

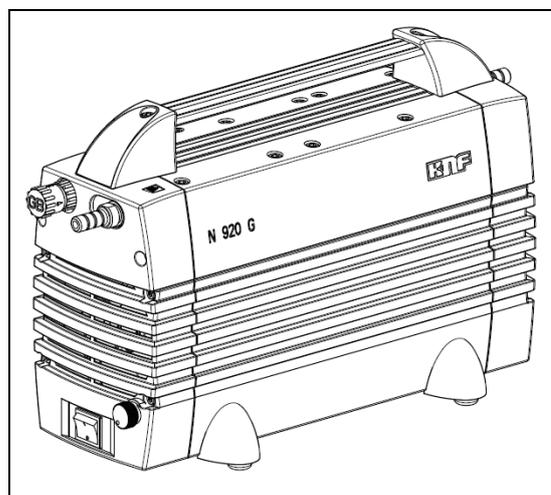
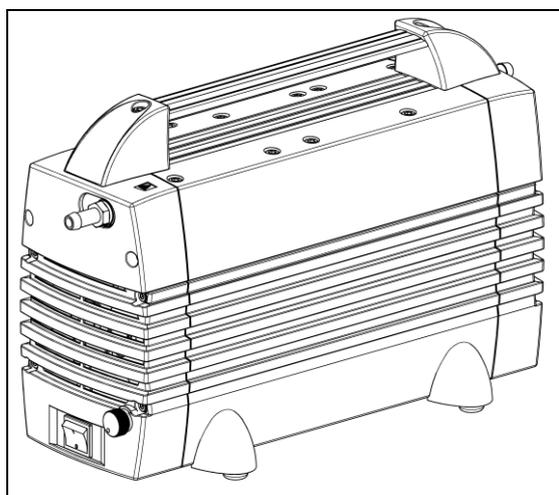
# Operating Instructions

Read and observe these Operating Instructions!

## Diaphragm Vacuum Pump

N920 AP.18  
N920 AP.29.18

N920 KT.29.18G



KNF Neuberger GmbH  
 Alter Weg 3  
 D-79112 Freiburg  
 Germany  
 Phone +49-(0)7664 / 5909-0  
 Fax +49-(0)7664 / 5909-99  
 E-Mail: [info@knf.de](mailto:info@knf.de)  
[www.knf.de](http://www.knf.de)

Contents	Page
1. About this document.....	3
2. Use .....	4
3. Safety .....	5
4. Technical Data .....	7
5. Design and Function .....	10
6. Installation and connection.....	12
7. Operation.....	13
8. Servicing.....	16
9. Troubleshooting.....	25
10. Spare parts and accessories.....	27
11. Returns .....	28
12. Health and safety clearance and decontamination form.....	29



## 1. About this document

### 1.1. Using the Operating Instructions

The Operating Instructions are part of the pump.

- Carefully study the Operating Instructions before using a pump.
- Always keep the Operating Instructions handy in the work area.
- Pass on the Operating Instructions to the next owner.

Project pumps

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

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

### 1.2. Symbols and Markings

#### Warning



**WARNING**

A danger warning is located here.

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

Warning, indicates the danger level.

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

#### Danger levels

Signal word	Meaning	Consequences if not observed
<b>DANGER</b>	warns of immediate danger	Death or serious injuries and/or serious damage are the consequence.
<b>WARNING</b>	warns of possible danger	Death or serious injuries and/or serious damage are possible.
<b>CAUTION</b>	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 parameters and conditions

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

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

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.

Accessories

Laboratory equipment or additional components connected to a pump have to be suitable for use with the pneumatic capabilities of the pump (see chapter 4).

### 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 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 chapters 6. *Installation and connection*, and 7. *Operation*.

The pumps are built according to the generally recognized rules of technology and in accordance with the occupational safety and accident prevention regulations. Nevertheless, dangers can result during their use which 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 instructions, at all times.

#### 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 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.

Do not expose any part of your body to the vacuum.

Open housing parts with notice sticker (see fig. 1) only after separating mains plug from power source.

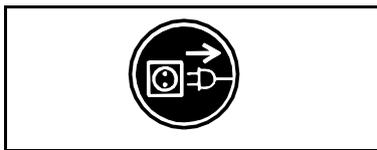


Fig. 1: Notice sticker

#### Handling dangerous media

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

#### Handling flammable media

Be aware that the pumps are not designed to be explosion-proof.

Make sure the temperature of the medium is always sufficiently below the ignition temperature of the medium, to avoid ignition or explosion. This also applies for unusual operational situations.

Note that the temperature of the medium increases when the pump compresses the medium.

Hence, make sure the temperature of the medium is sufficiently below the ignition temperature of the medium, even when it is compressed to the maximum permissible operating pressure of the pump. The maximum permissible operating pressure of the pump is stated in the technical specifications (see chapter 4).

If necessary, consider any external sources of energy, such as radiation, that may add heat to the medium.

In case of doubt, consult the KNF customer service.

#### Environmental protection

Store all replacement parts in a protected manner and dispose of them properly in accordance with the applicable environmental protection regulations. Observe the respective national and international regulations. This especially applies to parts contaminated with toxic substances.

Standards	<p>The pumps conform to the Directive 2011/65/EU (RoHS2).</p> <p>The pumps conform to the safety regulations of the EC Directive 2014/30/EU concerning Electromagnetic Compatibility and the EC Directive 2006/42/EC concerning Machinery.</p> <p>The following harmonized standards have been used:</p> <ul style="list-style-type: none"><li>▪ DIN EN 61010-1</li><li>▪ DIN EN 61326-1 class A</li><li>▪ DIN EN 50581</li></ul> <p>The pumps correspond to IEC 664:</p> <ul style="list-style-type: none"><li>▪ the overvoltage category II</li><li>▪ the pollution degree 2.</li></ul>
Customer service and repairs	<p>Only have repairs to the pump carried out by the KNF Customer Service responsible.</p> <p>Only authorized personnel should open those parts of the housing that contain live electrical parts.</p> <p>Use only genuine parts from KNF for servicing work.</p>

## 4. Technical Data

**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 electrical power supply.
- ➔ Remove the cause(s) of the fault before restarting.

### Pump materials

N 920 AP.18

N 920 AP.29.18

<i>Component</i>	<i>Pump material</i>
Pump head	Aluminum
Diaphragm	EPDM
Valve	EPDM

Tab. 2

N 920 KT.29.18G

<i>Component</i>	<i>Pump material</i>
Pump head	PPS
Diaphragm	PTFE-coated
Valve	EPDM
Gas ballast valve	PVDF

Tab. 3

**i** Refer to the type plate for the pump's electrical configuration.

**N 920 AP.18**  
**N 920 AP.29.18**

<i>Pneumatic performance</i>	
Max. permissible operating pressure [bar g]	0.5
Ultimate vacuum [mbar abs.]	1.5
Delivery rate at atm. pressure [l/min]*	max. 21
<i>Pneumatic connections</i>	
Hose connection [mm]	ID 9
<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]	10.5
Dimensions : L x H x W [mm]	324 x 226 x 158
Maximum permissible ambient relative humidity	80 % for temperatures up to 31 °C, decreasing linearly to 50 % at 40 °C
Max. altitude of site [m above sea level]	2000
<i>Electrical Data</i>	
Automatic mains power adjustment	100-240 V 50/60 Hz
Max. operating current [A]	1.3
Power consumption pump [W]	120
Maximum permitted mains voltage fluctuations	+/- 10 %
Protection class motor	IP20

Tab. 4

\* Liters in standard state (1,013 mbar)

**N 920 KT.29.18G**

<i>Pneumatic performance</i>	
Max. permissible operating pressure [bar g]	0.5
Ultimate vacuum [mbar abs.]	2.0 ≤ 5 with open gas ballast
Delivery rate at atm. pressure [l/min]*	max. 21
<i>Pneumatic connections</i>	
Hose connection [mm]	ID 10
<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]	8.5
Dimensions : L x H x W [mm]	324 x 226 x 158
Maximum permissible ambient relative humidity	80 % for temperatures up to 31 °C, decreasing linearly to 50 % at 40 °C
Max. altitude of site [m above sea level]	2000
<i>Electrical Data</i>	
Automatic mains power adjustment	100-240 V 50/60 Hz
Max. operating current [A]	1.4
Power consumption pump [W]	135
Maximum permitted mains voltage fluctuations	+/- 10 %
Protection class motor	IP20

Tab. 5

\* Liters in standard state (1,013 mbar)

## 5. Design and Function

### Design

- 1 Inlet (suction side)
- 2 Outlet (pressure side)
- 3 Potentiometer  
(only N 920 AP.29.18 and  
N 920 KT.29.18G)
- 4 Power switch
- 5 Gas ballast valve  
(only N 920 KT.29.18G)
- 6 Interface to vacuum con-  
troller VC 900

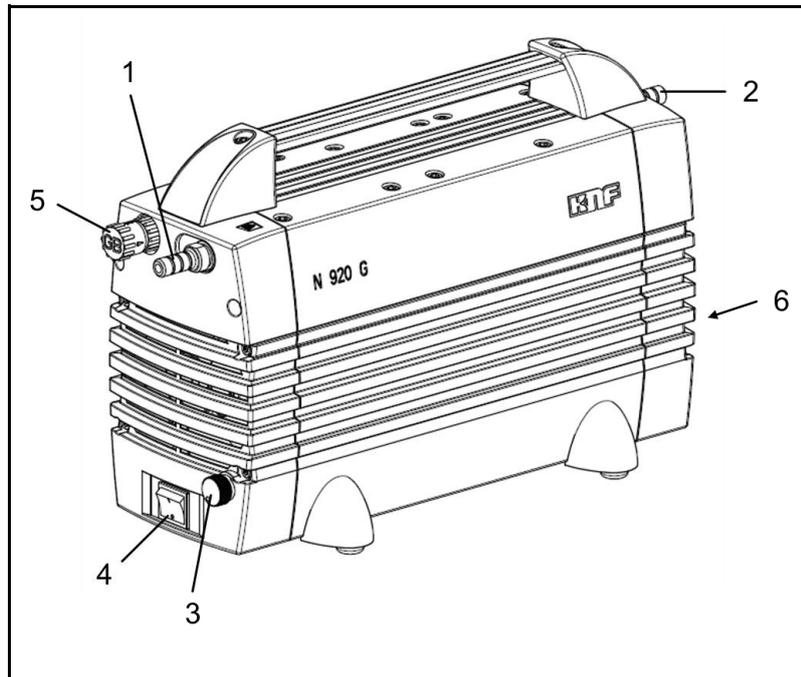


Fig. 2: Design N 920 KT.29.18G

### Function Diaphragm Pump

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

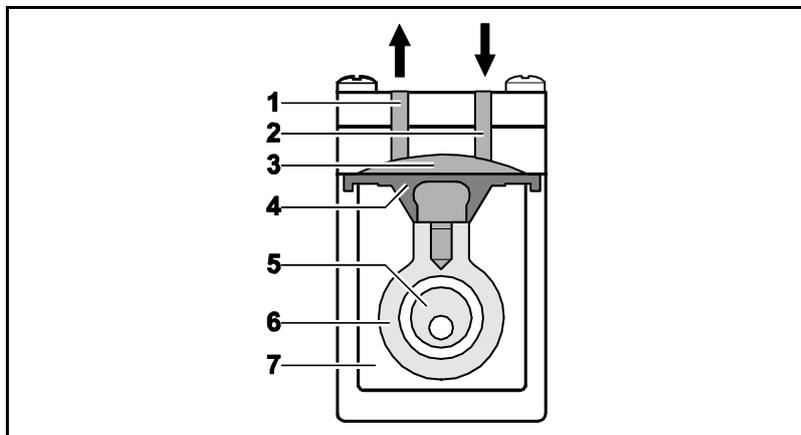


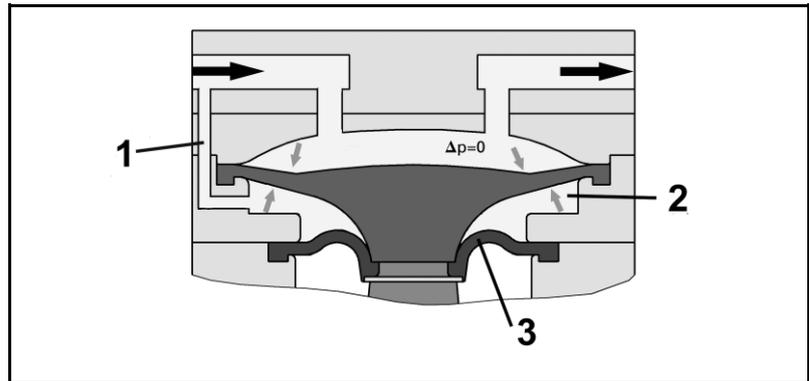
Fig. 3: Pump head

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 transfer chamber (3) is hermetically separated from the pump drive (7) by the diaphragm.

**Function diaphragm stabilization system  
(only N 920 AP.18 and N 920 AP.29.18)**

- 1 Balancing connection for vacuum chamber
- 2 Vacuum chamber
- 3 Stabilization diaphragm



*Fig. 4: Function diaphragm stabilization system*

An additional diaphragm, the so-called stabilization diaphragm (3), separates the underside of the working diaphragm from the “crank” space of the pump (see fig. 4). The space between the two diaphragms, called a vacuum chamber (2), is connected with the suction side of the pump via an balancing connection (1). This way, the vacuum chamber has approximately the same pressure as the working space of the diaphragm pump. The pressure difference between the upper and underside of the diaphragm approaches zero. The working diaphragm remains stable, independent of the inlet pressure of the pump. This improves the suction speed of the pump significantly, over its entire working range.

## 6. Installation and connection

Only install the pumps under the operating parameters and conditions described in chapter 4, Technical data.

Observe the safety precautions (see chapter 3).

### 6.1. Installation

- Before installation, store the pump at the installation location to bring it up to room temperature.
- Dimensions → See chapter 4, Technical data, for the dimensions of pump.
- Cooling air supply → Install the pump so that the motor fan can intake sufficient cooling air.
- Installation location → Make sure that the installation location is dry and the pump is protected against rain, splash, hose and drip water.
- Choose a safe location (flat surface) for the pump.
- Protect the pump from dust.
- Protect the pump from vibration and jolt.

### 6.2. Connection

- Connected components → Only connect components to the pump which are designed for the pneumatic data of the pump (see chapter 4).
- Pump exhaust → If the pump is used as a vacuum pump, safely discharge the pump exhaust at the pump's pneumatic outlet.
- Connection **i** A marking on the pump head shows the direction of flow.
  1. Remove the protective plugs from the pneumatic connectors of the pump.
  2. Connect the suction line and pressure line.
  3. Lay the suction and pressure line at a downward angle to prevent condensate from running into the pump.
  4. If necessary, use the interface cable to connect the pump with the vacuum controller VC 900 (Fig. 2/6, see Chapter 10.2 *Accessories* for interface cable). Further information on connecting see operating instructions VC 900.
  5. Insert the power cable's plug into a properly installed shockproof socket.

## 7. Operation

### 7.1. Preparing for Start-up

Before switching on the pump, observe the following points:

	Operational requirements
Pump	<ul style="list-style-type: none"> <li>▪ All hoses attached properly</li> <li>▪ Fan openings not blocked</li> <li>▪ Specifications of the power supply correspond with the data on the pump's type plate.</li> <li>▪ The pump outlet is not closed or constricted.</li> <li>▪ When the gas ballast valve is open, no reactive, explosive, or otherwise hazardous mixtures can form (otherwise, contact KNF Service).</li> </ul>

Tab. 6

### 7.2. Starting

- Only operate the pump under the operating parameters and conditions described in chapter 4, Technical data.
- Make sure the pump is used properly (see chapter 2.1).
- Make sure the pump is not used improperly (see chapter 2.2).
- Observe the safety precautions (see chapter 3).



#### WARNING

Hazard of the pump head bursting due to excessive pressure increase

- Do not exceed max. permissible operating pressure (see chapter 4).
- Monitor pressure during operation.
- If the pressure exceeds the maximum permissible operating pressure, immediately shut down 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 of the pump is not exceeded.

**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 side of the pump. For further information, contact your KNF technical adviser.

- Pump standstill → With the pump at a standstill, open pressure and suction lines to normal atmospheric pressure.

**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.

- After triggering of the thermal protection or in the event of power failure, remove the pump's mains plug from the socket so that the pump cannot start uncontrollably.
  - Attempt work on the pump only if the pump is separated from mains power.
- 

### 7.3. Switching pump on and off

#### Switching pump on

**i** The pump may not start up against pressure during switch-on. This also applies in operation following a brief power failure. If a pump starts against pressure, it may block. This activates the thermal switch, and the pump switches off.

- Make sure that no pressure is present in the lines during switch-on.
- Switch on pump with mains switch (see fig. 2).

**i** Depending on the level of the applied electrical voltage, initialization of the electronics can take up to one second, before the pump starts.

#### Switching off the pump/removing from operation

- When transferring aggressive media, flush the pump prior to switch-off to increase the service life of the diaphragm (see chapter 8.2.1).
- Switch off pump with mains switch (see fig. 2).
- Open pressure and suction lines to normal atmospheric pressure.
- Disconnect the power source.

### 7.4. Adjusting the flow rate

#### N 920 AP.18

The flow rate cannot be varied.

#### N 920 AP.29.18 und N 920 KT.29.18G

The pump's speed can be varied via the potentiometer (fig. 2/3). The flow rate can be adjusted this way.

### 7.5. Operating the pump via VC 900 (only N 920 KT.29.18G)

If the interface cable (accessories) is connected, the pump can be operated via the vacuum controller VC 900. For further information on operating see operating instructions VC 900.

### 7.6. Gas ballast

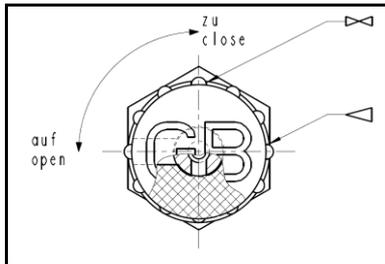


Fig. 5: Gas ballast switch



Personal injury caused by poisoning or explosion and damage to the pump

#### WARNING

→ Make sure that no reactive or explosive mixtures will be produced when the gas ballast valve is open.

- i** When transferring vaporous media, opening the gas ballast valve can minimize the formation of condensation in the pump heads.
- i** Opening the gas ballast valve deteriorates ultimate vacuum performance.

The gas ballast valve is opened and closed via the gas ballast switch (see Fig. 5).

Please contact KNF Service if you require an inert connection for the gas ballast.

## 8. Servicing

### 8.1. Servicing Schedule

Component	Servicing interval
Pump	Regular inspection for external damage or leaks
Diaphragm and valve plates	Replace at the latest, when pump output decreases

Tab. 7

### 8.2. Cleaning

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

#### 8.2.1. Flushing Pump



**WARNING**

Personal injury caused by poisoning or explosion and damage to the pump

→ When flushing the pump with inert gas, make sure that the gas ballast valve is closed so no reactive or explosive mixtures can form.

→ Before switching off the pump, flush it with air (if necessary for safety reasons: with an inert gas) for about five minutes under atmospheric conditions (ambient pressure).

If inert gas is used:

Connect the inert gas feed to the gas inlet of the pump and close the gas ballast valve. The safety precautions in Chapter 3 must be observed at all times.

#### 8.2.2. Cleaning Pump

→ Only use solvents for cleaning if the head materials cannot be attacked (check the resistance of the material!).

→ If compressed air is available, blow out the components.

### 8.3. Changing Diaphragm and Valve Plates

#### 8.3.1. N 920 AP.18 and N 920 AP.29.18

- Conditions
- Pump is switched off and mains plug is removed from the socket
  - Pump is clean and free of hazardous materials
  - Tubes removed from pump's pneumatic inlet and outlet

Spare parts/tools

Spare part/tool
Service Set (according to chapter 10)
Allen key 4 mm
Felt-tip pen
Stabilization diaphragm (if required)

Tab. 8

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



**WARNING**

Health hazard due to dangerous substances in the pump!

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

- ➔ Wear protective clothing if necessary, e.g. protective gloves.
- ➔ Flush pump before replacing the diaphragm and valve plates (see chapter 8.2.1).

- 1 Head cover
- 2 Screw
- 3 Intermediate plate, head 1
- 4 Valve plate
- 5 O-ring ( $\varnothing$  24 x 2)
- 6 O-ring ( $\varnothing$  5.5 x 2)
- 7 Intermediate plate, head 2
- 8 Intermediate plate, head 3
- 9 Diaphragm, head 1
- 10 Diaphragm, head 2
- 11 Diaphragm, head 3
- 12 Connecting rod, head 2
- 13 Connecting rod, head 3
- 14 Adapter
- 15 Pump housing
- 16 Fan
- 17 Stabilization diaphragm
- 18 O-ring ( $\varnothing$  5.5 x 2)
- 19 Screw

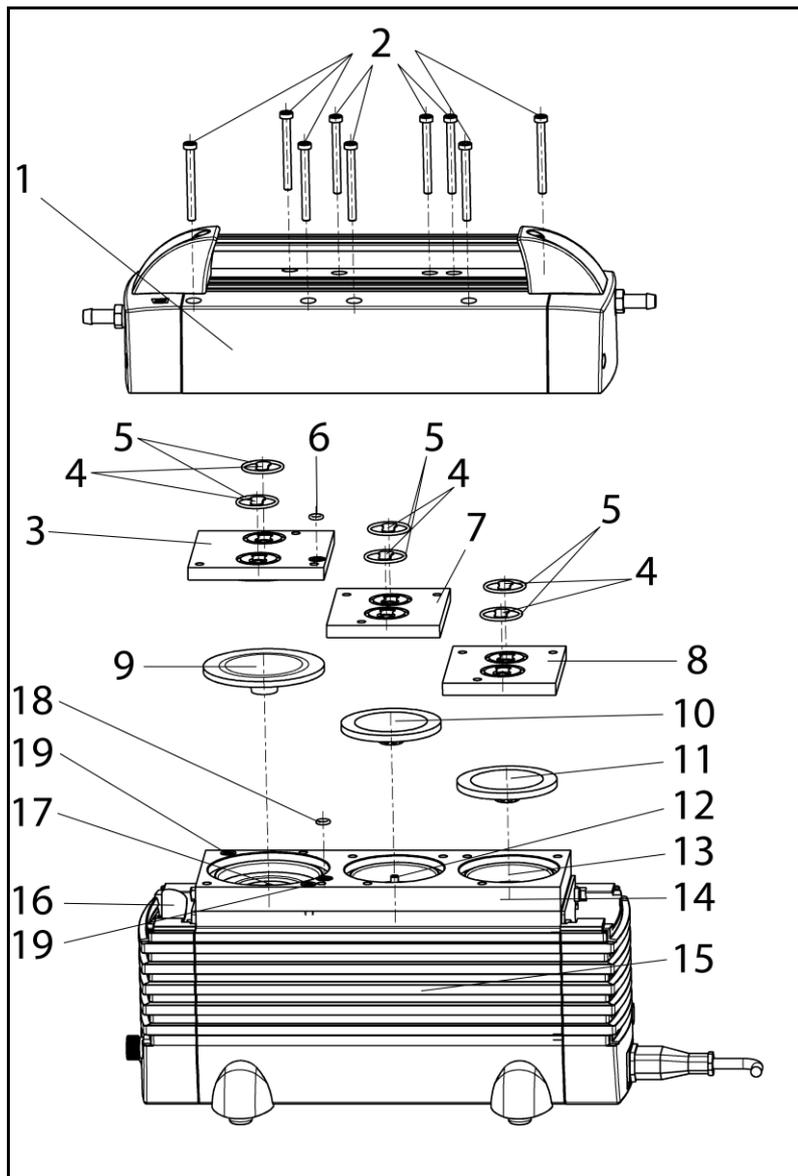


Fig. 6: Exploded drawing N 920 AP.18 / N 920 AP.29.18

### Remove pump head

1. Undo the nine screws (2) in the head cover (1) and lift the head cover off the pump housing (15) (see fig. 6).
2. Mark the position of intermediate plate (3) and adapter (14) relative to each other by a drawing line with a felt-tip pen. This helps avoid incorrect assembly later.
3. Mark the position of intermediate plate (7) and adapter (14) relative to each other by two drawing lines with a pencil.
4. Mark the position of intermediate plate (8) and adapter (14) relative to each other by three drawing lines with a pencil.
5. Lift the intermediate plates (3), (7) and (8) off the adapter.

### Change diaphragms

1. Turn the three diaphragms (9), (10) and (11) outwards with your hands, counter-clockwise. For this, turn the fan (16) such that you can easily grip each diaphragm with your hands.



For diaphragms (10) and (11):

Make sure the diaphragm spacers being between diaphragm and connecting rod do not fall into the pump housing.

If diaphragm spacers should adhere to the diaphragms, take them off and put them on the thread of the corresponding connecting rod.

The same number of diaphragm spacers must be mounted as were used for the previous assembly. This is necessary, in order to ensure the pump's pneumatic performance.

2. Remove the valve plates (4) and O-rings (5) from the intermediate plates (3), (7) and (8).
3. Remove O-ring (6) from the intermediate plate (3).
4. Remove O-ring (18) from adapter (14).



Carry out steps 5 to 11 only if the stabilization diaphragm also shall be changed.

5. Loosen the two screws (19) and remove the adapter (14) from the pump housing (15).  
The stabilization diaphragm (17) is now visible.
6. Remove the existing diaphragm spacers from the stabilization diaphragm (17).



It is important to later re-install the same quantity of diaphragm spacers in order to ensure the pump's pneumatic performance.

7. Use the assembly key to loosen the stabilization diaphragm (17) and then manually screw it out (in the counterclockwise direction).
8. Screw in the new stabilization diaphragm (17) and tighten it hand-tight with the assembly key.
9. Put spacer(s) onto the thread of the new stabilization diaphragm (17) (same number).

10. Place the adapter (14) onto the pump housing (15).
  - i** The adapter must be aligned flush with the pump housing (15). This is important for later installation of the diaphragm (9).
11. Tighten the two screws (19) to hand-tightness.
  - i** Begin with the outermost screw and make sure that the adapter (14) does not move while you are tightening the screws.
12. Screw the new diaphragm (9) into the thread of the stabilization diaphragm (17) and tighten it by hand.
  - i** To ensure proper pump performance, it is important to maintain a uniform distance everywhere between the outer edge of the diaphragm (9) and the adapter (14). If the distance is not uniform, you must re-loosen the screws (19) and re-align the adapter so the distance is the same everywhere.
  - i** Before you finally tighten the diaphragms, you are recommended to move the diaphragm to the upper dead center by rotating the fan (16).
13. Screw the new diaphragm (10) and (11) onto the connecting rods (12) and (13) and tighten it by hand.

#### Mount valve plates, intermediate plates and head cover

1. Lay the new O-ring (18) on the adapter (14).
2. Lay the new valve plates (fig. 7/4) and the new O-rings (5) on the intermediate plates (3), (7) and (8).
- i** Upper and lower sides of the valve plates are identical. For correct position see fig. 6.
3. Lay the new O-ring (6) on the intermediate plate (3).
4. Place the intermediate plates (3), (7) and (8) on the adapter (14) in the position indicated by the drawing lines.
5. Place the head cover (1) on the pump housing (15); tighten the screws (2) hand tight, evenly and diagonally.
6. Dispose of the old diaphragms, valve plates and O-rings properly.

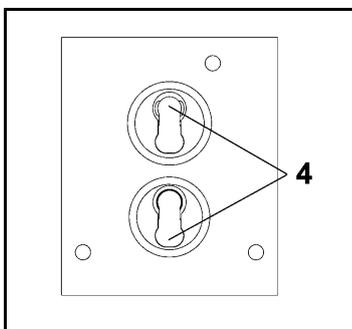


Fig. 7: Position of valve plates

#### Final steps

1. Reconnect suction and pressure line to the pump.
2. Reconnect the pump to the electricity supply.

If you have any questions about servicing, call your KNF technical adviser (see last page for contact telephone number).

**8.3.2. N 920 KT.29.18G**

- Conditions
- Pump is switched off and mains plug is removed from the socket
  - Pump is clean and free of hazardous materials
  - Tubes removed from pump's pneumatic inlet and outlet

Spare parts/tools

Spare part/tool
Service Set (according to chapter 10)
Allen key 4 mm
Phillips-head screwdriver No. 2
Felt-tip pen

Tab. 9

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

**WARNING**

Health hazard due to dangerous substances in the pump!

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

- ➔ Wear protective clothing if necessary, e.g. protective gloves.
- ➔ Flush pump before replacing the diaphragm and valve plates (see chapter 8.2.1).

- 1 Screws of pump handhold
- 2 Pump handhold
- 3 Screws of head cover
- 4 Head cover
- 5 Cover
- 6 Screws of cover
- 7 Screws of head plate
- 8 Disk spring at screw (7)\*
- 9 Washer at screw (7)\*
- 10 Head plate
- 11 Intermediate plate
- 12 O-ring (ø 24 x 2)
- 13 Valve plate
- 14 Intermediate plate
- 15 Intermediate plate
- 16 Diaphragm
- 17 Adapter
- 18 Housing
- 19 Screws
- 20 Fan
- 21 Connecting rod
- 22 Diaphragm
- 23 Gas ballast valve

\* see fig. 10

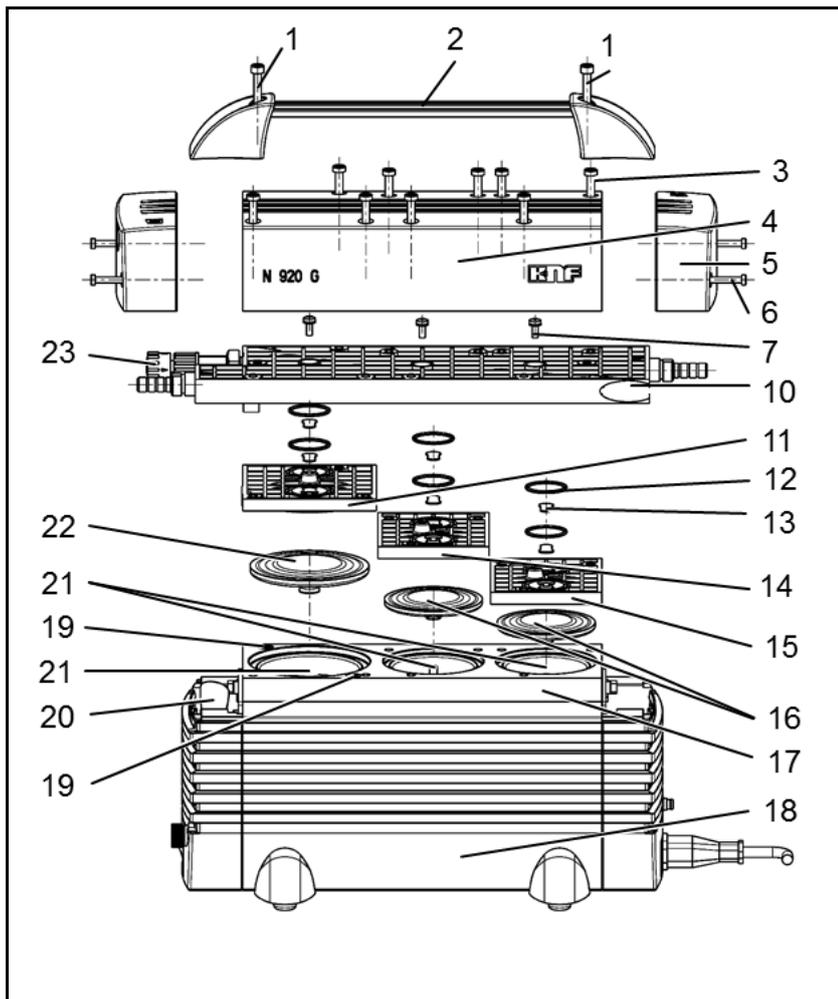


Fig. 8: Exploded drawing N 920 KT.29.18G

**Remove pump head**

1. Undo both screws (1) of pump handhold (2); remove pump handhold (see fig. 8).
2. Undo the nine screws (3) of the head cover (4).
3. Undo two screws (6) each, and remove both covers (5) at head cover (4).
4. Lift the head cover (4) off the pump housing (18).
5. Lift off head plate (10) with intermediate plates (11), (14) and (15).

### Change diaphragms

1. Turn the diaphragms (**16**) (2 pieces) and (**22**) (1 piece) outwards with your hands, counterclockwise. For this, turn the fan (**20**) such that you can easily grip each diaphragm with your hands.

**i** Make sure the diaphragm spacers being between diaphragm and connecting rod (**21**) do not fall into the pump housing. If diaphragm spacers should adhere to the diaphragms, take them off and put them on the thread of the corresponding connecting rod.

The same number of diaphragm spacers must be mounted as were used for the previous assembly. This is necessary, in order to ensure the pump's pneumatic performance.

2. Screw the new diaphragms (**16**) (2 pieces) and (**22**) (1 piece) onto the connecting rods (**21**) and tighten it by hand.

**i** Before you finally tighten the diaphragm, you are recommended to move the diaphragm to the upper dead center by rotating the fan (**20**).

3. Put head plate (**10**) with intermediate plates (**11**), (**14**) and (**15**) on adapter (**17**).

### Change valve plates

1. Mark the position of head plate (**10**) and intermediate plate (**11**) relative to each other by a drawing line with a felt-tip pen. This helps avoid incorrect assembly later.
2. Mark the position of head plate (**10**) and intermediate plate (**14**) relative to each other by two drawing lines with a pencil.
3. Mark the position of head plate (**10**) and intermediate plate (**15**) relative to each other by three drawing lines with a pencil.
4. Undo the three screws (**7**) in head plate (**10**) and remove head plate from intermediate plates (**11**), (**14**) and (**15**).

5. Remove valve plates (**13**) and O-rings (**12**) from intermediate plates (**11**), (**14**) and (**15**).

**i** Instead of lying on intermediate plate, O-rings could stick to head plate (**10**).

6. Lay the new valve plates (**13**) and the new O-rings (**12**) on the intermediate plates (**11**), (**14**) and (**15**).

**i** Upper and lower sides of the valve plates are identical. For correct position see fig. 9.

7. Dispose of the old diaphragms, valve plates and O-rings properly.

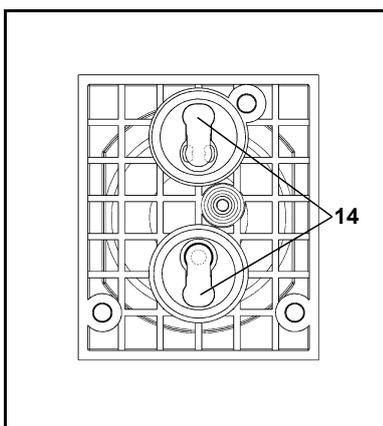


Fig. 9: Position of valve plates

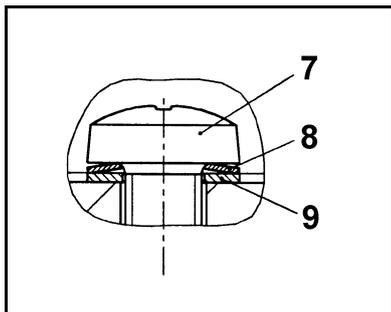


Fig. 10: Position and orientation of disk (8) and washer (9) at screw (7)

### Mount pump head

1. Place head plate (10) on intermediate plates (11), (14) and (15) in the position indicated by the drawing lines.
- i** At the front edge the three intermediate plates must lie in a line on which head plate is placed flushly.
2. Tighten the three screws (7) of head plate (10) carefully slightly hand-tight.
- i** For position and orientation of disk spring (8) and washer (9) of screw (7) see fig. 10.
3. Place head cover (4) on pump housing (18).
4. Tighten the nine screws (3) of head cover (4) slightly in the first instance. Start with the screws of medium pump stage, then tighten the screws on the right, at least these on the left.
5. Now, tighten the screws (3) firmly; tighten the center screws first, then continue outward.
- i** If the screws are stiff to turn, the intermediate plates do not lie in a line at front edge, or intermediate plates and head plate are not placed flushly (see step 1).
6. Remount the covers (5).
7. Remount pump handhold (2).

### Final steps

1. Reconnect suction and pressure line to the pump.
2. Reconnect the pump to the electricity supply.

If you have any questions about servicing, call your KNF technical adviser (see last page for contact telephone number).

## 9. Troubleshooting



Extreme danger from electrical shock!

→ 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. 10 to 13).

Pump does not transfer	
Cause	Fault remedy
No voltage in the power source	→ Check room fuse and switch on if necessary.
Thermal switch has operated following to over-heating.	→ Disconnect pump from mains. → Allow pump to cool. → Trace cause of over-heating and eliminate it.
Connections or lines blocked.	→ Check connections and lines. → Remove blockage.
External valve is closed or filter is clogged.	→ Check external valves and filters.
Condensate has collected in pump head.	→ Detach the condensate source from the pump. → Flush pump (see chapter 8.2.1).
Diaphragm or valve plates are worn.	→ Replace diaphragm and valve plates (see chapter 8.3).

Tab. 10

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 pump head.	→ Detach the condensate source from the pump. → Flush pump (see chapter 8.2.1).
There is gauge pressure on pressure side and at the same time vacuum or a pressure above atmospheric pressure on suction side.	→ Change the pressure conditions.
Pneumatic lines or connection parts have an insufficient cross section.	→ Disconnect pump from system to determine output values. → Eliminate throttling (e.g. valve) if necessary. → Use lines or connection parts with larger cross section if necessary.
Leaks occur on connections, lines or pump head.	→ Check that tubes sit correctly on hose nozzles. → Replace leaky tubes. → Eliminate leaks.
Connections or lines completely or partially clogged.	→ Check connections and lines. → Remove the clogging parts and particles.
Head parts are soiled.	→ Clean head components.
Diaphragm or valve plates are worn.	→ Replace diaphragm and valve plates (see chapter 8.3).

<b>Flow rate, pressure or vacuum too low</b>	
The pump does not achieve the output specified in the Technical data or the data sheet.	
Cause	Fault remedy
Replaced diaphragms and valve plates	<ul style="list-style-type: none"> <li>➔ Check that the spacers have been replaced onto the diaphragm screw thread.</li> <li>➔ Check head connection and hose connections for leaks.</li> <li>➔ Possibly carefully tighten the screws of the head cover crosswise.</li> </ul>
Gas ballast still open.	➔ Close gas ballast.

Tab. 11

<b>Pump is switched on, but does not run, the on/off-switch on the pump is not lit</b>	
Cause	Fault remedy
Pump is not connected with the power source.	➔ Connect pump to mains power.
No voltage in the power source	➔ Check room fuse and switch on if necessary.
The pump's overcurrent protection circuit has responded.	<ul style="list-style-type: none"> <li>➔ Remove the pump from the source of electrical power.</li> <li>➔ Determine and eliminate the cause of the overcurrent (e.g. improper pressure, liquid in the pump heads).</li> </ul> <p><b>i</b> The pump must be unplugged for some seconds before the electronics will allow to restart.</p>

Tab. 12

<b>Pump is switched on, but does not run, the on/off-switch on the pump is lit</b>	
Cause	Cause
The thermal switch has opened due to overheating	<ul style="list-style-type: none"> <li>➔ Remove pump's mains plug from the socket.</li> <li>➔ Allow pump to cool.</li> <li>➔ Trace cause of over-heating and eliminate it.</li> </ul>

Tab. 13

**Fault cannot be rectified**

If you are unable to determine any of the specified causes, send the pump to KNF Customer Service (see last page for the address).

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

## 10. Spare parts and accessories

### 10.1. Spare parts

Service Set contains all replacement parts needed for one complete service:

- 3 diaphragms
- 6 O-rings ( $\varnothing$  24 x 2)
- 6 valve plates
- Only for N 920 AP.18 and N 920 AP.29.18:  
2 O- rings ( $\varnothing$  5.5 x 2)

Spare parts	Order No.
Service set for N 920 AP.18	057456
Service set for N 920 AP.29.18	057456
Service set for N 920 KT.29.18G	305355
Service set for N 920 KT.29.18	111905
Stabilization diaphragm (only for N 920 AP.18 and N 920 AP.29.18)	056523
Gas ballast valve	136104

Tab. 14

### 10.2. Accessories

Accessories	Order No.
Silencer/ Filter G 1/8	007006
Sealing for hose connector	026906
Adjustable delivery through analog signal input; for external control	on request
Assembly key for stabilization diaphragm (only for N 920 AP.18 and N 920 AP.29.18)	116885
Interface cable Vacuum controller – KNF pump (2m)	307757
Interface cable Vacuum controller – KNF pump (5m)	307758

Tab. 15

## 11. Returns

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

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

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

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

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

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

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

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







**KNF worldwide**

Please find our local KNF partners at: [www.knf.com](http://www.knf.com)