Operating and Installation Instructions

Diaphragm Vacuum Pump and Compressor

Type range: **N 87 TTE**



Fig. 1: N 87 TTE

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 “PJ“ or “PM“) 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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KNF 121538-121541 09/19
Translation of original Operating and Installation Instructions, english

1. Description, Operating Conditions

KNF pumps in the N 87 range transfer, evacuate and compress 100% oil-free. In operation they are gas-tight, and maintenance-free.

1.1. Electrical Equipment

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

The Protection class of standard versions is IP54.

The motors used are fitted as standard with a thermal switch to protect against overloading.

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. You will find suitable pumps for areas where there is a danger of explosion in our Product Program.

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 87 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 not be used in areas where there is a danger of explosion.
- During operation an adequate supply of air for cooling must be provided.

1.4. Pump materials

See section 10.

2. Safety

Note that the pumps may only be used for their intended purpose (see section 1).

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

For vacuum pumps, the exhaust gases must be disposed safely.

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.

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 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.

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.

CE

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

The following harmonized standards have been used:

- DIN EN 50581
- DIN EN 55014-1/2
- DIN EN 61000-3-2/3
- DIN EN 60204-1

3. Installation

The pumps 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.

Install the pump so that the fan can draw in sufficient cooling air.

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.

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 +10% and -10% from that shown on the type-plate.

The motor must be connected to earth (ground) wire.

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 is impossible.

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

Pneumatic

Remove the protection plugs from the port threads.

Connect the suction and pressure lines (thread size G 1/8). For flow direction see marking on the pump head or data sheet.

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

4. Operation

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

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 (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.

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.

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.

Pumps that may be employed as vacuum pump and compressor must not be used to produce vacuum and pressure at the same time.

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.

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

Always change structured diaphragm, valve plates/sealings at the same time. If the structured diaphragm and the valve plates/sealings are not changed at the same time the nominal performance of the pump is not guaranteed after the service.

If a pump has been used for aggressive or toxic substances or other types of substances which are hazardous, hazardous to health, or injurious, the following points must be observed:

1. Clean the pump and its components before servicing.
2. Ensure that the service personnel is not subject to a health hazard. Apply the safety and protection measures that are necessary for the medium that has been handled by the pump (example: the use of protective gloves).
3. Ensure that discarded parts and materials are safely and correctly disposed of.

Parts required

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

Tab. 1 ** According to Spare parts list, section 8*

Tools required

Tools
Philips screwdriver no. 2
Philips screwdriver no. 1
Felt-tip marker

Tab. 2

Change the structured 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. 2 and 3):

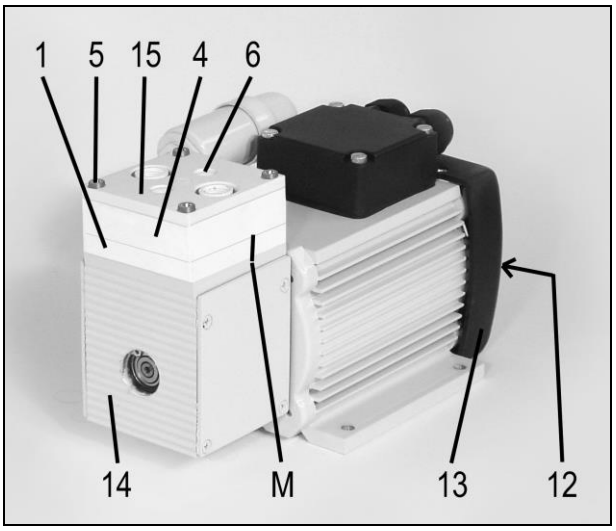


Fig. 2: Pump N 87 TTE

Specification

Pos Description

1 Intermediate plate
2 Valve plate/Sealing
3 does not exist
4 Head plate
5 Screw
6 Screw cap
7 Screw
8 Structured diaphragm
9 Diaphragm support
10 Diaphragm spacer
11 Disk spring
12 Fan
13 Fan cover
14 Housing
15 Top plate

M Mark

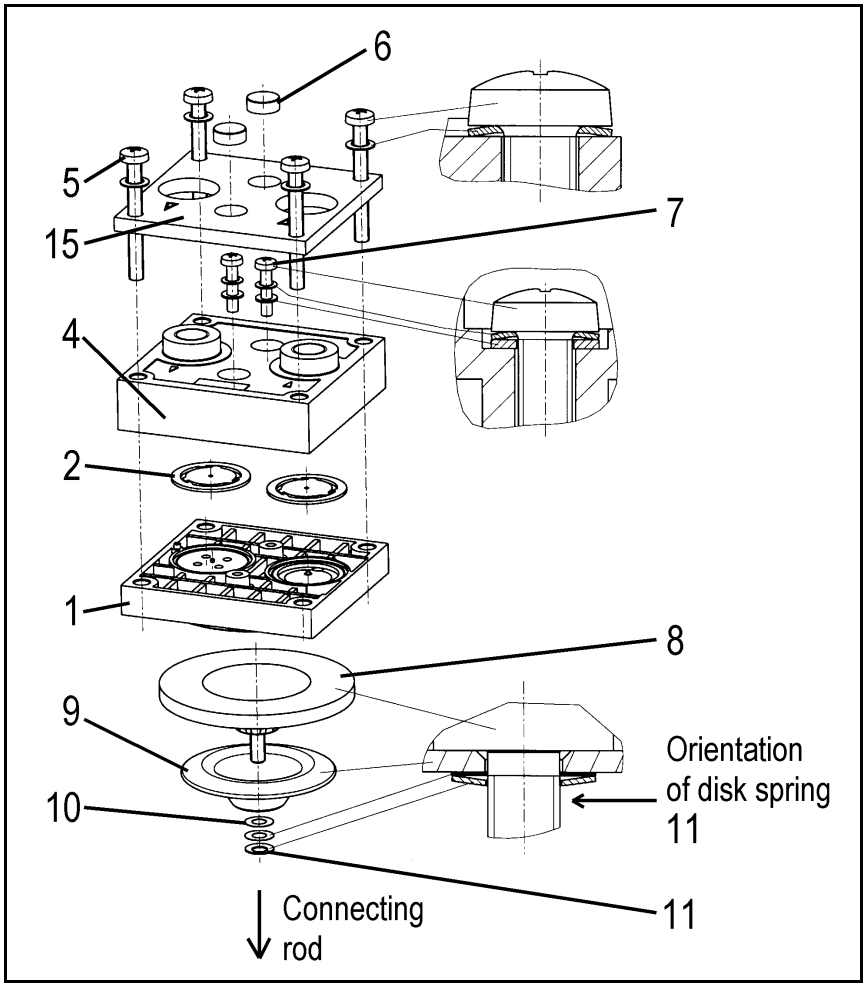


Fig. 3: Pump head (exploded drawing)

a) Remove pump head

1. Mark the position of top plate (**15**), head plate (**4**), intermediate plate (**1**) and housing (**14**) relative to each other by a drawing line (**M**) with a felt tip marker. This helps avoid incorrect assembly later.
2. Undo the 4 head screws (**5**) and remove top plate (**15**) and head plate (**4**) together with intermediate plate (**1**) from the pump housing.
3. Remove fan cover (**13**) from housing after loosening the four screws.

b) Change structured diaphragm

1. Turn the fan (**12**) to bring the structured diaphragm (**8**) to top dead centre.
2. Lift the edge of the structured diaphragm (**8**) and, gripping it on opposite sides, unscrew it by turning anti-clockwise.
3. Take the diaphragm support (**9**), diaphragm spacer(s) (**10**), and disk spring (**11**) 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. Put the diaphragm support (**9**), diaphragm spacer(s) (**10**), and disk spring (**11**), in that order, on the thread of the new structured diaphragm.
   The concave side of the disk spring must be towards the structured diaphragm.
6. Turn the fan (**12**) until the connecting rod (connecting part between motor shaft and structured diaphragm) is at top dead centre.
7. Screw the new structured diaphragm (**8**), complete with diaphragm support (**9**), diaphragm spacer(s) (**10**) and disk spring (**11**), into the connecting rod (clockwise) and tighten it by hand.

c) Change valve plates/sealings

1. Undo the screws (**7**).
2. Separate the head plate (**4**) from intermediate plate (**1**).
3. Remove the valve plates/sealings (**2**) from the intermediate plate (**1**).
4. 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.
5. Lay the new valve plates/sealings (**2**) in the recesses in the intermediate plate (**1**). The valve plates/sealings for suction and pressure sides are identical, as are upper and lower sides of the valve plates/sealings.

6. Place the head plate (**4**) on the intermediate plate (**1**), in the position indicated by the marking (**M**).
7. Check that the head plate (**4**) is centred by moving it gently sideways.
8. Join the head plate (**4**) and the intermediate plate (**1**) by tightening the two screws (**7**) with disk spring and washer until the screw heads are just seated (that is to say, until the first resistance is felt); than tighten each screw (**7**) another quarter-turn.

d) Refit pump head

1. Place the pump head (consisting of intermediate plate (**1**) with valve plates/sealings (**2**) and head plate (**4**)) on the housing according to the marking (**M**).
2. Place the top plate (**15**) on the head plate (**4**) according to the marking (**M**).
3. Tighten the screws (**5**) with disk spring gently diagonally.
4. Turn the fan (**12**) to check that the pump rotates freely.
5. Now tighten screws (**5**) diagonally, until the disk spring lies on plainly.
6. Refix the fan cover (**13**).

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

6. Cleaning

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

- Thermal switch has opened due to over-heating.
  - ▸ Disconnect pump from mains and allow 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 10 or the data sheet.
- 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.
- 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.

8. Spare parts

Pos. No*	Spare part	Order No.
(**2**)	Valve plate/sealing	057172
(**8**)	Structured diaphragm	024490

Tab. 3: Spare parts **according fig. 2 and 3*

9. Accessories

Description	Order No.
Hose connector for tube ID 6 (PVDF, G 1/8)	014052
Inserted screw connection D 6 (PVDF, G 1/8)	014049

Tab. 4: Accessories

10. Tables

Pump type	Max. permissible operating pressure (bar g)	Ultimate vacuum (mbar abs.)	Delivery rate* (l/min) at atm. pressure
N 87 TTE	1.5	140	7.5

Tab. 5: Pneumatic Data **Litre at STP*

Pump type	Material		
	Pump head	Structured diaphragm	Valve plates/ sealings
N 87 TTE	PVDF	PTFE	FFPM

Tab. 6: Pump Materials

11. 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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