

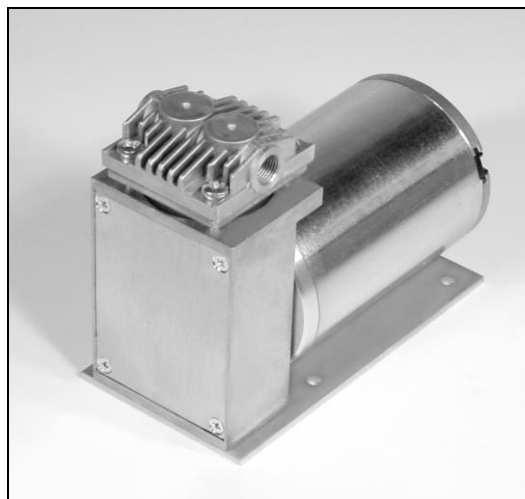
Swing Piston Compressors and Vacuum Pumps

NPK 09

NPK 09 DC

Operating and Installation Instructions

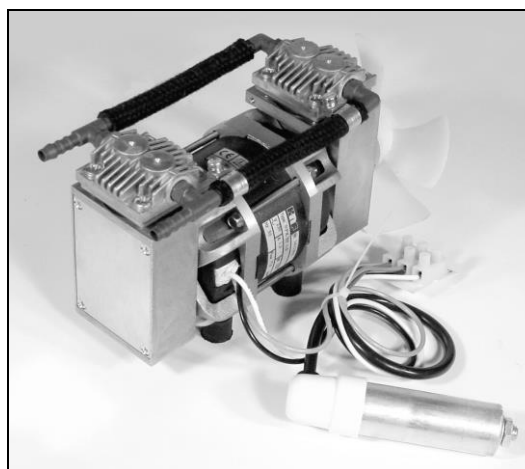
Read and observe these Operating and Installation Instructions!



NPK 09.1

NPK 09.2

NPK 09.1.2



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1. About this document

1.1. Using the Operating and Installation Instructions

The Operating and Installation Instructions are part of the pump.

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

Project pumps

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

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

1.2. Symbols and markings

Warning



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
DANGER	warns of immediate danger	Death or serious injuries and/or serious damage are the consequence.
WARNING	warns of possible danger	Death or serious injuries and/or serious damage are possible.
CAUTION	warns of a possibly dangerous situation	Minor injuries or damage are possible.

Tab. 1

Other information and symbols

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

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

i This symbol refers to important information.

2. Use

2.1. Proper use

The pumps are exclusively intended for transferring gases.

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 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, pump housing, diaphragms, and valves with the medium.

Only transfer gases which remain stable under the pressures and temperatures occurring in the pump.

2.2. Improper use

The pumps may not be operated in an explosive atmosphere.

The pumps are not suitable for transferring dusts.

The pumps are not suitable for transferring vapors and 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 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 especially applies to assembly, connection and servicing work.</p> <p>Make sure that the personnel has read and understood the Operating and Installation Instructions, and in particular the "Safety" chapter.</p>
Working in a safety-conscious manner	Observe the accident prevention and safety regulations when performing any work on the pump and during operation.
Handling dangerous media	When transferring dangerous media, observe the safety regulations when handling these media.
Handling combustible media	<p>Be aware that the pumps are not designed to be explosion-proof.</p> <p>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.</p> <p>Note that the temperature of the medium increases when the pump compresses the medium.</p> <p>Hence, make sure the temperature of the medium is sufficiently below the ignition temperature of the medium, even when it is compressed to the maximum permissible operating pressure of the pump.</p> <p>If necessary, consider any external sources of energy, such as radiation, that may add heat to the medium.</p> <p>In case of doubt, consult the KNF customer service.</p>
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.
EC Directives / Standards	For the purposes of the Machinery Directive 2006/42/EC, pumps are "partly completed machinery," and are therefore to be regarded as not ready for use. Partly completed machinery may not be commissioned until such time as it has been determined that the machine in which the partly completed machinery is to be assembled is in conformity with the provisions of the Machinery Directive 2006/42/EC. The following essential requirements of

Annex I of Directive 2006/42/EC (general principles) are applied and observed:

- General Principles No. 1
- No. 1.1.2. / 1.1.3. / 1.3.1. / 1.3.3. / 1.3.4. / 1.4.1. / 1.5.1.* / 1.5.2.* / 1.5.8. / 1.5.9. / 1.7.4. / 1.7.4.1. / 1.7.4.3.
(* only for pumps with AC motor)

As these partly completed machinery are OEM-models the power supplies and the equipment for disconnecting and switching-off the partly completed machinery respectively have to be considered when mounting as well as over-current and overload protective gear.

In addition a protection against mechanical parts in motion and hot parts, if existing, has to be provided when mounting.



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

The following harmonized standards have been used:

NPK 09 DC	NPK 09 NPK 09.1 NPK 09.2 NPK 09.1.2
DIN EN 55014-1/2	DIN EN 55014-1/2
DIN EN 60034-1	DIN EN 61000-3-2/3
DIN EN 50581	DIN EN 50581
DIN EN 61000-6-1/2	DIN EN 60335-1

Tab. 2

Customer service and repairs

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

4. Technical Data

Pump materials

Assembly	Material
Ribbed head; intermediate plate	Aluminium
Housing	Aluminium
Valve plate	1.4310
Gasket	NBR compound
O-ring	FPM
Diaphragm	PTFE compound

Tab. 3

Pneumatic values

Pump type	Delivery rate at atm. pressure [l/min]*	Max. permissible operating pressure [bar g]	Ultimate vacuum [mbar abs.]
NPK 09	12	7	100
NPK 09 DC	15		
NPK 09.1	24	-	-
NPK 09.2		7	-
NPK 09.1.2			100

Tab. 4

* Liters in standard state (1,013 mbar)

Pneumatic connections

Pump type	Suction side	Pressure side
NPK 09	Thread size G1/8"	
NPK 09 DC	Thread size G1/8"	
NPK 09.1	For hose ID6	Thread size G1/8"G1/8"
NPK 09.2	Thread size G1/8"	For hose ID6
NPK 09.1.2	For hose ID6	

Tab. 5

Electrical data

Parameter	Value
Electrical data	See type plate
Protection class	IP00

Tab. 6

Thermal-switch The ac-motors of the pumps are fitted as standard with a thermal-switch to protect against overloading.

Dimensions

Pump type	Dimensions [L x W x H]
NPK 09	approx. 132.5 x 81 x 107
NPK 09 DC	approx. 129 x 65 x 107
NPK 09.1	approx. 191 x 115 x 130
NPK 09.2	
NPK 09.1.2	

Tab. 7

Weight

Pump type	Weight [kg]
NPK 09	approx. 1.8
NPK 09 DC	approx. 1.6
NPK 09.1	approx. 2.2
NPK 09.2	
NPK 09.1.2	approx. 2.4

Tab. 8

Other parameters

Parameter	Values
Permissible ambient temperature	+ 5 °C to + 40 °C
Permissible media temperature	+ 5 °C to + 40 °C
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

Tab. 9

5. Design and function

Design NPK 09 DC

- 1 Outlet
- 2 Pump head
- 3 Inlet
- 4 Motor

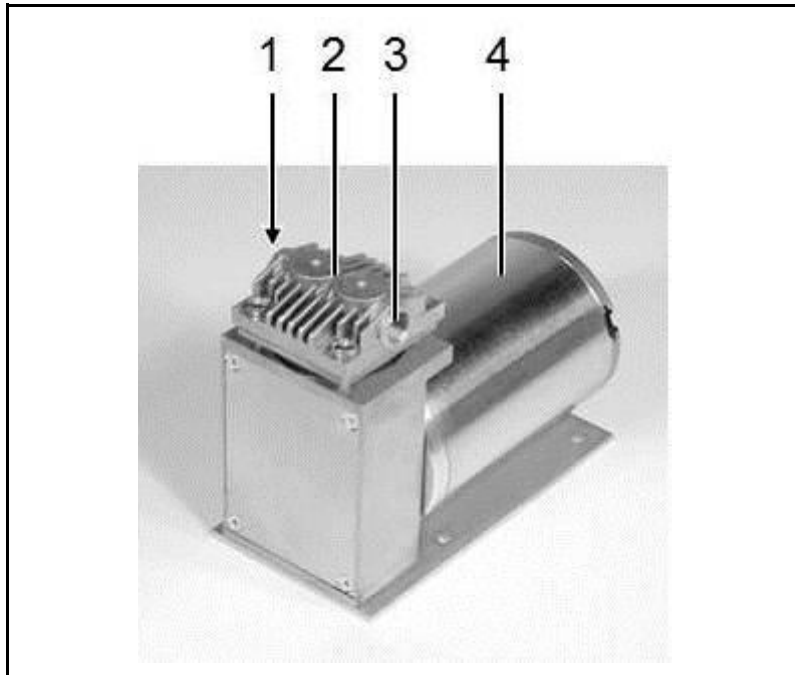


Fig. 1: Swing Piston Pump NPK 09 DC

Design NPK 09 AC

- 1 Outlet
- 2 Pump head
- 3 Inlet
- 4 Pneumatic head connection
- 5 Motor
- 6 Pneumatic head connection
- 7 Pump head

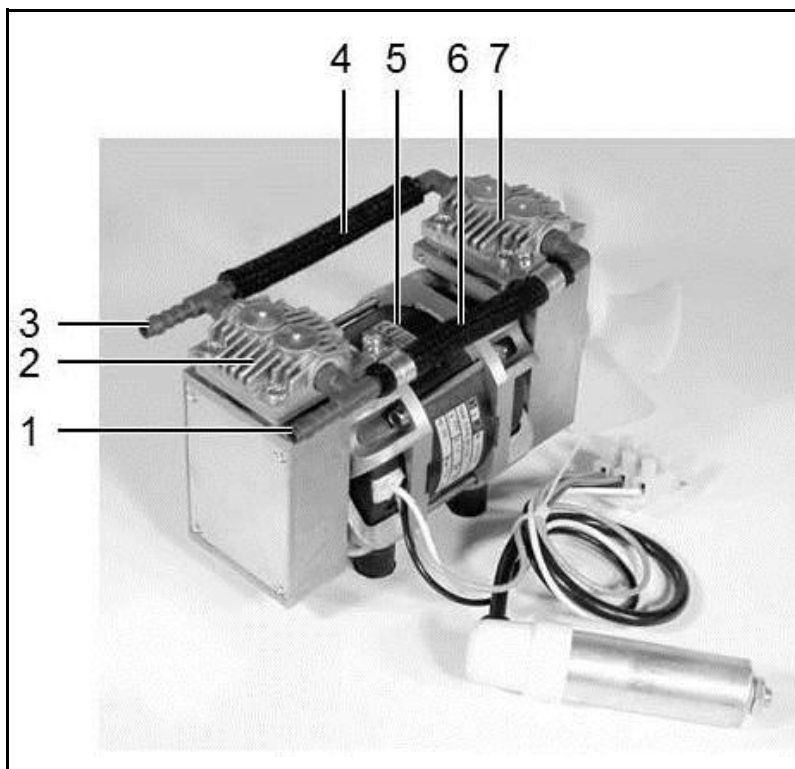


Fig. 2: Swing Piston Pump NPK 09 AC

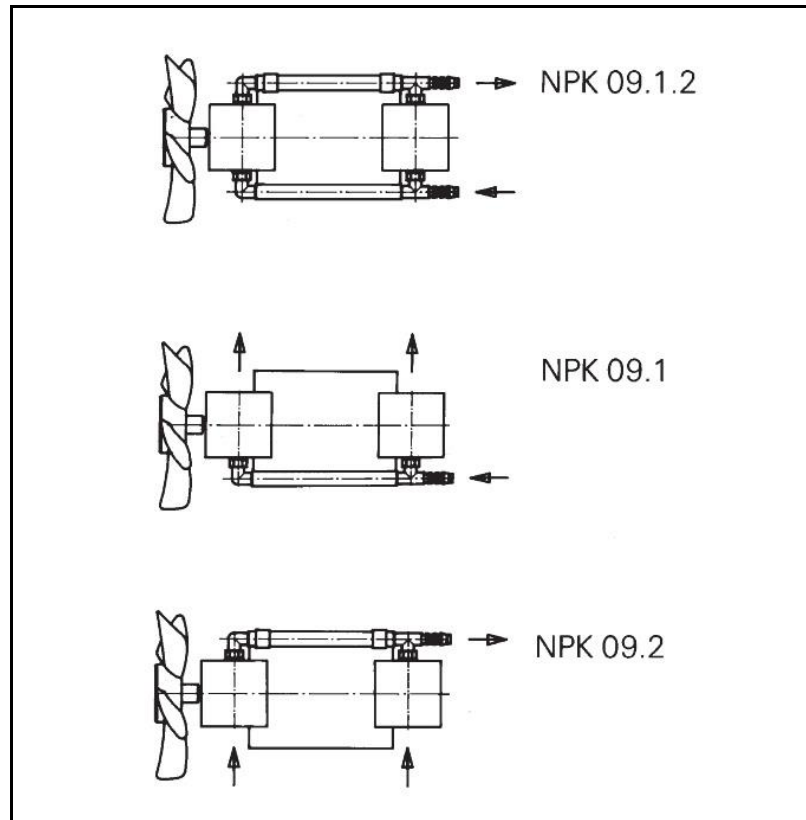


Fig. 3: Pneumatic connection of two-headed pumps

How Swing Piston Pumps work

- 1 Inlet valve
- 2 Outlet valve
- 3 Working chamber
- 4 Retainer plate
- 5 Piston seal
- 6 Eccentric
- 7 Connecting rod
- 8 Compressor housing

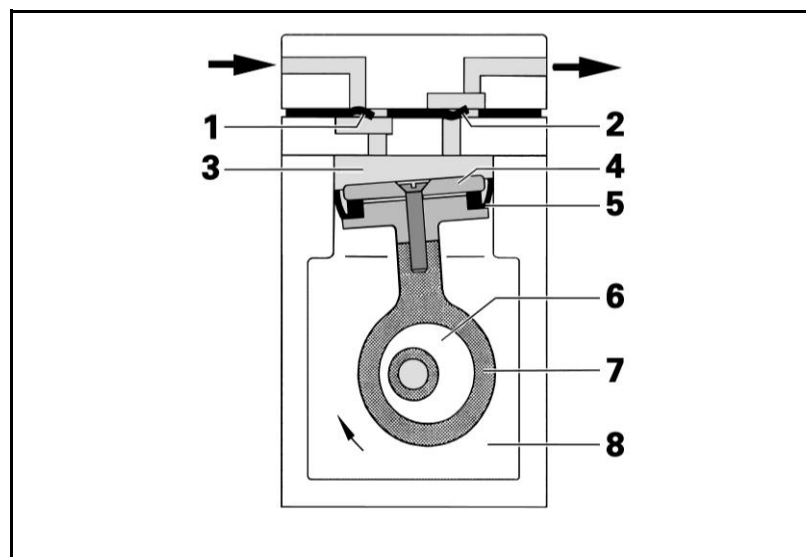


Fig. 4: How Swing Piston Pumps work

Swing Piston Pumps transfer, compress and evacuate air.

The swing piston, consisting of retainer plate (4) and piston seal (5), is moved up and down by the eccentric (6) and the connecting rod (7). In the downward stroke the swing piston aspirates the medium to be transferred via the inlet valve (1). In the upward stroke, the swing piston presses the medium out of the pump head via the outlet valve (2). The swing piston is sealed off from the compressor housing by a piston seal (5) and operates oil-free.

6. Installation and connection

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

Observe the safety precautions (see Chapter 3).

6.1. Installation of the pump

- Before installation, store the pump at the installation location to bring it up to ambient temperature.
- Mounting dimensions → See the data sheet for the mounting dimensions.
- Cooling air supply → When setting up or installing the pump, make sure that the fan can draw in an adequate amount of cooling air.
- When setting up or installing the pump, make sure that an accidental finger contact with the fan is impossible
- Installation location → Make sure that the installation location is dry and the pump is protected against rain, splash, hose and drip water.
- Install the pump at the highest point in the system to prevent condensate from collecting in the pump head.
- Choose a safe location (flat surface) for the pump.
- Protect the pump from dust.
- Protect the pump from vibrations and jolts.

6.2. Electrical connection

For pumps with AC motor:



DANGER

Extreme danger from electrical shock

- Only have the pump connected by an authorized specialist.
- Only have the pump connected when the power supply is disconnected.

For pumps with DC motor:

- Only have the pump connected by an authorized specialist.
- Only have the pump connected when the power supply is disconnected.
- When connecting the device to a power source, the relevant standards, directives, regulations, and technical standards must be observed.
- In the electrical installation, arrangements (complying with EN 60335-1) must be made for disconnecting the pump motor from the electrical supply.
- The motors of the pump must be protected according to EN 60204-1 (protection against excess current, or overloading).
- i** → For operating current see type plate or data sheet.

- ➔ It is recommended that an additional “Emergency Stop” switch is installed.
- ➔ The pump must be installed so that contact with live parts is impossible.

Connecting pump

1. Compare the supply data with the data on the motor-plate. For operating current see type plate.

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

The earth (ground) wire must be connected to the motor (not necessary on dc motors up to 24V).

2. Connect the earth (ground) wire to the motor (not necessary on dc motors up to 24V).
3. For NPK 09 AC:
Connect the mains cables to the connections L1 and N of the pump motor.
4. For NPK 09 DC:
Connect the positive and negative pole.

i Note the proper polarity (see marking on the motor).

Correct connection:

- + red cable
- black cable

EMC-compatible Installation (for NPK 09 DC)

The Tests:

- Magnetic field with energy-technical frequency
- Electromagnetic HF field, amplitude-modulated
- Electromagnetic HF field, pulse-modulated
- Discharging of static electricity
- High frequency, asymmetric
- Fast transients

were not carried out, cause the products do not contain electronic modules, which can be affected by these tests.

The Surge-test can only be passed with additional means, or is not mandatory, if: From EN61000-6-1 technical norm for EMC protection, part 1,10 test demands for EMC protection, table 3, EMC protection, D.C.- power in- and outputs. Remark 3: (quotation) Not to be used with input connections which are foreseen for a connection with a battery or a rechargeable battery which has to be removed or disconnected from the device for the recharge.

Devices with a D.C. power input which are foreseen to be operated with an A.C. / D.C. converter have to be tested at an A.C. power input of an A.C. / D.C. converter fixed by the manufacturer. In case

the converter was not fixed they have to be tested at an A.C. power input of a typical (usual) A.C. / D.C. converter.

The test is applicable for D C power inputs which are foreseen for a permanent connection to cables which are longer than 10 m.

6.3. Pneumatic connection

- | | |
|----------------------|------------------------------------------------------------------------------------------------------------------------------|
| Connected components | ➔ Only connect components to the pump which are designed for the pneumatic data of the pump (see Chapter 4, Technical data). |
| Pump exhaust | ➔ If the pump is used as a vacuum pump, safely discharge the pump exhaust at the pump's pneumatic outlet. |

Connecting pump

i A marking on the pump head shows the direction of flow.

1. Remove the protective plugs from the hose connectors.
2. If the accessories silencer, filter, and hose connector are present, screw them onto the corresponding hose connection threads.

i The filter or silencer is to be mounted on the suction side or pressure side of the pump head. With multiple-head pumps, this relates to the first pump head or last pump head.

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

7. Operation

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

Make sure the pumps are used properly (see Chapter 2.1).

Make sure the pumps are not used improperly (see Chapter 2.2).

Observe the safety precautions (see Chapter 3).



WARNING

Hazard of the pump head bursting due to excessive pressure increase

- Do not exceed max. permissible operating pressure (see Chapter 4, Technical data).
- Monitor pressure during operation.
- If the pressure exceeds the maximum permissible operating pressure, immediately switch off pump and eliminate fault (see Chapter 8. Troubleshooting).
- Only throttle or regulate the air or gas quantity in the suction line to prevent the maximum permissible operating pressure from being exceeded.
- If the air or gas quantity in the pressure line is throttled or regulated, make sure that the maximum permissible operating pressure is not exceeded.

i Excessive pressure (with all of the related hazards) can be prevented by placing a bypass line with a pressure-relief valve between the pressure and suction sides of the pump. For further information, contact our technical adviser (see last page for telephone number).

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

Switching pump on **i** The pump may not start up against pressure or vacuum during switch-on. This also applies in operation following a brief power failure.

→ Make sure that normal atmospheric pressure is present in the lines during switch-on.

Inspection → Regularly inspect the pump for external damage or leaks. Piston seal and valve plates are the only parts subject to wear. Wear is usually indicated by a drastic reduction in the pneumatic performance. When replacing parts proceed as described in Chapter 8.

→ Change the filter (accessories) if it is dirty.

8. Servicing

Before working on the pump, isolate the power supply securely, then check that the lines are not live.

The piston seal, and to a lesser extent the valve plates are the only parts of the pump subject to wear. They are simple to change.

When changing the piston seal, check the valve plates for damage (tongues bent, corrosion).

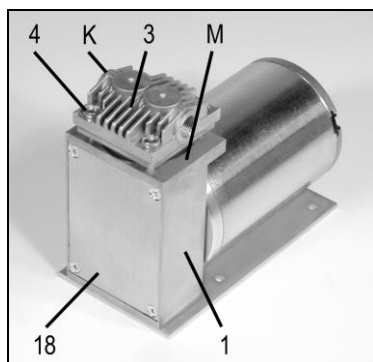


Fig. 5:
Pump element (single head types)

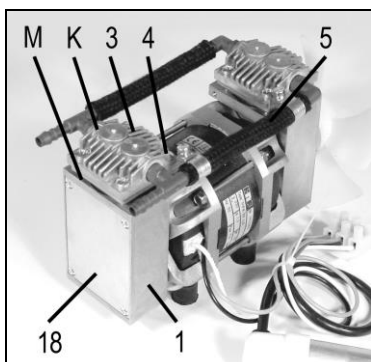


Fig. 6:
Pump element (twin head types)

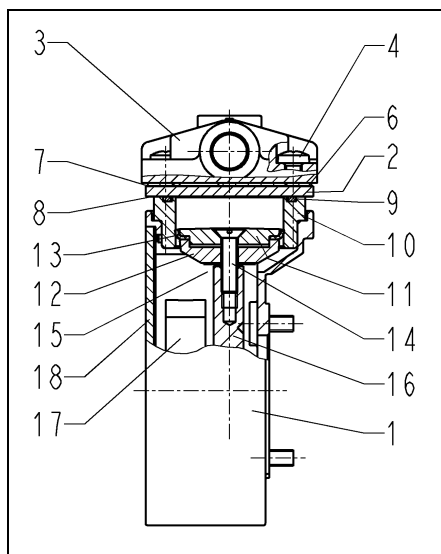


Fig. 7:
Pump element (all types)

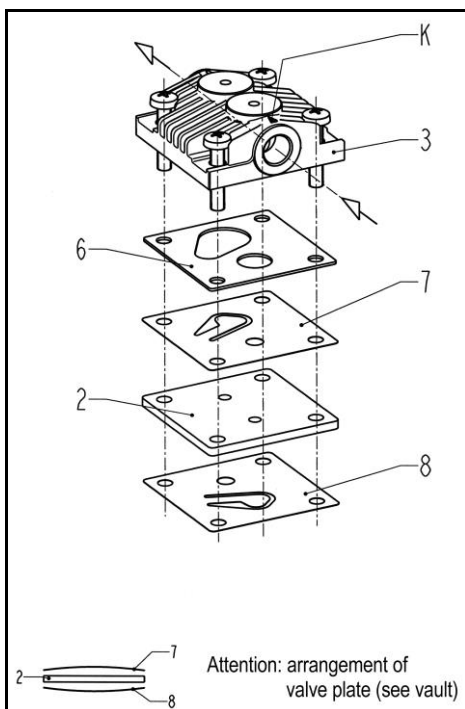


Fig. 8:
Pump head (all types)

Specifiacion

Pos. Description

- 1 Housing
 - 2 Intermediate plate
 - 3 Ribbed head
 - 4 Screw
 - 5 Connection (only twin head models)
 - 6 Gasket
 - 7 Valve Plate
 - 8 Valve Plate
 - 9 O-Ring
 - 10 Cylinder
 - 11 Retainer Plate
 - 12 Support
 - 13 Piston seal
 - 14 Screw
 - 15 Washer(s)
 - 16 Connecting rod
 - 17 Counter weight
 - 18 Cover
- M Mark
K Compression symbol

The position numbers in the following text refer to figs. 5 to 8.

8.1. Changing the piston seal

Parts required	Spare part*	Quantity
	Piston seal	1 (twin head pumps: 2)
	Countersunk flat head screw (14)	2 (twin head pumps: 2)

Tab. 10

* According to Spare parts list, section 11

Tools required	Tools/Material
	Screwdriver TX20
	Screwdriver (blade width 5,5 mm)
	Phillips screwdriver no. 1
	Felt-tip pen

Tab. 11

In the case of twin head pumps both piston seals should always be changed at the same time.

Dismantling

- In the case of twin head models the connecting pipework between the heads must first be removed.
- Make a mark (**M**) on the ribbed head (**3**), intermediate plate (**2**), and housing (**1**) with a felt-tip pen (see **M** in figures 5 and 6). This helps avoid incorrect assembly later.
- Unscrew the 4 screws (**4**) and take off the ribbed head (**3**).
- Remove gasket (**6**), valve plate (**7**), intermediate plate (**2**) and valve plate (**8**) from housing (**1**).
- Only for the pump model NPK09 DC: Take off the cover (**18**) after removing the 4 screws securing it.
For this pump type applies: Where reference is made to turning or holding the cooling fan, the necessary operations must be carried out by turning or holding the counter-weight (**17**).
- Turn the fan to bring the retainer plate (**11**) to top dead centre.
- Pull the cylinder (**10**) upwards to remove it.
- Hold the fan, loosen the retainer plate screw (**14**) and remove screw, retainer plate, support (**12**) and washer(s) (**16**).
- Remove the piston seal (**13**) from the retainer plate.
- Check that all parts are free from dirt and clean them if necessary (see section 9. *Cleaning*).
- Check the valve plates for damage (tongues bent, corrosion); if necessary use new ones when reassembling.

Assembly

1. Hold the connecting rod (**16**) vertical, and replace the cylinder (**10**) on the pump housing (**1**).
2. Re-assemble the "piston assembly":
 - Lay the new piston seal (**13**) on the retainer plate (**11**) with the sealing lip towards the free surface of the retainer plate.
 - Lay the support (**12**) on the retainer plate/piston seal assembly.
 - Push the new countersunk flat head screw (**14**) through the assembly, and fit the same number of washers as previously used.
3. Insert the piston assembly (retainer plate, support, piston seal and washer(s) with their screw) into the cylinder from above, on to the connecting rod.

The piston seal must not be distorted during assembly. It must make contact with the cylinder all round its circumference.

4. Fasten the "piston assembly" by tightening the screw (**14**).
5. Reassemble the "head assembly": stack the following parts on top of each other in the order given - ribbed head (**3**), gasket (**6**), valve plate (**7**), intermediate plate (**2**), and valve plate (**8**). Fig. 8 shows the correct orientation of the parts, particularly the valve plates, in relation to the compression symbol on the head plate. Both valve plates are identical, and they can be fitted either way up. The intermediate plate can also be fitted either way up.
6. Place the "head assembly" on the pump housing (**1**) - as a guide to orientation see fig. 5 (single head models) or fig. 6 (twin head models). Reference point is the compression symbol (indicated with a **K** in the diagrams), or the mark (**M**).
7. Tighten the screws (**4**) at first lightly, then firmly by hand, in a diagonal pattern (max. tightening torque 1.5 Nm).
8. Rotate the fan by hand to check that pump turns easily.
9. Pump model NPK 09 DC only: refit cover (**18**) to the housing.

For twin head pumps, repeat the operations described for the second head, and replace the connections between the two heads.

If, after changing the piston seal, the specified vacuum is not reached, check the following:

- pneumatic connections for tightness
- for twin head models that the head connections are gas-tight
- whether the washer(s) under the support has/have been assembled.

If, after changing the piston seal, the pump produces no flow, check the position and orientation of gasket (**6**), valve plate (**7**), intermediate plate (**2**) and valve plate (**8**). See fig. 5,6 and 8.

8.2. Changing the valve plates

Parts required	Spare part*	Quantity
	Valve plates	2 (twin head pumps: 4)

Tab. 12

* According to Spare parts list, section 11

Tools required	Tools/Material
	Screwdriver TX20
	Felt-tip pen

Tab. 13

In the case of twin head pumps, both valve plates must always be changed at the same time. The text below describes the operations necessary for one head.

To change the valve plates, the following operations of Section 8.1 *Changing the piston seal* must be carried out:

Disassembly

1 to 4, 10 and 11.

Assembly

5 to 8 using new valve plates (2 for each head).

For twin head pumps, repeat the operations described for the second head, and replace the connections between the two heads.

If, after changing the valve plates, the specified vacuum is not reached, check the following:

- pneumatic connections for tightness
- for twin head models that the head connections are gas-tight

If, after changing the valve plates, the pump produces no flow:

- check the position and orientation of gasket (6), valve plate (7), intermediate plate (2) and valve plate (8). See fig. 5, 6 and 8.

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

9. Cleaning

When changing valve plates and diaphragm, inspect all parts for dirt before assembling the pump head, and clean them if necessary.

As far as possible, clean the parts with a dry cloth. Solvents should not be used as they can attack the plastics, and synthetic rubber parts. If a compressed air line is available, blow the parts out with it.

10. Troubleshooting

For pumps with AC motor:



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.

For pumps with DC motor:

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

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

Check the pump (see Tab. 14 and 15).

Pump does not transfer	
Cause	Fault remedy
Thermal switch has operated following to over-heating.	<ul style="list-style-type: none"> → Disconnect pump from mains. → Allow pump to cool. → Identify and eliminate cause of overheating.
Connections or lines blocked.	<ul style="list-style-type: none"> → Check connections and lines. → Remove blockage.
External valve is closed or filter is clogged.	<ul style="list-style-type: none"> → Check external valves and filters.
Condensate has collected in pump head.	<ul style="list-style-type: none"> → Install pump at highest point in system.
Piston seal or valve plates are worn.	<ul style="list-style-type: none"> → Replace piston seal and valve plates (see Chapter 8)

Tab. 14

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.	➔ Install pump at highest point in system.
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.	➔ Eliminate leaks.
Connections or lines completely or partially jammed.	➔ Check connections and lines. ➔ Remove the jamming parts and particles.
Head parts are soiled.	➔ Clean head components.
Piston seal or valve plates are worn.	➔ Replace piston seal and valve plates (see Chapter 8)

Tab. 15

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.
2. Remove the pump
3. Clean the pump
4. Send the pump, together with completed Health and Safety Clearance and Decontamination Form to KNF stating the nature of the transferred medium.

11. Spare parts and accessories

Spare parts

Pos. Nr*	Description	Order-No.
(2)	Intermediate plate	025523
(3)	Ribbed head	051565
(4)	Screw	318015
(5)	Connection for NPK 09.1 NPK 09.1.2 (suction side)	026178
	Connection for NPK 09.2 NPK 09.1.2 (pressure side)	026179
(6)	Gasket	052650
(7)(8)	Valve plate	052649
(9)	O-Ring	317559
(10)	Cylinder	318168
(11)	Retainer Plate	308109
(12)	Support	311098
(13)	Piston seal	304346
(14)	Screw	110725
(15)	Washer	006886

Tab. 16: Spare Parts

*according to figure 7

Accessories

Description	Order-No.
Silencer/Filter (G 1/8)	007005
Hose connector for tube ID 6 mm (G 1/8)	000360

Tab. 17: Accessories

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).

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KNF worldwide

Find your local KNF partner on www.knf.com