Note!
Before operating the pump and the accessories, please read the operating and installation instructions and pay attention to the safety precautions!
1 About this document

1.1 Using the operating and installation instructions

The operating and installation instructions are part of the pump.

➔ Give the operating and installation instructions to the next owner.
➔ Keep the operating and installation instructions within reach at all times.

Project pumps
For customer-specific project pumps (pump models that begin with "PJ" or "PM"), there may be deviations from the operating and installation instructions.

➔ For project pumps, also observe the agreed specifications.

1.2 Symbols and markings

Warning notice

A notice that warns you of danger is located here. Possible consequences of a failure to observe the warning notice are specified here. The signal word, e.g., warning, indicates the danger level.

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

<table>
<thead>
<tr>
<th>Signal word</th>
<th>Meaning</th>
<th>Consequences if not observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>DANGER</td>
<td>warns of immediate danger</td>
<td>Death or serious injury or serious damage will result.</td>
</tr>
<tr>
<td>WARNING</td>
<td>warns of possible danger</td>
<td>Death or serious injury or serious damage are possible.</td>
</tr>
<tr>
<td>CAUTION</td>
<td>warns of a possibly dangerous situation</td>
<td>Minor injuries or damage are possible.</td>
</tr>
</tbody>
</table>

Tab. 1

Other notices and symbols
➔ An activity to be carried out is specified here (a step).

1. The first step of an activity to be carried out is specified here.

ℹ️ This symbol indicates important information.
2 Use

2.1 Proper use
The pumps are intended exclusively for transferring gases and vapors.

Responsibility of the owner
Only install and operate the pumps in accordance with the operating parameters and conditions described in Chapter 4 Technical data.
Protect compressors with a pressure relief device between the pressure side of the compressor and the first shut-off valve.
Only fully assembled pumps may be operated.
Make sure that the installation location is dry and that the pump is protected against rain, splash, gushing and drip water as well as from other contaminants.
The tightness of the connections between the pipes of the application and the pump (or the connection of the pump) is to be checked at regular intervals. Leaky connections carry the risk of releasing dangerous gases and vapors from the pump system.

Requirements for the transferred medium
Before transferring a medium, check whether the medium can be transferred danger-free in the specific application.
Before using a medium, check the compatibility of the media-contacting components (see 4 Technical data) with the medium.
Risk of dangerous gas mixtures during pump operation if the sealing lip breaks: Depending on the medium being transferred, breakage of the sealing lip can result in a dangerous mixture if the medium mixes with the air in the compressor housing.
Only transfer gases that remain stable under the pressures and temperatures that arise in the pump.

2.2 Improper use
The pumps may not be operated in explosive atmospheres.
The pumps are not suitable for transferring:
- Dusts
- Liquids
- Aerosols
- Biological and microbiological substances
- Fuel
- Explosives and flammable material
- Fibers
- Oxidants
- Food
Pumps that can produce both vacuum as well as overpressure may not be used to simultaneously produce vacuum and operating pressure.
No operating pressure may be applied to the suction side of the pump.
3 Safety

Observe the safety notices in chapters 7 Installation and connection and 8.1 Operation.

The pumps are built in accordance with the generally recognized rules of technology and the occupational safety and accident prevention regulations. Nevertheless, dangers can arise during their use that lead to injuries to the user or third parties or to damage to the pump or other property.

Only use the pumps in perfect technical condition, for their intended use, safely and aware of the dangers and in observation of the operating and installation instructions.

The components that are to be connected to the pumps must be designed according to the pneumatic data of the pumps.

When connecting the pumps to the electrical mains, observe the corresponding safety rules.

Personnel
Make sure that only trained and instructed personnel or specially trained personnel work on the pumps. This applies, in particular, to assembly, connection and servicing work.

Make sure that the personnel have read and understood the operating and installation instructions, particularly the chapter on safety.

Working in a safety conscious manner
Observe the regulations on accident prevention and safety during all work on the pumps and during operation.

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

Make certain that the pump is disconnected from mains and without power.

Make sure that no dangers arise from flow when gas connections are open, from noises or from hot, corrosive, dangerous and environmentally hazardous gases.

Make sure that an EMC-compliant installation of the pump is ensured at all times and that no dangerous situation can thereby arise.

Working with hazardous media
When transferring hazardous media, observe the safety regulations for the handling of these media.

Working with combustible media
Note that the pumps are not designed to be explosion-proof.

Make sure that the temperature of the medium is always sufficiently below the ignition temperature of the medium so as to prevent ignition or explosion. This also applies for abnormal operating situations.

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

Therefore, make sure that the temperature of the medium also remains 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 (4 Technical data).

If applicable, also take into consideration external energy sources (e.g., radiation sources) that could add heat to the medium.

In case of doubt, contact KNF Customer Service.

Environmental protection
Store and dispose of all replacement parts in accordance with environmental regulations. Observe the respective national and international regulations. This applies in particular to parts that are contaminated with toxic substances.

EU/EC directives/standards
With respect to the Machinery Directive 2006/42/EC, the pumps are partly completed machinery and are, therefore, to be regarded as not ready for use. Partly completed machinery may not be commissioned until it has
been determined that the machine into which the partly completed machinery is to be installed complies with the provisions of the Machinery Directive 2006/42/EC. The following fundamental 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. / 1.5.8. / 1.5.9. / 1.7.4. / 1.7.4.1. / 1.7.4.3.

As these partly completed machines are built-in devices, the mains connections and equipment for disconnecting and switching off the partly completed machinery as well as overcurrent and overload protection gear must be considered when mounting.

Furthermore, protection against contact with moving and hot parts, if present, must be provided during installation.

The pumps comply with Directive 2011/65/EC (RoHS2).

The following harmonized standards are satisfied:

- DIN EN 50581
- DIN EN 61000-6-2/3

Customer service and repairs

The pumps are maintenance-free. KNF does, however, recommend periodically inspecting the pumps for noticeable changes to noises and vibrations.

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

Housings with live components may only be opened by specialist personnel.
4 Technical data

Technical data

Pump materials

<table>
<thead>
<tr>
<th>Assembly</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ribbed plate, cylinder</td>
<td>PPS</td>
</tr>
<tr>
<td>Sealing lip</td>
<td>PTFE compound</td>
</tr>
<tr>
<td>Valve plate</td>
<td>FPM</td>
</tr>
<tr>
<td>Retainer plate</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Screw</td>
<td>Galvanized steel</td>
</tr>
</tbody>
</table>

*Tab. 2*

Pneumatic values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value NPK012PR</th>
<th>Value NPK012VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. permissible operating pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[bar rel*]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Continuous operation</td>
<td>2.5</td>
<td>1.0</td>
</tr>
<tr>
<td>-Interm. operation</td>
<td>5.0</td>
<td>-</td>
</tr>
<tr>
<td>Ultimate vacuum [mbar abs.]</td>
<td>220</td>
<td>140</td>
</tr>
<tr>
<td>Flow rate at atm. pressure [l/min]**</td>
<td>12.0 ± 10%</td>
<td>13.5 ± 10%</td>
</tr>
</tbody>
</table>

*Tab. 3* *Bar rel related to 1013 hPa*  
**Liters in standard state (1013 hPa, 20°C)*

Pneumatic connections

<table>
<thead>
<tr>
<th>Pump type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPK012</td>
<td>Hose connection ID 6</td>
</tr>
</tbody>
</table>

*Tab. 4*
**Technical data**

**Swing Piston vacuum pump NPK012**

**Electrical data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage [V]</td>
<td>24</td>
</tr>
<tr>
<td>Frequency [Hz]</td>
<td>-</td>
</tr>
<tr>
<td>Power $P$, [W]</td>
<td>43</td>
</tr>
<tr>
<td>Max. current consumption [A]</td>
<td>1.8</td>
</tr>
<tr>
<td>Motor protection class</td>
<td>IP 20</td>
</tr>
<tr>
<td>Max. permissible mains voltage fluctuations</td>
<td>See operating instructions for motor fluctuations</td>
</tr>
</tbody>
</table>

*Tab. 5*

The pump is equipped with an overcurrent protection. If this safety function is actuated, the pump is switched off and must be manually reset:

- Disconnect pump from mains.
- Before switching back on, eliminate the cause of the error(s).

**Weight**

<table>
<thead>
<tr>
<th>Pump type</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPK012</td>
<td>approx. 0.6</td>
</tr>
</tbody>
</table>

*Tab. 6*

**Other parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value NPK012PR</th>
<th>Value NPK012VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permissible ambient temperature [°C]</td>
<td>+ 5 to + 40</td>
<td></td>
</tr>
<tr>
<td>Permissible media temperature [°C]</td>
<td>+ 5 to + 40</td>
<td></td>
</tr>
<tr>
<td>Max. surface temperature* [°C]</td>
<td>+ 150</td>
<td>+ 120</td>
</tr>
<tr>
<td>Dimensions</td>
<td>See Chapter 7.1 Installing the pump Fig. 3</td>
<td></td>
</tr>
<tr>
<td>Highest permissible relative air humidity of the environment</td>
<td>80% for temperatures to 31°C, decreasing linearly to 50% at 40°C.</td>
<td></td>
</tr>
<tr>
<td>Maximum installation altitude [m above sea level]</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>Protection class of pump</td>
<td>IP 00</td>
<td></td>
</tr>
<tr>
<td>Starts against:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Pressure [bar gauge]</td>
<td>5.0</td>
<td>1.0</td>
</tr>
<tr>
<td>- Vacuum [mbar abs.]</td>
<td>220</td>
<td>140</td>
</tr>
</tbody>
</table>

*Tab. 7* *Value measured at pump head*
5 Design and function

Design

1 Pneumatic pump outlet
2 Pneumatic pump inlet
3 Motor
4 Pump head

Fig. 1 Design NPK012
Swing piston pumps transfer, compress and evacuate air. The swing piston, consisting of retainer plate (4) and sealing lip (5), is moved up and down by the eccentric (6) and the connecting rod (7). In the downwards stroke, the swing piston aspirates the gas to be transferred via the inlet valve (1). In the upwards stroke, the swing piston presses the medium out of the pump head via the outlet valve (2). The swing piston is sealed at the pump housing by a sealing lip (5) and functions oil-free.
6 Transport

General

Personal injury and/or property damage due to incorrect or improper transport of the pump

In the event of incorrect or improper transport, the pump can fall down, be damaged or injure persons.

➔ Use suitable auxiliary means if necessary (carrying strap, lifting gear, etc.).

➔ Where appropriate, wear suitable personal protective equipment (e.g., safety shoes, safety gloves).

Risk of injury from sharp edges on the packaging

There is a risk of injury from cutting on the sharp edges when grabbing corners or when opening the packaging.

➔ Where appropriate, wear suitable personal protective equipment (e.g., safety shoes, safety gloves).

➔ Transport the pump in the original packaging to the installation location.

➔ Store the original packaging of the pump (e.g., for later storage).

➔ Inspect the pump for transport damage after receiving it.

➔ Document any transport damage in writing.

➔ Remove any transport safeguards on the pump prior to commissioning.

Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage temperature [°C]</td>
<td>+5 to +40</td>
</tr>
<tr>
<td>Transport temperature [°C]</td>
<td>-10 to +60</td>
</tr>
<tr>
<td>Permissible humidity (non-condensing) [%]</td>
<td>30 to 85</td>
</tr>
</tbody>
</table>

Tab. 8 Transport parameters

Prior to commissioning, make sure that the pump has reached the ambient temperature (4 Technical data).
7 Installation and connection

The pumps are only to be installed in accordance with the operating parameters and conditions described in Chapter 4 Technical data.

→ Observe safety notices (see Chapter 3 Safety).

7.1 Installing the pump

→ Before installing, store the pump at the installation location to allow it to reach the ambient temperature.

Mounting dimensions

→ For mounting dimensions, see the following figures:

![Mounting dimensions diagram]

Fig. 3 Mounting dimensions pump series NPK012

*Maximum screw-in depth

Cooling air supply

![Warning sign]

Danger of getting burned by hot surfaces
Hot surfaces could occur if the pump overheats.

→ When installing the pump, make sure that sufficient cooling air infeed and discharge is ensured.

Immediate environment of the hot pump parts

→ During installation, make sure that no combustible or thermally deformable objects are positioned in the immediate environment of the hot pump parts (head, motor).
Installation location

- Make sure that the installation location is dry and that the pump is protected against rain, splash, gushing and drip water as well as from other contaminants.
- Make sure that the installation location is accessible for maintenance and service.
- Make sure that the pump is securely attached to the intended fastening holes.
- Mount the pump at the highest point in the system to prevent condensate from collecting in the pump head.
- Protect pump from dust.
- Protect pump from vibration and impact.
- Take protective measures against touching and foreign objects which could enter the pump.

Protection against foreign objects

- Take protective measures against touching and foreign objects which could enter the pump.

7.2 Electrical connection

**DANGER**

- Danger to life from electric shock
  - Only have the pump connected by an authorized specialist.
  - Only have the pump connected if the power supply is disconnected.

- When connecting to a power source, observe the applicable standards, directives, regulations and technical standards.
- Install a device for separating the pump motor from the electrical mains in the electrical installation (in accordance with EN 60335-1).
- Protect the pump motors in accordance with EN 60204-1 (overcurrent protection, overload protection).
- The motors may only be operated in an SELV circuit.

- The control lines of the BLDC motor are only protected to a voltage of up to 1.5 kV (cf. DIN EN 61000-4-2).
  - If higher ESD requirements are needed, measures are to be provided by the owner himself.

- Refer to the pump type plate for the max. current consumption.
- It is recommended that an additional emergency-off system be installed.
- Mount the pumps in such a way that it is not possible to touch the electrically live parts (electrical connection).
- The ground potential of the power supply, the interface(s) and the pump housing are to be at the same potential. Compensating currents via the motor controller are to be prevented as they may result in the destruction of the electronics. A sufficient potential equalization in accordance with EN 60479-1 is to be dimensioned.

Fastening the connection cables

- Fasten the connection cables so that
  - the cables do not come into contact with movable or hot parts.
  - the cables cannot be worn or damaged on sharp corners or edges
  - no tensile and pressure forces are exerted on the connection point of the cables (strain relief)
Connecting the pump

1. Compare the data of the supply voltage with the details on the motor type plate. See the pump type plate for the maximum current consumption of the pump.

   - The supply voltage may deviate by maximum +10% or –10% from the values on the type plate.

2. Establish the electrical connection to the pump.

   - Set the direction of rotation according to the arrow on the fan hood (see 7.1 Installing the pump and operating instructions for the motor).

   - Control voltage may only be applied if the motor controller is supplied with an operating voltage. The motor controller may otherwise be damaged.

   - Ensure the correct polarity (see designation on motor). With brushless three-phase motors (indicated by a B at the end of the type designation), incorrect polarity will result in destruction of the electronics.
### Swing Piston vacuum pump NPK012

**Installation and connection**

#### Connection diagram for motor controller

<table>
<thead>
<tr>
<th>Function</th>
<th>Wire lead color</th>
<th>Signal name</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Supply voltage</td>
<td>Red</td>
<td>U⁺</td>
<td>AWG 26 / UL 3266</td>
</tr>
<tr>
<td>- Supply voltage (0 V)</td>
<td>Black</td>
<td>U⁻ / GND</td>
<td>AWG 26 / UL 3266</td>
</tr>
<tr>
<td>Input signal for speed control</td>
<td>Blue</td>
<td>U_{Ctrl}</td>
<td>AWG 26 / UL 3266</td>
</tr>
<tr>
<td>Output signal for speed</td>
<td>Green</td>
<td>U_{Spd}</td>
<td>AWG 26 / UL 3266</td>
</tr>
<tr>
<td>Input signal for remote ON/OFF</td>
<td>White</td>
<td>U_{Rmt}</td>
<td>AWG 26 / UL 3266</td>
</tr>
<tr>
<td>Input signal for direction of motor rotation</td>
<td>Yellow</td>
<td>U_{Rot}</td>
<td>AWG 26 / UL 3266</td>
</tr>
</tbody>
</table>

#### Electrical connections

**Motor**

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>[V] 24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage range</td>
<td>[V] 9 – 26.4</td>
</tr>
</tbody>
</table>

#### Leads connections

<table>
<thead>
<tr>
<th>Function</th>
<th>Wire lead color</th>
<th>Signal name</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input signal for speed control U_{Ctrl}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PWM frequency range</td>
<td>[kHz] 20</td>
<td></td>
<td>[10 … 30]</td>
</tr>
<tr>
<td>Input level &quot;high&quot;</td>
<td>[V] 5</td>
<td></td>
<td>[2.5…5.5]</td>
</tr>
<tr>
<td>Input level &quot;low&quot;</td>
<td>[V] 0</td>
<td></td>
<td>[0…0.8]</td>
</tr>
<tr>
<td>Duty cycle range</td>
<td>[%] PR 30… 0</td>
<td>VA 50…0</td>
<td></td>
</tr>
<tr>
<td>Pulse duration description:</td>
<td>[%] PR 30</td>
<td>VA 50</td>
<td></td>
</tr>
<tr>
<td>Min. → min. pump output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. → max. pump output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input impedance @ 1 kHz</td>
<td>[kΩ] ≥ 10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Output signal for speed U_{Spd}

| Pulses per revolution                        | [-] 6           |
| Pulse duty cycle                             | [%] 50          |
| Output level "high"                          | [V] 5           | [2.5…6.0]   |
| Output level "low"                           | [V] 0           | [0…0.8]     |
| Max. current carrying capacity               | [mA] 2          |
| Input impedance @ 1 kHz                      | [kΩ] ≥ 10       |

#### Input signal for remote ON/OFF U_{Rmt}

| Input level "high" → Motor ON                | [V] 5           | [2.5…5.5 or open contact] |
| Input level "low" → Motor OFF                | [V] 0           | [0…0.8]                 |
| Input impedance @ 1 kHz                      | [kΩ] ≥ 10       |

#### Input signal for direction of motor rotation U_{Rot}

| Standard for pump                            | [V] 5           | [2.5…5.5 or open contact] |
| Not recommended for pump                     | [V] 0           | [0…0.8]                 |
| Input level "high" → Motor CCW               | [V] 5           | [2.5…5.5 or open contact] |
| Input level "low" → Motor CW                 | [V] 0           | [0…0.8]                 |
| Input impedance @ 1 kHz                      | [kΩ] ≥ 10       |

Tab. 9 Connection diagram for motor controller NPK 012_DC-B-M
Installation and connection

Swing Piston vacuum pump NPK012

7.3 Pneumatic connection

![Connection diagram without external setpoint setting](image1)

**CAUTION**

Personal injury or property damage through ejected plugs
If not removed, the plugs on the pressure side of the pump can be ejected by the resulting operating pressure.

→ Remove plugs during installation.

**Connected components**

→ Only connect components to the pump that are designed for the pneumatic data and thermal requirements of the pump. (see Chapter 4 Technical data).

**Pressure relief device**

→ Protect compressors by means of a pressure relief device between the pressure-side connections of the compressor and the first shut-off valve.

**Pump discharge**

→ If the pump is used as a vacuum pump, safely (with respect to medium and noise) drain the hot pump discharge that may, under certain circumstances, occur at the pneumatic outlet of the pump.
Connecting the pump

Risk of injury from mixing up suction and pressure side
Mixing up the suction and pressure side can result in breakage of connected components on the suction and pressure side.
→ Observe the marking of inlet and outlet.

1. Remove protective plugs from the hose connection threads.
2. Connect suction and pressure line (for mounting dimensions, see Chapter 4 Technical data).
3. Lay the suction and pressure line at a downward angle to prevent condensate from running into the pump.

* Secure the pressure-side connections with a fastener (e.g., hose/pipe clamp) to prevent the hoses from slipping down from the connection.
8 Operation

8.1 General

**WARNING**
Risk of burns from hot pump parts and/or hot medium
Some pump parts may be hot during or after operation of the pump.
→ Allow pump to cool after operation.
→ Take protective measures to protect against touching hot parts.

**WARNING**
Risk of crushing from moving components
Reaching into the open housing during operation of the pump may result in crushing injuries to fingers.
→ Make sure that reaching into the housing is avoided.
→ Cover the housing.

**CAUTION**
Risk of injury from bursting hoses during pressure applications due to excessively high temperatures
When operating the pump in pressure applications, hoses that are not designed for the head temperatures of the pump at the respective operating point could become porous and burst.
→ Use temperature-resistant pressure hoses at the pneumatic connections.
→ Wear protective equipment if necessary (e.g., safety gloves, hearing protection).

**WARNING**
Injury to eyes
Coming too close to the inlet/outlet of the pump may result in injury to the eyes due to the present vacuum/operating pressure.
→ Do not look into the pump inlet/outlet during operation.

→ Only operate the pumps in accordance with the operating parameters and conditions described in Chapter 4 Technical data.
→ Ensure the proper use of the pumps (See Chapter 2.1 Proper use).
→ Eliminate the possibility of improper use of the pumps (see Chapter 2.2 Improper use).
→ Observe safety notices (Chapter 3 Safety).
The pumps are built-in devices. Before they are commissioned, it must be ensured that the machines or systems into which the pumps are installed comply with the relevant provisions.

**WARNING**
Risk of bursting of pump head due to excessive pressure increase

- Do not exceed the maximum permissible operating pressure (see 4 Technical data).
- Monitor the pressure during operation.
- If the pressure exceeds the maximum permissible operating pressure of the pump: immediately switch off the pump and remedy the fault (see Chapter 10 Troubleshooting).
- Only throttle or regulate the air or gas quantity on the suction line to prevent the maximum permissible operating pressure from being exceeded.
- If the air or gas quantity on the pressure line is throttled or regulated, make sure that the maximum permissible operating pressure at the pump is not exceeded.
- Ensure that the pump outlet is not closed or restricted.

**Excessive pressure**, with all of the associated hazards, can be prevented by means of a bypass line with a pressure relief valve between the pressure and suction sides of the pump. Further information is available from the KNF technical adviser (for contact data, see www.knf.de).

**Operation with open suction-side gas connection** can result in contaminants and objects being drawn in.

**Pump standstill**

- When the pump is at a pump standstill, establish normal atmospheric pressure in the lines.
- The pump may start up against pressure and/or vacuum during switch-on (see 4 Technical data). This also applies during operation after a brief power failure.
- Ensure that normal atmospheric pressure is present in the lines when switching on.

**Vapors as medium**
The service life of the sealing lip can be extended by preventing the formation of condensate in the pump. Therefore:

- Only perform work with saturated or nearly saturated vapors with a warm pump.
- KNF recommends: When transferring aggressive media, flush the pump before switching off (see Chapter 9.1 Flushing the pump) to extend the service life of the sealing lip.

**Switching off/decommissioning pump**

- Establish normal atmospheric pressure in the lines (relieve pump pneumatically).

**Recommissioning**

- Before recommissioning, observe the applicable standards, guidelines, regulations and technical standards at the electrical connection.

**Inspecting the pump**

- Inspect the pump periodically for external damage or leakage.
8.2 Control functions DC-B-M

8.2.1 Speed specification

Speed without external setpoint setting
The motor operates the pump with a non-variable speed over the entire permissible pressure range (see Fig. 4).

Speed with external setpoint setting
The motor operates the pump with a variable speed between \( n_{\text{min}} \) and \( n_{\text{max}} \) (see Fig. 5). The speed is specified by means of the control voltage \( (U_{\text{ctrl}}) \).

Specification of the speed is performed via the blue lead (Connection diagram for motor controller NPK 012_DC-B-M).

8.2.2 Speed output

The speed is output via the green lead (Connection diagram for motor controller NPK 012_DC-B-M).

The motor controller generates a speed synchronous square frequency (\( f \)).

Fig. 6 Speed output NPK 012_DC-B-M

8.2.3 Input signal for direction of motor rotation

The input signal for direction of motor rotation is applied via the yellow lead (Connection diagram for motor controller NPK 012_DC-B-M).

8.2.4 Input signal for remote ON/OFF

The input signal for remote ON/OFF is applied via the white lead (Connection diagram for motor controller NPK 012_DC-B-M).

8.3 Intermittent operation (NPK012PR)

Switch-on duration/pulsed operation
At pressures in excess of 2.5 bar, the switch-on duration must be limited. We recommend a maximum switch-on duration of 15 min followed by a rest time of equal length.

The switch-on duration and switch-off duration are dependent on the heat generated in the pump head as well as its heat dissipation while at rest. If the pump is allowed to cool further, the switch-on duration can be extended or the rest phase shortened.

The maximum permissible temperature in operation should not exceed 150°C at the pump head and 95°C at the motor housing.

See sketch for measuring point:
Measuring point for max. temperature on pump head

Measuring point for max. temperature on motor housing

Fig. 7 Temperature measuring points NPK012

Contact KNF Customer Service for further information. Contact data: see www.knf.de.
9 Cleaning

9.1 Flushing the pump
When transferring dangerous and environmentally hazardous media, KNF recommends flushing the pump at atmospheric pressure for a few minutes prior to switch-off (if necessary for safety reasons: with an inert gas) to extend the service life of the diaphragm.

→ Discharge the media safely.

9.2 Cleaning the pump

---

\[ \text{CAUTION} \]

Risk of burns from hot pump parts
The pump head or motor may still be hot after operation of the pump.

→ Allow pump to cool after operation.

---

\[ \text{WARNING} \]

Health hazard due to dangerous substances in the pump
Depending on the medium being transferred, caustic burns or poisoning is possible.

→ Wear protective equipment if necessary, e.g., protective gloves, goggles.

→ Clean pump with suitable measures.

---

During cleaning work, ensure that no fluids enter the interior of the housing.

→ Solvents should only be used during cleaning if head materials are not affected (ensure resistance of the material).

→ If compressed air is available, blow out parts.
10 Troubleshooting

DANGER

Danger to life from electric shock

→ All work on the pump may only be performed by authorized specialists.
→ Disconnect the pump power supply before working on the pump.
→ Check and ensure that no voltage is present.

Check the pump (see following tables).

<table>
<thead>
<tr>
<th>Cause</th>
<th>Fault remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump is not connected to the electrical mains.</td>
<td>Connect pump to the electrical mains.</td>
</tr>
<tr>
<td>No voltage in the electrical mains.</td>
<td>Check room fuse and switch on if necessary.</td>
</tr>
<tr>
<td>Connections or lines are blocked.</td>
<td>Check connections and lines.</td>
</tr>
<tr>
<td></td>
<td>Remove blockage.</td>
</tr>
<tr>
<td>External valve is closed or filter is clogged.</td>
<td>Check external valves and filters.</td>
</tr>
<tr>
<td>Condensate has collected in the pump head.</td>
<td>Separate the source of the condensate from the pump.</td>
</tr>
<tr>
<td></td>
<td>Flush the pump with air at atmospheric pressure for a few minutes (if necessary for safety reasons: with an inert gas).</td>
</tr>
<tr>
<td>Max. voltage range of motor exceeded.</td>
<td>Disconnect pump from electrical mains.</td>
</tr>
<tr>
<td></td>
<td>The applied voltage must not exceed the value specified in Chapter 7.2 Electrical connection.</td>
</tr>
</tbody>
</table>

Tab. 10
Flow rate, pressure or vacuum too low
The pump does not achieve the flow rate specified in the technical specifications or in the data sheet.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Fault remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condensate has collected in the pump head.</td>
<td>➔ Separate the source of the condensate from the pump.</td>
</tr>
<tr>
<td></td>
<td>➔ Flush the pump with air at atmospheric pressure for a few minutes (if necessary for safety reasons: with an inert gas).</td>
</tr>
<tr>
<td>There is overpressure on the pressure side and at the same time</td>
<td>➔ Change the pneumatic conditions.</td>
</tr>
<tr>
<td>vacuum or pressure above atmospheric pressure on the suction side.</td>
<td></td>
</tr>
<tr>
<td>Pneumatic lines or connection parts have insufficient cross section or</td>
<td>➔ Disconnect pump from the system to determine the output values.</td>
</tr>
<tr>
<td>are throttled.</td>
<td>➔ Eliminate throttling (e.g., valve) if necessary.</td>
</tr>
<tr>
<td></td>
<td>➔ Use lines or connection parts with larger cross section if necessary.</td>
</tr>
<tr>
<td>Leaks occur at connections, lines or pump head.</td>
<td>➔ Eliminate leaks.</td>
</tr>
<tr>
<td>Connections or lines are completely or partially plugged.</td>
<td>➔ Check connections or lines.</td>
</tr>
<tr>
<td></td>
<td>➔ Remove the parts and particles that are causing the plugging.</td>
</tr>
<tr>
<td>Head parts are soiled.</td>
<td>➔ Clean head components.</td>
</tr>
<tr>
<td>Sealing lip broken</td>
<td>➔ Stop pump immediately.</td>
</tr>
</tbody>
</table>

Tab. 11

Fault cannot be rectified
If you are unable to identify any of the specified causes, send the pump to KNF Customer Service (contact data: see www.knf.com).

1. Flush pump with air at atmospheric pressure for a few minutes (if necessary for safety reasons: with inert gas) to free the pump head of dangerous or aggressive gases (see Chapter 9.1 Flushing the pump).
2. Clean the pump (see Chapter 9.2 Cleaning the pump).
3. Send the pump together with completed Health and Safety Clearance and Decontamination Form to KNF, stating the nature of the transferred medium.
11 Accessories

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suction filter</td>
<td>319074</td>
</tr>
<tr>
<td>Silencer</td>
<td>058987</td>
</tr>
</tbody>
</table>

*Tab. 12*
12 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).