Operating and Installation Instructions

Diaphragm Vacuum Pumps and Compressors

Type range:

UN012AT.16I	**UN024AT.16I**	**UN036AT.16I**	**UN036.0AT.16I**
UN012ST.11I	**UN024ST.11I**	**UN 036ST.11I**	**UN036.0ST.11I**
UN012ST.16I	**UN024ST.16I**	**UN 036ST.16I**	**UN036.0ST.16I**
UN012ST.26I	**UN024ST.26I**	**UN 036ST.26I**	**UN036.0ST.26I**

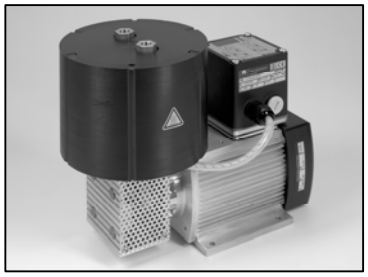

Fig. 1: UN012ST.26I

You have selected a high-quality KNF product; the following tips will help you operate it safely and reliably over a long period of time. Carefully study the Operating and Installation Instructions before using the pumps and observe at all times the relevant instructions to avoid dangerous situations. The manual was produced for the serial pumps stated above. With customer-specified projects (pump types starting with “PU“ or “MPU“) there could be differences in detail. For customer-specified projects please therefore take into account any agreed technical specifications, as well as these instructions.

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1. Description, Operating Conditions

KNF pumps in the UN 012, UN 024, UN 036 and UN 036.0 range transfer, evacuate and compress 100% oil-free. In operation they are gas-tight (leak rate: 6 x 10^{-3} mbar x l/sec), and maintenance-free.

Depending on the design, the pumps have the following characteristics:

- .16 designs have temperature-resistant pump heads for media with temperatures of up to 240 °C.
- .11 designs have a heating inset which heats the pump head to 240 °C (thermostatically regulated).
- .26 designs have a heating inset and an electronic control unit, so that the pump head can be heated to a selected temperature (60-240 °C). The software provided can be used to control the pump through a computer and operate it using user predefined cycles. The operating data are saved on the PC and can be printed out as a graphic.

1.1. Electrical Equipment

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

The motors have IP54 protection class as standard, with IP20 for the pump heads in the .11 and .26 models.

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 … + 240 °C.

For maximum permissible operating pressure, ultimate vacuum, and flow capacity see section 9.

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

Before pumping a medium, the compatibility of materials of pump head, diaphragm and valves with the medium must be checked (for pump materials: see section 9).

These pumps 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 + 10 °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 9.

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.

When using hot media, the pneumatic pump suction and pressure lines heat up, as do the pump head and the head insulation. Do not touch these parts; they could burn you.

Use only original KNF spare parts.

EC Directives / Standards

For the purposes of the Machinery Directive 2006/42/EC, pumps are “partly completed machinery,” and are therefore to be regarded as not ready for use. Partly completed machinery may not be commissioned until such time as it has been determined that the machine in which the partly completed machinery is to be assembled is in conformity with the provisions of the Machinery Directive 2006/42/EC. The essential requirements of Annex I of Directive 2006/42/EC (general principles) are applied and observed.

CE

The pumps conform to the EC Directive 2004/108/EC concerning Electromagnetic Compatibility.

The following harmonized standards have been used:

- DIN EN 61326-1
- DIN EN 61000-3-2/3
- DIN EN 60204-1

3. Installation

The pumps are built-in devices 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

DANGER

Extreme danger from electrical shock

➔ Only have the pump connected by an authorized specialist.

➔ Only have the pump connected when the power supply is disconnected.

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.

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 (e.g. electrical connection) is impossible.

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

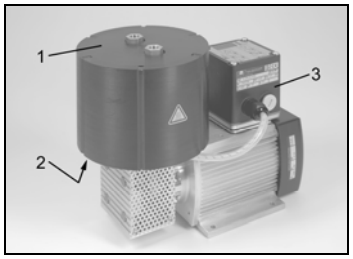

Fig. 2: Explanation of important elements on the basis of example UN 012 ST.26 I

Specification

1 Head insulation
2 Fixing screws of head insulation
3 Electronic housing (.-26-design only) or terminal cover (.-11-and .16-designs)

Electrical connection

1. Take off the housing for the electronics or terminal cover (see fig. 2); to do this, release the four screws.
2. Draw the mains cables into the electronics housing or the terminal cover through the free cable screw holes.

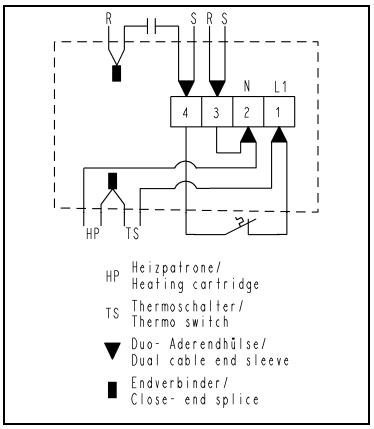

Fig. 3a: Electrical connection (.11-designs: with thermostat-regulated head heating) except for UN036_T.11I)

3. Connect the mains cables to the connections L 1 and N of the terminal block (see figs. 3a, 3b or 4).
4. Connect the earth (ground) wire to the pump motor.
5. Place the electronics housing or the terminal cover back in position and screw it tight; make sure the housing sealing is properly sited.
6. Only .26 versions (pumps with heated heads; electronically controlled): Connect the serial interface cable to an available, active COM port on the PC (to operate the pump without PC software, the interface cable can be detached on terminals X3/1-5 and removed; use the protective cap supplied to cover the unused cable fitting).

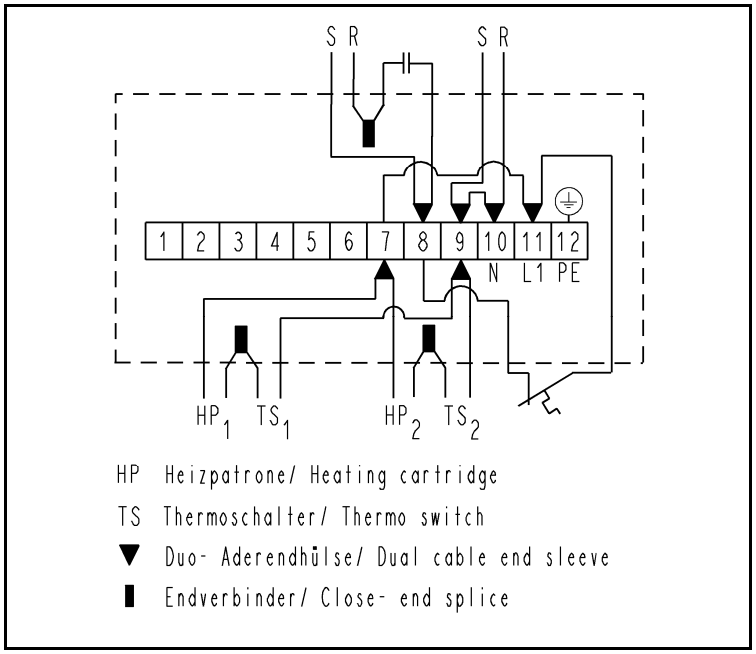

Fig. 3b: Electronic connection of UN036.0 _T.11I

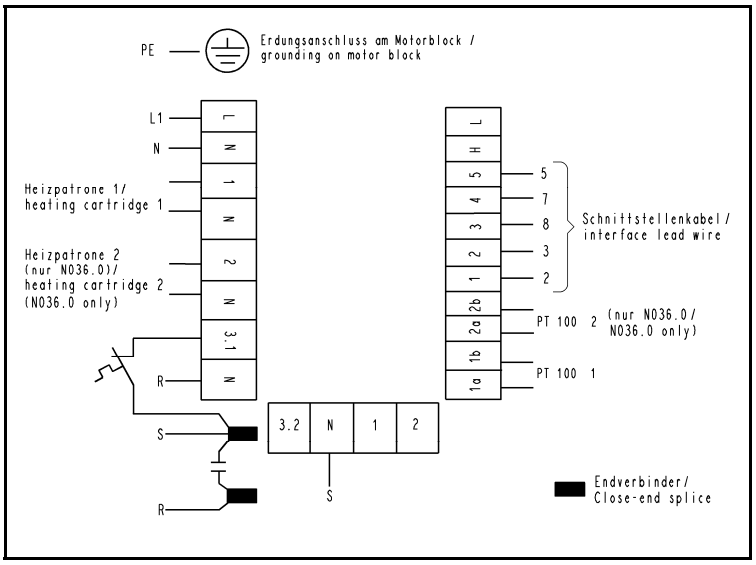

Fig. 4: Electronic connection (.26-designs: with electronically-controlled head heating)

Pneumatic

Remove the protection plugs from the port threads.

Connect the suction and pressure lines. For size of the port threads see section 9. For flow direction, see the marking on the pump head or data sheet.

Arrange the suction and pressure lines so that condensate cannot run into the pump (falling tubes).

4. Operation

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

DANGER

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 9).
- ➔ 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 9).

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 9) 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.

WARNING

Hazard of the pump head bursting due to excessive pressure increase

- ➔ Do not exceed max. permissible operating pressure (see chapter 9).
- ➔ Monitor pressure during operation.
- ➔ If the pressure exceeds the maximum permissible operating pressure, immediately switch off pump and eliminate fault (see chapter 7).
- ➔ Only throttle or regulate the air or gas quantity in the suction line to prevent the maximum permissible operating pressure from being exceeded.
- ➔ If the air or gas quantity in the pressure line is throttled or regulated, make sure that the maximum permissible operating pressure is not exceeded.
- ➔ Ensure that the pump outlet is not closed or constricted.

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.

Diaphragm and valve plates 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.

Operating pumps with electronic temperature control (.26 designs)

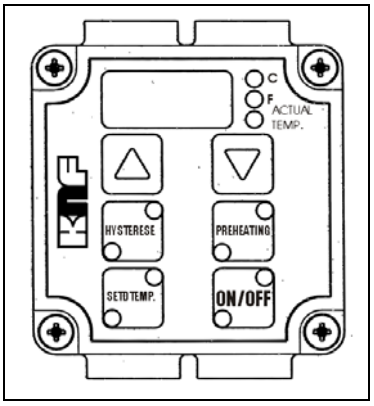

Fig. 5: Operating keys and display (only .26 design: with electronically-controlled head heating)

The pump can be operated either from the display or using the PC software. The display is on a higher level than the software, i.e. the pump can always be operated from the display. Pressing the "Off" button stops a PC-controlled cycle.

a.) Using the PC-Software

1. Insert CD into CD-ROM drive on the computer.
2. Install the PC software by running "Start_Setup.exe" or the Auto-setup routine.
3. Start the PC software by clicking on the "KNF-Pump Control" icon or running "KNF-Pump Control.exe".
4. Set the desired language from the start page and activate the program by clicking on "Start".
5. For additional information, please refer to the software description under the menu item “Help\Topic help”. You will find this file at C:\Program\knf\Pump Control\ knfhelpe.rtf. This document can be printed.

b.) Using keys of the display

See fig. 5 for operating keys and display.

Switching the pump on and off

The pump is switched on and off with the ON/OFF key.

Operating modes

UN012, UN024, UN036:

Operating mode 1 is selected at the factory. Changing the operating mode will cause error messages.

UN036.0:

Operating mode 4 is selected at the factory. The following settings can be selected:

- Operating mode 3: Enter a setpoint and a hysteresis temperature value. The two pump heads are regulated to this set point separately.
- Operating mode 4: Enter a separate set point and hysteresis temperature value for each pump head. The two pump heads are regulated separately. This mode is selected at the factory.

Setting the operating mode

1. Press the Up key and the Down key simultaneously. Within 5 seconds, press the Hysteresis key.
   - The current operating mode will be shown in the display.
2. Set the operating mode with the Up key or the Down key.
3. Press the Hysteresis key to accept the value. Alternative: 10 seconds after the last value input, the current value will be used as the set point.
   - UN012, UN024, UN036:
     Switching on with the device in operating mode 3 or 4 prompts error message E02.

- UN 036.0:
  Pump head 1 only is heated in operating mode 1.

° C and ° F

To input the set point temperature and the hysteresis, and for temperature display, a choice can be made between °C and °F.

LED for °C and LED for °F indicate which temperature display mode has been selected.

To change the temperature display mode, press the Up key and the Down key simultaneously and keep them pressed down for about 5 seconds.

- It is only possible to change between °C and °F if the pump has been turned off at the ON/OFF key.

Temperature display

During pump operation the display shows the actual temperature.

- The LED “Actual Temp” in the top right of the operating panel lights up.
- Only UN036.0: During operation in operating mode 3 or 4, the actual temperature for each of the pump heads are displayed, alternating at 5 sec intervals. The LED for the SET-TEMP key indicates the head.

To display the set point temperature during pump operation, the SET-TEMP key is pressed.

- The "Actual Temp" LED display is not visible while the set point temperature is displayed.
- The display switches back to the actual temperature 3 seconds after the SET-TEMP button has been released.
- UN036.0 in operating mode 4: When the SET-TEMP button is held down, the setpoint temperatures for each of the pump heads are displayed, alternating at 5 sec intervals. The LED for the SET-TEMP key indicates the head.

Setting the heating temperature

A temperature can be set to which the pump head is heated (setpoint temperature).

- The heating temperature can only be set if the pump has been turned off at the ON/OFF key.

1. Press the SET-TEMP key once.
   - The current set point temperature appears in the display after 2 seconds.
2. Adjust the desired temperature with the Up or Down key.
   - Temperature range:

     60-240 °C

     140-464 °F
   - To change between °C and °F, see above.
3. Press the SET-TEMP key to accept the value. Alternative: 10 seconds after the last value input, the current value will be adopted as the set point temperature.
4. UN 036.0 in operating mode 4: Repeat the set point temperature process for head 2. To do this, press the SET-TEMP key twice.

Adjusting the hysteresis

The hysteresis indicates the degree by which the set point temperature set is undercut until the heating cartridge begins to provide heat again.

- The hysteresis can only be set if the pump has been turned off at the ON/OFF key.

1. Press the Hysteresis key once.
   - The current hysteresis appears in the display after 2 seconds.
2. Adjust the desired hysteresis with the Up or Down key.
   - Hysteresis range:

     1-30 °C

     1-54 °F
   - To change between °C and °F see above.
3. Press the HYSTERESIS key to adopt the value. Alternative: 10 seconds after the last value input, the current value will be adopted as the set point temperature.
4. UN036.0 in operating mode 4: Repeat the hysteresis process for head 2. To do this, press the HYSTERESIS key twice.

Pre-heating the pump head

If the pump is switched on with the preheating function activated, pump operation will begin only when the pump head has reached the specified set point temperature. This then ensures that none of the constituents of the medium to be delivered will condense out.

1. Switch the preheating function on by using the Preheating key.
2. Switch the pump on with the ON/OFF key.
   - The pump head is heated up to the preset temperature, while the pump is not working.
   - LED ON lights up in the Preheating key.
3. When the preset temperature is reached, the pump starts to transfer.

5. Servicing

Before working on the pump, isolate the power supply securely, then check that the lines are not live.

VORSICHT

Danger of burning yourself when using hot media

➔ Let the pump head cool down before working on the pump.

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

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

WARNUNG

Health hazard due to dangerous substances in the pump

Depending on the substances transferred, caustic burns or poisoning are possible.

➔ Wear protective clothing if necessary, e.g. protective gloves.

➔ Clean pump with suitable measures.

After opening the pump head, or replacing the diaphragm and valve plates the high gas-tightness is no longer guaranteed. A leak test is able to verify that the original standard of gas-tightness has been achieved.

Spare part

Spare part*	Quantity
Valve plates	2 (per pump head)
Wave diaphragm	1 (per pump head)
O-Rings	2 (per pump head)

Tab. 1: Spare parts ** According to Spare parts list, chapter 8*

Tools and materials

Type range	Tools/Material
	Phillips screwdriver No. 1
UN012	Fork wrench or socket wrench 7 mm
UN024	Fork wrench or socket wrench 8 mm
UN036, UN036.0	Fork wrench or socket wrench 10 mm
	Pin-wrench for two-hole nuts, pin diameter 4 mm (available as “wrench for retainer plate”, a KNF accessory, see section 10)
	Screwdriver for slotted screw (only for .11-versions)
	Felt-tip pen
	Sharp knife

Tab. 2: Tools and material

Change the wave diaphragm and valve plates in the following sequence:

a.) Preparatory steps

b.) Removing pump head

c.) Changing diaphragm

d.) Changing valve plates and sealing rings

e.) Refitting pump head

f.) Final steps.

Proceed as follows (see fig. 6).

For two-headed pumps: Perform and finish all work on one pump head before working on the second pump head.

1 Support ring
2 Wave diaphragm
3 Intermediate plate
4 Head plate
5 Spring washer
6 Cap nut
7 Clamping disc
8 Connection rod disc
9 Connection rod extension
10 O-ring
11 Valve plate

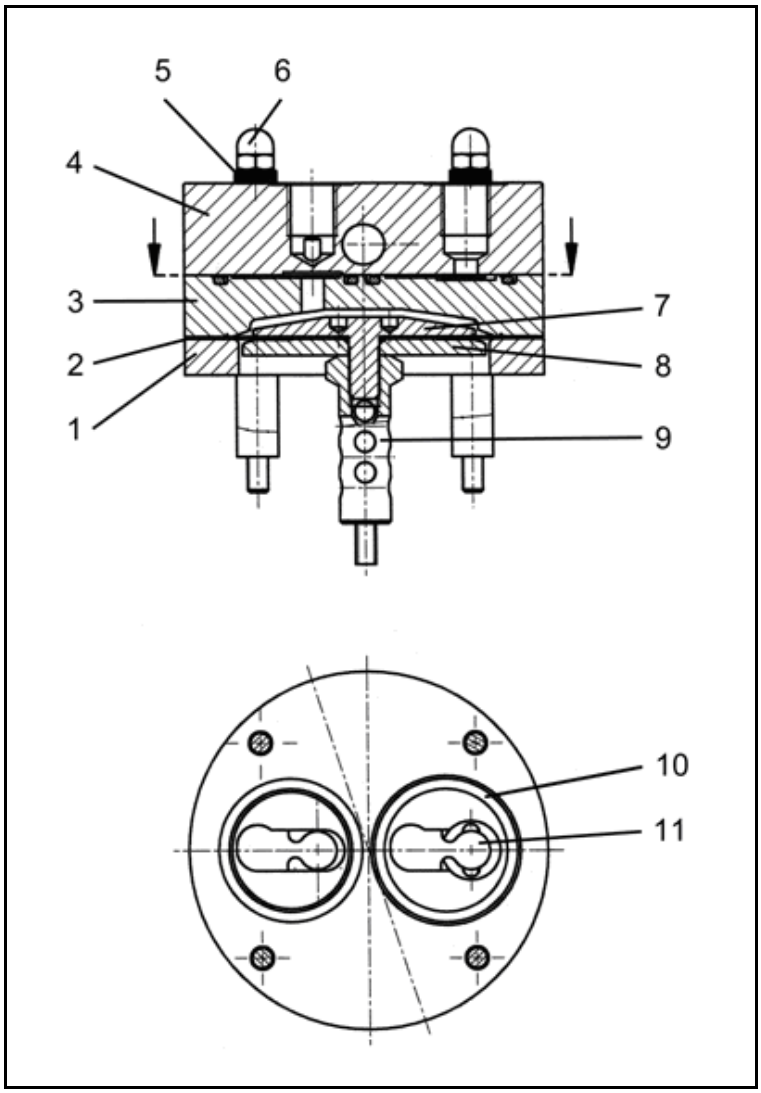

Fig. 6: Pump head (symbolic)

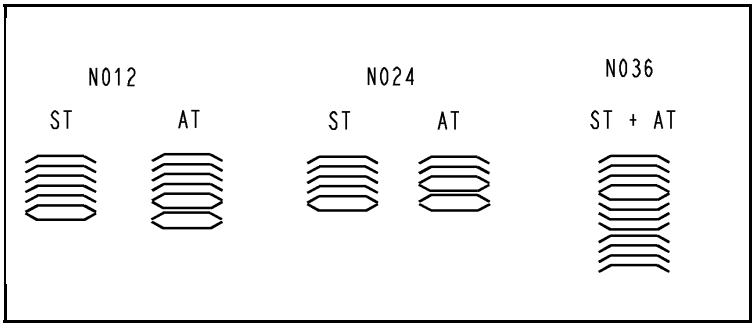

Fig. 7: Arrangement of the disk spring for material version of pump head

a.) Preparatory step

1. Disconnect the pump from the power supply; check that the pump is electrically dead and secure this.
2. Release the screws on the underside of the head insulation (see fig. 2) and lift the head insulation out upwards.
3. For .11 designs only (pumps with thermostatically-regulated head heating) and .26 designs (pumps with heated heads; electronically controlled): Remote the strain relief from the underside of the head insulation or from the compressor housing (N036.0).

b.) Removing pump head

For pumps with heating inset (.11 and .26 designs): The heating inset remains fitted in the head plate.

1. Mark the position of support ring (**1**), intermediate plate (**3**), and head plate (**4**) relative to each other by a drawing line with a felt-tip marker. This is to ensure that the parts will be reassembled in correct position at a later stage.
2. Release the cap nuts (**6**) and remove them together with the spring washers (**5**).

i The spring washers are fitted in order to maintain the tension of the wave diaphragm right across the temperature range of the pump.

3. Remove head plate (**4**).
4. Remove intermediate plate (**3**).
5. Remove the valve plates (**11**) and O-rings (**10**) from the intermediate plate (**3**).

c) Changing diaphragm

1. Cut around the circumference of the wave diaphragm (**2**) (cut clamping disc (**7**) free - to facilitate loosening).
2. Release the clamping disc (**7**) by turning it counter-clockwise with a pin wrench or a clamping disc wrench. To counter hold, insert open-ended wrench above the upper insulating plate and onto the connecting rod extensions (**9**).

i Take care to ensure that the shims do not slip under the diaphragm support (**8**).

3. Remove wave diaphragm (**2**).
4. Check that all parts are free from dirt and clean them if necessary (see section *6. Cleaning*).
5. Slide a new wave diaphragm (**2)** onto the threaded bolt of the retainer plate (**7**).
6. Screw the clamping disc (**7**) with wave diaphragm (**2**) into the connection rod extension (**9**); to tighten the retainer plate, use the wrench for clamping disc/the pin wrench to turn it firmly clockwise.

Tightening torque:

UN012: 7 Nm

UN024: 8 Nm

UN036, UN036.0: 13 Nm

d) Changing valve plates and sealing rings

1. Check that intermediate plate and head plate is clean (see section 6). If damage, distortion, or corrosion is evident on these parts, they should be replaced.
2. Place the intermediate plate (**3**) on the support ring (**1**) in the position indicated by the felt tip pen mark.
3. Lay the new valve plates (**11**) onto the valve seats of the intermediate plate (**3**).

The valve plates are identical for the pressure and suction side; the position of the valve plates is determined by the shape of the valve seats

4. Fit the new O-rings (**10**) in the intermediate plate (**3**).

e) Refitting pump head

1. Place the head plate (**4**) on the intermediate plate (**3**) in the position indicated by the felt-tip pen marking.
2. Place spring washers (**5**).
   For position see fig. 7.
3. Place the cap nuts (**6**) in position, and tighten to the torque value shown below.

   UN012: 2 Nm

   UN024: 5 Nm

   UN036, UN036.0: 7 Nm

f) Final steps

1. Refit the head insulation.
2. .11 designs only (pumps with thermostatic-regulated head heating) and .26 designs (pumps with heated heads; electronically controlled):

   Slide the protective tube into the bore of the base plate. Tighten the strain relief on the underside of the head insulation or on the compressor housing (UN036.0).
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 and wave 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 of motor:
  - Disconnect pump from mains and allow it to cool. Trace cause of over-heating and eliminate it.
- Connections or lines are blocked
- An external valve is closed, or a filter blocked.
- Liquid (condensate) has collected in the pump head:
  - Let the pump run for a few minutes pumping air (if necessary for safety reasons: pumping an inert gas.)
  - Install the pump at the highest point in the system.
- Diaphragms or valve plates are worn:
  - Section 5 Servicing.

Flow, pressure, or vacuum too low

- Compare the actual performance with the figures in section 9 or the data sheet.
- 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 plate is worn, or dirt is in the head.
  - ▸ Section 5 Servicing.

Pump head is not heating up:
(.11 and .26 designs only)

- Check the cable connections in the terminal box (.11 designs) or electronics housing (.26 designs) respectively (see Fig. 2).
- Check the voltage in the mains power supply.

If you do not find a fault, contact your KNF technical adviser.

Error messages in the display:
(.26-designs only)

- Displays E01:

  The temperature measured at the heating inset is outside the permissible range. For two-headed pumps this refers to head 1.

  - ▸ Pump and heating inset(s) are switched off.
- Displays E02:

  UN012, UN024, UN036:
  A two-head pump operating mode has been selected by mistake.

  UN 036.0:
  The temperature measured at the heating inset of head 2 is outside the permissible range.

  - ▸ Pump and heating inset(s) are switched off.
- Displays E03 or E04:

  The temperature measured at the heating inset of head 1 (E03) or head 2 (E04), with temperature controlling active, is 10 °C or more above the set point temperature which has been set.

  - ▸ Pump and heating inset(s) are switched off.
- Displays E05:

  Electronics error (transducer malfunction).

  - ▸ Pump and heating inset(s) are switched off.

If the pump does not operate properly and you cannot find any of the above faults, send it to the KNF Service Department.

In order for KNF to repair the pump, the customer must provide a statement on the media which were pumped and on pump cleaning. Please fill out the corresponding KNF form, and submit it together with the pump. A sample statement for copying can be found in section 11 of these operating instructions.

8. Spare parts and accessories

Spare parts

UN012 _T._I

Spare part	Order No.
Valve plate	049733
Wave diaphragm	049734
O-ring	055675
Spring washer	056019

Tab. 3

UN024 _T._I

Spare part	Order No.
Valve plate	049733
Wave diaphragm	051337
O-ring	055675
Spring washer	056020

Tab. 4

UN036 _T._I

UN036.0 _T._I

Spare part	Order No.
Valve plate	054112
Wave diaphragm	054111
O-ring	055676
Spring washer	056021

Tab. 5

9. Tables

Pump type	Max. permissible operating pressure (bar g)	Ultimate vacuum (mbar abs.)	Delivery rate* (l/min) at atm. pressure
UN012	1.5	240	10.5
UN024	1.5	200	18
UN036	1.5	200	30**

Tab. 6; Pneumatic Data **Liters in standard state (1,013 mbar); **Two headed pumps: Flowrate per pump head*

Pump type	Material*		
	Pump head	Wave diaphragm	Valve
UN0xx(.0)ST.xxI	Stainless steel	PTFE	PTFE
UN0xx(.0)AT.xxI	Aluminium	PTFE	PTFE

Tab. 7: Pump materials **Material abbreviations according DIN ISO 1629*

Pump type	Thread size
UN012xx.xxI	1/8” NPT
UN024xx.xxI	1/8” NPT
UN036(.0)12 xx.xxI	¼“ NPT

Tab. 8: Size of pneumatic port threads

10. Accessory

Wrench for clamping disc 018812

11. Product Return

➔ KNF provides warranty and non-warranty repair services for all products.

➔ A Return Material Authorization (RMA) number is required for all product returns.

- To receive an RMA number, submit a completed Decontamination Declaration form to rma@knf.com

➔ The Decontamination Declaration form can obtained from our website or by contacting KNF Technical Services.

- http://www.knf.com/pdfs/decontamdec.doc
- Phone: 609-890-8600

➔ Product return instructions will be provided when the RMA is issued.

KNF Neuberger, Inc
2 Black Forest Rd
Trenton, NJ 08691-1810

Phone: 609-890-8600

Fax: 609-890-8323

Website: www.knf.com/usa.htm