

INSTRUCTION MANUAL

OIL SEALED ROTARY VACUUM PUMP

PVD-180(B) [-K, -H, -Z]

PVD-360(B) [-K, -H, -Z]

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

Keep this manual with care to use at any time.

ULVAC, Inc.

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

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





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Types and Descriptions of Warning Labels Displayed on The Pump 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 |  | <ul style="list-style-type: none"> ·You may get an electric shock in the area around a portion with this warning label. Before maintenance or wiring, be sure to turn off the primary power supply. ·Be sure to close the lid of the terminal box before operating this unit. Never open it during operation. |
| 3 |  | 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 |  | <ul style="list-style-type: none"> ·This product is not made as the withstand pressure structure. Ensured pressure value of the Pump shall be 0.03MPaG (0.3kg/cm2G) (Gauge pressure). ·Do not run the Pump on blocking the Exhaust outlet or putting any device that might hamper gas passage onto the outlet. There is a risk that the pressure inside the vacuum pump rises up to cause break the casing or Oil level gauge resulting in overload of the motor. ·Following gases cannot be evacuated because these gases may cause the pump inner pressure to increase due to internal combustion. <ol style="list-style-type: none"> 1) explosive gas 2) flammable gas 3) gas which increases the susceptibility of substances to burn. <p>Long term storage of the Vacuum pump without operation might possibly cause trouble in operation caused by rust if you kept the Pump long time without operating it, ask a closest Service Center for the check. Indoor Use Only Mount at least 100mm from side walls.</p> |

| | | |
|----------|---|---|
| <p>5</p> |  | <ul style="list-style-type: none"> • There is a moving part around the section that this warning label is put. • Do not open a panel or a safety cover during operation. • You should turn off the power line of the moving part If the power of this Pump doesn't supply, the moving part may have a possible to move the moving part. Be sure to be caught in this Pump. |
|----------|---|---|

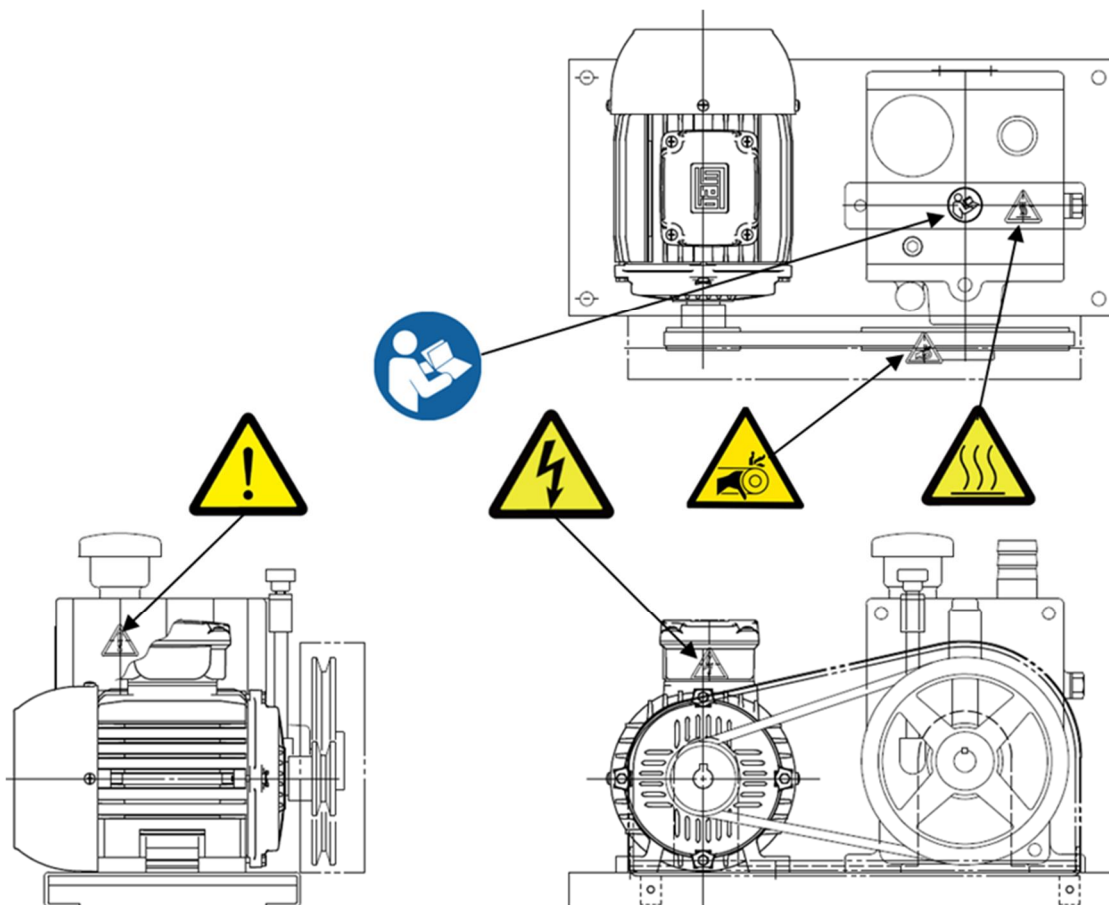


Fig. 1 Display positions of Labels

1. Pump Outline

The PVD-180, PVD-180B, PVD-360 and PVD-360B type oil rotary vacuum pump is a two-stage rotary blade type, compact, robust, easy to use, and designed to withstand a wide range of operating conditions. The ultimate pressure is low, and the vibration and noise associated with operation are sufficiently low. It is equipped with the following functions.

(1) Employment of gas ballast function

This product is installed with the gas ballast function as standard, so please use the gas ballast function according to your application. It is applicable to breathe in the condensed gas such as the steam and solution vapor.

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

(2) Oil anti-sack (backflow prevention device) mechanism ※Only PVD-180B, PVD-360B

When the pump stops the valve shuts off incoming oil and air and keeps a good vacuum for a long period of time. While the pump is running, the valve is open and appropriate amount of oil is supplied into the cylinder.

* Solenoid valve cannot support explosion-proof type.

* Not compatible with Spec.H

Table 1 Details model list

| Model 1 | Rev. | Model 2 | Naming |
|--|------|---|--------|
| PVD-18 | 0 | - | |
| Model 1 PVD-18 : 9m ³ /h (50Hz) PVD-36 : 19m ³ /h (50Hz) | | Model 2 - : Standard type B : Oil anti-sack mechanism | |
| Rev. 0 : Current Rev. | | | |
| Naming ^{*1} - : Standard type K : Spec. K H : Spec. H Z : Spec. Z | | | |

*1 There is not any naming for standard spec. Spec. K, H or Z is selectable as option. Options for pump head and accessories are different depending on the type.

■ Optional specification for special application

Following specification is available to meet various applications.

Table 2 Optional specifications and gasket material/oil type comparison table

| Specification | Applicable Model | | Gasket material | Oil tank capacity | Oil type *1 |
|---------------|--------------------|----------------------|--------------------|-------------------|-------------|
| | PVD-180 PVD-360 | PVD-180B PVD-360B | O-ring Oil seal | | |
| Standard | ✓ | ✓ | NBR | Standard | ULVOIL R-72 |
| Spec. K | ✓ | ✓ | FKM | Standard | ULVOIL R-72 |
| Spec. H | ✓ | n/a | NBR | Standard | ULVOIL R-72 |
| Spec. Z | ✓ | ✓ | NBR | Increase | ULVOIL R-72 |

*1 ULVOIL R-72 stands for mineral oil

【Spec. K】

- FKM is used for O-ring and sealing material of wetted surface
FKM is used for O-ring and sealing material of wetted surface in the case of Spec.K.
Gases and solvents that are resistant to FKM can be exhausted, but this is not guaranteed.

【Spec. H】

- External leak test
It is inspected before shipment if helium leak rate from outside to the Pump is less than 10^{-6} Pa·m³/sec (helium leak test by hood test method). Leak rate will increase due to aging degradation of seal materials and so leak rate during use is not guaranteed.
* PVD-180B, PVD-360B cannot support 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.
- There is no gas ballast valve. Refer to contents of “gas ballast port close” for performance described below.

【Spec. Z】

- Change oil tank capacity to increase oil tank specification
Change the amount of oil in the oil tank to the oil tank specification as shown in [Table 3](#).
This makes it easier to manage the amount of oil during high-load operation.

2. Performance specifications

Table 3 Performance specifications

| Description | | Type | PVD-180 | PVD-360 |
|--|----------------------|------|---|-----------------|
| | | | PVD-180B *2 | PVD-360B *2 |
| Designed pumping speed m ³ /hr (L/min) | 50Hz | | 9 (155) | 19 (310) |
| | 60Hz | | 11 (186) | 22 (372) |
| Ultimate pressure *1 Pa | GV Closed | | 0.67 | |
| | GV Opened | | 6.7 | |
| Motor | kW (Number of Poles) | | 0.4 (4) | 0.75 (4) |
| Pump revolution rpm | 50Hz | | 500 | |
| | 60Hz | | 600 | |
| Maximum water vapor capacity g/hr | | | 100 | |
| Oil | | | ULVOIL R-72 | |
| Oil capacity L | Standard | | 0.3 | 0.5 |
| | Z Specifications | | 1.5 | 1.7 |
| Cooling method | | | Air cooled | |
| Inlet tube (O.D. × I.D.) | | | φ 28 × φ 19 | φ 34 × φ 27 |
| Outlet cap mounting screw | | | G3/4 (PF3/4) | G1 (PF1) |
| Weight (without motor) | kg | | 33.5 | 43 |
| External dimensions WxDxH | mm | | 238 × 470 × 321 | 273 × 500 × 321 |
| Recommended oil mist trap (Optional) | | | TMX-1 | |
| Options | | | Oil mist trap, RF, explosion-resistant motor Special application(Spec. K, H and Z) | |

*1 Measured with a Pirani gauge. (Approx. 6.7×10^{-2} Pa when measured with a McLeod vacuum gauge.)

*2 The pump of this type, PVD-180B and 360B have following specific features in comparison with the standard type, PVD-180, -360.

- 1) The pump [Type: PVD-180B or 360B] has a solenoid valve called Vac. Lock Valve (means Anti Suck Back), when the pump stops the valve shuts off incoming oil and air and keeps a good vacuum for a long period of time.
- 2) While the pump is running, the valve is open and appropriate amount of oil is supplied into the cylinder. Please note the contents of "5.5. Electrical connections" and "6. Operation" for the running of PVD-180B or PVD-360B.

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°C)

3. Dimensional drawing

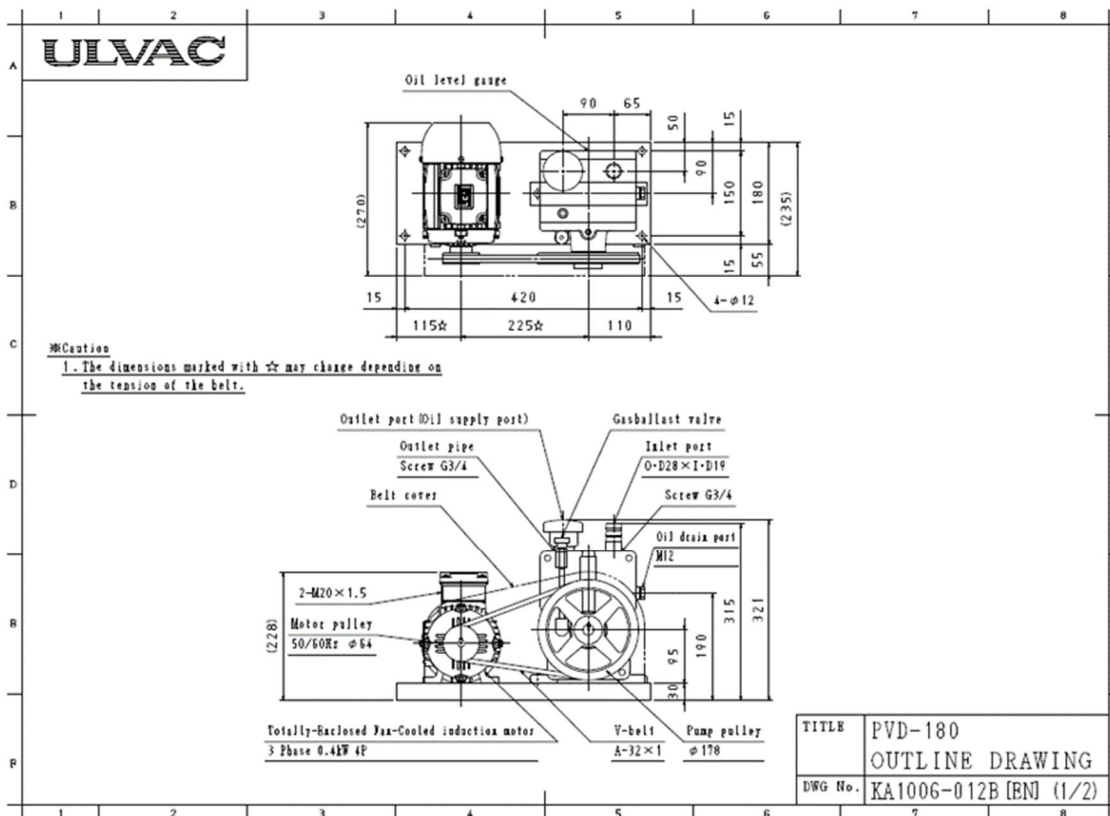


Fig. 2 Dimensional drawing PVD-180, PVD-180K

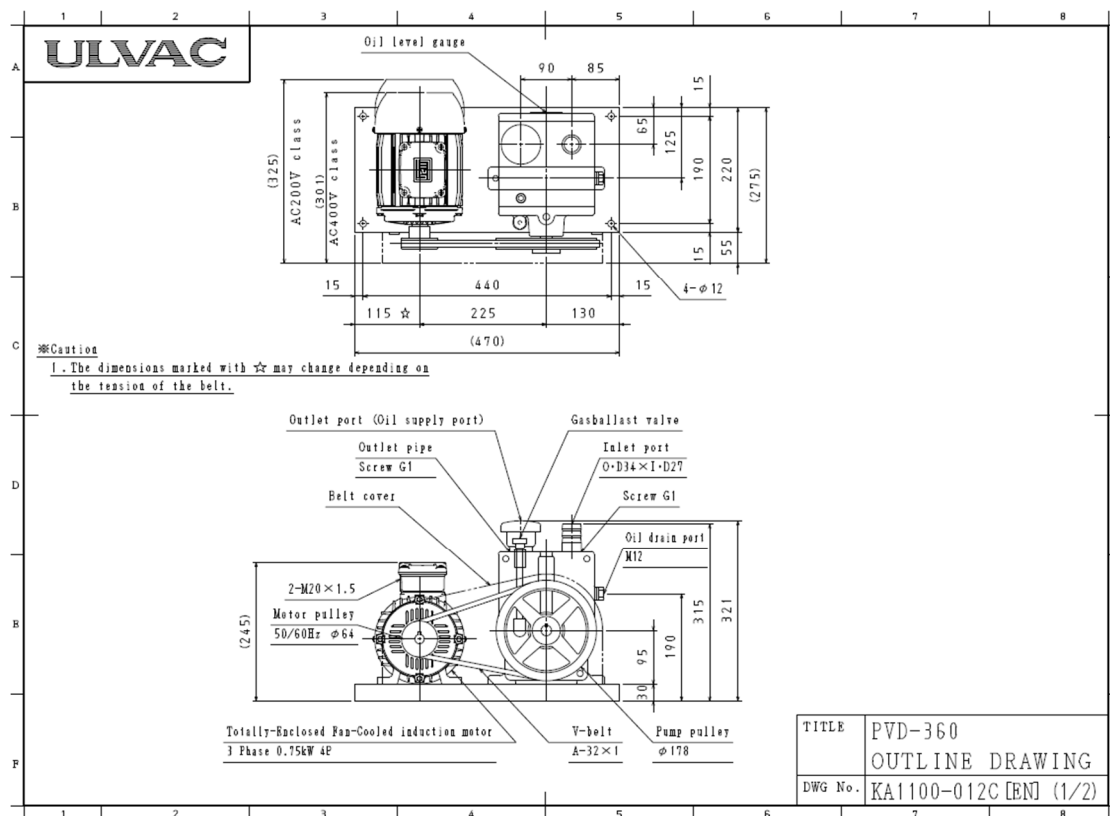


Fig. 3 Dimensional drawing PVD-360, PVD-360K

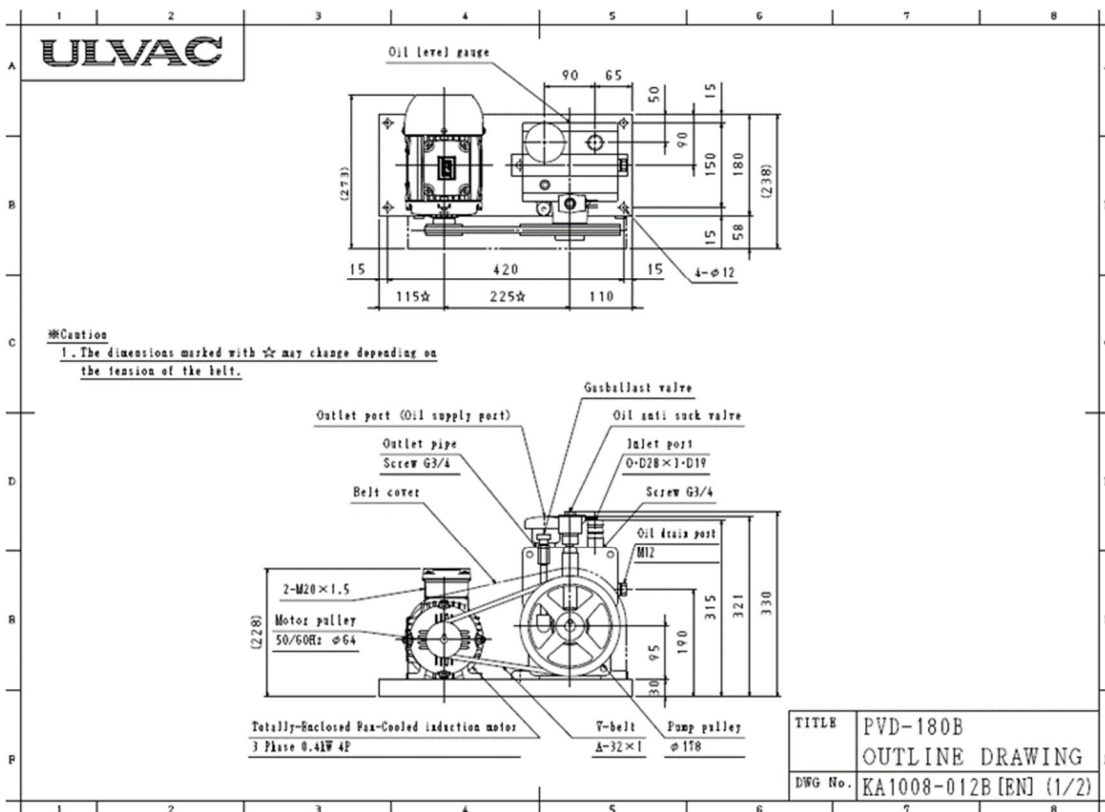


Fig. 4 Dimensional drawing PVD-180B, PVD-180B-K

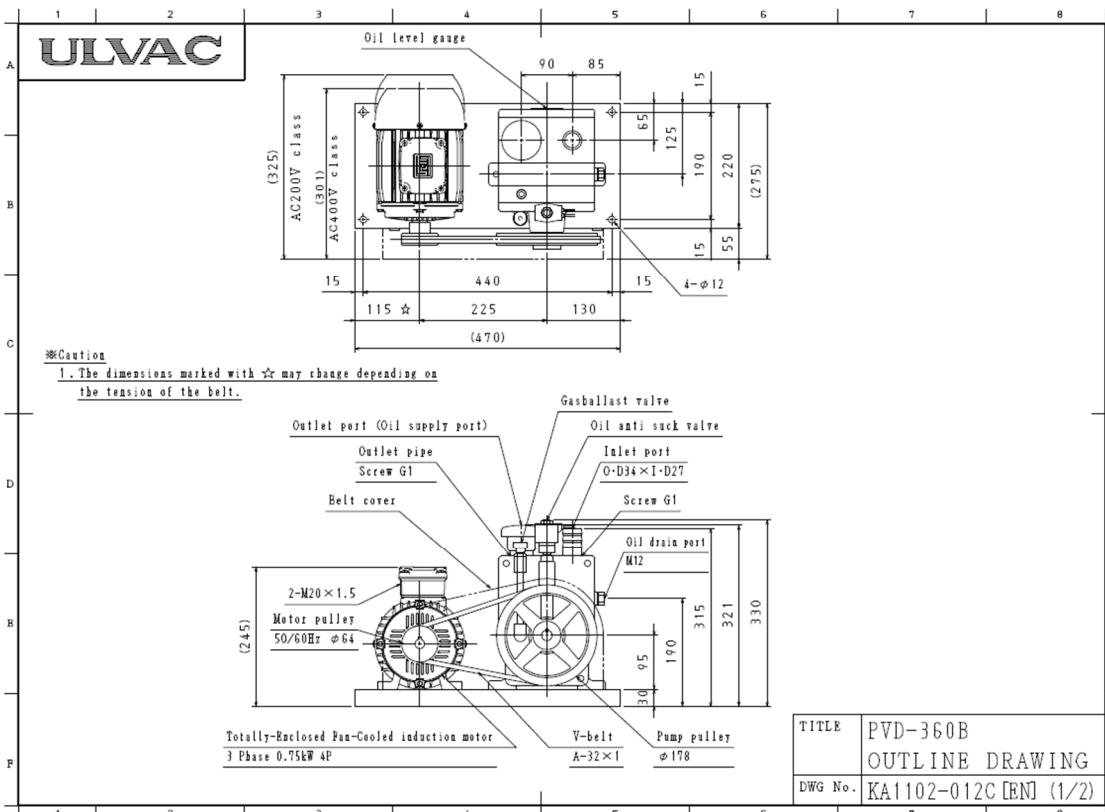


Fig. 5 Dimensional drawing PVD-360B, PVD-360B-K

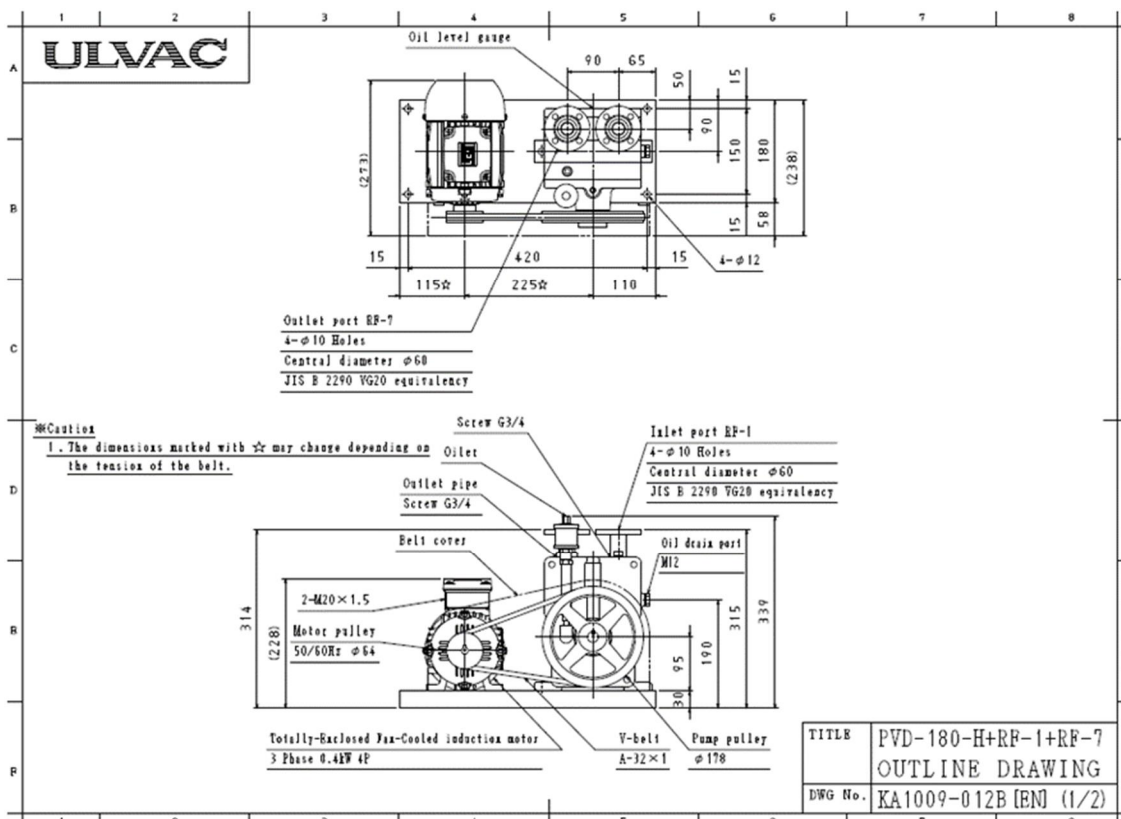


Fig. 6 Dimensional drawing PVD-180-H+RF-1+RF-7

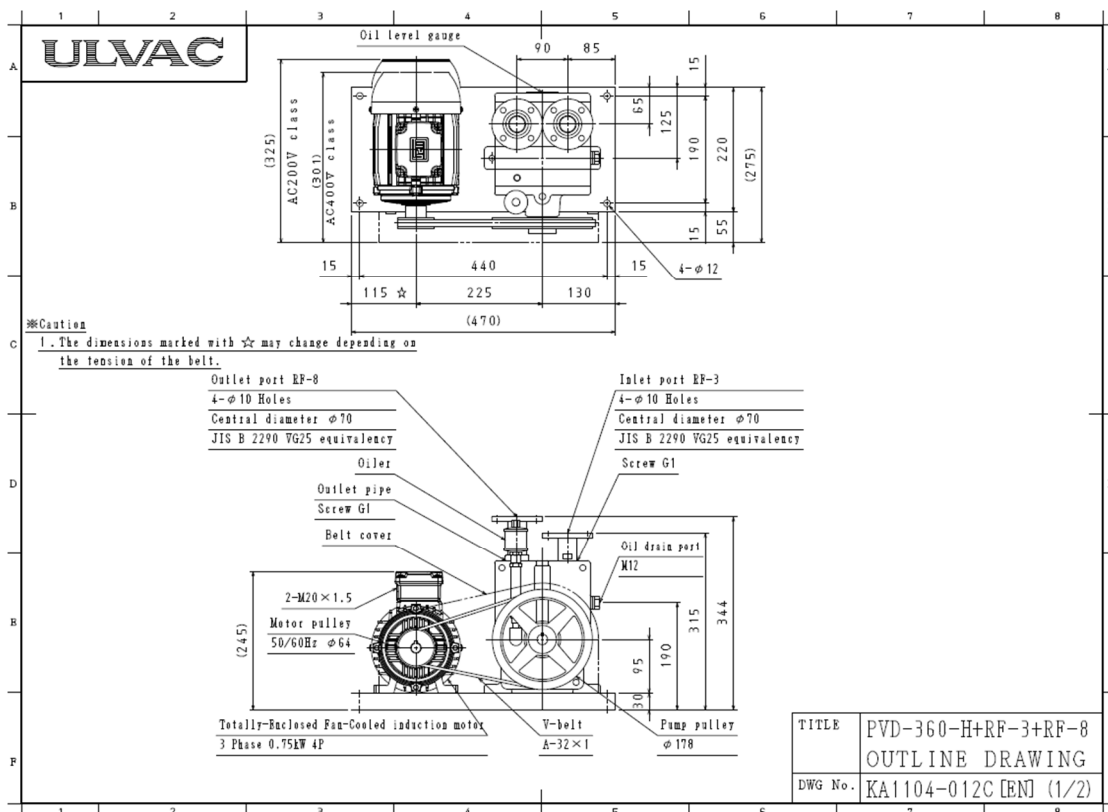


Fig. 7 Dimensional drawing PVD-360-H+RF-3+RF-8

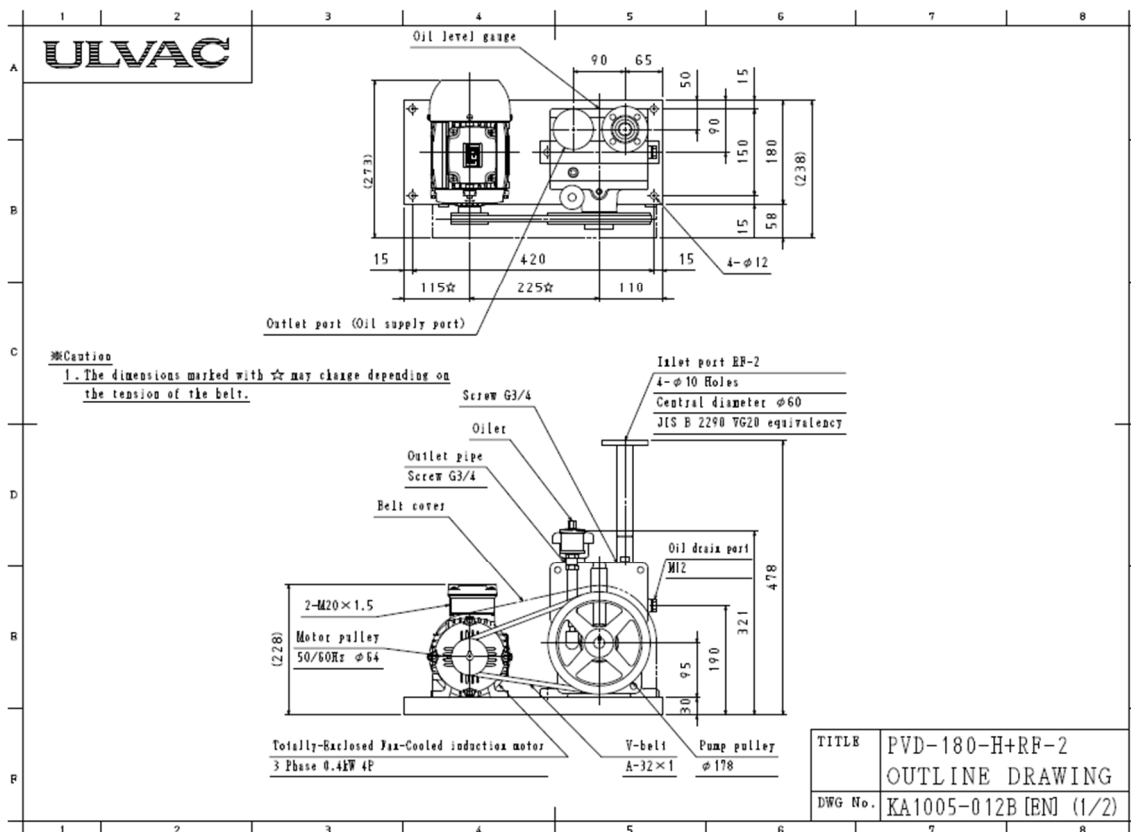


Fig. 8 Dimensional drawing PVD-180-H+RF-2

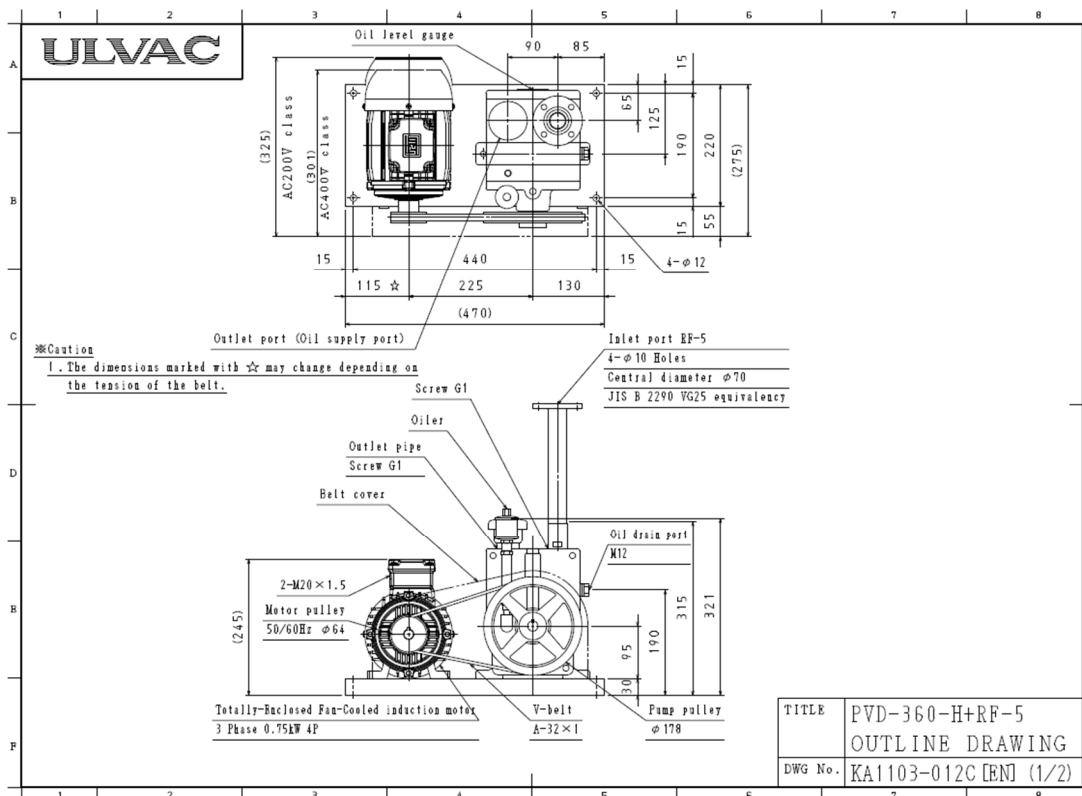


Fig. 9 Dimensional drawing PVD-360-H+RF-5

4. Pump Performance

4.1. Ultimate Pressure

"Ultimate pressure" means the lowest attainable pressure of the pump. Therefore, this pressure should be measured under the most favorable condition using new specified pump oil, by means of a vacuum gauge installed at the suction pipe of the pump; the rest of the vacuum system should be functionally disconnected from the pump.

The measured values of the ultimate pressure of the rotary vacuum pump may slightly a depending upon the kind of the vacuum gauge used. According to "Japan Industrial Standard [JIS] ultimate pressure is measured by means of a Mcleod gauge which is capable of measuring the partial pressure of air only.

If the ultimate pressure is measured without disconnecting the vacuum equipment, the observed pressure may be higher than the specified ultimate pressure of the pump due to the influence of the vapor or various kinds of gas produced from water drops or rust adhering to the inner wall of the equipment. If any other gauge except Mcleod gauge is used, the above-mentioned difference may be very large.

4.2. 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.

PVD-180-H, -360-H has no gas ballast valve. Refer to contents of "Gas Ballast Closed".

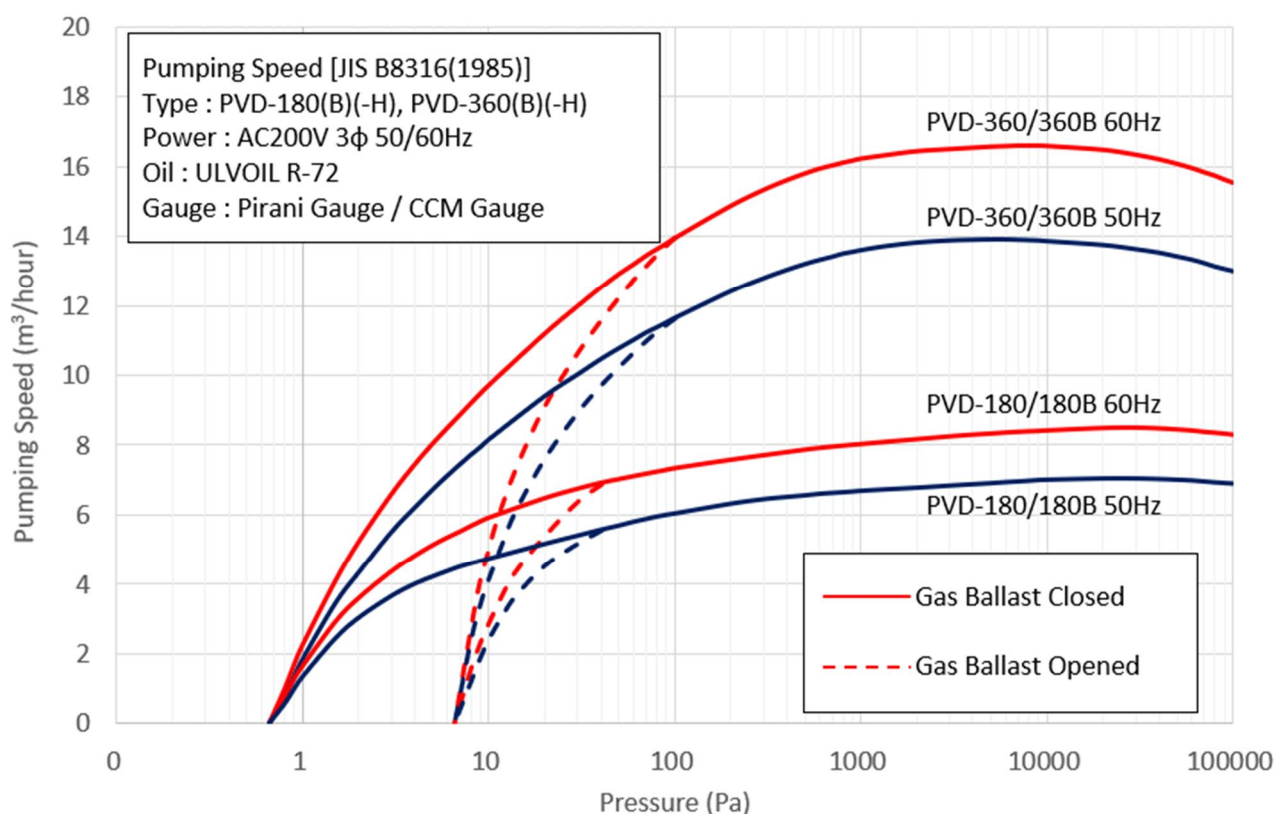


Fig. 10 Pumping speed curves

4.3. 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 $2.7 \times 10^4 \sim 4 \times 10^4$ Pa. If the pressure went down under 13.3 Pa, 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 $2.7 \times 10^4 \sim 4 \times 10^4$ 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. 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.

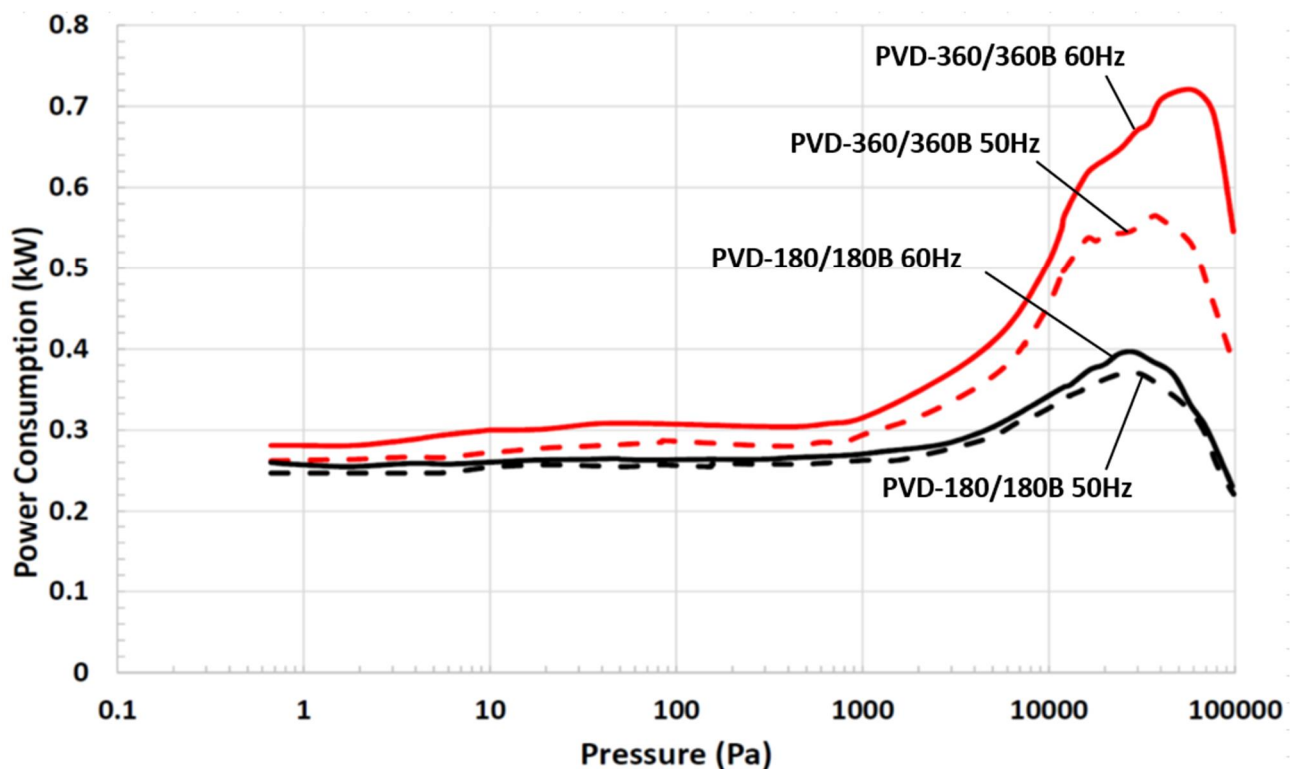


Fig. 11 Power curves

5. Preparation

5.1. Inspection

When unpacking, check the following items,

- 1) Is the pump received of the exact model you have ordered?
- 2) Are the complete accessories contained?
 - 2-1) In case you have ordered a pump without motor, following items should be contained in the pack; [Pump, Pump-base, V-belt, V-belt cover, Motor-pulley, Fitting bolts of motor and Pump oil]
 - 2-2) In case you have ordered a pump with motor, following items should be contained in the pack; [Pump, Pump-base, V-belt, V-belt cover, Motor-pulley, Pump oil and Motor]
- 3) Visually inspect if there is any damage to the pump and the parts caused by transportation.
- 4) Check for any looseness of screws or nuts or for any disconnection of parts.

Note: Should you have noticed any troubles or damages with the pump or its accessories, please contact our local agency or directly to ULVAC International Department.

5.2. 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. Do not put a wall or obstacle in and around 0.1m of the air inlet of the motor (Motor edge face). As precise clearances are provided with this machine, be sure to fulfill the following for its storage, install and operation.

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

Please set the pump horizontally on a rigid floor. The PVD pump is almost free from vibration during operation and has no need of anchor bolts in mounting. The base of the pump should be, however, installed reasonably flat to avoid possible rattling of the pump.

The use of anchor bolts or other fixing means is recommendable for a long time inattended running or for running on an unstable floor. Excessive dust, acid fume, solvent vapor etc. should be avoided in the environment.

5.3. Lubrication

- 1) Remove the outlet-cap or oil mist trap. [Fig.12] and make sure that oil drain plug is closed.
- 2) Fill the rotary vacuum pump oil specified by ULVOIL R-72 until the oil can be observed at the oil level window attached to a side of the pump. The optimum level is at 5 mm above the center line of the window glass during the running of the pump. Level will change depending on suction pressure. In most cases oil is added after operating the pump for a short while.

Note: If the amount of filled oil is by far no appropriate, the performance of the pump will not be in a satisfactory range.

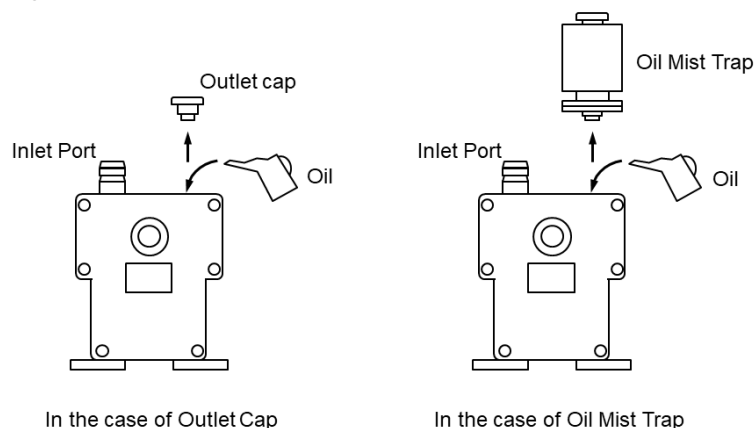


Fig. 12 Oil filling

5.4. Connection with Vacuum System

- 1) Be sure that the inside of vacuum equipment, pipes and vacuum valves are clean and free from excessive moisture or liquid, chips, dust, rust etc. before you connect the system with the pump.
Note: Breathing chips or visible dust will cause a mechanical trouble in the pump. Evacuating excessive moisture will not only harmful for obtaining guaranteed ultimate pressure but also may corrode the inside of the pump in the long run.

- 2) [PVD-180, PVD-360, PVD-180B and PVD-360B]

It is advisable to install a flexible connection (with vacuum grade rubber tubing or metal bellows) between pump inlet and vacuum piping to eliminate vibration. Application of thin layer of high vacuum grease at the joint will often be helpful for keeping vacuum tightness.

[PVD-180-H, PVD-360-H]

Connection with the flange to the pump Inlet, because the pump inlet is flange type. It is advisable to install a flexible connection (with metal bellows) between pump inlet and vacuum piping to eliminate vibration.

Note: A wire net (means suction filter) is provided within the suction port of the pump to prevent larger solids from entering the pump. Do not take the wire net off. The net should be washed and cleaned periodically according to your specific maintenance schedule.

- 3) Installation of a vacuum valve, a leak valve and a vacuum gauge between the equipment and the vacuum pump is required for PVD-180 and PVD-360 as shown in Fig.13. When the pump stops, shut the vacuum valve [A] to keep the equipment in vacuum, then open the leak-valve [B] and let air into the pump to prevent from counter-flow of the rotary vacuum pump oil in the pump.
- 4) It is advisable to install a flexible connection (with rubber tubing or metal bellows) between pump intake and vacuum piping to eliminate vibration.

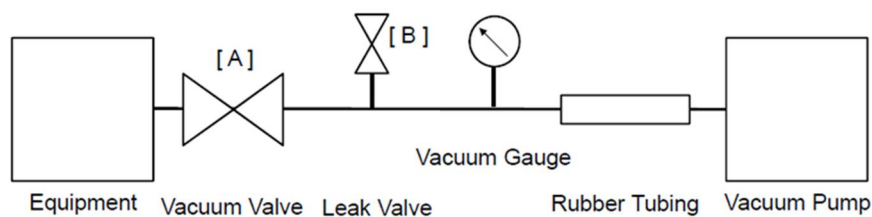


Fig. 13 Connection with Vacuum System for PVD-180, PVD-360

- 5) Connection as shown in Fig.14 and Fig.15 can be usable for PVD-180B and PVD-360B. In case of Fig.14, almost the same connection as Type PVD-180 and PVD-360 except no leak valve. In case of Fig.15, the equipment will be kept in vacuum by "Vac Lock Valve". The pressure-rise in the equipment will not exceed 66.6Pa within 20 minutes after Shut off of the pump. The back streaming of the pump liquid into the equipment will never occur but the pressure in the equipment will reach atmospheric usually in a day.

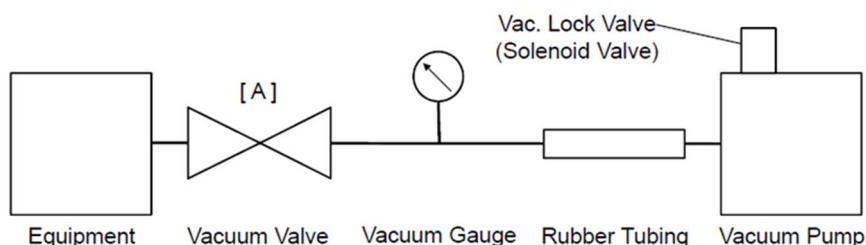


Fig. 14 Connection 1 with Vacuum System for PVD-180B, PVD-360B

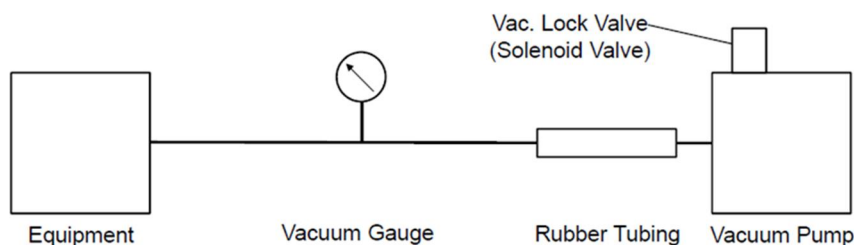


Fig. 15 Connection 2 with Vacuum System for PVD-180B, PVD-360B

- 6) Installation of a vacuum valve, a leak valve and a vacuum gauge between the equipment and the vacuum pump is required for PVD-180-H and PVD-360-H as shown in Fig.16. When the pump stops, shut the vacuum valve [A] to keep the equipment in vacuum, then open the leak-valve [B] and let air into the pump to prevent from counter-flow of the rotary vacuum pump oil in the pump.

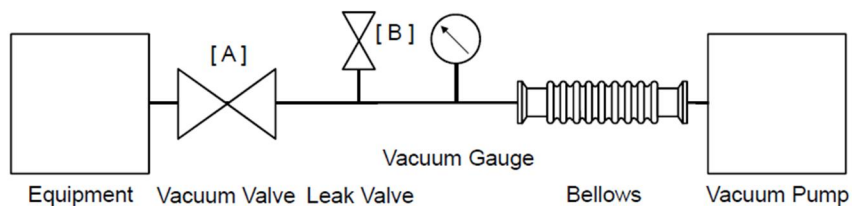


Fig. 16 Connection with Vacuum System for PVD-180-H, PVD-360-H

- 7) Use the flexible hose for connection between the pump outlet and the duct.

5.5. Electrical Connection

- 1) Fix the motor, the customer has, to the base, if the customer purchased the pump without the motor.
- 2) Remove the V-belt, when connecting the wires.
- 3) Switch in and watch the direction of rotation of the motor pulley. An arrow mark (like this: \Rightarrow) is put on the model name plate to indicate the right direction of rotation. If the pump does not rotate in the right direction, interchange any two of the three-phase leads.

※ Depending on the motor, it may not rotate clockwise even if it is connected as shown in Fig. 17

When operating for the first time, be sure to check the rotation direction of the motor before attaching the V-belt.

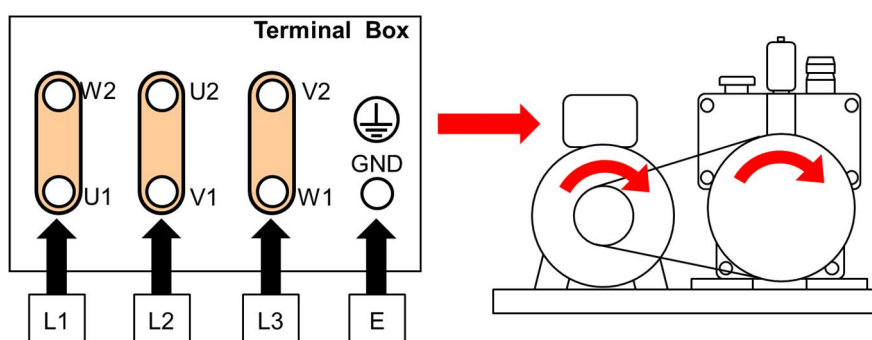


Fig. 17 Diagram of motor connection and pulley rotation direction

- 4) Be sure to install a safety circuit such as a motor breaker or fuse in front of the motor, and an electromagnetic switch (with thermal relay) for remote starting. Use the safety circuit capacity shown in Table 4.

Attention: Be sure to use the motor breaker. Since a current 5 to 10 times the rated current flows when the motor starts, a general-purpose breaker may trip at the motor starting current.

Table 4 Rated current for the standard motor

| 200V class Motor Poles : 4P | | | | |
|-----------------------------|--------|----------------------|-----------|-----------|
| Model | Motor | Rated current (A) ※1 | | |
| | | 200V/50Hz | 200V/60Hz | 220V/60Hz |
| PVD-180 | 0.4kW | 2.11 | 2.00 | 1.95 |
| PVD-180B | | | | |
| PVD-360 | 0.75kW | 3.36 | 3.12 | 3.02 |
| PVD-360B | | | | |

| 400V class Motor Poles : 4P | | | | | | |
|-----------------------------|--------|----------------------|-----------|-----------|-----------|-----------|
| Model | Motor | Rated current (A) ※1 | | | | |
| | | 380V/50Hz | 400V/50Hz | 415V/50Hz | 440V/60Hz | 460V/60Hz |
| PVD-180 | 0.4kW | 1.13 | 1.14 | 1.15 | 1.03 | 1.04 |
| PVD-180B | | | | | | |
| PVD-360 | 0.75kW | 1.71 | 1.64 | 1.62 | | 1.48 |
| PVD-360B | | | | | | |

* 1 Rated current are about standard motors. Should you use other motor, confirm the specific by the motor nameplate.

Table 5 Standard motor terminal size and protection circuit selection criteria

| Voltage Poles | Model | Motor | Terminal screw ^{*1} | Earth screw ^{*1} | Applicable wire gauge | Motor breaker or Fuse | Thermal relay ^{*2} |
|-----------------|---------------------|--------|------------------------------|---------------------------|-----------------------|-----------------------|-----------------------------|
| 200Vclass 4P | PVD-180 PVD-180B | 0.4kW | M4 | M4 | 0.75mm ² | 5A | 1.95A~ 2.11A |
| | PVD-360 PVD-360B | 0.75kW | M4 | M4 | 1.25mm ² | 15A | 3.02A~ 3.36A |
| 400Vclass 4P | PVD-180 PVD-180B | 0.4kW | M4 | M4 | 0.75mm ² | 3A | 1.03A~ 1.15A |
| | PVD-360 PVD-360B | 0.75kW | M4 | M4 | 1.25mm ² | 9A | 1.48A~ 1.71A |

* 1 Terminal size are about standard motors. Should you use other motor, confirm the specific by the motor specification.

* 2 Rated current are about standard motors. Should you use other motor, confirm the specific by the motor nameplate.

- 5) Fit the V-belt.
- 6) Connect the solenoid valve as [Fig.18] (only for Type PVD-180B or PVD-360B)

[Applied only for Type PVD-180B or PVD-360B]

The electrical supply to the solenoid valve so called "Vac. Lock Valve" should be made according to the specification which is printed on the nameplate attached to the solenoid valve. Typical connection for 200V 3phase motor and for a 200V 2phase solenoid is shown below.

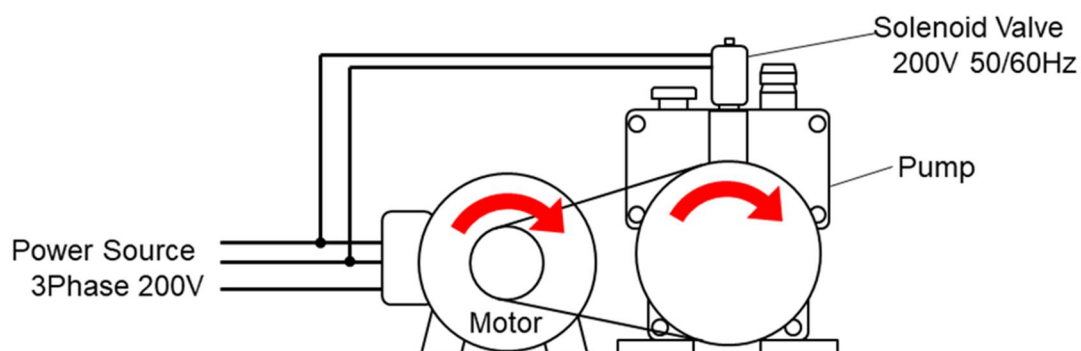


Fig. 18 Electrical wiring diagram for Vac. Lock Valve

Note: Separate wiring will eventually be required if you use a motor rated at different line voltage and cycle from those for the solenoid. Make sure the proper voltage and current are supplied to both motor and solenoid coil. Both may fail to operate if voltage is less than 90% or more than 110% of the rated.

6. Operation

6.1. Pump Start

Re-check prescribed installations once more and operate your pump as shown Fig.13, PVD-180 and PVD-360, in accordance with the following procedures to obtain the specific performance of the pump.

- 1) Close the vacuum valve [A] and open the leak valve [B].
- 2) Rotate your pump-pulley in the correct direction at least 2~3 revolutions by hand and Check the smoothness of rotation.
- 3) Turn the motor-switch on.
- 4) Close the leak valve [B] and open the vacuum valve [A] when the pump is rotating at a constant speed.

Note: 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 outlet, check and ensure that it is open. Too much clog would prevent the exhaust gas from passing through, raise the pressure inside the pump and might result in breaking it.

Note: Immediately after starting operation, the current is high. After 1 hour from starting operation, make sure that the current is below the rated current at the ultimate pressure

If the pump cannot be rotated smoothly by hand, follow the following steps.

- 1) Open the leak valve and rotate the pulley about 10 revolutions by your hand.
- 2) Check correct amount of charged oil.
- 3) If the pump does not rotate under the above procedures, contact the closest Service Center.
- 4) When the pump is kept running for several hours, the oil temperature in the case will rise , to about 70°C at a room temperature around 60-65°C. If the oil temperature exceed 70°C when the gas-ballast valve is kept closed, some troubles are suspected. Please stop the pump and contact the closest Service Center.

Note: If the pump does not start rotating, the pump cylinder might be filled up with oil.

[Don't worry about this problem if you would use Type PVD-180B and PVD-360B].

6.2. Pump Stop

- 1) Close the vacuum valve [A] to system.
- 2) Stop the motor and break vacuum (open the leak valve [B] or the gas-ballast valve).

Note: Make sure the leak Valve or gas-ballast valve is opened when the pump is stopped or in case of power failure, preventing the pump and vacuum system from being flooded with oil.

[Applied only for Type PVD-180B or -360B]

"Pump start", "Pump stop" procedures are almost the same as prescribed III-1, III-2. But, there are some different points (*) which are very important in order to obtain the specific performance of the pump, PVD-180B and PVD-360B.

- 1) * Make sure the Vac. Lock valve operates properly.
- 2) Operate the pump in accordance with the prescribed procedures III-1.
- 3) * Run the pump for more than two hours under closing suction port.
- 4) * Open the gas-ballast valve more than 5 hours.
- 5) * And continue the running of the pump under closing the gas-ballast valve for more than 24 hours.

As the result, considerable gases can be taken out from oil in the pump by the above procedures. And you are ready to evacuate your system.

6.3. Gas-ballast Valve

This product is installed with the gas ballast function as standard. PVD-180-H, -360-H has no gas ballast valve.

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 Vacuum Valve 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.

Note: 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.

Note: 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.

Note: 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.

6.4. Vacuum Pump Oil ULVOIL R-42 for Winter Use

In winter, if the pump could not be started easily, check the following points carefully. [Belt-tension, Motor fuse, smoothness of rotation of the pump, etc.]. In spite of normal behavior for the check points, if the pump could not be started easily, please replace oil to ULVOIL R-42.

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

Note: 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.

6.5. Oil mist trap (Option)

The oil mist trap can be mounted to trap the oil mist discharged from the Pump. For mounting the oil mist trap to PVD-180, PVD-360, PVD-180B and PVD-360B, remove the outlet cap and attach the oil mist trap TMX-1 as Fig.19. For more information, please see the instructions of OIL MIST TRAPS.

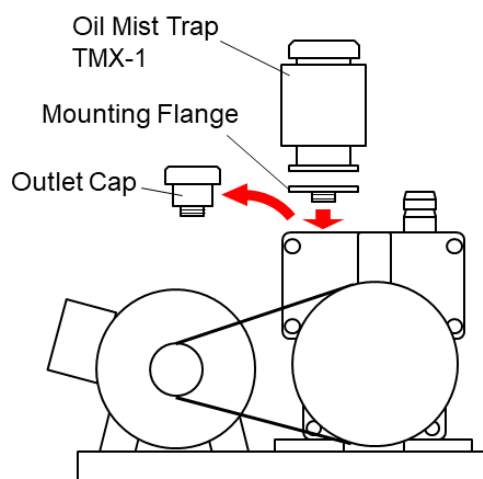


Fig. 19 Mount the oil mist trap to the pump

In the case of mounting the oil mist trap to PVD-180-H and PVD-360-H, attach the oil mist trap TMX-1H on the outlet flange. For more information, please see the instructions of OIL MIST TRAPS.

7. Maintenance and Check

7.1. 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.

7.2. Regular Check

7.2.1 Check and Replace Vacuum Pump Oil

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.

- 1) Remove the drain plug and drain almost all oil. Operate the pump for 10 seconds, the remained oil will then be completely drained. During the operation, it is advisable to let a small amount of leak out of the suction side. However, be careful about possible scattering of oil from the drain port.
- 2) Close the drain plug and fill new oil from Outlet.
- 3) If the oil is very dirty, repeat run for a minute and steps 1) ~ 2) two or three times, the pump will be almost clean.
- 4) In case when the pump oil is too much muddy, probably the specified ultimate pressure will not be obtained even if oil replacement is repeated several times. In such a case, please contact the Service Center close to you for purchase and repair.

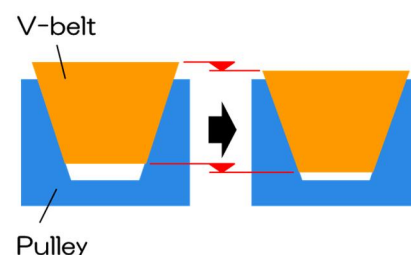
7.2.2 Check and Replace V-belt

The belt to connect the main body of pump and a motor to is made by rubber. When the belt tension continues driving in an insufficient state...

- The belt is shorten the life-time by the wear.
- The motor is shorten the life time by overheat.
- The pump is not start or not perform pumping speed.

Initial wear

Early operation, the belt tension decreases by the extension and fall in the pulley groove. Re-tension the belt 24 hours later after initial start. And 1week later, re-tension the belt.

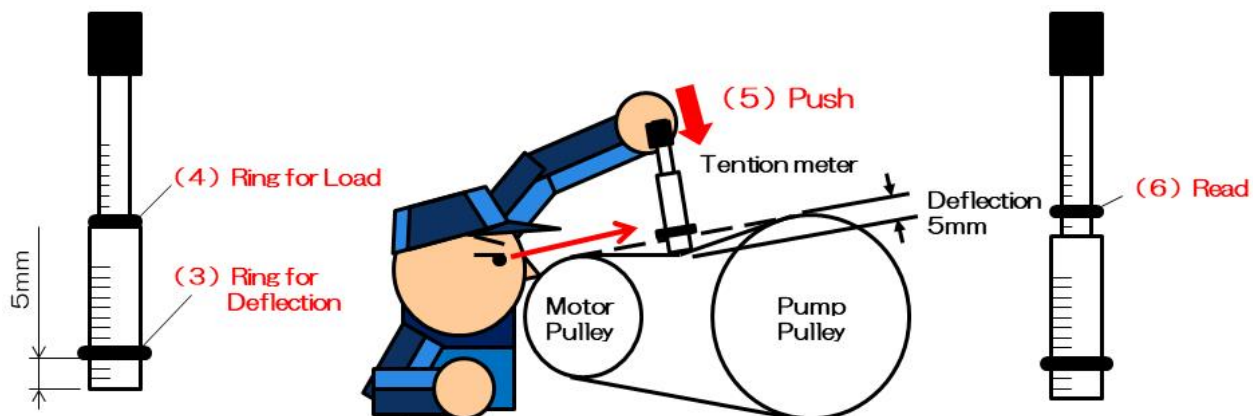


Maintenance the belt

Please check the belt tension at once in a half year. If necessary, please re-tension the belt. In addition, please change the belt, if there is an abnormality in it.

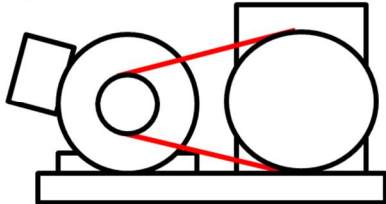
Measure the tension of the belt

- 1) Shut down the pump, and be sure to turn OFF the power supply.
- 2) Remove the belt cover.
- 3) Set the Ring for Deflection to 5mm.
- 4) Set the Ring for Load to 0N.
- 5) Push the center of the belt, between the motor pulley and the pump pulley, down 5mm with tension meter.
- 6) Read the load after pushing. It is normal that the load is 30-50N (3-5kgf).
- 7) If the tension of belt is right, attach the belt cover.

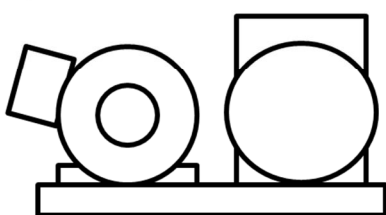
Replace and Re-tension the belt

1. Shut down the pump and be sure to turn OFF the power supply.

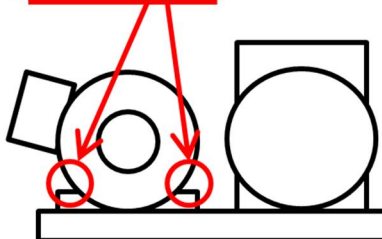
2. Remove the belt cover.



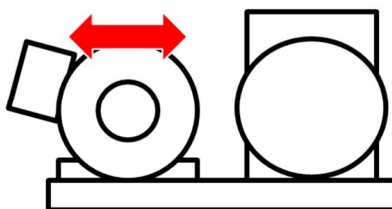
3. Remove the belt.



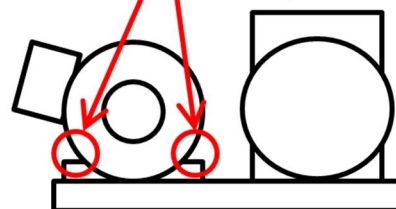
4. Loosen 4 bolts.



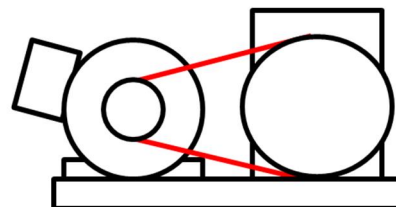
5. Slid the motor.



6. Tighten 4 bolts.
12.3N·m (125kgf·cm)



7. Attach the belt.



8. Measure the tension of the belt and pulley alignment.
OK → Go to 9
NG → Back to 3

9. Attach the belt cover

7.2.3 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.

7.2.4 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.

7.2.5 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.

7.2.6 Checking Noise and Abnormal Vibration

- 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.
- 4) Check whether the tension of the belt is right or not.

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

7.2.7 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. Replace the new Oil mist trap.

7.3. Main replacement parts

Table 6 PVD-180, PVD-180B, PVD-360, PVD-360B Main replacement parts list

| Description | | Model | Quantity |
|---------------------------------------|------------|---------------------------|----------|
| Oil Seal | | SC204011 | 2 |
| Bearing | | No.6204ZZ | 1 |
| | | No.6205CM | 1 |
| Oil Level Gauge | | φ35 | 1 |
| O-ring (Material : NBR) | PVD-180(B) | JIS B 2401 P-22A | 1 |
| | PVD-360(B) | JIS B 2401 P-30 . | 1 |
| Solenoid Valve (Only PVD-180B, -360B) | | CKD AB3X (Custom-made) | 1 |
| AL Gasket (Only PVD-180B, -360B) | | φ10×φ13×t1.5 | 1 |

Table 7 PVD-180-H, PVD-360-H Main replacement parts list

| Description | | Model | Quantity |
|-------------------------|-----------|------------------|----------|
| Oil Seal | | TC204011 | 1 |
| | | SC204011 | 1 |
| Bearing | | No.6204ZZ | 1 |
| | | No.6205CM | 1 |
| Oil Level Gauge | | Φ49 | 1 |
| O-ring (Material : NBR) | PVD-180-H | JIS B 2401 P-22A | 1 |
| | | JIS B 2401 V-34 | 2 |
| | PVD-360-H | JIS B 2401 P-30 | 1 |
| | | JIS B 2401 V-40 | 2 |

7.4. Trouble Shooting

Table 8 Performance specifications

| Trouble | Causes | Processing Method |
|------------------------|---|---|
| The Pump dose not run. | 1 Motor connection is wrong. | Check the connection. |
| | 2 Safety circuit such as a MS (Magnetic Switch) is not correctly set. | Make the Safety circuit conform to the Motor specification. |
| | 3 Oil viscosity got higher. | Change oil. |
| | 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 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.) |
| | 6 The Pump is not connected to the power supply. | Connect the Pump to the power supply. |
| | 7 The power switch is not turned on. | Turn on the power switch. |
| | 8 Are all three phases of power supply normal? Abnormal phase voltage. | Check the power supply. |
| | 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 |
| | 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. |
| | 11 Run only by the Motor. Is the Rotation and current value correct? | Replace the Motor. |
| | 12 Moisture or solvents were sucked in, forming rust inside the Pump. | Conduct the overhaul (replacement of the casing, rotor, cover and so on.) |
| | 13 Components inside the Pump have burnt out. | Conduct the overhaul. |
| | 14 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 ULVOIL R-42 |
| | 15 Pump was not vented when stopped. | Turn the Pump on and off several times in short intervals. |
| | 16 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. |
| | 17 The belt tension decreases | Re-tension the belt. |

| Trouble | Causes | | Processing Method |
|---|--------|---|---|
| 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 | Pressure measurement method is wrong. | Measure correctly the pressure. |
| | 3 | Vacuum gauge is not appropriate. | Use the Vacuum gauge that matches the measurement pressure range and correctly calibrated one to measure the pressure. |
| | 4 | Pipe connected to the Suction inlet is thin or connection distance is long. | Connect a pipe wider than inlet diameter and shorten the connection distance between the Vacuum chamber. |
| | 5 | Metal mesh at the inlet is clogged. | Remove the pipe above the inlet and wash the mesh. |
| | 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) |
| | 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. |
| | 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. |
| | 9 | Not using the ULVAC genuine oil. | Conduct the overhaul of the Pump and replace the oil with the ULVAC oil. |
| | 10 | New oil pump was just entered. | Perform no-load operation for a while. |
| | 11 | Leak valve is open | Close the valve. |
| | 12 | Motor rotation direction is reverse. | Do the connection again to correct the rotation direction. |
| | 13 | The oil is not circulating. a. Oil pit of the Cover or the like is clogged. | Conduct the overhaul. a. Clean the oil pit. |
| | 14 | Water entered inside the Pump. | Replace the oil. |
| | 15 | Not opening the solenoid valve. (PVD-180B, -360B) | Replace the solenoid valve. |
| | 16 | Exhaust valve vane is broken. | Replace the Exhaust valve vane. |

| Trouble | Causes | | Processing Method |
|----------------------|--------|---|--|
| Unusual sounds make. | 1 | Motor rotation direction is reverse. | Do the connection again to correct the rotation direction. |
| | 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 | Foreign matter has entered the Pump. | Conduct the overhaul. (Clean the Pump to eliminate foreign matter) |
| | 4 | 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 | Vanes are not moving. | Conduct the overhaul. Wash out substances stuck to the vane. |
| | 6 | Components inside the Pump have burnt out. | Conduct the overhaul. |
| | 7 | Belt cover screw is loose. | Tighten the screw. |
| | 8 | 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. |
| | 9 | The tension of the belt is loose. | Replace and Re-tension the belt |
| Abnormal heating | 1 | Keeping continuous operation under high suction pressure. | Pump surface temperature would rise up around 100°C on continuous operation under high suction pressure. |
| | 2 | The oil is not supplied by the specified volume. | Control the oil level. Supply the oil by the specified volume. |
| | 3 | Oil is dirty. | Replace with new oil. Conduct the overhaul. (Inside cleaning) |
| | 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. |
| | 6 | High temperature. | Please use it in environment with the air conditioning |
| | 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. |
| | 8 | The oil is not circulating. a. Oil pit of the Cover or the like is clogged. | Conduct the overhaul. a. Clean the oil pit. |

| Trouble | Causes | | Processing Method |
|---|--------|--|---|
| 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. |
| | 2 | Oil inlet is loose. | Tighten again the oil inlet. |
| | 3 | The drain port is loosening. | Re-tighten the drain port. |
| 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. |
| | 2 | Keeping continuous operation under high suction pressure | Put the oil mist trap on the Exhaust side. |
| | 3 | Oil mist trap is clogged. | Replace the oil mist trap. |
| | 4 | Exhaust valve vane is broken. | Replace the Exhaust valve vane. |
| 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. |
| | 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 | Abnormal sliding of the rotor and/or vane. | Conduct the overhaul. |
| | 4 | Keeping continuous operation under high suction pressure. | Adjust the pressure. |
| Initially, performance 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. |

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

PVD-180, PVD-180-K, PVD-180-H, PVD-180-Z

PVD-180B, PVD-180B-K, PVD-180B-Z

PVD-360, PVD-360-K, PVD-360-H, PVD-360-Z

PVD-360B, PVD-360B-K, PVD-360B-Z

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) This product does not include the record of information on chemical substances contained in the product by chemSHERPA ®.
- (5) The contents of this document are subject to change without notice in future.



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 9 Making format for names and contents of hazardous substances or elements

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

○: indicating that content of the hazardous substance or element in all homogeneous materials of the part does not exceed the requirements for concentration limits specified by SJ/T11363-2006.
 ×: indicating that content of the hazardous substance or element in, at least one kind of, homogeneous materials of the part exceeds the requirements for concentration limits specified by SJ/T11363-2006. Producer may further explain the technical excuse to the items marked with “X” perspecific conditions here.

ULVAC Components / Certificate of Decontamination

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

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

Product model:

Model:

Serial No.:

Application:

Remarks:

Contaminant (Check an applicable box.)

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

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

To: ULVAC

Attn: _____

Date: / / (YYYY/MM/DD)

Your company

Division

Contact

Phone

Fax

E-mail

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

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

株式会社アルバック
コンポーネント事業本部
<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



showcase.ulvac.co.jp

株式会社アルバック
コンポーネント事業本部 営業部
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TEL:0467-89-2416

ULVAC ,Inc.
Components Business HQ
<https://showcase.ulvac.co.jp/en/>

Please contact us for products, Service Base or other Inquiries from here.



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