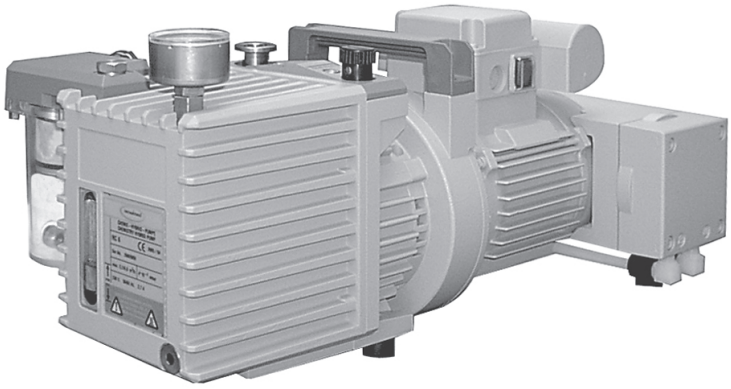
vacuubrand

Technology for Vacuum Systems

Instructions for use



RC 6

Chemistry-HYBRID-pump

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Dear customer,

Your VACUUBRAND HYBRID pump should support you for a long time without trouble and with maximal power. Thanks to our long practical experience we have much information how you could ensure powerful application and personal safety. Please read these instructions for use before the initial operation of your pump.
VACUUBRAND pumps are the result of many years of experience in construction and practical operation of these pumps combined with the latest developments in material and manufacturing technology.

Our quality maxim is the ”zero fault principle”:
Every pump, leaving our company, is tested intensively including an endurance run of 60 hours. Therefore also faults, which occur rarely, are identified and can be eliminated immediately.
The achievement of the specifications after the endurance run is tested for every pump.
Every VACUUBRAND pump achieves the specifications. We feel obliged to this high quality standard.
We know that the vacuum pump can not take a part of your real work and hope that our products contribute to an effective and trouble-free realisation of your work.

Yours
VACUUBRAND GMBH + CO KG

After sales service: Contact your local dealer or call (++49) 9342/808-193.

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Contents

Attention! Important notes!

Not permitted! Misuse may cause damage.

Caution! Hot surface!

Isolate equipment from mains.

Note.

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Safety information!

Remove all packing material, remove the product from its packing-box, remove protective covers from inlet and outlet ports and keep. Inspect the equipment.
If the equipment is damaged, notify the supplier and the carrier in writing within three days; state the item number of the product together with the order number and the supplier's invoice number. Retain all packing material for inspection.
Do not use the equipment if it is damaged.
If the equipment is not used immediately, replace the protective covers. Store the equipment in suitable conditions.

- ☞ **The pump is delivered without oil filling. Fill in oil before operating the pump (see section "Oil change")!**
- ☞ **Read and obey this manual before installing or operating the equipment.**
- ☞ Transport the pump at the provided handle.

Use the equipment **for the intended use only,** i. e. for generation of vacuum in vessels designed for that purpose.

- ☞ **Prevent any part of the human body from coming in contact with the vacuum.**
- ☞ Obey notes on correct vacuum and electrical connections.
- ☞ Adopt suitable measures to avoid that liquids flow on or into the pump motor when assembling or disassembling vacuum connections at the pump. **Risk of corrosion and/or short circuit!**
- ☞ Take care when connecting and deconnecting the vacuum tube.
- ☞ Make sure that the individual components are only connected, combined and operated according to their design and as indicated in the instructions for use.

Obey **national safety regulations and safety requirements** concerning the use of vacuum and electrical equipment and adopt precautionary measures.

- ☞ Ensure that the equipment is suitable for the intended operation.
- ☞ Provide a firm level platform for the equipment and check that the system to be evacuated is mechanically stable and that all fittings are secure.
  Attention: Flexible elements tend to shrink when evacuated.

The main on/off switch is located sidewise at the terminal box.

- ☞ Equipment must be connected only to a **suitable fused and protected electrical supply** and a suitable earth point (recommended slow-blow fuse according to voltage supply, see "Technical data"). Failure to connect the motor to ground may result in deadly electrical shock.
- ☞ The supply cable may be fitted with a moulded European IEC plug or a plug suitable for your local electrical supply. If the plug has been removed or has to be removed, the cable will contain wires colour coded as follows: green or green and yellow: earth; blue or white: neutral; brown or black: live.
- ☞ Check that mains voltage and current conform with the equipment (see rating plate).
- ☞ If the equipment is brought from cold environment into a room for operation, allow the equipment to warm up (pay attention to **water condensation on cold surfaces).**
- ☞ Ensure that installation is in compliance with limitations from the degree of protection, see section "Technical Data".
- ☞ Pay attention to the maximum permitted ambient temperature and make sure ventilation is adequate.

Do not permit any **uncontrolled pressurizing** (e. g. make sure that the exhaust pipeline cannot get blocked). If you have an exhaust-isolation valve, make sure that you cannot operate the equipment with the valve closed. **Risk of bursting!**

- ☞ Ensure that the system design does not allow the exhaust pipeline to get blocked.
- ☞ Avoid overpressure of more than 0.1 bar at the pump outlet.
- ☞ The diameter of the inlet and outlet pipeline should be at the least as large as the diameter of the pump connection pipelines.

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Due to the high compression ratio of the pumps, generated pressure at the outlet port might be higher than the maximum permitted pressure compatible with the mechanical stability of the system.

☞ Obey maximum permitted pressures and pressure differences.

Pay attention to symbol ”hot surfaces” on the equipment (according to IEC 1010 recommendation).

☞ Adopt suitable measures to prevent any danger arising from the formation of hot surfaces or electric sparks.

☞ Make sure ventilation is adequate if pump is installed in a housing or if ambient temperature is elevated.

To the best of our knowledge the equipment is in compliance with the requirements of the applicable **EC-directives** and harmonized standards (see ”Declaration of conformity”) with regard to design, type and model, especially directive IEC 1010. This directive gives in detail conditions, under which the equipment can be operated safely (see also IP degree of protection).

☞ Adopt suitable measures in case of differences, e. g. using the equipment outdoors, installation in altitudes of more than 1000 m above mean sea level, conductive pollution or dewiness.

The pumps have no approval for operation in or for pumping of potentially explosive atmospheres.

If pumping **different substances**, purge the pump with inert gas prior to changing the pumped media in order to pump out residues and to avoid reactions of the pumped substances with each other with and the pump material. Ensure that the materials of the wetted parts are compatible with the pumped substances, see section ”Technical data”.

Take into consideration interactions and chemical reactions of the pumped media.

The pumps are **not suitable** for pumping substances which may form **deposits** inside the pump.

☞ If there is a danger of the formation of **deposits** in the pump chamber (check inlet and outlet of the pump) inspect the pump chamber regularly and clean if necessary.

The pumps are **not suitable** to pump **unstable substances** and substances which react explosively under **impact** (mechanical stress) and/or when being exposed to **elevated temperatures** without air.

The pumps are **not suitable** to pump **self inflammable** substances, substances which are inflammable without air and **explosive substances**.

The pumps are **not suitable** for pumping dust and have **no approval** for operation below ground.

Ensure that the materials of the wetted parts are compatible with the pumped substances, see section ”Technical data”.

☞ If residues can occur or if aggressive or condensable substances may enter the product, install suitable protection (e.g. gas washing bottle).

☞ Use cold trap if pumping aggressive or corrosive fluids.

☞ Adopt suitable measures to prevent the release of dangerous, explosive, corrosive or polluting fluids.

☞ Use inert gas for gas ballast or ventilation if necessary.

☞ Take adequate precautions to protect people from the effects of dangerous substances (chemicals, thermal decomposition products of fluoroelastomers), wear appropriate safety-clothing and safety glasses.

☞ Observe applicable regulations when disposing of chemicals which may be contaminated by pumped substances.

☞ The user must take suitable precautions to prevent any formation of explosive mixtures in the expansion chamber or at the outlet. In case of a diaphragm crack, mechanically generated sparks, hot surfaces or static electricity may ignite these mixtures.

Important note on working with condensable vapours:
☞ Before commencing evacuation, allow pump to reach operating temperature and do not permit vapour inlet pressure to exceed the permitted maximum. Open gas ballast valve in case of pumping huge amounts of vapour.

Check oil level and condition of oil at regular intervals.

In case of excess temperature the motor is shut down by an embedded **thermal cutout in the winding**. Manual reset is necessary. Switch off pump or isolate the equipment from mains. Determine and eliminate cause of failure. Let pump cool down sufficiently before switching on again.
☞ Avoid heat supply (e.g. due to process gases).
☞ Ensure sufficient air admittance if pump is installed in a housing.

Ensure that in case of failure the pump and the vacuum system always will turn into a safe status.
☞ Failure of the pump (e. g. due to power failure) must not lead to a critical dangerous situation under any circumstances.
☞ Obey especially notes on operation and use and maintenance.
☞ Operating the pump, stand still of the pump or operating the air admittance valve must not lead to a critical or dangerous situation under any circumstances.

Under normal conditions, pump oils and lubrications are not toxic and their use entails no danger. Certain hazards are, however, associated with some of these products. The following precautions must be adopted during use and operation in order to meet health and safety requirements.
Adopt precautionary measures (e. g. wear appropriate safety-clothing and protective goggles) to avoid excessive contact with the skin and possible skin irritations (including dermatitis).
Do not inhale or swallow. Maintain adequate levels of hygiene and cleanliness.
Ensure that the pump location is well ventilated and that possible toxic effects of certain vapours are avoided.
☞ Use suitable collecting and disposing systems if necessary.
☞ Observe all relevant statutory requirements and regulations concerning the storage and disposal of oils.

Even if the medium pumped is air or an inert gas, the discharge from rotary vane pumps contains small quantities of oil vapour and crack products. These substances are contaminating particularly in closed spaces or in absence of adequate ventilation.
☞ Install oil mist filter and discharge gases and vapours according to regulations.

The dependability and operatability of the pump is not guaranteed if other-make filters are used.

The discharge from the pump invariably contains the evacuated gas or vapours!
☞ Prevent any dangerous reactions with oil or vapours or the impermissible or dangerous occurrence of emissions.

Use only **oil of the recommended type.**
Other oils or operating fluids may cause dangers or damage of the pump.

Use special oils for the pump if:
☞ The pump operates in the vicinity of potential ignition sources.
☞ Oxygen or other flammable gases account for a large proportion of the evacuated gases.

Attention: Do not allow oils to be poured into or enter the drainage system or other bodies of water. Spillage can cause accidents! Use suitable means for removing spilt oil.
☞ Observe all relevant statutory requirements and regulations concerning the use, storage and disposal of oil.

Use only **genuine spare parts and accessories.**
☞ Otherwise safety and performance of the equipment as well as the electromagnetic compatibility of the equipment might be reduced.

Ensure that maintenance is done only by suitable trained and supervised technicians. Ensure that the maintenance technician is familiar with the safety procedures which relate to the product processed by the vacuum system and that the equipment, if necessary, is appropriately decontaminated before starting maintenance.
Obey local and national safety regulations.

Before starting maintenance vent the system, isolate the pump and other components from the vacuum system and the electrical supply. Drain condensate if applicable, avoid the release of pollutants. Allow sufficient cooling of the pump. **Ensure that the pump cannot be operated accidentally. Never operate the pump if covers or other parts of the pump are disassembled. Never operate a defective or damaged pump.**

Before starting maintenance, **wait two minutes** after isolating the equipment from mains to allow the capacitors to discharge.

Attention: The pump might be contaminated with the process chemicals that have been pumped during operation. Ensure that the pump is decontaminated before maintenance and take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred.
☞ Wear appropriate safety-clothing when you come in contact with contaminated components.

As laid down in the statutory regulations (occupational, health and safety regulations and regulations for environmental protection), vacuum pumps returned to the manufacturer can be repaired only under certain conditions, see section "**Notes on return to the factory**".
☞ Avoid any contamination of pumped substances or of the environment.

Technical data

Type		RC 6
Pumping speed 50/60 Hz (PNEUROP)	m^3/h	5.8 / 6.8
Max. pumping speed 50/60 Hz	m^3/h	5.9 / 6.9
Ultimate partial pressure without gas ballast a.)	mbar	$4x10^{-4}$
Ultimate total pressure without gas ballast b.)	mbar	$2x10^{-3}$
Ultimate total pressure with gas ballast	mbar	$1x10^{-2}$
Max. permitted back pressure at the outlet (absolute)	bar	1.1
Max. permitted difference pressure between inlet and outlet	bar	1.1
Max. permitted pressure at the gas ballast (absolute)	bar	1.5
Max. inlet pressure for water vapour		c.)
Total pressure in oil reservoir d)	mbar	18
Oil temperature e.) (under typical operation conditions)	°C	60
Oil capacity min./max.	ml	340 / 530
Recommended oil		VACUUBRAND B-Oil
Ambient temperature range storage/operation	°C	-10 to +60 / +12 to +40
Max. permitted relative atmospheric moisture (during operation, no condensation)	%	30 to 85
Max. permitted range of supply voltage (see rating plate)		100-120 V +5%/-10% 230 V +/-10%
Motor power	kW	0,37
Nominal speed at 50/60 Hz	min^{-1}	1500 / 1800
Nominal current at: 110-120 V~ 50/60 Hz 230 V~ 50/60 Hz	 A A	 5.7/ 5.1 2.7 / 2.6
Motor protection		thermal cutout
Degree of protection IEC 529		IP 40
Mean sound pressure level according to DIN 45635 (measured at a distance of 1 m) at 50/60 Hz	dbA	50 / 52
Inlet connection (small flange)	DN	16
Outlet connection (hose nozzle)	DN	10
Dimensions L x W x H	mm	510 x 305 x 230
Weight, fully operational	kg	24.2

a.) Partial vacuum of permanent gases measured at pump inlet.
b.) The total vacuum is higher than the partial vacuum because the former includes the vapour pressure of the pump oil and other condensable vapours (e.g. water); the condition of the oil (cleanliness, content of hydrocarbons with higher partial pressures) is crucial for this value.
c.) The maximum inlet pressure for water vapour, or rather the maximum inlet pressure for vapour, cannot be specified in accordance with PNEUROP because it cannot be determined for the HYBRID pump in accordance with this standard. On account of the considerably reduced pressure in the oil-sealed part of the RC 6, however, the value is considerably higher than that of a conventional oil-sealed rotary-vane pump.
d.) With inlet sealed and without gas ballast.
e.) Oil temperature and pressure in the oil reservoir are the relevant parameters for maximum inlet pressure for vapours and chemical resistance.

We reserve the right for technical modification without prior notice!

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Components	Wetted parts
Diaphragm pump	
Head cover	ETFE
Housing cover insert	PTFE
Diaphragm	PTFE
Diaphragm clamping disc	ETFE
Valve	PTFE
Vacuum connections	ETFE / aluminium anodized
Hoses	PTFE
Rotary vane pump	
Metallic parts	stainless steel, grey cast iron, steel (partly plasma nitrated), aluminium alloy, nickel-plated, zinced
Plastic materials	epoxy resin, FPM, NBR, PTFE, PBT, PMP, PEEK, PPS glass-fibre reinforced, PFA, FFKM, PVC

The pump RC 6 doesn't contain any nonferrous heavy metal.

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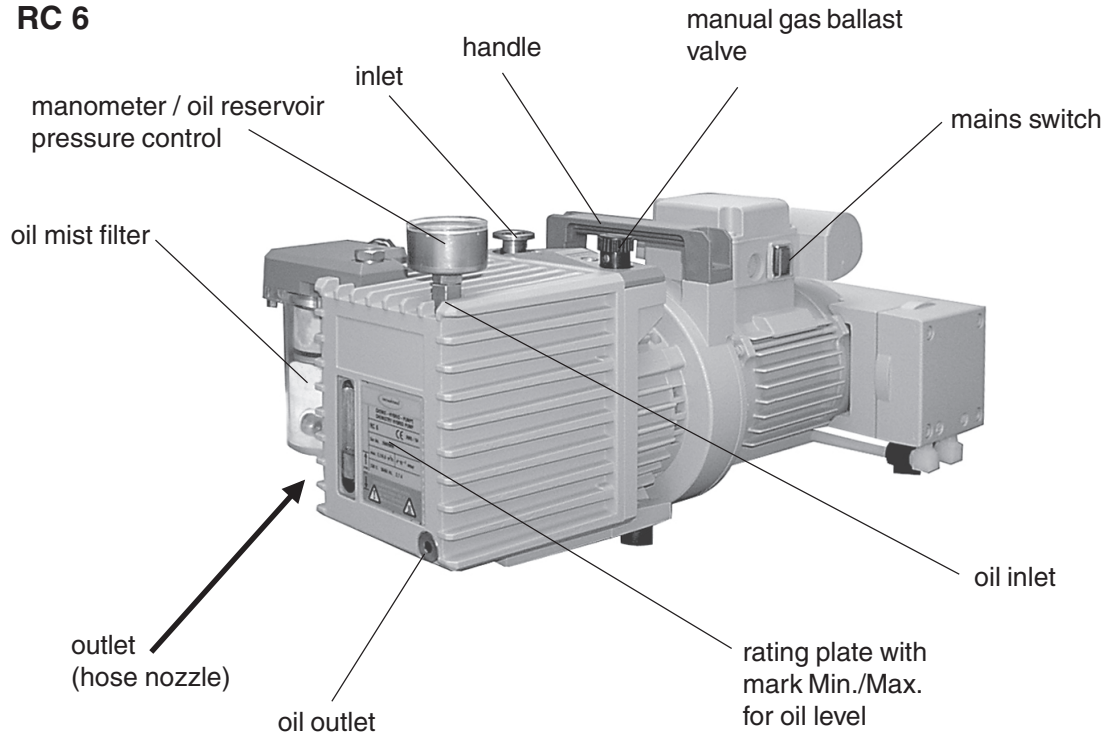
Use and operation

Method of operation

The RC 6 is a four-stage vacuum pump consisting of an oil-sealed, two-stage rotary pump with a series-connected two-stage diaphragm pump. The two units are mounted on a common shaft and are connected directly to the drive motor. The dry-running compressor-type diaphragm pump permanently evacuates the oil reservoir of the rotary pump, thus considerably increasing the latter's maximum vapour inlet pressure and chemical resistance.

With the gas ballast valve closed, the rotary vane pump shuts off vacuum-tight. This, in turn, prolongs the intervals between oil changes and improves corrosion resistance. The oil system incorporates an oil pump; this forced-lubrication system ensures an adequate supply of oil to the pump unit even at high inlet pressures. A mechanical retaining valve in the oil system prevents oil suck-back into the vacuum system.
The oil mist filter of the rotary vane pump removes 99 % of the oil mist. If an exhaust waste vapour condenser is fitted (available on request), the vapours handled by the pump can be condensed to a large extent and either recycled or disposed off in accordance with regulations.

RC 6



☞ The outlet (hose nozzle) is marked ”EX”.
Caution: Failure to connect the inlet and outlet lines correctly will cause excessive pressure and the risk of bursting.

☞ Make perfectly sure that the pump is not blocked or sealed on the outlet side and that no excessive back-pressure can build up on the outlet side.

The pump is supplied dry, in order to ensure that oil cannot make its way from the rotary vane pump into the housing of the oil mist filter. A can containing 0.5 litre of rotary-pump oil is supplied with the pump. Before **starting the pump for the first time**, remove the manometer with adapter (face wrench w/f 17) and **pour in the oil as described below**.

Attention! Because new oil contains gas, a considerable degree of foaming can occur during operation with new oil, and oil could penetrate the oil separator.
☞ Pour only approx. 350 ml of oil into the pump (bringing oil level to ”min.” mark, approx.).
☞ Reinstall the manometer (mind the O-ring) and with inlet line **closed**, operate the pump for approx. 5-10 minutes.
☞ Add approx. 100 ml of oil. As a rule, it is not necessary to use the maximum quantity of oil. **Do not overfill!**

Note: The pump must be operated in the normal position. When transporting a pump containing oil, take great care not to tilt the pump to an angle that would permit oil to make its way into the filter element.

Installing in a vacuum system

When installing pump in a vacuum system, avoid throttling losses.
☞ Use connecting pipes with large diameter and keep them as short as possible.
☞ Line nominal diameter must be at least equal to that of pump inlet connection.
☞ Reduce the transmission of vibration and prevent loading due to rigid pipelines. Insert elastic hoses or flexible elements as couplings between the pump and rigid pipes. **Attention:** Flexible elements tend to shrink when evacuated.

Protection of the pump and the environment:
☞ Protect pump against foreign matter.
☞ Install isolation valve (see section ”accessories”) for heat-up/run-out phase at inlet connection.
☞ Prevent backflow of condensate from outlet line into pump. Run exhaust pipelines always downwards.
☞ Prevent release of oil vapours, toxic or hazardous gases:
Install outlet line and dispose of vapours in accordance with regulations, use an **exhaust vapour condenser** (available on request).

Make sure the ventilation is adequate if the pump is installed in a housing or if ambient temperature is elevated (ambient temperature min. 12°C, max. 40 °C).

Prior to use

☞ **Max. ambient temperature**: 40 °C.
☞ Ambient temperature should be at least 12 °C, because otherwise the pump possibly does not start because of the high oil viscosity at low temperature.
☞ Check oil level of the rotary vane pump every time before starting the pump, however at least once a week. Check oil level more frequently if high gas or vapour quantities are pumped.
☞ Make sure ventilation is adequate if pump is installed in a housing or if ambient temperature is elevated. Keep a distance of min. 20 cm between fans and ambient parts.

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- ☞ If pump is installed in altitudes of more than 1000 m above mean sea level check compatibility with applicable safety requirements, e. g. EN 60034 (motor may overheat due to insufficient cooling).
- ☞ If the gas ballast valve is open, a power failure may cause unintentional ventilation of the pump. In case this constitutes a potential source of danger, take appropriate safety measures (e. g. install a electromagnetic operated gas ballast valve).
- ☞ When assembling, ensure vacuum-tightness. After assembly, check the complete system for leaks.

During operation

The pump does not reach its rated pumping speed, ultimate vacuum or max. inlet pressure for vapour and chemical resistance until it has reached operating temperature (after approx. 30 minutes).
☞ If necessary, use **isolation valve** (see ”accessories”).

The **pressure control of the oil reservoir** of the HYBRID pump is intended to check the operation of the diaphragm pump. If during the process the pressure inside the oil reservoir rises significantly (needle of the manometer clearly in the red zone), it is necessary to take appropriate measures to reduce the inlet pressure.
For the HYBRID principle to work it is necessary to prevent the pumped vapours from condensing inside the oil reservoir. Therefor the pressure inside the oil reservoir has to be lower than the vapour pressure of the pumped media at the oils temperature (60°C). If necessary the amount of pumped vapours has to be reduced or a cold trap has to be installed.
If no improvement occurs even with the recipient being absolutely leak tight, this points to a potential failure of the diaphragm pump, e.g. a diaphragm ckrack. A more accurate check of the pressure inside the oil reservoir is possible with a more precise manometer, e.g. vacuum gauge DVR 2. If a pressure higher than 25 mbar is measured with inlet port and gas ballast valve closed, check diaphragm pump and replace diaphragm if necessary.

- ☞ Evacuation can commence at any pressure equal or lower than atmospheric pressure.
- ☞ The pump can operate continuously at any pressure lower than atmospheric pressure. Oil consumption increases at inlet pressures in excess of 100 mbar. Consequently, check oil level at more frequent intervals.

Note: Attainable ultimate vacuum is limited by the properties of the vacuum vessel (leak-tightness, cleanliness and degassing of the inner surfaces), degassing of substances used and the condition of the pump oil (cleanliness, content of hydrocarbons with higher partial pressures).

When pumping condensable vapours (water vapour, solvents,...), open gas ballast valve by turning gas ballast cap.
- ☞ Arrow must point toward word ”Gasballast” on housing.
- ☞ Do not pump vapours until pump has reached operating temperature. Install isolation valve in inlet line and open approx. 30 minutes after pump has been started.

Check maximum vapour inlet pressure. Pump can operate continuously at any pressure lower than the appropriate maximum inlet pressure for vapour. Avoid sudden vapour surges when evacuating commences (large inner surfaces, large-volume vacuum vessel).
☞ Use flow-control valve in inlet line, open valve gradually.

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Operating pump when condensating in filter and separator catch pots:

Observe level of condensate in catch pots of separator and oil mist filter.

☞ Do not permit condensate in the inlet-side separator to rise as far as the bottom of the separator tube. Do not permit condensate in the oil mist filter to reach the bottom of the filter.

Before level rises too high, drain condensate by opening drain plug in transparent catch pot. Shut down and vent the pump beforehand.

☞ If the filter is clogged, oil mist might be visible in the oil filter housing, or the filter might be discoloured or exhibit deposits on the inside.
☞ The separated oil can not be reused unless it is free of contaminates and discolouration. Dispose of the condensate according with regulations.

If the filter element is clogged, disassemble oil mist filter and replace element.

☞ Under certain circumstances, clogged filter elements can be cleaned by using suitable solvents. However, it is safer to use a new filter element (see section ”accessories”).

Important: Observe applicable regulations when disposing used oil and chemicals which may be contaminated by pumped chemicals.

Pumping chemically aggressive or toxic gases and vapours:

☞ Implement special protective measures for pump and environment.
If the thermodynamic conditions peculiar to the application are such that vapours could condense in the rotary vane pump, install a cold trap (see section ”accessories”).
☞ Avoid explosive conditions when compressing explosive and flammable substances/ mixtures.

Important: The gas ballast of the diaphragm pump is permanently connected to the system.

☞ Wait until pump reaches operating temperature before connecting it to vacuum system.
☞ Before shutting down pump, allow it to run on with gas ballast valve initially open, and then with gas ballast valve closed.
☞ Protect pump against exposure to fluids and dust.
☞ The pump requires regular inspection and maintenance.

The drive and all bearings are encapsulated and are packed with life-long lubricant. Under normal operating conditions, the pump is maintenance-free. The valves and diaphragms are wear parts. Aging of the oil in the rotary vane pump necessitates oil changes.

Note: Any drop in the pumping speed of the diaphragm pump produces an increase in pressure in the oil reservoir. Although this does not have a direct effect on the pumping speed and ultimate vacuum attainable by the HYBRID pump, it does have a considerable effect on the aging of the oil and the HYBRID pump’s chemical resistance.

Shutdown:

Has the diaphragm pump been exposed to condensate or was the pump used to pump vapours?

☞ Allow pump to run on with gas ballast valve initially open, and then with gas ballast valve closed.

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Long-term:

- ➨ Drain old oil.
- ➨ Pour in a small quantity of new oil and briefly operate pump (to flush system).
- ➨ Drain oil.
- ➨ Fill pump with new oil.

Before transporting pump, drain condensate from catch pots of separator on inlet side and oil mist filter from outlet side.

Important: When transporting a pump containing oil, take great care not to tilt the pump to an angle that would permit oil to make its way into the filter element. Drain oil if necessary.

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Oil change

Before starting maintenance, isolate the pump from the vacuum system and the electrical supply so that the pump cannot be operated accidentally.

Has the pump been exposed to dangerous or corrosive gases?
Take appropriate safety measures (e. g. safety-clothing and protective goggles) to avoid inhalation and skin contact.
The pump and the oil may be contaminated with chemicals which have been pumped, adopt suitable decontamination measures if necessary.

Aging of the oil necessitates oil change in case of darker colour (see new oil), strange odour of the oil or foreign particles.
Depending on individual cases (especially if corrosive gases or vapours have been pumped) it may be efficient to check the oil at appropriate intervals.

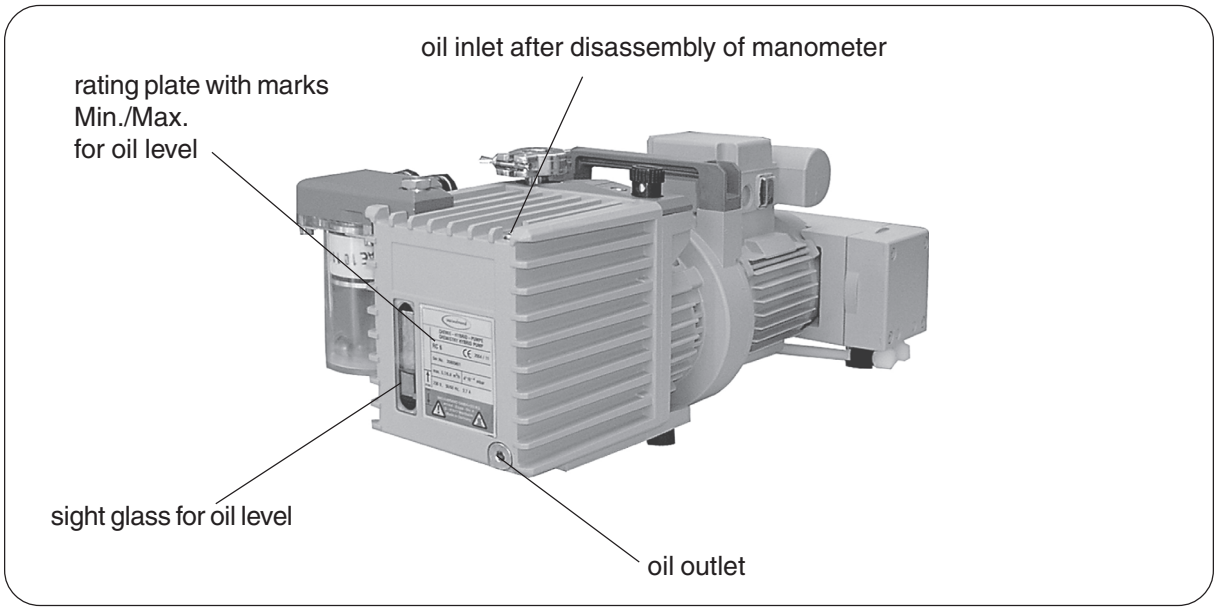
The oil contains small quantities of water/solvent:

☞ The oil can be cleaned to a certain extent by operating pump for 1 - 2 hours with the inlet line sealed and gas ballast valve open.

☞ After every oil change (apart from the first oil change after 100 operating hours), inspect and clean pump chambers of diaphragm pump.
☞ After every oil change, check condition of filter element in oil mist filter; replace element if necessary.

Under normal operating conditions:

➨ Check oil level every time before starting the pump.
☞ Carry out the first oil change after 100 hours operation time.
☞ Change oil on a yearly basis at the latest.
☞ Dispose of the used oil, which may be contaminated by chemicals, according to all applicable regulations.



Oil change:

- ➨ Heat pump to operating temperature before changing oil.
- ➨ Isolate the pump from the electrical supply and admit air. To vent remove manometer with adapter carefully (face wrench w/f 17). Mind the O-ring! Do not turn the manometer itself as leaks might be caused!
- ☞ Choose suitable pad, oil may drop.
- ➨ Remove oil drain plug below the rating plate, note O-ring.
- ➨ Tilt pump and catch oil in a suitable container.
- ☞ Dispose of the used oil according to the regulations.
- ➨ Reassemble oil drain plug and manometer, in each case with O-ring.
- ➨ To flush the pump, pour in fresh oil (approx. 50 ml) through the pump inlet.
- ➨ Operate the pump briefly, drain flushing oil, reassemble oil drain plug with O-ring and repeat flushing procedure if necessary.
- ➨ Remove manometer (as mentioned above).
- ➨ Fill in fresh oil through the oil inlet port (only approx. 350 ml) bringing the oil level approx. to ”min.” mark.
- ➨ Reinstall the manometer and with inlet line **closed**, operate the pump for approx. 5-10 minutes.
- ➨ Add approx. 100 ml of oil. As a rule, it is not necessary to use the maximum quantity of oil.
  Do not overfill!
- ➨ Remount manometer.

Note: The oil degasses and foams if the inlet pressure is low. This is a desirable condition which helps to protect the pump against corrosion and to prolong the working life of the oil.

The quantity, condition and quality of the pump oil have a decisive effect on the pump’s performance and dependability.
Important: It may not be possible to reach the specified ultimate vacuum if an oil other than **VACUUBRAND B-oil** is used. Similarly, failure to use the recommended oil may impair cold-start performance and pump lubrication!

Notes on choosing the correct oil for the application

The **standard oil** for rotary vane pumps is the **B-oil**, a mineral oil, which is used for the first filling of the pump.
The advantages of the B-oil are: Flat viscosity curve, low vapour pressure, good chemical resistance, extended stability when pumping oxidants, acid or basic vapours than conventional mineral oils and good skin compatibility.

Certain pumped media may attack the conventional oil in the pump. Special oils can be used preventively. It is at the users´ responsibility to check if the materials of the wetted parts are resistant against the pumped substances. This is also important if special oils are used.

Special oils

Rotary vane pump oil K 8
The rotary vane pump K 8 oil is a special oil designed for pumping acid vapours. The oil is very hygroscopic and has a limited capacity for acids. With decreasing pH, the anticorrosive effect also decreases and it is necessary to change the oil at appropriate intervals. When the pump will stand still for prolonged periods, the oil must be drained and the pump must be filled with mineral oil.

Silicone oil SI 2
Silicone oil SI 2 is used for rotary vane pumps when high aging stability is required.
Because of its chemical nature, the oil is resistant against many aggressive gases, particularly chlorine and hydrochloric acid, solvent vapours and acid or basic solvents.

Synthetic oil (perfluoropolyether oil)
Synthetic oils have an excellent chemical resistance and are certified for pumping pure oxygen. Therefore these oils are excellent for handling strong oxidants, e. g. halogens, nitrogen oxides, etc.
Attention: As perfluoropolyether oils mixed with mineral oils result in an emulsion, pumps used with these oils must be absolutely free of any mineral oil residues.

Pump oil		cat. no.
B-oil	1 l 5 l 20 l	68 70 10 68 70 11 68 70 12
K 8-oil	1 l 5 l 20 l	68 71 00 68 71 01 68 71 02
Silicon oil SI 2	1 l	68 75 00
Perfluoropolyether oil	0.5 l	68 76 00

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Replacing diaphragms and valves

☞ **Please read the whole chapter "Replacing diaphragms and valves" before starting maintenance.**

Some pictures show pumps in other versions. This does not influence the replacing of the diaphragms or valves!

All bearings are encapsulated and are filled with long-life lubricant. Under normal operating conditions, the pump is maintenance free. The valves and the diaphragms are wear parts.

Depending on individual cases it may be efficient to check and clean the pump heads on a regular basis, but at least every 10000 operating hours. Check diaphragms and valves for cracks or other damage. In case of normal wear the lifetime of the diaphragms and valves is > 10000 operating hours. The **operability of the diaphragm pump can be checked** as well by measuring the pressure in the oil reservoir:

- ➨ Unscrew manometer with adapter (face wrench w/f 17). Remove hose nozzle from distributor plate and install in tapped bore (oil inlet). Make sure O-ring is seated correctly.
- ➨ Using a suitable vacuum meter (e.g. DVR 2) and making sure that it is correctly calibrated, measure the pressure in the oil reservoir. When the pump operates with the inlet line closed, the measured pressure in the oil reservoir should be less than 25 mbar (with gas ballast valve of rotary vane pump closed).
- ➨ Remove hose nozzle from oil inlet. Reinstall hose nozzle in distributor plate and reassemble manometer with O-ring.
- ☞ Prevent internal condensation, transfer of liquids or dust. The diaphragm and valves will be damaged, if liquids are pumped in significant amount.

If the pump is exposed to corrosive gases or vapour or in case of deposits, maintenance should be carried out frequently.

- ☞ Regular maintenance will improve the lifetime of the pump and also protect both man and environment.

Before starting maintenance vent the system, isolate the pump and other components from the vacuum system and the electrical supply. Before starting maintenance, **wait two minutes** after isolating the equipment from mains to allow the capacitor to discharge. Drain condensate if applicable, avoid the release of pollutants. Allow sufficient cooling of the pump. **Ensure that the pump cannot be operated accidentally. Never operate the pump if covers or other parts of the pump are disassembled. Never operate a defective or damaged pump.**

Ensure that the maintenance technician is familiar with the safety procedures which relate to the products processed by the pumping system.

The pump might be contaminated with the process chemicals that have been pumped during operation. Ensure that the pump is decontaminated before maintenance and take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred.

- ☞ Wear appropriate safety-clothing when you come in contact with contaminated components.

Diaphragm **63 97 86**
Valve **63 84 20**
Vacuum gauge DVR 2 ..... **68 29 02**
Face wrench with torque indicator **63 75 80**

Tools required (metric):

- Phillips screw driver size 2
- Open-ended wrench w/f 14/17
- Hex key w/f 5
- Face wrench with torque indicator

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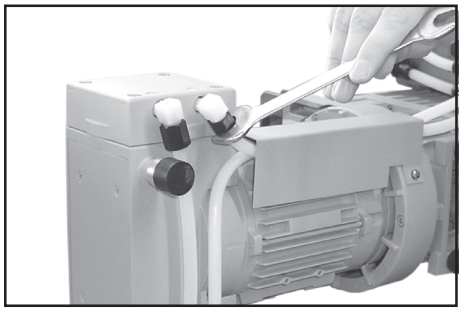
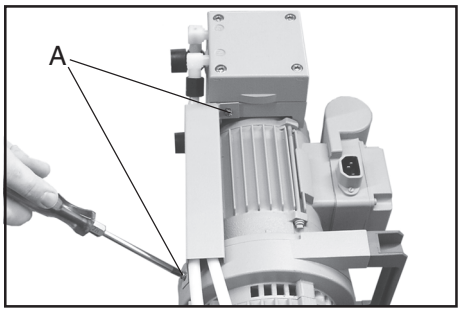
Cleaning and inspecting the pump heads:

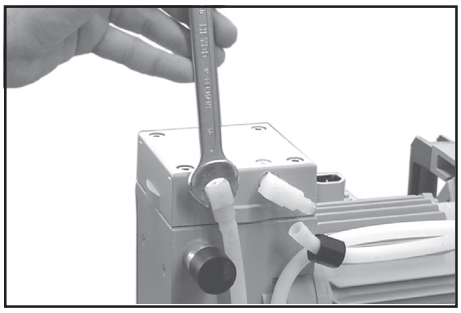
- ➨ Prevent any condensate from leaking from the catch pot of the oil mist filter.
- ☞ Drain condensate before beginning maintenance!
- ➨ **Attention!** Do not tilt pump to an angle that would allow oil to make its way into the oil mist filter or into the manometer.
- ☞ Drain oil (see ” Oil change”). Refill pump with oil before restarting the pump!
- ➨ If the pump is to be positioned in a way different than its operating position, support or underlay pump appropriately. **Attention**: Prevent any damage of the oil mist filter or the manometer. Do not prop up pump with oil mist filter.



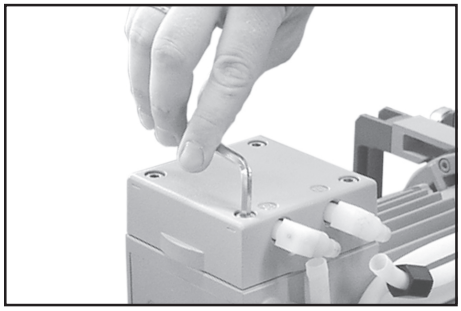
➨ Use open-ended wrench (w/f 17) to remove union nuts.



➨ Remove cover plate. Use Phillips screw driver size 2 to loosen screws (A). Pay attention to lock washers.



- ➨ Use open-ended wrench (w/f 14) to turn elbow fitting 1/4 of a turn, remove hose.
- ☞ Do not remove the elbow fitting from the pump head. Through reassembly a leak may result.



- ➨ To check valves use hex key to remove four socket head screws from pump head and remove upper housing (housing cover with housing cover insert), head cover and valves.
- ☞ Never remove parts by using a spiky or sharp-edged tool (e.g. screw driver), we recommend to use a rubber mallet or compressed air (to be blown carefully into port).
- ➨ Remove head cover from housing cover insert and check valves. Note position of valves and remove.
- ☞ Replace valves if necessary.
- ☞ Use petroleum ether or industrial solvent to remove deposits. Do not inhale.

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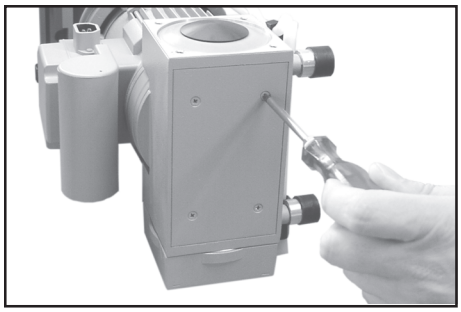
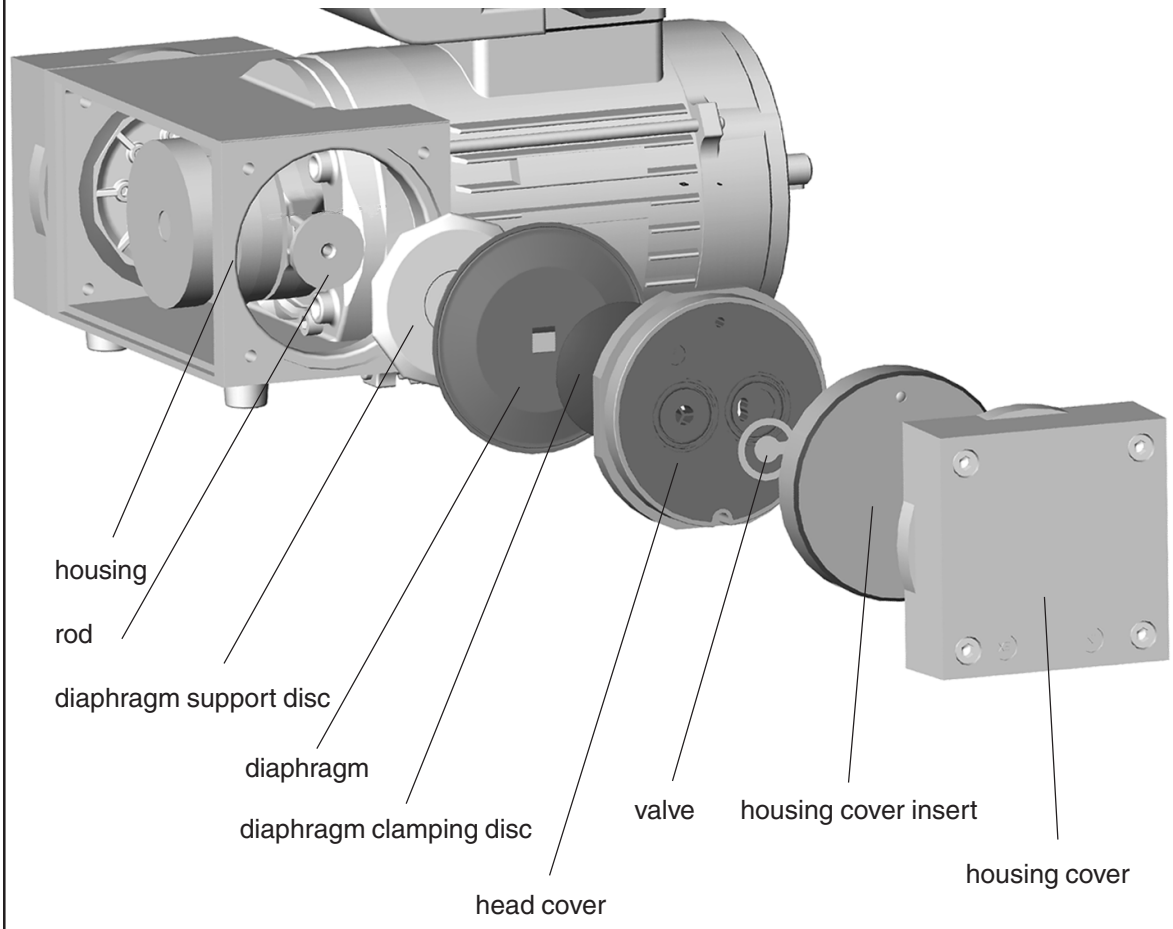
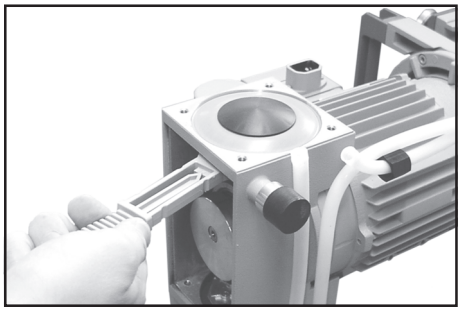


☞ Check diaphragm for damage and replace if necessary.
➨ To do so use Phillips screw driver to remove four countersunk head screws and lift off housing plate.
☞ Use petroleum ether or industrial solvent to remove deposits if necessary. Do not inhale.

View of the disassembled pump head parts



Replacing the diaphragm:



➨ Use a face wrench to remove diaphragm support disc.
➨ Check for washers under support disc. Do not mix the washers from the different heads. Make sure that the original number is reassembled at the individual pump head.
☞ Smaller number of washers: The pump will not attain ultimate vacuum. More washers: Clamping disc will hit head cover; noise or even blockade of the pump.

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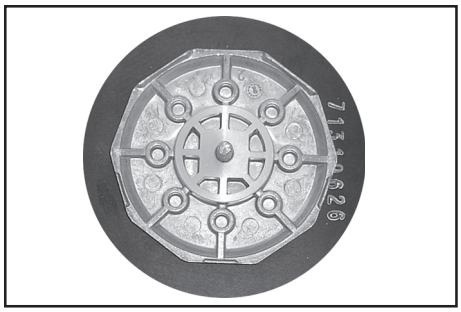
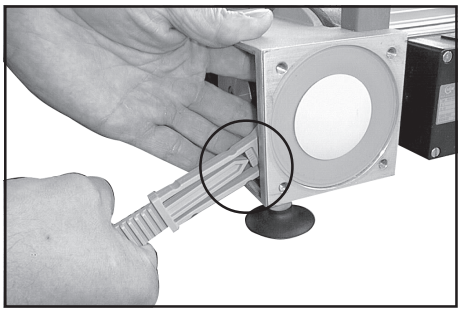


➨ Position new diaphragm between diaphragm clamping disc with square head screw and diaphragm support disc.
☞ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.
☞ **Note:** Position diaphragm with white PTFE side to diaphragm clamping disc (to pump chamber).
➨ Apply a drop of adhesive (OmniFit® 50M or Loctite® 243) to thread of screw.

OmniFit® and Loctite® are registered trade marks of Henkel Technologies

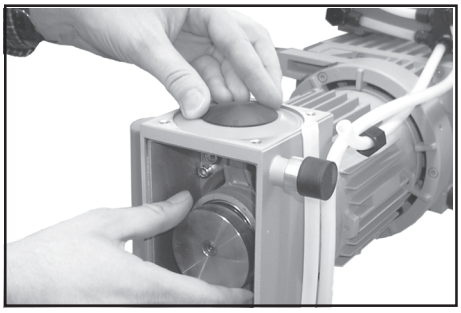


➨ Use **face wrench with torque indicator** (recommended: **face wrench with torque indicator from VACUUBRAND, Cat.-No.: 63 75 80**) to assemble diaphragm clamping disc, diaphragm and diaphragm support disc (and eventually washers) to the connecting rod.
☞ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.

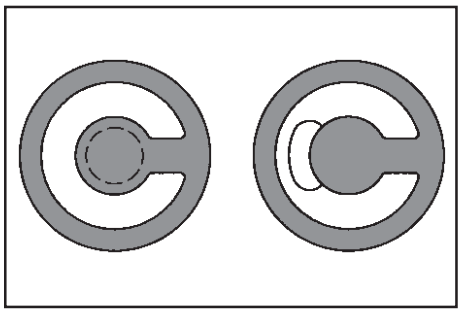
Optimum torque for the diaphragm support disc: **6 Nm.**

☞ The optimum torque is achieved if the pointer in the handle of the VACUUBRAND face wrench shows to the longer marking line.

Assembling pump heads:

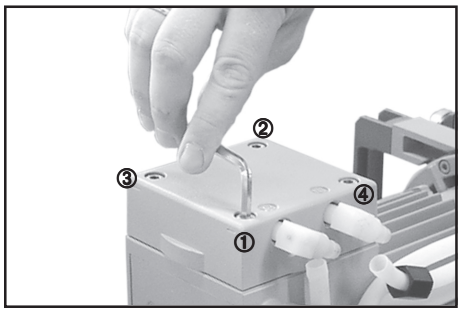


➨ By turning eccentric bushing (front of connecting rod), bring connecting rod into a position in which diaphragm is in contact with housing and centred with respect to bore.



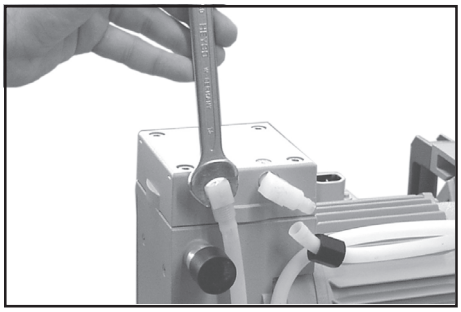
Reassemble in reverse order.

➨ Install head cover, valves and housing cover with housing cover insert.
☞ Make sure that the **valves are correctly seated**: Valves at the outlet with round centred opening under valve, valves at the inlet with kidney-shaped opening beside valve.
➨ By turning eccentric bushing, bring connecting rod into upper turning point position (Max. stroke of the rod).
☞ Pay attention that the diaphragm stays positioned centrally so that it will become clamped uniformly between housing and head cover.

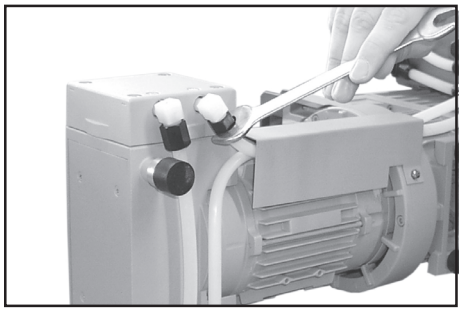


➨ Screw in four socket head screws fixing housing cover crosswise (e. g. in the sequence ①, ②, ③, ④) first slightly, then tighten.
☞ Do not tighten until head cover is in contact with housing, torque **12 Nm**.

Assembling fittings:



➨ Use open ended wrench (w/f 14) to reconnect hose to elbow fitting.



➨ Tighten union nuts first by hand and then tighten one full turn using open ended wrench (w/f 17).
➨ Assemble cover plate. Pay attention to lock washers. Put pump in normal operating position.

☞ **Attention**: Make sure that the pump is filled with oil before switching it on, refill oil if necessary (see ”Oil change”)!

Checking the operability of the diaphragm pump:

☞ The operability can be checked by measuring the pressure in the oil reservoir.
➨ Unscrew manometer with adapter (face wrench w/f 17). Remove hose nozzle from distributor plate and install in tapped bore (oil inlet). Make sure O-ring is seated correctly.
➨ Using a suitable vacuum meter (e.g. DVR 2) and making sure that it is correctly calibrated, measure the pressure in the oil reservoir. When the pump operates with the inlet line closed, the measured pressure in the oil reservoir should be less than 25 mbar (with gas ballast valve of rotary vane pump closed).
➨ Remove hose nozzle from oil inlet. Reinstall hose nozzle in distributor plate and remount manometer with O-ring.

If the pump does not achieve the ultimate pressure:

☞ In case the diaphragms and valves have been replaced, a run-in period of several hours is required before the pump achieves its ultimate vacuum.

If all pump heads achieve a vacuum below 85 mbar but pump does not achieve the ultimate total pressure:
Check hose connectors between pump heads and manifolds for leaks. If necessary recheck pump chamber.

Replacing the filter element in the oil mist filter

➨ Using hex key, remove drain plug (note O-ring fitted on drain plug). Drain condensate from catch pot.
➨ Position pump sideways so that it rests on the side with the mains switch, remove four socket head securing screws (using w/f 5 hex key) and remove filter catch pot.
➨ Using hex key (w/f 5), remove socket head screw in centre of bottom filter thrust ring. Remove filter element, filter thrust ring, top seal ring and O-ring.
☞ Clean or replace filter element. Dispose of oil and filter element in accordance with regulations.
➨ Assembly is the reverse of the disassembly procedure. Make sure that O-ring and sealing ring are correctly seated.

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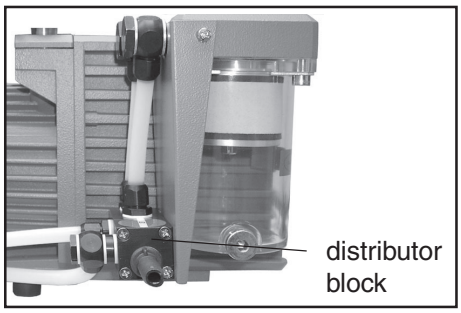
Inspecting the safety pop valve



➨ Remove four countersunk screws and lift off distributor block.
☞ Note position of valve before removing. Replace valve if damaged.
➨ Installation of the distributor block is the reverse of the removal procedure.

Filter element FO DN 10 ..... **64 01 87**
Safety pop valve **63 88 36**
Maintenance kit for aggregate RC 6 ..... **64 99 90**
(rotary vane pump and diaphragm pump)

A service manual with exploded view drawings, spare part lists and directions for repair is available on request (only in German or English).
☞ The service manual is for trained service people.

Accessories

Accessory	Cat.-Nr.
Ball valve VKE 16	67 55 04
Oil mist filter FO	69 80 03
Glass cold trap 1000i	66 70 56
Inlet-side seperator	69 80 07
Electromagnetic gas ballast valve	69 80 05
Small flange with hose nipple NW 16	66 25 31
Rubber vacuum hose (ID 19 mm)	68 60 05
PTFE vacuum hose (antistatic)* KF 16 / 500 mm KF 16 / 1000 mm KF 25 / 500 mm KF 25 / 1000 mm	 68 60 30 68 60 31 68 60 32 68 60 33
Inline butterfly valve VS 16	66 50 04
Retrofit kit pump unit PC 8 (console and exhaust waste vapour condensor with bowl)	69 99 49
Electromagnetic suction line valve VV 15C with small flange NW 16	67 41 10
Vacuum-controller CVC 2^{II}	68 31 50

* **PTFE vacuum hose** (antistatic) with stainless steel small flanges. The inner side of the PTFE hose is smooth for increased chemical resistance, reduced deposits and high conductance.

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Troubleshooting

Fault	Possible cause	Remedy
❑ Pump fails to start or stops immediately.	➔ Mains not connected?	☞ Plug in. Check fuse.
	➔ Phase failure?	☞ Check fuse (in building).
	➔ Oil temperature below 12 °C?	☞ Operate the pump in suitable ambient conditions.
	➔ Start-up control defective?	☞ Contact local distributer.
	➔ Excessive pressure in outlet line?	☞ Unblock line, open valve.
	➔ Motor thermally overloaded?	☞ Switch off pump, allow motor to cool (< 50 °C). Determine and eliminate cause of failure.
	➔ Pump blocked?	☞ See below.
❑ Pump does not achieve ultimate pressure or normal pumping speed.	➔ Centering ring not correctly positioned or leak in the pipeline or vacuum system?	☞ Check pump with a vacuum gauge directly at pump inlet port, check connections and line.
	➔ Inlet blocked?	☞ Ensure that the inlet pipeline does not become blocked.
	➔ Measuring procedure or pressure transducer not suitable for the applicaton?	☞ Choose suitable procedure.
	➔ Long narrow line?	☞ Use line with larger diameter, length as short as possible.
	➔ Oil contaminated (also solvent), not enough oil?	☞ Change oil and flush, check oil level, add oil if necessary.
	➔ Wrong type of oil?	☞ Change oil and flush.
	➔ Outgasing substances or vapour generated in the process?	☞ Check process parameters.
	➔ Pump not at operating temperature?	☞ Allow pump to reach its operating temperature.
	➔ None of the above causes?	☞ Contact local distributer.

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❑ Pump too noisy or strange noise.	➔ Too much oil?	☞ Lower oil level to mark max.
	➔ Overpressure in the outlet line?	☞ Open outlet line.
	➔ Motor overloaded?	☞ Allow motor to cool, identify and eliminate cause of failure. Keep air intake clear.
	➔ Defective diaphragm?	☞ Replace diaphragm.
	➔ Pump blocked?	☞ See below.
	➔ None of the above causes?	☞ Contact local distributor.
❑ Oil in inlet line.	➔ Back diffusion (small amount of oil, oil film)?	☞ Install sorption trap or separator if necessary.
	➔ Back-streaming (large quantities)?	☞ Contact local distributer.
❑ Oil leaking.	➔ Oil spilt while topping up?	☞ Mop up oil and dispose of accordingly.
	➔ Other cause?	☞ Contact local distributor.
❑ High oil consumption.	➔ High intake pressure?	☞ Normal. Top up oil level whenever necessary, install outlet filter.
	➔ Gas ballast operation?	☞ Top up oil level whenever necessary, install outlet filter.
	➔ Oil level too high?	☞ Reduce oil level to max. mark.
❑ Oil ages rapidly.	➔ Pumping aggressive gases?	☞ Use suitable oil.
	➔ Condensation in the pump?	☞ Use separator or cold trap.
	➔ Oil mist filter defective?	☞ Replace filter, check safety pop valve.
	➔ Diaphragm pump does not reach pumping speed?	☞ Maintenance of diaphragm pump.
❑ Pump blocked.	➔ Ambient temperature too high (>40°C)?	☞ Ensure adequate ventilation.
	➔ Other cause.	☞ Contact local distributor.

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Notes on return to the factory

Repair - return - DKD calibration

Safety and health of our staff, laws and regulations regarding the handling of dangerous goods, occupational health and safety regulations and regulations regarding safe disposal of waste require that for all pumps and other products the **"Health and safety clearance form"** must be send to our office duly completed and signed before any equipment is dispatched to our premises.
Fax or post a completed copy of the health and safety clearance form to us in advance. The declaration must arrive before the equipment. Enclose a second completed copy with the product. If the equipment is contaminated you must notify the carrier.

No repair / DKD calibration is possible unless the correctly completed form is returned. Inevitably, there will be a delay in processing the equipment if information is missing or if this procedure is not obeyed.

If the product has come in contact with chemicals, radioactive substances or other substances dangerous to health or environment, the product must be decontaminated prior to **sending it back to the factory.**

- ☞ Return the product to us **disassembled and cleaned** and accompanied by a certificate verifying decontamination or
- ☞ Contact an industrial cleaning and **decontamination service** directly or
- ☞ Authorize us to send the product to an industrial cleaning facility **at your expense.**

To expedite repair and to reduce costs, please enclose a detailed description of the problem and the product´s operating conditions with every product returned for repair. We submit **quotations** only on request and always at the customer´s expense. If an order is given, the costs incurred are offset from the costs for repair or from the purchase price, if the customer prefers to buy a new product instead of repairing the defective one.

- ☞ **If you do not wish a repair on the basis of our quotation, the equipment might be returned to you disassembled and at your charge!**

In many cases, the **components must be cleaned in the factory** prior to repair.
For cleaning we use an environmentally responsible water based process. Unfortunately the combined attack of elevated temperature, cleaning agent, ultrasonic treatment and mechanical stress (from pressurised water) may result in damage to the paint. Please mark in the health and safety clearance form if you wish a **repaint at your expense** just in case such a damage should occur.
We also replace parts due to optical aspects upon your request.
Before returning the equipment ensure that (if applicable):

- ☞ Oil has been drained and an adequate quantity of fresh oil has been filled in to protect against corrosion.
- ☞ Equipment has been cleaned and/or decontaminated.
- ☞ All inlet and outlet ports have been sealed.
- ☞ Equipment has been properly packed, if necessary, please order an original packaging (costs will be charged), marked as appropriate and the carrier has been notified.
- ☞ Ensure that the completed health and safety declaration is enclosed.

We hope for your understanding for these measures, which are beyond our control.

Scrapping and waste disposal:
Dispose of the equipment and any components removed from it safely in accordance with all local and national safety and environmental requirements. Particular care must be taken with components and waste oil which have been contaminated with dangerous substances from the process. Do not incinerate fluoroelastomer seals and "O"-rings.

- ☞ You may authorize us to dispose of the equipment **at your expense.**

Health and safety clearance form

Declaration concerning safety, potential hazards and safe disposal of waste, e. g. used oil.
Safety and health of our staff, laws and regulations regarding the handling of dangerous goods, occupational health and safety regulations, safety at work laws and regulations regarding safe disposal of waste, e. g. waste oil, require that for all pumps and other products this form must be send to our office duly completed and signed before any equipment is dispatched to our premises. **Products will not be accepted for any procedure and handling and repair / DKD calibration will not start before we have received this declaration.**

a) Fax or post a **completed copy of this form** to us in advance. The declaration must arrive before the equipment. **Enclose a second, completed copy with the product.** If the product is contaminated you must notify the carrier (**GGVE, GGVS, RID, ADR**).
b) Inevitably, the repair process will be delayed considerably, if this information is missing or this procedure is not obeyed. We hope for your understanding for these measures which are beyond our control and that you will assist us in expediting the repair procedure.
c) **Make sure that you know all about the substances which have been in contact with the equipment and that all questions have been answered correctly and in detail.**

1. Product (Model): .....

2. Serial No.: .....

3. List of substances in contact with the equipment or reaction products:

3.1 Chemical/substance name, chemical symbol:

a) .....

b) .....

c) .....

d) .....

3.2 Important informations and precautions, e. g. danger classification:

a) .....

b) .....

c) .....

d) .....

4. Declaration (please mark as applicable):

❑ **4.1 for non dangerous goods:**

We assure for the returned product that
- neither toxic, corrosive, biologically active, explosive, radioactive nor contamination dangerous in any way has occurred.
- the product is free of dangerous substances.
- the oil or residues of pumped media have been drained.

❑ **4.2 for dangerous goods:**

We assure for the returned product that
- all substances, toxic, corrosive, biologically active, explosive, radioactive or dangerous in any way which have pumped or been in contact with the product are listed in 3.1, that the information is complete and that we have not withheld any information.
- the product, in accordance with regulations, has been
  ❑ cleaned ❑ decontaminated ❑ sterilized.

5. Way of transport / carrier:

.....

Day of dispatch to VACUUBRAND:

.....

If the paint is damaged, we wish a repaint or a replacement of parts due to optical aspects at our expense (see "Notes on return to the factory"):

❑ yes ❑ no

We declare that the following measures - where applicable - have been taken:
- The oil has been drained from the product. **Important: Dispose of according to national regulations.**
- The interior of the product has been cleaned.
- All inlet and outlet ports of the product have been sealed.
- The product has been properly packed, if necessary, please order an original packaging (costs will be charged) and marked as appropriate.
- The carrier has been informed about the hazardous nature of the goods (if applicable).

We assure VACUUBRAND that we accept liability for any damage caused by providing incomplete or incorrect information and that we shall indemnify VACUUBRAND from any claims as regards damages from third parties.

We are aware that as expressed in § 823 BGB (Public Law Code of Germany) we are directly liable for injuries or damages suffered by third parties, particularly VACUUBRAND employees occupied with handling/repairing the product.

Signature: .....

Name (print): .....

Job title (print): .....

Company´s seal: .....

Date: .....

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-Technology for Vacuum Systems-
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CE

Konformitätserklärung
Declaration of conformity
Déclaration de conformité

Chemie-HYBRID-Pumpe / Chemistry-HYBRID-pump / Pompe HYBRIDE chimique

RC 6 (69 85 60, 69 85 61, 69 85 62) 230V

Hiermit erklären wir, dass das oben bezeichnete Gerät in Konzeption und Bauart sowie in der von uns in Verkehr gebrachten Ausführung den grundlegenden Anforderungen der zutreffenden, aufgeführten EU-Richtlinien entspricht. Bei einer mit uns nicht abgestimmten Änderung an dem Gerät verliert diese Erklärung ihre Gültigkeit.
We herewith declare that the product designated above is in compliance with the basic requirements of the applicable EC-directives stated below with regard to design, type and model sold by us. This certificate ceases to be valid if the product is modified without the agreement of the manufacturer.
Par la présente, nous déclarons que le dispositif désigné ci-dessus est conforme aux prescriptions de base des directives EU applicables et indiqués en ci que concerne conception, dessin et modèle vendu par nous-mêmes. Cette déclaration cesse d´être valable si des modifications sont apportées au dispositif sans notre autorisation préalable.

Maschinenrichtlinie (mit Änderungen) / Machine directive (with supplements) / Directive Machines (avec des suppléments)
98/37/EG
Niederspannungsrichtlinie / Low-Voltage Directive / Directive Basse Tension
73/23/EWG, 93/68/EWG
Richtlinie Elektromagnetische Verträglichkeit / Electromagnetic Compatibility Directive / Directive Compatibilité Electromagnétique
89/336/EWG, 92/31/EWG, 93/68/EWG
Angewandte Harmonisierte Normen / Harmonized Standards applied / Normes Harmonisées utilisées
EN 292-2, EN 61010-1, EN 1012-2, EN 61326
Managementsysteme / Management systems / Systèmes de Management
EN ISO 9001, EN ISO 14001

Wertheim, 08.07.2004
. . . . . .
Ort, Datum / place, date / lieu, date

Dr. Lachenmann
. . . . . .
(Dr. R. Lachenmann)
Geschäftsführer / Managing director / Gérant

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