

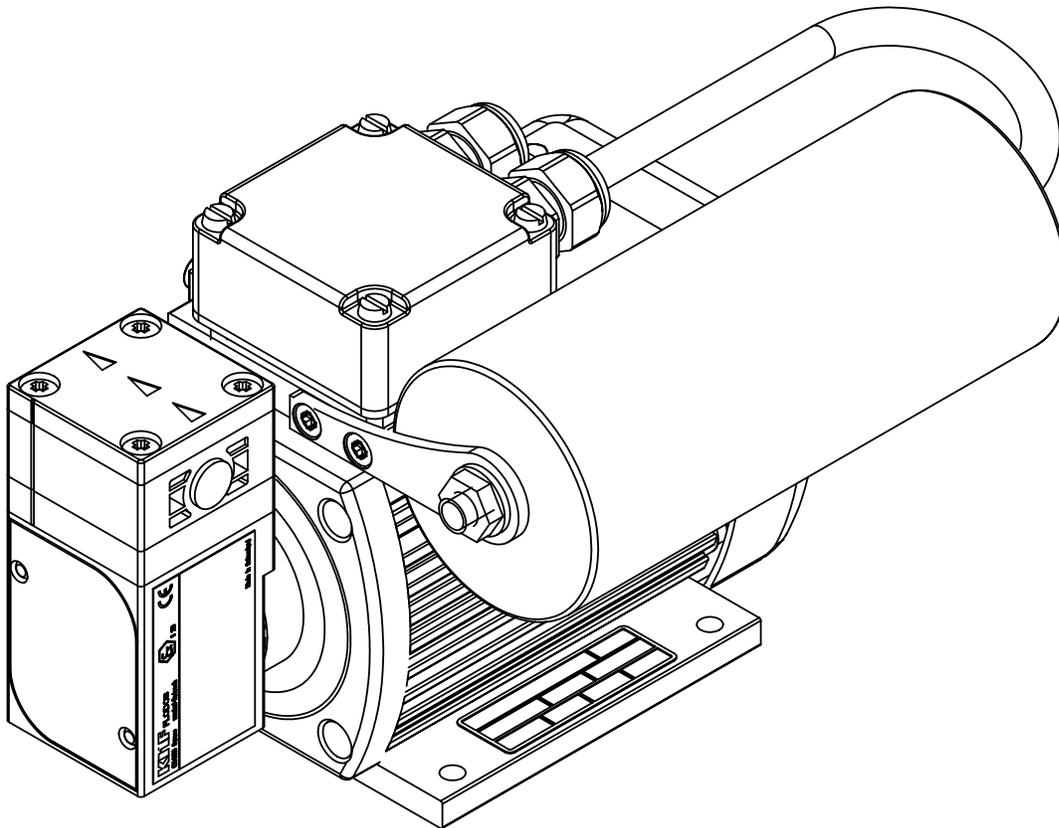
## NF 1.100 EX Diaphragm Liquid Pumps Operating Instructions



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid property damage, possible injury or death.

You have selected a KNF diaphragm liquid pump; the following tips will help you operate it safely and reliably over a long period. It is essential that you read these operating instructions before putting the pump into service. Follow them for all applications, they help prevent dangerous situations and damage.

These instructions apply to the series production pump models listed above. If there is a single letter before the "NF", this serves only to distinguish models for particular countries, it is not a technical identification. For customer-specific projects (their model codes begin with "PL" or "PML") there may be detail deviations from these operating instructions. In the case of project pumps therefore, please observe the agreed technical specification in addition to these operating instructions.



**II 2G EEx c IIB T5 X**

+5°C Ta +40°C

**EX8 03 09 39495 003 X**

These operating instructions apply to a pump without drive motor. Use of the pump also requires that the corresponding operating instructions for the drive motor be followed.

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## 1. Pump overview

1 Pump types
NF 1.100 E EX
NF 1.100.27 E EX

## 2. Description

It is essential that you read these operating instructions before putting the pump into service. Follow them for all applications, they help prevent dangerous situations and damage.

### 2.1 Pump variations

The diaphragm liquid pumps in the NF1.100-series are available in different variations.

1	Pump type		
	Flow rate at atmos. pressure	Max. suction head	Max. pressure head
	[l/min]	[mWg]	[mWg]
NF 1.100...	1.2	4	40

Flow rate is measured with water at 20°C.

2	Materials of head components	
NF 1.100 KP... (.27)	Head Valves Diaphragm O-ring Resonating diaphragm Diaphragm .27	PP EPDM PTFE-coated EPDM PTFE EPDM
NF 1.100 KT... (.27)	Head Valves Diaphragm O-ring Resonating diaphragm Diaphragm .27	PP FFPM PTFE-coated PTFE PTFE FFPM/FPM
NF 1.100 TT... (.27)	Head Valves Diaphragm O-ring Resonating diaphragm Diaphragm .27	PVDF FFPM PTFE-coated PTFE PTFE FFPM/FPM

3	Head configuration
NF ...	Given flow rate
NF ... .27	Given flow rate with over pressure relief valve.

4	Voltage / frequency
230 V / 50 Hz	For Ex-proof motors

#### Types of motor:

NF 1.100... E EX : Capacitor motor IP54

## 2.2 Operating principles

A diaphragm liquid pump is an oscillating positive displacement pump. An eccentric converts the rotary motion of the drive shaft into an oscillating movement of a connecting rod, which in turn transmits its motion to the diaphragm. In combination with inlet and outlet valves, this diaphragm motion produces the pumping action.

### 2.2.1 NF 1.100 - version (given flow rate)

This version illustrates the flow rates for the basic model.

### 2.2.2 NF 1.100 .27 - version (Integrated over-pressure relief valve)

The integrated over-pressure relief valve is available for all NF1.100 pumps.

How it works: If the pump runs against a closed system the pressure will increase rapidly and exceed the allowed limits. In order to prevent this from happening a relief valve has been integrated into the head. Should the pressure exceed the adjusted value (min. 1 up to 4 barg) the valve will open allowing the liquid to pass through the built-in bypass back into the inlet thus preventing the further build up of pressure. The factory sets the valve to a standard value of 4 barg.

## 2.3 Features of diaphragm liquid pumps

- These liquid pumps are self-priming, can run dry without damage, and are quiet.
- Compact, space-saving design.
- By using chemically-resistant materials such as PTFE, PVDF, FFPM, or other combinations of materials for parts that come into contact with the liquid, almost all neutral and aggressive liquids/gases can be handled.
- Diaphragm and valve plates are easy to change.

## 3. Areas of use

The KNF liquid pump NF1.100 is 100% oil free, liquid and gas tight and requires little or no maintenance.

The pump is designed for Equipment Group II and corresponds to Equipment Category 2. This means it can under certain conditions be used in areas where explosive atmospheres are likely to occur. This applies to gases and vapors as the explosive atmosphere and only in industrial use; its use is prohibited in mines and when mine gas is present. The exact conditions for use can be found below in these operating instructions as well as in the operating instructions for the drive motor.

### 3.1 Electrical data

- See type plate on drive motor.

### 3.2 Operating conditions

- ⚠ The pump may be used under certain conditions in industries (Equipment Group II of Directive 94/9/EC) for gases, vapors and mists (G) in areas where explosive atmospheres are likely to occur (Category 2). The conditions under which the pump can then be used are described in this section, in section 6 «Operation» as well as in the operating instructions for the drive motor.
- ⚠ The pump is intended for pumping liquids. Gases, vapors and mists in gas group II B, temperature class T5 can be pumped as the pump is being primed.  
The pump may only be used if:
  - a) the medium to be delivered is not explosive or belongs to one of the above named explosion groups, and
  - b) the environment in which the pump is located does not contain a potentially explosive atmosphere, or there is a potentially explosive atmosphere which belongs to one of the

above-named explosion groups. For temperature class, see section 3.3 «Ambient conditions».

- ⚠ The pump may not be used in areas where the explosive atmosphere is present constantly, for long periods of time or frequently.
- ⚠ Before using a medium, the operator must check whether the medium can be used without danger in the specific application; in particular, it must be ensured that even under extreme operating conditions (e.g. with respect to temperature, pressure and system fault conditions where the pump is installed) there is no risk of explosion.
  - Permissible media temperature: +5°C to +40°C.
  - Maximum permissible operating pressure, final vacuum, flow rate: see section 2.1 «Pump variations».
- ⚠ When classifying a pump environment into a potentially explosive atmosphere zone, apply the prevailing national and international regulations and guidelines for preventing hazards from explosive atmospheres. In special cases or where there is doubt concerning the assessment of the potentially explosive atmospheres, please contact KNF.
- 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 2.1 «Pump variations»). If you have more detailed questions, please contact KNF.
- The pumps must be protected from shocks and vibration.
- During operation an adequate supply of air for cooling must be provided.
- ⚠ If the pump is not equipped with a .27 valve (safety device) then the customer must arrange for the system to be protected against the build up of excessive pressures between the pump and the first shut-off valve downstream.
- ⚠ Use of the pump also requires that the corresponding operating instructions for the drive motor be followed.

If your potential application lies outside the above limits, please contact KNF.

### 3.3 Ambient conditions

- When the pump is operating the following ambient conditions must be maintained:
  - ▽ Ambient temperature during operation: see type-plate.
- ⚠ For use in hazardous environments containing combustible gases, vapors and aerosols the lowest ignition temperature of a possible hazardous atmosphere must be higher than the so-called "maximum surface temperature" (according to EN 50014) of the pump. The maximum surface temperature is defined in EN 50014 as the highest temperature obtainable in operation (under the least favorable conditions, but within recognized tolerances) by any part or surface of the pump. The maximum surface temperature is determined by the construction of the pump, and indicated on the pump type-plate as the temperature class. Ignition temperature for combustible gases and vapors are given in EN 60097-14 (and DIN VDE 0165).
- ⚠ Before placing the pump in service, you must also ensure that the lowest ignition temperature which could occur in the explosive atmosphere is higher than the "maximum surface temperature" of the motor. If the temperature classes on the motor type-plate and the pump type-plate are different, the lowest temperature class must always prevail. (E.g. motor: temperature class T3; pump: temperature class T4; relevant is temperature class T3).
- ➔ Section 11.2 shows the connection between temperature class, maximum surface temperature and permissible ignition temperature of combustible atmosphere.
- ⚠ In a specific pump application, restrictions for the pump environment will result from the type of explosive atmosphere

present; here you must observe the instructions in sections 3.2 «Operating conditions» and 6 «Operation».

- During operation an adequate supply of air for cooling must be provided.

## 4. Safety

- Note that the pumps may only be used for their intended purpose (see section 3.2 and operating instructions of the motor).
- Observe the safety advisories in sections 3.2 «Operating conditions» 3.3 «Ambient conditions» 5. «Installation» 6. «Operation» as well as in the operating instructions of the drive motor.

▽ The pump complies with Directive 94/9/EC for equipment and protective systems for intended use in potentially explosive atmospheres and meets the Standard EN 13463-1 and the prEN 13463-5 for explosion prevention and protection.

## 5. Installation

- ▲ The pump is an OEM model intended for installation in equipment. When installing it make certain that accident prevention regulations, and safety instructions – including those for subsequent operation (EN 1012) – are observed.
- ▲ Before putting the pump into service it must be established that machinery or equipment in which it is installed meets the relevant regulations.
- ▲ Note that the pump may only be used for the intended purpose (see section 3.2 «Operating conditions»). See also the operating instructions of the drive motor.
- ▲ Installing of the pump also requires that the corresponding operating instructions for the drive motor be followed.

### 5.1 Mechanical

- The dimensions of the mountings are given in the data sheet.
- The eccentric is glued to the motor shaft and further secured with a threaded screw.
- Install the pump so that the fan can draw in sufficient cooling air.
- ▲ The pump must be protected from water, in spray or droplet form, and excessive dust.
- ▲ The pump must be protected by its location or by means of additional measures from water as well as from electrical, chemical, thermal and mechanical influences such that in use the explosion prevention and protection is maintained.

### 5.2 Electrical

- ▲ Use of the pump also requires that the corresponding operating instructions for the drive motor be followed.
- ▲ 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.
- ▲ The pump may only be connected to the electrical supply, if it is certain that it can be safely operated in the potentially explosive atmosphere that is present (see section 3.2 «Operating conditions» and the operating instructions of the drive motor).
- ▲ Only electrical equipment that is absolutely necessary for operating the pump should be located in the hazardous area.
- ▲ The pump must be protected by its location or by means of additional measures from water as well as from electrical, chemical, thermal and mechanical influences such that in use the explosion prevention and protection is maintained.

- ▲ The pump must be installed so that there is no danger of ignition from an electrostatic charging.
- ➔ If there is a danger from an atmospheric discharge, protection against lightning must be arranged.
- ➔ Adequate means must be provided for ventilating, or otherwise removing heat from, the surroundings of the pump.

## 5.3 Hydraulic

- ▲ The customer must arrange for the pump to be protected by some means of pressure relief between the pressure connection on the compressor and the first shut-off valve downstream.
- ➔ If the pump is equipped with a .27-safety valve then a protection system is not required.
- Remove the protective caps from the in-/outlet.
- Equip the pump with hose connectors (recommended hose inside 8mm).
- Push the hoses over the full length of the hose barbs on both inlet and delivery sides.
- Check the installation for leaks.
- The pump, hoses and any other elements in the system must be suitable for the maximum permissible operating pressure.
- Keep the suction line as short as possible.

## 6. Operation

- ▲ The pump may be operated only under the conditions defined in section 3.2 «Operating conditions»; the pump must be connected according to the conditions described under section 5. «Installation». Also observe the conditions for operating the drive motor, which are found in the corresponding operating instructions. Failure to observe the conditions in these sections or in the operating instructions for the drive motor may result in an explosion hazard.
- ▲ The pump is an OEM model intended for installation in equipment. Before putting the pump into service it must be established that machinery or equipment in which it is installed meets the relevant regulations.
- ▲ Before placing the pump in service, verify that the conditions described in the operating instructions for the drive motor are met.
- ▲ For use in hazardous environments containing combustible gases, vapors and aerosols the lowest ignition temperature of a possible hazardous atmosphere must be higher than the so-called "maximum surface temperature" (according to EN 50014) of the pump. The maximum surface temperature is defined in EN 50014 as the highest temperature obtainable in operation (under the least favorable conditions, but within recognized tolerances) by any part or surface of the pump. The maximum surface temperature is determined by the construction of the pump, and indicated on the pump type-plate as the temperature class. Ignition temperature for combustible gases and vapors are given in EN 60097-14 (and DIN VDE 0165).
- ▲ Before placing the pump in service, you must also ensure that the lowest ignition temperature of a possible hazardous atmosphere must be higher than the so-called "maximum surface temperature" of the drive motor.
- ▲ Before using a medium, the operator must check whether the medium can be used without danger in the specific application; in particular, it must be ensured that even under extreme operating conditions (e.g. with respect to temperature, pressure and system fault conditions where the pump is installed) there is no risk of explosion.
- ▲ Specific safety instructions for the media being handled must be observed.
- ▲ Before handling any medium, it must be verified that it will not decompose under the conditions of pressure and temperature which will occur in the pump.
- ▲ Before pumping a medium, the compatibility of materials of

pump head, diaphragm and valves with the medium must be checked (for pump materials: see table 2).

If you have more detailed questions, please contact KNF.

- ⚠ The maximum permissible operating pressure (see type-plate or table 1) must not be exceeded.
- ⚠ During operation an adequate supply of air for cooling must be provided.
- ⚠ The maximum allowed motor speed for the pump is 3'500 rpm.
- Ambient conditions: see section 3.3.

## 7. Servicing

### 7.1 General

- ➔ For servicing the drive motor, see the corresponding operating instructions.
- ➔ Wear of diaphragm and valve plates is usually indicated by a drastic reduction in the pump performance. The replacement of these parts is described in section 8 «Changing diaphragm and valve plates».
- ⚠ In order to ensure explosion protection, the pump bearings must be replaced every 18,500 hours of operation. For this, return your pump to KNF.
- ⚠ Also note the intervals for replacing the motor bearings (see the operating instructions for the motor). If the operating instructions for the motor do not state when the bearings should be replaced, then ask the manufacturer of the motor. In case of doubt, please contact KNF.
- ⚠ When cleaning the pump, do not clean the head parts with a dry cloth to prevent an electrostatic charge on the parts and thus avoid a risk of ignition. For cleaning, use a damp cloth but avoid using a flammable cleaning agent. The cleaning process must occur outside of the explosive atmosphere.
- ➔ 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.) 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).
  - 2.) Ensure that discarded parts and materials are safely and correctly disposed of.

## 8. Changing diaphragm and valve plates

To ensure that the pump head is leak-tight after changing the diaphragm or valve plates, we recommend that diaphragm, valve plates, resonating diaphragm and o-ring are changed at the same time.

Tools and parts required:

- Parts according to spare parts list (section 12)
- Philips screwdriver No 2

### 8.1 Preparation

- ❶ When it is taken out of service, the complete installation, including the pump must be rinsed with a neutral liquid and then pumped empty.
- ❷ Take the unit out of operation, including separating it from the electrical supply (switch off the power supply, ensure that the unit is carrying no voltage, and verify that this is the case).
- ❸ Disconnect the inlet and outlet tubes from the pump head.

### 8.2 Removing the pump head

- ❶ Undo the 4 screws (pos. 2) and remove the complete head.

### 8.3 Changing the diaphragm

- ❶ Grip the diaphragm (pos. 8) carefully with both hands, and turn it anti-clockwise to unscrew it.
- ❷ Remove the spacers (pos. 9) from the thread of the old diaphragm, and fit them onto the new one.
- ❸ Screw in the new diaphragm, and tighten it firmly by hand.
- ❹ Push the edge of the diaphragm down firmly into place.

### 8.4 Changing the valves

- ❶ Lift the connection plate (pos. 6) from the intermediate plate (pos. 4)
- ❷ Remove the old valve plates (pos. 7), from the intermediate plate and discard them.
- ❸ Place the new valve plates (pos. 7), clean and dust-free into the correct positions in the intermediate plate.

### 8.5 Changing the O-ring

- ❶ Remove the resonating diaphragm (pos. 5).
- ❷ Remove the old o-ring from the connection plate (Pos. 3) and discard.
- ❸ Place a new o-ring into the connection plate.

### 8.6 Re-assembling the pump head

- ➔ The re-assembly procedure differs depending on the type of pump. There are two types to choose from without the pressure relief valve (section 8.6.1) or with the over pressure relief valve (section 8.6.2).

#### 8.6.1 NF 1.100 - version

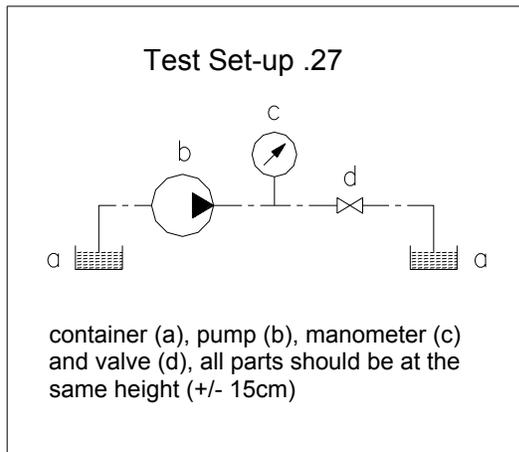
- ➔ The previous instructions in section 8.1 / 8.2 / 8.3 and 8.4 should be followed in the correct sequence.
- ❶ Place the resonating diaphragm (pos. 5) into the connection plate (pos. 6) and cover with the head plate (pos. 1).
- ❷ The connection plate (pos. 6) the intermediate plate (pos. 4) and the head plate (pos. 1) must be aligned via the screw holes.
- ❸ Fit the head plate (pos. 1) so that the flow arrows line up with the connections on the connection plate (pos. 6).
- ❹ Insert the screws (pos. 2), in the holes in the pump head.
- ❺ Place the complete head on the pump, and tighten the 4 screws (pos. 2) over diagonal with a max torque 1.5 Nm.

#### 8.6.2 NF 1.100 .27 - version

- ➔ The previous instructions in section 8.1 / 8.2 / 8.3 and 8.4 should be followed in the correct sequence.
- ❶ Place the Resonating diaphragm .27 (pos. 17) in the middle of the connection plate (pos. 6).
- ❷ Place the diaphragm .27 (pos. 18) centrally on the resonating diaphragm .27 (pos. 17).
- ❸ Put the spring (pos. 19) over the thread of the diaphragm (pos. 18).
- ❹ Carefully position the head plate .27 (pos. 22) with the adjusting screw and fastening nut over the top of the pump.
- ❺ The grooves on the side of the connection plate (pos. 6), the head plate .27 (pos. 22) and the intermediate plate (pos. 4) must be inline with another.
- ❻ The Head plate .27 (pos. 22) must be positioned so that the arrows correspond correctly to the direction in which the water will be flowing.
- ❼ Insert the screws (pos. 2), in the through holes in the pump head.
- ❽ Place the complete head on the pump, and tighten the 4 screws (pos. 2).
- ➔ The adjusted value of the over pressure relief valve should not have changed during this maintenance check but in case the values have changed please follow the procedure in section 8.7 «Adjusting the over-pressure relief valve».

## 8.7 Adjusting the over-pressure relief valve

- 1 Set the equipment up as shown in the drawing below.



- 2 Turn the pump on and wait until the system is free from air bubbles.
- 3 Close the valve (d) and read off the value on the manometer.
- 4 Loosen the fastening nut (pos. 20).
- 5 Turn the adjustment screw (pos. 21), clockwise for more pressure and anti-clockwise for less pressure.
- 6 Secure the adjustment screw (pos. 21) by tightening the fastening nut (pos. 20).

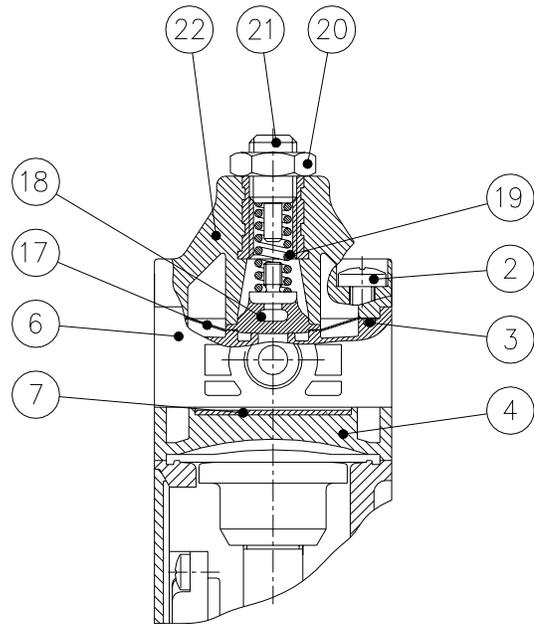
## 9. Troubleshooting

Before working on the pump ensure the mains supply is turned off.

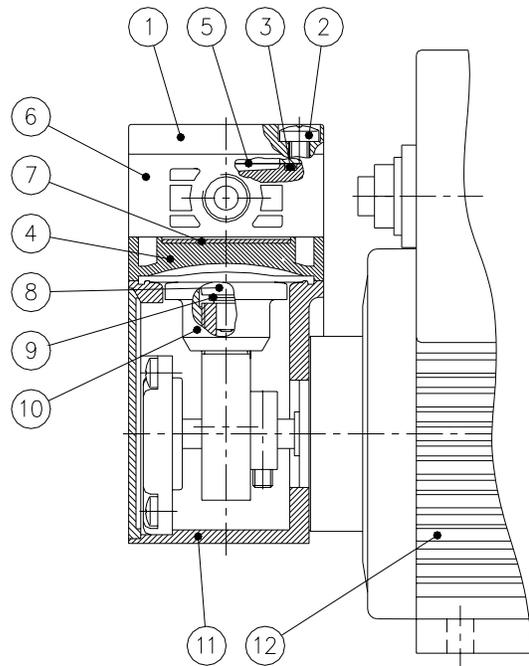
- Motor fails to start
  - 1 Pump is not connected to power supply.
  - 2 Power supply is switched off.
  - 3 The pressure in the delivery line from the pump is too high.
  - 4 Check that the suction and delivery hoses of the pump are connected to the correct ports on the application.
- Pump is not sucking liquid in.
  - 1 Suction side of pump is not connected, or liquid level in supply container is too low.
  - 2 Hose connections are leaking.
  - 3 A system valve is closed, or a filter blocked.
  - 4 Diaphragm and/or valves are worn out or dirty.
  - 5 The pump head is filled with gas. The gas pressure after the pump can not be overcome because of the compressibility of the gas in the working chamber.
  - 6 Check that the suction and delivery lines of the pump are connected to the correct ports on the application.
- Flow rate, suction head or pressure head are not high enough.
  - 1 The various components (hoses, valves, filters etc.) that make up the system on inlet and outlet sides of the pump offer too much resistance.
  - 2 Hose connections are leaking.
  - 3 Diaphragm and/or valves are worn out or are dirty.
  - 4 Possibly the viscosity of the medium is too high. Please consult KNF.
  - 6 Check that the suction and delivery lines of the pump are connected to the correct ports on the application.

## 10. Pump construction

NF 1.100 .27



NF 1.100



## Legend

Pos.	Description
1	Head plate
2	Head screws M4
3	O-ring
4	Intermediate plate
5	Resonating diaphragm
6	Connection plate
7	Valves
8	Diaphragm
9	Spacer
10	Support
11	Housing
12	Motor
17	Resonating diaphragm .27
18	Diaphragm .27
19	Spring
20	Fastening nut
21	Adjustment screw
22	Head plate .27

## 11. Technical data

### 11.1 General data

Typ		NF 1.100 E EX	NF 1.100.27 E EX
Flow rate <sup>1)</sup>	l/min	1.2	1.2
Suction height	mWg	4.0	4.0
Max Pressure head	mWg	40.0	40.0
Max. ambient temperature	°C	+5...+40	+5...+40
Max. temperature of the liquid	°C	+5...+40	+5...+40
Max. viscosity of the liquid	cSt	max. 150	max. 150

<sup>1)</sup> Measured with water at 20°C.

### 11.2 Temperature class

Connection between temperature class, maximum surface temperature of the pump (of the motor), and permissible ignition temperature of combustible atmosphere		
Temperature class (see pump and motor type-plate)	Maximum surface temperature of pump/motor in °C	Permissible ignition temperature of combustible atmosphere in °C
T1	450	>450
T2	300	>300
T3	200	>200
T4	135	>135
T5	100	>100
T6	85	>85

## 12. Spare parts

### 12.1 Spare parts list

Pos.	Description	Order No.	Quantity per pump head					
			NF 1.100 EX / NF 1.100.27 EX					
			KP	KP.27	KT	KT.27	TT	TT.27
2	Head screw	060 830	4	4	4	4	4	4
3	O-ring EPDM	064 039	1	-	-	-	-	-
3	O-ring PTFE	064 041	-	-	1	-	1	-
3	O-ring EPDM .27	068 879	-	1	-	-	-	-
3	O-ring PTFE .27	065 725	-	-	-	1	-	1
5	Resonating diaphragm	063 784	1	-	1	-	1	-
7	Valves EPDM	068 880	1	1	-	-	-	-
7	Valves FFPM	063 733	-	-	1	1	1	1
8	Diaphragm	063 640	1	1	1	1	1	1
9	Spacer	067 460	2	1	2	1	2	1
17	Resonating diaphragm .27	152 030	-	1	-	1	-	1
18	Diaphragm EPDM .27	151 424	-	1	-	-	-	-
18	Diaphragm FFPM/FPM .27	151 425	-	-	-	1	-	1

## 13. Return Requests / Inquiries

Direct all warranty and repair requests to the KNF Customer Service Department for instructions before returning any unit for repair or evaluation. We will fax you a "Return Instruction Sheet" for guidance on the proper marking, packing and documentation requirements or you can download this form from our website at <http://www.knf.com> by clicking on the Service/Support button.

Important information conforming to the "Right To Know" act, such as a Material Safety Data Sheet may be required.

Products shipped to KNF must have a Return Materials Authorization Number (RMA) file number marked on the outside of the package, otherwise they will be refused by our receiving department.

Last modification 28.11.2003

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