Operating Instructions
Self Drying Vacuumpump
PM 400 / PM 500
You have selected a high-quality KNF product; the following tips will help you operate it safely, and reliably over a long period of time.

Carefully study operating instructions before using the pumps and observe at all times the relevant instructions to avoid dangerous situations.

0. List of Contents
1. Description, Operating Conditions
2. Safety
3. Installation
4. Operation
5. Servicing
6. Trouble Shooting
7. Ordering Information
8. Specifications
1. Description, Operating Conditions

The pumps transfer, and evacuate 100 % oil-free. In operation they are gastight, and maintenance-free.

The self drying pumps make it possible during evacuation to blow the condensated liquid out of the pump heads at high speed, while maintaining the vacuum in the recipient at a constant level. After drying the pump heads the pumps achieve a greatly improved vacuum and evacuate much faster than pumps without a drying system.

The control for the drying system is effected via solenoid valve and three variables:
- The time between switching on the drying system and the first ventilation of the pump heads \( t_1 \)
- The duration of the ventilation of the pump heads \( t_2 \)
- The interval between pump head ventilation operations \( t_3 \).

This pump model is equipped with the solenoid valve for ventilating the pump heads. The scope of delivery does not include control electronics.

1.1 Electrical Equipment
- See section 8 for full electrical data.
- The pumps are fitted with a thermal -switch to protect against overloading.

1.2 Operating Conditions

⚠️ The pumps and/or the drying system must not be used in areas where there is a danger of explosion.

⚠️ These pumps must not be used if the entry of air into the pump during venting (drying system) could result in the creation of reactive, explosive or otherwise hazardous mixtures. Prior to any use of the pump ensure that the creation of reactive, explosive or otherwise hazardous mixtures during the supply of air is prevented.

- For maximum permissible operating pressure, ultimate vacuum, and flow capacity: see chapter 8.
- The pumps must not be used for liquids. You will find suitable liquid pumps in our Product Program.

If your potential application lies outside the above limits discuss it with our technical adviser (see last page for contact telephone number).

1.3 Ambient Condition

When the pumps are operating the following ambient conditions must be maintained:
- The pumps and/or the drying system must not be used in areas where there is a danger of explosion.
- Ambient temperature during operation: between \( +5 °C \) .... \(+40 °C\).
- During operation an adequate supply of air for cooling must be provided.

2. Safety

- Note that the pumps may only be used for their intended purpose.

⚠️ The pumps and/or the drying system must not be used in areas where there is a danger of explosion.

⚠️ These pumps must not be used if the entry of air into the pump during venting (drying system) could result in the creation of reactive, explosive or otherwise hazardous mixtures.

Prior to any use of the pump ensure that the creation of reactive, explosive or otherwise hazardous mixtures during the supply of air is prevented.

⚠️ Components connected to the pumps must be designed to withstand the pneumatic performance of the pumps (see chapter 8).

- Plug the pump only into properly installed grounded outlets.

⚠️ When the operation of the pump is interrupted by the thermal switch, it will re-start automatically after cooling down. Take all care necessary to prevent this leading to a dangerous situation.

⚠️ Specific safety instructions and measures for the media being handled must be observed.

- Parts of the casing marked with the sign below are only allowed to be opened after pulling out the plug (disconnecting the power source).

- Use only original KNF replacement parts.

3. Installation

- Choose a safe location (flat surface for the pump).
- Install the pump so as to ensure adequate flow of air cooling.
- Connect the suction and pressure lines (tube ID 10 mm).
- Arrange the pressure line so that condensate can flow out of the the pump (falling pipe).
- The condensate is conducted out of the pump via the pressure line. A container is to be installed to catch the condensate.
- The solenoid valve must be connected to the drying system control electronics (not included in scope of delivery); see fig. 1.
- Plug the pump only into properly installed grounded outlets.
- Compare the supply data with the electrical data of the pump. The voltage must not vary by more than \(+10 \%\), and \(-10 \%\) from that shown on the type-plate.

4. Operating Instructions

4.1 Operating Conditions

⚠️ The pumps and/or the drying system must not be used in areas where there is a danger of explosion.

⚠️ These pumps must not be used if the entry of air into the pump during venting (drying system) could result in the creation of reactive, explosive or otherwise hazardous mixtures.

Prior to any use of the pump ensure that the creation of reactive, explosive or otherwise hazardous mixtures during the supply of air is prevented.

⚠️ Specific safety instructions for the media being handled must be observed.

- The pumps must not start against...
4.2 Operation

Taking the pump into operation

1. Plug the mains plug of the pump into a properly installed safety socket.
2. Switch the pump on at the pump mains switch (see fig. 1).
3. If cyclic drying of the pump heads is required in the current evacuation process, switch the drying system on at the mains switch of the control system (not included in scope of delivery).
   - The drying system should only be switched on if a container has been attached to the pressure line of the pump which will catch the condensate; otherwise the condensate will flow out uncontrollably.

Check:

1. Tubing for correct tubing.
2. Electrical connections for correct connection.

After the evacuation/process has been completed, take the pump out of operation:

1. Purge the pump including the connecting hoses with air at full flow rate for about 5 minutes.
2. If the drying system is switched on: Switch the drying system off at the mains switch of control system

(not included in scope of delivery).

3. Switch the pump off at the mains switch of the pump.
4. Pull the mains plug of the pump out of the socket.

5. Servicing: Changing Diaphragms and Valve Plates/Sealings

The diaphragms in both pump heads should be changed at the same time. When diaphragms are changed, valve plates/sealings should also be replaced. If the diaphragms are not changed in both heads at the same time or diaphragms and valve plates/sealings are not changed at the same time the nominal performance of the pump is not guaranteed after the service.

If a pump has been used for aggressive or toxic substances or other types of substances which are hazardous, hazardous to health, or injurious, the following points must be observed:

1.) Clean the pump and its components before servicing.
2.) Ensure that the service personnel is not subject to a health hazard. Apply the safety and protection measures that are necessary for the medium that has been handled by the pump (example: the use of protective gloves).
3.) Ensure that discarded parts and materials are safely and correctly disposed of.
Fig. 2: Cross section of pump heads (symbolic)

a) Preparatory steps

1. Shut down system (see section 4.2) including disconnecting the pump from the power source (pull out plug of pump).
2. Remove tubing from the inlet and outlet connectors of the pump.
3. On the pneumatic head connections, loosen one of the union nuts by hand. Then slightly loosen the angle-fitting in the pump head by turning it anticlockwise, so that the connecting tube can be pulled out.
4. Undo the screws that hold the fan cover (see fig. 1) and remove the fan cover from the motor.

b) Removing pump head

1. Undo the eight screws and lift the pump head off the housing.
2. The solenoid valve of the drying system remains fitted in this situation.

(c) Changing diaphragm

1. Position the pump so that the diaphragm surface is upwards.
2. Turn the fan to bring the structured diaphragm to top dead centre.
3. Using a small screwdriver, between the housing and the outer edge of the structured diaphragm, carefully lift the edge of the diaphragm lightly upwards at one point (making sure not to damage the housing). Now grip the edge of the diaphragm on opposite sides, unscrew it by turning anti-clockwise.
4. Take the diaphragm spacer(s) off the connecting rod and retain them.
5. Check that all parts are free from dirt and clean them if necessary.
6. Put the diaphragm spacer(s) on the thread of the new diaphragm.
7. Fit the new structured diaphragm, hold the connecting rod with one finger, and gently screw in (clockwise) the structured diaphragm with diaphragm spacers.
8. Turn the fan until the structured diaphragm is at the top dead centre. Using a small screwdriver, between the housing and the outer edge of the structured diaphragm, carefully lift the edge of the diaphragm lightly upwards at one point. Now grip the edge of the diaphragm on opposite sides (do not overstretched the diaphragm!) and tighten the structured diaphragm clockwise.

(c) Changing valve plates/sealings

1. Undo the two screws.
2. Separate the head plate with top plate from intermediate plate.
3. Remove the valve plates/sealings from the intermediate plate.
4. Check that the valve seats, the head plate and intermediate plate are clean. If scratches, distortion, or corrosion are evident on these parts they should be replaced.
5. Lay the new valve plates/sealings in the recesses in the intermediate plate. The valve plates/sealings for suction and pressure sides are identical, as are upper and lower sides of the plates/sealings.
6. Refitting pump head

1. Turn the fan to bring the structured diaphragm to medium position.
2. Place the intermediate plate with valve plates/sealings on the housing, in the position indicated by the felt-tip pen marking.
3. Place the head plate on the intermediate plate in the position indicated by the felt-tip pen marking.
4. Place top plate in position.
and insert screws ⑦ with disk springs ⑧, and tighten them until the screw heads are just fully seated (do not completely tighten them!).

1. The concave side of the first three disc springs must point away from the screw head, the next three towards it (see fig. 2, detail X).
2. Gently tighten the screws ⑤, evenly and diagonally.
3. Turn the fan to check that the pump rotates freely.
4. Now tighten screws ⑤ hand-tight.
5. Tighten each of the screws ⑦ a half-turn more.

Repeat operations b), c), d), and e) for the second pump head.

f) Final steps
1. Refit the pneumatic head connection:
   Place tube onto the connecting part of the angle fitting, turn angle fitting to a straight position and tighten the nut.
2. Refit the fan cover.
3. Reconnect the pump to the electricity supply.
   ▶ If you have any questions about servicing call our technical adviser (see last page for contact telephone number).

6. Troubleshooting
   ▶ Sufficient vacuum is not reached
      Possible reasons:
      1. Tube connections are not tight
      2. Condensate in the pump head
         ▶ Switch the drying system on or reduce the interval between pump head ventilation operations.
      3. Diaphragms and/or valve plates/ sealings are worn out
         ▶ Changing diaphragms and valve plates/sealings:
           see section 5.
      4. If this problem occurs after changing of diaphragms and valve plates/sealings:
         ▶ See information in section 5.
      5. Pump is switched on, but does not run, the on/off-switch on the pump is not lit
         Possible reason:
         1. The thermal switch has opened due to overheating
         ▶ Disconnect the pump from the power source, let the pump cool down, investigate the reason for the overheating and irradiate it.

   ▶ Pump is switched on, but does not run, the on/off-switch on the pump is lit
      Possible reason:
      1. The thermal switch has opened due to overheating
      ▶ Disconnect the pump from the power source, let the pump cool down, investigate the reason for the overheating and irradiate it.

7. Ordering Information
   Service Set
   A Service Set contains all replacement parts needed for one complete service of the pump.
   Service Set contains
   2 diaphragms, 4 valve plates/sealings
   Order No. 047499

8. Specifications
   Capacity: max. 60 l/min
   Ultimate vacuum: 4 mbar abs.
   Permissible operating pressure:
   max. 1 bar
   Permissible ambient temperature: +5…+40 °C
   Hose connection for tube ID 10 mm
   Voltage pump: 230 V
   Frequency: 50 Hz
   Power consumption pump: 220 W
   Fuse pump (2 x): 3.15 T [A]
   IP 54
   Voltage solenoid valve: 24 V DC

   ▶ CE - Safety Demands
   ▪ The pumps correspond to the safety regulations of the EU low voltage directive 73/23 EWG and of the EU directive concerning electromagnetical compatibility 89/336 EWG. The requirements of the following harmonised standards are fulfilled:
     EN 55014
     EN 61000-6-1
     EN 61000-6-3
     EN 61000-3-2/3
     EN 61010-1
   ▪ The pumps correspond to IEC 664:
     ▪ the overvoltage category II
     ▪ the pollution degree 2.
Appendix:
Customer statement for repair order (sample statement for copying)

In order for KNF to repair the pump, the customer must provide a statement on the media which were pumped and on pump cleaning. Please fill out the corresponding KNF form, and submit it together with the pump.

Statement/Certificate
We confirm that the pump model listed below (please specify)
............................................
............................................
............................................
Serial-No. (please specify)
............................................
............................................
............................................
was used to pump the following media:
............................................
............................................
............................................
............................................
............................................
............................................
............................................
and that the pump listed above was cleaned. There are no poisonous, aggressive, biological, radioactive or other dangerous media in the pump.

Company Date/Signature

KNF Neuberger GmbH
Alter Weg 3
D-79112 Freiburg
Tel. ++49/7664/5909-0
Fax ++49/7664/5909-99
E-Mail: info@knf.de
www.knf.de