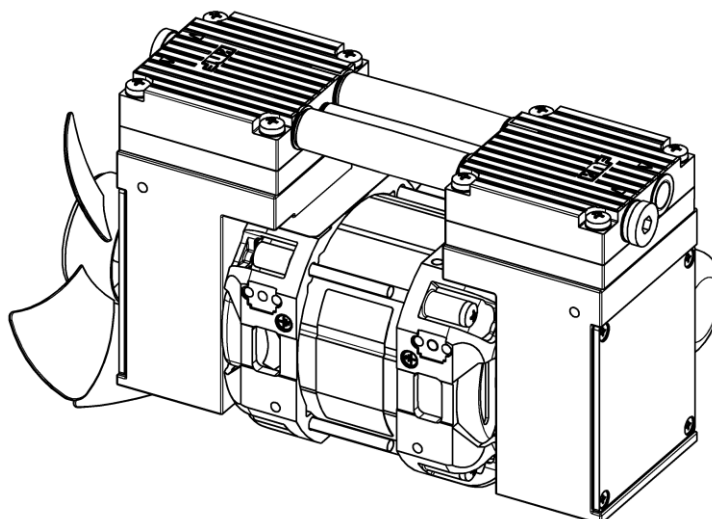


Diaphragm Vacuum Pumps

N 916.50 KPE

Operating and Installation Instructions

Read and observe these Operating and Installation Instructions!



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1. About this document

1.1. Using the Operating and Installation Instructions

The Operating and Installation Instructions are part of the pump.

➔ Pass on the Operating and Installation Instructions to the next owner.

Project pumps

Customer-specific project pumps (pump models which begin with "PJ" or "PM") may differ from the Operating and Installation Instructions.

➔ For project pumps, also observe the agreed upon specifications.

1.2. Symbols and markings

Warning



WARNING

A danger warning is located here.

Possible consequences of a failure to observe the warning are specified here. The signal word, e.g.

Warning, indicates the danger level.

➔ Measures for avoiding the danger and its consequences are specified here.

Danger levels

Signal word	Meaning	Consequences if not observed
DANGER	warns of immediate danger	Death or serious injuries and/or serious damage are the consequence.
WARNING	warns of possible danger	Death or serious injuries and/or serious damage are possible.
CAUTION	warns of a possibly dangerous situation	Minor injuries or damage are possible.

Tab. 1

Other information and symbols

➔ An activity to be carried out (a step) is specified here.

1. The first step of an activity to be carried out is specified here. Additional, consecutively numbered steps follow.

i This symbol refers to important information.

2. Use

2.1. Proper use

The pumps are exclusively intended for transferring gases and vapors.

Owner's responsibility

Operating parameters and conditions

Only install and operate the pumps under the operating parameters and conditions described in chapter 4, Technical data.

Only complete pumps may be taken into service.

Make sure that the installation location is dry and the pump is protected against rain, splash, hose and drip water.

Requirements for transferred medium

Before using a medium, check whether the medium can be transferred danger-free in the specific application case.

Before using a medium, check the compatibility of the materials of the pump head, diaphragm and valves with the medium.

Only transfer gases which remain stable under the pressures and temperatures occurring in the pump.

2.2. Improper use

The pumps may not be operated in an explosive atmosphere.

The pumps are not suitable for transferring dusts.

The pumps are not suitable for transferring liquids.

The pumps are not suitable for aggressive media. For aggressive media there are other pumps in the KNF product program – please ask us for detail.

The pumps must not be used to create vacuum and overpressure simultaneously.

An overpressure must not be applied to the suction side of the pump.

3. Safety

i Note the safety precautions in chapters 6. *Installation and connection*, and 7. *Operation*.

The pumps are built according to the generally recognized rules of technology and in accordance with the occupational safety and accident prevention regulations. Nevertheless, dangers can result during their use which lead to injuries to the user or others, or to damage to the pump or other property.

Only use the pumps when they are in a good technical and proper working order, in accordance with their intended use, observing the safety advice within the Operating and Installation Instructions, at all times.

Personnel	<p>Make sure that only trained and instructed personnel or specially trained personnel work on the pumps. This especially applies to assembly, connection and servicing work.</p> <p>Make sure that the personnel has read and understood the Operating and Installation Instructions, and in particular the "Safety" chapter.</p>
Working in a safety-conscious manner	Observe the accident prevention and safety regulations when performing any work on the pump and during operation.
Handling dangerous media	When transferring dangerous media, observe the safety regulations when handling these media.
Handling combustible media	<p>Be aware that the pumps are not designed to be explosion-proof.</p> <p>Make sure the temperature of the medium is always sufficiently below the ignition temperature of the medium, to avoid ignition or explosion. This also applies for unusual operational situations.</p> <p>Note that the temperature of the medium increases when the pump compresses the medium.</p> <p>Hence, make sure the temperature of the medium is sufficiently below the ignition temperature of the medium, even when it is compressed to the maximum permissible operating pressure of the pump. The maximum permissible operating pressure of the pump is stated in the technical specifications (chapter 4).</p> <p>If necessary, consider any external sources of energy, such as radiation, that may add heat to the medium.</p> <p>In case of doubt, consult the KNF customer service.</p>
Environmental protection	Store all replacement parts in a protected manner and dispose of them properly in accordance with the applicable environmental protection regulations. Observe the respective national and international regulations. This especially applies to parts contaminated with toxic substances.
EC Directives / Standards	For the purposes of the Machinery Directive 2006/42/EC, pumps are "partly completed machinery," and are therefore to be regarded as not ready for use. Partly completed machinery may not be commissioned until such time as it has been determined that the

machine in which the partly completed machinery is to be assembled is in conformity with the provisions of the Machinery Directive 2006/42/EC. The following essential requirements of Annex I of Directive 2006/42/EC (general principles) are applied and observed:

- General Principles No. 1
- No. 1.1.2. / 1.1.3. / 1.3.1. / 1.3.3. / 1.3.4. / 1.4.1. / 1.5.1. / 1.5.2. / 1.5.8. / 1.5.9. / 1.7.4. / 1.7.4.1. / 1.7.4.3.

As these partly completed machinery are OEM-models the power supplies and the equipment for disconnecting and switching-off the partly completed machinery respectively have to be considered when mounting as well as over-current and overload protective gear.

In addition a protection against mechanical parts in motion and hot parts, if existing, has to be provided when mounting.



The pumps conform to the Directive 2011/65/EU.

The following harmonized standards have been used:

- DIN EN 55014-1/2
- DIN EN 61000-3-2/3
- DIN EN 60335-1
- DIN EN 50581

Customer service and repairs

Only have repairs to the pumps carried out by the KNF Customer Service responsible.

Use only genuine parts from KNF for servicing work.

4. Technical Data

Pump materials

Assembly	Material
Pump head	PPS
Diaphragm	EPDM
Valve plates	EPDM
O-rings	FPM

Tab. 2

Pneumatic performance

Parameter	Value
Max. permissible operating pressure [bar g]	0,5
Ultimate vacuum [mbar abs.]	20
Delivery rate at atm. pressure [l/min]*	16

Tab. 3

* Liters in standard state (1013 mbar)

Electrical data

Parameter	Value
Electrical data	see type label
Protection class	IP00

Tab. 4

Thermal-switch The pumps are fitted as standard with a thermal-switch to protect against overloading.

Other parameters

Parameter	Value
Permissible ambient temperature	+ 5 °C to + 40 °C
Permissible media temperature	+ 5 °C to + 40 °C
Dimensions:L x H x W [mm]	approx. 205 x 133 x 114,5
Pneumatic connections	Thread size G 1/8
Weight [kg]	approx. 3.0
Maximum permissible ambient relative humidity	80 % for temperatures up to 31 °C, decreasing linearly to 50 % at 40 °C
Max. altitude of site [m above sea level]	2000

Tab. 5

5. Design and Function

Design

- 1 Fan
- 2 Pneumatic pump inlet
- 3 Motor
- 4 Pneumatic head connection
- 5 Pneumatic pump outlet
- 6 Capacitor (electrical connected, not assembled)

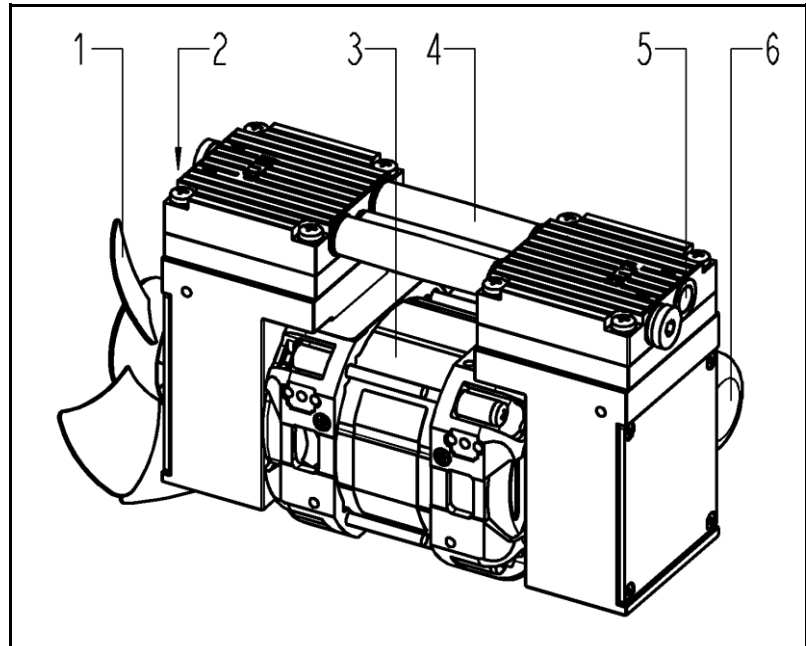


Fig. 1: Diaphragm Vacuum Pump N 916.50 KPE

How diaphragm pumps work

- 1 Outlet valve
- 2 Inlet valve
- 3 Working chamber
- 4 Diaphragm
- 5 Eccentric
- 6 Connecting rod
- 7 Pump drive

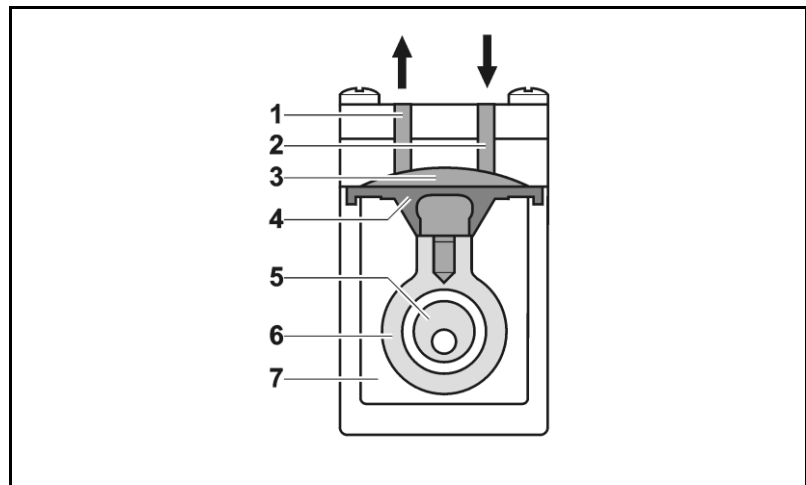


Fig. 3: Pump head

Diaphragm pumps transfer, compress (depending on pump version) and evacuate gases and vapors.

The elastic diaphragm (4) is moved up and down by the eccentric (5) and the connecting rod (6). In the downward stroke it aspirates the gas to be transferred via the inlet valve (2). In the upward stroke, the diaphragm presses the medium out of the pump head via the outlet valve (1). The diaphragm hermetically seals the working chamber (3) from the pump drive (7).

6. Installation and connection

Only install and operate the pumps under the operating parameters and conditions described in chapter 4, Technical data.

Observe the safety precautions (see chapter 3).

6.1. Installation of the pump

- Before installation, store the pump at the installation location to bring it up to ambient temperature.
- Mounting dimensions → For the mounting dimensions see Fig. 3, p. 9.
- Immediate environment → When installing the pump, ensure that no flammable objects or objects subject to thermal deformation are located in the immediate vicinity of hot pump parts (head, motor).
- Installation position → The pump may be installed in any position. Use metal screws to fasten the pump at the indicated attachment points.
- Cooling air supply → Install the pump so that the motor fan can intake sufficient cooling air.
- Attach connection cables → Fasten the connection cables so that:

 - the cables do not contact moving parts
 - the cables will not chafe or be damaged on sharp edges or corners
 - no pulling or pushing forces are exerted on the cable's connection points (strain relief)
- Installation location → Make sure that the installation location is dry and the pump is protected against rain, splash, hose and drip water.

i The IP protection class of the pump motor is indicated on the type plate.

→ Install the pump at the highest point in the system to prevent condensate from collecting in the pump head.

→ Protect the pump from dust.

→ Protect the pump from exposure to fats and oils.

→ Protect the pump from vibrations and jolts.

Protection against touching and foreign objects



WARNING

Hazard of injuries during operation

- Take protective measures against touching parts connected to electrical power (electrical connection, possibly motor coils).
- Take protective measures against touching moving parts (e.g. fans).
- The pump will restart automatically after the automatic resetting temperature limiter has been triggered.

Hazard of damage to the pump during operation

- Take protective measures against foreign objects which could enter the pump.

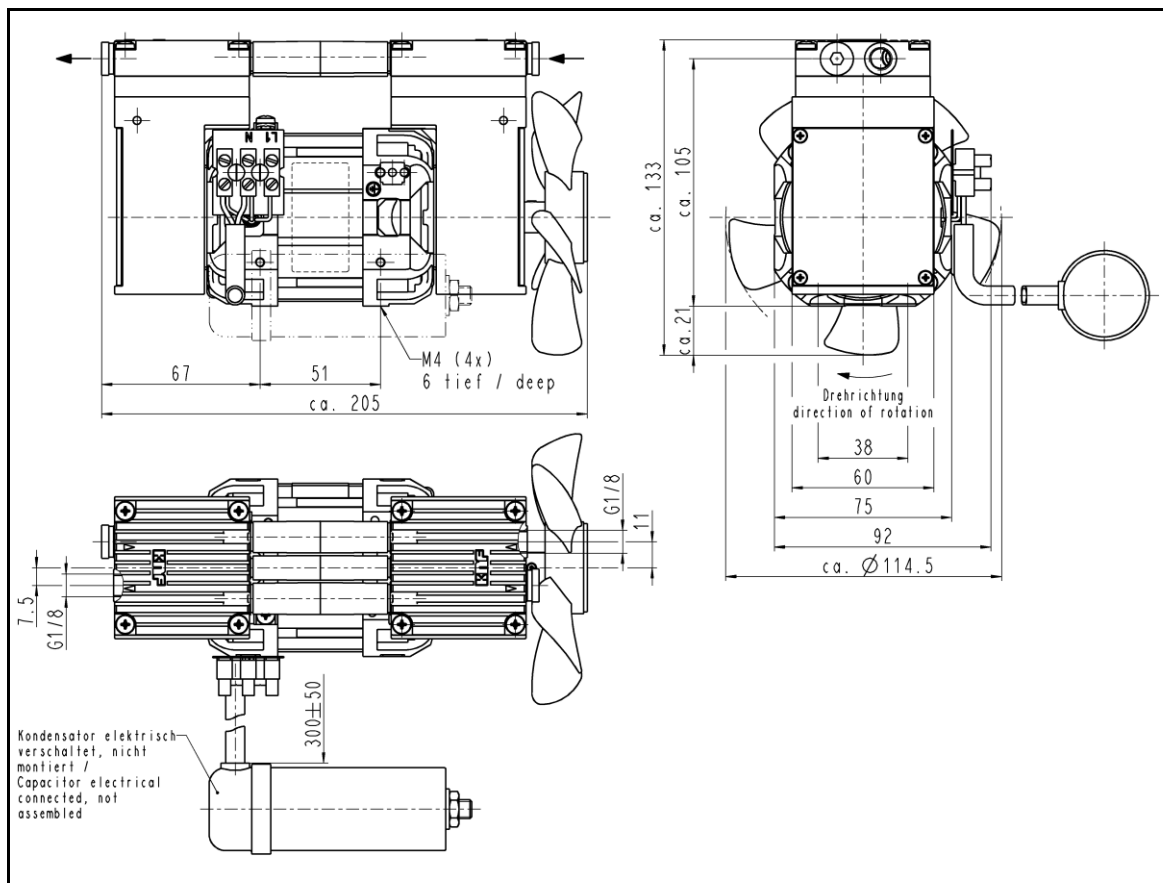


Fig. 3: Mounting dimensions pump N 916.50 KPE
(All dimensional tolerances conform to DIN ISO 2768-1,
Tolerance Class V)

6.2. Electrical connection



Extreme danger from electrical shock

DANGER

- Only have the pump connected by an authorized specialist.
 - Only have the pump connected when the power supply is disconnected.
-
- When connecting the device to a power source, the relevant standards, directives, regulations, and technical standards must be observed.
 - In the electrical installation, arrangements (complying with EN 60335-1) must be made for disconnecting the pump motor from the electrical supply.
 - KNF recommends that a fuse is installed in the motor supply circuit (overcurrent release).
 - It is recommended that an additional “Emergency Stop” switch is installed.
 - The pump must be installed so that contact with live parts is impossible.

Connecting pump

1. Compare the supply data with the data on the motor-plate. For operating current see type plate.

i The voltage must not vary by more than + 10% and - 10% from that shown on the type-plate.

2. Connect the earth (ground) wire to the motor.
3. Connect motor cables:

i The pump N 916.50 KPE is connected electrically by means of a terminal strip.

6.3. Pneumatic connection

- | | |
|----------------------|--|
| Connected components | → Only connect components to the pump which are designed for the pneumatic data of the pump (see chapter 4, Technical data). |
| Pump exhaust | → If the pump is used as a vacuum pump, safely discharge the pump exhaust at the pump's pneumatic outlet. |

Connecting pump

i A marking on the pump head shows the direction of flow.

1. Remove the protective plugs from the hose connection threads.
2. Connect the suction line and pressure line (thread size G 1/8).

i Possible condensate is drained off through the pressure line; for that reason a tank to catch the condensate must be installed in the pressure line.

i Lay the suction and pressure line at a downward angle to prevent condensate from running into the pump.

7. Operation

- Only operate the pumps under the operating parameters and conditions described in chapter 4, Technical data.
- Make sure the pumps are used properly (see chapter 2.1).
- Make sure the pumps are not used improperly (see chapter 2.2).
- Observe the safety precautions (see chapter 3).
- The pumps are intended for installation. Before putting them into service it must be established that machinery or equipment in which they are installed meets the relevant regulations.



WARNING

Hazard of the pump head bursting due to excessive pressure increase

- Do not exceed max. permissible operating pressure (see chapter 4, Technical data).
- Monitor pressure during operation.
- If the pressure exceeds the maximum permissible operating pressure, immediately switch off pump and eliminate fault (see chapter 9. Troubleshooting).
- Only throttle or regulate the air or gas quantity in the suction line to prevent the maximum permissible operating pressure from being exceeded.
- If the air or gas quantity in the pressure line is throttled or regulated, make sure that the maximum permissible operating pressure is not exceeded.
- Ensure that the pump outlet is not closed or constricted.

i Excessive pressure (with all of the related hazards) can be prevented by placing a bypass line with a pressure-relief valve between the pressure and suction sides of the pump. For further information, contact our technical adviser (see last page for telephone number).

- Pump standstill → With the pump at a standstill, open pressure and suction lines to normal atmospheric pressure.



Automatic starting can cause personal injury and pump damage

WARNING

When the operation of the pump is interrupted by the thermal switch, the pump will restart automatically after cooling down.

- Take all necessary care to prevent this leading to a dangerous situation.

Switching pump on

i The pump may not start up against pressure or vacuum during switch-on. This also applies in operation following a brief power failure. If a pump starts against pressure or vacuum, it may block. This activates the thermal switch, and the pump switches off.

- Make sure that no pressure or vacuum is present in the lines during switch-on.

Switching pump off

- KNF recommends that, at the end of an evacuation operation, the pump should be allowed to run for a few minutes with the medium air (or, if necessary for safety reasons, with an inert gas) to remove condensate from the pump heads (drying of the pump).
- Open pressure and suction lines to normal atmospheric pressure.

8. Servicing

8.1. Servicing schedule

Component	Servicing interval
Pump	- Regular inspection for external damage or leaks
Tube connection	- Regular inspection for external damage or leaks
Diaphragm and valve plates	- Replace if pump's pressure or flow rate change without apparent reason - Replace at the latest, when pump output decreases

Tab. 6

8.2. Cleaning

i When cleaning, make sure that no liquids enter the inside of the housing.

8.2.1. Flushing pump

→ Flush the pump under atmospheric conditions some minutes with air (or, if necessary for safety reasons, with an inert gas) prior to switch-off.

8.2.2. Cleaning pump

Conditions ▪ Motor disconnected from mains and de-energized



WARNING

Health hazard due to dangerous substances in the pump!

Depending on the substance transferred, caustic burns or poisoning are possible.

- Wear protective clothing if necessary, e.g. protective gloves.
- Clean pump with suitable measures.



CAUTION

Danger of burns from hot pump parts

The pump head or motor may be hot even after the pump has been shut off.

- Allow the pump to cool off after operation.

- As far as possible, clean the parts with a dry cloth. Solvents should not be used as they can attack the plastics, and synthetic rubber parts.
- If compressed air is available, blow out the components.

8.3. Replacing diaphragm and valve plates

Conditions

- Motor disconnected from mains and de-energized
- Pump is clean and free of dangerous substances
- Tubes/pipes removed from pump's pneumatic inlet and outlet



Danger of burns from hot pump parts

The pump head or motor may be hot even after the pump has been shut off.

CAUTION → Allow the pump to cool off after operation.

- Always replace diaphragm and the valve plates together to maintain the performance and safety of the pump.



Health hazard due to dangerous substances in the pump!

Depending on the substance transferred, caustic burns or poisoning are possible.

WARNING

→ Wear protective clothing if necessary, e.g. protective gloves.

→ Clean pump with suitable measures.

Spare parts

Spare part*	Position**	Quantity
Diaphragm	(8)	2
Valve plate	(2)	6
O-rings	(3)	6

Tab. 7

* according to Spare parts list, chapter 10

** according to Fig. 5

Tools and material

Qty.	Tools/material
1	Phillips screwdriver No. 2
1	small slotted screwdriver
1	Felt-tip pen

Tab. 8

* according to accessories list, chapter 10

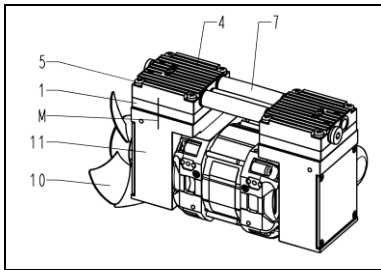


Fig. 4: Pump N 916.50 KPE

Remove pump head

- At both pump heads:
Mark the position of head plate (Fig. 4/4), intermediate plate (1) and pump housing (11) relative to each other by a drawing line (M) with a felt-tip pen. This helps avoid incorrect assembly later.
- At both pump heads:
Undo the four screws (5) in the head plate.
- Remove both pump heads (each consisting of a head plate (4) and intermediate plate (1)) together from the pump housing (11).

i The connecting tubes should remain in place.

Change diaphragm

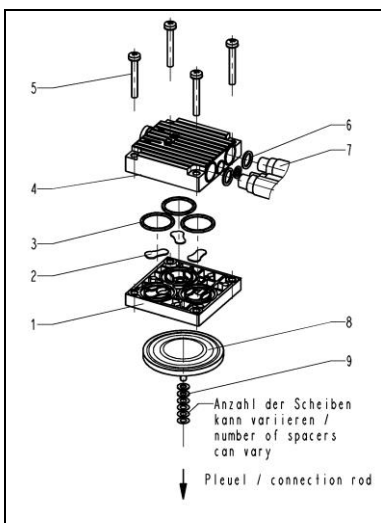


Fig. 5: Pump head (exploded drawing, symbolic)

- Turn the fan (Fig. 4/10) to bring one diaphragm (Fig. 5/8) to top dead centre.
- Lift the edge of the diaphragm (Fig. 5/8) and, gripping it on opposite sides, unscrew it by turning anti-clockwise.
- Take the diaphragm spacers (9) off the threaded portion of the diaphragm and retain them.
- Check that all parts are free from dirt and clean them if necessary (see chapter 8.2.2).
- Put the diaphragm spacers (9) on the thread of the new diaphragm.
- Turn the fan (Fig. 4/10) until the connecting rod (connecting part between motor shaft and diaphragm) is at top dead centre.
- Screw the new diaphragm (Fig. 5/8), complete with diaphragm spacers (9), into the connecting rod (clockwise) and tighten it by hand.
- Carry out steps 1 to 7 for the second pump head.

Change valve plates

- Separate the head plate (4) from the intermediate plate (1).
- Remove the valve plates (2) and the O-rings (3) from the intermediate plate (1).
- Check that the valve seats in the head plate and intermediate plate are clean; if scratches or distortion are evident on these parts they should be replaced.
- Lay in valve plates:

i The valve plates are identical for all valves, as are upper and lower sides of the valve plates.

Lay the new valve plates/sealings (2) in the recesses in the intermediate plate (1).

- Lay the new O-rings (3) in the intermediate plate (1).

6. Place the head plate (4) on the intermediate plate (1), in the position indicated by the marking (Fig. 4/M).
7. Check that the head plate (Fig. 5/4) is centered by moving it gently sideways.
8. Carry out steps 1 to 7 for the second pump head.
9. Dispose of the old diaphragm and valve plates properly.

Refit pump heads

1. Place the two pump heads that are joined by the connecting tube (7) on the housing according to the markings (Fig. 4/M).
2. On both pump heads:
Gently tighten the screws (Fig. 5/5) , evenly and diagonally.
3. Turn the fan (Fig. 4/10) to check that the pump rotates freely.
4. Now tighten at both pump heads screws (Fig. 5/5) diagonally hand-tight.

Final steps

1. Reconnect suction and pressure line to the pump.
2. Reconnect the pump to the electricity supply.

If you have any questions about servicing call out technical adviser (see last page for contact telephone number).

9. Troubleshooting



Extreme danger from electrical shock!

→ Disconnect the pump power supply before working on the pump.

DANGER → Make sure the pump is de-energized and secure.

→ Check the pump (see Tab. 9 and 10)

Pump does not transfer	
Cause	Fault remedy
Thermal switch has operated following to over-heating.	<ul style="list-style-type: none"> → Disconnect pump from mains. → Allow pump to cool. → Trace cause of over-heating and eliminate it.
Connections or lines blocked.	<ul style="list-style-type: none"> → Check connections and lines. → Remove blockage.
External valve is closed or filter is clogged.	<ul style="list-style-type: none"> → Check external valves and filters.
Condensate has collected in pump head.	<ul style="list-style-type: none"> → Detach the condensate source from the pump. → Flush pump (see chapter 8.2.1). → Install the pump at the highest point in the system
Diaphragm or valve plates are worn	<ul style="list-style-type: none"> → Replace diaphragm and valve plates (see chapter 8.3).

Tab. 9

Flow rate, pressure or vacuum too low	
The pump does not achieve the output specified in the Technical data or the data sheet.	
Cause	Fault remedy
Condensate has collected in pump head.	<ul style="list-style-type: none"> → Detach the condensate source from the pump. → Flush pump (see chapter 8.2.1). → Install the pump at the highest point in the system
There is gauge pressure on pressure side and at the same time vacuum or a pressure above atmospheric pressure on suction side.	<ul style="list-style-type: none"> → The pump is not designed for this condition.
The cross section of pneumatic lines, or connected components is too small, or they are restricted.	<ul style="list-style-type: none"> → To measure the performance, disconnect the pump from the system (small diameter tubing or valve can significantly affect performance). → Eliminate throttling (e.g. valve) if necessary. → Use lines or connection parts with larger cross section if necessary.
Leaks occur on connections, lines or pump head.	<ul style="list-style-type: none"> → Eliminate leaks.
Connections or lines completely or partially jammed.	<ul style="list-style-type: none"> → Check connections and lines. → Remove the jamming parts and particles.
Head parts are soiled.	<ul style="list-style-type: none"> → Clean head components.
Diaphragm or valve plates are worn	<ul style="list-style-type: none"> → Replace diaphragm and valve plates (see chapter 8.3).

Tab. 10

Fault cannot be rectified

If you are unable to determine any of the specified causes, send the pump to KNF Customer Service (see last page for the address).

1. Flush the pump under atmospheric conditions some minutes with air (if necessary for safety reasons: with an inert gas) to free the pump head of dangerous or aggressive gases (see chapter 8.2.1).
2. Remove the pump.
3. Clean the pump (see chapter 8.2.2).
4. Send the pump, together with completed Health and Safety Clearance and Decontamination Form, to KNF stating the nature of the transferred medium.

10. Spare parts and accessories

Spare parts

Spare part	Position*	Order No.
Valve plates	(2)	122814
Diaphragm	(8)	121718
O-ring	(3)	001926

Tab. 11

*according to Fig. 5

11. Returns

Prerequisite for repairing a pump by KNF is a completed Decontamination Form.

This is made available on the KNF website as a download. To find the form, select your country on the overview page (www.knf.com). You can find the Decontamination Form in the download area.

If you have questions, please contact your sales partner (contact data: see www.knf.com).

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