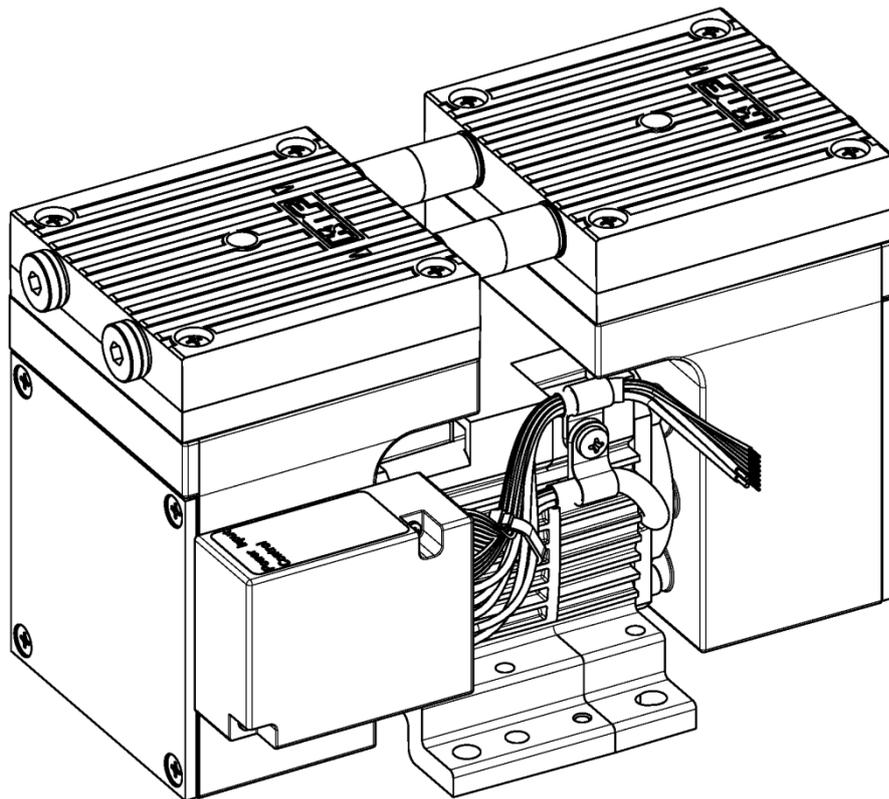


OEM

**N 828 / N 838
TRANSLATION OF ORIGINAL OPERATING AND
INSTALLATION INSTRUCTIONS
ENGLISH**

MINI DIAPHRAGM VACUUM PUMPS



Note!

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

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1. About this document

1.1. Using the Operating and Installation Instructions

The Operating and Installation Instructions are part of the pump.

→ Pass on the Operating and Installation Instructions to the next owner.

Project 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



A danger is located here.

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

WARNING Warning, indicates the danger level.

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

Danger levels

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

Tab. 1

Other information and symbols

→ An activity to be carried out (a step) is specified here.

1. The first step of an activity to be carried out is specified here. Additional, consecutively numbered steps follow.

i This symbol refers to important information.

2. Use

2.1. Proper use

The pumps are exclusively intended for transferring 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.

The pumps are not suitable for transferring liquids.

The pumps are not suitable for transferring aerosol.

The pumps are not suitable for transferring biological and microbiological substances.

The pumps are not suitable for transferring fuel.

The pumps are not suitable for transferring explosive and combustible materials.

The pumps are not suitable for transferring fibers.

The pumps are not suitable for transferring oxidizing agent.

The pumps are not suitable for transferring 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 7. 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 trained and instructed personnel or specially trained personnel work on the pumps. This especially applies to assembly, connection and servicing work.

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

Working in a safety conscious manner Observe the accident prevention and safety regulations when performing any work on the pump and during operation.

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.

	<p>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).</p> <p>If necessary, consider any external sources of energy, such as radiation, that may add heat to the medium.</p>
Thermal switch	<p>For pumps with AC motor:</p> <p>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.</p> <p>In case of doubt, consult the KNF customer service.</p>
Environmental protection	<p>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.</p>
EU/EC Directives / Standards	<p>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:</p> <ul style="list-style-type: none"> - 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. (<i>*only for pumps with AC motor</i>) <p>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.</p> <p>In addition a protection against mechanical parts in motion and hot parts, if existing, has to be provided when mounting.</p>



The pumps conform to the Directive 2011/65/EU.

The following harmonized standards have been used:

N 828 _NE N 838 _NE N 838.1.2 KNE	N 828 _NDC N 838 _NDC	N 828 KNDC-B N 828 KN.29DC-B N 838 KNDC-B N 838 KN.29DC-B N 838.1.2 KNDC-B N 838.1.2 KN.29DC-B
DIN EN 55014-1/2	DIN EN 55014-1/2	DIN EN 61000-6-2/3
DIN EN 61000-3-2/3	DIN EN 60034-1	DIN EN 50581
DIN EN 60335-1	DIN EN 61000-6-1/2	
DIN EN 50581	DIN EN 50581	

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 material

Assembly	Material: N 828 AN_ N 838 AN_	Material: N 828 KN_ N 838 KN_ N 838.1.2 KNE N 838.1.2 KNDC-B N 838.1.2 KN.29DC-B
Pump head	Aluminum	PPS
Diaphragm	EPDM	EPDM
Valve	FPM	FPM

Tab. 3

Pneumatic Values

Pumps with AC motor

Parameter	Value: N 828 ANE N 828 KNE	Value: N 838 ANE N 838 KNE	Value: N 838.1.2 KNE
Max. permissible operating pressure [bar g]	1.0	0.5	0.5
Ultimate vacuum [mbar abs.]	100	100	90
Flow rate at atm. pressure [l/min]*	28	34	42

Tab. 4

*Liters in standard state (1013 mbar)

Pumps with DC motor

Parameter	Value: N 828 ANDC N 828 KNDC	Value: N 838 ANDC N 838 KNDC
Max. permissible operating pressure [bar g]	1.0	0.5
Ultimate vacuum [mbar abs.]	100	100
Flow rate at atm. pressure [l/min]*	27	32

Tab. 5

*Liters in standard state (1013 mbar)

Pumps with brushless DC motor

Parameter	Value: N 828 KNDC-B N 828 KN.29DC-B	Value: N 838 KNDC-B N 838 KN.29DC-B	Value: N 838.1.2 KNDC-B N 838.1.2 KN.29DC-B
Max. permissible operating pressure [bar g]	1.0	0.5	0.5
Ultimate vacuum at nominal speed [mbar abs.]	100	100	100
Flow rate at atm. Pressure and nominal speed [l/min]*	28	34	60
Flow rate at atm. Pressure and 0.1V control voltage (only .29-version) [l/min]*	6	8.5	12

Tab. 6

*Liters in standard state (1013 mbar)

Pneumatic connections

Pump type	Value
N 828 AN_ / N 828 KN_ N 838 AN_ / N 838 KN_ N 838.1.2 KNE N 838.1.2 KNDC-B / N 838.1.2 KN.29DC-B	Thread size G 1/8

Tab. 7

Electrical Parameter

Pumps with AC motor, Pumps with DC motor

Parameter	Value
Voltage / Frequencies	See Type plate
Max. operating current	
Pump power consumption	
Motor protection class: N 828 AN_ / N 828 KN_ / N 838 AN_ / N 838 KN_	IP 00
Motor protection class: N 838.1.2 KNE	IP 20
Maximum permissible mains voltage fluctuations	± 10%

Tab. 8

Pumps with brushless DC motor

Parameter	Value: N 828 KNDC-B N 828 KN.29DC-B	Value: N 838 KNDC-B N 838 KN.29DC-B	Value: N 838.1.2 KNDC-B N 838.1.2 KN.29DC-B
Voltage [V]	24	24	24
Control voltage (only .29 version) [V]	0.1...5*	0.1...5*	0.1...5*
Max. operating current [A]: - for $p > p_{atm.}$ - for $p < p_{atm.}$	2.4 2.0	2.4 2.2	4.2 3.9
Starting current	The starting current can be up to 50% above the maximum operating current.		
Starting ramp [ms]	800	800	800
Max. power con- sumption of the pump [W]: - for $p > p_{atm.}$ - for $p < p_{atm.}$	57.6 48.0	57.6 52.8	100.8 93.6
Maximum permis- sible mains volt- age fluctuations	± 10%	± 10%	± 10%
Motor protection class	IP 20	IP 20	IP 20
Overcurrent limi- tation of the motor electronics [A]	7.5	7.5	7.5

Tab. 9

*further control voltage versions on demand

For pumps with AC motor:

Thermal switch

i The pumps are fitted with a thermal 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.

i For N 828 KNDC-B, N 828 KN.29DC-B, N 838 KNDC-B, N 838 KN.29DC-B, N 838.1.2 KNDC-B, N 838.1.2 KN.29 DC-B:

The pump is protected against overheating by a temperature sensor on the motor board and equipped with overcurrent protection.

If one of these safety functions is triggered or if the maximum blocking time of the rotor is exceeded due to a fault, the pump will be shut down and must be manually reset, as follows:

- Separate pump from the mains.
- Remove the cause(s) of the fault before restarting.

Weight

Pump type	Wert
N 828 AN_ / N 828 KN_	2.2 kg
N 838 ANE / N 838 KNE	2.6 kg
N 838.1.2 KNE	4.4 kg
N 838 ANDC / N 838 KNDC	2.4 kg
N 828 KNDC-B / N 828 KN.29DC-B	2.0 kg
N 838 KNDC-B / N 838 KN.29DC-B	2.5 kg
N 838.1.2 KNDC-B / N 838.1.2 KN.29DC-B	3.0 kg

Tab. 10

Other Parameter

Parameter	Wert
Permissible ambient temperature	+ 5°C to + 40°C
Permissible media temperature	+ 5°C to + 40°C
Dimensions L x H x W [mm]: N 828 ANE N 828 KNE N 838 _NE N 838.1.2 KNE N 828 _NDC N 838 _NDC N 828 KNDC-B / N 828 KN.29DC-B N 838 KNDC-B / N 838 KN.29DC-B N 838.1.2 KNDC-B / N 838.1.2 KN.29DC-B	ca. 152 x 115,5 x 79 ca. 152 x 118 x 79 ca. 153 x 122 x 84 ca. 243 x 129 x 95 ca. 150 x 119 x 79 ca. 150 x 123 x 82 ca. 138 x 125 x 115 ca. 137 x 129 x 115 ca. 198 x 128 x 115
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

Tab. 11

5. Design and function

Design N 828_NE

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

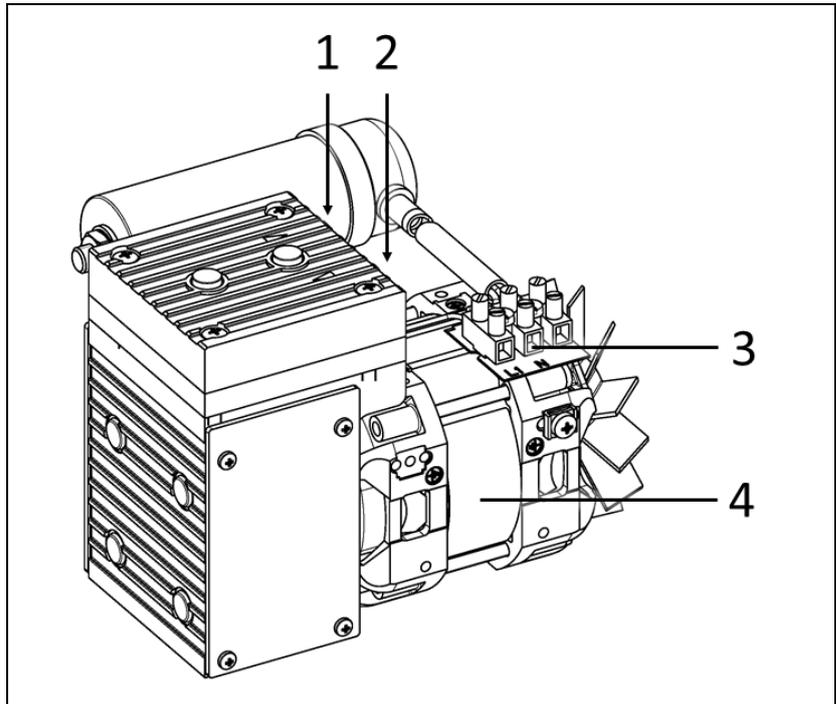


Fig. 1: Design N 828_NE

Design N 838_NE

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

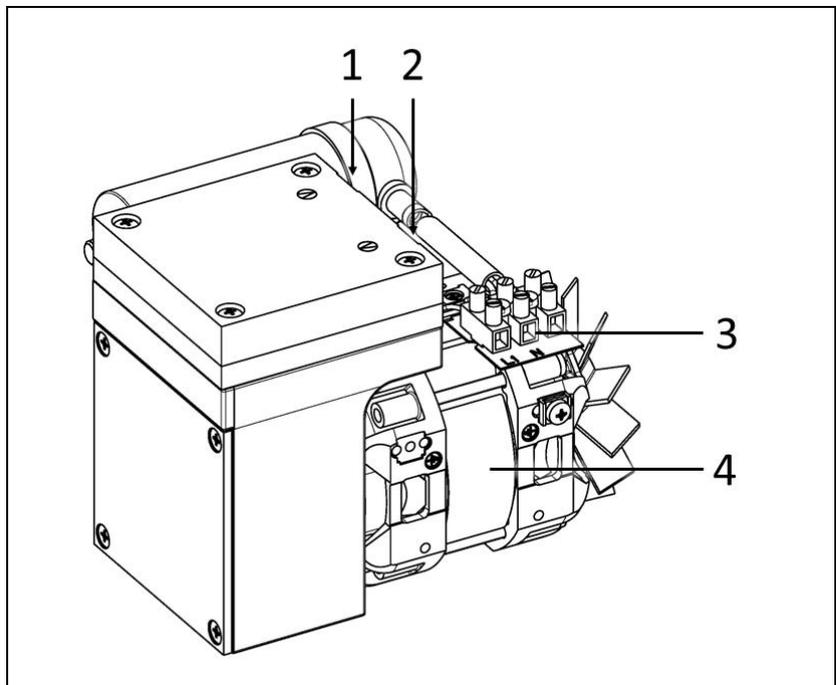


Fig. 2: Design N 838_NE

Design N 838.1.2 KNE

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

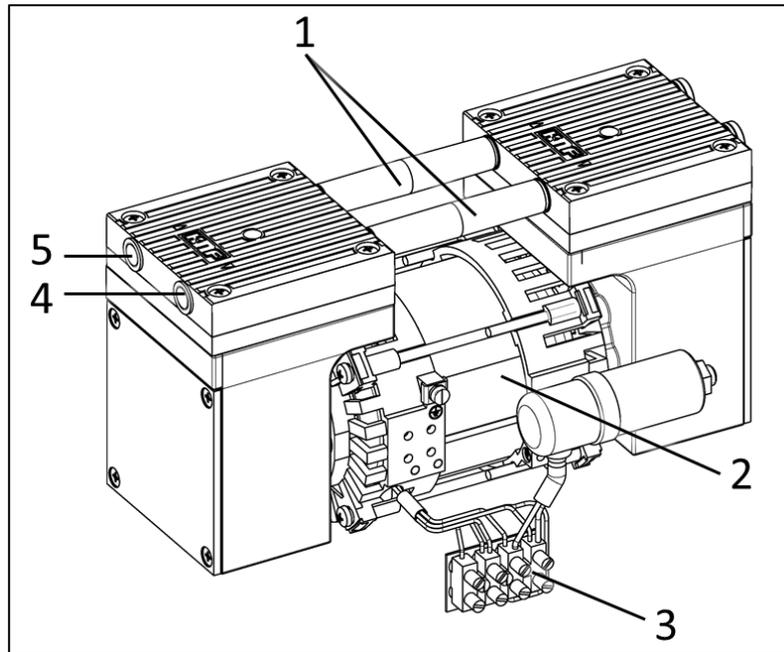


Fig. 3: Design N 838.1.2 KNE

Design N 828 _NDC

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

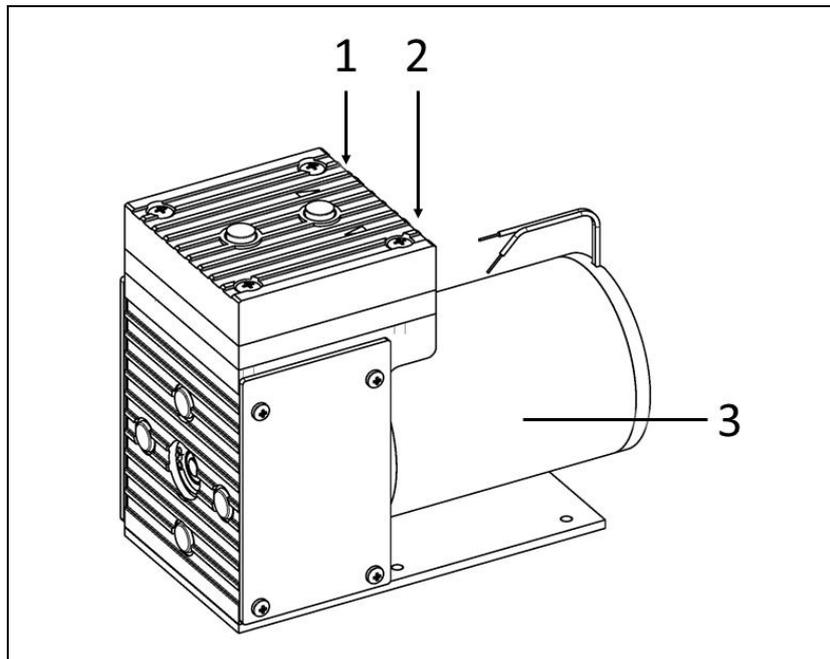


Fig. 4: Design N 828 _NDC

Design N 838 _NDC

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

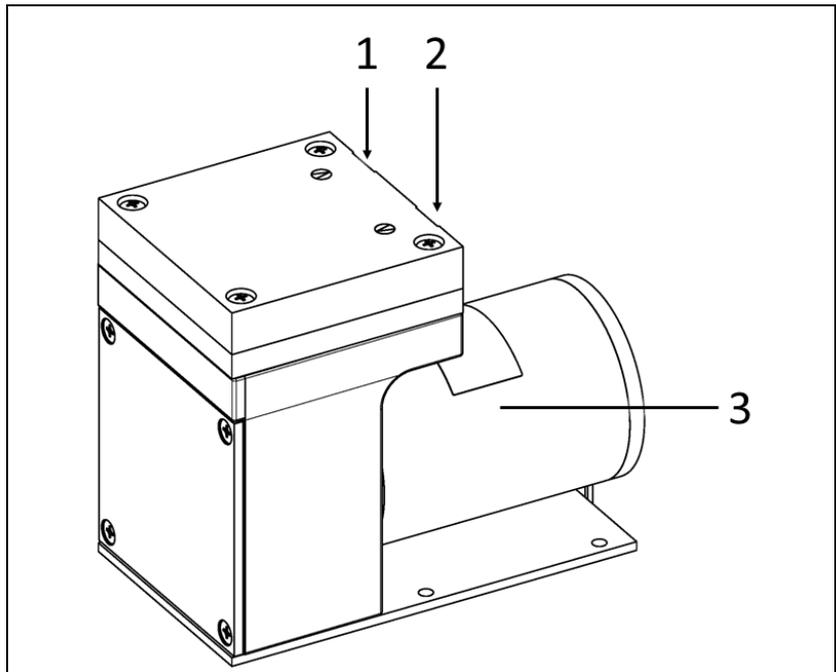


Fig. 5: Design N 838 _NDC

Design N 828 KNDC-B and N 828 KN.29DC-B

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

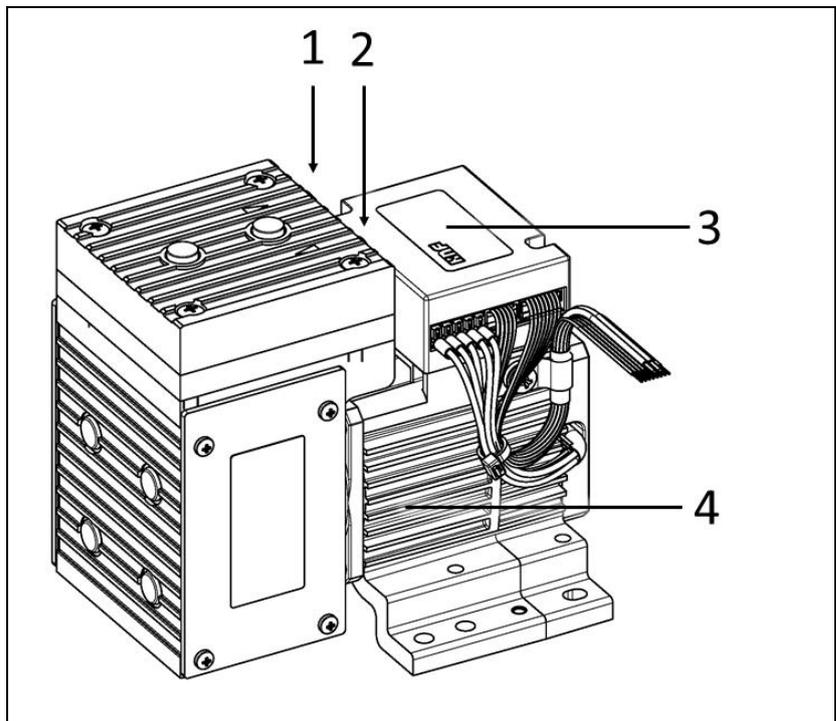


Fig. 6: Design N 828 KNDC-B and N 828 KN.29DC-B

Design N 838 KNDC-B and N 838 KN.29DC-B

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

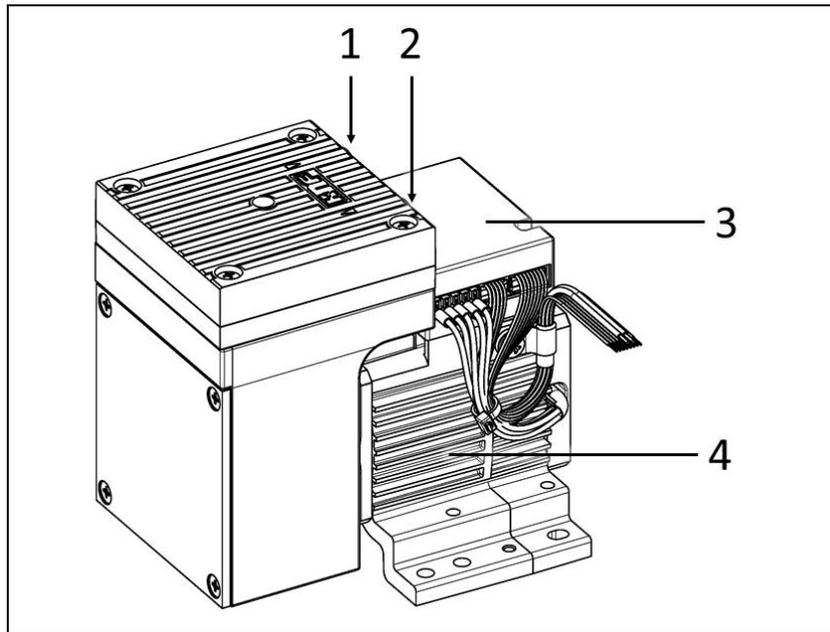


Fig. 7: Design N 838 KNDC-B and N 838 KN.29DC-B

Design N 838.1.2 KNDC-B and N 838.1.2 KN.29DC-B

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

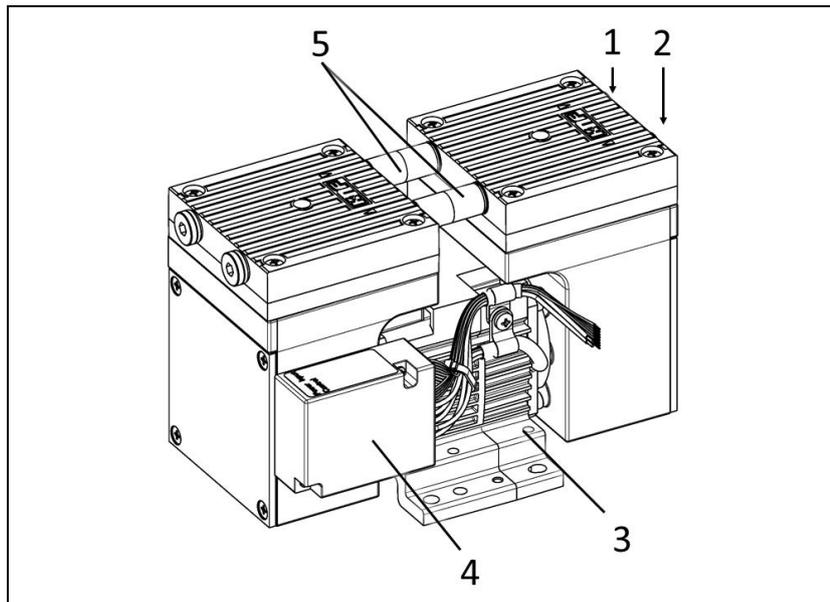


Fig. 8: Design N 838.1.2 KNDC-B and N 838.1.2 KN.29DC-B

Function Diaphragm Pump

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

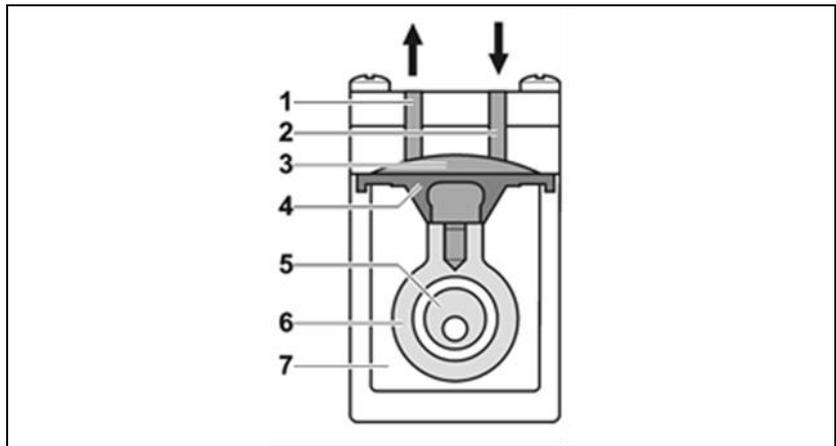


Fig. 9: Pump head

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. 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).

6.1. Installation of the pump

- ➔ Choose a safe location (flat surface) for the pump.
- ➔ Before installation, store the pump at the installation location to bring it up to ambient temperature.

Mounting dimensions

- ➔ For mounting dimensions see:

Fig. 10	N 828 _NE
Fig. 11	N 838 _NE
Fig. 12	N 838.1.2 KNE
Fig. 13	N 828 _NDC
Fig. 14	N 838 _NDC
Fig. 15	N 828 KNDC-B and N 828 KN.29DC-B
Fig. 16	N 838 KNDC-B and N 838 KN.29DC-B
Fig. 17	N 838.1.2 KNDC-B and N 838.1.2 KN.29DC-B

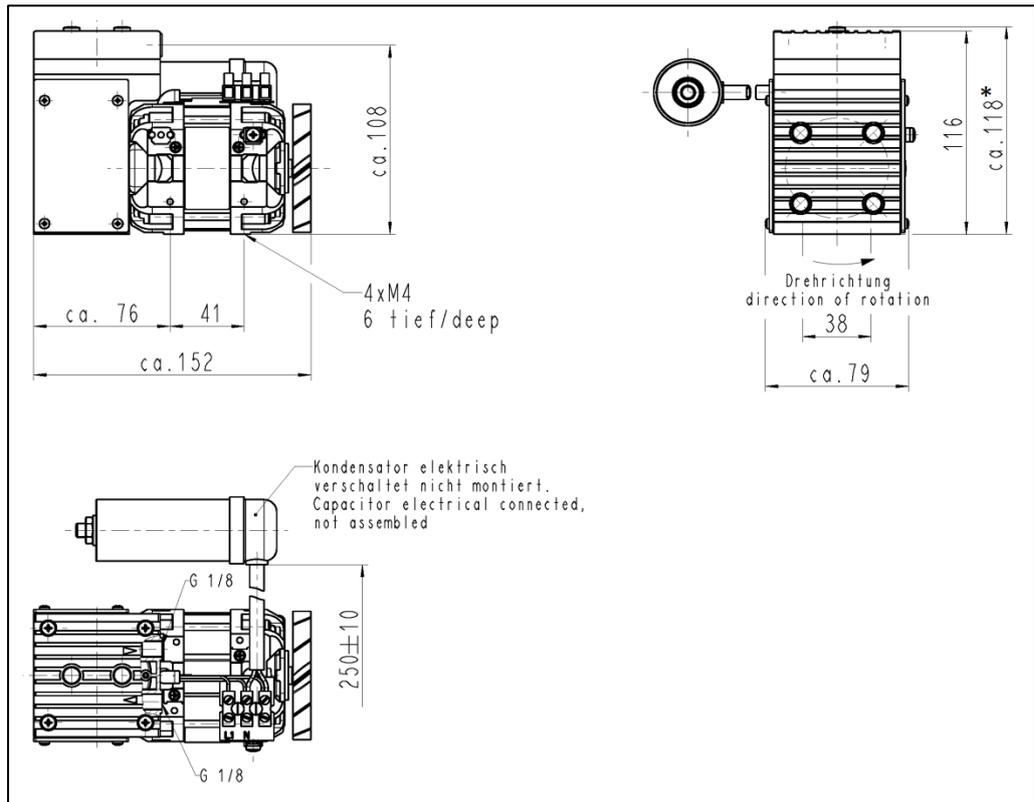


Fig. 10: Mounting dimensions N 828_NE (All dimensional tolerances conform to DIN ISO 2768-1, Tolerance Class V)
*only N 828 KNE

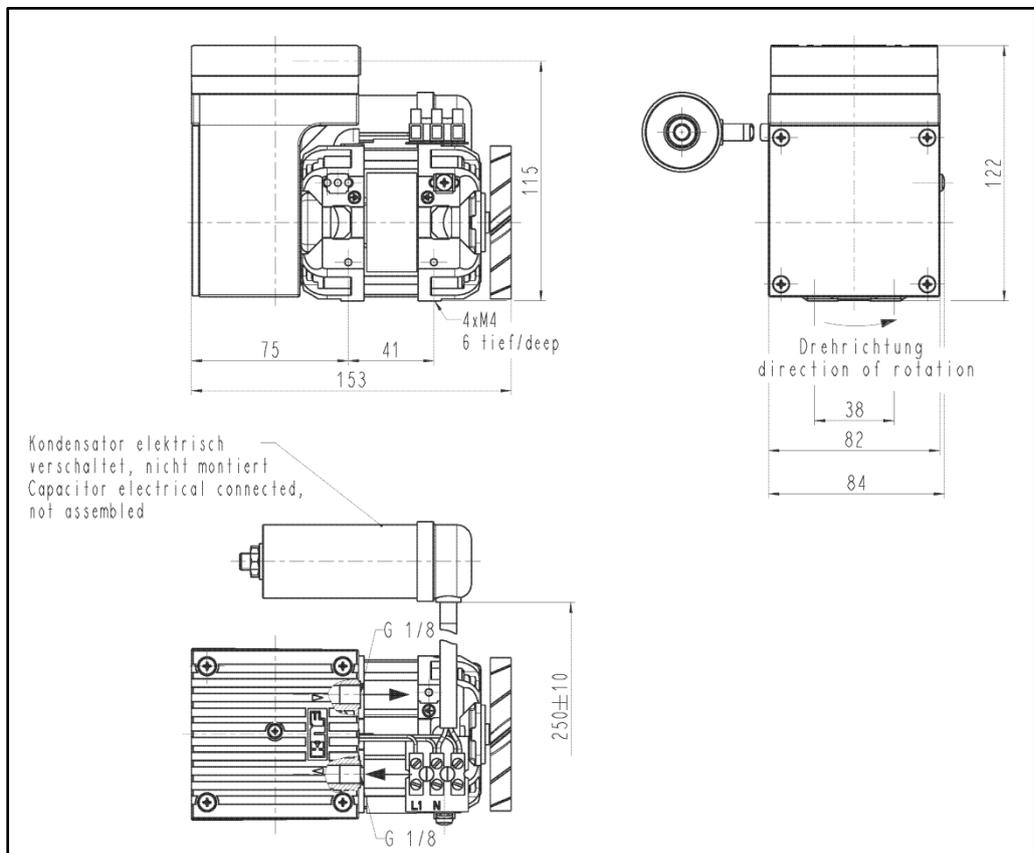


Fig. 11: Mounting dimensions N 838_NE (All dimensional tolerances conform to DIN ISO 2768-1, Tolerance Class V)

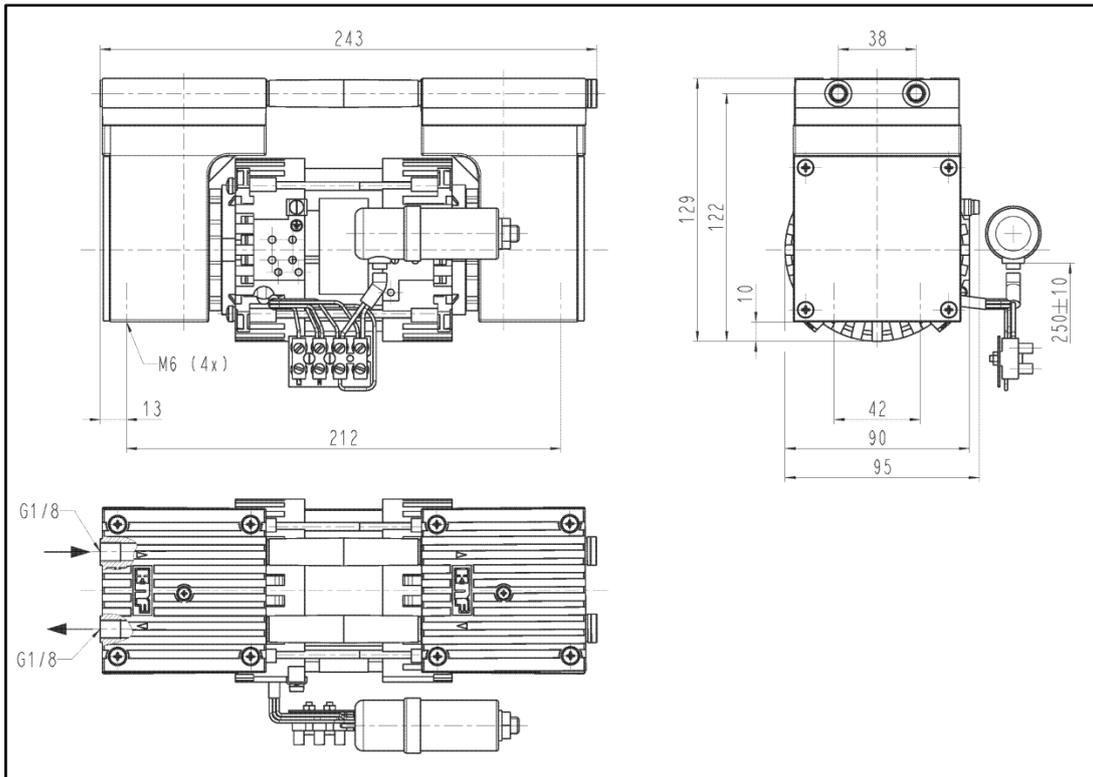


Fig. 12: Mounting dimensions N 838.1.2 KNE (All dimensional tolerances conform to DIN ISO 2768-1, Tolerance Class V)

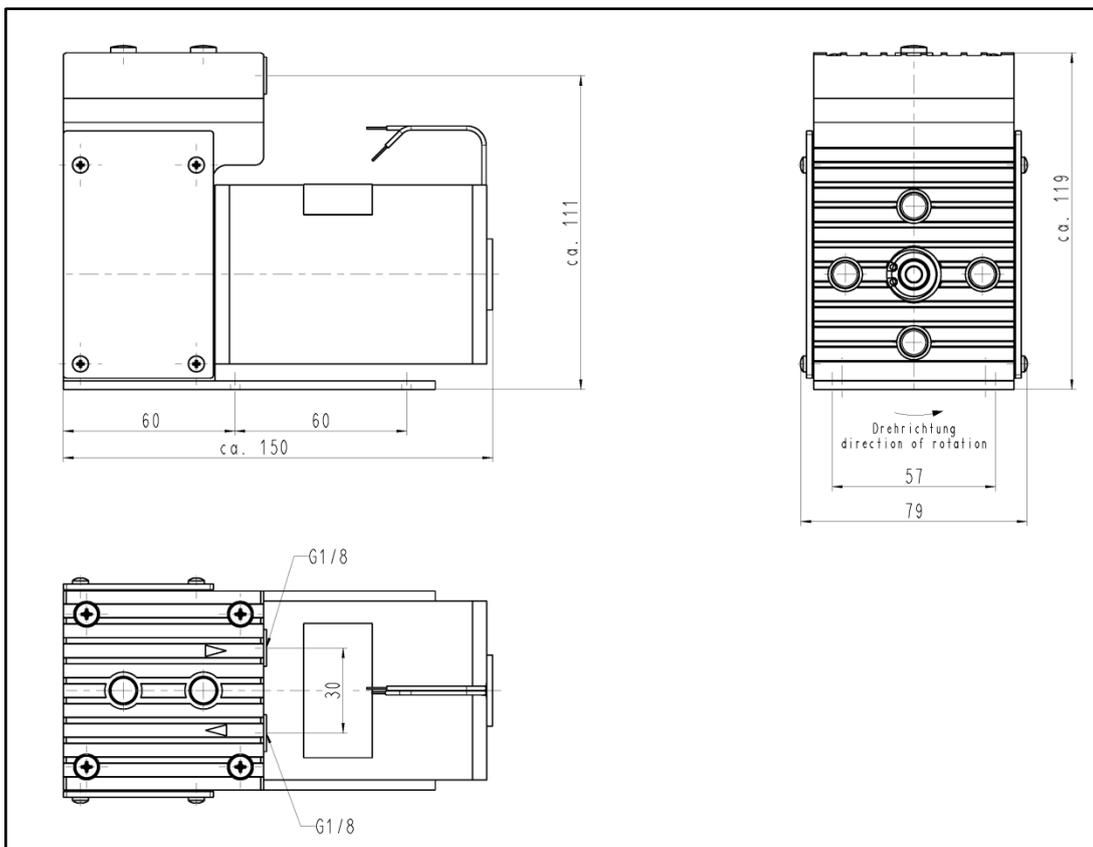


Fig. 13: Mounting dimensions N 828_NDC (All dimensional tolerances conform to DIN ISO 2768-1, Tolerance Class V)

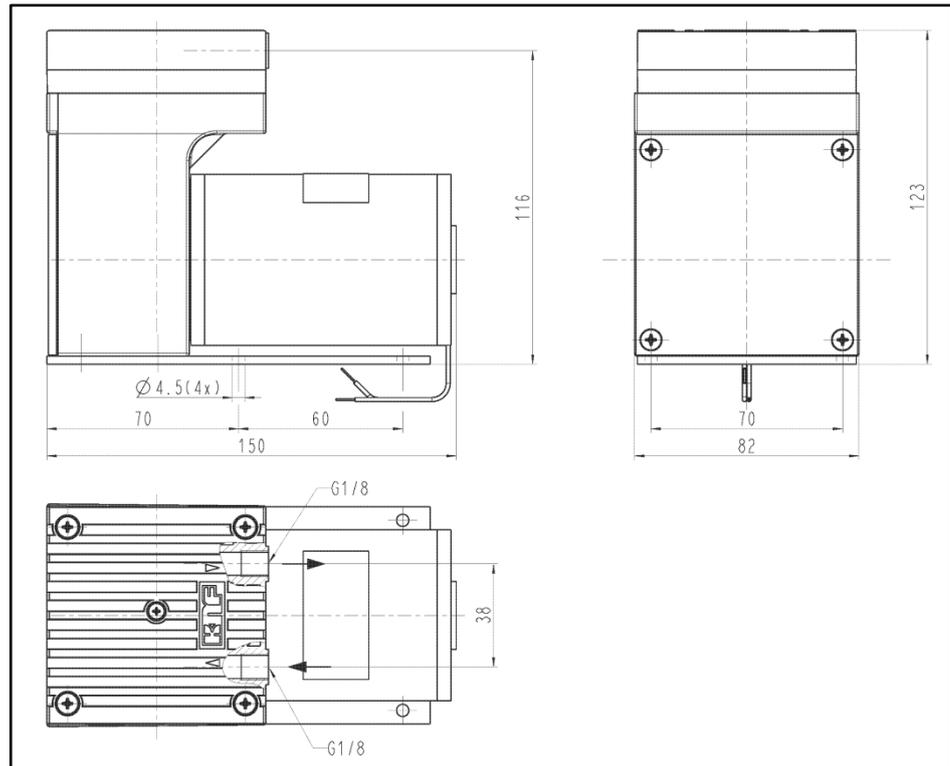


Fig. 14: Mounting dimensions N 838 _NDC (All dimensional tolerances conform to DIN ISO 2768-1, Tolerance Class V)

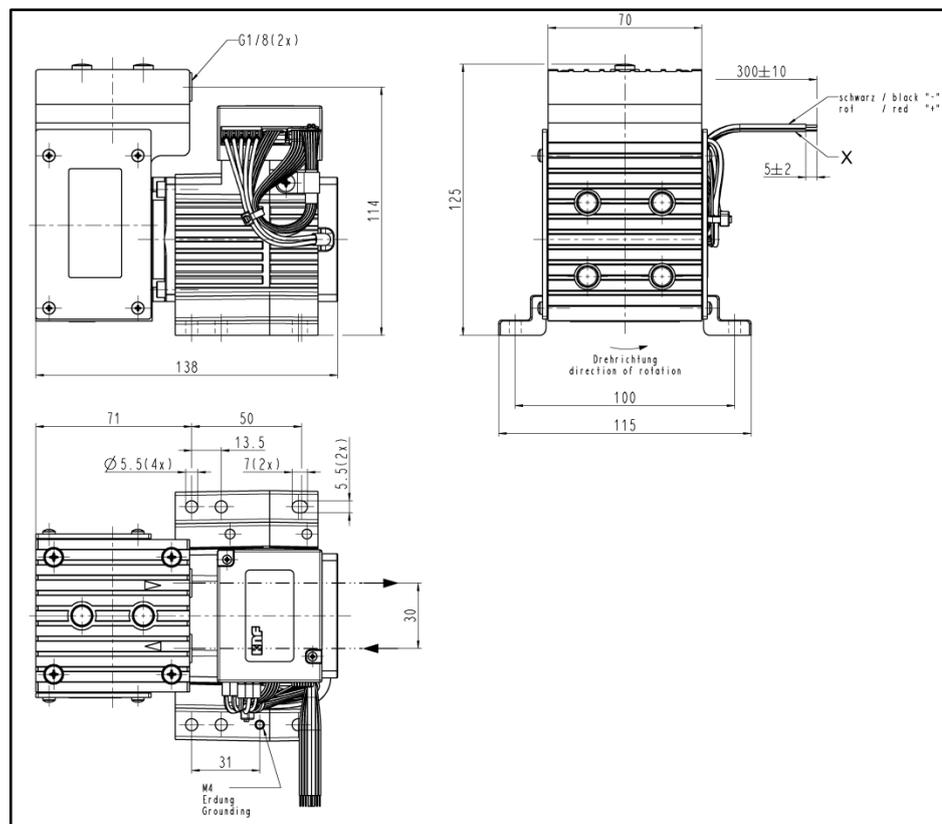


Fig. 15: Mounting dimensions N 828 KNDC-B and N 828 KN.20DC-B (All dimensional tolerances conform to DIN ISO 2768-1, Tolerance Class V)
*Connection (X) only for N 828 KN.29DC-B

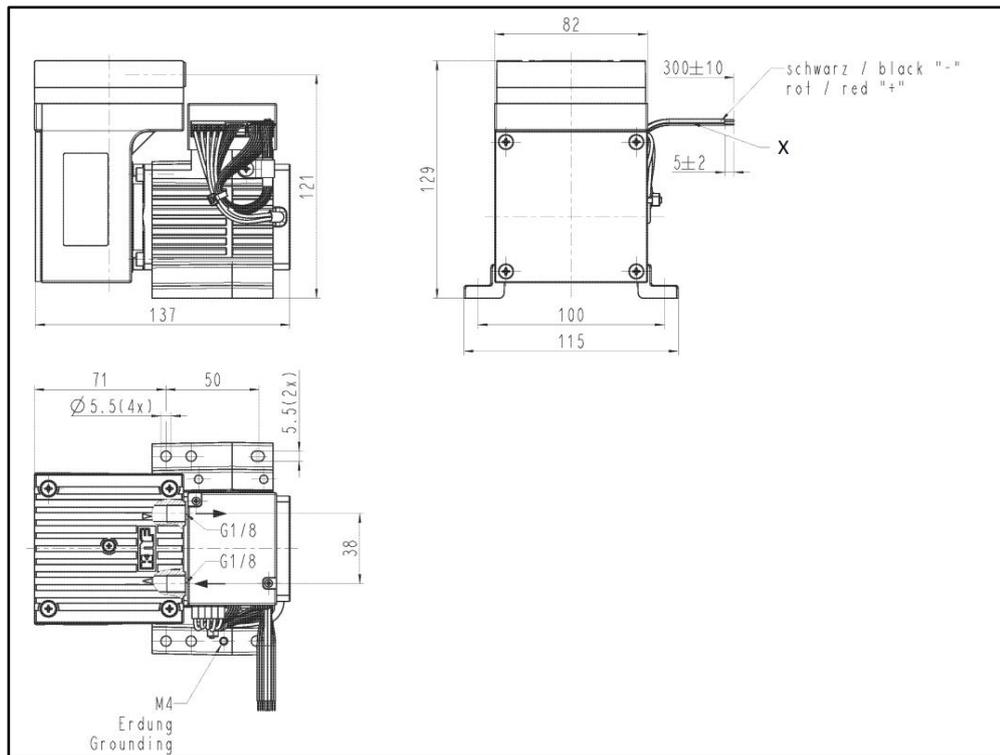


Fig. 16: Mounting dimensions N 838 KNDC-B and N 838 KN.29DC-B (All dimensional tolerances conform to DIN ISO 2768-1, Tolerance Class V)
 *Connection (X) only for N 838 KN.29DC-B

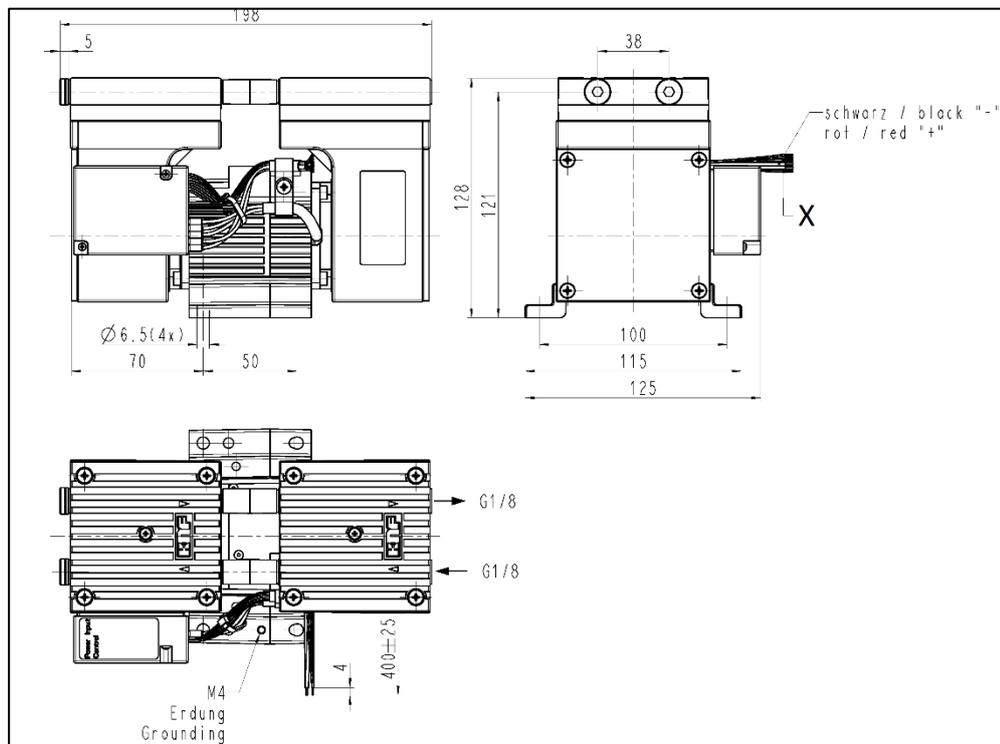


Fig. 17: Mounting dimensions N 838.1.2 KNDC-B and N 838.1.2 KN.29DC-B (All dimensional tolerances conform to DIN ISO 2768-1, Tolerance Class V)
 *Connection (X) only for N 838.1.2 KN.29DC-B

Cooling air supply		<p>Danger of burns from hot surfaces</p> <p>Hot surfaces may be caused by overheating of the pump.</p>
		<p>WARNING → Install the pump so that the motor fan can intake sufficient cooling air.</p>
		<p>→ For pumps with fan: Install the pump so as accidental finger contact with the fan is impossible.</p>
Immediate ambient of the hot pump parts		<p>→ 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).</p>
Installation location		<p>→ 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.</p>
		<p>→ Make sure, that the installation location is accessible for maintenance and service.</p>
	<p>i</p>	<p>The IP protection class of the pump motor is indicated on the type plate.</p>
		<p>→ Install the pump at the highest point in the system to prevent condensate from collecting in the pump head.</p>
		<p>→ Protect the pump from dust.</p>
		<p>→ Protect the pump against grease and oils.</p>
		<p>→ Protect the pump from vibrations and jolts.</p>
		<p>Personal injury and/or damage to property because of vibration</p>
		<p>WARNING In conjunction with adjacent components, vibration of the pump may result in crushing and/or damage to these components.</p>
		<p>→ Make sure that vibrations of the pump do not result in hazards associated with adjacent components.</p>
Foreign matter protection		<p>→ Protect the pump against contact and intrusion of foreign matter.</p>

6.2. 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.
- For pumps with AC motor:
The motors of the pump must be protected according to EN 60204-1 (protection against excess current, or overloading).
- i** For max. operating current of the pump see pump's type plate.
- For pumps with DC motor:
The pumps may only be operated in a SELV power circuit.
- It is recommended that an additional "Emergency Stop" switch is installed.
- The pump must be installed so that contact with live parts is impossible.

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).
- i** Pumps with AC motor are fitted as standard with a thermal switch to protect against overloading.

Pumps with AC motor

1. Compare the supply data with the data on the pump 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 earth (ground) wire to the motor.
3. Connect motor wires.

Pumps with DC 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.

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 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: "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. 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. Electrical connect of the pump according to Tab. 12, page 27 (N 8__ K_DC-B) and Tab. 13, page 28 (N 8__ K_.29DC-B).

i Note the proper polarity (see marking on the motor). Incorrect lead connection will damage electronics of brushless DC motors (type designation ending with B). The supply wires have inverse-polarity protection in the motor board for this purpose, while the control-voltage wires do not have this protection function.

i Control voltage may only be applied if the motor controller is supplied with operating voltage. Otherwise damages can occur on the motor controller.

N 8__K_DC-B

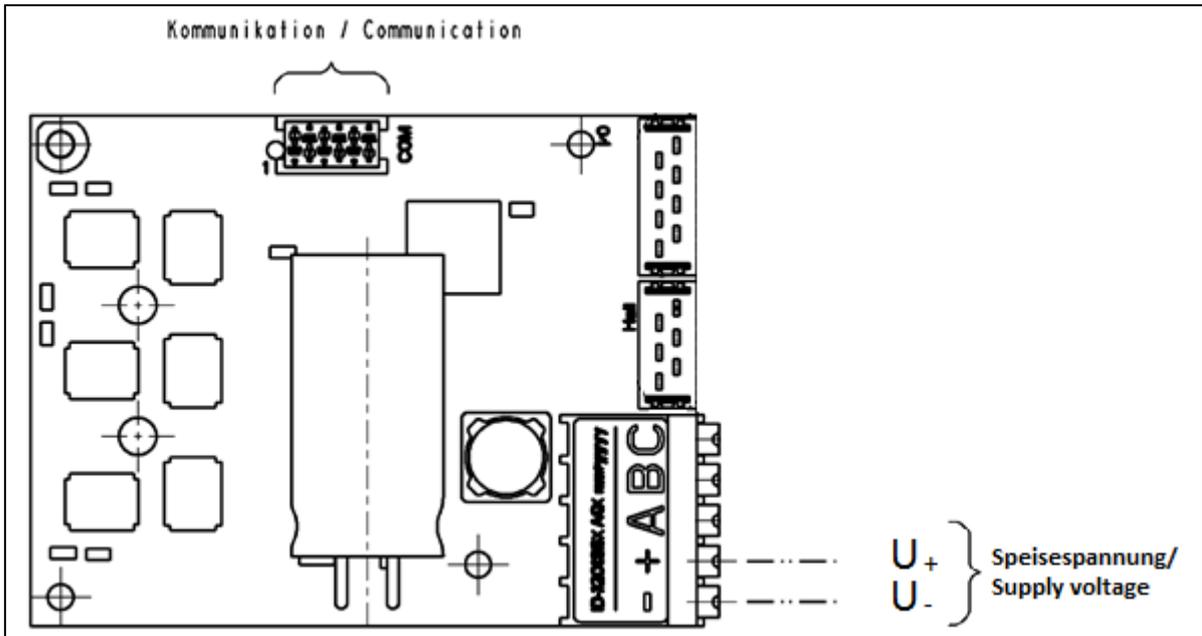


Fig. 18: Connection plan motor electronics N 8__K_DC-B

Motor			
Nennspannung / Nominal voltage	[V]	24	
Spannungsbereich / Voltage range	[V]	7 ... 30	
Elektrische Anschlüsse / Electrical connection			
Litzenbelegung / lead assignment			
Funktion / function	Litzenfarbe lead color	Signalname signal name	Größe / size
+ Speisespannung + Supply voltage	rot / red	U+	AWG 18
- Speisespannung (0V) - Ground (0V)	schwarz / black	U- / GND	AWG 18

Tab. 12 : Connection plan motor electronics N 8__K_DC-B

N 8__K_.29DC-B

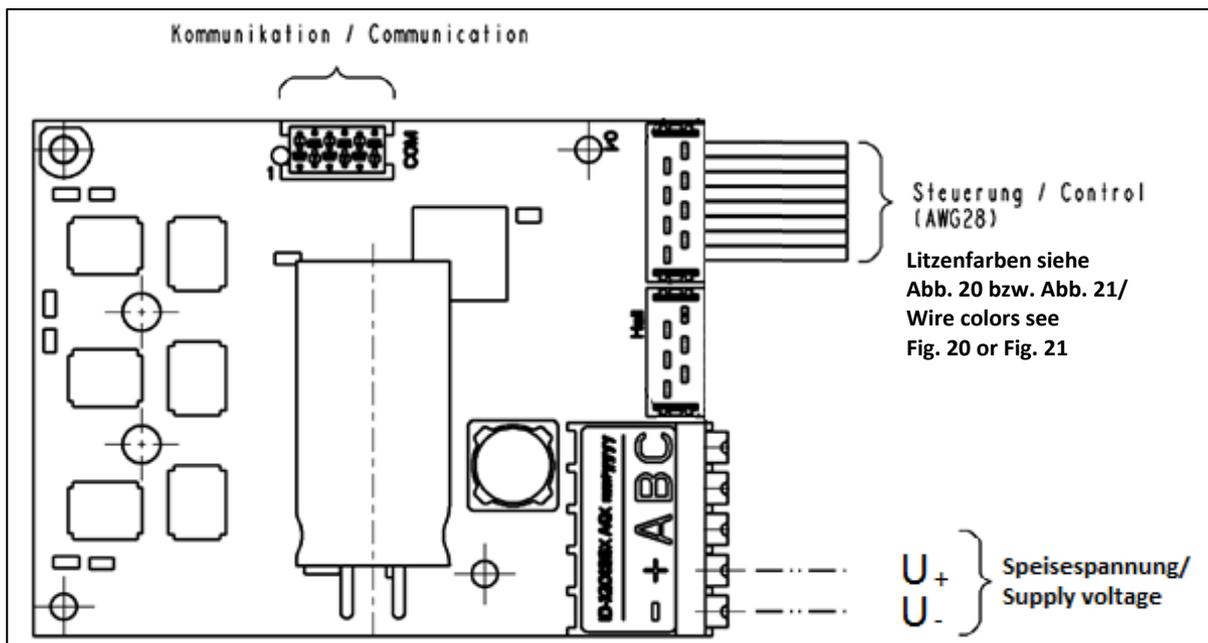


Fig. 19: Connection plan motor electronics N 8__K_.29DC-B

Motor			
Nennspannung / Nominal voltage	[V]	24	
Spannungsbereich / Voltage range	[V]	7 ... 30	
Elektrische Anschlüsse / Electrical connection			
Litzenbelegung / lead assignment			
Funktion / function	Litzenfarbe lead color	Signalname signal name	Größe / size
+ Speisespannung + Supply voltage	rot / red	U ₊	AWG 18
- Speisespannung (0V) - Ground (0V)	schwarz / black	U ₋ / GND	AWG 18
5V Ausgangsspannung 5V power supply	schwarz / black	U _{5V}	AWG 28 UL 20932
Eingangssignal Drehzahlregelung Input signal speed control	weiß / white	U _{Ctrl}	AWG 28 UL 20932
Ausgangssignal Drehzahl Output signal speed	gelb / yellow	U _{Spd}	AWG 28 UL 20932
Eingangssignal Remote EIN/AUS Input signal Remote ON/OFF	grün / green	U _{Rmt}	AWG 28 UL 20932
Ausgangssignal Fehler Output signal fault	lila / purple	U _{Flt}	AWG 28 UL20932
Masse Ground	grau & blau & orange grey & blue & orange	GND	AWG 28 UL 20932
5V Ausgangsspannung U _{5V} / 5V Power supply U _{5V}			
Ausgangsspannung DC Control voltage range DC	[V]	5 ± 0.2	
Max. Ausgangsstrom Max. current output	[mA]	170	

Tab. 13 (part 1): Connection plan motor electronics N 8__K_.29DC-B

Eingangssignal Drehzahlregelung U_{Ctrl} / Input signal speed control U_{Ctrl}			
Analog	Steuerspannungsbereich DC Control voltage range DC	[V]	0...5
	Steuerspannungsbeschreibung: min. → Pumpe min. Förderleistung max. → Pumpe max. Förderleistung Control voltage description min. → pump min. flow max. → pump max. flow	[V]	min. 0.1 max. 5
	Max. Eingangsspannung Max. input voltage	[V]	5.5
	Schwellenspannung Treshold voltage	[mV]	25 ± 0.5
	PWM Frequenzbereich PWM frequency range	[Hz]	100 [50 ... 150]
PWM-Signal	Eingangspegel „high“ Input level „high“	[V]	5 [4.2 ... 5.5]
	Eingangspegel „low“ Input level „low“	[V]	0 [0 ... 0.9]
	Tastgradbereich Duty cycle range	[%]	0 ... 100
	Tastgradbeschreibung: min. → Pumpe min. Förderleistung max. → Pumpe max. Förderleistung Duty cycle description min. → pump min. flow max. → pump max. flow	[%]	min. 2 max. 100
	Eingangsimpedanz @ 1kHz Input impedance @ 1kHz	[kΩ]	≥ 12
Ausgangssignal Drehzahl U_{Spd} / Output signal speed U_{Spd}			
Analog	Pulse pro Umdrehung Pulses per revolution	[-]	1
	Pulstastverhältnis Pulse duty cycle	[%]	50 ± 1
PWM-Signal	PWM Frequenz PWM frequency	[Hz]	50 ± 0.5
Ausgangspegel „high“ Output level „high“		[V]	5 [4.1 ... V_{5V}]
Ausgangspegel „low“ Output level „low“		[V]	0 [0 ... 0.6]
Max. Strombelastbarkeit Max. current carrying capacity		[mA]	10
Ausgangsimpedanz @ 1 kHz Output impedance @ 1 kHz		[kΩ]	≥ 9
Eingangssignal Remote EIN/AUS U_{Rmt} / Input signal Remote ON/OFF U_{Rmt}			
Eingangspegel „high“ → Motor EIN Input level „high“ → motor ON		[V]	5 [3.9 ... 5.5]
Eingangspegel „low“ → Motor AUS Input level „low“ → motor OFF		[V]	0 [0 ... 0.9]
Eingangsimpedanz @ 1 kHz Input impedance @ 1 kHz		[kΩ]	≥ 1.8

Tab. 13 (part 2): Connection plan motor electronics N 8__ K_.29DC-B

Ausgangssignal Fehler U_{Fit} / Output signal fault U_{Fit}		
Eingangsspiegel „high“ → Fehler vorhanden Input level „high“ → error detected	[V]	5 [3.9 ... 5.5]
Eingangsspiegel „low“ → kein Fehler Input level „low“ → no error	[V]	0 [0 ... 0.9]
Max. Strombelastbarkeit Max. current carrying capacity	[mA]	10
Ausgangsimpedanz @ 1kHz Output impedance @ 1kHz	[kΩ]	≥ 9

Tab. 13 (part 3): Connection plan motor electronics N 8__ K_.29DC-B

i If the black wire is used as voltage source and at the same time as the default control voltage for the white wire, the output voltage decreases when the voltage source is under load. At the same time the default voltage for the white wire decreases. Because of this the nominal final speed can no longer be reached.

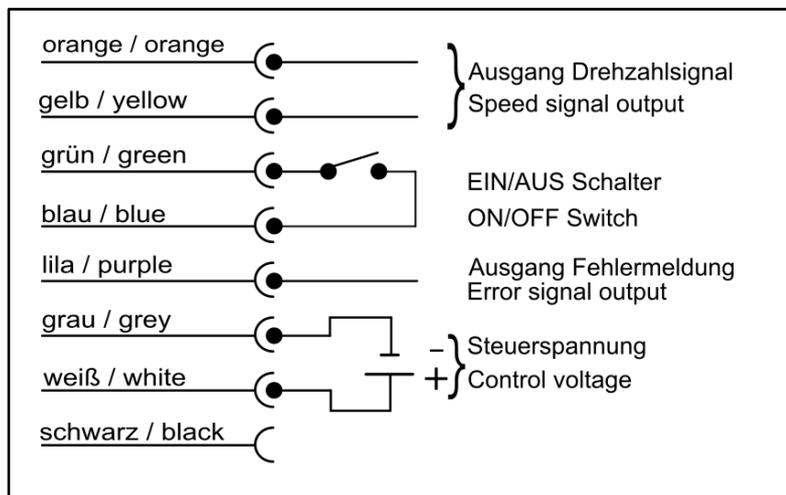


Fig. 20: Exposition Control without Potentiometer

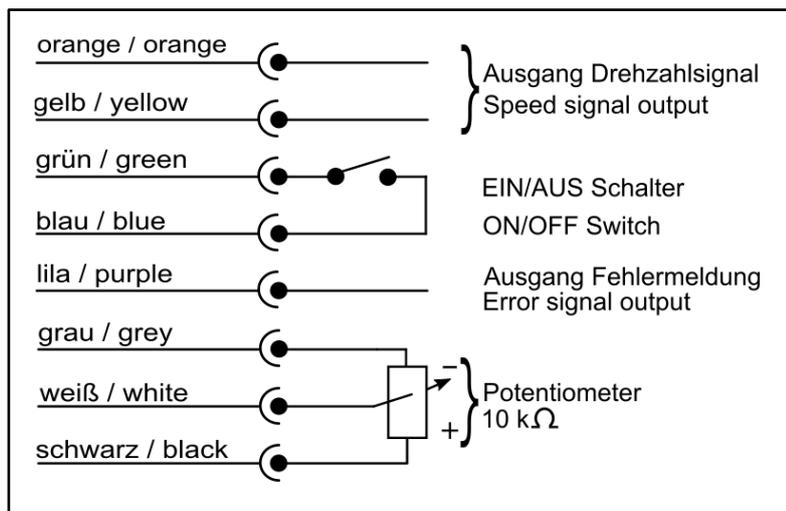


Fig. 21: Exposition Control with Potentiometer

6.3. 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). |
| 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. 7 for mounting dimensions).

4. Lay the suction and pressure line at a downward angle to prevent condensate from running into the pump.

7. Operation

7.1. General



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

- 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.

- Pump standstill → With the pump at a standstill, open pressure and suction lines to normal atmospheric pressure.
- 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 8.2.1) to increase the service life of the diaphragm.
- 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 overload switch and the pump switches off.
- i** For pumps with DC 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.
- Install overload switch (see Chapter 6.2).
- Make sure that there is no pressure in the hoses before switching on the pump.
- i** For pumps with brushless DC motor:
The pumps may start against pressure or vacuum. This also allowed if you experience a brief power interruption.
- Switching off the pump / removing from operation → Restore the system to normal atmospheric pressure (release pneumatic pressure in pump).

7.2. Control functions (for pumps with brushless DC motor)

7.2.1. Speed control

DC-B (constant speed)

The motor drives the pump at a constant, unchangeable speed across the entire permissible pressure range.

.29DC-B (regulated speed)

The motor drives the pump at a changeable speed between n_{min} and n_{max} . Speed is specified via the control voltage.

7.2.1.1. Speed input (.29 versions)

Speed range The speed range of $n_{min} \dots n_{max}$ is shown scaled to the control voltage U_{Ctrl} :

- $U_{Ctrl \ min} \ 0.1 \ V$
- $U_{Ctrl \ max} \ 5.0 \ V$

If the control voltage is less than $U_{Ctrl \ min}$, the motor is OFF.

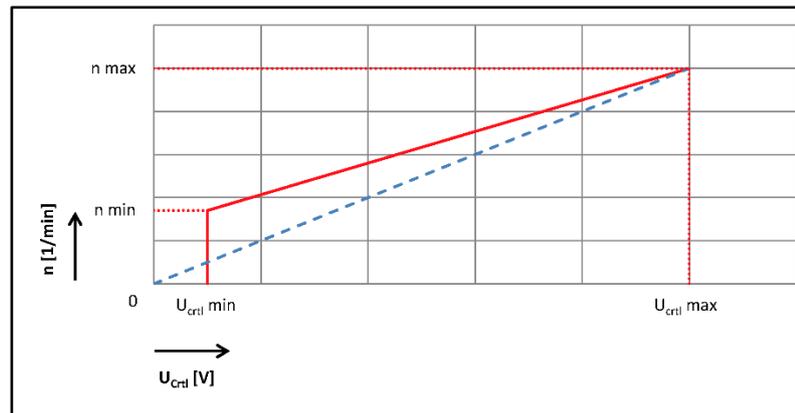


Fig. 22: Control-voltage/speed curve (standard)

Speed specification Speed is specified through the 8-pin controller connection (white wire, see Tab. 13).

Optional analog settings for control voltage input

The following additional settings can be made at the factory upon request:

- Modify control voltage values $U_{Ctrl \ min}$ and $U_{Ctrl \ max}$
- If the control voltage is less than $U_{Ctrl \ min}$, the motor will be ON.

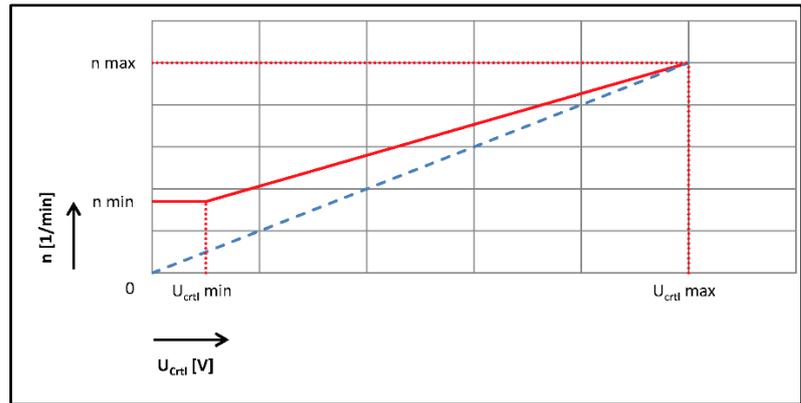


Fig. 23: Scaled control-voltage/speed curve (optional)

7.2.1.2. Speed output (.29 versions)

Speed output Speed is outputted through the 8-pin controller connection (yellow wire, see Tab. 13).

The motor controller generates speed-synchronized pulse-width modulation (see Fig. 24).

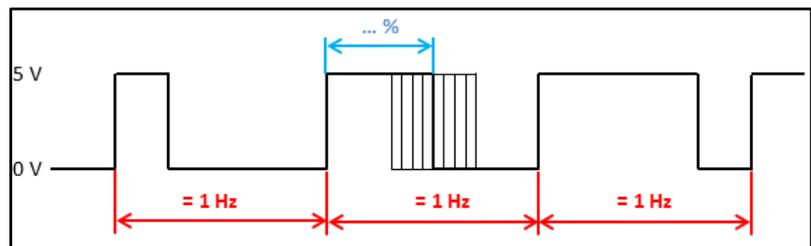


Fig. 24: Analog speed output (standard)

Optional speed output

The motor controller generates a speed-synchronized right-angle frequency with 5V TTL level (see Fig. 25).

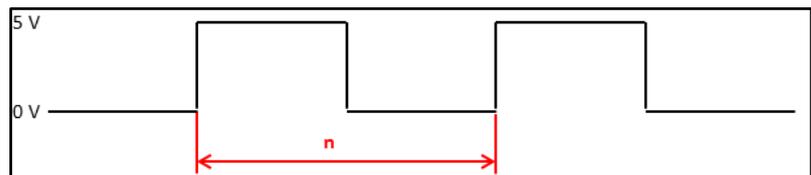


Fig. 25: Digital speed output (optional)

7.2.2. Remote ON/OFF (.29 versions)

Remote ON/OFF Remote ON/OFF is through an 8-pin controller connection (green wire, see Tab. 13).

i To start the motor, the green wire must be bridged to the ground of the controller connection (grey wire, blue wire or orange wire).

7.2.3. External digital activation (.29 versions, optional)

External activation

If desired, the pump motor can be activated externally. This requires a special setting at the factory (contact data: see www.knf.com).

External activation is through the 6-pin communication connection (see Fig. 19).

Connector type: Micro-Match Female Top Entry

Part no.: 7-215079-6

i When the motor is activated externally, the control inputs are inactive.

Connection communication plug (see Fig. 19)

- PIN 1 – do not connect
- PIN 2 – do not connect
- PIN 3 – GND
- PIN 4 – 5V (max. 50 mA)
- PIN 5 – TX MBLC
- PIN 6 – RX MBLC

Motor connection options – external control unit

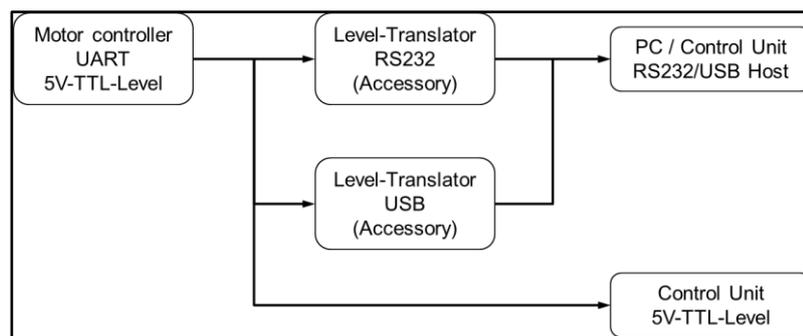


Fig. 26: External activation options (optional)

The following motor functions can be controlled:

- Motor remote ON/OFF
In the factory condition, the motor is OFF when operating voltage is applied. However, as an option the motor can be ON when operating voltage is applied.
- Motor speed
Setting motor speed within speed limits n_{\min} and n_{\max} .
- Reed-out of the following process parameters:
 - Actual/Nominal motor speed
 - Control limit of motor speed
 - Operating current of the motor
 - Temperature of the motor controller
 - Fault status
 - Software version number

Interface protocol The connection between the PC and motor controller can be operated as an RS-232 interface. Accordingly, in the operating system it is managed as an additional COM connection and can be addressed with conventional terminal software.

Interface configuration

- Baud rate: 57600 bits/s
- Data bits: 8
- Parity: none
- Stop bits: 1
- Flow control: none

Tables Tab. 14 to Tab. 16 contain the necessary command sets, shown as ASCII characters. When transmitting, the commands must be followed by ASCII character <CR> (carriage return, decimal value 013). The underlined expressions are not characters, but symbols as explained in table Tab. 16.

Parameter	Command*	Function	Reply
Motor	dB	Start	<u>S</u> ; <u>E</u>
	dE	Stop	<u>S</u> ; <u>E</u>
Speed	dSnnnn [nnnn = speed value]	Set nominal speed	<u>ns</u> ; <u>E</u>

Tab. 14: Control commands

* A pause of at least 25 ms is required after the "dB" instruction set.

Parameter	Command	Reply
Actual motor speed; Operating current of the motor; Temperature of the motor controller; Fault status	pP	<u>ni</u> ; <u>ii</u> , <u>ti</u> , <u>ei</u> , <u>E</u>
Fault status (single value)	gP	<u>ei</u> ; <u>E</u>
Nominal motor speed	gS	<u>ns</u> ; <u>E</u>
Minimum possible motor speed	gSl	<u>nl</u> ; <u>E</u>
Maximum possible motor speed	gSh	<u>nh</u> ; <u>E</u>
Software version number	iV	<u>V</u> ; <u>E</u>

Tab. 15: Reed commands

Symbol	Interpretation	Meaning
E	Announcement of completion	0 command cannot be completed
		1 command completed
		? command unclear
S	Status message	For service only
V	Version number	e.g. 01.018
ni	Actual motor speed	Value [min^{-1}]
ns	Nominal motor speed	Value [min^{-1}]
nl	Minimum nominal motor speed	Value [min^{-1}]
nh	Maximum nominal motor speed	Value [min^{-1}]
ii	Operating current of the motor	Value [mA]
ti	Temperature of the motor controller	Value [$^{\circ}\text{C}$]
ei	Fault status	16 bit value

Tab. 16: Symbols

The symbols represent the ASCII codes of sequences of digits any length. The controller processes input values only as whole numbers (integers).

Interface level

i See p. 28 for pin assignment of the motor controller's communication plug.

Parameter	Value
Rx KNF MBLC	Low: 0V...0.9V High: 4.2V...5.2V
Tx KNF MBLC	Low: 0V...0.6V High: 4.5V...5.2V

Tab. 17

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. 18

8.2. Cleaning

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

8.2.1. 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.

8.2.2. 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.

8.3. Replacing the diaphragm and valve plates

8.3.1. AN_-versions (with pump head made of aluminum)

- 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. 2	1
Phillips screwdriver no. 1 (only for DC pumps N 828)	1
Felt-tip pen	1

Tab. 19

*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.



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.

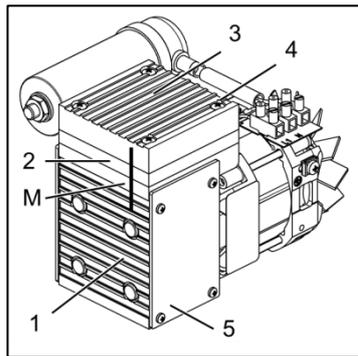


Fig. 27: One-headed pump
(N 828 ANE)

Specification

- 1 Housing
- 2 Intermediate plate
- 3 Head plate
- 4 Screw
- 5 Cover
- 6 Valve plate/sealing
- 7 Structured Diaphragm
- 8 Diaphragm spacer
- 9 Connection rod
- 10 Counter weight

M Mark

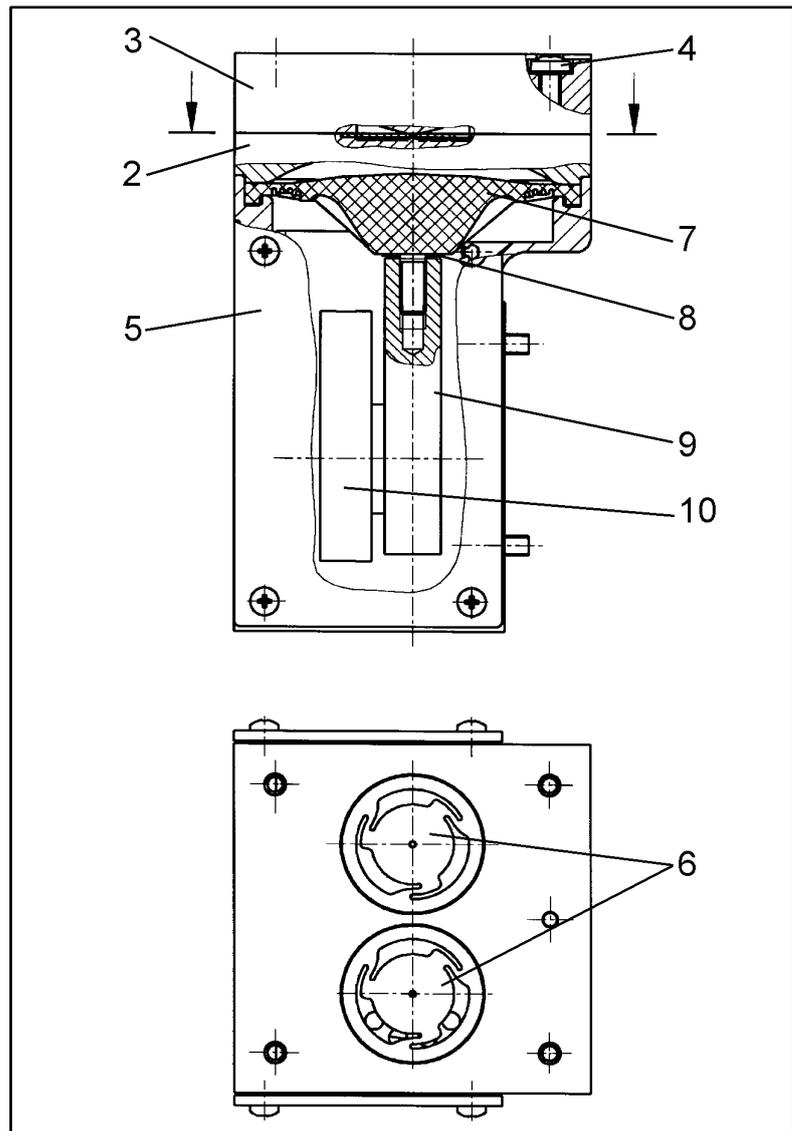


Fig. 28: Section for AN_-version (pump head made of aluminum)

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 (5) 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 (10).

b.) Remove 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 (M) with a felt-tip marker. 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.) Change diaphragm

1. Turn the fan to bring the diaphragm (7) to top dead centre.
2. Lift the edge of the diaphragm and, gripping it on opposite sides, unscrew it by turning anti-clockwise.
3. Take the diaphragm spacer(s) (8) off the threaded portion of the diaphragm and retain it/them.
4. Check that all parts are free from dirt and clean them if necessary (see Chapter 8.2. Cleaning).
5. Put the diaphragm spacer(s) rod (8) in the thread of the new diaphragm.
6. Turn the fan until the connecting rod (9) is at top dead centre.
7. Screw the new diaphragm (7), complete with diaphragm spacer(s) (8) into the connecting rod (9) (clockwise) and tighten it by hand.

d.) Change valve plates/sealings

1. Separate the head plate (3) from intermediate plate (2).
2. Remove the valve plates/sealings (6) 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 (6) in the recesses in the intermediate plate (2). The valve plates/sealings for suction and pressure sides are identical, as are upper and lower sides of the plates.
5. Check that the valve plates/sealings are not deformed by moving them gently sideways in their recesses.

e.) Refit pump head

1. Turn the fan to bring the diaphragm (7) to top dead centre.
2. Place the intermediate plate (2) with valve plates/sealings (6), and head plate (3) on the housing, in the position indicated by the marking (M).
3. Check that the head plate (3) 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 structured diaphragm (7) to top dead centre.
7. Now tighten screws (4) firmly diagonally (tightening-torque: 3.5 Nm).

f.) Final steps

1. In the case of DC version (no cooling fan): refix the cover (5) to housing (1).
2. Connect the pump to the electrical supply.

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

8.3.2. N 828 KN_-versions (with pump head made of plastic)

- 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. 2	1
Phillips screwdriver no. 1 (Only pumps N 828_ with DC motor)	1
Felt-tip pen	1

Tab. 20

*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. In the case of models with two pump heads service 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.

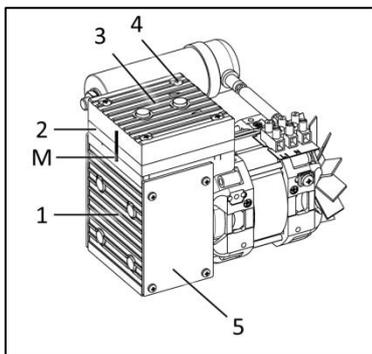


Fig. 29: One-headed pump (N 828 KNE)

Legend

- 1 Housing
- 2 Intermediate plate
- 3 Head plate
- 4 Screw
- 5 Cover
- 6 Valve plate/sealing
- 7 Structured diaphragm
- 8 Diaphragm spacer
- 9 Screw
- 10 Screw cap
- 11 Disk spring
- 12 Washer

M Marking

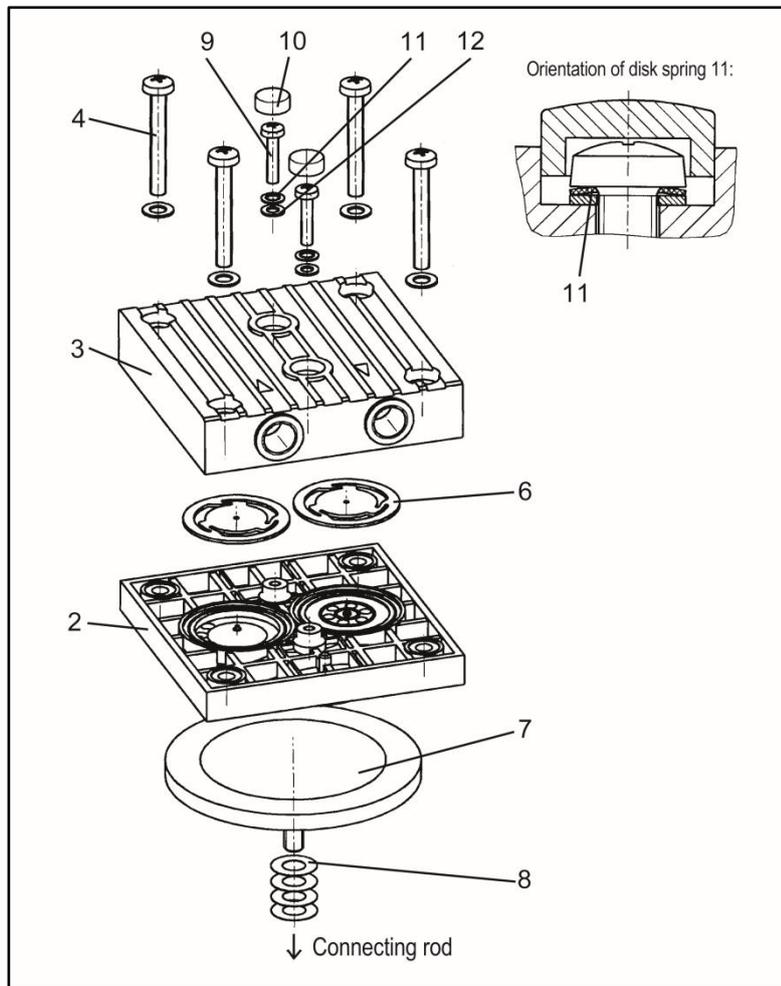


Fig. 30: Pump head N 828 KN_-versions (pump head made of plastic)

a.) Preparatory steps

1. Remove the pumps 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 (5) 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.

b.) Remove 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, see Fig. 29). This helps avoid incorrect assembly later.
2. Undo the 4 screws (4) in the head plate (3) and lift the head plate with the intermediate plate off the pump housing.

c.) Change diaphragm

1. Turn the fan to bring the diaphragm (7) to top dead centre.
2. Lift the edge of the diaphragm and, gripping it on opposite sides, unscrew it by turning anti-clockwise.
3. Take the diaphragm spacer(s) (8) off the threaded portion of the diaphragm and retain it/them.
4. Check that all parts are free from dirt and clean them if necessary (see Chapter 8.2. Cleaning).
5. Put the diaphragm spacer(s) (8) on the thread of the new diaphragm.
6. Turn the fan until the connecting rod (connecting part between motor shaft and diaphragm) is at top dead centre.
7. Screw the new diaphragm (7), complete with diaphragm spacer(s) (8) into the connecting rod (clockwise) and tighten it by hand.

d.) Change valve plates/sealings

1. Use a small screwdriver to remove the two screw caps (10) on the pump head and then undo the screw(s) (9).
2. Separate the head plate (3) from intermediate plate (2).
3. Remove the valve plates/sealings (6) from the intermediate plate.
4. Check that the valve seats in the head plate and intermediate plate are clean; if scratches or distortion corrosion are evident on these parts they should be replaced.
5. Lay the new valve plates/sealings (6) in the recesses in the intermediate plate (2). The valve plates/sealings for suction and pressure sides are identical, as are upper and lower sides of the valve plates/sealings.
6. Check that the valve plates/sealings are not deformed by moving them gently sideways in their recesses.
7. Place the head plate (3) on the intermediate plate (2), in the position indicated by the marking (M).
8. Check that the head plate (3) is centered by moving it gently sideways.

9. Join the head plate (3) and the intermediate plate (2) by tightening the two screws (9) with disk spring (11) and washer (12). For orientation of disk spring (see Fig. 30). Torque for tightening the screw(s): 25 Ncm.
10. Install the screw cap(s) (10).

e.) Refit pump head

1. Turn the fan to bring the diaphragm (8) to top dead centre.
2. Place the pump head (consisting of intermediate plate (2) with valve plates/sealings (6), and head plate (3) on the housing, in the position indicated by the marking (M).
3. Gently tighten the screws (4), evenly and diagonally.
4. Turn the fan to check that the pump rotates freely.
5. Turn the fan again to bring the diaphragm to top dead centre.
6. Now tighten screws (4) firmly (torque: 3.5 Nm).

f.) Final steps

1. Only in the case of DC versions (no cooling fan): refix the cover (5).
2. Connect the pump to the electrical supply.

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

8.3.3. N 838 KN_-versions (with pump head made of plastic)

- 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 part/tool	Quantity
1 Service Set*	1
Phillips screwdriver no. 2	1
Felt-tip pen	1

Tab. 21

*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. In the case of models with two pump heads service 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.

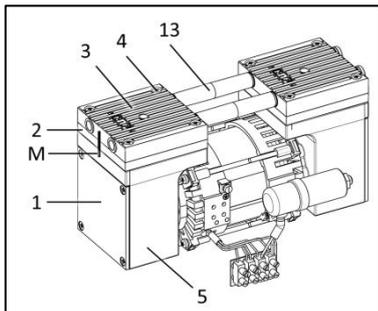


Fig. 31: Two-headed pump (N 838.1.2 KNE)

Legend

- 1 Cover
- 2 Intermediate plate
- 3 Head plate
- 4 Screw
- 5 Housing
- 6 Valve plate/sealing
- 7 Structured diaphragm
- 8 Diaphragm spacer
- 9 Screw
- 11 Disk spring
- 12 Washer
- 13 Pneumatic connection

M Marking

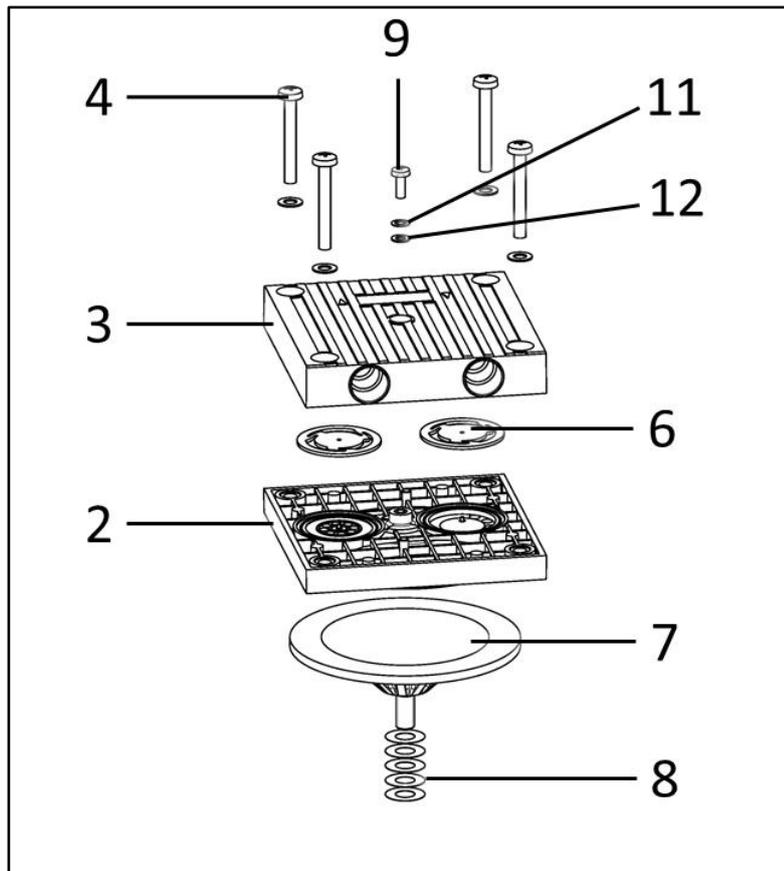


Fig. 32: Pump head N 838 KN_-versions (pump head made of plastic)

a.) Preparatory steps

1. Remove the pumps 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) and for pump N 838.1.2 KNE: Remove cover (1) 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.

b.) Remove pump head

1. Mark the position of the head plate (3), intermediate plate (2) and housing (5) relative to each other by a drawing line with a felt-tip marker (M, see Fig. 31). This helps avoid incorrect assembly later.
2. Undo the 4 screws (4) in the head plate (3) and lift the head plate with the intermediate plate off the pump housing. For two-headed pumps: Undo the head-plate screws (4) in the head plate (3) and lift the two head-plates with the intermediate plates (2) and the pneumatic connections (13) off the pump housing.

c.) Change diaphragm

1. Turn the fan to bring the diaphragm (7) to top dead centre.
2. Lift the edge of the diaphragm and, gripping it on opposite sides, unscrew it by turning anti-clockwise.
3. Take the diaphragm spacer(s) (8) off the threaded portion of the diaphragm and retain it/them.
4. Check that all parts are free from dirt and clean them if necessary (see Chapter 8.2. Cleaning).
5. Put the diaphragm spacer(s) (8) on the thread of the new diaphragm.
6. Turn the fan until the connecting rod (connecting part between motor shaft and diaphragm) is at top dead centre.
7. Screw the new diaphragm (7), complete with diaphragm spacer(s) (8) into the connecting rod (clockwise) and tighten it by hand.
8. Carry out steps 1. – 7. For the second pump head.

d.) Change valve plates/sealings

1. Use a small screwdriver to undo the screw (9).
2. Separate the head plate (3) from intermediate plate (2).
3. Remove the valve plates/sealings (6) from the intermediate plate.
4. Check that the valve seats in the head plate and intermediate plate are clean; if scratches or distortion corrosion are evident on these parts they should be replaced.
5. Lay the new valve plates/sealings (6) in the recesses in the intermediate plate (2). The valve plates/sealings for suction and pressure sides are identical, as are upper and lower sides of the valve plates/sealings.
6. Check that the valve plates/sealings are not deformed by moving them gently sideways in their recesses.
7. Place the head plate (3) on the intermediate plate (2), in the position indicated by the marking (M).
8. Check that the head plate (3) is centered by moving it gently sideways.
9. Join the head plate (3) and the intermediate plate (2) by tightening the screw (9) with disk spring (11) and washer (12). Torque for tightening the screw(s): 35 Ncm.
10. Carry out steps 1. – 9. For the second pump head.

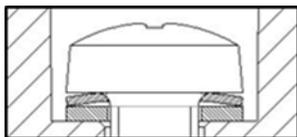


Fig. 33: Orientation of the disk spring (11)

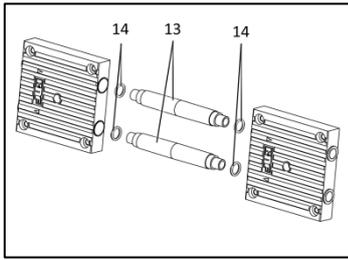


Fig. 34: Extraction of pneumatic connection and O-rings

11. For two-headed pumps:
Pull apart the pump heads and take the pneumatic connections (13) and the O-rings (14) (see Fig. 34).
12. For two-headed pumps:
Change the O-rings on both sides of the pneumatic connection.
13. For two-headed pumps:
Connect the pneumatic connection (with the O-rings) to the pump heads.

e.) Refit pump head

1. Turn the fan to bring the diaphragm (8) to top dead centre.
2. Place the pump head(s) (consisting of intermediate plate (2) with valve plates/sealings (6), and head plate (3) on the housing, in the position indicated by the marking (M).
3. Gently tighten the screws (4), evenly and diagonally.
4. Turn the fan to check that the pump rotates freely.
5. Turn the fan again to bring the diaphragm to top dead centre.
6. Now tighten screws (4) firmly (torque: 3.5 Nm).

f.) Final steps

1. Only in the case of DC versions (no cooling fan) and N 838.1.2 KNE: refix the cover (1).
2. Connect the pump to the electrical supply.

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

9. 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. 22 and Tab. 23).

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: <ul style="list-style-type: none"> ▪ The motor board's overcurrent protection circuit has activated. ▪ Maximum temperature of motor board is exceeded ▪ Maximum blocking time of the rotor is exceeded 	→ Separate pump from the mains. → Determine and remove the cause of the overcurrent (for example: improper pressure, liquid in the pump heads). i The pump must be separated from the mains for several seconds before the electronics will permit restarting.
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 connected 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. 22

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 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.
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 the shim rings have been replaced onto the diaphragm screw thread. ➔ Check head connection and hose connections for leaks.

Tab. 23

Fault visualization on the motor controller (for pumps with brushless DC motor)

The excess of the overcurrent limit, the excess of the maximum temperature of the motor board or the blocking of the rotor is shown as a fault. A red LED on the BLDC motor controller signals the cause of fault.

Optional setting:

If desired, the motor controller can be programmed so that the error output voltage exhibits the same characteristics as the LED. With factory settings, only 1 or 0 are logically outputted as voltage at the fault output.

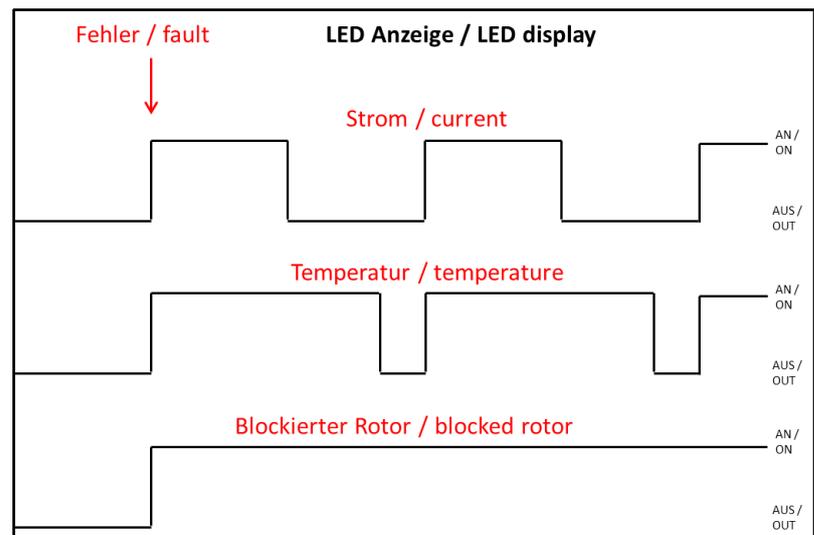


Fig. 35: LED blinking duration according to different faults

To delete the error condition the motor has to be disconnected from the mains.

Fault cannot be rectified

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

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, 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
 - 4x O-rings

Spare parts kit for pump type	Order-No.
N 828	043824
N 838	043825
N 838.1.2	313749

Tab. 24

10.2. Accessories

General accessories

Description	Order-No.
Silencer G 1/8	007006
Hose connector (straight) for all pump types except N 838.1.2 KN_: PA, G 1/8, ID 6	000360
Hose connector for N 838.1.2 KN_: PA, G 1/8, ID 8	004975

Tab. 25

General for pumps with brushless DC motor

Description	Order-No.
PWM analog voltage converter Function: Smoothing of the speed output signal into an analog voltage output and simultaneous transformation of 5V to $\leq 5V$	On request
External potentiometer for setting of the speed	On request
RS232 Level-Translator with SUB-D9 plug	On request
RS232 Level-Translator with Micro-USB plug	On request
Completely connectorized control cable (analog or digital controlling)	On request

Tab. 26

11. Returns

Prerequisite for repairing a pump by KNF is a completed Decontamination Form.

This is made available on the KNF website as a download. To find the form, select your country on the overview page (www.knf.com). You can find the Decontamination Form in the download area.

If you have questions, please contact your sales partner (contact data: see www.knf.com).

KNF worldwide

Find your local KNF partner on www.knf.com