

Instruction Manual

Direct drive oil-sealed rotary vacuum pump

Model

GHD-101A GHD-101B GHD-101C GHD-101D

Read this manual before using the product.

Keep it in a safe place ready for use as necessary.

The content of this manual is liable to change without prior notice in the event of improvements in performance and capabilities.



O. Introduction

0.1 Before using the vacuum pump

Thank you for your purchase of the vacuum pump.

After receiving the pump, check it against the details of the order, and verify that there has been no damage in transit.



Always read this manual thoroughly before installation, operation, inspection, and maintenance to ensure that the pump retains its performance over the long-term, and ensure that you understand the safety cautions, pump specifications, and method of operation.



Attention

Copying of any part of this manual for use by a third party is prohibited without permission of Ulvac.

0.2 Safety icons

This manual and the pump warnings include safety icons to assist in understanding points to be followed.

The meanings of these icons are as described below.

A Danger

There is a very real danger of death or serious injury to the operator if the equipment is used incorrectly.

Warning

There is a danger of death or serious injury to the operator if the equipment is used incorrectly.

Caution

There is a danger of moderate injury or disability to the operator, or physical damage, if the equipment is used incorrectly.

Attention

There is a possibility of damage to the equipment, or problems with operation, if the equipment is used incorrectly.

Warning

The surface of the pump may be very hot (40-80°C). Use appropriate protection to avoid direct contact with these surfaces. Incorporate the pump into equipment for use.

use

例 Warning

Contact with the motor will result in electric shock. When connected to a power supply, disconnect the power supply plug, and check that power is no longer supplied.

Pump intake

Pump exhaust

-02-

Danger

Ensure that only dry air or dry nitrogen enters this pump.

Danger

If the pump has been used to exhaust toxic gases, the pump itself, and the vacuum pump oil (pump oil) will also be toxic. Be aware of this when performing maintenance.

Warning

Ensure that this pump is dismantled and repaired only by a repair technician. Failure to follow this requirements may result in abnormal operation or electric shock.



Warning

Always ensure that the main power supply has been disconnected before inspecting or repairing. Failure to do this may result in electric chocks or injuries due to the pump suddenly starting.

Warning

Ensure that the equipment is earthed correctly. Installation of an earth leakage breaker is recommended. Failure to earth the equipment correctly may result in electric shock in the event of a malfunction or earth leakage.

Warning

Do not operate the pump with the exhaust blocked, or with the passage of gas on the exhaust side obstructed. Under these conditions, the pump pressure increases, and this may cause it to burst, oil to spray out of the oil level gauge, or the motor to become overloaded.

The pump is not pressure-resistant, and has an internal pressure limit of 0.03 MPa (gauge pressure).

Warning

Do not use the pump in an explosive atmosphere. Use under such conditions may result in fire.

Caution

Do not put your fingers or anything else in the motor openings. Failure to follow this requirement may result in electric shocks, injuries, or fire.

Caution

Do not touch the rotating parts such as the motor, shaft or joints while the pump is operating. Failure to do so may result in injury or fire.

Caution

Ensure that the vicinity of the motor and pump is completely free of inflammable material. Failure to follow this requirement may result in fire.

Ensure that the vicinity of the motor is free of obstacles which may obstruct ventilation. Obstructed ventilation may result in fire.



Caution

The pump becomes very hot during operation, and it should therefore not be touched, either in operation or immediately after it has stopped. Contact with the hot pump may result in burns.

Caution

Ensure that all wiring work is performed in accordance with electrical equipment standards and internal wiring regulations. Incorrect wiring work may result in fire.

Caution

If the pump ceases to operate, or a fault occurs, switch the main power supply off immediately to prevent any accidents, and contact your dealer or Ulvac, for inspection and repair.

Attention

Do not operate the pump when it doesn't have any pump oil in it. It will break the pump.

- 0.4 Receiving and storing the pump
 - 0.4.1 Receiving the pump

The pump has been shipped with great care, however the following procedure is recommended once the packing has been removed.

- (1) Check that the product is as ordered.
- (2) Check that all the accessories are there.
- (3) Check that no damage has occurred in transit.
- (4) Check that no nuts or bolts have become loose in transit. Have any nuts come off?

Contact your dealer or Ulvac if a problem has occurred.

0.4.2 Surroundings during storage, mounting, and operation

This pump is designed with very tight tolerances, and the following conditions must therefore be satisfied during storage, mounting, and operation.

- Temperature and humidity in operation: humidity at 7°C 40°C, 85% or less RH
- (2) Maximum height above sea level during storage and operation: 1,000 m
- (3) Other (during storage and operation)
 - a) No corrosive or explosive gas.
 - b) No condensation.
 - c) No dust.
 - d) Installed indoors.
 - e) Not stacked on other items, or likely to fall.
 - f) Not in direct sunlight.
 - g) Not near a heat source.
 - h) Pump oil put in the pump and inlet port sealed with a cap if stored for a long period of time.
 - i) Not stored with moisture inside pump.

Caution

The pump weighs 20kg or more, and lifting or moving it alone may therefore result in injury. Failure to do so may result in injury. Always ensure that at least two people perform the installation as shown in 3.1 Installation.



The pump will be damaged if it is subjected to shock it is overturned.



Always use the pump indoors.



Attention

Pump oil must be put in the pump and the inlet port sealed if storing it unused for a long period of time.



Attention

Do not leave the pump unused with moisture inside it. Corrosion of pump components is accelerated if it is left in this condition, and the pump may seize and no longer rotate.

0.5 Protective Equipment

A single-phase motor is connected to this pump.

An overload protection device (automatic-recovery type thermal protector) is built-in to the single-phase motor.

Other protective equipment (e.g. earth leakage breaker) is also recommended to be fitted.



Attention

Use the motor only at the rated voltage. Use at a different voltage may result in the overload protection not operating correctly, motor burnout, or fire.

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1. Using the pump safely

1.1 Dangers unique to the pump, and safety measures

Read this section thoroughly before operating or inspecting the pump. Understand the potential dangers and methods of avoiding these dangers, before commencing operation.

1.1.1 **Anger** Leakage of dangerous gases and substances

Primary causes		Avoidance and actions to be taken
Injury due to contact with toxic	⇒	(1) Wear protective gear suitable for the toxic
pump oil in the pump, or with		substances when inspecting.
hazardous materials adhering to the pump, during inspection and disposal.		(2) Employ a specialist waste disposalcontractor to ensure that hazardous materialsare properly detoxified when dismantling, ordisposing of hazardous materials.
		(3) Employ a properly licensed waste disposal contractor.

1.1.2 **WARNING** Electric shock

Primary causes		Avoidance and actions to be taken
Electric shock resulting from	⇒	(1) Always ensure that the power supply has
contact with conducting parts of the		been disconnected before commencing
motor.		wiring work. Always earth the pump.
		(2) Always ensure that the power supply has
		been disconnected before inspecting or
		moving the pump.
		(3) Do not put your fingers or any thin objects
		in the motor openings.

Primary causes		Avoidance and actions to be taken
Increased internal pressure, with consequent bursting of the pump.	⇒	Internal pressure limit is 0.03 MPa (gauge pressure). If measurement of the pump exhaust pressure shows a value of 0.03 MPa (gauge pressure), check and remove obstructions to the passage of gas in the exhaust. When using an oil mist trap, ensure that the passage is clear by replacing or cleaning it.

1.1.4 **Caution** High temperature

1.1.3 **M** Warning Bursting

Primary causes		Avoidance and actions to be taken					
Burns due to high temperatures.	⇒	(1) The pump becomes hot during operation. Pump body \rightarrow 40-80°C Motor \rightarrow 40-80°C					
		(2) High temperatures of the pump surfaces					
		bring a danger of burns if the pump is					
		touched by accident. Do not touch the					
			pump while it is in operation. Ensure that				
	the pump is stopped, and wait until it has						
		cooled, before commencing inspection.					

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.

The SDS is provided as reference information for safe use of dangerous and toxic chemicals. Persons handling pump oil are, on their own responsibility, required to implement the necessary safety measures in use. The SDS is therefore not to be considered as a guarantee of safety.

2. Pump description

2.1 Performance details

able 1 Pump performance	Table 1	Pump	performance
-------------------------	---------	------	-------------

MODEI	_	GHD-101A	GHD-101B	GHD-101C	GHD-101D				
Voltage	V	100	220-240						
Frequency	/ Hz	50/60Hz							
TYPE		Gaede type, 2-stage, direct-drive							
Exhaust ve L/minut	locity e	100(50Hz)/120(60Hz)							
6.7×10 ⁻¹									
Ditimate G.V. 0000000000000000000000000000000000									
	Standard R-2								
Oil	Amount mL	1000							
Ambient temp range	erature	7~40							
Location of	use	Indoors							
Noise level	dB(A)	70							
Inlet/exhaust	Inlet		KF-25 (NW-25)					
port diameter	Exhaust	Standard	-type (G1-size scre	ew exhaust can be	attached)				
Overall dime mm	nsions	155(W) x 413.5(L) x 234.5(H)							
Weight	t	22							
Leakag Pa ∙ m³/s	e sec		1×1	10 ⁻⁶					

Note 1) G.V. stands for gas ballast valve.

Note 2) The "ultimate pressure" in the above table is that shown on a Pirani vacuum gauge.

Note 3) The vapor pressure, viscosity, and oiliness, etc. of the pump oil varies with the type, and this may affect the pump performance. Please use the sealed rotary vacuum pump oil specified by us.

Specified oil : R-2

- Note 4) It may be difficult to start the pump of the ambient temperature is below the minimum value.
- Note 5) The "noise level" in the above table is the maximum value (the value when a standard exhaust port is attached to the pump exhaust and the pump is operated under a high load). The noise level can be lowered by attaching an oil mist trap.

Table 2 Motor performance

MODEL	GHD-101A	GHD-101B	GHD-101C	GHD-101D								
Voltage V	100	115-120	200	220-240								
Frequency Hz		50/60										
TYPE	Single-phase, 300W, 2-pole, condenser operation											
Full-load	5.5 (50Hz)	4.5 (50Hz)	2.5 (50Hz)	2.5 (50Hz)								
current value A	6.3 (60Hz)	5.3 (60Hz)	2.9 (60Hz)	2.7 (60Hz)								
Rotation speed r/min		2800 (50Hz)	/ 3300 (60Hz)									

Caution

The pump becomes very hot during operation, and it should therefore not be touched, either in operation or immediately after it has stopped. Contact with the hot pump may result in burns.



Select a motor that is appropriate for the power supply. Use the motor only at the rated voltage. Use at a different voltage may result in the overload protection not operating correctly, motor burnout, or fire.

Do not use the motor at a voltage below the minimum rated voltage. It will not start correctly.

2.2 Dimension drawings



Fig. 1 GHD-101 Sealed rotary vacuum pump dimension drawings

3. Installation

3.1 Installation

Select a location with as little dust and humidity as possible for the installation, and ensure that the pump is installed level. Select a location that will enable installation, removal, inspection, and cleaning operations.

Pay attention to the ambient temperature, especially when installing the pump inside another device. Place the pump on anti-vibration rubber, etc. to ensure that vibrations do not reach the pump.

Refer to "0.4.2 surroundings during storage, mounting, and operation" regarding the ambient conditions.



Fig. 2 How to move the sealed rotary vacuum pump

Caution

The pump weighs 20kg or more, and lifting or moving it alone may therefore result in injury. Failure to do so may result in injury or fire.

Always ensure that at least two people perform the installation as shown in Fig. 2.

Attention

The pump will break if operated on an incline, on its side, or upside down. Ensure that the intake is on the top, and that the pump is level.

Warning

Do not use the pump in an explosive atmosphere. Use under such conditions may result in fire.

3.2 Establishing an exhaust

As this pump is shipped with the correct amount of pump oil inside, ensure that it is transported with the exhaust sealed with an oil cap. Remove this oil cap before starting the pump, and fit either a standard exhaust port or an oil mist trap. (Refer to Fig. 3.)



Fig. 3 Establishing an exhaust

Attention

An oil mist trap is effective when the pump is operated under conditions with a large amount of oil mist (when used for a long time under high pressures).

Marning

The pump is not pressure-resistant, and has an internal pressure limit of 0.03 MPa (gauge pressure). If the pump is operated while the exhaust is blocked or when a device that inhibits the passage of gas at the exhaust side is fitted, the pressure inside the pump rises, and oil may spray from the oil level gauge, the cover may be broken, and the motor may be overloaded.

3.3 Vacuum piping

(1) Remove any powder, dust, or rust from the internal walls of the vacuum chamber, piping, and vacuum valve etc. before connection to the pump.



The metal mesh in the inlrt port prevents introduction of foreign matter into the pump. Do not remove it during use. Introduction of powder and dust into the pump will result in a malfunction. If moisture is introduced to the pump, not only will the ultimate pressure increase, but the inside of the pump will rust and may lead to the pump malfunctioning.

(2) Install the vacuum valve (A) and leak valve (B) between the vacuum chamber and pump as shown in Fig. 4.



Fig. 4 Vacuum chamber and basic piping connections

(3) This pump is fitted with an oil backflow prevention device. It is effective for preventing the oil from back flowing when the pump is stopped. (It is not a gas backflow prevention device.)

The backflow prevention device uses the oil pressure inside the pump to return the internal pressure to atmospheric pressure when the pump is stopped and to close the valve directly below the intake.

Warning

The backflow prevention device does not guarantee to do this 100%. In the case that the internal pressure is not returned to atmospheric pressure when the pump is stopped, approximately 400 ml of oil will enter the vacuum chamber in a short time. Also, even if the internal pressure is returned to atmospheric pressure when the pump is stopped, the pressure in the vacuum chamber will return to atmospheric pressure in a short time.

In addition to installing the vacuum valve (A) and leak valve (B) between the vacuum chamber and pump as shown in Fig. 4., ensure that there is more capacity between the pump and vacuum chamber that the amount of the oil backflow.

- 3.4 Wiring
 - (1) Check that the power supply voltage and the voltage that the motor uses are the same.
 - (2) This pump rotates clockwise as seen from the front of the pump (level gauge side).
 - (3) An overload protection device (automatic-recovery type thermal protector) is built-in to prevent damage to the motor from over current.
 - (4) Other protective equipment (e.g. earth leakage breaker) is also recommended to be fitted.



Fig. 5 Wiring drawings

(5) The power cord consent (inlet) is suitable for EN60320-1.



Fig. 6 Power cord consent (Inlet EN60320-1)

- (6) Insert the power cord into the power cord consent (inlet). If the power cord is not included with the pump, it is available as an option.
 - a) Electric cord selection criteria

There are four types of motor that can be used with this pump: single-phase 100V, 115-120V, 200V, and 220-240V. The electric cord selection criteria are shown in Table 3. Ensure that the selection is made according to these criteria. Select an EN60320-1 plug to be inserted into the power cord consent (inlet).

Power supply voltage	Voltage standard	Current standard	Temperature standard
100-120V	125V or more	10A or more, instantaneous (5sec) 10A or more	70°C or
200-240V	250V or more	10A or more, instantaneous (5sec) 10A or more	more

Table 3 Electric cord selection criteria

Install the fuse of 10A - 15A or circuit breaker in the branch circuit of the equipment side.

b) Fastener

When using the pump with an electric cord, use a fastener. It prevents the electric cord from coming out of the consent. Select a fastener that fits the shape of the electric cord.

- c) How to attach the fastener and electric cord Attach the fastener according to the following steps 1-5. (Refer to Fig. 7.)
- (1) Insert one side of the fastener into one of the holes to the side of the electric cord consent.
- (2) While squeezing the other side of the fastener, insert it into the hole on the other side of the consent.
- (3) Lift the fastener.
- (4) Firmly insert the electric cord.
- (5) Lower the fastener.





Fig. 7 How to attach the fastener and electric cord

WARNING

Commence wiring work only after removing the power plug or turning it off. Do not carry out wiring work while the wiring is live under any circumstances. Working under such conditions may result in electric shock.

A Caution

Ensure that all wiring work is performed in accordance with electrical equipment standards and internal wiring regulations. Incorrect wiring work may result in fire.

Warning

When the pump is directly connected to the user's device (plug is not the main disconnection), connect a suitable circuit breaker to the pump at the end user's side.

Caution

Passing current through the earth wire in the event of a short reduces the danger of electric shock.

Use a power cord with the appropriate plug and earth wire with the pump.

Besides the power cord, There is a place that can connect the ground wire to the pump. Ground wire attachment point the (M4 tap) has been provided on the base side of the pump. (Refer to fig. 1.) Therefore, in case of installing the pump in the housing, etc., it can also be connected to housing and the pump in the ground wire. Ensure that wiring and earthing work is done in accordance with local regulations and safety requirements.

Marning

Unsuitable earthing brings the danger of electric shock.

When repairing or changing the plug or electric cord, ensure that it is not connected to anything other than the earth.

Irrespective of the presence or absence of yellow stripes, the green insulated covering indicates the earth wire.

Caution

If the appropriate wiring method is unclear, or if there are any questions, check with an electrical technician or the service division.

Do not change the supplied plug. If it is unsuitable for the power supply, have the wiring work done by an electrical technician.

Caution

The pump must be earthed to the wiring or through a metal surface connected to earthed equipment.

3.5 Fluctuations in the power supply voltage and frequency

Standard: Rotating electric machine general rules, JIS C 4034-1:1999, JEC-2137-2000.

There is no problem to main parts when operated continuously under the voltage and frequency fluctuations in area A, and no problem to main parts when operated under the voltage and frequency fluctuations in area B. (Refer to Fig. 8.) Here, "no problem" means that the pump can be operated safely and without the life of the parts being shortened, and does not refer to the pump characteristics or the rated conditions such as a rise in temperature. The ratings are the rated torque (N.m).



Fig. 8 Fluctuations in the power supply voltage and frequency

Warning

Commence wiring work only after removing the power plug. Do not carry out wiring work while the wiring is live under any circumstances. Working under such conditions may result in electric shock.

Ensure that the earth is installed correctly. Incorrect earthing may result in electric shock in the event of a malfunction or earth leakage.

A dedicated earth leakage breaker should also be installed.

Caution

Fit overload protection equipment which is appropriate for the motor capacity. Fire may result if overload protection is not fitted, or is not appropriate for the motor capacity.

4. Operation

4.1 Safety cautions

WARNING

The pump is not pressure-resistant, and has an internal pressure limit of 0.03 MPa (gauge pressure). Do not operate the pump with the exhaust blocked, or with the passage of gas on the exhaust side obstructed. Under these conditions, the pump pressure increases, and this may cause it to burst, oil to spray out of the oil level gauge, or the motor to become overloaded.



Attention

(1) The pump oil deteriorates extremely quickly during semiconductor manufacturing processes.

We recommend that the pump oil is first changed within the initial 10 days, and that you then decide on a schedule for changing the oil after assessing the condition of the pump oil.

(2) Change the pump oil frequently when large amounts of water, etc. are introduced into the pump. If the oil is used after moisture has been introduced, the lubrication properties of the oil will decrease and the pump parts will rust leading to pump malfunctions.

(3) If chemical substances such as acids are introduced to the pump, immediately change the pump oil as the pump can rust and no longer be usable even after just being left for one night.

(4) If chemicals that reduce the pump oil's lubrication properties are introduced, change the pump oil as they may lead to the pump seizing.

(5) Operating the pump at high intake pressures of 1,000 Pa or more leads to the pump oil being consumed quickly, and not enough pump oil being supplied to the pump. Insufficient pump oil may lead to parts wearing quickly and seizures, etc. Avoid operating continuously at high intake pressures as much as possible, and don't forget to add pump oil.

4.2 Starting

Close the leak valve (B), open the vacuum valve (A) which is connected to the intake, turn the pump power supply switch on, and start the pump. The pump starts to suck and exhaust.

(Refer to Fig. 4.)

The pump may rotate slowly for several seconds to a minute and be difficult to start when starting for the first time after not having been used for a long time or after being disassembled and reassembled. This is due to the pump being overloaded because the pump oil is not sufficiently distributed inside the pump. Either leave the pump running in that condition to allow the pump oil to distribute throughout the pump, or perform jogging (switching the pump on and off quickly) several times. Operation may be possible if the leak valve (B) is opened. After the pump begins to operate normally, close the leak valve (B), and return to normal operation. (Refer to Fig. 4.)

Caution

(1) Failure to do so may result in burns. The pump gets hot during operation (40-80°C), so don't touch the motor or pump body.

(2) Oil mist comes out of the exhaust when the pump is operated at high pressures. Either attach an oil mist trap or attach a duct connected to outside the building.

Attention

The temperature of the oil inside the pump reaches 50-90°C after a few hours of operation.

If the oil temperature exceeds this range, it may indicate that something is wrong with the pump, so please inspect the pump or contact Ulvac.

4.3 Operating when it is cold

The pump may rotate slowly for several minutes and be difficult to start when starting for the first time when used when the ambient temperature is low. This is due to the pump being overloaded because the pump oil viscosity has increased. Either leave the pump running in that condition to allow the pump to warm up, or perform jogging (switching the pump on and off quickly) several times. Operation may be possible if the leak valve (B) is opened. After the pump has warmed up, close the leak valve (B), and return to normal operation. (Refer to Fig. 4.)

4.4 Stopping

Close the vacuum valve (A), and quickly open the leak valve (B), and turn the pump switch off. After the intake side has returned to atmospheric pressure, close leak valve (B), and seal the intake side. (Refer to Fig. 4.)

Caution

Failure to do so may result in burns. The pump becomes hot (40-80°C) during operation. After stopping, do not touch the motor or pump until they have cooled.

4.5 Backflow prevention device

This pump is fitted with an oil backflow prevention device. It is effective for preventing the oil from back flowing when the pump is stopped. (It is not a gas backflow prevention device.)

The backflow prevention device uses the oil pressure inside the pump to return the internal pressure to atmospheric pressure when the pump is stopped and to close the valve directly below the intake.

Warning

The backflow prevention device does not guarantee to do this 100%. In the case that the internal pressure is not returned to atmospheric pressure when the pump is stopped, approximately 400 ml of oil will enter the vacuum chamber in a short time. Also, even if the internal pressure is returned to atmospheric pressure when the pump is stopped, the pressure in the vacuum chamber will return to atmospheric pressure in a short time.

In addition to installing the vacuum valve (A) and leak valve (B) between the vacuum chamber and pump as shown in Fig. 4., ensure that there is more capacity between the pump and vacuum chamber that the amount of the oil backflow.

4.6 Thermal protector

An automatic-recovery type thermal protector is built-in to this pump. This automatically breaks the circuit of the motor power supply and prevents the motor from being damaged if the pump stops rotating during operation or if an over current flows to the motor due to an overload.

Operating temperature	Recovery-possible temperature
130 °C±5 °C	83 °C±15 °C

Table 4 Thermal protector characteristics

If the thermal protector is caused to operate, turn the switch off and contact Ulvac. The motor is extremely hot at this time. Do not touch it. (Refer to "6.4 Trouble checklist".)



Caution

Failure to do so may result in burns. The pump surfaces become hot (40-80°C). After stopping, do not touch the motor or pump until they have cooled.

4.7 Gas ballast valve

This pump is fitted with a gas ballast valve as standard. It is effective when water vapor or other condensed gases are introduced to the pump.

After condensed gases are introduced to the pump, they are converted to liquids by the pump's compression process, mixed with the pump oil, and are circulated around the pump. If this happens, it is the same as when oil with a high water vapor content is used, and the ultimate pressure increases. The lubrication properties of the oil also decrease, and the life of the shaft seal is shortened.

If air or dry nitrogen is introduced from the gas ballast valve directly before the pump's compression process, then the condensed gases are not converted into liquids; they are expelled through the exhaust together with the air. When using the gas ballast valve, the higher the pump temperature the higher the "gas ballast effect". So, before introducing condensed gases to the pump, open the gas ballast valve and operate the pump for approximately 20 minutes. When the temperature has risen to about 70°C, open the vacuum valve (A) and operate the pump. (Refer to Fig. 4.) The "gas ballast effect" may be insufficient when the temperature is low. If the gas ballast valve is left open when condensed gases are not being introduced to the pump, not only may pump oil be sprayed around and the power be reduced, but the ultimate pressure will also be increased. Also, as there is a limit to the

amount of condensed gases (air or other gases that contain small amounts of water or other vapor that may contaminate the oil) that can be dealt with by the gas ballast valve, condensed gases may be mixed with the pump oil after large amounts of them have been introduced to the pump or they were introduced without the gas ballast valve being opened. If this occurs, close vacuum valve (A), close the gas ballast valve, and leave the pump to operate without doing anything for a while. This will cause the oil temperature to rise and allow the gas ballast effect to clean the oil. (Refer to Fig. 4.)

Do this with the gas ballast valve closed until you reach the ultimate pressure. If the pump oil is not cleaned after doing this for a long time, it is necessary to change the pump oil.

Caution

The vacuum pump becomes hot (40-80°C) during operation. Only touch the valve when operating the gas ballast valve.

Always close the gas ballast valve before starting the pump.

If the gas ballast valve is left open when condensed gases are not being exhausted from the pump, not only may pump oil be sprayed around and the power be reduced, but the ultimate pressure will also be increased.

Close the gas ballast valve when condensed gases are not being exhausted from the pump.

4.8 Attaching the oil mist trap (option) element

The OMT-100A, OMT-200A, OMI-100, and OMI-200 oil mist traps can be attached to the GHD-101 to collect the exhausted oil mist. Attach an OMT-100A, OMT-200A, OMI-100, or OMI-200 oil mist trap to the exhaust section instead of the standard exhaust port. Attaching one of these oil mist tarps will prevent the oil mist from being exhausted and also reduce the exhaust noise.

Refer to the oil mist trap instruction manual for details.

4.9 Operation restrictions when attaching the oil mist trap (option) element

The following operation restrictions apply when using an oil mist trap. Replace the filter if it becomes clogged.

The internal pressure limit of this pump is 0.03 MPa (gauge pressure). If measurement of the pump exhaust pressure shows a value of 0.03MPa (gauge pressure), replace the oil mist trap filter.

Warning

Failure to follow this requirement may result in the pump breaking. Observe the operation restrictions when using an oil mist trap. Replace the filter if it becomes clogged.

4.10 Magnetic coupling

This pump uses a magnetic coupling to transfer the motor power to the pump body without touching it.

Caution

In the following cases the magnetic power of the magnetic coupling which transfers the motor power may weaken.

- When starting the pump after it has been stopped for a long time.

- When starting the pump after disassembling and reassembling it.

- When starting the pump when the ambient temperature is low and the pump oil viscosity is high.

- When starting the pump when there is a problem (pump lock, etc.) inside the pump.

In these cases, the motor noise will increase but the pump will not operate (the motor is running but the pump is stopped). Perform jogging (switching the pump on and off quickly) several times. Operation may be possible if the leak valve (B) is opened. After the pump begins to operate normally, close the leak valve (B), and return to normal operation. (Refer to Fig. 4.)

5. Pump performance

5.1 Ultimate pressure

The "ultimate pressure" referred to in catalogs and this instruction manual means "the lowest pressure attainable when the pump is operated without any gas being introduced through the intake (no-load operation)". We measure this with a Pirani vacuum gauge at the intake while using the specified pump oil.

In actual vacuum devices, the ultimate pressure is higher than the values stated in catalogs. This is for the following reasons.

- 1. The vacuum gauge is installed far from the pump, and also water vapor produced by the drops of water and rust that are on the inside walls of the device and on the piping, etc. increase the ultimate pressure.
- 2. The volatile substances that are dissolved in the pump oil become gas again and increase the ultimate pressure. (Deterioration of the pump oil)
- 3. Vacuum leaks in the vacuum path that lead to gas being introduced increase the ultimate pressure.

5.2 Exhaust velocity

The exhaust speed of a sealed rotary vacuum pump varies depending on the type gas being introduced and the pressure. Generally, the exhaust speed is highest at high pressures and reduces together with the pressure. The nominal exhaust speed of this pump is that when introducing dry air to the pump. Fig. 9 shows the relationship between the intake pressure and exhaust speed.

5.3 Required power

The power required to drive the pump is the total of that for the rotation friction (mechanical work) and that for compressing the air (compression work), and reaches a maximum at approximately an intake pressure of 4×10^4 to 2.7×10^4 Pa. At 13,3 Pa or less, there is little compression work, and almost all the power is consumed by mechanical work.



Fig. 9 Exhaust velocity curve

6. Maintenance, inspection and repair

6.1 Maintenance

Check the following at least once every three days when using the pump.

- (1) Check that the pump oil amount is within the red circle on the oil level gauge.
- (2) Check that the pump oil is not discolored.
- (3) Check that there are no abnormal noises.
- (4) Check that the motor voltage is normal.
- (5) Check that there are no oil leaks.

If any problem is found, deal with it according to "6.4 Trouble checklist".

6.2 Periodic inspection

While it is necessary to change the details of the inspection according the usage condition of the pump, check the following items periodically. This will help prevent the pump from malfunctioning and increase its lifetime.

A Caution

(1) Always turn off the power supply before inspecting the equipment. Never turn the power supply on during an inspection. Failure to do so may result in injury.

(2) The pump is hot immediately after use. Wait for it to cool before inspecting. Failure to do so may result in burns.

(1) Inspecting the electric cord and wiring

Cracks in the electric cord or loose terminals may lead to electric shocks or injuries. If any cracks are found in the electric cord, replace it. If any loose terminals are found, tighten them.

(2) Pump oil periodic change

The pump oil deteriorates with operation of the pump. Use the oil level gauge to check the pump oil for cloudiness and viscosity, and change the oil before it deteriorates. By periodically changing the pump oil, the deterioration of the pump performance can be avoided and the lifetime of the pump can be lengthened. If the pump is operated with large amounts of moisture, etc. in the pump oil, the ultimate pressure is increased and the moving parts of the pump with move less smoothly finally resulting in the pump breaking down. Change the pump oil according to "6.3 Pump oil change".

(3) Pump oil amount inspection

Add the specified pump oil as necessary to ensure that the pump oil level is always within the red circle on the oil level gauge during operation.

(4) Oil leak inspection

If oil leaks from the drain plug seal, replace the seal. The necessary o-rings and seals are kept in stock at the service departments listed at the end of this manual. Contact them as necessary.

(5) Intake metal mesh inspection

Dust, etc. contained in the intake gas can clog the metal mesh and reduce the pump performance.

(6) Abnormal noise and vibration inspectionCheck that there are no loose nuts and bolts, etc.

(7) Oil mist trap inspection

When using an oil mist trap instead of the standard exhaust port, pay attention to whether the filter inside the oil mist trap is clogged or not. If the filter becomes too clogged, the exhaust gas will not have any way to escape and the pressure inside the pump will rise. This can lead to oil spraying from the oil level gauge, and oil leaking from the drain plug seal, etc. The internal pressure limit of this pump is 0.03 MPa (gauge pressure).

In addition to the above inspection items, disassemble and repair the pump if it has been used continuously for a long time or if there is severe contamination due to the intake gases. Contact your nearest dealer or the service division (see last page of this manual).

Inspection cycle	Inspection item	Details	What to do
Refore use	Oil	Check that the oil amount is the specified amount.	Add oil.
Wiri	Wiring	Check that there are no cracks in the electric cord or loose terminals.	Replace the electric cord. Tighten the terminals.
	Oil	Check that the oil is not discolored. Red/brown color; cloudy white color is abnormal.	Change the oil.
Once every	Noise	Check that the noise is normal.	Check that the nuts and bolts are tightened.
three days	Vibration	Check that the vibration is normal.	Contact the manufacturer for further clarification.
	Current	Check that it is at or below the rated current.	Check for causes of overload. Contact the manufacturer for further clarification.
Once a week	Surface temperature	Check that the surface temperature is normal. 50°C or more above room temperature is abnormal.	Check for causes of overload. Contact the manufacturer for further clarification.
	Oil leaks	Check that oil is not leaking from any of the plugs.	Replace the seals. Or, contact the manufacturer.
Once every 3,000 hours	Intake metal mesh	Check that it is not clogged with dust, etc.	Clean the metal mesh.
Once every six months	Oil	Necessary even if normal.	Change the oil.

Table 5 Periodic inspection table

A Danger

When requesting Ulvac's service division for disassembly or repair, always note the gases used, and complete the check list ("Conditions of Use Check Sheet") at the end of this manual. If the pump has been used to exhaust toxic gases, the pump itself, and the pump oil will also be toxic. Use with some gases may render disassembly and repair impossible. Pay sufficient attention.

6.3 Pump oil change

Deterioration of the pump oil can lead to an increase in the vacuum device pressure. Close the pump intake, and change the pump oil if the specified ultimate pressure cannot be achieved. If volatile substances (moisture, solvents, etc.) are mixed with the pump oil or there is sludge at the bottom of the pump, changing the pump oil once may not be sufficient to return the ultimate pressure to its specified value. In this case, change the pump oil several times. Deterioration of the pump oil is not only caused by contamination due to intake gases, but is also caused by normal pump operation over time.

We recommend that you periodically change the oil as shown in Table 5.

Danger

If the pump has been used to exhaust toxic gases, the pump itself, and the pump oil will also be toxic. Pay sufficient attention.

Caution

(1) Wear rubber gloves and protective eyewear, etc.

(2) Read "1.2 Safety data sheet (SDS)" before adding oil.

If pump oil accidentally comes in contact with your hands, or gets in your eyes, use the first aid measures described in "1.2 Safety data sheet (SDS)".



Attention

Do not use any pump oils other that those specified by Ulvac. Using other oils may cause the pump performance to be reduced and its lifetime to be shortened.

< Pump oil change procedure >

- Open the pump inlet port to the room air and operate the pump for five seconds. This will effectively exhaust any oil remaining in the pump.
- (2) Remove the standard exhaust port, then remove the drain plug, and empty the oil from the pump.
- (3) Attach the drain plug, and add the specified amount of the specified pump oil through the oil opening. (Refer to Fig. 10.)
 Ensure that the oil surface level is always within the range on the oil level gauge while operating the pump. If there is insufficient oil in the pump, the pump performance will be decreased and it may also lead to malfunctions.
 If the oil amount decreases to where it cannot be seen on the oil level gauge, the ultimate pressure will increase and the exhaust noise may not stop.
 If the oil amount is more than the maximum oil level, oil drops may be sprayed out of the exhaust when operating at high pressures.
- (4) When the pump oil is badly contaminated, add new pump oil and operate the pump for a few minutes to clean the pump. If the contamination is very bad, repeat this procedure a few times.
- (5) After changing the pump oil, operate the pump until it warms up, and check the ultimate pressure.
- (6) If the contamination is very bad and oil sludge accumulates at the bottom of the pump, the ultimate pressure may not be achievable even after changing the pump oil. In this case, it is necessary to disassemble and repair the pump.



Fig. 10 Adding oil to the sealed rotary vacuum pump

6.4 Trouble checklist

Problem	Cause	Countermeasure	Ref.
Pump doesn't rotate	(1) Not connected to power	(1) Connect to power supply	3.4
	(2) Power supply side switch is	(2) Turn the power supply side	4.2
	(3) Input power supply voltage	(3) Adjust to rated voltage	3.5
	(4) overload protection device tripped	(4) Turn off the power supply, and leave the pump until it has cooled down sufficiently (until the overload protection device is automatically reset)	4.6
	(5) Defective motor	(5) Replace the motor	6.2
	(6) Oil viscosity has risen due to ambient temperature being low	(6) Perform warming operation	4.3
	(7) Foreign matter has been introduced to the pump and stuck to the rotors, etc.	(7) Disassemble and repair (replace the cylinder, rotors, etc.)	6.2
	(8) The inside of the pump has rusted due to moisture or solvents being introduced	(8) Disassemble and repair (replace the cylinder, rotors, etc.)	6.2
	(9) A reactive gas was introduced, and caused reactive products to accumulate inside the nump while it was stopped	(9) Disassemble and repair (clean the inside of the pump and remove the reactive products)	6.2
	(10) Other pump internal parts	(10) Disassemble and repair (replace the broken parts)	6.2
Pump rotation is		(1) Adjust to rated voltage	35
irregular	abnormal		0.0
	(2) Defective pump wiring	(2) Redo pump wiring	3.4
	(3) Oil viscosity has risen due to ambient temperature being low	(3) Perform warming operation	4.3
	(4) Foreign matter introduced into pump	(4) Remove foreign matter, dissemble and clean	6.2
Pressure doesn't	(1) Pump is too small for the	(1) Select another pump	5.2
drop	vacuum chamber		
	(2) Incorrect pressure measurement method	(2) Measure pressure correctly	5.1
	(3) Vacuum gauge not suitable	(3) Measure the pressure with a vacuum gauge that is suitable for the pressure range and has been calibrated	5.1
	(4) The pipe connected to the intake is small, or the pipe is too long	(4) Connect a pipe with a diameter greater than that of the intake, and reduce the length of the pipe between the pump and vacuum chamber	5.1

Table 6 Trouble checklist

Problem	Cause	Countermeasure	Ref.
Pressure doesn't drop	(5) The intake metal mesh is clogged	(5) Remove the pipe from above the intake and clean the metal mesh	6.2
	(6) Insufficient oil	(6) Add the specified amount of oil	6.3
	(7) Oil has deteriorated	(7) Change the oil	6.3
	(8) The pipe connected to the	(8) Find the leak with a leak	5.1
	pump is leaking	detector, etc. and stop it	
	(9) Not using the oil specified by	(9) After disassembling and	6.3
	Ulvac	the specified oil	
	(10) Oil is not circulating	(10) Disassemble and repair	6.2
	Clogged oil holes in cover,	Clean the oil holes	
	etc.		
Abnormal noise	(1) Input power supply voltage abnormal	(1) Adjust to rated voltage ±10%	3.5
	(2) Defective motor	(2) Replace the motor	6.2
	(3) Foreign matter introduced	(3) Remove foreign matter,	6.2
	(4) Insufficient oil	(4) Add the specified amount of	63
		oil	0.0
	(5) Oil is not circulating	(5) Disassemble and repair	
	Clogged oil holes in cover,	Clean the oil holes	6.2
	etc.	(6) Disconamble and repair	
	have broken	(replace the broken parts)	6.2
	(1) Continuous operation with	(1) The pump surface	1.1
Pump surface is	high intake pressures	temperature may reach 80°C if	
(room		operated continuously at high	
temperature +		intake pressures, but this is not a	
50°C or more)		problem	
	(2) Insufficient oil	(2) Add the specified amount of	6.3
	(If the oil amount is low, the	oil	
	pump cooling function may not		
	WORK WEII)	(3) Attach a cooling device such	
	(3) The intake gas is not	as a gas cooler to the intake side	
	(4) Oil is not circulating	(4) Disassemble and repair	6.2
	Clogged oil holes in cover,	Clean the oil holes	
	etc.		
Lots of oil is	(1) The pump has more than the	(2) Remove oil until the specified	6.2
sprayed from the	specified amount of pump oil	amount	
exhaust	(2) Continuous operation with	(2) Attach on ail miat tran to the	4.0
	L(2) Continuous operation with	exhaust side	4.0
Oil is leaking to	(1) Deterioration of the o-rings or	(1) Inspect and replace the	6.2
outside the pump	oil seals on the case or cover,	o-rings and seals	
	etc.	-	

7. Disposal

Ensure that the pump is disposed of in accordance with national legislation, and as required by your local authority.

Caution

(1) Engage the services of a specialist contractor for disposal if the pump has been used to exhaust toxic or dangerous gases. The pump body and pump oil become toxic.

(2) Dispose of pump oil in accordance with the section on cautions for disposal in

"1.2 Safety Data Sheet (SDS)".

8. Maintenance parts

8.1 Maintenance parts list

Table 7 GHD-101 Maintenance parts list

Product name	No.	Parts name	Q'TY
	13	Air open valve spring	1
	16	Oil seal _SC-13-25-7	1
	17	Oil seal VC-12-22-4	1
	30	Check valve	1
	36	Outlet valve spring	2
	37	Outlet valve	2
	49	O ring (Casing)	1
	50	O ring _S-6	3
	51	O ring _S-7	1
	52	O ring _S-16	1
	53	O ring _S-20	1
	54	O ring _S-32	1
GHD-101 Maintenance kit A	55	O ring _S-53	1
	56	O ring _S-71	2
	57	O ring _P-5	1
	58	O ring _P-8	1
	59	O ring _P-9	2
	60	O ring _P-12	1
	61	O ring _P-12.5	2
	62	O ring _P-24	1
	63	O ring _SS040	1
	64	O ring _SS110	1
	65	O ring _N-28	1
	77	O ring _P-20	1
	18	1st Vane	2
GHD-101 Maintenance kit B	19	2nd Vane	2
	39	Oil level gauge	1

(Note) Refer to the disassembly drawings for the relationship between parts.

8.2 Disassembly drawings





<u>Warranty</u>

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

(2) Malfunctions occurring under normal conditions of use during the period of the warranty will be repaired free of charge.

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

Normal conditions of use are as follows:

- a) Atmosphere, temperature, and humidity in operation : 7 40°C Maximum 85% RH
- b) Type and temperature of exhaust gas: Dry air or dry nitrogen, 7 40°C
- c) Operation in accordance with the user's manual.
- (3) Repairs are chargeable during the warranty period in the following cases:
 - a) Malfunctions due to natural disasters and fire.
 - b) Malfunctions due to salt damage, inflammable gases, corrosive gases, radiation, or particular atmospheres (e.g. pollution).
 - (c) Malfunctions due to conditions of use which differ from those noted in the user's manual (e.g. performance details, maintenance, inspection).
 - d) Malfunctions caused by modification or repair that is 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 judged by Ulvac technical personnel to be due to conditions of use not suited to the vacuum pump.
 - j) Consumables
- (4) Disclaimer
 - a) We shall not be liable for any malfunctions of our products caused by the customer, regardless if the malfunction falls within the warranty period, nor be liable for any loss of opportunity for the customer's clients or for compensation of any damages to other products, labor costs, production loss, transportation expenses and other related work.
 - b) We shall not be liable for any secondary damages that occur for the customer due to filed claims and patent infringements of a third party.

Conditions of Use Check Sheet (Instructuion manual)

- * For the safety of repair personnel, enter the relevant details in the check sheet below, and attach it to the items to be repaired.
- * Repair and inspection cannot be undertaken unless the relevant details are provided in this check sheet.
- * The information provided is protected under privacy legislation, and is used solely in determining the causes of malfunctions, and in detoxification. This information will not be disclosed to a third party.

Model	Production number
1. Gases used (this informatic	on must be entered)
(1) Toxic to humans?	Y/N (confirm with signature at bottom of sheet)
(2) Offensive smell?	Y/N
(3) Type and name of gas	
* Some substances may require	notification under the Occupational Safety and Health Act.
2. Usage	
Operation: <u>hours/day</u> ,	months/year [] Continuous operation [] Intermittent operation
Details of use:	
3 Malfunction details II Abnor	mal noise [] Abnormal pressure [] Abnormal operation [] Oil leaks
Other Symp	
4. Reason for request	[] Repair (overhaul) [] Regular inspection
5. Other	
Your company name	Person in charge
Address	
Telephone	Fax
Email	
Dealer	Person in charge
Telephone	Fax
* If you do not deal directly wit	h Ulvac, enter the name of your dealer.
6. Confirmation	
Gases and substances use	d with this pump or equipment are not toxic to humans.
The pump and equipment are	not contaminated with substances toxic to humans.
Signature	Seal Date
t To avoid problems when the	nenorting the nump romave ail from the nump before
sending it.	insporting the pump, remove on nom the pump before

* Send this check sheet to Ulvac's Service Division (CS Center). Refer to the attached list of addresses.