ULVAC

INSTRUCTION MANUAL

OIL SEALED ROTARY VACUUM PUMP

VD30C
VD40C
VD60C
VD90C

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/

ULVAC

CE EC DECLARATION OF CONFORMITY CE

We hereby declare that the following our products conform the essential health and safety requirement of the following directives and standards.

Product	Oil Sealed Rotary Vacuum Pump	
Model	VD30C, VD40C, VD60C, VD90C	
Manufacturer	ULVAC, Inc. 2500 HAGISONO, CHIGASAKI-SHI, KANAGAWA-KEN, 253-8543 JAPAN	
Test standard	Machinery directive	2006/42/EC Annex I EN1012-2:1996
	Low Voltage directive (Motor)	2006/95/EC EN60034-1: 2004

Test lab.	ULVAC, Inc. CHINA QUARITY CERTIFICTION CENTER(motor)

Note: This declaration becomes invalid if technical or operational modifications are introduced without the manufacture's consent.

Signature : 

Date : 30 / October / 2015

Name : KIYOKAZU YANAGISAWA

Title : General Manager of Components Division

0. Before Using This Product

We thank you very much for purchasing our product.

You are kindly requested, upon delivery of this 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 this product in safe and effective way. Please read this manual beforehand to correctly use the Pump.

You are requested to 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. 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 this 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 this product might not be ensured if any of the devices put together did not conform to same regulations or this product itself was modified. ULVAC shall be not liable to guarantee performance and safety in such cases above. Any modification of this 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 this product before installing or removing this 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 this 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 this 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	**① 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.** **② It is prohibited to use this instruction manual except for explanation when using the VD30C, VD40C, VD60C and VD90C and other purpose Components Division of ULVAC, Inc. agreed.** **③ 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 this 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 this 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 this 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.**

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.

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.

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.

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.

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

You are kindly requested to acknowledge that specifications and/or price of this 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.

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.

Installation and storage

① 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.

② Give the instruction them further to use the unloading machinery such as crane to take out this 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.

③ Only the technically entitled person should be in charge of conducting the unloading operation and operating the unloading machinery.

④ 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.

Transfer

① You have a risk of giving damage to your back as the load larger than safety standard shall be required to transfer this product.

VD30C: 58kg
VD40C: 60kg
VD60C: 90kg
VD90C: 113kg

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.

② Never try to enter beneath the Pump unit when lifted it up.
Use its top eyebolt to load/unload the unit.

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 and electric cables so that they absorber vibrations to prevent them from breaking and/or dismantling.

Inlet / outlet port piping <Mounting>

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

Power Supply wiring <Mounting>

① 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.

② 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.

③ Ensure to have a correct grounding.
You have a risk of getting electrical shock in case of failure or electric leakage.

④ You are recommended further to install a dedicated earth leakage breaker.

⑤ It is imperative to put the Overload protection device.
Otherwise it would cause the motor burn out and/or fire.

⑥ 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:

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

※ motor rated current, refer to "Table 4".

Operation

This pump is not pressure-proof.

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/cm^{2}G) (Gauge pressure).

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.

① 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.

② Person other than Repair technician should not be in charge of dismantling, repairing or remodeling this product. You have a risk of getting injured or electrical shock by a fire or erroneous move.

③ 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.

④ 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.

① 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 casing a fire.

② 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.

③ 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.

④ 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.

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.

Power Supply wiring <Dismantling>

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

Inlet / outlet port piping <Dismantling>

① Take off the piping following the Install Manual of the system.

② The Inlet and outlet piping remains very hot while after having stopped the Pump.
Be sure to take it off after the Pump has sufficiently cooled down.

③ Make airtight completely the Pump exhaust outlet with a blank flange.

Transfer

① You have a risk of giving damage to your back as the load larger than safety standard shall be required to transfer this product.

VD30C: 58kg
VD40C: 60kg
VD60C: 90kg
VD90C: 113kg

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.

② Never try to enter beneath the Pump unit when lifted it up.
Use its top eyebolt to load/unload the unit.

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		**Before use, read through the instruction manual and fully understand its contents.**
2		**・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		**During operation or for a while after operation stops, do not touch the unit as each portion is at a very high temperature. - If a human body touches the unit, it may get burned.**
4		**・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. 1) explosive gas 2) flammable gas 3) gas which increases the susceptibility of substances to burn.**
		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. Indoor Use Only Mount at least 100mm from side walls.
5		**Before wiring, please confirm the power-supply voltage you use. Please confirm the power-supply voltage you'll use and change crossline in the terminal box. Refer to “3.5 Electrical Connection”.**

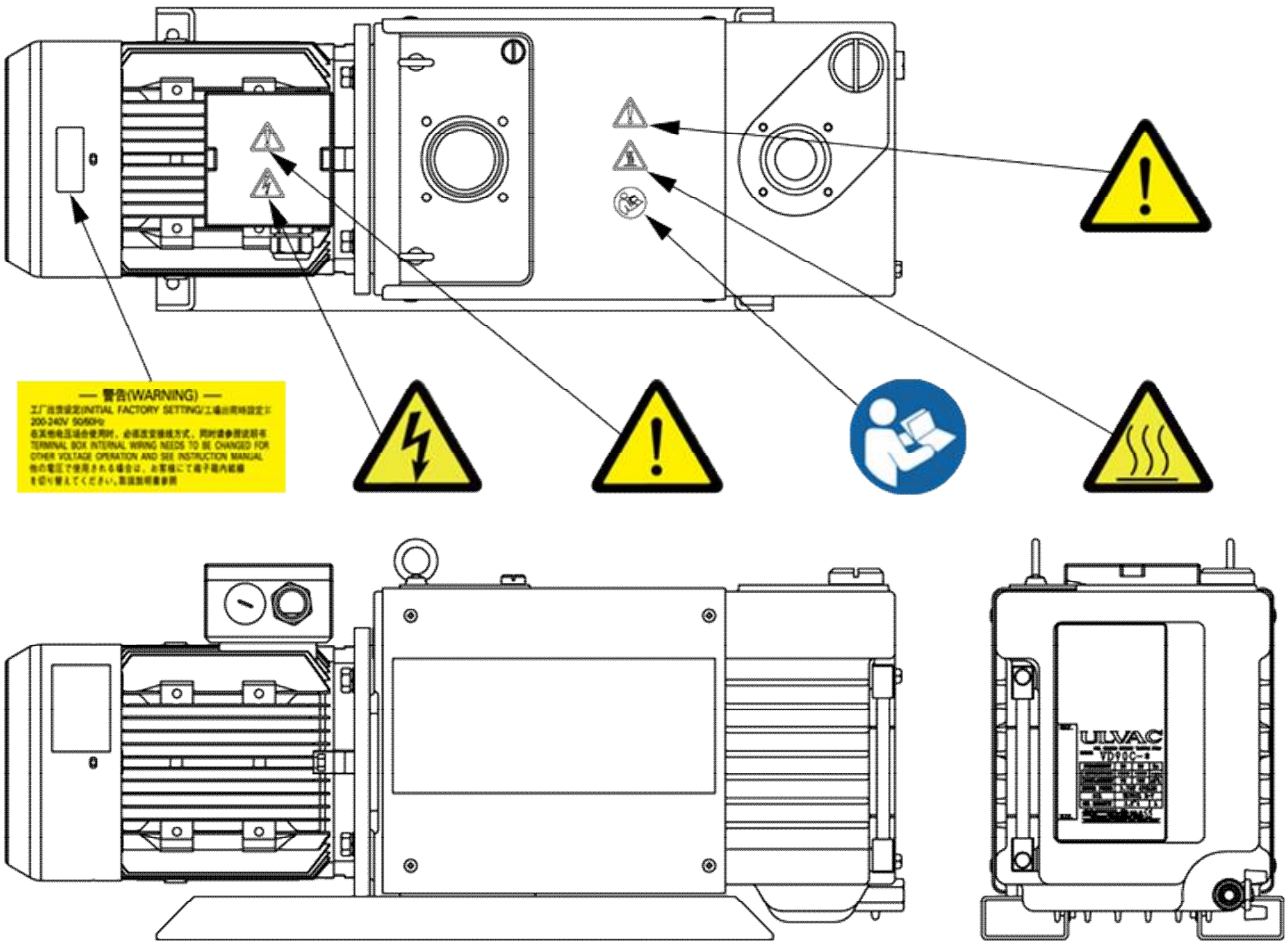
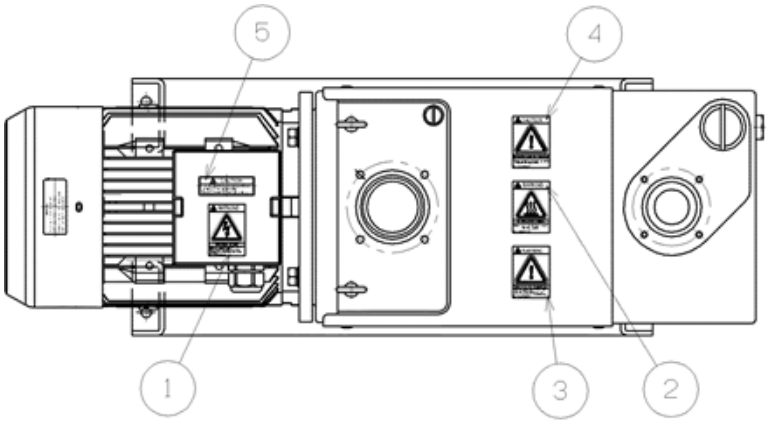


Fig. 1 Warning Label

This product can be used in compliance with the requirements of UL1450 "Standard for Motor-Operated Air Compressors, Vacuum Pumps, and Painting Equipment" by replacing the warning label according to the figure below.



①: Hazardous voltage.
②: Hot heating part present.
③: There is a risk of explosion.
④: Checkup after storage for a long period.
⑤: Installation location attention.

Fig. 2 Warning Label replacement

0.5 Acceptance and Storage of the Pump

0.5.1 Unpacking/Acceptance of the Pump

① 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.

② Give the instruction them further to use the unloading machinery such as crane to take out this 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.

③ Only the technically entitled person should be in charge of conducting the unloading operation and operating the unloading machinery.

④ 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.

Upon delivery of this 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 this product might be resolved with a charge.

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

IMPORTANT

① Whether the delivered is exactly the one you have ordered.

② Whether accessories (standard accessories, optional parts) are attached or not.

③ Whether there is no break or damage through transport or not.

④ 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

Part name	Specification	Quantity	Remarks
Oil one time portion	ULVOIL R-72	1 set	For the consumed amount, refer to the specification table.
Quick Start Manual	Japanese/ English	1 copy	—

※Fluorine oil is not included in the shipment for F specifications. If fluorine oil is required, it must be ordered separately.

0.5.2 Transfer

① You have a risk of giving damage to your back as the load larger than safety standard shall be required to transfer this product.

VD30C: 58kg
VD40C: 60kg
VD60C: 90kg
VD90C: 113kg

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.

② Never try to enter beneath the Pump unit when lifted it up.
Use its top eyebolt to load/unload the unit.

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 : -10°C to 50°C, less than 95%RH

② Ambient temperature and humidity for operation : 4°C to 40°C, less than 80%RH

※However, use pump oil "ULVOIL R-42" for operation at 4-10°C,
and pump oil "ULVOIL R-72" for operation at 10-40°C.

③ Height (for both storage and operation) : Lower than 1,000 meters altitude

④ External vibration (for both storage and operation) : Vibration acceleration less than114dB (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.

① Do not give the Pump a shock or lay it down. It might impair the Pump operation.

**② 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.**

**③ 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.**

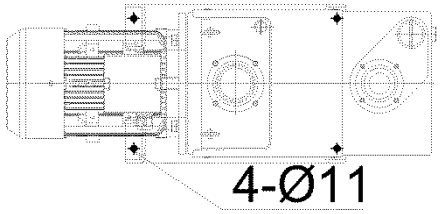
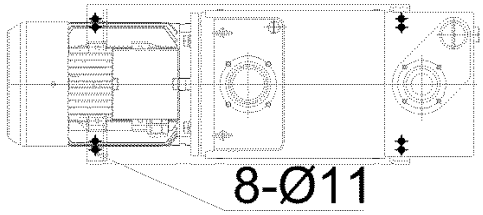
④ Indoor use only

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
VD30C VD40C VD60C	 The Pump has four holes. The Pump is fixed with four bolts.	More than “M8 x 20mm”	Kurashiki Kako., Ltd. Model: KLB-3560(Recommended) * **NOT** included
VD90C	 The Pump has eight holes. The Pump is fixed with four bolts: Four places of outside or center side of the Pump.		

The detail of the holes position: Refer to the Fig. 3 ~ Fig. 10.

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.

Refer to “3.5 Electrical Connection” to select the overload protective device. It is recommended to put together another protective device such as a earth leakage breaker.

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

Table of Contents

Tables and Illustrations

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
 **Leakage of poisonous and combustible gas** **Getting injured on touching any toxic pump oil, pump, generated material or sucked substance at the occasion of check or disposal.**	**Do not exhaust any hazardous gas such as toxic and combustible.**
	① When you check the Pump, please wear a brace that supports the toxic substances that exhaust the Pump.
	② To overhaul or dispose, ask the special agency to do the detoxification process.
	③ Ask the disposal agency licensed by the administration for disposal.

1.1.2 ! Warning Transfer of heavy material

Factors	Avoidance methods and measures
 **Getting injured on transferring** **the Pump weight** **VD30C: 58kg** **VD40C: 60kg** **VD60C: 90kg** **VD90C: 113kg**	**① Only technically entitled person should be in charge of loading/unloading and operating machines.**
	② 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.

1.1.3 ! Warning Electric shock

Factors	Avoidance methods and measures
 **Getting electrical shock on touching the current-carrying part of the motor.**	① Be sure to cut the electricity to do electrical connection.
	② Never fail to take the earth connection.
	③ Ensure to close the cover of motor terminal box and never open it during operation.
	④ Be sure to cut the electricity to do checking or installation.
	⑤ Never attempt to put in the hand or bar into the opening of the Motor.
Motor terminal mount gets burnt.	Tighten close the terminal. Check the tightening once a month. (Refer to “3.5 Electrical Connection”)

1.1.4 ! Warning Explosion

Factors	Avoidance methods and measures
 **Pressure inside the Pump rises up and the Pump explodes.**	Ensured pressure value of the Pump is 0.03MPaG (0.3 kg/ cm^2G) (Gauge pressure).
	Check the Exhaust side pressure of the Pump. If it was over 0.03 MPaG (0.3 kg/cm^2G) (Gauge pressure) take away anything in and around the exhaust outlet that hampers gas passage. When utilizing the oil mist trap, perform the periodic maintenance so that no - resistance can be realized in passage of gas.

1.1.5 ! Caution High temperature

Factors	Avoidance methods and measures
 **Getting burnt on touching the high temperature part.**	① The Pump gets high temperature during operation.
	② 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.

1.2 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、** **In the case of ambient temperature 4-10℃)** **The 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 do not use the chemical material except the above-mentioned chemical material (vacuum pump oil).**

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

The VD30C, VD40C, VD60C and VD90C are a compact, low noise, two-stage vacuum pump that permits high speed rotation. Features of this pump include the following:

(1) High maintainability

Pump main body section unit can be dismounted and remounted simply by removing the side panel when there is no piping on the exhaust side (it is not necessary to disconnect the motor or remove the piping from the intake port). This facilitates the overhaul of the Pump, replacement of the oil seal, check of the coupling spider, and others. Also daily check (oil level check, oil filling, oil change) can be performed from one direction.

Furthermore, as to the way of removing and the way of mounting the Pump main body, refer to “5.2.8 Inspection for coupling spider”.

(2) Employment of spring less vane

This prevents the Pump from stopping due to breakage of spring.

(3) Employment of lubrication pump system

When in the exhaust operation in the vicinity of the atmospheric pressure, the stable exhaust performance can be obtained.

(4) Employment of hydraulic oil anti-sucking system

If the power fails or the Pump is stopped for a long time without venting the intake side to atmospheric pressure, the Pump oil will flow back to the cylinder, making restart difficult. This pump is equipped with the oil anti-sucking feature to minimize the amount of oil flowing back to the cylinder and to reduce the load at restart of the Pump.

(5) Employment of variable oil level system

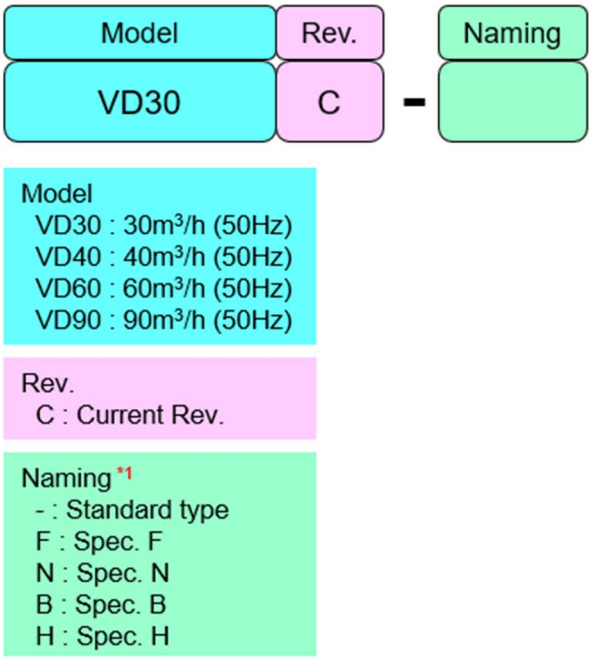
This pump has a wide oil level indicating range to allow easy control of oil level. The Pump is operable if the oil level is between the two level lines of the oil level gauge during operation.

(6) Employment of 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.

Note : Spec.B and Spec.H don't have the gas ballast function.

Table. 2 Details model list



*1 There is not any naming for standard spec. Spec. F, N, B 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.

■ Optional specification for special application

Following specification is available to meet various applications.

Table. 3 Optional specifications and gasket material/oil type comparison table

Specification	Applicable Model		O-ring	Oil seal		Oil type *1
	VD30C VD40C	VD60C VD90C		Wetted surface	Atmosphere side	
Standard	✓	✓	FKM	FKM	FKM	ULVOIL R-72
Spec. F	✓	✓	FKM	FKM	FKM	BARRIERTA J60F
Spec. N	✓	n/a	NBR	NBR	NBR	ULVOIL R-72
Spec. B	✓	n/a	Silicon rubber	Silicon rubber	NBR	ULVOIL R-72
Spec. H	✓	✓	FKM	FKM	FKM	ULVOIL R-72

*1 ULVOIL R-72 stands for mineral oil, BARRIERTA J60F stands for fluorine oil.

【Spec. F】

- Fluorine oil is used as lubricating oil
  The Spec. F uses extremely chemically stable and inert fluorine oil as a countermeasure against oil deterioration caused by corrosive, combustible, and oxidizing gases.
- Fluorine oil cannot be replaced with mineral oil (ULVOIL R-72).
- At the factory, assembly inspection is performed using fluorinated oil, but we do not ship products with fluorinated oil. Please order separately if necessary.

【Spec. N】

- NBR is used for O-ring and sealing material of wetted surface in the case of Spec. N.
  This specification is not suitable in case the Pump runs in the high load that the Pump temperature exceeds more than 80℃ because heat resistance of NBR is inferior as compared with FKM.
- Spec. N is not available for the VD60C and VD90C.

【Spec. B】

- Silicon rubber is used for O-ring and sealing material of wetted surface in the case of Spec. B.
  NBR, which has high sealing performance, is used for shaft seal at atmospheric side. Similarly to Spec. N, this specification is not suitable in case the Pump runs in the high load that the Pump temperature exceeds more than 80℃.
- Independent oil filling to oil seal
  Oil is supplied to the atmospheric seal part (oil seal) independently from circulating oil by mounting the oiler to the Pump. It suppresses damage on the atmospheric seal part by not circulating moisture, chemicals and dust, which have been mixed with lubricant oil inside the oil tank, to the atmospheric seal part.
- There is no gas ballast port. Refer to contents of “gas ballast port close” for performance described below.
- Spec. B is not available for the VD60C and VD90C.

【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･m^3/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. 4 Specifications

Specifications							
Model				VD30C	VD40C	VD60C	VD90C
Designed pumping speed		50Hz	m^3/hr	30	40	60	90
			L/min	500	670	1000	1500
			cfm	17.66	23.54	35.31	52.97
		60Hz	m^3/hr	36	48	72	108
			L/min	600	800	1200	1800
			cfm	21.29	28.25	42.38	63.57
Ultimate pressure *1	Gas ballast port close		Pa	0.67			
			Torr	5×10^{-3}			
			mbar	6.7×10^{-3}			
	Gas ballast port open		Pa	2			
			Torr	1.5×10^{-2}			
			mbar	2.0×10^{-2}			
Maximum water vapor tolerance	Gas ballast port open	50Hz	Pa	1300	1360	1320	970
			Torr	9.8	10.2	9.9	7.3
			mbar	13.0	13.6	13.2	9.7
	Gas ballast port open	60Hz	Pa	1400	1760	2800	2820 *2
			Torr	10.5	13.2	21.0	21.2
			mbar	14.0	17.6	28.0	28.2
Maximum water vapor capacity	Gas ballast port open	50Hz	g/h	190	270	430	480
		60Hz	g/h	250	410	1100	1650 *2
Motor *3	Type			Totally enclosed fan cooled 3 phase induction motor			
	Energy efficiency class			IE3			
	kw (number of poles)			1.5(4)		2.2(4)	3.7(4)
	HP (number of poles)			2 (4)		2.95(4)	4.96(4)
	Voltage *4	50Hz		200V～240V/380V～415V			
		60Hz		200V～240V/380V～460V			
Oil *5				ULVOIL R-72			
Oil capacity			L	1.0 ~ 2.5		2.5 ~ 4.0	
Cooling method				Air cooled			
Inlet				VG40 equivalency / KF40 (optional)		VG50 equivalency / KF50 (optional)	
Outlet				VG40 equivalency / KF40 (optional)			
Weight			kg	58	60	90	113
External dimensions WxDxH			mm	210 x 660 x 324	210 x 680 x 324	280 x 761 x 371	280 x 831 x 371
Applicable standard				CE / cTUVus			
Standard accessory				A dose of oil, a set of Quick Start Manual			
Recommended oil mist trap (Optional) *6				TM201: for low load operation TM401: for high load operation		TM401: for low load operation TM-2: for high load operation	
Options				Oil mist trap, gas ballast valve, oil return mechanism, ISO flange, explosion-resistant motor, special type for special application (spec F, N, B and H)			

*1 Measured with a Pirani gauge. (Apprx. $6.7X10^{-2}$Pa when measured with a McLeod vacuum gauge.)
*2 VD90C is not allowed the continuous operation in the inlet pressure at 1,000Pa or more.
VD90C maximum water vapor tolerance / maximum water vapor capacity (in the continuous operation) : 1000Pa / 600g/h
*3 Increased safety explosion-resistant motor and pressure proof explosion-resistant motor are available as an option.
*4 Factory shipment setup is 200V class Δ delta connection. Please change it to Y connection if working voltage is 400V class.
*5 Other oil types are available, upon request.
*6 High load operation means repeat pumping down between atmospheric pressure and vacuum in short term or long time operation at 10,000 Pa (75 Torr) or higher.

When you use the Pump in Quebec, Canada, French labels and instruction manual are necessary. Please contact beforehand.

2.3 System Flow

Power supply is required.

And you prepare wiring, safety circuit and exhaust processing equipment, etc.

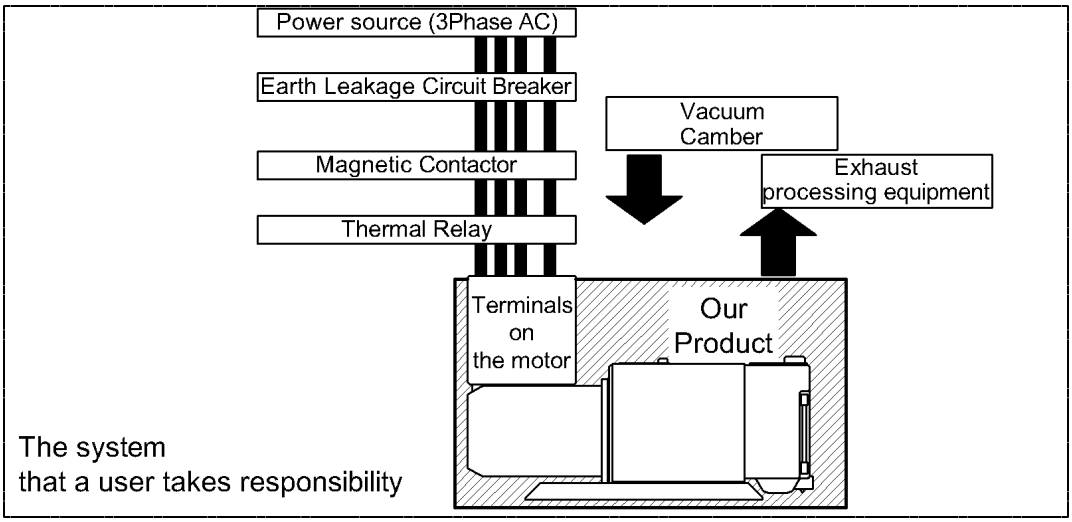


Fig. 3 Location of vacuum pump in host device

2.4 Dimensional drawing

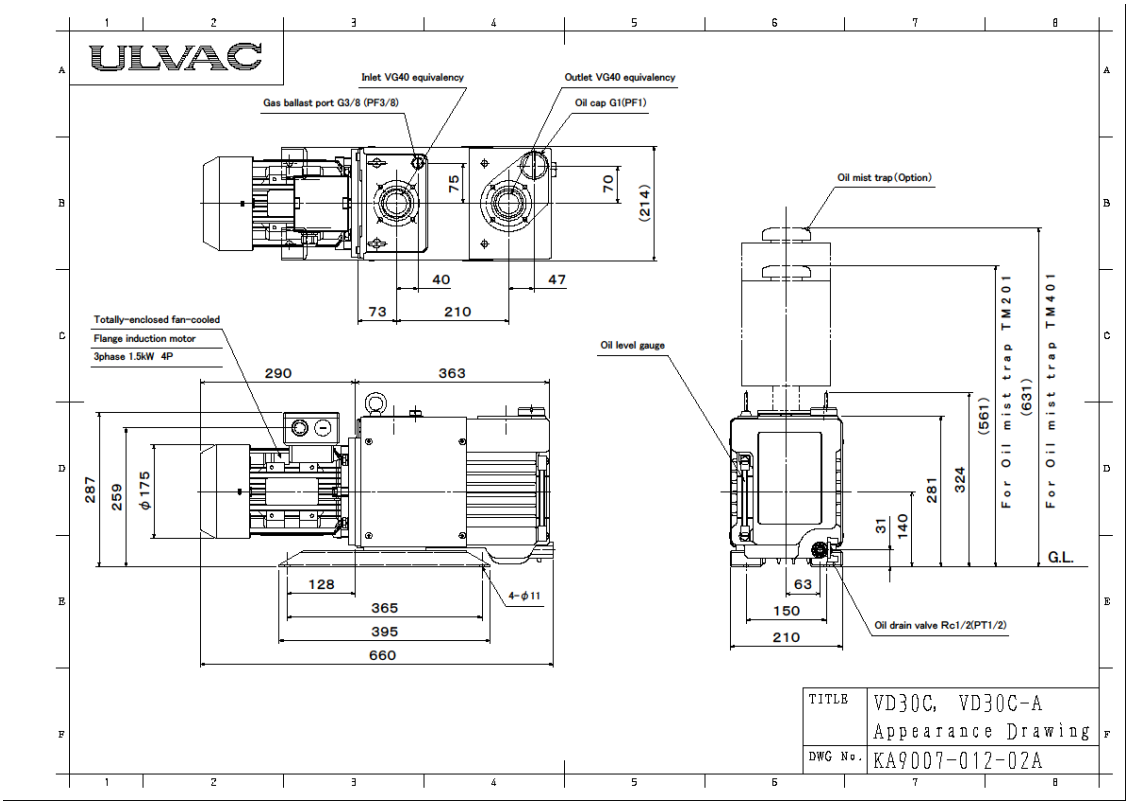


Fig. 4 Dimensional drawing VD30C, VD30C-F, VD30C-N

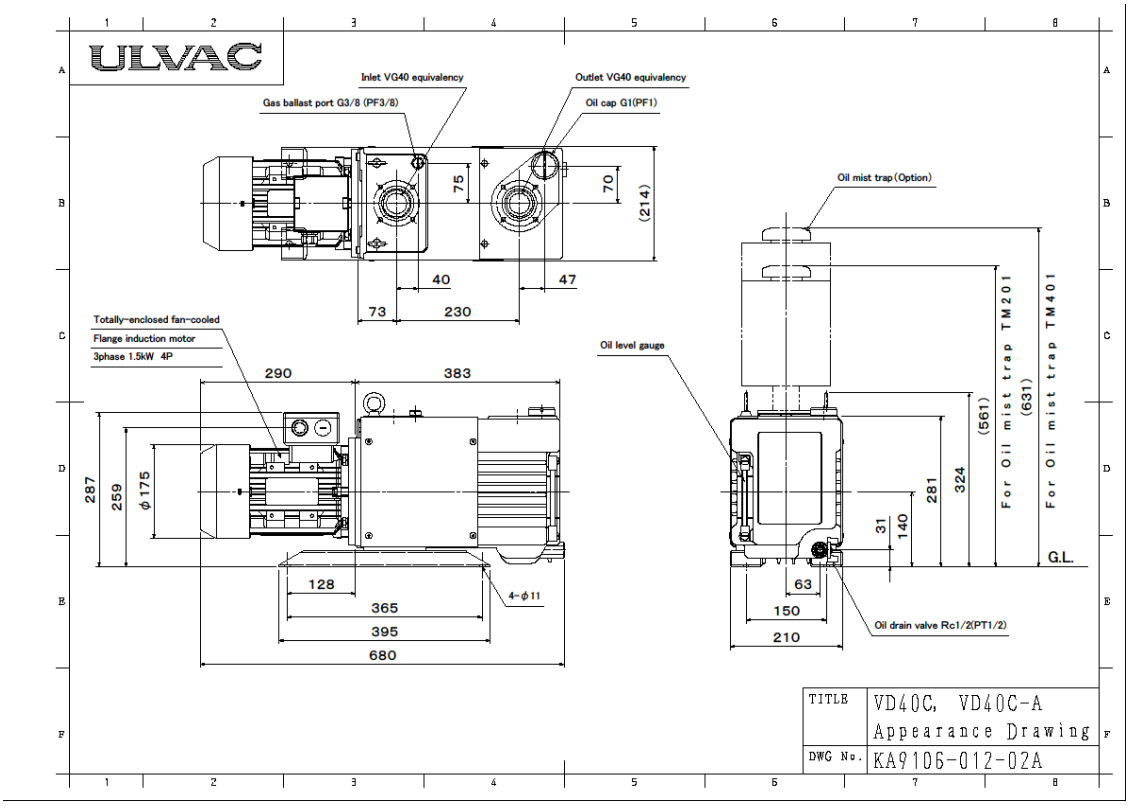


Fig. 5 Dimensional drawing VD40C, VD40C-F, VD40C-N

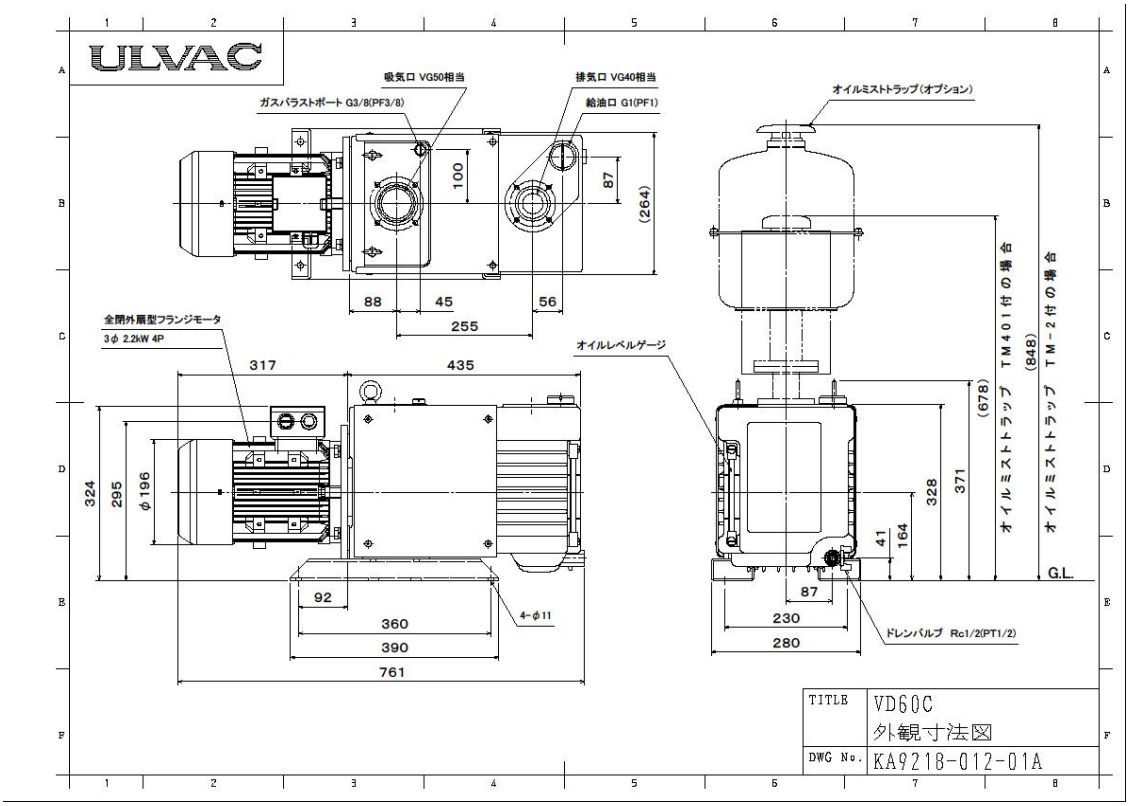


Fig. 6 Dimensional drawing VD60C

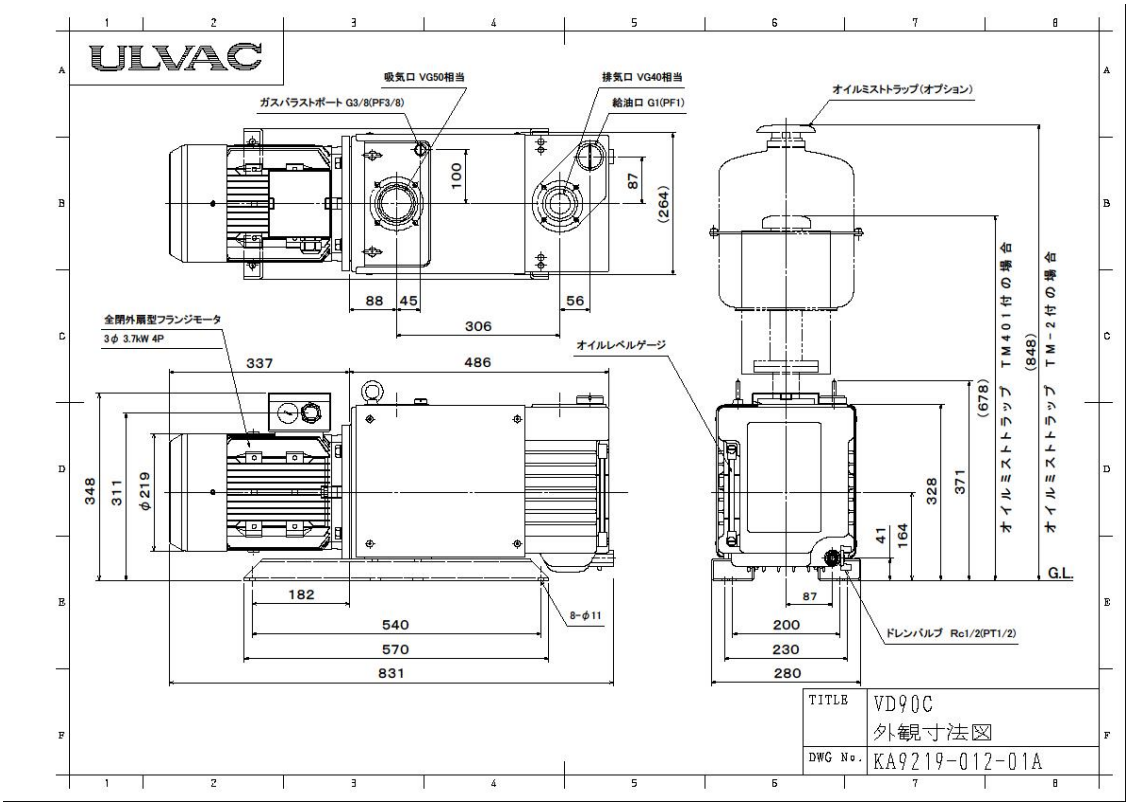


Fig. 7 Dimensional drawing VD90C

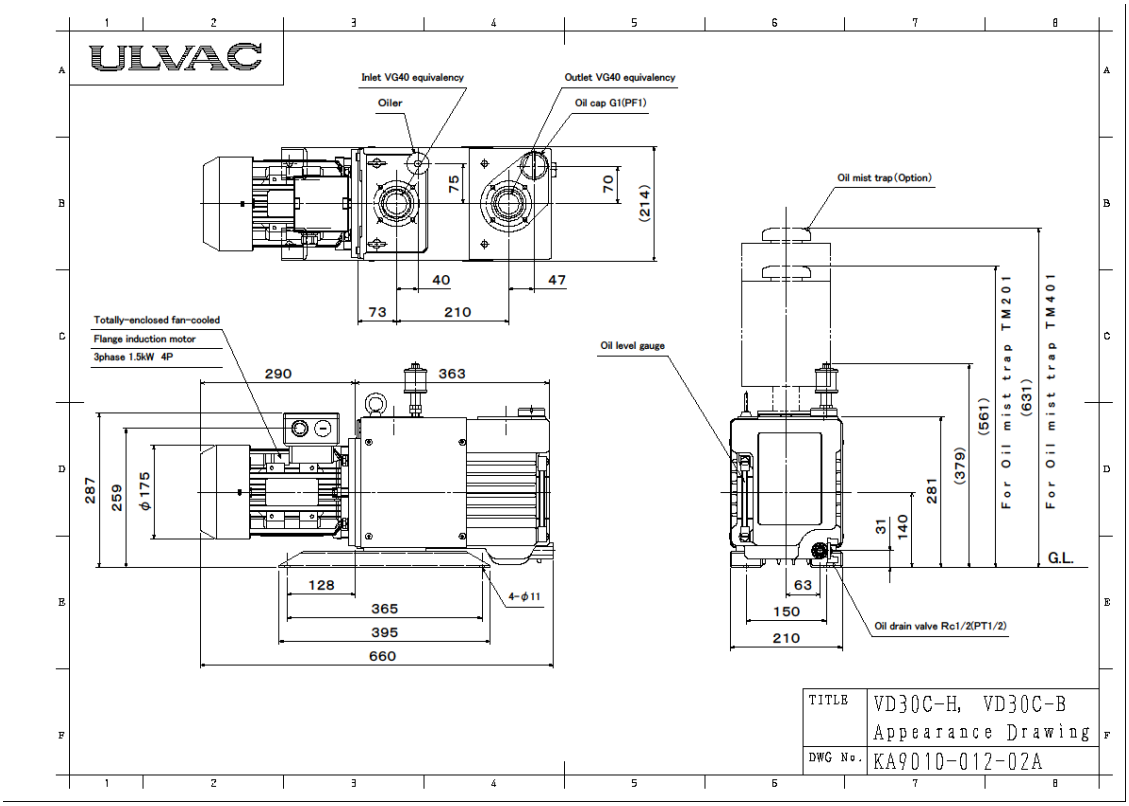


Fig. 8 Dimensional drawing VD30C-H, VD30C-B

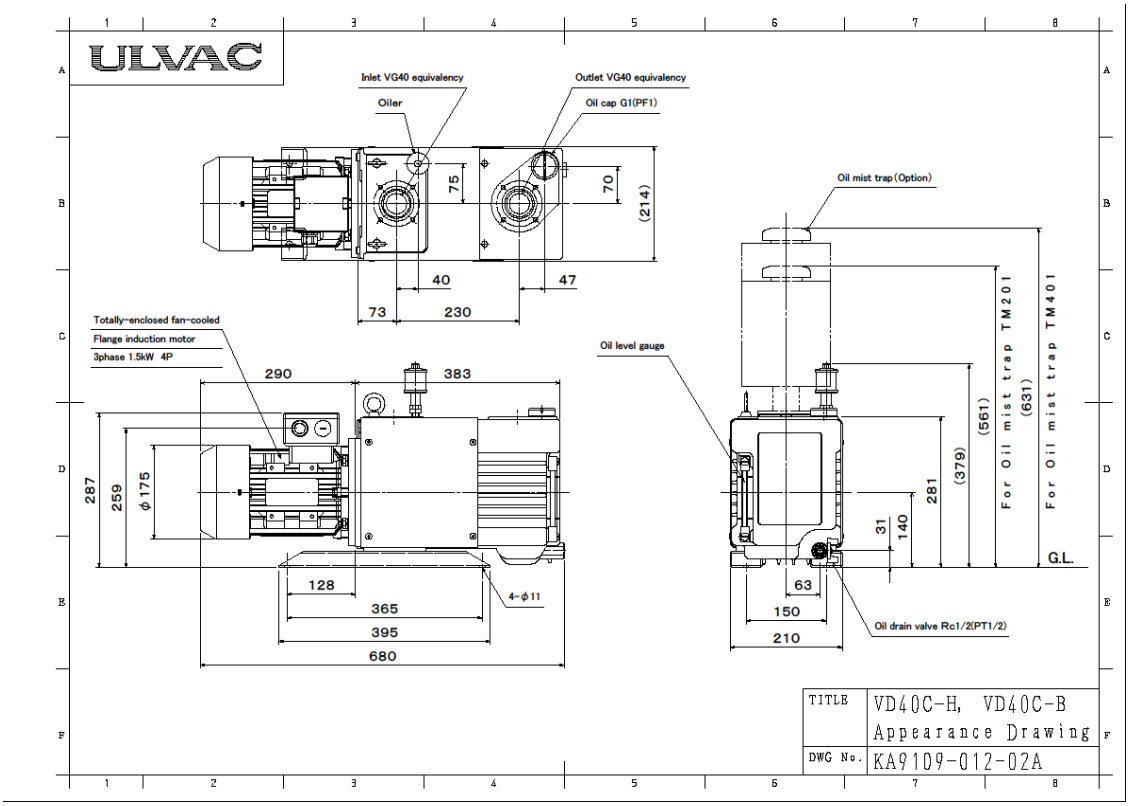


Fig. 9 Dimensional drawing VD40C-H, VD40C-B

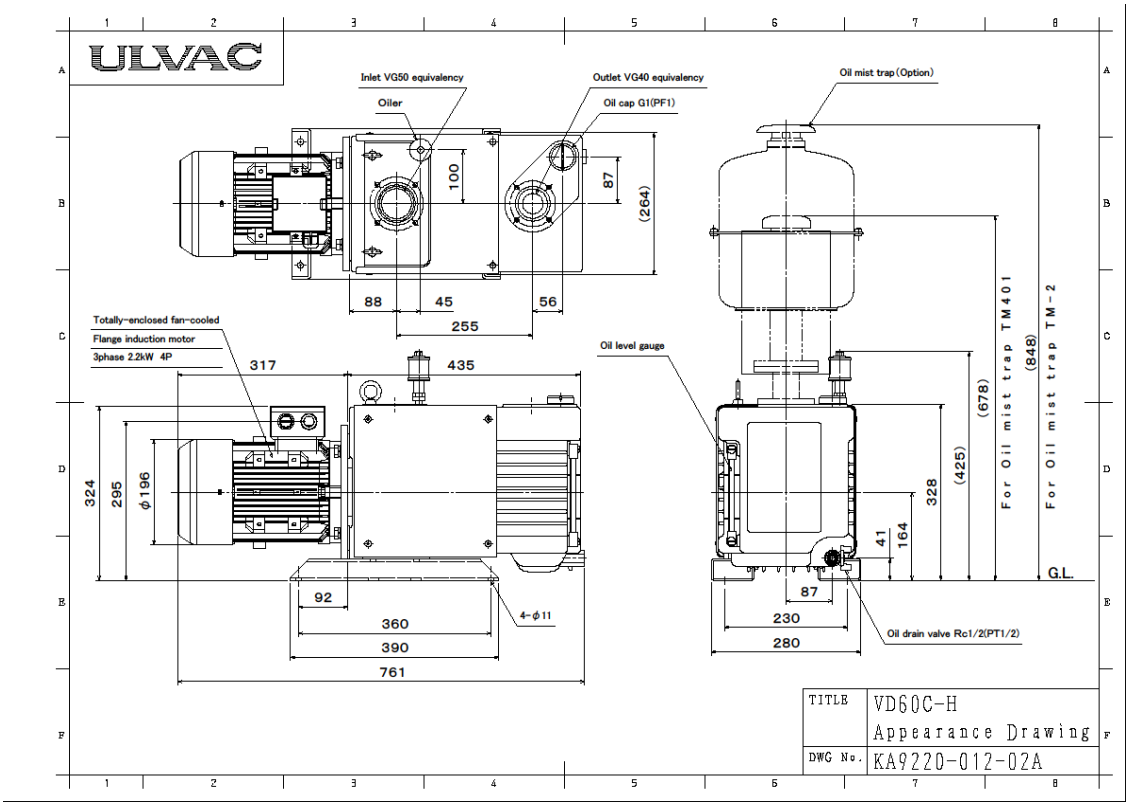


Fig. 10 Dimensional drawing VD60C-H

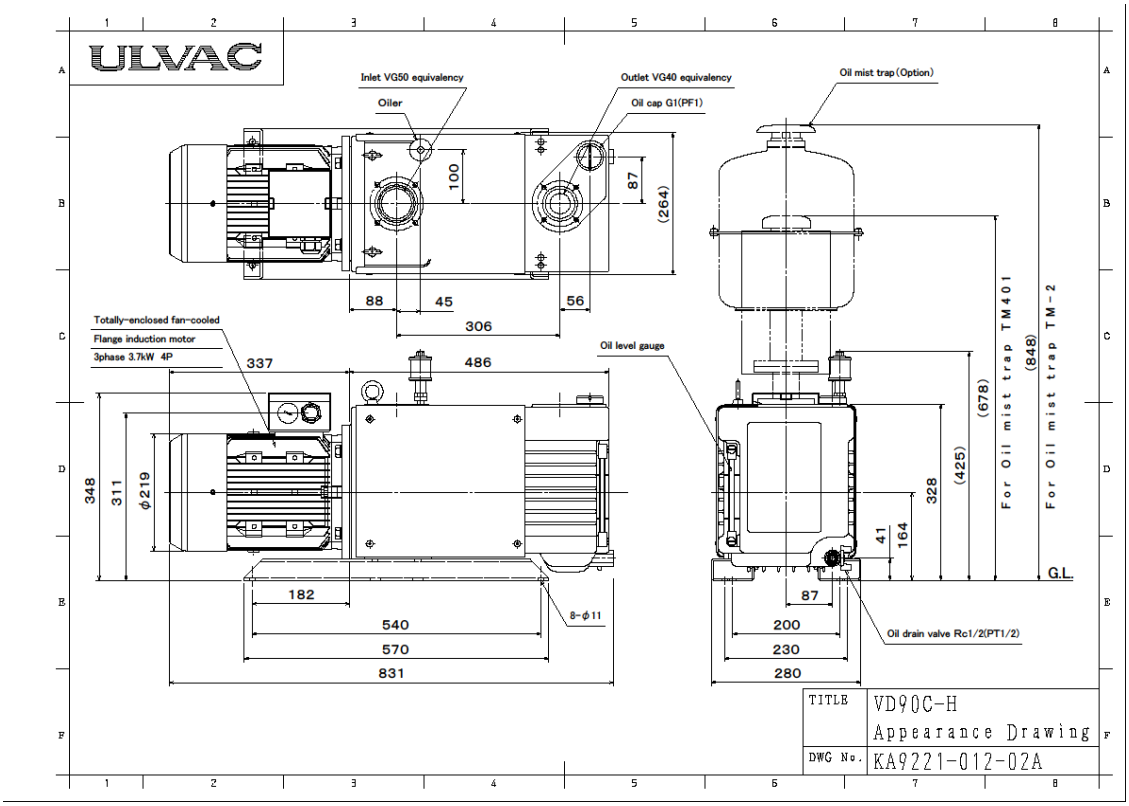


Fig. 11 Dimensional drawing VD90C-H

2.5 Pump Performance

2.5.1 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.

2.5.2 Pumping 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.12 and Fig.13 show the relation of the suction pressure and exhaust speed.

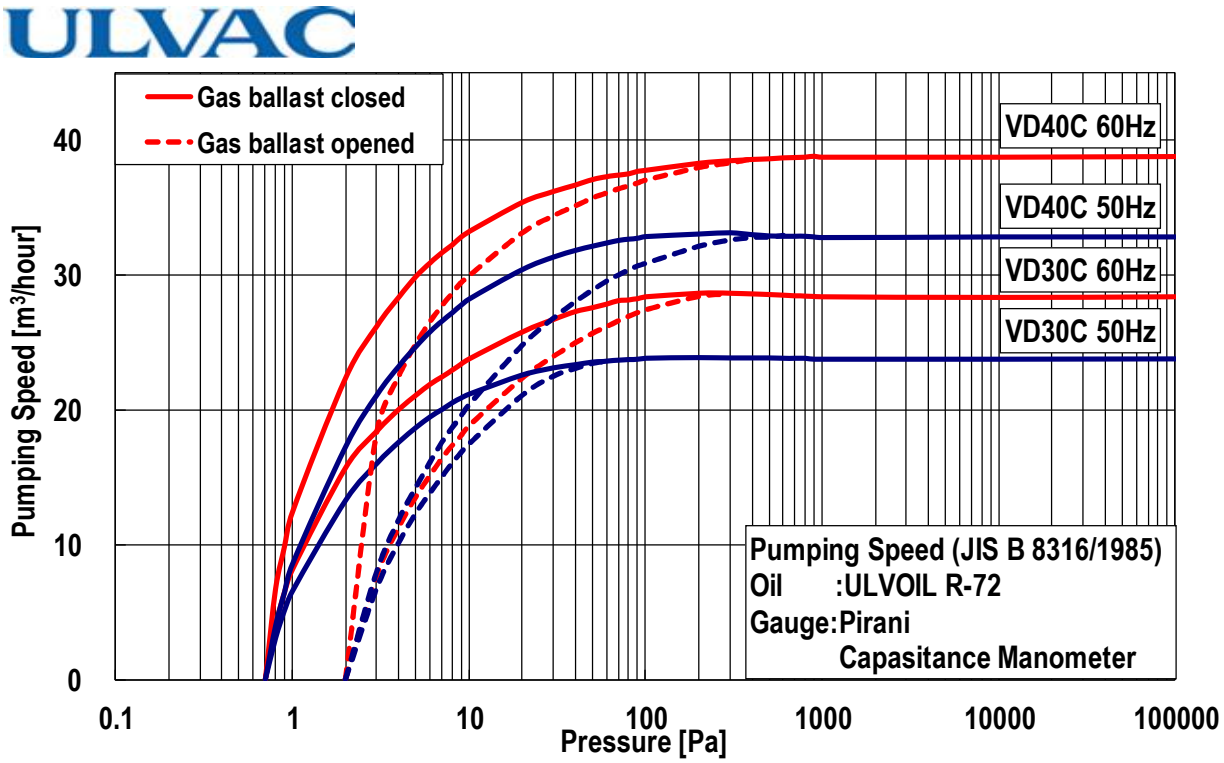


Fig. 12 Pumping speed curves - MODEL VD30C/VD40C

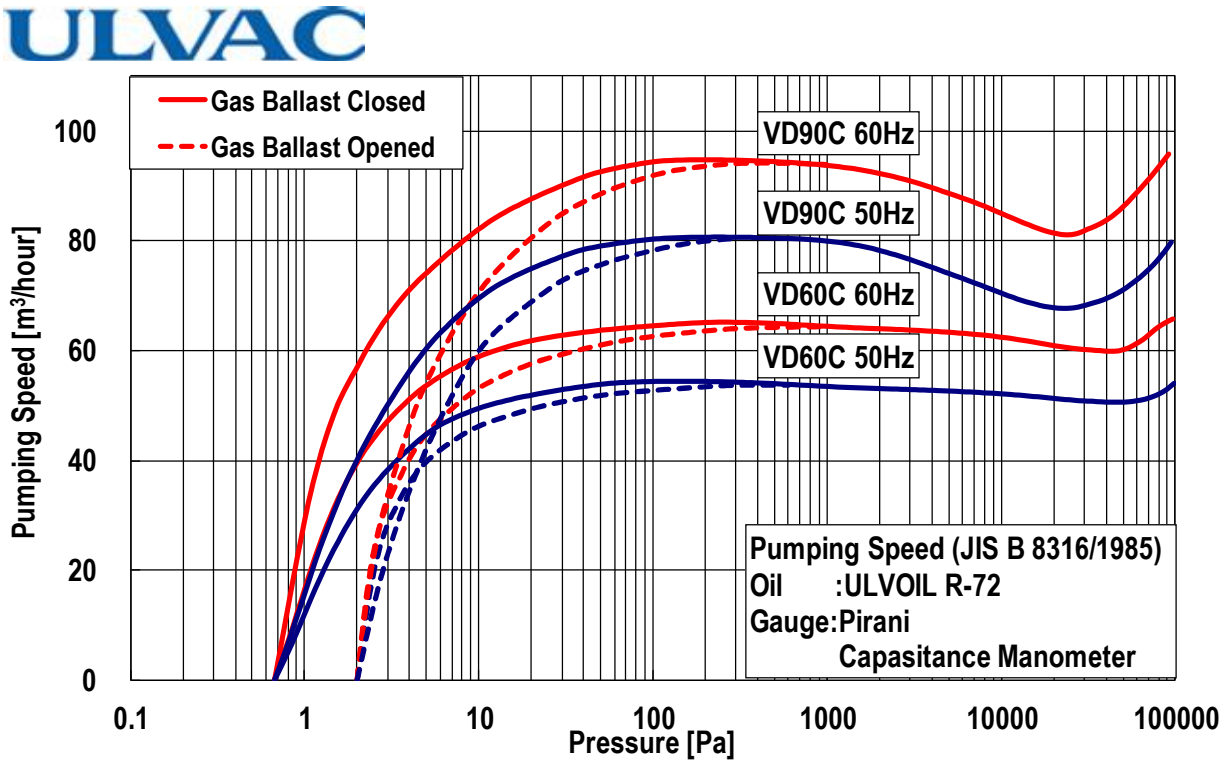


Fig. 13 Pumping speed curves - MODEL VD60C/VD90C

2.5.3 Power Requirements

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 3×10^4 ~ 4×10^4 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 3×10^4 ~ 4×10^4 Pa.

Operation opening the gas ballast valve would require larger motive energy at all the time as its compression work is large even the suction pressure was small. (Note: Spec.B and Spec.H don't have gas ballast function.) 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.

“Motor” listed on the “Table 4” are adopted taking into consideration of the above condition to drive the Pump.

3. Mounting

① You are requested to 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. 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 this 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.

② Be sure to clear any energy sources, e.g. electricity, coolant and so on of this product before installing or removing this 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”.

① 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. 4 to Fig. 11”.

② By the form of the rack, the Pump may cause resonance, and their vibration may become big.
On this case, sandwich the protection against vibration rubber between a pump and rack.

3.2 Lubrication

Remove oil filling plug, and fill the Pump with oil until oil level should be between the two level lines (MAX and MIN on the Pump case) on the oil level gauge.

When the oil level is between the two level lines, the Pump is allowed to start.

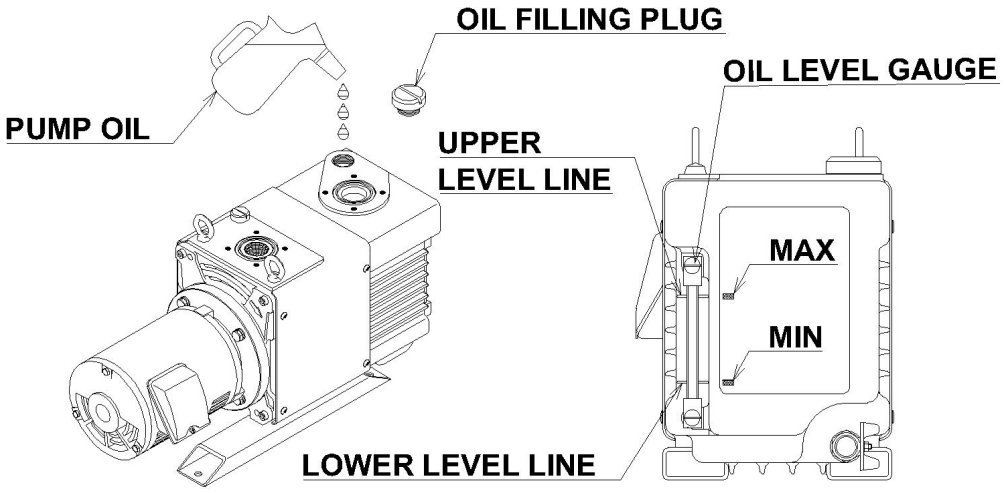


Fig. 14 Lubrication and oil level indication

① 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.

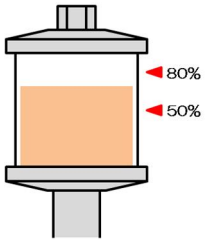
② Weal protective gears such as rubber gloves, protective goggle and so on.
Should the oil touched to your hand are entered in your eye, immediately follow the emergency treatment described on the SDS.

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.

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

② 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 and shaft sealing and result in leak, noise, motor overload and operation stop.

③ Spec.B and Spec.H pump also need oil supply to Oiler. Fill the Oiler with oil until 50-80% of all.



3.3 Inlet port Piping

Provide main valve, vacuum gauge and leak valve between the vacuum chamber and pump, as shown in Fig. 15.

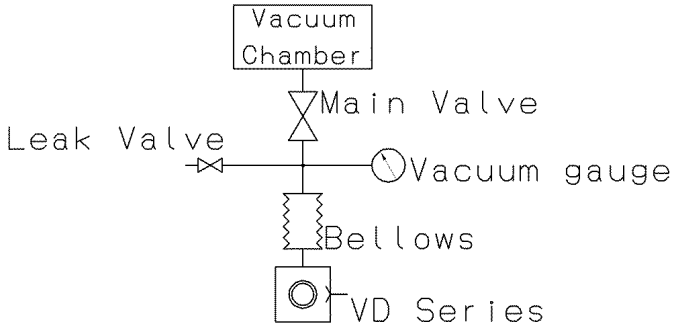


Fig. 15 Connection to vacuum chamber (example)

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

MODEL	Flange at the pipe	
VD30C	VF40	JIS B 2290:1998 Vacuum technology-Flange dimensions; Attachment book (Reference) Flange dimensions for maintenance
VD40C		
VD60C	VF50	
VD90C		

① 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.

② 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.

③ 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.

④ Clear the sand completely after having sand blasted the vacuum chamber.

⑤ Pay attention not to give damage to the Flange sheet face, Gasket slot or gasket itself.

⑥ 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.

⑦ 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.

⑧ Put the Main valve, Vacuum gauge and Leak valve between the Vacuum chamber and the Pump

⑨ 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.

3.4 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	
VD30C	VF40	JIS B 2290:1998 Vacuum technology-Flange dimensions; Attachment book (Reference) Flange dimensions for maintenance
VD40C		
VD60C		
VD90C		

① 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.

② 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.

③ 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.

④ Be sure to use pipes made of metal (electricity-conducting material). Ensure also to take a grounding

⑤ 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.

⑥ 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.

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.

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

3.5 Electrical Connection

Conduct the electrical connection referring to the Fig. 16, Fig.17 and Table.5..

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.

The motor is set up the connection matched to voltage for each destination at factory shipment.
Before starting the pump, check first that the connection is matched to used voltage.

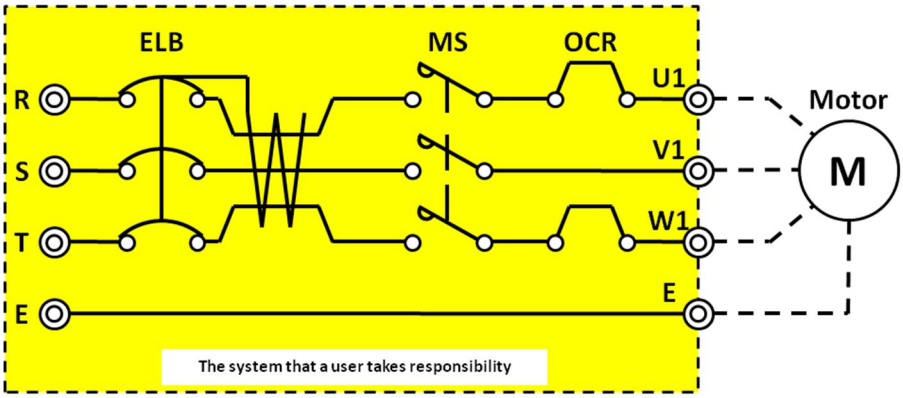


Fig. 16 Recommended connection diagram

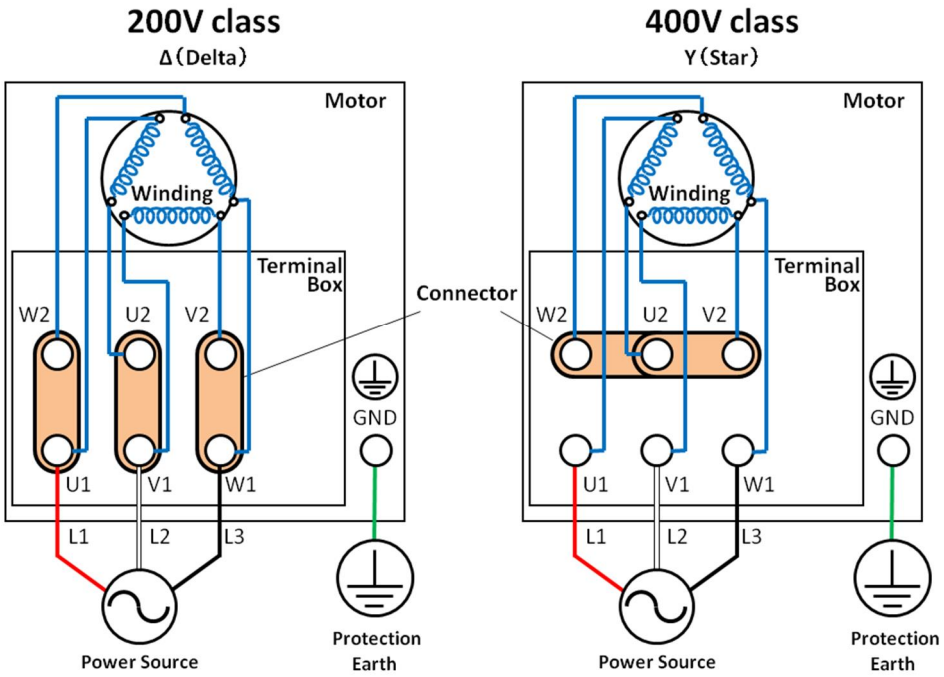


Fig. 17 Electrical wiring diagram

IMPORTANT

① Use crimping terminals for the connection and tighten screws.
Check also screws fixing the connector tighten.

② Motor rotation direction is clockwise viewed from the motor side.
Refer to the arrow mark castled on the Motor flange

③ 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.

④ 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.

⑤ Minimize the length of the ground wire

⑥ 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:

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

※ motor rated current, refer to "Table 4".

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.

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.

① Turn OFF the Power Supply to do the electrical connection.
Never try to work on it on keeping the electricity turned ON.

② A correct wiring work must observe the law and the rule that relates safely. A wrong wiring work might start a fire.

③ The measures such as lockout/tag out should be executed not so as to turn the power switch by mistakes during working.

④ 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

⑤ Use a safety circuit which keeps the motor from starting a fire which is caused by over current.

⑥ 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.

⑦ 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.

⑧ Never fail to close the Terminal box cover to operate the Pump.

⑨ Do not use it excluding the voltage rating of the motor. It causes damaging by a fire and a fire of the motor.

Do the Direct-in start connection.

Table. 5 Rated current value of the standard motor

MODEL	MOTOR	the connection inside the terminal box	Voltage	Frequency	Rated Current	Breaker	cable	Recommended Wire Gauge	Applicable Wire Gauge	Recommended Wire Gauge	Applicable Wire Gauge	Recommended Wire Gauge	Applicable Wire Gauge	Terminal Symbols	Terminal Screws	Tightening Torque	Solderless Terminals
	kw		V	Hz	A	A		For Japan		For America		For Europe and China			Size・Form	N・m	JST Corporation
VD30C VD40C	1.5	Δ (Delta)	200	50	6.3	10	settinng < 40m	$2mm^2$	$2mm^2$–$5.5mm^2$	AWG14	AWG14–AWG10	$2.5mm^2$	$2.5mm^2$–$6mm^2$	U1 V1 W1	M4 Hexagon nut	1.2–1.5	R2–4
			220	50	6.3												
			240	50	6.7												
			200	60	6.0												
			220	60	5.6												
			230	60	5.6												
			240	60	5.5												
		Y (Star)	380	50	3.6		settinng < 125m							⏚	M5 Cross recessed head screw	2.0–2.5	R2–5
			400	50	3.7												
			415	50	3.8												
			380	60	3.2												
			400	60	3.2												
			440	60	3.2												
			460	60	3.2												
VD60C	2.2	Δ (Delta)	200	50	8.6	15	settinng < 30m	$2mm^2$	$2mm^2$–$5.5mm^2$	AWG14	AWG14–AWG10	$2.5mm^2$	$2.5mm^2$–$6mm^2$	U1 V1 W1	M4 Hexagon nut	1.2–1.5	R2–4
			220	50	8.5												
			240	50	9.3												
			200	60	8.2												
			220	60	7.6												
			230	60	7.6												
			240	60	7.5												
		Y (Star)	380	50	4.9		settinng < 85m							⏚	M5 Cross recessed head screw	2.0–2.5	R2–5
			400	50	5.1												
			415	50	5.2												
			380	60	4.5												
			400	60	4.4												
			440	60	4.3												
			460	60	4.3												
VD90C	3.7	Δ (Delta)	200	50	14.4	20	settinng < 30m	$3.5mm^2$	$3.5mm^2$–$5.5mm^2$	AWG12	AWG12–AWG10	$4mm^2$	$4mm^2$–$6mm^2$	U1 V1 W1	M5 Hexagon nut	2.0–2.5	R3.5–5
			220	50	14.1												
			240	50	15.0												
			200	60	13.8												
			220	60	12.8												
			230	60	12.6												
			240	60	12.3												
		Y (Star)	380	50	8.1		settinng < 100m							⏚	M6 Cross recessed head screw	4.0–5.0	R3.5–6
			400	50	8.4												
			415	50	8.7												
			380	60	7.4												
			400	60	7.3												
			440	60	7.1												
			460	60	7.2												

4. Operation

4.1 Caution on Operation

This pump is not pressure-proof.

① Never run the Vacuum pump on blocking up the exhaust outlet, putting any device that hampers the gas passage. There is a risk that pressure in the Pump rises, and the main body of the Pump and the oil level gauge might explode, or the motor become an overload.

② This product is not made as the withstand pressure structure.
Ensured pressure value of the Pump shall be 0.03MPa (0.3kgf/cm2) (Gauge pressure).
If any valve was put to a pipe after the Exhaust outlet, check and ensure that it is open.

① Never fail 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 rod sealing and result in leak, noise, motor overload and operation stop.

② 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.

③ 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 this product keeping sucked the water.

④ 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.
When using this product in suction of chemical material, it is out of range of warranty.

⑤ 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.
When using this product in suction of solvents, it is out of range of warranty.

⑤ Caution shall be required for the operation under high pressure range.

(1) In the continuous operation of VD90C, perform it in the inlet pressure at 1000Pa or less. The temperature of the Pump becomes very high temperature, and the Pump may break.

(2) 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. Also, it is recommended to install the oil recovery mechanism (Option).
The maintenance cycle might become shorter.

(3) Upon performing the continuous operation at the high suction pressure, the oil temperature becomes very high temperature. As a result, the oil rapidly deteriorates, and the attained pressure and the exhaust speed go bad, and it causes the rapid abrasion of parts and the failure of seizing up. Frequently perform replacement of the Pump oil. Also, it is effective to cool the oil inside the Pump by installing the oil cooler.

When using the automatic vacuum breaker (Time lag electromagnetic leak valve which introduces the air in the Pump by the valve opening in 3~5 sec. after stopping the motor for the Pump drive), do connection so that it gangs with the motor.

4.2 Operation Start

Before starting the Pump, check the following again.

(1) Piping and wire connection are completed.

(2) Checking the oil level

Ensure that the oil level is between the two level lines on the oil level gauge shown in Fig, 14.

(3) Checking the rotating direction

Close the main valve on the Inlet side, open the leak valve, and run the Pump for two to three seconds to check the rotating direction of the motor.

If the motor is rotating in the correct direction (Clockwise as viewed from the motor side), pressure will drop. If it is reversed, interchange two of the three wires shown in Fig, 17.

(4) After checking (1), (2) and (3) above, close the leak valve and run the Pump. Here, ensure that the vacuum gauge between the main valve and the Pump indicates a pressure close to the ultimate pressure.

① You have a risk of getting burnt. Do not touch the Motor and Pump unit as they become high temperature during operation.
Apply an appropriate protection to avoid touching the surface as necessary.

② Refrain from touching any part other than valve when operating the Gas ballast.

③ Ensure to close the Gas ballast to start the operation.
The oil might jet out during operation around high pressure range.

④ Oil mist would appear through the Exhaust side if operated around high pressure range.
Attach the oil mist trap (option) and perform the duct piping, and pass the oil through the removal devices.

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

①Check first the oil level and fill it appropriately.

②The 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 main valve on the Inlet side, open the leak valve to vent the Pump to atmosphere, and stop the Pump.

(2) Open the Suction leak valve to make atmospheric pressure inside the Pump.

The Vacuum pump gets high temperature during operation. Refrain from touching the Motor and Pump unit until the Pump cools down after having stopped operation.
Apply an appropriate protection to avoid touching the surface as necessary.

① Ensure to close the Main 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 chamber.

② If failed in closing the Main valve, the vacuum might leak from the Exhaust side through the Pump unit.

4. 4 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.

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 valve 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 valve 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 raises enough to open the main valve (Fig. 15) 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 Main valve, breathe in the air through the gas ballast valve 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.

① The Vacuum pump gets high temperature during operation. As the gas ballast valve also gets high temperature, be sure to wear protective gear such as a pair of gloves.

② Ensure to close the gas ballast valve to start operating the Pump.
The oil might jet out of the gas ballast valve during the operation around high pressure range.

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

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 cold district

Starting the Pump operation might become difficult in winter season or in the cold district.

This is the overload phenomenon caused by increased viscosity of the Pump oil. To make sure, you should confirm that the capacity of the motor overload protective device conforms to the motor rated value, the Pump is not broken and the cable does not have abnormality. Then, warm up the Pump oil or replace the oil with the Vacuum pump oil ULVOIL R-42 having lower viscosity.

Recommended type of oil:

(1) ULVOIL R-72 (standard oil)

(2) ULVOIL R-42 (For cold district in winter. In the case of ambient temperature 4~10℃)

IMPORTANT

① When temperature is low, and a pump does not run, warm up the Pump oil or turn the Pump on and off several times in short intervals.

② When the Pump stops after run for several seconds, you try to move it while putting slow leak in it, there is the thing that the Pump can run consecutively. As the Pump warmed, you close the slow leak valve, and please return it to regular running.

① It is better to use the ULVOIL R-42 having less viscosity that enables you to start rotating the Pump around 4℃.

You should, however, replace it with the ULVOIL R-72 if the temperature gets 10℃ or more. Be cautious as using the ULVOIL R-42 in warm season would cause such troubles as sealing error, oil leak or more serious trouble, due to its lower viscosity.

③ ULVOIL R-42 is unfitted for high load operation. When performing the high load operation, use ULVOIL R-72, and either warm the Pump oil or perform the Pump jog at several times, and start it up.

4.6 Oil mist trap (Optional)

The oil mist trap can be mounted to trap the oil mist discharged from the Pump.

	Pressure at the inlet	
	10000Pa or less	10000Pa or more
VD30C/VD40C	TM201	TM401
VD60C/VD90C	TM401	TM-2 (With an adapter)

For more information, please see the instructions OIL MIST TRAPS.

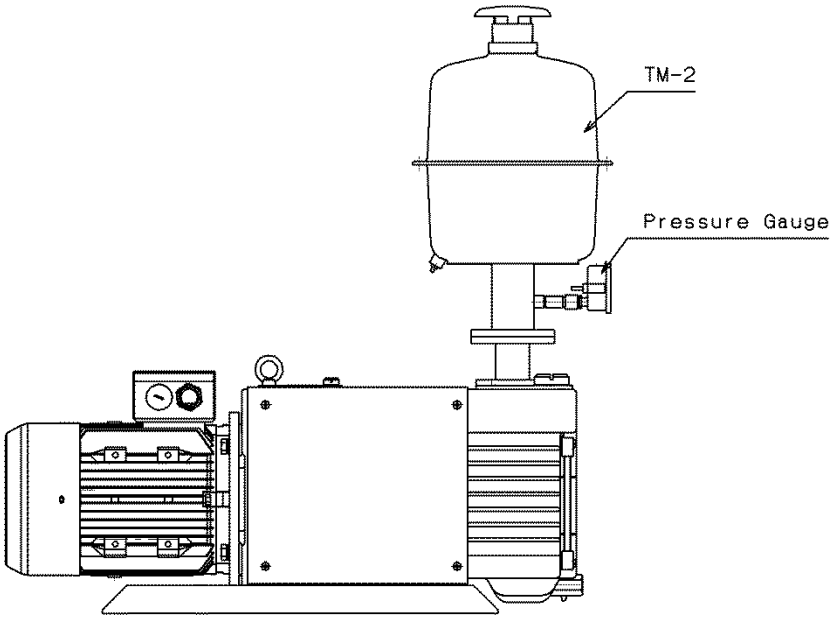


Fig. 18 Installation example VD90C

Limit value of the pressure inside the Pump is 0.03MPaG (0.3kg/cm2G) (Gauge pressure). If the pressure is raised, filter element please exchange.
We recommend you to install a Pressure monitor.

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 (include the oil mist trap) and might result in breaking it.

5. Maintenance and Check

5.1 Maintenance

You should check following points at least once per three days while you continue operation.

Check the machine much more frequently during high overload operation (continuous operation at 1000Pa or more, repeated operation between atmospheric pressure and vacuum).

(1) Whether the Vacuum oil pump oil volume is between two level lines or not.

(2) Whether the Vacuum pump oil is discolored or not.

(3) Whether there is no oil leak from the Pump.

(4) Whether there is no foreign noise.

(5) Whether there is anything strange in the motor current value.

5.2 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.

① 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.

② 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.

③ Ensure to have a correct grounding.
You have a risk of getting electrical shock in case of failure or electric leakage.

④ You are recommended further to install a dedicated earth leakage breaker.

⑤ It is imperative to put the overload protection device.
Otherwise it would cause the motor burn out and/or fire.

5.2.1 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 Fig.14)

5.2.2 Vacuum Pump Oil Check

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

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 is rise, leading to poor function of the mechanical friction parts of the Pump. In the worst case, the Pump will seize up and cannot be rotated.

The vacuum pump oil will be gradually deteriorated not only by contamination with sucked gas, but also by temperature rise during pump operation.

It is recommended to replace the first Pump oil within 10 days after operation start, and see how it got contamination, viscosity and discoloring to determine the oil replacement cycle. Check and replace the oil periodically.

The oil level gauge is for checking the Pump oil level. Since the oil is not circulating between the Pump case and the oil level gauge, contamination or discoloring of the oil may not be observed on the oil level gauge. Periodically drain approx. 50 ml, of oil through the drain valve and check the oil for contamination and discoloring.

Table. 6 Recommended replacement cycle of the vacuum pump oil

Purpose	Replacement timing
Vacuum system for study / laboratory, small vacuum system	Within 6 months ~ 1 year
Vacuum system for production / vacuum evaporation	Within 3 ~ 6 months
Vacuum valve exhaust system / large vacuum evaporation system	Within 3 months
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 / food packing system	Within 1 week

① **Never fail 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 rod sealing and result in leak, noise, motor overload and operation stop.

⑥ **The Pump oil might deteriorate in a shorter time depending on the use. It is recommended to replace the first Pump oil within 10 days after operation start, and see how it got contamination, viscosity and discoloring to determine the oil replacement cycle.**

③ **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 this product keeping sucked the water.

④ **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.
When using this product in suction of chemical material, it is out of range of warranty.

⑤ **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.
When using this product in suction of solvents, it is out of range of warranty.

⑦ **Caution shall be required for the operation under high pressure range.**

(1) In the continuous operation of VD90C, perform it in the inlet pressure at 1000Pa or less. The temperature of the Pump becomes very high temperature, and the Pump may break.

(2) 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. Also, it is recommended to install the oil recovery mechanism (option).
The maintenance cycle might become shorter.

(3) Upon performing the continuous operation at the high suction pressure, the oil temperature becomes very high temperature. As a result, the oil rapidly deteriorates, and the attained pressure and the exhaust speed go bad, and it causes the rapid abrasion of parts and the failure of seizing up. Frequently perform replacement of the Pump oil. Also, it is effective to cool the oil inside the Pump by installing the oil cooler.

5.2.3 Replace Vacuum Pump Oil

Proceed as follows.

(1) Shut down the Pump and open the drain port to drain the oil in the Lubrication chamber. Upon completion of draining the oil, close the drain port again and run the Pump under no load for approx. 5 seconds to drain the oil adhered to the Pump parts.

(2) Close the drain port and fill fresh oil through the oil filling port. (Refer to Fig.14) Fresh oil until the oil level comes the upper line of the oil level gauge.

(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.

① 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.

② Weal protective gears such as rubber gloves, protective goggle and so on.
Should the oil touched to your hand are entered in your eye, immediately follow the emergency treatment described on the SDS.

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.

5.2.4 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.

5.2.5 Checking Gas Ballast Function

When used the Gas ballast function, the valve or in the introduction passage inside the Pump may be stuck in the dust. Replacement parts and repair support at the local service center. Please contact us.

5.2.6 Checking 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.

If there is the metal mesh is dirty, please wash that.

Further it is anticipated that any welding scale drops off in the pipe particularly at the beginning of the system start. Be fully cautious.

5.2.7 Checking 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 “5.5 Trouble check list.”

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

5.2.8 Checking 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. Please contact the closest Service center.

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. (Refer to Fig. 19).

(1) Stop the Pump and turn OFF the Power Supply. Disconnect the power cable of the motor.
(2) Use a Phillips screw driver to remove the pen head screw with cross recess x 8 fixing the Panel.
(3) Use a wrench to remove the M8 nut x 4 and spring washer x 4 fixing the Pump unit.
(4) Remove the Pump unit from the medium case.
(5) Now you can check the spider of the coupling. Replace the spider with a new one.
(6) 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.
(7) Put the M8 nut x 4 and spring washer x 4 removed in the item (3) above (Recommended tightening torque: 25 N・m).
(8) Put the pen head screw with cross recess x 8 removed in the item (2) above.
(9) Execute the wiring.

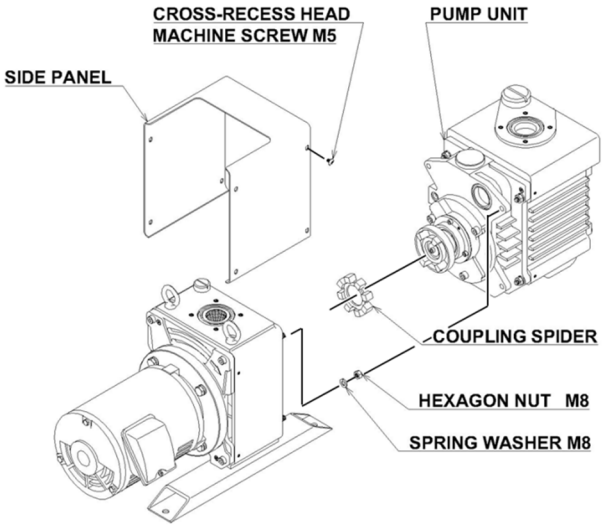


Fig. 19 Replacement of coupling spider

① When removing and installing the Pump main body for replacement of the coupling spider and for overhaul, lift and support the Pump main body by a crane, etc. to ensure the work safety.

Example: Wrap nylon sling around the Pump main body so that it does not fall down, and lift and support it by a crane.

Example: Install 2 pieces of M8 eyebolts to the exhaust port, and lift and support by a crane, etc.

② Be sure to turn OFF the Power Supply when putting on and taking out the Motor.

③ Only the technically entitled person should be in charge of operating the machine such as crane.

5.2.9 Checking Oil Mist Trap (option)

To use the Oil mist trap, be cautious not to have clog of the filter element in the trap. Too much clog would prevent the exhaust gas from passing through the filter element, 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/cm^{2}G) (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. For the pressure monitor mounting position, refer to Fig.17 or the instruction manual for the oil mist trap.

5.2.10 Checking drain valve

If you leave the drain valve with half opened for several months, it might get deformed that you might not be able to shut the Pump all the way. When storing the Pump, please make sure the valve is completely shut. If you are using the plug instead of valve, the same situation will be applied.

5.3 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.

5.4 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 this production on forecast.

Please contact the Service Center close to you listed at the end of the document as for the overhaul. Do not forget to fill and submit the Contamination certificate enclosed in the end of the document.

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.

① 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.

② You shall be in need of replacing such parts as listed on the "9. Main Displacement parts" at minimum.
Do not forget to fill and submit the Contamination certificate

5.5 Trouble shooting

Table. 7 Troubleshooting

Trouble	Causes		Processing Method	Reference
The Pump dose not run.	1	Motor connection is wrong.	Check the connection.	3.5
	2	Safety circuit such as a MS (Magnetic Switch) is not correctly set.	Make the Safety circuit conform to the Motor specification.	3.5
	3	Oil viscosity got higher.	Change oil.	3.2 5.2.1 5.2.2
	4	Foreign substance entered in the Pump caused burning the rotor or the like	Conduct the overhaul (replacement of the cylinder, rotor, cover and so on.)	5.4
	5	Reactive agent accumulated inside the Pump while the Pump was stopped after having exhausted the reactive gas.	Conduct the overhaul (Cleaning inside the Pump, removal of reactive agent and so on.)	5.4
	6	The Pump is not connected to the power supply.	Connect the Pump to the power supply.	3.5
	7	The power switch is not turned on.	Turn on the power switch.	3.5
	8	Are all three phases of power supply normal? Abnormal phase voltage.	Check the power supply.	3.5
	9	Are the Safety circuit such as a MS (Magnetic Switch) and MCCB (Molded Case Circuit Breaker) normal? Trips.	Right the cause of trips. Reset	3.5

Trouble	Causes		Processing Method	Reference
The Pump dose not run.	10	Are the Safety circuit such as a MS (Magnetic Switch) and MCCB (Molded Case Circuit Breaker) normal? Failure of components.	Check the Safety circuit and replace.	3.5
	11	Run only by the Motor. Is the Rotation and current value correct?	Replace the Motor	5.4
	12	Moisture or solvents were sucked in, forming rust inside the Pump.	Conduct the overhaul (replacement of the casing, rotor, cover and so on.)	5.4
	13	Water absorption expands the vanes.	Conduct the overhaul (replace the vanes)	5.4
	14	Components inside the Pump have burnt out.	Conduct the overhaul.	5.4
	15	Temperature is low	a. turn the Pump on and off several times in short intervals. b. warm up the Pump oil. c. move a pump while putting slow leak in a pump d. Replace the oil. ULVOIL R-42	2.2 4.1 4.2 4.5
	16	Pump was not vented when stopped.	Turn the Pump on and off several times in short intervals.	4.1 4.2 4.3
	17	The oil is not supplied by the specified volume. a. Oil flow to outside of pump.	Control the oil level. Conduct the overhaul. Supply the oil by the specified volume. a. Replace O-rings, etc.	3.2 5.2.1 5.2.2

Trouble	Causes		Processing Method	Reference
Unusual sounds make.	1	Motor rotation direction is reverse.	Do the connection again to correct the rotation direction.	3.5
	2	The oil is not supplied by the specified volume.	Control the oil level. Supply the oil by the specified volume. Conduct the overhaul. (Replacement of the Pump part)	3.2 5.2.1 5.2.2
	3	Foreign matter has entered the Pump.	Conduct the overhaul. (Clean the Pump to eliminate foreign matter.	5.4
	4	Cooling fan is touching.	Check the Cooling fan mount and clear the error.	5.2.8 5.4
	5	The oil is not circulating. a. Oil pit of the Cover or the like is clogged. b. Oil distributor valve has a trouble.	Conduct the overhaul. a. Clean the oil pit. b. Check and repair the Oil distributor valve.	5.4
	6	Vanes are not moving.	Conduct the overhaul. Wash out substances stuck to the vane.	5.4
	7	Components inside the Pump have burnt out.	Conduct the overhaul.	5.4
	8	Panel screw is loose.	Tighten the screw.	5.2.7
	9	Rattling sounds on starting or stopping the machine.	There is no particular problem as it’s a phenomenon caused by vanes that temporarily make irregular motions.	-

Trouble	Causes		Processing Method	Reference
The pressure does not decline, and the Pumping speed is slow.	1	Pump exhaust capacity is smaller compared to the Vacuum chamber capacity.	Select another Pump type.	2
	2	Pressure measurement method is wrong.	Measure correctly the pressure.	2.5.1
	3	Vacuum gauge is not appropriate.	Use the Vacuum gauge that matches the measurement pressure range and correctly calibrated one to measure the pressure.	2.5.1
	4	Pipe connected to the Suction inlet is thin or connection distance is long.	Connect a pipe wider than inlet diameter and shorten the connection distance between the Vacuum chamber.	3.3 2.5.1
	5	Metal mesh at the inlet is clogged.	Remove the pipe above the inlet and wash the mesh.	4.1 5.2.6
	6	The oil is not supplied by the specified volume.	Control the oil level. Supply the oil by the specified volume. Conduct the overhaul. (Replacement of the Pump part)	3.2 5.2.1 5.2.2

Trouble	Causes		Processing Method	Reference
The pressure does not decline, and the Pumping speed is slow.	7	Oil is dirty. a. Water is being suctioned. b. Dust is being suctioned. c. Solvent vapor is being suctioned. d. Foreign substance enters in.	Replace with new oil. Conduct the overhaul. (Inside cleaning) a. Put the trap into the front stage of the Pump. b. Put filters/traps into the front stage of the Pump. c. Put the trap by use application into the front stage of the Pump. d. Put filters into the front stage of the Pump.	3.2 5.2.1 5.2.2
	8	There is a leak in the pipe connecting with the Pump.	Use a Leak detector or the like to find out the leak position and stop it.	3.3
	9	Not using the ULVAC genuine oil.	Conduct the overhaul of the Pump and replace the oil with the ULVAC oil.	3.2 5.2.1 5.2.2
	10	New oil pump was just entered.	Perform no-load operation for a while.	-
	11	Leak valve is open	Close the valve.	3.3
	12	Motor rotation direction is reverse.	Do the connection again to correct the rotation direction.	3.5
	13	The oil is not circulating. a. Oil pit of the Cover or the like is clogged. b. Oil distributor valve has a trouble.	Conduct the overhaul. a. Clean the oil pit. b. Check and repair the Oil distributor valve.	5.4
	14	Water entered inside the Pump.	Replace the oil.	3.2 5.2.1 5.2.2

Trouble	Causes		Processing Method	Reference
Abnormal heating	1	Keeping continuous operation under high suction pressure.	Pump surface temperature would rise up around 100℃ on continuous operation under high suction pressure.	4 4.1 4.2 4.3
	2	The oil is not supplied by the specified volume.	Control the oil level. Supply the oil by the specified volume.	3.2
	3	Oil is dirty.	Replace with new oil. Conduct the overhaul. (Inside cleaning)	3.2 5.2.1 5.2.2
	4	Suction gas is hot.	Install a cooling device such as the gas cooler on the suction side.	-
	5	Area around the Pump is enclosed.	Make the ventilation available.	0.5.3
	6	High temperature	Please use it in environment with the air conditioning	0.5.3
	7	There is a leak in the pipe connecting with the Pump.	Use a Leak detector or the like to find out the leak position and stop it.	3.3
	8	The oil is not circulating. a. Oil pit of the cover or the like is clogged. b. Oil distributor valve has a trouble.	Conduct the overhaul. a. Clean the oil pit. b. Check and repair the oil distributor valve.	5.4

Trouble	Causes		Processing Method	Reference
Oil leaks to the outside of the Pump.	1	Deterioration of the O-ring and/or oil seal of the Case and Cover.	Conduct the overhaul.	5.4
	2	Oil inlet is loose. The drain port is loosening.	Tighten again the oil inlet. Re-tighten the drain port.	5 5.1 5.2
The motor current value is abnormal.	1	Foreign substance entered inside the Pump impaired the Motor rotation.	Conduct the overhaul. Removal of foreign substance inside the Pump.	5.4
	2	There is a leak in the pipe connecting with the Pump.	Use a Leak detector or the like to find out the leak position and stop it.	3.3
	3	Abnormal sliding of the rotor and/or vane.	Conduct the overhaul.	5.4
	4	Keeping continuous operation under high suction pressure.	Adjust the pressure.	-
Lot of oil mist blowing out of the Exhaust outlet.	1	Pump is filled over the specified volume.	Drain the oil until it gets the specified volume.	3.2 5.2.1 5.2.2
	2	Keeping continuous operation under high suction pressure	Put the oil mist trap on the Exhaust side.	4.6
	3	Oil mist trap is clogged.	Replace the oil mist trap.	4.6 5.2.8
Initially, performanc e was being satisfied, but the vacuum degree became decreased.	1	Oil is dirty. a. Water is being suctioned. b. Dust is being suctioned. c. Solvent vapor is being suctioned d. Foreign substance enters in.	Replace with new oil. Conduct the overhaul.(Inside cleaning) a. Put the trap into the front stage of the Pump. b. Put filters/traps into the front stage of the Pump. c. Put the trap by use application into the front stage of the Pump. d. Put filters into the front stage of the Pump.	3.2 5.2.1 5.2.2

6. Removal / transport

6.1 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) Discharge the lubrication oil.

(4) Remove the Suction/exhaust piping and put Blind flanges to the Pump inlet and outlet to seal them up

① 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.

② 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.

③ Keep applying a plate displaying the name of exhausted gas on a place easily seen on the Pump.

① You have a risk of giving damage to your back as the load larger than safety standard shall be required to transfer this product.

VD30C: 58kg
VD40C: 60kg
VD60C: 90kg
VD90C: 113kg

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.

② Never try to enter beneath the Pump unit when lifted it up.
Use its top eyebolt to load/unload the unit.

7. 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.

① 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.

② Dispose the vacuum pump oil following the description of the [Caution on disposal] in the Chemical Material Safety Data Sheet. Contact our Sales division as for the SDS.

8. 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.

8.1 Warrantable Items

(1) Oil Rotary Vacuum Pump

VD30C, VD30C-F, VD30C-N, VD30C-B, VD30C-H
VD40C, VD40C-F, VD40C-N, VD40C-B, VD40C-H
VD60C, VD60C-H
VD90C, VD90C-H

8.2 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

8.3 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.

8.4 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.

8.5 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 9. Main Displacement Parts)

8.6 Others

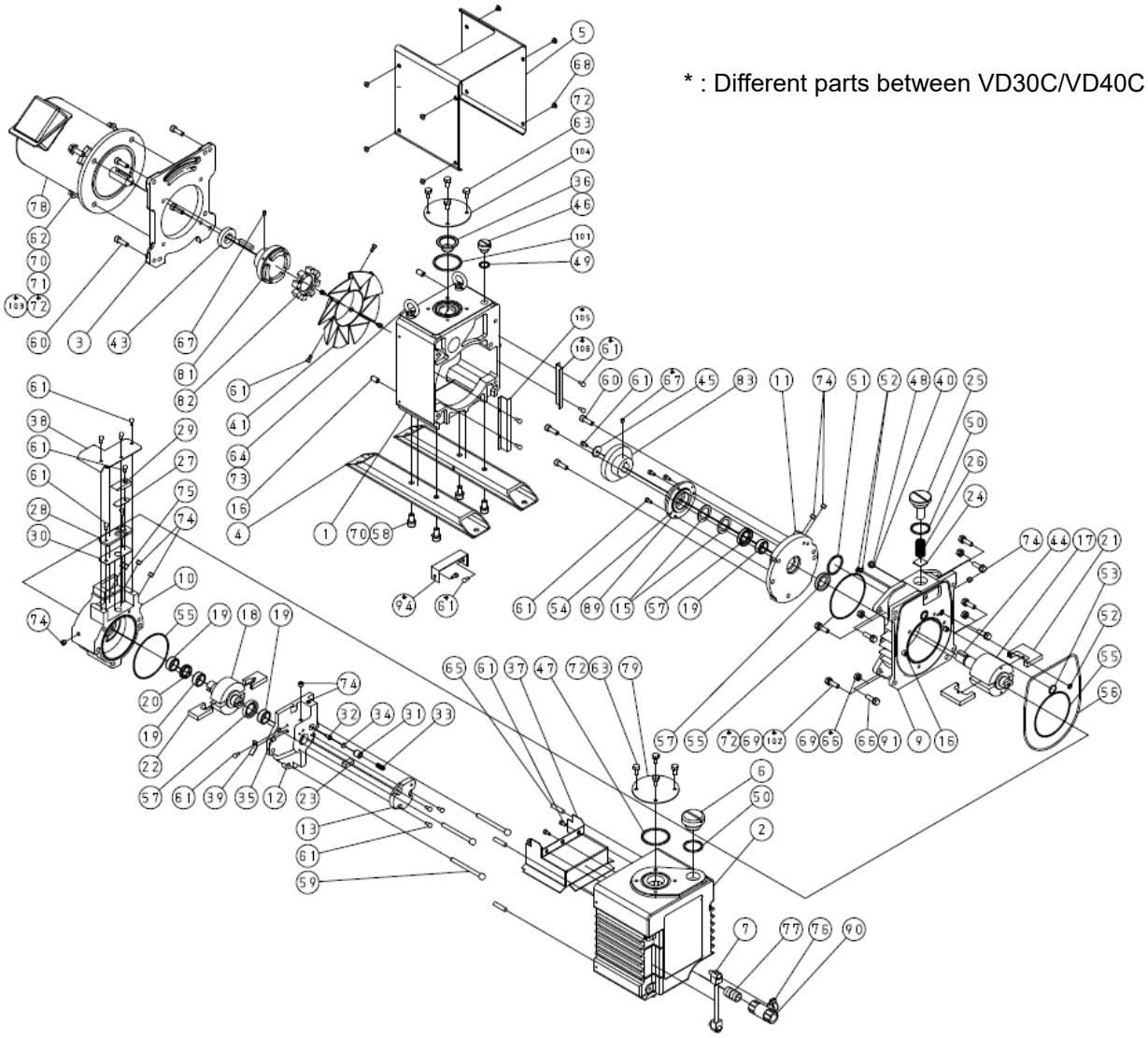
(1) In case, special agreement or memorandum for specifications is made individually.

(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.

9. Main Replacement Parts



* : Different parts between VD30C/VD40C and VD60C/VD90C

Fig. 20 Exploded perspective view

Table. 8 Parts list

No.	Descriptions	Drawing No.	Q'ty				No.	Descriptions	Drawing No.	Q'ty				No.	Descriptions	Drawing No.	Q'ty				No.	Descriptions	Drawing No.	Q'ty			
			VD30C	VD40C	VD60C	VD90C				VD30C	VD40C	VD60C	VD90C				VD30C	VD40C	VD60C	VD90C				VD30C	VD40C	VD60C	VD90C
1	Intermediate case	KA9002-021-01	1	1			18	2nd rotor shaft	KA9002-023-02	1	1			40	O-ring pipe	KA9002-028-05	1	1	1	1	69	Spring washer	M8	8	8	10	10
		KA9202-021-01			1	1			KA9202-023-02			1	1	41	Cooling fan	KA9002-029-01	1	1			70	Spring washer	M10	8	8	4	4
2	Pump case	KA9002-021-02	1	1			19	Slide bearing	EC403-013-01	4	4	2	2			KA9202-029-01			1	1		Spring washer	M12			4	4
		KA9201-021-02			1	1			KA9202-035-01			2	2	43	Coupling collar	KA9002-029-03	1	1			71	Plain washer	M10	4	4		
3	Motor flange	KA9002-021-03	1	1			20	Slide bearing guide ring	EC403-013-02	1	1					KA9202-029-03			1	1		Plain washer	M12			4	4
		KA9201-021-03			1	1			KA9202-035-02			1	1	44	Coupling key	KA9002-029-04	1	1			72	Helical insert screw	M8x1.5	8	8	14	14
4	Base	KA9002-021-04	2	2			21	1st vane	For VD30C	2						KA9202-029-04			1	1	73	Helical insert screw	M10x1.5	6	6	2	2
		KA9202-033-01			1				For VD40C		2			45	Key stopper	EC403-017-05	1	1			74	Hexagon socket headless taper plub	R1/8	8	8	8	8
		KA9202-033-02			1				For VD60C			2		46	Seal plug	KA0327-02	1	1	1	1	75	Hexagon socket headless taper plub	R3/8	1	1	1	1
		KA9212-033-01				1			For VD90C				2	47	O-ring	V55	1	1	1	1	76	Ball valve	Rc1/2	1	1	1	1
		KA9212-033-02				1	22	2nd vane	For VD30/40C	2	2			48	O-ring	P10A	1	1	1	1	77	Barrel nipple	R1/2	1	1	1	1
5	Side panel	KA9002-021-05	1						For VD60/90C			2	2	49	O-ring	P18	1	1	1	1	78	Motor	1.5kW 4P	1	1		
		KA9101-021-05		1			23	Oil pump vane	KA9002-024-04	1	1	1	1	50	O-ring	P36	2	2	3	4			2.2kW 4P			1	
		KA9201-021-05			1		24	1st exhaust valve valve	KA9002-025-01	1	1	2	3	51	O-ring	P40	1	1					3.7kW 4P				1
		KA9212-021-05				1	25	1st exhaust valve spring	KA9002-025-02	1	1	2	3		O-ring	P48			1	1	79	40A flange for storage	KG5001-011-01	1	1	1	1
6	Seal plug	KA0327-05	1	1	1	1	26	1st exhaust valve spring	KA9002-025-03	1	1	2	3	52	O-ring	S8	3	3	3	3	81	Coupling for motor	KA9002-030-01	1	1		
7	Oil level gauge	KA9002-021-07	1	1			27	2st exhaust valve valve	KA9002-026-01	1	1			53	O-ring	S18	1	1	1	1			KA9202-031-01			1	1
		KA9202-021-07			1	1			KA9202-026-01			2	2	54	O-ring	S60	1	1	1	1	82	Coupling spider	M-84	1	1		
9	1st cylinder	KA9002-022-01	1				28	2st exhaust valve valve	KA9002-026-02	1	1			55	O-ring	S105	3	3					M-90			1	1
		KA9101-022-01		1					KA9202-026-02			1	1		O-ring	S120			3	3	83	Coupling for pump	KA9002-030-02	1	1		
		KA9202-022-01			1		29	2st exhaust valve valve	KA9002-026-03	1	1			56	O-ring	AS568-267	1	1					KA9202-031-02			1	1
		KA9212-022-01				1			KA9202-026-03			1	1		O-ring	AS568-274			1	1	89	Oil seal case	KA9202-034-01	1	1	1	1
10	2nd cylinder	KA9002-022-02	1	1			30	2st exhaust valve valve	KA9002-026-04	1	1			57	Oil seal	EC403-016-04	3	3	3	3	90	Hexagon socket headless taper plub	R1/2	1	1	1	1
		KA9202-022-02			1	1			KA9202-026-04			1	1	58	Hexagon socket head cap screw	M10x20	4	4	4	4	91	Hexagon head bolt	M8x25	4	4	4	4
11	Front cover	KA9002-022-03	1	1			31	Oil distribution valve	EC403-015-01	1	1	1	1	59	Hexagon socket head cap screw	M8x90	3	3			101	O-ring	V55	1	1		
		KA9202-022-03			1	1	32	Oil distribution valve valve	EC403-015-03	1	1	1	1		Hexagon socket head cap screw	M8x110			3	3		O-ring	V70			1	1
12	Rear cover	KA9002-022-04	1	1			33	Oil distribution valve	EC403-015-04	1	1	1	1	60	Hexagon socket head cap screw	M8x25	7	7	7	7	102	Hexagon socket head cap screw	M8x30			6	6
		KA9202-022-04			1	1	34	Oil distribution valve	EC403-015-02	1	1	1	1	61	Hexagon socket head cap screw	M5x10	21	21	29	29	103	Helical insert screw	M12x1.5			4	4
13	Oil pump cover	KA9002-022-05	1	1			35	Perforated plug	EC403-015-05	1	1	1	1	62	Hexagon head bolt	M10x30	4	4			104	40A flange for storage	KG5001-011-01	1	1		
		KA9202-022-05			1	1	36	Inlet port mesh	KR5535-150-03	1	1				Hexagon head bolt	M12x40			4	4		50A flange for storage	KG5001-011-02			1	1
15	Spacer	EC403-017-06	2	2	2	2			EC403-018-05			1	1	63	Hexagon head bolt	M8x12	8	8	8	8	105	Rectification plate A	KA9202-030-01			1	1
16	Parallel pin	KM6126-135-01	10	10	10	10	37	1st exhaust baffle	KA9002-028-02	1	1			64	Eye bolt	M10	2	2	2	2	106	Rectification plate B	KA9202-030-02			1	1
17	1st rotor shaft	KA9002-023-01	1						KA9202-028-02			1	1	65	Stud bolt	M8x22	4	4			106	Protect plate	KA9202-032-01			1	1
		KA9101-023-01		1			38	2nd exhaust baffle	KA9002-028-03	1	1			66	Hexagon nut	M8	4	4									
		KA9202-023-01			1				KA9202-028-03			1	1	67	Hexagon socket headless set	M6x8	1	1	2	2							
		KA9212-023-01				1	39	Baffle for perforated plug	KA9002-028-04	1	1	1	1	68	Cross-recessed head machine	M5x6	8	8	8	8							

Table. 9 Main replacement parts list (VD30C/VD40C)

Location	Parts No.	Description	Specification	VD30C VD40C		VD30C-A VD40C-A		VD30C-B VD40C-B		VD30C-H VD40C-H	
				Material	Q'ty	Material	Q'ty	Material	Q'ty	Material	Q'ty
Shaft	57	Oil seal		FKM	3	NBR	3	Silicone rubber NBR	2 1	FKM	3
	21	1st Vane	For VD30C	Resin	(2)	←		←		←	
			For VD40C	Resin	(2)	←		←		←	
	22	2nd Vane	For VD30C/40C	Resin	2	←		←		←	
Exhaust valve	50	O-ring	For first exhaust valve P36	FKM	1	NBR	1	Silicone rubber	1	FKM	1
	30	Gasket	For second exhaust valve	Non asbestos gasket	1	←		←		←	
	24	1st exhaust valve plate	For first exhaust valve	SUS	1	←		←		←	
	26	1st exhaust valve spring	For first exhaust valve	SUS	1	←		←		←	
	27	2nd exhaust valve plate	For first exhaust valve	SUS	1	←		←		←	
Cylinder	56	O-ring	AS568-267	FKM	1	NBR	1	Silicone rubber	1	FKM	1
	48	O-ring	P10A	FKM	1	NBR	1	Silicone rubber	1	FKM	1
	51	O-ring	P40	FKM	1	NBR	1	Silicone rubber	1	FKM	1
	52	O-ring	S8	FKM	3	NBR	3	Silicone rubber	3	FKM	3
	53	O-ring	S18	FKM	1	NBR	1	Silicone rubber	1	FKM	1
	54	O-ring	S60	FKM	1	NBR	1	Silicone rubber	1	FKM	1
	55	O-ring	S105	FKM	3	NBR	3	Silicone rubber	3	FKM	3
Inlet port	101	O-ring	V55	FKM	1	NBR	1	Silicone rubber	1	FKM	1
Outlet Port	47	O-ring	V55	FKM	1	NBR	1	Silicone rubber	1	FKM	1
Plug	50	O-ring	P36	FKM	1	NBR	1	Silicone rubber	1	FKM	1
	49	O-ring	P18	FKM	1	NBR	1	No Need			
Oil separating	34	Gasket	For Oil separating	FKM	1	NBR	1	PTFE	1	FKM	1
Coupling	82	Coupling Spider	ABSO-FLEX MARK Ⅱ M-84	Special rubber	1	←		←		←	
Oil Level Guage	7	Oil Level Guage ASS'Y		FEP/FKM	1	FEP/NBR	1	Glass/ Silicone rubber	1	Glass/ FKM	1

Table. 10 Main replacement parts list (VD60C/VD90C)

Location	Parts No.	Description	Specification	VD60C		VD90C		VD60C-H		VD90C-H	
				Material	Q'ty	Material	Q'ty	Material	Q'ty	Material	Q'ty
Shaft	57	Oil seal		FKM	3	←		←		←	
	21	1st Vane	For VD60C	Resin	(2)	←		←		←	
			For VD90C	Resin	(2)	←		←		←	
	22	2nd Vane	For VD60C/90C	Resin	2	←		←		←	
Exhaust valve	50	O-ring	For first exhaust valve P36	FKM	2	FKM	3	FKM	2	FKM	3
	30	Gasket	For second exhaust valve	Non asbestos gasket	1	←		←		←	
	24	1st exhaust valve plate	For first exhaust valve	SUS	2	SUS	3	SUS	2	SUS	3
	26	1st exhaust valve spring	For first exhaust valve	SUS	2	SUS	3	SUS	2	SUS	3
	27	2nd exhaust valve plate	For first exhaust valve	SUS	2	←		←		←	
Cylinder	56	O-ring	AS568-274	FKM	1	←		←		←	
	48	O-ring	P10A	FKM	1	←		←		←	
	51	O-ring	P48	FKM	1	←		←		←	
	52	O-ring	S8	FKM	3	←		←		←	
	53	O-ring	S18	FKM	1	←		←		←	
	54	O-ring	S60	FKM	1	←		←		←	
	55	O-ring	S120	FKM	3	←		←		←	
Inlet port	101	O-ring	V70	FKM	1	←		←		←	
Outlet Port	47	O-ring	V55	FKM	1	←		←		←	
Plug	50	O-ring	P36	FKM	1	←		←		←	
	49	O-ring	P18	FKM	1	←		No Need			
Oil separating	34	Gasket	For Oil separating	FKM	1	←		←		←	
Coupling	82	Coupling Spider	ABSO-FLEX MARK Ⅱ M-90	Special rubber	1	←		←		←	
Oil Level Guage	7	Oil Level Guage ASS'Y		FEP/FKM	1	←		Glass/ FKM	1	←	

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. 11 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

Form: A00315268-02-00

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 Request for SDS: Yes/No	Received by	
ULVAC job No.		

ULVAC

株式会社アルバック
規格品事業部
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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