
INSTRUCTION MANUAL

OIL SEALED ROTARY VACUUM PUMP

VS1501

VS2401

Before using this product, be sure to read this operation manual. Keep this manual with care to use at any time.

ULVAC, Inc.

Components Division

<http://www.ulvac.co.jp/>

0. Before Using This Product

We thank you very much for purchasing our product.

You are kindly requested, upon delivery of the product, to check that the delivered product is exactly what you have ordered and it has no damage caused by transport or the like.

This manual gives description on operation and maintenance procedure appropriate to use the product in safe and effective way. Please read this manual beforehand to correctly use the Pump.

You are requested to install and operate the product in compliance with the laws and regulations relating to the safety, e.g. Fire Defense Law, Electric wiring regulation and so on in the country and region you use the product. Consequently you shall be requested to attend general safety lectures officially effective in the area, such as electrical safety, Cargo handling safety and so on. Note that any person not attended such lectures shall be restricted from handling the product. Operators shall need to attend such kind of training and have special knowledge, skill and title regarding the electricity, machinery, cargo, vacuum and so on.

This product is designed to conform to regulations valid at the time of issue of this manual and its conformity is not ensured if any of regulations shall be changed in the future.

The performance and safety of the product might not be ensured if any of the devices put together did not conform to same regulations or the product itself was modified. ULVAC shall be not liable to guarantee performance and safety in such cases above. Any modification of the product by the user is out of the scope of guarantee by us and not be guaranteed in any manner.

Be sure to clear any energy sources, e.g. electricity, coolant and so on of the product before installing or removing the product.

Please note that any of the parts used in this product shall keep the performance at the time of the shipment but shall not survive eternally. Any of the parts cannot, under any application supposed under socially-accepted idea, help but inevitably deteriorate its performance and get easily result in causing trouble of the product. You are kindly requested consequently to take your application situation into consideration and help yourself to implement the protective maintenance so as to avoid troubles.

Through implementation of the protective maintenance, you shall reduce occurrence of the trouble due to wear and/or failure of the part and bring reducing the occurrence of the downtime caused by the product trouble and fire as well as a risk of affecting the another process.

We would like to ask you again to establish the protective maintenance plan as well as conduct the part replacement and overhaul in accordance with such a plan.

Please do not hesitate to contact our sales office or agency closest to you or the Components Division if you had any question or unclear on the use.

IMPORTANT

Author's copyright of this instruction manual belongs to Components Division of ULVAC, Inc.

It is prohibited to copy a part and/or this entire manual without authorization by Components Division of ULVAC, Inc.

It is prohibited to use this instruction manual except for explanation when using the VS1501, VS2401 and other purpose Components Division of ULVAC, Inc. agreed.

It is prohibited to hand over and disclose this instruction manual to third parties without agreement by Components Division of ULVAC, Inc.

0.1 Safety Symbol Marks

We display symbol marks regarding the safety in this manual and on the product to make clear items to observe. Descriptions attached to the symbol are classified as illustrated below;

0.2 Meanings of Safety Symbol Marks



If the user makes a mistake in handling, it indicates an imminent possibility that the user is subject to death or heavy injury.



If the user makes a mistake in handling, it indicates a possibility that the user is subject to death or heavy injury.



If the user makes a mistake in handling, it indicates a possibility that the user is subject to moderate injury or it leads to significant damage of the machine. It indicates a possibility that damage of the machine is caused and the normal operation is impaired.

IMPORTANT

[IMPORTANT] description shall be given where there is particular information to notice for the operation or maintenance work of the product.



Training for the electrical safety is required as there is a risk of electrical shock.



Check and ensure that the pump is sufficiently cooled down as this section keeps high temperature after having stopped the pump.

0.3 Safety Precautions

Descriptions are given as the method to keep away from danger and actions that must be restricted on the use of the product.

Use of this product and this Instruction Manual.

IMPORTANT

Please read this Instruction Manual before starting installation, operation check or maintenance of this product to use it in long term. You are requested to fully understand the safety precautions, specifications and operation methods of this product.



DANGER

Use of the toxic, combustible or combustion susceptible gas other than inactive gas is not allowed as there is a risk of leakage of the gas from the Pump unit if it was exhausted by the vacuum pump.



DANGER

Pump oil as well as the Pump unit becomes toxic should the toxic gas was sucked in the vacuum pump. Pay attention to execute maintenance work.



DANGER

Use of the toxic, combustible or combustion susceptible gas and substance other than inactive gas is not allowed as there is a risk of causing fire or explosion inside the Pump unit if it was exhausted by the vacuum pump.



WARNING

We would be obliged to refrain from handling and/or executing maintenance of the product if the detail of used hazardous substance was not disclosed or the product has exhausted such substance that the detoxification process is hardly conducted.

**WARNING**

You are kindly requested to acknowledge that specifications and/or price of the product and description of the Instruction Manual are subject to change without prior notice for improvement.

Any change shall update the version number at the top right of the Instruction Manual cover and issue the revised version.

If you need the latest manual, please feel free to contact our Components Division.

**WARNING**

This Instruction Manual shall absolutely need to be delivered to the last user that uses the product.

**WARNING**

To export this product abroad, you have to clear the examination in accordance with the Foreign Exchange law, Foreign Trade law and relevant decree, ordinance and order.

Please feel free to contact our sales office or agency closest to you or our Components Division.

**CAUTION**

Any part of this Instruction Manual shall be in no manner reproduced for the third party without our approval.

Installation and storage

This product is packed with the wooden frame. Please ask the special agency for dismantling it.

Advise the dismantling agent to wear leather gloves and use appropriate tools such as pinch bar as they have a risk of cutting the hand by nail or chip.



Give the instruction them further to use the unloading machinery such as crane to take out the product of the wooded frame, lift it up with its top eyebolt and transfer it on lifting. Check the eyebolt whether it has no error before use.

Only the technically entitled person should be in charge of conducting the unloading operation and operating the unloading machinery.

There is a risk that the Pump might drop or lay down when attempted unreasonable operation or machinery setup was not sufficient. You are strictly restricted to enter beneath the Pump.

Advise the dismantling agent to wear leather gloves and use appropriate tools such as pinch bar as they have a risk of cutting the hand by nail or chip.

Transfer

You have a risk of giving damage to your back as the load larger than safety standard shall be required to transfer the product.



VS1501 : 232kg

VS2401 : 271kg

Be sure to use the loading machinery (such as mobile crane) to lift up the Pump or load it on the pallet and fix it with Jack and run the Pallet truck for its transfer.

Countermeasure to the earthquake



There is a risk that the Pump lays down or slides and breaks peripheral units if it was not correctly fixed. Be sure to give allowances to the vacuum piping, coolant piping, and electric cables so that they absorber vibrations to prevent them from breaking and/or dismantling.

Inlet piping <Mounting>



Check and ensure that any of hazardous energy is blocked before starting the operation.

Coolant piping <Mounting>



Check and ensure that any of hazardous energy is blocked before starting the operation.

Power Supply wiring <Mounting>

Check and ensure that any of hazardous energy is blocked before starting the operation.

Entitled staff should conduct the wiring operation. Erroneous wiring work might cause a fire.

Conduct the wiring operation correctly in compliance with laws and rules concerning the safety (e.g. Fire Defense Law, Electric Equipment Technology standard, Internal line cord) in the country and region you use the product.



Ensure to have a correct grounding. You are recommended further to install a dedicated Leak breaker. You have a risk of getting electrical shock in case of failure or electric leakage.

It is imperative to put the Overload protection device. Otherwise it would cause the motor burn out and/or fire.

Wire size, please determined by considering the voltage drop of the wire. Typically, the voltage drop, please to be within 2% of the rated voltage of the motor.

Voltage drop calculation:

$$\sqrt{3} \times \text{wire resistance } (\Omega / \text{km}) \times \text{Wiring length (m)} \times \text{motor rated current (A)} \times 10^{-3}$$

※ motor rated current, refer to "Table 2".

Operation



Do not run the Pump on blocking the exhaust outlet or putting any device that might hamper gas passage onto the outlet. There is a risk that the pressure inside the Vacuum pump rises up to cause break or oil leak of the casing or Oil level gauge resulting in overload of the motor.

This product is not made as the withstand pressure structure. Ensured pressure value of the Pump shall be 0.03MPaG (0.3kg/cm²G) (Gauge pressure).

Be sure to turn OFF the Power Supply to execute check and repair. You have a risk of getting electrical shock or injury by accidental sudden move.

Person other than Repair technician should not be in charge of dismantling, repairing or remodeling the product.



WARNING

You have a risk of getting injured or electrical shock by a fire or erroneous move.

Do not touch the Motor, vacuum pump or piping during the pump operation and just after stopped it while the pump unit keeps high temperature. You have a risk of getting burned.

Should you found any malfunction or error, just turn OFF the Power Supply to prevent accident and ask the agency or closest Service Center for check and repair.

Do not attempt to put your hand or article in the opening of the motor; you have a risk of getting electrical shock, injury or causing a fire.



CAUTION

Do not touch any rotary section such as the motor, main spindle or spindle joint during operation of the Vacuum pump; it shall bring in injuries.

Strictly refrain from putting any combustible substance in and around 1m of the motor and Vacuum pump; there is a risk of getting a fire.

Do not put a wall or obstacle in and around 0.3m of the air outlet of the motor (Motor edge face). You have a risk of getting burned or fire caused by over heat.



CAUTION

Be sure to lubricate the machine.

If the lubrication oil came down lower than limit level during operation, it might give damage on the bearing, gear and shaft sealing and result in leak, noise, motor overload and operation stop.

Ensure to flow the Coolant during operation. Required Coolant volumes shall be;



CAUTION

Coolant volume VS1501 : 4~6 L/min

VS2401 : 5~7 L/min

Water pressure: 0.5 MPaG (Gauge pressure)

Outlet/inlet differential pressure: 0.1MPaG (Gauge pressure) or more

Coolant temperature : 5° C ~ 30° C

The water included little impurities (ex. Industrial Water) is recommended for cooling water.



CAUTION

Depending on the water quality, the inside wall of cooling water tube is covered with water scale (CaCO₃ etc.) and cooling water flow rate may be decreased. Cooling water tube is corroded by Chlorine ion (Cl⁻) and cooling water leak may be caused. In case of using pure water, cooling water leak may be caused by metal component dissolution, too.

In these cases, the repair service may be for a fee.

[Reference] Standard Water Quality of Industrial Water

Turbidity mg/L	pH -	Alkalinity CaCO ₃ mg/L	Hardness Mg, CaCO ₃ mg/L	Evaporation residue mg/L	Chlorine ion Cl ⁻ mg/L	Iron Fe mg/L	Manganese Mn mg/L
20 max.	6.5-8.0	75 max.	120 max.	250 max.	80 max.	0.3 max.	0.2 max.

Establishment: Japan Industrial Water Association



WARNING

Do not operate the Pump in hazardous area (where there is a risk of creating hazardous atmosphere by explosive gas). It might cause injury and/or fire.

Power Supply wiring <Dismantling>



Be sure to cut off the electricity before starting install or dismantling operation.

Coolant piping <Dismantling>



Should you remove the Coolant joint immediately after having stopped the Pump, there is a risk that the coolant remained inside the Pump comes to a boil and jets out. Keep flowing the Coolant as far as the Pump temperature cools down.

The Pump is and remains very hot during and while after having stopped operation. You have a risk of getting burned if a part of the body touched it. Keep flowing the Coolant as far as the Pump temperature cools down.

Use a flow meter (HWFM: for example Flow sight) applicable to visually check the Coolant supply source that no water is flowing.

Inlet piping <Dismantling>



Take off the piping following the Install Manual of the system.

The Inlet piping remains very hot while after having stopped the Pump. Be sure to take it off after the Pump has sufficiently cooled down.

Make airtight completely the Pump exhaust outlet with a blank flange.

Transfer



You have a risk of giving damage to your back as the load larger than safety standard shall be required to transfer the product.

VS1501 : 232kg





VS2401 : 271kg

Be sure to use the loading machinery (such as mobile crane) to lift up the Pump or load it on the pallet and fix it with Jack and run the Pallet truck for its transfer.

0.4 Types and Descriptions of Warning Labels Displayed on This Machine and Displayed Positions

Warning labels are attached on the warning locations in this system.

Be sure to check them before starting operation of the Pump.

1		<p>Before use, read through the instruction manual and fully understand its contents.</p>
2		<ul style="list-style-type: none"> • You may get an electric shock in the area around a portion with this warning label. Before maintenance or wiring, be sure to turn off the primary power supply. • Be sure to close the lid of the terminal box before operating this unit. Never open it during operation.
3		<p>During operation or for a while after operation stops, do not touch the unit as each portion is at a very high temperature.</p> <ul style="list-style-type: none"> - If a human body touches the unit, it may get burned.
4		<ul style="list-style-type: none"> • This product is not made as the withstand pressure structure. Ensured pressure value of the Pump shall be 0.03MPaG (0.3kg/cm²G) (Gauge pressure). • Do not run the Pump on blocking the Exhaust outlet or putting any device that might hamper gas passage onto the outlet. There is a risk that the pressure inside the vacuum pump rises up to cause break the casing or Oil level gauge resulting in overload of the motor. • Following gases cannot be evacuated because these gases may cause the pump inner pressure to increase due to internal combustion. <ol style="list-style-type: none"> 1) explosive gas 2) flammable gas 3) gas which increases the susceptibility of substances to burn. <p>Long term storage of the Vacuum pump without operation might possibly cause trouble in operation caused by rust if you kept the Pump long time without operating it, ask a closest Service Center for the check.</p> <p>Indoor Use Only Mount at least 100mm from side walls.</p>
5	<p style="text-align: center;">— 警告(WARNING) —</p> <p>工厂出荷設定(INITIAL FACTORY SETTING/工場出荷時設定): 200-240V 50/60Hz</p> <p>在其他电压场合使用时, 必须改变接线方式, 同时请参照说明书 TERMINAL BOX INTERNAL WIRING NEEDS TO BE CHANGED FOR OTHER VOLTAGE OPERATION AND SEE INSTRUCTION MANUAL</p> <p>他の電圧で使用される場合は、お客様にて端子箱内結線 を切り替えてください。取扱説明書参照</p>	<p>Before wiring, please confirm the power-supply voltage you use.</p> <p>Please confirm the power-supply voltage you'll use and change crossline in the terminal box. Refer to “3.5 Electrical Connection”.</p>

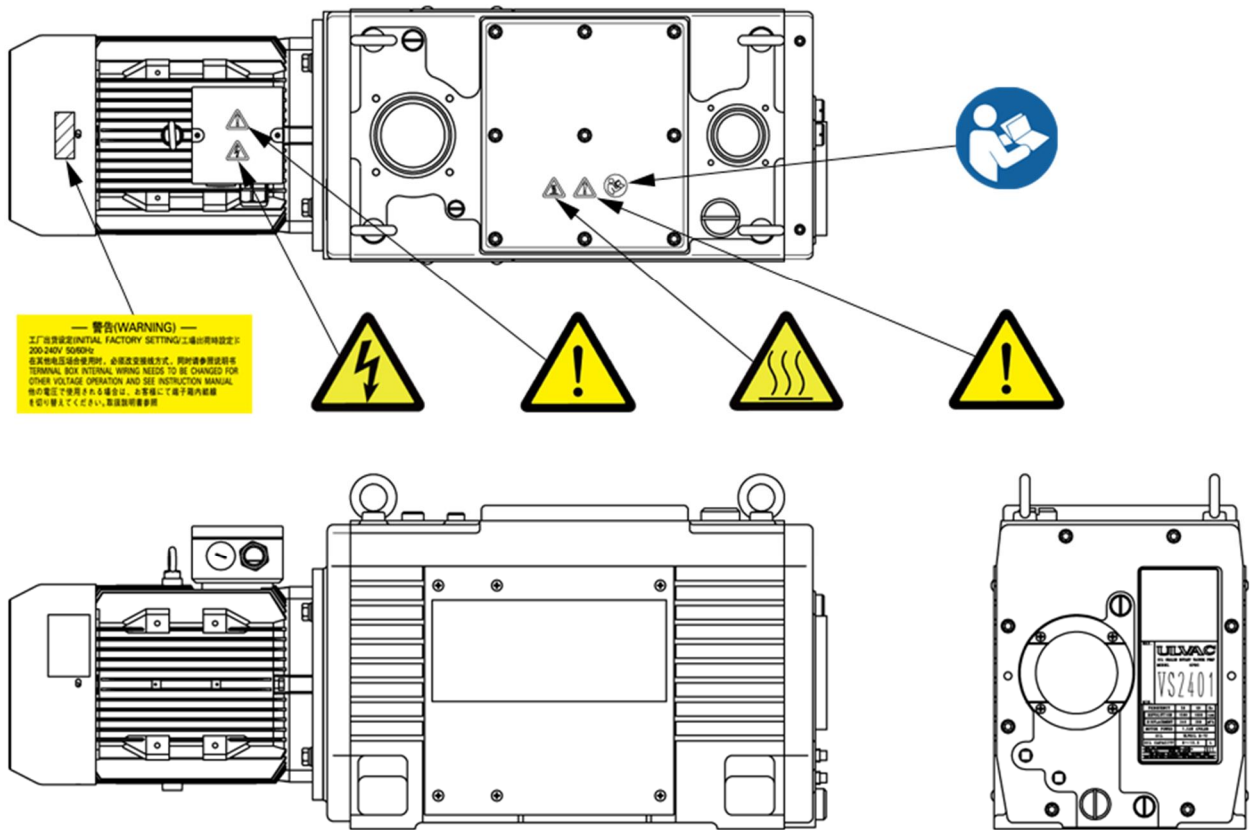


Fig. 1 Warning Label display position

0.5 Acceptance and Storage of The Pump

0.5.1 Unpacking/Acceptance of The Pump



This product is packed with the wooden frame. Please ask the special agency for dismantling it.

Advise the dismantling agent to wear leather gloves and use appropriate tools such as pinch bar as they have a risk of cutting the hand by nail or chip.

Give the instruction them further to use the unloading machinery such as crane to take out the product of the wooded frame, lift it up with its top eyebolt and transfer it on lifting. Check the eyebolt whether it has no error before use.

Only the technically entitled person should be in charge of conducting the unloading operation and operating the unloading machinery.

There is a risk that the Pump might drop or lay down when attempted unreasonable operation or machinery setup was not sufficient. You are strictly restricted to enter beneath the Pump.

Advise the dismantling agent to wear leather gloves and use appropriate tools such as pinch bar as they have a risk of cutting the hand by nail or chip.

Upon delivery of the product, check first that the delivered is exactly what you have ordered and there is no break or damage through transport or the like. Claim after use of the product might be resolved with a charge.

Although we pay full attention on shipping, you are kindly requested to check the following upon unpacked the product.

IMPORTANT

Whether the delivered is exactly the one you have ordered.

Whether accessories (Pump oil for one lubrication, optional parts) are attached or not.

Whether there is no break or damage through transport or not.

Whether any bolt or nut got loose or taken off through transport or not.

Should you found any trouble, please do not hesitate to contact our Sales division or your agency.

Table. 1 standard accessories

Oil one time portion	ULVOIL R-72	1 set	For the consumed amount, refer to the specification table.
Quick Start Manual		1 copy	—

0.5.2 Transfer

You have a risk of giving damage to your back as the load larger than safety standard shall be required to transfer the product.



VS1501 : 232kg

VS2401 : 271kg

Be sure to use the loading machinery (such as mobile crane) to lift up the Pump or load it on the pallet and fix it with Jack and run the Pallet truck for its transfer.

0.5.3 Ambient Condition for Storage, Install and Operation

As precise clearances are provided with this machine, be sure to fulfill the following for its storage, install and operation;

- (1) Ambient temperature and humidity for storage : -30°C to 60°C, less than 95%RH
- (2) Ambient temperature and humidity for operation : 10°C to 40°C, less than 80%RH
- (3) Height (for both storage and operation) : Lower than el. 1,000m.
- (4) External vibration (for both storage and operation) : Vibration acceleration less than 114dB (0.5G)
- (5) Miscellaneous (for both storage and operation) :
 - a. There shall be no corrosion behavior or explosive gas.
 - b. There shall be no freeze or dew formation.
 - c. There shall be no dust.
 - d. It shall be in house.
 - e. Another pump shall not be put on the Pump.
The Pump shall not be laid down nor put touching its motor edge face or oil gauge edge face with the ground.
 - f. There shall be no direct sun beam.
 - g. Heat source shall be put away from the Pump.

Do not give the Pump a shock or lay it down. It might impair the Pump operation.



Strictly refrain from putting any combustible substance in and around 1m of the motor and Vacuum pump; there is a risk of getting a fire.

**Do not put a wall or obstacle in and around 0.1m of the air inlet of the motor (Motor edge face).
You have a risk of getting burned or fire caused by over heat.**

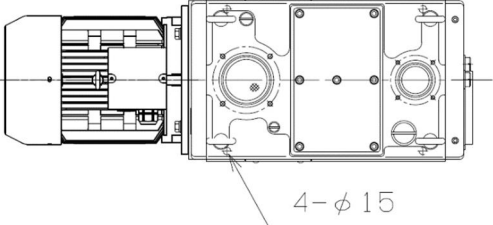
Indoor use only

Install the machine horizontal to a place where there are less dust and humidity.

In case you fix the Pump to floor, fix the Pump to the floor with bolts at four places.

Fix the Pump horizontally so that there is not a wobble.

Refer to “3.1 Storage/ Installation”, too.

Model	Foot print	Bolt	Anti-vibration Rubber mount
VS1501 VS2401	 <p>The Pump has four holes. The Pump is fixed with four bolts.</p>	More than “M12 x 40mm”	Kurashiki Kako., Ltd. Model: KLB-8030 (Recommended) * NOT included

The detail of the holes position: Refer to the Fig. 2,3

0.6 Protective Device

This machine is equipped with the Three-phase AC motor.

This motor is not equipped with the protective device. Put an overload protective device to connect through the motor with the Power Supply. It is imperative to put the overload protective device under direction of the Electrical Installation Technical Standard (1965, Department of Trade and Industry decree No. 61). Refer to “3. 6 Electric connection” to select the overload protective device. It is recommended to put together another protective device such as a leakage breaker.



**It is imperative to put the Overload protection device.
Otherwise it would cause the motor burn out and/or fire.**

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Request Form for Repair/Inspection of ULVAC Components /Certificate of Contamination
SERVICE CENTER

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1. For Your Safety Use


1.1 This Product Intrinsic Hazardous Nature and Safety Measures

Before operating or checking this machine, thoroughly read this paragraph, and after fully understanding about latent danger and on how to avoid danger, perform the work.


1.1.1 Danger Leakage of dangerous gas and dangerous materials

Factors	Avoidance methods and measures
<div style="text-align: center;">   </div> <p>Leakage of poisonous and combustible gas</p> <p>Getting injured on touching any toxic pump oil, pump, generated material or sucked substance at the occasion of check or disposal.</p>	<p>Do not exhaust any hazardous gas such as toxic and combustible.</p> <p>When you check the Pump, please wear a brace that supports the toxic substances that exhaust the Pump.</p> <p>To overhaul or dispose, ask the special agency to do the detoxification process.</p> <p>Ask the disposal agency licensed by the administration for disposal.</p>


1.1.2 Warning Transfer of heavy material

Factors	Avoidance methods and measures
<div style="text-align: center;">  </div> <p>Getting injured on transferring the pump.</p> <p>Pump weight</p> <p>VS1501 : 232kg</p> <p>VS2401 : 271kg</p>	<p>Only technically entitled person should be in charge of loading/unloading and operating machines.</p> <p>There is a risk that the Pump might drop or lay down when attempted unreasonable operation or machinery setup was not sufficient. You are strictly restricted from entering beneath the Pump.</p>


1.1.3 Warning Electric shock

Factors	Avoidance methods and measures
 <p>Getting electrical shock on touching the current-carrying part of the motor.</p>	<p>Be sure to cut the electricity to do electrical connection. Never fail to take the grounding.</p> <p>Never fail to take the earth connection.</p> <p>Ensure to close the cover of motor terminal box and never open it during operation.</p> <p>Be sure to cut the electricity to do checking or installation.</p> <p>Never attempt to put in the hand or bar into the opening of the Motor.</p>
<p>Motor terminal mount gets burnt.</p>	<p>Tighten close the terminal. Check the tightening once a month.</p> <p>(Refer to “3. 6 Electrical connection”)</p>


1.1.4 Warning Explosion

Factors	Avoidance methods and measures
 <p>Pressure inside the pump rises up and the pump explodes.</p>	<p>Ensured pressure value of the Pump is 0.03MPaG(0.3 kg/ cm²G) (Gauge pressure).</p> <p>Check the Exhaust side pressure of the Pump.</p> <p>If it was over 0.03 MPaG (0.3 kg/cm²G) (Gauge pressure) take away anything in and around the exhaust outlet that hampers gas passage.</p> <p>When utilizing the oil mist trap, perform the periodic maintenance so that no - resistance can be realized in passage of gas.</p>

1.1.5 Caution High temperature

Factors	Avoidance methods and measures
 <p>Getting burnt on touching the high temperature part.</p>	<p>The Pump gets high temperature during operation.</p> <p>Pump unit :70°C(during unloaded operation) :80°C (when used the Gas ballast)</p> <p>Motor :70°C</p>
	<p>As the surface temperature is high, you have a risk of getting burnt by accidentally touching it with the hand or the like. Refrain from touching the pump during operation. Wait until the temperature sufficiently cools down after having stopped the pump to conduct check or something.</p>
	<p>Do not touch the Pump unit or the Motor when operating the Gas ballast port.</p>

1.1.6 Caution Leakage of hot coolant

Factors	Avoidance methods and measures
 <p>Kept operating without supplying the Coolant. Boiled hot vapor jet out the Coolant outlet.</p>	<p>Put a Flow meter in the line to set the interlock so that the Pump stops when Coolant was blocked out.</p>
	<p>If you kept operating without supplying the water, immediately stop the Pump and keep away from it.</p>
	<p>Stop the Pump and ensure that the Pump temperature got cooled down to take out the Pump and check it.</p>

1.2 Chemical Material Safety Data Sheet (SDS)

IMPORTANT

Chemical material used for this Pump;

(1) ULVOIL R-72 (Standard)

(2) ULVOIL R-42 (For cold district in winter)

The Chemical Material Safety Data Sheet introduces the chemical material potential to use or touch on operating this machine. Please contact our Sales division if you are in need.

Read it with attention to acknowledge the toxic characteristics described on the SDS.

Please contact us separately if you want to use any chemical material (Vacuum pump oil) other than described on the

SDS is posted as referential to ensure safe operation of the hazardous and/or toxic chemical material.



Any person in charge of operating the Pump oil shall be requested to be responsible to cause means appropriate to actual operation of the machine referring to it.

Note that the SDS itself shall be never a safety certificate in any manner.

2. Pump Outline

2.1 Characteristics

VS series pumps are Rotary wing type (Goethe type) single stage vacuum pumps designed to apply

to such process like vacuum packaging, suction transfer, electronic device, thermal process and so on that use the vacuum.

This machine is equipped with functions as described below;

(1) Low noise, low vibration.

(2) Adopted Spring less vane.

It prevents the pump from stop by spring break.

(3) Adopted special cooling system and forced lubrication method.

This adoption ensures a stable discharge performance under high suction pressure. Further, optional additions (Oil mist trap , oil return from the Oil mist trap) shall enhance the stable exhaust performance under continuous discharge operation around atmospheric pressure.

(4) Adopted hydraulic oil anti-suck method.

If you stopped the Pump long time by a sudden blackout without returning the Suction line to the atmospheric pressure, the pump oil might flow back in the cylinder and cause trouble in restarting operation. This machine has equipped the Oil anti-suck to prevent the oil from flowing

back at maximum to decrease the load in restarting the pump.

(5) Adopted variable oil volume system.

This machine is equipped with a wider oil volume indicator so as to facilitate the oil volume control. Pump operation is available any time if the oil level was within the indicated oil volume range.

(6) Gas Ballast Function

This product is installed with the gas ballast function as standard. When using the gas ballast function depending on the application, the needle valve, the pipe and the like are connected to gas ballast port (G3/8).It is applicable to breathe in the condensed gas such as the steam and solution vapor.

Table. 2 Details model list

Model 1	Rev.	Naming
VS150	1	-
Model 1 VS150 : 150m ³ /h (50Hz) VS240 : 240m ³ /h (50Hz)		
Rev. 1 : Current Rev.		
Naming *1 - : Standard type R : Spec. R H : Spec. H		

- *1 There is not any naming for standard spec. Spec. R or H is selectable as option. Options for pump head and accessories are different depending on the type.
- *2 Multiple voltage motor is not available in the case of explosion-protection and flame-proof motor. Voltage needs to be specified.

【Spec. F】

- A SUS pipe is used for the cooling water flow path.
Depending on the type of gas to be exhausted, it may be liquefied by the compression process inside the pump,
- By choosing a cooling water pipe made of SUS, corrosion resistance is improved.

【Spec. H】

- Independent oil filling to oil seal
The Pump inside and atmospheric seal part are isolated each other by closing the connection pass between the Pump inside and shaft seal by mounting the oiler to the Pump. The Pump oil circulates through the connection pass in the case of the standard model.
- External leak test
It is inspected before shipment if helium leak rate from outside to the Pump is less than 10⁻⁶ Pa·m³/sec (helium leak test by hood test method). Leak rate will increase due to aging degradation of seal materials and so leak rate during use is not guaranteed.
- There is no gas ballast port. Refer to contents of “gas ballast port close” for performance described below.

2.2 Performance Specifications

Table. 3 Performance specifications

Model		VS1501	VS2401
Designed pumping speed m ³ /h(L/min)	50Hz	150(2500)	240(4000)
	60Hz	180(3000)	288(4800)
Ultimate pressure *1 Pa	GP Close *2	5.3	5.3
	GP Open *2	80	80
Motor	kW (Pole)	5.5 (4)	7.5 (4)
Revolution rpm	50Hz	1500	
	60Hz	1800	
Required oil level *3 L	MIN	8.0	
	MAX	10.5	
Coolant	Water volume L/min	4~6	5~7
	Water pressure MPaG (Gauge pressure)	0.5	
	Outlet/inlet differential pressure MPaG (Gauge pressure)	0.1	
	Temperature °C	5 ~ 30	
Weight	kg	232	271

*1) The ultimate pressure is the value indicated on the Pirani gauge when the standard oil (ULVOIL R-72) is used. The ultimate pressure when the McLeod gauge is used is approx. one digit lower than the value indicated on the Pirani gauge.

*2) GP close: When the gas ballast port is closed GP open : When the gas ballast is fully opened

*3) The type of rotary pump oil differs depending on vapor pressure, viscosity, etc. The use of a wrong type of oil can lower the pump performance. So use the pump oil recommended ULVAC. recommended type of oil: (1) ULVOIL R-72 (standard oil), (2) ULVOIL R-42 (oil for use in coldseason)

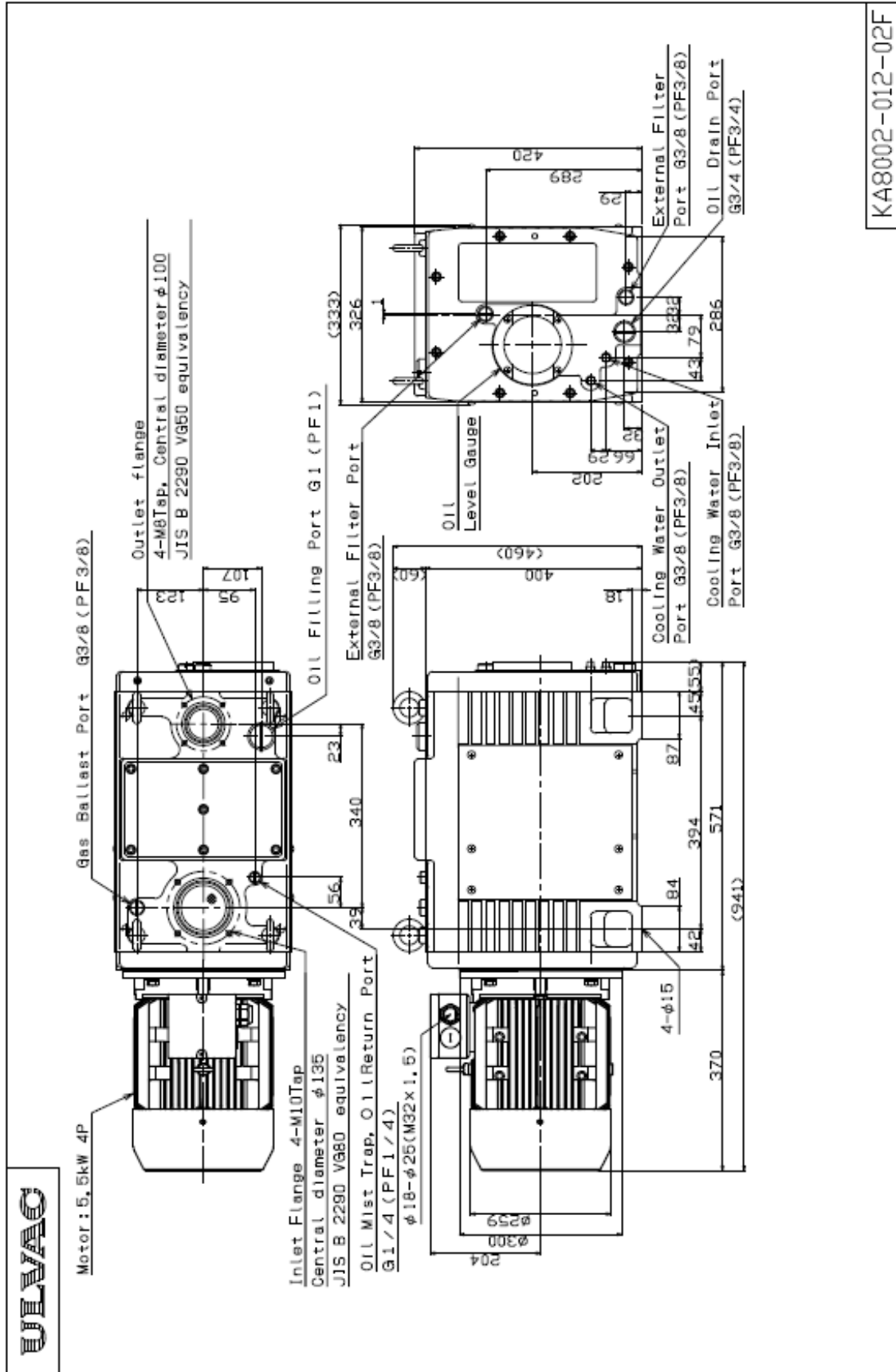
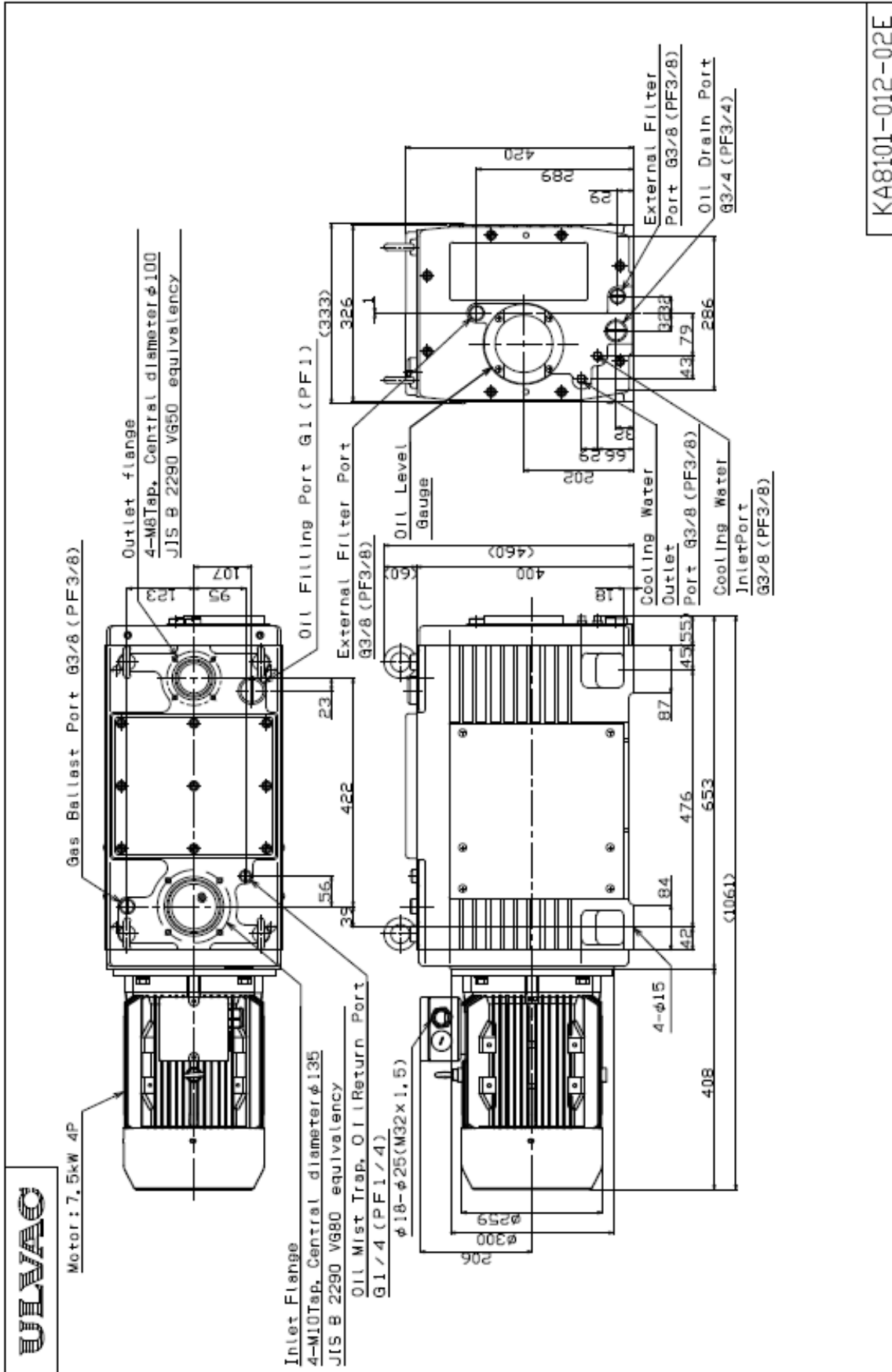


Fig. 2 VS1501 Dimensional drawing



KA8101-012-02E

Fig. 3 VS2401 Dimensional drawing

3. Mounting



WARNING

You are requested to install and operate the product in compliance with the laws and regulations relating to the safety, e.g. Fire Defense Law, Electric wiring regulation and so on in the country and region you use the product. Consequently you shall be requested to attend general safety lectures officially effective in the area, such as electrical safety, Cargo handling safety and so on. Note that any person not attended such lectures shall be restricted from handling the product.

Operators shall need to attend such kind of training and have special knowledge, skill and title regarding the electricity, machinery, cargo, vacuum and so on.

Be sure to clear any energy sources, e.g. electricity, coolant and so on of the product before installing or removing the product.

3.1 Storage/ Installation

Install the machine horizontal to a place where there are less dust and humidity. Make a layout taking into consideration of works such as setting, removal, check, cleaning and so on.

As for the environmental condition, please refer to “0.5.3 Ambient Condition for Storage, Install and Operation”



CAUTION

Operating the pump on laying it down or putting it reverse would give damage to the pump. Ensure to install the pump horizontal to the ground level as illustrated on the “Fig. 2, 3 VS Dimensional drawing”.

3.2 Lubrication

Remove the oil filling plug and fill the pump with oil until the oil level comes between the two level lines of the oil level gauge (MAX and MIN marks on the plate for the casted lines on the pump case: Refer to the “Fig. 4 Lubrication and water piping drawing”).

The pump is operable if the oil level is between the two level lines of the oil level gauge during operation.



Read “1. 2 Chemical Material Safety Data Sheet” previously before starting lubrication. Please obtain the latest version of Safety Data Sheet (SDS) from our Sales Department.

Wear protective gears such as rubber gloves, protective goggles and so on.

Should the oil touched to your hand are entered in your eye, immediately follow the emergency treatment described on the SDS.



The oil level comes down approximately 1cm when operated the Pump. Do not start the pump with the minimum level oil.



Ensure to use the vacuum pump oil designated by ULVAC. Operation using oil other than designated shall be out of our scope of guarantee as it might impair the pump performance and shorten the life cycle.

3.3 Water Piping

Take out the R3/8 plug on the Coolant inlet/outlet and put the joint (of nylon tube) for the water piping.

(Refer to the “Fig. 4 Lubrication and water piping drawing”.)



CAUTION

Be sure to flow the Coolant with the volume indicated on the Table 1 Performance specifications or more. The pump temperature would rise up if the water volume becomes less than specified particularly on high suction pressure operation and cause the pump failure. You are recommended to put a Flow meter for the Coolant and cause the interlock so that the Pump stops if the coolant flows less than specified volume.

When the operation stopped in winter, the water piping and Jacket have a risk of breaking by freeze-up of the water inside. Open the Coolant drain of the Jacket (Refer to Fig. 4) during operation stop to discharge the water inside by blowing in the pneumatic air through the water inlet.



CAUTION

The water included little impurities (ex. Industrial Water) is recommended for cooling water.

Depending on the water quality, the inside wall of cooling water tube is covered with water scale (CaCO_3 etc.) and cooling water flow rate may be decreased. Cooling water tube is corroded by Chlorine ion (Cl^-) and cooling water leak may be caused. In case of using pure water, cooling water leak may be caused by metal component dissolution, too.

In these cases, the repair service may be for a fee.

[Reference] Standard Water Quality of Industrial Water

Turbidity mg/L	pH -	Alkalinity CaCO_3 mg/L	Hardness Mg, CaCO_3 mg/L	Evaporation residue mg/L	Chlorine ion Cl^- mg/L	Iron Fe mg/L	Manganese Mn mg/L
20 max.	6.5-8.0	75 max.	120 max.	250 max.	80 max.	0.3 max.	0.2 max.

Establishment: Japan Industrial Water Association



The machine is designed not to cause any leakage under restricted condition and demonstrated by the Leak test. However, it still has a risk of leaking under any abnormal condition other than specified, for example abnormal water pressure rise. In such a case, the leakage shall remain unstopped unless the supply from the system stops. You should refrain from installing electrical equipment or wiring beneath the Pump and on the floor around the Pump.

We recommend you to put the Leak sensor on the floor beneath the Pump and engage it with the interlock system of the equipment. Close the Coolant supply valve (HWSV) immediately you noticed the leakage. Put the [Closed] tag onto the handle after having closed the valve.

Put a Flow meter (HWFM: for example Flow sight) applicable to visually check the flow onto the Coolant supply source to make it possible to check the flow.



If you use several pumps, be sure to connect the Coolant pipes parallel. Cooling capacity might come down if connected them serial and cause the failure.

You should put a filter at the front stage if you are obliged to use the water containing much impurity such like water stain, iron and the like.

Appropriate flow might not be ensured when the supply source and discharge outlet were apart or there was level difference in the piping (discharge outlet was elevated higher than the Pump). In such a case, cause a measure to ensure the flow volume, such as to change the piping layout, put a larger pipe or raise the supply pressure within the specification range.

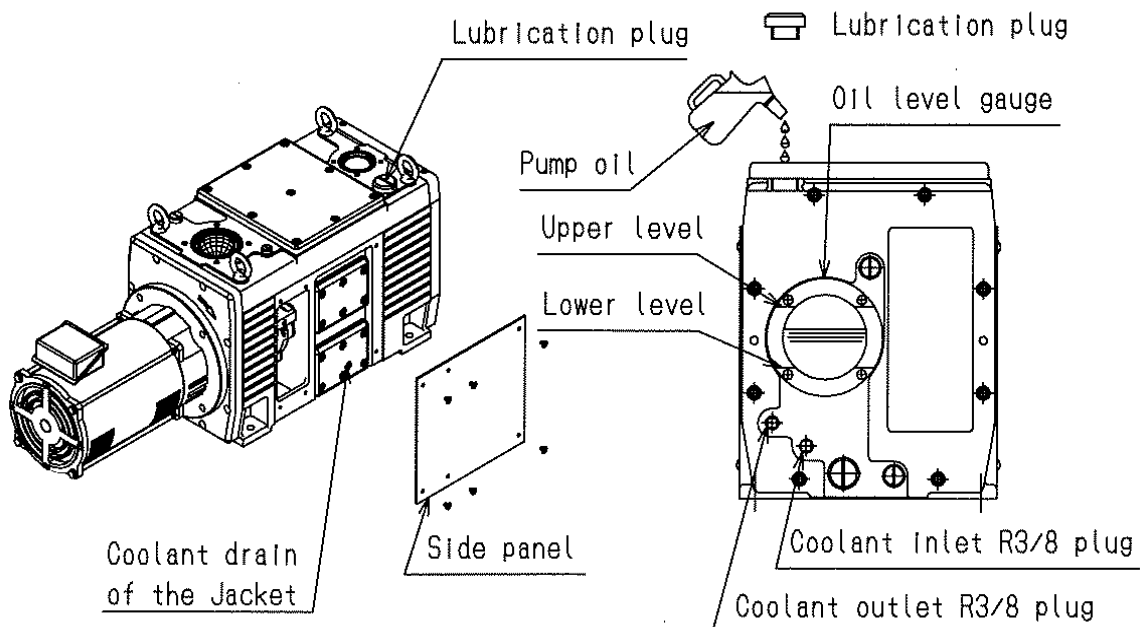


Fig. 4 Lubrication and water piping drawing

3.4 Inlet port Piping

Provide main valve, vacuum gauge and leak valve between the vacuum chamber and pump, as shown in Fig. 5. Use the flange for connection between the Pump Inlet and the piping.

MODEL	Flange at the pipe	
VS1501	VF80	JIS B 2290:1998 Vacuum technology-Flange dimensions; Attachment book (Reference)
VS2401		Flange dimensions for maintenance

Wash sufficiently inside the Vacuum chamber, pipes, Main valve and so on to connect them to the Pump. If dirty unit were connected, it would cause a trouble such like raise the ultimate pressure or extend the depression time to the specified pressure. Wear a pair of gloves to touch any vacuum section. Do not touch with the bare hand.

Pay a full attention to completely clear the welding scale and/or rust inside the pipe. If obliged to conduct a welding work close to or on the inlet, take a measure such as to remove the Pump unit or put a cover sheet on the inlet in order not to allow any foreign substance enter inside.

Should the Pump sucked the water or substance such as dust, powder and so on, it would impair the ultimate pressure and further cause a trouble. The Pump has a really slight clearance to keep rotation and easily gets impossible to rotate by any foreign substance entered inside.



CAUTION

Clear the sand completely after having sand blasted the vacuum chamber.

Pay attention not to give damage to the Flange sheet face, Gasket slot or gasket itself.

Metal mesh on the Suction inlet is put to keep foreign substances away from the Pump unit. Be sure not to take it off unless necessitated so to check it.

Use a pipe having bellows between the Vacuum chamber and inlet of the Mechanical Booster Pump so as to avoid any direct load to the Pump flange and not to transfer the Pump vibration to the Vacuum chamber.

Put the Main valve, Vacuum gauge and Leak valve between the Vacuum chamber and the Pump

You should put the Leak valve closer as possible to the Main valve in order to prevent the oil from rising up to the Vacuum chamber when the Pump stopped.

If you use it together with the mechanical booster pump, be sure to put the valve above the Pump.

3.5 Outlet port Piping

Use the flange for connection between the Pump Outlet and the piping.

It is recommended to provide an oil mist trap to reduce oil consumption and to trap oil mist.

MODEL	Flange at the pipe	
VS1501	VF50	JIS B 2290:1998 Vacuum technology-Flange dimensions; Attachment book (Reference)
VS2401		Flange dimensions for maintenance

Exhaust piping is classified mainly to following three types;

(1) Piping with the Oil mist trap

The Oil mist trap shall be put so as to prevent the oil mist from going out of the Exhaust outlet. It is imperative to put the Oil mist trap for the high suction pressure (10kPa – atmospheric pressure) continuous operation. Further it is also required to collect the oil pooled in the trap to decrease the oil consumption. (Refer to Fig. 2 and 3 Oil mist trap return port.)

Use the Tester to do cable check between the Oil mist trap unit (or the Exhaust outlet flange) and Grounding in the Motor terminal box of the Pump.

(2) Oil mist trap + Duct piping

In case where required to keep a cleaner room environment such as the Clean room, put the Oil mist trap and install the Duct from its outlet.

(3) Duct piping

Where required to keep the room environment as in (2) above, install the Duct. You should cause measures to avoid such problems as oil splash to the Duct piping and oil consumption on the high suction pressure continuous operation. Ensure to use the Duct made of electricity-conducting material.

Use of the toxic, combustible or combustion susceptible gas other than inactive gas is not allowed as there is a risk of leakage of the gas from the Pump unit if it was exhausted by the vacuum pump.

Use of the toxic, combustible or combustion susceptible gas and substance other than inactive gas is not allowed as there is a risk of causing fire or explosion inside the Pump unit if it was exhausted by the vacuum pump.

**DANGER**

It is not allowed to use any corrosive gas other than inactive gas as it might cause corrosion and/or give damage on pump parts when discharged through vacuum pump.

Be sure to use pipes made of metal (electricity-conducting material). Ensure also to take a grounding

If to exhaust any combustible, combustion susceptible or corrosive gas, be sure to use pipes made of high pressure withstanding and corrosion resistant metal. Ensure also to take a grounding.

In the case of the process flowing combustible gas/susceptibility of substances to burn gas, you are requested to introduce the diluent gas. Flow the diluent gas from the intake side so that the gas concentration to be exhausted becomes lower than the explosion limit.

**WARNING**

If the pipe connected to the outlet had a small diameter or attached foreign substance inside, it might raise the pressure inside the pipe and impair the Pump operation. A caution shall be required.

There is a risk that the pressure inside the Vacuum pump rises up to cause break or oil leak of the casing or Oil level gauge resulting in overload of the motor.

**CAUTION**

Pay attention not to give damage to the Flange sheet face, Gasket slot or gasket itself.

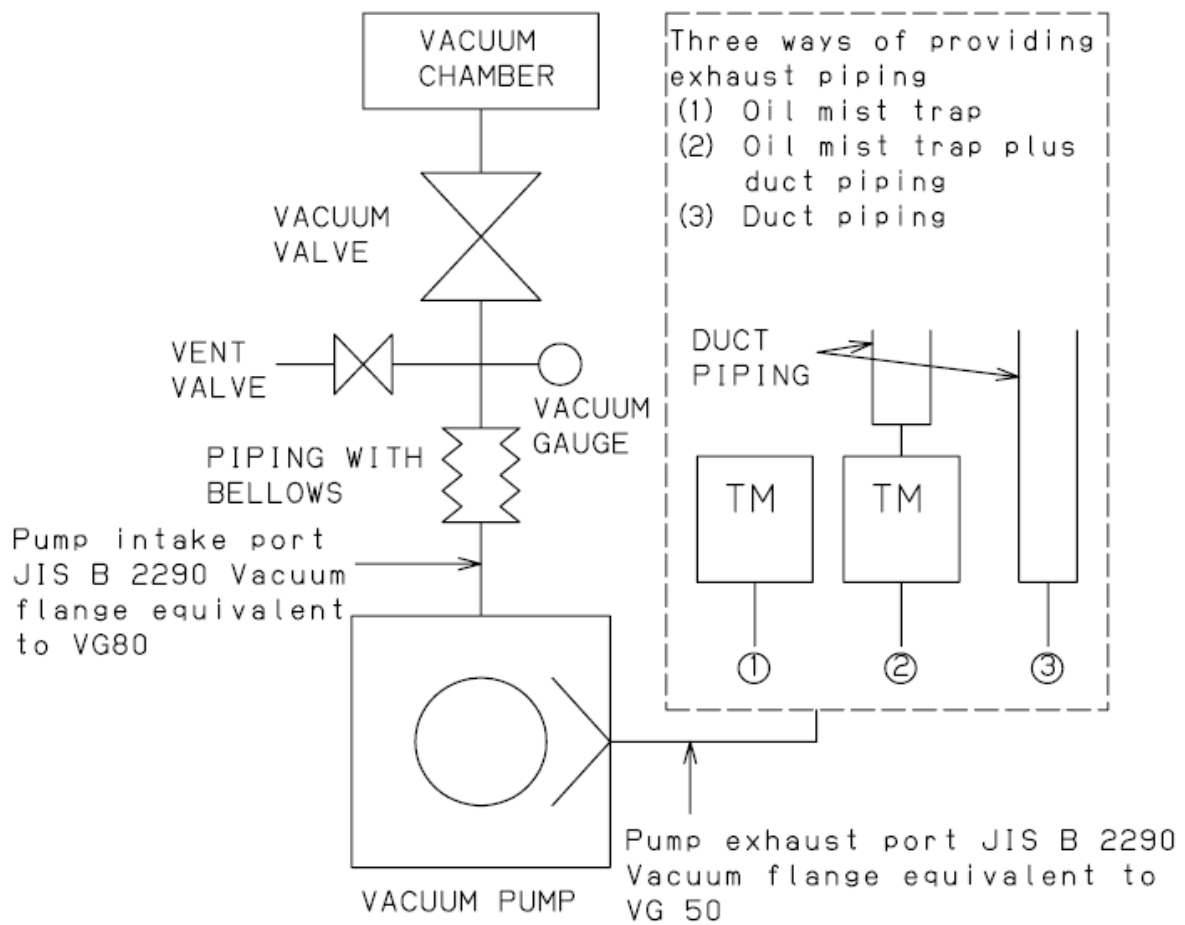



Fig. 5 Suction/Exhaust piping connection diagram

3.6 Electrical Connection

Conduct the electrical connection referring to the Fig. 6, Fig.7 and Table 3.

Without changing motor, it is possible to run the Pumps both with 200V and 400V class utilities by changing wire connection in the motor terminal box because multi voltage motor, for both 200V and 400V classes, is used for this pump.



Before wiring, please confirm the line voltage you use.

Please confirm the used line voltage and change crossline in the terminal head.

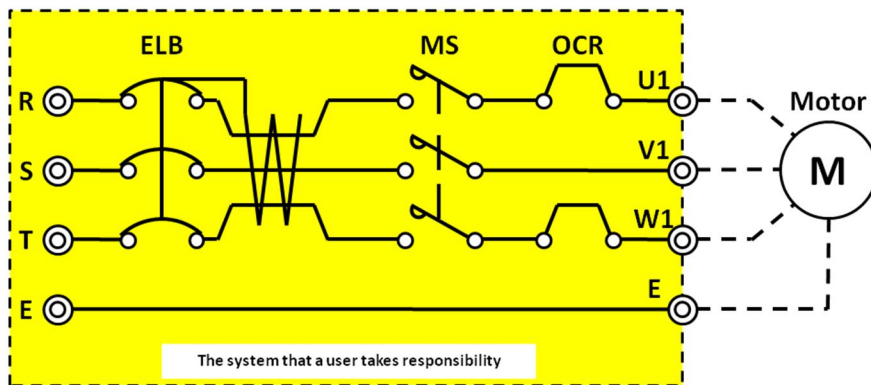


Fig. 6 Recommended connection diagram

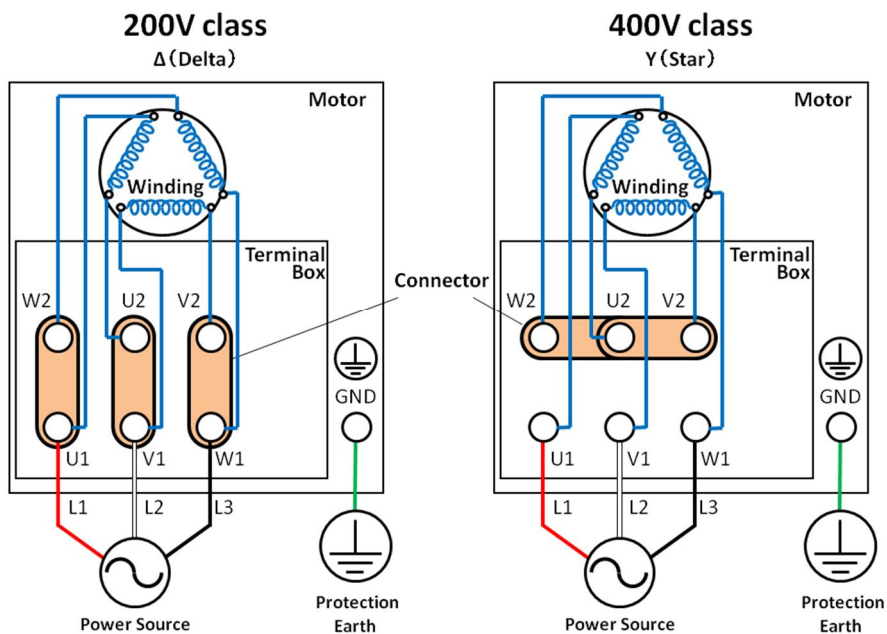


Fig. 7 Electrical wiring diagram

IMPORTANT

Use crimping terminals for the connection and tighten screws.
Check also screws fixing the connector tighten.

Motor rotation direction is clockwise viewed from the motor side.
Refer to the arrow mark castled on the Motor flange

Be sure also to put a safety circuit such as MCCB(Molded Case Circuit Breaker), MC(Magnetic Contactor) and THR(Thermal Relay) for the electrical connection.

Ensure to have a correct grounding.
You have a risk of getting electrical shock in case of failure or electric leakage.
You are recommended further to install a dedicated earth leakage breaker.

Minimize the length of the ground wire

Wire size, please determined by considering the voltage drop of the wire.
Typically, the voltage drop, please to be within 2% of the rated voltage of the motor.

Voltage drop calculation:

$$\sqrt{3} \times \text{wire resistance } (\Omega / \text{km}) \times \text{Wiring length (m)} \times \text{motor rated current (A)} \times 10^{-3}$$

※ motor rated current, refer to "Table 3".



WARNING

Install and operate this product in compliance with the laws and regulations relating to the safety, e.g. Fire Defense Law, Electric wiring regulation and so on. In the country and region you use this product.



WARNING

IE3 motor is used for this pump.

Striking current tends to be high because efficiency of IE3 motor is higher than conventional motor. Because of this consequence, there could be momentary operation by striking current of the motor in the case of current set rating of MCCB (Molded Case Circuit Breaker), ELCB (Earth Leakage Circuit Breaker) and THR (Thermal Relay).

It is required to readjust setting of MCCB, ELCB and THR.

**Turn OFF the Power Supply to do the electrical connection.
Never try to work on it on keeping the electricity turned ON.**


**A correct wiring work must observe the law and the rule that relates safely.
A wrong wiring work might start a fire.**

**The measures such as lockout/tag out should be executed not so as to
turn the power switch by mistakes during working.**

**You have a risk of getting electrical shock when the machine caused a
failure or electrical leakage.**

Make sure to have the steady grounding.

You are also recommended to install a dedicated earth leakage breaker.

**The screw of the earth terminal at the motor side is provided with an “earth
mark  ” in the terminal box.**

**The diameter of the cable to connect to a ground is the same as a cable
supplying a power supply in a motor at least.**

Be sure to ground the motor ground terminal

200V - 240V: Ground to 100ohm or less

380V - 460V: Ground to 10 ohm or less



WARNING

**Use a safety circuit which keeps the motor from starting a fire which is
caused by over current.**

**Install a safety circuit suitable for the capacity of the motor. If a safety
circuit is not installed, or if a safety circuit that is unsuitable for the motor
capacity is installed, the motor will be damaged leading to fire.**

**The safety circuit must use the one that operates by the ratings current
value of the motor that uses it.**

**Do the setting of the safety circuit in a rating current value of the motor in
line with the voltage and the frequency of the power supply.**

**When a motor is different from the standard, please do the setting of the
safety circuit in a rating current value of the motor you use.**

Never fail to close the Terminal box cover to operate the Pump.

**Do not use it excluding the voltage rating of the motor. It causes damaging
by a fire and a fire of the motor.**



CAUTION

Do the Direct-in start connection.

Table. 4 Rated current value of the VS series standard motor

型番	VS1501		VS2401	
使用モーター Motor	全閉外扇フランジ型3相交流モーター Totally-Enclosed Fan-Cooled Flange Induction Motor			
kW (極数)	5.5 (4)		7.5 (4)	
端子箱内結線 ※12 the connection inside the terminal box	デルタ(Δ) delta	スター(Y) star	デルタ(Δ) delta	スター(Y) star
RATED CURRENT A	21.0A (200V-50Hz)	12.1A (380V-50Hz)	29.0A (200V-50Hz)	16.5A (380V-50Hz)
RATED VOLTAGE V	21.1A (220V-50Hz)	12.7A (400V-50Hz)	28.8A (220V-50Hz)	17.2A (400V-50Hz)
	23.8A (240V-50Hz)	13.6A (415V-50Hz)	32.6A (240V-50Hz)	18.5A (415V-50Hz)
	19.9A (200V-60Hz)	10.9A (380V-60Hz)	27.5A (200V-60Hz)	14.7A (380V-60Hz)
	19.4A (208V-60Hz)	10.5A (400V-60Hz)	26.4A (208V-60Hz)	14.3A (400V-60Hz)
	18.7A (220V-60Hz)	10.6A (440V-60Hz)	25.4A (220V-60Hz)	14.4A (440V-60Hz)
	18.2A (240V-60Hz)	10.9A (460V-60Hz)	24.7A (240V-60Hz)	14.8A (460V-60Hz)

Table. 5 Terminal box main dimension

TYPE	VS1501	VS2401
Earth screw	M6	M6
Terminal screw	M5	M5
Wire outlet (The screw type)	φ 25 (M32)	φ 25 (M32)

3.7 Miscellaneous Connection Port

This machine is equipped with several ports to connect peripheral devices. (Refer to Fig. 2 and 3.)

Table. 6 Miscellaneous connection port

Name	Diameter	Purpose
Gas ballast port	G3/8 (PF3/8)	Used to introduce the gas into the Gas ballast system.
Oil mist trap (TM) oil recovery port	G1/4 (PF1/4)	Used to forcibly collect the oil pooled in the TM by the differential pressure.
Filter port	G3/8×2 (PF3/8×2)	Used to connect external filtration device to extend the oil life cycle.

4. Operation

4.1 Caution on Operation



WARNING

This pump is not pressure-proof.

Never run the Vacuum pump on blocking up the exhaust outlet, putting any device that hampers the gas passage or putting any oil mist trap not conforming to the ULVAC pump. There is a risk that the pressure inside the rises up as far as the Pump unit and/or Oil level gauge breaks or the Motor gets overloaded.

This product is not made as the withstand pressure structure. Ensured pressure value of the Pump shall be 0.03MPaG (0.3kg/cm²G) (Gauge pressure).

If any valve was put to a pipe after the Exhaust outlet, check and ensure that it is open.



WARNING

Never fail to flow the coolant during operation, Required coolant volume shall be;

VS1501 : 4~6 L/min

VS2401 : 5~7 L/min

This machine adopts the air introduction method to reduce the noise on achieving the ultimate pressure (called “punch noise.”) The punch noise shall be mitigated by breathing in slight air through the slow leak valve.

Take off the slow leak valve if any trouble was predicted to breathe in the air. That time the punch noise shall remain as it is.

The Pump oil might deteriorate in a shorter time depending on the use.

It is recommended to replace the first Pump oil within ten days after operation start and see how it got dirty to determine the oil replacement cycle.

If the Pump breathes in a lot of water or the like, you should replace the oil more frequently. If kept operation without getting rid of breathed water, it would deteriorate lubrication of the oil and further help corrosion of the Pump inside and result in causing a failure. Do not store the product keeping sucked the water.



CAUTION

If the Pump breathed in chemical material such as acid, immediately replace the oil as it would cause the rust during the stop in one night to make the system e not applicable to operate.

We shall be not liable to the durability to chemical material.

You should also replace the oil if breathed in the solution to deteriorate lubrication of the oil as it would also cause biting inside. You shall have a risk if breathed in the solution in operation even you replaced the oil.

Caution shall be required for the operation under high pressure range.

Continuous operation one hour or more under high pressure 1000Pa or more would increase the oil volume that are discharged as the oil mist and cause rapid parts wear or cause a trouble such as burning.

You are recommended to control the oil level on regularly supplying the pump oil. The maintenance cycle might become shorter.

4.2 Operation Start

Before starting the pump, check the following again.

- (1) Piping and wire connection are completed .
- (2) Checking the oil level (Refer to the “Fig. 4 Lubrication and water piping drawing”)

The oil level shall be between level lines of the Oil level gauge (casted line on the Pump case, indication of MAX and MIN). The oil level comes down approximately 1 cm after started operation. Add the oil if it was around the minimum level.
- (3) Coolant volume

Ensure that the Coolant flows 4~6 L/min for the VS1501 and 5~7 L/min for the VS2401. Check also that there is no leakage of the Coolant.
- (4) Direction of rotation

Close the Vacuum valve on the Suction inlet and open the Leak valve. Run the Pump 2 or 3 seconds to check the direction of the Motor rotation by the Fan put on the edge face. The pressure shall come down if the rotation direction was correct (clockwise viewed from the Motor). If it rotated reverse, the Power Supply phase is reversed. Replace connection of two of three wires shown on Fig. 7.
- (5) Check and ensure the item (1) (2) (3) and (4) above, then close the Leak valve to run the Pump.

Check this time whether the Vacuum gauge between the Vacuum valve and Pump unit indicates the pressure comes down around the ultimate pressure.



WARNING

You have a risk of getting burnt. Do not touch the Motor and Pump unit as they become high temperature (70°C ~ 80°C) during operation.

Apply an appropriate protection to avoid to touch the surface as necessary.

Refrain from touching any part other than valve when operating the Gas ballast.

Ensure to close the Gas ballast to start the operation.



The oil might jet out during operation around high pressure range.

Oil mist would appear through the Exhaust side if operated around high pressure range.

Provide the Duct piping or exhaust system to discharge it outdoor.

**CAUTION**

Ensure to flow the Coolant with the specified volume. Lack of the Coolant might give damage to the Pump unit or evaporate the water remained in the Pump to raise the pressure inside the Cooling system resulting in accidentally jetting out the hot steam.

**CAUTION**

Follow the process described below if the rotation at start was not smooth;

Check first the oil level and fill it appropriately.

The oil might enter inside the Pump cylinder if you left the Pump stopped longtime (three days or more) even you kept the atmospheric pressure inside the Pump when stopped it last time. The Overload protective device might work if you attempted to restart the Pump under such a condition.

This time, do the inching start of the Pump (repeat turning ON/OFF in a short time) several times.

4.3 Operation Stop

- (1) Close the Vacuum valve at the Suction inlet and stop the Pump unit.
- (2) After the Pump stop, open the Leak valve and return the pressure inside the Pump to the atmospheric pressure.



CAUTION

The Vacuum pump gets high temperature (70°C ~ 80°C) during operation. Refrain from touching the Motor and Pump unit until the Pump cools down after having stopped operation.



CAUTION

Ensure to close the Vacuum valve and open the Leak valve to stop the Pump. If failed in following this procedure, the Pump cylinder gets filled with the oil in several minutes, which might make difficult to restart operation or give damage to the Pump unit.

Further the oil might accidentally flow back to the Vacuum tank.

If failed in closing the Vacuum valve, the vacuum might leak from the Exhaust side through the Pump unit.

- (3) Discharge the water inside the Cylinder jacket if the ambient temperature came down under 5°C during the operation stop. (Supply the compressed air 0.3 MPaG (Gauge pressure) through then Coolant inlet without closing the water outlet.) Water remaining inside the jacket might freeze up and potentially cause crack on the cylinder.

4.4 Gas Ballast Function

This product is installed with the Gas ballast function as standard. Connect the Needle valve, pipe and the like with the Gas ballast port (G3/8) subject to the purpose to use the function. It is applicable to breathe in the condensed gas such as the steam and solution vapor. Breathed condensed gas shall be liquefied through the Compress process of the Pump, mixed with the Pump oil and then cycled mixed together inside the Pump unit. This status brings you the same situation that you used the high steam pressure oil that raises the ultimate pressure. It also shortens the life cycle of the Shaft seal since the oil lubrication shall deteriorate.

If introduced the air or dry nitrogen through the Gas ballast port just before the Pump compression process, the condensed gas is not liquefied but exhausted with the air through the Exhaust valve.

To use the Gas ballast, breathe in the air through the Gas ballast port before sucking in the condensed gas and operate the Pump around twenty minutes; this is because the "Gas ballast effect" becomes larger as the Pump temperature is higher. Wait until the Pump temperature rises around 70°C to open the Vacuum valve (Fig. 2, 3) So as to operate the Pump. The "Gas ballast effect" under low temperature shall be lower than the specified process performance.

Note further that keeping the Gas ballast valve open when not breathing in the condensed gas shall cause the Pump oil splashing and power loss and further rise the ultimate pressure. You have to note also that the condensed gas might remain in the Pump oil after you have exhausted a lot of condensed gas or exhausted the condensed gas (air or gas that contains less water or other steam that contaminates the oil) without opening the Gas ballast valve since the process capacity of the condensed gas by the Gas ballast valve is limited.

In such a case, close the Vacuum valve, breathe in the air through the Gas ballast port and idle operate the Pump. Then the oil temperature shall rise up and be cleaned by means of the Gas ballast effect. Keep on idle operating the Pump without opening the Gas ballast valve as far as the specified ultimate pressure is attained. You need to replace the Pump oil if it was not cleaned after operated long time.



CAUTION

The Vacuum pump gets high temperature (70°C ~ 80°C) during operation. As the Gas ballast port also gets high temperature, be sure to wear protective gear such as a pair of gloves.

Ensure to close the Gas ballast port to start operating the Pump.

The oil might jet out of the Gas ballast port during the operation around high pressure range.



CAUTION

If you kept opening the Gas ballast port when not exhausting the condensed gas, it might cause the oil splash, power loss or ultimate pressure rise.

Keep the Gas ballast port closed when not exhausting the condensed gas.

**WARNING**

The guaranteed pressure resistance of this pump is 0.03 MPa (0.3 kg / cm²) (gauge pressure). Operate the supply pressure of the gas ballast gas to be introduced within the following range.

Supply pressure: Atmospheric pressure to 0.03 MPa (0.3 kg / cm² (gauge pressure)) or less.

4.5 Vacuum Pump Oil for Winter Season

Starting the Pump operation might become difficult in winter in the cold district or where the Pump was installed outdoor.

This is the overload phenomenon caused by increased viscosity. To make sure, you should confirm that the capacity of the motor overload protective device conforms to the motor rated value and warm up the Pump oil or replace the oil with the Vacuum pump oil ULVOIL R-42 having lower viscosity.

**CAUTION**

Pump rotation might have a trouble if lubricated with the ULVOIL R-72 when the temperature got down beneath 10°C. It is because the rotation is hampered by increased viscosity of the oil inside the Pump unit under lower temperature.

It is better to use the ULVOIL R-72 having less viscosity that enables you to start rotating the Pump around 4°C. You should, however, replace it with the ULVOIL R-72 if the temperature gets 10°C or more. Be cautious as using the ULVOIL R-42 in warm season would cause such troubles as sealing error or oil leak due to its lower viscosity.

5. Pump Performance

5.1 Ultimate Pressure

“Ultimate pressure” described in the catalogue and this document means “the limit value pressure obtained by the pump in a state not introducing any gas through the suction inlet (no load operation).”

ULVAC measures the value by the Pirani gauge connected to the Pump suction inlet using the specified vacuum pump oil after having completely blocked out the Pump unit from the system. Be cautious as the Pirani gauge as well as the thermocouple vacuum gauge would indicate a value 5 to 10 times much than the value that the Mcleod gauge shall indicate. This is caused by the fact that the Mcleod gauge shall get rid of the condensed gas constituent (mainly water) included in the measured gas.

Actual vacuum equipment on the site shall likely to raise the ultimate value higher than the catalogue value as the vacuum gauge was put far away from the Pump or maybe affected by the water drop, rust or other substances attached to the system inside wall or pipe, or water vapor and miscellaneous gas generated from attached substances. It is because the oil vapor pressure is raised up since the volatile gas melt in the Pump oil, foreign substance and gas sucked in the Pump from the vacuum chamber might contaminate the gauge head and/or decompose (deteriorate) the Pump oil constituent.

5.2 Exhaust Speed

Exhaust speed of the Oil rotary pump shall vary depending on the type and pressure of the sucked gas. It shall indicate the maximum exhaust speed in the high pressure range and lower speed little by little lower becomes the pressure.

Effective exhaust speed of this machine is the maximum value when it sucked in the dried air.

Fig. 8 and 9 show the relation of the suction pressure and exhaust speed.

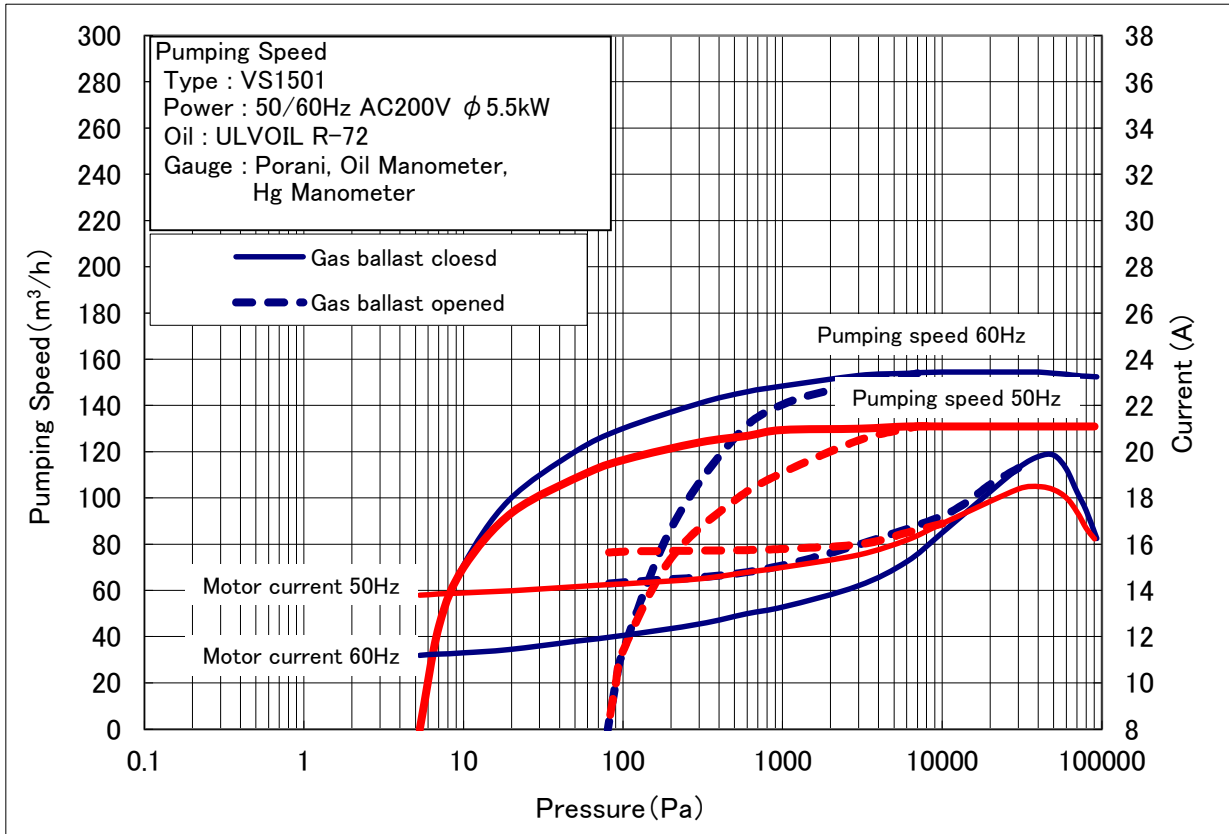


Fig. 8 Show the relationship between the suction pressure and pumping speed - MODEL VS1501

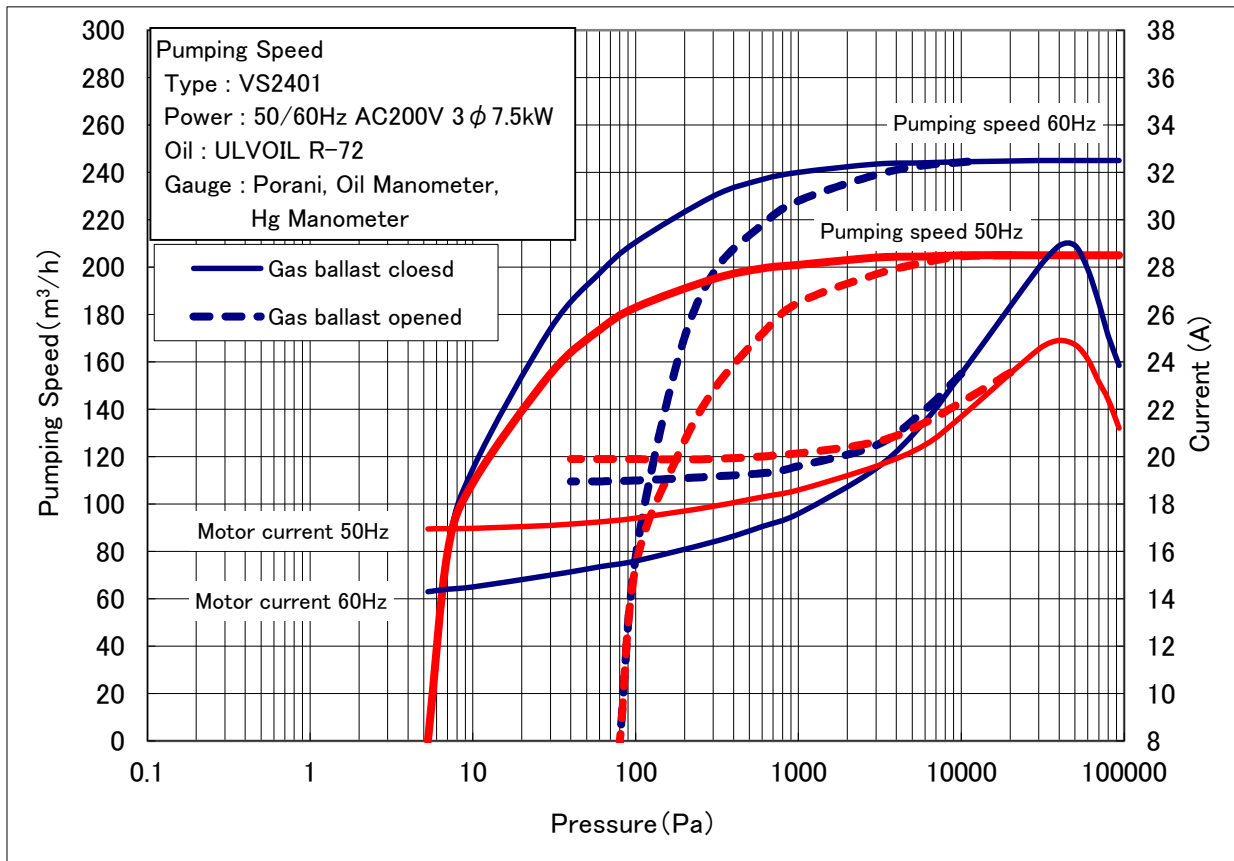


Fig. 9 Show the relationship between the suction pressure and pumping speed - MODEL VS2401

5.3 Required Motive Energy

Motive energy to drive the Vacuum pump is a total value of the work of the mechanical element on the rotary friction (mechanical work) and the work of compressing the air (compression work) that becomes maximum when the suction pressure is between $3 \times 10^4 \sim 4 \times 10^4$ Pa.

If the pressure went down under 10Pa, the compression work becomes smaller, then most of the motive energy shall be spent on the mechanical work.

General use of the Pump shall indicate the largest load pressure range while the suction pressure was between $3 \times 10^4 \sim 4 \times 10^4$ Pa. Operation opening the Gas ballast port would require larger motive energy at all the time as its compression work is large even the suction pressure was small. Further, when the temperature of the Pump site was low (in cold district or outdoor installation) starting the Pump would require larger motive energy since the Pump oil temperature was low and its viscosity is higher. However the motive energy value shall decrease and come stable as the oil viscosity comes lower while the Pump temperature shall rise as it goes through operation.

IMPORTANT



For VS1501, the motor output may exceed its capacity during operation at above 30kpa.

In such case, please refrain from continuous operation or adjust the flow volume, in order to prevent burn out or other defects.

IMPORTANT



For VS2401, the motor output may exceed its capacity during operation at above 20kpa.

In such case, please refrain from continuous operation or adjust the flow volume, in order to prevent burn out or other defects.

6. Maintenance and Check

6.1 Maintenance

- (1) You should check following points at least once per three days while you continue operation.
- (2) Whether the Vacuum oil pump oil volume is between two level lines or not.
- (3) Check the machine much more frequently during high overload operation (continuous operation 1kPa or more, repeated exhaust atmospheric pressure – vacuum).
- (4) Whether the Vacuum pump oil is discolored or not.
- (5) Whether the Coolant flows by specified volume.
- (6) Whether there is no foreign noise.
- (7) Whether there is anything strange in the Motor current value.
- (8) Whether there is no oil leak from the Oil seal.
- (9) Whether there is no water leak.

6.2 Regular Check

Although you have to consider checkpoints depending on the use of the Pump, you should check the following regularly; it is helpful to avoid trouble and extend the pump life cycle.



Check and ensure that any of hazardous energy is blocked before starting the operation.

Entitled staff should conduct the wiring operation.

Erroneous wiring work might cause a fire.

Conduct the wiring operation correctly in compliance with laws and rules concerning the safety (e.g. Fire Defense Law, Electric Equipment Technology standard, Internal line cord) in the country and region you use this product.

Ensure to have a correct grounding.

You have a risk of getting electrical shock in case of failure or electric leakage.

You are recommended further to install a dedicated earth leakage breaker.

It is imperative to put the overload protection device.

Otherwise it would cause the motor burn out and/or fire.

6.2.1 Pump Oil Level Check

The pump oil level should be between the two level lines (MAX and MIN on the pump case) on the oil level gauge. (Refer to the " Fig. 4 Lubrication and water piping drawing".)

6.2.2 Vacuum Pump Oil Check

The vacuum pump oil will be gradually deteriorated not only by contamination with sucked gas, but also by temperature rise during pump operation. Check the oil for contamination and viscosity and discoloring periodically.

If substances of low boiling point (water, organic solvent, etc.) are mixed with pump oil or sludge collects on the bottom of the pump case, the ultimate pressure cannot be recovered by one oil change, but the oil must be changed several times.

If the pump is operated using pump oil containing much moisture content, the ultimate pressure will rise, leading to poor functioning of the mechanical friction parts of the pump. In the worst case, the pump will seize up and cannot be rotated.

Table 6 gives a guide for pump oil change frequency.

Table. 7 Recommended replacement cycle of the vacuum pump oil

Purpose	Replacement timing
Vacuum system for study / laboratory, small vacuum system	Within 6 month ~ 1 year
Vacuum system for production, vacuum evaporation	Within 3 ~ 6 month
Vacuum valve exhaust system, large vacuum evaporation system	Within 3 month
Metallurgy vacuum system such as thermal treatment, melting and the like	Within 1 month
High vacuum dry, vacuum impregnation, vacuum formation and vacuum packing system	Within 1 month
Low vacuum dry, pug mill and food packing system	Within 1 week

6.2.3 Replace Vacuum Pump Oil

Proceed as follows.

- (1) Shut down the pump and open the drain valve to drain the oil in the pump case.
Upon completion of draining the oil, close the drain valve again and run the pump under no load for approx. 5 seconds to drain the oil from the cylinder.
- (2) Close the drain valve and fill fresh oil through the oil filling port. (Refer to Fig. 4.)
Pour oil until the oil level comes between the two level lines of the oil level gauge (MAX and MIN on the plate for the casted lines on the pump case).
- (3) If the oil is severely contaminated, fill fresh oil and run the pump for several minutes under no load to clean the pump interior. Repeat this operation several times depending on the degree of oil contamination.
- (4) After changing the oil with fresh oil, run the pump to warm it up and then check the ultimate pressure.
- (5) If the specified ultimate pressure cannot be attained by oil change, sludge or other deposit may have collected on the bottom of the pump case. In that event, overhaul is required. Contact your local ULVAC organization or representative.



Use of the toxic, combustible or combustion susceptible gas and substance other than inactive gas is not allowed by the vacuum pump.



If the Pump was used to exhaust the toxic gas, the Pump oil as well as the Pump unit shall become toxic. Pay a full attention.

DANGER



Read "1. 2 Chemical Material Safety Data Sheet" previously before starting lubrication.



Please obtain the latest version of Safety Data Sheet (SDS) from our Sales Department.



Wear protective gears such as rubber gloves, protective goggles and so on.

Should the oil touched to your hand are entered in your eye, immediately follow the emergency treatment described on the SDS.

CAUTION



Ensure to use the vacuum pump oil designated by ULVAC. Operation using oil other than designated shall be out of our scope of guarantee as it might impair the Pump performance and shorten the life cycle.

CAUTION

6.2.4 Oil Leak Check

The Pump system needs repair if occurred any oil leak from the Shaft sealing or Pump unit. Type of the seals and O-rings are listed at the end of this document. Please contact the Service Center close to you for purchase and repair.

6.2.5 Checking The Gas Ballast Function

When used the Gas ballast function, there might occur clog in the Needle valve attached to the Gas ballast port or in the introduction passage inside the Pump by the dust or the like. You should regularly check whether the air is breathed in through the port.

6.2.6 Checking The Metal Mesh at The Suction Inlet

The Suction inlet might be clogged by the dust contained in the gas breathed in from the Vacuum chamber and thus the Pump performance might be impaired. Further it is anticipated that any welding scale drops off in the pipe particularly at the beginning of the system start. Be fully cautious.

6.2.7 Checking The Noise and Abnormal Vibration

Checking around the pump

- (1) Check whether bolts and nuts and the like fixing the pump are loose or not.
- (2) Check whether pipes connected to the inlet/outlet are loose or not.
- (3) Check and ensure that there is no leakage from the piping and valves.

Checking the pump

Please refer to the "6.5 Trouble check list."

Should the condition was not recovered after having checked points indicated there, please contact the closest Service center.

6.2.8 Checking The Coupling and Spider

The spider of the coupling that connects the pump body and the motor is made of rubber. Replace it if the spider is damaged.

Replace it once a year by rule of thumb. If the pump is started and stopped several hundreds of times a day, however, shorten the replacement frequency.

To replace the coupling spider, proceed as follows.

- (1) Stop the pump and turn OFF the Power Supply. Disconnect the power cable of the motor.
- (2) Use a wrench to remove the M12 hexagon head bolt x 4 and spring washer x 4 and plain washer x 4 fixing the Motor.
- (3) Remove the motor from the pump unit.(Do use crane to Remove the motor.)
- (4) Now you can check the spider of the coupling. Replace the spider with a new one.

- (5) Put the new coupling spider in one of the coupling. Meet the ratchet of both couplings and mount the pump unit in the medium case.
- (6) Put the M12 hexagon head bolt x 4 and spring washer x 4 and plain washer x 4 removed in the item (2) above (Recommended tightening torque: 45N · m).
- (7) Execute the wiring.



CAUTION

Use the loading equipment such as a crane to put on and take out the Motor to ensure the safety. Be sure to turn OFF the Power Supply when putting on and taking out the Motor.

Only the technically entitled person should be in charge of operating the machine such as crane.

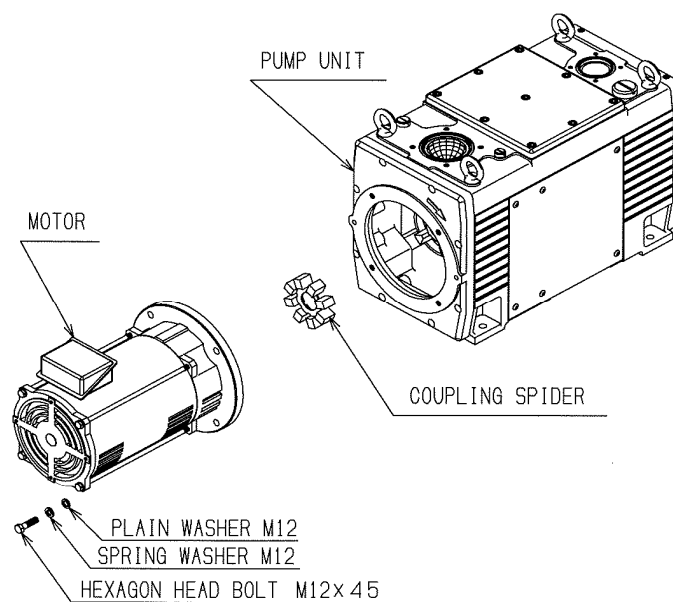


Fig. 10 Replacement of coupling spider

6.2.9 Checking The Oil Mist Trap

To use the Oil mist trap, be cautious not to have clog of the filter in the trap. Too much clog would prevent the exhaust gas from passing through the filter, raise the pressure inside the Pump unit and might result in breaking it.

Limit value of the pressure inside the Pump is 0.03MPaG (0.3kg/cm²G) (Gauge pressure). We recommend you to install a Pressure monitor. Refer to the Instruction Manual of the Oil mist trap as for the install position of the Pressure monitor.

It is recommended to mount a pressure monitor (G1/4). For the pressure monitor mounting position, refer to the instruction manual for the oil mist trap.

6.2.10 Adjusting The Slow Leak Valve

This machine adopts the air introduction method to reduce the noise on achieving the ultimate pressure. If the Slow leak valve was clogged, a high sputtering sound (called “punch noise.”) is generated during operation on the ultimate pressure. Adjust the Slow leak valve in such a case.

Shown below is the procedure to adjust the slow leak valve. (Refer to the “Fig. 11 Slow leak valve adjustment”.) Put a pair of cotton gloves as the Pump system has high temperature sections.

(1) Take off the Side panel (at right viewed from the Level gauge) under the state operated the

Pump on the ultimate pressure.

(2) Rotate the Slow leak valve at the Coupling section counterclockwise until it stops and keep it open around one minute.

Then rotate the slow leak valve clockwise until it stops and wait until the punch noise occurs.

Upon the punch noise occurred, rotate the slow leak valve little by little counterclockwise until the punch noise stops. Under this state, Tighten Lock nuts of the Slow leak valve.



CAUTION



Couplings are put close to the slow leak valve. Pay attention not to get your hand caught during adjustment work or the like.

You are recommended to check the ultimate pressure when adjusted the slow leak valve.

Pay attention not to open the slow leak valve too much as the ultimate pressure would not come down to the specified pressure.

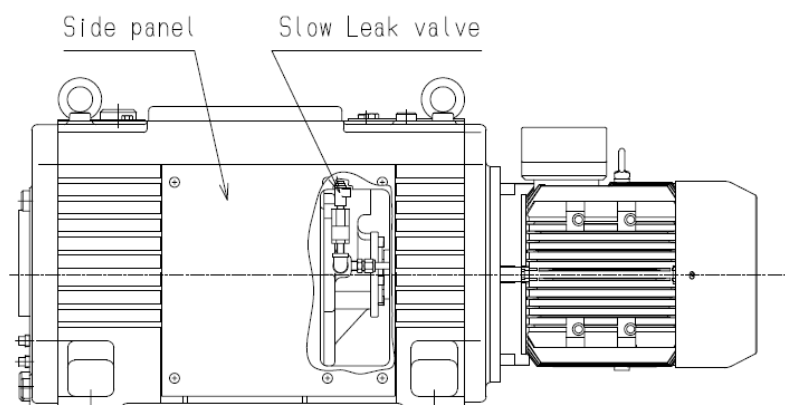


Fig. 11 Slow leak valve adjustment

6.2.11 Replacing The Exhaust Valve Vane



Replace the Exhaust valve vane every 9,000 hours. It might break earlier if the Pump sucked the foreign substance or water.

Procedure to replace the Exhaust valve vane is shown on the next page.



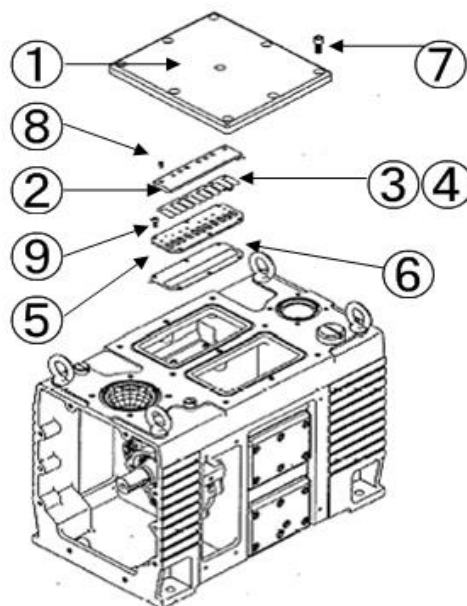
«Procedure to replace the Exhaust valve vane»

(1) Required tools and parts

Name	Specifications		Quantity	
	VS1501	VS2401	VS1501	VS2401
Exhaust valve vane		Exhaust valve vane A	2	1
		Exhaust valve vane B	—	2
Exhaust valve gasket	For VS1501	For VS2401	1	1
Required tools				
Hexagon wrench	M10, M6, M4			
Torque wrench	M10, M6, M4 (2 ~ 30Nm)			

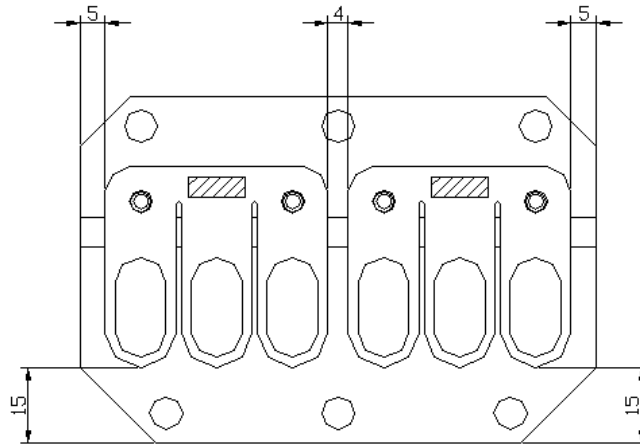
(2) Replacement procedure

No	Operation	Note	Parts name
1	Take off the top cover.	①	Top cover
		⑦	Hexagon socket head cap screw M10 × 25
2	Take off the exhaust valve seat.	⑤	Exhaust valve seat
		⑨	Hexagon socket head cap screw M6 × 14
3	Take off the exhaust valve guide.	②	Exhaust valve guide
		⑧	Hexagon socket head cap screw M4 × 8
4	Replace the exhaust valve vane.	③	Exhaust valve vane (A)
		④	Exhaust valve vane (B)
5	Put the exhaust valve guide onto the Exhaust valve seat.	②	Exhaust valve guide
		⑧	Hexagon socket head cap screw M4 × 8
6	Replace the exhaust valve gasket.	⑥	Exhaust valve gasket
7	Put the exhaust valve seat onto the cylinder.	⑤	Exhaust valve seat
		⑨	Hexagon socket head cap screw M6 × 14
8	Put the top cover.	①	Top cover
		⑦	Hexagon socket head cap screw M10 × 25

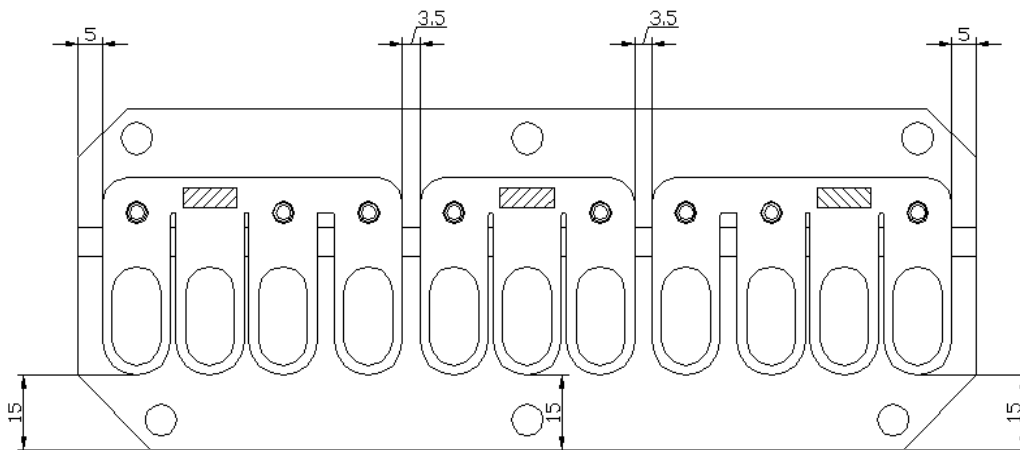

 Relation of the size of applicable bolts and specified torque value

Bolt size	(Nm)
M4	2 ~ 3
M6	8 ~ 10
M10	25 ~ 30

Set the position of the exhaust valve to the following. After having fixed it, confirm that there are no deviation of the mounting position for the exhaust valve and no interval between the exhaust valve and the exhaust valve seat.



VS1501



VS2401

6.2.12 Cleaning The Coolant Jacket



To clean the Jacket, stop the Pump operation and turn OFF the Power Supply.

- (1) Check whether there is no dust such as water stain pooled in the Jacket that is a water passage inside the cylinder.
- (2) Take off the Jacket cover at the Cylinder side to clean the inside. Check the Coolant volume after having cleaned it out.

If there found remarkable Pump contamination or performance deterioration due to the operation condition, you are recommended to conduct regular overhaul regardless of the check items described above.

Overhaul shall be required to keep the performance as well as the safety and further to continue the production on forecast.

Please contact the Service Center close to you listed at the end of the document as for the overhaul.

You are requested to conduct the overhaul once a year.



If there found remarkable Pump contamination or performance deterioration due to the operation condition, you are recommended to conduct the overhaul earlier than one year period.

You shall be in need of replacing such parts as listed on the “10. Main Displacement parts” at minimum.

6.2.13 Cleaning The Oil Tank

Sucked foreign substance, generated substance, Pump oil sludge and the like are likely to accumulate up inside the Oil tank. Much accumulation makes it harder to get rid of only by the oil replacement and lubrication by contaminated and deteriorated oil would give the Pump damage.

In such a case, you are requested to open the Oil tank to get rid of the accumulated substance and clean it. (Simple overhaul)

6.2.14 Oil spray inside oil level gauge

Oil is sprayed continuously, to the interior of the level gauge, during the operation of the pump. If the sprayed amount is reduced, there is a possibility of foreign compound clogging the pump. Please try to repeat on and off, or unclog the spray hole with a wire (smaller than $\phi 0.8$), or over haul the pump in order to clear the oil path.



«Simple overhaul method»

(1) Precaution on the work

- 1) To dismantle the Pump, be sure to turn OFF the Power Supply to ensure the safety to start working on.
- 2) Refrain from starting the work immediately after having stopped the Pump as the unit keeps high temperature. Leave the Pump unit 10 minutes or more on flowing the water and confirm that the Pump surface temperature has sufficiently come down to start working.
- 3) You should tighten every bolt with the specified torque. (Check the torque by “Relation of the size of applicable bolts and specified torque value on P. 32.)
- 4) Be cautious so as not to drop bolt or the like inside the Cylinder

(2) Required tools and parts

Name	Specifications	
	VS1501	VS2401
Hexagon wrench	M10	
Torque wrench	M10 (25 ~ 30Nm)	

(3) Cleaning the Oil tank

▪ Operation 1:

Remove eight bolts fixing the Pump back cover. Put two of removed bolts at positions shown at right (right photo) to make it easier to take off the Back cover.



▪ Operation 2:

Take off the Oil tank (back) cover to clean inside the Oil tank. Pay a full attention on handling the tank cover as it is heavy (20kg). Use a waste cloth to wipe out the oil stain inside.



▪ Operation 3:

Put the Pump back cover and tighten the eight bolts. Pay a full attention on handling the tank cover as it is heavy (20kg).



▪ Operation 4:

Open the Lubrication plug and lubricate with the new oil. Check and ensure that the Drain plug (valve) is closed.

(4) Cleaning for cylinder exhaust valve

Work ①: Remove the bolts (M10x7pcs) mounting the upper cover. It becomes easy upon mounting the removed 2 pieces of bolts on the tap hole.

Work ②: Upon removing the upper cover, two openings can be seen in the cylinder. Put the lid of prevention for foreign object drop to the opposite side opening part of the exhaust valve unit.

Work ③: Remove the bolts (M6 x 6 pcs) mounting the exhaust valve unit, and dismount the exhaust valve unit and the exhaust valve gasket. Caution should be taken not to drop foreign objects into the hole of the cylinder.

Work ④: Remove the bolts (M4 x 4 pcs) located at the exhaust valve guide of the exhaust valve unit, and disassemble it to the exhaust valve seat/the valve plate/the valve guide.

Work ⑤: Wipe off foreign objects/sludge attached to each parts with solvents and soft waste. Do not damage the surface without using a hard brush/scrubber. Do not bend and fold by applying the force to the exhaust valve plate.

Work ⑥: Clean also the inside of the exhaust valve unit mounting part of the cylinder opening, and remove foreign objects/sludge.

Work ⑦: In a retrograde order, assemble/mount the exhaust valve unit. Tighten all bolts with the specified torque. (Confirm with "Relations with the bolt size and the specified torque value" to be used in P.32)



※ The simple overhaul is recommended to be executed once every 6 months. However, since the extent of stains may differ depending on the customer's use conditions, set the interval (Periods) of the valid simple overhaul every processes.

6.3 Checkup after storage for a long period

Long term storage of the Vacuum pump without operation might possibly cause trouble in operation caused by rust.

If you kept the Pump long time without operating it, ask a closest Service Center for the check.

6.4 Overhaul

If there found remarkable Pump contamination or performance deterioration due to the operation condition, you are recommended to conduct regular overhaul regardless of the check items described above.

Overhaul shall be required to keep the performance as well as the safety and further to continue the production on forecast.

Please contact the Service Center close to you listed at the end of the document as for the overhaul.

Do not remember to fill and submit the Contamination certificate enclosed in the end of the document.



WARNING

We would be obliged to refrain from handling and/or executing maintenance of this product if the detail of used hazardous substance was not disclosed or this product has exhausted such substance that the detoxification process is hardly conducted.



CAUTION

**You are requested to conduct the overhaul once a year.
If there found remarkable Pump contamination or performance deterioration due to the operation condition, you are recommended to conduct the overhaul earlier than one year period.**

**You shall be in need of replacing such parts as listed on the “10. Main Displacement parts” at minimum.
Do not forget to fill and submit the Contamination certificate.**

6.5 Trouble Check List

Table. 8 Trouble check list

Trouble	Causes	Processing method	Reference
The Pump does not run.	(1) Motor connection is wrong.	(1) Check the connection.	3.6
	(2) Safety circuit such as the Electromagnetic breaker is not correctly set.	(2) Make the Safety circuit conform to the Motor specification.	3.6
	(3) Oil viscosity got higher.	(3) Replace the oil.	3.2 , 4.5
	(4) Foreign substance entered in the Pump caused burning the Rotor or the like.	(4) Conduct the overhaul (replacement of the Cylinder, Rotor, Cover and so on.)	6.2.2
	(5) Reactive agent accumulated inside the Pump while the Pump was stopped after having exhausted the reactive gas.	(5) Conduct the overhaul (cleaning inside the Pump, removal of reactive agent and so on.)	
Trouble	Causes	Processing method	Reference
Abnormal noise sounds.	(1) Motor rotation direction is reverse.	(1) Do the connection again to correct the rotation direction.	3.6
	(2) Slow leak valve is clogged.	(2) Remove the Side panel and wash and adjust the Slow leak valve.	6.2.10
	(3) Rattling sounds on starting or stopping the machine.	(3) There is no particular problem as it's a phenomenon caused by vanes that temporarily make irregular motions.	

Trouble	Causes	Processing method	Reference
Abnormal noise sounds.	<p>(4) The oil is not circulating.</p> <p>a) Oil pit of the Cover or the like is clogged.</p> <p>b) Oil distributor valve has a trouble.</p> <p>(5) The Coolant is not circulating. (The Coolant does not flow by specified volume.)</p> <p>(6) Vanes are not moving.</p> <p>(7) Panel screw is loose.</p> <p>(8) Oil is not filled. Oil is under the lower limit of the Oil level gauge.</p>	<p>(4) Overhaul.</p> <p>a) Clean the oil pit.</p> <p>b) Check and repair the Oil distributor valve.</p> <p>(5) a) Keep flowing the Coolant by the specified volume.</p> <p>b) Should the noise remain as it is even flowed the specified volume water, conduct the overhaul, check and repair the inside.</p> <p>(6) Overhaul. Wash out substances stuck to the vane.</p> <p>(7) Tighten the screw.</p> <p>(8) Overhaul (Replacement of the Cylinder, Rotor and Cover)</p>	6.2.10

Trouble	Causes	Processing method	Reference
Pressure does not come down.	(1) Pump exhaust capacity is smaller compared to the Vacuum chamber capacity.	(1) Select another Pump type.	
	(2) Pressure measurement method is wrong.	(2) Measure correctly the pressure.	5.1
	(3) Vacuum gauge is not appropriate.	(3) Use the Vacuum gauge that matches the measurement pressure range and correctly calibrated one to measure the pressure.	
	(4) Pipe connected to the Suction inlet is thin or connection distance is long.	(4) Connect a pipe wider than inlet diameter and shorten the connection distance between the Vacuum chamber.	
	(5) Metal mesh at the Suction inlet is clogged.	(5) Remove the pipe above the inlet and wash the mesh.	6.2.5
	(6) Oil is not supplied to the specified volume.	(6) Supply the oil to the specified volume.	3.2 6.2.1
	(7) The oil is deteriorated.	(7) Replace the oil.	3.2 6.2.3
	(8) There is a leak in the pipe connecting with the Pump.	(8) Use a Leak detector or the like to find out the leak position and stop it.	3.4
	(9) Not using the ULVAC genuine oil.	(9) Conduct the overhaul of the Pump and replace the oil with the ULVAC oil.	3.2 6.2.3

Trouble	Causes	Processing method	Reference
Pressure does not come down.	<p>(10) The oil is not circulating.</p> <p>a) Oil pit of the Cover or the like is clogged.</p> <p>b) Oil distributor valve has a trouble.</p> <p>(11) Water entered inside the pump.</p> <p>(12) Exhaust valve vane is broken.</p>	<p>(10) Overhaul.</p> <p>a) Clean the oil pit.</p> <p>b) Check and repair the Oil distributor valve.</p> <p>(11) Replace the oil. Check the water leakage. (Check and replace the Cooling pipe and/or Joints if necessary.)</p> <p>(12) Replace the Exhaust valve vane.</p>	<p>3.2</p> <p>6.2.11</p>
<p>Pump surface temperature is abnormally high.</p> <p>Room temperature +60°C or more</p>	<p>(1) Coolant does not flow. (Specified volume is not flowing.)</p> <p>(2) Keeping continuous operation under high suction pressure.</p> <p>(3) The oil is not supplied by the specified volume. (Less oil volume would lower the cooling effect of the Pump.)</p> <p>(4) Suction gas is hot.</p>	<p>(1) Keep flowing the Coolant by the specified volume.</p> <p>(2) Pump surface temperature would rise up around 100°C on continuous operation under high suction pressure. No problem.</p> <p>(3) Control the oil level. Supply the oil by the specified volume.</p> <p>(4) Install a cooling device such as the Gas cooler on the suction side.</p>	<p>4.1</p> <p>3.2</p>

Trouble	Causes	Processing method	Reference
<p>Pump surface temperature is abnormally high.</p> <p>Room temperature+60°C or more</p>	<p>(5) The oil is not circulating.</p> <p>a) Oil pit of the Cover or the like is clogged.</p> <p>b) Oil disturb</p> <p>(6) Area around the Pump is enclosed.</p>	<p>(5) Overhaul</p> <p>a) Clean the oil pit.</p> <p>b) Check and repair the Oil distributor valve.</p> <p>(6) Make the ventilation available.</p>	
<p>Lot of oil mist blowing out of the Exhaust outlet.</p>	<p>(1) Pump is filled over the specified volume.</p> <p>(2) Keeping continuous operation under high suction pressure</p> <p>(3) Exhaust valve vane is broken.</p> <p>(4) Oil mist trap is clogged.</p>	<p>(1) Drain the oil until it gets the specified volume.</p> <p>(2) Put the Oil mist trap on the Exhaust side.</p> <p>(3) Replace the Exhaust valve vane.</p> <p>(4) Replace the Filter element.</p>	<p>3.2 6.2.2</p> <p>3.5</p> <p>6.2.11</p> <p>6.2.9</p>
<p>Oil leak outside the Pump</p>	<p>(1) Deterioration of the O-ring and/or Oil seal of the Case and Cover.</p> <p>(2) Oil inlet is loose.</p>	<p>(1) Check the O-ring and Oil seal. Replace them if necessary.</p> <p>(2) Tighten again the Oil inlet.</p>	<p>6.2.4</p>
<p>Water leak outside the Pump.</p>	<p>(1) Deterioration of the O-ring and/or gasket of the Cover.</p> <p>(2) Coolant joints and so on got loose, or not tighten.</p> <p>(3) Sealing of Plugs and the like is not sufficient.</p>	<p>(1) Check the O-ring and Gasket. Replace them if necessary.</p> <p>(2) Check and repair Joints and so on.</p> <p>(3) Check and repair Plugs and so on.</p>	

Trouble	Causes	Processing method	Reference
Abnormal Motor current value	(1) Foreign substance entered inside the Pump impaired the Motor rotation. (2) Abnormal sliding of the Rotor and/or vane. (3) Keeping continuous operation under high suction pressure.	(1) Overhaul, removal of foreign substance inside the Pump. (2) Overhaul, check and repair inside. (3) Adjust the pressure.	

7. Removal / transport

7.1 Operation procedure

- (1) Stop the Pump, and set the inside of the Pump to the atmospheric pressure.
- (2) Shut the electricity supply and remove the cable connection.
- (3) Please let cooling water run until the temperature of the pump falls after a stop.
- (4) If the temperature of the pump falls, please close a supply valve of cooling water.
- (5) Please take out cooling water from a pump and remove laying of the pipes.
- (6) Please take out pump oil.
- (7) Remove the Suction/exhaust piping and put Blind flanges to the Pump inlet and outlet to seal them up



Use of the toxic, combustible or combustion susceptible gas and substance other than inactive gas is not allowed by the vacuum pump. Pump oil as well as the Pump unit becomes toxic should the toxic gas was sucked in the vacuum pump. Pay attention to execute maintenance work.



DANGER

You should replace with the nitrogen gas completely the Pump that exhausted any special gas. Note further that only the entitled person for special gas handling should be in charge of the removal work.

Keep applying a plate displaying the name of exhausted gas on a place easily seen on the Pump.



WARNING

You have a risk of giving damage to your back as the load larger than safety standard shall be required to transfer this product.

**VS1501 : 232kg
VS2401 : 271kg**

Be sure to use the loading machinery (such as mobile crane) to lift up the Pump or load it on the pallet and fix it and run the Pallet truck for its transfer.

**Never try to enter beneath the Pump unit when lifted it up.
Use its top eyebolt to load/unload the unit.**

8. Disposal

Make sure to keep in compliance with the laws and regulations established by the local governments to dispose the Vacuum pump. You should ask the dedicated disposal agency for the disposal particularly if the Pump has exhausted any toxic gas.

Note that you are requested to bear the cost and charges relating to the disposal.



CAUTION

You should ask a special disposal agency for the disposal particularly if the Pump has exhausted any toxic gas hazardous to the human body. The Pump oil as well as the Pump unit gets hazardous.

Follow the description "Caution on disposal" of Chemical Material Safety Data Sheet to dispose the Pump.

9. Warranty Clauses

This product was shipped after rigid company inspection. However, in case any failure occurs under ULVAC's responsibility, such as defect in manufacturing and damage during transportation, Buyer shall inform ULVAC, Inc. or the local ULVAC representatives. ULVAC will repair or exchange it at free of charge.

9.1 Warrantable Items

(1) Oil Rotary Vacuum Pump

VS1501 / VS1501-R / VS1501-H

VS2401 / VS2401-R / VS2401-H

9.2 Duration of guarantee

(1) Domestic business in Japan: one year after shipping date from ULVAC.

(2) Direct export transaction: one year after date of B/L.

9.3 Warrantee scope

(1) Domestic business in Japan:

- Product, which has damage, caused by a failure on delivery.
- Products not satisfying the standard specifications although this product is used under the service conditions described in this document such as temperature range and power etc.

(2) Direct export transaction:

- Product, which has damage, caused by a failure on delivery.
The warrantee scope shall confirm to INCOTERMS2010.
- Products not satisfying the standard specifications although this product is used under the service conditions described in this document such as temperature range and power etc.

9.4 Response procedure

(1) Domestic business in Japan:

ULVAC send a replacement or Buyer return the defective items to ULVAC, Inc. or to the local ULVAC representatives for repair. If field service is required, Buyer shall ask ULVAC, Inc. or the local ULVAC representatives.

(2) Direct export transaction:

ULVAC send a replacement or Buyer return the defective items to ULVAC, Inc. or to the local ULVAC representatives for repair. Return charge shall be paid by Buyer.

9.5 Disclaimer

- (1) Failure occurred after expiration of warranty period
- (2) Failure caused by force majeure, such as fire, storm and flood damage, earthquake, lightning strike, war etc.
- (3) Failure occurred due to carelessness handling or faulty usage.
- (4) Products remodeled, disassembled or repaired without ULVAC's acceptance
- (5) Failure occurred under abnormal environment, such as intense electromagnetic field, radiation, high-temperature, high-humidity, flammable gases, corrosive gases, dust etc.
- (6) Failure occurred by noise.
- (7) Secondary damage by defect of this Product defect.
- (8) Secondary damage to Buyer by the reason that third party sued ULVAC for patent infringement.
- (9) ULVAC engineer decided the reason of failure was improper use which does not conform to the use condition of this Product.
- (10) Consumable parts (refer to 10. Main Displacement Parts)

9.6 Others

- (1) In case, special agreement or memorandum for specifications is made individually.
- (2) Buyer shall inform ULVAC when this product is exported out of Japan. In the meantime, Buyer shall take necessary procedures according to Foreign Exchange and Foreign Trade Law.
- (3) As for the question and consultation, Buyer shall check the model and serial number and ask the local representative or ULVAC, Inc.
<http://www.ulvac.co.jp/eng/support/index.html>
- (4) The contents of this document are subject to change without notice in future.

10. Main Displacement Parts

Table. 9 Main displacement parts list (VS1501/VS2401 Common)

	Section	Name	Standard / Dimensions	Materials	Q' ty	
VS1501 VS2401 common	Front cover	Oil seal	TCV507212	Fluorine rubber	1	
		Bearing	NU208EW	SUJ	1	
	Rear cover	Oil seal	TCV507212	Fluorine rubber	1	
		Bearing	NU208EW	SUJ	1	
	Oil seal case	Oil seal	TCV456812	Fluorine rubber	1	
		O-ring	G75*1	Fluorine rubber	1	
	Cylinder	O-ring	P10A*1	Fluorine rubber	6	
		O-ring	AS568-262 (ISO-262)	Fluorine rubber	2	
		O-ring	AS568-282 (ISO-282)	Fluorine rubber	1	
		Inlet	O-ring	V100*1	Fluorine rubber	1
		Outlet	O-ring	V70*1	Fluorine rubber	1
	Rotor shaft	O-ring	G30*1	Fluorine rubber	1	
		O-ring	G35*1	Fluorine rubber	2	
	Oil level gauge	O-ring	G110*1	Fluorine rubber	1	
		Oil level gauge gasket		Non-asbestos sheet	1	
	Oil distributor valve	O-ring	P10A*1	Fluorine rubber	1	
		Oil distributor gasket		Fluorine rubber	1	
	Plugs	O-ring	P14*1	Fluorine rubber	1	
		O-ring	P18*1	Fluorine rubber	3	
		O-ring	P28*1	Fluorine rubber	1	
O-ring		P36*1	Fluorine rubber	1		
Coupling	Coupling spider	ABSO-FLEX MARK0 II For M-132*2	Special rubber	1		
VS1501	Top cover	O-ring	AS568-254 (ISO-254)	Fluorine rubber	2	
	Exhaust valve	Exhaust valve vane	Exhaust valve vane A	SUS	2	
		Exhaust valve gasket	For VS1501	Non-asbestos sheet	1	
	Cylinder	Jacket cover gasket	For VS1501	Non-asbestos sheet	1	
VS2401	Top cover	O-ring	AS568-264 (ISO-264)	Fluorine rubber	2	
	Exhaust valve	Exhaust valve vane	Exhaust valve vane A	SUS	1	
		Exhaust valve vane	Exhaust valve vane B	SUS	2	
		Exhaust valve gasket	For VS2401	Non-asbestos sheet	1	
	Cylinder	Jacket cover gasket	For VS2401	Non-asbestos sheet	1	

*1: O-ring of JIS standard

*2: Manufactured by TSUKIBOSHI KASEI Co., Ltd.

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<https://showcase.ulvac.co.jp/ja/>

製品情報・サービス拠点・お問い合わせはこちらから



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This mark is applied to the electronic information product sold in the People's Republic of China. The figure at the center of the mark is the validity date of environmental protection. This product does not influence the environment, the human body and the property during the period reckoning the manufacturing date as long as the caution for safe use regarding the products are observed.

*The environmental protection validity date is not the product warranty period.

Table. Making format for names and contents of hazardous substances or elements

Name of parts	Hazardous substances or elements					
	Pb	Hg	Cd	Cr ⁶⁺	PBB	PBDE
Body	○	○	○	○	○	○

○: indicating that content of the hazardous substance or element in all homogeneous materials of the part does not exceed the requirements for concentration limits specified by SJ/T11363-2006.

×: indicating that content of the hazardous substance or element in, at least one kind of, homogeneous materials of the part exceeds the requirements for concentration limits specified by SJ/T11363-2006. Producer may further explain the technical excuse to the items marked with “X” perspecific conditions here.

ULVAC Components / Certificate of Decontamination

This is a certificate of decontamination for repair and inspection request of ULVAC Components. All material must be certified as decontaminated and this certificate must be submitted to your closest local ULVAC service center or sales office prior to shipment.

Please consult with your closest local ULVAC service center or sales office if our components are used with toxic gases or contaminated with reactive products or substances produced by reaction.

Product model:

Model:

Serial No.:

Application:

Remarks:

Contaminant (Check an applicable box.)

- I guarantee that above returned item(s) is not contaminated with harmful substances.
- Above returned item(s) is contaminated with the following harmful substances.

	Name of contaminant (molecular formula)	Characteristics
1		
2		
3		
4		
5		

To: ULVAC

Attn: _____

Date: / / (YYYY/MM/DD)

Your company

Division

Contact

Phone

Fax

E-mail

Please pack returned item(s) carefully before shipment. Any accident occurred during transportation to us **and during disassembly** caused by contaminant is under your responsibility. It is also to be understood that ULVAC may decline to repair returned item(s) depending on the type of contaminant and degree of contamination, and return it to you.

To be filled in by ULVAC	Received by	
Request for SDS: Yes/No		
ULVAC job No.		

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