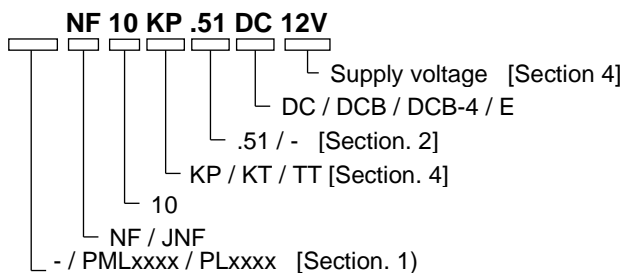


DIAPHRAGM LIQUID PUMP

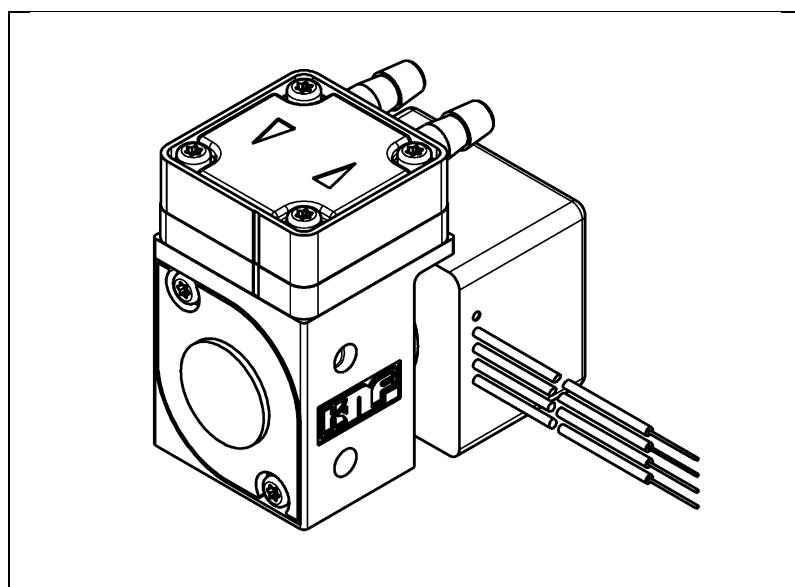
NF 10



Operating Instructions

Read and observe these operating instructions!

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



KNF Flodos AG
 Wassermatte 2
 6210 Sursee, Schweiz
 Tel +41 (0)41 925 00 25
 Fax +41 (0)41 925 00 35
 www.knf.com
 info.flodos@knf.com

Contents	page
1. About this document.....	2
2. Use	3
3. Safety	5
4. Technical Data.....	7
5. Assembly and function	10
6. Installation and connection.....	11
7. Operation.....	15
8. Servicing.....	18
9. Troubleshooting.....	20
10. Spare parts	22
11. Return of the pump.....	23

1. About this document

1.1. Using the operating instructions

The operating instructions are part of the pump.

→ Pass on the operating instructions to the next owner.

Project pumps Customer-specific project pumps (pump models which begin with "PL" or "PML") may differ from the operating 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.

WARNUNG 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 liquids and gases.

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.

The pump may be operated only when fully assembled.

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

The temperature of the media must lie within the allowed limits stated in chapter 4.

The media should not contain particles as these can prevent the pump from working correctly. If this can not be guaranteed a filter (approx. 50 µm) must be used in front of the pump.

.51*-Version – Version with Food grade approval

The .51 versions of our diaphragm liquid pump range have been certified by NSF according to the standard NSF/ANSI 169 and can therefore be used, without any limitations, with foodstuffs.

All materials used for the wetted parts have been through a series of toxicological tests. In order to ensure that the food grade quality is maintained NSF will carry out a yearly audit checking all of the production processes.

Only the pumps marked with “.51” have been certified by NSF and contain materials which have a FDA certificate of conformity.

To see the operating conditions see 4.2

NSF: National Sanitary Foundation

FDA: Food and Drug Administration

ANSI: American National Standard Institute

*on request it is possible to deliver pumps with customer specific material combinations.

- All certified pumps are clearly marked with “51” in the pump description on the type sticker along with the NSF-logo. If none or only one of these things are not present then the pump is not certified.
- Because the requirements of how the pump needs to be cleaned are dependant on the application and KNF can not influence this the responsibility lies with the user. The regulations NSF/ANSI 169 regulate OEM products and does not mention how the cleaning should be made.
- All wetted parts can be replaced as spare parts without losing the certification. Component parts can not be traded as certified parts. Only original parts / assemblies from KNF may be used.

2.2. Improper use

The pumps may not be operated in an explosive atmosphere.

The pump may not be exposed to a positive pressure on the inlet side.

For special modifications outside the standard technical specifications please contact a KNF pump specialist.

3. Safety

i Note the safety precautions in sections 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 leads to injuries to the user or others, or to damage to the pump or other property.

Only use the pumps in proper technical condition and in accordance with their intended use in a safety and danger-conscious manner while observing the operating instructions.

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 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.
Notes	All warning stickers and pump information placed on the pump should be kept in a readable condition.
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.
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>



EU directives/standards	<p>The pumps are in accordance with the requirements of the guidelines 2011/65/EU (ROHS2)</p> <p>According to the machinery directive 2006/42/EG pumps are incomplete machines and are thus to be considered as not ready for use. The use of an incomplete machine is forbidden until it has been proven that the machine in which the incomplete machine is integrated meets the requirements of the machinery directive 2006/42/EG.</p> <p>The Basic requirements of the machinery directive 2006/42/EG according to appendix I (general principles) are to be used and maintained.</p> <p>The following harmonised standards are fulfilled:</p> <p>NF 10 DC</p> <ul style="list-style-type: none"><li>▪ EN 55022<li>▪ EN 55011 <p>NF 10 DCB / DCB-4</p> <ul style="list-style-type: none"><li>▪ EN 61000-6-2<li>▪ EN 61000-6-3 (incl.: EN 55022 / EN 55011) <p>NF 10 E</p> <ul style="list-style-type: none"><li>▪ EN 55014-1 <p>Customer service and repairs Only have repairs to the pumps carried out by the KNF Customer Service responsible.</p>
-------------------------	---

4. Technical Data

Pump materials

The pump type **KP** stands for:

Head component	Material ¹⁾
Pump head *	PP
Valves / seals	EPDM
Diaphragm	EPDM
Resonating diaphragm	EPDM

Tab. 2

¹⁾ according DIN ISO 1629 and 1043.1

The pump type **KT** stands for:

Head component	Material ¹⁾
Pump head *	PP
Valves / seals	FFKM
Diaphragm	PTFE
Resonating diaphragm	FFKM

Tab. 3

¹⁾ according DIN ISO 1629 and 1043.1

The pump type **KV** stands for:

Head component	Material ¹⁾
Pump head *	PP
Valves / seals	FKM
Diaphragm	FKM
Resonating diaphragm	FKM

Tab. 4

¹⁾ according DIN ISO 1629 and 1043.1

* Pump head (Fig.1): contains connection plate and intermediate plate

Hydraulic ratings

Parameter	Value
Flow rate [ml/min] ^{1), 2)}	≥ 100
Max. allowed pressure NF 10 [bar]	1
Suction height [mWg]	3

Tab. 5

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

²⁾ Flow rates may vary from the values shown according to fluid viscosity, pump head material and hoses / hose connectors used. Calibration with the pumped medium is required.

Hydraulic connections

Parameter	Value
Recommended tube size ID [mm]	≤ 4

Tab. 6

Specifications NF 10 DC

Motor voltages		12V	24V
Power [W]		3.7	3.4
Max. current at max load [A]		0.28	0.13
Max. motor current [A]		0.31	0.14
Lead size [-]	AWG22		
Protection class [-]	IP30		
Weight ¹⁾ [g]	60		

Tab. 7

Specifications NF 10 DCB / DCB-4

Motor options	DCB-4	DCB 12V	DCB 24V
Power consumption [W]	1.8	1.6	1.9
I load max. [A]	0.15	0.13	0.08
Supply voltage [V]	10-26.4	12	24
Lead size [-]	AWG28		
Protection class	IP40		
Weight 1) [g]	56		

Tab. 8

i In the case of type NF 5 DCB-4 the *supply voltage* is not designed for operation with pulse-width modulated voltages (PWM).

However, a PWM signal (frequency 500Hz or higher) can be used to control the *control voltage*.

i Electrostatic sensitive components (ESD)

Specifications NF 10 E

Motor voltage	230V/50Hz	115V/60Hz
Power [W]	18.5	19.6
Max. current at max. load [A]	0.17	0.37
Max. motor current [A]	0.19	0.41
Power supply range [V]	230V \pm 10%	115V \pm 10%
Protection class [-]	IP00	
Weight ¹⁾ [g]	385	

Tab. 5

Motor voltage	100V/50-60Hz	
	50Hz	60Hz
Power [W]	18	13.3
Max. current at max. load [A]	0.40	0.28
Max. motor current [A]	0.44	0.31
Power supply range [V]	100V \pm 10%	
Protection class [-]	IP00	
Weight ¹⁾ [g]	385	

Tab. 6

¹⁾ The weight can differ slightly from the stated value depending on the version

i Electrostatic sensitive components (ESD)

Various parameters

Parameter	Value
Ambient temperature range (°C)	+ 5 to + 40
Media temperature range (°C)	+ 5 to + 80
Allowed kinematic viscosity of the media [cSt]	\leq 150

Tab. 7

5. Assembly and function

Assembly

- 1 Outlet
- 2 Inlet
- 3 Connection plate
- 4 Motor Drive
- 5 Motor leads
- 6 Head plate
- 7 Intermediate plate

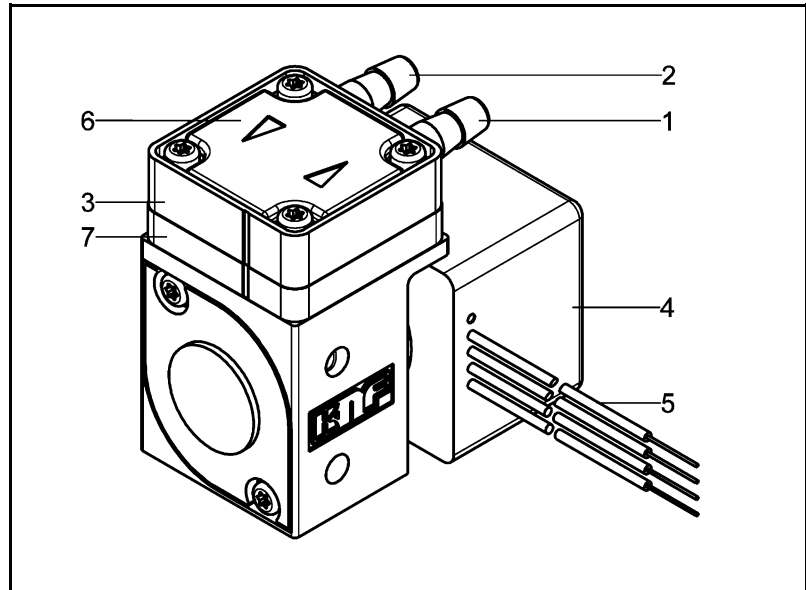


Fig. 1: Diaphragm–Liquid pump NF 10

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

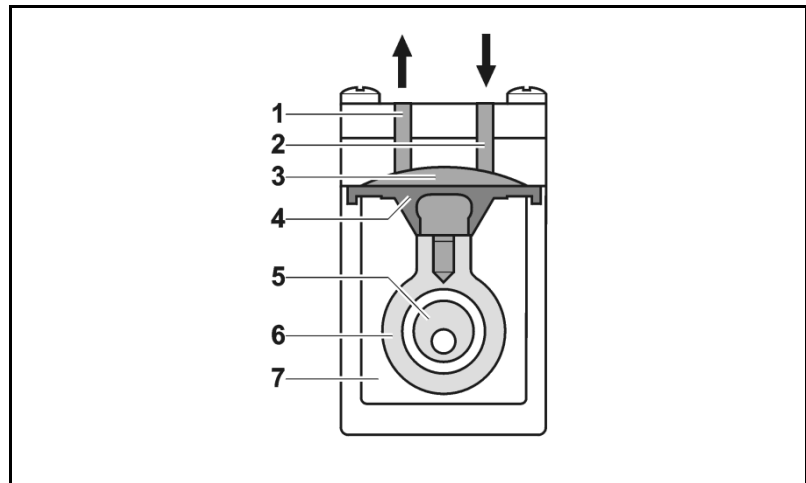


Fig. 2: Working principles

Diaphragm fluid 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).

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

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

Mounting dimensions

➔ Mounting dimensions (see Fig. 3 to 6)

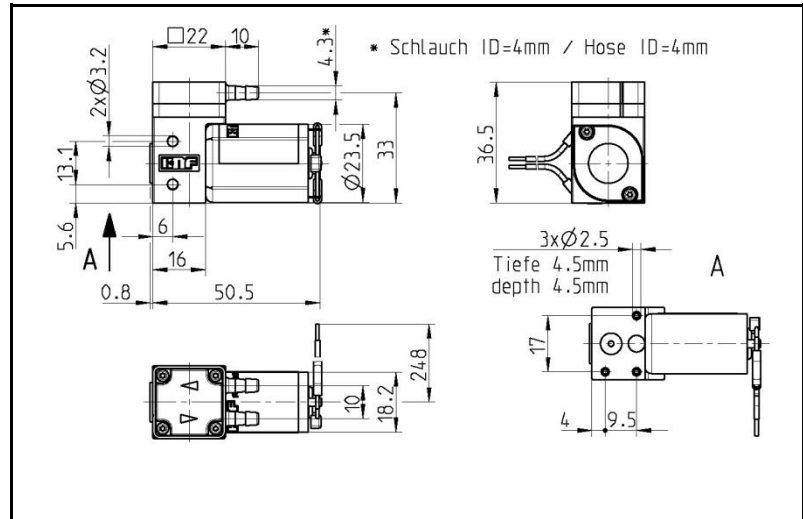


Fig. 3: Mounting dimensions NF 10 DC

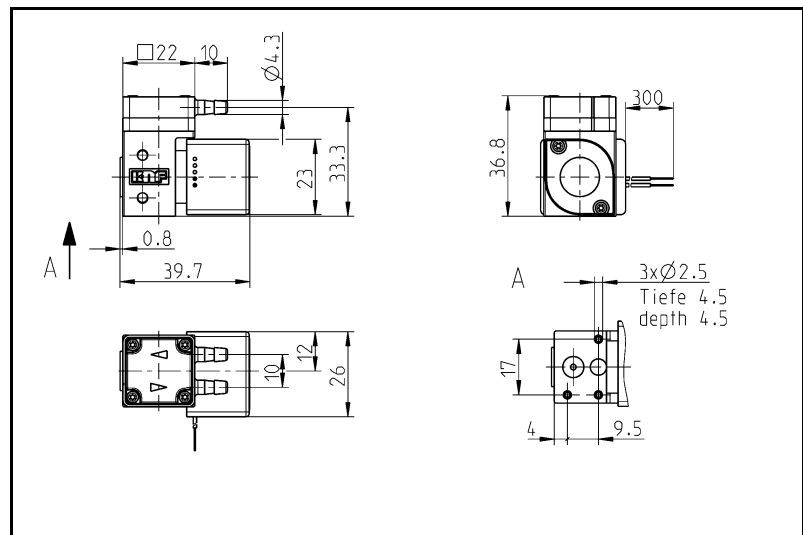


Fig. 4: Mounting dimensions NF 10 DCB

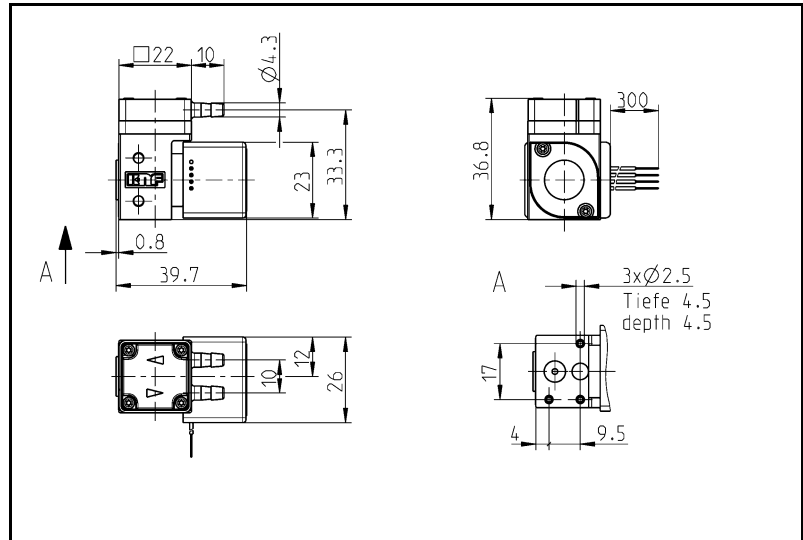


Fig. 5: Mounting dimensions NF 10 DCB-4

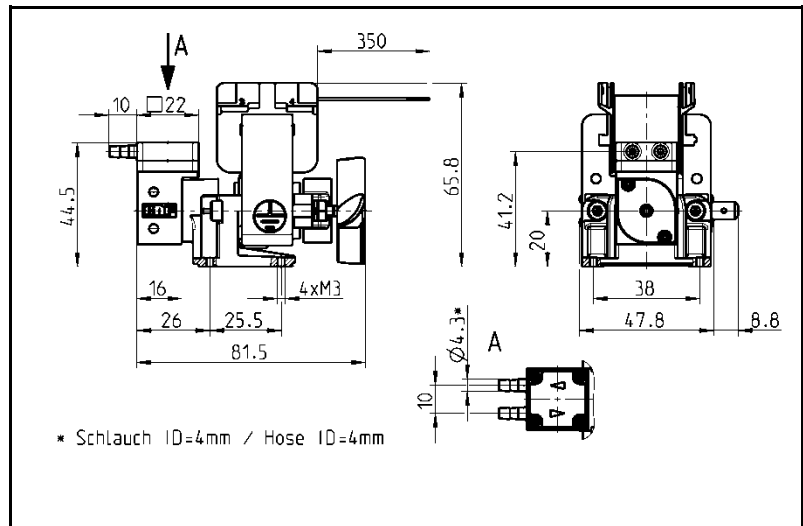


Fig. 6: Mounting dimensions NF 10 E

Installation

- ➔ Make sure that the installation location is dry and the pump is protected against rain, splash, hose and drip water.
- ➔ Protect the pump from dust.
- ➔ Protect the pump from vibrations and jolts.

Mounting orientation

- ➔ The pump can be mounted in any orientation. The priming and accuracy of the pump is optimal if installed as in the illustration (Fig.8).

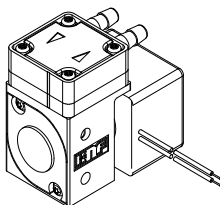


Fig. 7: optimal installation/horizontal

Touch contact and foreign object protection

For pumps with alternating current motors:



WARNING

Danger of injury whilst in use

→ Take protective measures against touching parts which are energised (live) such as electrical connections or windings.

→ Take protective measures against touching moving parts (e.g. fan).

Danger of damaging the pump whilst in use.

→ Take protective measures that water, dust or foreign objects can get into the pump. E.g. penetrate into the motor (see protection class)

6.2. Electrical Connection

For pumps with alternating current motors:



CAUTION

Life threatening situations from electric shock

→ Pump should only be connected by a specialist.

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

For pumps with direct current motors:

1. Pump should only be connected by a specialist.

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

→ For the electrical connection ensure that the relevant guidelines, regulations and technical standards are fulfilled.

6.3. Electrical Connection

- 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 norms, directives, regulations and technical standards must be observed.

Connecting the pump

1. Compare the data of the supply voltage and the maximum permissible current with the information on the motor type plate.
2. Connect the motor cable. Electrical data section 4.

i Attention: observe the polarity of the leads!

For DC motors:

Red motor lead: +

Black motor lead: -

In the case of a Brushless motor false polarity can cause damage to the electronics.

6.4. Hydraulic connection

Connected components

- Only connect components to the pump which are designed for the pneumatic data of the pump (see Chapter 4, Technical data).

Tubing

- Only use tubing which is suitable for the maximum pressure of the pump. (see section 4.)
- Only use tubing which is resistant to the liquids being pumped.

6.4.1. Connecting tubing to the pump

i Arrows on the pump head indicate the flow direction.

1. Remove the protective caps from the connections.
2. Connecting the inlet and outlet tubing.

i Keep the inlet tube so short as possible in order to keep the priming process as short as possible..

3. If the pump is used to build up pressure it is important to ensure that all hydraulic connections on the outlet side are secure to prevent leakage.
4. Check tubes and hose barbs for leak tightness.
5. Check that the system is leak tight.

7. Operation

- The pumps should only be used under normal operating parameters / conditions which are described in section 4 – technical data.
- Ensure that the pumps are being used correctly (see section 2.1).
- Improper use of the pump must be avoided (see section 2.2).
- Observe the safety notes (see chapter 3).
- The pumps are components which have to be integrated into a machine. Before they are put into operation it is important to ensure that the machine / equipment complies with the appropriate regulations.



CAUTION

Danger of burning
The motor heats up

- Don't touch the motor
- Don't let the motor come in contact with flammable materials



WARNING

Danger of bursting of the fluid system due to overpressure.

The pump builds up pressure. A closed system can cause the max. permitted operating pressure to be exceeded. This can cause injuries or damage to the pump and the system.

- Avoid operation against a closed system.
- Only use wetted parts that are rated for at least the operating pressure of the pump.
- If necessary, limit the maximum system pressure by suitable measures.

- 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. For further information please contact a KNF specialist (Telephone number: see front page).

- Pump standstill → If the pump stops running release the pressure in the system to that atmospheric conditions are created.

For pumps with a thermal switch:

**WARNING**

Physical injury and damage to the pump due to automatic start.

If in the case of excessive temperatures the thermal switch will stop the motor. Once cooled down the motor will automatically start operation again.

→ Ensure that no dangerous situation can thereby arise.

Switching the pump on and off

Adjusting and controlling the motor speed

The motor speed and thus the flow rate can be adjusted / controlled

For more details see section 4 Technical Data

Impulse operation

Duty cycle / impulse operation

KNF pumps are designed for continual use

Short start and stop cycles can change the lifetime 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 front page).

Turning the pump on

→ In order to guarantee that the pump can start every time it is advisable to reduce the back pressure down to an acceptable level. This is also the case if there is a short power cut.

i For more specific information contact the KNF specialist (Telephone number: see front page).

Turning the pump off

→ KNF recommends that after pumping aggressive liquids the pump should be rinsed thoroughly. (see section 8.2.1), as this will help to lengthen the lifetime.

→ Ensure that there are atmospheric pressure conditions in the system (release the hydraulic pressure).

Flow rate NF 10

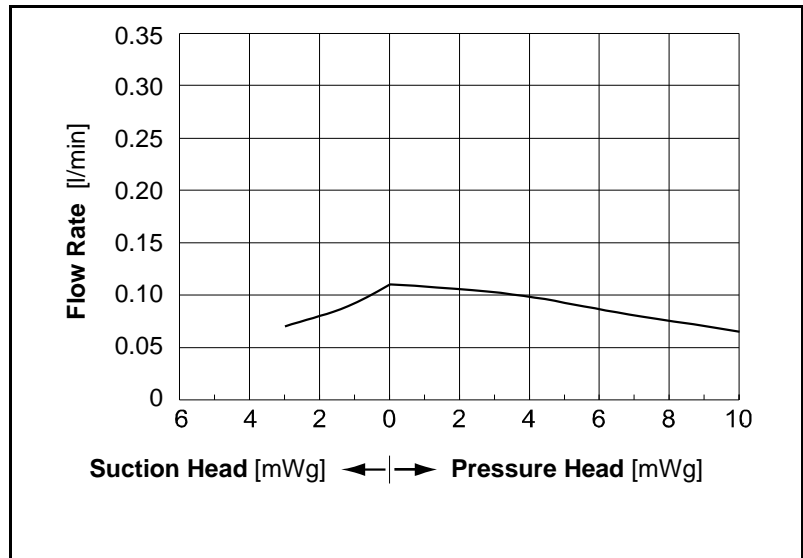


Fig. 8: Flow rate of the pump NF 10 DC

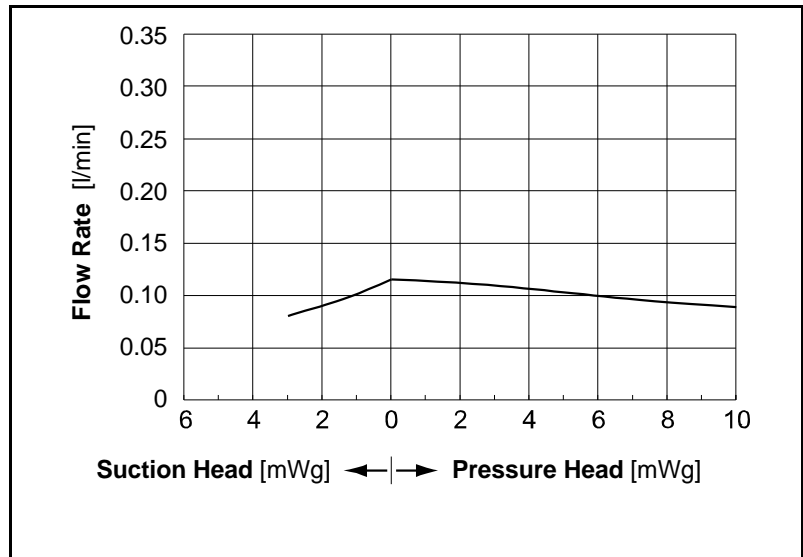


Fig. 9: Flow rate of the pumps NF 10 E and NF 10 DCB und NF 10 DCB-4

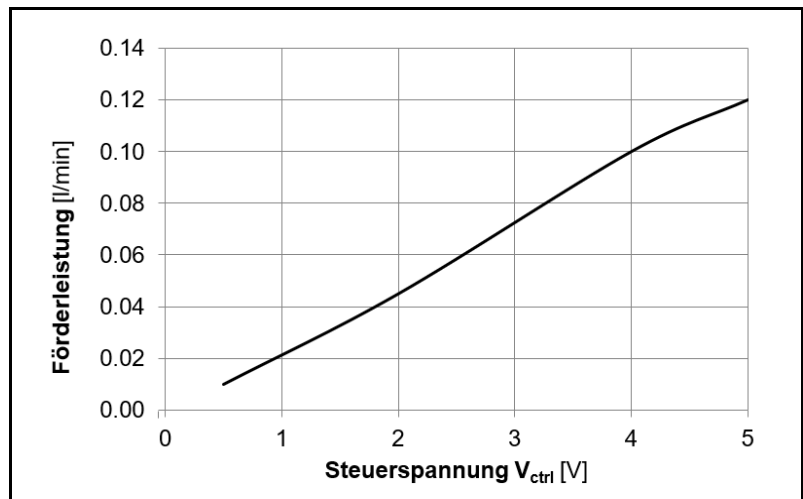


Fig. 6: Flow rate of pump NF 10 DCB-4 depending of control voltage

8. Servicing

8.1. Servicing schedule

Component	Servicing interval
Pump	- Regular inspection for external damage or leaks
Pump head	- Clean the pump internally: if the flow rate changes, the pump does not pump or no vacuum is created (section 8.2)
Diaphragm and valves	- At the latest change when the flow drops off

Tab. 12

8.2. Cleaning

Information on procedure

**WARNUNG**

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.
- ➔ Rinse the pump with a neutral liquid and pump empty.

8.2.1. Flushing the pump

- ➔ When 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

- ➔ Wipe the outside of the pump with a soft dry cloth. Ensure that any cleaning solvents used will not damage the materials of the pump head and crankcase housing (check material resistance properties).
- ➔ If there is compressed air available, blow off the separate parts.

Prior requirements

- Pump must be switched off and mains plug removed from the socket.
- The pump must be free of any hazardous substances.
- Hoses must be disconnected from the pump head.
- It is recommended to replace the diaphragm when the head parts are removed.

Tools

Qty.	Tool
1	Screwdriver TORX T6

Tab. 13

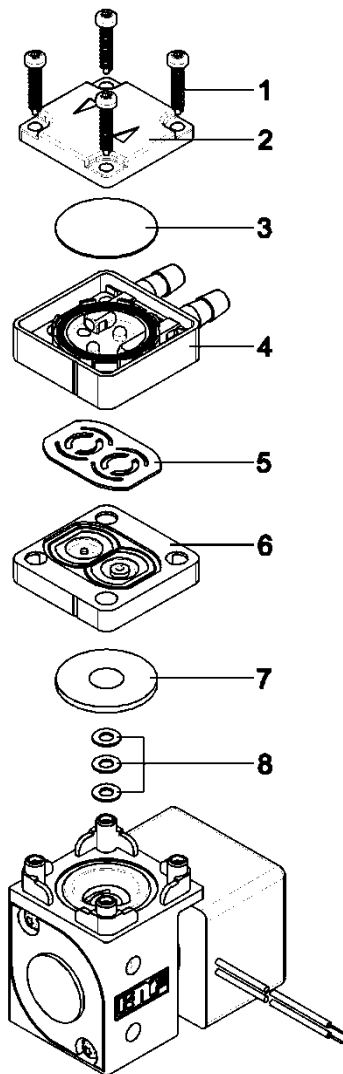


Fig. 11

- 1 Head screws
- 2 Head plate
- 3 Resonating diaphragm
- 4 Connection plate
- 5 Valve plate
- 6 Intermediate plate
- 7 Diaphragm
- 8 Spacer

Disassembling the pump head

1. Undo the 4 head screws (1) using a Torx T6 screwdriver and remove the head plate (2).
2. Remove the resonating diaphragm (3) from the connection plate (4).

Removing valves and seals

3. Remove the connection plate (4) from the intermediate plate (6).
4. Take out the valves (5) from the intermediate plate (6).
5. Grip the diaphragm (7) and turn it anti-clockwise. Ensure that none of the spacers (8) don't fall into the housing.

It is recommended to replace the diaphragm (7).

Clean the parts

6. Using a cloth clean the Head plate (2), connecting plate (4), intermediate plate (6), valve plate (5) and diaphragm (7) and blow compressed air over them.

Replace the diaphragm

7. Place all of the spacers (8) back onto the diaphragm thread.
8. Screw the diaphragm (7) securely back into the con-rod. Make sure that no spacers (8) fall into the housing.
9. By lightly pressing on the diaphragm push the ridge on the underside of the diaphragm into the groove of the housing..

Install the valves

10. Place the „dust free“ valve plate(5) into the intermediate plate (6).

Assemble the pump head

11. Place the resonating diaphragm (3) in the top of the connection plate (4) and cover with the head plate (2).
12. The visible lines down the side of the pump must be inline on the intermediate and connection plate.
13. The head plate (2) must be positioned so that the arrows coincide with the hydraulic connections on the connection plate (4).
14. Push the four head screws (1) into the head holes.
15. Place the pump head onto the pump housing and tighten the head screw diagonally.
16. Connect the pump up with the inlet and outlet tubes.

8.3. Replace the diaphragm and valves

The same procedure is to followed as in section 8.2 cleaning. But instead of just cleaning the diaphragm (7), resonating diaphragm (3) and valves (5) these must be replaced with new parts.

9. Troubleshooting

For pumps with alternating current motors:



GEFAHR

Life threat by electric shock

→ Before working on the pump separate the pump from the power supply.

→ Ensure that the pump is de-energised.

Pump does not pump	
Possible cause	Corrective action
Pump not connected to mains power supply.	→ Connect pump to mains supply.
Power supply is not switched on.	→ Switch on power supply.
Connections or tubing are blocked	→ Check tubing lines and connections. → Remove blockage.
External valve is closed or filter is blocked.	→ Check valve timing and filters.
Diaphragm or valves are worn out.	→ Replace diaphragm and valves (See paragraph 8.3).

Tab. 14

Pump is not priming / sucking	
Possible cause	Corrective action
Pump is not connected suction side.	→ Check the arrows on the pump head indicating flow direction.
Liquid in the container is too low.	→ Fill container.
Hose connections are not tight.	→ Check for tightness – use clamp to ensure a good fit.
System valve is closed or filter is blocked.	→ Open the valve. → Clean / replace filter.
The vacuum is too small for the suction height.	→ Reduce suction height.
Valves are blocked by particles	→ Clean the pump head (see section 8.2).
Pump head materials are not resistant to the liquids being pumped.	→ Check compatibility lists and choose suitable version.
Inlet and outlet tubes have been wrongly connected.	→ Check the arrows on the pump head indicating flow direction

Tab. 15

Flow rate, suction height or pressure is too low	
The pump does not achieve the technical performance data stated on the data sheet	
Cause	Fault remedy
Components in the system such as tubing, valves or filter are causing too much resistance.	<ul style="list-style-type: none"> ➔ Change installation. ➔ Take larger tubes.
Connections are not tight	➔ Use another connection or use clamps to ensure a tight fit.
Particles in the pump	➔ Use a filter – clean the pump head. (see section 8.2)
Viscosity of the liquid is too high	➔ Contact your local KNF company.
Inlet and outlet tubing are connected wrongly.	➔ Check the arrows on the pump head indicating flow direction.
The head parts are not resistant against the media.	➔ Replace the head parts with a compatible variation.

Tab. 16

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 section 8.2.1).
2. Dismantle the pump.
3. Clean the pump (see section 8.2.2).
4. Send the pump, with completed decontamination statement (see Chapter 11), to KNF customer services, stating the nature of the pumped medium.

10. Spare parts

Spare part	Order No.
Spares-Kit Assembly sheet	151356
Spare part NF 10 JNF 10_V	151366
Spare part NF 10 JNF 10_P	151367
Spare part NF 10 JNF 10_T	151368

Tab. 17

11. Return of the pump

i The condition for the repair of a pump by KNF is the KNF undertakes to repair the pump only under the condition that the customer provides a certificate of the pumped medium and cleaning of the pump. For this purpose, please follow the instructions on www.knf.com/repairs.

Please contact your KNF sales representative directly if you need additional support for your return service.

KNF worldwide

Please find your local KNF partners at: www.knf.com

