

NOTICE: This document contains references to P.V.R. Please note that P.V.R. s.r.l. is now part of Agilent Technologies. For more information, go to [www.agilent.com/chem/vacuum](http://www.agilent.com/chem/vacuum).

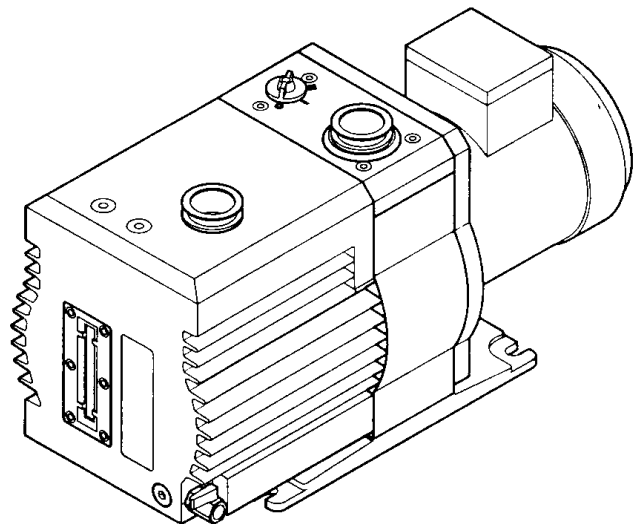


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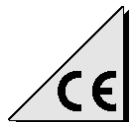
Agilent Technologies Italia S.p.A. Vacuum Products Division  
Via Santa Vecchia, 107 - 23868 Valmadrera (LC) ITALY

*Vacuum pump*

## **PHV K Series**



 **P.V.R.**<sub>s.r.l.</sub>  
**Vacuum Pumps**



**MANUFACTURER**



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Exploded view and spare parts list		

## 1 GENERAL INFORMATION



This manual contains information necessary for the proper operation of the pump in order to prevent unsuitable use and for the safety of the operators.

Do not attempt any other type of operation without having first contacted our Service Department.

The information provided herewith does not intend to replace, integrate or change any rules, regulations, law by decree, directive or law of specific character in force in the Country where the installation takes place.

The suggestions given to the staff engaged in the installation and servicing assumes that the personnel is expert and prepared in facing any problem of servicing, both mechanical and electrical.

For any questions or information not included in this manual, please contact our Service Department, always providing: model (type), serial number, year of manufacture, stated on the name plate.

			
pompe per vuoto <b>Robart</b>			
TIPO TYPE			
N°		ANNO YEAR	
PORTATA CAPACITY		(50 hz) m <sup>3</sup> /h	(60 hz) m <sup>3</sup> /h
PRESSIONE FINALE (ass.) ULTIMATE PRESSURE (abs.)			mbar
Valmadrera (Lc) ITALY -			

In the manual two symbols are used:



**ATTENTION:**

*Instructions that, if not followed, could result in serious personal injuries.*



**WARNING:**

*For instructions that, if not followed, could cause damages to the machine..*



Hot surfaces



Electrical danger

## 2 PRODUCT SPECIFICATIONS

### 2.1 Pump description

PHV K pump series are rotary vane oil lubricated two stage vacuum pumps.

The flanged electric motor is coupled by means of an elastic coupling.

The cooling is made by means of forced air by a centrifugal fan.

At the inlet there is a mesh filter in order to protect the pump from solid parts.

An integrated non-return valve prevents the oil from going back and the return of air in the chamber to be pumped down during the stop phase.

The separation of oil smokes from discharged air takes place in the TMF oil mist filter (optional). The filtered oil is recovered automatically by the pump by precipitation (this takes place when the machine is not working or during its operation at the maximum vacuum, i.e. inlet is closed).

A three position adjustable gas ballast valve prevents the condensation inside the pump when small vapour quantities are sucked.

Pumps starting from size PHV 120 are equipped with a water cooling circuit.

## 2.2 Expected use

The vacuum pumps described in this manual can pump only air and small quantity of water vapour.

They are suitable to evacuate closed systems or to operate at a constant vacuum till  $1 \times 10^{-3}$  mbar.

The ambient temperature and the inlet temperature must be included between 12 and 40 °C. In case you get temperatures outside this range, please get in touch with us.

The suction or other types of gas or vapours must be declared in advance to P.V.R. that will give the conformity to the specific use.

## 2.3 Forbidden use



### ATTENTION:

*It is forbidden to suck through the pump:*

✘ *Liquids or solid substances;*

✘ *Dangerous, explosive or aggressive gas and vapours;*

*It is forbidden to use the discharge of the pump to create even limited pressures.*

*It is forbidden to install the pump in a potentially explosive ambient.*

## 2.4 Protections

The pump must be protected against suction of dust and liquids.

For applications where this protection is not warranted it is recommended to install a pressure gauge on the oil tank for a visual control of the oil separator blockage.

The pump is supplied without control panel. The electric motor must be protected according to the regulations in force.



### ATTENTION:

*In case of applications where the pump stop or failure can cause damages to people or things, safety measures for the system must be provided.*

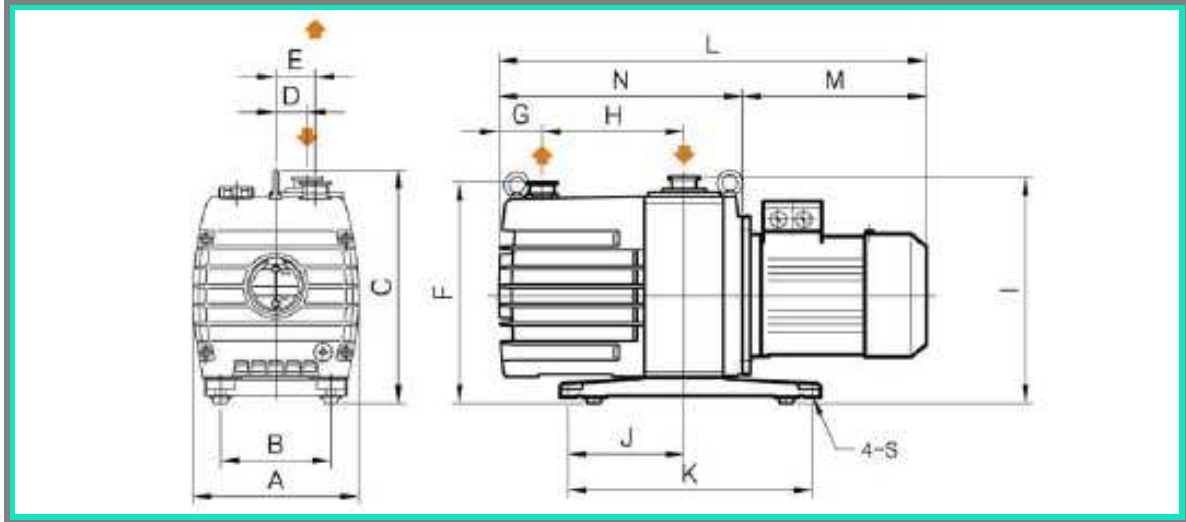
## 2.5 Accessories

The following accessories useful for the installation and the operation are available:

- external inlet filter
- discharge oil mist trap type TMF
- vacuum gauges/ vacuum switches
- pressure gauges / pressure switches
- pipe fittings

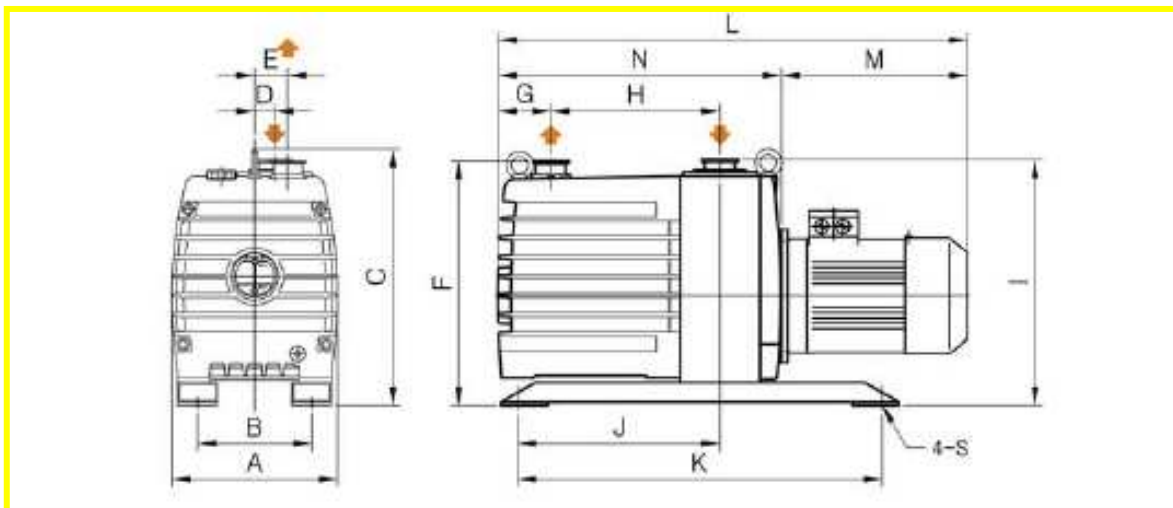
## 2.6 Weight and dimensions

### PHV 5-10-20-30 K



MODEL	A	B	C	D	E	F	G	H	I	J	K	N	S	M	L
PHV5K	170	120	261	24	40	247	45	130	253	94	240	244	Ø9	210	454
PHV10K	170	120	261	24	40	247	45	155	253	94	240	269	Ø9	210	479
PHV20K	210	140	297	40	50	282	55	180	288	147	310	309	Ø12	234	543
PHV30K	210	140	297	40	50	282	58	210	288	147	310	242	Ø12	234	576

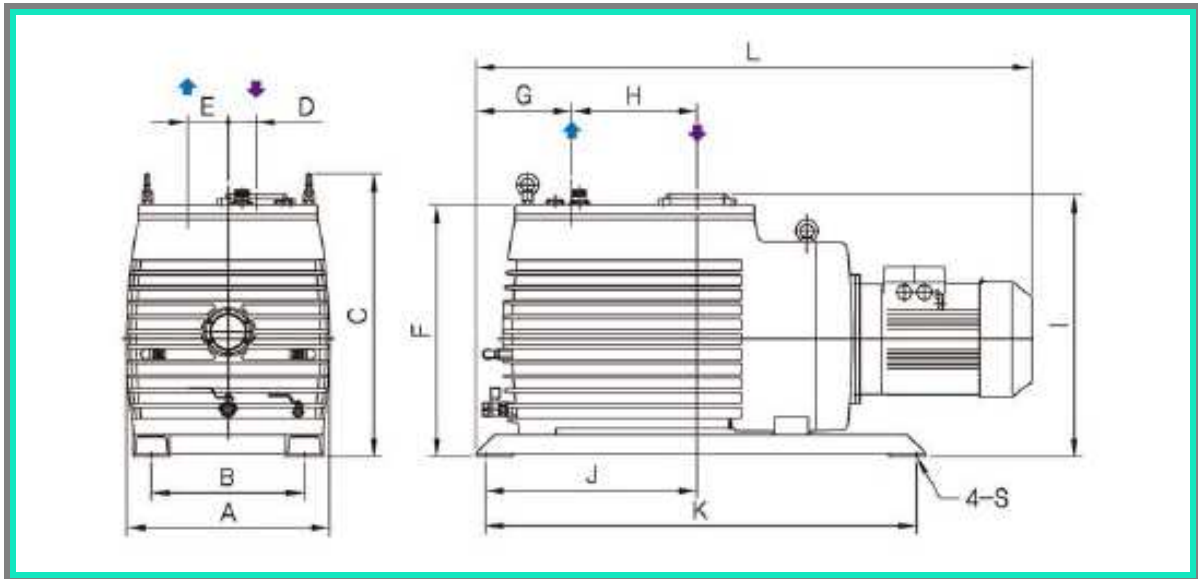
### PHV 50-75 K



MODEL	A	B	C	D	E	F	G	H	I	J	K	N	S	M	L
PHV50K	250	185	387	30	50	368	80	255	370	305	550	428	Ø14	281	709
PHV75K	280	185	441	30	50	412	85	295	415	355	600	479	Ø14	312	791

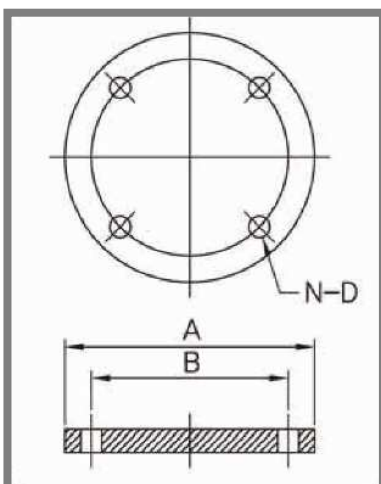
# PHV K Series

## PHV 120-180-270-360K



MODEL	A	B	C	D	E	F	G	H	I	J	K	S	L
PHV120K	320	230	501	40	65	414	193	175	465	348	740	Ø14	974
PHV180K	400	305	575	58	75	490	195	200	528	375	805	Ø18	1101
PHV270K	400	305	645	58	75	560	203	250	598	433	895	Ø18	1179
PHV360K	550	415	771	76	110	686	258	225	714	458	1040	Ø18	1377

## ISO FLANGE DIMENSIONS



STANDARD	A	B	N	D
ISO40	Ø 100	Ø 80	4	M8
ISO63	Ø 130	Ø 110	4	M8
ISO100	Ø 165	Ø 145	8	M8

## 2.7 Technical features

DESCRIPTION			PHV5K	PHV10K	PHV20K	PHV30K	PHV50K	PHV75K
Nominal capacity	50Hz	m <sup>3</sup> /h	5	10	20	30	50	75
	60Hz	m <sup>3</sup> /h	6	12	24	36	60	90
Ultimate pressure	Gas ballast C	mbar	1x10 <sup>-3</sup>					
	Gas ballast I		7x10 <sup>-3</sup>					
	Gas ballast II		1x10 <sup>-2</sup>					
H2O max. vapour pressure		Mbar	53	53	33	33	53	53
Oil charge		Litre	1.1	1.2	2.0	2.3	4.5	6.5
Inlet		DN	25KF				40KF	
Discharge		DN	25KF				40KF	
Motor power		kW	0.37		0.75		1.5	2.2
Revolutions number	50Hz	R.P.M	1400					
	60Hz		1700					
Noise level (closed gas ballast valve)		dB (A)	50	50	52	52	56	56
Total weight		kg	21	22.5	38	41	68	84

DESCRIPTION			PHV120K	PHV180K	PHV270K	PHV360K
Nominal capacity	50Hz	m <sup>3</sup> /h	120	180	270	360
	60Hz	m <sup>3</sup> /h	144	216	324	432
Ultimate pressure	Closed gas ballast valve	mbar	1x10 <sup>-3</sup>			
	Open gas ballast valve		7x10 <sup>-3</sup>			
Oil charge		Litre	11	16	17	28
Inlet		DN	ISO63			ISO100
Discharge		DN	ISO63			ISO100
Motor power		kW	4	5.5	7.5	11
Revolutions number	50Hz	R.P.M	1400			
	60Hz		1700			
Water cooling (lower than 20 °C)		L/min			6	8
Total weight		kg	172	290	358	584

## 3 SAFETY RULES



### **ATTENTION:**

*Despite of all the precautions adopted when designing the equipment, there are some risk elements that arise during operation and servicing.*

### **HOT SURFACES**



The temperature of the pump surfaces may exceed 80°C.

Install the pump in a protected area accessible only by authorized personnel, to prevent possible personal injuries by coming into contact with hot surfaces. The pump can be placed inside other machines by adopting the necessary safeguards. Before carrying out any maintenance on the pump, be sure the pump is cold.

### **HARMFUL SUBSTANCES EMISSION**

The discharged air contains part of traces of oil mist. Check the compatibility with the work environment. A failure or the seals wear can cause an oil leakage. Avoid the dispersion to the ground and the pollution of other materials. In case air containing dangerous substances must be pumped down (for example, biological or microbiological agents), adopt filtering systems before introducing air in the work environment.

Used oil coming from the pump must be disposed of in accordance with the regulations in force in the Country of use.



*Do not dispose into the environment.*

### **HAZARD CAUSED BY VACUUM**

Avoid the contact with the pump inlet port during the pump operation. Introduce air in the inlet circuit before every operation.

The contact with parts under vacuum can cause injuries.

### **HAZARD CAUSED BY PRESSURE**

The pump tank is pressurized. Do not open the oil filling and discharge plugs during operation.

### **FOR A SAFE MAINTENANCE**

All maintenance operations must be carried out with the pump idle, disconnected from the electrical supply, with the pump cold, vented to atmospheric pressure. Prevent unexpected start-up (e.g. block the power switch with a personal lock).

### **ELECTRIC SAFETY**



Some components of the electric equipment are electrically charged during operation whose contact may cause serious injuries to persons or objects.

Connection and control of the electric system must be carried out by skilled personnel only.

The electric equipment must comply with the EN 60204-1 standard and with the other laws in force in the Country of use.

Besides, electric equipment must comply with EN 61000-6-4 and EN 61000-6-2 standards concerning electromagnetic compatibility and electromagnetic immunity for industrial environments.



## **FIRE HAZARD**

The use of the pump for situations unforeseen or not recommended by this manual, as well as lack of correct maintenance, may create high risks for overheating or fire.

In case of a fire do not use water to extinguish but use a powder CO2 extinguisher or other means compatible with the electric equipment and lubricating oil.

## **4 TRANSPORT - HANDLING**

### **4.1 Lifting**

The orientation of the packed components must correspond to the instructions given by the pictograms on the external covering of the packaging.

For the unloading use a lifting equipment suitable for the pump weight.

Use the suitable lifting eyebolts to lift the pump.

### **4.2 Unpacking and components control**

When receiving the machine, check that the packing is intact or if it shows signs of damages occurred during transportation.

If there is no damage, proceed to the unpacking and check further the machine.

In case damages are found, inform immediately **P.V.R.** and the carrier.

### **4.3 Storage**

The pumps must be stored or transported without oil and protected from the atmospheric agents at a temperature between -15°C and 50°C (normal humidity rate).

## **5 COMMISSIONING**

### **5.1 Location**

- ✎ The pump must be installed in a protected area (see safety rules).
- ✎ It must be fastened with support feet on horizontal plane.
- ✎ It must be accessible for correct and easy maintenance, by respecting the minimum distances from possible obstructions.
- ✎ It must be accessible to suitable lifting equipment.
- ✎ Ensure the change of air in the room or inside the machine where the pump has to be installed. To assure a sufficient cooling, avoid to overpass 40°C of ambient temperature.
- ✎ The pump must be protected against jets or sprays of water that may penetrate the tank through the exhaust port.
- ✎ Whenever the pump is installed outside, it must be protected against atmospheric agents and it must be used with an oil suitable for low temperature (see lubricants table).
- ✎ Avoid warm air coming from the exhaust or the cooling fans causing discomfort to the personnel.

## 5.2 Connection to the machine

- ✋ Inlet and discharge ports should be connected to the system using clamps according to International Standards.
- ✋ Make sure the pipes and the flanges are clean.
- ✋ Use pipes as much as short and thick as possible, having at least the same diameter as the one of their ports.
- ✋ Max. pressure of the oil is 1,5 Kg/cm<sup>2</sup>.
- ✋ Make sure the pipes and the flanges are vacuum tight, i.e. there isn't any vacuum leakage.

## 5.3 Discharge air pipeline installation

When required, it is possible to pipe the pump discharge air to other rooms, or outside.  
Use pipes with the same diameter as the tank discharge port with a maximum length of 15 m.  
For longer pipes increase pipe diameter.  
Pipe weights must not rest on the pump.  
In the final length use flexible pipes or pipe fittings.



### **WARNING:**

*this pipe must be descending, to avoid the condensate going back to the tank.*

*Do not connect ball valves to this pipeline.*

## 5.4 ELECTRIC CONNECTION

- ✋ The control panel and electric connections must be carried out by skilled personnel and conform to the EN 60204-1 rules or other local regulations in the Country of use.
- ✋ The electric equipment must comply with EN 61000-6-4 and EN 61000-6-2 standard concerning electromagnetic compatibility, emission standard and immunity for industrial environments.
- ✋ Check the main voltage and frequency in use to correspond to the data stamped on the motor name plate.
- ✋ The electric motor must be protected against overload. The full load amperage value on the motor name plate must be considered when sizing the electrical components and motor protection against overloading.
- ✋ Make sure the grounding is correctly done.
- ✋ Carry out the electric connection following the diagram shown on the motor terminal box.
- ✋ Check direction of rotation of the motor:
  1. Open the inlet and discharge ports.
  2. Lay the transport protection caps on the inlet port.
  3. Switch the pump on for 2 to 3 seconds checking that the plastic cap get tight on the inlet port.

## 5.5 Commissioning

Before using the pump, carry out the following operations:

- ✎ Check the oil level through the sight glass, if necessary fill it up.
- ✎ Make sure there isn't any oil leaks.



### **WARNING**

*The operation without lubricant causes serious damages to the pump.*



### **WARNING:**

*An oil quantity larger than the necessary one may damage the pump or the electric motor.*

## 5.6 Suggestions for the use

- ✎ In case of suction in presence of permanent gases, the pump can operate with the gas ballast valve closed.
- ✎ In presence of condensable vapours, it is advisable to let the pump run with closed inlet port until the operative temperature is achieved (about 5 minutes).
- ✎ Before switching the pump off, let the pump run at maximum vacuum for at least thirty minutes with the gas ballast valve in position open, to eliminate any condensate in the oil.
- ✎ In case of temporary stop, close the inlet and let the pump run until getting back to work.



### **WARNING:**

*Avoid operating pump for long periods with inlet port vented to atmospheric pressure.*

*Avoid frequent stop-starting, as this will lead to premature coupling elastic element wear.*

*It is advisable not to exceed 10 starting/hour.*

*For more frequent starting, it is recommended to install a progressive starter (soft starter) or a star/delta starter.*

*When using a star/delta starter, the vacuum pump can start exclusively with the inlet vented to atmospheric pressure.*

## 5.7 Water vapour suction

In order to pump down water vapour it is essential to take the pump temperature to its operating value letting it run for thirty minutes at maximum vacuum. In case there are other condensate in the oil, let the pump run at maximum vacuum for at least thirty minutes.

It is advisable to carry out this operation before stopping the pump for a long time. The gas ballast valve will allow the elimination of water condensate from the lubricating oil.

## 6 SERVICING

### 6.1 General information

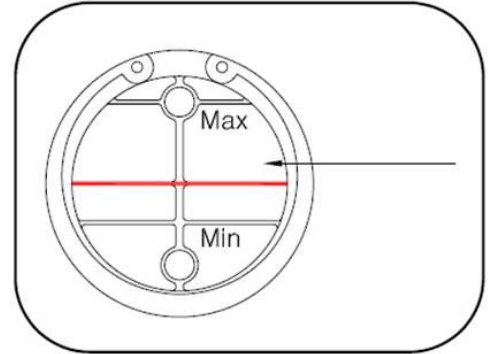


**ATTENTION**

Before every maintenance operation:

- ⚠ Ensure the pump insulation from the electric network so that the pump can't automatically start.
- ⚠ Make sure the pump has reached a non-dangerous temperature.
- ⚠ Introduce air in the suction circuit

The exhausted oil and the replaced spare parts must be considered as special waste products and handled according to the regulations in force in the Country of use.



### 6.2 Oil control

The oil level can be checked through the level sight glass placed in the rear part of the pump; in case of oil shortage, fill it up through the suitable plugs.

The oil condition can be checked visibly, the oil in good condition is clean and limpid. If the oil becomes dark, change it.

### 6.3 Oil change

For a correct operation, oil change should be done when the pump is still warm.

Use only the recommended oil types.



**WARNING:**

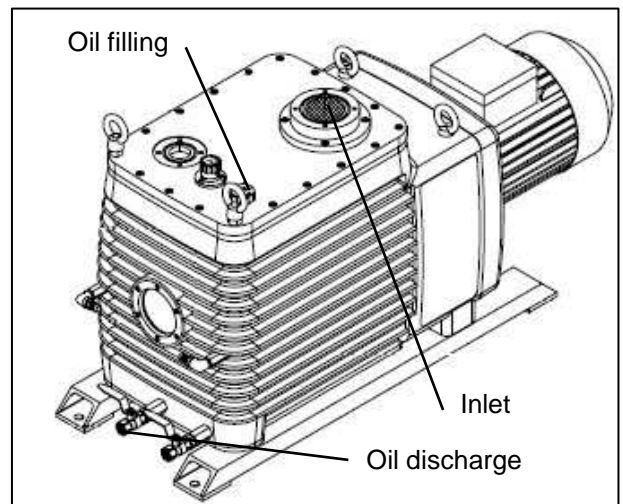
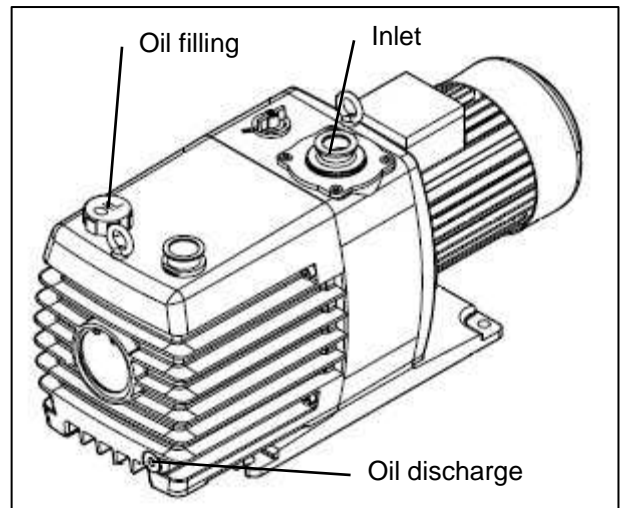
Use protective gloves to avoid injury caused by heat.

Oil should be changed as follows:

- ⚠ After the first 100 working hours, if it is polluted.
- ⚠ Next change, every 2000 ÷ 3000 working hours;
- ⚠ When vacuum level decreases.

To change the oil, follow these steps:

- a) Switch the pump off.
- b) Drain the exhausted oil in the special containers by opening the drain valve or the discharge plug.
- c) Drain the exhausted oil remains by running the pump for a short period (10 seconds maximum) with the inlet port and the oil drain valve open.
- d) Go on making the pump run by filling with fresh oil from the inlet port in to remove the last impurities.
- e) Stop the pump, close the oil drain valve or the oil discharge plug and fill with fresh oil from the provided plugs in.



## 6.4 Inlet filter cleaning

The cleaning depends on the ambient where the pump operates.

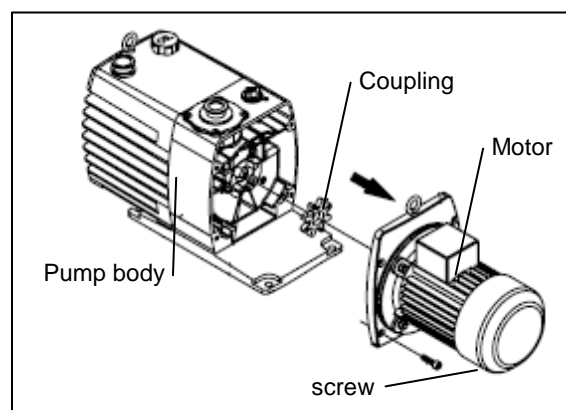
Remove the filter from the inlet port and clean it by means of compressed air. Replace the filter if it is damaged.

## 6.5 Motor disassembly and re-assembling

### Models 5 ÷ 75

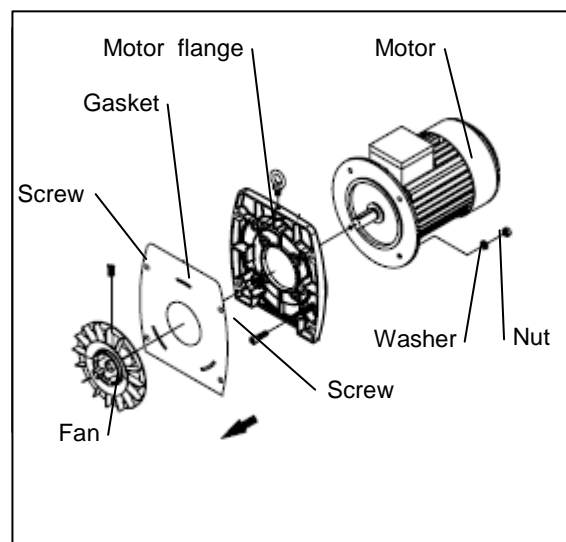
#### Disassembly

- a) Make sure that the power supply is provided with a switch and that the pump is perfectly not operating and at atmospheric pressure.
- b) Loosen the two motor lower screws;
- c) Fasten the motor in order to avoid its fall;
- d) Loosen the two upper screws;
- e) Remove the motor and the flange from the pump;
- f) Remove the coupling element from the fan;
- g) Loosen the fan screw;
- h) Make the fan slide along the motor shaft;
- i) Remove the gasket from the motor flange;
- j) Loosen the four screws of the motor flange and remove the motor from the flange itself.



#### Re-assembling

- a) Make sure that all the parts are clean and check their conditions;
- b) Fix the motor to the flange by means of the four screws;
- c) Fit the gasket to the motor flange
- d) Fit the motor and the fan by making them slide axially. Avoid sudden or forced movements to prevent the coupling surfaces from being damaged;
- e) Fix the fan to the motor shaft by means of its screw;
- f) Insert the coupling element on the fan;
- g) Assemble the motor and the pump and tighten the four screws.



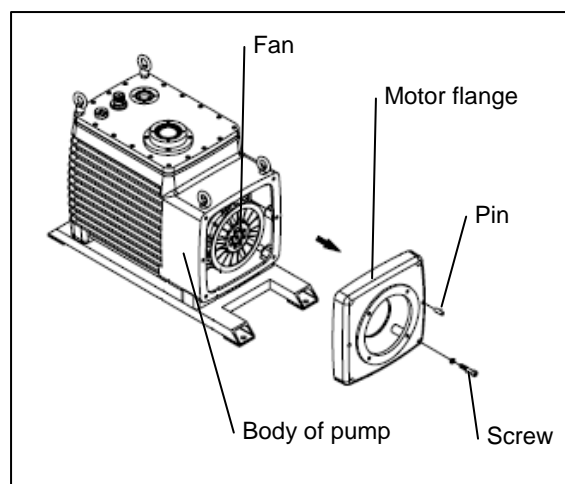
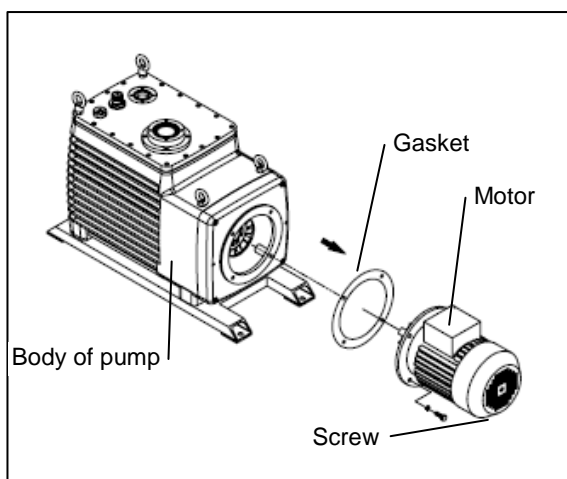
## Models 120 ÷ 360

### Disassembly

- a) Make sure that the power supply is provided with a switch and that the pump is perfectly not operating and at atmospheric pressure.
- b) Loosen the two motor lower screws;
- c) Fasten the motor in order to avoid its fall;
- d) Loosen the two upper screws;
- e) Remove the motor and the gasket from the motor flange;
- f) Remove the two pins;
- g) Loosen the motor flange screws;
- h) Remove the motor flange from the oil tank.

### Re-assembling

- i) Make sure that all the parts are clean and check their conditions;
- j) Fix the motor flange to the tank tightening the four screws;
- k) Assemble the two pins on the motor flange;
- l) Fit the motor and the gasket by making them slide axially. Avoid sudden or forced movements to prevent the coupling surfaces from being damaged.
- m) Tighten the four screws.

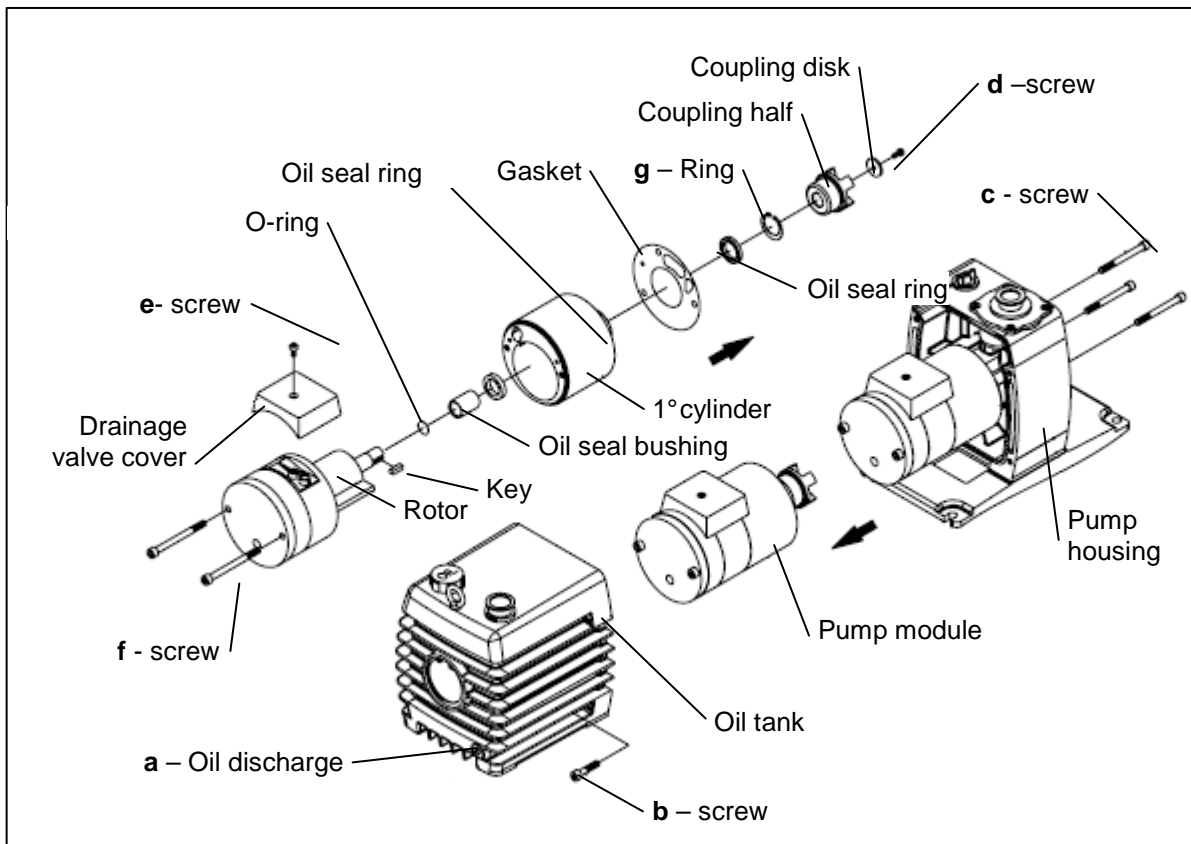


## 6.6 How to replace the oil seal ring

### Model 5 ÷ 30

#### Disassembly

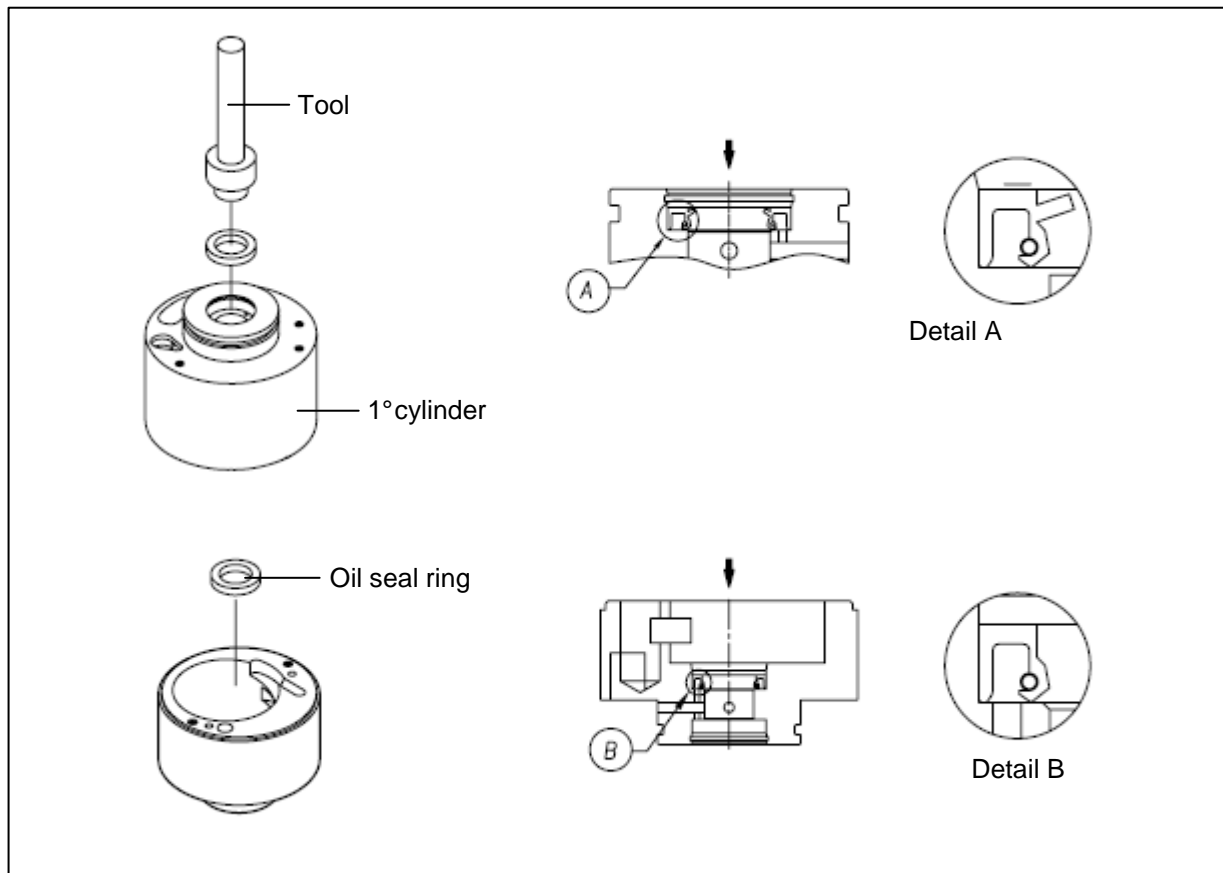
- a) Check that the power supply is provided with a switch and that the pump is perfectly not operating and at atmospheric pressure.
- b) Drain the oil in a proper container by opening the drainage valve **a**.
- c) Remove the motor from the pump unit (see 6.5).
- d) Loosen oil tank screws **b** and remove the tank from the pump housing.
- e) Loosen the three screws **c** and remove the pump housing from the pump module with caution.
- f) Loosen the screw **d**.
- g) Loosen the screw **e** and remove the cover.
- h) Extract the key from its seat on the rotor.
- i) Loosen the two screws **f** of the pump housing rear cover and extract the first cylinder.
- j) Extract the seeger ring **g** using the suitable tools.
- k) Extract the oil seal with caution.



## Reassembly

Use the following oil seal rings:

- Models 5 and 10: D20 x 30 x 7
- Models 20 and 30: D25 x 35 x 7



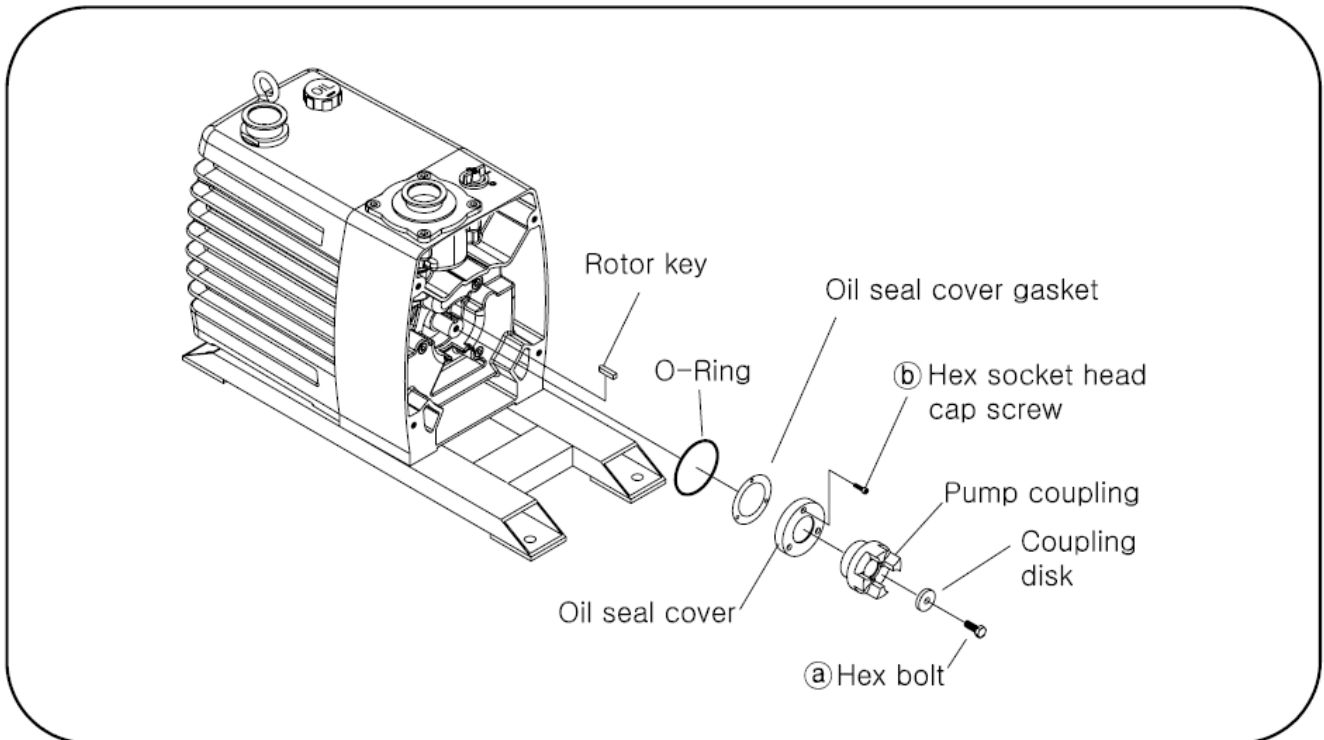
- a) Oil the external surface of the oil seal ring;
- b) Insert the first cylinder having the seal set upwards.
- c) Insert the seal in the first cylinder, with the writing upwards.
- d) Push the seal towards the bottom of the cylinder by means of the assembly tool. Pay attention to not damage the seal.
- e) Reassemble the remaining parts by following the disassembly procedure backwards.



## Models 50 and 75

### Disassembly

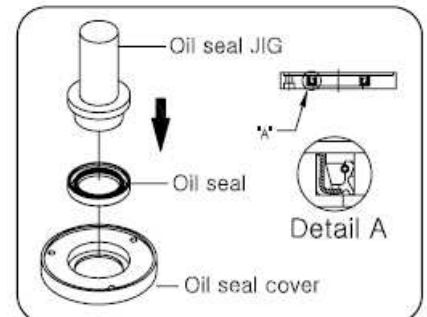
- Check that the power supply is provided with a switch and that the pump is perfectly not operating and at atmospheric pressure.
- Drain the oil in a proper container by opening the drain valve.
- Remove the motor from the pump (see 6.5)
- Remove the coupling screw and extract the disk and coupling half.
- Remove the key.
- Unscrew the three screws of the cover and remove the cover.
- Lay the cover on a plane and remove the seal with caution.



### Reassembly

Use a seal D32 x 44 x 8

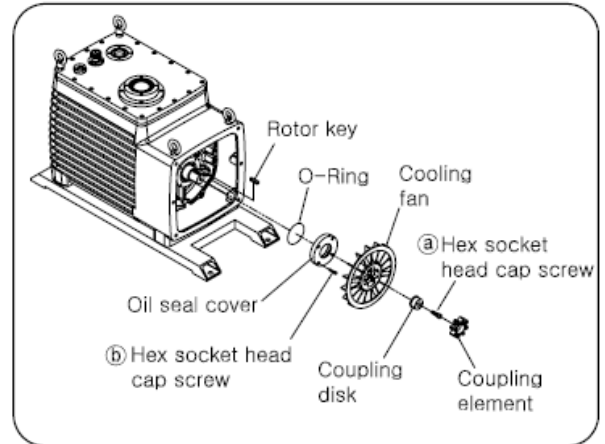
- Oil the seal.
- Insert the cover with the seal seat upwards.
- Insert the new seal in the cover, with the writing downwards
- Push to seal towards the bottom of seat by means of the suitable assembly tool. Pay attention to not damage the seal.
- Reassemble the remaining parts by following the disassembly procedure backwards.



## Models 120 ÷ 360

### Disassembly

- a) Check that the power supply is provided with a switch and that the pump is perfectly not operating and at atmospheric pressure.
- b) Drain the oil in a proper container by opening the drain valve.
- c) Remove the motor from the pump (see 6.5)
- d) Extract the coupling half.
- e) Unscrew the coupling screw and extract the disk and the fan.
- f) Extract the key from the rotor.
- g) Unscrew the screws from the cover and extract the cover.
- h) Lay the cover on a plane and remove the seal with caution.

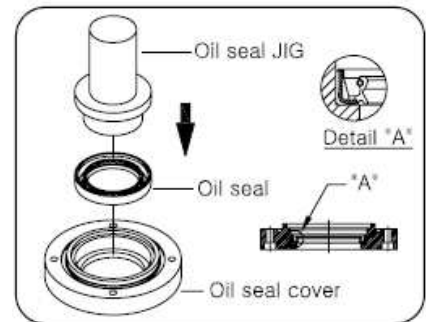


### Reassembly

Use the following seals:

- Model PHV K 120: D40 x 60 x 10
- Models PHV K 180 270: D55 x 70 x 8
- Models PHV K 360: D65 x 85 x 13

- a) Oil the seal.
- b) Insert the cover with the seal seat upwards.
- c) Insert the seal in the cover, with the groove upwards.
- d) Push to seal towards the bottom of seat by means of the suitable assembly tool. Pay attention to not damage the seal;
- e) Reassemble the remaining parts by following the disassembly procedure backwards.



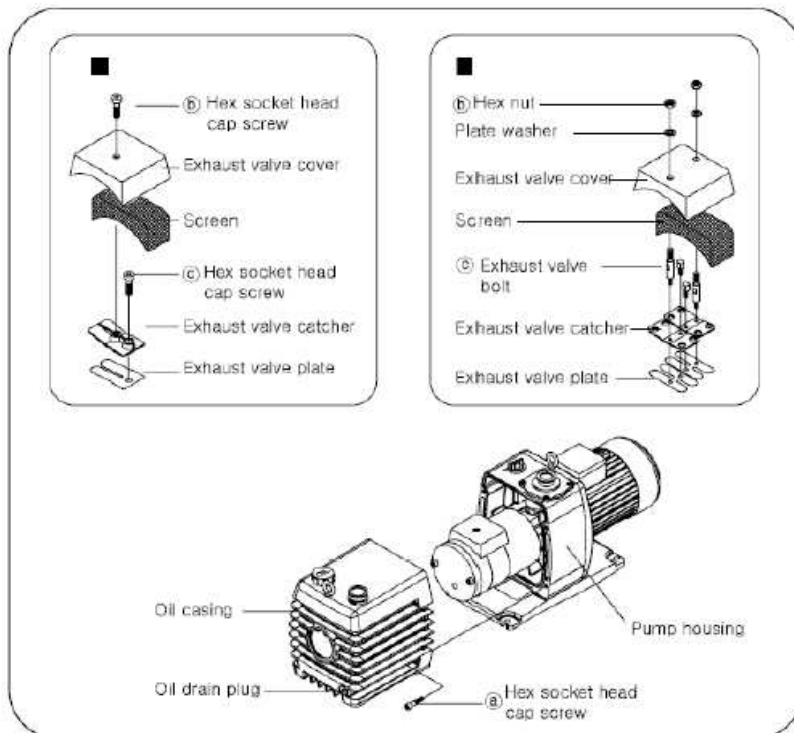
## 6.7 Control and replacing of the discharge valve

### Models 5 ÷ 75

- Check that the power supply is provided with a switch and that the pump is perfectly not operating and at atmospheric pressure.
- Drain the oil in a proper container by opening the drain valve or the discharge plug.
- Remove the tank from the pump by loosening the assembly screws.
- Loosen the screws or the nuts of the drain valve.
- Extract the discharge valve cover and the filter.
- Loosen the screw/s of the valve.
- Extract the valve catcher and the valve plate.
- Clean the parts and change the valve plate, if it has been damaged.
- Reassemble the remaining parts by following the disassembly procedure backwards.

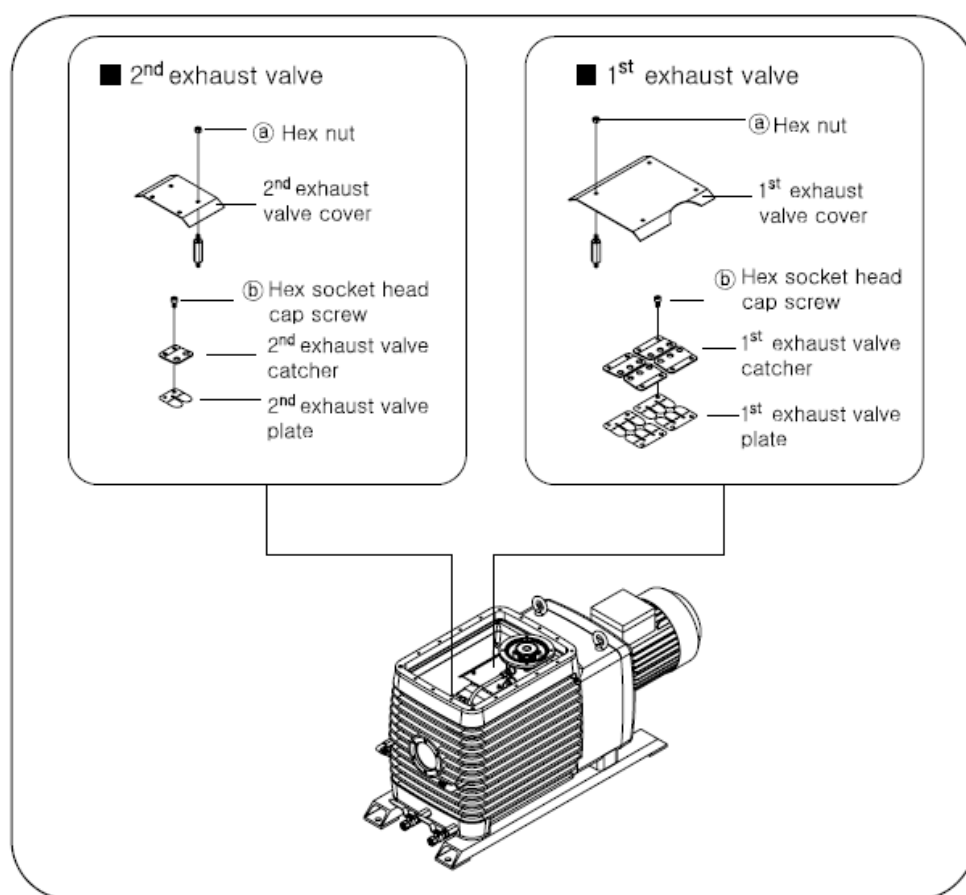
PHV 5/10/20/30 K

PHV 50/75 K



## Models 120 ÷ 360

- Check that the power supply is provided with a switch and that the pump is perfectly not operating and at atmospheric pressure.
- Drain the oil in a proper container by opening the drain valve or the discharge plug.
- Remove the inlet port, the gas ballast valve and the upper cover.
- Unscrew the nuts and remove the valve covers.
- Unscrew the screws and remove the valve catcher and the valve plate.
- Clean the parts and change the valve plates, if damaged.
- Reassemble the remaining parts by following the disassembly procedure backwards.



## 6.8 Checking the inlet valve



### WARNING:

*Genuine spare parts are suggested to be used.*

#### Models 5 ÷ 75

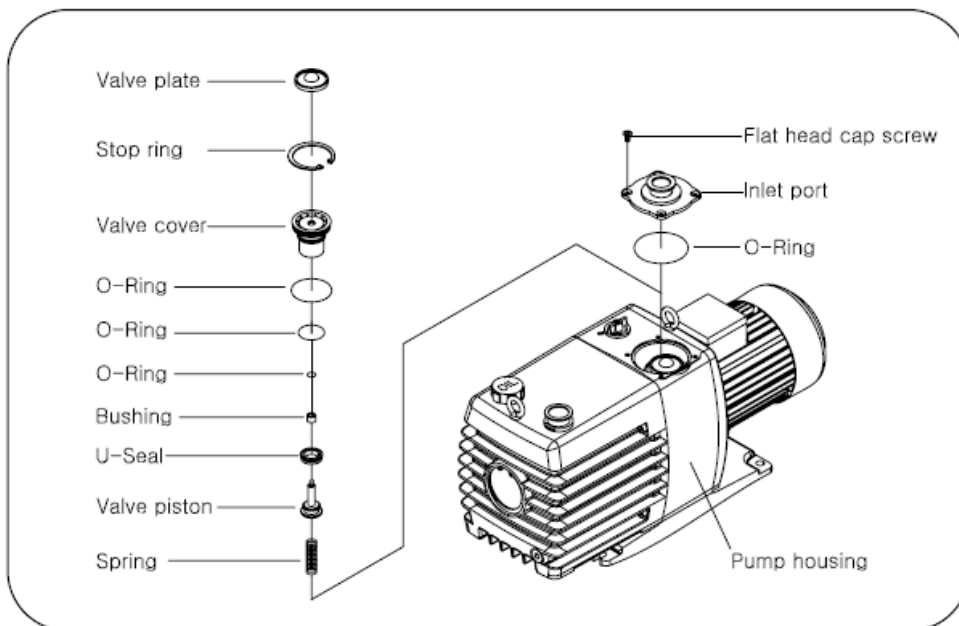
- a) Remove the inlet flange by loosening the four screws and extract the O-ring.
- b) Remove the valve plate.
- c) Remove the seeger ring.
- d) Remove the valve pulling the piston gradually.
- e) Remove the piston and the O-ring from the cover.
- f) Remove the gasket from the piston.



### WARNING:

*The spacer inside the cover is fixed with adhesive, do not try to remove it.*

- g) Remove the O-ring from the valve cover.
- h) Extract the spring.



## Models 120 ÷ 360

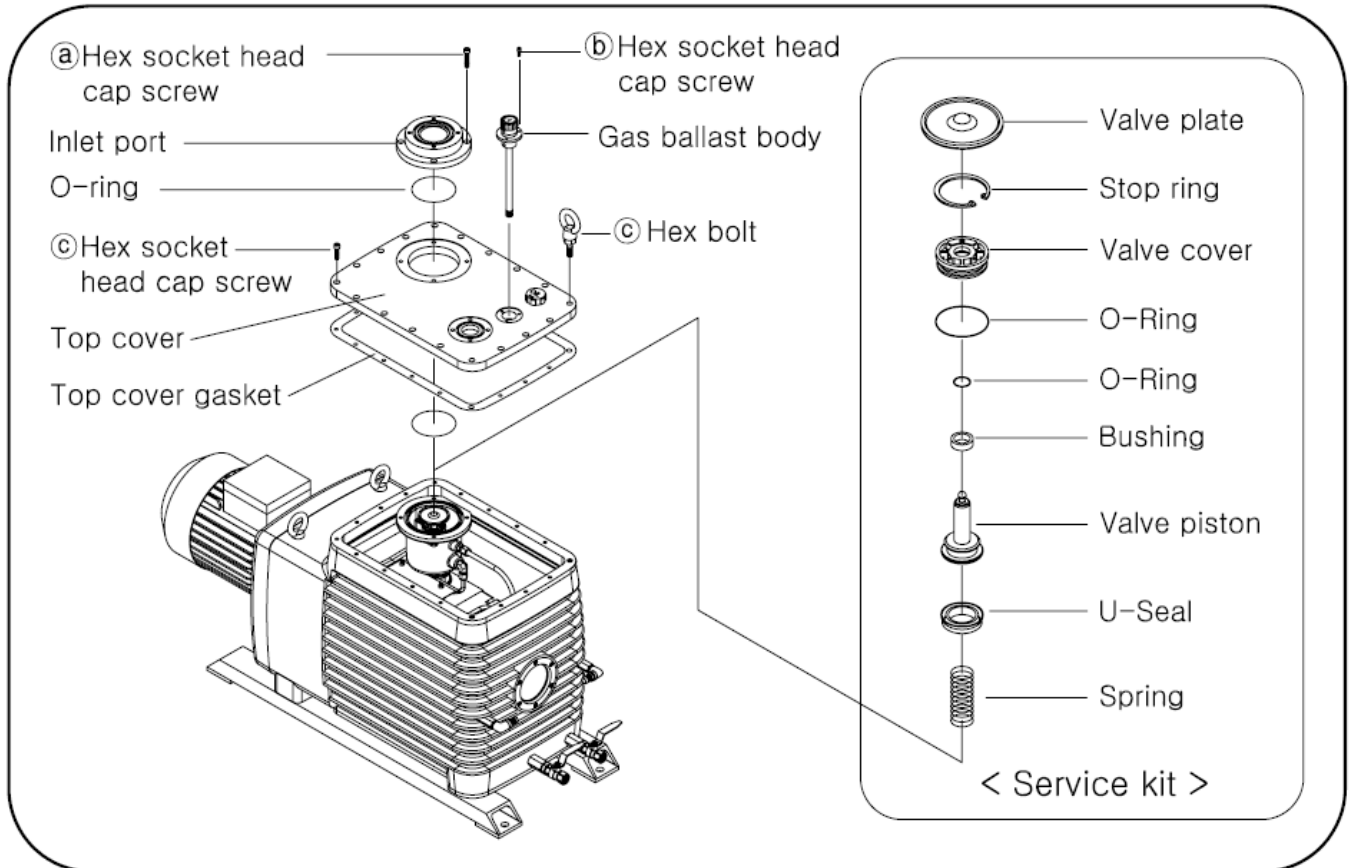
- a) Remove the inlet flange by loosening the four screws and extract the O-ring.
- b) Remove the gas ballast valve by screwing its screws.
- c) Unscrew the screws of the upper cover and remove the cover and its gasket.
- d) Remove the valve by pulling the piston gradually.
- e) Remove the piston and the O-ring from the cover.
- f) Remove the gasket from the piston.



### WARNING:

The spacer inside the cover is fixed with adhesive, do not try to remove it.

- g) Remove the O-ring from the valve cover.
- h) Extract the spring.



## 6.9 Pump overhaul

For this operation it is advisable to ask our Customer Service Department.

The overhaul consists of the complete disassembly, cleaning of all the parts and the replacement of the parts subject to wear (pump and motor bearings, vanes and gaskets).

## 6.10 Spares necessary for the normal servicing

The essential spares are showed in the list of the exploded view attached to this manual.

## 6.11 How to order spare parts

When ordering spare parts always state the pump model (type), the serial number, the year of production, the electric motor characteristics (single phase/three-phase, kW, Hz), position reference on the spare parts list, description and needed quantity.

## 7 LUBRICANTS

Use our synthetic lubricant LPA1 68 or any other lubricants suitable for the ultimate pressure of the pump.

## 8 DECOMISSIONING AND DISPOSAL

For the de-commissioning before handling, drain oil from the pump. If the oil is polluted, flush the pump with fresh oil (see "oil change").

Drain the oil from the tank, plug inlet and discharge ports and store the pump. In case of demolition, differentiate the parts according to the manufacturing materials and proceed to the disposal according to the regulation in force.

## 9 RETURN FOR REPAIR

In case of repair at P.V.R. the substances that got in touch with the pump must be declared, as well as other hazards which may be involved in handling the pump. Fill in the form "Declaration of Contamination of Vacuum Equipment and components".

Drain the oil before shipment.

## 10 TROUBLESHOOTING

Trouble	Cause	Remedy
Failure in starting	1. Adherence among movable and fixed parts	1. Disassemble the pump and remove the adherence
	2. Very thick oil	2. Increase the room temperature or change oil
	3. Exhausted oil or deposition of foreign material	3. Change oil and clean
	4. Clogged oil circuit in the bearings	4. Disassemble and clean
	5. Wrong motor voltage	5. Replace the motor
	6. Wrong electrical connection	6. Verify and repair
	7. Motor failure	7. Contact P.V.R.
Maximum vacuum not achieved	1. Gas-ballast valve too much open	1. Close the gas ballast valve
	2. Inlet pipe connected to the outlet one	2. Rectify the connection
	3. Too much tight inlet pipe	3. Replace the pipe with one of larger diameter
	4. Outlet pipe with an inferior diameter than the one of the outlet port	4. Replace the pipe with one of proper diameter
	5. Seal leaks	5. Repair the leaks
	6. Problems with the inlet valve	6. Disassemble the valve clean it and if necessary repair it.
	7. Unsuitable oil	7. Change with the suggested oil
	8. Exhausted and/or scarce vacuum	8. Change and/or fill up
	9. Clogged oil circuit	9. Disassemble the pump and remove the clogging
	10. Broken oil seal	10. Replace the seal
	11. Vane not fitted properly	11. Disassemble and reassemble rightly
	12. Exhaust valve broken	12. Replace the valve
	13. Damaged vacuum gauge	13. Replace the vacuum gauge
Poor capacity at the outlet	1. Inlet and outlet pipe too tight or too long	1. Replace the pipes
	2. Exhausted oil	2. Change the oil
	3. Broken inlet valve	3. Replace the valve
	4. Clogged inlet filter	4. Clean the filter
	5. Not appropriate oil	5. Change with the suggested oil
	6. Seal leaks	6. Repair the leaks
	7. Pump with not sufficient performances	7. Replace the pump with one of better performances



Trouble	Cause	Remedy
Dark and muddy oil	1. Exhausted oil	1. Change the oil
	2. Not suited oil	2. Change with the suggested oil
	3. Oil shortage	3. Fill up
	4. Loss of vacuum in the seals	4. Repair the leaks
Loss of vacuum at the stop	1. Loss of vacuum in the seals	1. Repair the leaks
	2. Broken inlet valve	2. Replace the valve
Unusual or loud noise	1. Broken coupling elements	1. Replace with new elements
	2. Oil shortage	2. Fill up
	3. Not working or worn oil pump	3. Replace the pump
	4. Broken vane	4. Disassemble the pump and replace the vane
	5. Exhaust valve screen out of position	5. Replace the screen
	6. Damaged motor bearings	6. Repair or replace the motor
Excessive oil Consumption	1. Worn drainage valve O-ring	1. Replace the O-ring
	2. Worn or misplaced oil seal	2. Replace the seal and clean the oil feeding circuit
	3. Corroded or worn oil seal sleeve	3. Replace the sleeve
	4. Leaks from the outlet or inlet ports	4. Replace the O-Rings
	5. Leaks from the gasket between pump and oil tank	5. Replace the gasket
Oil in the vacuum circuit	1. Inappropriate oil vapour tension	1. Clean the pump and change the oil with the suggested one
	2. Oil backflow at the pump stop	2. Verify and if necessary repair the suction valve
	3. Broken suction valve plate seal	3. Replace the plate
	4. Worn or corroded seals of the inlet port in the lower part	4. Replace the port

Trouble	Cause	Remedy
Overheating	1. Oil shortage	1. Fill up
	2. Inlet pipe connected to the outlet	2. Rectify the connection
	3. Clogged oil feeding	3. Disassemble the pump clean and replace oil
	4. Failure at the oil pump	4. Repair or replace the pump
	5. Deposition of foreign material in the oil pump	5. Clean the pump and verify the surfaces
	6. Room temperature higher than 40°C	6. Verify the air conditioning systems if existing
	7. Insufficient oil vapour pressure	7. Verify the air circulation
	8. Excessive sucked gas temperature	8. Intervene on the process or install a cooling system
Exhaust gas leaks	1. Broken outlet port O-Ring	1. Replace the O-Ring
	2. Scored or worn oil tank seal surfaces	2. Sand the surfaces or replace the tank
	3. Scored or worn seal surfaces of the body of the pump	3. Sand the surfaces or replace the body of the pump
Excessive oil mists	1. Excessive oil quantity in the tank	1. Reduce the oil quantity
	2. Gas ballast excessively opened	2. Close the gas ballast
	3. Clogged exhaust valve screen	3. Replace the screen