figure6. Pumping speed curve ・・・・・・・・・・・・20

Figure7. Characteristics of motor power ・・・・・・・・・・・・21

Figure8. Lubrication of the oil sealed rotary vacuum pump ・・・・・・・・・・・・27

Figure9. Disassembly drawing of GHD-031 oil sealed rotary vacuum pump ・・・・・・・33

Table1. Specification ・・・・・・・・・・・・ 5

Table2. Power cable selection standards ・・・・・・・・・・ 13

Table3. Characteristics of the thermal protector ・・・・・・・・・・ 17

Table4. Periodic inspection table ・・・・・・・・・・ 24

Table5. Trouble check list ・・・・・・・・・・ 28

Table6. GHD-031 Maintenance parts list ・・・・・・・・・・ 32

Attached table: Safety Data Sheet (SDS) for Vacuum Pump Oil R-2

O. Introduction

0.1 Before using the vacuum pump

Thank you for purchasing this product. Your custom is very much appreciated. This pump is only for vacuum pumping, and may malfunction or cause accidents if not handled appropriately. Please use instruction manuals after attention enough for check / maintenance / security sides after a reading well.

Personnel handling the equipment

Only persons who have read this manual thoroughly, and have sufficient understanding of safety, pump specifications, and method of operation, can operate this pump.

Read the manual thoroughly

Please completely read a manual well to use this product definitely. Please read the section on “introduction in the security” “use for safe operation” by all means.

Keep this manual in a safe place

Keep the instruction manual carefully. After reading this manual, be sure to keep it in a safe place, which is readily accessible to others needing to use it.

Copying this manual is prohibited

This instruction manual can copy no part for sale without our permission.

Statutory requirements for disposal

Follow all statutory and local authority regulations when disposing of this pump.

Safety during repair

When it is asked us for repair, please inform the use situation of having hazardous substance or not in particular for the safe management of the repair worker.

The use situation declines repair in the case of lack of foresight.

Confirmation at the time of the unpacking

Although the pump is delivered with great care, check the following after unpacking.

(1) Confirm whether it is the model of the pump of the order.
(2) The specified accessories have been provided.
(3) No parts have been damaged in transportation.
(4) Neither screws nor nuts have become loose nor were lost in transportation.

If there are any problems, contact the company from which you purchased the pump or the sales department of the manufacturer.

0.2 Safety symbols

In this instruction manual and on warning labels attached to the pump, the following symbols are used so that matters which must be strictly adhered to can be readily understood.

These symbols are divided as shown below.

⚠ Danger

When mishandled, there is an imminent danger of the operator suffering a fatal accident or serious injury.

⚠ Warning

When mishandled, there is a possibility of the operator suffering a fatal accident or serious injury.

⚠ Caution

When mishandled, there is a possibility of the operator suffering an injury (light or medium injury) or of damage occurring to property.

⚠ Note

When mishandled, there is a possibility of the pump being damaged or malfunctioning.

High temperature

Some parts of the pump may reach temperatures of 60° C or more during operation. Touching such components may result in burns.

Electric shock

Always switch off the main power supply before installing electrical wiring or performing any electrical work on the pump. Failure to do so may result in electric shock.

The inlet port of the pump

The outlet port of the pump

Various label putting positional externals

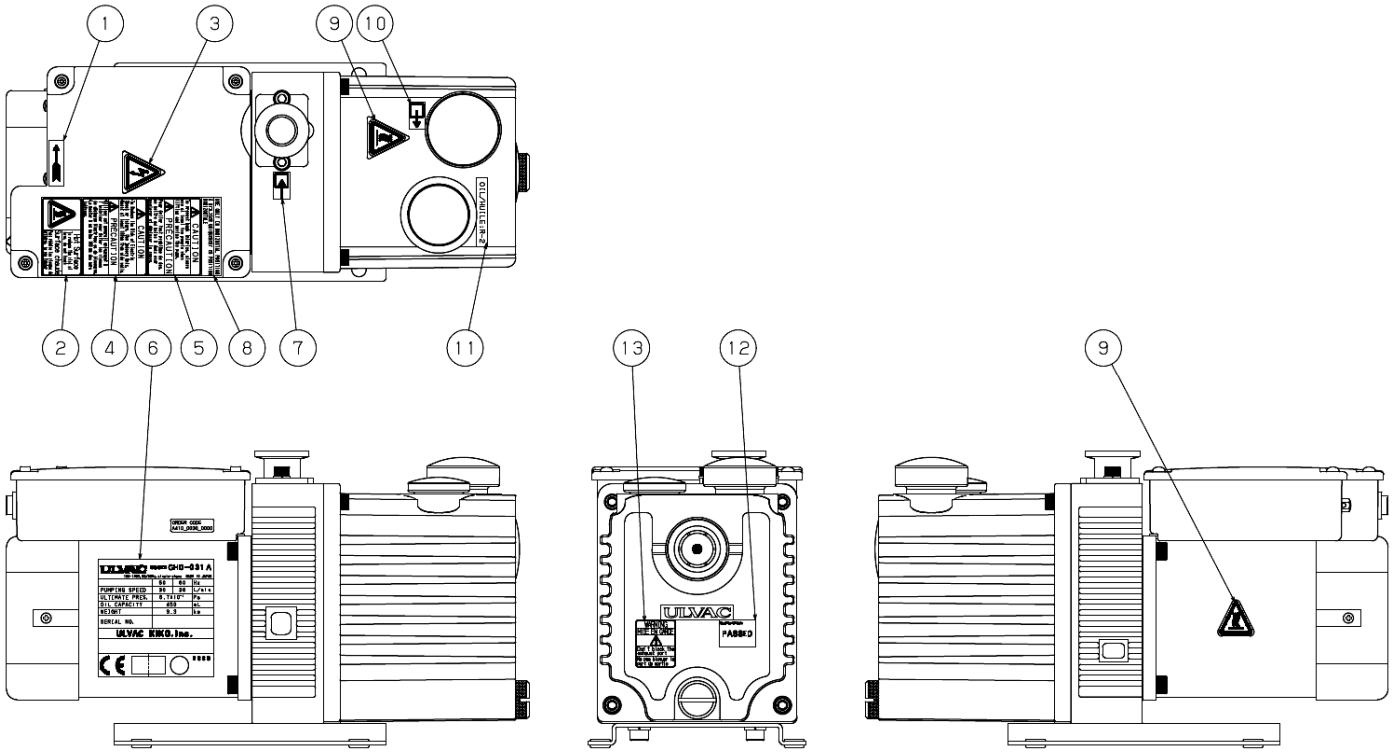
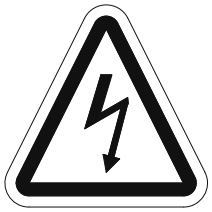
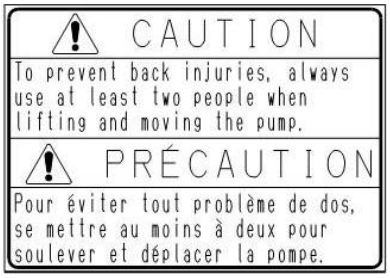
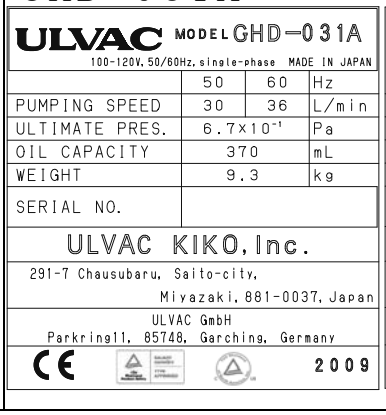
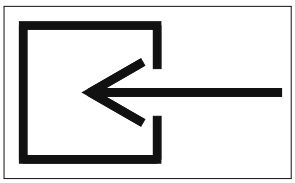
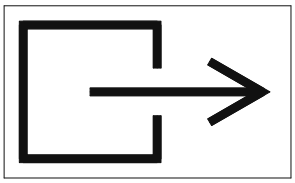


Table for various labels

No.	Label name	Label
①	Rotation	
②	Burn caution	
③	Electric shock caution	
④	Installation caution	
⑤	Transportation caution	
⑥	Pump	GHD－０３１A  GHD－０３１B 

No.	Label name	Label
⑦	Inlet	
⑧	Position	
⑨	High temperature caution	
⑩	Outlet	
⑪	Pump oil (R-2)	
⑫	Passed	
⑬	Warning explosion	

1. For safe operation

1.1 Hazards peculiar to the pump and safety measures

Before operating or inspecting the pump, read this section carefully to fully understand potential hazards and prevention methods.

The pump is not to be used with toxic of flammable gases.

1.1.1 ⚠ Danger Leakage of dangerous gas and material

Cause	Prevention method and measures
Injury due to touching toxic pump oil in the pump or harmful substances attached to the pump during inspection or disposal.	① Before overhauling and disposing of the pump, ask a waste disposal specialist to make it safe. ② Ask an authorized waste disposal specialist to carry out disposal.

⚠ Danger

This pump is for dry air or dry nitrogen absorption of the inert gas. This pump cannot absorb poisonousness and flammable gas. Leak from the main body of pump and, as well as the vent of the pump, is very in danger.

1.1.2 ⚠ Warning ⚠ Electric shock

Cause	Prevention method and measures
The energized part of the motor was touched.	① When connecting electric wires, always turn off the power and be sure to connect the earth wire. ② When inspecting and transferring the pump, always turn off the power.

⚠ Caution

Arrange wires correctly in accordance with the “Electrical Equipment Technical Standard” and “Wiring Regulations.” Incorrect wiring may result in fire.

1.1.3 ⚠ Warning  Explosion

Cause	Prevention method and measures
Pump inside pressure rises, and the level gauge of the pump ejects.	The maximum internal pump pressure is 0.03 MPa (gauge pressure). Measure the pressure at the outlet side and, if the pressure is 0.03 MPa or more (gauge pressure); remove objects which block the passage of gas from the outlet side. When an oil mist trap is adopted, replace or clean it so that it will not block the passage of gas.

⚠ Warning

There is a risk of explosion. Never block the outlet or operate the pump with equipment mounted at the outlet side which blocks the passage of gas. Otherwise, the internal pump pressure increases causing the pump to explode, the oil level gauge to protrude or the motor to be overloaded. This pump is not resistant to pressure. The internal pump pressure is limited to 0.03 MPa (gauge pressure).

1.1.4 ⚠ Caution  High temperature

Cause	Prevention method and measures
High temperatures caused burns.	①The pump reaches a high temperature during operation. (Temperature increasing) Pump main unit during non-load operation →30K Motor during non-load operation →35K Pump main unit during high-load operation →35K Motor during high-load operation →40K (High-load operation: Operation at a pressure of 1kPa ～ 10kPa) ②Please be sure to protect and cool surface of vacuum pump and away from human body. Use this pump as built-in type. ③Since the surface temperature is hot, touching the surface accidentally may result in burns. Never touch the pump during operation. When carrying out inspection, wait for 10 minutes until the pump has cooled down completely after it stops.

⚠ Caution

Never place combustible materials around the motor or pump. There is a risk of fire. Also, do not place objects which block ventilation around the motor. Abnormal heat generation may result in burns or fire.

1.2 Safety Data Sheet (SDS)

The attached “Safety Data Sheet (SDS)” shows chemical materials which may be used or touched when operating the pump. Read the SDS carefully in order to understand the harmful properties of these materials.

Contact us before using chemical materials (vacuum pump oil) other than those mentioned in this instruction manual.

⚠ Caution

SDS is submitted as reference information to ensure safe handling of hazardous and harmful materials. Personnel handling the pump oil should be aware that proper measures must be taken depending on the conditions of use as their responsibility. Keep in mind that the SDS itself is not a warranty for safety. Newest SDS shall be used when the safety of material is investigated

2. Outline of the pump

2.1 Specification

This oil sealed rotary vacuum pump is a rotary vane pump (hereinafter called Gaede type pump) in which the pump is directly driven by the motor. Since the pump is small, light, and quite simply constructed, it is easily maintained and repaired.

Table 1.Specification

Model		Unit	GHD-031A		GHD-031B	
			50Hz	60Hz	50Hz	60Hz
Type		-	Rotary vane (2 vanes)			
Pumping speed		L/min	30	36	30	36
Ultimate Pressure		Pa	6.7×10^{-1}			
Motor	Type	-	1φ.100W.2P.Capacitor Run			
	Voltage	V	100-110	100-120	200-240	
	Thermal Class	-	E			
Full-load current		A	1.85(100V) 1.80(110V)	1.89(100V) 1.71(120V)	0.94(200V) 0.84(240V)	1.02(200V) 1.03(240V)
Motor speed		r/min	2500(100V) 2600(110V)	3100(100V) 3300(120V)	2400(200V) 2600(240V)	2900(200V) 3100(240V)
Oil	Standard oil	-	R-2			
	Oil amount	mL	370			
Weight		kg	9.3			
Ambient temperature range		℃	7～40			
Installation features		-	Indoor			
Noise level		dB(A)	50or less (Ultimate pressure at 1m. With OMT-050A)			
Inlet port diameter		-	KF-16(NW-16)			
Max. size		mm	120(W)×288.5(L)×163(H)			
Leak rate		$Pa\cdot m^3/sec$	1×10^{-6}			
IP Class		-	20			

Note 1: The ultimate pressure values in the above table are indicated by a Pirani gauge

Note 2: The vacuum pump oil please uses our designated oil turn vacuum pump oil. (designated oil : R-2)

Note3: If the oil temperature is lower than 7° C, operation start-up may be difficult. Operation start-up may be difficult.

2.2 Dimensional drawing

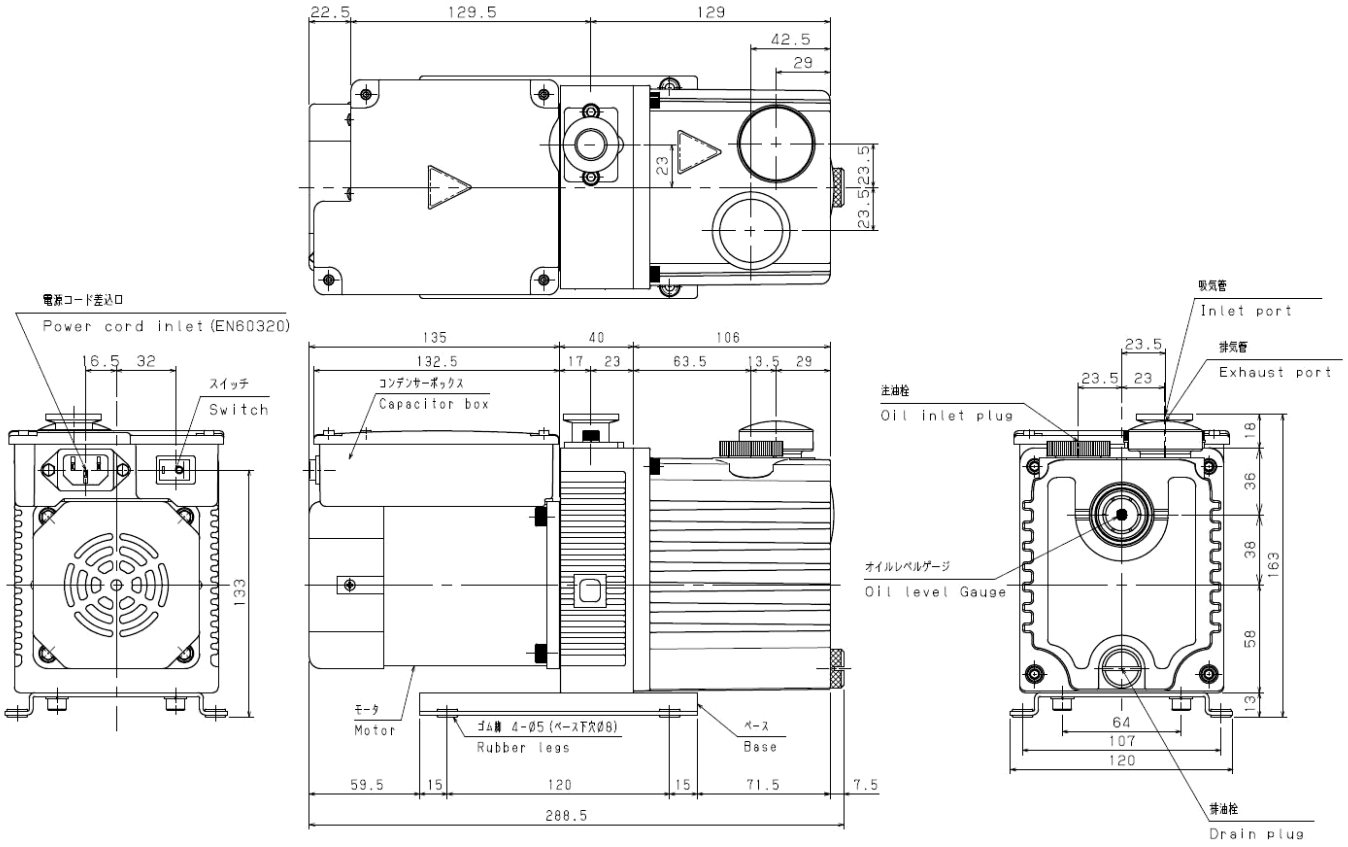


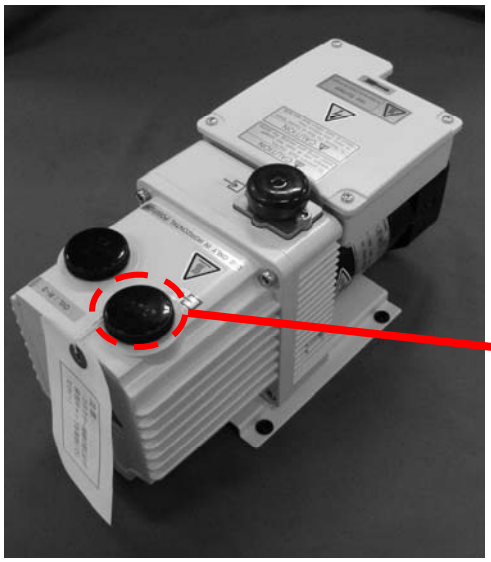
Figure1. Dimensional drawing of GHD-031 oil sealed rotary vacuum pump.

3. Measures before it starts

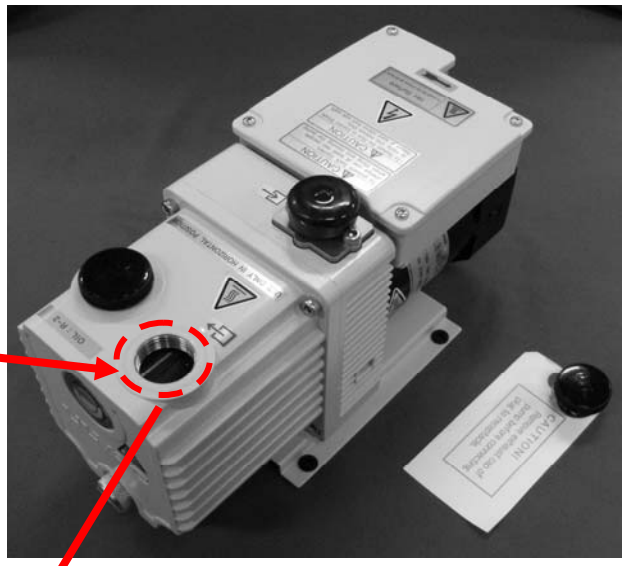
3.1 Securing of exhaust vent

Please remove the oil cap for transportation without fail before starting the pump, and exchange it for the attached exhaust entrance cap.

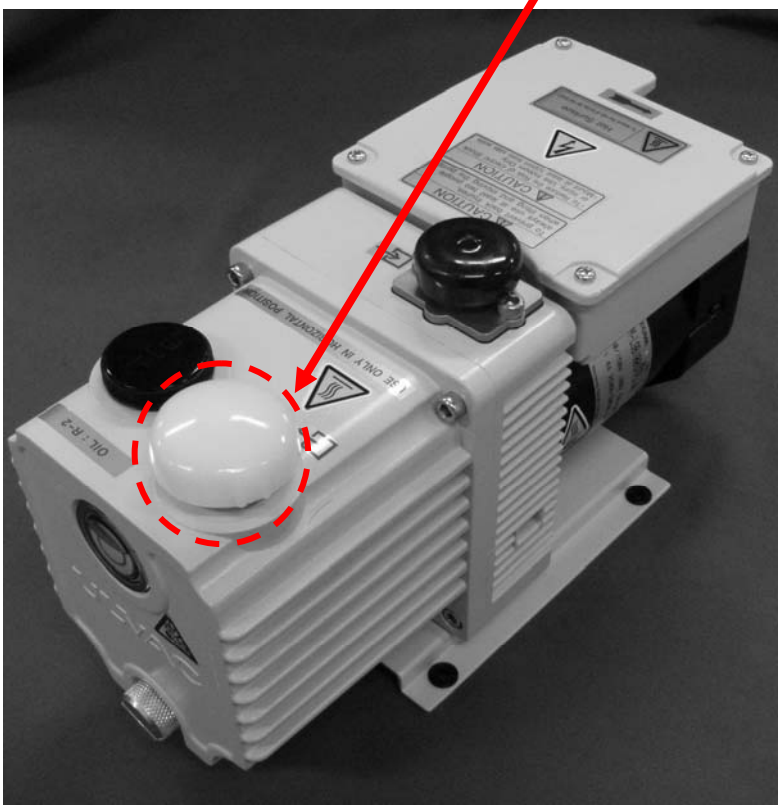
At the unpacking



Detaching of oil cap



Installation of exhaust entrance cap



⚠ Warning

This product closes the exhaust vent with the oil cap so that the vacuum pump oil should not leak while transporting it because it ships it by injecting the vacuum pump oil in a regulated amount. Please remove the oil cap for transportation without fail before starting the pump, and exchange it for the attached exhaust entrance cap.

There is a risk of explosion. Never block the outlet or operate the pump with equipment mounted at the outlet side which blocks the passage of gas. Otherwise, the internal pump pressure increases causing the pump to explode, the oil level gauge to protrude or the motor to be overloaded. This pump is not resistant to pressure. The internal pump pressure is limited to 0.03 MPa (gauge pressure).

3.2 Installation

The pump should be installed on a level surface in a location with minimal dust, dirt and humidity and be arranged with consideration given to ease of installation, removal, inspection and cleaning. Particular attention should be paid to the ambient temperature when building the pump into equipment. Use a rubber vibration isolator to separate the pump from other equipment and to isolate the pump from the vibrations of other equipment.

⚠ Caution Environmental conditions for storage, installation and operation

Since this pump is precisely engineered, ensure that the following conditions be satisfied during storage, installation and operation.

① Ambient temperature, relative humidity: 7° C ～ 40° C 85% RH or less

② Height above sea level during storage and installation 1000 m or less

③ Minimum required distances from the wall 100mm or more

④ Other conditions for storage and operation

- a. Free from corrosive and explosive gases.
- b. No condensation.
- c. Dust-free environment.
- d. Indoors.
- e. Do not place pumps on top of each other or place a pump on its side.
- f. Not subject to direct sunlight.
- g. Far from heat sources.
- h. When you keep it for a long period of time, put pump oil into a pump and seal a inlet port with a cap.
- i. Don't keep it, where moisture is attracted.

⚠ Warning

Do not use the pump in an explosive atmosphere. Failure to do so will result in injury or fire.

⚠ Note

If the pump is operated whilst it is tilted, placed on its side or upside-down, the pump will be damaged. Install the pump level with the inlet facing up as shown in Figure1.

3.3 Vacuum piping

(1) Before connecting the pipe to the pump, clean the inner walls of the vacuum chamber, piping and vacuum valve to completely eliminate moisture, fine particles, dust, dirt and rust.

(2) Show general exhaust system in figure 2.

Between vacuum chamber and the pump, figure 2 please attach , stop valve (A) and leak valve (B).

(3) Backflow preventer

A backflow preventer is incorporated into the pump to prevent the oil from flowing back while the pump is stopped.

The countercurrent prevention mechanism of the oil is taken in in this pump. As of a pump stop, it is effective for the prevention of the countercurrent of the oil. (It is not countercurrent prevention mechanism of the gas.)

The countercurrent prevention valve opens and closes a countercurrent prevention valve with the oil pressure of a hydraulic pump taken in to a vacuum pump under an air inlet. As of a pump stop, the check valve closes. The vacuum pump oil prevents an inflow to the upper part than an inlet port. Besides, the vacuum pump becomes the atmospheric pressure. But it is not a thing to guarantee the 100% of movement.

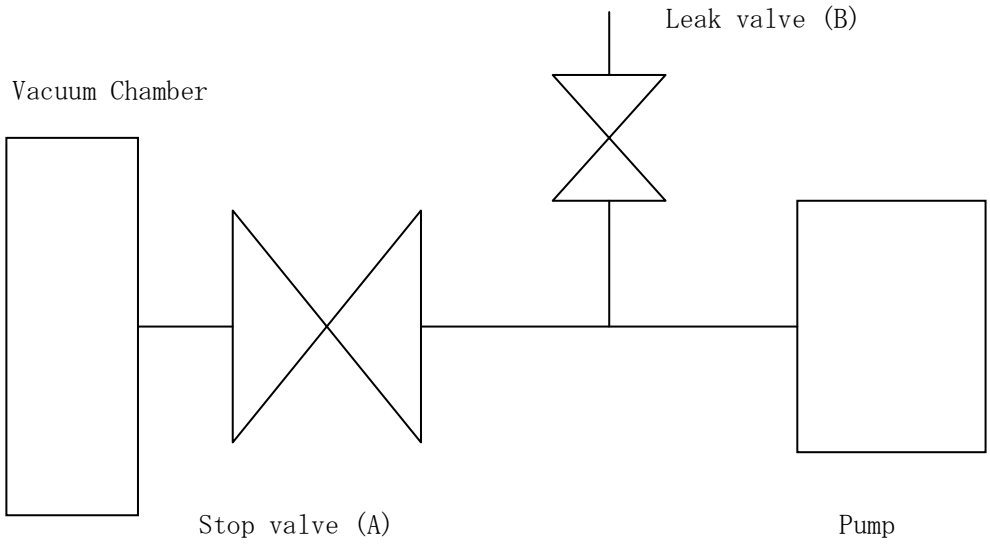


Figure 2. Basic piping diagram to the vacuum chamber

⚠ Note

If fine particles, dust or dirt, etc are evacuated, the pump may malfunction. If moisture is evacuated, not only does the ultimate pressure increase but also the inside of the pump becomes rusty causing the pump to malfunction.

Oil please establish the capacities more than oil countercurrent quantity to the vacuum room side approximately 300mL at the time of a pump stop in a short time between a stop valve (A) which I flow backward, and figure 2 shows to by all means, installation of leak valve (B) or a pump and a vacuum room by any chance when countercurrent prevention mechanism does not act.

⚠ Note

The inlet filter in the inlet port has been adopted to prevent foreign matter from entering the pump. Do not remove the inlet Filter.

3.4 Electric wiring

⚠ Warning

Unplug cords for power supply before connecting wires.

Otherwise an electric shock occurs.

(1)The pump rotates in the clockwise direction as seen from the front of the pump (level gauge side).

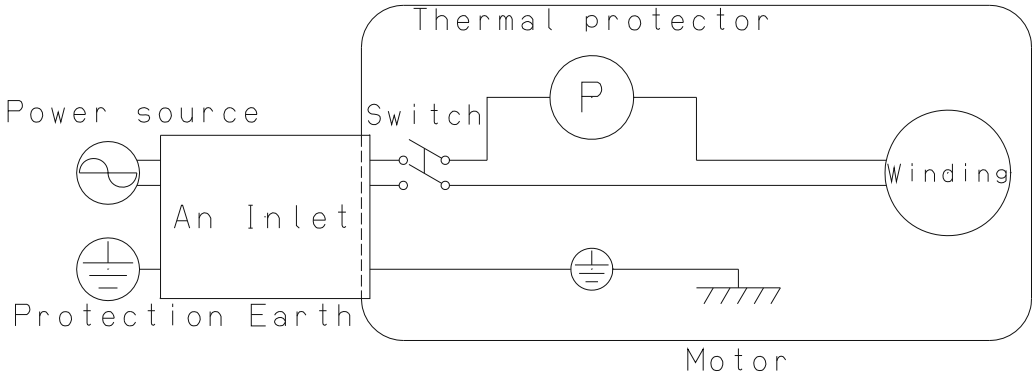


Figure3. Electric wiring diagrams

(2) An inlet is suitable for standards of EN60320－1.

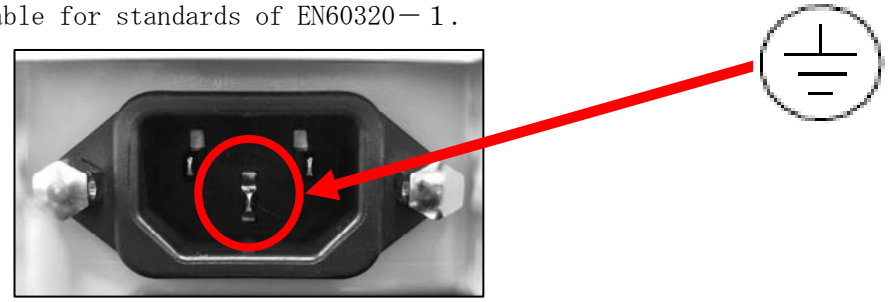


Figure4. Inlet (EN60320-1)

(3) Insert an including plug cord into an Inlet as shown in figure4.

⚠ Caution Grounding instructions

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

If power code is not equipped (option) then appropriate grounding shall be provided upon installation.

a) Power cable selection standards

This vacuum pump single-phase alternating current 100-100V/100-120V (50/60Hz) specifications (model : GHD-031A) or single-phase alternating current 200-240V (50/60Hz) specifications (model : GHD-031B) sticks.

The power supply voltage is a model : GHD-031A (100-120V) time and a model :

The choice standards of the power supply cord are more different in GHD-031B (200-240V).

The power cable selections standards are shown in a table 2.Do not fail to select your power cable in accordance with the standards.

For a shape of the cable plug to be inserted in the pump motor power inlet, select type IEC60320-C13.

Table2. Power cable selection standards

Supply Voltage	Voltage Rating	Current Rating	Temperature Rating
100-120V	125V or more	10A or more instantaneous (5sec) 10A or more	70℃ or more
200-240V	250V or more	10A or more instantaneous (5sec) 10A or more	

Install the fuse of 5A - 10A or circuit breaker in the branch circuit of the equipment side.

b)Precautions

b-1) Unplug-preventive hardware (Option)

Whenever you may operate the vacuum pump with your power cable, provide it with the unplug-preventive hardware, which should be selected so as to fit

the shape of the power cable.

The unplug-preventive hardware allows you to secure the power cable so that the motor may not accidentally have it unplugged.

For a procedure for installing the unplug-preventive hardware, refer to “b-2 How to Install Unplug-preventive Hardware.”

⚠ Warning

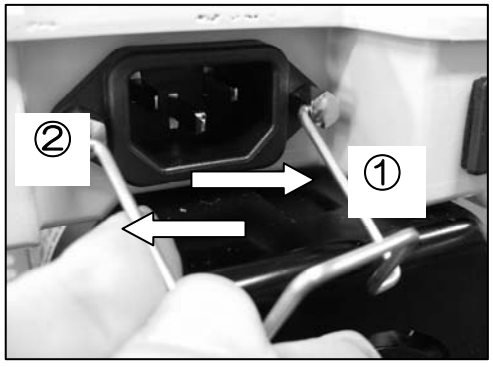
Whenever you may operate the vacuum pump with the power cable, does not fail to secure it with the unplug-preventive hardware.

b-2) How to install unplug-preventive hardware

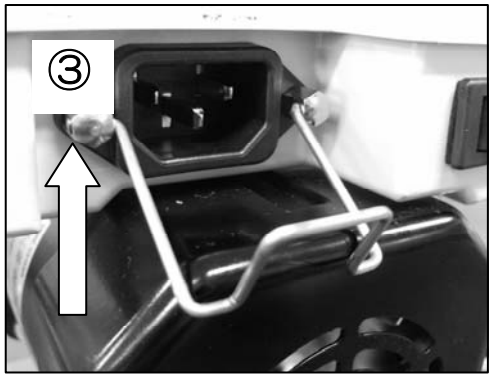
Install the unplug-preventive hardware in accordance with the procedure as follows

① Let one end of the unplug-preventive hardware Catch the hole to the side of the inlet in the interior.

② While pushing the unplug-preventive hardware at the other end, let it catch the hole to the side of the inlet in the interior.

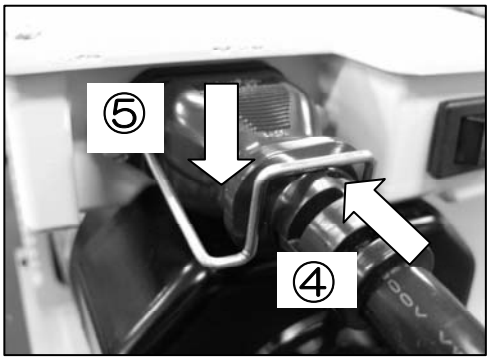


③ Raise the unplug-preventive hardware.



④ Insert the power cable firmly enough.

⑤ Lower the unplug-preventive hardware and cable.



Now, the unplug-preventive hardware is completely installed.

3.5 Fluctuations in the power voltage and frequency

Standard: Rotation electricity machine general rulesIEC60034-1:2004.

It is assumed the one that it is possible to use it by being able to use by continuously driving the voltage change and the frequency veering in area A in the main rated value without the obstacle on practical use, and driving the voltage change and the frequency veering in area B in the main rated value without the obstacle on practical use.

However, operation with "it is convenient and safe is maintained on "practical use, it means not resulting in the grade which shortens a life remarkably, and the characteristic, a temperature rise, etc. do not apply correspondingly in the state of rating. Moreover, main rating shows rated torque (N·m).

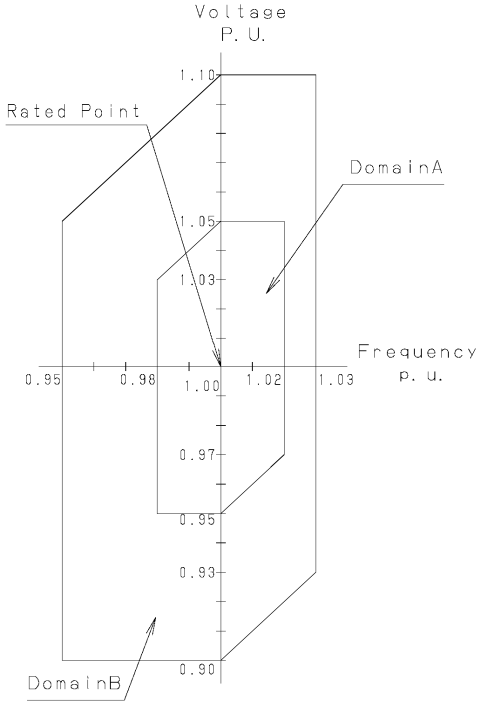


Figure5. Change region of the voltage and frequency

4. Operation

4.1 Cautions for operation

⚠ Warning

There is a risk of explosion. Never block the outlet or operate the pump with equipment mounted at the outlet side which blocks the passage of gas. Otherwise, the internal pump pressure increases causing the pump to explode, the oil level gauge to protrude or the motor to be overloaded. This pump is not resistant to pressure. The internal pump pressure is limited to 0.03 MPa (gauge pressure).

It leads to the trouble of the pump when I use it with having breathed in water. When this absorbed the medicines such as acid / the solvent in this vacuum pump, an oil level gauge jumps out. In addition, This causes the pomp rock. Please change pumps oil.

4.2 Start of operation

To start operation, close leak valve (B), open vacuum valve (A) to the inlet port, and turn on the power switch. Then the pump starts beings to exhaust. (see Figure2.)
Never insert hands, fingers, or thin objects through the motor opening.

⚠ Caution

The motor and pump become hot (temperature increase under non-load operation: 35K, temperature increase under high-load operation: 40K) during operation of the pump. There is a risk of burns. Never touch the motor or pump during operation.

If operation is performed at high pressure, oil mist is generated at the exhaust side. Install an oil mist trap or connect a duct to discharge the oil mist outside the room. Or, install a ventilator.

4.3 Stopping the operation

To stop operation, close vacuum valve (A), open leak valve (B) quickly, and turn the power switch b off .(see Figure2.)

Please close a leak valve (B) and seal a suction side as much as possible, after making a suction side into atmospheric pressure.

4.4 Operation in cold climates

When using the pump in winter, in cold climates, or outdoors, it is sometimes difficult to start the pump. This is an overload phenomenon resulting from the increase in the viscosity of the pump oil. To start the pump in such conditions, warm up the pump oil, or turn the pump on and off several times in short intervals.

When the pump stops after rotating for a few seconds, open leak valve (B) and continuous operation may become possible. After the pump has warmed up, close leak valve (B) and return to ordinary operation. (see Figure2.)

4.5 Thermal protector

An overload protector (Auto reset thermal protector) is incorporated.

Thermal protector activates when the pump motor is overloaded (e.g. locked rotor, out range of voltage, close ventilation).

Table 3.Characteristics of the thermal protector

Model		Operation temperature	Reset temperature
GHD-031	1φ,100W	120℃±5℃	76℃±15℃

When the thermal protector has been actuated, turn off the switch and contact us.

The motor is very hot when the thermal protector has actuated. Never touch it with your hand.

When the cause of the malfunction has been eliminated, check that the motor has cooled down, and restart operation (see “6.4 Trouble check list”).

The use of another protective device (such as an earth leakage breaker) in addition to the overload protector is recommended.

4.6 Magnet coupling

⚠ Caution

This vacuum pump is use magnet coupling. Malfunction occurs during pump driving in the pump inside. Magnet coupling transmitting the power of the motor comes off. The pump stops, and the driving sound of the motor grows big. The main body of pump stops, but the motor continues turning.

Please ask order ahead or us for check repair by all means.

4.7 Oil mist trap (Option)

An oil mist trap can be installed in order to remove oil mist from the pump. As such an oil mist trap, model OMT-050A is available.

Remove the standard outlet port from the outlet port of the pump and install an oil mist trap instead. The oil mist trap not only prevents oil mist generation but also reduces exhaust noise. For details, refer to the instruction manual for the oil mist trap.

4.8 Restriction on operation when the oil mist trap is installed

When using the oil mist trap, there are some restrictions on operation.

When the filter is clogged, replace it.

⚠ Warning

Be sure to observe the restrictions on operation when the oil mist trap is installed. There is a risk of explosion. When the filter is clogged, replace it.

Pump internal pressure rises, and an oil level gauge jumps out, and there is a threat that a motor becomes the overload. Pump internal pressure rises, and an oil level gauge jumps out.

5. Pump perfomance

5.1 Ultimate pressure

The term “ultimate pressure” as employed in the catalogue and in this manual is defined as “the minimum pressure obtained by the pump without the introduction of gas from the pump inlet (i.e. the non-load condition).” For this pump, measurement is performed using the specified pump oil with only a Pirani vacuum gauge installed at the pump inlet port.

Also, the actual ultimate pressure of the vacuum device becomes higher than that noted in t he catalogue for the following reasons.

The vacuum gauge is installed at a distance from the pump, and the steam and a variety of gases are generated by water droplets and rust on the inside walls of the pump and piping.

The volatilization ingredient which melted into pump oil does gasification again and raises arrival pressure. (Deterioration of the pump oil)

When there is a source of supply of the gas such as omissions of vacuum (leak) in a vacuum course, arrival pressure becomes loud.

5.2 Pumping speed

The pumping speed of the pump depends on the type and pressure of the gas to be evacuated. The pumping speed usually reaches the maximum at a high pressure range, and it gradually decreases as the pressure reduces.

The nominal pumping speed of this pump is the maximum pumping speed when dry air is evacuated. Figure6 shows the relationship between the evacuation pressure and pumping speed.

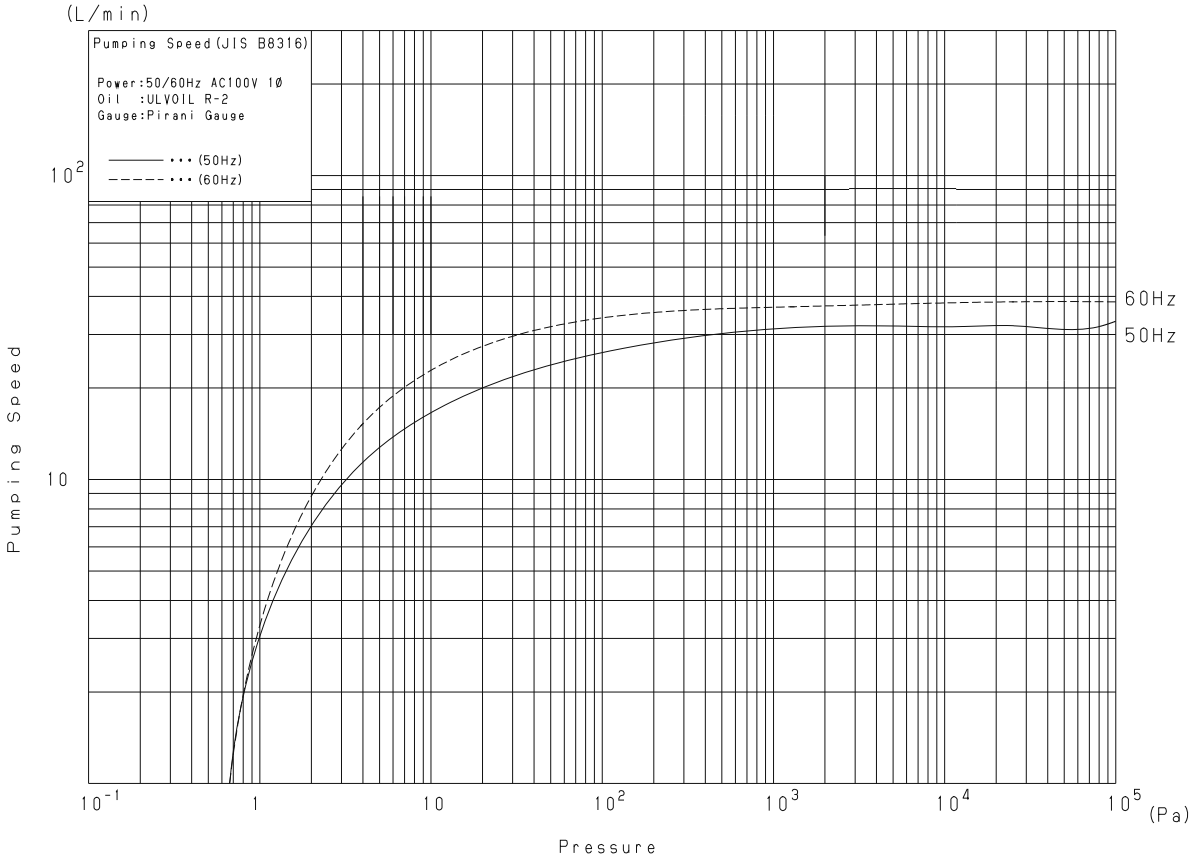


Figure6. Pumping speed curve

5.3 Power requirement

The power required to operate the pump is the total of the power required to overcome the rotational resistance of the pump (mechanical work) and the power required to compress the air (compression work)and reaches a maximum at an inlet evacuation pressure of around 2.7×10^4 to 4×10^4 Pa.

If the inlet evacuation pressure has reduced to 13.3 Pa or less, the compression work is considerably reduced and more power is consumed in mechanical work.

Figure7. Shows minimum power required operating the pump.

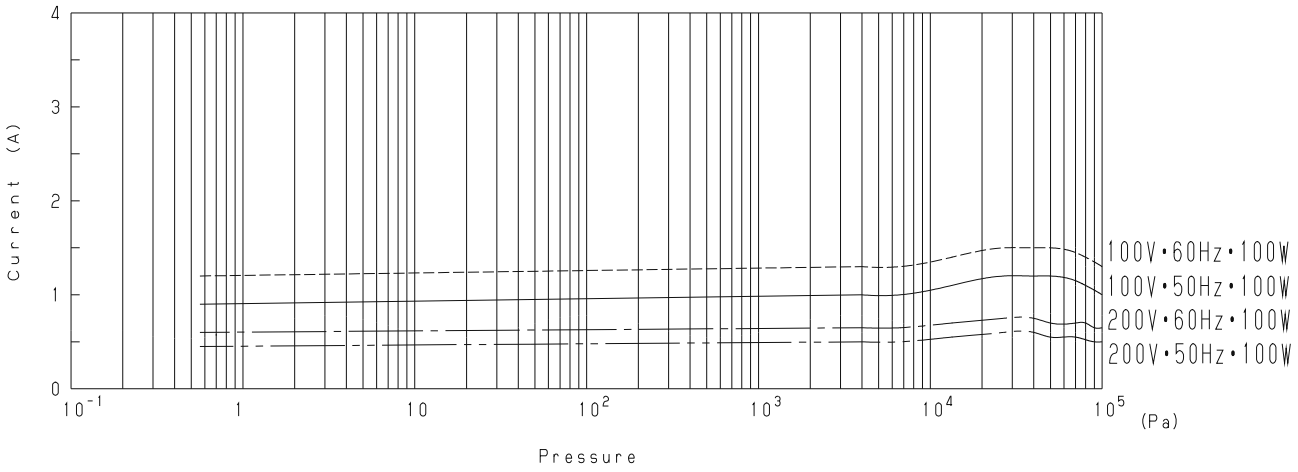


Figure7. Characteristics of motor power

6. Maintenance, Inspection and Repair

6.1 Maintenance

Check the following during operation at least once every three days.

(1) Is the amount of the pump oil in the range of the red circle of the oil level gauge?

(2) Does not the vacuum pump oil discolor?

(3) Is not an abnormal sound done?

(4) Is not abnormality found in the value of the current of the motor?

(5) Is not there the oil leak?

If there is any problem, take proper measures in accordance with "6.4 Trouble check list."

6.2 Periodic inspection

The items to be checked should be changed as necessary depending on the environment where the pump is used. However, always check the following in order to prevent a malfunction and to lengthen the service life of the pump.

⚠ Caution

Pulled out the power plug before starting inspection and do not turn it on while inspection is in progress. Doing so will result in injury.

The pump is very hot immediately after it is stopped. Wait for 10 minutes until the pump has cooled down completely and then start inspection. There is a risk of burns.

(1) Periodic replacement of the pump oil

The pump oil deteriorates with operation. Check the viscosity and level of contamination of the pump oil with the oil level gauge, and replace the pump oil in good time.

If the pump oil is replaced periodically, the deterioration of the pump oil is minimized and the service life of the pump is lengthened.

If operation is continued with a lot of moisture mixed with the pump oil, the ultimate pressure will not reach the standard value, the movement at the section where the mechanical friction is generated becomes slow, and the pump finally becomes damaged. Replace the pump oil in accordance with "6.3 Replacement of the pump oil."

(2) Inspection of the amount of pump oil

Please replenish it with a prescribed pump as the pump oil side is in the range of the red circle of the oil level gauge while driving.

(3) Inspection of oil leakage

When oil leak was caused by drain plug seal region, the exchange of the part is necessary. Our specified O-rings and seals are always available from the service departments shown at the back of this manual. When necessary, contact them.

(4) Inspection of abnormal sounds and vibration

Check the nuts and bolts for looseness.

(5) Inspection of the oil mist trap

When using the oil mist trap in replacement of the standard outlet port, pay attention to the clogging of the filter in the oil mist trap.

If the clogging advances, evacuated gas cannot be exhausted any longer, which causes the oil gauge to protrude and oil leakage from the shaft seal section or drain plug seal section. The maximum internal pump pressure is 0.03 MPa (gauge pressure).

When the pump is operated continuously for a long time or when the pump is extremely contaminated with evacuated gas, overhaul is required. Contact the nearest sales or service department among those listed at the back of this manual.

Table 4. Periodic inspection table

Frequency	Item	Measures Details	Measures
Once/3 days	Oil	Amount.	Refill the oil.
		Color (Reddish brown, dark blown, and cloudy white are not good.)	Replace the oil.
	Sound	Abnormal sound.	Check nuts and bolts for looseness. If not clear, contact us.
	Vibration	Abnormal vibration.	
	Current value	Difference from the rated value.	Check the cause of an overload. If not clear, contact us.
Once/week	Surface temperature	Surface temperature (The temperature higher than the room temperature by 40K or more is abnormal.)	Check the cause of an overload. If not clear, contact us.
	Oil leakage	Oil leakage from the plugs.	Replace seals, or contact us.
Once/ 3000hours or once/6 months	Oil	Clogged with dust.	Replace the oil.

⚠ Warning

When requesting the manufacturer's service department to overhaul the pump, always write the type of the vacuumed gas on the "Pump Usage Check Sheet" attached at the back of this manual and submit it. Note that if toxic gases are exhausted, both the pump itself and pump oil will become contaminated. Please be sufficiently aware that use with some gases will preclude overhaul.

6.3 Replacement of the pump oil

The pressure of the vacuum device may increase due to the deterioration of the pump oil. In such a case, close the inlet port of the pump and check that the specified ultimate pressure has been reached.

If not, replace the pump oil. If substances having a high vapor pressure (such as moisture or solvents) are mixed with the pump oil, or if sludge is accumulated at the bottom of the pump, the ultimate pressure cannot be reached with only one replacement and the pump oil must be replaced several times.

The deterioration of the pump oil is caused not only by the contamination due to evacuated gas but also by the changes in the properties of the pump oil itself (depending on the operation time). Periodic replacement in accordance with Table 4 showing an oil replacement guide is recommended.

⚠ Warning

Keep in mind that if the pump was used in accordance with its exhausting toxic gas, both the pump unit and pump oil might become contaminated.

⚠ Caution

Wear protective equipment such as rubber gloves and safety goggles.

Be sure to read the attached “Safety Data Sheet.” before adding oil. If the oil accidentally comes into contact with your hands or enters your eyes, take proper measures in accordance with the section “First-aid treatment” shown in “Safety Data Sheet.”

⚠ Note

Use only oils specified by us(R-2). If other oils are used, the pump performance will deteriorate or its life will shorten.

Pump oil replacement procedure (see Figure8.)

(1) Release the pump inlet port to the atmosphere and operate the pump for five seconds. The oil remaining in the pump is discharged efficiently.

(2) Remove the outlet port and drain plug to discharge the pump oil.

(3) Mount the drain plug, and add the required amount of the new specified pump oil through the oil inlet port.

(4) If the pump oil is contaminated extremely, add new pump oil and perform operation for a while (several minutes) to clean the pump. Repeat this a few times.

(5) After replacing with the new pump oil, operate the pump and when the pump has become warm, check the ultimate pressure.

(6) If the pump oil is so dirty that oil sludge accumulates at the bottom of the pump, the specified ultimate pressure even after the pump oil is replaced. In such a case, overhaul the pump.

(7) Remove the oil inlet plug from the oil inlet port, and add the pump oil which has been delivered together with the pump or the pump oil specified by us (R-2) up to the range marked with the red line on the oil level gauge.

(8) When making the first lubrication, add oil near to the upper oil level limit shown on the oil level gauge. After lubrication, mount the oil inlet plug to the pump. Always keep the oil level of the pump within the oil limit range shown on the oil level gauge during operation. If the amount of oil is incorrect, the performance of the pump will deteriorate resulting in the malfunctioning of the pump.
When the amount of oil has reduced and the oil level has reached an area below the lower red line which shows the lower limit on the oil level gauge such that the level cannot be seen, the ultimate pressure increases and exhausting sound may not cease.

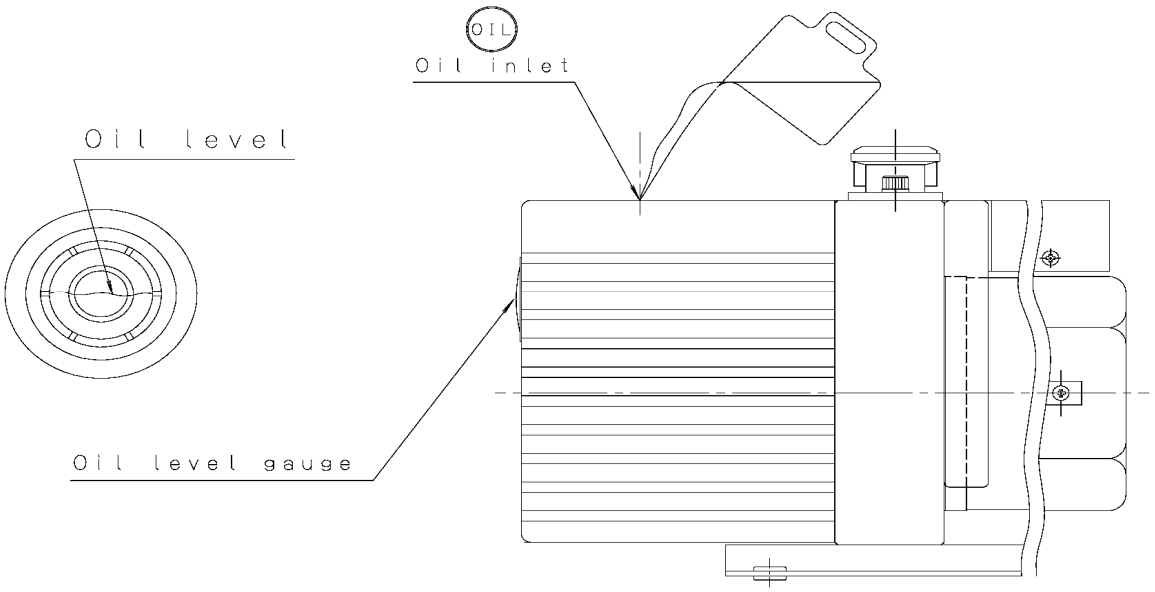


Figure8. Lubrication of the oil sealed rotary vacuum pump

Note

Do not operate the pump without adding pump oil. If it is operated in oil-less condition, the pump will be damaged.

6.4 Trouble check list

Table5. Trouble check list

Problem	Cause	Measures	Reference
The pump does not rotate.	①The pump is not connected to the power supply.	①Connect the pump to the power supply.	3．4
	②The power switch is not turned on.	②Turn on the power switch.	4．2
	③ Problem with power supply voltage.	③Set the power supply voltage to within ±10% of the rated voltage.	3．5
	④The overload protector has actuated.	④Wait till the temperature goes down to 76 ± 15℃.	4．5
	⑤The motor malfunctions.	⑤Replace the motor.	6．2
	⑥ Low ambient temperature has increased the oil viscosity.	⑥Increase the ambient temperature to 7℃ or more.	4．4
	⑦The entrance of foreign matter into the pump caused the rotor to burn out.	⑦Overhaul (replace the cylinder and rotor).	6．2
	⑧ Moisture or solvents were sucked in, forming rust inside the pump.	⑧Overhaul (replace the cylinder and rotor).	6．2
	⑨Reaction product accumulated in the pump when the pump stops after exhausting reactive gas.	⑨Overhaul (cleans the pump inside and removes reaction products).	6．2
	⑩ Water absorption expands the vanes.	⑩Overhaul (replace the vanes).	6．2
	⑪ Components inside the pump have burnt out.	⑪Overhaul (replace the damaged components).	6．2
The pump’s rotation is unstable.	① Problem with power supply voltage.	①Set the power supply voltage to within ±10% of the rated voltage.	3．5
	②Defective wiring to the pump.	②Perform wiring to the pump again.	3．4
	③ Low ambient temperature has increased the oil viscosity.	③Increase the ambient temperature to 7℃ or more.	4．4
	④Foreign matter has entered the pump.	④Disassemble and clean the pump to eliminate foreign matter.	6．2

Problem	Cause	Measures	Reference
The pressure does not decrease.	①The pump is too small for the volume of the vacuum chamber.	①Select another pump.	5．2
	②The pressure measurement method is not correct.	②Measure the pressure correctly.	5．1
	③The vacuum gauge is not suitable.	③Measure with a calibrated vacuum gauge suitable for the pressure range.	5．1
	④The pipe connected to the inlet port is small, or the piping distance is long.	④Use pipes having a diameter larger than the inlet port diameter, or reduce the distance from the vacuum.	5．1
	⑤The wire mesh at the inlet port is clogged.	⑤Remove the piping from the upper section of the inlet port, and clean the wire mesh.	6．2
	⑥The specified amount of oil has not been added.	⑥Add the specified amount of oil.	6．3
	⑦The oil has deteriorated.	⑦Replace the oil.	6．3
	⑧Leakage occurs from the pipe connected to the pump.	⑧ Locate the leakage with a leakage detector and stop the leakage.	--
	⑨Our specified oil is not being used.	⑨Overhaul the pump and replace with oil specified by us.	6．3
	⑩ Oil does not circulate, or the oil hole of the cover is clogged.	⑩Overhaul and clean the oil hole.	6．2
Abnormal sound is generated.	① Problem with power supply voltage.	①Set the power supply voltage to within ±10% of the rated voltage.	3．5
	②The motor malfunctions.	②Replace the motor.	6．2
	③Foreign matter has entered the pump.	③Eliminate the foreign matter and overhaul the pump.	6．2
	④The specified amount of oil has not been added.	④Add the specified amount of oil.	6．3
	⑤The coupling malfunctions.	⑤Overhaul (replace the coupling).	6．2

Problem	Cause	Measures	Reference
Abnormal sound is generated.	⑥Oil does not circulate, or the oil hole of the cover is clogged.	⑥Overhaul and clean the oil hole.	6．2
	⑦ Components inside the pump have burnt out.	⑦Overhaul (replace the damaged components).	6．2
Pump surfaces are extremely hot.	① Continuous operation at high evacuation pressure.	①When it runs by high inhalation pressure consecutively, there is no problem in particular in pump surface temperature to less than 40K.	4．1
	②The specified amount of oil has not been added. (If the oil amount is not sufficient, the cooling effect of the pump will be reduced.)	②Add the specified amount of oil.	6．3
	③The temperature of the evacuated gas is high.	③Mount cooling equipment such as a gas cooler at the inlet side.	--
	④Oil does not circulate, or the oil hole of the cover is clogged.	④Overhaul and clean the oil hole.	6．2
A lot of oil splashes out from the outlet port.	①The pump is been filled in excess of the specified amount.	①Discharge the oil until it reduces to the specified amount.	6．3
	② Continuous operation is performed at a high evacuation pressure.	②Install an oil mist trap at the outlet side.	4．7 4．8
The oil leaks outside the pump.	①Deterioration of the O-ring and the oil seal of the case and cover.	①Check and replace the O-ring and oil seal.	6．2

7. Disposal

Follow state law and local government regulations for disposal of the pump.

⚠ Caution

In case a harmful toxic gas has been exhausted by accident, ask a specialist for waste disposal. Not only the pump itself but also the pump oil becomes toxic.

For the disposal of pump oil, follow the instructions given under “Cautions for disposal” In “Safety Data Sheet.”

8. Maintenance parts

8.1 Maintenance parts list

Table6. GHD-031 Maintenance parts list

Product name	No.	Parts name	Q'ty
GHD-031 Maintenance kit A	15	Outlet valve	2
	16	Outlet valve spring	2
	22	Check valve	1
	24	Oval ring	1
	25	Air open valve	1
	26	Air open valve spring	1
	36	O ring_S-12	1
	37	O ring_S-56	1
	38	O ring_S-60	1
	39	O ring（Casing）	1
	40	O ring_P-5	1
	41	O ring_P-8	1
	42	O ring_P-9	2
	43	O ring_P-12.5	1
	44	O ring_P-18	1
	45	O ring_G-50	1
	46	Oil seal _VC-10-20-4	1
	47	Oil seal _SC-11-25-7	1
	81	O ring_SS040	1
	82	O ring_SS110	1
	84	Air open route O ring	1
	85	O ring_P-20	1
GHD-031 Maintenance kit B	13	1st Vane	2
	14	2st Vane	2
	18	Oil pump vane	1
	27	Oil level gauge	1
	32	Inner coupling	1

Note 1: For the relationship between components, see the disassembly drawing.

8.2 Disassembly drawing

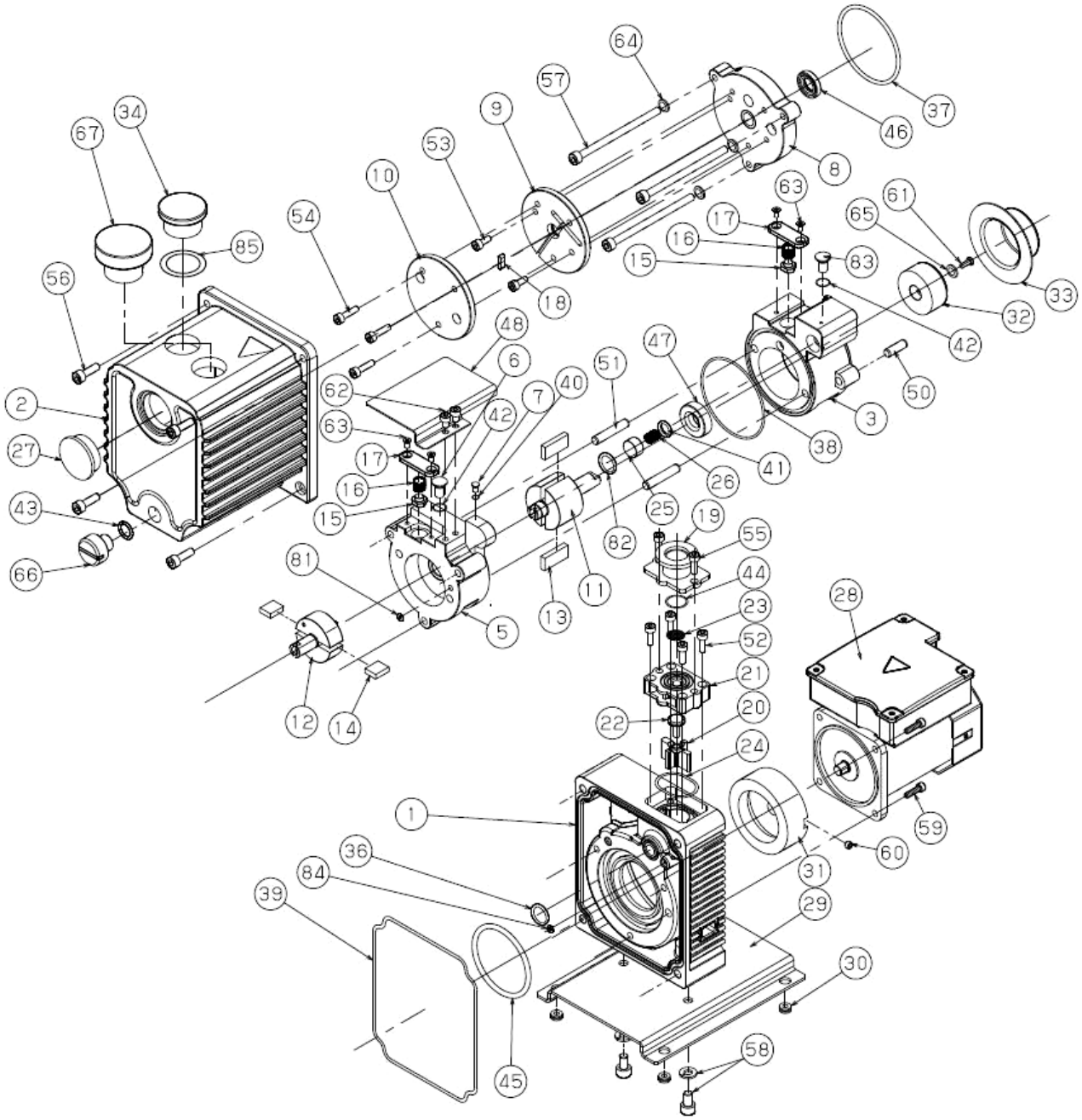


Figure9. Disassembly drawing of GHD-031 oil sealed rotary vacuum pump

Warranty

(1) The warranty for this pump (this equipment) extends for a period of one year from the date of shipment.

(2) Any malfunctions or defects which occur under normal usage conditions during the warranty period will be repaired free of charge.

Note, the warranty stated here is an individual warranty covering the pump. In addition, the scope of the warranty coverage concerning repairs is limited to the repair and/or replacement of parts.

Normal usage conditions refer to the following:

a) Ambient temperature and humidity during operation: 7 - 40°C, below 85% RH

b) Operation in accordance with the user manual

(3) Repair fees will incur during the warranty period for the following cases:

a) Malfunctions due to a natural disaster or fire.

b) Malfunctions caused by special atmospheric conditions, such as salt damage, inflammable gas, corrosive gas, radiation or pollution.

c) Malfunctions caused by usage conditions that differ from those stated in the user manual (performance specifications, maintenance and inspection, etc.).

d) Malfunctions caused by modifications or repairs carried out by a party other than the manufacturer, or by a service company not approved by the manufacturer.

e) Malfunctions caused by noise (electric disturbance).

f) Malfunctions that occur when not using a rated power supply.

g) Malfunctions that occur when there is an abnormal rise in internal pressure due to the pump exhaust outlet being blocked during operation, etc.

h) Malfunctions that occur, when the pump is damaged as a result of being dropped or falling, etc.

i) Malfunctions which are determined by the manufacturer's technical personnel to be caused by conditions that do not comply with the usage conditions for this vacuum pump.

j) Malfunctions due to the replacement of consumables.

(4) Disclaimer

a) We shall not be liable for any malfunctions of our products caused by the customer, regardless if the malfunction does not fall within the warranty period, nor shall we be liable for any loss of opportunity for the customer's clients or for compensation for any damages to other products, labor costs, production loss, transportation expenses and other related work.

b)We shall not be liable for any claims and patent infringements, including secondary damages, filed a claim by a third party against the customer.

Usage Status Check Sheet (for use in Instruction Manual)

* For the purpose of safety control of repair personnel, fill in within the heavy line frame and attach the sheet to the item of which repair is requested.
* In case this sheet were not attached or filled in, your request of repair and service may not be accepted.
* In accordance with the Private Information Protection Law, the provided information will be used only for determining the cause of failure and whether detoxifying washing should be conducted. It will never be provided to any third person.

Model Name: _____ Manufacturer's Serial No.:_____

1. Inhaled Gas * Please be sure to fill in.

(1) Whether there is harmful effect on human bodies Yes No (Sing your name below.)

(2) Whether there is unusual smell Yes No

(3) Type and Name of Gas: _____

* Industrial Safety and Health Law designates particular substances as the materials to be notified.

2. Usage Status

Operation Method: Approx. ( ) hours per day, ( ) years and ( ) months

□ Continuous Operation □ Intermittent Operation

Usage: _____

3. Failure Status □Unusual Noise □Abnormal Pressure □Abnormal Actuation

□Oil Leakage Other Symptoms: _____

4. Detail of Request □Repair (Overhaul) □Regular Checks

5. Others: _____

Company Name: Personnel in charge: _____

Address: _____

Tel: Fax: E-mail: _____

Agent Name; Personnel in charge: _____

Address: _____

Tel: Fax: _____

* In case you do not have any direct transaction with us, please be sure to fill in the agent name.

6. Confirmation

The gas and substance used in this pump or unit is harmless to human bodies, or it is not contaminated by any substance harmful to human bodies.

Signed_____(seal) Date: _____

* In order to avoid a trouble during transportation, please evacuate oil from any oil pump before shipping.
* You are requested to ship the package to our Service Division (CS Center). (See the attached list of addresses.)