

# Operating Manual 050e/052e

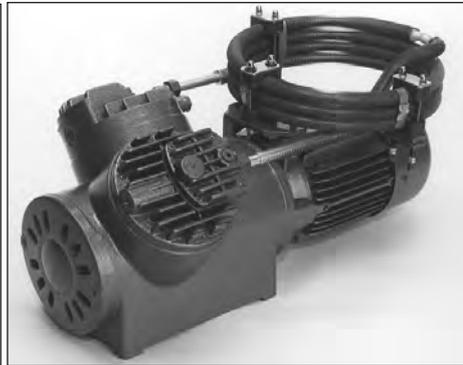
## Diaphragm -Compressors

**N 286.15 ANE**  
**N 286.15 AN.9E**  
**N 286.15 SNE**  
**N 286.15 SN.9E**

**N 2400.15 ANE**



*Fig. 1*  
N 286.15 ANE



*Fig. 2:*  
N 2400.15 ANE

### Explanation of the Type Code

**N 286.15 SN.9E**

- └ E: OEM model
- └ .9: pump head guranteed gas tight  
( $6 \times 10^{-3}$  mbar l/s)
- └ Diaphragm material:  
N: CR  
V: FPM  
T: PTFE-coated  
P: EPDM
- └ Head material:  
A: Aluminium  
S: Stainless steel
- └ Head connections:  
.15: Compressor, 2-stage (in line)

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Pump type	Delivery* (l/min) at atm. pressure	Maximum permissible operating pressure (bar g)
N 286.15 ANE	25	12
N 286.15 AN.9 E	25	12
N 286.15 SNE	25	12
N 286.15 SN.9 E	25	12
N 2400.15 ANE	150	12

\* Litre at STP

Pump type	Material		
	Pump head	Diaphragm	Valve
N 286.15 ANE	Aluminium	CR	CR
N 286.15 AN.9 E	Aluminium	CR	CR
N 286.15 SNE	Stainless steel	CR	CR
N 286.15 SN.9 E	Stainless steel	CR	CR
N 2400.15 ANE	Aluminium	CR	Stainless steel

Material abbreviations of elastomers according to ISO 1629

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 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. Please therefore take into account the agreed technical specifications, as well as these instructions.

# 1. Instructions for the authority responsible for operation

## 1.1 Pump specifications

- See type plate, motor plate and table 1
- Weight:  
N 286.15 ANE: about 25 kg  
N 2400.15 ANE: about 52 kg
- For pumps with guaranteed gas-tightness (.9 versions):  
After opening the pump head, or replacing the diaphragm or valve plates/reed valves the gas-tightness is no longer guaranteed. A leak test is able to verify that the original standard of gas-tightness has been achieved
- The noise emissions from the pumps are (with hose connectors fitted):

type range N 286: less than 70 dB(A),  
type range N 2400: about 70 dB(A)

- The pumps conform to the safety regulations of the EC Directive 89/336 EEC concerning Electromagnetic Compatibility. From the point of view of the Machinery Directive (EEC 89/392), these pumps are intended for

installation in equipment, and are not considered to be ready for use.

## 1.2 Installing the pumps

Pumps in the N 286 and N 2400 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 (EN 1012) are observed.

⚠ For pumps with explosion-proof-motor: please observe the additional Instructions for Operation and Connection. Explosion-proof-motors may be recognised by the letters 'Ex' on the motor-plate.

- Note that the pumps may only be used for their intended purpose (see section 1.3 Operating conditions).

## Mechanical

- The dimensions of the mountings are given in figures 3 to 4
- Install the pump so as to ensure adequate flow of air cooling
- Fit the pump at the highest point in the system, so that condensate can not collect in the head of the pump -

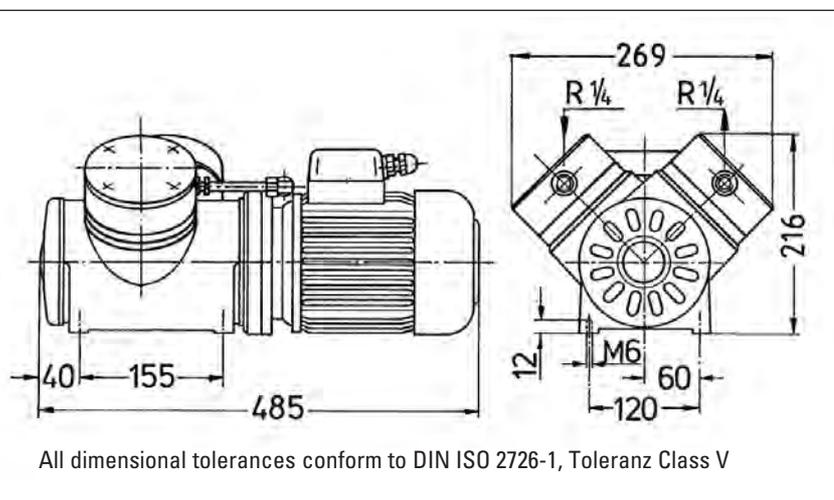


Fig. 3: Dimensions of the pumps  
N 286\_E

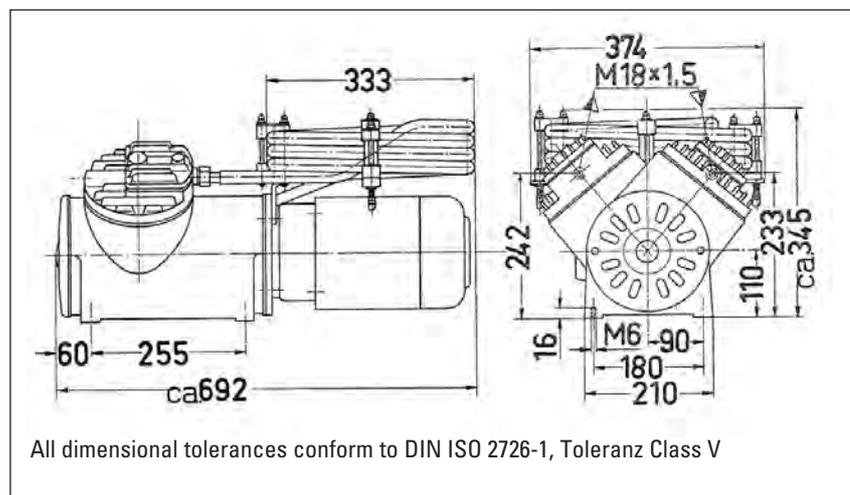


Fig. 4: Dimensions of the pumps  
N 2400\_E

that prolongs working life

- The pumps must be protected from water, in spray or droplet form, and excessive dust.

### 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 motor-plate
- The earth (ground) wire must be connected to the motor
- In the electrical installation, arrangements (complying with EN 60204-1) must be made for disconnecting the pump motor from the electrical supply
- When installed, the motors of the pumps must be protected according to EN 60204-1 (protection against excess current, or overloading)
- It is recommended that an additional „Emergency Stop“ switch is installed
- The pump must be installed so that contact with live parts is impossible.

### Pneumactical

- ⚠ For compressors, 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
- ⚠ Components connected to the pumps must be designed to withstand the pneumatic performance of the pumps.
- KNF recommends mechanically disengaging the pump from the piping system. This can be achieved with flexible tubing or pipes, for example. This will avoid transferring to the system any pump oscillations that may arise.
- Arrange the suction and pressure lines so that condensate cannot run into the pump.

Before putting the pumps in service it must be established that machinery or equipment in which they are installed meets the relevant regulations.

### 1.3 Operating conditions

- The pumps may be employed for handling air, gases, and vapours at temperatures between + 5°C and + 40°C
- For pneumatic and electrical data: see type-plate, motor-plate and table 1
- ⚠ The pumps must not be used in areas where there is a danger of explosion. The exception to this rule is that under certain conditions pumps fitted with an explosion-proof-motor be employed in such areas; it

is essential to study the separate instructions for pumps with explosion-proof motors including the limits on the use of pumps described there. Explosion-proof-motors may be recognised by the letters 'Ex' on the motor-plate

- Ambient temperature during operation: between + 5°C and + 40°C
- Before pumping a medium, the compatibility of the materials of pump head, diaphragm, and valves with the medium must be checked. For pump materials, see table 2
- The pumps must be protected from shocks and vibration
- During operation an adequate supply of air for cooling must be provided
- For compressors, 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 your potential application lies outside the above limits discuss it with our technical adviser (see last page for contact telephone number).

### 1.4 Operating the pumps

The pumps are intended for installation. Before putting them into service it must be established that machinery or equipment in which they are installed meets the relevant regulations.

- ⚠ 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 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 the 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 or vacuum. When it is switched on the pressure in the suction and pressure lines must be atmospheric. This also applies when the pump restarts after the power has been cut off for a short period.
- ⚠ The maximum permissible operating pressure (see type-plate or table 1) must not be exceeded. Exception: If the data sheet includes values for intermittent operation, they may only be employed briefly.
- 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.
- During operation an adequate supply of air for cooling must be provided.
- Change the filter (accessory) if it is dirty.
- Diaphragm and valve plates (N 286\_NE) or to lesser extent reed valves (N 2400\_ANE) 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 3.
- Ambient conditions: see chapter 1.3.

## ▶ 2. Instructions for the operating personnel

### 2.1 Specifications/Operating Conditions

- For pneumatic and electrical data: see type-plate and motor-plate.
- The pumps may be employed for handling air, gases, and vapours at temperatures between + 5°C and + 40°C.
- The pumps must not be used for liquids.
- ⚠ The pumps must not be used in areas where there is a danger of explosion. The exception to this rule is that under certain conditions

pumps fitted with an explosion-proof-motor be employed in such areas; it is essential to study the separate instructions for pumps with explosion-proof motors including the limits on the use of pumps described there. Explosion-proof-motors may be recognised by the letters 'Ex' on the motor-plate.

- Ambient temperature during operation: between + 5° and + 40°C.

## 2.2 Operating the pumps

The pumps are intended for installation. Before putting them into service it must be established that machinery or equipment in which they are installed meets the relevant regulations.

⚠ 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 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 the materials of pump head, diaphragm, and valves with the medium must be checked. For pump materials, see table 2.
- Only complete pumps may be taken into service.
- The gas-tightness of the connections to the pump must be checked regularly; with leaky connections, there is a danger that hazardous gases or vapours may escape from the pump system.

⚠ The maximum permissible operating pressure (see type plate and table 1) must not be exceeded. Exception: If the data sheet includes values for

intermittent operation, they may only be employed briefly.

- 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.
- The pumps must not start against pressure or vacuum. When it is switched on the pressure in the suction and pressure lines must be atmospheric. This also applies when the pump restarts after the power has been cut off for a short period.
- ⚠ The pump heads heat up during operation - avoid contact with them.
- Do not expose any part of your body to the vacuum.
- Change the filter (accessories) if it is dirty.
- Noise emissions from the pump may disrupt communication.
- The life of the diaphragm is prolonged if the formation of condensate is avoided. Therefore the following precautions should be taken:
  - Run the pump for a few minutes to warm it up before handling saturated or nearly saturated vapours.
  - Before switching off the pump, flush it with air (if necessary for safety reasons: with an inert gas) for about two minutes under atmospheric conditions (ambient pressure).

# ▶ 3. Service Instructions

## 3.1 Servicing

For pneumatic and electrical data: see type-plate, motor-plate and table 1.

Diaphragm(s) and valve plates or to lesser extent reed valves are the only parts subject to wear. They are simple to change. When replacing parts proceed as described.

- Always service both heads at the same time.
- ⚠ Before working on the pumps isolate the power supply securely, then check that the lines are not live.
- ⚠ If a pump has been used for dangerous or injurious substances, the following points must be observed:

- ▶ Clean the pump and its components before servicing.
- ▶ Take all safety and protection measures that are necessary for the medium that has been handled by the pump.
- ▶ Ensure that discarded parts and materials are safely and correctly disposed of.

- For pumps with guaranteed gas-tightness (.9 versions): After opening the pump head, or replacing the diaphragm or valve plates/reed valves the gas-tightness is no longer guaranteed. A leak test is able to verify that the original standard of gas-tightness has been achieved.

### 3.1.1 N 286.15 ANE N 286.15 SNE

For versions with guaranteed gas-tightness (.9 versions) see section 3.1.2.

When diaphragms are changed, valve plates should also be replaced.

#### Change diaphragm, valve plates

##### Parts required:

(according to spare parts list, section 3.3.1):

- Diaphragms (F) (2 pieces)
- Hexagon socket countersunk head screws (D) (2 pieces)
- Valve plates (Z) (2 pieces)

##### Tools required:

- Allen key 4
- Allen key 5
- Screwdriver blade width 5.5 mm
- Fork wrench 19 mm
- Pencil.

##### Proceed as follows:

- 1 Undo the nuts (L) and (M) (see figure 5) and remove interstage cooler (R).
- 2 Undo the screws that hold the motor fan cover and remove the fan cover from the motor.
- 3 For one of the pump heads: Mark the position of housing (A), intermediate plate (X), and ribbed plate (W) relative to each other by a drawing line with a pencil. This helps avoid incorrect assembly later.
- 4 Undo the six hexagon socket head cap screws (Y) and lift off ribbed plate (W), valve plate (Z) and intermediate plate (X).
- 5 Undo the hexagon socket countersunk head screw (D).
- 6 Remove retainer plate (E) and diaphragm (F).
- 7 Inspect all parts for dirt and clean them if necessary.
- 8 Turn the fan until the connecting rod (K) is in mid-stroke.
- 9 Lay the retainer plate (E) on the new diaphragm (B); lay the diaphragm with retainer plate on the connecting rod.
- 10 Tighten the new hexagon socket

- countersunk head screw (D) firmly.
- 11 Place intermediate plate (C) on the housing (A) according to the marks made previously.
- 12 Place the new valve plate (Z) on the intermediate plate (according to figure 3) and then the ribbed plate (W) according to the marks made previously.
- 13 Tighten the hexagon socket head cap screws (Y) uniformly and diagonally.
- 14 Turn the fan to check that the pump rotates freely.
- 15 Carry out steps 3 to 14 for the second pump head
- 16 Remount the fan cover
- 17 Refit interstage cooler (R).

### 3.1.2 N 286.15 AN.9E N 286.15 SN.9E

See figures 5 and 7.

#### Parts required:

(according to spare parts list, section 3.3.2):

- Diaphragms (F) (2 pieces)
- Valve plates (Z) (2 pieces)
- O-ring (U) (2 pieces)

#### Tools required:

- Allen key 5
- Screwdriver blade width 5.5 mm
- Fork wrench 19 mm
- Wrench for retainer plate (see section 3.4 Accessories)
- Pencil.

#### Proceed as follows:

- 1 Undo the nuts (L) and (M) (see figure 5) and remove interstage cooler (R).
- 2 Undo the screws that hold the motor fan cover and remove the fan cover from the motor.
- 3 For one of the pump heads: Mark the position of housing (A), intermediate plate (X), and ribbed plate (W) relative to each other by a drawing line with a pencil. This helps avoid incorrect assembly later.
- 4 Undo the six hexagon socket head cap screws (Y) and lift off ribbed plate (W), valve plate (Z) and intermediate plate (X).
- 5 Remove O-ring (U).
- 6 To undo the retainer plate (E), use the wrench for retainer plate to turn it anti-clockwise; remove retainer plate and diaphragm (F).
- 7 Inspect all parts for dirt and clean them if necessary.
- 8 Turn the fan until the connecting rod (K, see figure 5) is in mid-stroke.
- 9 Lay the retainer plate (E) on the new diaphragm (B); lay the diaphragm with retainer plate on the connecting rod.
- 10 To tighten the retainer plate (E), use the wrench for retainer plate to turn it clockwise.
- 11 Fit new O-ring in the intermediate plate (X).
- 12 Place intermediate plate (X) on the housing according to the marks made previously.
- 13 Place the new valve plate (Z) on the intermediate plate (according to figure

7) and then the ribbed plate (W) according to the marks made previously.

- 14 Tighten the hexagon socket head cap screws (Y) uniformly and diagonally.
- 15 Turn the fan to check that the pump rotates freely.
- 16 Carry out steps 3 to 15 for the second pump head.
- 17 Remount the fan cover.
- 18 Refit interstage cooler (R).

### 3.1.3 N 2400.15 ANE

See figures 8 and 9.

#### Change diaphragm

#### Parts required:

(according to spare parts list, chapter 3.3.3)

- Diaphragms (B) (2 pieces)
- Gaskets (D) (2 pieces)
- Cross recessed countersunk head cap screws (M) (6 pieces)

#### Tools required:

- Allen key 5
- Phillips screwdriver No. 2
- Screwdriver (blade width 5.5 mm)
- Fork wrench 27 mm
- Pencil

#### Proceed as follows:

- 1 Undo the interstage cooler (R) nuts (L) and (M) (see figure 8).
- 2 Undo the 2 nuts holding the holding device (Q) and remove interstage cooler.
- 3 Undo the screws that hold the motor fan cover and remove the fan cover from the motor.
- 4 Mark the position of housing (A), spacer ring (W; second stage only) and diaphragm head (C) relative to each other by a drawing line with a pencil. This helps avoid incorrect assembly later.
- 5 Undo the hexagon socket head cap screws (F) (2 screws), (G) (2 screws), and (H) (4 screws) and lift off ribbed plate (E) and gasket (D).
- 6 Remove the diaphragm head (C).
- 7 Undo the 3 cross recessed countersunk screws (M).
- 8 Remove retainer plate (R) and diaphragm (B).
- 9 Inspect all parts for dirt and clean them if necessary.
- 10 Turn the fan until the connecting rod (S) is in mid-stroke.
- 11 Position the new diaphragm (B) on the connecting rod.
- 12 Lay the retainer plate (R) on the new diaphragm (B). The roll pin (P) fits in the small hole in the retainer plate.
- 13 Tighten the new countersunk screws (M) firmly.
- 14 Place diaphragm head (C) on the diaphragm according to the marks made previously, but check that the head of the valve fastening screw (K) lies directly above the hole in the retainer plate (R).
- 15 Fit the new gasket (D) and the cover plate (E) on housing.
- 16 Tighten the hexagon socket head cap screws (F), (G) and (H) uniformly and

diagonally.

- 17 Turn the fan to check that the pump rotates freely.
- 18 Carry out steps 3 to 17 for the second pump head.
- 19 Remount the fan cover.
- 20 Refit interstage cooler.

#### Change the reed valves

#### Parts required:

(according to spare parts list, section 3.3.3):

- Reed valve (L/N; they are identically) (6 pieces)
- Gasket (D) (2 pieces)

#### Tools required:

- Allen key 5
- Fork wrench 27 mm
- Fork wrench 17 mm
- Fork wrench 8 mm (or socket wrench)
- Pencil

#### Proceed as follows:

- 1 Remove head as described in section „Change diaphragm“ (steps 1 to 6).
- 2 Undo the reed valve screws (J) and (K).
- 3 Inspect all parts for dirt and clean them if necessary.
- 4 Fit new reed valves (L) and (N).
- 5 Replace O-rings (M).
- 6 Carry out steps 11 to 19 of section „Change diaphragms“.

#### 3.2 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

- 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 respective reed valves are worn.
  - ▶ Section 3.1 Servicing.

#### Flow, pressure, or vacuum too low

- Compare the actual performance with the figures on type-plate or in table 1.
- 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 respective reed valves are worn, or dirt is in the head.
  - ▶ Section 3.1 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 the Appendix of these operating instructions.

### 3.3 Spare Parts

#### 3.3.1 N 286.15 ANE N 286.15 SNE

Ident.*	Description	Order-No.
D	Hexagon socket countersunk head screw	110711
F	Diaphragm N(CR)	04241
Z	Valve plate (CR)	01528

\* according to fig. 6

#### 3.3.2 N 286.15 AN.9E N 286.15 SN.9E

Ident.*	Description	Order-No.
F	Diaphragm N(CR)	04241
	O-ring	04848
Z	Valve plate (CR)	23933

\* according to fig. 7

#### 3.3.3 N 2400.15 ANE

Ident.*	Description	Order-No.
B	Diaphragm N(CR)	03473
D	Gasket	110686
L; N	Reed valve	03475
M	Cross recessed countersunk head screw	110732

\* according to fig. 9

### 3.4 Accessories

Description	Order-No.
Filter for pumps	
N 286.15 ANE	
N 286.15 AN.9E	
N 286.15 SNE	
N 286.15 SN.9E	00352
N 2400 ANE.15	00358
Wrench for retainer plate for pumps	
N 286.15 AN.9E	
N 286.15 SN.9E	18812
Hose connector R 1/4" for pumps	
N 286.15 ANE	
N 286.15 AN.9E	
N 286.15 SNE	
N 286.15 SN.9E	00362
N 2400 ANE.15	00365
Pressure relief valve	

### Return Requests/Inquiries

Direct all warranty and repair requests to 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.

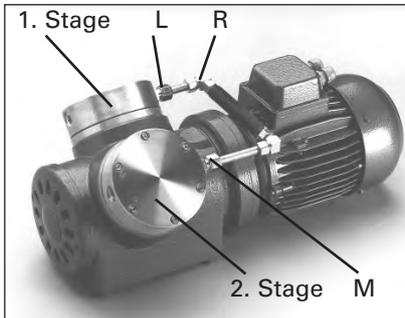


Fig. 5: N 286 \_\_ E

**Description**

- (A): Housing
- (D): Hexagon socket counter-sunk head srew
- (E): Retainer plate
- (F): Diaphragm
- (K): Connecting rod
- (L): Nut
- (M): Nut
- (R): Interstage cooler
- (W): Ribbed plate
- (X): Intermediate plate
- (Y): Hexagon socket head cap screw
- (Z): Valve plate

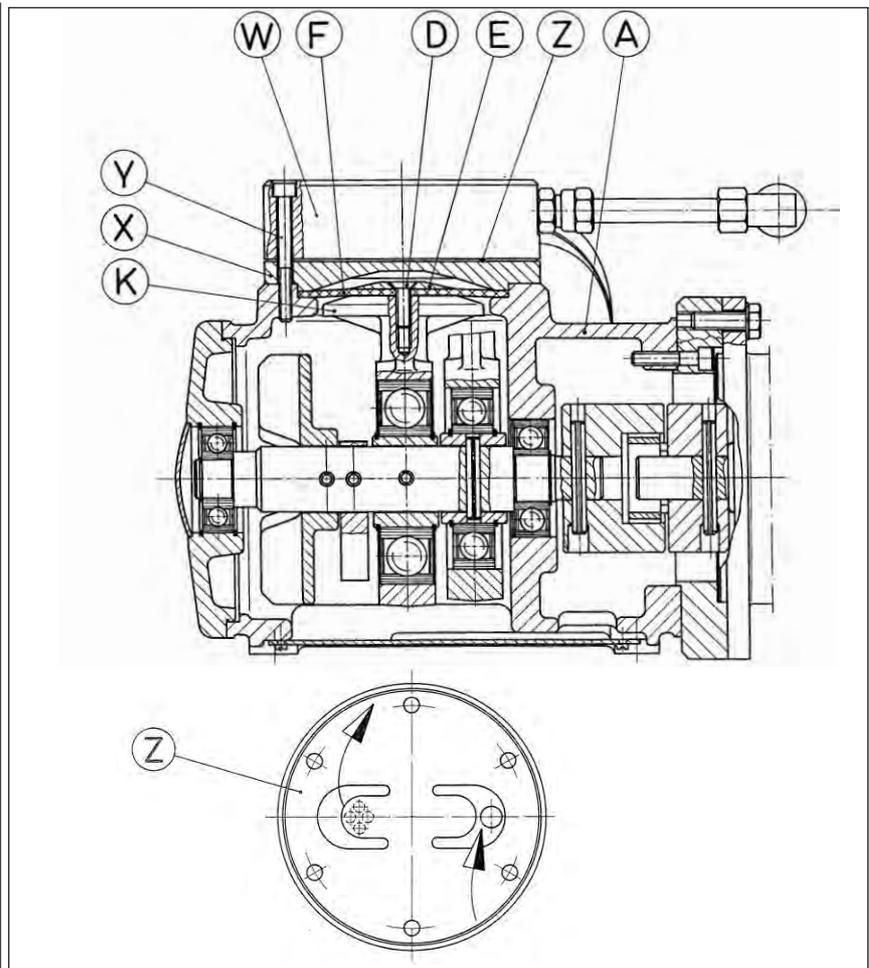


Fig. 6: Pump parts N 286 \_\_ E

**Description**

- (A): Housing
- (E): Retainer plate
- (F): Diaphragm
- (K): Connecting rod
- (U): O-ring
- (Q): Locating peg
- (W): Ribbed plate
- (X): Intermediate plate
- (Y): Hexagon socket head cap screw
- (Z): Valve plate

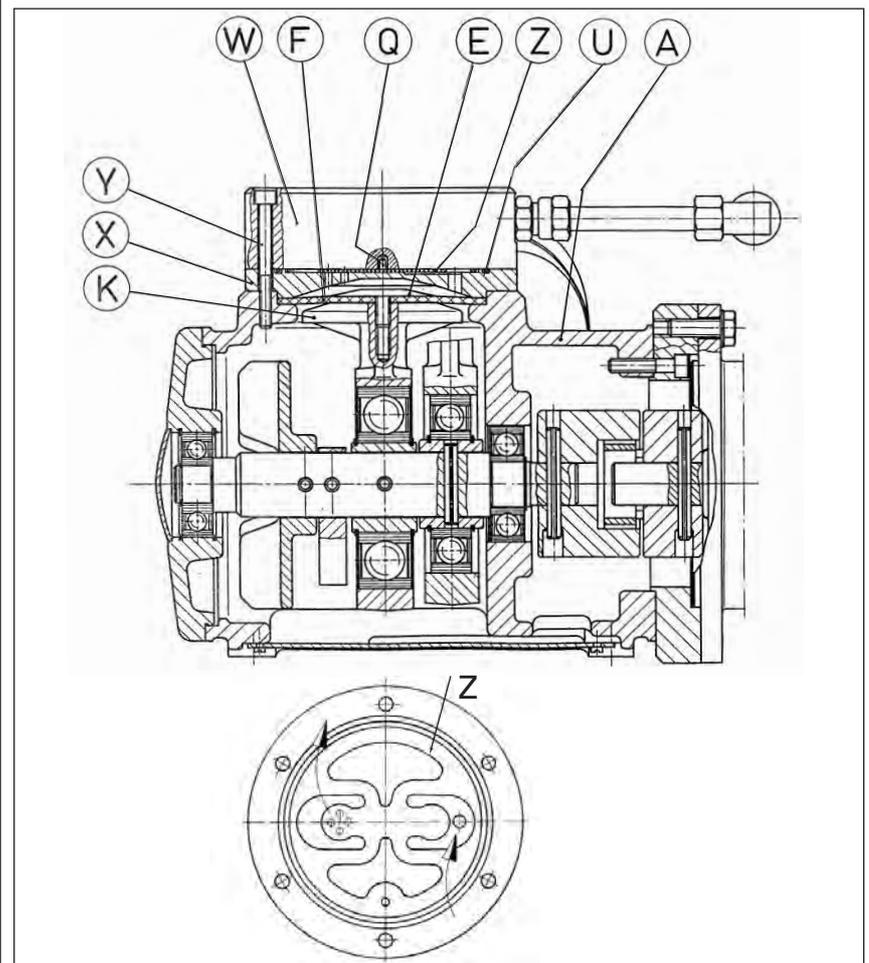


Fig. 7: Pump parts N 286 \_\_ 9 E

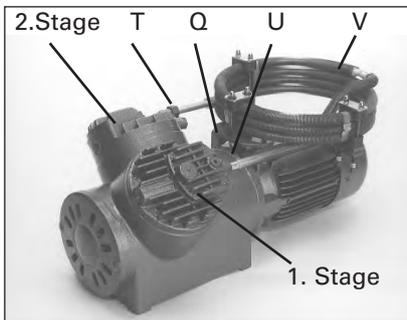


Fig. 8: N 2400.15 ANE

**Description**

- (A): Housing
- (B): Diaphragm head
- (C): Diaphragm head
- (D): Gasket
- (E): Head
- (F): Hexagon socket head cap screw
- (G): Hexagon socket head cap screw
- (H): Hexagon socket head cap screw
- (J): Slotted cheese head screw
- (K): Slotted cheese head screw
- (L): Reed valve
- (M): Cross recessed countersunk head screw
- (N): Reed valve
- (P): Locating peg
- (Q): Holding device
- (R): Retainer plate
- (S): Connecting rod
- (T): Nut
- (U): Nut
- (V): Interstage cooler
- (W): Spacer ring

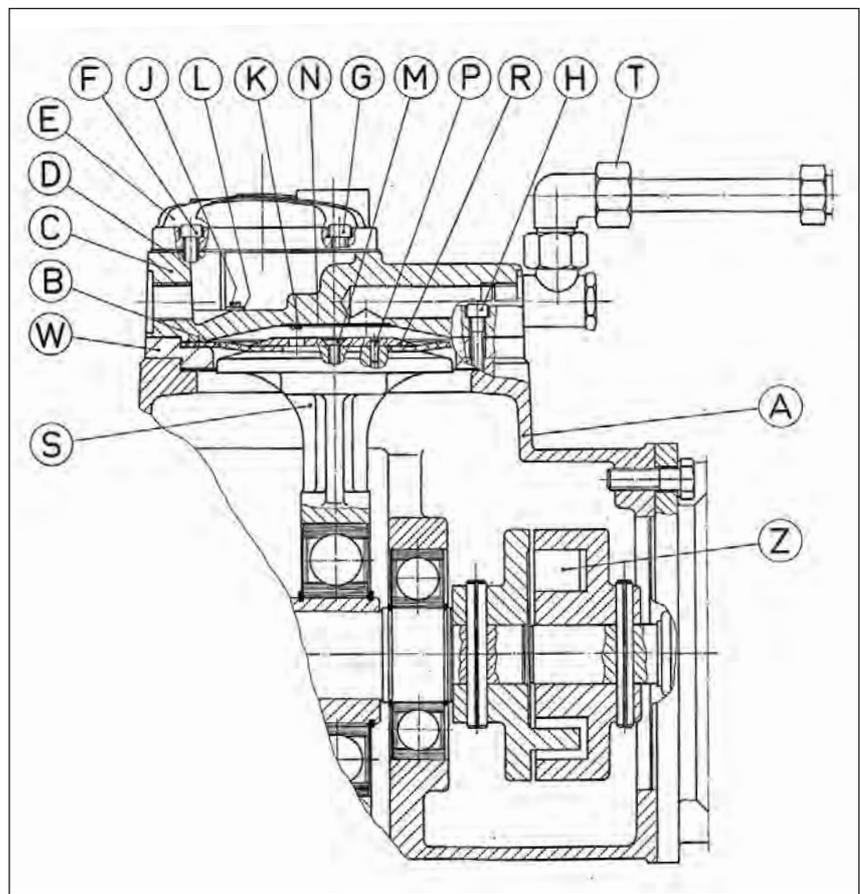


Fig. 9: Pump parts  
N 2400.15 ANE

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