vacuubrand

Technology for Vacuum Systems

Instructions for use

MD 1 VARIO-SP
MD 1

Diaphragm pumps

Dear customer,

Your VACUUBRAND diaphragm pumps are designed to provide you with many years of trouble-free service with optimal performance. Our many years of practical experience allow us to provide a wealth of application and safety information. Please read these instructions for use before the initial operation of your pump.
VACUUBRAND diaphragm pumps combine our many years of experience in design, construction and practical operation, with the latest developments in material and manufacturing technology.

Our quality maxim is the ”zero defect” principle:
Every diaphragm pump, before leaving our factory, is tested intensively, including an endurance run of 18 hours. Any faults, even those which occur rarely, are identified and can be eliminated immediately.
After completion of the endurance run, every pump is tested, and must achieve specifications before shipment.
We are committed to providing our customers only pumps that meet this high quality standard.
While our pumps cannot eliminate all of your work, we design, manufacture and test them to ensure that they will be an effective and trouble-free tool to assist you in that work.

Yours,
VACUUBRAND GMBH + CO KG

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

Trademark index:
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Safety information!

Important information!

NOTICE

This manual is an integral part of the equipment described therein. It describes the safe and proper use of the vacuum pump.
Keep this manual complete and accessible to personnel at all times!
Make operating personnel aware of dangers arising from the pump and the pumped substances.

Read this manual carefully before installing or operating the equipment. Observe the instructions contained in this manual.
VACUUBRAND disclaims any liability for inappropriate use of these pumps and for damage resulting from disregarding the instructions contained in this manual.

Do not modify the equipment without authorization.

This manual is only to be used and distributed completely and unchanged. It is strictly the users' responsibility to check carefully the validity of this manual with respect to his product.
Manual-no.: 999085 / 06/10/2010

The following signal word panels and safety symbols are used throughout this manual:

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER ➨ DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING ☞ WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION • CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE NOTICE is used to address practices not related to personal injury.

Caution! Hot surface!

Disconnect equipment from power.

Formatting used in this manual:
Note: The signal word panels in all sections of this manual always refer to all paragraphs of the same format (➨ / ☞ / • / plain text) following each signal word panel.

General information

NOTICE

Remove all packing material from the packing box. Remove the product from its packing-box and retain all packaging until the equipment is inspected and tested. Remove the protective caps from the inlet and outlet ports and retain for future use. Inspect the equipment promptly and carefully.
If the equipment arrives damaged, notify the supplier and the carrier in writing within three days. Retain all packing material for inspection. State the item number of the product together with the order number and the supplier's invoice number. Failure to check and give notice of damage will void any and all warranty claims for those deficiencies.
Replace the protective caps, if the equipment is not used immediately. Store the equipment in dry and non-corrosive conditions (see also "Technical data", pg. 16).
Use the mounted handle or the recessed grips when moving the pump.

WARNING

☞ **Do not use any damaged equipment.**

Intended use

WARNING

☞ Do not use the pump or any system parts on humans or animals.
☞ Prevent any part of the human body from coming into contact with vacuum.

☞ Ensure that the individual components are only connected, combined and operated according to their design and as indicated in the instructions for use.
☞ Comply with all notes on correct vacuum and electrical connections; see section "Use and operation", pg. 22.
☞ Use the equipment **only as intended**, that is, for generation of vacuum in vessels designed for that purpose. Any other use will automatically invalidate all warranty and liability claims. Remain aware of safety and risks.

☞ Do not use the pump to generate pressure.

NOTICE

The pumps are designed for **ambient temperatures** during operation between +50°F and +104°F (+10°C and +40°C). Check the maximum temperatures if installing the pump in a cabinet or a housing. Make sure ventilation is adequate to maintain recommended operating temperature. Install an external automatic ventilation system if necessary. If pumping hot process gases, make sure that the maximum permitted gas inlet temperature is not exceeded. The maximum permitted gas inlet temperature depends on several parameters like inlet pressure and ambient temperature (see ”Technical data”, pg. 16).

Do not aspirate particles and dust.
Do not pump liquids.

Ensure that the pump is chemically resistant to the pumped substances prior to operation.

Setting up and installing the equipment

⚠ DANGER

➡ Equipment must be connected only to a **suitable electrical supply** and a suitable ground point. As such, the plug (pumps with AC motor) must be plugged into an outlet that is properly grounded. Provide a slow blow fuse according to the electrical supply (see ”Technical data”, pg. 16). Failure to connect the motor to ground may result in deadly electrical shock.
The supply cable (pumps with AC motor) may be fitted with a molded European IEC plug or a plug suitable for your local electrical supply. The cable contains wires color coded as follows: green or green and yellow: ground; blue or white: neutral; brown or black: hot.

⚠ WARNING

☞ Due to the high compression ratio, the pump may generate overpressure at the outlet. Check pressure compatibility with system components (e.g., exhaust pipeline or exhaust valve) at the outlet.

☞ Do not permit any **uncontrolled pressurizing**. Make sure that the exhaust pipeline cannot become blocked. If there is an exhaust isolation valve, make sure that you cannot operate the equipment with the valve closed to avoid a **risk of bursting!**

☞ Always provide a free and pressureless exhaust outlet to avoid damage to pump valves and risk of bursting.

⚠CAUTION

- Provide a firm, level platform for the equipment. Check that the system which you are going to evacuate is mechanically stable. Check that all fittings are secure. Ensure a stable position of the pump without any mechanical contact other than the pump feet. Comply with all applicable safety regulations.

- Comply with **maximum permissible pressures** at inlet and outlet and with **maximum permissible pressure differences** between inlet and outlet. See section ”Technical data”, pg. 16. Do not operate the pump with overpressure at the inlet.
- Avoid overpressure of more than 17.5 psi absolute (1.2 bar absolute) in the event that inert gas is connected to the pump, or to a venting valve.

- Keep the electrical power cord away from heated surfaces.
- **Note**: Flexible elements will shrink when evacuated.
- Ensure that no liquids can flow on or into the pump motor when assembling or disassembling vacuum lines at the pump. Risk of corrosion and/or short circuit!

NOTICE

Check the power source and the pump’s rating plate to be sure that the power source and the equipment match in voltage, phase, and frequency.

On pumps with a dual-voltage motor, check that the voltage selection switch is set correctly. Do not change the setting of the voltage selection switch while the pump is connected to AC power. **Unplug the pump before setting the voltage selection switch.**

Note: If the pump is switched on with wrong voltage selection, the motor may be damaged!

Keep a minimum distance of 8 in (20 cm) between the cooling fan and surrounding items (e.g., housing, walls, etc.). Check fan regularly for dust/dirt. Clean fan guard grill if necessary to avoid a reduction of ventilation.
Use only hoses at the inlet and outlet of the pump with an inner diameter at least as large as the diameter of the pump's tubing (to avoid overpressure at the outlet, and reduction of pumping speed at the inlet).
Connect hoses gas tight at inlet and outlet of the pump.

Allow the equipment to equilibrate to ambient temperature if you bring it from cold environment into a room prior to operation. Notice if there is water condensation on cold surfaces.

Ensure that no foreign objects can be drawn into the pump.
Comply with all **applicable and relevant safety requirements** (regulations and guidelines). **Implement the required actions and adopt suitable safety measures.**

Ambient conditions

⚠WARNING

☞ Do not use this product in an area where it can fall or be pulled into water or other liquids.

⚠ DANGER

➨ Do not reach for this product if it has fallen into liquid. There is a risk of deadly electrical shock. Unplug the system immediately.

NOTICE

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. Directive EN 61010-1 gives in detail the conditions under which the equipment can be operated safely (see also IP degree of

protection, ”Technical data”, pg. 16).

Adopt suitable measures in case of differences from recommended conditions, e.g., using the equipment outdoors, installation in altitudes of more than 3300 ft (1000 m) above mean sea level, conductive pollution or external condensation on the pump.
Pay attention to the **permissible maximum ambient and gas inlet temperatures** (see ”Technical data”, pg. 16).

Do not operate this product near flames.

Operating conditions

DANGER

- **These pumps are not approved for operation in potentially explosive atmospheres. Do not operate the pumps in potentially explosive atmospheres.**
- **These pumps are not approved for the pumping of potentially explosive atmospheres. Do not pump potentially explosive atmospheres.**

- The pumps are **not suitable** to pump any of the substances listed below.
  Do not pump:
  - **unstable substances**
  - substances which react explosively under **impact** (mechanical stress) without air
  - substances which react explosively when being exposed to **elevated temperatures** without air,
  - **self inflammable** substances,
  - substances which are **inflammable without air**
  - **explosive substances**.

NOTICE

Do not pump substances which may form **deposits** inside the pump. The pumps are not suitable for pumping substances which may form deposits inside the pump. Deposits and condensate in the pump may lead to increased temperatures even to the point of exceeding the maximum permitted temperatures.

Check the inlet and outlet of the pump, if there is a danger of forming **deposits** inside the pump, e.g., in the pump chambers (the pump chamber is the part between diaphragm and head cover. See section ”Replacing diaphragms and valves”, pg. 33). Inspect the pump chambers regularly and clean if necessary.
The pumps are **not suitable** for pumping dust and they are **not approved** for operation below ground.
Do not pump dust and **do not operate** the pump **below ground**.

When changing the substances pumped, we recommend to purge the pump with air or inert gas prior to changing the pumped media. Purging the pump will pump out residues and it will reduce the possibility of reactions of the pumped substances with each other and with the pump’s materials.
Consider interactions and chemical reactions of the pumped media. Ensure that the materials of the pump’s wetted parts are compatible with the pumped substances, see section ”Technical data”, pg. 16.

Safety during operation

⚠ DANGER

➡ Adopt suitable measures to prevent the release of dangerous, toxic, explosive, corrosive, noxious or polluting fluids, vapors and gases. To prevent any emission of such substances from the pump outlet, install an appropriate collecting and disposal system and take protective action for pump and environment.

⚠ WARNING

☞ Never operate this pump if it has a damaged cord or plug. If the pump is not working properly, has been dropped or has fallen into water, contact your pump service provider.

☞ Prevent any part of the human body from coming into contact with vacuum.

☞ Make sure that the exhaust pipeline cannot become

blocked.

☞ You must take suitable precautions to prevent any formation of explosive mixtures in the pump chamber or at the outlet of the pump. In case, e.g., of a diaphragm failure, mechanically generated sparks, hot surfaces or static electricity may ignite these mixtures. Use inert gas for venting, if necessary.

☞ Drain appropriately or otherwise remove any potentially explosive mixtures at the outlet of the pump, or dilute them with inert gas to non-explosive concentrations.

☞ Comply with applicable regulations when disposing of chemicals. Take into consideration that chemicals may be contaminated. Take adequate precautions to protect people from the effects of dangerous substances (chemicals, thermal decomposition products of fluoroelastomers). Use appropriate protective clothing and safety goggles.

☞ Use only **original manufacturer's spare parts and accessories**. Otherwise the safety and performance of the equipment, as well as the electromagnetic compatibility of the equipment might be reduced.
The CE mark or the cTÜVus mark may be voided if not using original manufacturer's spare parts.

⚠CAUTION

- Ensure that no parts of your clothing, hair or fingers can be caught or drawn in at the inlet of the pump. Never insert fingers or drop any other object into the inlet or outlet.

- Pay attention to the safety symbol "hot surfaces" on the equipment. Hot parts may cause burns if touched. Adopt suitable measures to prevent any danger arising from hot surfaces or electric sparks. Ensure that hot surfaces of the pump do not cause burns. Provide a suitable contact guard if necessary.

- Failure of the pump (e.g., due to power interruption), failure of connected components or of parts of the sup-

ply, or a change of parameters must not be allowed to lead to a dangerous situation under any circumstances. In case of a diaphragm failure or in case of a leak in the manifold, pumped substances might be released into the environment or into the pump housing or motor. Especially comply with notes on use and operation and maintenance.

- The residual **leak rate of the equipment** might render possible an exchange of gas, albeit extremely slight, between the environment and the vacuum system. Adopt suitable measures to prevent contamination of the pumped substances or the environment.

NOTICE

Do not start the pump if the pressure difference between inlet and outlet exceeds 16 psi (1.1 bar) at maximum. Prevent the backpressure of gases and the backflow of condensates at the outlet.

Never aspirate liquids or dust into the pump.

Provide appropriate protective measures to allow for the possibility of failure and **malfunction**. The protective measures must also allow for the requirements of the respective application.

Pumps with AC motor:
In case of overload, the motor is shut down by a **self-hold thermal cutout** in the winding.
Note: Only manual reset is possible. Switch off the pump and disconnect from the power source. Identify and eliminate the cause of failure. Wait approx. five minutes before restarting the pump.

⚠CAUTION

- **Note**: In case of **supply voltage below 100V**, the lock of the cutout might be impaired and the pump may restart on its own after sufficient cooling down. Take appropriate precautions, if an automatic restart of the pump may lead to a dangerous situation.

Pumps with DC power:
A temperature sensor at the circuit board protects the motor: Current limitation in case the temperature at the circuit board raises above 158°F (70°C). At temperatures above 185°F (85°C) the pump is switched off. In case of a motor blockage (after 10 start-up attempts) the pump is switched off.
Note: Only manual reset is possible. Disconnect the pump from the power source. Identify and eliminate the cause of failure.

NOTICE

The A-weighted emission sound pressure level of the pump does not exceed 70 dB(A). Measurement according to EN ISO 2151:2004 and EN ISO 3744:1995 with standard silencer or exhaust tube at outlet.

Maintenance and repair

NOTICE

In order to comply with laws (occupational, health and safety regulations, safety at work law and regulations for environmental protection) vacuum pumps, components and measuring instruments can only be returned when certain procedures (see section ”**Notes on return to the factory**”, pg. 41) are followed.

Take advantage of our service seminars, which put special focus on the maintenance and repair of vacuum pumps. For details see www.vacuubrand.com.
Wear parts have to be replaced regularly. In case of normal wear, the lifetime of the diaphragms and valves is > 10000 operating hours. Bearings have a typical durability of 40000 h. Motor capacitors have a typical durability in the range of 10000 to 40000 h depending strongly on operation conditions including ambient temperature, humidity or load.

WARNING

☞ **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.**

☞ **Switch off the pump. Disconnect the electrical power cord and wait two minutes** before starting maintenance to allow the capacitors to discharge.

☞ **Note**: The pump may be contaminated with process chemicals, which have been pumped during operation. Ensure that the pump is completely decontaminated before maintenance commences. Take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred. Use appropriate protective clothing, safety goggles and protective gloves.

CAUTION

- Check every motor capacitor regularly by measuring its capacity and estimating its time in operation. Replace old capacitors early enough to prevent a failure in operation. If an old motor capacitor fails, the capacitor may get hot. It may even melt or emit a flame, which could be **dangerous for persons and equipment in the vicinity**. The capacitors have to be replaced by an electrician.

- Vent the pump before starting maintenance. Isolate the pump and other components from the vacuum system. Allow sufficient cooling of the pump.
- Ensure that **maintenance** is done only by suitably trained and supervised technicians. Ensure that the maintenance technician is familiar with the safety procedures, which relate to the products processed by the pumping system.
  Only dismantle the pump as far as necessary.

Technical data

Type		MD 1	MD 1 VARIO-SP
Maximum pumping speed (ISO 21360)	cfm (m^3/h)	0.7 / 0.8 * (1.2 / 1.4 *)	1.0 (2200 rpm) (1.7)
Ultimate vacuum (absolute)	Torr (mbar)	1.1 (1.5)	< 0.75 (700 rpm) (< 1.0)
Maximum permissible inlet pressure (absolute)	psi (bar)	16 (1.1)	
Maximum permissible outlet pressure (absolute)	psi (bar)	16 (1.1)	
Maximum pressure difference between inlet and outlet	psi (bar)	16 (1.1)	
Permissible ambient temperature storage / operation	°F (°C)	14 to 140 / 50 to 104 (-10 to +60 / +10 to +40)	
Permissible relative atmospheric moisture during operation (no condensation)	%	30 to 85	
Rated motor power	hp (kW)	0.11 (0.08)	0.09 (0.064)
No-load speed	rpm	1500 / 1800 *	0 - 2200 **
Maximum permissible range of supply voltage (±10%) Attention: Observe specifications of rating plate!		100-120 V~ 50/60 Hz; 200-230 V~ 50/60 Hz; 120V~ 60 Hz	24 V DC safe extra low voltage (SELV)*****
Maximum rated current at: 100-120 V~ 50/60 Hz 200-230 V~ 50/60 Hz 120 V~ 60 Hz 24 V DC	 A A A A	 1.6 / 1.7 0.8 / 0.85 1.7 -	 - - - 7
Motor protection		thermal cutout, manual reset***; MD 1 C/US: additional fuse 2.5AT	current limitation (temperature sensor on the circuit board)
Degree of protection IEC 529		IP 44****	IP 20
Inlet		hose nozzle for tubing I.D. 1/4” (6 mm) G 1/8”	
Outlet		silencer / G1/8”	

Type		MD 1	MD 1 VARIO-SP
Dimensions L x W x H approx. MD 1 C/US	in (mm) in (mm)	11.9 x 5.6 x 8.5 (303 x 143 x 215) 12.3 x 5.6 x 8.5 (312 x 143 x 215)	8.8 x 5.6 x 6.4 (223 x 143 x 163) -
Dimensions L x W x H without handle approx. MD 1 C/US	in (mm) in (mm)	11.9 x 5.6 x 6.4 (303 x 143 x 163) 12.3 x 5.6 x 6.4 (312 x 143 x 163)	8.8 x 5.6 x 6.4 (223 x 143 x 163) -
Weight approx. MD 1 C/US	lbs. (kg) lbs. (kg)	14.3 (6.5) 14.8 (6.7)	9.0 (4.1) -

* at 50/60 Hz
** running smoothly only at motor speeds higher than 200 rpm
*** In case of supply voltage below 100V, the lock of the cutout might be restricted.
**** Pumps with voltage changeover switch: IP 40
***** The pump is designed for operation with safe extra low voltage. Accordingly only safe extra low voltage (SELV) may be connected to the voltage supply connections.

Wetted parts

Components	Wetted materials
Housing cover	aluminum alloy (AlSi12)
Head cover	aluminum alloy (AlSi12)
Diaphragm clamping disc	aluminum alloy (AlSi12)
Diaphragm	PTFE
Valves	FPM
Inlet (hose nozzle)	aluminum, anodized
Outlet (silencer)	aluminum / silicone rubber
Fittings	aluminum, anodized
Tubing	PE

We reserve the right for technical modification without prior notice!

Gas inlet temperatures

Operating condition	Inlet pressure	Permitted range of gas temperatures at inlet
Continuous operation	> 75 Torr (100 mbar) (high gas load)	➨ 50 °F to 104 °F (+10°C to +40°C)
Continuous operation	< 75 Torr (100 mbar) (low gas load)	➨ 32 °F to 140 °F (0°C to +60°C)
Short-time (< 5 minutes)	< 75 Torr (100 mbar) (low gas load)	➨ 14 °F to 176 °F (-10°C to +80°C)

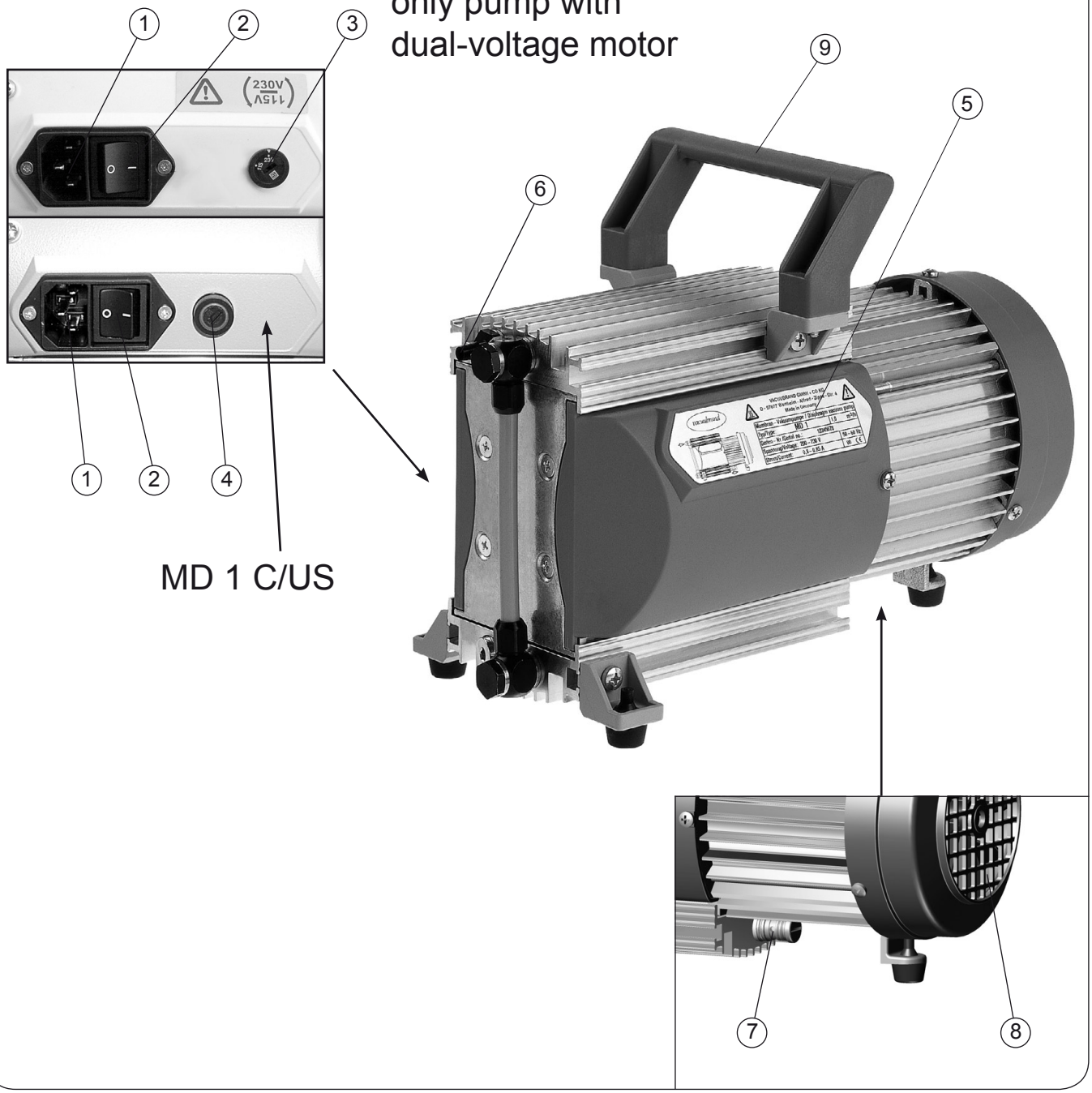
Abbreviations

FPM: Fluoroelastomer
GND: Ground
PE: Polyethylene
PTFE: Polytetrafluoroethylene
PWM: Pulse width modulation

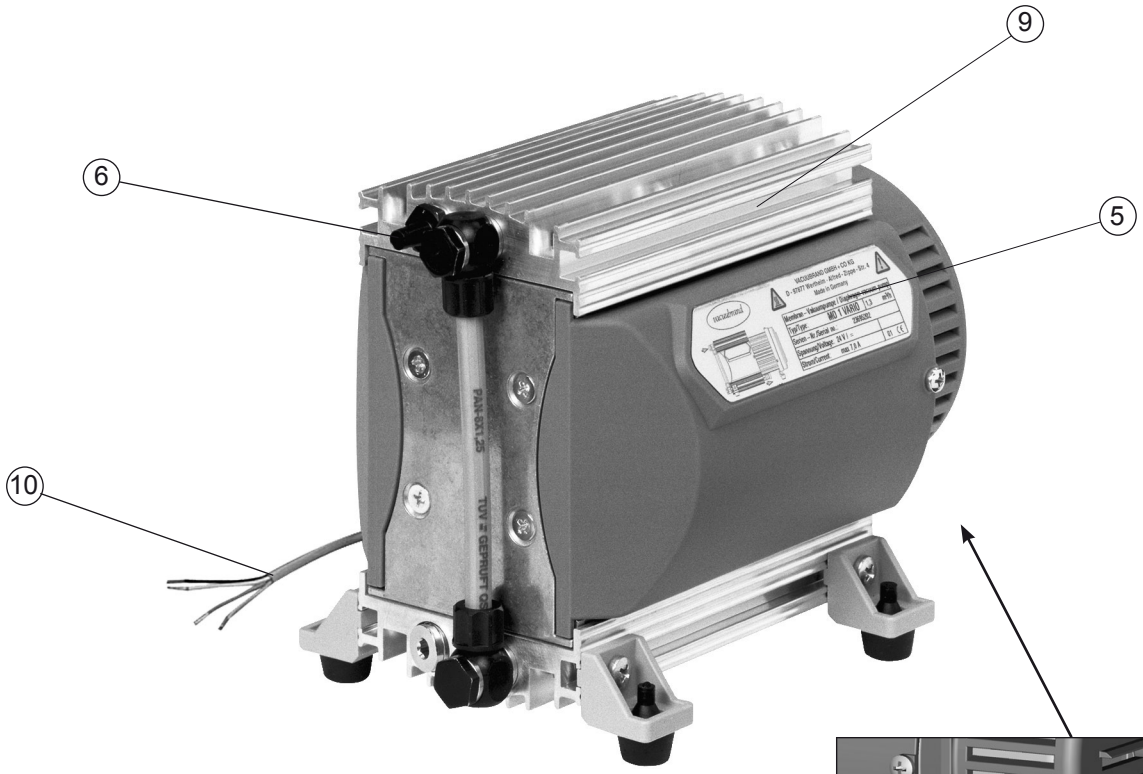
Pump parts

Position	Component
1	Power connection
2	ON/OFF switch
3	Voltage selection switch
4	Fuse holder
5	Pump rating plate
6	Inlet
7	Outlet
8	Fan
9	Handle (removable) / recessed grip
10	Control line

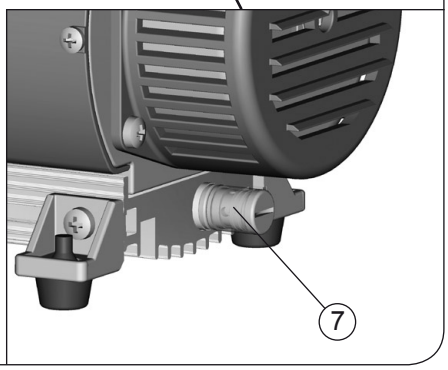
MD 1


only pump with
dual-voltage motor
1
2
3
230V
115V
1
2
4
MD 1 C/US
9
5
6
7
8

MD 1 VARIO-SP



Ensure sufficient venting of the pump!



Only pumps with dual-voltage motor!

voltage selection switch

Change the selection at the voltage selection switch only if the pump is unplugged from the power source.

Voltage selection switch:

1. Disconnect the electrical power cord.

2. Use a screw driver to adjust the **voltage selection switch** at the terminal box of the pump to the supply voltage:

   ”115” corresponds to 90-132 V and
   ”230” corresponds to 180-253 V.

☞ Check that the voltage selection switch is positioned correctly. Check every time before starting the pump.

Note: If the pump is switched on with wrong voltage selection, the motor may be damaged!
Change the selection at the voltage selection switch only if the pump is unplugged from the power source.

Replacing the device fuse (only MD 1 C/US)

➨ Unscrew the fuse holder at the side of the pump using a slotted screw driver.

➨ Replace the defective fuse by a fuse of the same type (see ”Technical data”, pg. 16). Reassemble holder with fuse to the pump.

Use and operation

Controlling the MD 1 VARIO-SP

Connecting the cable:

The connecting cable contains four differently colored wires.

wire in connecting cable	assignment
red	+24V DC (supply voltage, max 7A)
blue	GND (24V)
white	voltage input: 0V to 10V DC (max. 24V) or PWM: 5V to max. 24V (depending on the control signal input for motor speed)
black	GND Signal

External setting of the motor speed via PWM *(factory set)*:

PWM (5V - max. 24V), frame frequency: 100Hz to 1.5kHz
0% to 100% PWM: Linear increase of the motor speed:
0 rpm (at 0% PWM) to 2200 rpm (at 100% PWM)
Pump will run smoothly only at motor speeds higher than 200 rpm, e.g., at a frame frequency of 100 Hz and 25% PWM: pulse-width 2.5 ms

NOTICE

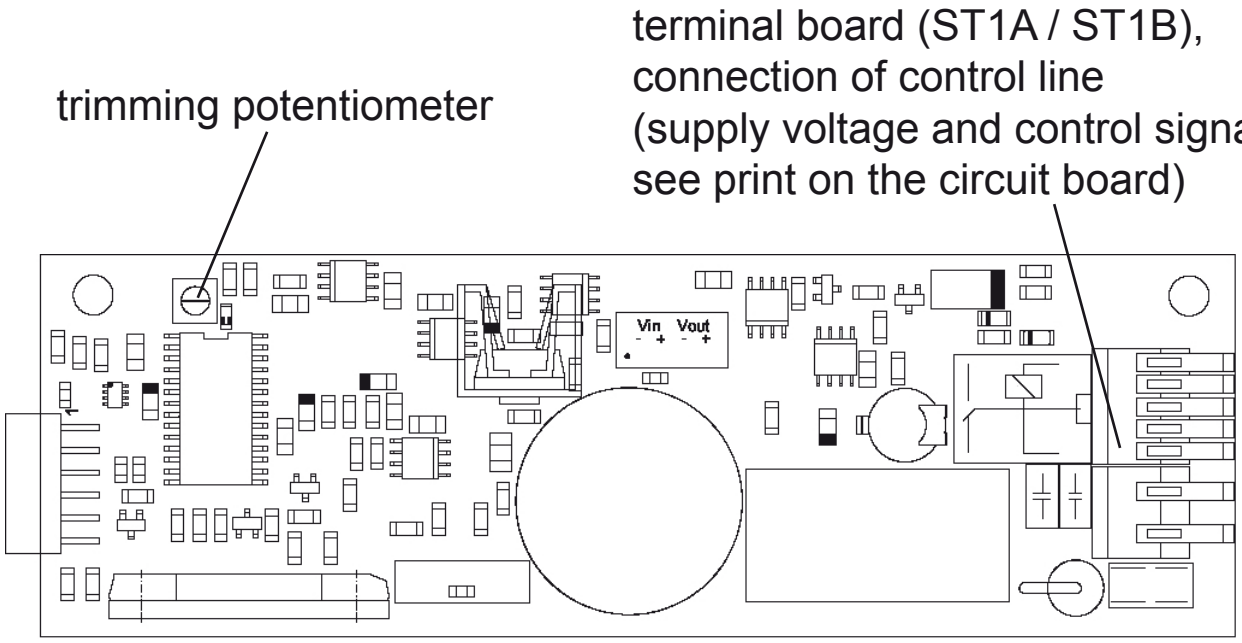
As set at the factory, the pump is designed for operation with a control signal; i.e., without a control signal, the pump does not start!
To operate the pump without a control signal, change the settings on the circuit board (see below)!

Selecting the control signal input:
(PWM / voltage / internal setting)

To select a control signal input other than the factory set one (PWM), the control line at the terminal board has to be reconnected.
Remove the screw affixing the plastic cover with the cable duct. Slide the cover aside carefully and only as far as necessary.

Attention: All work related to the circuit board must be carried out in a ESD protected area or under ESD protective measures! Reassemble the cover after having completed the changes.

Layout of circuit board

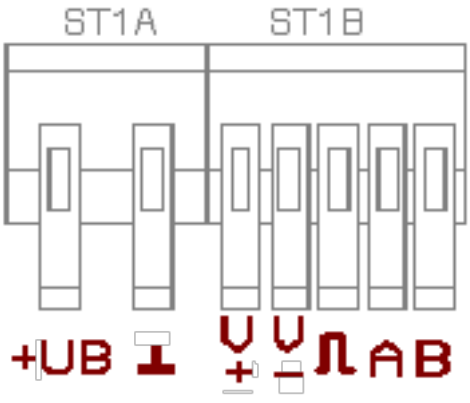


Terminal board

(Connection of the control line on the circuit board)

Voltage supply:

Terminal ST1A	+UB	GND ⊥
Supply voltage	red	blue



Control signal (setting the motor speed):

Terminal ST1B	V+	V-	PWM ⎍	A	B
PWM	-	black	white	-	-
Voltage 0-10V DC	white	black	-	-	-
Internal setting of the motor speed	-	-	-	-	-

External setting of the motor speed via voltage input:

Voltage input: analog 0V .... 10V DC (max. 24V !)

➨ Connect the black and the white wire accordingly to the terminal board ST1B (see table above).

0V to 10V:
Linear increase of the motor speed (0 rpm (at 0V) to 2200 rpm (at 10V))
(Pump will run smoothly only at motor speeds higher than 200 rpm.)

Internal setting of the motor speed via trimming potentiometer:

☞ Ensure that no control signal is applied, e.g., by removing the white and the black wires from the terminal board ST1B.
☞ Supply the pump with the required supply voltage of 24V DC.

Adjusting the motor speed with the trimming potentiometer:

Turning the trimming potentiometer to the right increases the motor speed (maximum 2200 rpm);
Turning the trimming potentiometer to the left decreases the motor speed (minimum 0 rpm). Pump will run smoothly only at motor speeds higher than 200 rpm)

☞ To stop pump, disconnect pump from DC voltage supply.

Notes regarding the motor speed

Pumping at **high motor speed** increases the **pumping speed** of the pump. Ensure sufficient cooling of the pump!
Pumping at **low motor speed** increases the lifetime of diaphragms and valves!
The pump attains the best ultimate vacuum in the low speed range between approx. 600 and 1000 rpm.

Installing a pump in a vacuum system

⚠WARNING

☞ Connect a gas-tight exhaust line at the pump outlet if necessary. Always vent exhaust gases appropriately (e.g., into a fume hood). If dangerous or polluting fluids could be released at the outlet, install an appropriate system to catch and dispose of those fluids.

☞ Never block the gas outlet. The exhaust line must always be free of obstructions (no back pressure) to ensure an unimpeded discharge of gas. The cross-section of the outlet tubing must be at least the size of the pump's exhaust connection.

⚠CAUTION

- Reduce the transmission of vibration. Prevent mechanical load due to rigid pipelines. Insert elastic hoses or flexible elements as couplings between the pump and rigid pipes. **Note**: Flexible elements will compress or flatten when evacuated if not designed for use under vacuum.

NOTICE

Hose connections at the pump inlet must always be gas tight. Particles and dust must not be aspirated. If necessary, you must install appropriate filters. You must ensure their suitability concerning gas flow, chemical resistance and resistance to clogging prior to use.

Make sure ventilation is adequate, especially if the pump is installed in an enclosure, or if the ambient temperature is elevated. Provide external ventilation, if necessary. Keep a distance of minimum 8 in (20 cm) between fan and adjacent equipment or casework.

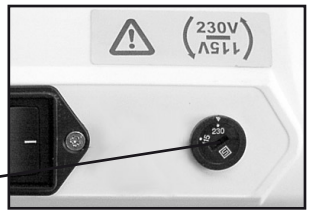
A power failure may cause accidental ventilation of the pump. If this constitutes a potential source of danger, take appropriate safety measures.
Check the power source and the pump's rating plate to be sure that the power source and the equipment match in voltage, phase, and frequency.

Pump with dual-voltage motor: Check that the voltage selection switch is positioned correctly. Check every time before starting the pump.
Note: If the pump is switched on with wrong voltage selection, the motor may be damaged!
Change the selection at the voltage selection switch only if the pump is unplugged from the power source.

Voltage selection switch:
1. Disconnect the electrical power cord.
2. Use a screw driver to adjust the **voltage selection switch** to the supply voltage:

”115” corresponds to 90-132 V and
”230” corresponds to 180-253 V.

⚠ voltage selection switch



Use connecting hoses with large diameter and keep them as short as possible to avoid flow losses. Locate the pump as closely as possible to the application.
Always install outlet tubing descending from the pump to avoid backflow of condensate towards the pump.

Use a suitable valve to isolate the pump from the vacuum application. This is to allow the pump to warm up before pumping condensable vapors and to clean the pump after use before it is switched off.
When assembling, ensure **vacuum-tightness**. After assembly, check the whole system for leaks.
Secure hose connections at the pump appropriately, e.g., with hose clamps, to protect against accidental detachment.

During operation

⚠WARNING

☞ Vent and dispose of **potentially dangerous gases or vapors** at the outlet of the pump appropriately.

⚠CAUTION

- Due to the high compression ratio, the pump might generate overpressure at the outlet. Check pressure compatibility with system components (e.g., exhaust tubing or exhaust valve) at the outlet. Ensure that the pump outlet is neither blocked nor restricted.

NOTICE

Maximum ambient temperature: 104 °F (40 °C)
Check the maximum temperatures, if installing the pump in a cabinet or a housing. Make sure ventilation is adequate, especially if the ambient temperature is elevated.

If the pump is installed at an altitude of more than 3300 ft (1000 m) above mean sea level, check compatibility with applicable safety requirements, especially IEC 60034. There is a risk of the motor overheating due to insufficient cooling.
Do not start the pump, if the **pressure difference between inlet and outlet ports exceeds max. 16.0 psi (1.1 bar)**. Attempts to start the pump at higher pressure difference may cause stalling and damage of the motor.
Check compatibility with the **maximally permitted pressure** at outlet and the **maximum pressure difference** between inlet and outlet ports.

Operating the pump at a high inlet pressure or pumping dusty gases for a long time may cause clogging of the silencer at the outlet. Check the silencer regularly and replace if necessary.

Prevent internal condensation, transfer of liquids or dust. The diaphragms and valves will be damaged if liquids are pumped in significant amounts.
Check the pump regularly for external soiling and deposits. Clean the pump if necessary to avoid an increase of the pump's operating temperature.

Pumps with AC motor:
In case of overload, the motor is shut down by a **self-hold thermal circuit breaker** in the winding.
Note: Only a manual reset is possible. Switch off the pump and disconnect the electrical power cord. Identify and eliminate the cause of failure. Wait approximately five minutes before restarting the pump.

⚠CAUTION

- **Note**: In case of **supply voltage below 100V**, the lock of the breaker may not latch and the pump might restart on its own after sufficient cooling. Take appropriate precautions, if an automatic restart of the pump may lead to a dangerous situation.

Pumps with DC motor:
A temperature sensor at the circuit board protects the motor: Current limitation in case the temperature at the circuit board raises above 158°F (70°C). At temperatures above 185°F (85°C) the pump is switched off. In case of a motor blockage (after 10 start-up attempts) the pump is switched off.
Note: Only manual reset is possible. Disconnect the pump from the power source. Identify and eliminate the cause of failure.

NOTICE

A warm up period (approximately 15 min.) is required to ensure that the rated ultimate vacuum and pumping speed are attained. Avoid overheating (e.g., due to hot process gases).

Shutdown & storage

The pump can be switched off under vacuum.

NOTICE

Short-term:
Has the pump been exposed to condensate?
Allow the pump to continue to run at atmospheric pressure for a few minutes.

Has the pump been exposed to media which may damage the pump materials or form **deposits**?
Check and clean pump heads if necessary.

Long-term:
Take measures as described above regarding short-term shutdown.
Separate the pump from the application.
Close inlet and outlet ports (e.g., with transport caps).
Store the pump under dry conditions.

Accessories

Digital vacuum gauge DVR 2 .....**682902**

Vacuum hose (rubber I.D. 1/4” (6 mm ID) **686000**

For additional accessories such as vacuum valves, small-flange components, vacuum gauges or vacuum controllers, refer to www.vacuubrand.com

Troubleshooting

Fault	Possible cause	Remedy
❑ Pump does not start or stops immediately.	➡ Electrical power cord not plugged in, electrical supply failure?	✓ Plug in power cord. Check fuse. Check electrical supply voltage.
	➡ Device fuse blown (if applicable)?	✓ Identify cause of failure. Replace device fuse.
	➡ Overpressure in outlet line?	✓ Remove blockage in line, open valve, or reduce overpressure.
	➡ Motor overloaded?	✓ Allow motor to cool down, identify and eliminate cause of failure. Manual reset is necessary. Switch off pump or unplug.
❑ Pump does not achieve its ultimate vacuum or usual pumping speed.	➡ Centring ring at small flange connection not correctly positioned, or leak in the pipeline or vacuum system?	✓ Check pump directly - connect vacuum gauge directly at pump inlet - then check connection, pipeline and vacuum system if necessary.
	➡ Long, narrow vacuum line?	✓ Use lines with larger diameter, length as short as possible.
	➡ Pump has been exposed to condensate?	✓ Allow pump to run for some minutes with atmospheric pressure at the inlet to purge.
	➡ Deposits have been formed inside the pump?	✓ Clean and inspect the pump heads.
	➡ Diaphragms or valves damaged?	✓ Replace diaphragms and/or valves.
	➡ Outgassing substances or vapor generated in the process?	✓ Check process parameters.
	➡ Only **VARIO-SP** version: Pump temperature too high (motor speed reduced)?	✓ Ensure sufficient cooling of the pump or reduce inlet pressure.

Fault	Possible cause	Remedy
❑ Pump too noisy.	➡ Atmospheric or high pressure at the pump inlet?	✓ Connect hose or silencer to pump outlet. Be careful not to cause outlet over-pressure, especially with condensable vapors.
	➡ Diaphragm crack or diaphragm clamping disc loose?	✓ Perform maintenance.
	➡ Other than above mentioned causes?	✓ Contact local distributor.
❑ Pump seized.		✓ Contact local distributor.

➡ A service manual with exploded view drawings, spare parts list and directions for repair is available on request.

☞ The service manual is intended for trained service people only.

Replacing diaphragms and valves

☞ **Please read section ”Replacing diaphragms and valves” completely before starting maintenance.**
The pictures may show other versions of pumps. This does not change the method of replacing diaphragms and valves.

⚠WARNING

☞ **Never operate the pump if covers or other parts of the pump are disassembled.**
Never operate a defective or damaged pump.

☞ Before starting maintenance, **disconnect the electrical power cord**. **Wait two minutes** after isolating the equipment from power to allow the capacitors to discharge.
☞ Ensure that the pump cannot be operated accidentally.

☞ **Note**: The pump might be contaminated with the process chemicals that have been pumped during operation. Ensure that the pump is decontaminated before maintenance. Take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred. Ensure that the maintenance technician is familiar with the safety procedures which relate to the products processed by the pumping system.
Use appropriate protective clothing, safety goggles and protective gloves.
☞ Avoid the release of pollutants.

⚠CAUTION

- **Ensure that maintenance is done only by suitably trained and supervised technicians.**
- Check every motor capacitor regularly by measuring its capacity and estimating its service life. Replace old capacitors early enough to prevent a failure. The capacitors must be replaced by a trained electrician.
- Allow sufficient cooling of the pump before starting maintenance.

- **Vent the pump and isolate it from the vacuum system before you start maintenance.**

NOTICE

The valves and diaphragms as well as the motor capacitors are wear parts. If the rated ultimate vacuum is no longer achieved or in case of increased noise level, the pump interior, the diaphragms and the valves must be cleaned and the diaphragms and valves must be checked for cracks or other damage.
All bearings are encapsulated and are filled with long-life lubricant. Under normal operating conditions, the drive system is maintenance free.

In demanding circumstances, it may be efficient to check and clean the pump heads on a regular basis. In normal use, the lifetime of the diaphragms and valves is more than 10,000 operating hours.

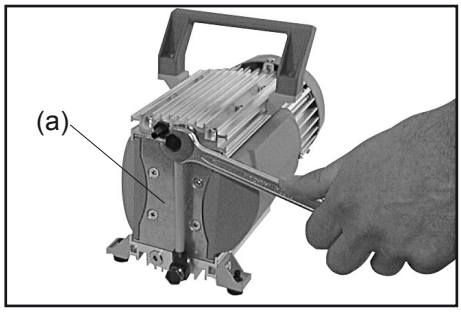
- Prevent internal condensation, transfer of liquids or dust. The diaphragms and valves will be damaged if liquid is pumped in significant amount.
- Carry out maintenance frequently if the pump is exposed to corrosive media or in case of deposits.
- Regular maintenance will improve the lifetime of the pump and also protect both users and the environment.

Service kit for MD 1 (diaphragms, valves, diaphragm key) **696824**

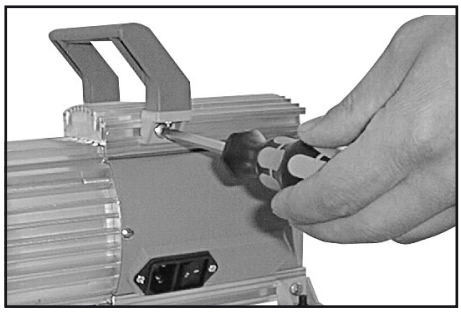
Tools required (metric):

- Diaphragm key width 46 mm
- Open end wrench width 15 / 16 mm
- 4 mm wide Allen key
- Phillips screwdriver size 2

Cleaning and inspecting the pump heads

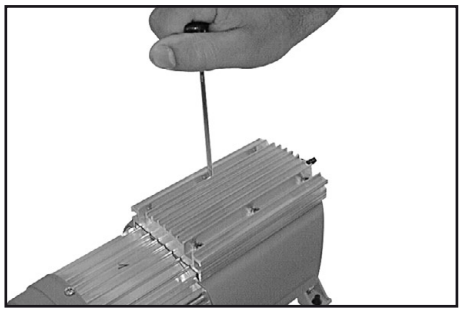


➡ Use an open end wrench (width 15 mm) to remove the screw-in fitting from the pump head, and remove along with the connecting hose.
Attention: Do not remove the housing bearing flange (a).

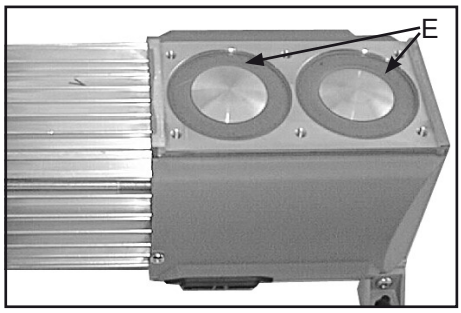


➡ Loosen the two screws (use Phillips screw driver) at the handle and remove handle.

☞ Service only one side of the pump at a time to avoid the mixing of parts.

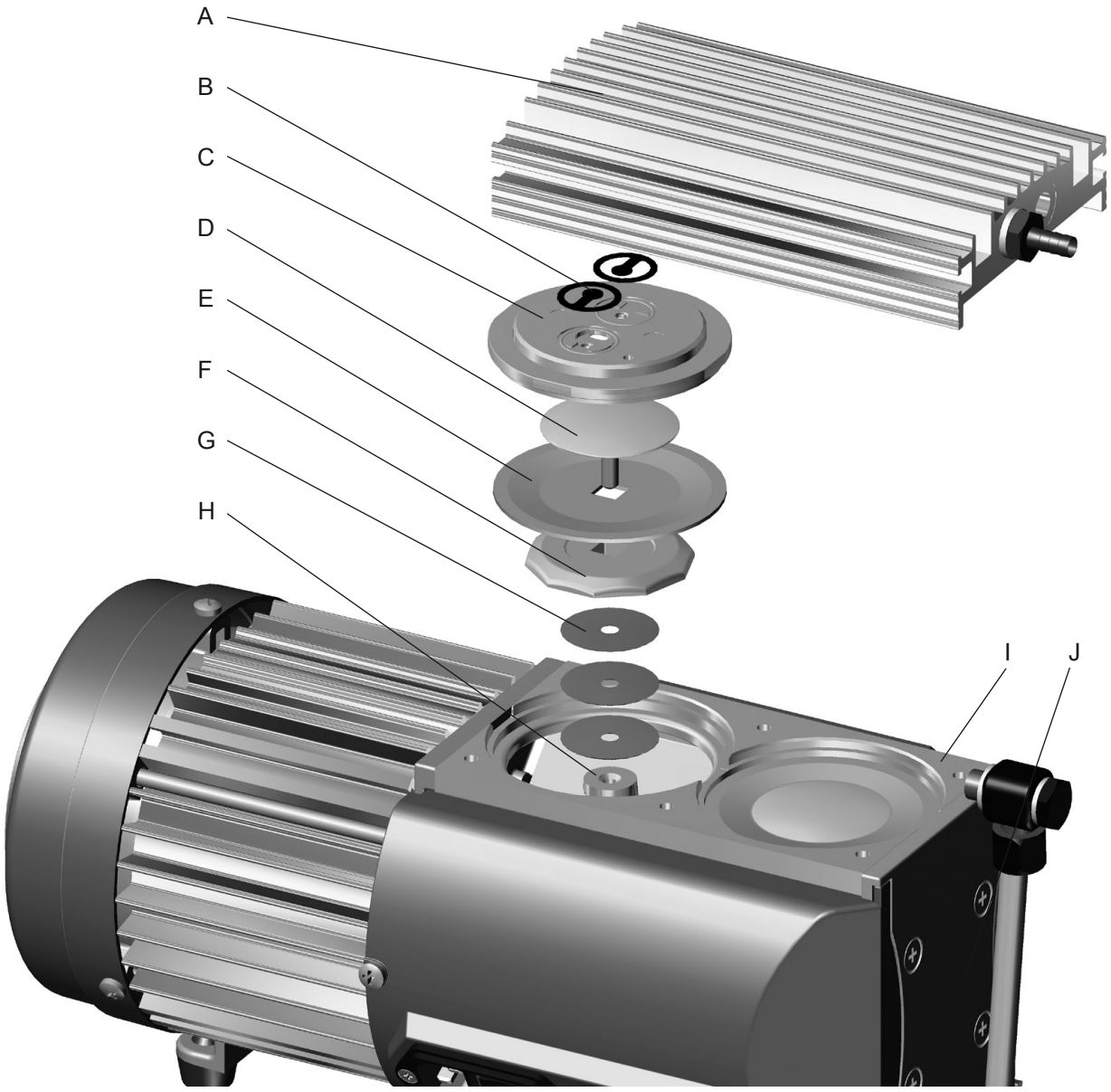


➡ Disassemble the housing cover (A) to check the valves (B).
➡ Unscrew six Allen screws with a 4mm wide Allen key. Remove the housing cover (A) together with head covers (C) and valves (B).
☞ Never use a pointed or sharp-edged tool to remove parts (e.g., screwdriver). We recommend using a rubber mallet or compressed air (to be blown carefully into port).



➡ Remove the head cover (C) carefully from the housing cover (A). Note position and alignment of valves (B). Remove the valves.
☞ Replace valves if necessary.
☞ Use petroleum ether or other industrial solvent to remove deposits. Do not inhale vapors.
☞ Check diaphragm (E) for damage and replace if necessary.

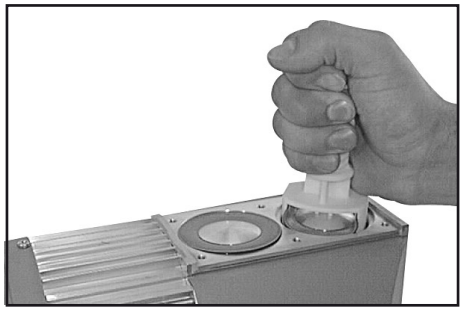
View of the disassembled pump head parts



Pump head parts:

A: Housing cover
B: Valves
C: Head cover
D: Diaphragm clamping disc with square head screw
E: Diaphragm
F: Diaphragm support disc
G: Washer
H: Connecting rod
I: Housing
J: Housing bearing flange

Replacing the diaphragm



➡ Lift diaphragm carefully sidewise.

☞ Never use a pointed or sharp-edged tool to lift the diaphragm. If necessary, press down the diaphragm clamping disc of the adjacent pump head to bring the diaphragm into its upper turning point position.

➡ Use the diaphragm key to grip the diaphragm support disc (F) below the diaphragm.

➡ Unscrew diaphragm support disc (F) with diaphragm (E) and diaphragm clamping disc (D).

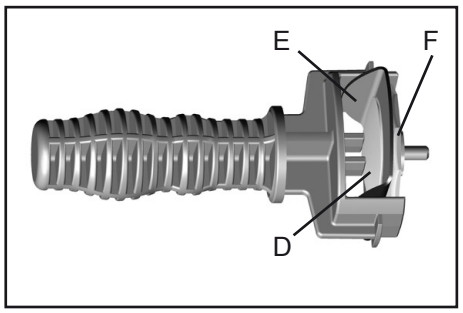
➡ Check for washers (G) between the diaphragm support disc (F) and the connecting rod (H). Do not mix the washers from the different pump heads, since these are set at the factory to ensure proper pump performance. Make sure that the original number is reassembled at the individual pump head.

☞ Too few washers: The pump will not attain vacuum specification. Too many washers: Diaphragm clamping disc will hit head cover, causing noisy operation and possibly causing the pump to seize up.

☞ If the old diaphragm is difficult to separate from the diaphragm support disc, immerse assembly in naphtha or petroleum ether. Do not inhale vapors!

➡ Position new diaphragm (E) between diaphragm clamping disc with square head screw (D) and diaphragm support disc (F).

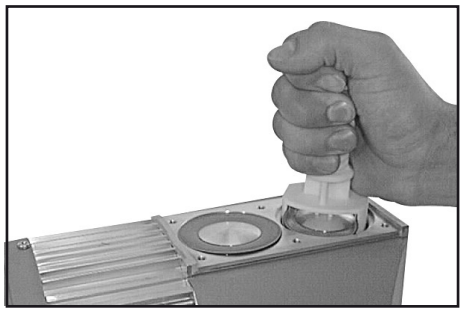
☞ **Note**: Position diaphragm with pale side towards diaphragm clamping disc (facing pump chamber).



☞ Make sure that the square head screw of the diaphragm clamping disc is correctly seated in the guide hole of the diaphragm support disc.

➡ Lift the diaphragm at the side. Place the diaphragm carefully together with diaphragm clamping disc and diaphragm support disc in the diaphragm key.

☞ Avoid damage of the diaphragm: Do not excessively bend or crease the diaphragm.

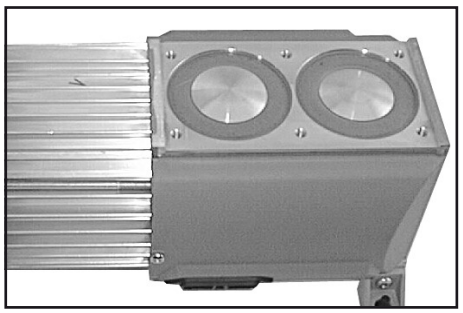


☞ Assemble the original number of washers (G) between diaphragm support disc (F) and connecting rod (H).

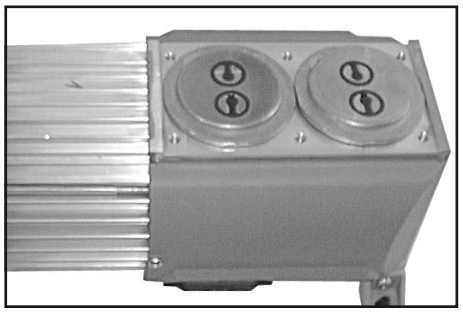
➨ Screw diaphragm clamping disc (D), diaphragm (E), diaphragm support disc (F), and washers (G) to connecting rod (H).

➨ Optimum torque for the diaphragm support disc: 3 $ft \cdot lb_f$ (4 Nm).

Assembling the pump heads



➨ Bring the diaphragms (E) into a position, in which they are in contact with the housing (I) and centered with respect to the bore.



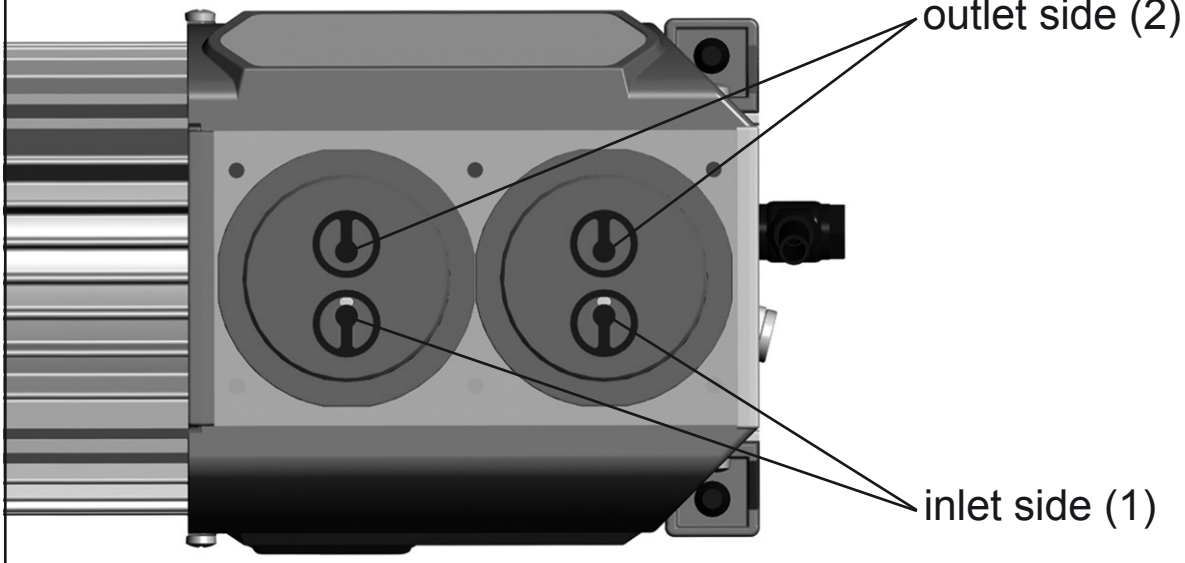
➨ Put on head covers (C).

☞ Pay attention to the correct orientation of the head covers (see figure below).

☞ Make sure that the diaphragms stay centered with respect to the bores so that they will become clamped uniformly between housing (I) and head covers (C).

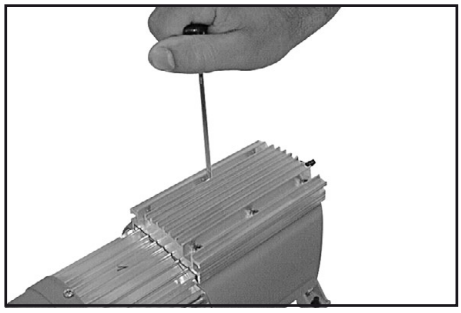
➨ Put the valves (C) in place. See figure below for the correct position of the valves:
Inlet side of pump head: The valve tongue points at the kidney-shaped orifice in the valve seat (1).
Outlet side of pump head: The valve is oriented the opposite direction as the valve at the inlet side. Round orifice under the valve tongue (2).

Scheme of pump heads with head covers and valves



➡ Put on housing cover (A).

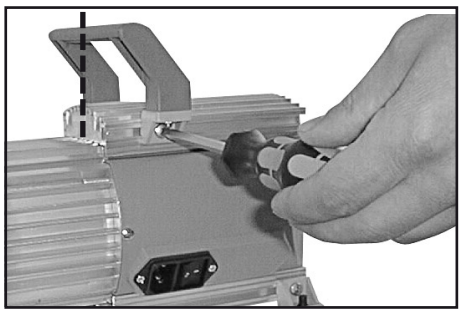
☞ Move housing cover slightly to ensure that the head covers are correctly positioned.



➡ Screw in the Allen head screws at the head covers diagonally at first slightly with a 4 mm wide Allen key, then tighten.

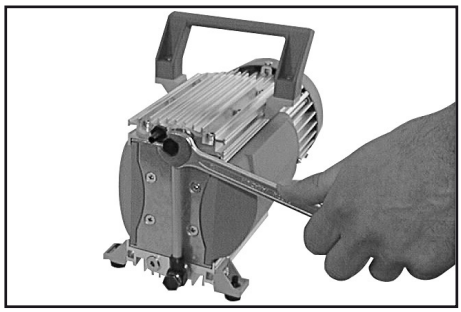
☞ Maximum torque: 4.4 ft·lb$_f$ (6 Nm).

Replace diaphragms and valves of the opposite side of the pump in the same way!



➨ Assemble handle with screws and tighten.
☞ Ensure that the handle is positioned over the pump's center of gravity. The handle is correctly positioned if the end of the handle is flush with the end of the housing cover.

Assembling the fitting



➨ Use an open end wrench (width 15mm) to assemble the screw-in fitting with connection hose to the pump head. If necessary, steady with an open end wrench (width 16mm).

If the pump does not achieve the ultimate vacuum:

- Whenever the diaphragms and valves have been replaced, a break-in period of several hours is required before the pump achieves its ultimate vacuum.
- In case of an unusual noise, switch off pump immediately and check clamping disc positions.

If the specified ultimate vacuum is not achieved, and if this does not change after the break-in period:
Check hose connectors at pump head for leaks. If necessary recheck valve seats and diaphragms.

Notes on return to the factory

Repair - return - DKD calibration

NOTICE

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“**, see pg. 45, must be sent to our office fully completed and signed before any equipment is shipped to the authorized service center.

Fax or mail 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 followed.

⚠CAUTION

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 service center**.

- 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 **repair quotations** only on request and always at the customer's expense. If an order is placed, the costs incurred for problem diagnosis 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 may be returned to you disassembled and at your expense.**

In many cases, the **components must be cleaned in the factory** prior to repair.
For cleaning we use an environmentally friendly water-based process. Unfortunately the combined attack of elevated temperature, cleaning agent, ultrasonic treatment and mechanical stress (from pressurized 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 will also replace parts for cosmetic reasons at your request and at your expense.

NOTICE

Before returning the equipment, ensure that (if applicable):

- Equipment has been cleaned and/or decontaminated.
- All inlet and outlet ports have been capped.
- Equipment has been properly packed, (if necessary, please order original packaging materials at your cost), marked appropriately and the carrier has been notified of any possible contamination.
- The completed health and safety clearance form is enclosed.

We thank you in advance for your understanding of the necessity for these measures that protect our employees, and ensure that your pump is protected in shipment.

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 your processes. Do not incinerate fluoroelastomer seals and O-rings.

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

Warranty

VACUUBRAND shall be liable for insuring that this product, including any agreed installation, has been free of defects at the time of the transfer of risk.

VACUUBRAND shall not be liable for the consequences of improper handling, use, servicing or operation of this product or the consequences of normal wear and tear of wearing parts such as diaphragms, seals, valves, vanes, condensers, oil and the breakage of glass or ceramic parts, for the consequences of chemical, electrochemical or electrical influences or the failure to follow the instructions in this manual.

Claims for defects against VACUUBRAND shall be limited to one year from delivery. The same shall apply to claims for damages irrespective of legal grounds.

For further information on general terms and conditions refer to www.vacuubrand.com.

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 sent to our office fully 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. Comply with national and international transport regulations.
b) Inevitably, the repair process will be delayed considerably if this information is missing or this procedure is not obeyed. We appreciate your understanding for these measures which are intended to protect our employees, and ask you that you 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 information 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 been 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. Method of transport / carrier:

.....
Date of dispatch to VACUUBRAND:

.....

If the paint is damaged, we wish a repaint or a replacement of parts for reason of appearance at our expense (see ”Notes on return to the factory”, pg. 41):
❑ 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 and marked as appropriate. If necessary, please order original packaging (costs will be charged).
❑ The carrier has been informed about the hazardous nature of the goods (if applicable).

By our signature below we acknowledge that we accept liability for any damage caused by providing incomplete or incorrect information and improper packaging 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

Declaration of conformity

Diaphragm pump

MD 1 (230V; 696080, 696081, 696082)
MD 1 VARIO-SP (24V; 696101)
MD 1 C/US (100-120V / 200-230V; 2613565)

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.

Machine directive (with supplements)
2006/42/EG
Low-Voltage Directive (not applicable to MD 1 VARIO-SP (696101) 24V)
2006/95/EG
Electromagnetic Compatibility Directive
2004/108/EG
Harmonized Standards applied
DIN EN 12100-2, DIN EN 61010-1, DIN EN 1012-2, DIN EN 61326-1
Management systems
EN ISO 9001, EN ISO 14001 (1997-2006)

Wertheim, 27.05.2010
. . . . . .
place, date

. . . . . .
(Dr. F. Gitmans)
Managing Director

ppa. . . . . .
(Dr. J. Dirscherl)
Technical Director

VACUUBRAND GMBH + CO KG
-Technology for Vacuum Systems-

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Web: www.vacuubrand.com

Certificate

TÜV

Certificate no. CU 72070564 01

License Holder:
VACUUBRAND GMBH + Co. KG
Alfred-Zippe-Str. 4

97877 Wertheim
Germany

Manufacturing Plant:
VACUUBRAND GMBH + Co. KG
Alfred-Zippe-Str. 4

97877 Wertheim
Germany

Test report no.: USA-RC 02271487 003 **Client Reference:** Jürgen Dirscherl

Tested to: UL 61010A-1:2002 R12.02
CAN/CSA-C22.2 No. 1010.1-92+A2:97

Certified Product: Diaphragm Vacuum Pump for Laboratory Use **License Fee - Units**

Model Designation: M v w x yy z 7
v=E,Z,D,V; w=0.5,1,1.5;
x=C,S,blank; y=A-Z, blank;
z=AK,EK,2AK,AK+EK,AK+EK TE,
AK+EK Peltronik,IK+EK,AK-SY+EK,blank

Rated Voltage: AC 100-120/200-230V, 50/60Hz
Rated Current: 1.7/0.85A
Protection Class: I

Special Remarks: Replaces Certificate CU72032013.

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Appendix: 1, 1-2

Licensed Test mark:

TUV Rheinland of North America, Inc. C US

Signatures

Stephan Schmitt
President

Dipl.-Ing. M. Raap
QA Certification Officer

Date of Issue (day/mo/yr)
01/03/2007

TÜV Rheinland of North America, Inc., 12 Commerce Road, Newtown, CT 06470, Tel (203) 426-0888 Fax (203) 426-4009

This certificate is only valid for pumps with the respective mark (Licensed Test mark) on the pump rating plate.

Certificate

TÜVRheinland®

Certificate no. CU 72101050 01

License Holder:
VACUUBRAND GMBH + Co. KG
Alfred-Zippe-Str. 4

97877 Wertheim
Germany

Manufacturing Plant:
VACUUBRAND GMBH + Co. KG
Alfred-Zippe-Str. 4

97877 Wertheim
Germany

Test report no.: USA-DS 31081254 001 **Client Reference:** M. von Przychowski

Tested to: UL 61010-1:2004 R10.08
CAN/CSA-C22.2 NO. 61010-1-04+GI1 (R2009)

Certified Product: Diaphragm Vacuum Pump for Laboratory Use **License Fee - Units**

Model Designation: Mx yzzz VARIO-SP 7
x = E, Z, D, V
y = 0.5, 1, 1.5, 2x1, 2
z = A-Z, blank

Rated Voltage: DC 24V
Rated Current: 7A
Protection Class: III

7

Appendix: 1, 1

Licensed Test mark:

TUV Rheinland of North America, Inc. c us

Signature

Dipl.-Ing. J. Engels
QA Certification Officer
TUV Rheinland of North America, Inc., 12 Commerce Road, Newtown, CT 06470, Tel (203) 426-0888 Fax (203) 426-4009

Date of Issue (day/mo/yr)
31/05/2010

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