P8114-2-01-14

ULVAC

Instruction Manual

for

Direct-Drive Oil Sealed Rotary Vacuum Pump

Model

G-20DA
G-25SA
G-50DA
G-50SA

Before Use

For safe and efficient use of this pump, please read this manual carefully before operation.

After reading the manual, keep it in your file for future reference.

Specifications in this manual are subject to change without notice due to future improvement.

ULVAC KIKO, Inc.

O. Preface

0.1 Before Using This Pump

We, ULVAC KIKO,Inc. thank you for purchasing our vacuum pump. When receiving our vacuum pump, please confirm the product is the same Model No. as you ordered. Also, check to make sure there are no damages.

CAUTION

To ensure a long life for this pump, read this manual carefully prior to installation, operation, and maintenance. Also, pay attention to ascertain the details of safety, specification, and operational precautions of this pump.

NOTE

0.2 Safety precautions (General Expression)

Safety precautions are identified in this manual using headers DANGER, WARNING, CAUTION, and NOTE.

DANGER

"Danger" Indicates major hazardous situations, which present an immediate threat of death or serious injury.

WARNING

"Warning" Indicates hazardous situations, which may present a potential to death or serious injury.

CAUTION

"Caution" Indicates hazardous situations where a potential hazard or unsafe practice could cause personal injury or equipment damage.

NOTE

"Note" Indicates undesirable situations where a potential hazard could cause equipment damage or abnormal operation.

0.3 Safety Precautions

DANGER

When evacuating toxic or inflammable gas, there may be danger of leaking gas from parts besides inlet port. Practice cautionary steps when working any kind of gases.

DANGER

After evacuating toxic gases, the inside of pump and pump oil is contaminated and toxic. Therefore, handle pump with care during maintenance.

WARNING

Do not overhaul or repair this pump. Only authorized maintenance personnel should handle this pump to avoid ignition, abnormal action, and electric shock.

WARNING

Switch off power before checking or repairing the pump to avoid any problems (electric shock or personal injury) caused by suddenly starting up.

WARNING

Connect an electrical wire cord to ground potential terminal tightly to avoid electric shock caused by mechanical trouble or electrical leakage.

WARNING

Do not plug exhaust port or place any materials inside of exhaust port, because it will reduce pumping speed during operation. Pump explosion, oil level gauge bursting, or motor over loading are consequences of excessive pressure inside the pump. This pump is not a compressor. The maximum pressure inside this pump is 0.03 MPa (GAUGE).

⚠ WARNING

Do not use this pump in an explosive or flammable atmosphere. It may cause personal injuries or fires.

⚠ CAUTION

Do not insert objects, fingers, or another pump body parts into the inlet port. It may cause electric shock, personal injuries, or fires.

⚠ CAUTION

Do not touch the motor body, shaft, or shaft coupling joint during operation. It may cause personal injuries.

⚠ CAUTION

Do not place flammable objects around the pump. It may cause fires. Also, do not place obstacles around the pump so as to obstruct cooling air. Abnormal temperature rising may cause burns or fires.

⚠ CAUTION

Electric wiring should be carried out in accordance with Electric Regulation and Instructions. Miswriting may cause fires.

⚠ CAUTION

Switch off electric power right away in case of a malfunction to prevent any troubles. In the case of a malfunction, contact your local agent or ULVAC KIKO, Inc. Sales and Service Center immediately.

⚠ NOTE

Do not start the pump without pump-oil. Failing to do so will lead to pump destruction.

0.4 Acceptance and Store of Product

0.4.1 Acceptance of Product

We delivered the pump with the utmost care. After unpacking, please check up and confirm items as shown below,

(1) The pump is what you ordered.

(2) Spare parts (single use of pump oil, optional parts)

(3) Any damages during transportation.

(4) Any loose screws and nuts.

If you find any abnormal circumstances, please contact your local ULVAC KIKO,Inc. Sales or Service Center.

0.4.2 Store of Product, Installation, Operating condition

This pump is a type of precision equipment; therefore, it is necessary to satisfy the following items for store product.

(1) Operational temperature and humidity : 7～40° C , 85 % RH >

(2) Installation place should be at an altitude no higher than 1000m above sea levels for storing or operation.

(3) Required conditions while storing or operating

a. Do not use corrosive or explosive gases.

b. No areas with high moisture.

c. No areas with dust particles.

d. Use indoors only.

e. Do not pile up, or lay on its side.

f. Keep out of direct sun light.

g. Keep away from heat source.

NOTE

Do not treat with force, or lay on its side. It may cause damage.

0.5 Protective Precautions

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.

NOTE

Do not apply any voltages other than specifically rated for the motor of this pump. The over-load protector does not operate normally, consequently it may cause burning the motor or firing.

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DRAWING AND TABLE LIST

1. For Safety Operation

1.1 Hazardous of Product and Safety Precautions

Before operating or inspecting the pump, read this manual carefully. And pay attention to ascertain the detail of potential hazardous and preventive procedure so that must be operated or inspected the pump.

1.1.1 ⚠ DANGER Leakage of hazardous gases and materials

Cause		Preventive Procedure
Leakage of toxic or inflammable gases.	⇒	Before evacuating gases to the pump inlet, dilute them to safety level.
Injuries of skin by direct contact with contaminated oils or adhered hazardous materials of the pump body when checking or disposing dispose the pump.	⇒	① After wearing suitable protector for evacuating hazardous materials, check or abolish the pump. ② Before checking or disposing the pump, non-hazardous treatment must be requested for the authorized professional specialist, then check or the pump. ③ Disposal must be requested for the professional specialist authorized by the administration.

1.1.2 ⚠ WARNING Electric shock

Cause		Preventive Procedure
Electric shock by touching electrical bare portion of the motor when electric power is on.	⇒	① Switch off power certainly before electric wiring Connect electrical wire cords to ground potential terminals tightly. ② Switch off power before inspection or removing. ③ Do not insert objects, fingers, or any thin bars into the inlet port.

1.1.3 ⚠ WARNING Explosion

Cause		Preventive Procedure
Pump explosion is consequence of excessive pressure inside the pump.	⇒	The maximum pressure inside the pump is 0.03 MPa (GAUGE). If inlet pressure of the pump is higher than 0.03 MPa (GAUGE), eliminate any objects which may cause obstruct gas flowing to the inlet port. When using oil mist trap, exchange or clean them to avoid gas flowing.

1.1.4 ⚠ CAUTION High Temperature

Cause		Preventive Procedure
Burn at high temperature.	⇒	① Temperature of the pump is high as shown below pump body → 70 ～ 80 ℃ motor → 70 ～ 80 ℃ ② High temperature surface of the pump may cause to burn as a result of direct skin contact by accident. Do not touch the pump body during operation. Inspection should be carried out after stopping and cooling down the pump.

1.2 Safety Data Sheet (SDS)

The chemical material, which is applied or possible to contact when operating this pump are described. Read this manual carefully to understand characteristics of the chemical material (vacuum pump oil) which is described on SDS sheet. When applying other vacuum pump oils besides the description in this manual, contact your local ULVAC KIKO,Inc. Sales and Service Center.

⚠ CAUTION

SDS presents the reference information of hazardous chemical material to keep safety precautions. When handling the pump oil, it is necessary to take proper and practical treatments, which are adapted handling the oil. After understanding the above mention, these treatments must be done. Therefore, SDS is a not safety warranty.

2.General Description of the Pump

2.1 Principal Features

This oil rotary vacuum pump is a sliding vane type (so called Gaede type), with direct driven motor. As it is a small sized, lightweight, and simple structure, it is easy to maintain or over-haul.

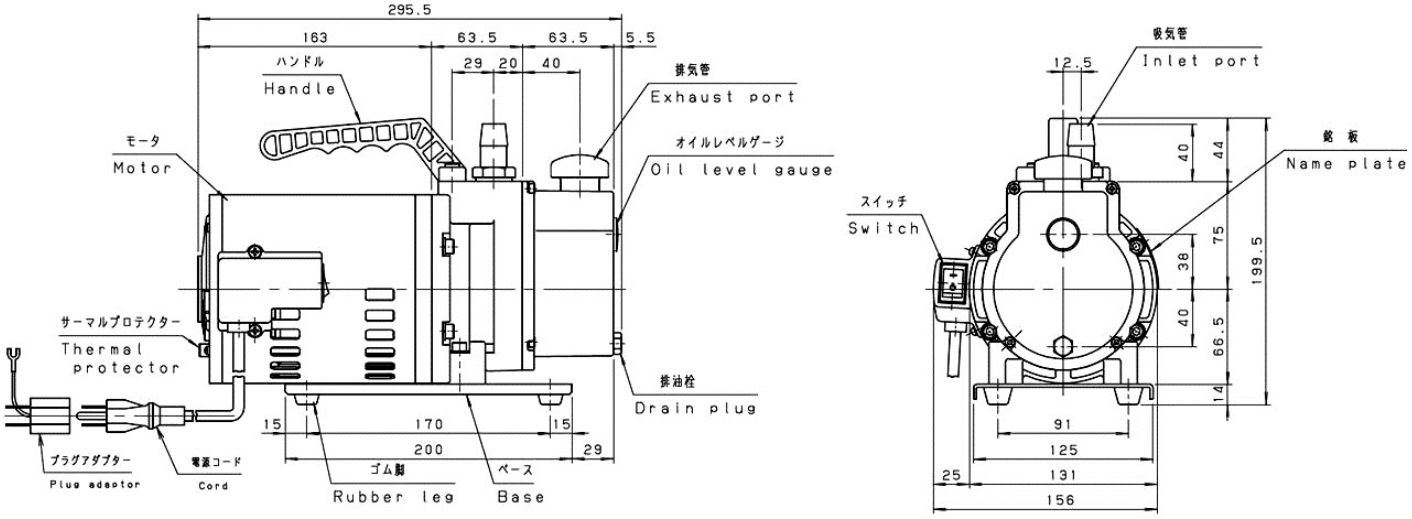
Table-1 Specification

Model		G-20DA	G-25SA	G-50DA	G-50SA
Type		Sliding vane 2 stages	Sliding vane 1 stages	Sliding vane 2 stages	Sliding vane 1 stages
Pumping speed L/min	50Hz	20	20	50	50
	60Hz	24	24	60	60
Ultimate pressure	Pa	1.3	9.3	1.3	9.3
Motor	W, (Poles)	100 (4)		200 (4)	
Full load current A	50Hz	3.7		5.6	
	60Hz	3.0		4.8	
Motor revolution r/min	50Hz	1,450		1,440	
	60Hz	1,740		1,730	
Pump oil	Recommended	SMR-100			
	Capacity, (mL)	230	230	260	360

Note 1. Ultimate pressure indication by Pirani gauge.

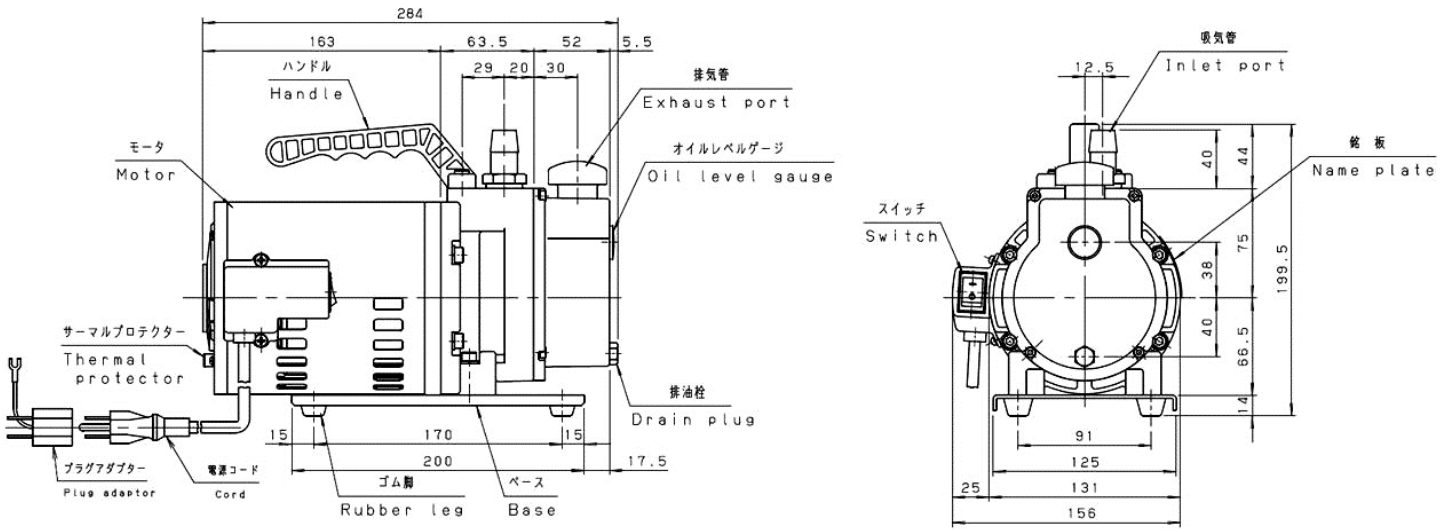
2. Vapor pressure, viscosity, or characteristics of vacuum pump oils are different respectively. Our recommended oil is SMR-100.

2.2 Dimensional Drawings



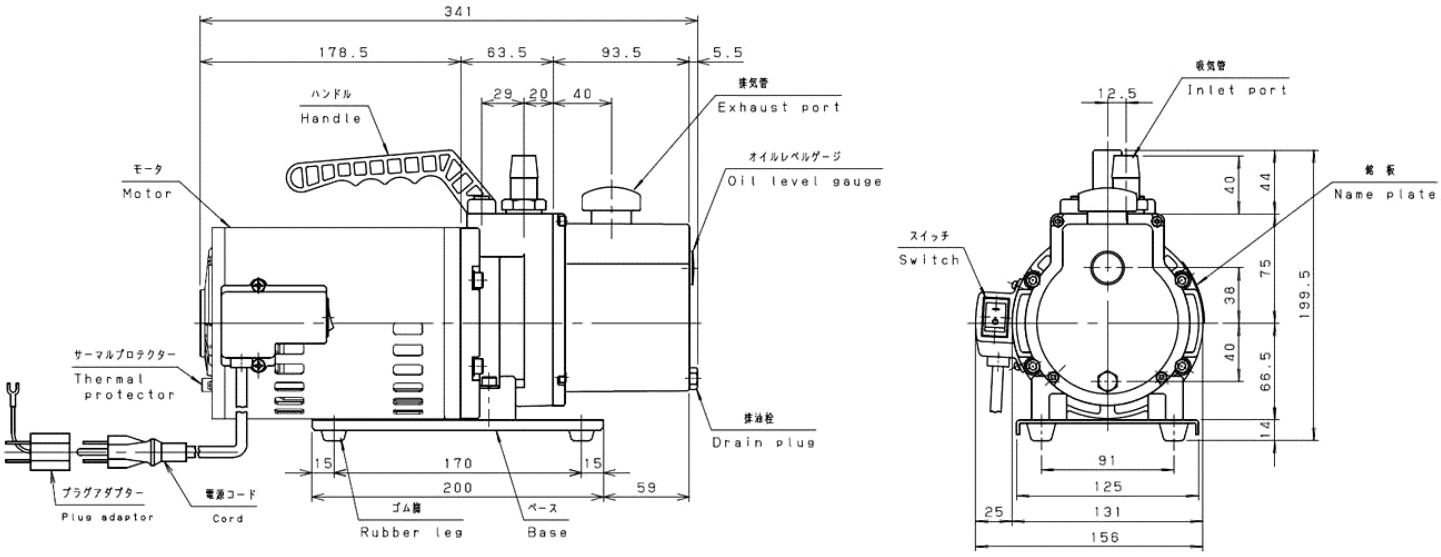
Motor ; Single phase, 100V(50/60Hz), 100W, 4Poles,Split phase starting
Weight ; 9.0 kg(with motor)

Fig-1 General Assembly Drawing of G-20DA



Motor ; Singhle phase, 100V(50/60Hz), 100W, 4Poles, Split phase starting
Weight ; 8.5kg(with motor)

Fig-2 General Assembly Drawing of G-25SA



Motor ; Singhle phase, 100V(50/60Hz), 200W, 4Poles, Split phase starting
Weight ; 11.0kg(G-50DA･50SA : with motor)

Fig-3 General Assembly Drawing of G-50DA･50SA

3. Setting up

3.1 Installation

Installation must be done at a place of low moisture, low dust particle, and also level. The layout arrangement should be considered for setting up, overhaul, checking, or cleaning the pump. When setting up the pump in any systems, pay attention to temperature in atmosphere. Mount rubber isolator to absorb vibration from the pump. On the environmental condition, refer to「**0.4.2 Store of Product**」.

⚠ CAUTION

Do not tilt, lay its side, or operate up side down. It may cause damage. The pump must be placed on a level place in an upright position as shown in Fig-1, 2, 3.

3.2 Oil charging

Remove the oil-filling plug, and then fill the oil (one time charge) to the pump or recommended oil (SMR-100) up to specified quantity through the oil filling port. In first oil charging, pour the oil up to maximum scale of oil gauge. Then, attach the exhaust port. (see Fig-4) Oil quantity must be checked or adjusted to keep the oil quantity is always in the range of oil gauge during operating the pump.

Improper oil quantity may cause the performance deterioration of the pump, and also may cause damage. When oil quantity is out of gauge scale ultimate pressure become higher, and it may cause bubbling sound like "poko poko".

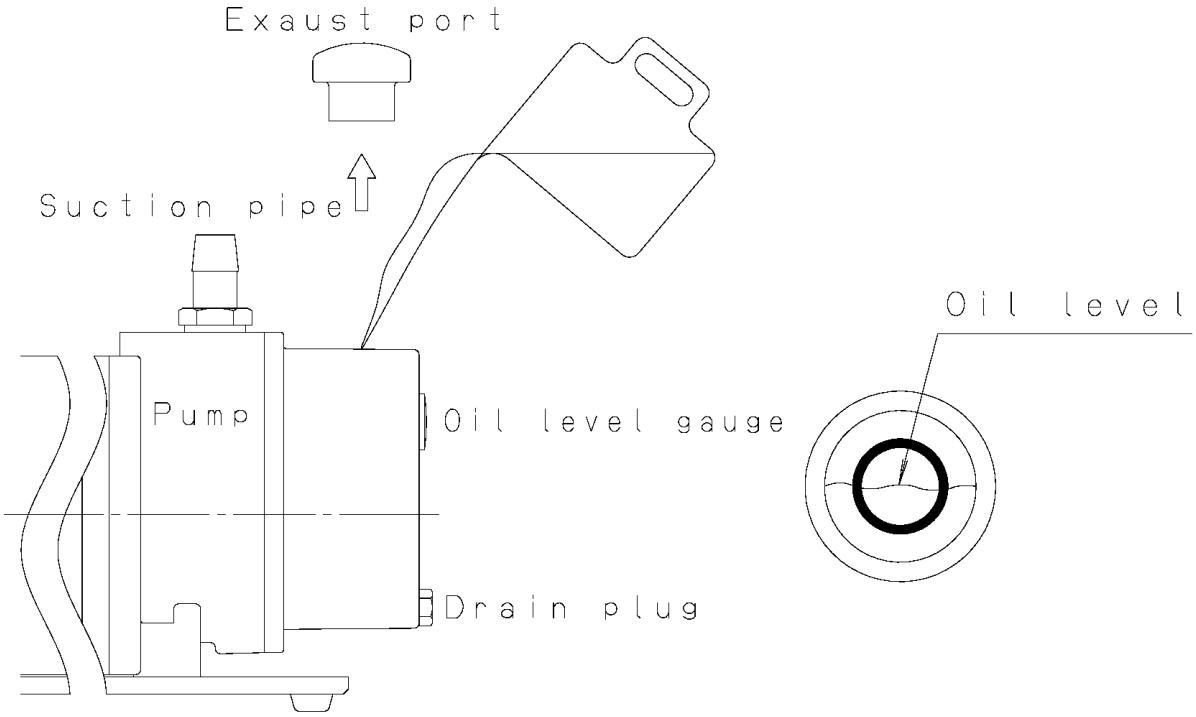


Fig-4 Oil Charge to Rotary Vacuum Pump

CAUTION

① Wear protective rubber gloves or goggles.

② Before charging oils ,read the 「1.2 Safety Data Sheet(SDS)」. When the contaminated oil touching the skin or coming into the eye accidentally, follow the item first-aid-treatment of「Safety Data Sheet(SDS)」.

NOTE

Do not apply other vacuum pump oils besides our recommended. If applying other vacuum pump oils, it may cause the performance deterioration or shortening the lifetime of the pump.

3.3 Vacuum Tubing

(1) Clean inner surfaces of vacuum vessel, tubing and valve. Then, after eliminating water moisture, small particle, dust or rust carefully, connect tube to the pump.

NOTE

If evacuating small size powder or dust particle, vacuum pump may cause trouble.

(2) Install the shut off valve (A) and the pump vent valve (B) in between the pump inlet port and the vessel as shown in Fig-5.

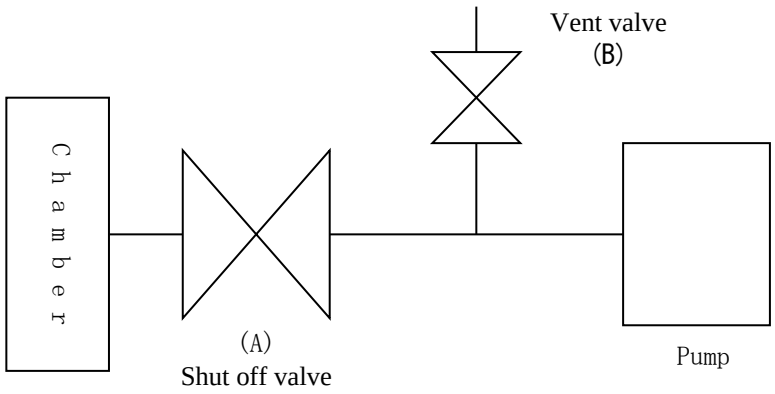


Fig-5 Vacuum Pumping System Diagram

(3) Vacuum tubing between inlet port and another port is provided with vacuum rubber hose.

NOTE

Do not eliminate mesh-filter for preventing different objects come into the inlet port of the pump.

3.4 Electric wiring

(1) This pump has performed beforehand electric wiring by the side of a pump.

(2) Plug the power wire cord in the power outlet of 100V, single phase.

(3) The over-load protector (thermal protector, manual reset type) is provided for this pump.

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.

WARNING

Switch off power before electric wiring. Never connect electric wire cord when power line is hot. This may cause electric shock.

NOTE

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

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·m).

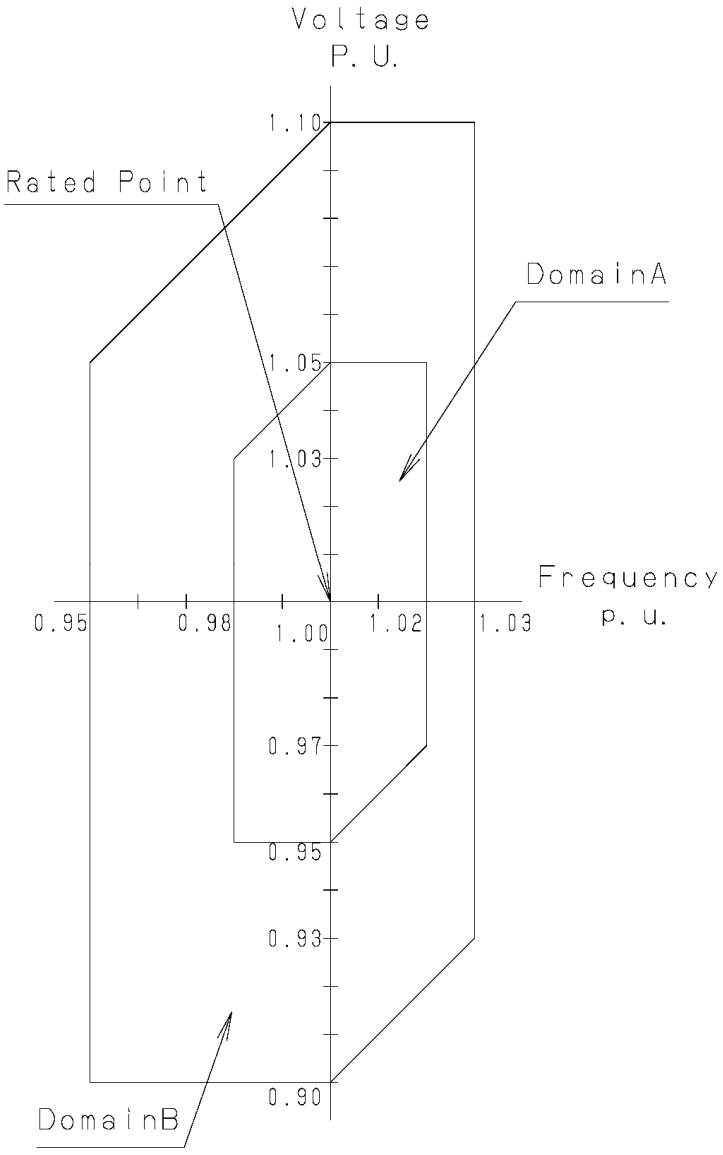


Fig-6 Change region of the voltage and frequency

4. Operating Instructions

4.1 Operating precautions

WARNING

Explosion hazard. Do not plug the exhaust port or place any materials inside of the exhaust port, because it will reduce pumping speed during operation. Pump explosion, oil level gauge bursting, or over loading of the motor are consequences of excessive pressure inside the pump. This pump is not a compressor.
The maximum pressure inside this pump is 0.03 MPa (GAUGE).

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.

NOTE

① In manufacturing process of semi-conductor, pump oil will be contaminated in a very short term. First oil changing should be done within 10 days. Then, after checking oil contamination, it should be recommended to decide the interval for changing oil.

② When evacuating much quantity of water moisture, change oil frequently. If operating pump a long term as taking water moisture into the pump, this may cause deterioration of oil lubricity, corrosive acceleration of parts inside the pump, also trouble of the pump.

③ When evacuating chemicals (acid or like), change the pump oil after stopping the pump immediately to prevent operational impossibility owing to rusting while stopping it for one night.

④ When evacuating solvents, change the pump oil after stopping the pump to prevent deterioration of oil lubricity and trouble cause (sticking, etc).

⑤ Continuous running at suction presser higher than 1.0kPa may cause high consumable rates of pump oil and oil shortage. And too oil shortage may also cause parts consumption and sticking, therefore supply pump oil without fail.

4.2 Start up Operation

Close the pump vent valve (B); open the shut-off valve (A) to inlet port of the pump, then turn on the power switch to start operation. The pump begins running(see Fig-5).

⚠ CAUTION

① Firing hazard. Do not touch the motor or the pump body as these surface temperature should be higher (70～80° C).

② Operating the pump at high-pressure region must be generated oil mist from exhaust port. Attach the oil mist trap or connect the duct to exhaust oil mist

⚠ NOTE

If the pump rotation is not so smooth, take action needed as described below.

① Check oil quantity, and charge proper quantitative oil.

② When stopping the pump for long term (3days or more) at low temperature, pump oil will come into the pump cylinder. (At end of former operation, vented air into the pump may also cause same situation) If restarting the pump at this condition, over load protector may be operated. Then, carry out several start-stop operations in a short time cycle.

⚠ NOTE

After operating the pump for several hours, oil temperature inside the pump may be risen up to 70 ～80° C. If the temperature is over this, the pump may have troubles. Maintain the pump, or contact ULVAC KIKO ,Inc.

4.3 Shut down Operation

Close shut off valve (A), open pump vent valve (B), then turn off power switch of the pump(see Fig-5). If stopping the pump by no opening pump vent valve, the oil will be filled inside the pump cylinder within several minutes. This may cause back flowing oil to the vacuum vessel. For next operation, restarting the pump will be difficult because of not so smooth rotation, thermal protector operating, motor firing by over loading.

When stopping the pump operation by electric stoppage, close shut off valve (A) quickly and then open pump vent valve (B).

⚠ 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.

⚠ CAUTION

Firing hazard. As the surface of the pump body is higher temperature(70 ～80° C) during operation, do not touch it until cooled down after stopping the pump.

4.4 Oil shut off valve

Oil shut off valve is built in G-50SA. It is very effective to prevent back flowing oil from the pump. This valve is provided for emergency as electric stoppage. For normal case, operate 「4.3 Shut down Operation」.

⚠ NOTE

① After closing shut off valve (A) and opening pump vent valve (B), stop the pump. If this procedure is not performed, pump oil must be filled inside the pump. It may cause difficulty on restarting or damage the pump, also back flowing oil to the vacuum vessel.

② If the shut off valve (A) is not closed for shut down operation, this may cause air leakage through inside the pump to the vacuum vessel.

4.5 Start up procedures in cold climate

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.

In the case of the pump stoppage after several second operating, continuous operating will be possible by opening the pump vent valve. After warming up the pump, close the pump vent valve, and operate normally.

4.6 Set up oil mist trap (option)

Oil mist trap OMT-050A for G-20DA, 25SA, 50DA, 50SA can be equipped for trapping oil mist out of the pump. After eliminating the standard exhaust pipe, equip the oil mist trap to the exhaust port. This can reduce oil mists and exhausting noise.

Read the instruction manual of OMT-050A in detail.

4.7 Restriction in an operation of the oil mist trap (option)

When using oil mist trap, the following items should be restricted in an operation.

When the filter clogged with oil, change the filter.

The maximum pressure inside this pump is 0.03MPa(GAUGE).

For pressure reading excess 0.03MPa(GAUGE) in exhaust port, change the filter.

WARNING

Explosion hazard. Keep the operational restriction in setting the oil mist trap.

When the filter clogged with oil, change the filter.

5. Specification

5.1 Ultimate Pressure

The 「Ultimate Pressure」 described in the catalog or this manual means obtainable minimum pressure by vacuum pumping at inlet port without conducting gas (no load operating). Our ULVAC KIKO, Inc. applies the specified pump oil and measures the pressure at inlet port attached the sensor of only the Pirani gauge.

Pirani gauge indicates 5～10 times higher pressure reading than by the McLeod gauge. This means condensable contents (almost water vapor), included in the gas, could not be measured by the McLeod gauge.

In actual vacuum system, the ultimate pressure reading will be higher than the catalog description. This reason will be shown as follows.

① When the vacuum sensing head location is far from the pump, any water vapor or gas, generated from any water droplet or any rust adhered to the inside surface of the vacuum vessel or the vacuum tubing may cause high ultimate pressure.

② Any volatile contents dissolved into the pump oil will vaporize and it may cause higher ultimate pressure.

③ If there is any leakage or gas source in the vacuum tubing, the ultimate pressure will be high.

5.2 Pumping Speed

Pumping speed of the oil rotary pump must be changed with sort of gases. Generally, pumping speed will be max in high-pressure range, and will be proportional to vacuum pressure reduction. The standard pumping speed of this pump shows the maximum speed when pumping dry air. Inlet pressure Vs pumping speed is shown in Fig-7.

5.3 Required Electricity

Driving power for motor is totaled mechanical work based on rotor friction and air compression work. It will be maximum at 4×10^{4} ～2.7×10^{4} Pa. At lower pressure than 13.3Pa, compression work is small and almost power will be mechanical work consumption. Fig-8 shows minimum power required operating the pump.

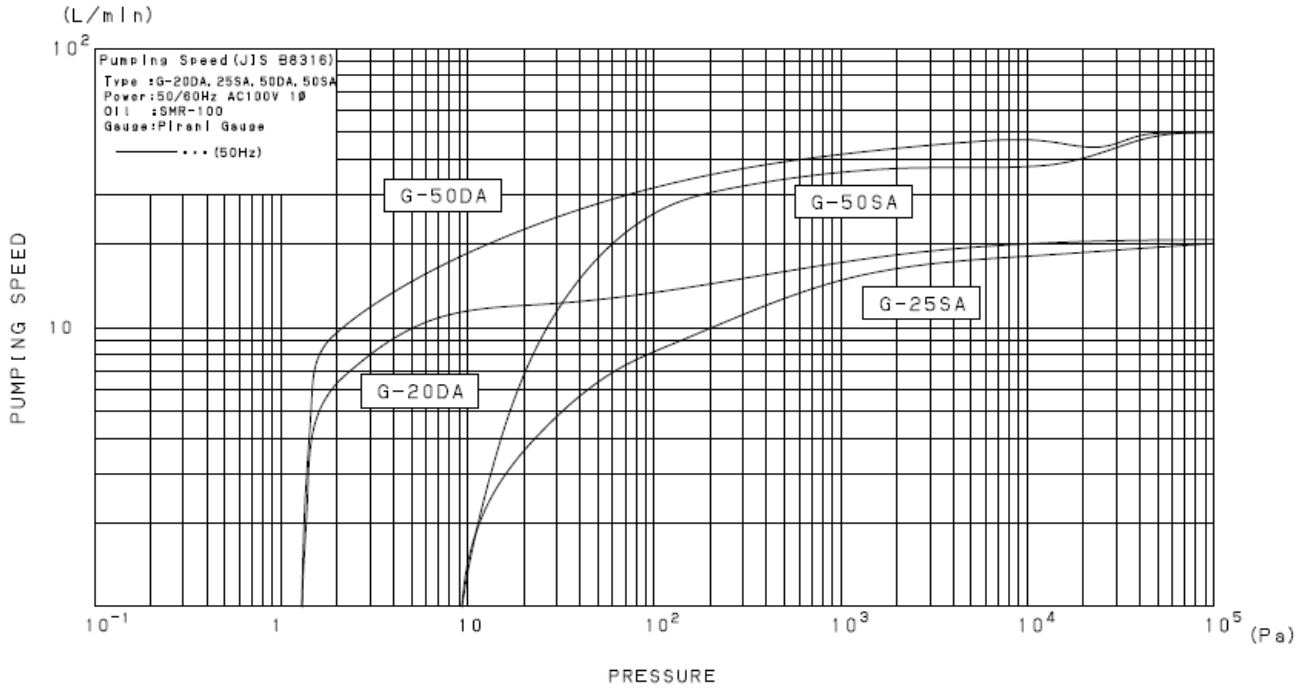


Fig-7 Characteristics of Vacuum pumping speed

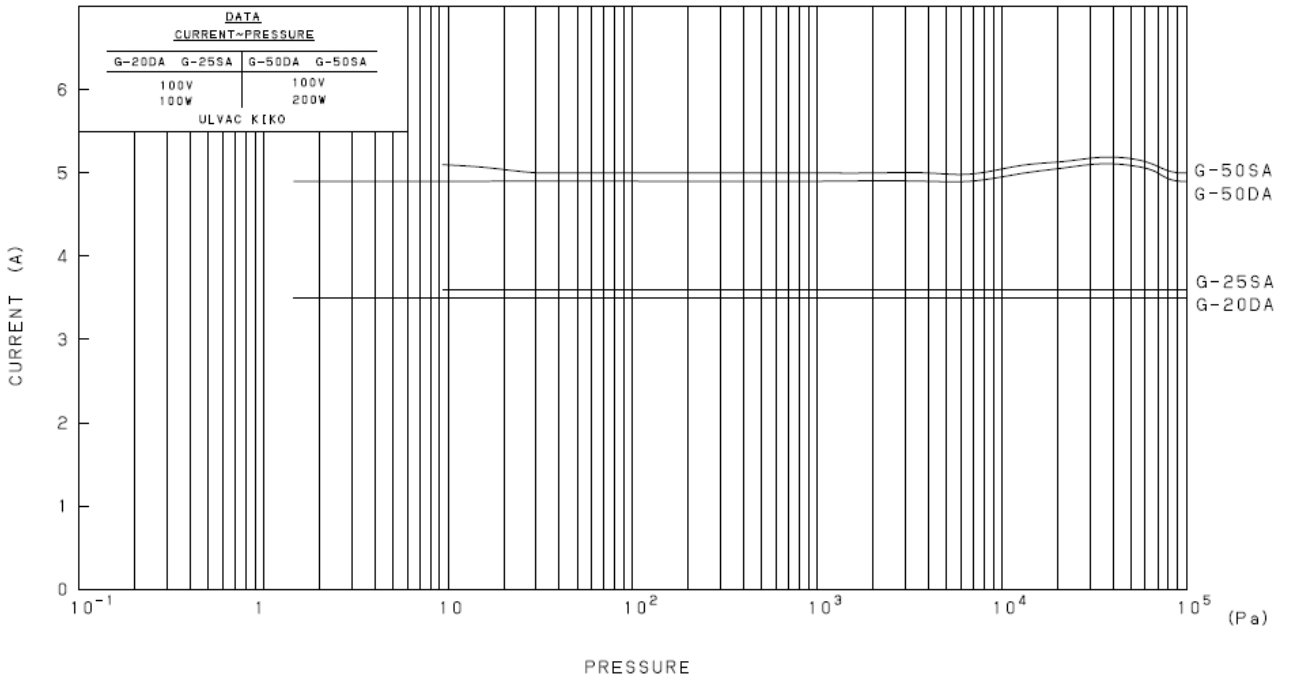


Fig-8 Characteristics of Motor power

6.Maintenance, Inspection, Repair

6.1 Maintenance

Check and confirm the following items at least every 3 days while operating.

(1) Oil level is in red ring marking of oil gauge.

(2) Change in color of the oil.

(3) Usual sound or not?

(4) Motor current, normal or not?

(5) Oil leak from oil seal assembly.

If detecting any problems, take an action needed by 「6.5 Trouble Check List」.

6.2 Scheduled Inspection

The inspection items should be changed for operational conditions of the pump. Inspecting the following items will be effective to avoid any troubles or to extend the pump life.

⚠ CAUTION

① Turn off power switch certainly before inspection. Never turn on power switch for inspection. It may cause personal injuries.

② Directly after stopping the pump, the pump body is high temperature. Wait until it will be cooled down, and inspect it. Burning hazard.

(1) Periodical changing the pump oil

Pump oil should be deteriorated with operating time. After checking the oil contamination and viscosity, change the oil quickly. Periodical changing the pump oil can suppress the performance deterioration, also elongate the pump life.

If continuing the pump operation in the situation with much water, the ultimate pressure comes up to higher pressure. Then the pump motion become dull by mechanical friction, the pump may cause damage. Change the pump oil by「6.3 Oil Change」.

Table-2 Scheduled Inspection

Inspect cycle	Inspect Item	Inspect content	Action item
Every 3 days	Oil quantity Oil contamination	Specified oil level	Recharge oil
		Reddish brown or milky white→abnormal Black→not abnormal	Change oil
	Sound & Vibration	Unusual sound & Unusual vibration	Tighten bolts/nuts or Contact your local Representative
	Motor current	Specified rating	Confirm over current source or Contact your local Representative
Weekly	Surface temperature rising	>50℃ UP →abnormal	Confirm over heat source or Contact your local Representative
	Oil leak	Oil leak from seals or plugs	Change seals, O-rings or Contact your local Representative
Every 3000hr or Every half year	Mesh filter, inlet port	Dust clogging	Clean the mesh filter
	Pump oil	Inspect oil certainly	Change oil
Every year	Spider	Broken spider	Change spider

(2) Inspecting the pump oil quantity

Recharge the specified pump oil as oil level is always in the range (red circle marking) of oil gauge during operating.

(3) Inspecting the pump oil leakage

When happening the oil leakage from shaft seals or drain-plug seals, repair must be needed. As our service center provides the specified O-rings or seals, please contact your local ULVAC KIKO, Inc. service center.

(4) Inspecting the mesh filter in the inlet port

Any dust included in evacuated gases may cause clog the mesh filter and down pumping efficiency.

(5) Inspecting the abnormal noise or vibration

Check up any loose screws and nuts.

(6) Inspecting the spider of coupling

When broken the spider of coupling. Change the spider of coupling by「6.4 Replacement of Spider in Coupling」.

(7) Inspecting the oil mist trap

When applying the oil mist trap instead of the standard vacuum tubing, pay attention for clogging of the mesh filter of the oil mist trap. Heavy clogging may cause increasing inside pressure or bursting out the oil level gauge. Also, it may cause oil leakage from shaft seals or drain plug seals.

The maximum pressure inside this pump is 0.03 MPa (GAUGE).

Besides the inspecting items mentioned above, overhaul is useful when continuing the operation for long term or observing heavy contaminated oils.

Please contact your local ULVAC KIKO,Inc. Sales and Service Center.

⚠ DANGER

When requesting overhaul or repair the pump, inform the sort of evacuated gases on the "Check sheet for repair" attached at end of this manual, and submit the sheet by all means. When evacuating toxic gases, the pump body and the oil may cause toxic. We cannot overhaul or repair the pump evacuated some sort of toxic gases.

6.3 Oil change

Oil deterioration may cause the operating pressure rising. Confirm the specked ultimate pressure by plugging the pump inlet port. If observing the high ultimate pressure, change the pump oil. If mixing volatile contents (water, solvent) in the pump oil or precipitated sludge on the pump bottom, several times oil changing procedures should be necessary. The oil deterioration may be caused not only by oil contamination due to evacuated gases but also by oil performance change depending on long operating time. We recommend periodical oil change by the Table-2 "Scheduled Inspection".

DANGER

When evacuating toxic gases, the pump body and the pump oil may cause toxic. Pay attention certainly.

CAUTION

① Wear suitable protector (rubber gloves, goggles).

② Before charging the oil, read the「1.2 Safety Data Sheet(SDS)」. When the contaminated oil touched skin or came into eye accidentally, follow the first-aid-treatment of「1.2 Safety Data Sheet(SDS)」.

NOTE

Do not apply the different type of vacuum pump oil besides our recommended. If applying the different type of vacuum pump oil, it may cause the performance deterioration or shortening the lifetime of the pump.

[Oil Change Procedure]

(1) Unplug the inlet port and operate the pump for 5 sec. We can discharge the remained oil inside the pump, effectively.

(2) Disconnect the standard exhaust pipe, unplug the drain port, and then drain off the oil.

(3) Plug the drain port; charge the recommended new oil as fixed quantity from the exhaust port. (see Fig-4)

(4) If the oil contamination is heavy, operating the pump for several minutes with the new pump oil will be necessary for cleaning the pump inside. Several cleaning procedures should be necessary for very heavy contamination.

(5) After warming up the pump by operating with the new pump oil, confirm the ultimate pressure.

(6) When depositing the oil sludge on the pump bottom as heavily contaminated oil, the specified ultimate pressure is difficult to obtain. Overhauling and repairing should be needed.

6.4 Replacement of Spider in Coupling

The spider (made of rubber) is used between the pump head and the motor. It is recommended that it be checked once a year and replaced if found defective. If the pump is started and stopped hundreds of times per day, it is necessary to check it within a shorter time. To remove the spider, please remove the 4 bolts, which time the coupling, will be visible.

To have the pump reassembled after overhauling, fit the spider to the coupling, (as shown by Fig-9), adjust the direction of indented part of the pump head (female) and that of the motor (male), fit them tightly together, and tighten the bolts firmly to the motor.

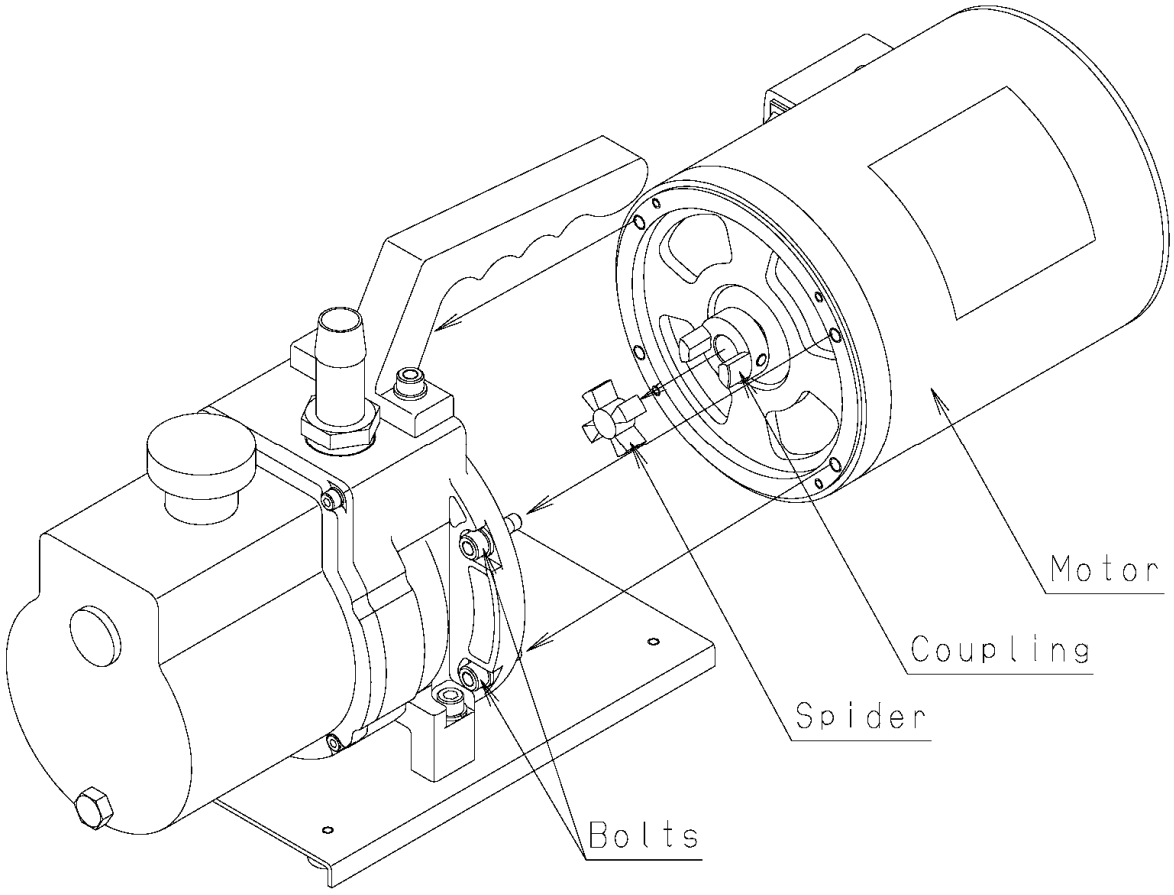


Fig-9 Replacement of Spider in Coupling

6.5 Trouble Check List

Table-3 Trouble Check List

Trouble	Cause	Procedure	Note
No rotating pump	① No connecting power	① Connect power cord	3.4
	② Power switch off	② Turn on power switch	4.2
	③ Abnormal input voltage	③ Adjust input voltage within ±10%	3.5
	④ Overload relay operated	④ Reset button switch	
	⑤ Inferior motor	⑤ Replace motor	4.5
	⑥ High oil viscosity at low temperature	⑥ Warm atmosphere above +7℃	6.2
	⑦ Sticking the rotor by coming different objects into the pump	⑦ Overhaul and repair (change cylinder or rotor)	6.2
	⑧ Generating rust inside the pump by evacuating water vapor or solvent	⑧ Overhaul and repair (change cylinder or rotor)	
	⑨ After evacuating reactive gases, reacted materials deposited inside the pump	⑨ Overhaul and repair (clean and eliminate any reacted materials inside the pump)	
	⑩ Internal parts damaged	⑩ Overhaul and repair (change the parts)	
Irregular rotation of the pump	①Abnormal input voltage	①Adjust input voltage within ±10%	3.5
	②Inferior wire connect ion to the pump	②Connect wire again to the pump	3.4
	③High oil viscosity at low temperature	③Warm atmosphere above +7℃	4.5
	④Coming different objects into the pump	④Eliminate different objects then overhaul and repair the pump	
No pressure reduction	① Low pumping capacity for vacuum vessel volume	① Re-select the pumping capacity	5.2
	② Vacuum pressure measuring is not correct	② Measure the vacuum pressure correctly	5.1
	③ Inadequate applying vacuum gauge	③ Apply the corrected vacuum gauge adapted to measuring pressure range	
	④ Small diameter and long suction tubing	④ Connect same diameter tubing with inlet port(suction) and short distance to the vacuum vessel	5.1
	⑤ Clogged the different objects on the mesh filter inside the inlet port	⑤ Disconnect the suction tubing, clean the mesh filter	6.2
	⑥ Insufficient quantity of the oil	⑥ Fill the oil up to the specified quantity	3.2
	⑦ Oil deteriorated	⑦ Change the oil	6.3

Trouble	Cause	Procedure	Note
	⑧ Leakage from the tube connection with the pump	⑧ Detect leakage by the leak detector, and stop leakage	
	⑨ Applying no specified oil	⑨ Charge specified oil after overhauling or repairing	6.3
	⑩ No circulating oil. Clogging the oil aperture of the pump cover	⑩ Overhauling and repairing, clean the oil aperture	
Unusual sound	① Abnormal input voltage	① Adjust input voltage within ±10%	3.5
	② Inferior motor	② Replace motor	
	③ Coming different objects into the pump	③ Eliminate different objects then overhaul and repair the pump	
	④ Insufficient quantity of the oil	④ Fill the oil up to the specified quantity	3.2
	⑤ broken the spider of coupling	⑤ Change the spider of coupling	6.4
	⑥ No circulating oil. Clogging oil aperture of the pump cover	⑥ Overhauling and repairing, clean the oil aperture	
	⑦ Internal parts damaged	⑦ Overhauling and repairing (Replace parts)	
Abnormal high temperature on the pump surface R.T > +50 ℃	① Continuous operating at high suction pressure	① Temperature of the pump surface will be 80℃ during continuous operation, but no problem happened	
	② Insufficient quantity of the oil(Oil shortage, low cooling effect)	② Fill the oil up to the specified quantity	3.2
	③ High temperature evacuating gases	③ Set the gas cooling unit on suction side	
	④ No circulating oil. Clogging the oil aperture of the pump cover	④ Overhauling and repairing, clean the pump aperture	
Oil spouting from exhaust port	① Too sufficient oil quantity for the specified level	① Drain the oil to the specified level	3.2
	② Continuous operating at igh suction pressure	② Set oil mist-trap on exhaust side	4.6
Oil leak out of the pump	① O-rings or oil seals of the case or the cover	① Inspect and replace o-ring or oil seals	6.2

7. Product Disposal

When disposing the pump, check and dispose the pump in accordance with laws and regulations by the local administration.

CAUTION

①When evacuating toxic gases which present hazardous situations to the human body entrust the pump should be disposed with authorized professional specialist.

②For 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

Table-4 G-20DA Maintenence Parts List

Product name	No.	Parts name	Q'ty
G-20DA Maintenance kit	4	1st vane	2
	5	Vane spring	3
	8	2nd vane	2
	10	Outlet valve	3
	14	Oil level gauge	1
	20	Spider	1
	32	Oil seal_HTC-11-25-7	1
	33	Oil seal_SC-12-25-7	1
	34	O-ring_S-15	1
	35	O-ring_S-29	1
	36	O-ring_S-120.9	1
	37	O-ring_P-8	1
	38	O-ring_P-18	1

Table-5 G-25SA Maintenence Parts List

Product name	No.	Parts name	Q'ty
G-25SA Maintenance kit	4	Vane	2
	5	Vane spring	2
	7	Outlet valve	2
	11	Oil level gauge	1
	17	Spider	1
	6・29	Side cover with Bearing	1
	30	Oil seal_HTC-11-25-7	1
	31	Oil seal_SC-12-25-7	1
	32	O-ring_S-15	1
	33	O-ring_S-29	1
	34	O-ring_S-120.9	1
	35	O-ring_P-8	1
	36	O-ring_P-18	1

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

Table-6 G-50DA Maintenence Parts List

Product name	No.	Parts name	Q'ty
G-50DA Maintenance kit	4	1st vane	2
	5	Vane spring	3
	8	2nd vane	2
	10	Outlet valve	4
	14	Oil level gauge	1
	20	Spider	1
	32	Oil seal_HTC-11-25-7	1
	33	Oil seal_SC-12-25-7	1
	34	O-ring_S-15	1
	35	O-ring_S-29	1
	36	O-ring_S-120.9	1
	37	O-ring_P-8	1
	38	O-ring_P-18	1

Table-7 G-50SA Maintenence Parts List

Product name	No.	Parts name	Q'ty
G-50SA Maintenance kit	4	Vane	2
	5	Vane spring	2
	7	Outlet valve	3
	8	Outlet valve spring	3
	23	Oil level gauge	1
	29	Spider	1
	41	Bearing_6900	1
	42	Oil seal_HTC-11-25-7	1
	43	Oil seal_SC-12-25-7	1
	44	Oil seal_VC-10-20-4	1
	45	O-ring_S-4	1
	46	O-ring_S-15	1
	47	O-ring_S-18	2
	48	O-ring_S-29	1
	49	O-ring_S-120.9	1
	50	O-ring_P-8	1
	51	O-ring_P-18	1

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

8.2 Disassembly Drawing

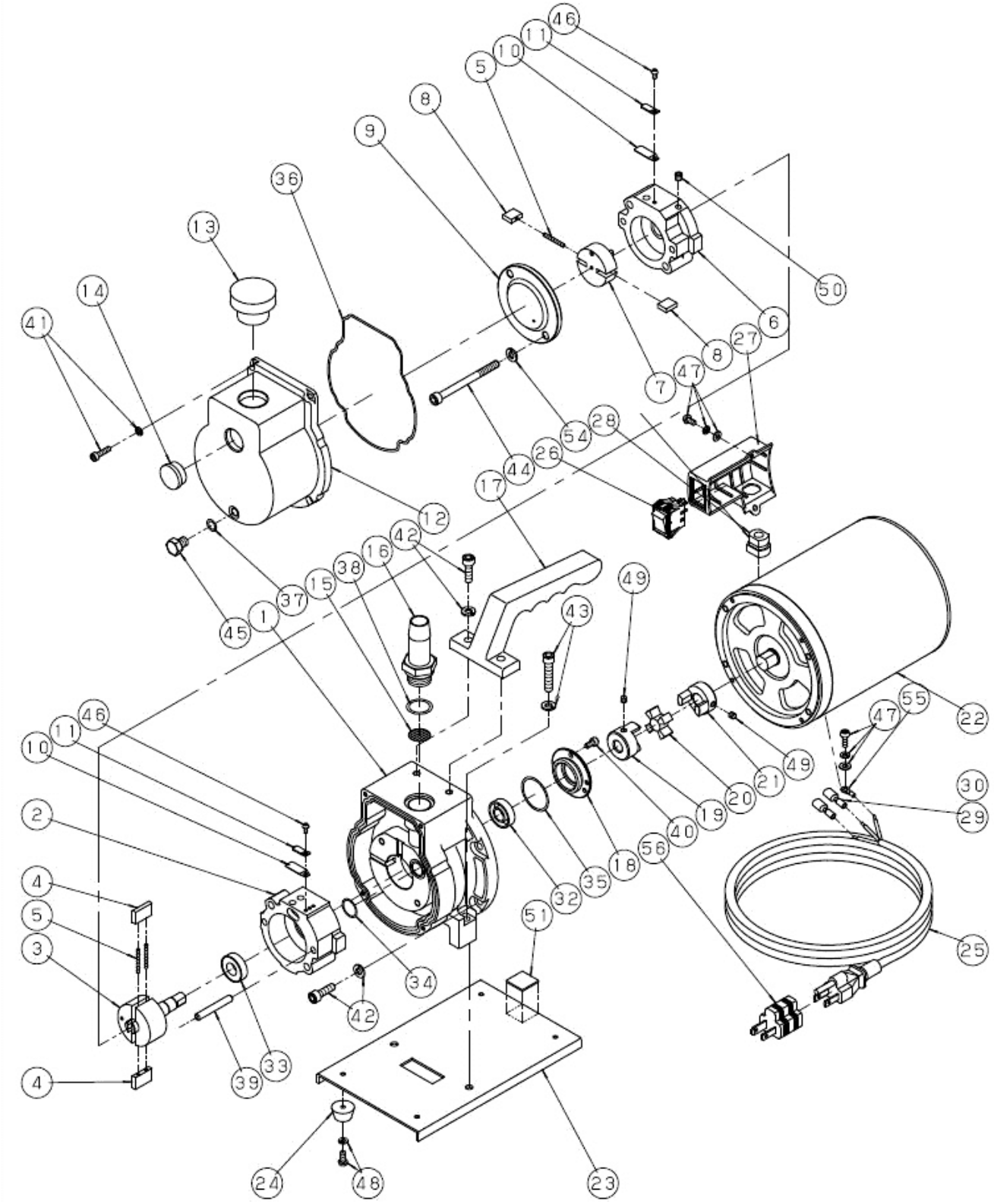


Fig-10 Disassembly Drawing of G-20DA

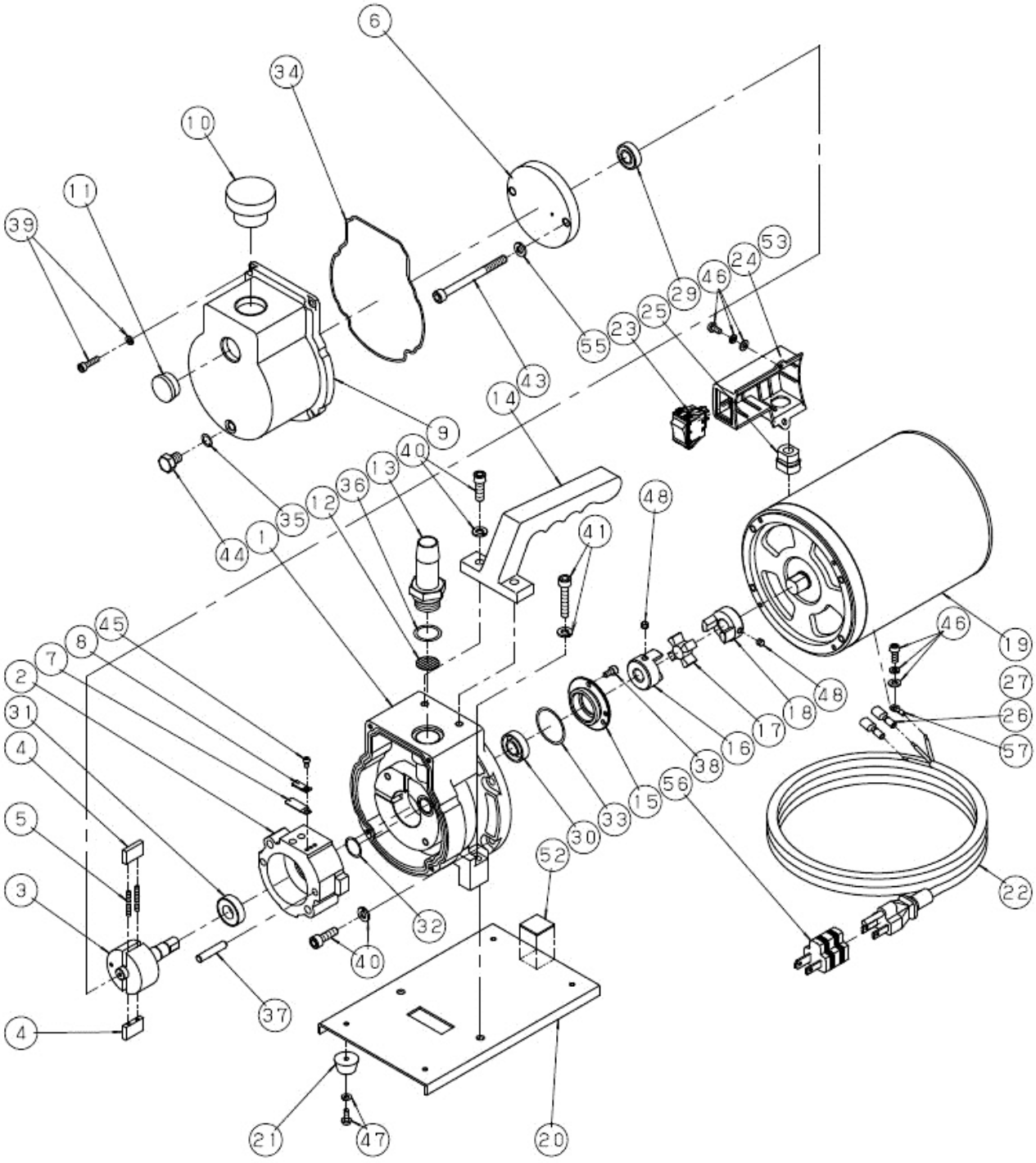


Fig-11 Disassembly Drawing of G-25SA

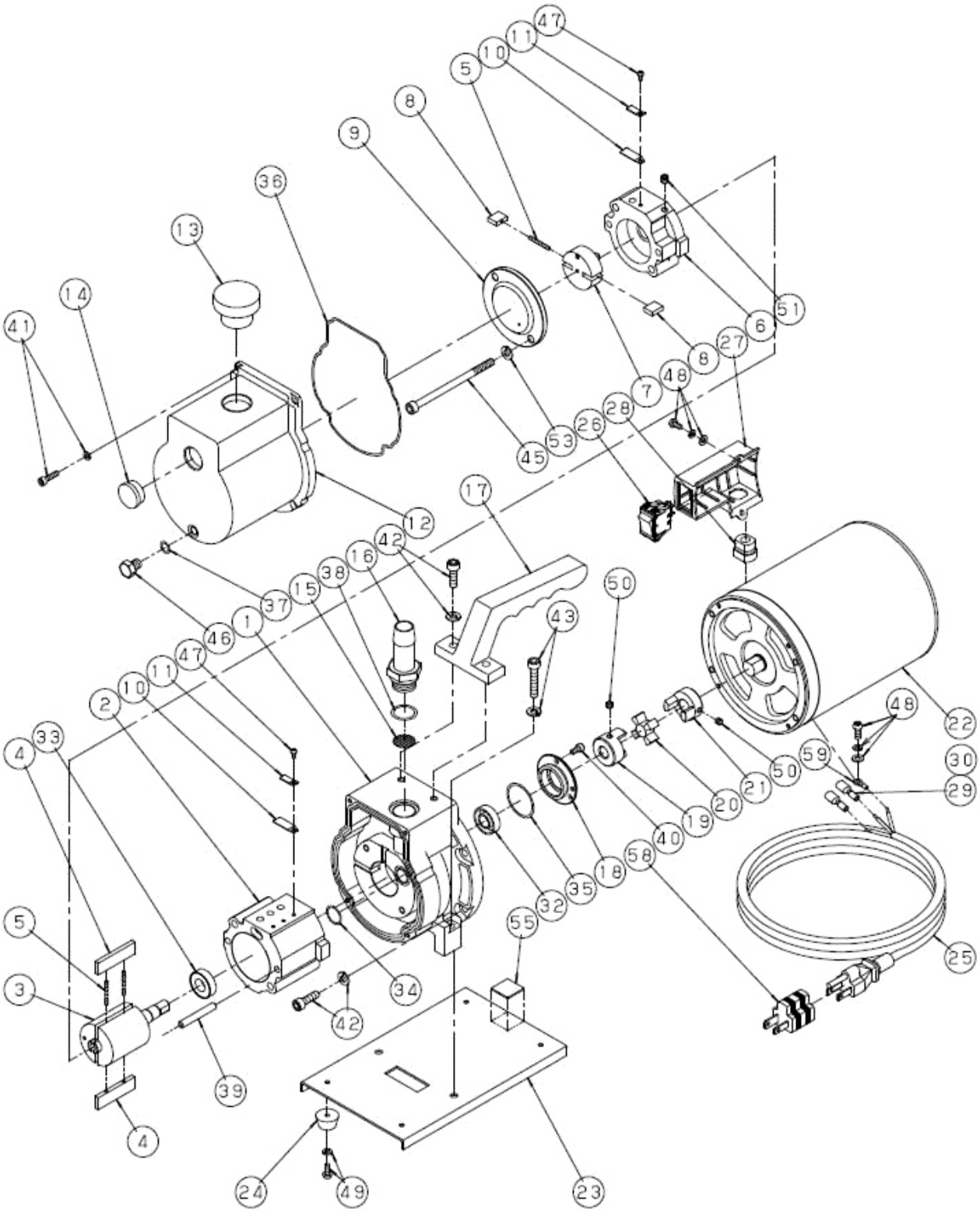


Fig-12 Disassembly Drawing of G-50DA

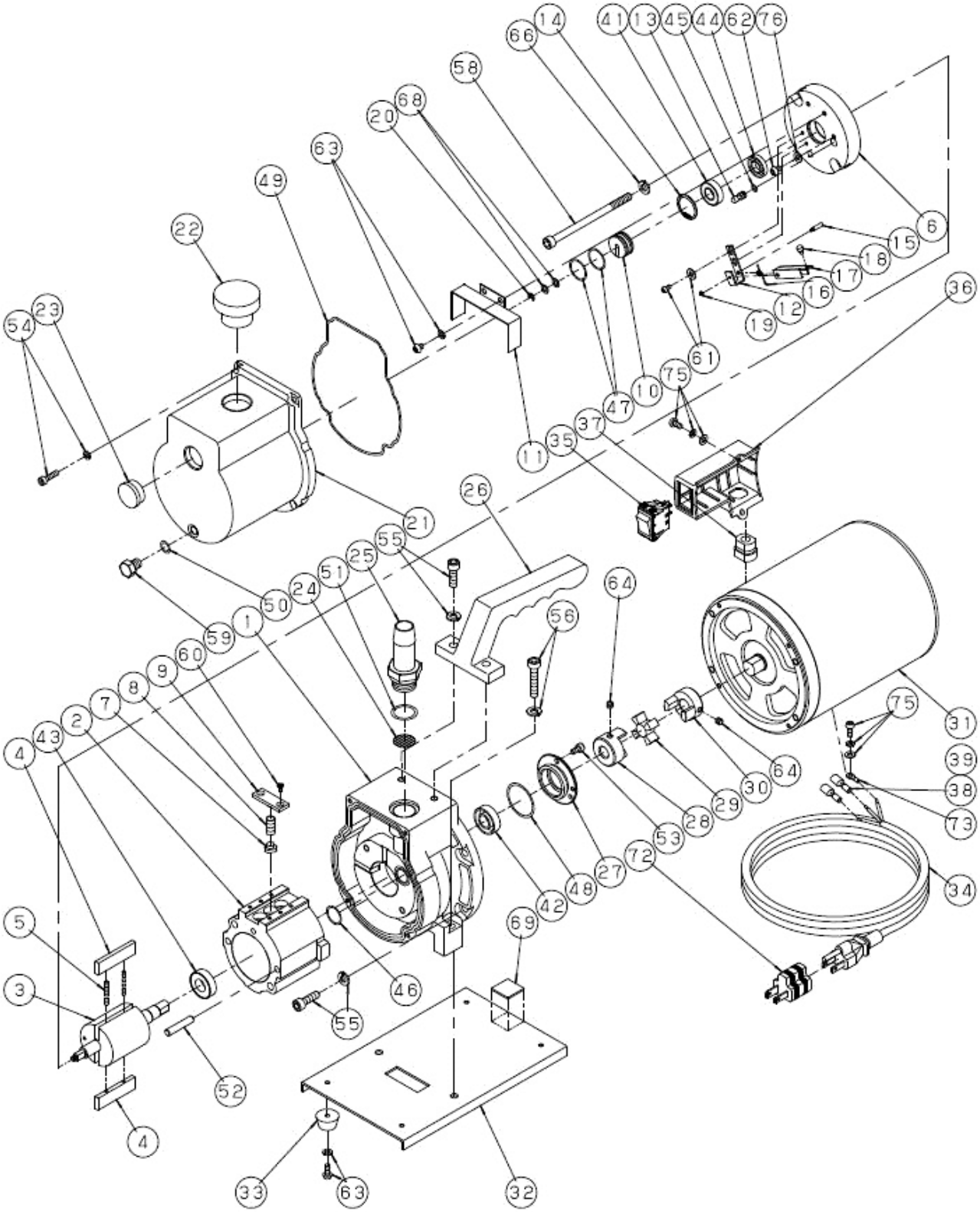


Fig-13 Disassembly Drawing of G-50SA

Warranty

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

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

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

Normal usage conditions refer to the following:

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

b) Operation in accordance with the user manual

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

a) Malfunctions due to a natural disaster or fire.

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

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

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

e) Malfunctions caused by noise (electric disturbance).

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

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

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

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

j) Malfunctions due to the replacement of consumables.

(4) Disclaimer

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

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

Usage Status Check Sheet (for use in Instruction Manual)

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

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

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

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

(2) Whether there is unusual smell Yes No

(3) Type and Name of Gas:_____

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

2. Usage Status

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

□ Continuous Operation □ Intermittent Operation

Usage:_____

3. Failure Status □Unusual Noise □Abnormal Pressure □Abnormal Actuation □Oil Leakage Other

Symptoms:_____

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

5. Others:_____

Company Name: Personnel in charge:

Address:

Tel: Fax: E-mail:

Agent Name; Personnel in charge:

Address:

Tel: Fax:

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

6. Confirmation

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

Signed_____(seal) Date: _____

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