

Operating and Installation Instructions

Diaphragm Vacuum Pumps and Compressors

Type ranges: **UN85.3KTI** **UN86KNI** **UN86KNDCB**
 UN85.3KNI **UN86KTI** **UN86KTDCB**
 UN85.3KNDC **UN86KNDC**
 UN85.3KTDC **UN86KTDC**



Fig. 1:
UN86KNI with IP 00-Motor

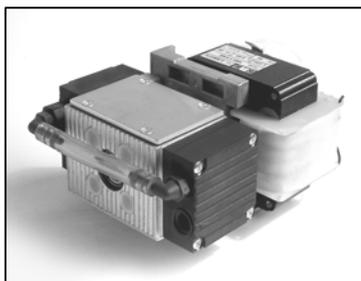


Fig. 2:
UN85KNI with IP 00-Motor



Fig. 3:
UN86KNDCB with brushless dc motor

You have selected a high-quality KNF product; the following tips will help you operate it safely and reliably over a long period of time. Carefully study the Operating and Installation Instructions before using the pumps and observe at all times the relevant instructions to avoid dangerous situations. The manual was produced for the serial pumps stated above. With customer-specified projects (pump types starting with "PU" or "MPU") there could be differences in detail. For customer-specified projects please therefore take into account any agreed technical specifications, as well as these instructions.

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1. Description, Operating Conditions

KNF pumps in the UN 85.3, and UN 86 range transfer, evacuate and compress oil-free. In operation they are gas-tight, and maintenance-free. The noise level from the pumps is less than 55dB(A) with hose connectors fitted.

1.1. Electrical Equipment

See the motor-plate for full electrical data.

Protection class of standard version is IP00.

1.2. Operating Conditions

Handling air, gases, and vapours at temperatures between + 5 °C ...+ 40 °C.

For maximum permissible operating pressure, ultimate vacuum, and flow capacity see section 10.

The pumps must not be used in areas where there is a danger of explosion.

Before pumping a medium, the compatibility of materials of pump head, diaphragm and valves with the medium must be checked (for pump materials: see section 10).

KNF pumps in the N 85.3, and N 86 range must not be used for liquids. You will find suitable liquid pumps in our Product Program.

If your potential application lies outside the above limits discuss it with our technical adviser (see last page for contact telephone number).

1.3. Ambient Conditions

When the pump is operating the following ambient conditions must be maintained:

- Ambient temperature during operation: between + 5 °C ...+ 40 °C.
- The pump must be protected from the effects of dust and water.
- During operation an adequate supply of air for cooling must be provided.
- The pumps must not be used in areas where there is a danger of explosion.

1.4. Pump materials

See section 10.

2. Safety

The pumps have Protection Class 00, and so offer no protection against contact or foreign bodies. It is therefore essential to provide protection for persons against contact with live parts (e.g. electrical connections, motor windings), and moving parts (e.g. fan). Protection against the entry of foreign bodies must also be provided.

The pump has no protection against water. In this case too, as far as is relevant, measures to protect the pump must be taken before putting it into service.

Note that the pumps may only be used for their intended purpose.

The pumps must not be used in areas where there is a danger of explosion.

Components connected to the pump must be designed to withstand the pneumatic performance of the pump.

Take care that safety regulations are observed when connecting the pump to the electricity supply.

Specific safety instructions for the media being handled must be observed.

For pumps with a thermal switch:

When the operation of the pump is interrupted by the thermal switch, the pump will re-start automatically after cooling down. Take all care necessary to prevent this leading to a dangerous situation.

Use only original KNF spare parts.

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



The pumps conform to the EC Directive 2004/108/EC concerning Electromagnetic Compatibility.

The following harmonized standards have been used:

UN85.3K_I UN86K_I	UN85.3K_DC UN86K_DC	UN86K_DCB
DIN EN 55014-1/2	DIN EN 55014-1/2	DIN EN 55014-1
DIN EN 61000-3-2/3	DIN EN 60034-1	DIN EN 61000-6-2
DIN EN 60335-1		

Tab. 1

3. Installation

Pumps in the UN 85.3, and UN 86 range are OEM models intended for installation in equipment. When installing them make certain that accident prevention regulations, and safety instructions, including those for subsequent operation are observed. The safety instructions in section 2 must be observed.

Mechanical The dimensions of the mountings are given in Data Sheet E 008. Install the pump so that the fan can draw in sufficient cooling air. Install the pump so as accidental finger contact is with the fan is impossible.

Fit the pump at the highest point in the system, so that condensate cannot collect in the head of the pump - that prolongs working life.

Rubber feet (accessories) may be used to reduce noise, and vibration. They are not suitable for mounting the pump on its side, or suspended.

Electrical **When making the electrical installation the safety regulations must be observed. In particular make sure that the electricity supply is isolated before trying to connect the pump.**

Compare the supply data with the data on the motor-plate. The voltage must not vary by more than +6% 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 24 V).

For brushed dc motor lead wires connection:

- Red: V+
- Black: Ground

Caution: → **Incorrect lead wire connection will damage motor.**

For brushless dc motor lead wire connection:

- Red: V+
- Blue: Ground
- White: Voltage control 0-5 V DC (4 wire motor only)
- Green: Frequency output (4 wire motor only)

Caution: → **Incorrect lead wire connection will damage motor.**

In the electrical installation, arrangements (complying with EN 60335-1) must be made for disconnecting the pump motor from the electrical supply.

The pump must be installed so that contact with live parts (e.g. electrical connection) is impossible.

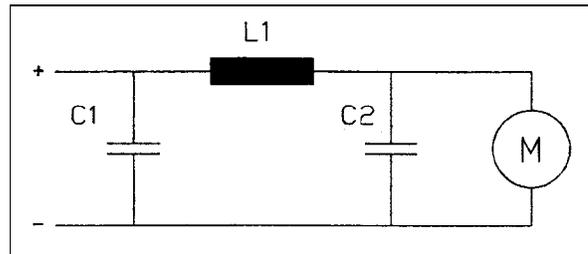
We recommend that a fuse is installed in the supply circuit; the operating current is given in Data Sheet E 008

EMC-compatible Installation (brushless DC motor)

To ensure interference suppression according to EN 55014-1:1993 + A1:1997 pump types equipped with the brushless DC motor (DC B) must be equipped with a supplemental electronic circuit.

The supplemental circuitry is not necessary if a voltage supply has a suppression of > 20 dB at 150 kHz and 0 dB at 1 MHz.

The supplemental circuit must be structured according to the following electrical diagram and the components defined therein in order to achieve the required level of suppression.



C1:	Capacitor	1 μF
C2:	Capacitor	1000 μF
L1:	Choke coil	6 μF

Pneumatic Remove the protection plugs from the port threads (thread size 1/8" NPT, special models may have other threads).

The accessories silencer, filter and hose connectors are screwed into the port threads.

Connect the suction and pressure lines.

Arrange the suction and pressure lines so that condensate cannot run into the pump.

4. Operation

Specific safety instructions for the media being handled must be observed.

Before pumping a medium, the compatibility of materials of pump head, diaphragm and valves with the medium must be checked (for pump materials: see section 10).

If combustible media are used:

- Hazard of fires and explosions due to excessively high media temperature.
- 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 (section 10).
- 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.

The pump must not start against pressure or vacuum. When it is switched on the pressure in the suction and pressure lines must be atmospheric. This must be so even when the pump restarts after the power has been cut off for a short period.

The maximum permissible operating pressure (see section 10) must not be exceeded, even when the flow is restricted.

To prevent the maximum permissible operating pressure being exceeded, restriction or control of the air or gas flow should only be carried out in the suction line.

If restriction or control of the air or gas flow is made on the pressure side ensure that the maximum permissible operating pressure is not exceeded.

When the pump is at a standstill the inlet and exhaust must be at normal atmospheric pressure.

Change the filter if it is dirty.

Diaphragm 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 section 5.

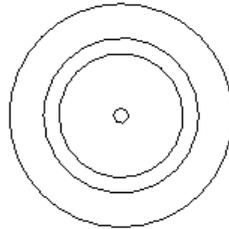
Ambient conditions: see section 1.3.

5. Servicing

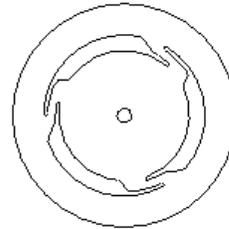
Before working on the pump, isolate the power supply securely, then check that the lines are not live.

Diaphragm and valve plates or valve plate/sealing rings are the only parts of the pump subject to wear. They are simple to change.

Always change the diaphragm, valve plate/sealing rings or valve plates and sealing rings at the same time. Service all heads.



**Separate
Valve plate
&
Sealing ring**



**Integrated
Valve plate/sealing ring**

Note: Pumps that are built of a new configuration may include the integrated Valve plate/sealing rings

Parts required

Spare part*	Quantity
Valve plates or Valve plate/sealing rings	2 (per pump head)
Sealing rings	2 (per pump head) (if required)
Structured diaphragm(s)	1 (per pump head)

Tab. 2

* According to Spare parts list, section 8

Tools required

Tools/Material
Phillips screwdriver No. 1
Felt-tip pen

Tab. 3

Always change the diaphragm, valve plate/sealing rings or valve plates and sealing rings at the same time. In the case of models with two heads service both heads.

Change the diaphragm(s), valve plate/sealing rings or valve plates and sealing rings in the following sequence:

- a) Remove pump head
- b) Change diaphragm
- c) Change valve plate/sealing rings or valve plates
- d) Change sealing rings (if required)
- d) Refit pump head

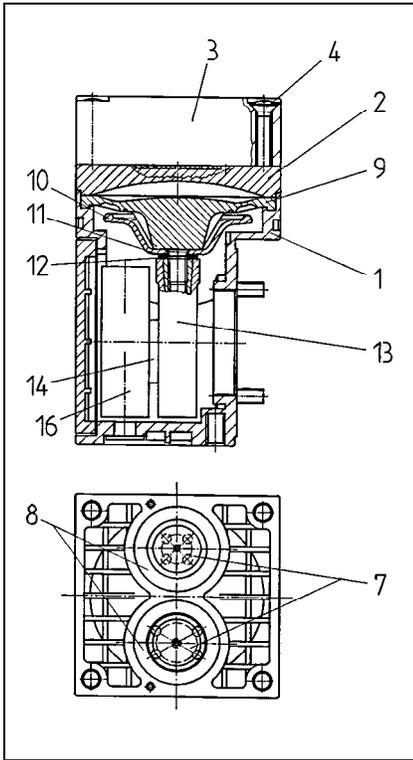


Fig. 5: Model UN86

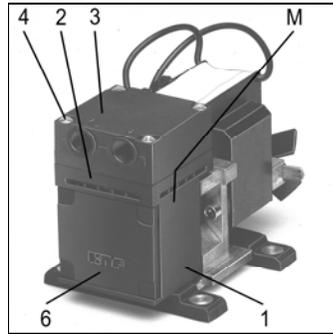


Fig. 4: Model UN86

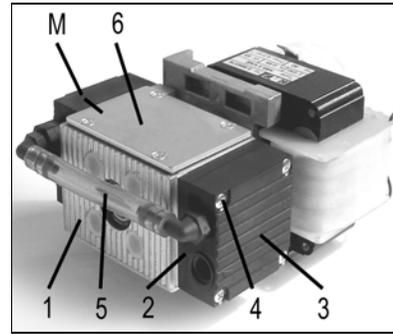


Fig. 6: Model UN85.3

Specification

Pos. Description

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> 1 Housing 2 Intermediate Plate 3 Head Plate 4 Screw 5 Connection (only N 85.3 range) 6 Cover 7 Valve Plate or Valve plate/Sealing Ring 8 Sealing Ring (if required) | <ul style="list-style-type: none"> 9 Structured Diaphragm 10 Diaphragm Support Cup (only UN 85 und UN 86 range) 11 Diaphragm Shim Ring 12 Diaphragm Shim Ring 13 Connection Rod 14 Eccentric 16 Counter weight |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

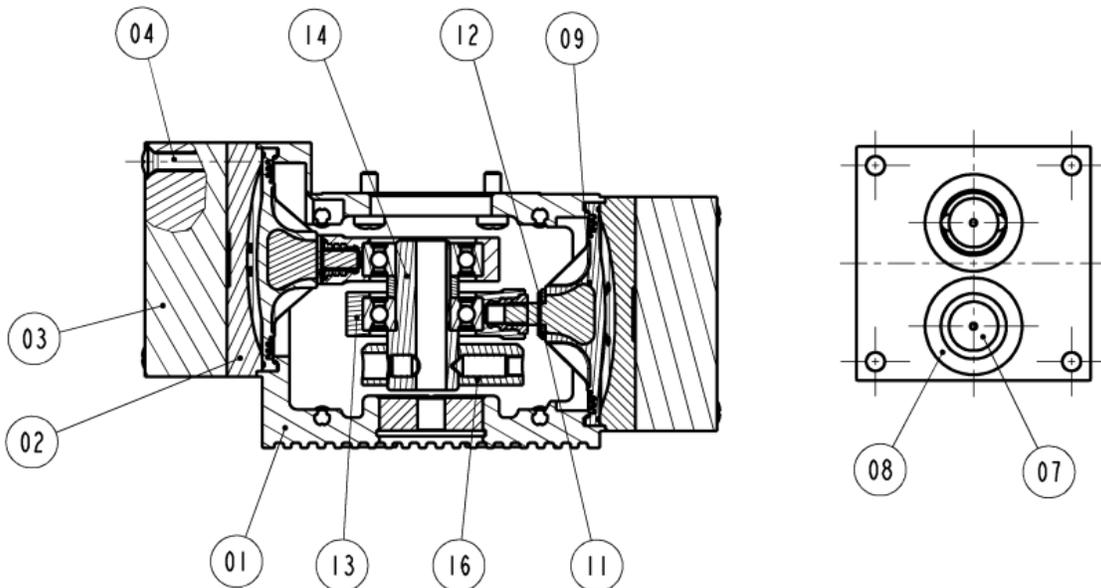


Fig. 7: Model UN 85.3

Proceed as follows:

a) Removing the pump head model UN 86

(See figs. 4 and 5)

1. Make a mark **(M)** on the head plate **(3)**, intermediate plate **(2)**, and housing **(1)** with a felt-tip pen. This helps avoid incorrect assembly later.
2. Undo the 4 screws (with washers if included) **(4)** in the head plate and lift the head plate with the intermediate plate off the pump housing. (If washers are included with the screws, be sure to keep them on the screw body for ease of re-assembly.)
3. Only for models with dc motors (no cooling fan): remove cover **(6)** from pump housing **(1)**; to do this insert a screwdriver into the slots on the sides, and prise the cover off (with care the adhesive gasket between cover and housing may be reused).

On these models, which have no fan, where reference is made to turning or holding the cooling fan, the necessary operations must be carried out by turning or holding the counterweight **(16)**.

a) Removing the pump head model UN 85.3

(See figs. 6 and 7)

1. Make a mark **(M)** on the head plate **(3)**, intermediate plate **(2)**, and housing **(1)** with a felt-tip pen. This helps avoid incorrect assembly later.
2. Remove the pneumatic connection **(5)** by pulling the tubing from the connectors.
3. Undo the 4 screws (with washers if included) **(4)** in the head plate and lift the head plate **(3)** with the intermediate plate **(2)** off the pump housing. (If washers are included with the screws, be sure to keep them on the screw body for ease of re-assembly.)
4. Only for models with dc motors (no cooling fan): undo the 4 screws securing the cover **(6)** to the pump housing **(1)**, and remove the cover **(6)**.

On these models, which have no fan, where reference is made to turning or holding the cooling fan, the necessary operations must be carried out by turning or holding the counterweight **(16)**.

b) Changing the diaphragm model UN 86

(See figs. 4 and 5)

1. Turn the fan to bring the structured diaphragm **(9)** to top dead centre.

2. Lift the edge of the diaphragm, and gripping it on opposite sides, unscrew it by turning counter-clock-wise. Please take care that the diaphragm shim rings (**11&12**) on the threaded portion of the diaphragm do not fall into the housing.
3. Take the diaphragm shim rings (**11**), and diaphragm support cup (**10**) off the threaded portion of the diaphragm and retain them.
4. Check that all parts are free from dirt and clean them if necessary (see section 6. *Cleaning*).
5. Put the diaphragm support cup and diaphragm shim rings, in that order, on the thread of the new diaphragm.
6. Turn the fan until the connecting rod (**13**) is at top dead centre.
7. Screw the new structured diaphragm, complete with diaphragm support, diaphragm shim ring(s), and spring washer, into the connecting rod (clockwise) and tighten it by hand.

b) Changing the diaphragm model UN 85.3

(See figs. 6 and 7)

1. Turn the fan to bring the structured diaphragm (**9**) to top dead centre.
2. Lift the edge of the diaphragm, and gripping it on opposite sides, unscrew it by turning counter-clock-wise. Please take care that the spring washers (**12**) and diaphragm shim ring(s) (**11**) on the threaded portion of the diaphragm do not fall into the housing.
3. Take the spring washers (**12**), diaphragm shim ring(s) (**11**), and the washer (**15**) off the threaded portion of the diaphragm and retain them.
4. Check that all parts are free from dirt and clean them if necessary (see section 6. *Cleaning*).
5. Put the washer, diaphragm shim ring(s), and spring washer, in that order, on the thread of the new diaphragm.
 - The concave side of the spring washer must be towards the diaphragm.
6. Turn the fan until the connecting rod (**13**) is at top dead centre.
7. Screw the new structured diaphragm, diaphragm shim rings, into the connecting rod (clockwise) and tighten it by hand.

c) Changing the valve plates

(See figs. 4 and 5 for N 85 and N 86, and figs. 6 and 7 for N 85.3)

1. Separate the head plate (**3**) from intermediate plate (**2**).
2. Remove the valve plates or valve plate/sealing rings (**7**) and sealing rings (**8**) (if required) from the intermediate plate.

3. Check that the valve seats in the head plate and intermediate plate are clean. If scratches, distortion, or corrosion are evident on these parts they should be replaced.
4. Lay the new valve plates or valve plate/sealing in the recesses in the intermediate plate. The valve plates or valve plate/sealing rings for suction and pressure sides are identical, as are upper and lower sides of the plates.
5. Check that the valve plates or valve plate/sealing rings are not deformed by moving them gently sideways in their recesses.
6. Lay the sealing rings (if required) on the intermediate plate.

d) Refitting the pump head

(See figs. 4 and 5 for N 86, or figs. 6 and 7 for N 85.3)

1. Turn the fan to bring the diaphragm to top dead centre.
2. Place the intermediate plate (2) with valve plates or valve plate/sealing rings (7) and sealing rings (8) (if required), and head plate (3) on the housing, in the position indicated by the marking (M).
3. Check that the head plate is centred by moving it gently sideways.
4. Gently tighten the screws (4), evenly and diagonally.
5. Turn the fan to check that the pump rotates freely.
6. Turn the fan again to bring the diaphragm to top dead centre.
7. Now tighten all head screws (4) to a torque setting of 70 N-cm.
8. In the case of a dc versions (no cooling fan): reattach the cover (6) to housing (1).
9. In the case of a type N 85.3 refit the pneumatic connection (5).

6. Cleaning

When changing valve plates or valve plate/sealing rings 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.

7. Trouble Shooting

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

The following tips for fault-finding are best employed in the sequence shown.

Pump produces no flow

- Pumps with thermal switches:
Thermal switch has opened due to over-heating.
 - ▶ Disconnect pump from mains and allow cooling.
Trace cause of over-heating and eliminate it.
- Connections or lines are blocked
- An external valve is closed, or a filter blocked.
- Liquid (condensate) has collected in the pump head.
 - ▶ Let the pump run for a few minutes pumping air (if necessary for safety reasons: pumping an inert gas.)
 - ▶ Install the pump at the highest point in the system.
- Diaphragms or valve plates are worn.
 - ▶ Section 5 Servicing.

Flow, pressure, or vacuum too low

- Compare the actual performance with the figures in section 10 or the data sheet.
- There is pressure on the pressure side, and at the same time vacuum or a pressure above atmospheric, on the suction side.
 - ▶ The pump is not designed for this condition.
- The cross-section of pneumatic lines, or connected components is too small, or they are restricted.
 - ▶ To measure the performance, disconnect the pump from the system (small diameter tubing or a valve can significantly affect performance).
- There is a leak at a connector, in a line, or in the pump head.
- Diaphragm or valve plate are worn, or dirt is in the head:
 - ▶ Section 5 Servicing.
- N 85.3: after changing the diaphragms or valve plates, the head has been reassembled in the wrong position.

If the pump does not operate properly and you cannot find any of the above faults, send it to the KNF Service Department.

In order for KNF to repair the pump, the customer must provide a

statement on the media which were pumped and on pump cleaning. Please fill out the corresponding KNF form, and submit it together with the pump. A sample statement for copying can be found in section 11 of these operating instructions.

8. Spare parts

- For pump heads with head plate screws only:
1 diaphragm, 2 valve plates and 2 sealing rings.
- For pump heads with head plate screws and washers:
1 diaphragm, 2 valve plate/sealing rings.

Pos. Nr*	Description	Order-No.
(2)	Intermediate Plate for UN86KN ..., UN85.3KN ... UN 86KT ..., UN 85.3KT...	074191 204635
(3)	Head Plate	074190
(4)	Screw	010567
(5)	Connection for UN 85.3 ...	071348
(7)	Valve Plate for UN85.3KN ... UN85.3KT ..., UN86KT ... UN86KN ...	022582 022581 026242
	Valve Plate / Sealing Ring for UN85.3KN ... UN85.3KT ..., UN86KT ... UN86KN ...	117523 117520 117517
(8)	Sealing Ring (if required) for UN85.3KN ... UN85.3KT ..., UN86KT ... UN86KN ...	022584 022583 026241
(9)	Structured Diaphragm for UN85.3KN ... UN86KT ... UN85.3KT UN86KN	027629 022460 022460 026968
(10)	Diaphragm Support Cup UN86KN ..., UN86KT ...	043399
(11)	Diaphragm Shim Ring (0.1 mm)	024986
(12)	Diaphragm Shim Ring (0.5 mm)	021446

Tab. 4: Spare Parts

*according to figs. 4 to 7

9. Accessories

Description	Order-No.
Silencer/Filter	072233
Hose Connector 1/8 MPTM, 1/4 HID	072235
Rubber Foot for UN85.3.I and N86.I	024435

Tab. 5: Accessories

10. Tables

Pump type	Max. permissible operating pressure (bar g)	Ultimate vacuum (mbar abs.)	Delivery rate* (l/min) at atm. pressure
UN85.3KNI	0.3	25	5
UN85.3KTI	0.3	30	5
UN85.3KNDC	0.3	25	5
UN85.3KTDC	0.3	30	5.5
UN86KNI	2.4	100	6
UN86KTI	2.5	160	5.5
UN86KNDC	1.5	100	6.5
UN86KTDC	1.5	160	6
UN86KNDCB	2.4	100	6
UN86KTDCB	2.5	160	5.5

Tab. 6: Pneumatic Data

*Litre at STP

Pump type	Material*		
	Pump head	Structured diaphragm	Valves
UN85.3KNI	PPS	EPDM	CR
UN85.3KTI	PPS	PTFE	FFPM
UN85.3KNDC	PPS	EPDM	CR
UN85.3KTDC	PPS	PTFE	FFPM
UN86KNI	PPS	EPDM	FPM
UN86KTI	PPS	PTFE	FFPM
UN86KNDC	PPS	EPDM	FPM
UN86KTDC	PPS	PTFE	FFPM
UN86KNDCB	PPS	EPDM	FPM
UN86KTDCB	PPS	PTFE	FFPM

Tab. 7: Pump Materials

* Material abbreviations according to DIN ISO 1629 and 1043.1

11. Product Return

- ➔ KNF provides warranty and non-warranty repair services for all products.
- ➔ A Return Material Authorization (RMA) number is required for all product returns.
 - To receive an RMA number, submit a completed Decontamination Declaration form to rma@knf.com
- ➔ The Decontamination Declaration form can be obtained from our website or by contacting KNF Technical Services.
 - <http://www.knf.com/pdfs/decontamdec.doc>
 - Phone: 609-890-8600
- ➔ Product return instructions will be provided when the RMA is issued.

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