Diaphragm Vacuum Pumps

N 816.3 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

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.

<table>
<thead>
<tr>
<th>Signal word</th>
<th>Meaning</th>
<th>Consequences if not observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>DANGER</td>
<td>warns of immediate danger</td>
<td>Death or serious injuries and/or serious damage are the consequence.</td>
</tr>
<tr>
<td>WARNING</td>
<td>warns of possible danger</td>
<td>Death or serious injuries and/or serious damage are possible.</td>
</tr>
<tr>
<td>CAUTION</td>
<td>warns of a possibly dangerous situation</td>
<td>Minor injuries or damage are possible.</td>
</tr>
</tbody>
</table>

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.

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

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.

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

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
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.

Make sure that the personnel has read and understood the Operating and Installation Instructions, and in particular the “Safety” chapter.

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
Be aware that the pumps are not designed to be explosion-proof.

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.

Note that the temperature of the medium increases when the pump compresses the medium.

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).

If necessary, consider any external sources of energy, such as radiation, that may add heat to the medium.

In case of doubt, consult the KNF customer service.

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 (RoHS2).

The following harmonized standards have been used:
- DIN EN 55014-1/2
- DIN EN 61000-3-2/3
- DIN EN 50581
- DIN EN 60335-1

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

<table>
<thead>
<tr>
<th>Assembly</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump head</td>
<td>PPS</td>
</tr>
<tr>
<td>Diaphragm</td>
<td>EPDM</td>
</tr>
<tr>
<td>Valve plates/sealings</td>
<td>EPDM</td>
</tr>
</tbody>
</table>

Tab. 2

Pneumatic performance

N 816.3 KPE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. permissible operating pressure [bar g]</td>
<td>0,5</td>
</tr>
<tr>
<td>Ultimate vacuum [mbar abs.]</td>
<td>15</td>
</tr>
<tr>
<td>Delivery rate at atm. pressure [l/min]*</td>
<td>16</td>
</tr>
</tbody>
</table>

Tab. 3  * Liters in standard state (1013 mbar)

N 816.6 KPE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. permissible operating pressure [bar g]</td>
<td>0,5</td>
</tr>
<tr>
<td>Ultimate vacuum [mbar abs.]</td>
<td>10</td>
</tr>
<tr>
<td>Delivery rate at atm. pressure [l/min]*</td>
<td>28</td>
</tr>
</tbody>
</table>

Tab. 4  * Liters in standard state (1013 mbar)

Pneumatic Connections

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N 816.3 KPE</td>
<td>Thread size G 1/8</td>
</tr>
<tr>
<td>N 816.6 KPE</td>
<td>for hose ID 6mm</td>
</tr>
</tbody>
</table>

Tab. 5

Electrical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical data</td>
<td>see type label</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP00</td>
</tr>
</tbody>
</table>

Tab. 6

Thermal-switch  The pumps are fitted as standard with a thermal-switch to protect against overloading.
Diaphragm Vacuum Pumps N 816.3 KPE and N 816.6 KPE

Technical Data

Weight

<table>
<thead>
<tr>
<th>Pump type</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N 816.3 KPE</td>
<td>approx. 3.0</td>
</tr>
<tr>
<td>N 816.6 KPE</td>
<td>approx. 3.15</td>
</tr>
</tbody>
</table>

Tab. 7

Other parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permissible ambient temperature</td>
<td>+ 5 °C to + 40 °C</td>
</tr>
<tr>
<td>Permissible media temperature</td>
<td>+ 5 °C to + 40 °C</td>
</tr>
<tr>
<td>Dimensions N 816.3 KPE: L x H x W [mm]</td>
<td>approx. 202 x 133 x 114.5</td>
</tr>
<tr>
<td>Dimensions N 816.6 KPE: L x H x W [mm]</td>
<td>approx. 247 x 109 x 145</td>
</tr>
<tr>
<td>Maximum permissible ambient relative humidity</td>
<td>80 % for temperatures up to 31 °C, decreasing linearly to 50 % at 40 °C</td>
</tr>
<tr>
<td>Max. altitude of site [m above sea level]</td>
<td>2000</td>
</tr>
</tbody>
</table>

Tab. 8
5. Design and Function

Design N 816.3 KPE

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 816.3 KPE

Design N 816.6 KPE

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

Fig. 2: Diaphragm Vacuum Pump N 816.6 KPE
Function Diaphragm Pump

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 transfer chamber (3) is hermetically separated from the pump drive (7) by the diaphragm.
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. 4, p. 11 (pump N 816.3 KPE) and Fig. 5, p. 12 (pump N 816.6 KPE).

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.

For pump N816.3 KPE:

In order to drain off possible condensate successfully, KNF recommends that pumps are installed in oblique position (with the suction line in higher position than the pressure line; for flow direction see the markings on the pump heads).

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.

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.

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**Fig. 4: Mounting dimensions pump N 816.3 KPE**

(All dimensional tolerances conform to DIN ISO 2768-1, Tolerance Class V)
Fig. 5: Mounting dimensions pump N 816.6 KPE
(All dimensional tolerances conform to DIN ISO 2768-1,
Tolerance Class V)
6.2. Electrical connection

**DANGER**

- Extreme danger from electrical shock
- 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.
   - 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:
   - The pump N816.3 KPE is connected electrically by means of a terminal strip. The pump N816.6 KPE is connected using a three-pole tab terminal (one 6.3 x 0.8-plug each for L1, N and ground).
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**
- A marking on the pump head shows the direction of flow.

4. For pump N816.3 KPE:
   - Remove the protective plugs from the hose connection threads.
   - For pump N816.6 KPE:
     - Remove the protective plugs from the hose connectors of the pressure and suction side.

5. For pump N816.3 KPE:
   - Connect the suction line and pressure line (thread size G 1/8).
   - For pump N816.6 KPE:
     - Connect the suction line to head 1 (see Fig. 2/6) and the pressure line to head 3 (Fig. 2/1) (tube inner diameter 6 mm).

- 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.

- 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.

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**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.

**WARNING**

Automatic starting can cause personal injury and pump damage

➔ 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

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 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

<table>
<thead>
<tr>
<th>Component</th>
<th>Servicing interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump</td>
<td>Regular inspection for external damage or leaks</td>
</tr>
<tr>
<td>Tube connection</td>
<td>Regular inspection for external damage or leaks</td>
</tr>
<tr>
<td>Diaphragm and valve plates/sealings</td>
<td>Replace if pump's pressure or flow rate change without apparent reason</td>
</tr>
<tr>
<td></td>
<td>Replace at the latest, when pump output decreases</td>
</tr>
</tbody>
</table>

Tab. 9

8.2. Cleaning

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

Health hazard due to dangerous substances in the pump!

**WARNING**

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/sealings

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

<table>
<thead>
<tr>
<th>Conditions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger of burns from hot pump parts</td>
<td></td>
</tr>
<tr>
<td>The pump head or motor may be hot even after the pump has been shut off.</td>
<td></td>
</tr>
<tr>
<td>CAUTION</td>
<td></td>
</tr>
<tr>
<td>➞ Allow the pump to cool off after operation.</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Conditions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Health hazard due to dangerous substances in the pump!</td>
<td></td>
</tr>
<tr>
<td>Depending on the substance transferred, caustic burns or poisoning are possible.</td>
<td></td>
</tr>
<tr>
<td>➞ Wear protective clothing if necessary, e.g. protective gloves.</td>
<td></td>
</tr>
<tr>
<td>➞ Clean pump with suitable measures.</td>
<td></td>
</tr>
</tbody>
</table>

8.3.1. N 816.3 KPE

<table>
<thead>
<tr>
<th>Spare part*</th>
<th>Position**</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diaphragm</td>
<td>(12)</td>
<td>2</td>
</tr>
<tr>
<td>Valve plate/sealing</td>
<td>(2)</td>
<td>4</td>
</tr>
</tbody>
</table>

Tab. 10 * according to Spare parts list, chapter 10 ** according to Fig. 7

<table>
<thead>
<tr>
<th>Tools and material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qty.</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

Tab. 11 * according to accessories list, chapter 10
Remove pump head

1. At both pump heads:
   - Mark the position of head plate (Fig. 6/3), intermediate plate (1) and pump housing (15) relative to each other by a drawing line (M) with a felt-tip pen. This helps avoid incorrect assembly later.

2. At both pump heads:
   - Undo the four screws (4) in the head plate.

3. Remove both pump heads (each consisting of a head plate (3) and intermediate plate (1)) together from the pump housing (15).
   - The connecting tube should remain in place.

Change diaphragm

1. Turn the fan (Fig. 6/14) to bring one diaphragm (Fig. 7/12) to top dead centre.

2. Lift the edge of the diaphragm (Fig. 7/12) and, gripping it on opposite sides, unscrew it by turning anti-clockwise.

3. Take the diaphragm spacers (13) off the threaded portion of the diaphragm and retain them.

4. Check that all parts are free from dirt and clean them if necessary (see chapter 8.2.2).

5. Put the diaphragm spacers (13) on the thread of the new diaphragm.

6. Turn the fan (Fig. 6/14) until the connecting rod (connecting part between motor shaft and diaphragm) is at top dead centre.

7. Screw the new diaphragm (Fig. 7/12), complete with diaphragm spacers (13), into the connecting rod (clockwise) and tighten it by hand.

8. Carry out steps 1 to 7 for the second pump head.

Change valve plates/sealings

1. Pull the connecting tube (11) out of one of the two head plates (3); take care to ensure that the sealing (9) is not lost.

2. Use a small screwdriver to remove the two screw caps (5) on the pump head and undo the screws (6).

3. Separate the head plate (3) from the intermediate plate (1).

4. Remove the valve plates/sealings (2) from the intermediate plate (1).

5. 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.

6. Lay in valve plates/sealings:
   - The valve plates/sealings for suction and pressure sides are identical, as are upper and lower sides of the valve plates/sealings.
Lay the new valve plates/sealings (2) in the recesses in the intermediate plate (1).

7. Check that the hole of the valve plates/sealings (2) is centred on the centering pin of intermediate plate (1) by moving them gently sideways.

8. Place the head plate (3) on the intermediate plate (1), in the position indicated by the marking (Fig. 6/M).

9. Check that the head plate (Fig. 7/3) is centred by moving it gently sideways.

10. Join the head plate (3) and the intermediate plate (1) by tightening the two screws (6) (hand-tight).

For placement of disk spring (7) and washer (8) and for orientation of disk spring see Fig. 8.

11. Install the screw caps (5).

12. Carry out steps 2 to 11 for the second pump head.

13. Dispose of the old diaphragm and valve plates/sealings properly.

Refit pump heads

1. Put the sealing (9) into the head plate (3); push the connecting tube (11) into the hole in the head plate (3).

Ensure that the O-ring (10) lies on the end of the connecting tube.

2. Place the two pump heads that are joined by the connecting tube (11) on the housing according to the markings (Fig. 6/M).

3. On both pump heads:
   Gently tighten the screws (Fig. 7/4) , evenly and diagonally.

4. Turn the fan (Fig. 6/14) to check that the pump rotates freely.

5. Now tighten at both pump heads screws (Fig. 7/4) 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).
### 8.3.2. N 816.6 KPE

#### Spare parts

<table>
<thead>
<tr>
<th>Spare part*</th>
<th>Position**</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diaphragm</td>
<td>(12)</td>
<td>3</td>
</tr>
<tr>
<td>Valve plate/sealing</td>
<td>(2)</td>
<td>6</td>
</tr>
</tbody>
</table>

*according to Spare parts list, chapter 10

**according to Fig. 10

#### Tools and material

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Tool/material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Phillips screwdriver No. 2</td>
</tr>
<tr>
<td>1</td>
<td>small slotted screwdriver</td>
</tr>
<tr>
<td>1</td>
<td>Felt-tip pen</td>
</tr>
</tbody>
</table>

*aaccording to accessories list, chapter 10

#### A) Pump heads 1 and 2

**Remove pump heads**

1. Remove the pneumatic connection (Fig. 9/18) between pump head 1 and pump head 3 from the hose connector of pump head 3.

2. At pump heads 1 and 2:
   Mark the position of head plate (3), intermediate plate (1) and housing (15) relative to each other by a drawing line (M) with a felt-tip pen. This helps avoid incorrect assembly later.

3. At both pump heads:
   Undo the four screws (4) in the head plate (3).

4. Remove both pump heads (each consisting of a head plate (3) and intermediate plate (1)) together from the pump housing (15).

   The pneumatic connections (16) and (17) should remain in place.

**Change diaphragm**

1. Turn the fan (Fig. 9/14) to bring one diaphragm (Fig. 10/12) to top dead centre.

2. Lift the edge of the diaphragm (12) and, gripping it on opposite sides, unscrew it by turning anti-clockwise.

3. Take the diaphragm spacers (13) off the threaded portion of the diaphragm and retain them.

4. Check that all parts are free from dirt and clean them if necessary (see chapter 8.2.2).

5. Put the diaphragm spacers (13) on the thread of the new diaphragm.

6. Turn the fan (Fig. 9/14) until the connecting rod (connecting part between motor shaft and diaphragm) is at top dead centre.
7. Screw the new diaphragm (Fig. 10/12), complete with diaphragm spacers (13), into the connecting rod (clockwise) and tighten it by hand.

8. Carry out steps 1 to 7 for the second pump head.

**Change valve plates/sealings**

1. Use a small screwdriver to remove the two screw caps (5) on the pump head and the undo the screws (6).

2. Separate the head plate (3) from the intermediate plate (1).

3. Remove the valve plates/sealings (2) from the intermediate plate (1).

4. 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.

5. Lay in valve plates/sealings:

   The valve plates/sealings for suction and pressure sides are identical, as are upper and lower sides of the valve plates/sealings.

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

6. Check that the hole of the valve plates/sealings (2) is centred on the centering pin of intermediate plate (1) by moving them gently sideways.

7. Place the head plate (3) on the intermediate plate (1), in the position indicated by the marking (M).

8. Check that the head plate (3) is centred by moving it gently sideways.

9. Join the head plate (3) and the intermediate plate (1) by tightening the two screws (6) (hand-tight).

   For placement of disk spring (7) and washer (8) and for orientation of disk spring see Fig. 11.

10. Install the screw caps (5).

11. Carry out steps 1 to 10 for the second pump head.

12. Dispose of the old diaphragm and valve plates/sealings properly.

**Refit pump heads**

1. Place the two pump heads that are joined by the connecting hose (16) on the housing according to the markings (M).

2. On both pump heads:
   
   Gently tighten the screws (4), evenly and diagonally.

3. Turn the fan (14) to check that the pump rotates freely.

4. Now tighten at both pump heads screws (4) diagonally hand-tight.
B) Pump head 3

Remove pump head
1. Mark the position of head plate (3), intermediate plate (1) and housing (15) relative to each other by a drawing line (M) with a felt-tip pen. This helps avoid incorrect assembly later.
2. Undo the four screws (4) in the head plate.
3. Remove the pump head from the pump housing (15).

Change diaphragm
1. Turn the fan (14) to bring one diaphragm (12) to top dead centre.
2. Lift the edge of the diaphragm (12) and, gripping it on opposite sides, unscrew it by turning it anti-clockwise.
3. Take the diaphragm spacers (13) off the threaded portion of the structured diaphragm and retain them.
4. Check that all parts are free from dirt and clean them if necessary (see chapter 8.2.2.).
5. Put the diaphragm spacers (13) on the thread of the new diaphragm.
6. Turn the fan (14) until the connecting rod (connecting part between motor shaft and diaphragm) is at top dead centre.
7. Screw the new diaphragm (12), complete with diaphragm spacers (13), into the connecting rod (clockwise) and tighten it by hand.

Change valve plates/sealings
1. Use a small screwdriver to undo the two screw caps (5) on the pump head and then undo the screws (6).
2. Separate the head plate (3) from intermediate plate (1).
3. Remove the valve plates/sealings (2) from the intermediate plate (1).
4. Check that the valve seats in the head plate and intermediate plate are clean; if scratches or distortion are evident an these parts they should be replaced.
5. Lay in the valve plates/sealings:
   - The valve plates/sealings for suction and pressure sides are identical, as are upper and lower sides of the valve plates/sealings.
   - Lay the new valve plates/sealings (2) in the recesses in the intermediate plate (1).
6. Check that the hole of the valve plates/sealings (2) is centred on the centering pin of intermediate plate (1) by moving them gently sideways.

7. Place the head plate (3) on the intermediate plate (1), in the position indicated by the marking (M).

8. Check that the head plate (3) is centred by moving it gently sideways.

9. Join the head plate (3) and the intermediate plate (1) by tightening the two screws (6) (hand-tight).

For placement of disk spring (7) and washer (8) and for orientation of disk spring see Fig. 13.

10. Install the screw caps (5).

11. Dispose of the old diaphragms and valve plates/sealings properly.

**Refit pump head**

1. Place the pump head on the housing according to the marking (M).

2. Gently tighten the screws (4), evenly and diagonally.

3. Turn the fan (14) to check that the pump rotates freely.

4. Now tighten the screws (4) on both pump heads diagonally hand-tight.

5. Slide the pneumatic connection (18) onto the hose connector of pump head 3.

**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

**DANGER**

- Disconnect the pump power supply before working on the pump.
- Make sure the pump is de-energized and secure.

- Check the pump (see Tab. 14 and 15)

### Pump does not transfer

<table>
<thead>
<tr>
<th>Cause</th>
<th>Fault remedy</th>
</tr>
</thead>
</table>
| Thermal switch has operated following to over-heating. | ➞ Disconnect pump from mains.  
➤ Allow pump to cool.  
➤ Trace cause of over-heating and eliminate it. |
| Connections or lines blocked.              | ➞ Check connections and lines.  
➤ Remove blockage.                         |
| External valve is closed or filter is clogged. | ➞ Check external valves and filters.                                        |
| Condensate has collected in pump head.     | ➞ Detach the condensate source from the pump.  
➤ Flush pump (see chapter 8.2.1).  
➤ Install the pump at the highest point in the system  
➤ N816.3 KPE:  
➤ Install the pump in an oblique position (see chapter 6.1 Installation of the pump), so that the condensate can drain away better. |
| Diaphragm or valve plates/sealings are worn | ➞ Replace diaphragm and valve plates/sealings (see chapter 8.3). |

*Tab. 14*

### Flow rate, pressure or vacuum too low

The pump does not achieve the output specified in the Technical data or the data sheet.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Fault remedy</th>
</tr>
</thead>
</table>
| Condensate has collected in pump head.     | ➞ Detach the condensate source from the pump.  
➤ Flush pump (see chapter 8.2.1).  
➤ Install the pump at the highest point in the system  
➤ N816.3 KPE:  
➤ Install the pump in an oblique position (see chapter 6.1 Installation of the pump), so that the condensate can drain away better. |
| There is gauge pressure on pressure side and at the same time vacuum or a pressure above atmospheric pressure on suction side. | ➞ The pump is not designed for this condition. |
| The cross section of pneumatic lines, or connected components is too small, or they are restricted. | ➞ 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. | ➞ Eliminate leaks. |
Flow rate, pressure or vacuum too low
The pump does not achieve the output specified in the Technical data or the data sheet.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Fault remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connections or lines completely or partially jammed.</td>
<td>➔ Check connections and lines. ➔ Remove the jamming parts and particles.</td>
</tr>
<tr>
<td>Head parts are soiled.</td>
<td>➔ Clean head components.</td>
</tr>
<tr>
<td>Diaphragm or valve plates/sealings are worn</td>
<td>➔ Replace diaphragm and valve plates/sealings (see chapter 8.3).</td>
</tr>
</tbody>
</table>

Tab. 15

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 to KNF with a filled out decontamination declaration (see chapter 11) and specification of the medium transferred.
10. Spare parts and accessories

**Spare parts**

<table>
<thead>
<tr>
<th>Spare part</th>
<th>Position*</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve plates/sealing</td>
<td>(2)</td>
<td>059267</td>
</tr>
<tr>
<td>Diaphragm</td>
<td>(12)</td>
<td>052066</td>
</tr>
<tr>
<td>Sealing**</td>
<td>(9)</td>
<td>048411</td>
</tr>
<tr>
<td>O-ring**</td>
<td>(10)</td>
<td>048416</td>
</tr>
</tbody>
</table>

*Tab. 16*  
*according to Fig. 8 and 11*  
**only for pump type N816.3 KPE**
11. Returns

Pumps and systems used in laboratories and process-based industries are exposed to a wide variety of conditions. This means that the components contacting pumped media could become contaminated by toxic, radioactive, or otherwise hazardous substances.

For this reason, customers who send any pumps or systems back to KNF must submit a Health and safety clearance and decontamination form in order to avoid a hazardous situation for KNF employees. This Health and safety clearance and decontamination form provides the following information, among other things:

- physiological safety
- whether medium-contacting parts have been cleaned
- whether the equipment has been decontaminated
- media that have been pumped or used

To ensure worker safety, work may not be started on pumps or systems without a signed Health and safety clearance and decontamination form.

For optimal processing of a return, a copy of this declaration should be sent in advance via e-mail, regular mail, or fax to KNF Customer Service (refer to final page for address). In order to avoid endangering employees who open the shipment's packaging, despite any residual hazards, the original version of the Health and safety clearance and decontamination form must accompany the delivery receipt on the outside of the packing.

The template for the Health and safety clearance and decontamination form is included with these Operating Instructions and may also be downloaded from the KNF website.

The customer must specify the device type(s) and serial number(s) in the Health and safety clearance and decontamination form in order to provide for the unambiguous assignment of the Declaration to the device that is sent to KNF.

In addition to the customer's declaration of physiological safety, information about operating conditions and the customer's application are also of importance to ensure that the return shipment is handled appropriately. Therefore, the Health and safety clearance and decontamination form requests this information as well.
12. Health and safety clearance and decontamination form

Health and safety clearance and decontamination form

This declaration must be present and complete (the original must accompany the shipment’s delivery receipt) before the returned device can be examined.

Device type: ...............................................................................................................

Serial number(s): .......................................................................................................

 .................................................................................................................................

Reason for returning the device (please describe in detail):

(The device(s) was(were) in operation □ yes □ no)

 .................................................................................................................................

 .................................................................................................................................

 .................................................................................................................................

 .................................................................................................................................

 .................................................................................................................................

 .................................................................................................................................

 .................................................................................................................................

We confirm that the above device(s)

☐ has(have) pumped exclusively physiologically unobjectionable media and that it(they) are free of hazardous materials and any materials that are harmful to health.

Pumped media: ............................................................................................................

The device(s) was(were) cleaned □ yes □ no

☐ has(have) pumped media of the following category(categories) which are not physiologically objectionable and that cleaning of the device(s) (potentially only media-contacting parts) is required.

☐ aggressive .............................................................................................................

☐ biological .............................................................................................................

☐ radioactive ..........................................................................................................

☐ toxic ....................................................................................................................

☐ other ...................................................................................................................

The device(s) was(were) decontaminated and work can proceed without special measures □ yes

Method / proof: ...........................................................................................................

 .................................................................................................................................

 .................................................................................................................................

 .................................................................................................................................

 .................................................................................................................................

 .................................................................................................................................

 .................................................................................................................................

The device(s) was(were) not decontaminated and special measures are required before starting work □ yes

Measures: ............................................................................................................... 

 .................................................................................................................................

 .................................................................................................................................

 .................................................................................................................................

 .................................................................................................................................

 .................................................................................................................................

 .................................................................................................................................

 Legally binding declaration

We herewith affirm that the information provided in this form is correct and complete. Shipment of the devices and components is in compliance with statutory regulations.

..........................................................................................................................................

Company (stamp) Date Name Authorized signature Position