

### **Instruction Manual**

### for

### **Direct-Drive Oil Sealed Rotary Vacuum Pump**

Model GLD-051 GLS-051

Before using the product, be sure to read this manual. 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.

### 0. Introduction

### 0.1 Before using the vacuum pump

Thank you for purchasing our vacuum pump (hereinafter called "pump"). When you have received the pump, check that the delivered pump is as per your order and that it has not been damaged in transportation, etc.

## A Warning \_\_\_\_\_

In order to use the pump for as long as possible, read this instruction manual thoroughly before performing installation, operation, inspection and maintenance, and sufficiently understand the cautions for safety, the specifications and operation methods of the pump.

## \_ \Lambda Note \_\_\_\_\_

No part of this instruction manual may be copied for use by a third party without our permission.

### 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.

# Marning \_\_\_\_\_

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.



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

## \land Danger \_\_\_

When toxic or flammable gases are exhausted from the pump, they may leak not only from the pump outlet but also from the pump unit itself. Take proper measures suitable for the type of gas.

# \land Danger \_\_\_\_\_

After the pump has been used for exhausting toxic gasses, not only the pump itself but also vacuum pump oil (hereinafter called "pump oil") get toxic. Keep this in mind when performing the maintenance.

## Marning \_\_\_\_\_

Never allow people other than repair engineers to disassemble or repair the pump. Failure to do so may result in ignition or malfunction, leading to injury or electric shock.

# \Lambda Warning \_\_\_\_\_

Before performing inspection or repair, always turn off the power switch. Failure to do so may result in electric shock or the unexpected start of the pump, leading to injury.

## A Warning

Connect the earth wire correctly. It is recommended that a dedicated earth leakage breaker should be installed. If the earth wire is not connected, there is a possibility of electric shock occurring in the case of a malfunction or electrical leakage.

# A 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).

## \Lambda Warning \_\_\_\_\_

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

## ▲ Caution

Do not insert fingers or objects into the opening of the motor. Doing so may result in electric shock, injury, or fire.



Never touch the rotating section of the motor, shaft or coupling while the pump is in operation. Failure to do so will result in injury.

# ▲ 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.

# ⚠ Caution \_\_\_\_\_

Do not touch the motor while the pump is in operation or when the pump is still hot immediately after it stops. Touching it will result in burns.

# ⚠ Caution \_\_\_\_\_

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

## ▲ Caution \_\_\_\_\_

If the pump ceases operation or malfunctions, turn off the power switch immediately to prevent accidents, and ask the company from which you purchased the pump or the manufacturer for inspection and repair.

# \land Note

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

### 0.4 Acceptance and storage of the pump

#### 0.4.1 Acceptance of the pump

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

- ① The delivered pump is in accordance with your request.
- 2) The specified accessories (enough pump oil to use the pump once; optional equipment) 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.

0.4.2 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:  $7^{\circ}C \sim 40^{\circ}C$ , 85% RH or less
- 2 Height above sea level during storage and installation: 1,000 m or less
- ③ 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.

### Note \_\_\_\_\_

Do not subject the pump to shocks or place the pump on its side. Doing so may damage the pump.

### 0.5 Protective device

The pump is provided with a single-phase 100V (50/60Hz) motor.

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

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



Use the pump only at the rated voltage. Use at other than the rated voltage will interfere with correct operation of the overload protector, and result in the motor burning out, or fire.

### Contents

0. Introduction	
0.1 Before using the vacuum pump	
0.2 Safety symbols	
0.3 Cautions for safety	
0.4 Acceptance and storage of the pump	
0.4.1 Acceptance of the pump	
0.4.2 Environmental conditions for storage,	installation and operation $\cdots$ 05
0.5 Protective device	
1 For Orfe Organition	
1. For Safe Operation	1
1.1 Hazards peculiar to the pump and safety me	
1.1.1 \Lambda Danger Leakage of hazardous gase	es and substances ····· 1
1.1.2 \land Warning Electric shock	
1.1.3 \land Warning Explosion	
1.1.4 🛕 Caution High temperature	
1.2 Safety Data Sheet (SDS)	
2. Outline of the Pump	
2.1 Specification	
2.2 Dimensional drawing	
3. Installation	
3.1 Installation	····· 5
3.2 Lubrication	
3.3 Vacuum piping	
3.4 Electric wiring	
3.5 Fluctuation in the power voltage and frequ	
4. Operation	····· 9
4.1 Cautions for operation	· · · · · · · · · · · · · · · · · · ·
4.2 Start of operation	
4.3 Stopping the operation	10
4.4 Operation in cold climates	
4.5 Backflow preventer	
4.6 Gas ballast valve	
4.7 Installation of the oil mist trap (Option)	)
4.8 Restriction on operation when the oil mist	t trap is installed ······ 13

5. Pump Performance	
5.1 Ultimate pressure	14
5.2 Pumping speed	
5.3 Power requirement	14
6. Maintenance, Inspection and Repair	
6.1 Maintenance	
6.2 Periodic inspection	
6.3 Replacement of the pump oil	
6.4 Replacement of the coupling spider	
6.5 Trouble check list	
7. Disposal	23
8. Maintenance parts	
8.1 Maintenance parts list	
8.2 Disassembly drawing	

### Warranty

Safety Data Sheet (SDS) Pump Usage Check Sheet (Use this sheet for requesting an overhaul.) Contact address of sales and service departments

### Figures and Tables

Fig.	1	Dimensional drawing of GLD-051 oil sealed rotary vacuum pump	4
Fig.	2	Dimensional drawing of GLS-051 oil sealed rotary vacuum pump ······	4
Fig.	3	Lubrication of the oil sealed rotary vacuum pump	5
Fig.	4	Basic piping diagram to the vacuum chamber	6
Fig.	5	Change region of the voltage and frequency	7
Fig.	6	Pumping speed curve	15
Fig.	7	Characteristics of Motor power	15
Fig.	8	Replacement of the coupling spider	20
Fig.	9	Disassembly drawing of GLD-051 oil sealed rotary vacuum pump	26
Fig.	10	Disassembly drawing of GLS-051 oil sealed rotary vacuum pump	27

Table 1	Specification	 	3
Table 2	Periodic inspection table	 •••••	17
Table 3	Trouble check list	 	21
Table 4	GLD-051 Maintenance parts list	 	24
Table 5	GLS-051 Maintenance parts list	 	25

Attached table: Safety Data Sheet for Vacuum Pump Oil SMR-100

### 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.

### 1.1.1 🛆 Danger Leakage of hazardous gases and substances

Cause	Prevention method and measures
Leakage of toxic and flammable gases	$\Rightarrow$ Dilute hazardous gases to a safe concentration before they enter the pump inlet.
Injury due to touching toxic pump oil in the pump or harmful substances attached to the pump during inspection or disposal	<ul> <li>⇒ ① Wear protective equipment suitable for toxic substances when carrying out inspection.</li> <li>② Before overhauling and disposing of the pump, ask a waste disposal specialist to make it safe.</li> <li>③ Ask an authorized waste disposal specialist to carry out disposal.</li> </ul>

### 1.1.2 🛕 Warning Electric shock

Cause	Prevention method and measures
The energized part of the	$\Rightarrow$ ① When connecting electric wires, always turn off the
motor was touched.	power and be sure to connect the earth wire.
	② When inspecting and transferring the pump, always turn off the power.
	3 Never insert hands, fingers, or thin objects through the
	motor opening.

### 1.1.3 🔥 Warning Explosion

Cause		Prevention method and measures
The pressure in the pump	$\Rightarrow$	The maximum internal pump pressure is 0.03 MPa (gauge
increased causing the pump		pressure).
to explode.		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.

### 1.1.4 🛕 Caution High temperature

Cause	Prevention method and measures
High temperatures caused	$\Rightarrow$ ① The pump reaches a high temperature during operation.
burns.	Pump main unit during non-load operation $\rightarrow 40 \sim 80^{\circ}$ C
	Motor during non-load operation $\rightarrow 40 \sim 80^{\circ}C$
	2 Since the surface temperature is hot, touching the
	surface accidentally may result in burns. Never touch
	the pump during operation. When carrying out
	inspection, wait until the pump has cooled down
	completely after it stops.

#### 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.

### 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.

Model		GLD-051		GLS-051			
		$50 \mathrm{Hz}$	$60 \mathrm{Hz}$	$50 \mathrm{Hz}$	60Hz		
Туре			Sliding var	ne 2 stages	Sliding va	Sliding vane 1 stage	
Pumping	speed	L/min	50	60	50	60	
Ultimate	G.V. Close	Pa	6.7×	10-1	9	9.3	
pressure	G.V. Open	Pa	6	6.7		_	
Motor		V	Single Phase, 100(50/60Hz), 110(60Hz)		Single Phase, 100(50/60Hz), 110(60Hz)		
		W, Poles	200, 4		200, 4		
Full load	current	А	5.6(100V)	4.8(100V) 5.1(110V)	5.6(100V) 4.8(100V) 5.1(110V)		
Motor rev	rolution	r/min	1,440(100V)	1,730(100V) 1,740(110V)	1,440(100V) 1,730(100V 1,740(110V		
Weight		kg	13.9		12.9		
Pump oil Recommended Capacity			SMR-		IR-100		
		mL	500 to 800		400 to 700		
Inlet port diameter		KF-25(NW-25)					

Table 1 Specification

Note 1: Ultimate pressure indication by Pirani gauge.

Note 2: Vapor pressure, viscosity, or characteristics of vacuum pump oils are different respectively. Our recommended oil is SMR-100.

Note 3: "G.V." is an abbreviation for gas ballast valve.

#### 2.2 Dimensional drawing

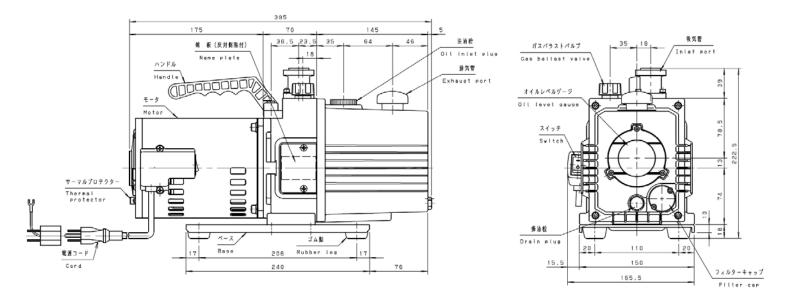


Fig. 1 Dimensional drawing of GLD-051 oil sealed rotary vacuum pump Motor; Single phase, 100V, 200W, 4Poles, split phase start

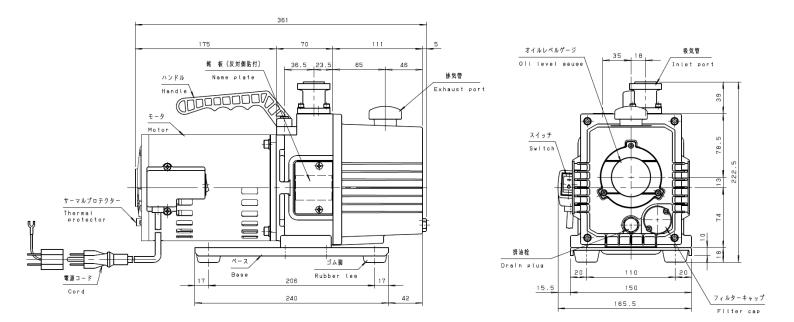


Fig. 2 Dimensional drawing of GLS-051 oil sealed rotary vacuum pump Motor; Single phase, 100V, 200W, 4Poles, split phase start

#### 3. Installation

#### 3.1 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. See "0.4.2 Environmental conditions for storage, installation and operation" for details.

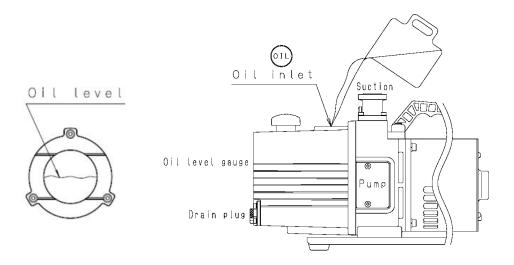
## \land Note

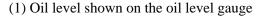
If the pump is operated whilst it is tilted, placed on its side or upside-down, the pump will be damaged. Install the pump level with the inlet facing up as shown in Fig. 1.2.

### 3.2 Lubrication

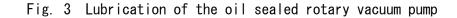
Remove the lubrication plug from the lubrication port, and add the pump oil which has been delivered together with the pump or the pump oil specified by us (SMR-100) up to the range marked with the line on the oil level gauge. When making the first lubrication, add oil near to the upper oil level limit shown on the oil level gauge. After lubrication, mount the lubrication plug to the pump (see Fig. 3).

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 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.





(2) Lubrication method



## ▲ Caution ———

1 Wear protective equipment such as rubber gloves and safety goggles.

(2) 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."

## \_ \Lambda Note \_\_\_\_\_

Use only oils specified by us. If other oils are used, the pump performance will deteriorate or its life will be shortened.

- 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.

\_ 🕂 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.

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

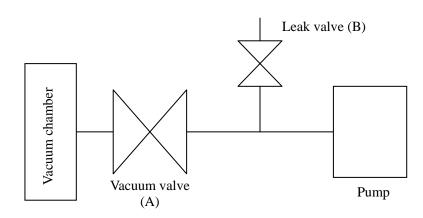


Fig. 4 Basic piping diagram to the vacuum chamber

(3) Use a KF-25 (NW-25) flange for the connection to the inlet port.

## \land Note –

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

#### 3.4 Electric wiring

- (1) Plug the power cord or the motor lead to a power compatible with the motor rating.
- (2) This pump is wired for use on 100 V single-phase power as standard.
- (3) If the pump motor is changed with a motor for use on three phase power, turn ON the power switch after plugging the power cord to the terminal block of the motor and check if the motor rotates counterclockwise as viewed from the back of the motor. At this time, noise will be heard from the pump, which is operated in atmospheric air, but this is not a trouble.
- (4) If the pump rotates in the reverse direction, unplug the power cord and interchange two of the three phases. If the pump rotates in the reverse direction, oil may be diffused from the intake port or the pump may fail.
- (5) Upon checking the connection, turn OFF the power switch.
- (6) The over-load protector (thermal protector, manual reset type) is provided for this pump.

#### 3.5 Fluctuations in the power voltage and frequency Standard: Rotation electricity machine general rules

#### JIS C 4034-1:1999, JEC-2137-2000

To the voltage change and frequency change in Domain A, in main rated values, it operates continuously, and can be used practically convenient, and to the voltage change and frequency change in Domain B, it shall operate with main rated values and shall be used practically convenient.

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  $(N \cdot m)$ .

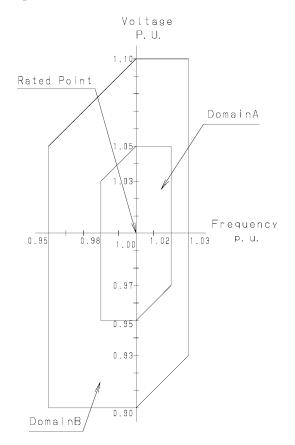


Fig. 5 Change region of the voltage and frequency

### A Warning

It will cause a serious damage or movement failure to the motor in case of impressing the inverter controlled pressure is given towards the motor itself.

Please carefully be noted and do not take the above action.

## A Warning

Before connecting wires, turn off the power switch. Never perform wiring with the power supplied as an electric shock will occur. Connect the earth wire correctly. Failure to do so may result in electric shock if a failure or earth leakage occurs. Installation of a dedicated earth leakage breaker is also recommended.

# A Caution

Perform electric wiring correctly in accordance with the "Electric Equipment Technical Standard" and "Internal Wiring Regulation." Incorrect wiring will result in fire.

# ▲ Caution

Install an overload protector suitable for the capacity of the motor. If an overload protector is not installed, or if an overload protector that is unsuitable for the motor capacity is installed, the motor will be damaged leading to fire.

### 4. Operation

4.1 Cautions for operation

### Marning ·

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 pump internal 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).

## ▲ Caution

Do not stop and restart this equipment repeatedly. When restarting this equipment, make sure that the pump (motor) has stopped completely before turning on the power. If the pump (motor) has not stopped completely and the equipment is restarted, the pump's (motor) current rises and either the protection device is activated or the motor may become damaged.

# \land Note –

- (1) In the process of manufacturing semiconductors, pump oil may deteriorate over a very short period of time. It is recommended that the pump oil should be replaced within 10 days after starting use of the pump, and the replacement frequency of the pump oil should be decided based on the contamination level of the pump oil.
- (2) If the pump evacuate a lot of moisture, replace the oil frequently. If the pump is used with gas which contains a lot of moisture, the lubricity of the pump oil deteriorates and corrosion of the pump's components advance, causing the pump to malfunction.
- ③ If chemicals including acid has been evacuated, the pump may become rusty while it is not being operated (i.e. overnight), making operation impossible. If such chemicals are evacuated, replace the pump oil immediately.
- (4) Solvents which deteriorate the lubricity of the pump oil will cause scoring, etc. If such a solvent is evacuated, replace the oil.
- (5) If operation is performed continuously at a high evacuation pressure of 10 kPa or more, a large amount of pump oil is consumed, causing a shortage of oil and insufficient lubrication of the pump. If such a condition continues, components will rapidly wear and become scored. Avoid continuous operation at a high evacuation pressure as much as possible and, without fail, add pump 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 Fig. 4).

## / Caution \_

- (1) The motor and pump become hot (temperature increase under non-load operation: 40°C, temperature increase under high-load operation: 80°C) during operation of the pump. There is a risk of burns. Never touch the motor or pump during operation.
- (2) 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.

# / Note \_\_\_\_\_

When the pump does not rotate correctly, take the following measures.

- a) Check the amount of oil, and adjust if necessary.
- b) In an environment where the ambient temperature is low, if the pump is left unused for a long time (three days or longer), the pump oil enters the cylinder. (This phenomena cannot be avoided even if the pump pressure is released to atmospheric pressure after last using the pump.) If the pump is restarted in this condition, an overload is applied to the pump and the overload protector may actuate. In such a case, turn the pump on and off several times in short intervals.

## Note -

The oil temperature in the pump increases to  $70 \sim 80^{\circ}$ C if operation continues for several hours. If the oil temperature exceeds this range, there is a possibility of the pump malfunctioning. Check the pump or contact us.

#### 4.3 Stopping the operation

To stop operation, close vacuum valve (A), open leak valve (B) quickly, and turn the power switch off (see Fig. 4).

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

## 

Do not stop and restart this equipment repeatedly. When restarting this equipment, make sure that the pump (motor) has stopped completely before turning on the power. If the pump (motor) has not stopped completely and the equipment is restarted, the pump's (motor) current rises and either the protection device is activated or the motor may become damaged.



The motor and pump become hot (temperature increase under non-load operation: 40  $^{\circ}$ C, temperature increase under high-load operation: 80  $^{\circ}$ C) during operation. There is a risk of burns. Never touch the motor or pump until they have cooled down completely after the pump is stopped.

#### 4.4 Operation in cold climates

In winter-season, when operating the pump in cold environment, it will be difficult to start up the pump. It is called over-load operation because of high viscosity of the pump oil at low temperature.

If the pump does not restart, warm up the pump oil, or try to keep the pump within the operating temperature for a little while and then turn on the power again.

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.

#### 4.5 Backflow preventer

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

The backflow preventer actuates in the case of an emergency including power failure. So, after the pump is stopped due to a power failure, follow the procedures mentioned in "4.3 Stopping the operation" to stop the operation.

# ▲ Note —

- (1) To stop the pump, always close vacuum valve (A) and then open leak valve (B). If this procedure is neglected, the pump oil fills the cylinder, making restart difficult or causing damage to the pump. The pump oil also may flow back to the vacuum chamber side.
- (2) If vacuum valve (A) is not closed, air may leak into the device side through the pump increasing the pressure.

#### 4.6 Gas ballast valve

The pump is equipped with a gas ballast valve in order to evacuate vapor and condensable gases such as solvent vapor.

Evacuated condensable gas that liquefies in the compression and pressurization processes of the pump is mixed with the pump oil and starts circulating through the pump together with the oil. In such a case, the same effect as when oil of a high steam pressure is used is produced, and the ultimate pressure of the pump increases. Moreover, the lubricity of oil deteriorates and the service life of the shaft seal is shortened.

If air or dry nitrogen enters through the gas ballast valve just before the compression and pressurization processes of the pump, condensable gas will not liquefy and will be exhausted together with air through the outlet valve. When the gas ballast valve is used, the "gas ballast effect" increases as the pump temperature becomes high. So, before evacuating condensable gas, perform operation for approximately 20 minutes with the gas ballast open, and after the pump temperature reaches approximately  $50 \sim 65^{\circ}$ C, open vacuum valve (A) and continue operation. If the temperature is low, a satisfactory "gas ballast effect" is not achieved.

If the gas ballast valve is left open when condensable gas is not evacuated, not only does the pump oil scatter and power is lost, but also the ultimate pressure increases. Furthermore, since the gas ballast valve's capacity to process condensable gas is limited, condensable gas remains in the pump oil when a lot of condensable gas is exhausted or when condensable gas (air and gas containing small amounts of moisture and other vapor which make the oil dirty) is exhausted without opening the gas ballast valve. In such a case, perform non-load operation with vacuum valve (A) closed and the gas ballast valve open. Then the oil temperature increases and the pump oil is purified due to the effect of the gas ballast valve. Continue non-load operation with the gas ballast valve closed until the specified pressure is reached. If the pump oil is not cleaned even a long time, replace the pump oil.

# ▲ Caution

The vacuum pump becomes hot (temperature increase under non-load operation: 40 °C, temperature increase under high-load operation: 80 °C) during operation. Do not touch any section other than the valve while the gas ballast valve is in operation.

When starting operation, be sure to close the gas ballast valve.

## ▲ Note \_\_\_\_\_

If the gas ballast valve is left open without condensable gas being exhausted, the pump oil scatters, power is lost, or the ultimate pressure increases. Close the gas ballast valve when condensable gas is not exhausted.

### 4.7 Installation of the 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, models OMT-050A and OMS-050 are available. Remove the standard exhaust port from the exhaust 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.

The internal pump pressure is limited to 0.03 MPa (gauge pressure). When the pressure measured at the outlet side has reached 0.03 MPa (gauge pressure), replace the oil mist trap filter.

# \_ \land 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.

### 5. Pump Performance

### 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.

Note that the Pirani gauge shows values approximately five to ten times higher than those shown by the McLeod gauge. This is because condensable gas components (mainly moisture) included in the measured air are removed when the McLeod gauge is used.

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

- ① 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.
- (2) Gasifying of volatile components which have dissolved in the pump oil. (Deterioration of pump oil)
- ③ Existence of a gas supply source including vacuum leakage in the vacuum path.

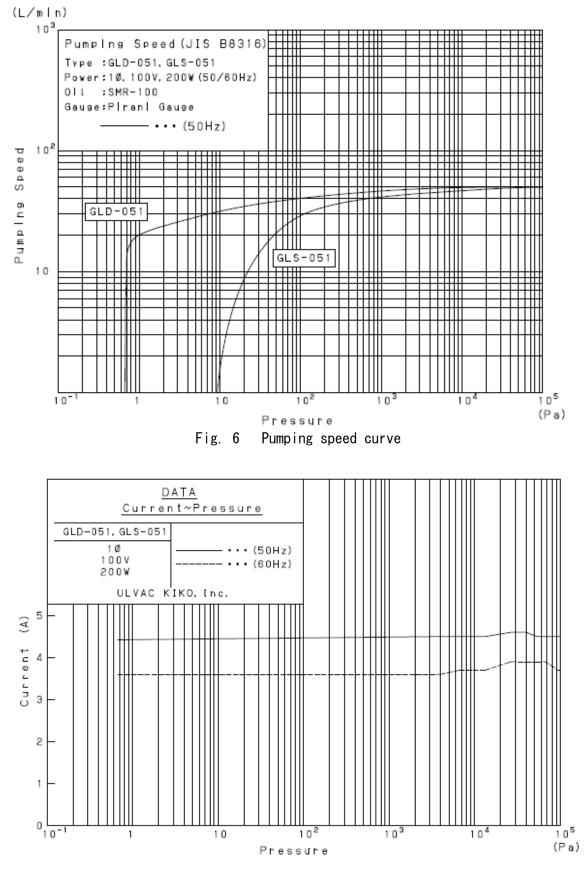
### 5.2 Pumping speed

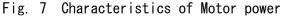
The pumping speed of the pump depends on the type and pressure of the gas to be evacuated. The pumping speed usually reaches the maximum at a high pressure range, and it gradually decreases as the pressure reduces.

The nominal pumping speed of this pump is the maximum pumping speed when dry air is evacuated. Fig. 6 shows the relationship between the evacuation pressure and pumping speed.

#### 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  $2.7 \times 10^4$  to  $4 \times 10^4$  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. Fig-7 shows minimum power required operating the pump.





### 6. Maintenance, Inspection and Repair

### 6.1 Maintenance

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

- (1) Amount of pump oil (To be within the range shown with lines on the oil level gauge)
- (2) Discoloration of the pump oil
- (3) Abnormal sound
- (4) Problem with the motor current value
- (5) Oil leak from the oil seal

If there is any problem, take proper measures in accordance with "6.5 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

- ① Turn off the power before starting inspection and do not turn it on while inspection is in progress. Doing so will result in injury.
- (2) The pump is very hot immediately after it is stopped. Wait for a while 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."

Frequency	Item	Details	Measures
Once/3	Oil	Amount	Refill the oil.
days		Color (Reddish brown, dark blown, and cloudy white are not good.)	Replace the oil.
	Sound	Abnormal sound	Check nuts and bolts for
	Vibration	Abnormal vibration	looseness. If not clear, contact us.
	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 50°C or more is abnormal.)	Check the cause of an overload. If not clear, contact us.
	Oil leakage	Oil leakage from the shaft seal section and plugs.	Replace seals, or contact us.
Once/3,000 operation	Evacuation wire mesh	Clogged with dust	Clean the wire mesh.
hours or once/6 months	Oil	Even if no problem is recognized, be sure to replace the oil.	Replace the oil.
Once/year	Spider	Damage or fracture	Replace the spider.

Table 2 Periodic inspection table

2) Inspection of the amount of pump oil

Refill the pump oil so that the pump oil level is kept within the range of the lines showing the upper and lower limits on the oil level gauge during operation.

3) Inspection of oil leakage

When oil leaks from the shaft seal section or drain plug seal section, repair is required. Our specified O-rings and seals are always available from the service departments shown at the back of this manual. When necessary, contact them.

- Inspection of evacuation wire mesh If the wire mesh is clogged with dust included in the evacuated gas, the pump's efficiency may deteriorate.
- 5) Inspection of abnormal sounds and vibration Check the nuts and bolts for looseness.

6) Inspection of the coupling spider

Check the spider of the coupling which connects the main pump unit and motor of the pump for damage. If cracks or fractures are found on the spider, replace it in accordance with "6.4 Replacement of the coupling spider."

#### 7) Inspection of the oil mist trap

When using the oil mist trap in replacement of the standard exhaust 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.

### Danger \_\_\_\_\_

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 2 showing an oil replacement guide is recommended.

## \Lambda Danger \_\_\_\_\_

Keep in mind that if the pump is used for exhausting toxic gas, both the main pump unit and pump oil will become contaminated.

## ▲ Caution

① Wear protective equipment such as rubber gloves and safety goggles.

\_\_\_\_\_

② 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."

# \_ \Lambda Note \_

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

< Pump oil replacement procedure >

- (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 exhaust 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 lubrication port (see Fig. 3).
- (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.

#### 6.4 Replacement of the coupling spider

A rubber spider is used at the section connecting the pump main unit and the motor. It is recommended that this spider be periodically inspected once a year or so. If the corner is chipped or cracked, replace it. If the pump is started and stopped hundreds of times a day, increase the inspection frequency.

To take out the spider, remove the four bolts which fix the motor to the pump main unit, and remove the motor. Then the coupling can be removed and the spider taken out. After inspecting the spider, mount the spider to either of the two coupling, and adjust the position so that both claws of the couplings are engaged with each other as shown in Fig. 8.

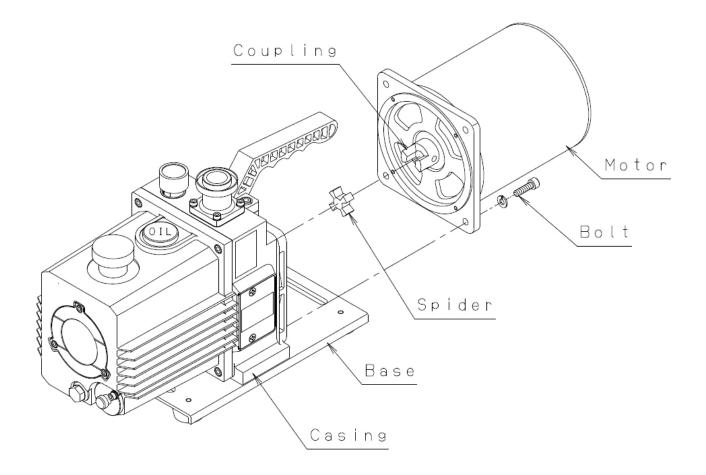


Fig. 8 Replacement of the coupling spider

Connect the concave section (female) of the pump unit with the convex section (male) of the motor, push the motor into the pump so that both connecting surfaces come completely into contact with each other, and fix the motor with bolts.

### 6.5 Trouble check list

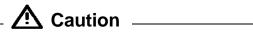
Problem	Table 3 Troubl Cause	e check list Measures	Reference
The pump	①The pump is not connected to the	①Connect the pump to the power	3.4
does not rotate.	power supply.	supply.	3.4
	<sup>②</sup> The power switch is not turned on.	②Turn on the power switch.	4.2
	③ Problem with power supply voltage	(3) Set the power supply voltage to within $\pm 10\%$ of the rated voltage.	3.5
	(4) The overload protector has actuated.	④Press the reset button.	
	<sup>5</sup> The motor malfunctions.	⑤Replace the motor.	
	<sup>(6)</sup> Low ambient temperature has increased the oil viscosity.	(6) Increase the ambient temperature to $7^{\circ}$ C or more.	4.4
	7 The entrance of foreign matter into the pump caused the rotor to burn out.	⑦ Overhaul (replace the cylinder and rotor).	6.2
	<sup>(8)</sup> Moisture or solvents were sucked in, forming rust inside the pump.	(8) Overhaul (replace the cylinder and rotor).	6.2
	③ Reaction product accumulated in the pump when the pump stops after exhausting reactive gas.	Overhaul (clean the pump inside and remove reaction products).	
	① Components inside the pump have burnt out.	① Overhaul (replace the damaged components).	
The pump's rotation is	① Problem with power supply voltage	① Set the power supply voltage to within $\pm 10\%$ of the rated voltage.	3.5
unstable.	<sup>(2)</sup> Defective wiring to the pump	<sup>(2)</sup> Perform wiring to the pump again.	3.4
	③Low ambient temperature has increased the oil viscosity.	$(3)$ Increase the ambient temperature to $7^{\circ}$ C or more.	4.4
	④ Foreign matter has entered the pump.	④ Disassemble and clean the pump to eliminate foreign matter.	
The pressure does not	① The pump is too small for the volume of the vacuum chamber.	①Select another pump.	5.2
decrease.	<sup>(2)</sup> The pressure measurement method is not correct.	<sup>(2)</sup> Measure the pressure correctly.	5.1
	③The vacuum gauge is not suitable.	<sup>3</sup> Measure with a calibrated vacuum gauge suitable for the pressure range.	
	(4) The pipe connected to the inlet port is small, or the piping distance is long.	(4) Use pipes having a diameter larger than the inlet port diameter, or reduce the distance from the vacuum chamber.	5.1
	<sup>(5)</sup> The wire mesh at the inlet port is clogged.	<sup>(5)</sup> Remove the piping from the upper section of the inlet port, and clean the wire mesh.	6.2

Table 3 Trouble check list

Problem	Cause	Measures	Reference
The pressure does not	<sup>(6)</sup> The specified amount of oil has not been added.	<sup>(6)</sup> Add the specified amount of oil.	3.2
decrease.	T The oil has deteriorated.	⑦ Replace the oil.	6.3
	8 Leakage occurs from the pipe connected to the pump.	<sup>(8)</sup> Locate the leakage with a leakage detector and stop the leakage.	
	<sup>(9)</sup> Our specified oil is not being used.	Overhaul the pump and replace with oil specified by us	6.3
	① Oil does not circulate, or the oil hole of the cover is clogged.	(11) Overhaul and clean the oil hole.	
Abnormal sound is	(1) Problem with power supply voltage	① Set the power supply voltage to within $\pm 10\%$ of the rated voltage.	3.5
generated.	2 The motor malfunctions.	2Replace the motor.	
	③Foreign matter has entered the pump.	③Eliminate the foreign matter and overhaul the pump.	
	(4) The specified amount of oil has not been added.	4 Add the specified amount of oil.	3.2
	<sup>(5)</sup> The coupling spider malfunctions.	<sup>(5)</sup> Replace the coupling spider.	6.4
	<sup>(6)</sup> Oil does not circulate, or the oil hole of the cover is clogged.	<sup>(6)</sup> Overhaul and clean the oil hole.	
	⑦ Components inside the pump have burnt out.	$\widehat{\mathcal{T}}$ Overhaul (replace the damaged components).	
Pump surfaces are extremely hot (50 °C or more higher than the room temperature)	①Continuous operation at high evacuation pressure	<ol> <li>If continuous operation is performed at a high evacuation pressure, the pump surface temperature reaches 80°C. However, this is not a serious problem.</li> </ol>	
	② The 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.	3.2
	<sup>3</sup> The temperature of the evacuated gas is high.	<sup>(3)</sup> Mount cooling equipment such as a gas cooler at the inlet side.	
	④ Oil does not circulate, or the oil hole of the cover is clogged.	0 Overhaul and clean the oil hole.	
A lot of oil splashes out	① The pump is been filled in excess of the specified amount.	①Discharge the oil until it reduces to the specified amount.	3.2
from the exhaust port.	② Continuous operation is performed at a high evacuation pressure.	2 Install an oil mist trap at the outlet side.	4.7
The oil leaks outside the pump.	① Deterioration 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.



- ① When a harmful toxic gas has been exhausted, ask a specialist for waste disposal. Not only the pump itself but also the pump oil become toxic.
- ② 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

Product name	No.	Parts neme	Q'ty
	15	Outlet valve	2
	16	Outlet valve spring	2
	18	Check valve	2
	19	Check valve spring	2
	47	Oil seal_HTC-11-25-7	1
	48	Oil seal_SC-12-25-7	1
	49	Oil seal_VC-12-22-4	1
	50	Oil seal_VC-10-20-4	1
	51	O-Ring_S-3	2
	52	O-Ring_S-5	1
GLD-051	53	O-Ring_S-12	2
Maintenance kit A	54	O-Ring_S-20	1
	55	O-Ring_S-29	1
	56	O-Ring_S-46	1
	57	O-Ring_S-55	1
	58	O-Ring_P-10	1
	59	O-Ring_P-12	1
	60	O-Ring_P-24	1
	61	O-Ring_G-55	1
	62	O-Ring_V-150	1
	63	O-Ring_N-28	1
	91	O-Ring_P-20	1
	4	1st Vane	2
GLD-051	5	Vane spring	3
Maintenance kit B	8	2nd Vane	2
	34	Spider	1

Table 4 GLD-051 Maintenance parts list

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

Product name	No.	Parts name	Q'ty
	12	Outlet valve	1
	13	Outlet valve spring	1
	15	Check valve	2
	16	Check valve spring	2
	42	Oil seal_HTC-11-25-7	1
	43	Oil seal_SC-12-25-7	1
GLS-051	44	Oil seal_VC-10-20-4	1
	45	O-Ring_S-12	2
Maintenance kit A	46	O-Ring_S-20	1
	47	O-Ring_S-29	1
	48	O-Ring_S-55	1
	49	O-Ring_P-10	1
	50	O-Ring_P-24	1
	51	O-Ring_G-55	1
	52	O-Ring_V-150	1
	53	O-Ring_N-28	1
GLS-051	4	Vane	2
	5	Vane spring	2
Maintenance kit B	29	Spider	1

Table 5 GLS-051 Maintenance parts list

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

### 8.2 Disassembly drawing

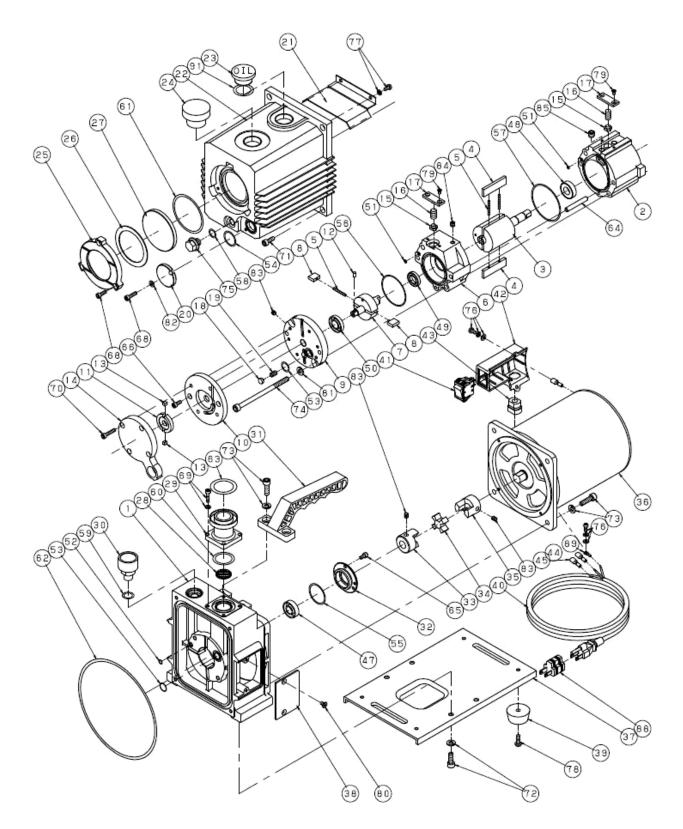


Fig. 9 Disassembly Drawing of GLD-051 oil sealed rotary vacuum pump

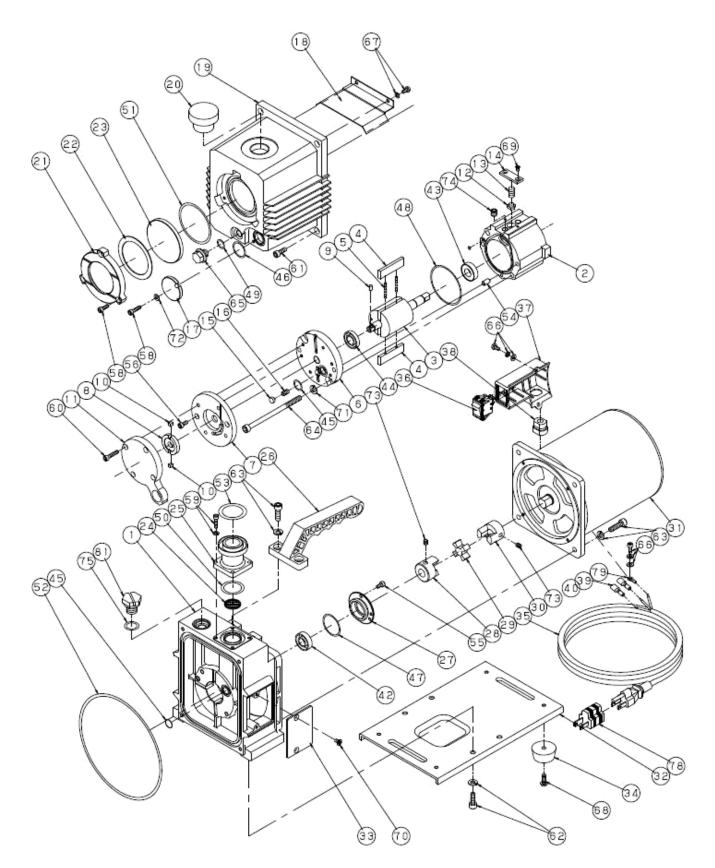


Fig. 10 Disassembly Drawing of GLS-051 oil sealed rotary vacuum pump

### <u>Warranty</u>

- (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.

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### Safety Data Sheet

### 1. Identification of the Substance/Preparation and of the Company

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1.	Identification of the Substa	ance/Preparation and of the Company		
	Product Name	SMR-100 (Mineral oil)		
	Product Code	00001		
	Supplier	ULVAC KIKO, Inc.		
	Address	291-7, Chausubaru, Saito-city,Miyazaki, Japan		
		Tel: 81-983-42-1415 FAX: 81-983-42-1107		
	Manufacturer	MORESCO Corporation.		
	Address	5-5-3, Minatojima-minamimachi, Chuo-ku, Kobe-city, Hyogo, Japan		
	Emergency Telephone Number	Functional Fluids Sales Department Sales Section		
		Tel: 81-6-6262-3310 FAX: 81-6-6262-3327		
		Functional Fluids Sales Department Tokyo Sales Section		
		Tel: 81-3-3273-7526 FAX: 81-3-3281-7756		
		Lubricating Oils Manufacturing Department Technology Section		
		Tel: 81-791-42-2100 FAX: 81-791-43-3179		
		Customer Center		
		Tel: 81-6-6262-3385 FAX: 81-6-6262-3327		
		Email Address: customercenter@moresco.co.jp		
	Recommended Use and	Vacuum Pump Oil		
	Restrictions on Use			
2.	Hazard Identification GHS Classification: Physical Hazards	Not applicable to the GHS Classification		
	Health Hazards	Not applicable to the GHS Classification		
	Environmental Hazards	Not applicable to the GHS Classification		
	Hazardous to Aquatic Envir			
	Hazardous to Aquatic Envir	Toliment		
	Label Elements:			
	Pictograms/Symbols	None		
	Signal Word	None		
	Hazard Statements	None		
	Precautionary Statements	[Prevention]		
		None		
		[Response]		
		None		
		[Storage]		
		None		

### [Disposal]

None

3.	Composition/Information on Ingredients			
	Distinction between Substance a	nd Mixture :	Substance	
	Chemical Name/Generic Name		Petro-hydrocarbons	
	Chemical Formula :		Not identified	
	Ingredient and Concentration		Lubricating base oil	100%
4.	<b>First-Aid Measures</b>			
	Inhalation:	Remove victim	to fresh air and let him rinse m	outh thoroughly with water.
		Wrapping a bla	nket and the like around him to	keep warm for a rest, call a
		doctor/physicia	in immediately.	
	Skin Contact:	Rinse skin with	n soap and water.	
	Eye Contact:	Immediately rin	nse eyes with clean water for at	least 15 minutes. Remove

contact lenses if present. Continue rinsing. If eye irritation persists, get medical attention.

Ingestion:	Call a doctor/physician immediately. Do not induce vomiting.
	If affected, the mouth should be rinsed out thoroughly with water.
Expected Acute and	If swallowed, may suffer from diarrhea and vomiting.
Delayed Symptoms, and	May cause inflammation if in eyes.
Most Important Symptoms/	May cause inflammation if on skin.
Effects:	May feel unwell if mist is inhaled.

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### 5. Fire-Fighting Measures

0 0	
Suitable Extinguishing Media	Foggy reinforcing agent, foam, powder, or carbon dioxide
Unsuitable Extinguishing Media	Jet water
Specific Hazards	Currently there is no useful information.
Specific Fire-Fighting Measures	Shut off the fire source.
	Use powder or carbon dioxide extinguishers at the beginning of fire.
	It is effective to intercept the air from a big fire with foam
	extinguishers. Use of water may cause spreading of fire.
	Cool the surrounding facilities with water spray.
	Evacuate non essential personnel around the fire.
Special Protective Actions for	Wearing protective glasses, protective clothing, and if necessary,
Fire-Fighting	respiratory protective equipment, start to fight fire on the windward
	side.

\_\_\_\_\_

6.	Accidental Release Measures	
	Personal Precautions, Protective	If skin or eye contact is possible, wear protective equipment. If mist
	Equipment and Emergency Procedures	is produced, wear respiratory protective equipment to avoid
		inhalation.
	Environmental Precautions	Take up as much as possible to avoid soil contamination and water pollution.
		Avoid release to the environment.
	Collection/Neutralization	Eliminate the source of ignition of the surrounding.
	and Methods/Materials for Containment	<ul> <li>In the case of a large amount: Dike ahead of liquid spill area to minimize migration and then sweep into an empty container for disposal in a safe place. After disposal, wash away with plenty of water. In doing so, take care to prevent the high concentration of wastes from entering public watercourses such as rivers.</li> <li>In the case of a small amount: Take up into an empty container by absorbing the spill with earth and sand or rags, and furthermore sop up with rags thoroughly.</li> </ul>
	Prevention of Secondary Hazards	Remove all the ignition sources immediately. (Do not smoke nearby
		and keep away from sparks and flames.)
		Report to the related organs for help.
7.	Handling and Storage	
7.	Handling and Storage Handling:	Before repairing machinery with remnant oils on, remove them
7.	5 6	Before repairing machinery with remnant oils on, remove them thoroughly in a safe place. Take precautionary measures against
7.	Handling:	Before repairing machinery with remnant oils on, remove them thoroughly in a safe place. Take precautionary measures against static discharge and wear electro conductive clothing and shoes.
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7.	Handling:	Before repairing machinery with remnant oils on, remove them thoroughly in a safe place. Take precautionary measures against static discharge and wear electro conductive clothing and shoes. As vapors released from petroleum products are heavier than air, they are liable to stagnate. Due to it, attention should be paid to ventilation and fire.
7.	Handling:	<ul> <li>Before repairing machinery with remnant oils on, remove them thoroughly in a safe place. Take precautionary measures against static discharge and wear electro conductive clothing and shoes.</li> <li>As vapors released from petroleum products are heavier than air, they are liable to stagnate.</li> <li>Due to it, attention should be paid to ventilation and fire.</li> <li>Handle at room temperatures, paying attention to moisture and to impurities not to mix with.</li> <li>If skin or eye contact is possible, wear protective equipment. If mist is produced, wear respiratory protective equipment to avoid</li> </ul>
7.	Handling:	<ul> <li>Before repairing machinery with remnant oils on, remove them thoroughly in a safe place. Take precautionary measures against static discharge and wear electro conductive clothing and shoes.</li> <li>As vapors released from petroleum products are heavier than air, they are liable to stagnate.</li> <li>Due to it, attention should be paid to ventilation and fire.</li> <li>Handle at room temperatures, paying attention to moisture and to impurities not to mix with.</li> <li>If skin or eye contact is possible, wear protective equipment. If mist is produced, wear respiratory protective equipment to avoid inhalation.</li> </ul>
7.	Handling:	<ul> <li>Before repairing machinery with remnant oils on, remove them thoroughly in a safe place. Take precautionary measures against static discharge and wear electro conductive clothing and shoes.</li> <li>As vapors released from petroleum products are heavier than air, they are liable to stagnate.</li> <li>Due to it, attention should be paid to ventilation and fire.</li> <li>Handle at room temperatures, paying attention to moisture and to impurities not to mix with.</li> <li>If skin or eye contact is possible, wear protective equipment. If mist is produced, wear respiratory protective equipment to avoid inhalation.</li> <li>Use a pump and the like to take out of container.</li> </ul>
7.	Handling:	<ul> <li>Before repairing machinery with remnant oils on, remove them thoroughly in a safe place. Take precautionary measures against static discharge and wear electro conductive clothing and shoes.</li> <li>As vapors released from petroleum products are heavier than air, they are liable to stagnate.</li> <li>Due to it, attention should be paid to ventilation and fire.</li> <li>Handle at room temperatures, paying attention to moisture and to impurities not to mix with.</li> <li>If skin or eye contact is possible, wear protective equipment. If mist is produced, wear respiratory protective equipment to avoid inhalation.</li> <li>Use a pump and the like to take out of container.</li> <li>Do not suck through a tube.</li> </ul>
7.	Handling:	<ul> <li>Before repairing machinery with remnant oils on, remove them thoroughly in a safe place. Take precautionary measures against static discharge and wear electro conductive clothing and shoes.</li> <li>As vapors released from petroleum products are heavier than air, they are liable to stagnate.</li> <li>Due to it, attention should be paid to ventilation and fire.</li> <li>Handle at room temperatures, paying attention to moisture and to impurities not to mix with.</li> <li>If skin or eye contact is possible, wear protective equipment. If mist is produced, wear respiratory protective equipment to avoid inhalation.</li> <li>Use a pump and the like to take out of container.</li> </ul>
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Refer to '10. Stability and Reactivity'.

Avoiding Contact

Precautions for Safe Handling	Obtain special instructions before use.
	Do not handle until all safety precautions have been read
	understood.
	Be cautious not to use any naked fire.
	As vapors released from petroleum products are heavier than
	they are liable to stagnate.
	Wash hands thoroughly after handling.
	Use only outdoors or in a well-ventilated area.
	Do not eat, drink or smoke when using this product.
	Do not press an empty container. It may explode under pressure.
	Do not drink.
	Keep out of reach of children.
torage:	
Technical Measures	Avoid heat, sparks, flames, and static electricity.
	Keep container tightly closed.
Incompatible Materials	Refer to '10. Stability and Reactivity'.
Conditions for Safe Storage	Store in a well-ventilated area.
	Store avoiding exposure to direct sunlight.
	Store away from oxidizer.
	Store locked up.
Materials for Containers/Packaging	When replacing the container, use metal or glass container. Se
	kinds of resin-treated container may melt.
	Use airtight, anti-breakage type containers.

### 8. Exposure Controls/Personal Protection

Permissible Concentration (Exposure Limit, a biological exposure index):			
Health (2010): $3mg/m^3$ (mineral oil mist) <sup>1)</sup>			
TWA 5mg/ $m^3$ (mineral oil mist) <sup>2)</sup>			
of Hazardous Substances in Labor Operation Air: Not established			
When mist and vapors are produced, seal off sources or provide exhaust			
ventilation. Facilities for rinsing eyes and washing a body are required near the			
workplace.			
Wear appropriate respiratory protection.			
If necessary, wear oil-resistant protective gloves.			
If diffusion is possible, wear eye protection.			
If necessary, wear protective clothing and face protection.			
Wash hands thoroughly after handling.			
Regularly inspect protective equipment according to the inspection table of			

protective equipment.

Do not eat, drink or smoke when using this product.

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### 9. Physical and Chemical Properties

i nysicai anu Chenneai i roperties	
Physical State:	
Appearance	Liquid
Color	Light yellow
Odor	Slight Oily odor
pH	Not applicable
Melting/Freezing Point	Not applicable
Boiling Point	165° <b>C</b> /13Pa(0.1mmHg)
Flash Point	$\geq 200^{\circ} C(COC)$
Explosive Range (Explosive Limits)	Upper limit: 7% Lower limit: 1% (estimated value)
Vapor Pressure	No data available
Vapor Density (air=1)	No data available
Specific Gravity (Density)	0.88g/cm <sup>3</sup> (15°C)
Solubility	Insoluble in water
Partition Coefficient: n-octanol/water	No data available
Auto-ignition Temperature	No data available
Pour point	≦-15°C
Volatility	None (at room temperatures)

### 10. Stability and Reactivity

Stability	Stable
Possibility of Hazardous Reactions	Reacts with strong oxidizer.
Conditions to Avoid	No data available (Hazardous reactions will not occur under normal
	use)
Incompatible Materials	Strong oxidizer
Hazardous Decomposition Products	None

### 11. Toxicological Information

Acute Toxicity:	
Oral	ATEmix(Oral)>5000mg/kg
Dermal	ATEmix(Dermal)>5000mg/kg
Inhalation	ATEmix(Inhalation)>5mg/L
Skin Corrosion/Irritation	Information is not classified as Skin Corrosion/Irritation.
Serious Eye Damage/Eye Irritation	Information is not classified as Serious Eye Damage/Eye Irritation.
Respiratory or Skin Sensitization	Information is not classified as Respiratory or Skin Sensitization.
Germ Cell Mutagenicity	Information is not classified as Germ Cell Mutagenicity.

#### Date Prepared: May 19, 2015 1KE

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Carcinogenicity	Information is not classified as Carcinogenicity.
Reproductive Toxicity	Information is not classified as Reproductive Toxicity.
STOT/Systemic Toxicity -	Information is not classified as Specific Target Organ Toxicity/
Single Exposure	Systemic Toxicity (Single Exposure).
STOT/Systemic Toxicity –	Information is not classified as Specific Target Organ Toxicity/
Repeated Exposure	Systemic Toxicity (Repeated Exposure).
Aspiration Hazard	Information is not classified as Aspiration Hazard.

#### 12. Ecological Information

Ecotoxicity	Information is not classified as Aquatic Toxicity.
Persistence and Degradability	No information available
Bioaccumulative Potential	No information available
Mobility in Soil	No information available
Hazardous to the ozone layer	No information available
Other Adverse Effects	No information available
Environmental Criteria	No information available

#### **13. Disposal Considerations**

Waste Residues	Dispose the waste according to national and local regulations.
	Do not dump.
Contaminated Containers	Contaminated or empty container/packaging are to be disposed according to
and Packaging	national and local regulations.

#### **14. Transport Information**

International Regulation	
UN Classification	Not applicable
Special Precautions	Load the containers in a manner that they are certain not to result in direct
	sunlight exposure, damage, corrosion, leak, while being transported.
	Do not place heavy load on top of the container.

#### **15. Regulatory Information**

No Information

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### 16. Other Information

References:

1) Recommendation of Occupational Exposure Limits by Japan Society for Occupational Health

- 2) Thresholds limit values for chemical substances and physical agents and biological exposure indices by ACGIH
- 3) SDS of raw materials

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- 1. As evaluations on hazards are not necessary satisfactory, special attention should be paid for use.
- 2. This SDS, summarizing matters to be attended to, is required for proper use of the product and is intended for normal use.
- 3. Referring to this SDS, properly use and handle this product on the user's own responsibility.
- 4. The contents of this SDS are based on information available as of today and our knowledge. The information, data, and evaluations herein are not guaranteed, and in addition, may be revised due to revision of laws or knowledge newly obtained.

### 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 fi	ll in.
(1) Whether there is harmful effect on h	numan 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 p	per day, ()years and()months
Continuous Operation     Intermi	ttent Operation
Usage:	
3. Failure Status □Unusual Noise	□Abnormal Pressure □Abnormal Actuation
□Oil Leakage	Other Symptoms:
4. Detail of Request □Repair (Overh	aul) □Regular Checks
5. Others:	
Company Name:	Personnel in charge:
Address:	
	E-mail:
Agent Name;	Personnel in charge:
Address:	
Tel: Fax:	
* In case you do not have any direct tra	insaction 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 harmfu	Il 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.)