

# Operating and Installation Instructions

## Mini Diaphragm Vacuum Pumps

Type ranges:	<b>N 89 KNE</b>	<b>N 811 KNE</b>	<b>N 815 KNE</b>
	<b>N 89 KTE</b>	<b>N 811 KTE</b>	<b>N 815 KTE</b>
	<b>N 89 KNDC</b>	<b>N 811 KNDC</b>	<b>N 815 KNDC</b>
	<b>N 89 KTDC</b>	<b>N 811 KTDC</b>	<b>N 815 KTDC</b>

## Mini Diaphragm Vacuum Pumps and Compressors

Type range:	<b>N 814 KNE</b>	<b>N 814 KTE</b>
	<b>N 814 KNDC</b>	<b>N 814 KTDC</b>



Fig. 1: N 89 KNDC



Fig.. 2: N 815 KNE

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

KNF Neuberger SAS  
4, Bld. d'Alsace Z.I.  
F-68128 Village-Neuf  
Tel. 0033 (0)389 70 35 00  
Fax 0033 (0)389 69 92 52

E-mail: [info@knf.fr](mailto:info@knf.fr)  
[www.knf.fr](http://www.knf.fr)

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## 1. Description, Operating Conditions

KNF pumps in the N 89, N 811, N 814 and N 815 range transfer and evacuate 100% oil-free. In operation they are gas-tight, and maintenance-free.

### 1.1. Electrical Equipment

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

Protection class of standard version is IP00.

### 1.2. Operating Conditions

Handling air, gases, and vapours at temperatures between + 5 °C + 40 °C.

For maximum permissible operating pressure, ultimate vacuum, and flow capacity see section 10.

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

Before pumping a medium, the compatibility of materials of pump head, diaphragm and valves with the medium must be checked (for pump materials: see section 10).

KNF pumps in the N 89, N 811, N 814 and N 815 range must not be used for liquids. You will find suitable liquid pumps in our Product Program.

If your potential application lies outside the above limits discuss it with our technical adviser (see last page for contact telephone number).

### 1.3. Ambient Conditions

When the pump is operating the following ambient conditions must be maintained:

- Ambient temperature during operation: between + 5 °C + 40 °C.
- The pumps must not be used in areas where there is a danger of explosion.
- The pumps must be protected from the effects of dust and water.
- During operation an adequate supply of air for cooling must be provided.

### 1.4. Pump materials

See section 10.

## 2. Safety

**The pumps have Protection Class 00, and so offer no protection against contact or foreign bodies. It is therefore essential to provide protection for persons against contact with live parts (e.g. electrical connections, motor windings), and moving parts (e.g. fan). Protection against the entry of foreign bodies must also be provided.**

**The pumps have no protection against water. In this case too, as far as is relevant, measures to protect the pump must be taken before putting it into service.**

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.

For pumps with a thermal switch: When the operation of the pump is interrupted by the thermal switch, the pump will re-start automatically after cooling down. Take all care necessary to prevent this leading to a dangerous situation.

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

Use only original KNF spare parts.

### EC Directives / Standards

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

- General Principles No. 1
- No. 1.1.2. / 1.1.3. / 1.3.1. / 1.3.3. / 1.3.4. / 1.4.1. / 1.5.1.\* / 1.5.2.\* / 1.5.8. / 1.5.9. / 1.7.4. / 1.7.4.1. / 1.7.4.3.  
(\* only for pumps with AC motor)

As these partly completed machinery are OEM-models the power supplies and the equipment for disconnecting and switching-off the partly completed machinery respectively have to be considered when mounting as well as over-current and overload protective gear.

In addition a protection against mechanical parts in motion and hot parts, if existing, has to be provided when mounting.



The pumps conform to the Directive 2011/65/EU (RoHS2).

The pumps conform to the Directive 2014/30/EU concerning Electromagnetic Compatibility.

The following harmonized standards have been used:

N89 K_E	N89 K_DC
N811 K_E	N811 K_DC
N814 K_E	N814 K_DC
N815 K_E	N815 K_DC
DIN EN 55014-1/2	DIN EN 55014-1/2
DIN EN 61000-3-2/3	DIN EN 60034-1
DIN EN 60335-1	DIN EN 61000-6-1/2
DIN EN 50581	DIN EN 50581

*Tab. 1*

### 3. Installation

**The pumps in the N 89, N 811, N 814 and N 815 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 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.  
For pumps with fan: Install the pump so that accidental finger contact with the fan is impossible.  
Fit the pump at the highest point in the system, so that condensate cannot collect in the head of the pump - that prolongs working life.

**Electrical** **When making the electrical installation the safety regulations must be observed. In particular make sure that the electricity supply is isolated before trying to connect the pump.**  
Compare the supply data with the data on the motor-plate. The voltage must not vary by more than +10% and -10% from that shown on the type-plate.  
The earth (ground) wire must be connected to the motor (not necessary on dc motors up to 24 V).  
With dc motors the wires must be connected to the correct polarity.  
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 (connection, possibly windings) is impossible.  
For pumps with ac motor: We recommend that a fuse is installed in the supply circuit; the operating current is given in Data Sheet.

#### **EMC-compatible Installation (for N89/811/814/815 DC)**

The Tests:

- Magnetic field with energy-technical frequency
- Electromagnetic HF field, amplitude-modulated
- Electromagnetic HF field, pulse-modulated
- Discharging of static electricity
- High frequency, asymmetric
- Fast transients

were not carried out, cause the products do not contain electronic modules, which can be affected by these tests.

The Surge-test can only be passed with additional means, or is not mandatory, if: From EN61000-6-1 technical norm for EMC protection, part 1,10 test demands for EMC protection, table 3, EMC protection, D.C.- power in- and outputs. Remark 3: (quotation) Not to be used with input connections which are foreseen for a connection with a battery or a rechargeable battery which has to be removed or disconnected from the device for the recharge.

Devices with a D.C. power input which are foreseen to be operated with an A.C. / D.C. converter have to be tested at an A.C. power input of an A.C. / D.C. converter fixed by the manufacturer. In case the converter was not fixed they have to be tested at an A.C. power input of a typical (usual) A.C. / D.C. converter.

The test is applicable for D C power inputs which are foreseen for a permanent connection to cables which are longer than 10 m.

Pneumatic

Remove the protection plugs from the port threads.

The accessories silencer, and hose connectors (where applicable) are screwed into the port threads.

Connect the suction and pressure lines (thread size G1/8). 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 (sloping lines).

## 4. Operation

**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 pumping a medium, the compatibility of materials of pump head, diaphragm and valves with the medium must be checked (for pump materials: see section 10).

The pump must not start against pressure or vacuum. When it is switched on the pressure in the suction and pressure lines must be atmospheric. This must be so even when the pump restarts after the power has been cut off for a short period.

The maximum permissible operating pressure (see section 10) must not be exceeded.

To prevent the maximum permissible operating pressure being exceeded, restriction or control of the air or gas flow should only be carried out in the suction line.

If restriction or control of the air or gas flow is made on the pressure side ensure that the maximum permissible operating pressure is not exceeded.

When the pump is at a standstill the inlet and exhaust must be at normal atmospheric pressure.

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 diaphragm and valve plates/sealings at the same time.

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

Tab. 2

\* According to Spare parts list, section 8

Tools	Type range	Tools/Material
	All beside N 815 KNE und N 815 KTE	Phillips screwdriver no. 1
	Only N 815	Phillips screwdriver no. 2
		Felt-tip pen

Tab. 3

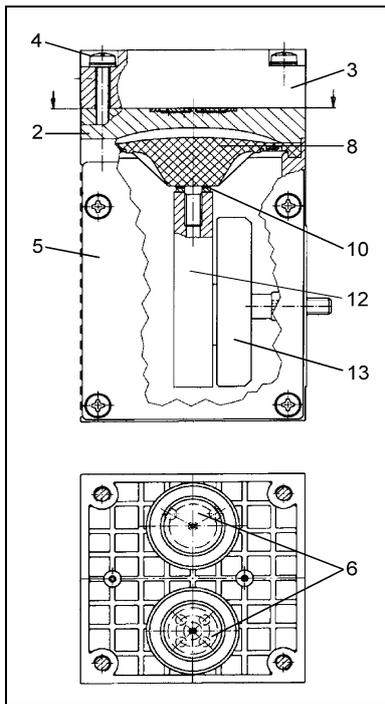


Fig. 3: Type ranges N 89/N 811

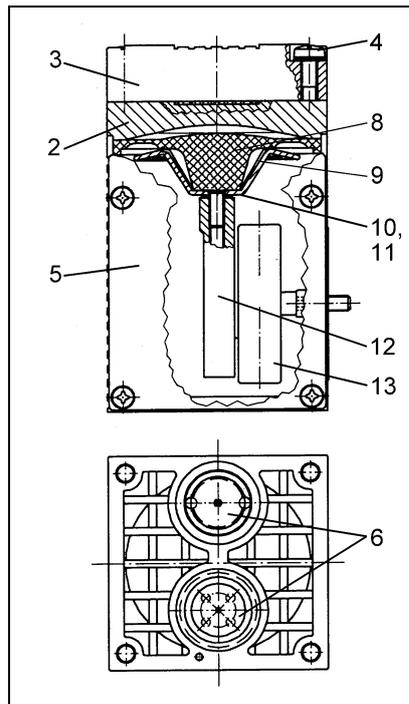


Fig. 4: Type range N 815

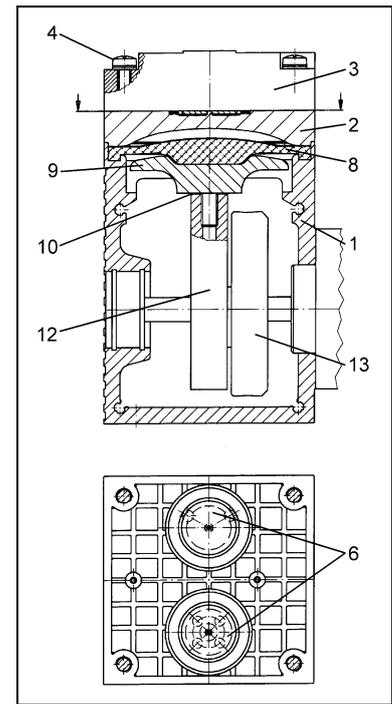


Fig. 5: Type range N 814

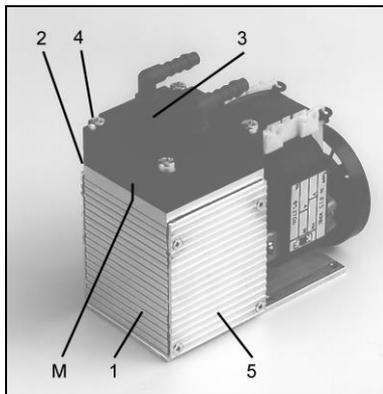


Fig. 6: (for all pump types)

### Specification

#### Pos. Description

- |    |                                                          |
|----|----------------------------------------------------------|
| 1  | Housing                                                  |
| 2  | Intermediate plate                                       |
| 3  | Head plate                                               |
| 4  | Screw                                                    |
| 5  | Cover                                                    |
| 6  | Valve plate/sealing                                      |
| 8  | Structured diaphragm                                     |
| 9  | Diaphragm support (only for type ranges N 814 and N 815) |
| 10 | Diaphragm spacer(s)                                      |
| 11 | Disc spring (only for type range N 815)                  |
| 12 | Connection rod                                           |
| 13 | Counter weight                                           |

M: Mark

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

- a) Remove pump head
- b) Change structured diaphragm
- c) Change valve plates/sealings
- d) Refit pump head

Proceed as follows (see figs. 3 and 6 for type ranges N 89 / N 811, figs. 5 and 6 for type range N 814, or figs. 4 and 6 for type range N 815):

**a) Remove pump head**

1. Make a mark (**M**) on the head plate (**3**), Intermediate plate (**2**) and housing (**1**) This helps avoid incorrect assembly later.
2. Undo the 4 screws (**4**) in the head plate and lift the head plate with the intermediate plate off the pump housing.
3. Only for models with dc motors (no cooling fan): Remove cover (**5**) from pump housing after loosening the four screws.
  - On these models, which have no fan, where reference is made to turning or holding the cooling fan, the necessary operations must be carried out by turning or holding the counterweight (**13**).

**b) Change structured diaphragm**

1. Turn the fan to bring the structured diaphragm (**8**) to top dead centre.
2. Lift the edge of the structured diaphragm and, gripping it on opposite sides, unscrew it by turning anti-clockwise.
3. Type ranges N 89 / N 811:  
Take the diaphragm spacer(s) (**10**) off the threaded portion of the structured diaphragm and retain them.  
Type range N 814:  
Take the diaphragm support (**9**) and the diaphragm spacer(s) (**10**), and disc spring (**11**), off the threaded portion of the structured diaphragm and retain them.  
Type range N 815:  
Take the diaphragm support (**9**) and the diaphragm spacer(s) (**10**) off the threaded portion of the structured diaphragm and retain them.
4. Check that all parts are free from dirt and clean them if necessary (see section 6. Cleaning).
5. Type ranges N 89 / N 811:  
Put the diaphragm spacer(s) (**10**) on the thread of the new structured diaphragm.  
Type range N 814:  
Put the diaphragm support (**9**), and the diaphragm spacer(s) (**10**) on the thread of the new structured diaphragm.  
Type range N 815:  
Put the diaphragm support (**9**), diaphragm spacer(s) (**10**), and disc spring (**11**), in that order, on the thread of the new structured diaphragm.  
The concave side of the disc spring must be towards the structured diaphragm.
6. Turn the fan until the connecting rod (**12**) is at top dead centre.

7. Screw the structured diaphragm, complete with diaphragm support (only type ranges N 814 and N 815), diaphragm spacer(s), and disc spring (only type range N 815) into the connecting rod (clockwise) and tighten it by hand.

**c) Change valve plates/sealings**

1. Separate the head plate (3) from intermediate plate (2).
2. Remove the valve plates/sealings (6) from the intermediate plate.
3. Check that the valve seats in the head plate and intermediate plate are clean; if scratches, distortion, or corrosion are evident on these parts they should be replaced.
4. Lay the new valve plates/sealings (6) in the recesses in the intermediate plate (2). The valve plates/sealings for suction and pressure sides are identical, as are upper and lower sides of the valve plates/sealings.
5. Check that the valve plates/sealings are not deformed by moving them gently sideways in their recesses.

**d) Refit pump head**

1. Turn the fan to bring the structured diaphragm to top dead centre.
2. Place the intermediate plate (2) and head plate (3) on the housing, in the position indicated by the marking (M).
3. Check that the head plate is centered by moving it gently sideways.
4. Gently tighten the screws (4), evenly and diagonally.
5. Turn the fan to check that the pump rotates freely.
6. Turn the fan again to bring the diaphragm to top dead centre.
7. Now tighten screws (4) firmly In the case of dc version (no cooling fan): refix the cover (5) to housing (1).

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.

As far as possible, clean the parts with a dry cloth. Solvents should not be used as they can attack the plastics, and synthetic rubber parts. 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 a thermal switch:  
Thermal switch has opened due to over-heating of motor.
  - ▶ Disconnect pump from mains and allow to cool.  
Trace cause of over-heating and eliminate it.
- Connections or lines are blocked.
- An external valve is closed, or a filter blocked.
- Liquid (condensate) has collected in the pump head.
  - ▶ Let the pump run for a few minutes pumping air (if necessary for safety reasons: pumping an inert gas.)
  - ▶ Install the pump at the highest point in the system.
- Diaphragms or valve plates/sealings are worn.
  - ▶ Section 5 Servicing.

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

- Compare the actual performance with the figures in section 9 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.

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 12 of these Operating and Installation Instructions.

## 8. Spare parts

### Pump range N 89

Pos. Nr.*	Spare part	Pump type	Order-No.
(2)	Intermediate plate	N 89 KNE, N 89 KNDC	028789
(2)	Intermediate plate	N 89 KTE, N 89 KTDC	044408
(3)	Head plate		028791
(6)	Valve plate/sealing	N 89 KNE, N 89 KNDC	113947
(6)	Valve plate/sealing	N 89 KTE, N 89 KTDC	113950
(8)	Structured diaphragm	N 89 KNE, N 89 KNDC	029231
(8)	Structured diaphragm	N 89 KTE, N 89 KTDC	029232

Tab. 4

\*according to figs. 3 and 6

### Pump range N 811

Pos. Nr.*	Spare part	Pump type	Order-No.
(2)	Intermediate plate	N 811 KNE, N 811 KNDC	028789
(2)	Intermediate plate	N 811 KTE, N 811 KTDC	044408
(3)	Head plate		028791
(6)	Valve plate/sealing	N 811 KNE, N 811 KNDC	113947
(6)	Valve plate/sealing	N 811 KTE, N 811 KTDC	113950
(8)	Structured diaphragm	N 811 KNE, N 811 KNDC	029231
(8)	Structured diaphragm	N 811 KTE, N 811 KTDC	029232

Tab. 5

\*according to figs. 3 and 6

### Pump range N 814

Pos. Nr.*	Spare part	Pump type	Order-No.
(2)	Intermediate plate		043259
(3)	Head plate		029148
(6)	Valve plate/sealing	N 814 KNE, N 814 KNDC	113949
(6)	Valve plate/sealing	N 814 KTE, N 814 KTDC	113950
(8)	Structured diaphragm	N 814 KNE, N 814 KNDC	043262
(8)	Structured diaphragm	N 814 KTE, N 814 KTDC	043261

Tab. 6

\*according to figs. 5 and 6

**Pump range N 815**

Pos. Nr.*	Spare part	Pump type	Order-No.
(2)	Intermediate plate	N 815 KNE, N 815 KNDC	024970
(2)	Intermediate plate	N 815 KTE, N 815 KTDC	044534
(3)	Head plate		024968
(6)	Valve plate/sealing	N 815 KNE, N 815 KNDC	059267
(6)	Valve plate/sealing	N 815 KTE, N 815 KTDC	057172
(8)	Structured diaphragm	N 815 KNE, N 815 KNDC	024489
(8)	Structured diaphragm	N 815 KTE, N 815 KTDC	024490
(9)	Diaphragm support		025064

Tab. 7

\*according to figs. 4 and 6

**9. Accessories**

N 89

N 811

N 814

Description	Order No.
Filter/ Silencer	000346
Hose connector PA, G 1/8	000360

Tab. 8

N 815

Description	Order No.
Silencer G1/8	000346
Hose connector PA, G 1/8	000360
90° Hose connector PA, G 1/8	001858
Hose connector PVDF, G 1/8	014052

Tab. 9

## 10. Tables

Pump type	Max. permissible operating pressure (bar g)	Ultimate vacuum (mbar abs.)	Delivery rate* (l/min) at atm. pressure
N 89 KNE	0.5	100	9.5
N 89 KNDC	0.5	100	9
N 89 KTE	0.5	170	9.5
N 89 KTDC	0.5	170	9
N 811 KNE	0.5	100	11.5
N 811 KNDC	0.5	100	11
N 811 KTE	0.5	170	11.5
N 811 KTDC	0.5	170	11
N 814 KNE	2.0	240	11.5
N 814 KNDC	2.0	240	12
N 814 KTE	2.0	290	11.5
N 814 KTDC	2.0	290	12
N 815 KNE	-	100	15
N 815 KNDC	-	100	16
N 815 KTE	-	160	14
N 815 KTDC	-	160	15

Tab. 10: Pneumatic Data

\*Litre at STP (1013 mbar)

Pump type	Material		
	Pump head	Wave diaphragm	Valve
N 89 KNE	PPS	EPDM	CR
N 89 KNDC	PPS	EPDM	CR
N 89 KTE	PPS	PTFE-coated	FFPM
N 89 KTDC	PPS	PTFE-coated	FFPM
N 811 KNE	PPS	EPDM	CR
N 811 KNDC	PPS	EPDM	CR
N 811 KTE	PPS	PTFE-coated	FFPM
N 811 KTDC	PPS	PTFE-coated	FFPM
N 814 KNE	PPS	EPDM	FPM
N 814 KNDC	PPS	EPDM	FPM
N 814 KTE	PPS	PTFE-coated	FFPM
N 814 KTDC	PPS	PTFE-coated	FFPM
N 815 KNE	PPS	CR	EPDM
N 815 KNDC	PPS	CR	EPDM
N 815 KTE	PPS	PTFE-coated	FFPM
N 815 KTDC	PPS	PTFE-coated	FFPM

Tab. 11: Pump Materials

## 11. Returns

Pumps and systems used in laboratories and process-based industries are exposed to a wide variety of conditions. This means that the components contacting pumped media could become contaminated by toxic, radioactive, or otherwise hazardous substances.

For this reason, customers who send any pumps or systems back to KNF must submit a Health and safety clearance and decontamination form in order to avoid a hazardous situation for KNF employees. This Health and safety clearance and decontamination form provides the following information, among other things:

- physiological safety
- whether medium-contacting parts have been cleaned
- whether the equipment has been decontaminated
- media that have been pumped or used

To ensure worker safety, work may not be started on pumps or systems without a signed Health and safety clearance and decontamination form.

For optimal processing of a return, a copy of this declaration should be sent in advance via e-mail, regular mail, or fax to KNF Customer Service (refer to final page for address). In order to avoid endangering employees who open the shipment's packaging, despite any residual hazards, the original version of the Health and safety clearance and decontamination form must accompany the delivery receipt on the outside of the packing.

The template for the Health and safety clearance and decontamination form is included with these Operating Instructions and may also be downloaded from the KNF website.

The customer must specify the device type(s) and serial number(s) in the Health and safety clearance and decontamination form in order to provide for the unambiguous assignment of the Declaration to the device that is sent to KNF.

In addition to the customer's declaration of physiological safety, information about operating conditions and the customer's application are also of importance to ensure that the return shipment is handled appropriately. Therefore, the Health and safety clearance and decontamination form requests this information as well.

## 12. Health and safety clearance and decontamination form



Form: Rev. 02 / download: [www.knf.com](http://www.knf.com)

### Health and safety clearance and decontamination form

This declaration must be present and complete (the original must accompany the shipment's delivery receipt) before the returned device can be examined.

Device type: .....

Serial number(s): .....

.....

.....

Reason for returning the device (please describe in detail):

(The device(s) was(were) in operation       yes       no)

.....

.....

.....

.....

.....

We confirm that the above device(s)

has(have) pumped exclusively **physiologically unobjectionable** media and that it(they) are free of hazardous materials and any materials that are harmful to health.

Pumped media: .....

The device(s) was(were) cleaned       yes       no

has(have) pumped media of the following category(categories) which are not physiologically unobjectionable and that cleaning of the device(s) (potentially only media-contacting parts) is required.

Name, chemical formula, Material Safety Data Sheet

aggressive .....

biological .....

radioactive .....

toxic .....

other .....

The device(s) was(were) decontaminated and work can proceed without special measures       yes

Method / proof: .....

.....

The device(s) was(were) not decontaminated and special measures are required before starting work       yes

Measures: .....

.....

Legally binding declaration

We herewith affirm that the information provided in this form is correct and complete. Shipment of the devices and components is in compliance with statutory regulations.

.....  
 Company (stamp)      Date      Name      Authorized signature      Position





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