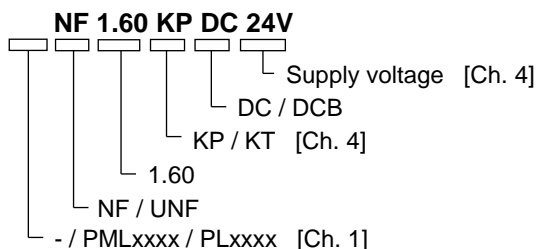


# DIAPHRAGM LIQUID PUMP

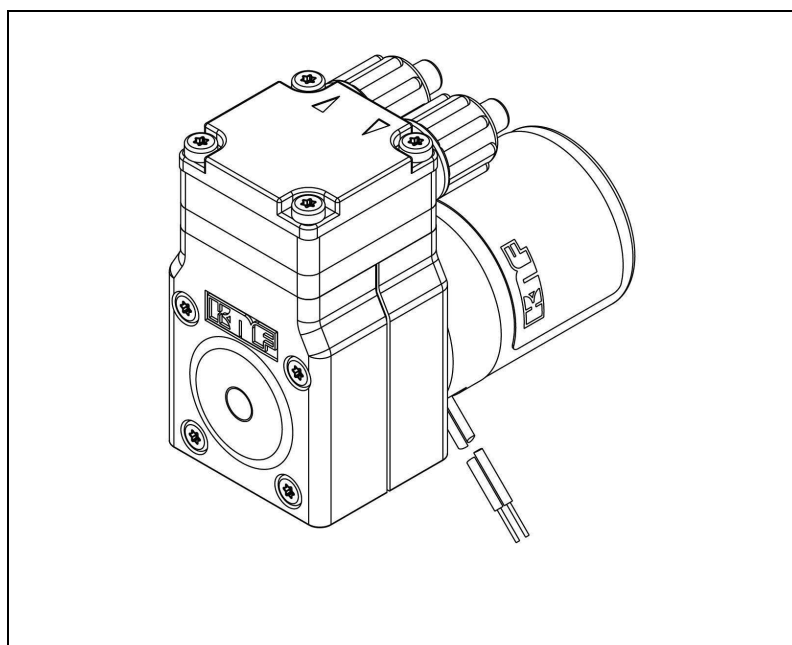
## NF 1.60



### Operating and Installation Instructions

Read and observe these operating and installation instructions!

An additional letter prefixing the NF model code is a country-specific designation, with no technical relevance.



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## 1. About this document

### 1.1. Use of 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 "PL" or "PML") may differ from the operating and installation instructions.

- ➔ In the case of project pumps, take note of any additionally agreed specifications.

### 1.2. Symbols and markings

#### Warning



**WARNING**

This symbol indicates a potential danger.

It also indicates the possible consequences of failure to observe the warning. The signal word (i.e. "Warning") indicates the level of danger.

- ➔ This specifies measures for avoiding the danger and the consequences of failure to implement these measures.

#### Danger levels

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

Tab. 1

#### Other information and symbols

- ➔ This indicates an activity (step) that needs to be carried out.
- 1. This indicates the first step of an activity to be carried out. Any additional steps required are consecutively numbered.

**i** This symbol indicates important information.

## 2. Use

### 2.1. Intended use

The pumps are intended for transferring and metering liquids.

#### 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. Pumps must only be operated when fully assembled.
Requirements for transferred medium	Before transferring or metering a medium, check that it can be transferred without risk in the specific application case. Before using a medium, check the compatibility of the materials of the pump head, pump housing, diaphragm and valves with the pumped medium. The temperature of the medium must lie within the permissible temperature range (see Chapter 4). The pumped medium should not contain particles as these can prevent the pump from working correctly. If this cannot be guaranteed, a filter < 100 µm with sufficiently large filter area must be used upstream of the pump.

### 2.2. Improper use

The pumps must not be operated in an explosive atmosphere. For special modifications outside the standard technical specifications please contact a KNF pump specialist.

### 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 pertinent 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 in perfect working order and in accordance with their intended use. Always ensure adherence to the operating and installation instructions and work in a safety-conscious manner.

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 all personnel have read and understood the operating and installation instructions, and in particular the "Safety" chapter.</p>
Working in a safety-conscious manner	<p>Always ensure adherence to all pertinent accident prevention and safety regulations when working on and operating the pump.</p>
Handling dangerous media	<p>When pumping dangerous media, observe the safety regulations for handling such media.</p>
Notes	<p>Always ensure adherence to all information stickers on the pumps, such as flow direction arrows and type plates, and keep stickers in legible condition.</p>
Environmental protection	<p>All replacement parts should be properly stored and disposed of in accordance with the applicable environmental protection regulations. Ensure adherence to the pertinent national and international regulations. This especially applies to parts contaminated with toxic substances.</p>
Disposal	<p>Dispose of all packaging in an environmentally appropriate manner. The packaging materials are recyclable.</p> <p>Ensure that the pump is disposed of in an environmentally appropriate manner at the end of its useful life. Use appropriate waste collection systems for the disposal of end-of-life equipment. Used pumps contain valuable recyclable materials.</p>



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EU directives/standards	<p>The pumps are in accordance with the requirements of the guidelines 2011/65/EU (ROHS2)</p> <p>The pumps conform to the safety requirements regarding electromagnetic compatibility in EC Directive 2004/108/EC.</p> <p>Under Machinery Directive 2006/42/EC, pumps are partly completed machinery, and as such should not be regarded as ready for use. The partly completed machinery must not be put into service until the final machinery into which it is to be installed has been declared to be in conformity with the provisions of this Directive. Always ensure implementation and enforcement of the basic requirements of the Machinery Directive 2006/42/EC according to Appendix I (General Principles).</p> <p>The following harmonised standards are met:</p> <p><b>NF 1.60 DCB</b></p> <ul style="list-style-type: none"><li>▪ EN 55014-1</li><li>▪ EN 61000-6-3</li><li>▪ EN 61000-6-1</li><li>▪ EN 55014-2</li></ul> <p><b>NF 1.60 DC</b></p> <ul style="list-style-type: none"><li>▪ EN 55011</li></ul>
Customer service and repairs	<p>All repairs to the pump(s) must be carried out by the relevant KNF Customer Service team.</p> <p>Only use KNF original parts for all maintenance work.</p>

## 4. Technical data

### Pump materials

The pump type **KP** stands for:

Assembly	Material <sup>1)</sup>
Pump head *	PP
Valves	EPDM
O-rings	EPDM
Diaphragm	EPDM
Resonating diaphragm	PTFE

Tab. 2 <sup>1)</sup> according to DIN ISO 1629 and 1043.1

The pump type **KT** stands for:

Assembly	Material <sup>1)</sup>
Pump head *	PP
Valves	FFKM
O-ring	FFKM
Diaphragm	PTFE-coated
Resonating diaphragm	PTFE

Tab. 3 <sup>1)</sup> according to DIN ISO 1629 and 1043.1

\* Pump head (Fig. 1) comprises an intermediate plate and a connecting plate

### Hydraulic ratings

Parameter <sup>3)</sup>	Value
Flow rate [l/min] <sup>1), 2)</sup>	≥ 0.65
Permissible pressure [bar g]	6
Suction head [mWG]	3
Max. inlet pressure [mWG]	3

Tab. 4

<sup>1)</sup> Measured with water at 20°C / at atmospheric pressure

<sup>2)</sup> Flow rates may vary from the values shown, depending on fluid viscosity, pump head material and the hoses / hose connectors used.

<sup>3)</sup> For special modifications outside the standard technical specifications please contact a KNF pump specialist.

### Hydraulic connections

Parameter	Value
Hose connection NF ID / AD [mm]	4 - 6
Hose connection UNF ID / AD [Inch]	1/8" - 1/4"

Tab. 5

**Specifications NF 1.60 DCB**

Motor voltage	12V	24V
Power consumption [W]	7.5	
Max. I load [A]	0.65	0.35
Max. permissible current consumption [A]	1.1	0.57
Lead size [-]	AWG24	
Protection class [-]	IP54 (motor/housing only on request)	
Weight <sup>1)</sup> [g]	210	

Tab. 6

**Specifications NF 1.60 DC**

Motor voltage	12V	24V
Power consumption [W]	10	
Max. I load [A]	0.8	0.4
Max. permissible current consumption [A]	1.4	0.71
Protection class [-]	IP00	
Weight <sup>1)</sup> [g]	340	

Tab. 7

<sup>1)</sup> The weight may differ slightly from the stated value, depending on the version.

**i** Electrostatic sensitive components (ESD)

**Other parameters**

Parameter	Value
Permissible ambient temperature range [°C]	+ 5 to + 40
Permissible media temperature range [°C]	+ 5 to + 80
Permissible kinematic viscosity of the media [cSt]	≤ 150

Tab. 8

## 5. Assembly and function

### Assembly

- 1 Outlet
- 2 Inlet
- 3 Head plate
- 4 Connecting plate
- 5 Intermediate plate
- 6 Motor

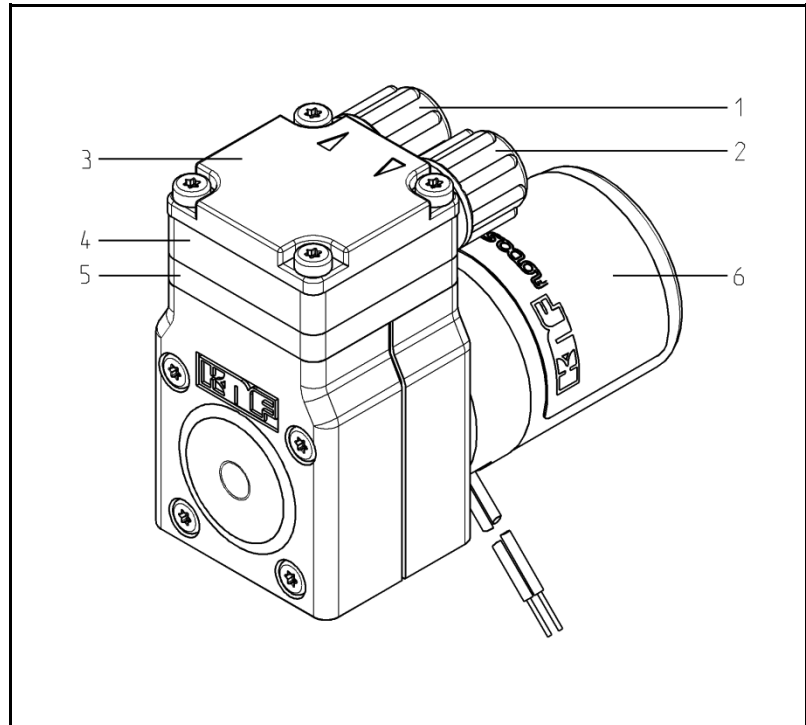


Fig. 1: Diaphragm liquid pump NF 1.60

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

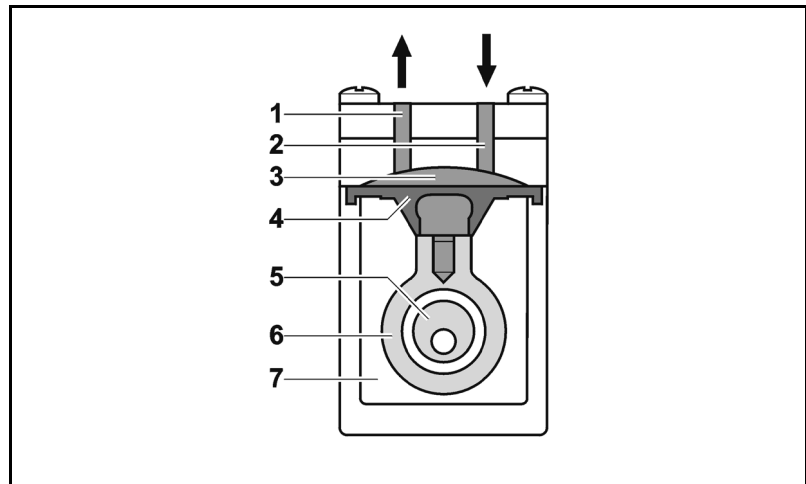


Fig. 2: Operating principle

Micro-diaphragm liquid pumps are based on reciprocating displacement pump technology. An elastic diaphragm (4) is moved up and down by the eccentric (5) and the connecting rod (6). During the down stroke, the diaphragm sucks in the medium through the inlet valve (2). During the up stroke, it forces medium out of the pump head through the exhaust valve (1). The diaphragm hermetically seals off the working chamber (3) from the pump drive (7).

#### NF 1.60 version (specified flow rate)

This pump type represents this product in its simplest form and delivers media at the specified flow rate.



## 6. Installation and connection

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

Observe the safety notes (see Chapter 3).

### 6.1. Installation

→ Before installation, store the pump at the installation location to bring it up to ambient temperature.

Mounting dimensions

→ Mounting dimensions (see Fig. 3 and 4)

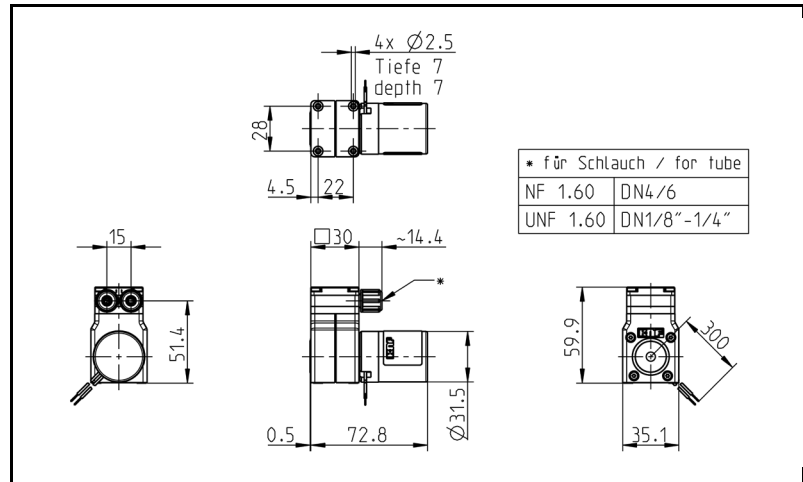


Fig. 3: Mounting dimensions NF 1.60 DCB

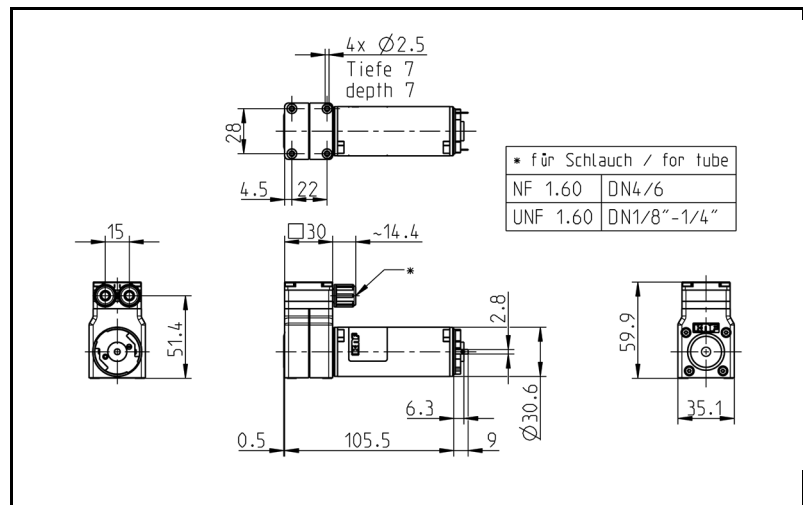


Fig. 4: Mounting dimensions NF 1.60 DC

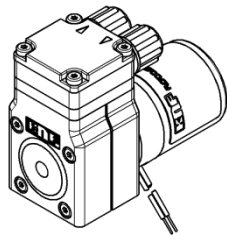


Fig. 5: Optimal mounting orientation

Installation location

→ Make sure that the installation location is dry and the pump is protected against water in the form of rain, spray, splashes and drips.

→ Protect the pump against dust.

→ Protect the pump against vibration and impact.

Mounting orientation

→ The pump can be mounted in any orientation.

→ Generally speaking, the pump can be mounted in any orientation. For maximum precision and rapid venting, install pump as shown in the illustration (Fig. 5).

Decoupling

→ KNF recommends mechanically decoupling the pump from the pipework system, e.g. by using flexible hoses or pipes. This prevents any oscillations of the pump being transferred to the system.

## 6.2. Electrical connection

For pumps with direct current motors:

→ Pump should only be connected by an authorised specialist.

→ Only connect the pump when the power supply is turned off.

→ All electrical connection work must adhere to the pertinent norms, directives, regulations and technical standards.

### Connecting the pump

1. Make sure that the power supply data match the data on the motor type plate. The current consumption can be found on the type plate.

2. Connect the motor cables. For electrical data see Chapter 4.

**i** Always check polarity of cables.

For DC motors:

red motor lead: +

black motor lead: -

In the case of brushless DC motors:

incorrect polarity may damage the electronics.

## 6.3. Hydraulic connection

Connected components

→ Only connect components to the pump that are designed to handle the hydraulic data of the pump (see Chapter 4, Technical data).

Hoses

→ Only use hoses that are suitable for the maximum operating pressure of the pump (see Chapter 4).

→ Only use hoses that are sufficiently chemically resistant to the liquids being pumped.

## 7. Operation

- The pumps should only be used under the operating parameters/conditions described in Chapter 4, Technical data.
- Ensure that the pumps are being used correctly (see Chapter 2.1).
- Improper use of the pumps must be prevented (see Chapter 2.2).
- Observe the safety notes (see Chapter 3).
- Pumps are components intended to be incorporated into another machine. Ensure that the machinery/equipment in which the pumps are installed complies with the pertinent regulations before putting them into service.



Risk of burning  
The drive heats up.

**CAUTION**

- Avoid contact with the pump drive.
- Avoid contact with flammable materials.

- i** Excessive pressures and the dangers thus caused can be prevented by using a bypass system with a pressure relief valve between the pressure and suction side of the pump. Further information is available from your KNF specialist (Telephone number: see first page).

- Pump standstill → If the pump stops running, reduce the pressure in the system until it is at normal atmospheric pressure.

For pumps with thermal switch or electronic overload protection:



**WARNING**

Risk of physical injury and damage to the pump due to automatic start  
If the pump overheats and the thermal switch / electronics stops pump operation, the pumps will restart automatically as soon as they have had time to cool down.

- Take steps to ensure that this cannot produce a hazardous situation.

### Switching the pumps on and off

Adjusting and controlling the motor speed

The motor speed of the pump, and thus the flow rate, is adjustable and can also be regulated to some extent.

For more details, see Chapter 4, Technical data

### Duty cycle / short cycle operation

Impulse operation

KNF pumps are designed for continuous operation.

Short start and stop cycles may adversely affect the service life of the brushed motors.

- i** If the pump is operated with short cycles in your application, please contact a KNF pump specialist for further information (Telephone number: see first page).

**Turning the pump on**

- In order to guarantee that the pump can start every time it is advisable to reduce the back pressure to an acceptable level. This must also be done after a short power cut.

**i** For more specific information contact the KNF specialists.

**Turning the pump off**

- KNF recommends: if pumping aggressive liquids, the pump should be rinsed thoroughly prior to switch off (see Chapter 8.2.1), as this will help to lengthen the service life of the diaphragm.
- Restore the system to normal atmospheric pressure (release hydraulic pressure in pump).

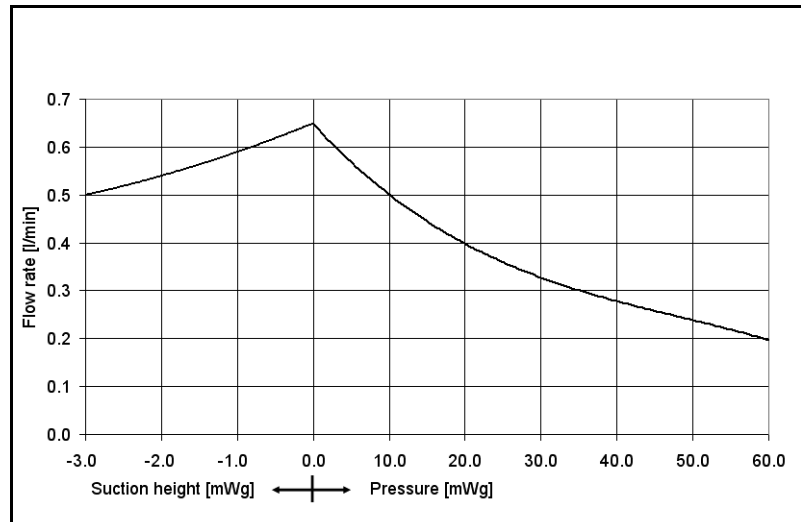
**Flow rate NF 1.60**

Fig. 6: Flow rate of pumps NF 1.60 DCB and NF 1.60 DC

## 8. Servicing

### 8.1. Servicing schedule

Component	Servicing interval
Pump	- Regular inspection for external damage or leaks
Pump head	- Clean if the flow rate decreases, the pump does not work or no vacuum is created (Chapter 8.2)
Diaphragm, valve plates and seals	- Change as soon as pumping capacity decreases, preferably sooner

Tab. 9

### 8.2. Cleaning

Information on procedure



**WARNING**

- Health hazard due to dangerous substances in the pump  
 Depending on the medium pumped, risk of caustic burns or poisoning.
- ➔ Wear protective clothing if necessary, e.g. protective gloves.
  - ➔ Rinse the pump with a neutral liquid and pump empty.

#### 8.2.1. Flushing the pump

- ➔ If pumping aggressive media, KNF recommends flushing the pump with a neutral fluid under atmospheric conditions for a few minutes before switching off, to extend the service life of valves and diaphragm.

#### 8.2.2. Cleaning the pump

- ➔ Where possible, wipe the components with a dry cloth. Do not use cleaning solvents as these may corrode plastic parts.
- ➔ If there is compressed air available, blow off components.

Prior requirements

- Pump or drive must be switched off and disconnected from mains.
- The pump must be free of any hazardous substances.
- Hoses must be disconnected from the pump head.
- We recommend replacing the diaphragm when the head parts are removed.

Tools

Qty.	Tool
1	T10 Torx screwdriver

Tab. 10

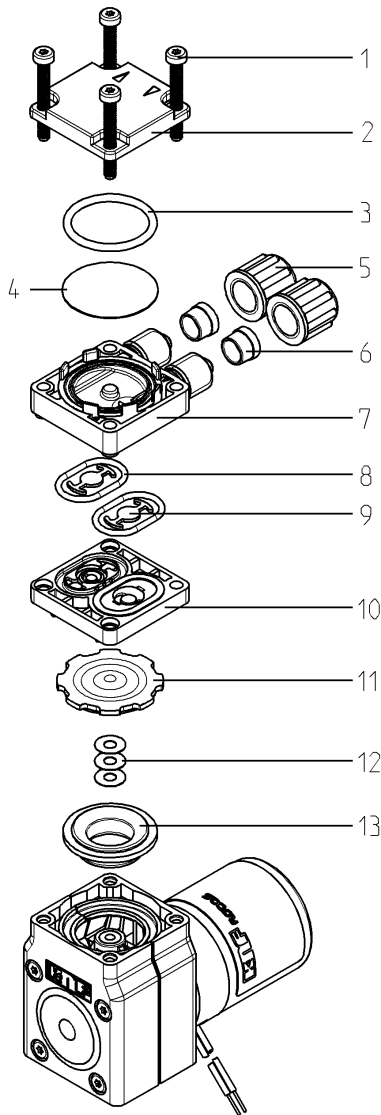


Fig. 7

- 1 Head screws
- 2 Head plate
- 3 Seal
- 4 Resonating diaphragm
- 5 Union nuts
- 6 Clamp ring
- 7 Connecting plate
- 8 Seals
- 9 Anchor valves
- 10 Intermediate plate
- 11 Rolled diaphragm
- 12 Washers
- 13 Insert ring

### Dismantling the pump head

1. Undo the 4 head screws (1) using a Torx T10 screwdriver.
2. Undo the union nut (5) and remove hose. Leave clamp ring (6) on hose.
3. Remove seal (3) and resonating diaphragm (4) from the connecting plate (7).

### Removing the valves and seals

4. Remove both anchor valves (9) from the intermediate plate (10) and the connecting plate (7).
5. Remove both anchor valve seals (8) from the connecting plate (7).
6. Loosen the rolled diaphragm (11) by means of the connecting plate (7). Make sure that no washers (12) fall into the housing.

We recommend replacing the rolled diaphragm (11).

### Cleaning the parts

7. Clean the anchor valves (9), anchor valve seals (8), resonating diaphragm (4) and associated seal (3) and rolled diaphragm (11) with a cloth and then blow off with compressed air.
8. Use compressed air to blow out the intermediate plate (10), connecting plate (7) and head plate (2).

### Mounting the diaphragm

9. Check position of insert ring (13)
10. Screw rolled diaphragm (11) with washers (12) into the connecting rod. Make sure that no washers (12) fall into the housing.
11. Tighten rolled diaphragm carefully using the connecting plate (7).

### Mounting the valves and seals

12. Place the seals (8) and anchor valves (9) into the intermediate plate (10) and the connecting plate (7).

**Mounting the pump head**

13. Insert intermediate plate (10)

CAUTION: Make sure that the orientation is correct so that the connections point in the right direction.

A pin and hole system prevents incorrect assembly.

14. Place the connecting plate (7) on top of the intermediate plate (10).
15. Insert seal (3) and resonating diaphragm (4) in connecting plate (7).
16. Place head plate (2) on connecting plate (7) and secure using the 4 head screws (1).
17. Push hose with clamp ring (6) onto connecting plate (7) and secure with union nut (5).

**8.3. Replacing diaphragm, valves and seals**

Same procedure as in Chapter 8.2, "Cleaning", except that the rolled diaphragm (11), resonating diaphragm (4), anchor valves (9) and seals (8) are replaced rather than cleaned.

## 9. Troubleshooting

Pump does not work	
Cause	Fault remedy
Pump not connected to mains power supply	→ Connect pump to mains supply
Power supply is not switched on	→ Switch on power supply
Thermal switch or pump electronics have tripped	→ Disconnect pump from mains power supply → Allow pump to cool → Identify and eliminate cause of overheating/overload
Connections or pipes are blocked	→ Check pipes and connections → Remove blockage
External valve is closed or filter is blocked	→ Check external valves and filters
Diaphragm, valve plates or seals are worn out	→ Replace diaphragm, valve plates and seals (see Chapter 8.3)

Tab. 11

Pump is not priming	
Cause	Fault remedy
Suction side of pump not connected	→ Connect the suction side of the pump
Liquid in the priming container is too low	→ Fill priming container
Hose connections are not leak-tight	→ Secure transition joints between hose and connections with clamps or other clamping elements
System valve is closed or filter is blocked	→ Open the system valve → Clean filter
Pump head is filled with gas. The system is unable to handle the pressure on the pressure side.	→ Reduce pressure on pressure side
Particles in the pump	→ Clean the pump head (see Chapter 8.2)
The pump parts are not resistant to the medium to be pumped	→ Replace the pump head with a compatible version
Incorrect interchange of outlet and inlet line connections	→ Remove outlet and inlet lines and re-connect correctly

Tab. 12



<b>Flow rate, suction head or pressure head is too low</b>	
The pump does not achieve the performance stated in the Technical Data or on the data sheet.	
Cause	Fault remedy
Components in the system connected to the suction and pressure sides, such as hoses, valves or filters, are causing too much resistance	➔ Modify installation, check cross-sections of components
Hose connections are not leak-tight	➔ Secure transition joints between hose and hose connections with clamps or other clamping elements
Particles in the pump	➔ Clean the pump head, install suction-side filter if required (see Chapter 8.2)
Viscosity of the pumped medium is too high	➔ Contact KNF
Incorrect interchange of outlet and inlet line connections	➔ Remove outlet and inlet lines and re-connect correctly
The pump parts are not resistant to the medium to be pumped	➔ Replace the pump head with a compatible version

Tab. 13

**Fault cannot be rectified**

If you are unable to identify any of the above causes, please send the pump to KNF customer services (see address on last page).

1. Flush the pump to clear the pump head of any hazardous or aggressive fluids (see Chapter 8.2.1).
2. Dismantle the pump.
3. Clean the pump (see Chapter 8.2.2).
4. Send the pump, with completed decontamination declaration (see Chapter 10), to KNF customer services stating the nature of the pumped medium.

### 10. Decontamination declaration

**i** KNF shall only undertake to repair the pump on condition that the customer provides certification of the transferred media and the cleaning of the pump (decontamination declaration).

➔ Copy this page.

Enter the pump model, the Serial No. and the transferred media in the form below and send the signed form together with the flushed and cleaned pump to KNF customer services (see address on last page)

### Customer decontamination declaration for repair order

We confirm that the pump below has been used to pump the following media, and that the pump has been flushed and cleaned.

Pump model	
Serial No.	
Pumped media	

The pump does not contain aggressive, biological, radioactive, poisonous, or other dangerous media.

\_\_\_\_\_ Company

\_\_\_\_\_ Date/Signature



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