

Operating Instructions 039 e

Diaphragm Vacuum Pumps

N 834.3 ANE
N 834.3 ATE
N 834.3 FTE

N 843.3 ANE
N 843.3 AN.22E

N 860 ANE
N 860 ATE
N 860 FTE
N 860.3 ANE
N 860.3 ATE
N 860.3 FTE

N 880.3 AN.22E



Fig. 1: N 880.3 AN.22 E

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 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. Within 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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1. Description, Operating Conditions

KNF pumps in the N 834, N 843, N 860, and N 880 range transfer and evacuate 100% oil-free. In operation they are gas-tight, and maintenance-free.

Pumps with the model code .22 (e.g. N 880.3 AN.22 E) are fitted with the patented dynamic mass balancing. This system eradicates the imbalance that results from gas forces.

1.1 Electrical Equipment

- See the motor-plate for full electrical data.
- Protection class of standard versions is IP 54.
- The pumps 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 table 1.
- The pumps must not be used in areas where there is a danger of explosion; pumps with flame-proof motors on request.
- 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).

▽ KNF pumps in the N 834, N 843, N 860 and N 880 range must not be used for liquids.

If your potential application lies outside the above limits discuss it with our technical adviser (see last page for contact telephon 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.
- During operation an adequate supply of air cooling must be provided.
- The pumps must not be used in areas where there is a danger of explosion.

1.4 Pump materials

See Table 2.

2. Safety

- 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.
- 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.
- For pumps with dynamic mass balancing (.22-versions): If the pump is mounted on a platform that is itself a vibrating system, or contains one, care must be taken that the two systems do not interfere each other.
- Use only original KNF spare parts.

▽ Pumps in the N 834, N 843, N 860 and N 880 range conform to the safety regulations of the EC Low Voltage Directive 73/23 EEC, and of the EC Directive 89/336 EEC concerning Electromagnetic Compatibility.

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.
- 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.
- For pumps with dynamic mass balancing (.22-versions):
 1. If the pump is mounted on a platform that is itself a vibrating system, or contains one, care must be taken that the two systems do not interfere each other.
 2. The pump must be supported on rubber mounts, or springs so that the natural frequency of the system is $f_{ei} > 1.7$ Hz. For lower values of f_{ei} correct operation of the dynamic mass balancing cannot be guaranteed.

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 volta-

ge 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 motor 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. For size of the port threads see table 3. For flow direction see marking on the pump head or data sheet.
- 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 table 2).**

- The pumps must not start against pressure. This also applies when the pump restarts after the power has been cut off for a short period.
- The maximum permissible operating pressure (see table 1) 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 diaphragms and valve plates/sealings at the same time. In the case of models with two heads service all heads.
- ▶ For twin-headed pumps: The process of replacing diaphragms and valve plates/sealings should be completed separately for each individual head before starting work on the next one. This will prevent from mixing up parts.

5.1 ANE and ATE types

Parts and tools required:

- 1 Service Set (see section 8)
- Allen key 4 mm
- Screwdriver blade width 2 mm
- Phillips screwdriver No. 2
- Pump ranges N 834 and N 843: Ring spanner 17 mm (alternative: open-ended spanner 17 mm) and open-ended spanner 22 mm
- Pump ranges N 860 and N 880: Ring spanner 22 mm (alternative: open-ended spanner 22 mm) and open-ended spanner 24 mm
- Felt-tip pen

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

- a) Preparatory steps
- b) Removing pump head
- c) Changing diaphragm
- d) Changing valve plates/sealings
- e) Refitting pump head
- f) Final steps

- ▶ The position numbers in the following text refer to figs. 2 and 3.

a.) Preparatory steps

- 1 Turn off power, check and test that the lines are not live.
- 2 For two-headed pumps: Unscrew the fittings 11 of the pneumatic head connections 10, and pull the connection upwards.
- 3 Undo the screws that hold the fan cover 12 and remove the fan cover from the motor.

b) Removing pump head (for each head separately)

- 1 Make a mark (M) on the ribbed plate 3, intermediate plate 2, and housing 1 with a felt-tip pen. This is to ensure that the parts will be reassembled correctly at a later stage.
- 2 Undo the 4 screws 4 in the ribbed plate and lift the ribbed plate with the intermediate plate off the pump housing.

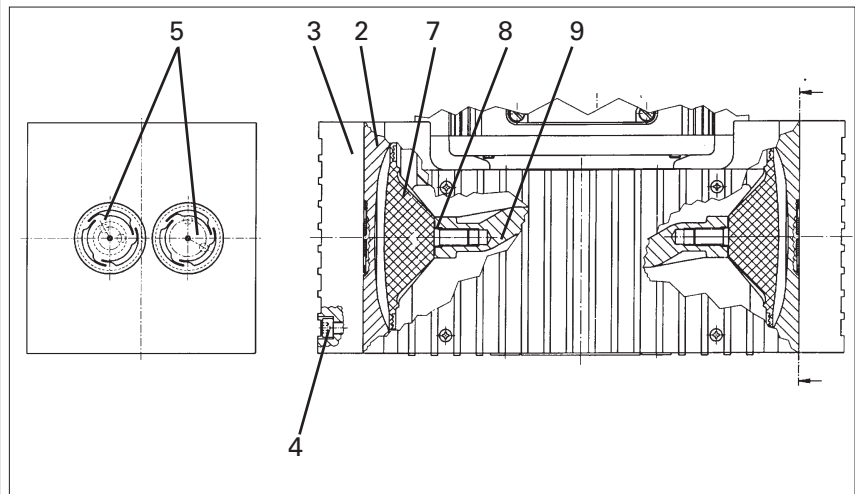


Fig. 2: Pump heads ANE and ATE types (symbolic)

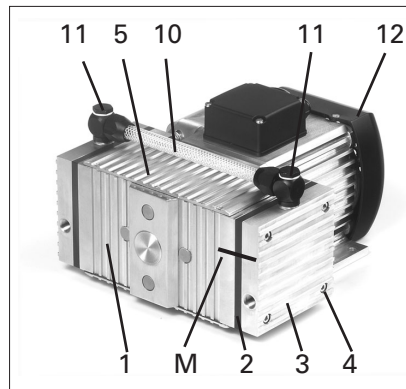


Fig. 3

c) Changing diaphragm

- 1 Position the pump so that the diaphragm surface is upwards.
- 2 Turn the fan to bring the structured diaphragm 7 to top dead centre.
- 3 Using a small screwdriver, between the housing and the outer edge of the structured diaphragm, carefully lift the edge of the diaphragm lightly upwards at one point (making sure not to damage the housing). Now grip the edge of the diaphragm on opposite sides, unscrew it by turning anti-clockwise.
- 4 Take the diaphragm spacer(s) 8 off the connecting rod 9 and retain them.
- 5 Check that all parts are free from dirt and clean them if necessary (see section 6. Cleaning).
- 6 Put the diaphragm spacer(s) on the thread of the new diaphragm.
- 7 Fit the new structured diaphragm 7: hold the connecting rod 9 with one finger, and gently screw in (clockwise) the structured diaphragm with diaphragm spacers.
- 8 Turn the fan until the structured diaphragm is at the top dead centre. Using a small screwdriver, between the housing and the outer edge of the structured diaphragm, carefully lift the edge of the diaphragm lightly upwards at one point. Now grip the edge of the diaphragm on opposite sides and tighten the structured diaphragm.

Specification

| Pos | Description |
|-----|-------------------------------|
| 1 | Housing |
| 2 | Intermediate plate |
| 3 | Ribbed plate |
| 4 | Hexagon socket head cap screw |
| 5 | Valve plate/sealing |
| 6 | does not exist |
| 7 | Structured diaphragm |
| 8 | Diaphragm spacer(s) |
| 9 | Connecting rod |
| 10 | Pneumatic connection |
| 11 | Union |
| 12 | Fan cover |

M Mark

clock-wise (hand-tight).

d) Changing valve plates/sealings

- 1 Separate the ribbed plate 3 from intermediate plate 2.
- 2 Remove the valve plates/sealings 5 from the intermediate plate.
- 3 Check that the valve seats, the ribbed 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 5 in the recesses in the intermediate plate. The valve plates/sealings for suction and pressure sides are identical, as are upper and lower sides of the valve plates/sealings.

e) Refitting pump head

- 1 Turn the fan to bring the structured diaphragm 7 to middle position.
- 2 Place the intermediate plate 2, with valve plates/sealings 5 and ribbed plate 3 on the housing, in the position indicated by the marking (M).
- 3 Gently tighten the screws 4, evenly and diagonally.
- 4 Turn the fan to check that the

- pump rotates freely.
- 5 Now tighten screws 4 firmly (hand-tight).

For two-headed pumps:
Repeat operations b), c), d), and e) for the second pump head.

f) Final steps

- 1 For two-headed pumps:
Refit the the pneumatic head connection 10. When tightening the union 11, prevent the unit from slewing by using a spanner.
- 2 Refit the fan cover 12
- 3 Reconnect the pump to the electricity supply.
- If you have any questions about servicing call our technical adviser (see last page for contact telephone number).

5.2 FTE types

Parts and tools required:

- 1 Service Set (see section 8)
- Screwdriver blade width 2 mm
- Phillips screwdriver No. 2
- Felt-tip pen

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

- a) Preparatory steps
- b) Removing pump head
- c) Changing diaphragm
- d) Changing valve plates/sealings
- e) Refitting pump head
- f) Final steps

- The position numbers in the following text refer to fig. 4.

a.) Preparatory steps

- 1 Turn off power, check and test that the lines are not live.
- 2 For two-headed pumps:
On the pneumatic head connections, loosen one of the union nuts by hand. Then slightly loosen the angle-fitting in the pump head by turning it anticlockwise, so that the connecting tube can be pulled out.
- 3 Undo the screws that hold the fan cover (see fig. 3, position 12) and remove the fan cover from the motor.

b) Removing pump head (for each head separately)

- 1 Make a mark (M) on the top plate 1, head plate 2, intermediate plate 3, and housing 4 with a felt-tip pen. This is to ensure that the parts will be reassembled correctly at a later stage.
- 2 Undo the eight screws 5 and lift the pump head off the housing 4.

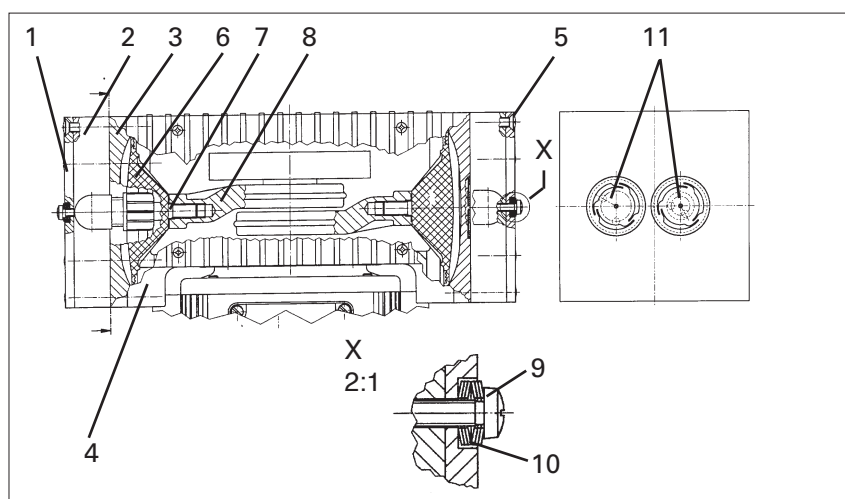


Fig. 4: Pump heads FTE types (symbolic)

c) Changing diaphragm

- 1 Position the pump so that the diaphragm surface is upwards.
- 2 Turn the fan to bring the structured diaphragm 6 to top dead centre.
- 3 Using a small screwdriver, between the housing and the outer edge of the structured diaphragm, carefully lift the edge of the diaphragm lightly upwards at one point (making sure not to damage the housing). Now grip the edge of the diaphragm on opposite sides, unscrew it by turning anti-clockwise.
- 4 Take the diaphragm spacer(s) 7 off the connecting rod 8 and retain them.
- 5 Check that all parts are free from dirt and clean them if necessary (see section 6. Cleaning).
- 6 Put the diaphragm spacer(s) 7 on the thread of the new diaphragm.
- 7 Fit the new structured diaphragm 6: hold the connecting rod 8 with one finger, and gently screw in (clockwise) the structured diaphragm with diaphragm spacers.
- 8 Turn the fan until the structured diaphragm is at the top dead centre. Using a small screwdriver, between the housing and the outer edge of the structured diaphragm, carefully lift the edge of the diaphragm lightly upwards at one point. Now grip the edge of the diaphragm on opposite sides (do not overstretch the diaphragm!) and tighten the structured diaphragm clock-wise.

d) Changing valve plates/sealings

- 1 Undo the two screws 9
- 2 Separate the head plate 2 with top plate 1 from intermediate plate 3.
- 3 Remove the valve plates/sealings 11 from the intermediate plate.
- 4 Check that the valve seats, the head plate and intermediate plate are clean. If scratches, distortion,

Specification

Pos* Description

- | | |
|----|---|
| 1 | Top plate |
| 2 | Head plate |
| 3 | Intermediate plate |
| 4 | Housing |
| 5 | Cross recessed raised counter-sunk head screw |
| 6 | Structured diaphragm |
| 7 | Diaphragm spacer(s) |
| 8 | Connecting rod |
| 9 | Cross recessed raised cheese head screw |
| 10 | Disk spring |
| 11 | Valve plate/sealing |

- or corrosion are evident on these parts they should be replaced.
- 5 Lay the new valve plates/sealings 11 in the recesses in the intermediate plate. The valve plates/sealings for suction and pressure sides are identical, as are upper and lower sides of the valve plates/sealings.

e) Refitting pump head

- 1 Turn the fan to bring the structured diaphragm 6 to medium position.
- 2 Place the intermediate plate 3, with valve plates/sealings 11 on the housing, in the position indicated by the marking (M).
- 3 Place the head plate 2 on the intermediate plate 3 in the position indicated by the marking (M)
- 4 Place top plate 1 in position. and insert screws 9 with disk springs 10, and tighten them until the screw heads are just fully seated (do not completely tighten them!).
► The concave side of the first three disc springs must point away from the screw head, the next three towards it (see fig. 4,

detail X).

- 5 Gently tighten the screws ⑤, evenly and diagonally.
- 6 Turn the fan to check that the pump rotates freely.
- 7 Now tighten screws ⑤ firmly
- 8 Tighten each of the screws ⑨ a half-turn more.

For two-headed pumps:
Repeat operations b), c), d), and e) for the second pump head.

f) Final steps

- 1 For two-headed pumps:
Refit the the pneumatic head connection:
Place tube onto the connecting part of the angle fitting, turn angle fitting to a straight position and tighten the nut.
- 2 Refit the fan cover.
- 3 Reconnect the pump to the electricity supply.

▶ 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 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

- For pumps with thermal switch:
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.
▶ 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 1.2 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.
 - After changing the diaphragms or valve plates/sealings, a 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.
- ▶ **If you send your KNF pump to the KNF Service Department, please include information about the medium it was handling.**
- ▶ **If you have been handling dangerous gases, please clean the pump before despatch.**

8. Replacement Parts

A Service Set contains all parts needed for one complete service: for each pump head 1 diaphragm, 2 valve plates/sealings.

| Service Set for pump | Order-No. |
|----------------------|-----------|
| N 834.3 ANE | 045525 |
| N 834.3 ATE | 057359 |
| N 834.3 FTE | 057359 |
| N 843.3 ANE | 045388 |
| N 843.3 AN.22 E | 045388 |
| N 860 ANE | 047496 |
| N 860 ATE | 047497 |
| N 860 FTE | 047497 |
| N 860.3 ANE | 047498 |
| N 860.3 ATE | 047499 |
| N 860.3 FTE | 047499 |
| N 880.3 AN.22 E | 045387 |

9. Tables

Table 1: Pneumatic Data
See next page.

Table 2: Pump Material
See next page.

Table 3: Size of pneumatic port threads
See next page.

Table 1: Pneumatic data

| Pump type | Maximum permissible operating pressure (bar g) | Ultimate vacuum (mbar abs.) | Delivery (l/min)* at atm. pressure |
|-----------------|--|-----------------------------|------------------------------------|
| N 834.3 ANE | 1 | 10 | 34 |
| N 834.3 ATE | 1 | 10 | 34 |
| N 834.3 FTE | 1 | 10 | 33 |
| N 843.3 ANE | 1 | ≤ 3 | 43 |
| N 843.3 AN.22 E | 1 | ≤ 3 | 43 |
| N 860 ANE | 1 | 80 | 60 |
| N 860 ATE | 1 | 80 | 60 |
| N 860 FTE | 1 | 80 | 60 |
| N 860.3 ANE | 1 | 2 | 60 |
| N 860.3 ATE | 1 | 2 | 60 |
| N 860.3 FTE | 1 | 2 | 60 |
| N 880.3 AN.22 E | 1 | 2 | 80 |

* Litre at STP

Table 2: Pump material

| Pump type | Pump head | Material | |
|-----------------|-----------------|----------------------|--------|
| | | Structured diaphragm | Valves |
| N 834.3 ANE | Aluminium alloy | EPDM | CR |
| N 834.3 ATE | Aluminium alloy | PTFE | FFPM |
| N 834.3 FTE | PTFE | PTFE | FFPM |
| N 843.3 ANE | Aluminium alloy | EPDM | CR |
| N 843.3 AN.22 E | Aluminium alloy | EPDM | CR |
| N 860 ANE | Aluminium alloy | EPDM | EPDM |
| N 860 ATE | Aluminium alloy | PTFE | FFPM |
| N 860 FTE | PTFE | PTFE | FFPM |
| N 860.3 ANE | Aluminium alloy | EPDM | EPDM |
| N 860.3 ATE | Aluminium alloy | PTFE | FFPM |
| N 860.3 FTE | PTFE | PTFE | FFPM |
| N 880.3 AN.22 E | Aluminium alloy | EPDM | FPM |

Material abbreviations according to ISO 1629

Table 3: Size of pneumatic port threads

| Pump type | Thread size |
|-----------------|-------------|
| N 834.3 ANE | G 1/4' |
| N 834.3 ATE | G 1/4' |
| N 834.3 FTE | G 1/4' |
| N 843.3 ANE | G 1/4' |
| N 843.3 AN.22 E | G 1/4' |
| N 860 ANE | G 3/8' |
| N 860 ATE | G 3/8' |
| N 860 FTE | G 3/8' |
| N 860.3 ANE | G 3/8' |
| N 860.3 ATE | G 3/8' |
| N 860.3 FTE | G 3/8' |
| N 880.3 AN.22 E | G 3/8' |

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