

Instruction Manual for

Direct-Drive Oil Sealed Rotary Vacuum Pump

Model

GLD-137AA

GLD-202AA

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.

EC Declaration of Conformity

| We, | ULVAC KIKO,Inc. |
|-----|---|
| | |
| of | 291-7 Chausubaru, Saito-city, Miyazaki, 881-0037. Japan |

In accordance with the following Directive:

2006/42/EC Machinery Directive

declare under our sole responsibility that the product,

Type of Product Model Name

: Oil Sealed Rotary Vacuum Pump

: GLD-040,GLD-136A,GLD-137AA,

GLD-201A,GLD-202AA,GLD-280A, GLD-136C,GLD-137CC,GLD-201B,

GLD-202BB, GLD-280B

to which this declaration related is in conformity with the following standards:

EN 1012-2:1996+A1:2009

Compressors and vacuum pumps – Safety requirements, Part2. Vacuum pumps

IEC/EN 61010-1:2010

Safety requirement for electrical equipment for measurement, control and

laboratory use - Part 1: General requirement

IEC/EN 60034-1:2010

Rotating electrical machines

following the provisions of

The person stated below will keep the following technical documentation:

- operating and maintenance instructions
- technical drawings
- description of measures designed to ensure conformity
- other technical documentation, e.g. quality assurance measures for design and production

Person authorized to compile the technical file:

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(name & signature)

Introduction 0.

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.

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.



Note _____

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

0.2 Protective device

The pump is equipped with a three-phase 200-240 V (50/60 Hz) and 400-460 (50/60 Hz) motor. This pump is not provided with a protective device. Therefore when connecting the motor to the power source, be sure to connect an overload protector.

About the overload protection, please use overload protection device (motor breaker and thermal relay of electromagnetic switch) which can protect electric motor by all means.

Full load current of each voltage is listed in table 1.

The electric capacity of the overload protection device (thermal relay of electromagnetic switch and motor contact breaker) sets it to full-load current, but please check on the selection of an appropriate overload protection device and electric capacity setting to the supplier of the overload protection device to use based on full load current of the voltage using the pump by all means.

The installation of an overload protector is obligatory under the "Electric Equipment Technical Standard" (METI Ordinance No. 61, 1965).

This motor incorporates a temperature sensor (PTO: which opens at 135°C) and leader wires are arranged in the terminal box. Use these wires to take out the signal wire.

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

Table 1 FULL-LOAD CURRENT

| | Full-load current [A] | | | |
|-------------|-----------------------|-------|-----------|------|
| | GLD-1 | 137AA | GLD-202AA | |
| Voltage [V] | 50Hz | 60Hz | 50Hz | 60Hz |
| 200 | 2.10 | 1.90 | 2.90 | 2.70 |
| 220 | 2.20 | 1.90 | 3.10 | 2.60 |
| 230 | 2.30 | 1.90 | 3.30 | 2.70 |
| 240 | 2.40 | 2.00 | 3.60 | 2.70 |
| 380 | 1.30 | 1.10 | 1.80 | 1.50 |
| 400 | 1.30 | 1.10 | 1.90 | 1.60 |
| 415 | 1.40 | _ | 2.00 | _ |
| 440 | _ | 1.20 | _ | 1.60 |
| 460 | _ | 1.20 | _ | 1.70 |

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.



⚠ Caution _____

- 1) Be sure to use different power cords for the motor and for taking out a temperature sensor signal.
- 2) Apply a voltage of 250 V or less to the wire for taking out the temperature sensor signal. Connect a fast-acting an fuse having a capacity of 250 V, 2.5 A between the relay circuit and temperature sensor.



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.

0.3 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.



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



✓!\ Warning

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



!\ Caution

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



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



<u>∕</u>∭∖ Warning

The Vacuum Pump Unit is device a built-in device. Do not install it without adequate protection against heat hazard. The surface temperature of the vacuum Pump Unit can exceed 90 degrees in case it is operated under high pressure (atmospheric to 10kPa).



Warning

It gets an electric shock touching the motor energizing part. Please work after pulling out the power plug without fail when wires electricity is connected, it checks, and it transfers it.



The Inlet port of the pump



The exhaust port of the pump

0.4 Cautions for safety



This pump is for dry air or the dry nitrogen suck only.



⚠ Warning _

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.



⚠ 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.



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 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).



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.



✓ Caution

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.



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.



✓!\ Note

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

- 0.5 Acceptance and storage of the pump
 - 0.5.1 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.

0.5.2 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° C ~ 40° C, 85% RH or less
- ② Height above sea level during storage and installation: 1,000 m or less
- ③ Minimum required distances from the wall, 100mm
- 4 Other conditions for storage and operation
 - a) Free from corrosive and explosive gases
 - b) No condensation
 - c) Dust-free environment
 - d) Indoors
 - e) Do not place pumps on top of each other or place a pump on its side.
 - f) Not subject to direct sunlight
 - g) Far from heat sources



Caution Caution

Since the pump weighs as much as 20 kg, do not lift or transport it by yourself. Doing so may cause an injury. Perform such work by two people as shown in 3.1 "Installation."



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



For indoors use only.



When you keep it, without using a pump for a long period of time, please put pump oil into a pump and seal a inlet port. Oil is not put into a pump, but if it is kept where a inlet port is opened wide, water absorption may expand vanes of a pump and a pump may stop rotating.

⚠ Note _____

Please do not leave it, where moisture is sucked. If it is left with moisture sucked, since water absorption expansion of vanes and the corrosion of pump parts will be promoted, a pump may stop rotating.

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Warranty

Safety Data Sheet (SDS)

Pump Usage Check Sheet (Use this sheet for requesting an overhaul.)

Contact address of sales and service departments

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1. For Safe Operation

1.1 Hazards peculiar to the pump and safety measures

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

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

1.1.1 🛕 Danger Leakage of hazardous gases and substances

Cause

Prevention method and measures

Injury due to touching toxic pump oil in the pump or harmful substances attached to the pump during inspection or disposal

- ⇒ ①Before overhauling and disposing of the pump, ask a waste disposal specialist to make it safe.
 - ② Ask an authorized waste disposal specialist to carry out disposal.

1.1.2 A Warning Electric shock

Cause

Prevention method and measures

The energized part of the motor was touched.

- ⇒ ① When connecting electric wires, always turn off the power and be sure to connect the earth wire.
 - ② When inspecting and transferring the pump, always turn off the power.
 - ③ Never insert hands, fingers, or thin objects through the motor opening.



✓ Caution _

Do not expose any part of the human body to vacuum.

1.1.3 A Warning Explosion

Cause

Prevention method and measures

The pressure in the pump increased causing the pump to explode.

 \Rightarrow The maximum internal pump pressure is 0.03 MPa (gauge pressure).

Measure the pressure at the outlet side and, if the pressure is 0.03 MPa or more (gauge pressure), remove objects which block the passage of gas from the outlet side. When an oil mist trap is adopted, replace or clean it so that it will not block the passage of gas.

1.1.4 • Caution High temperature

Cause

Prevention method and measures

High temperatures caused burns.

- \Rightarrow 1) The pump reaches a high temperature during operation. Pump main unit during non-load operation $\rightarrow 32 \sim 65^{\circ}\text{C}$ Motor during non-load operation \rightarrow 22 ~ 55°C Pump main unit during high-load operation $\rightarrow 52 \sim 85^{\circ}\text{C}$ Motor during high-load operation \rightarrow 32 ~ 65°C (High-load operation: Operation at a pressure of 1kPa ~ 10kPa)
 - ② If you use the pump in a high ambient temperature and have a high gas throughput, the temperature of the pump-body may exceed 90°C and you must fit suitable guards to prevent contact with hot surfaces.
 - ③ Please be sure to protect and cool surface of vacuum pump and away from human body. Use this pump as built-in type.
 - 4 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 for 10 minutes 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. Newest SDS shall be used when the safety of material is investigated.

2. Outline of the Pump

2.1 Specification

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

Table 2 Specification

| Model | | Unit | GLD-137AA | | GLD-202AA | |
|---------------------|----------------------------|------------------------|---|--------------|-------------------|--------------|
| | | Oiiit | 50 Hz | 60 Hz | 50 Hz | 60 Hz |
| Туре | | | Rotary vane (2 vanes) | | | |
| Pumpin | g speed | L/min | 135 | 162 | 200 | 240 |
| Ultimate | G.V. close | Pa | | 6.7× | (10-1 | |
| pressure | G.V. open | 1 a | | 6. | | |
| | Type | | 3-phase, 400 | | | 0W, 4 poles, |
| Motor | Турс | | | external fan | | external fan |
| 1,10,01 | Voltage | V | 200-240/ | 200-240/ | 200-240/ | 200-240/ |
| | | | 380-415 | 380-460 | 380-415 | 380-460 |
| | | | 2.10(200V) | 1.90(200V) | 2.90(200V) | 2.70(200V) |
| | | | 2.20(220V) | 1.90(220V) | 3.10(220V) | 2.60(220V) |
| | | | 2.30(230V) | 1.90(230V) | 3.30(230V) | 2.70(230V) |
| Full-loa | d current | Α | 2.40(240V) | 2.00(240V) | 3.60(240V) | 2.70(240V) |
| 1 411-1040 | a current | 7.1 | 1.30(380V) | 1.10(380V) | 1.80(380V) | 1.50(380V) |
| | | | 1.30(400V) | 1.10(400V) | 1.90(400V) | 1.60(400V) |
| | | | 1.40(415V) | 1.20(440V) | 2.00(415V) | 1.60(440V) |
| | | | | 1.20(460V) | | 1.70(460V) |
| | | | 1435(200V) | 1720(200V) | 1440(200V) | 1730(200V) |
| | | | 1440(220V) | 1735(220V) | 1445(220V) | 1745(220V) |
| | | | 1445(230V) | 1740(230V) | 1450(230V) | 1745(230V) |
| D | 14: | /: | 1450(240V) | 1745(240V) | 1455(240V) | 1750(240V) |
| Revo | lution | r/min | 1440(380V) | 1735(380V) | 1445(380V) | 1740(380V) |
| | | | 1445(400V) | 1745(400V) | 1450(400V) | 1745(400V) |
| | | | 1450(415V) | 1745(440V) | 1450(415V) | 1755(440V) |
| | | | , , | 1750(460V) | , , | 1760(460V) |
| Standard oil | | | SMR-100 | | | , , , |
| Oli | Oil Standard on Oil amount | | 1,000 | | 1,100 | |
| Weight | | kg | 26 29 | | - | |
| Ambient to | emperature | $^{\circ}\!\mathbb{C}$ | , | | lls below the 7 ° | |
| range | | _ | operation start-up may be difficult.) | | | |
| Noise level | | dB (A) | 57 or less(Ultimate pressure at 1m) | | | 1) |
| Inlet port diameter | | | KF-25 (NW-25) | | | |
| Max. size | | mm | $170(W) \times 485.5(L) \times 240(H)$ $170(W) \times 513.5(L) \times 240(H)$ | | | |
| Leak | rate | Pa·m ³ /sec | | $1 \times$ | 10 ⁻⁶ | |

Note 1: Ultimate pressure indication by Pirani gauge.

Note 2: Vacuum pump oils have different steam pressures, viscosities, and oil properties depending on the type. Always use the oil sealed rotary vacuum pump oil specified by us. The use of other oils will affect the pump's performance.

Specified oil: SMR-100

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

Note 4: The motor voltage is switched between 200V and 400V by changing the wire connection in the terminal box.

2.2 Dimensional drawing

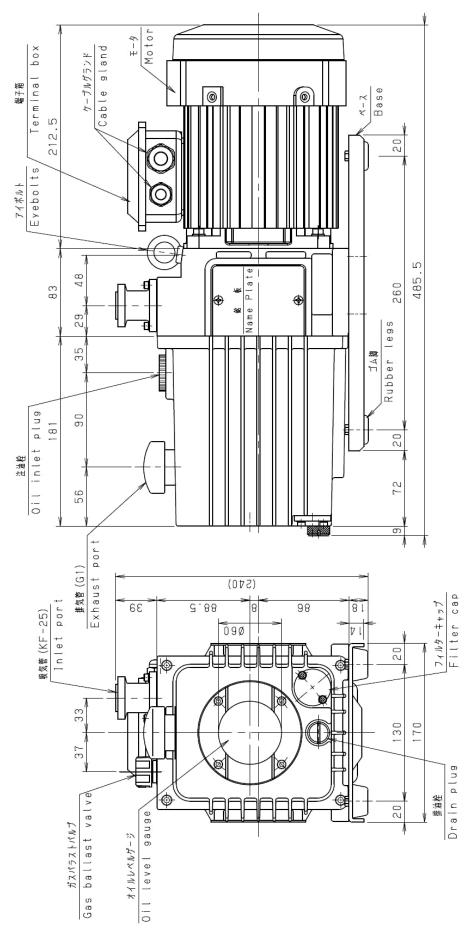
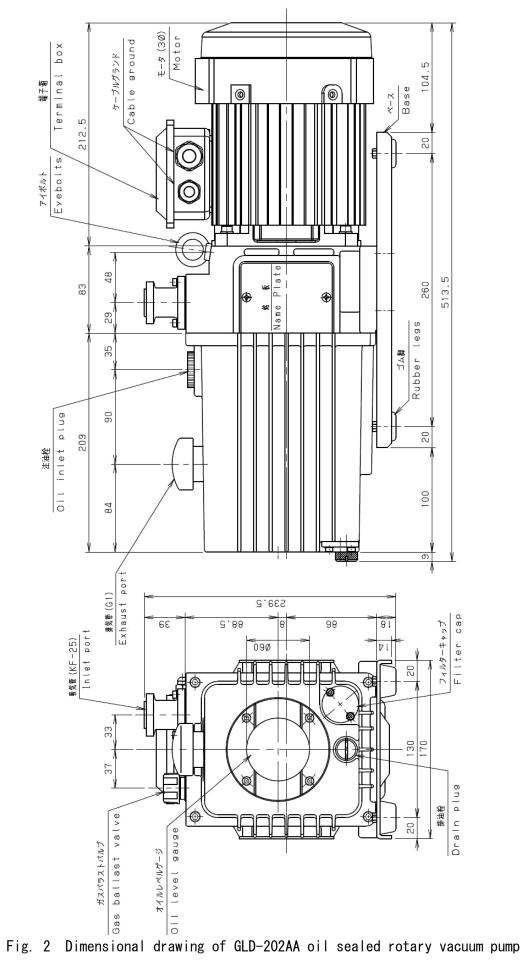


Fig. 1 Dimensional drawing of GLD-137AA oil sealed rotary vacuum pump



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 installation, storage and operation" for details.



Fig. 3 Transportation method of the oil sealed rotary vacuum pump



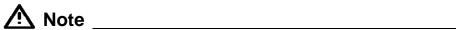
Caution

Since the pump weighs as much as 20 kg, do not lift or transport it by yourself. Doing so may cause an injury. Always carry out work with two people as shown in Fig. 3.



Caution

Minimum required distances from the wall, 100mm.



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.



Caution

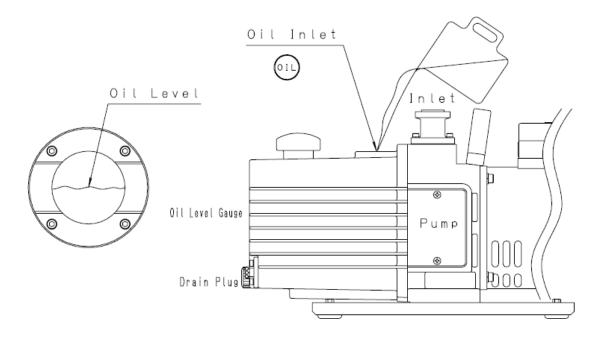
Keep strictly to the followings if you install the pump with eyebolts.

- ① You must not use eyebolts if it exceed the pump in weight.
- ② Surely check out wear and bend of eyebolts before using. Don't use them if you find them deformation.
- 3 Sling the pump up slowly. It is dangerous to sling up rapidly.
- ④ Keep strictly to an angle of 60 degrees at wires when you sling it up.

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. 4).

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.



(1) Oil level shown on the oil level gauge

(2) Lubrication method

Fig. 4 Lubrication of the oil sealed rotary vacuum pump



- 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."



!\ 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

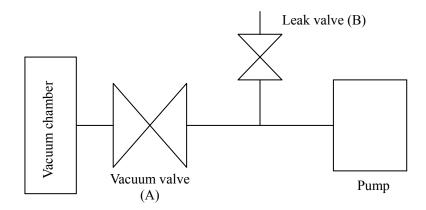
(1) Before connecting the pipe to the pump, clean the inner walls of the vacuum chamber, piping and vacuum valve to completely eliminate moisture, fine particles, dust, dirt and rust.



∕! 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. 5.



Basic piping diagram to the vacuum chamber

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



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

3.4 Electric wiring

- (1) The pump rotates in the clockwise direction as seen from the front of the pump (level gauge
- (2) When wiring, open the terminal box of the motor and connect the wires as shown in Figs. 6
- (3) Use a power cord having a diameter of ϕ 1.5mm.
- (4) If wires are connected as shown in Figs. 6 and 7, the pump rotates clockwise as seen from the front of the pump (level gauge side). If the pump rotates in the opposite direction, turn off the power immediately, exchange the wires connected to the U-phase and V-phase, rotate the pump again and check that the pump rotates in the correct direction.
- (5) In order to prevent the motor from burning due to an overcurrent, install an overload protector (Table 3) for the electric wiring.
- (6) The screw of the earth terminal at the motor side is provided with an "earth mark" in the terminal box.
- (7) Use power cords of the same diameter for the motor and earth.
- (8) This motor incorporates a temperature sensor (PTO: which opens at 135°C) and leader wires are arranged in the terminal box. Use these wires to take out the signal wire. Connect the temperature sensor (PTO) as shown in Fig. 7. The specifications of the temperature sensor are shown in Table 4.
- (9) The larger cable gland is for wires having a diameter of ϕ 6 to ϕ 12, and the smaller one is for wires having a diameter of ϕ 4 to ϕ 8. Use a cable gland that is suitable for the size of the power cord to be used.



Warning

If the pump is directly (and permanently) connected to the host equipment then the end-user has to provide adequate disconnection device.



✓!\ Note

GROUNDING INSTRUCTIONS

In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing an escape wire for the electric current. This pump is equipped with a cord having a grounding wire with an appropriate grounding plug. The plug must be plugged into an outlet that is properly installed and grounded in accordance with all local codes and ordinances. If power code is not equipped (option) then appropriate grounding shall be provided upon installation.



Warning

Improper installation of the grounding plug is able to result in a risk of electric shock. When repair or replacement of the cord or plug is required. do not connect the grounding wire to either flat blade terminal. The wire with insulation having an outer surface that is green with or without yellow stripes is the grounding wire.



Note

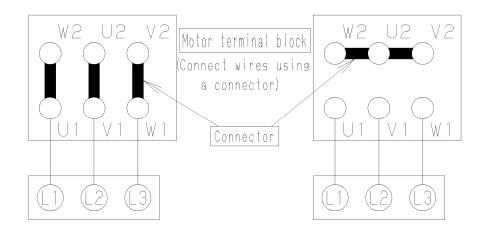
Check with a qualified electrician or serviceman when the grounding instructions are not completely understood, or when in doubt as to whether the product is properly grounded. Do not modify the plug provided; if it does not fit the outlet, have the proper outlet installed by a qualified electrician.



This pump must be connected to a grounded, metallic, permanent wiring system, or an equipment-grounding terminal or lead on the product.

⚠ Warning

Protection device against overheat must be installed for the Pump Unit according Fig. 7. The installed disconnecting device (e.g. relay) must comply with the relevant EN/IEC standards and must have adequate interrupting capacity to disconnect the pump from the supply in case overheating occurs.



3-phase, 200V power source 3-phase, 400V power source Fig. 6 Terminal box internal wiring diagram

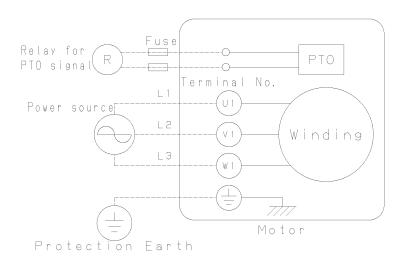


Fig. 7 Electric wiring diagram

Table 3 Electric capacity of the motor overload protector

| Motor output (W) | Set value for thermal relay of electromagnetic switch (A) | Motor breaker (A) |
|------------------|---|---|
| 400 | Full-load current of the motor (Marked on the motor nameplate.) | Full-load current of the motor (Marked on the motor nameplate.) |
| 550 | Full-load current of the motor (Marked on the motor nameplate.) | Full-load current of the motor (Marked on the motor nameplate.) |

Table 4 Specification of the temperature sensor (PTO)

| Type | Operating Principle | Operating Curve | Cut-off(A) |
|--------------------------------------|---|-----------------|-----------------------------------|
| Normally closed thermostat PTO | Bimetallic strip, indirectly heated, with normally closed (N/C) contact | I O N.R. | 2.5A at 250V with $\cos \phi$ 0.4 |

N.R.T.: Nominal running temperature of the PTO

3.5 Fluctuations in the power voltage and frequency

Standard: Rotation electricity machine general rules

IEC60034-1:2004

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·m).

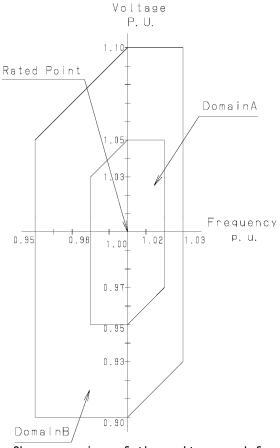


Fig. 8 Change region of the voltage and frequency

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.

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.



Caution

- 1) Be sure to use different power cords for the motor and for taking out a temperature sensor signal.
- 2) Apply a voltage of 250 V or less to the wire for taking out the temperature sensor signal. Connect a fast-acting an fuse having a capacity of 250 V, 2.5 A between the relay circuit and temperature sensor.

4. Operation

4.1 Cautions for operation



✓! Warning -

There is a risk of explosion. Never block the outlet or operate the pump with equipment mounted at the outlet side which blocks the passage of gas. Otherwise, the 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).



- (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, water absorption expands the vanes of the pump, 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.
- 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.
- 6 Do not block the flow of air to the motor fan as the temperature of the motor and pump will increase.

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. 5).

✓ Caution _

- 1) The motor and pump become hot (temperature increase under non-load operation: 25°C, temperature increase under high-load operation: 45°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.



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.



The oil temperature in the pump increases to $32 \sim 85$ °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. 5).

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



Caution

The motor and pump become hot (temperature increase under non-load operation: 25 °C, temperature increase under high-load operation: 45 °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

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

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

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: 25°C, temperature increase under high-load operation: 45°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.



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-200A and OMI-200 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,

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.



Marning _____

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

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. 9 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 2.7×10^4 to 4×10^4 Pa. If the inlet evacuation pressure has reduced to 13.3 Pa or less, the compression work is considerably reduced and more power is consumed in mechanical work.

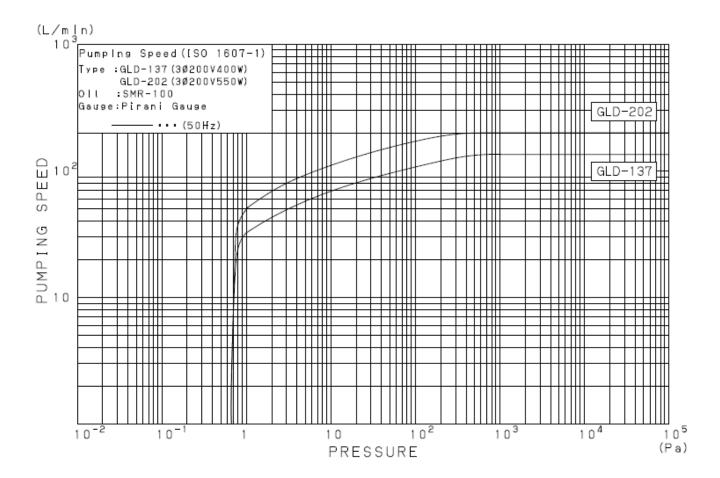


Fig. 9 Pumping speed curve

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 Pulled out the power plug or turn off the disconnecting device 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 10 minutes until the pump has cooled down completely and then start inspection. There is a risk of burns.

1) Periodic replacement of the pump oil

The pump oil deteriorates with operation. Check the viscosity and level of contamination of the pump oil with the oil level gauge, and replace the pump oil in good time. If the pump oil is replaced periodically, the deterioration of the pump oil is minimized and the service life of the pump is lengthened.

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

Table 5 Periodic inspection table

| | | • | |
|---|------------------------|---|---|
| Frequency | 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 | Inlet Filter | Clogged with dust | Clean the inlet filter. |
| operation 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. |

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.

4) Inspection of evacuation inlet filter

If the inlet filter 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 5 showing an oil replacement guide is recommended.

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

Caution

- 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."



/! 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. 4).
- (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. 10.

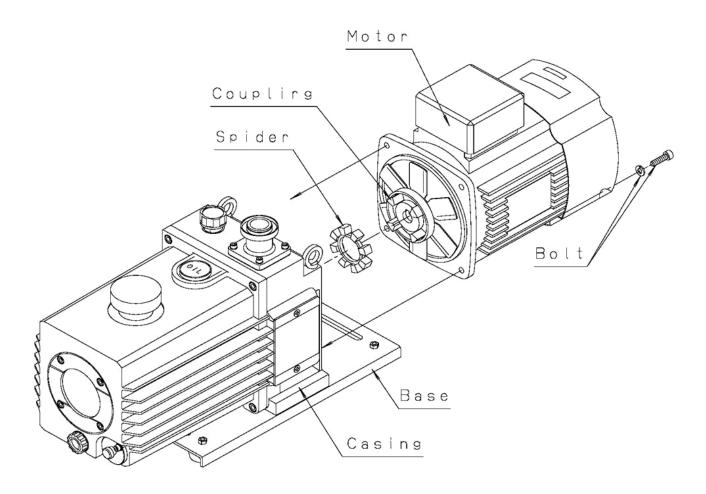


Fig. 10 Replacement of the coupling spider

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

Table 6 Trouble check list

| Problem | Cause | Measures | Reference |
|---------------------------|--|--|-----------|
| The pump does not rotate. | ①The pump is not connected to the power supply. | ①Connect the pump to the power supply. | 3.4 |
| does not rotate. | ②The 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. | ④ Press the reset button. | |
| | ⑤The motor malfunctions. | ⑤ Replace the motor. | |
| | ⑥Low ambient temperature has increased the oil viscosity. | ⑥ Increase the ambient temperature to 7°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 |
| | 8 Moisture or solvents were sucked in, forming rust inside the pump. | ® Overhaul (replace the cylinder and rotor). | 6.2 |
| | | | |
| | ¹⁰ Water absorption expands the vanes. | ①Overhaul (replace the vanes) | |
| | ① Components inside the pump have burnt out. | ①Overhaul (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. | ②Defective wiring to the pump | ②Perform wiring to the pump again. | 3.4 |
| | ③Low ambient temperature has increased the oil viscosity. | ③ Increase the ambient temperature to 7°C or more. | 4.4 |
| | ④ Foreign matter has entered the pump. | ① Disassemble and clean the pump to eliminate foreign matter. | |
| The pressure does not | ①The pump is too small for the volume of the vacuum chamber. | ① Select another pump. | 5.2 |
| decrease. | ②The pressure measurement method is not correct. | ②Measure the pressure correctly. | 5.1 |
| | ③The vacuum gauge is not suitable. | 3 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 |
| | ⑤The wire mesh at the inlet port is clogged. | ⑤Remove the piping from the upper section of the inlet port, and clean the wire mesh. | 6.2 |

| Problem | Cause | Measures | Reference |
|---|--|---|-----------|
| The pressure does not | (6) The specified amount of oil has not been added. | ⑥Add the specified amount of oil. | 3.2 |
| decrease. | The oil has deteriorated. | 7 Replace the oil. | 6.3 |
| | | | |
| | Our specified oil is not being used. | | 6.3 |
| | ① Oil does not circulate, or the oil hole of the cover is clogged. | ① Overhaul and clean the oil hole. | 6.5 |
| 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. | ②The motor malfunctions. | ② Replace the motor. | |
| | ③ Foreign matter has entered the pump. | ③Eliminate the foreign matter and overhaul the pump. | |
| | ① The specified amount of oil has not been added. | ④ Add the specified amount of oil. | 3.2 |
| | ⑤The coupling spider malfunctions. | ⑤ Replace the coupling spider. | 6.4 |
| | ⑥ Oil does not circulate, or the oil hole of the cover is clogged. | ⑥ Overhaul and clean the oil hole. | 6.5 |
| | 7 Components inside the pump have burnt out. | ⑦ Overhaul (replace the damaged components). | |
| Pump surfaces are extremely hot (50 °C or more higher than the room temperature) | ① Continuous operation at high evacuation pressure | ① If continuous operation is performed at a high evacuation pressure, the pump surface temperature reaches 80°C. However, this is not a serious problem. | |
| | 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 |
| | ③ The temperature of the evacuated gas is high. | ③ 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. | ④ Overhaul and clean the oil hole. | 6.5 |
| A lot of oil splashes out | ①The pump is been filled in excess of the specified amount. | ① Discharge the oil until it reduces to the specified amount. | 3.2 |
| from the exhaust port. | ②Continuous operation is performed at a high evacuation pressure. | ②Install 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.



Caution _____

- ① In case a harmful toxic gas has been exhausted by accident, ask a specialist for waste disposal. Not only the pump itself but also the pump oil become toxic.
- 2 For the disposal of pump oil, follow the instructions given under "Cautions for disposal" in "Safety Data Sheet."
- 3 Delegate the disposing of inlet filters to venders for waste disposal.

8. Maintenance parts

8.1 Maintenance parts list

Table 7 GLD-137AA Maintenance parts list

| Product name | No. | Parts name | Q'ty |
|------------------------------|-----|----------------------|------|
| | 16 | Outlet valve | 2 |
| | 17 | Outlet valve spring | 2 |
| | 24 | Check valve | 2 |
| | 25 | Check valve spring | 2 |
| | 49 | Oil seal_HTC-17-40-9 | 1 |
| | 50 | Oil seal_SC-17-30-7 | 2 |
| | 51 | Oil seal_SC-15-30-7 | 1 |
| | 52 | O-ring_P-12 | 1 |
| | 53 | O-ring_P-12.5 | 1 |
| | 54 | O-ring_P-35 | 1 |
| CLD 127 | 55 | O-ring_S-5 | 3 |
| GLD-137 Maintenance kit A | 56 | O-ring_S-12 | 1 |
| Widnitenance Rit II | 57 | O-ring_S-16 | 2 |
| | 58 | O-ring_S-20 | 1 |
| | 59 | O-ring_S-30 | 2 |
| | 60 | O-ring_S-45 | 1 |
| | 61 | O-ring_S-70 | 4 |
| | 62 | O-ring_G-55 | 1 |
| | 63 | O-ring_V-175 | 1 |
| | 64 | O-ring_JASO1016 | 1 |
| | 65 | O-ring_JASO3056 | 1 |
| | 66 | O-ring_N-28 | 1 |
| | 92 | O-ring_P-20 | 1 |
| | 13 | 1st vane | 2 |
| GLD-137 | 14 | 2nd vane | 2 |
| Maintenance kit B | 15 | Vane spring | 5 |
| | 41 | Spider | 1 |

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

Table 8 GLD-202AA Maintenance parts list

| Product name | No. | Parts name | Q'ty |
|------------------------------|-----|----------------------|------|
| | 16 | Outlet valve | 4 |
| | 17 | Outlet valve spring | 4 |
| | 24 | Check valve | 2 |
| | 25 | Check valve spring | 2 |
| | 49 | Oil seal_HTC-17-40-9 | 1 |
| | 50 | Oil seal_SC-17-30-7 | 2 |
| | 51 | Oil seal_SC-15-30-7 | 1 |
| | 52 | O-ring_P-12 | 1 |
| | 53 | O-ring_P-12.5 | 1 |
| | 54 | O-ring_P-35 | 1 |
| CLD 202 | 55 | O-ring_S-5 | 3 |
| GLD-202 Maintenance kit A | 56 | O-ring_S-12 | 1 |
| Wantenance Rit 11 | 57 | O-ring_S-16 | 2 |
| | 58 | O-ring_S-20 | 1 |
| | 59 | O-ring_S-30 | 2 |
| | 60 | O-ring_S-45 | 1 |
| | 61 | O-ring_S-70 | 4 |
| | 62 | O-ring_G-55 | 1 |
| | 63 | O-ring_V-175 | 1 |
| | 64 | O-ring_JASO1016 | 1 |
| | 65 | O-ring_JASO3056 | 1 |
| | 66 | O-ring_N-28 | 1 |
| | 90 | O-ring_P-20 | 1 |
| | 13 | 1st vane | 2 |
| GLD-202 | 14 | 2nd vane | 2 |
| Maintenance kit B | 15 | Vane spring | 7 |
| | 41 | Spider | 1 |

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

8.2 Disassembly drawing

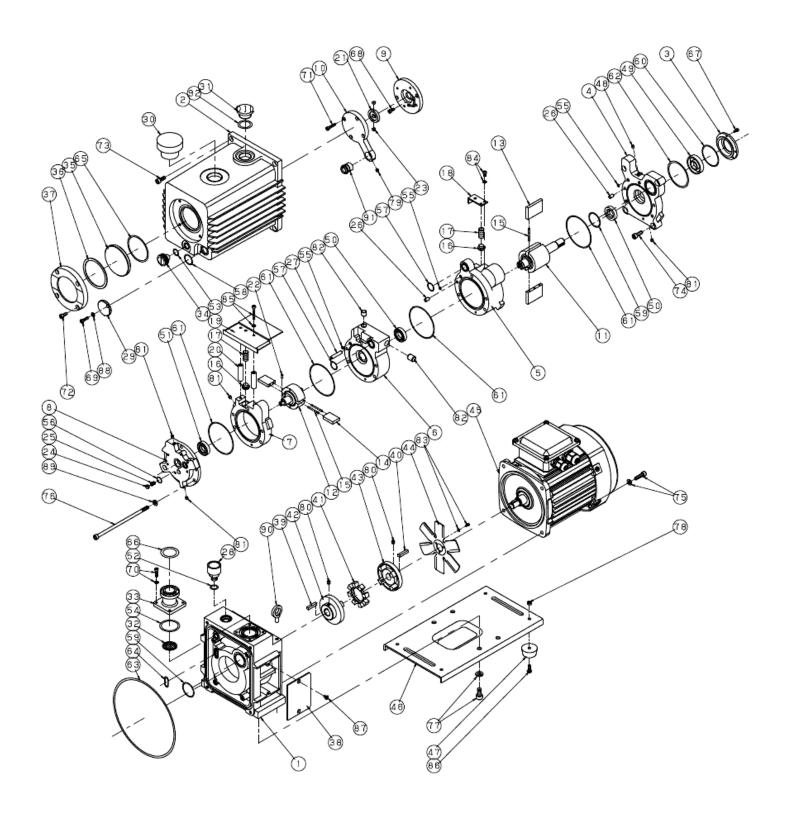


Fig. 11 Disassembly drawing of GLD-137AA oil sealed rotary vacuum pump

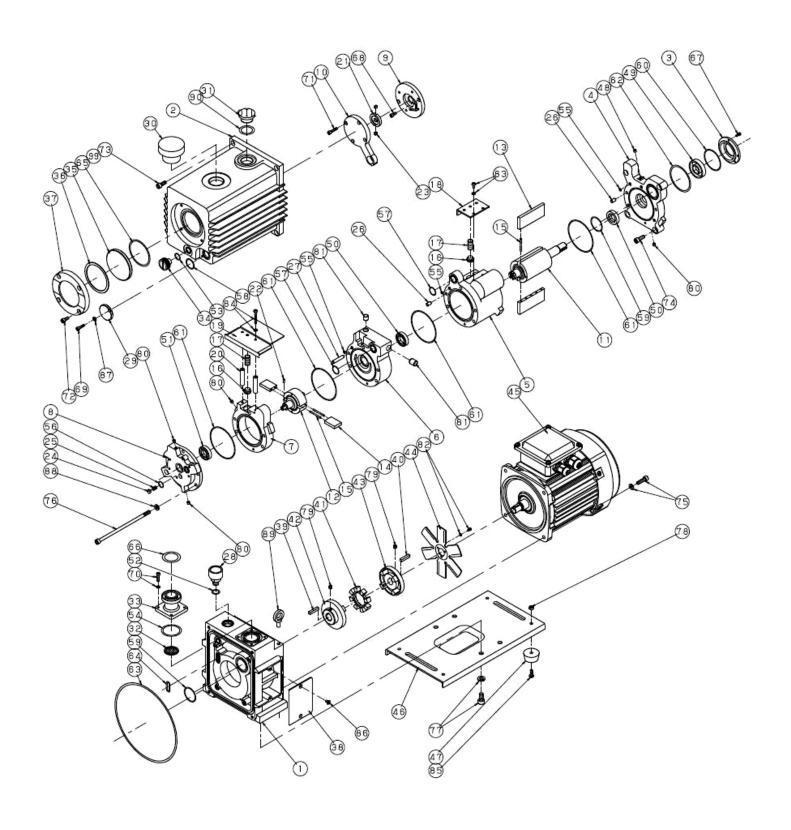


Fig. 12 Disassembly drawing of GLD-202AA oil sealed rotary vacuum pump

Warranty

- (1) The warranty for this pump 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

Identification of the Substance/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 Environment

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 and Mixture: Substance

Chemical Name/Generic Name : Petro-hydrocarbons

Chemical Formula: Not identified

100% Ingredient and Concentration Lubricating base oil

First-Aid Measures 4.

> Inhalation: Remove victim to fresh air and let him rinse mouth thoroughly with water.

> > Wrapping a blanket and the like around him to keep warm for a rest, call a

doctor/physician immediately.

Skin Contact: Rinse skin with soap and water.

Immediately rinse eyes with clean water for at least 15 minutes. Remove Eye Contact:

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.

Fire-Fighting Measures

Suitable Extinguishing Media Foggy reinforcing agent, foam, powder, or carbon dioxide

Unsuitable Extinguishing Media Jet water

Specific Hazards Currently there is no useful information.

Shut off the fire source. Specific Fire-Fighting Measures

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

Fire-Fighting

Wearing protective glasses, protective clothing, and if necessary,

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
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.

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.

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

Handling:

Technical Measures

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.

Handle at room temperatures, paying attention to moisture and to impurities not to mix with.

If skin or eye contact is possible, wear protective equipment. If mist is produced, wear respiratory protective equipment to avoid inhalation.

Use a pump and the like to take out of container.

Refer to '8. Exposure Controls/Personal Protection'.

Do not suck through a tube.

Do not weld, heat, hole, and cut off the container. Residues may

ignite involving explosion.

Full Ventilation System

Local Exhaust Ventilation/

Avoiding Contact Refer to '10. Stability and Reactivity'.

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Precautions for Safe Handling Obtain special instructions before use.

Do not handle until all safety precautions have been read and

understood.

Be cautious not to use any naked fire.

As vapors released from petroleum products are heavier than air,

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.

Storage:

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. Some

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):

Japan Society for Occupational Health (2010): 3mg/m³ (mineral oil mist) 1)

ACGIH (2010): TWA 5mg/ m³ (mineral oil mist) ²⁾

Standards for Allowable Density of Hazardous Substances in Labor Operation Air: Not established

Engineering Controls: 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.

Personal Protective Equipment

Respiratory Protection: Wear appropriate respiratory protection.

Hand Protection: If necessary, wear oil-resistant protective gloves.

Eye Protection: If diffusion is possible, wear eye protection.

Skin and Body Protection: If necessary, wear protective clothing and face protection.

Hygienic Precautions: 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.

9. Physical and Chemical Properties

Physical State:

Appearance Liquid

Color Light yellow
Odor Slight Oily odor
pH Not applicable

Melting/Freezing Point Not applicable

Boiling Point 165°C/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)

Solubility

Partition Coefficient: n-octanol/water

Auto-ignition Temperature

No data available

No data available

Pour point $\leq -15^{\circ}$ 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.

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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

Bioaccumulative Potential

Mobility in Soil

Hazardous to the ozone layer

Other Adverse Effects

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

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

- 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.

| | | Manufacture | r's Seria | al No.:_ | |
|--|--|-------------------|--------------------------------------|-------------|---------------------------------|
| 1. Inhaled Gas | * Please be sure to | fill in. | | | |
| (1) Whether there | is harmful effect on | human bodies | Yes | No | (Sing your name below.) |
| (2) Whether there | is unusual smell | | Yes | No | , |
| (3) Type and Nam | e of Gas: | | | | |
| | | | | | ances as the materials to be |
| notified. | | а с с . 9 | | | |
| | | | | | |
| 2. Usage Status | | | | | |
| _ | l: Approx. () hours | s per day. () | vears ar | nd () | months |
| - | eration Interr | | | () | |
| • | | • | • | | |
| | | | | | |
| 3 Failure Status | □Unusual Noise | □ A bnorm: | al Press | ure | □Abnormal Actuation |
| o. i aliuic otatus | | | | | |
| | UOII Leakage | Other Sympto | /IIIO. | | |
| 4. Detail of Degue | et -Donair (Over | rhaul\ _Dagul | | | |
| · | est □Repair (Over | , 3 | | | |
| · | est □Repair (Over | , 3 | | | |
| 5. Others: | . , | | ar Chec | ks | |
| 5. Others: | | | ar Chec | ks | |
| 5. Others: Company Name: Address: | | Personnel in o | ar Chec | ks | |
| 5. Others: Company Name: Address: Tel: | | Personnel in o | ar Chec charge: E-n | ks nail: | |
| 5. Others: Company Name: Address: Tel: Agent Name; | Fax: | Personnel in o | ar Chec charge: E-n charge: | ks nail: | |
| 5. Others: Company Name: Address: Tel: Agent Name; Address: | Fax: | Personnel in o | ar Chec charge: E-n charge: | ks nail: | |
| 5. Others: Company Name: Address: Tel: Agent Name; Address: Tel: | Fax: | Personnel in o | ar Chec charge: E-n charge: | ks nail: | |
| 5. Others: Company Name: Address: Tel: Agent Name; Address: Tel: | Fax: | Personnel in o | ar Chec charge: E-n charge: | ks nail: | |
| 5. Others: Company Name: Address: Tel: Agent Name; Address: Tel: | Fax: | Personnel in o | ar Chec charge: E-n charge: | ks nail: | |
| 5. Others: Company Name: Address: Tel: Agent Name; Address: Tel: * In case you do r 6. Confirmation | Fax: Fax: not have any direct t | Personnel in o | charge: E-n charge: | hail: | |
| 5. Others: Company Name: Address: Tel: Agent Name; Address: Tel: * In case you do r 6. Confirmation The gas and sub | Fax: Fax: not have any direct t | Personnel in o | charge: E-m charge: us, pleas | hail: | sure to fill in the agent name. |
| 5. Others: Company Name: Address: Tel: Agent Name; Address: Tel: * In case you do r 6. Confirmation The gas and sub | Fax: Fax: not have any direct to the stance used in this postance. | Personnel in o | charge: E-m charge: us, pleas | hail: | sure to fill in the agent name. |

- * 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.)