

Operating and Installation Instructions

Mini Diaphragm Vacuum Pumps

Type ranges:	UN89KNI	UN811KNI	UN815KNI
	UN89KTI	UN811KTI	UN815KTI
	UN89KNDC	UN811KNDC	UN815KNDC
	UN89KTDC	UN811KTDC	UN815KTDC

Mini Diaphragm Vacuum Pumps and Compressors

Type range:	UN814KNI	UN814KTI
	UN814KNDC	UN814KTDC



Fig. 1: UN89KNDC



Fig.. 2: UN815KNI

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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List of Contents

	Page
1. Description, Operating Conditions.....	2
2. Safety.....	3
3. Installation.....	4
4. Operation.....	5
5. Servicing.....	6
6. Cleaning.....	9
7. Trouble Shooting.....	10
8. Spare parts.....	11
9. Accessories.....	12
10. Tables.....	13
11. Product Return.....	14

1. Description, Operating Conditions

KNF pumps in the UN89, UN811, UN814 and UN815 range transfer and evacuate 100% oil-free. In operation they are gas-tight, and maintenance-free.

1.1. Electrical Equipment

See the motor-plate for full electrical data of the motor.

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 UN89, UN811, UN814 and UN815 range must not be used for liquids. You will find suitable liquid pumps in our Pro-duct 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 pumps must not be used in areas where there is a danger of explosion.
- The pumps must be protected from the effects of dust and water.
- During operation an adequate supply of air for cooling must be provided.

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 pumps have 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.

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.

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

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:

UN89K_I	UN89K_DC
UN811K_I	UN811K_DC
UN814K_I	UN814K_DC
UN815K_I	UN815K_DC
DIN EN 55014-1/2	DIN EN 55014-1/2
DIN EN 61000-3-2/3	DIN EN 60034-1
DIN EN 60335-1	

Tab. 1

3. Installation

The pumps in the UN89, UN811, UN814 and UN815 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	<p>The dimensions of the mountings are given in Data Sheet.</p> <p>Install the pump so that the fan can draw in sufficient cooling air.</p> <p>For pumps with fan: Install the pump so that accidental finger contact with the fan is impossible.</p> <p>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.</p>
Electrical	<p>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.</p> <p>Compare the supply data with the data on the motor-plate. The voltage must not vary by more than +10% and -10% from that shown on the type-plate.</p> <p>The earth (ground) wire must be connected to the motor (not necessary on dc motors up to 24 V).</p> <p>For brushed dc motor lead wires connection:</p> <ul style="list-style-type: none"> • Red: V+ • Black: Ground <p>Caution: → Incorrect lead wire connection will damage motor.</p> <p>For brushless dc motor lead wire connection:</p> <ul style="list-style-type: none"> • Red: V+ • Blue: Ground • White: Voltage control 0-5 V DC (4 wire motor only) • Green: Frequency output (4 wire motor only) <p>Caution: → Incorrect lead wire connection will damage motor.</p> <p>In the electrical installation, arrangements (complying with EN 60335-1) must be made for disconnecting the pump motor from the electrical supply.</p> <p>The pump must be installed so that contact with live parts (connection, possibly windings) is impossible.</p> <p>For pumps with ac motor: We recommend that a fuse is installed in the supply circuit; the operating current is given in Data Sheet.</p>
Pneumatic	<p>Remove the protection plugs from the port threads.</p> <p>The accessories silencer, and hose connectors (where applicable) are screwed into the port threads.</p> <p>Connect the suction and pressure lines. For the flow direction, see the marking on the pump head or data sheet.</p> <p>Arrange the suction and pressure lines so that condensate cannot run into the pump (sloping lines).</p>

4. Operation

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

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 (table 1).
- 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.

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).

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.

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.

Diaphragm and valve plates/sealings 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/sealings are the only parts of the pump subject to wear. They are simple to change.

Always change diaphragm and valve plates/sealings at the same time.

Spare part	Spare part*	Quantity
	Valve plates/sealings	2
	Structured diaphragm	1

Tab. 2

* According to Spare parts list, section 8

Tools	Type range	Tools/Material
	All beside UN815KNI and UN815KTI	Phillips screwdriver no. 1
	Only UN 815	Phillips screwdriver no. 2
		Felt-tip pen

Tab. 3

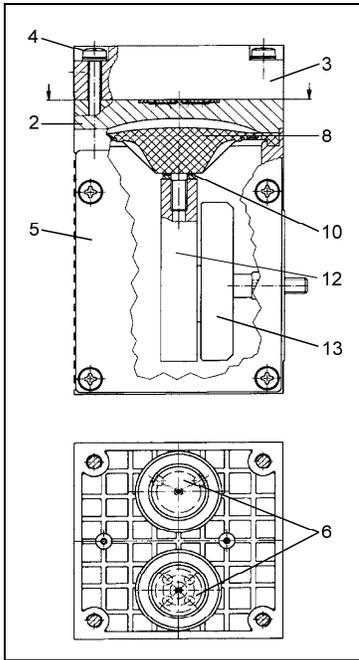


Fig. 3: Type ranges UN89 / UN811

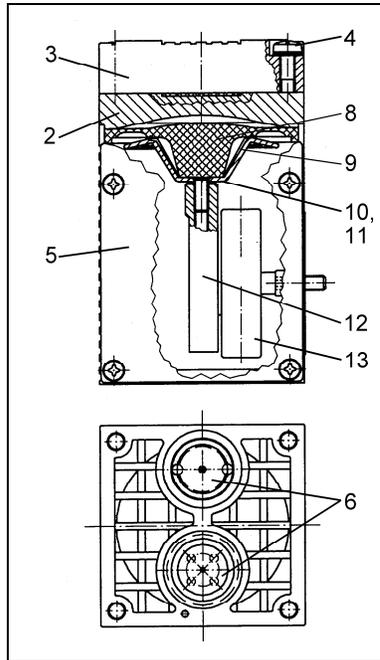


Fig. 4: Type range UN815

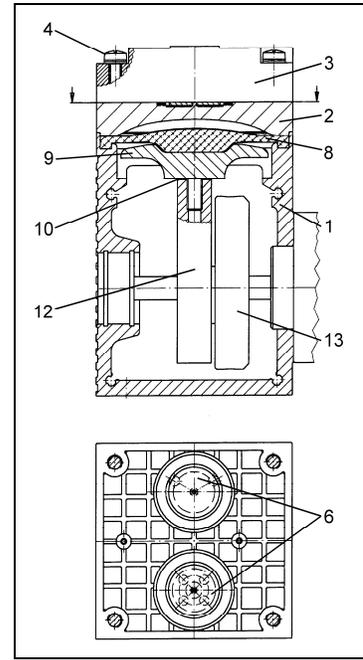


Fig. 5: Type range UN814

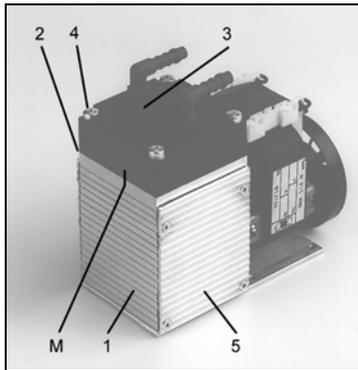


Fig. 6: (for all pump types)

Specification

Pos. Description

- 1 Housing
- 2 Intermediate plate
- 3 Head plate
- 4 Screw
- 5 Cover
- 6 Valve plate/sealing
- 8 Structured diaphragm
- 9 Diaphragm support cup (only for type UN815)
- 9 Connection rod disc (only for type UN814)
- 10 Diaphragm shim ring(s)
- 12 Connection rod
- 13 Counter weight

M: Mark

Change the diaphragm and valve plates/sealings in the following sequence:

- a) Remove pump head
- b) Change structured diaphragm
- c) Change valve plates/sealings
- d) Refit pump head

Proceed as follows (see figs. 3 and 6 for type ranges UN89 / UN 811, figs. 5 and 6 for type range N 814, or figs. 4 and 6 for type range N 815):

a) Remove pump head

1. Make a mark (**M**) on the head plate (**3**), Intermediate plate (**2**) and housing (**1**) This helps avoid incorrect assembly later.
2. Undo the 4 screws (**4**) in the head plate and lift the head plate with the intermediate plate off the pump housing.
3. Only for models with dc motors (no cooling fan): Remove cover (**5**) from pump housing after loosening the four screws.
 - 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 (**13**).

b) Change structured diaphragm

1. Turn the fan to bring the structured diaphragm (**8**) to top dead centre.
2. Lift the edge of the structured diaphragm and, gripping it on opposite sides, unscrew it by turning counter-clockwise.
3. Type ranges UN89 / UN811:
Take the diaphragm shim ring(s) (**10**) off the threaded portion of the structured diaphragm and retain them.
Type range UN814:
Take the connection rod disc (**9**) and the diaphragm shim ring (s) (**10**) off the threaded portion of the structured diaphragm and retain them.
Type range UN815:
Take the diaphragm support cup (**9**) and the diaphragm shim rings (**10**), off the threaded portion of the structured diaphragm and retain them.
4. Check that all parts are free from dirt and clean them if necessary (see section 6. Cleaning).
5. Type ranges UN89 / UN811:
Put the diaphragm shim ring (s) (**10**) on the thread of the new structured diaphragm.
Type range UN814:
Put the connection rod disc (**9**), and the diaphragm shim rings (**10**) on the thread of the new structured diaphragm.
Type range UN815:
Put the diaphragm support cup (**9**) and the diaphragm shim ring(s) (**10**), in that order, on the thread of the new structured diaphragm.
6. Turn the fan until the connecting rod (**12**) is at top dead centre.
7. Screw the structured diaphragm, complete with diaphragm support (only type ranges UN814 and UN815), and diaphragm shim ring(s) (only type range UN815) into the connecting rod (clockwise) and tighten it by hand.

c) Change valve plates/sealings

1. Separate the head plate (3) from intermediate plate (2).
2. Remove the valve plates/sealings (6) 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/sealings (6) in the recesses in the intermediate plate (2). The valve plates/sealings for suction and pressure sides are identical, as are upper and lower sides of the valve plates/sealings.
5. Check that the valve plates/sealings are not deformed by moving them gently sideways in their recesses.

d) Refit pump head

1. Turn the fan to bring the structured diaphragm to top dead centre.
2. Place the intermediate plate (2) and head plate (3) on the housing, in the position indicated by the marking (M).
3. Check that the head plate is centered 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 screws (4) firmly In the case of dc version (no cooling fan): reattach the cover (5) to housing (1).

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

6. Cleaning

When changing valve plates and wave 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

- For pumps with a thermal switch:
Thermal switch has opened due to over-heating of motor.
 - ▶ Disconnect pump from mains and allow it to cool.
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/sealings are worn.
 - ▶ Section 5 Servicing.

Flow, pressure, or vacuum too low

- Compare the actual performance with the figures in section 9 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 plates/sealings are worn, or dirt is in the head.
 - ▶ Section 5 Servicing.

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 and Installation Instructions.

8. Spare parts

Pump range UN89

Pos. Nr.*	Spare part	Pump type	Order-No.
(2)	Intermediate plate	UN89KNI, UN89KNDC	074524
(2)	Intermediate plate	UN89KTI, UN89KTDC	203751
(3)	Head plate		074192
(6)	Valve plate/sealing	UN89KNI, UN89KNDC	074523
(6)	Valve plate/sealing	UN89KTI, UN89KTDC	113950
(8)	Structured diaphragm	UN89KNI, UN89KNDC	029231
(8)	Structured diaphragm	UN89KTI, UN89KTDC	029232

Tab. 4

*according to figs. 3 and 6

Pump range UN811

Pos. Nr.*	Spare part	Pump type	Order-No.
(2)	Intermediate plate	UN811KNI, UN811KNDC	074524
(2)	Intermediate plate	UN811KTI, UN811KTDC	203751
(3)	Head plate		074192
(6)	Valve plate/sealing	UN811KNI, UN811KNDC	074523
(6)	Valve plate/sealing	UN811KTI, UN811KTDC	113950
(8)	Structured diaphragm	UN811KNI, UN811KNDC	029231
(8)	Structured diaphragm	UN811KTI, UN811KTDC	029232

Tab. 5

*according to figs. 3 and 6

Pump range UN814

Pos. Nr.*	Spare part	Pump type	Order-No.
(2)	Intermediate plate		043259
(3)	Head plate		073631
(6)	Valve plate/sealing	UN814KNI, UN814KNDC	113949
(6)	Valve plate/sealing	UN814KTI, UN814KTDC	113950
(8)	Structured diaphragm	UN814KNI, UN814KNDC	043262
(8)	Structured diaphragm	UN814KTI, UN814KTDC	043261

Tab. 6

*according to figs. 5 and 6

Pump range UN815

Pos. Nr.*	Spare part	Pump type	Order-No.
(2)	Intermediate plate		074196
(3)	Head plate		074194
(6)	Valve plate/sealing	UN815KNI, UN815KNDC	059267
(6)	Valve plate/sealing	UN815KTI, UN815KTDC	057172
(8)	Structured diaphragm	UN815KNI, UN815KNDC	026160
(8)	Structured diaphragm	UN815KTI, UN815KTDC	024490
(9)	Diaphragm support cup		025064

Tab. 7

*according to figs. 4 and 6

9. Accessories

UN89, UN811, UN814, UN815

Description	Order No.
Filter/ Silencer	072233
Hose Connector 1/8 MPTM, ¼ HID	072235

Tab. 8

10. Tables

Pump type	Max. permissible operating pressure (bar g)	Ultimate vacuum (mbar abs.)	Delivery rate* (l/min) at atm. pressure
UN89KNI	0.5	100	9.5
UN89KNDC	0.5	100	9
UN89KTI	0.5	170	9.5
UN89KTDC	0.5	170	9
UN811KNI	0.5	100	11.5
UN811KNDC	0.5	100	11
UN811KTI	0.5	170	11.5
UN811KTDC	0.5	170	11
UN814KNI	2.0	240	11.5
UN814KNDC	2.0	240	12
UN814KTI	2.0	290	11.5
UN814KTDC	2.0	290	12
UN815KNI	-	100	15
UN815KNDC	-	100	16
UN815KTI	-	160	14
UN815KTDC	-	160	15

Tab. 10: Pneumatic Data

*Litre at STP (1013 mbar)

Pump type	Material*		
	Pump head	Wave diaphragm	Valve
UN89KNI	PPS	EPDM	CR
UN89KNDC	PPS	EPDM	CR
UN89KTI	PPS	PTFE-coated	FFPM
UN89KTDC	PPS	PTFE-coated	FFPM
UN811KNI	PPS	EPDM	CR
UN811KNDC	PPS	EPDM	CR
UN811KTI	PPS	PTFE-coated	FFPM
UN811KTDC	PPS	PTFE-coated	FFPM
UN814KNI	PPS	EPDM	FPM
UN814KNDC	PPS	EPDM	FPM
UN814KTI	PPS	PTFE-coated	FFPM
UN814KTDC	PPS	PTFE-coated	FFPM
UN815KNI	PPS	CR	EPDM
UN815KNDC	PPS	CR	EPDM
UN815KTI	PPS	PTFE-coated	FFPM
UN815KTDC	PPS	PTFE-coated	FFPM

Tab. 11: Pump Materials

*Material abbreviations according 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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