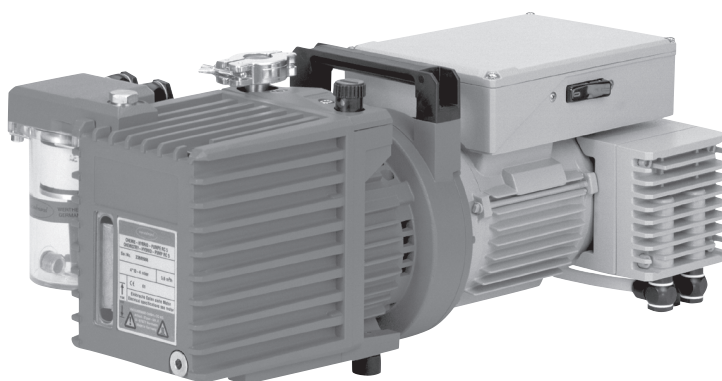




Technology for Vacuum Systems

Instructions for use



RC 5

Chemistry-HYBRID-pump

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.



Attention! Important notes!



Not permitted! Misuse may cause damage.



Caution! Hot surface!



Isolate equipment from mains.



Note.

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Supplementary information concerning the instructions for use 99 78 31 / HYBRID pump

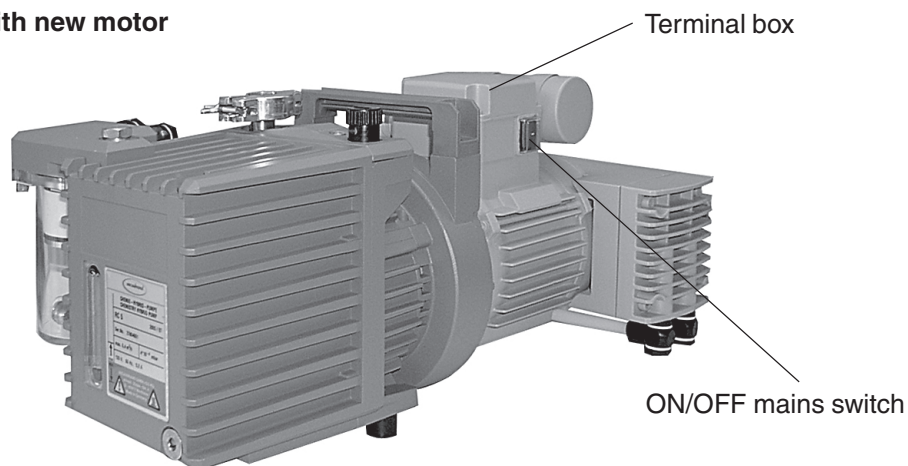
HYBRID pump VACUUBRAND RC 5 in latest design is equipped with a new motor (see figure). The following modifications have to be considered:

Technical Data

Type		RC 5
Motor power single phase	W	370
Current draw* at operation		
230 V ~ 50/60 Hz	A	2,7 / 2,6
100-120 V ~ 50/60 Hz	A	5,7 / 5,1
Max. permitted range of supply voltage		120 V ~ +5%/-10% 60 Hz 230 V ~ +/-10% 50/60 Hz
Motor protection		thermal cutout

* When the pump is starting, for a short period the current draw might be two or three times as much as during operation.

HYBRID pump with new motor



We reserve the right for technical modification without prior notice!

Safety information!



Remove all packing material, remove the product from its packing-box, remove protective covers from inlet and outlet ports and keep them. 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.

☞ **Read and obey this manual before installing or operating the equipment.**



Use the equipment **for the intended use only**, i. e. for generation of vacuum.

☞ **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 disconnecting 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.

☞ 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 0.85 A for 230 V). 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).

Direction of rotation of pumps with three phase motor: Pumps wired ready for connection with three phase motor are supplied with a mains plug. The electrical wiring is laid out for a right-handed rotary field.

Checking the direction of rotation:

Switch on pump for a few seconds and check if the pump sucks at inlet. If no suction occurs switch of pump immediately. The three phase socket has to be checked and if necessary corrected by an electrician.

☞ 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".



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 0.2 bar in case inert gas is connected.

☞ The diameter of the inlet and outlet pipeline should be at the least as large as the diameter of the pump connection pipelines.



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 moisture.



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).
- ☞ Adopt suitable measures to prevent the release of dangerous, explosive, corrosive or polluting fluids.
- ☞ 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. 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, make sure that gas ballast valve remains open all times and do not permit vapour inlet pressure to exceed the permitted maximum.



Check oil level and condition of oil at regular intervals.

If a single-phase motor overheats, it is shut down by an embedded **thermostatic cutout in the winding**. Three-phase motors are equipped with a circuit-breaker which isolates all the poles in the event of an overload. Manual reset is necessary. Determine and eliminate cause of failure.

☞ **Single-phase motor:** Switch off pump or isolate the equipment from mains. Wait approx. five minutes before restarting the pump.

☞ **Three-phase motor:** Wait approx. two minutes before restarting the pump.

☞ 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.

☞ Gases and vapours discharged from the pump should be transported outwards by means of hoses.

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.



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.

In case of normal wear the lifetime of the motor capacitors is about 40000 operating hours. The capacitors have to be replaced by an electrician.

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

Model		RC 5
Pumping speed 50/60 Hz (PNEUROP)	m ³ /h	5.6 / 6.4
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	6x10 ⁻³
Max. inlet pressure for water vapour		c.)
Total pressure in oil reservoir ^{d.)}	mbar	20
Oil temperature ^{e.)}	°C	72
Oil capacity min./max.	ml	350 / 550
Recommended oil		VACUUBRAND B-Oil
Ambient temperature range storage/operation	°C	-10 to +60 / +12 to +40
Max. permitted relative atmospheric moisture (operation)	%	30 to 85
Motor power	kW	0,37
Nominal current at 50/60 Hz	min ⁻¹	1500 / 1800
Nominal current at:		
100 V 50/60 Hz, 1 ~	A	6.6 / 5.7
110-115 V 50/60 Hz, 1 ~	A	6.0 / 5.2
220-240 V 50/60 Hz, 1 ~	A	3.0 / 2.6
220/380 V 50 Hz, 3 ~	A	1.95 / 1.1
Motor protection:		
single-phase		thermal
three-phase		all poles isolated if motor overloaded
Classification of protection, DIN 40050		IP 40
Mean sound pressure level to DIN 45635 (measured at a distance of 1 m)	dbA	56
Inlet connection (small flange)	DN	16
Outlet connection (hose nozzle)	DN	10
Dimensions L x W x H (to top of inlet adapter)	mm	505 x 300 x 210
Weight, fully operational	kg	25.5

a.) Partial vacuum of permanent gases measured at pump inlet.

b.) The total vacuum, e.g. measured with thermal-conductivity vacuummeter, 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 5, 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!

Components	Wetted parts
Diaphragm pump	
Head cover	PFA
Diaphragm	PTFE
Diaphragm clamping disc	ETFE
Valve	FFKM
Vacuum connections	aluminium anodized
Rotary vane pump	
Metallic parts	stainless steel, grey cast iron, steel, aluminium
Plastic materials	epoxy resin, FPM, NBR, PTFE, PBT, PMP, PEEK

The pump RC 5 doesn't contain any nonferrous heavy metal.

We reserve the right for technical modification without prior notice!

Use and operation

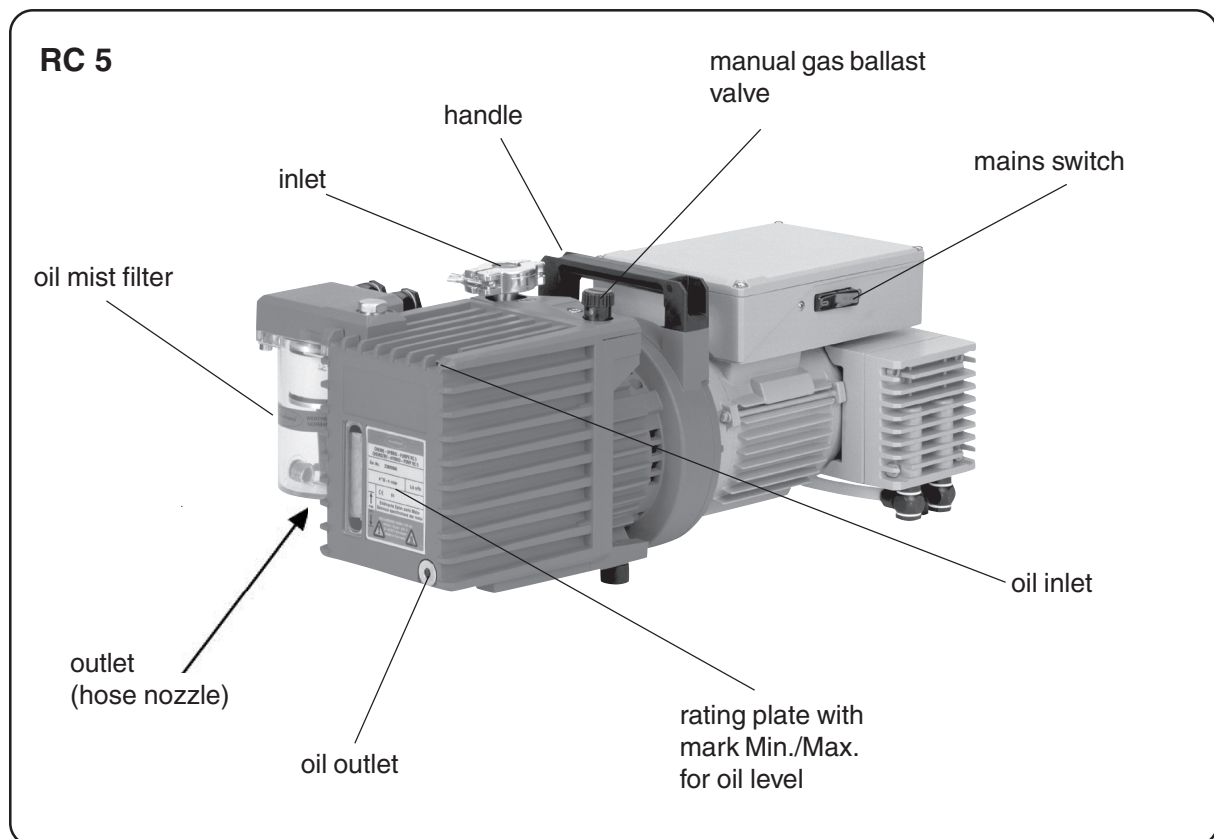


Method of operation

The RC 5 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.





☞ The inlet is marked "IN" and the outlet 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 1 litre of rotary-pump oil is supplied with the pump. Before **starting the pump for the first time**, remove the oil filler plug from the top of the rotary vane pump housing 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. 400 ml of oil into the pump (bringing oil level to "min." mark, approx.).

☞ Reinstall the oil filler plug 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.

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.

☞ 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).

If a single-phase motor overheats, it is shut down by an embedded thermostatic cut-out in the winding. Three-phase motors are equipped with a circuit-breaker which isolates all the poles in the event of an overload.

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 section "accessories").

☞ 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.

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 contaminants 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.

Short-term:

- ☞ Restart not possible until **2 minutes** have elapsed (cool-down phase of start-up controller).

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.

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 pumped 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 (with the exception of 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.

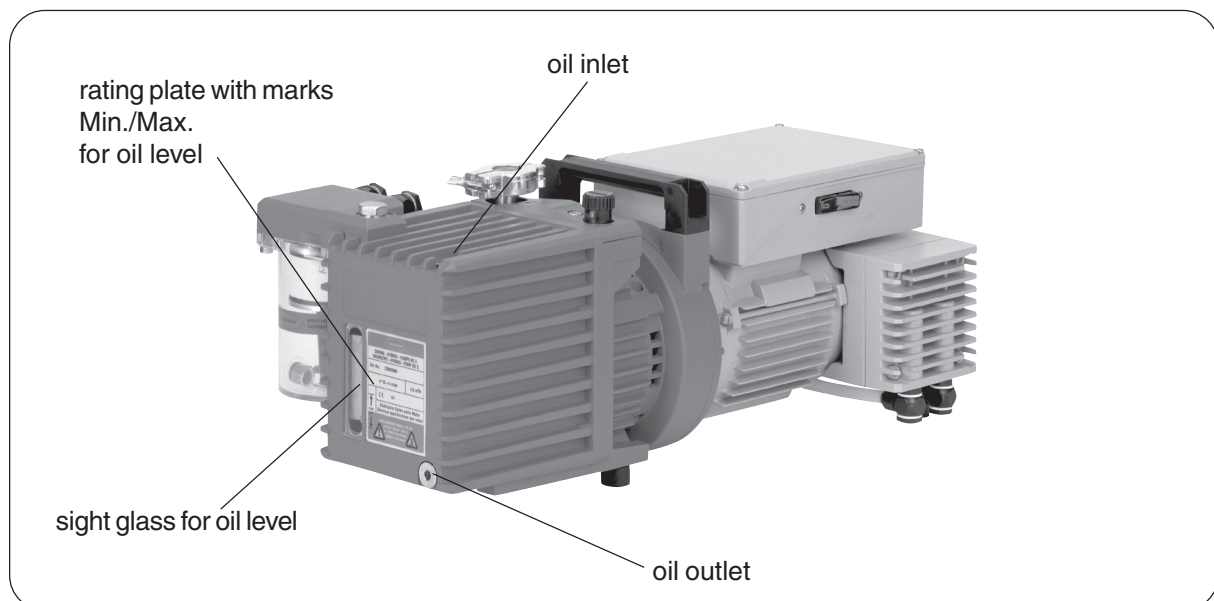
Under normal operating conditions:

➤ 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.
- ☞ 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 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 and repeat flushing procedure if necessary.
- Remove oil filler plug.
- Fill in fresh oil through the oil inlet port (only approx. 400 ml) bringing the oil level approx. to "min." mark.
- Reinstall the oil filler plug 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!**
- Close oil filler plug.

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** 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

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, e. g. Fomblin®*)

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	68 70 10
	5 l	68 70 11
	20 l	68 70 12
K 8-oil	1 l	68 71 00
	5 l	68 71 01
	20 l	68 71 02
Silicon oil SI 2	1 l	68 75 00
Perfluoropolyether oil	0.5 l	68 76 00

* reg. trade mark Montedison

Replacing diaphragms and valves

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

Some pictures show pumps of other variants. 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 as well as the motor capacitors 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:

- Remove oil filler plug. Remove hose nozzle from distributor plate and install in tapped bore for oil filler plug (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 tapped bore for oil filler plug. Reinstall hose nozzle in distributor plate and install filler plug 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 capacitors 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 72 39
Valve	63 88 36
Vacuum gauge DVR 2	68 29 02
Face wrench with torque indicator	63 75 80

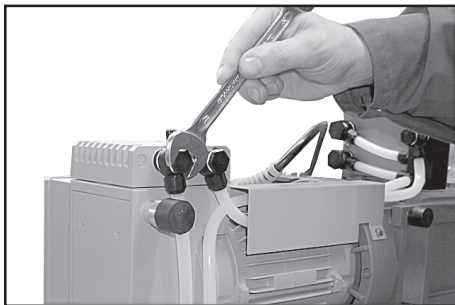


Tools required (metric):

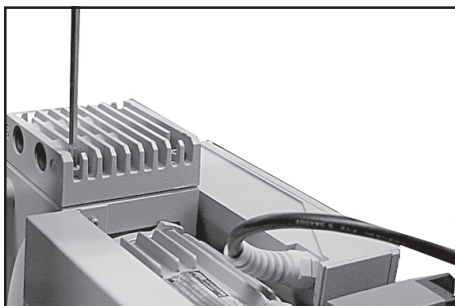
- Phillips screw driver size 2
- Open-ended wrench w/f 10/15/17
- Hex key w/f 5
- Face wrench with torque indicator

Cleaning and inspecting the pump heads:

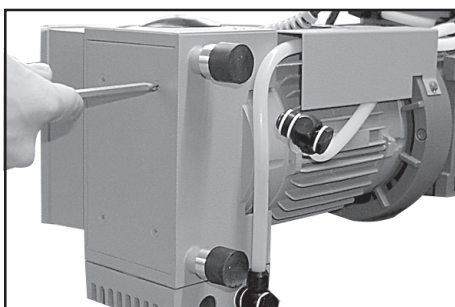
- If the position of the pump is to be changed as to work more comfortably, the pump may be placed so that rests on the side with the mains switch. Prevent any condensate from leaking from the catch pot of the oil mist filter.
- Drain condensate before beginning maintenance!
Attention! Do not tilt pump to an angle that would allow oil to make its way into the oil mist filter. Drain oil if necessary (see "Oil change"). Refill pump with oil before starting the pump!
- If the pump is to be positioned in a way different than described above drain oil beforehand and support or underlay pump appropriately. Attention: Prevent any damage of the oil mist filter, do not prop up pump with oil mist filter.



- Use open-ended wrench, remove screw-in fittings from all pump heads and remove manifold.



- To check the valves use hex key to remove four socket-head screws from pump head and remove housing cover with 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 carefully from housing cover. Note position of valves and remove them.
- ⚠ Replace valves if necessary.
- ⚠ Use petroleum ether or industrial solvent to remove deposits. Do not inhale.



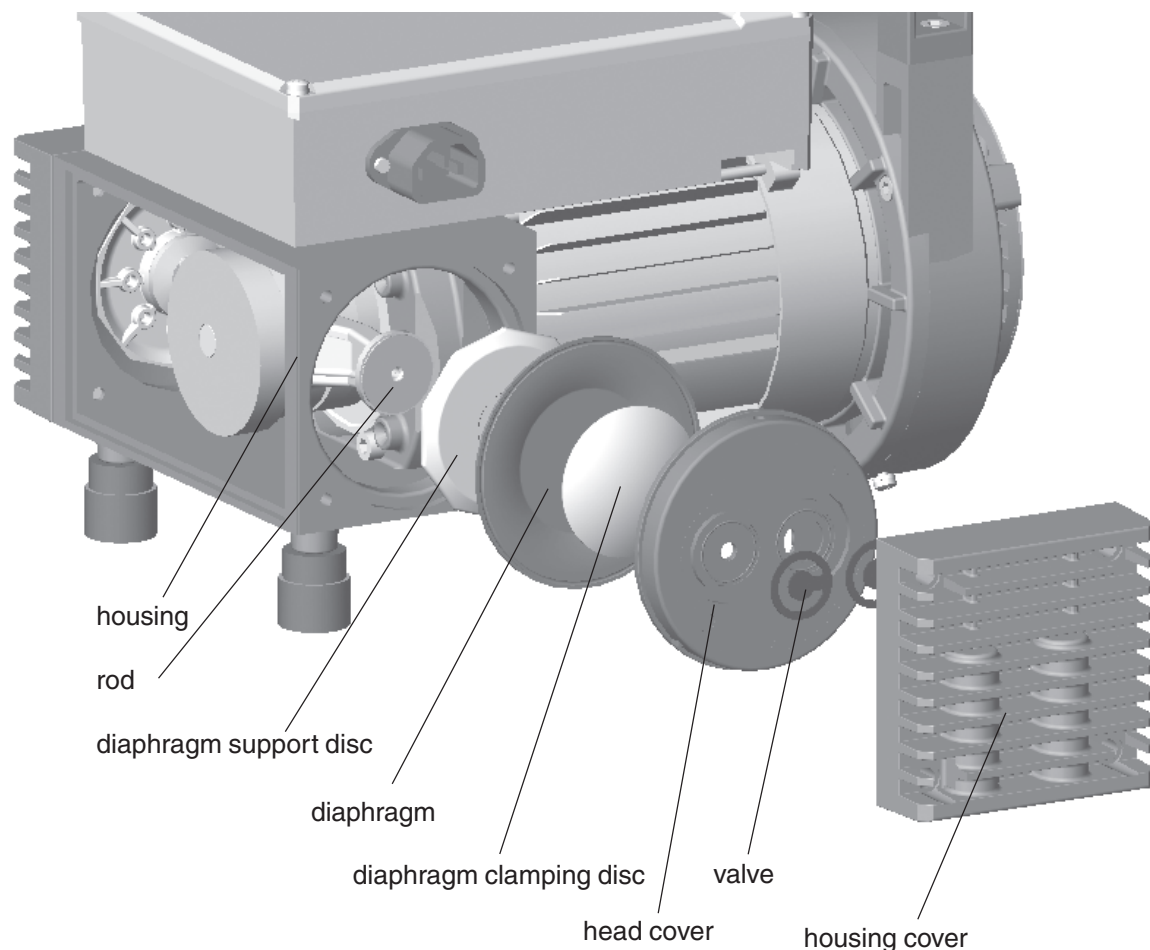
- ⚠ Check diaphragm for damage and replace if necessary.
- To do so use Phillips screw driver to remove four counter-sunk head screws and lift off housing plate.
- ⚠ Use petroleum ether or industrial solvent to remove deposits if necessary. Do not inhale.

Replacing the diaphragm:



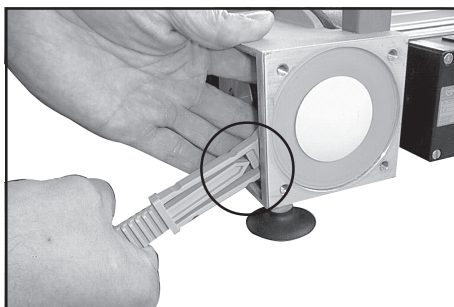
- Use a metallic face wrench to remove diaphragm support disc.
- Check for washers under clamping disc. Do not mix the washers from the different heads. Make sure that the original number is reassembled at the individual pump head.
- ⚠ Smaller number of washers: The pump will not attain ultimate vacuum.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

View of the disassembled pump head parts



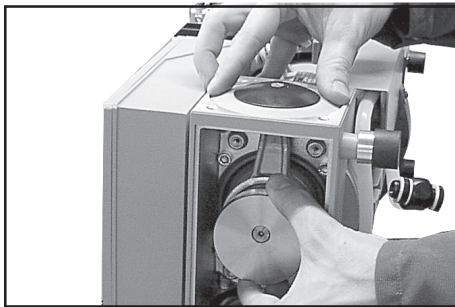
- ➔ Position new diaphragm between diaphragm clamping disc with square head screw and diaphragm support disc.
- ⚠ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.
- ⚠ **Note:** Position diaphragm with white PTFE side 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

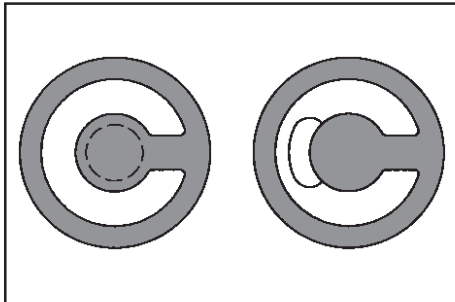


- ➔ Use **face wrench with torque indicator** (recommended: **face wrench with torque indicator from VACUUBRAND, Cat.-No.: 63 75 80**) to assemble diaphragm clamping disc, diaphragm and diaphragm support disc (and eventually washers) to the connecting rod.
 - ⚠ Make sure that the square head screw of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

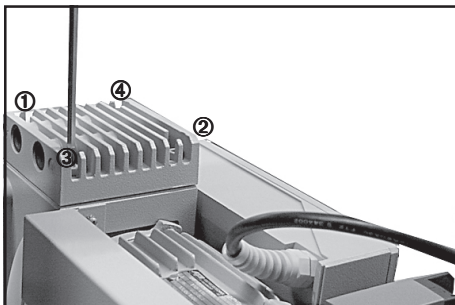


- ➔ By turning eccentric bushing (front of connecting rod), bring connecting rod into a position in which diaphragm is in contact with housing and centered with respect to bore.



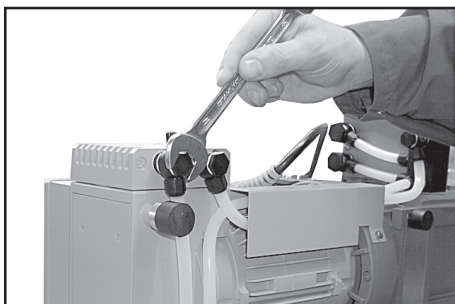
Reassemble in reverse order.

- ➔ Install head cover, valves and housing cover.
- ☞ 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.



- ➔ By turning the eccentric bushing, bring connecting rod into upper turning point position.
- ☞ Max. stroke of the rod.
- ➔ Screw in four socket head screws fixing housing cover cross-wise (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 and assemble screw-in fittings at all pump heads and 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")!

Operability of diaphragm pump:

- ☞ Can be checked by measuring the pressure in the oil reservoir.
- ➔ Remove oil filler plug. Remove hose nozzle from distributor plate and install in tapped bore for oil filler plug (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 tapped bore for oil filler plug. Reinstall hose nozzle in distributor plate and install filler plug 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.

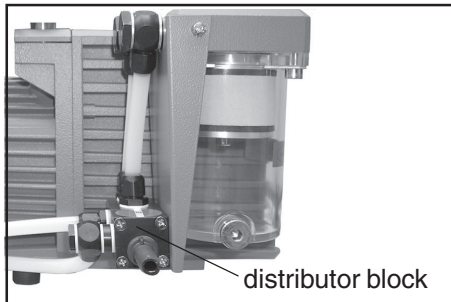
If all pump heads achieve a vacuum below 85 mbar but pump does not achieve the ultimate total pressure:

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 and 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.

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 21

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 separator	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
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

Troubleshooting

Fault	Possible cause	Remedy
<input type="checkbox"/> Pump fails to start or stops immediately.	<ul style="list-style-type: none"> ➔ Mains not connected? ➔ Phase failure? ➔ Oil temperature below 12 °C? ➔ Start-up control defective? ➔ Excessive pressure in outlet line? ➔ 2 minutes have not elapsed since shutdown? ➔ Motor thermally overloaded? ➔ Pump blocked? 	<ul style="list-style-type: none"> ☞ Plug in. Check fuse. ☞ Check fuse (in building). ☞ Operate the pump in suitable ambient conditions. ☞ Contact local distributor. ☞ Unblock line, open valve. ☞ Switch off, wait 2 minutes (start-up controller trips automatically). ☞ Switch off pump, allow motor to cool (< 50 °C). Determine and eliminate cause of failure. ☞ See below.
<input type="checkbox"/> Pump does not achieve ultimate pressure or normal pumping speed.	<ul style="list-style-type: none"> ➔ Centering ring not correctly positioned or leak in the pipeline or vacuum system? ➔ Blocked inlet? ➔ Measuring procedure or pressure transducer not suitable for the applicaton? ➔ Long narrow line? ➔ Oil contaminated (also solvent)? ➔ Oil of incorrect type? ➔ Defective outlet valve? ➔ Outgasing substances or vapour generated in the process? ➔ Pump not at operating temperature? ➔ None of the above causes? 	<ul style="list-style-type: none"> ☞ Check pump with a vacuum gauge directly at pump inlet port, check connections and line. ☞ Ensure that the inlet pipeline does not become blocked. ☞ Choose suitable procedure. ☞ Use line with larger diameter, length as short as possible. ☞ Change oil and flush, check oil level, add oil if necessary. ☞ Change oil and flush. ☞ Replace valve cap and/or valve spring. ☞ Check process parameters. ☞ Heat pump to operating temperature. ☞ Contact local distributor.

<p>❑ Pump too noisy or strange noise.</p>	<p>➔ Too much oil?</p> <p>➔ Overpressure in the outlet line?</p> <p>➔ 2 Minutes have not elapsed since shutdown?</p> <p>➔ Motor overloaded?</p> <p>➔ Defective diaphragm?</p> <p>➔ Pump blocked?</p> <p>➔ None of the above causes?</p>	<p>☞ Lower oil level to mark max.</p> <p>☞ Open outlet line.</p> <p>☞ Switch off, wait 2 minutes (start-up controller trips automatically)</p> <p>☞ Allow motor to cool, identify cause of failure. Keep air intake clear.</p> <p>☞ Replace diaphragm.</p> <p>☞ See below.</p> <p>☞ Contact local distributor.</p>
<p>❑ Oil in inlet line.</p>	<p>➔ Back diffusion (small amount of oil, oil film)?</p> <p>➔ Back-streaming (large quantities)?</p>	<p>☞ Install sorption trap or separator if necessary.</p> <p>☞ Contact local distributor.</p>
<p>❑ Oil leaking.</p>	<p>➔ Oil spilt while topping up?</p> <p>➔ Other cause?</p>	<p>☞ Mop up oil and dispose of accordingly.</p> <p>☞ Contact local distributor.</p>
<p>❑ High oil consumption.</p>	<p>➔ High intake pressure?</p> <p>➔ Gas ballast operation?</p> <p>➔ Oil level too high?</p>	<p>☞ Normal. Top up oil level whenever necessary, install outlet filter.</p> <p>☞ Top up oil level whenever necessary, install outlet filter.</p> <p>☞ Reduce oil level to max. mark.</p>
<p>❑ Oil ages rapidly.</p>	<p>➔ Pumping aggressive gases?</p> <p>➔ Condensation in the pump?</p> <p>➔ Oil mist filter defective?</p> <p>➔ Diaphragm pump does not reach pumping speed?</p>	<p>☞ Use suitable oil.</p> <p>☞ Use separator or cold trap.</p> <p>☞ Replace filter, check safety pop valve.</p> <p>☞ Maintenance of diaphragm pump.</p>
<p>❑ Pump blocked.</p>	<p>➔ Ambient temperature too high (>40°C)?</p> <p>➔ Other cause.</p>	<p>☞ Ensure adequate ventilation.</p> <p>☞ Contact local distributor.</p>

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.**



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.**

- vacuubrand*



**Konformitätserklärung
Declaration of conformity
Déclaration de conformité**

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

RC 5 (69 84 60, 69 84 64, 69 84 65) 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

DIN EN 12100-2, DIN EN 61010-1, DIN EN 1012-2, DIN EN 61326

Managementsysteme / Management systems / Systèmes de Management

EN ISO 9001, EN ISO 14001 (1997-2006)

Wertheim, 03.04.2006

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Ort, Datum / place, date / lieu, date

.....
(Dr. R. Lachenmann)

Geschäftsführer / Managing director / Gérant

VACUUBRAND GMBH + CO KG

-Vakuumtechnik im System-

-Technology for Vacuum Systems-

-Technologie pour système à vide-

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Dr. Bu

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