



Operating and Installation Instructions

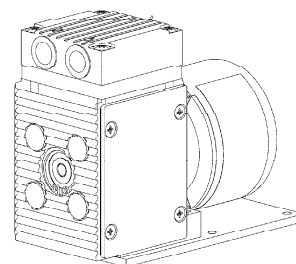
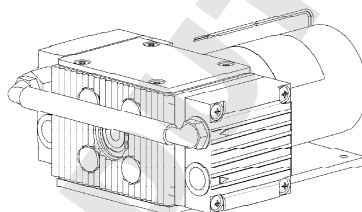
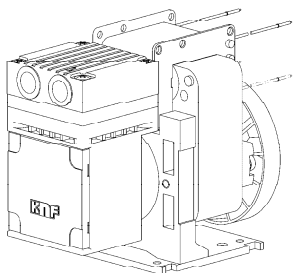
Read and observe these Operating and Installation Instructions!

Diaphragm Vacuum Pumps and Compressors

N 85.3 KNE
N 85.3 KTE
N 86 KNE
N 86 KTE

N 85.3 KNDC
N 85.3 KTDC
N 86 KNDC
N 86 KTDC

N 86 KNDC-B
N 86 KTDC-B



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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.

- ➔ Forward the Operating and Installation Instructions to any subsequent owners of the pump.

Project pumps

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

- ➔ In 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.

- ➔ Here you will see actions for avoiding the danger and potential consequences.

Danger levels

Signal word	Meaning	Consequences if not observed
DANGER	warns of immediate danger	Consequences include death or serious injuries and/or serious property damage.
WARNING	warns of potential danger	Death or serious injuries and/or serious property damage are possible.
CAUTION	warns of a potentially dangerous situation	Minor injuries or damage to property are possible.

Tab. 1

Other information and symbols

- ➔ This indicates an activity (step) that must be carried out.

1. This indicates the first step of an activity to be carried out. Any additional steps are consecutively numbered.

- i** This symbol indicates important information.

2. Use

2.1. Intended use

The pumps are exclusively intended for transferring gases and vapors.

Owner's responsibility

Operating parameters and conditions

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

Only complete pumps may be taken into service.

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

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 must not be operated in an explosive atmosphere.

The pumps are not suitable for transferring dust.

The pumps are not suitable for transferring liquids.

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 pressure simultaneously.

Never apply positive pressure to the suction side of the pump.

3. Safety

i Observe the safety precautions in Chapters 6. *Installation and connection* and 7. *Operation*.

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

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

Personnel	<p>Make sure that only trained and instructed personnel or specially trained personnel work on the pumps. This applies especially to assembly, connection, and servicing work.</p> <p>Make sure that all personnel have read and understood the Operating and Installation Instructions, especially the "Safety" chapter.</p>
Working in a safety-conscious manner	<p>Observe the accident prevention and safety regulations when performing any work on the pump and during operation.</p> <p>Ensure that the pump is separated from the mains and is de-energized.</p>
Handling dangerous media	<p>When transferring dangerous media, observe the safety regulations for handling such media.</p>
Handling flammable media	<p>Be aware that the pumps are not designed to be explosion-proof.</p> <p>Make sure that the temperature of the medium is always sufficiently below its ignition temperature, to avoid ignition or explosion. This also applies to unusual operating situations.</p> <p>Note that the temperature of the medium increases when the pump compresses the medium.</p> <p>Hence, make sure that the temperature of the medium is sufficiently below its ignition temperature, even when it is compressed to maximum permissible operating pressure of the pump. The pump's maximum permissible operating pressure is stated in the Technical data (see Chapter 4).</p> <p>Consider any external sources of energy, such as sources of radiation, that could additionally heat the medium.</p> <p>In case of doubt, consult the KNF customer service.</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 applies especially to parts contaminated with toxic substances.</p>
EC directives / standards	<p>For the purposes of 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 ma-</p>

chine in which the partly completed machinery is to be assembled conforms to 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 pumps conform to the Directive 2011/65/EU (RoHS2).

The pumps conform to the safety requirements regarding electromagnetic compatibility in Directive 2004/108/EC.

The following harmonized standards are met:

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

Tab. 2

Customer services and repairs

All repairs to the pump(s) must be carried out by the relevant KNF Customer Service team.

Housings with voltage-carrying parts may be opened by technical personnel only.

Use only genuine parts from KNF for servicing work.

4. Technical data

N 85.3 KNE

N 85.3 KTE

<i>Pneumatic performance</i>	
Max. permissible operating pressure [bar g]	0.3
Ultimate vacuum [mbar abs.]	25 (N85.3 KNE) 30 (N85.3 KTE)
Flow rate at atm. pressure [l/min]*	5
<i>Pneumatic connections</i>	
Thread size	G 1/8
<i>Ambient and media temperature</i>	
Permissible ambient temperature	+ 5 °C to + 40 °C
Permissible media temperature	+ 5 °C to + 40 °C
<i>Other parameters</i>	
Weight [kg]	1.25
Dimensions: L x H x W [mm]	approx. 131 x 75 x 109
Maximum permissible ambient relative humidity	80 % for temperatures up to 31 °C, decreasing linearly to 50 % at 40 °C
Maximum altitude of installation [m above sea level]	2000
<i>Electrical data</i>	
Voltage / Frequencies	See type label
Max. operating current	
Pump power consumption	
Maximum permissible mains voltage fluctuations	+/- 10 %
Motor protection class	IP 00
<i>Pump materials</i>	
Pump head	PPS
Diaphragm	EPDM (N85.3 KNE) PTFE coated (N85.3 KTE)
Valves	EPDM (N85.3 KNE) FFPM (N85.3 KTE)

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

Thermo switch

The pumps are fitted with a thermo switch to protect against over-loading.



WARNUNG

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.

N 86 KNE**N 86 KTE**

<i>Pneumatic performance</i>	
Max. permissible operating pressure [bar g]	2.4 (N86 KNE) 2.5 (N86 KTE)
Ultimate vacuum [mbar abs.]	100 (N86 KNE) 160 (N86 KTE)
Flow rate at atm. pressure [l/min]*	6 (N86 KNE) 5.5 (N86 KTE)
<i>Pneumatic connections</i>	
Thread size	G 1/8
<i>Ambient and media temperature</i>	
Permissible ambient temperature	+ 5 °C to + 40 °C
Permissible media temperature	+ 5 °C to + 40 °C
<i>Other parameters</i>	
Weight [kg]	1.1
Dimensions: L x H x W [mm]	approx. 104 x 91 x 69
Maximum permissible ambient relative humidity	80 % for temperatures up to 31 °C, decreasing linearly to 50 % at 40 °C
Maximum altitude of installation [m above sea level]	2000
<i>Electrical data</i>	
Voltage / Frequencies	See type label
Max. operating current	
Pump power consumption	
Maximum permissible mains voltage fluctuations	+/- 10 %
Motor protection class	IP 00
<i>Pump materials</i>	
Pump head	PPS
Diaphragm	EPDM (N86 KNE) PTFE coated (N86 KTE)
Valves	EPDM (N86 KNE) FFPM (N86 KTE)

Tab. 4

* liters in standard state (1013 mbar)

Thermo switch

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

**WARNUNG**

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.

N 85.3 KNDC

N 85.3 KTDC

<i>Pneumatic performance</i>	
Max. permissible operating pressure [bar g]	0,3
Ultimate vacuum [mbar abs.]	25 (N85.3 KNE) 30 (N85.3 KTE)
Flow rate at atm. pressure [l/min]*	5
<i>Pneumatic connections</i>	
Thread size	G 1/8
<i>Ambient and media temperature</i>	
Permissible ambient temperature	+ 5 °C to + 40 °C
Permissible media temperature	+ 5 °C to + 40 °C
<i>Other parameters</i>	
Weight [kg]	0.72
Dimensions: L x H x W [mm]	approx. 129 x 50 x 105
Maximum permissible ambient relative humidity	80 % for temperatures up to 31 °C, decreasing linearly to 50 % at 40 °C
Maximum altitude of installation [m above sea level]	2000
<i>Electrical data</i>	
Motor type	DC motor
Voltage	See type label
Max. operating current	
Maximum permissible mains voltage fluctuations	+/- 10 %
Motor protection class	IP 00
<i>Pump materials</i>	
Pump head	PPS
Diaphragm	EPDM (N85.3 KNDC) PTFE coated (N85.3 KTDC)
Valves	EPDM (N85.3 KNDC) FFPM (N85.3 KTDC)

Tab. 5

* liters in standard state (1013 mbar)

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

N 86 KNDC		N 86 KTDC	
<i>Pneumatic performance</i>			
Max. permissible operating pressure [bar g]	1.5		
Ultimate vacuum [mbar abs.]	100	(N86 KNDC)	
	160	(N86 KTDC)	
Flow rate at atm. pressure [l/min]*	6.5	(N86 KNDC)	
	6	(N86 KTDC)	
<i>Pneumatic connections</i>			
Thread size	G 1/8		
<i>Ambient and media temperature</i>			
Permissible ambient temperature	+ 5 °C to + 40 °C		
Permissible media temperature	+ 5 °C to + 40 °C		
<i>Other parameters</i>			
Weight [kg]	0.58		
Dimensions: L x H x W [mm]	approx. 106 x 74 x 43		
Maximum permissible ambient relative humidity	80 % for temperatures up to 31 °C, decreasing linearly to 50 % at 40 °C		
Maximum altitude of installation [m above sea level]	2000		
<i>Electrical data</i>			
Motor type	DC motor		
Voltage	See type label		
Max. operating current			
Maximum permissible mains voltage fluctuations	+/- 10 %		
Motor protection class	IP 20		
<i>Pump materials</i>			
Pump head	PPS		
Diaphragm	EPDM	(N86 KNDC)	
	PTFE coated	(N86 KTDC)	
Valves	EPDM	(N86 KNDC)	
	FFPM	(N86 KTDC)	

Tab. 6

* liters in standard state (1013 mbar)

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

N 86 KNDC-B		N 86 KTDC-B	
<i>Pneumatic performance</i>			
Max. permissible operating pressure [bar g]	2.4	(N86 KNDC-B)	
	2.5	(N86 KTDC-B)	
Ultimate vacuum at nominal speed [mbar abs.]	100	(N86 KNDC-B)	
	160	(N86 KTDC-B)	
Flow rate at atm. pressure and nominal speed [l/min]*	6	(N86 KNDC-B)	
	5.5	(N86 KTDC-B)	
<i>Pneumatic connections</i>			
Thread size	G 1/8		
<i>Ambient and media temperature</i>			
Permissible ambient temperature	+ 5 °C to + 40 °C		
Permissible media temperature	+ 5 °C to + 40 °C		
<i>Other parameters</i>			
Weight [kg]	0.58		
Dimensions L x H x W [mm]	approx. 108 x 88 x 54		
Maximum permissible ambient relative humidity	80 % for temperatures up to 31 °C, decreasing linearly to 50 % at 40 °C		
Maximum altitude of installation [m above sea level]	2000		
<i>Electrical data</i>			
Motor type	Brushless DC motor		
Voltage	See type label		
Control voltage**			
Max. operating current			
Maximum permissible mains voltage fluctuations	+/- 10 %		
Motor protection class	IP 30		
<i>Pump materials</i>			
Pump head	PPS		
Diaphragm	EPDM	(N86 KNDC-B)	
	PTFE coated	(N86 KTDC-B)	
Valves	EPDM	(N86 KNDC-B)	
	FFPM	(N86 KTDC-B)	

Tab. 7

* liters in standard state (1013 mbar)

** project version only

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

5. Assembly and function

Assembly of N 85.3 K_E

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

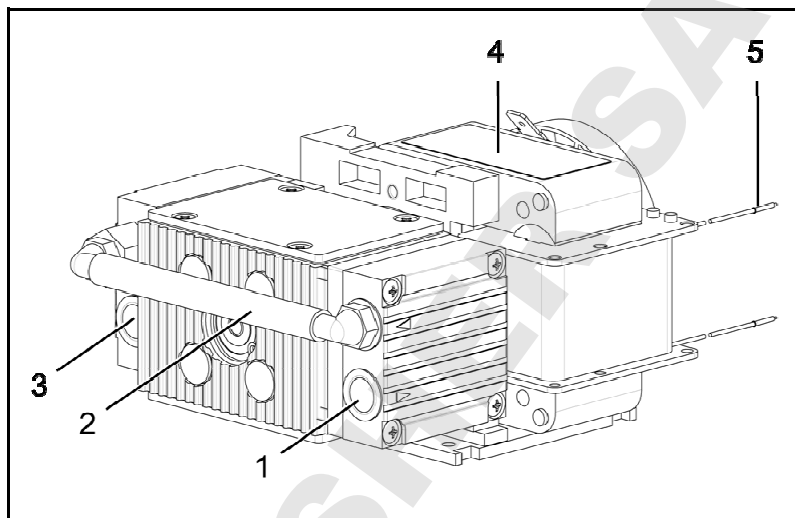


Fig. 1: Assembly of N 85.3 K_E

Assembly N 86 K_E

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

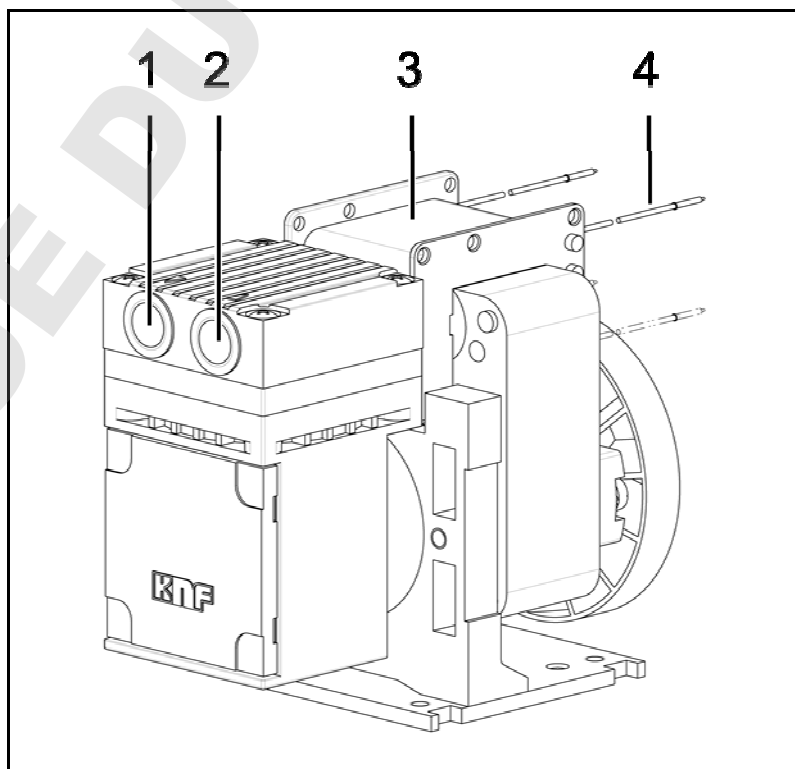


Fig. 2: Assembly of N 86 K_E

Assembly of N 85.3 K_DC

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

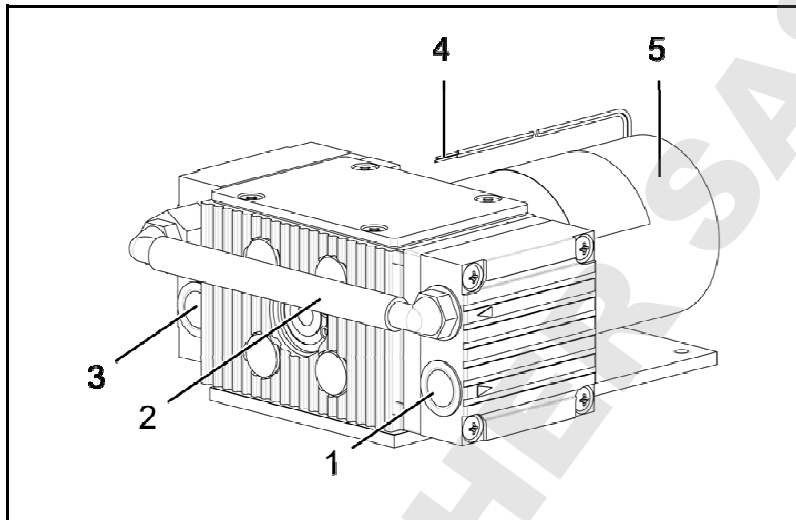


Fig. 3: Assembly of N 85.3 K_DC

Assembly of N 86 K_DC

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

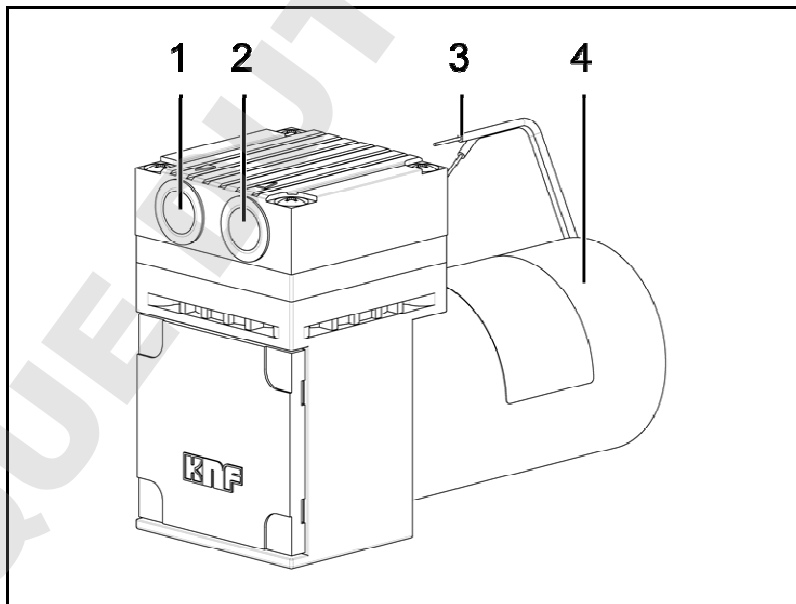


Fig. 4: Assembly of N 86 K_DC

Assembly of N 86 K_DC-B

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

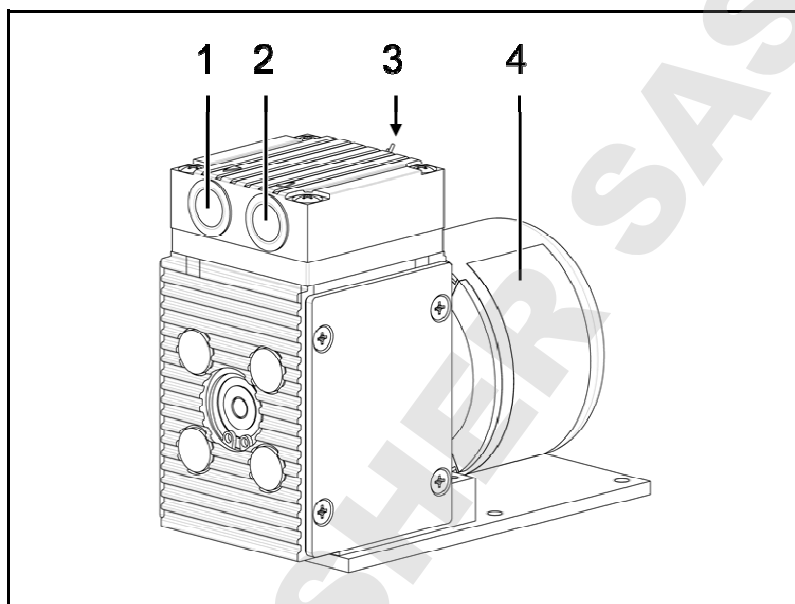


Fig. 5: Assembly of N 86 K_DC-B

How diaphragm pumps work

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

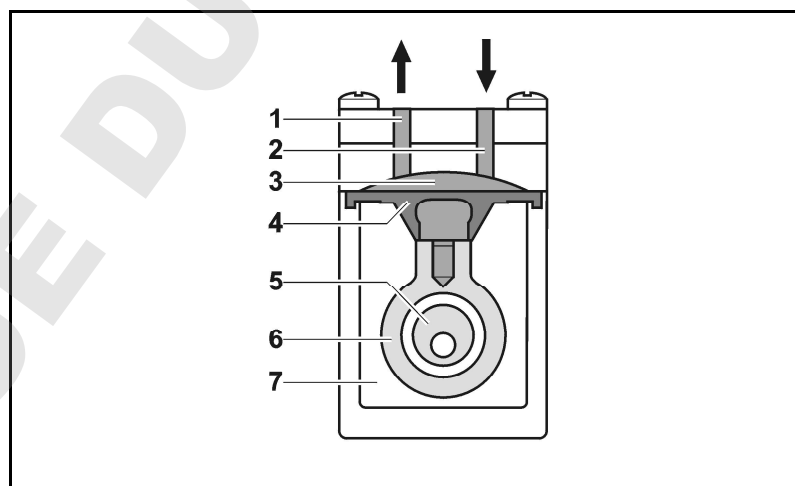


Fig. 6: Pump head

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

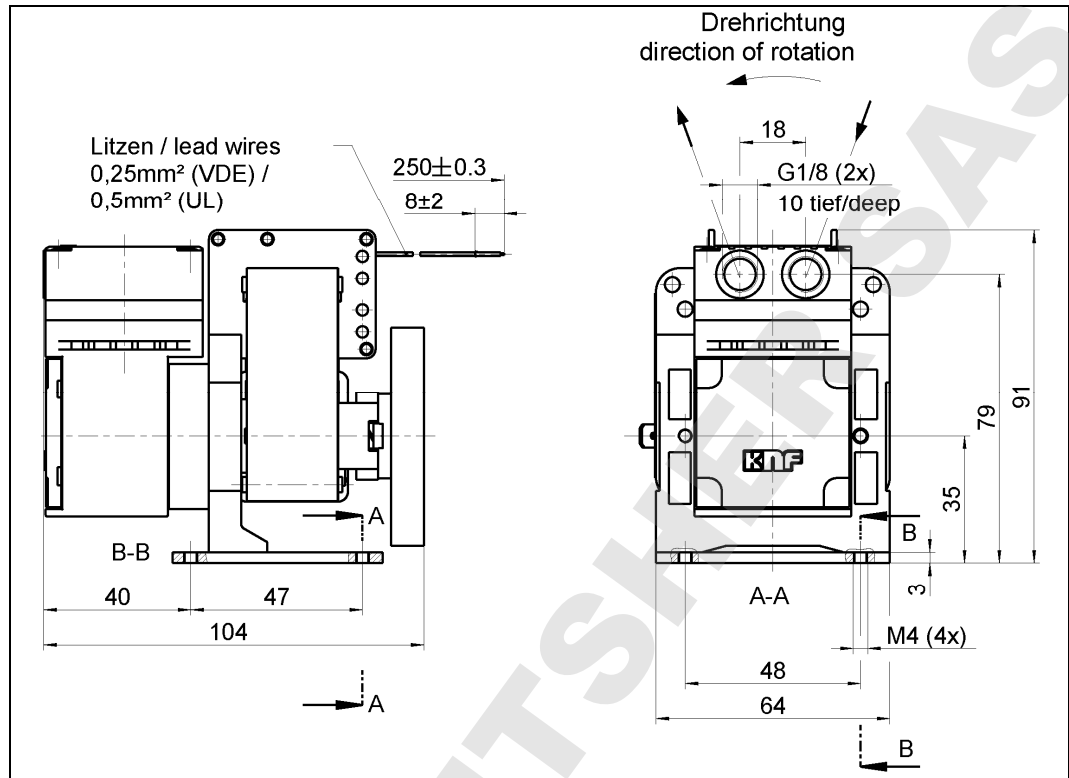


Fig. 8: Attachment dimensions of N N 86 K_E
(dimensional tolerances according to DIN ISO 2768-1, tolerance class V)

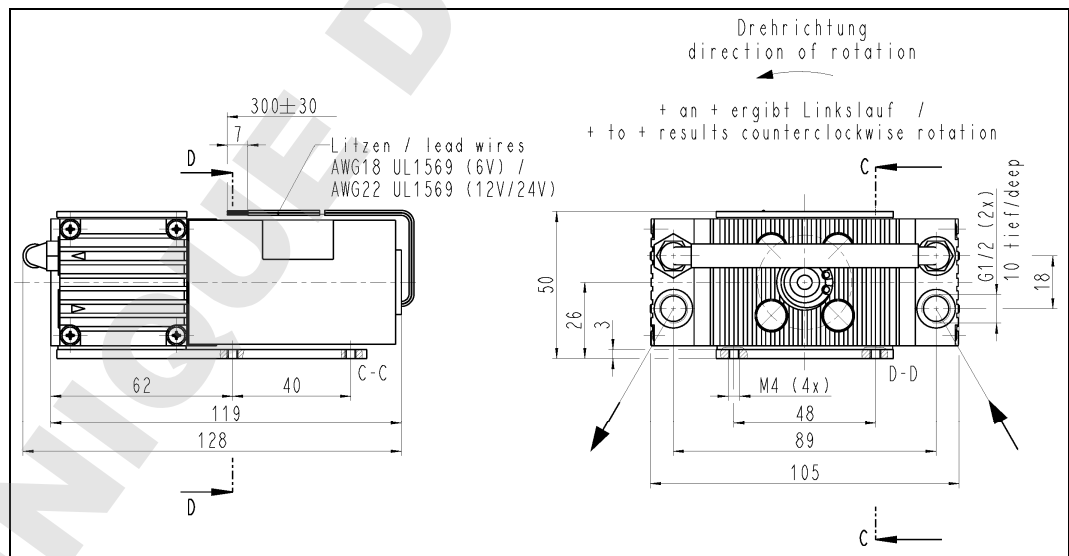


Fig. 9: Attachment dimensions of N 85.3 K_DC
(dimensional tolerances according to DIN ISO 2768-1, tolerance class V)

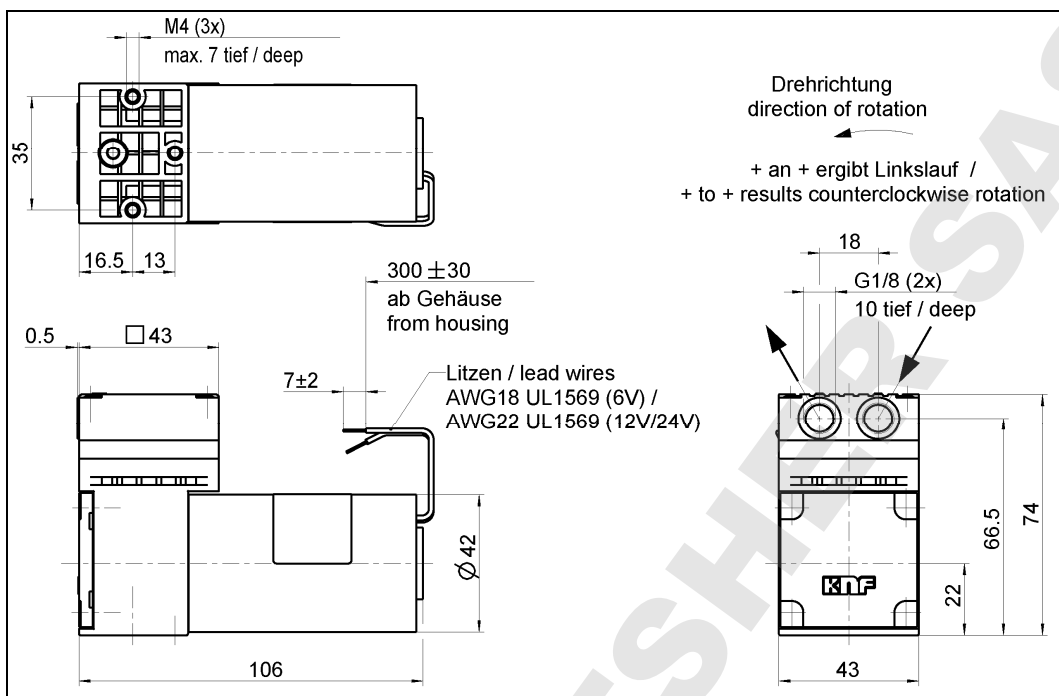


Fig. 10: Attachment dimensions of N 86 K_{DC}
(dimensional tolerances according to DIN ISO 2768-1, tolerance class V)

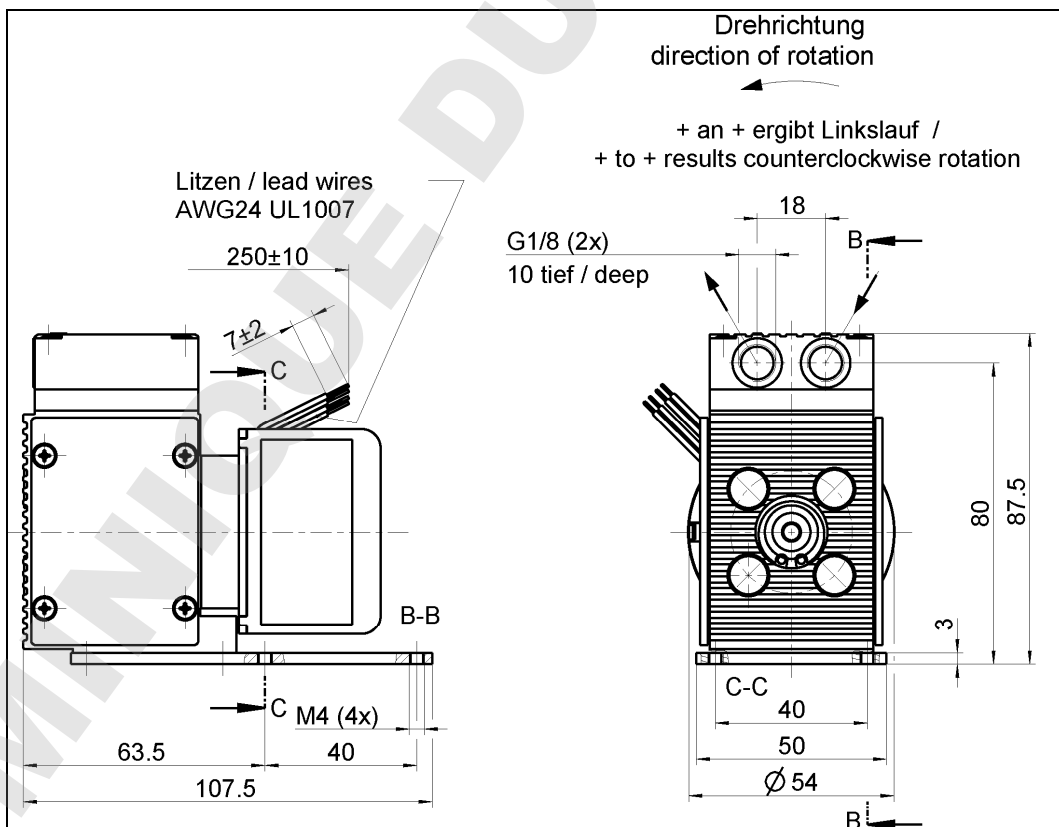


Fig. 11: Attachment dimensions of N 86 K_{DC-B}
(dimensional tolerances according to DIN ISO 2768-1, tolerance class V)

Cooling air supply Only for AC pumps:

- ➔ When setting up or installing the pump, make sure that the fan can draw in an adequate amount of cooling air.

- For pumps with fan: Install the pump so as accidental finger contact with the fan is impossible.
- 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.
 - i** The pump motor's IP protection class is provided on the type plate.
 - Set up or install the pump at the highest point in the system to prevent condensate from collecting in the pump head.
 - Protect the pump against dust.
 - Protect the pump against grease and oils.
 - Protect the pump against vibration and impact.
 - 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.

6.2. Electrical connections



Extreme danger from electrical shock

→ Only have the pump connected by an authorized specialist.

GEFAHR

→ 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 DIN 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).
 - i** → For operating current see type plate.
 - For pumps with DC motor:
The pumps may only be operated in a SELV power circuit.

Pumps with AC motor

1. Make sure that the power supply data match the data on the pump type plate.

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

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

Pumps with DC motor (brushed)

1. Make sure that the power supply data match the data on the pump 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

1. Make sure that the power supply data match the data on the pump 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 (see type plate):

red connection cable: +

bluek 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 C_1 :

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

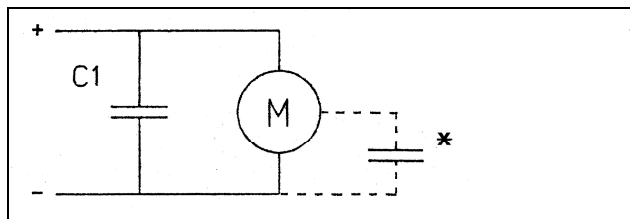


Fig. 12: Supplemental electronic circuit N 86 K_DC-B **with** "K" marking on the type plate

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

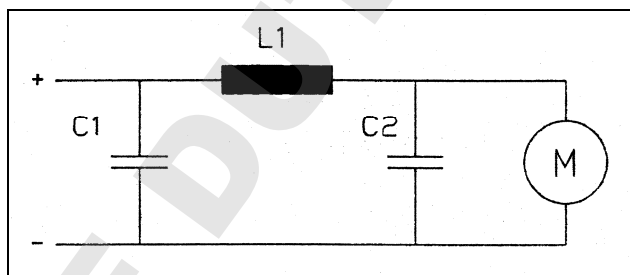


Fig. 13: Supplemental electronic circuit N 86 K_DC-B **without** "K" marking on the type plate

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	
Frequenzgang Eingangssignal Frequency generator output	grün / green	FG _{Out}	-	AWG 24 UL 1007	
DC oder PWM Steuereingang V _{Ctrl} / DC or PWM input V _{Ctrl}					
Steuerspannungsbereich DC Control voltage range DC	[V]			1.0...4.7	
Max. Eingangsspannung Max. input voltage	[V]			±30	
Eingangswiderstand (V _{Ctrl} < 5V) Input resistance (V _{Ctrl} < 5V)	[kΩ]			typ. 10	
Schwellenspannung Treshold voltage	[V]			1.0±0.2	
Drehzahl / Spannung Konstante Speed / V _{Ctrl} relation (at no load)	[rpm/V]			typ. 950±250	
Nominal PWM Signalamplitude Nominal PWM signal amplitude				5	
PWM Signal Minimalwert PWM signal „low“ level	[V]			max 0.1	
PWM Frequenzbereich PWM frequency range	[kHz]			>6	
PWM Anteil Schwellwert (V _{Ctrl} 5V ohne Last) PWM duty cycle treshold (V _{Ctrl} 5V no load)	[%]			~12	
PWM Anteil volle Drehzahl (V _{Ctrl} 5V ohne Last) PWM duty cycle full speed (V _{Ctrl} 5V no load)	[%]			~70	
FG Frequenzgang / FG frequency output					
FG Impulse pro Umdrehung FG pulses per revolution				6	
Impulsdauer „high“ Pulse length „high“	[%]			33	
Ausgangsserienwiderstand Output series resistance	[kΩ]			3.9	
Ausgangspegel „high“ (I _{out} < 0.1mA) Output level „high“ (I _{out} < 0.1mA)	[V]			4.2...5.4	
Ausgangspegel „low“ (I _{out} < 0.1mA) Output level „low“ (I _{out} < 0.1mA)	[V]			max 0.5	

Tab. 8: Connection plan motor electronics for pumps with brushless DC motor

6.3. Pneumatic connections

- | | |
|----------------------|--|
| Connected components | → Connect to the pump only components that are designed to handle the pump's pneumatic specifications (see Chapter 4. Technical data). |
| Pump discharge | → When using the pump as a vacuum pump, safely divert the pump's discharge from its pneumatic outlet. |
| Connecting the pump | i See markings on the pump head for the direction of flow.

<ol style="list-style-type: none">1. Remove protective plugs from the hose connection threads.2. If the accessories silencer or hose connector are present, screw them onto the corresponding hose connection threads. i Install the silencer in the pump's outlet.

<ol style="list-style-type: none">3. Connect suction and pressure lines.4. Lay the suction and pressure lines at a downward angle to prevent condensate from running into the pump. |

7. Operation

- Operate the pump only under the operating parameters and conditions described in Chapter 4. Technical data.
- Make sure the pump is used properly (see Chapter 2.1).
- Avoid improper use of the pump (see Chapter 2.2).
- Observe the safety precautions (see Chapter 3).
- The pumps are components that are intended to be incorporated into another machine. Before putting them into service it must be established that machinery or equipment in which they are installed meet the relevant regulations.



WARNING

Excessive pressure may cause the pump head to burst.

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

i Excessive pressure can be prevented by placing a bypass line with a pressure relief valve between the pressure and suction side of the pump. For further information, contact your KNF technical adviser.

Pump standstill

- When the pump stops, restore the system to normal atmospheric pressure (release pneumatic pressure in pump).

Switching on the pump

- Make sure that there is no pressure in the hoses before switching on the pump.



For pumps with AC motor:

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. This activates the overload switch and the pump switches off.

- i** For pumps with DC motor (brushed and brushless):
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 6.2)
- Switching off the pump/removing from operation → Restore the system to normal atmospheric pressure (release pneumatic pressure in pump).

8. Servicing

8.1. 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. 9

8.2. Cleaning

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

8.2.1. Flushing the 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.

8.2.2. Cleaning the 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.

8.3. Replacing the diaphragm and valve plates

8.3.1. N 85.3 K_E and N 85.3 K_DC

Requirements

- 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
1 Service Set*	1
Phillips screwdriver no. 1	1
Felt-tip pen	1

Tab. 10

* according to Chapter 10

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 8.2.1).



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

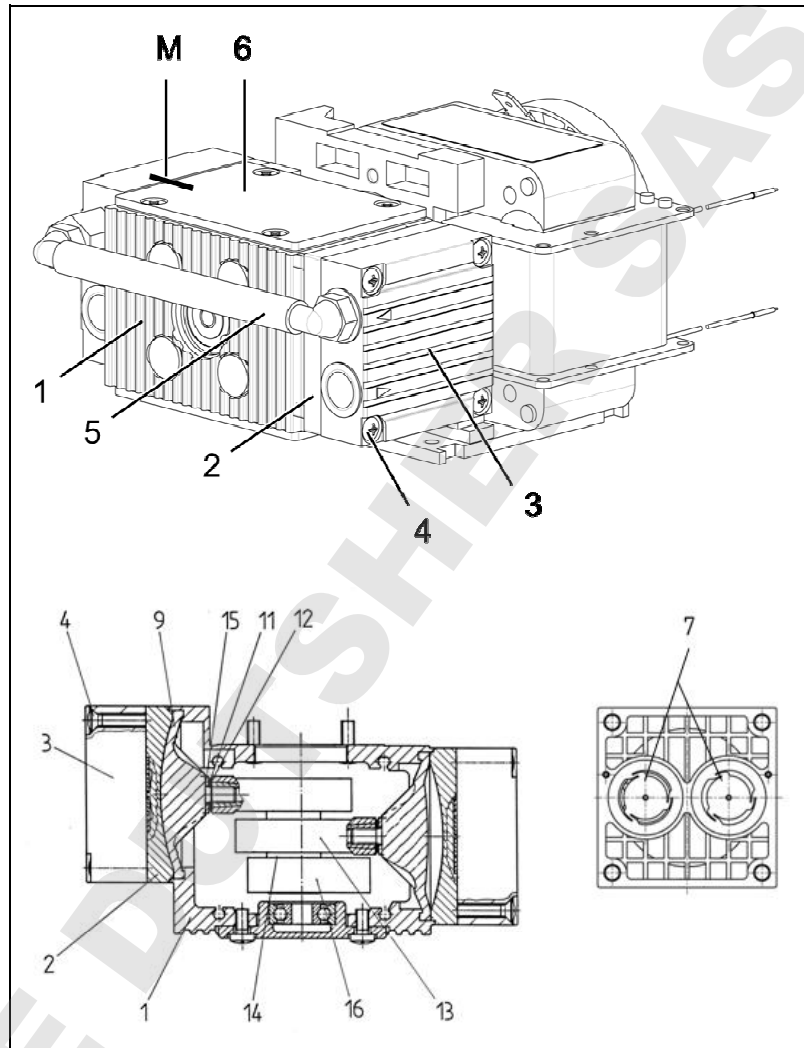


Fig. 14: Two-headed pump (N 85.3 K_E)

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 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 section 6. *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 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.
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 last page for contact telephone number).

8.3.2. N 86 K_E, N 86 K_DC and N 86 K_DC-B

Requirements

- 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
1 Service Set*	1
Phillips screwdriver no. 1	1
Felt-tip pen	1

Tab. 11

* according to Chapter 10

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 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.

For the two-headed pumps N 838.1.2 KNE, N 838.1.2 KNDC-B and N 838.1.2 KN.29DC-B:

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



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 8.2.1).



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

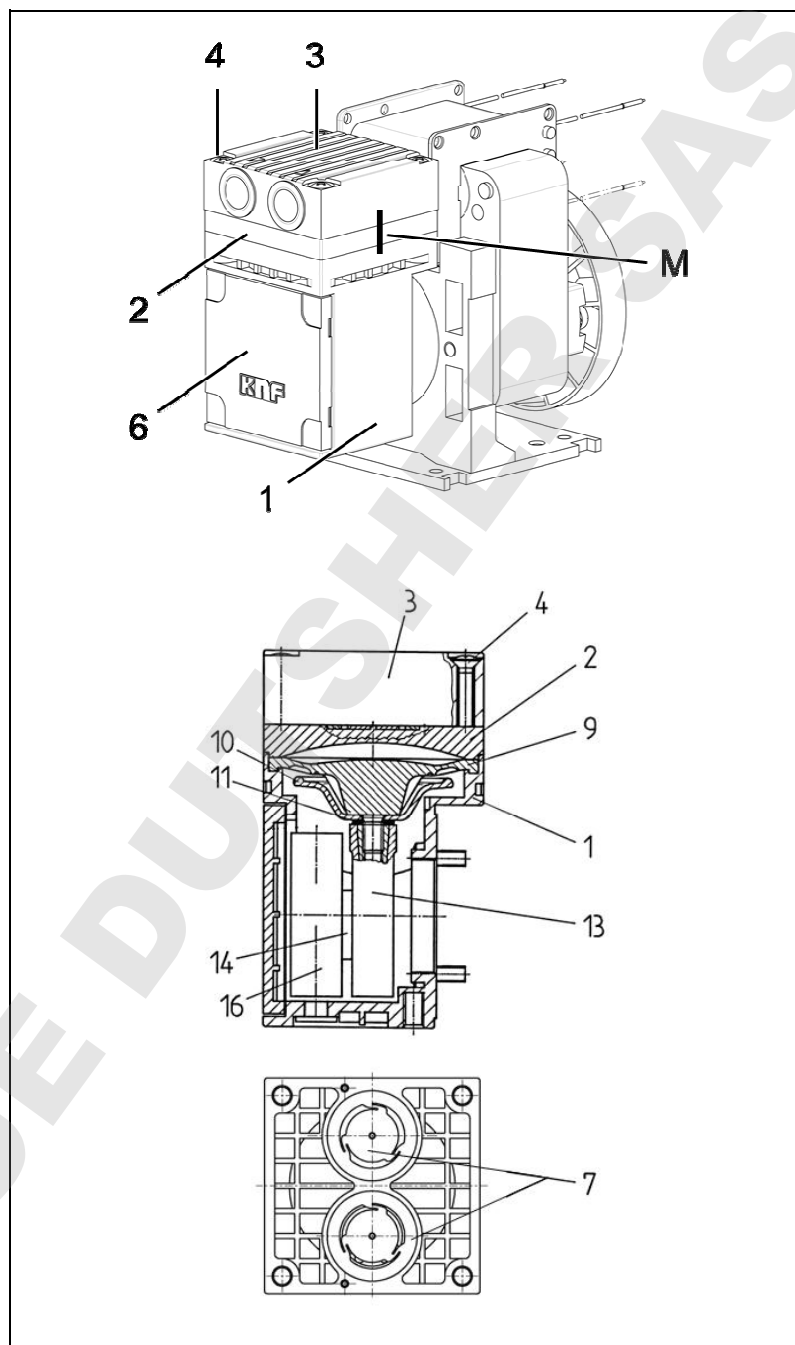


Fig. 15: One-headed pump (N 86 K_E)

The position numbers in the following text refer to fig. 15.
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 section 8.2. *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 last page for contact telephone number).

9. Troubleshooting



Risk of electric shock, danger of death!

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

DANGER

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

→ Check the pump (see Tab. 12 and 13).

Pump does not work	
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	→ 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.	→ Disconnect pump from the mains. → Allow pump to cool. → Identify and eliminate cause of overheating.
Connections or hoses are blocked.	→ 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.	→ Detach the condensate source from the pump. → Flush the pump (see Chapter 8.2.1). → Install the pump at the highest point in the system.
Diaphragm or valve plates are worn.	→ Replace diaphragm and valve plates (see Chapter 8.3).

Tab. 12

Flow rate, pressure, or vacuum are too low	
The pump does not achieve the performance stated in the technical data or on 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 8.2.1). → 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 8.3).
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 (N 85.3). → Check head connection and hose connections for leaks.

Tab. 13

Fault cannot be rectified

If you are unable to identify the cause of the problem, please send the pump to KNF customer services (see last page for the address).

1. Flush the pump (see Chapter 8.2.1).
2. Clean the pump (see Chapter 8.2.2).
3. Send the pump, together with completed Health and Safety Clearance and Decontamination Form (Chapter 12), to KNF stating the nature of the transferred medium.

10. Spare parts and accessories

10.1. 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.
N 85.3 KN	032498
N 85.3 KT	032482
N 86 KN	043241
N 86 KT	043242

Tab. 14

10.2. Accessories

Description	Order No.:
Silencer	000345
Filter	000346
Hose Connector PA	001936
Hose Connector PVDF	025671
Rubber Foot for N 85.3. E and N 86. E	024435

Tab. 15

11. Returns

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

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

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

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

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

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

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

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

12. Health and safety clearance and decontamination form



Form: Rev. 30 / download: www.knf.com

Health and safety clearance and decontamination form

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

Device type:

Serial number(s):

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

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

We confirm that the above device(s)

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

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

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

Name, chemical formula, Material Safety Data Sheet

aggressive

biological

radioactive

toxic

other

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

Method / proof:

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

Measures:

Legally binding declaration

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

Company (stamp)

Date

Name

Authorized signature

Position

DOMINIQUE DUTSHER SAS

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