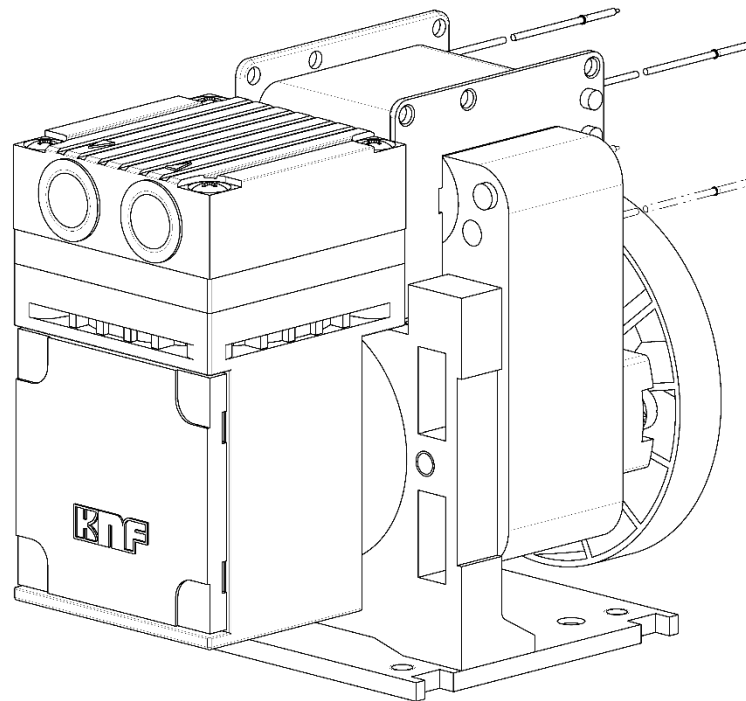


OEM

**N85.3, N86
TRANSLATION OF ORIGINAL OPERATING AND
INSTALLATION INSTRUCTIONS
ENGLISH**

DIAPHRAGM PUMP



Note!

Before operating the pump and the accessories, please read the operating instructions and pay attention to the safety precautions!

KNF Neuberger GmbH
Alter Weg 3
79112 Freiburg
Germany
Phone +49-(0)7664-5909-0
Fax +49-(0)7664-5909-99

E-mail: info@knf.de
www.knf.de

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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.

- ➔ Always keep the Operating and Installation Instructions handy in the work area.
- ➔ Pass on the Operating and Installation Instructions to the next owner.

Project pump

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

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

1.2. Symbols and markings

Warning



WARNING

A danger is located here.

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

Warning, indicates the danger level.

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

Danger levels

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

Tab. 1

Other information and symbols

- ➔ An activity to be carried out (a step) is specified here.
1. The first step of an activity to be carried out is specified here. Additional, consecutively numbered steps follow.



This symbol refers to important information.

2. Use

2.1. Proper use

The pumps are exclusively intended for transferring gases and vapors.

Owner's responsibility

Operating parameter and conditions

Only install and operate the pumps under the operating parameters and conditions described in Chapter 4. Technical Data.

Only complete pumps may be taken into service.

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

The gas-tightness of the connections between the application pipes and the pump (or the pump connection) must be checked regularly; with leaky connections, there is a danger that hazardous gases or vapors may escape from the pump system.

Requirements for transferred medium

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

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

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

2.2. Improper use

The pumps may not be operated in an explosive atmosphere.

The pumps are not suitable for transferring;

- dusts
- liquids
- aerosol
- biological and microbiological substances
- fuel
- explosive and combustible materials
- fibers
- oxidizing agent
- foodstuffs.

The pumps are not suitable for use with aggressive media. Other pumps in the KNF product line are designed for use with aggressive media. Please contact us for more information.

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

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

3. Safety

i Note the safety precautions in Chapter 6. Installation and connection and 8. Operation.

The pumps are built according to the generally recognized rules of the 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.

Components connected to the pump must be designed to withstand the pneumatic performance of the pump.

Take care that safety regulations are observed when connecting the pump to the electricity supply.

Personnel Make sure that only specially trained personnel or trained and instructed 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.

Ensure that the pump is separated from the mains and is de-energized.

The pump heads heat up during operation – avoid contact with them.

Make sure that there are no hazards due to flow with open gas connections, noises or hot gases.

Ensure that an EMC-compatible installation of the pump is ensured at all times and that this cannot lead to a hazardous situation.

Handling dangerous media When transferring dangerous media, observe the safety regulations when handling these media.

If the diaphragm ruptures, the transferred medium will mix with the air in the environment.

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

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.

For pumps with AC motor:

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

Project-specific pumps that are **not** fitted with a thermal switch must be protected by the user against the risk of overheating

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.

EU/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.
(*only for pumps with AC motor)

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 safety objectives of the following Directive(s) have been met:

- Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (Annex II amended by Commission Delegated Directive (EU) 2015/863).
- For N85.3K_E and N86K_E:
Directive 2014/35/EU on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits in accordance with Annex I, No. 1.5.1. of the Directive 2006/42/EC.

The following harmonized standards were taken as a basis:

N 85.3 K_E N 86 K_E	N 85.3 K_DC N 86 K_DC	N 86 K_DC-B
EN IEC 55014-1/2	EN IEC 55014-1/2	EN IEC 55014-1/2
EN IEC 61000-3-2	EN IEC 61000-6-1/2	EN IEC 61000-6-2/3
EN 61000-3-3	EN 60034-1	
EN 60335-1		
EN IEC 63000	EN IEC 63000	EN IEC 63000

Tab. 2

Customer service and repairs

The pump is maintenance-free. But KNF recommends, checking the pump regularly with regard to conspicuous changes in noise and vibrations.

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

Housing with voltage-caring parts may be opened by technical personnel only.

Use only genuine parts from KNF for servicing work.

4. Technical Data

Pump materials

N85.3KN_
N86KN_

Assembly	Material
Pump head	PPS
Diaphragm	EPDM
Valves	EPDM

Tab. 3

N85.3KT_
N86KT_

Assembly	Material
Pump head	PPS
Diaphragm	PTFE-coated
Valves	FFPM

Tab. 4

Pneumatic values

N85.3K_E
N85.3K_DC

Parameter	Value
Max. permissible operating pressure [bar g]	0.3
Ultimate vacuum [mbar abs.]	
-N85.3KNE, N85.3KNDC	25
-N85.3KTE, N85.3KTDC	30
Delivery rate at atm. pressure [l/min]*	5

Tab. 5

*Liters in standard state (1013 mbar)

N86KN_

Parameter	Value
Max. permissible operating pressure [bar g]	
-N86KNE, N86KNDC-B	2.4
-N86KNDC	1.5
Ultimate vacuum [mbar abs.]	100
Delivery rate at atm. pressure [l/min]*:	
-N86KNE, N86KNDC-B	6
-N86KNDC	6,5

Tab. 6

*Liters in standard state (1013 mbar)

N86KT_

Parameter	Value
Max. permissible operating pressure [bar g] -N86KTE, N86KTDC-B -N86KTDC	2,5 1,5
Ultimate vacuum [mbar abs.]	160
Delivery rate at atm. pressure [l/min]*: -N86KTE, N86KTDC-B -N86KTDC	5,5 6

Tab. 7

*Liters in standard state (1013 mbar)

Pneumatic Connections

Pump type	Value
N85.3	Thread size G 1/8
N86	Thread size G 1/8

Tab. 8

Electrical data

N85.3K__E

N86K__E

Parameter	Value
Voltage [V] / Frequencies [Hz]	See type plate
Max. operating current [A]	
Pump power consumption	
Protection class Motor	IP 00
Maximum permitted mains voltage fluctuations	± 10%

Tab. 9

Thermo switch

The pumps are fitted with a thermo switch to protect against overloading:

**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.



Project-specific pumps that are **not** fitted with a thermal switch must be protected by the user against the risk of overheating.

N85.3K_DC

N86K_DC

Parameter	Value
Motor type	DC motor
Voltage [V]	See type plate
Max. operating current [A]	
Protection class Motor	IP20
Maximum permitted mains voltage fluctuations	± 10%

Tab. 10

i The pumps are not protected against overloading and they have no overcurrent protection.

N85.3K_DC-B

N86K_DC-B

Parameter	Value
Motor type	Brushless DC motor
Voltage [V]	See type plate
Max. operating current [A]	
Protection class Motor	± 10%
Maximum permitted mains voltage fluctuations	
Motor type	IP30

Tab. 11

i The pumps are not protected against overloading and they have no overcurrent protection.

Weight

Pump type	Value [kg]
N85.3K_E	1,25
N86K_E	1,1
N85.3K_DC	0,72
N86K_DC	0,58
N86K_DC-B	0,58

Tab. 12

Other parameters

Parameter	Value
Permissible ambient temperature	+ 5 bis + 40
Permissible media temperature	+ 5 bis + 40
Dimensions L x W x H [mm] N85.3K_E N86K_E N85.3K_DC N86K_DC N86K_DC-B N86K_.29DC-B	ca. 131 x 75 x 109 ca. 104 x 91 x 69 ca. 129 x 50 x 105 ca. 106 x 74 x 43 ca. 108 x 87 x 54 ca. 108 x 88 x 54
Maximum permissible ambient relative humidity	80 % for temperatures up to 31 °C, decreasing linearly to 50 % at 40 °C
Max. altitude of site: [m above sea level]	2000

Tab. 13

5. Design and function

Design N85.3K_E

- 1 Inlet (suction side)
- 2 Pneumatic connection
- 3 Outlet (pressure side)
- 4 Motor
- 5 Electrical connection

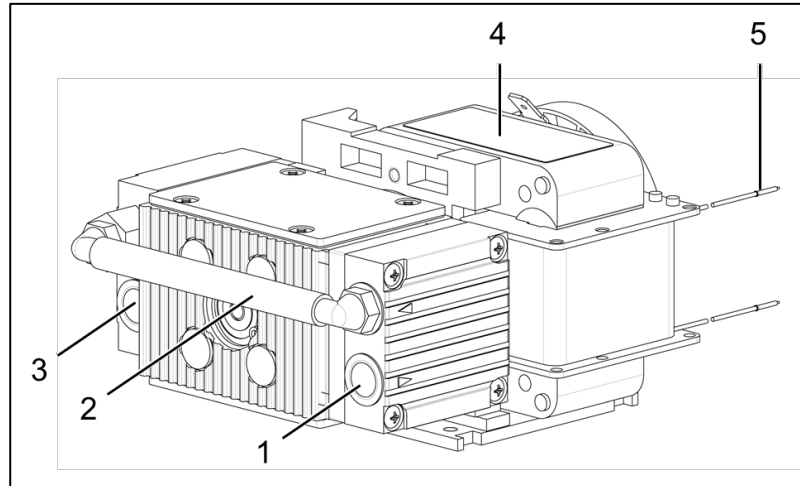


Fig. 1: Design N85.3K_E

Design N86K_E

- 1 Outlet (pressure side)
- 2 Inlet (suction side)
- 3 Motor
- 4 Electrical connection

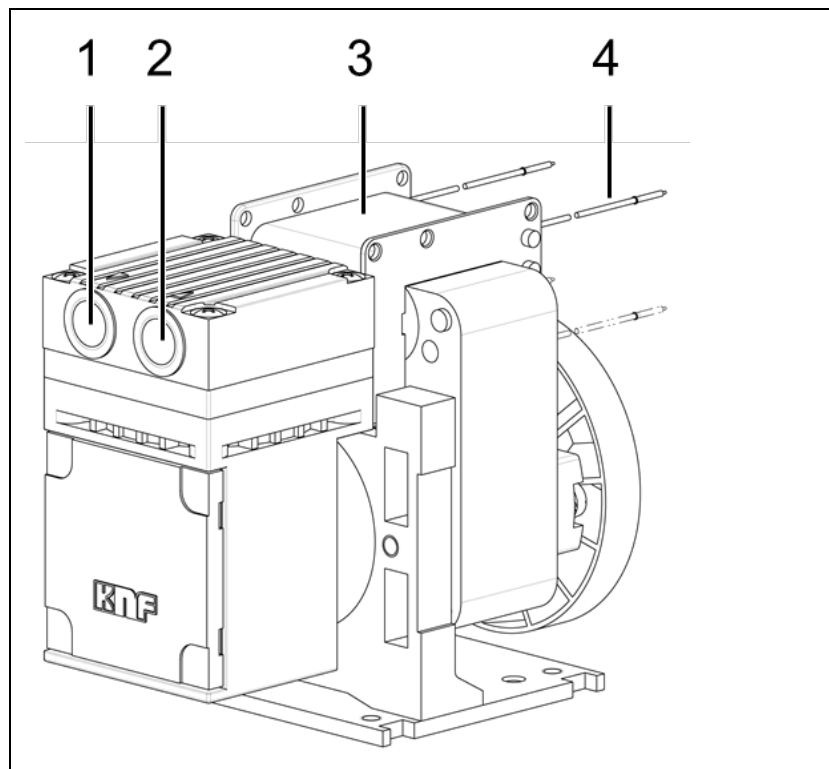


Fig. 2: Design N86K_E

Design N85.3K_DC

- 1 Inlet (suction side)
- 2 Pneumatic connection
- 3 Outlet (pressure side)
- 4 Electrical connection
- 5 Motor

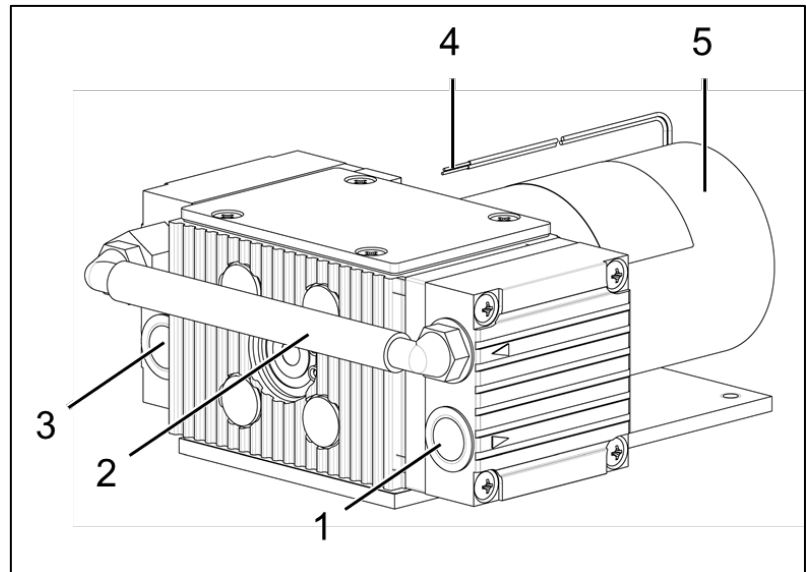


Fig. 3: Design N85.3K_DC

Design N86K_DC

- 1 Outlet (pressure side)
- 2 Inlet (suction side)
- 3 Electrical connection
- 4 Motor

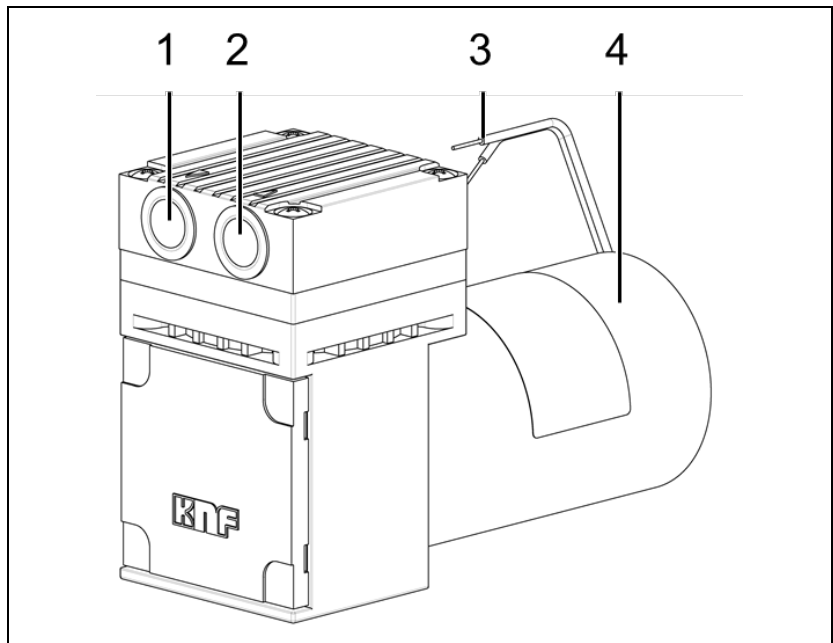


Fig. 4: Design N86K_DC

Design N86K_DC-B

- 1 Outlet (pressure side)
- 2 Inlet (suction side)
- 3 Electrical connection
- 4 Motor

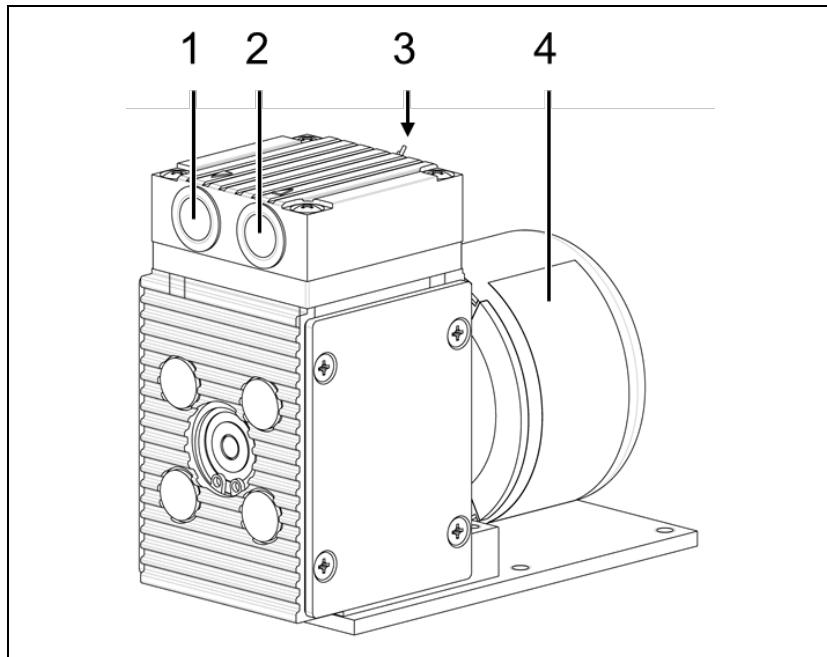


Fig. 5: Design N86K_DC-B

Function Diaphragm Pump

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

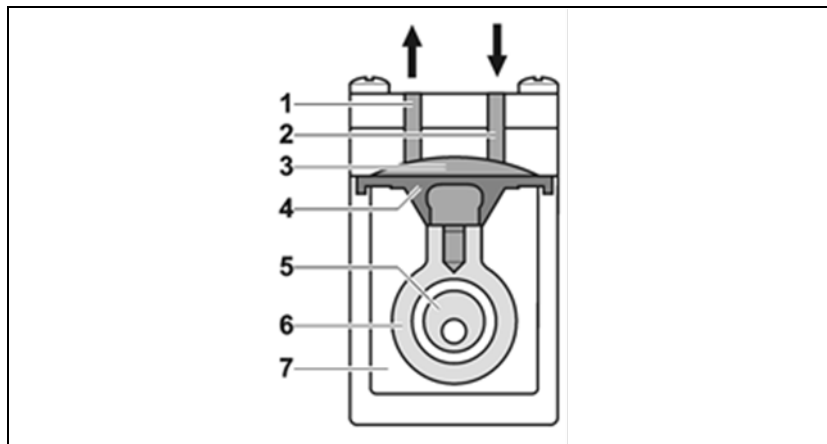


Fig. 6: Pump head

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

The elastic diaphragm (4) is moved up and down by the eccentric (5) and the connection 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. Transportation



Danger of injury due to sharp edges on the package.

When handling or opening the package there is the possibility of injury by cutting at sharp edges.

CAUTION → If necessary, wear proper personal protective equipment (e.g. safety gloves).



Personal injury and/or damage to property because of false or improper transportation of the pump

Due to false or improper transportation the pump can fall down, become damaged and injure people.

CAUTION

- If necessary, use suitable aids (eyebolt, harness, lifting device, etc.).
- If necessary, wear proper personal protective equipment (e.g. safety gloves, safety shoes).

Only two-headed pump:



Personal injury and/or damage to property because of false or improper transportation of the pump

If the pump is raised and/or carried on the connection during transport, leaks and/or damages to the pump may result.

CAUTION

- Do not carry the pump on the pneumatic connection.

- Transport the pump in the original packaging to the installation location.
- Store the original packaging of the pump (e.g., for later storage).
- Inspect the pump for transport damage after receiving it.
- Document any transport damage in writing.
- Remove any transport safeguards on the pump prior to commissioning.

Parameter

Parameter	Value
Storage temperature [°C]	+ 5 to + 40
Transport temperature [°C]	- 10 to + 60
Permissible humidity (non-condensing) [%]	30 to 85

Tab. 14

i Before putting into operation, make sure that the pump has reached the ambient temperature (see Chapter 4. Technical Data).

7. Installation and connection

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

Observe the safety precautions (see Chapter 3).

7.1. Installation of the pump

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

Mounting dimensions ➔ See Fig. 7 to Fig. 12 for mounting dimensions.

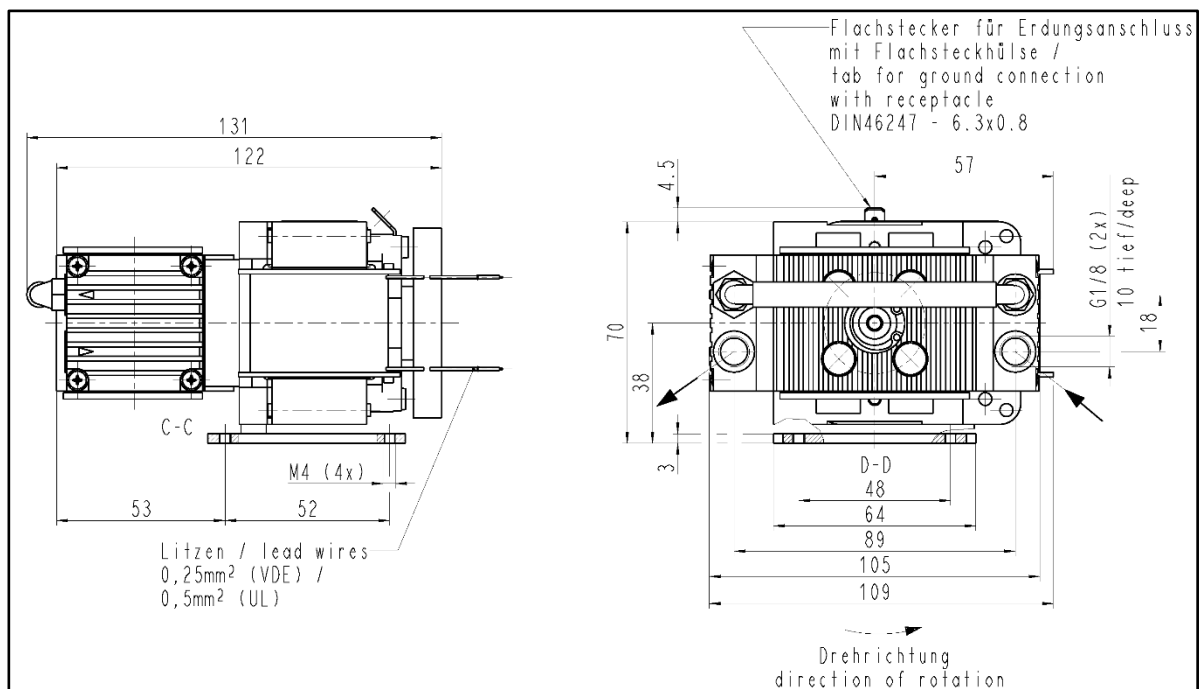


Fig. 7: Mounting dimensions pump series N85.3K_E

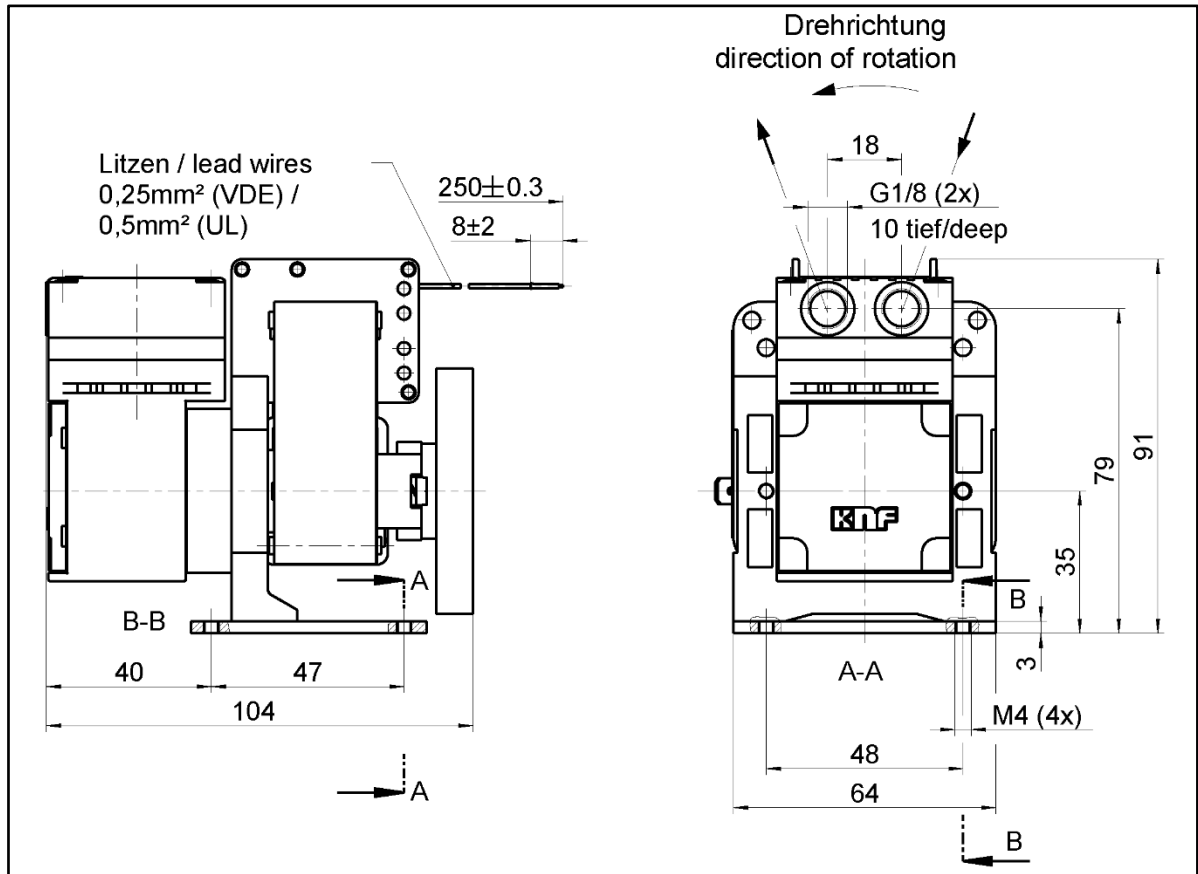


Fig. 8: Mounting dimensions pump series N86K_E

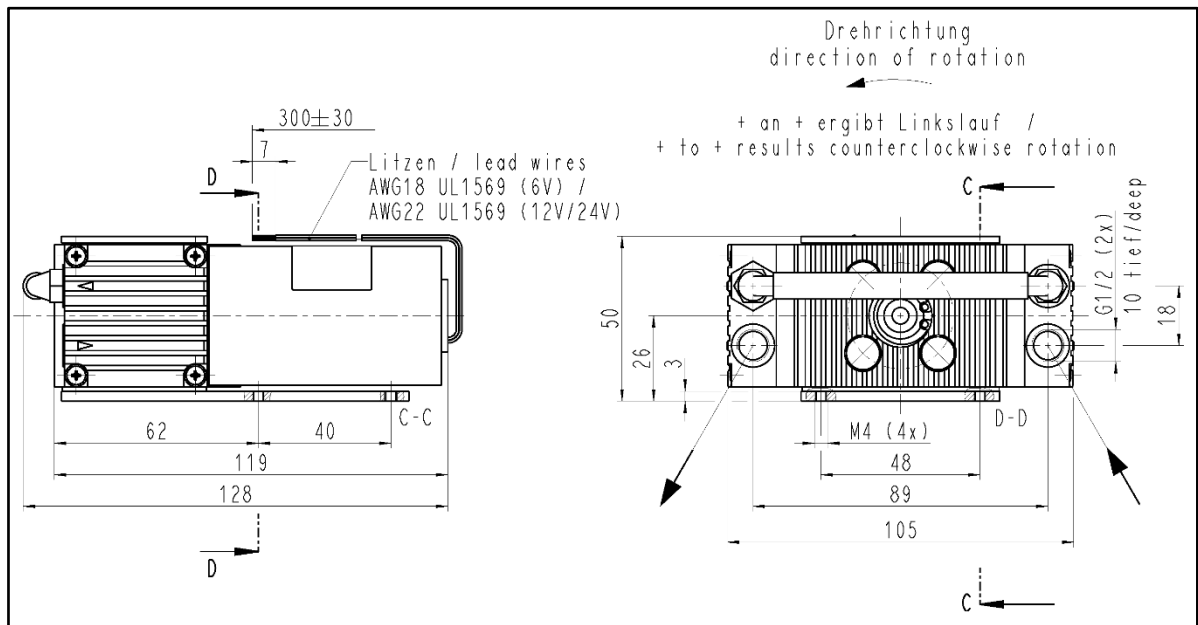


Fig. 9: Mounting dimensions pump series N85.3K_DC

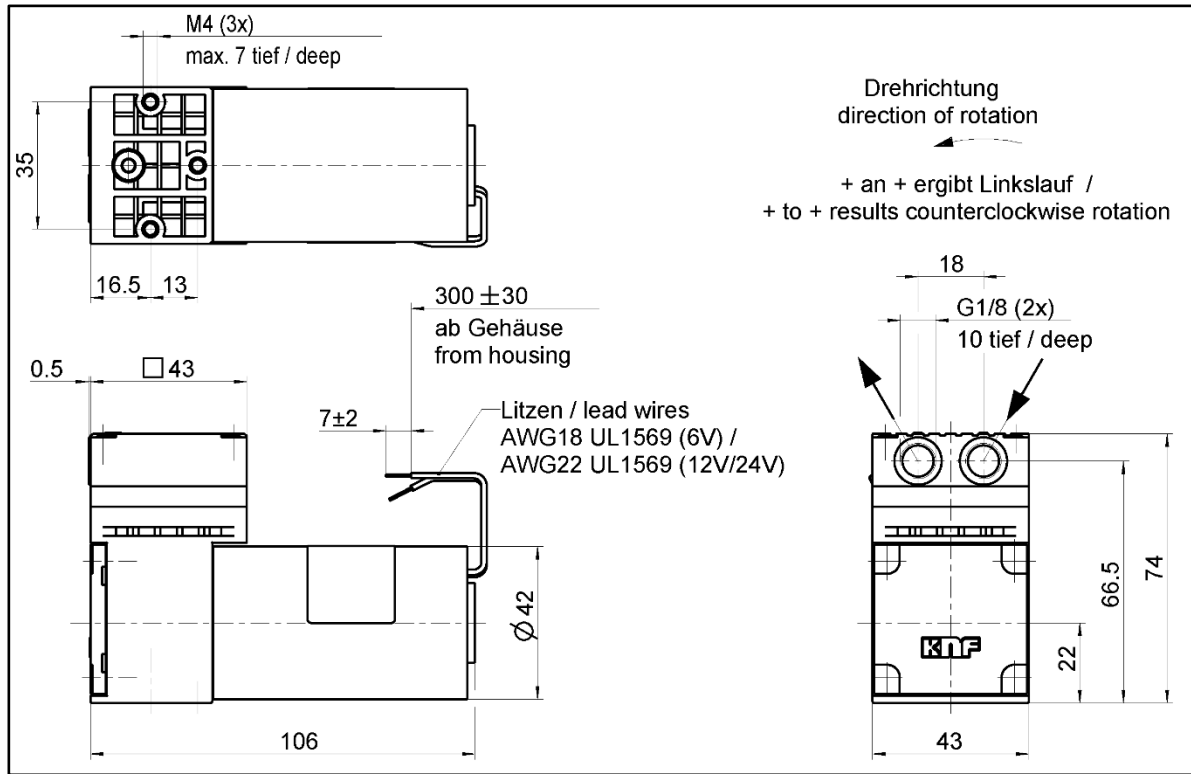


Fig. 10: Mounting dimensions pump series N86K_DC

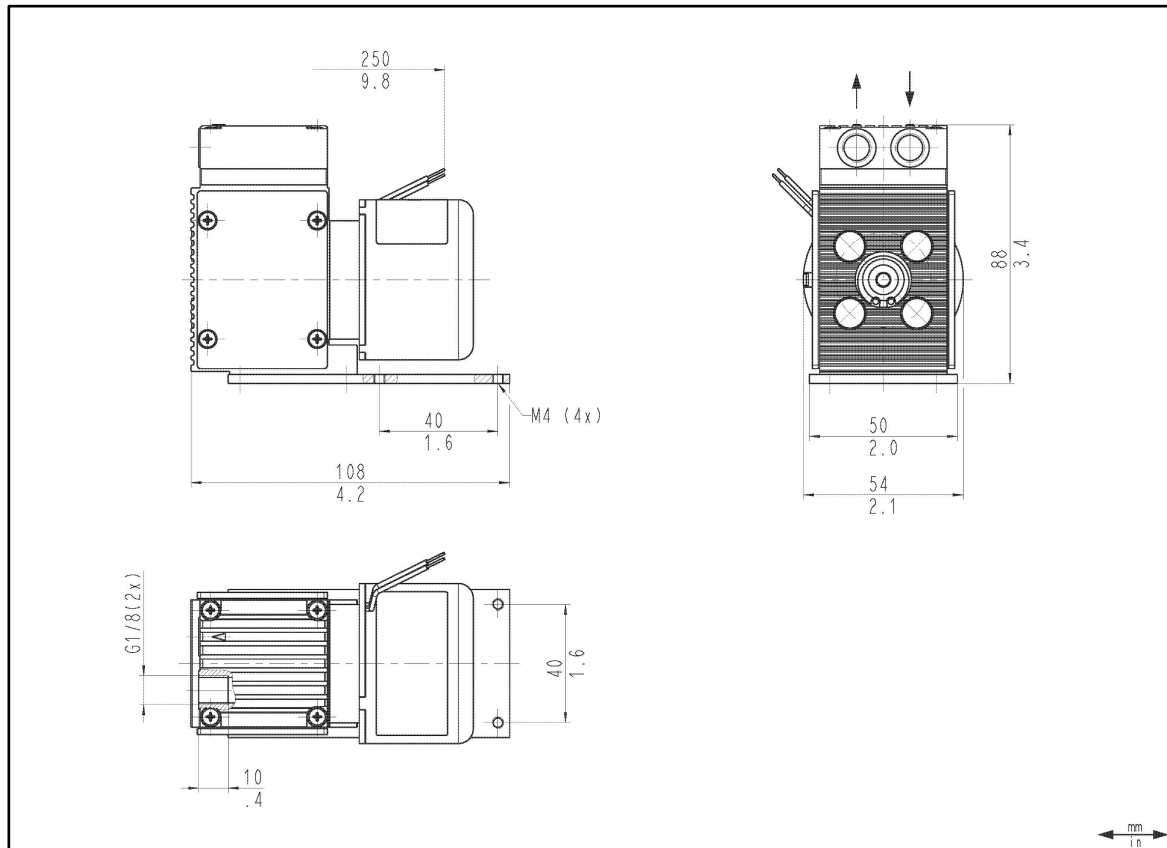


Fig. 11: Mounting dimensions pump series N86K_DC-B (2 wires)

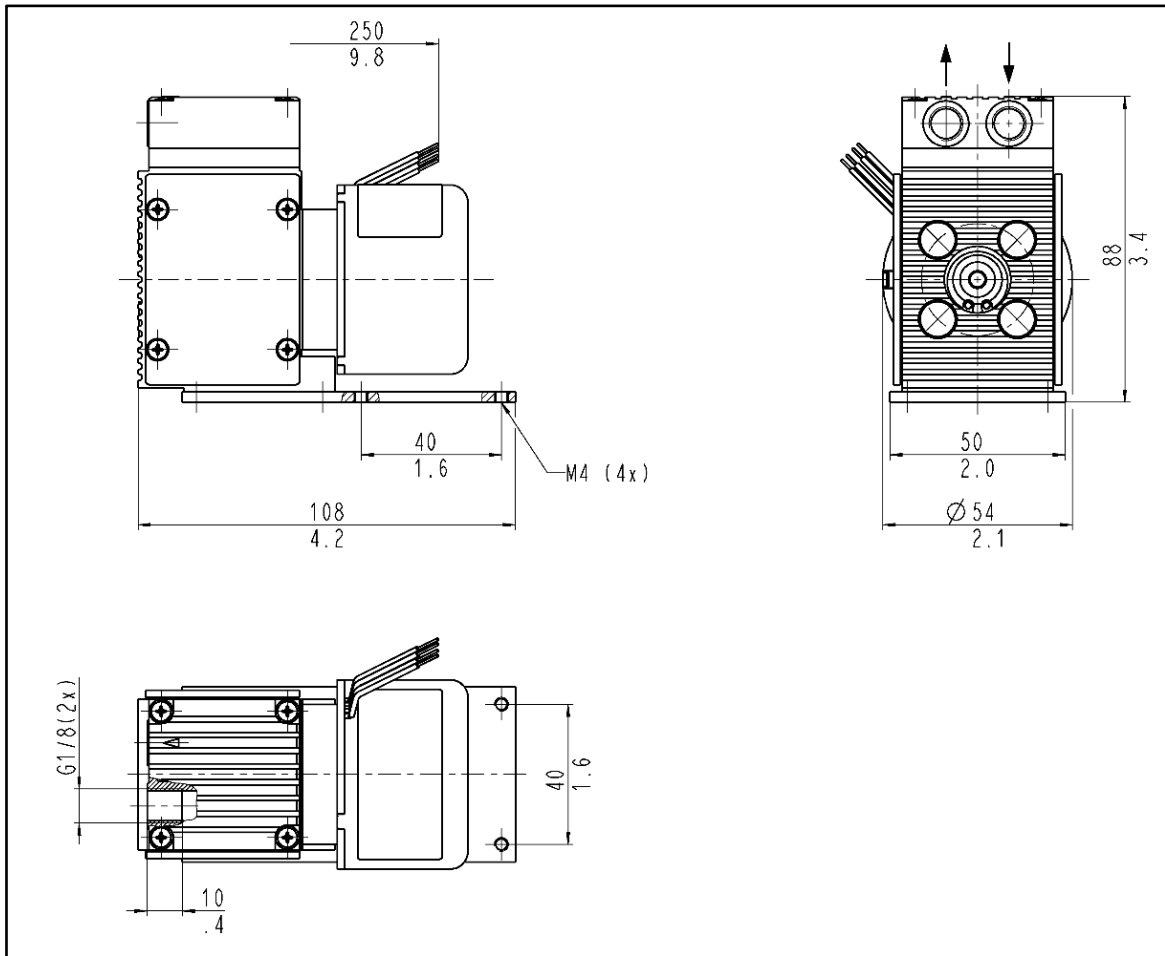


Fig. 12: Mounting dimensions pump series N86K_29DC-B (4 wires)

Cooling air supply

Only for pumps with AC motor:



Danger of burns from hot surfaces

Hot surfaces may be caused by overheating of the pump.

WARNING

→ Install the pump so that the motor fan can intake sufficient cooling air.

→ Install the pump so that accidental finger contact with the fan is impossible.

Immediate ambient of the hot pump parts

→ When installing, make sure that there are no combustible or thermally malleable objects placed in the immediate ambient of the hot pump parts (head, motor).

Installation location

→ Make sure that the installation location is dry and the pump is protected against rain, splash, hose and drip water as well as other pollutions.

→ Make sure, that the installation location is accessible for service.



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 against grease and oils.
 - Protect the pump from vibrations and jolts.
- i** Rubber feet (accessories) may be used to reduce noise, and vibration. They are not suitable for mounting the pump on its side, or suspended.

**WARNING**

Personal injury and/or damage to property because of vibration

In conjunction with adjacent components, vibration of the pump may result in crushing and/or damage to these components.

- Make sure that vibrations of the pump do not result in hazards associated with adjacent components.

Foreign matter protection

- Protect the pump against contact and intrusion of foreign matter.

7.2. Electrical connection



Extreme danger from electrical shock

DANGER

→ Only have the pump connected by an authorized specialist.

→ Only have the pump connected when the power supply is disconnected.

- When connecting the device to a power source, the relevant standards, directives, regulations, and technical standards must be observed.
- In the electrical installation, arrangements (complying with EN 60335-1) must be made for disconnecting the pump motor from the electrical supply.
- It is recommended that an additional “Emergency Stop” switch is installed.
- The pump must be installed so that contact with live parts (electrical connection) is impossible.
- For pumps with AC motor:
The motors of the pump must be protected according to DIN EN 60204-1 (protection against excess current, or overloading).



For max. operating current of the pump see type plate.



For pumps with DC motor:

The pumps may only be operated in a SELV power circuit.

Attach connection cables



Fasten the connection cables so that:

- the cables do not contact moving or hot 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).



Pumps with AC motor:

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



Project-specific pumps that are **not** fitted with a thermal switch must be protected by the user against the risk of overheating.

Pumps with AC motor

1. Compare the supply data with the data on the motor plate. For maximum operating current of the pump see pump's 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 wires.

Pumps with DC motor (brushed)

1. Compare the supply data with the data on the motor plate. For maximum operating current of the pump see pump's type plate.

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

2. Connect the positive and negative terminals.

i Note the proper polarity:
red connection cable: +
black connection cable: -

EMC-compatible Installation

The Tests:

- Magnetic field with energy-technical frequency
- Electromagnetic HF field, amplitude-modulated
- Electromagnetic HF field, pulse-modulated
- Discharging of static electricity
- High frequency, asymmetric
- Fast transients

were not carried out, cause the products do not contain electronic modules, which can be affected by these tests.

The Surge-test can only be passed with additional means, or is not mandatory, if: From DIN EN 61000-6-1 technical norm for EMC protection, part 1,10 test demands for EMC protection, table 3, EMC protection, D.C.- power in- and outputs. Remark 3: (quotation) Not to be used with input connections which are foreseen for a connection with a battery or a rechargeable battery which has to be removed or disconnected from the device for the recharge.

Devices with a D.C. power input which are foreseen to be operated with an A.C. / D.C. converter have to be tested at an A.C. power input of an A.C. / D.C. converter fixed by the manufacturer. In case the converter was not fixed they have to be tested at an A.C. power input of a typical (usual) A.C. / D.C. converter.

The test is applicable for D C power inputs which are foreseen for a permanent connection to cables which are longer than 10 m.

Pumps with brushless DC motor

3. Compare the supply data with the data on the motor plate. For maximum operating current of the pump see pump's type plate.

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

4. Connect the positive and negative terminals.

i Note the proper polarity:
red connection cable: +
blue connection cable: -

i Motors marked with a "K" on the type plate of the motor have inverse-polarity protection.

EMC-compatible
Installation

To ensure interference suppression according to DIN EN 55014-1 + A1 and DIN EN 61000-6-3 + A1 pump types equipped with the brushless DC motor (DC-B) must be equipped with a supplemental electronic circuit.

The supplemental circuit must be structured according to the following electrical diagram with the capacitor C₁:

- C1** Capacitor 1
(470 μ F, 35V)
M Motor
* Capacitor in the motor
(100nF, 50V)

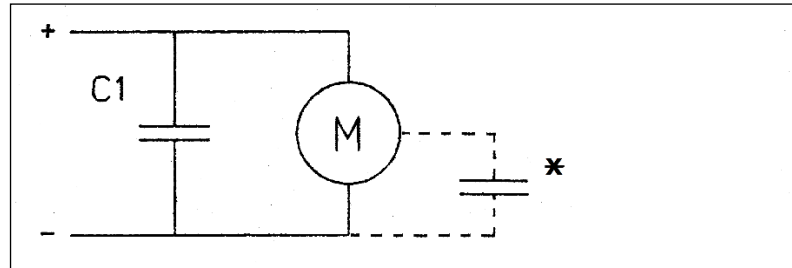


Fig. 1: Supplemental electronic circuit N 86 K_DC-B with "K" marking on the type plate

To ensure interference suppression according to DIN EN 55014-1 + A1 pump types equipped with the brushless DC motor (DC-B) (**without** "K" marking on the type plate of the motor) must be equipped with a supplemental electronic circuit.

The supplemental circuitry is not necessary if a voltage supply has a suppression of > 20 dB at 150 kHz and 0 dB at 1 MHz.

The supplemental circuit must be structured according to the following electrical diagram and the components defined therein in order to achieve the required level of suppression.

- C1** Capacitor 1 (1 μ F)
C2 Capacitor 2 (1000 μ F)
C1 Choke coil (6 μ H)
M Motor

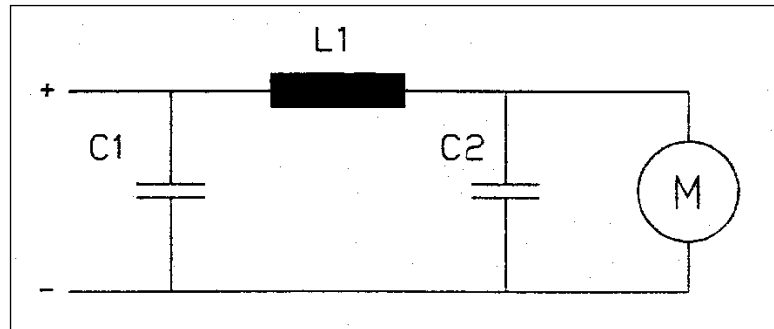


Fig. 2: Supplemental electronic circuit N 86 K_DC-B without "K" marking on the type plate

For pumps with brushless DC motor **without** "K" marking on the type plate the following harmonized standards are met:

- DIN EN 55014-1
- DIN EN 61000-6-2

Motor		2-Litzen (Standard)		4- Litzen (optional)	
Nennspannung / Nominal voltage	[V]	12	24	12	24
Spannungsbereich / Voltage range	[V]	10...15	14...28	10...15	14...28
Elektrische Anschlüsse / Electrical connection					
Litzenbelegung / lead assignment					
Funktion / function	Litzenfarbe lead color	Signalname signal name	Größe / Size		
+ Speisespannung + Supply voltage	rot / red	+ V _S	AWG 24 UL 1007	AWG 24 UL 1007	
- Speisespannung - Ground (0V)	blau oder schwarz blue or black	- V _S / GND	AWG 24 UL 1007	AWG 24 UL 1007	
Drehzahlregelung Eingangssignal Speed control voltage input signal	weiß / white	V _{Ctrl}	-	AWG 24 UL 1007	
Drehzahlausgang Tach output	grün / green	V _{TCh}	-	AWG 24 UL 1007	
Drehzahlregelung Eingangssignal V _{Ctrl} / Speed control voltage input signal V _{Ctrl}					
Steuerspannungsbereich DC Control voltage range DC	[V]			1.0...4.7	
Max. Eingangsspannung Max. input voltage	[V]			±30	
Schwellenspannung Treshold voltage	[V]			1.0±0.2	
Eingangswiderstand (V _{Ctrl} < 5V) Input resistance (V _{Ctrl} < 5V)	[kΩ]			≥. 10	
PWM Frequenzbereich PWM frequence	[kHz]			≥ 6	
Eingangsspiegel „high“ Input level „high“	[V]			5	
Eingangsspiegel „low“ Input level „low“	[V]			0 [0...0.1]	
Tastgradbereich Duty cycle range	[%]			≤ 12 – ≥ 70	
Tastgradbeschreibung min. → Motor Aus (ohne Last) Duty cycle description min. → Motor stop (without load)	[%]			≤ 12	
Tastgradbeschreibung max. → Motor max Drehzahl (o Last) Duty cycle description max. → Full speed (without load)	[%]			≥ 70	
Drehzahlregelung Ausgangssignal V _{TCh} / Speed control voltage output signal V _{TCh}					
Impulse pro Umdrehung Pulses per revolution	[-]			6	
Puls Tastverhältnis Pulse duty cycle	[%]			33	
Ausgangsspiegel „high“ Output level „high“	[V]			5 [4.2...5.4]	
Ausgangsspiegel „low“ Output level „low“	[V]			0 [0...0.6]	
Max. Strombelastbarkeit Max current carrying capacity	[mA]			0.1	
Ausgangsserienwiderstand Output series resistance	[kΩ]			3.9	

Tab. 15: Connection plan motor electronics for pumps with brushless DC motor

7.3. Pneumatic connection



CAUTION

Personal injury or damages to property by ejected protective plugs

If the protective plug at the pressure side of the pump hasn't been removed, it could be ejected because of the overpressure during operation.

→ Remove the protective plug during the installation.

- | | |
|------------------------|--|
| Connected components | → Only connect components to the pump which are designed for the pneumatic data of the pump (see Chapter 4, Technical Data). |
| Pressure relief device | → Protect the pump with a pressure relief device between the pressure connection of the pump and the first shut-off valve. |
| 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.



Confusion between suction and pressure sides can lead to breakage of connected components on the suction and pressure sides.

1. Remove the protective plugs from the hose connection threads.
2. The accessories silencer, filter, and hose connectors (where applicable) are screwed into the port threads.



Mount the silencer at the pressure side if necessary.

3. Connect the suction line and pressure line (see Chapter 4, Tab. 13 for mounting dimensions).
4. Lay the suction and pressure line at a downward angle to prevent condensate from running into the pump.

8. Operation



Danger of burns from hot pump parts or hot medium

During or after operation of the pump, some pump parts may be hot.

WARNING

- Allow the pump to cool after operation.
 - Take safety precautions against the contact of hot parts/media.
-



Injury of the eyes

During excessive approach to the inlet or outlet of the pump, the eyes could be injured by the upcoming vacuum or overpressure.

WARNING

- Don't look into the pump's inlet or outlet during the 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.
-



Hazard of the pump head bursting due to excessive pressure increase

WARNING

- 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 10. Troubleshooting).
 - Only throttle or regulate the air or gas quantity in the suction line to prevent the maximum permissible operating pressure from being exceeded.
 - If the air or gas quantity in the pressure line is throttled or regulated, make sure that the maximum permissible operating pressure is not exceeded.
 - Ensure that the pump outlet is not closed or constricted.
-

- i** Excessive pressure (with all of the related hazards) can be prevented by placing a bypass line with a pressure-relief valve between the pressure and suction sides of the pump. For further information, contact our technical adviser (contact data: see www.knf.com).

For pumps with AC motor:



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.

- i** Project-specific pumps that are **not** fitted with a thermal switch must be protected by the user against the risk of overheating.
- Pump standstill → With the pump at a standstill, open pressure and suction lines to normal atmospheric pressure.
- Switching on the pump **i** For pumps with AC motor:
The pump may not start up against pressure or vacuum during switch-on. This also applies in operating 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.
- i** Do not allow the pumps to start against pressure or vacuum. If you experience a brief power interruption, check for the presence of pressure or vacuum before restarting. If a pump starts against pressure or vacuum, it may block.
→ Install overload switch (see Chapter 7.2)
- Vapors as media The life of the diaphragm is prolonged the formation of condensate is avoided. Therefore the following precautions should be taken:
→ Run the pump for a few minutes to warm it up before handling saturated or nearly saturated vapors.
→ KNF recommends: When transferring aggressive media, flush the pump prior to switch off (see Chapter 9.2.1) to increase the service life of the diaphragm.
- Switching off the pump / removing from operation → Restore the system to normal atmospheric pressure (release pneumatic pressure in pump).

9. Servicing

9.1. Servicing schedule

Component	Servicing interval
Pump	- Regular inspection for external damage or leaks
Hose connections	- Regular inspection for external damage or leaks
Diaphragm and valve plates	- Replace when pumping capacity decreases, or sooner
Silencer (accessory)	- Change if it is dirty

Tab. 16

9.2. Cleaning

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

9.2.1. Flushing pump

➔ Before switching off the pump, flush it with air (or with inert gas if required for safety reasons) under atmospheric conditions (ambient pressure) for about five minutes.

9.2.2. Cleaning pump

- Requirements
- Pump disconnected from mains and de-energized.



WARNING

Dangerous substances in the pump can cause a health hazard.

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

- ➔ Wear protective clothing if necessary, e.g. protective gloves.
- ➔ Take the proper steps to clean the pump.



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.

- ➔ Solvent should be used for cleaning only if the head materials are not corroded (ensure compatibility of the material).
- ➔ If compressed air is available, blow out the parts.

9.3. Replacing the diaphragm and valve plates

9.3.1. N85.3K_E and N85.3K_DC

- Requirement
- Pump disconnected from mains and de-energized.
 - Pump is clean and free of hazardous materials.
 - Hoses removed from pump's pneumatic inlet and outlet.

Spare part/tool	Quantity
Service Set*	1
Phillips screwdriver no. 1	1
Felt-tip pen	1

Tab. 17

*according to Chapter 11

Information on procedure

Diaphragm and valve plates/sealings are the only parts of the pump subject to wear. They are simple to change.

Always change valve plates/sealings and diaphragm on both heads at the same time. If the diaphragm and the valve plates/sealings are not changed at the same time the nominal performance of the pump is not guaranteed after the servicing.



WARNING

Dangerous substances in the pump can cause a health hazard.

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

- ➔ Wear protective clothing if necessary, e.g. protective gloves.
- ➔ Flush the pump before replacing the diaphragm and valve plates/sealings (see Chapter 9.2.1).



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.

Change the diaphragms and valve plates/sealings in the following sequence:

- a.) Preparatory steps
- b.) Remove pump head
- c.) Change diaphragm
- d.) Change valve plates/sealings
- e.) Refit pump head
- f.) Final steps

Except for the preparatory and final steps, perform and finish all work on one pump head before working on the second pump head.

- 1 Housing
- 2 Intermediate plate
- 3 Head plate
- 4 Screw
- 5 Connection
- 6 Cover
- 7 Valve plate/sealing
- 8
- 9 Diaphragm
- 10
- 11 Diaphragm spacer(s)
- 12 Disk spring(s)
- 13 Connection Rod
- 14 Eccentric
- 15 Washer
- 16 Counter weight

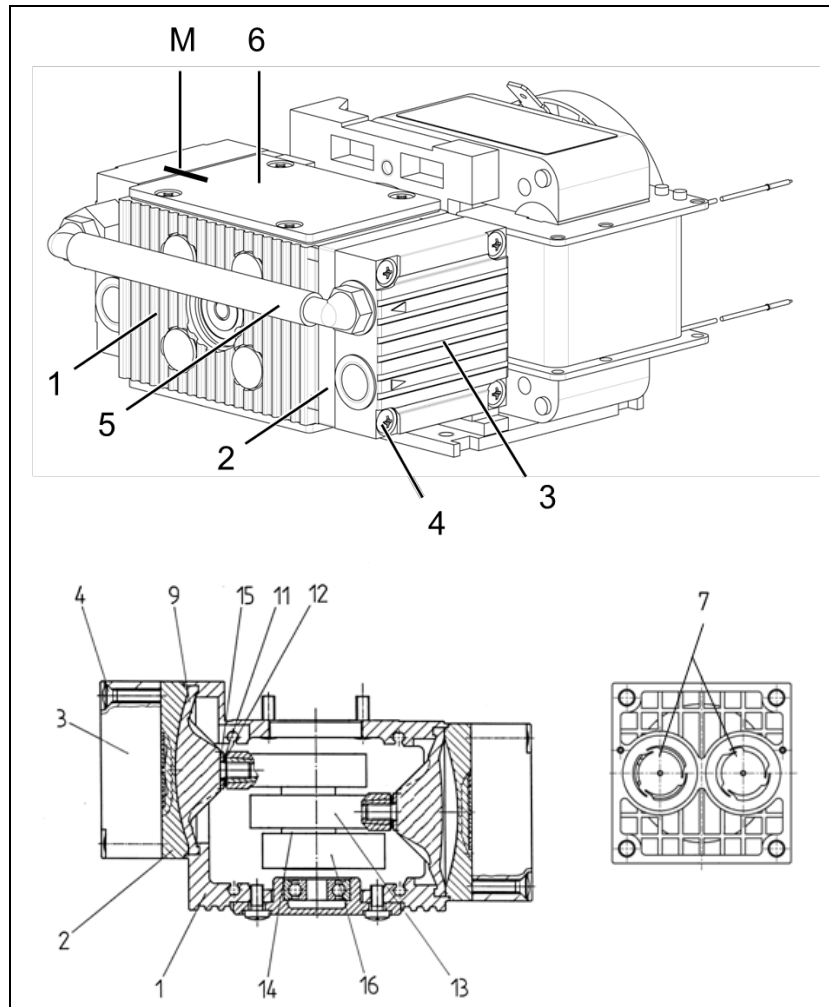


Fig. 13: Two-headed pump (N85.3K_E)

The position numbers in the following text refer to Fig. 13. Proceed as follows:

a.) Preparatory steps

1. Remove the pump from the source of electrical power. Make sure the pump is voltage-free and secure it.
2. Only for models with DC motors (no cooling fan): Remove cover (6) from pump housing after loosening the four screws. On these models, which have no fan, where reference is made to turning or holding the cooling fan, the necessary operations must be carried out by turning or holding the counterweight (16).

b) Removing the pump head

1. Mark the position of the head plate (3), intermediate plate (2), and housing (1) relative to each other by a drawing line with a felt-tip marker (M). This helps avoid incorrect assembly later.
2. Remove the pneumatic connection (5) by pulling the tubing from the connectors.
3. Undo the 4 screws (4) in the head plate and lift the head plate (3) with the intermediate plate (2) off the pump housing.

c) Changing the diaphragm

1. Turn the fan to bring the diaphragm (9) to top dead centre.
2. Lift the edge of the diaphragm, and gripping it on opposite sides, unscrew it by turning anti-clock-wise. Please take care that the disc spring (12) and diaphragm spacers (11) on the threaded portion of the diaphragm do not fall into the housing.
3. Take the disc spring (12), diaphragm spacer(s) (11), and the washer (15) 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 9.2. Cleaning).
5. Put the washer, diaphragm spacer(s), and disc spring, in that order, on the thread of the new diaphragm.
 - The concave side of the disc spring must be towards the diaphragm.
6. Turn the fan until the connecting rod (13) is at top dead centre.
7. Screw the new diaphragm, complete with washer, diaphragm spacer(s), and disc spring, into the connecting rod (clockwise) and tighten it by hand.

d) Changing the valve plates

1. Separate the head plate (3) from intermediate plate (2).
2. Remove the valve plates/sealings (7) from the intermediate plate.
3. Check that the valve seats in the head plate and intermediate plate are clean. If scratches, distortion, or corrosion are evident on these parts they should be replaced.
4. Lay the new valve plates/sealings in the recesses in the intermediate plate. The valve plates/sealings for suction and pressure sides are identical, as are upper and lower sides of the valve plates/sealings
5. Check that the valve plates/sealings are not deformed by moving them gently sideways in their recesses.

e) Refitting the pump head

1. Turn the fan to bring the diaphragm to top dead centre.
2. Place the intermediate plate (2) with valve plates/sealings (7) and head plate (3) on the housing, in the position indicated by the marking (M).
3. Check that the head plate is centred by moving it gently sideways.
4. Gently tighten the screws (4), evenly and diagonally.
5. Turn the fan to check that the pump rotates freely.
6. Turn the fan again to bring the diaphragm to top dead centre.

7. Now tighten screws (4) firmly and diagonally.

8. Refit the pneumatic connection (5).

f.) Final steps

1. In the case of DC version (no cooling fan): refix the cover (6) to housing (1).

2. Connect the pump to the electrical supply.

If you have any questions about servicing call our technical adviser (see contact data: www.knf.com).

9.3.2. N86K_E, N86K_DC and N86K_DC-B

- Requirement
- Pump disconnected from mains and de-energized.
 - Pump is clean and free of hazardous materials.
 - Hoses removed from pump's pneumatic inlet and outlet.

Spare parts/tools

Spare part/tool	Quantity
Service Set*	1
Phillips screwdriver no. 1	1
Felt-tip pen	1

Tab. 18

*according to Chapter 11

Information on procedure

Diaphragm and valve plates/sealings are the only parts of the pump subject to wear. They are simple to change.

Always change valve plates/sealings and diaphragm on both heads at the same time. If the diaphragm and the valve plates/sealings are not changed at the same time the nominal performance of the pump is not guaranteed after the servicing.

**WARNING**

Dangerous substances in the pump can cause a health hazard.

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

- ➔ Wear protective clothing if necessary, e.g. protective gloves.
- ➔ Flush the pump before replacing the diaphragm and valve plates/sealings (see Chapter 9.2.1).

**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.

Change the diaphragms and valve plates/sealings in the following sequence:

- a.) Preparatory steps
- b.) Remove pump head
- c.) Change diaphragm
- d.) Change valve plates/sealings
- e.) Refit pump head
- f.) Final steps

- 1 Housing
- 2 Intermediate plate
- 3 Head plate
- 4 Screw
- 6 Cover
- 7 Valve plate/sealing
- 9 Diaphragm
- 10 Diaphragm support
- 11 Diaphragm spacer(s)
- 13 Connection Rod
- 14 Eccentric
- 16 Counter weight

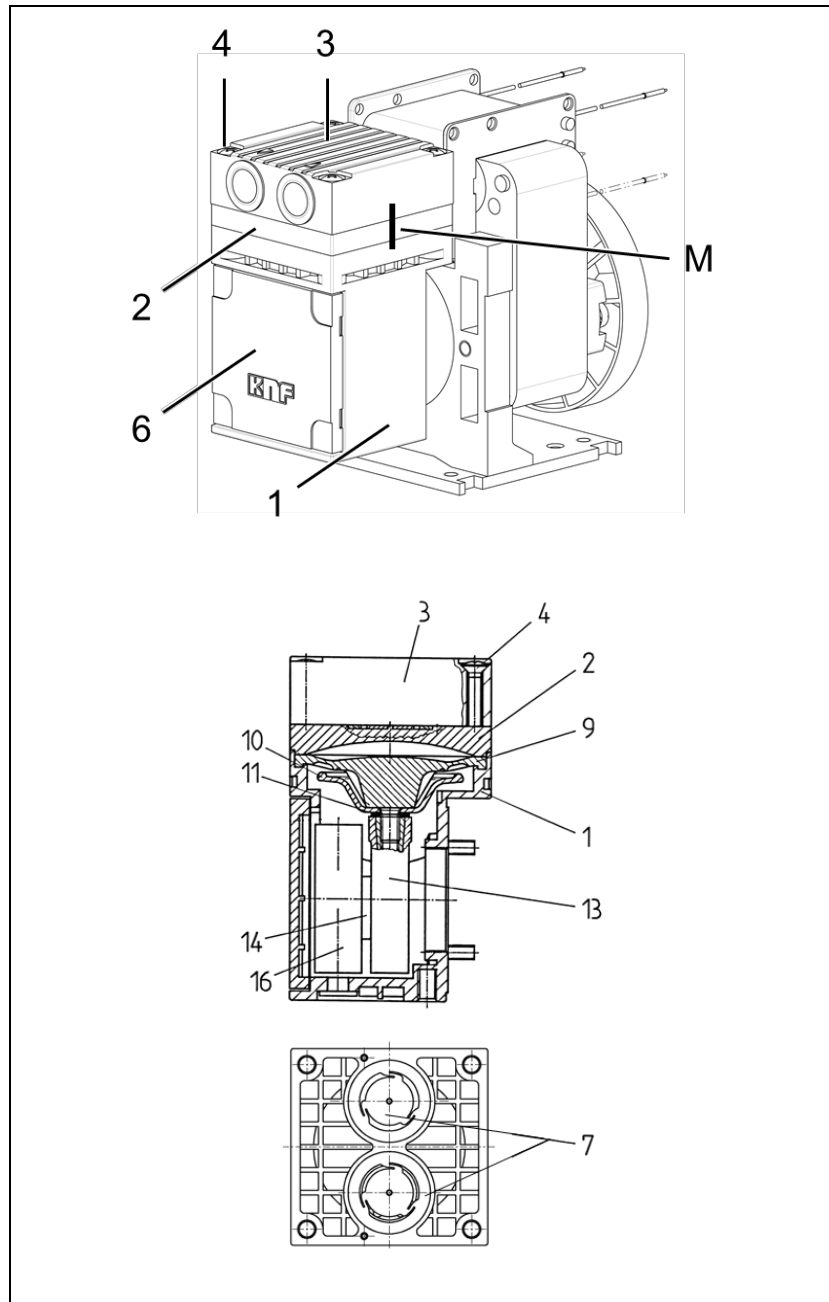


Fig. 14: One-headed pump (N86K_E)

The position numbers in the following text refer to Fig. 14. Proceed as follows:

a.) Preparatory steps

1. Remove the pump from the source of electrical power. Make sure the pump is voltage-free and secure it.
2. Only for models with dc motors (no cooling fan): remove cover (6) from pump housing (1); to do this insert a screwdriver into the slots on the sides, and prise the cover off (with care the sealing between cover and housing may be reused).
On these models, which have no fan, where reference is made to turning or holding the cooling fan, the necessary operations

must be carried out by turning or holding the counterweight (16).

b) Removing the pump head

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

c) Changing the diaphragm

1. Turn the fan to bring the diaphragm (9) to top dead centre.
2. Lift the edge of the diaphragm, and gripping it on opposite sides, unscrew it by turning anti-clock-wise. Please take care that the disc spring (12), diaphragm spacers (11) on the threaded portion of the diaphragm do not fall into the housing.
3. Take the disc spring (12), diaphragm spacer(s) (11), and diaphragm support (10) 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 9.2. Cleaning).
5. Put the diaphragm support, diaphragm spacer(s), and disc spring, in that order, on the thread of the new diaphragm.
 - The concave side of the disc spring must be towards the diaphragm.
6. Turn the fan until the connecting rod (13) is at top dead centre.
7. Screw the new diaphragm, complete with diaphragm support, diaphragm spacer(s), and disc spring, into the connecting rod (clockwise) and tighten it by hand.

d) Changing the valve plates

1. Separate the head plate (3) from intermediate plate (2).
2. Remove the valve plates/sealings (7) from the intermediate plate.
3. Check that the valve seats in the head plate and intermediate plate are clean. If scratches, distortion, or corrosion are evident on these parts they should be replaced.
4. Lay the new valve plates/sealings in the recesses in the intermediate plate. The valve plates/sealings for suction and pressure sides are identical, as are upper and lower sides of the valve plates/sealings
5. Check that the valve plates/sealings are not deformed by moving them gently sideways in their recesses.

e) Refitting the pump head

1. Turn the fan to bring the diaphragm to top dead centre.
2. Place the intermediate plate (2) with valve plates/sealings (7) and head plate (3) on the housing, in the position indicated by the marking (M).
3. Check that the head plate is centred by moving it gently side-ways.
4. Gently tighten the screws (4), evenly and diagonally.
5. Turn the fan to check that the pump rotates freely.
6. Turn the fan again to bring the diaphragm to top dead centre.
7. Now tighten screws (4) firmly and diagonally.

f.) Final steps

1. In the case of a dc versions (no cooling fan):
Refix the cover (6) to housing (1).
2. Connect the pump to the electrical supply.

If you have any questions about servicing call our technical adviser (see contact data: www.knf.com).

10. Troubleshooting



DANGER

Extreme danger from electrical shock!

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

- Check the pump (see Tab. 19 and Tab. 20).

Pump does not transfer	
Cause	Fault remedy
Pump not connected to the mains.	→ Connect pump to the mains.
No voltage in the mains.	→ Check room fuse and switch on if necessary.
For pumps with brushless DC motor: Wrong polarity of the connection wires	<ul style="list-style-type: none"> → Separate pump from the mains. → Be aware of right polarity of the connection wires and connect pump.
For pumps with AC motor: The pump's thermal switch has triggered.	<ul style="list-style-type: none"> → Disconnect pump from the mains. → Allow pump to cool. → Identify and eliminate cause of overheating.
Connections or hoses are blocked.	<ul style="list-style-type: none"> → Check hoses and connections. → Remove blockage.
External valve is closed or filter is clogged.	→ Check external valves and filters.
Condensate has collected in the pump head.	<ul style="list-style-type: none"> → Detach the condensate source from the pump. → Flush the pump (see Chapter 9.2.1). → Install the pump at the highest point in the system.
Diaphragm or valve plates are worn.	→ Replace diaphragm and valve plates (see Chapter 9.3).

Tab. 19

Flow rate, pressure or vacuum too low	
The pump does not achieve the output specified in the Technical data or the data sheet.	
Cause	Fault remedy
Condensate has collected in the pump head.	<ul style="list-style-type: none"> ➔ Detach the condensate source from the pump. ➔ Flush the pump (see Chapter 9.2.1). ➔ Install the pump at the highest point in the system.
Presence of positive pressure on the pressure side with simultaneous vacuum or positive pressure on the suction side.	<ul style="list-style-type: none"> ➔ Change the pressure conditions.
Cross-section of pneumatic hoses or connectors too narrow or restricted.	<ul style="list-style-type: none"> ➔ Disconnect the pump from the system and determine output values. ➔ Remove restriction (e.g. valve) if necessary. ➔ If applicable, use larger-diameter hoses or connectors.
Leaks in connections, hoses or pump head.	<ul style="list-style-type: none"> ➔ Make sure the hoses are properly seated on the hose connectors. ➔ Replace leaking hoses. ➔ Eliminate leaks.
Connections or hoses completely or partially clogged.	<ul style="list-style-type: none"> ➔ Check hoses and connections. ➔ Remove any parts or particles causing blockages, check filter
Pump head components are soiled.	<ul style="list-style-type: none"> ➔ Clean head components.
Diaphragm or valve plates are worn.	<ul style="list-style-type: none"> ➔ Replace diaphragm and valve plates (see Chapter 9.3).
Diaphragm and valve plates have been replaced.	<ul style="list-style-type: none"> ➔ Make sure that number and thickness of the diaphragm spacers correspond to the original delivery state and that they have been replaced properly onto the diaphragm screw thread. ➔ Make sure that the pump heads are properly positioned (N85.3). ➔ Check head connection and hose connections for leaks.

Tab. 20

Fault cannot be rectified

If you are unable to identify the cause of the problem, please send the pump to KNF customer services (see contact data: www.knf.com).

1. Flush the pump (see Chapter 9.2.1).
2. Clean the pump (see Chapter 9.2.2).
3. Send the pump, together with completed Health and Safety Clearance and Decontamination Form, to KNF stating the nature of the transferred medium.

11. Spare parts and accessories

11.1. Spare parts

A spare parts kit contains all parts needed for complete overhaul of the pump head:

- For one-headed pumps:
 - 1x diaphragm
 - 2x valve plates/sealings
- For two-headed pumps:
 - 2x diaphragm
 - 4x valve plates/sealings

Spare parts kit for pump type	Order-No.
N85.3KN	032498
N85.3KT	032482
N86KN	043241
N86KT	043242

Tab. 21

11.2. Accessories

Description	Order-No.
Silencer	000345
Filter	000346
Hose Connector PA	001936
Hose Connector PVDF	025671
Rubber Foot for N85.3_E and N86_E	024435

Tab. 22

12. Returns

Preparing for return

1. Flush the pump with air for a few minutes (if necessary for safety reasons: with inert gas) to free the pump head of dangerous or aggressive gases (see Chapter 9.2.1).

i Please contact your KNF sales partner if the pump cannot be flushed due to damages.

2. Remove the pump.
3. Clean the pump (see Chapter 9.2.2).
4. Send the pump together with the completed Health and Safety Clearance and Decontamination Form to KNF, stating the nature of the transferred medium.
5. Pack the device securely to prevent further damages to the product. If necessary, request original packaging for a fee.

Returns

KNF shall undertake to repair the pump only under the condition that the customer presents a certificate regarding the medium that is pumped and the cleaning of the pump. Please follow the instructions at knf.com/repairs here.

Contact your KNF sales partner directly if you require additional support for your return service.

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KNF worldwide

Find your local KNF partner on www.knf.com