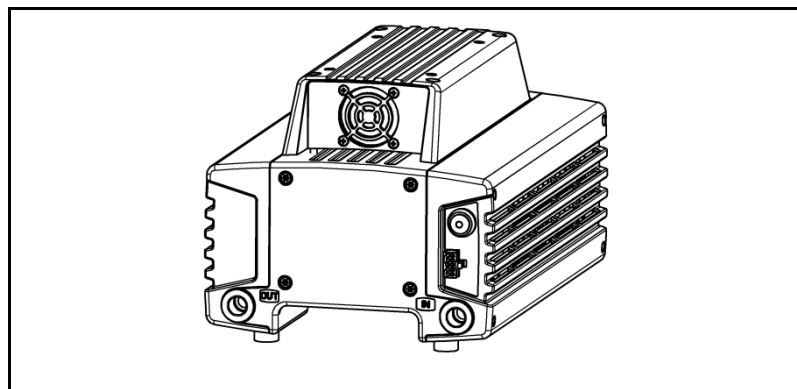


Diaphragm Vacuum Pumps

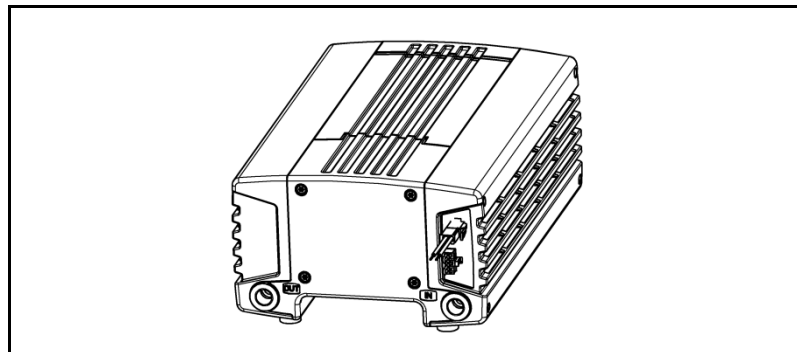
N 950.50 KNE-W

Operating and Installation Instructions

Read and observe these
Operating and Installation
Instructions!



N 950.50 KNDC-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.



- 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</p>

commissioned until such time as it has been determined that the machine 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 N 950.50 KNE-W)

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.

The following harmonized standards are met:

N 950.50 KNE-W	N 950.50 KNDC-B
DIN EN 61000-6-2/3	DIN EN 61000-6-2/3
DIN EN 50581	DIN EN 50581
DIN EN 60204-1	

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 950.50 KNE-W

<i>Pneumatic performance</i>	
Max. permissible operating pressure [bar g]	0.5
Ultimate vacuum [mbar abs.]	≤ 2 mbar ≤ 4 mbar with opened gas ballast (special version)
Flow rate at atm. pressure [l/min]*	55
<i>Pneumatic connections</i>	
Thread size	G 1/4
<i>Ambient and media temperature</i>	
Permissible ambient temperature	+ 10 °C to + 40 °C
Permissible media temperature	+ 5 °C to + 40 °C
<i>Other parameters</i>	
Weight [kg]	7.4
Dimensions: L x H x W [mm]	286 x 163 x 186
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>	
Automatic mains power adjustment	100-240 V 50-60 Hz
Max. operating current [A]	1.9
Pump power consumption [W]	140
Maximum permissible mains voltage fluctuations	+/- 10 %
Motor protection class	IP 20
<i>Pump materials</i>	
Pump head	PPS
Diaphragm	PTFE-coated
Valve	FPM

Tab. 3

* liters in standard state (1013 mbar)

i The pump is supplied by a universal power supply with integrated overload protection. It 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, 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.

N 950.50 KNDC-B

<i>Pneumatic performance</i>	
Max. permissible operating pressure [bar g]	0.5
Ultimate vacuum [mbar abs.]	≤ 2 mbar ≤ 4 mbar with opened gas ballast (special version)
Flow rate at atm. pressure [l/min]*	55
<i>Pneumatic connections</i>	
Thread size	G 1/4
<i>Ambient and media temperature</i>	
Permissible ambient temperature	+ 10 °C to + 40 °C
Permissible media temperature	+ 5 °C to + 40 °C
<i>Other parameters</i>	
Weight [kg]	6.5
Dimensions L x H x W [mm]	286 x 118 x 186
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 [V]	24 V
Max. operating current [A]	5 A
Pump power consumption [W]	120
Maximum permissible mains voltage fluctuations	+/- 10 %
Motor protection class	IP 20
<i>Pump materials</i>	
Pump head	PPS
Diaphragm	PTFE-coated
Valve	FPM

Tab. 4

* liters in standard state (1013 mbar)



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, 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.

5. Assembly and function

Assembly of N 950.50 KNE-W

- 1 Inlet (suction side)
- 2 Outlet (pressure side)
- 3 Power switch, mains cable
- 4 Control cable connection
- 5 Pressure switch for gas ballast valve (special version)

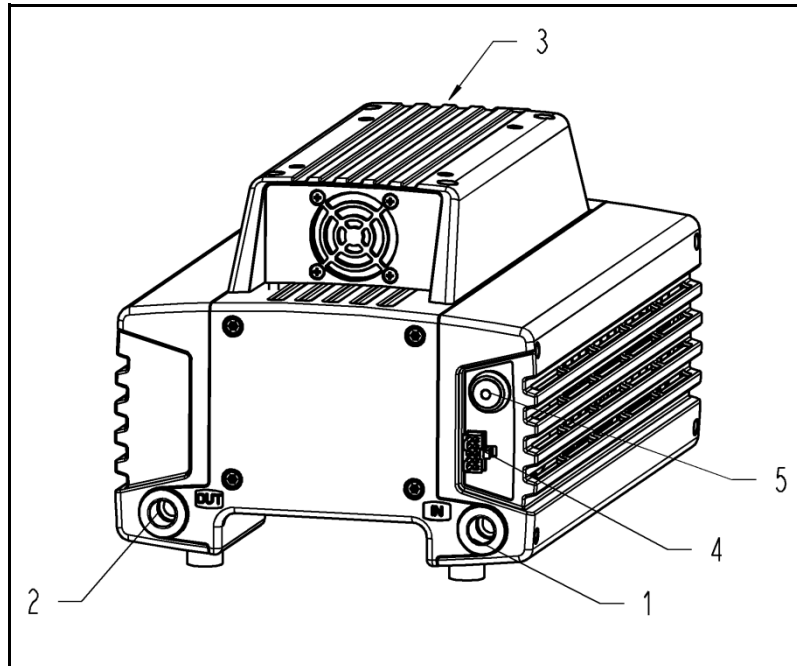


Fig. 1: Assembly of N 950.50 KNE-W

Assembly of N 950.50 KNDC-B

- 1 Inlet (suction side)
- 2 Outlet (pressure side)
- 3 Mains connection DC
- 4 Control cable connection

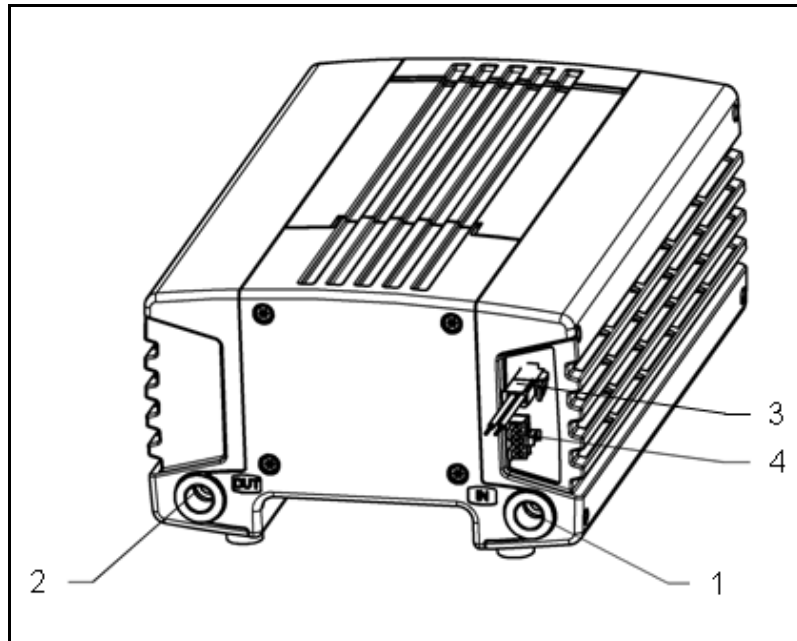


Fig. 2: Assembly of N 950.50 KNDC-B

How diaphragm pumps work

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

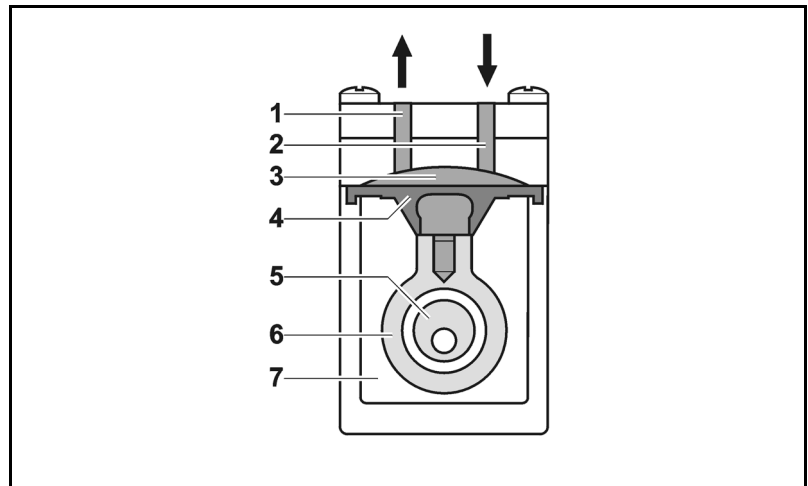


Fig. 3: Pump head

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).

6. Installation and connection

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

Observe all safety precautions (see Chapter 3).

6.1. Setting up or installing 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.

Dimensions ➔ Refer to Fig. 4 (N 950.50 KNE-W) or Fig. 5 (N 950.50 KNDC-B) for the pump dimensions.

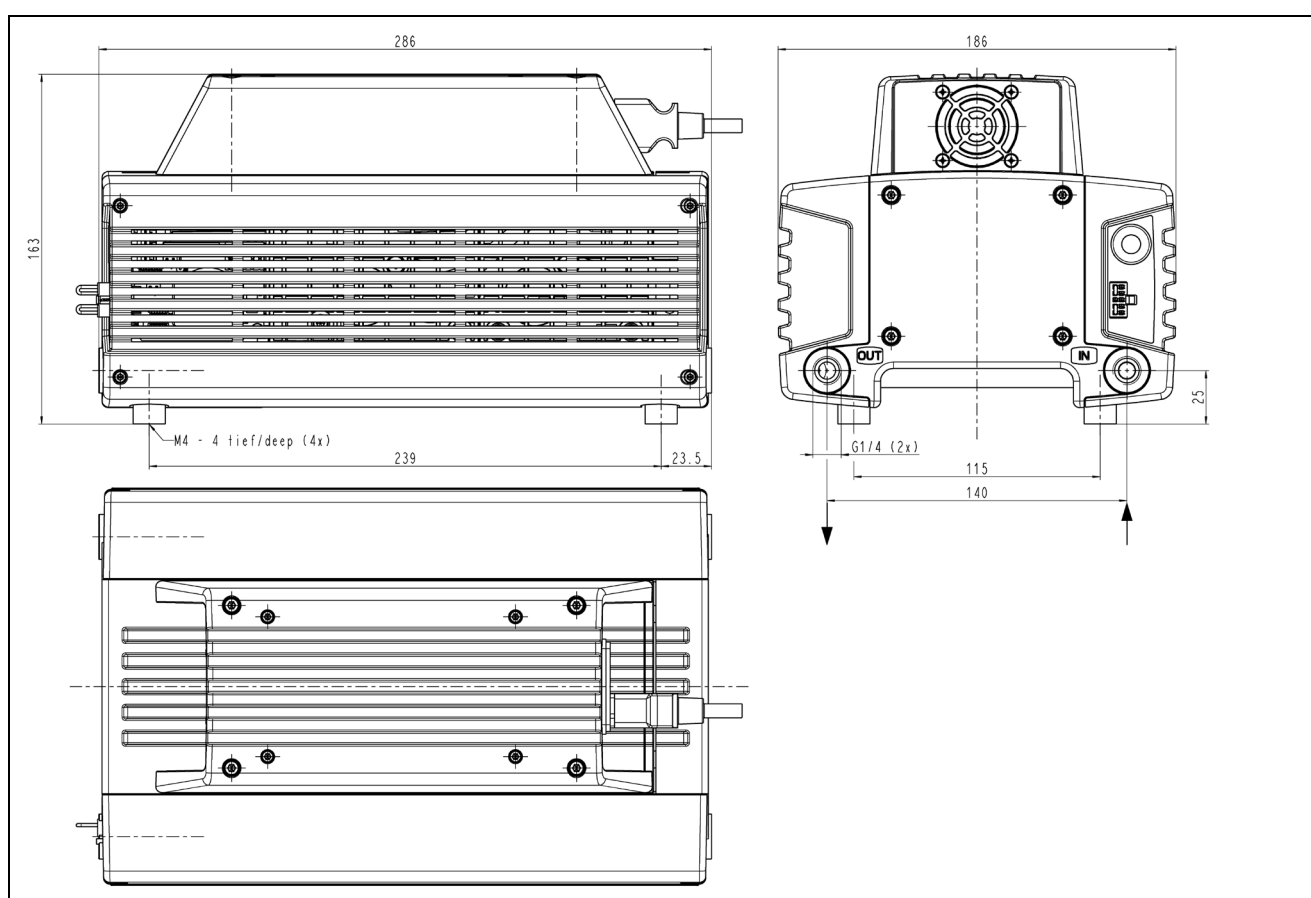


Fig. 4: Dimensions of N 950.50 KNE-W
(dimensional tolerances according to DIN ISO 2768-1, tolerance class V)

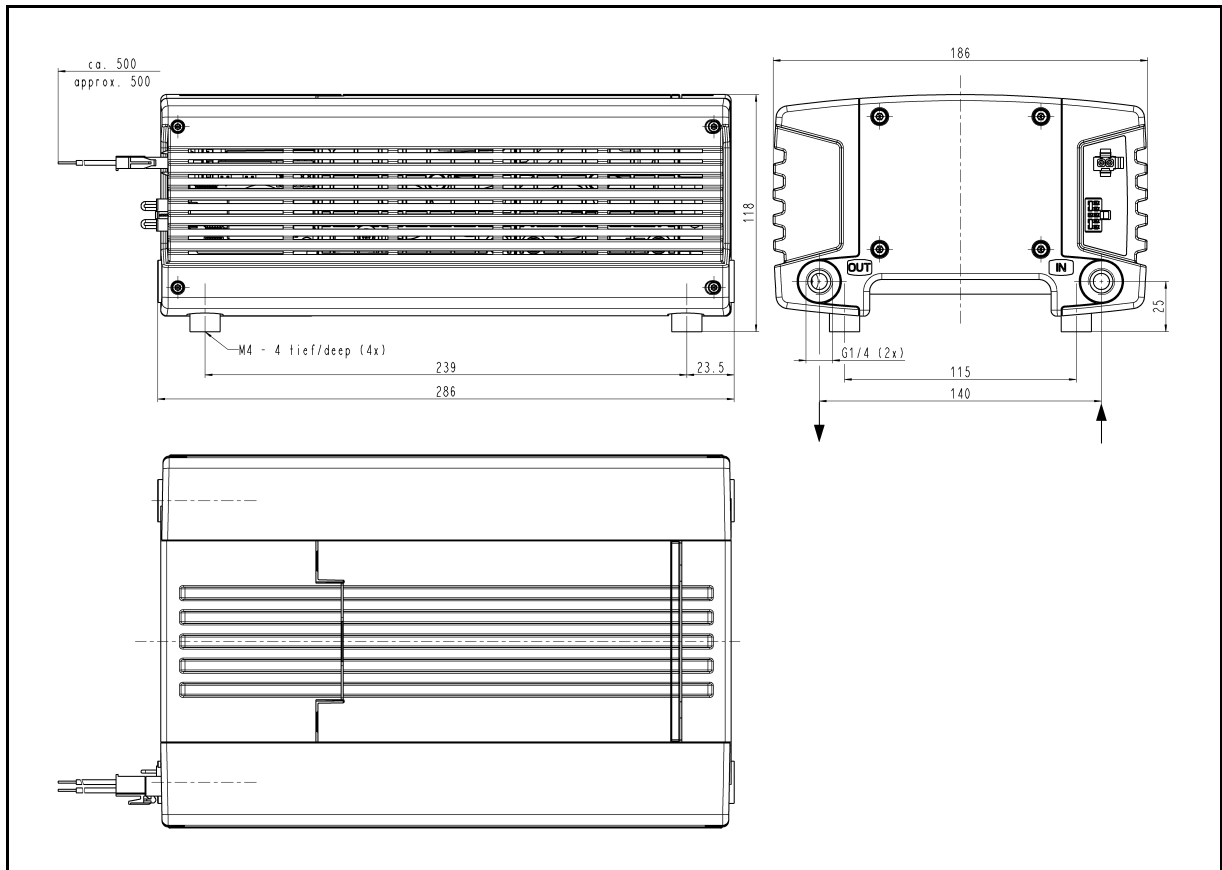


Fig. 5: Attachment dimensions of N 950.50 KNDC-B

(dimensional tolerances according to DIN ISO 2768-1, tolerance class V)

Cooling air supply

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

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.



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.

6.2. Electrical connections

N 950.50 KNE-W

1. Make sure that the power supply data match the data on the pump type plate.
2. Insert the mains cable plug into a properly installed shockproof socket.

N 950.50 KNDC-B

- ➔ Only have the pump connected by an authorized specialist.
- ➔ Only have the pump connected when the power supply is disconnected.
- ➔ When connecting the device to a power source, the relevant norms, directives, regulations and technical standards must be observed.
- ➔ The electrical installation must be fitted with a device that disconnects the pump motor from the mains (according to EN 60335-1).
- ➔ It is recommended that an additional "Emergency Stop" switch is installed.

Connecting the pump

1. Make sure that the power supply data match the data on the pump type plate.
2. Connect the positive and negative terminals.



Note the proper polarity:

red connection cable: +

black connection cable: -

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



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

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



Inlet and outlet are identified as "IN" and "OUT", respectively.

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.

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

7.1. General

- ➔ 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.



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 stoppage

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

Switching on the pump



Do not allow the pump to start against pressure. If you experience a brief power interruption, check for the presence of pressure or vacuum before restarting. If a pump starts against pressure, it may block. This activates the overload switch and the pump switches off.

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

- ➔ Pump N 950.50 KNE-W only: Switch on pump with power switch (see Fig. 1, page 8).
 - i** Depending on the applied electrical voltage, initialization of the electronics may take up to one second before the pump starts.
 - i** The flow rate is set to a fixed value as standard. This is achieved with a plug in the control cable connection (see Fig. 1/4 and Fig. 2/4, page 8).
- Switching off the pump/removing from operation
- ➔ Pump N 950.50 KNE-W only: Switch off pump with power switch (see Fig. 1, page 8).
 - ➔ Restore the system to normal atmospheric pressure (release pneumatic pressure in pump).
 - ➔ Pump N 950 KNE-W only: Pull out the pump's mains plug.

7.2. Control

- i** Only for pumps with external actuation at the control cable connection (see Fig. 1 and 2).
- Control cable, see accessories on page 33
- Control cable pin assignments, see Fig. 6, page 16

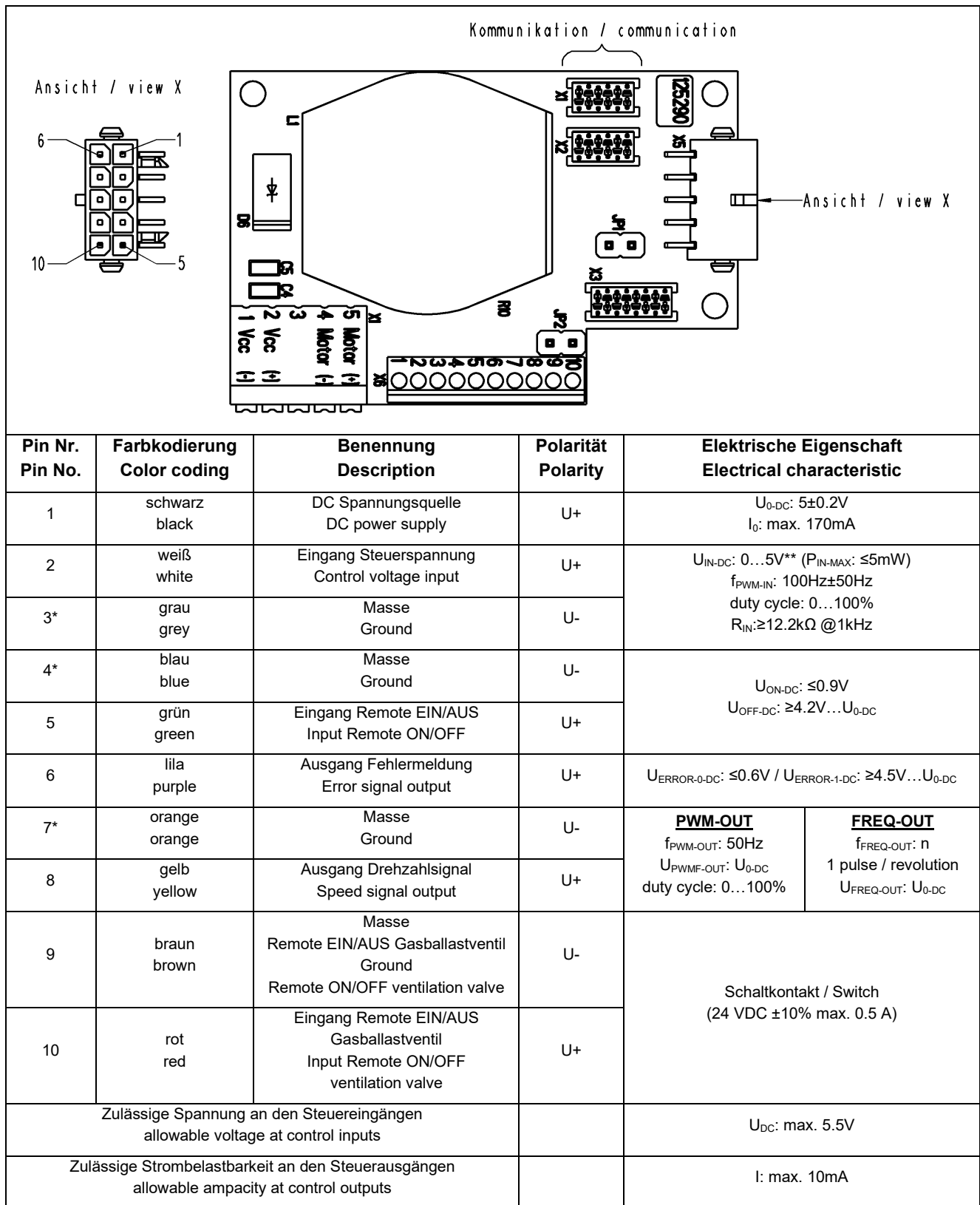


Fig. 6: Control cable pin assignments

* Ground Pin 3, 4 and 7 are connected with each other

** further control voltage versions on demand



If Pin 1 is simultaneously used as control voltage specification for Pin 2, please contact the KNF customer services (see last page for telephone number).

7.2.1. Speed control

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

Speed range

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

- $U_{c\min}$: 0.1V
- $U_{c\max}$: 5.0V

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

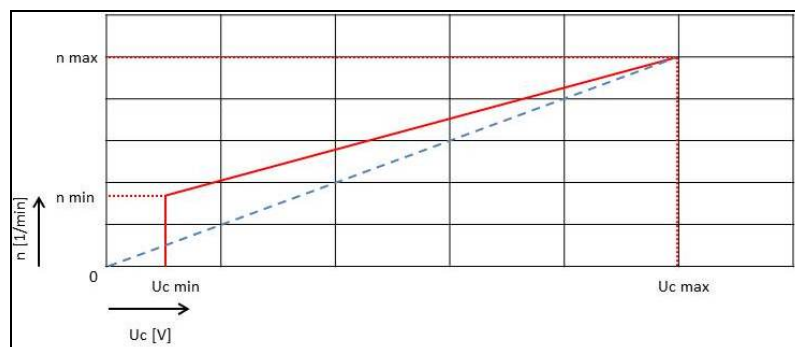


Fig. 7: Control-voltage/speed curve (standard)

Speed specification

Speed is specified through the 10-pin controller connection, Pin 2 (see Table in Fig. 6).

Optional analog settings for control voltage input

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

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

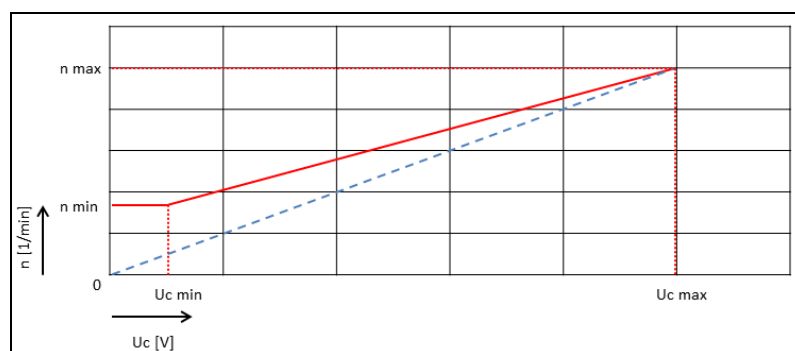


Fig. 8: Scaled control-voltage/speed curve (optional)

7.2.1.2. Speed output

Speed output

Speed is outputted through the 10-pin controller connection (Pin 8, see Table in Fig. 6).

The motor controller generates speed-synchronized pulse-width modulation (see Fig. 9).

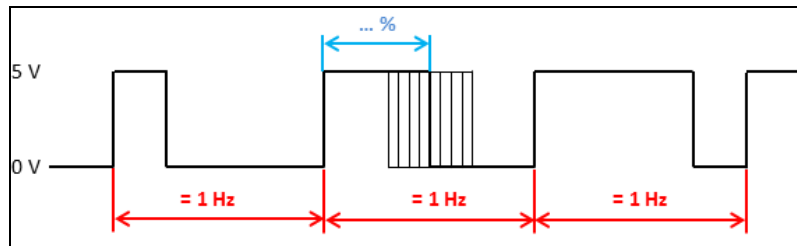


Fig. 9: Analog speed output (standard)

Optional speed output

The motor controller generates a speed-synchronized right-angle frequency with 5V TTL level (see Fig. 10).

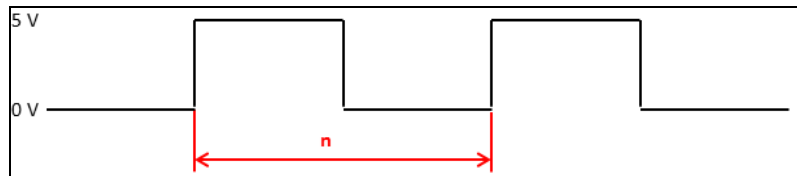


Fig. 10: Digital speed output (optional)

7.2.2. Remote ON/OFF

Remote ON/OFF is through an 10-pin controller connection (Pin 5, see Fig. 6).

i To start the motor, Pin 5 must be bridged to the ground of the controller connection.

External activation

7.2.3. External digital activation (optional)

If desired, the pump motor can be activated externally. This requires a special setting at the factory (see final page for contact address).

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

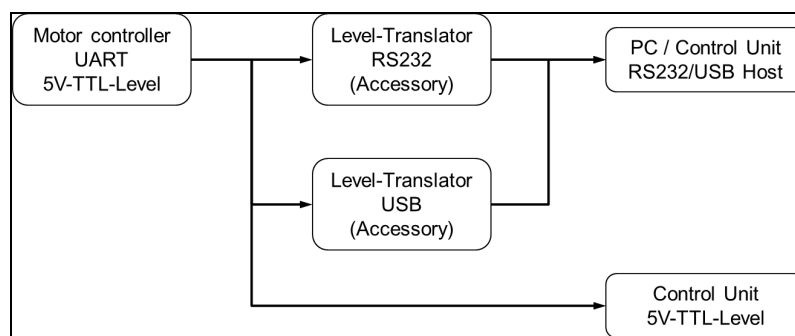
Connector type: Micro-Match Female Top Entry

Part no.: 7-215079-6

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

Connection communication plug (see Fig. 6 top)

- 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. 11: 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} .
- Read-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 5 to 7 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 7.

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. 5: 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. 6: Read commands

Symbol	Interpretation	Meaning
<u>E</u>	Announcement of completion	0 command cannot be completed
		1 command completed
		? command unclear
<u>S</u>	Status message	For service only
<u>V</u>	Version number	e.g. 01.018
<u>ni</u>	Actual motor speed	Value [min ⁻¹]
<u>ns</u>	Nominal motor speed	Value [min ⁻¹]
<u>nl</u>	Minimum nominal motor speed	Value [min ⁻¹]
<u>nh</u>	Maximum nominal motor speed	Value [min ⁻¹]
<u>ii</u>	operating current of the motor	Value [mA]
<u>ti</u>	temperature of the motor controller	Value [°C]
<u>ei</u>	Fault status	16 bit value

Tab. 7: 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. 16 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. 8

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/filter (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

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
Spare parts set according to spare parts list, Chapter 10
Allen key 2.5-mm (hexagon)
Phillips screwdriver No. 2
Allen key 3-mm (hexagon)
Felt-tip pen

Tab. 10

Information on procedure

- ➔ Always replace diaphragm and valve plates together to maintain the pump performance.



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 (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.

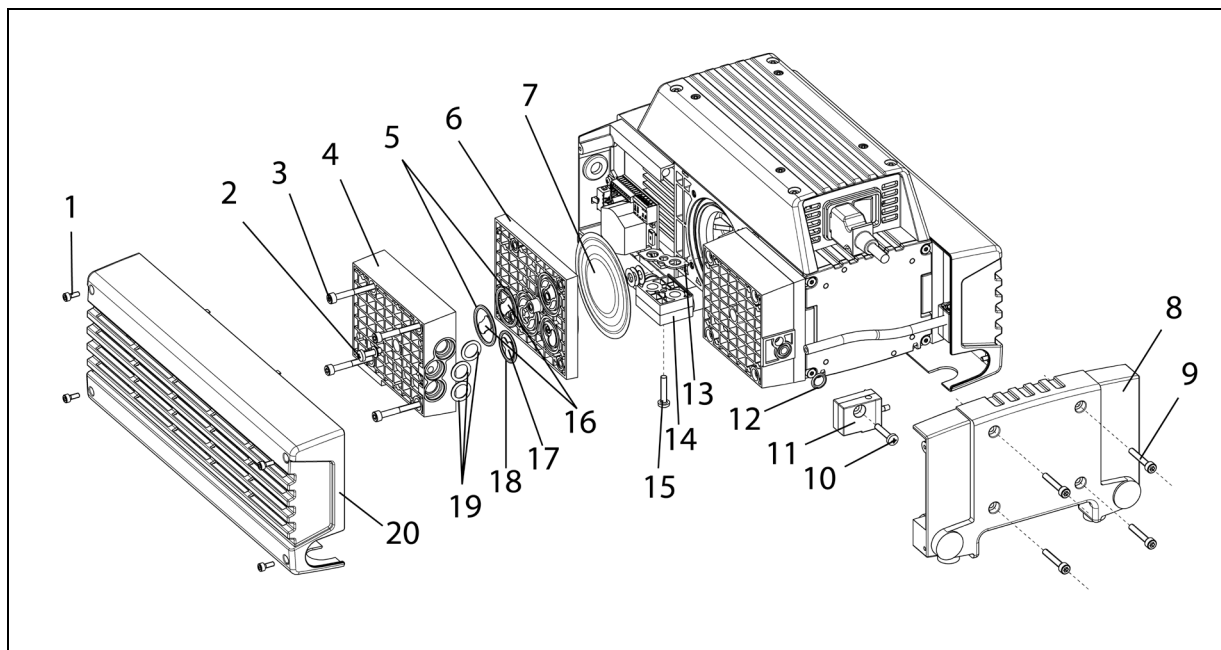


Fig. 12: Exploded drawing N 950.50 KNE-W

- | | | | |
|----|--|----|--|
| 1 | 8x attachment screws
(head cover) | 11 | 2x connection blocks .50 |
| 2 | 4x head screws | 12 | 2x O-rings (\varnothing 7.65 x 1.78) |
| 3 | 16x attachment screws
(head) | 13 | 2x flat seals |
| 4 | 4x head plates | 14 | 2x connection blocks .1.2 |
| 5 | 8x O-rings (\varnothing 24 x 2) | 15 | 2x attachment screws
(connection .1.2) |
| 6 | 4x intermediate plates | 16 | 8x valve plates |
| 7 | 4x diaphragms | 17 | 6x valve plates |
| 8 | 1x connection cover | 18 | 6x O-rings (\varnothing 18.77 x 1.78) |
| 9 | 4x attachment screws
(connection cover) | 19 | 6x O-rings (\varnothing 10 x 2.5) |
| 10 | 2x attachment screws
(connection .50) | 20 | 2x head covers |

Removing the pump head

1. Undo the eight screws (Fig. 12/1) and remove the head covers (20).
2. Undo the connection cover's (8) attachment screws (Fig. 13/9) and remove the connection cover.
3. Remove the head connection's (11) screws (10) and remove the head connection.

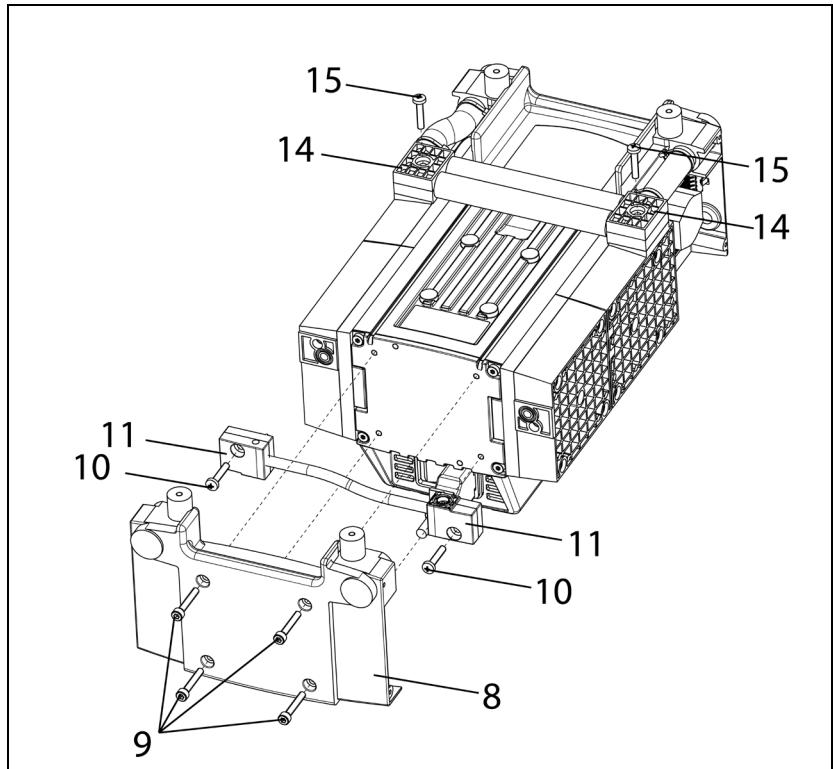


Fig. 13: Disassembling the head connections

4. Remove O-rings (Fig. 14/12).
5. Remove the head connection's (14) screws (15) and remove the head connection.
6. Remove flat seals (Fig. 14/13).

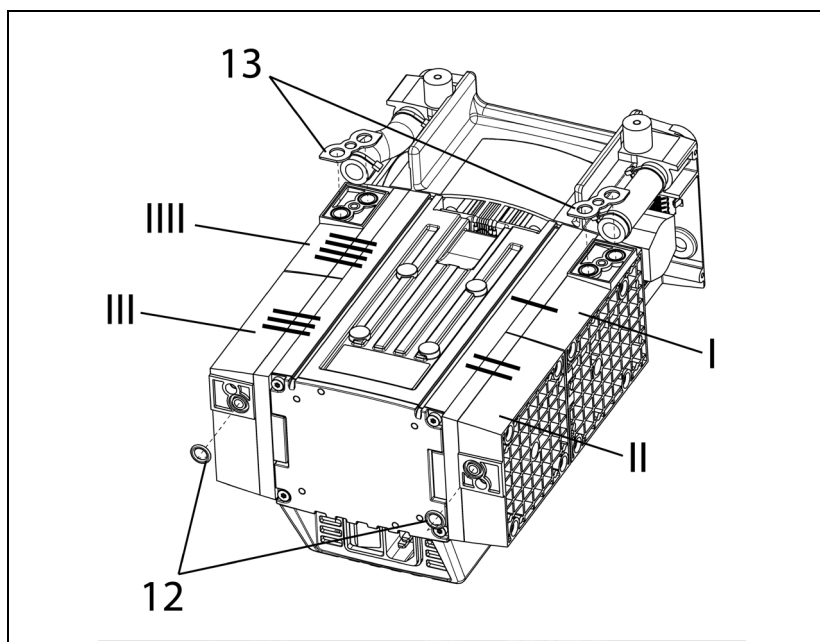


Fig. 14: Marking the pump

7. Head 1 (Fig. 14/I):

Use a felt-tip pen (**M**) to apply a single mark to the head plate, intermediate plate, and compressor housing.

8. Head 2 (Fig. 14/II):

Use a felt-tip pen (**M**) to apply two marks to the head plate, intermediate plate, and compressor housing.

9. Head 3 (Fig. 14/III):

Use a felt-tip pen (**M**) to apply three marks to the head plate, intermediate plate, and compressor housing.

10. Head 4 (Fig. 14/IV):

Use a felt-tip pen (**M**) to apply four marks to the head plate, intermediate plate, and compressor housing.

i During re-assembly, refer to the marks on the individual heads to ensure that the parts are properly re-assembled.

11. Undo the 8 attachments screws (Fig. 12/3) on the heads (**1** and **2**) and remove the heads (**1** and **2**).

12. Pull apart heads 1 (Fig. 15/I) and 2 (**II**) and remove O-rings (**19**).

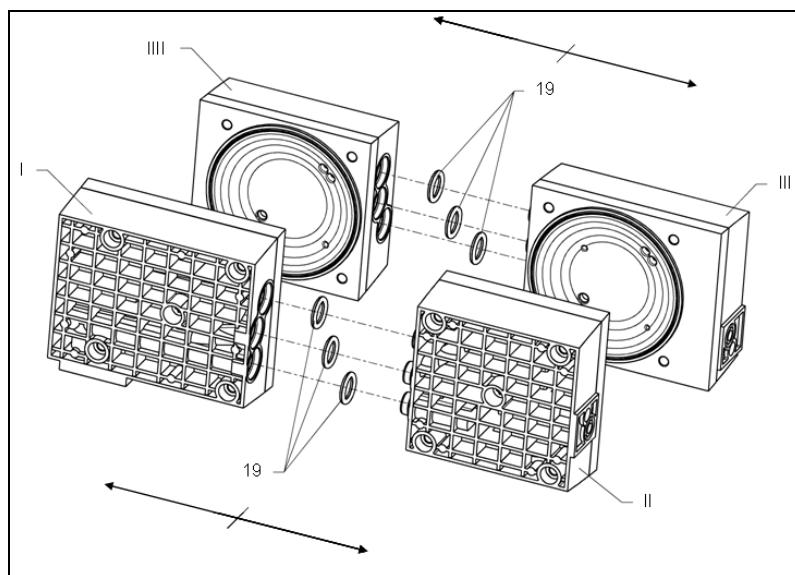


Fig. 15: Removing the O-rings

13. On both heads, undo the head screw (Fig. 12/2) in the head plate (4) and remove head plate from the intermediate plate (6).

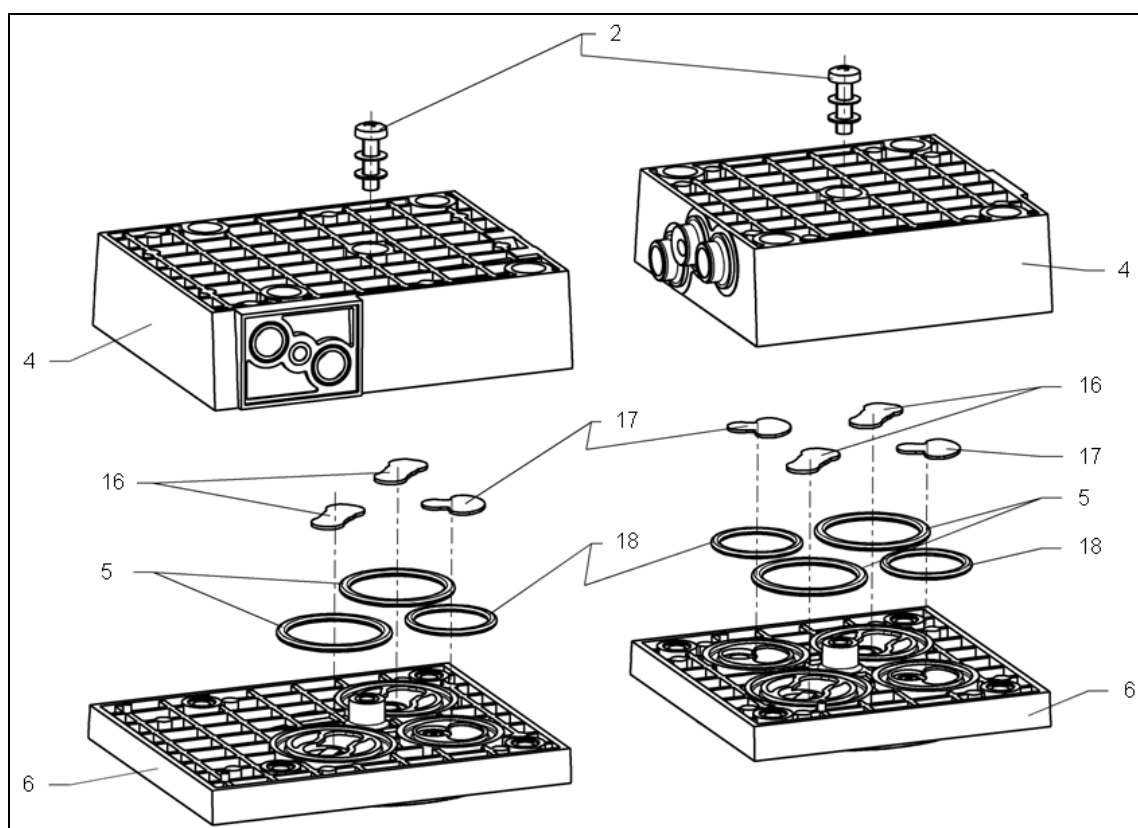


Fig. 16: Exploded drawing of pump heads 1 and 2

Replacing the valve plates and install intermediate plates

1. Remove from the intermediate plates (Fig. 12/6) the valve plates (16) and (17) and the O-rings (5) and (18).
2. Insert the new valve plates (Fig. 12/16) and (17) and the new O-rings (5) and (18) into the intermediate plates (6).

i The upper and lower sides of the valve plates are identical.

3. Place head plate (Fig. 12/4) onto the intermediate plates (6), observing the felt-tip pen marks (Fig. 14/M).
4. With your hands, carefully and lightly tighten the head plate's head screw (Fig. 12/2) on both heads (tightening torque: 60 Ncm).

i Refer to Fig. 18 for arrangement and alignment of disk springs and the screw's washer.

5. Place three O-rings (Fig. 15/19) on the head connection.
6. Press together heads 1 and 2 (Fig. 14/I and II).

Replacing the diaphragms and install pump head

1. Manually remove the both diaphragms (Fig. 17/7) by turning them in the counterclockwise direction.

i Use caution to prevent the diaphragm spacers (21) located between the diaphragm and the connecting rod from falling into the pump housing. The diaphragm spacers (21) must be installed in the same quantity as before in order to ensure the pump's pneumatic performance.

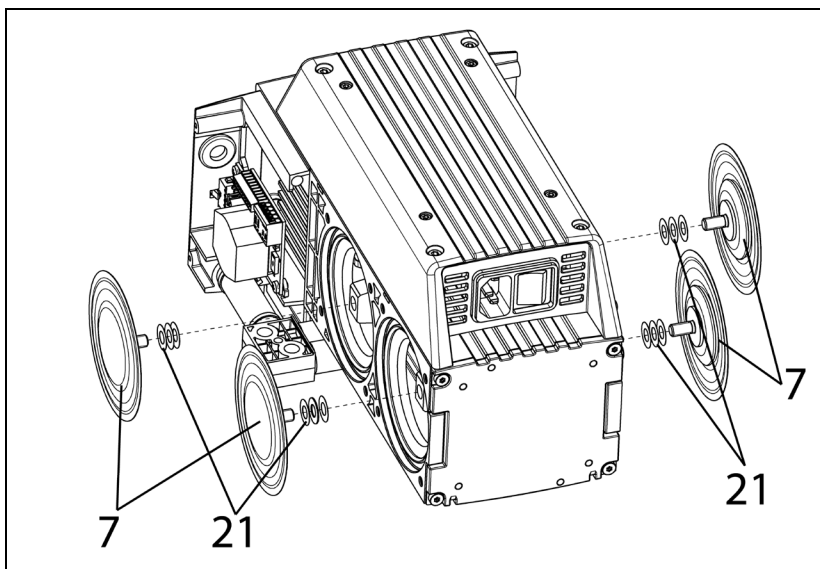


Fig. 17: Replacing the diaphragm

2. Manually screw the new diaphragms (Fig. 17/7) into the connecting rods' threads and tighten to hand tightness.

i Before you finally tighten the diaphragms, you are recommended to move the diaphragm to the upper dead center.

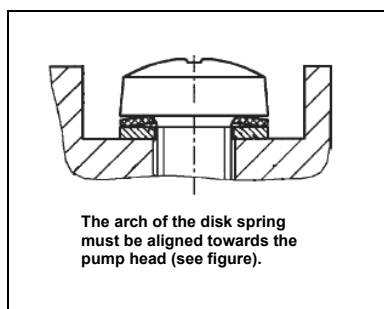


Fig. 18: Aligning the disk spring

3. Place heads 1 and 2 onto the compressor housing; alternately tighten attachment screws (Fig. 12/3) to hand-tightness (tightening torque: 3.5 Nm).
4. Repeat steps 11-13 (Removing pump head), steps 1-6 (Replacing the valve plates and install intermediate plates) and steps 1-3 (Replacing the diaphragms and install pump head) for heads 3 and 4 (Fig. 14/III and IIII).

Install head cover

1. Insert flat seals (Fig. 14/13) into the head connection receiver.
2. Mount the connection (14) on the connection hose and tighten the head connections' attachment screws (Fig. 13/15) hand-tight.
3. Insert O-rings (Fig. 14/12) into the head connection receiver.
4. Mount the connection (11) on the connection hose and tighten the head connections' attachment screws (Fig. 13/10) hand-tight.
5. Reinstall the head connection cover (8):
To do this, manually tighten the head connection cover's attachment screws (9).
6. Reinstall the head covers (Fig. 12/20):
To do this, manually tighten the eight attachment screws (1).
7. Properly dispose of the old diaphragms, valve plates, and O-rings.

Final steps

1. Reconnect suction and pressure line on the pump.
2. Reconnect the pump to the mains.

If you have any questions about servicing, call your KNF 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. 11 and 12).

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.
<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 N 950.50 KNDC-B: Wrong polarity of the connection wires	→ Separate pump from the mains. → Be aware of right polarity of the connection wires and connect pump.
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).
Diaphragm or valve plates are worn.	→ Replace diaphragm and valve plates (see Chapter 8.3).

Tab. 11

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.	→ Detach the condensate source from the pump. → Flush the pump (see Chapter 8.2.1).
Presence of positive pressure on the pressure side with simultaneous vacuum or positive pressure on the suction side.	→ Change the pressure conditions.

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
Cross-section of pneumatic hoses or connectors too narrow or restricted.	→ 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.	→ Make sure the hoses are properly seated on the hose connectors. → Replace leaking hoses. → Eliminate leaks.
Connections or hoses completely or partially clogged.	→ Check hoses and connections. → Remove any parts or particles causing blockages.
Pump head components are soiled.	→ Clean head components.
Diaphragm or valve plates are worn.	→ Replace diaphragm and valve plates (see Chapter 8.3).
Diaphragm and valve plates have been replaced.	→ Make sure that the shim rings have been replaced onto the diaphragm screw thread. → Check head connection and hose connections for leaks.

Tab. 12

Fault visualization on motor controller

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 the 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.

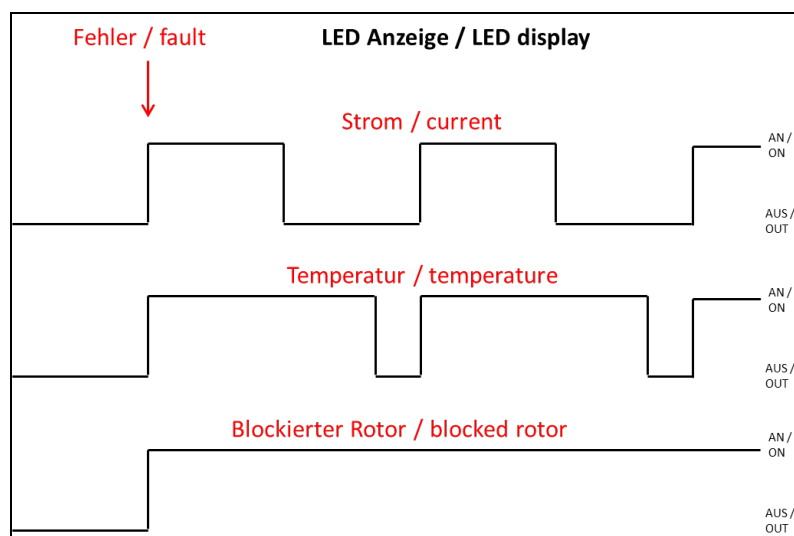


Fig. 19: LED blinking duration according to different faults

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 (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, 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:

- 4x diaphragms
- 8x valve plates
- 6x valve plates
- 2x flat seals
- 8x O-rings (ø 24 x 2)
- 6x O-rings (ø 18.77 x 1.78)
- 6x O-rings (ø 10 x 2.5)
- 2x O-rings (ø 7.65 x 1.78)

Spare parts kit for pump type	Order No.:
N 950.50 KNE-W / N 950.50 KNDC-B	125411

Tab. 13

10.2. Accessories

Description	Order No.:
Small flange connection for suction or pressure side, stainless steel, KF 16	048116
Hose connector (G 1/4, for hose ID 9)	004950
Seal for hose connector	029112
Control cable (all functions) 0.5 m length	125391
PWM analog voltage converter Function: Smoothing of the speed output signal into an analog voltage output and simultaneous transformation of 5V to ≤ 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. 14

11. Returns

Preparing for return

1. Flush the pump with air for a few minutes (if necessary for safety reasons: with inert gas) to free the pump head of dangerous or aggressive gases (see Chapter 8.2.1 Flushing the pump).
- i** Please contact your KNF sales partner if the pump cannot be flushed due to damages.
2. Remove the pump.
3. Clean the pump (see Chapter 8.2.2 Cleaning the pump).
4. Send the pump together with the completed Health and Safety Clearance and Decontamination Form to KNF, stating the nature of the transferred medium.
5. Pack the device securely to prevent further damages to the product. If necessary, request original packaging for a fee.

Returns

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

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

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KNF worldwide

Find your local KNF partner at: www.knf.com