KNF 339416-339418 02/23

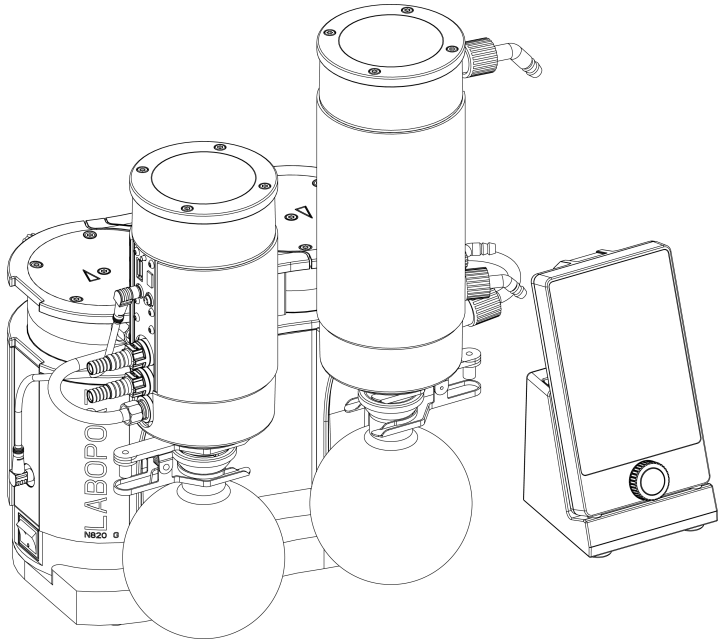
EN

Labor

SC820G / SC840G

TRANSLATION OF ORIGINIAL OPERATING INSTRUCTION ENGLISH

LABOPORT®
VACUUM SYSTEM



Notice!
Before operating the pump and accessories, read and observe the operating and installation instructions as well as the safety information!

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1 Scope of delivery

- Laboport ® vacuum system:
  SC820G or SC840G (**1**)
- Vacuum controller (**8**)
- USB cable (**13**)
- Charging cradle (**9**)
- Vacuum controller Bluetooth stick (**10**)
- Vacuum system Bluetooth stick (**11**)
- Signal cable (**14**)
- Coated collection flasks (2x) (**7**)
- Flask clamp (2x) (**6**)
- Key for hose connector (WAF 14) (**4**)
- Power supply incl. plug insert (EU, US, UK, AU) (**12**)
- Power cable (**3**)
- Operating instructions (**2**)
- QuickStart
- Safety brochure

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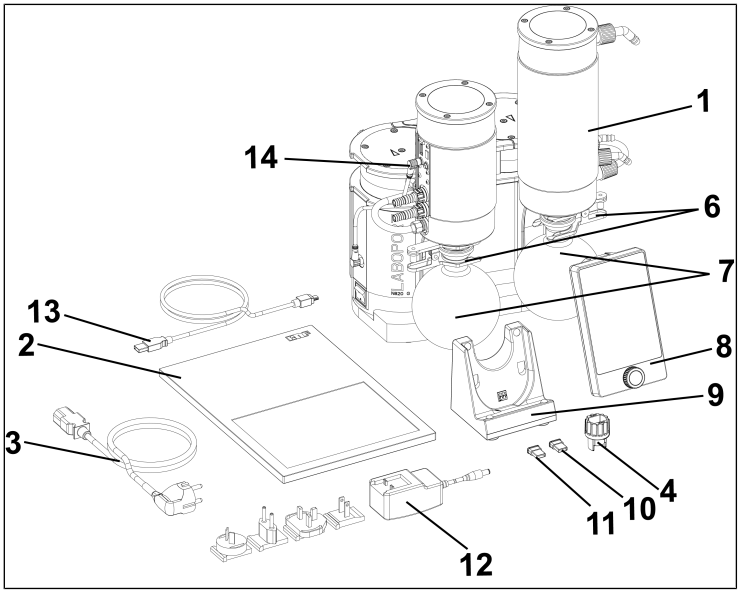

Fig.1: Scope of delivery (SC820G illustrated as example)

Unpack vacuum system

1. Check the vacuum system and the accessories supplied for transport damage after unpacking.
2. If the packaging is damaged, inform the responsible forwarding agent so that a damage report can be prepared. For further information, read Chapter *7 Transport [▷ 38]*.

2 About this document

2.1 Using the operating instructions

The operating instructions are part of the vacuum system.

→ In the event of uncertainties with regard to the content of the operating instructions, please contact the manufacturer (contact data: see *www.knf.com*). Have the type and serial number of the vacuum system at hand when doing so.

→ Read the operating instructions before putting the vacuum system into operation.

→ Only pass the operating instructions on to the subsequent owner in full and unchanged.

→ Keep the operating instructions within reach at all times.

2.2 Exclusion of liability

The manufacturer assumes no liability for damages and malfunctions resulting from failure to observe the operating instructions.

The manufacturer assumes no liability for damages and malfunctions resulting from changes or modifications to the device and improper handling.

The manufacturer assumes no liability for damages and malfunctions resulting from impermissible spare parts and accessories.

2.3 Symbols and markings

Warning notice

WARNING

A notice that warns you of danger is located here.

Possible consequences of a failure to observe the warning notice are specified here. The signal word, e.g., Warning, indicates the danger level.

→ Measures for avoiding the danger and its consequences are specified here.

Danger levels

Signal word	Meaning	Consequences if not observed
DANGER	warns of immediate danger	Death or serious injury or serious damage will result.
WARNING	warns of possible danger	Death, serious injury or serious damage is possible.
CAUTION	warns of a possibly dangerous situation	Minor injury or damage is possible.
NOTICE	Warns of possible damage	Damage is possible.

Tab.1: Danger levels

Other notices and symbols

→ An activity to be carried out is specified here (a step).

1. The first step of an activity to be carried out is specified here.
   Other sequentially numbered steps follow.

i This symbol indicates important information.

Explanation of pictograms

Pictogram	Meaning
	General warning symbol
	Warning of hot surface
	Warning of electrical voltage
	Warning of explosive atmosphere
	Warning of poisonous substances
	ESD protected area
	Observe the operating instructions
	General mandatory sign
	Unplug mains plug
	Use foot protection
	Use hand protection
	WEEE Symbol for separate tracking of electrical and electronic devices. The use of this symbol means that this product must be disposed of with normal household waste.
	Recycling

Tab.2: Explanation of pictograms

2.4 List of abbreviations

Abbreviation	Term
PTFE	Polytetrafluoroethylene
FFPM	Perfluoro rubber
PVDF	Polyvinylidene fluoride
PP	Polypropylene
FPM	Fluororubber
FEP	Fluoroethylene propylene
Tab.	Table
Fig.	Figure
a/o.	And/or
e.g.	For example
Perm.	Permissible
et al.	And the like
opt.	If necessary
Max.	Maximum
Min.	Minimum
HLK	High-performance condenser
AS	Separator
HT	Vacuum controller
LS	Charging cradle

3 Safety

Observe the safety notices in Chapters *8 Setup and connection [▶ 40]* and *9 Operation [▶ 51]*.

3.1 Personnel and target group

Personnel

Make sure that only specially trained and instructed personnel work on the vacuum systems. This applies in particular to commissioning and maintenance work.

Make sure that the personnel have read and understood the operating instructions, particularly the chapter on safety.

Target group

Target group	Definition
User	Laboratory worker
Specialized personnel	Specialized personnel are personnel who - have relevant professional training in the field covered in the particular section of text; - have current knowledge of the field covered in the particular section of text.

Tab.3: Target group

Who-does-what matrix

Lifecycle phase	User	Specialized personnel
Transport		X
Setup	X	X
Preparing for commissioning	X	X
Commissioning	X	X
Operation	X	X
Servicing		X
Troubleshooting		X
Disposal		X

Tab.4: Who-does-what matrix

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3.2 Responsibility of the operator

The vacuum systems are built according to the generally accepted rules of engineering and the occupational safety and accident prevention regulations. Nevertheless, dangers can arise during their use that lead to injuries to the user or third parties or to damage to the vacuum system or other property.

Make sure that no hazardous situation, physical damage or impairment of the vacuum system can occur.

Operating parameter

Operate and set up the vacuum systems only under the operating parameters and operating conditions described in Chapters *3.4 Operating conditions [▷ 12]* and *5 Technical data [▷ 25]*.

High-performance condenser

Only use the high-performance condenser at the pneumatic system outlet; there is a risk of implosion if installed on the pneumatic system inlet.

Ensure the correct assignment of the gas and coolant hose connections on the high-performance condenser. Inlets and outlets of gas connections must not be interchanged.

Accessories

Laboratory equipment or additional components connected to a vacuum system must be designed for the pneumatic data of the vacuum system (see *5 Technical data [▷ 25]*).

3.3 Working in a safety conscious manner

Observe the regulations on accident prevention and safety during all work on the vacuum systems and during operation.

Avoid contact with the pump heads and housing parts, as the pump heats up during operation.

Make sure that the vacuum system is disconnected from the mains and de-energized when working on the vacuum system.

When connecting the vacuum systems to the electrical power, observe the corresponding safety rules.

Do not expose any body parts to the vacuum.

Ensure that no hazards arise from gas flowing when gas connections are open, from the effects of noise or from hot, corrosive, dangerous and environmentally hazardous gases.

Avoid the release of hazardous, toxic, explosive, corrosive, harmful or environmentally hazardous gases or vapors, e.g. by using suitable laboratory equipment with fume hood and ventilation control.

3.4 Operating conditions

Only use the vacuum systems in perfect technical condition, for their intended purpose, safely and aware of the dangers and in observation of the operating instructions.

Only vacuum systems that are fully assembled and in the condition as delivered are allowed to be operated.

Make sure that the installation location is dry and that the vacuum system is protected against rain, spray water, splash water and dripping water as well as from other contamination.

Regularly check the tightness of the connections between the piping of the application and the vacuum system (or the pneumatic connection of the vacuum system). Leaky connections carry the risk of releasing dangerous gases and vapors from the pump system.

The components that are to be connected to the vacuum system must be designed according to the pneumatic data of the vacuum system.

3.5 Media

Requirements of pumped media

Before transferring a medium, check whether the medium can be transferred danger-free in the specific application.

Take note of any change in the state of matter (condensation, crystallization).

Before using a medium, check the compatibility of the media-contacting components (see *5 Technical data [▷ 25]*) with the medium.

Only transfer gases that remain stable under the pressures and temperatures that arise in the vacuum system.

Handling of hazardous media

Upon breakage of the diaphragm and/or leaks, the transferred medium mixes with the air in the surroundings and/or in the vacuum system housing. Make sure that a dangerous situation cannot arise as a result.

When pumping hazardous media, follow the safety regulations that apply for working with these media.

Working with combustible media and explosive atmosphere

Note that the vacuum system is only suitable for pumping explosive atmosphere according to its designation (see type plate) and must not be set up in potentially explosive atmospheres.

Make certain that the temperature of the medium is always sufficiently below the ignition temperature of the medium so as to prevent ignition or explosion. This also applies for abnormal operating situations.

At the same time, note that the temperature of the medium rises as the pump compresses the medium.

Therefore, make certain that the temperature of the medium also remains sufficiently below the ignition temperature of the medium even when it is compressed to the maximum permissible operating pressure of the vacuum system. The maximum permissible operating pressure of the vacuum system is given in Chapter *5 Technical data [▷ 25]*.

Make certain that the permissible ambient temperature (see *5 Technical data [▷ 25]*) is not exceeded.

Where applicable, also take into account external energy sources (such as radiated heat sources) that might heat the medium further.

In case of doubt, contact KNF Customer Service.

3.6 Use

3.6.1 Proper use

The vacuum systems are intended exclusively for delivering gases and vapors.

The vacuum systems are intended exclusively for operation in indoor areas and in non-explosive atmospheres. The Ex designation is valid only for the pumping chamber (media-contacting area).

i Vacuum systems with ATEX designation do not always conform to the regulations governing potentially explosive atmospheres in countries outside the EU.

3.6.2 Foreseeable misuse

The vacuum systems are not allowed to be operated in explosive atmospheres.

The pumps are not suitable for use in underground mining.

The vacuum systems are not suitable for transferring the following:

- Dusts
- Liquids
- Aerosols
- Biological and microbiological substances
- Fuels
- Explosives
- Fibers
- Oxidizing agents
- Foodstuffs.

As standard, the vacuum systems must not be used for simultaneous generation of vacuum and positive pressure.

Do not apply positive pressure to the suction side of the vacuum system.

The vacuum system must not be used if reactive explosive, or otherwise dangerous mixtures can occur (e.g. with the medium) when the gas ballast valve of the pump is open.

3.7 Directives and standards

EU/EC Directives / Standards

The vacuum systems conform to the directives/Ordinances:

- 2011/65/EU (RoHS)
- 2014/30/EU (EMC)
- 2006/42/EC (MD)

The part of the pump that comes into contact with the media complies with Directive 2014/34/EU (ATEX).

- UK Regulation S.I. 2008/1597 Supply of Machinery (Safety)

- UK Regulation S.I. 2016/1091 Electromagnetic Compatibility
- UK Regulation S.I. 2012/3032 Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

The following harmonized/listed standards are met:

- EN 1012-2
- EN ISO 12100
- EN 61010-1
- EN 61326-1

The part of the pumps that comes into contact with the media satisfies the following harmonized standards:

- EN ISO 80079-36
- EN ISO 80079-37
- EN 1127-1

Per IEC 664, the pumps comply with:

- Overvoltage category II
- Degree of soiling 2

3.8 Customer service and repair

Customer service and repairs

The vacuum systems are maintenance-free. However, KNF recommends periodic inspection of the vacuum system for obvious changes in noise or vibration.

Only have repairs to the vacuum systems performed by qualified KNF personnel.

Housings with electrically live components may only be opened by specialist personnel.

Use only genuine spare parts from KNF when performing servicing work.

3.9 Disposal

Environmental protection WEEE

Store the vacuum system and all replacement parts in accordance with the environmental protection regulations. Observe both the respective national and international regulations here. This applies in particular to parts that are contaminated with toxic substances.

If you no longer need your packaging materials (e.g. for return shipment or other transport of the vacuum system), dispose of them in an environmentally friendly manner.

This product is marked in conformance with the EU directive on the disposal of Waste Electrical and Electronic Equipment (WEEE). Old devices must not be disposed of with household waste. Proper disposal and recycling help to protect natural resources and the environment. The end user is responsible for disposing of old devices according to the national and international regulations. Alternatively, KNF products (old devices) may also be returned to KNF for a fee (see Chapter *13 Returns [▷ 100]*).

4 Explosion protection

4.1 Using for transferring explosive atmospheres

Always use vacuum systems of the corresponding device category and temperature class to pump explosive atmospheres.

These vacuum systems have the following EU explosion protection designations:

Designation	Description
	Symbol for explosion-protected devices
II	Device group (see *4.3.1 Device groups [▷ 19]*)
3/-G	Device category (see *4.3.2 Device categories for gas [▷ 20]*)
Ex	Symbol indicates that the device satisfies one or more ignition protection types.
h	Symbol for ignition protection type (see *4.3.5 Ignition protection type [▷ 22]*)
IIB + H2	Explosion groups (see *4.3.3 Explosion groups [▷ 21]*)
T3	Temperature class (see *4.3.4 Temperature classes [▷ 22]*)
Gc	Equipment protection level (See Chapter *4.3.6 Equipment protection level for gas [▷ 23]*)
	Special operating conditions (See Chapter Special operating conditions)
Internal atmosphere only	Special conditions (see *4.3.7 Special operating conditions [▷ 24]*)

Tab.5: Explosion protection designation

An ignition hazard evaluation according to the standards DIN EN ISO 80079-36 and DIN EN ISO 80079-37 was carried out for the vacuum systems.

The explosion protection designation can also be found at the following location:

- Vacuum system type plate

4.2 Information on the Ex-designation

This KNF vacuum system is marked with the following device designation according to the latest explosion protection directive. The designation is only valid for the transfer section (media-contacting region) of the vacuum system:

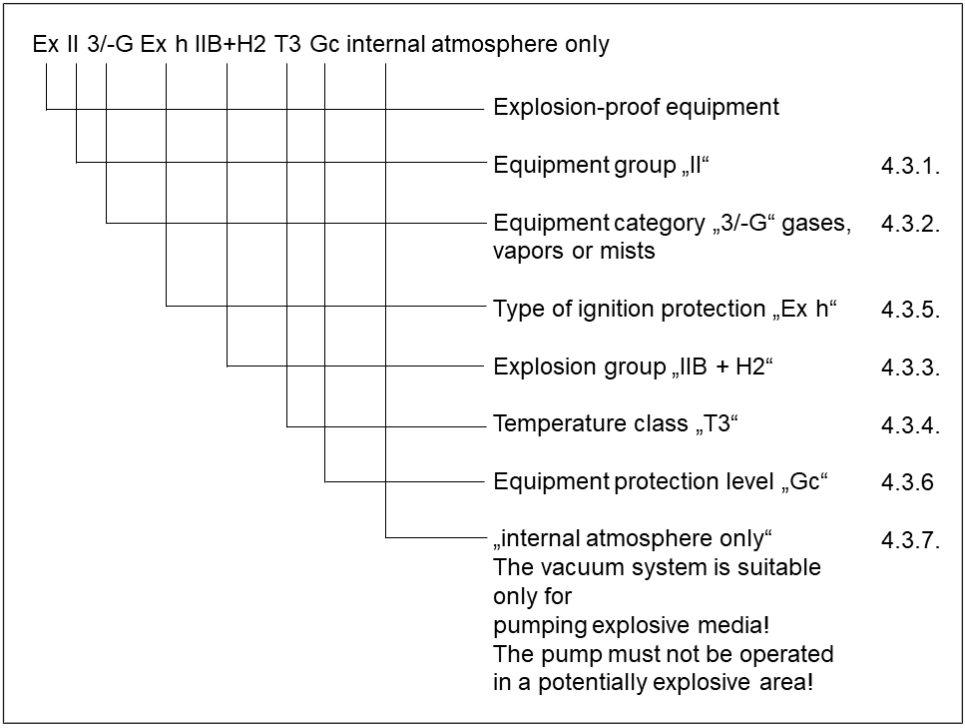

Fig.2: EX-designation of the vacuum system

Category "3/-G" vacuum systems are designed for the transfer of gases, vapors or mists with which it is unlikely that an explosive atmosphere will form. However, if this does happen, in all probability it will happen only rarely and for a short period of time.

The devices are to be arranged so that they cannot be mechanically damaged from the outside.

It is forbidden to make any changes to the vacuum systems. After a wearing part is replaced, the original function of the vacuum system must be tested by verifying that the specified ultimate vacuum is reached (see Operating instructions, Chapter *10 Servicing [▷ 73]*).

4.3 Explanations of the explosion protection designation

4.3.1 Device groups

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Device group I	Device group I applies for devices that are used in underground plants of mines as well as their underground systems that could be endangered by methane and/or combustible dusts.
Device group II	Device group II applies for devices that are used in other areas that could be endangered by an explosive atmosphere.

4.3.2 Device categories for gas

The device category describes the frequency and the duration of the occurrence of explosive atmospheres during operation.

Device category	Description
1G	Devices of this category are designed for use in areas in which an explosive atmosphere consisting of a mixture of air and gases, vapors or mists is present constantly or for long periods of time or often.
1D	Devices of this category are designed for use in areas in which an explosive atmosphere consisting of a dust/air mixture is present constantly or for long periods of time or often.
2G	Devices of this category are designed for use in areas in which it is to be expected that an explosive atmosphere consisting of gases, vapors or mists forms occasionally.
2/2G	Devices that extract from zone 1 and are designed for use in areas in which it is to be expected that an explosive atmosphere consisting of gases, vapors or mists forms occasionally.
2/-G	Devices that extract from zone 1 but are not designed for installation in a potentially explosive atmosphere (zone).
2D	Devices of this category are designed for use in areas in which it is to be expected that an explosive atmosphere consisting of a dust/air mixture forms occasionally.
3G	Devices of this category are designed for uses in areas in which it is to be expected that an explosive atmosphere resulting from gases, vapors or mists occurs, though in all likelihood occurs only seldom and for a very short length of time.
3/-G	Devices that extract from zone 2 but are not designed for installation in a potentially explosive atmosphere (zone).
3D	Devices of this category are designed for uses in areas in which it is to be expected that an explosive atmosphere resulting from stirred-up dust occurs, though in all likelihood occurs only seldom and for a very short length of time.

Tab.6:

4.3.3 Explosion groups

Combustible gases and vapors are classified according to explosion groups(I, IIA, IIB and IIC) and temperature classes. The following table shows the classification of the most common combustible gases and vapors.

	T1	T2	T3	T4	T5	T6
I	Methane	–	–	–	–	–
IIA	Acetone Ethane Ethyl acetate Ammonia Ethyl chloride Benzene Acetic acid Carbon monoxide Methane Methanol Methyl chloride Naphthalene Phenol Propane Toluene	i-amyl acetate n-butane n-butyl alcohol Cyclohexanone 1,2-dichloroethane Acetic anhydride	Gasoline Diesel fuel Jet fuel Heating oils n-hexane	Acetaldehyde	–	–
IIB	Town gas	Ethylene Ethyl alcohol	Hydrogen sulfide	Ethyl ether	–	–
IIC	Hydrogen	Acetylene	–	–	–	Carbon disulfide

Tab.7:

The classification of gases and vapors into groups with respect to explosion group and temperature class applies for the transferred medium.

Transferred medium

The device must only be used to transfer gases and vapors that belong to the respective explosion group and the corresponding temperature class (or lower), (see designation on the type plate) or which are not explosive and not combustible.

Surroundings of the device

The device must not be set up in potentially explosive atmospheres. It is only suitable for the transfer of explosive atmosphere corresponding to its designation (see type plate).

4.3.4 Temperature classes

Maximum surface temperature

The maximum surface temperature is the highest temperature reached by a surface of the device under the most unfavorable conditions.

Ignition temperature

The maximum surface temperature of the device must always be lower than the lowest ignition temperature of the gas/air or vapor/air mixture in which it is used.

Temperature class

The maximum surface temperature is derived from the construction of the device and is stated as the temperature class.

Temperature class	Max. surface temperature [°C]	Ignition temperature [°C]
T1	450	> 450
T2	300	> 300
T3	200	> 200
T4	135	> 135
T5	100	> 100
T6	85	> 85

Tab.8:

4.3.5 Ignition protection type

Designation	Description
h	Constructional safety "c"
h	Ignition source monitoring "b"
h	Liquid immersion "k"

Tab.9:

An ignition hazard evaluation according to the standards DIN EN ISO 80079-36 and DIN EN ISO 80079-37 was carried out for the devices. The protective goals were reached by applying the ignition protection type of constructional safety "c".

4.3.6 Equipment protection level for gas

The equipment protection level describes the frequency and the duration of the occurrence of explosive atmospheres in an area.

Equipment protection level	Description*	Constructional safety
Ga	Devices with very high protection level for use in potentially explosive atmospheres. With these devices, there is no risk of ignition during normal operation or in the event of foreseeable or infrequent faults/malfunctions.	Very high
Gb	Devices with high protection level for use in potentially explosive atmospheres in which there is no risk of ignition during normal operation or in the event of foreseeable or infrequent faults/malfunctions.	High
Gc	Device with increased protection level for use in potentially explosive atmospheres. There is no risk of ignition during normal operation. The devices have a number of additional protection measures which ensure that, in the event of commonly foreseeable faults in the device, no danger of ignition exists.	Increased

*Tab.10: *According to ISO 80079-36*

4.3.7 Special operating conditions

Designation	Description
Internal atmosphere only	Special operating conditions

Additional conditions for the devices:

- Do not set up the device outdoors. Commissioning may only be performed with suitable weather- and corrosion-protection paneling.
- Do not set up the device in potentially explosive atmospheres. It is only suitable for the transfer of explosive atmosphere corresponding to its designation (see type plate).
- Set the device up in such a way that it cannot be damaged from outside.
- Set the device up in such a way that it is not exposed to UV radiation.

5 Technical data

Technical data

Materials of media-contacting components

Assembly	Material
Pump head	Modified PTFE
Diaphragm	PTFE-coated
Valve	FFPM
Pump connection	PTFE/FFPM
Gas ballast	PTFE/FFPM
AS hose connector	PVDF/FPM
Separator adapter	PP
AS hose connection	FEP/FPM
HLK hose connection	FEP/FPM/PP
HLK hose connector	PVDF
Overpressure relief valve	PTFE
Pressure sensor	Ceramic
Sealing rings	FPM, FFPM
Vent valve	FPM, FFPM

Tab.11: Materials of media-contacting components

Pneumatic data

Parameter	Value SC820G	Value SC840G
Max. permissible operating pressure [bar rel*]	0.1	0.1
Ultimate vacuum [mbar abs.]		
At min. speed:		
Gas ballast closed	≤ 6	≤ 6
Gas ballast open	≤ 17	≤ 17
At max. speed:		
Gas ballast closed	≤ 8	≤ 8
Gas ballast open	≤ 15	≤ 15
Flow rate at atm. pressure [l/min]**		
At min. speed:	10 ± 10%	18 ± 10%
At max. speed:	20 ± 10%	34 ± 10%

Tab.12: Pneumatic data SC820G
**Bar rel related to 1013 hPa*
***Liters in the standard state based on ISO 8778 and ISO 21360-1/2 (1013 hPa, 20°C; based on ISO 8778 and ISO 21360-1/2)*

Pneumatic connections

Parameter	Value
Inlet hose connection [mm] (Hose connector)	ID 8 / 9.5
Outlet hose connection [mm] (hose connector)	ID 10

Tab.13: Pneumatic connections

Electrical data

Parameter	Value SC820G	Value SC840G
Voltage [V]	100 – 240	100 – 240
Frequency [Hz]	50/60	50/60
Power consumption [W]	60	100
Max. current draw [A]	0.66 – 0.35	1.0 – 0.6
Max. permissible line voltage fluctuation	± 10%	± 10%

Tab.14: Electrical data

Weight

Device type	Unit	Weight
SC820G	[kg]	12.4
SC840G	[kg]	14.8

Tab.15: Weight

Other parameters

Parameter	Value
Permissible ambient temperature [°C]	+ 5 to + 40
Permissible media temperature [°C]	+ 5 to + 40
Highest permissible relative air humidity of the environment	80% for temperatures to 31°C, decreasing linearly to 50% at 40°C (non-condensing).
Maximum installation altitude [m above sea level]	2000
Vacuum system protection class (DIN EN 60529 / IEC 60529)	IP30
Dimensions L x H x W [mm] SC820G SC840G	 347 x 416 x 260 366 x 416 x 274
Equipment protection	■ Overcurrent protection ■ Overtemperature protection (drive) ■ Blocking protection (drive)

Tab.16: Other parameters

Vacuum controller and charging cradle of the vacuum system

Parameter	Unit	Value
Dimensions (W x H x D) of vacuum controller	[mm]	96 x 162 x 50.8
Dimensions (W x H x D) of charging cradle	[mm]	96 x 100.5 x 87.9
Weight of vacuum controller	[g]	690
Weight of charging cradle	[g]	260
Operating voltage	[V DC]	24
Current draw	[A]	1
Frequency band of the wireless connection	[GHz]	2.4
Range of the wireless connection	-	Unobstructed max. 50 m; through walls max. 10 m
Power supply	-	Via integral rechargeable batteries or supplied power adapter
DC charging socket	-	Outer diameter: 6.3 mm Inner diameter: 2 mm
Batteries	-	6 x Mignon AA 1.2 V 2600 mAh; quick-charging; see spare parts list in chapter *11.1 Spare parts [▷ 90]*
Battery operating time*	-	Up to 8 h, depending of frequency of inputs and data transmission
Charging time*	[h]	Approx. 1

*Tab.17: *Value applies for the rechargeable batteries included as standard*

Use only the original power adapter from KNF to charge the vacuum system vacuum controller.

Several vacuum systems within the range of the wireless connection can be operated in parallel via the associated vacuum controller.

6 Product description

6.1 SC820G, SC840G

1 System outlet
2 HLK
3 Flask clamp
4 Collection flask
5 Collection flask
6 Power switch
7 Signal cable
8 System inlet
9 Venting / Inert gas connection
10 Separator
11 Status display
12 Rotary/push knob
13 Coolant connection

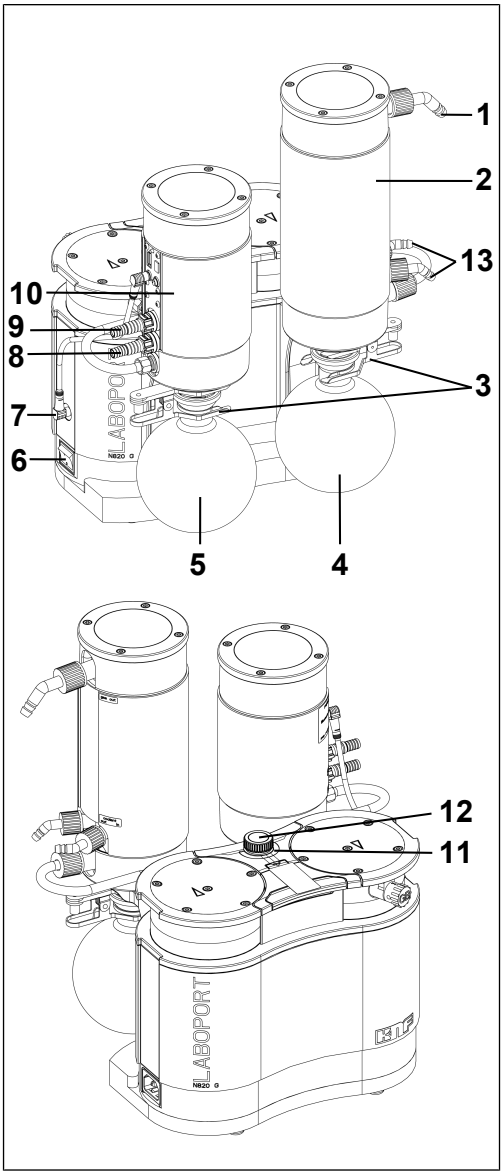

Fig.3: Product description, vacuum system SC820G

Design of the vacuum system

The collection flask (**5**) catches particles and droplets at the inlet of the pump which have been suctioned out of the recipient contrary to the requirements of the pump. The collection flask is coated (implosion protection) and mounted on the separator **9** with a flask clamp (**3**).

The high-performance condenser (**2**) at the pump outlet recovers solvents back from the transferred gas instead of letting them escape into the environment or into the fume cupboard. The condenser is lined for thermal insulation and as protection against bursting.

The solvents that are precipitated in the condenser are collected in the collection flask (**4**), which is coated (bursting protection). A flask clamp (**3**) fixes the collection flask to the condenser flange. A circulating cooler or running cold water (or other cooling medium) cools the high-performance condenser to condensation temperature.

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6.2 Vacuum controller

1 Touchscreen
2 Charging cradle
3 Rotary/push knob
4 Connection socket
5 Charging contacts

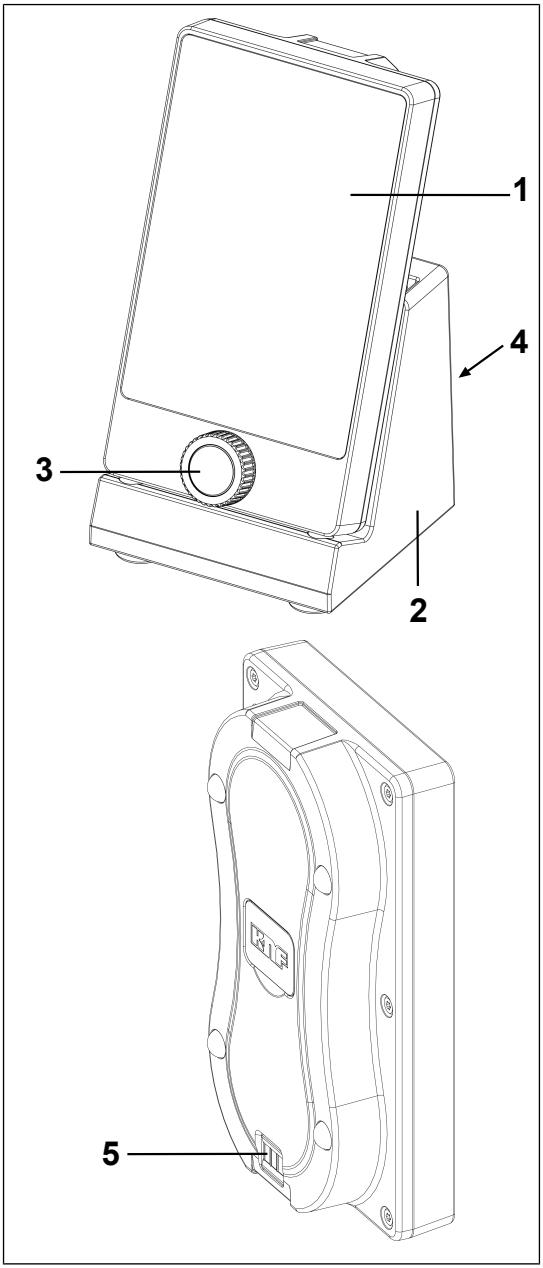

Fig.4: Vacuum controller

Function

The process parameters with which the vacuum system regulates the pressure are set via the vacuum controller.

Settings can be made on the vacuum controller via the touchscreen (**1**) and using the rotary knob (**3**).

The vacuum system can be operated remotely via a wireless link using the vacuum controller. In this way, the vacuum system can be operated conveniently when it is located inside a cabinet or in a closed fume cupboard.

When the vacuum controller is in the charging cradle (**2**), the rechargeable batteries of the vacuum controller are automatically recharged. This takes place even when the vacuum controller is switched off.

When the charge in the batteries is very low, the vacuum controller emits an acoustic signal.

6.3 Pump

The vacuum system can be switched on and off with the power switch (**6**). The vacuum system can be stopped (emergency stop) with the rotary/push knob (**3**).

Function of a diaphragm pump

1 Outlet valve
2 Inlet valve
3 Transfer chamber
4 Diaphragm
5 Eccentric
6 Connecting rod

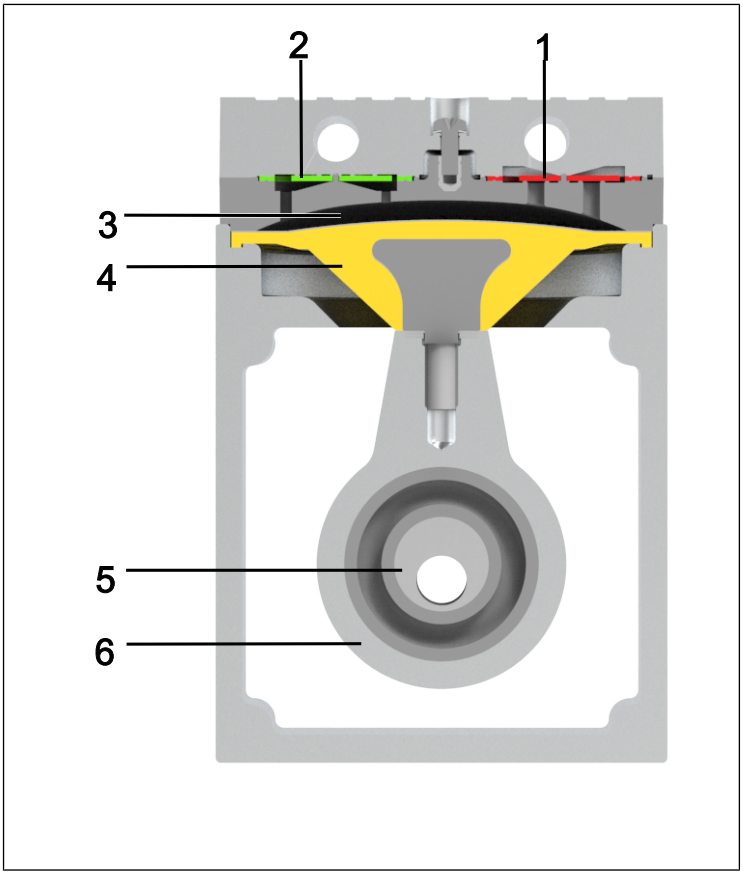

Fig.5: Function of a diaphragm pump

Diaphragm pumps transfer, compress (depending on the version) and evacuate gases and vapors.

The elastic diaphragm (4) is moved up and down by the eccentric (5) and the connecting rod (6). In the downwards stroke, it aspirates the gas to be transferred via the inlet valve (2). In the upwards stroke, the diaphragm presses the medium out of the pump head via the outlet valve (1). The transfer chamber (3) is separated from the pump drive by the diaphragm.

6.4 Gas ballast

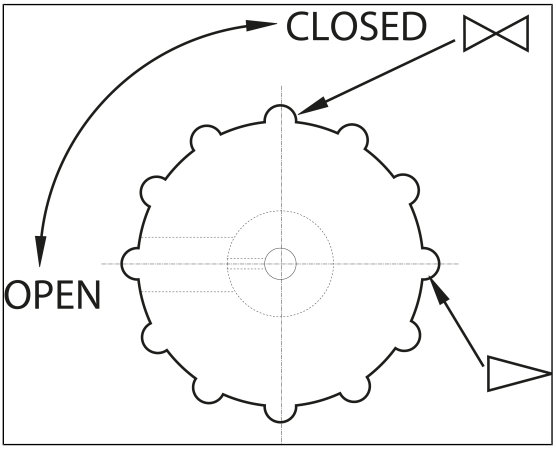

Fig.6: Operating button for gas ballast

DANGER

Personal injury through poisoning or explosion and damage to the pump

→ When the gas ballast valve is open, make sure that no reactive or explosive mixtures can form.

→ Close the gas ballast valve if necessary.

→ If inert gas is necessary, contact KNF Service.

NOTICE

If vaporous media are transferred, the formation of condensate in the pump heads can be minimized by opening the gas ballast valve.

NOTICE

The ultimate vacuum that can be achieved is worse when the gas ballast valve is open (see the Chapter *5 Technical data [▷ 25]*).

7 Transport

General

CAUTION

Personal injury and/or damage to equipment due to incorrect or improper transport of the vacuum system

If it is transported incorrectly or improperly, the vacuum system may fall and be damaged or injure people.

→ Always transport the vacuum system by holding the carrying handle provided for this purpose.

→ Use suitable auxiliary means if necessary (carrying strap, lifting gear, etc.).

→ Where appropriate, wear suitable personal protective equipment (e.g., safety shoes, safety gloves).

CAUTION

Risk of injury from sharp edges on the packaging

There is a risk of injury from cutting on the sharp edges when grabbing corners or when opening the packaging.

→ Where appropriate, wear suitable personal protective equipment (e.g., safety shoes, safety gloves).

→ Transport the vacuum system in its original packaging to the installation site.

→ Keep the original packaging of the vacuum system (e.g. for later storage).

→ Check the vacuum system for transport damage upon receipt.

→ Document any transport damage in writing.

→ If necessary, remove the transport locks before commissioning the vacuum system.

→ Do not mount the two collection flasks (see Chapter *Connecting the pump [▷ 45]*) on the vacuum system until you have brought the vacuum system to the installation site.

Parameter

Parameter	Value
Storage temperature [°C]	+ 5 to + 40
Transport temperature [°C]	- 10 to + 60
Permissible humidity (non-condensing) [%]	30 to 85

Tab.18: Transport parameters

NOTICE

Before commissioning, make sure that the vacuum system has reached the ambient temperature (*5 Technical data [▷ 25]*).

8 Setup and connection

→ Only connect the vacuum system in accordance with the operating parameters and conditions described in Chapter *5 Technical data [▸ 25]*.

→ Observe the safety instructions (see Chapter *3 Safety [▸ 10]*).

Coolant for high-performance condenser

A circulating cooler or cold running water (or other cooling medium) is required to cool the high-performance condenser to condensing temperature.

→ Before connecting, store the vacuum system at the installation location to allow it to reach the room temperature so no condensation may form.

Cooling air supply

WARNING

Danger of burning on hot surfaces

Hot surfaces could occur if the pump overheats.

→ When installing the vacuum system, make sure that sufficient cooling air infeed and discharge is ensured.

Installation location

→ Make sure that the installation location is dry and that the vacuum system is protected against rain, sprayed water, splashed water and dripping water as well as from other contamination.

→ Select a secure location (level surface) for the vacuum system.

→ Protect the vacuum system from dust.

→ Protect the vacuum system from vibration, shock and external damage.

→ Make sure that it is easy to operate the power switch.

Transport of the vacuum system

NOTICE

Property damage due to incorrect or improper transport

The collection flasks can be damaged if they remain mounted on the vacuum system while it is being transported.

→ Remove the collection flasks before transporting the vacuum system.

→ If there are liquids in the collection flasks, empty them or dispose of the liquids in an environmentally friendly manner.

→ Store the collection flasks in a safe location.

→ Reassemble the collection flasks after transport.

8.1 Preparing for commissioning

Ensure the following points before switching the vacuum system on:

	Necessary operating requirements
Vacuum system	- Connect all hoses correctly (see Chapter *Connecting the pump [▷ 45]*)
Vacuum system	- Data of the voltage supply system are consistent with the details on the type plate of the vacuum system. - Vacuum system outlet is not closed or restricted. - When operating with gas ballast: When venting the pump through the air inlet, no explosive or poisonous mixtures can occur.
Vacuum system	- Collection flasks correctly mounted (with flask clamps). (see Chapter *Connecting the pump [▷ 45]*)
Vacuum system	- Signal cable plugged in (see Chapter *Connecting the pump [▷ 45]*)
Vacuum system	- USB Bluetooth sticks are correctly plugged into the vacuum controller and the vacuum system (separator) (see Chapter *8.4 Connecting the vacuum controller to the vacuum system [▷ 50]*)
Vacuum system	- Charging cradle connected to the power adapter

Tab.19: Operating requirements for commissioning

8.2 Perform commissioning

WARNING

Risk of burns from hot vacuum parts and/or hot medium

during or after operation of the vacuum system, some vacuum system parts may be hot.

→ Allow the vacuum system to cool down after operation.

→ Take protective measures to protect against touching hot parts.

WARNING

Injury to eyes

Coming too close to the inlet/outlet of the vacuum system may result in injury to the eyes due to the present vacuum/ operating pressure.

→ Do not look into the vacuum system inlet/outlet during operation.

→ Only operate the vacuum system in accordance with the operating parameters and operating conditions described in Chapter *5 Technical data [▷ 25]*.

→ Ensure the proper use of the vacuum system (see Chapter Proper use).

→ Eliminate the possibility of improper use of the vacuum system (see Chapter *3.6.2 Foreseeable misuse [▷ 14]*).

→ Observe the safety instructions (see Chapter *3 Safety [▷ 10]*).

WARNING

Risk of bursting of pump head due to excessive pressure increase

→ Do not exceed the maximum permissible operating pressure (see *5 Technical data [▶ 25]*).

→ Monitor the pressure during operation.

→ If the pressure exceeds the maximum permissible operating pressure of the vacuum system: Switch the pump off immediately and remedy the malfunction (see Chapter Störung beheben).

→ Do not attempt to throttle or regulate the quantity of air and/or gas except with the rotary/push knob.

→ Ensure that the vacuum system outlet is not closed or restricted.

CAUTION

Risk of bursting of high-performance condenser

The high-performance condenser is not pressure-resistant.

→ Make sure that the gas outlet of the high-performance condenser is not blocked or restricted.

→ Observe the maximum permissible operating pressure of the vacuum system (see *5 Technical data [▶ 25]*).

i In order for the high-performance condenser to recover solvent from the pumped gas, it must be cooled by means of a cold water connection or circulating cooler.

DANGER

Risk of dangerous gas mixtures during pump operation

Depending on the medium being transferred, breakage of the media-contacting components can result in a dangerous mixture if the medium mixes with the air in the compressor housing or the surroundings.

→ Before using a medium, check the compatibility of the media-contacting components (see *5 Technical data [▷ 25]*) with the medium.

Pump standstill

→ Establish normal atmospheric pressure in the lines while the pump is at a standstill (relieve pump pneumatically).

Connecting the pump

i The following item numbers refer to Fig. 3.

1. Connect the signal cable to the pump (see Fig. 3/**7**) and the separator (Fig. 23/**3**) (see Fig. 7).
   When connecting, make sure that the cable passes under the hose connection.

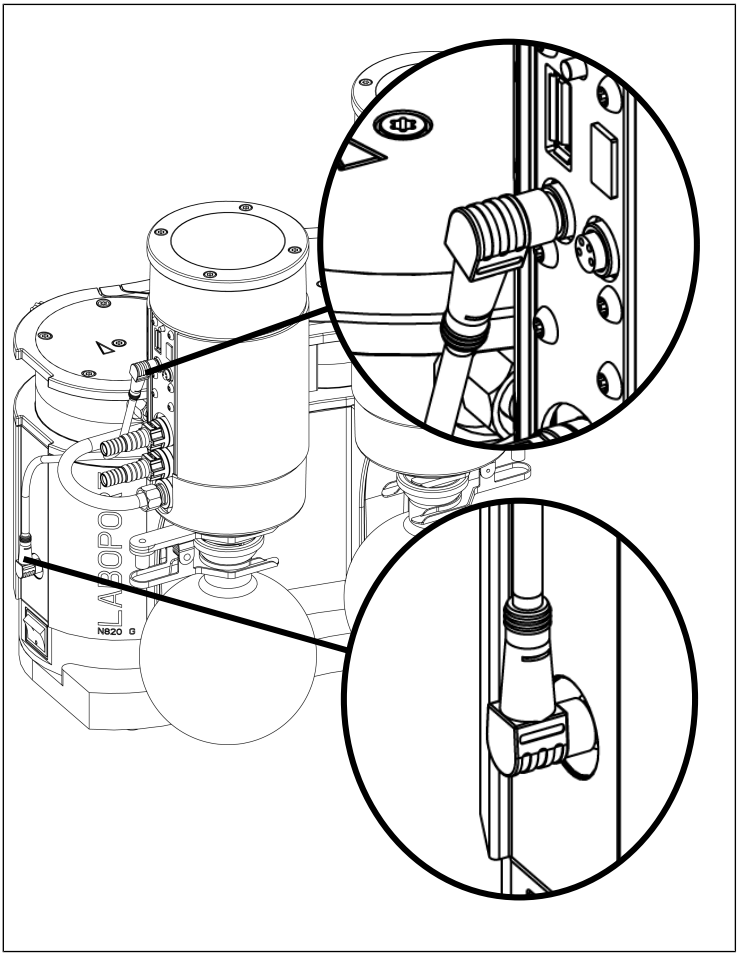

Fig.7: Connecting the signal cable

Ensure that the signal cable is correctly aligned with the separator (30° angle; see Fig. 7).

2. Remove the protective caps from the pneumatic connections of the vacuum system (see **1** and **8** or **1** and **7**).
3. Connect the lines to the pneumatic inlet and outlet.

Connected components

Only connect components to the vacuum system that are designed for the pneumatic data of the vacuum system (see Chapter *5 Technical data [▶ 25]*).

4. Place the collection flask (**4** and/or **5**) on the separator adapter (**9**) and/or on the condenser (**2**) and secure the collection flask with the flask clamp (**3**).

i Make sure that the flask clamp is firmly held in place by tightening the flask clamp screw as far as it will go.

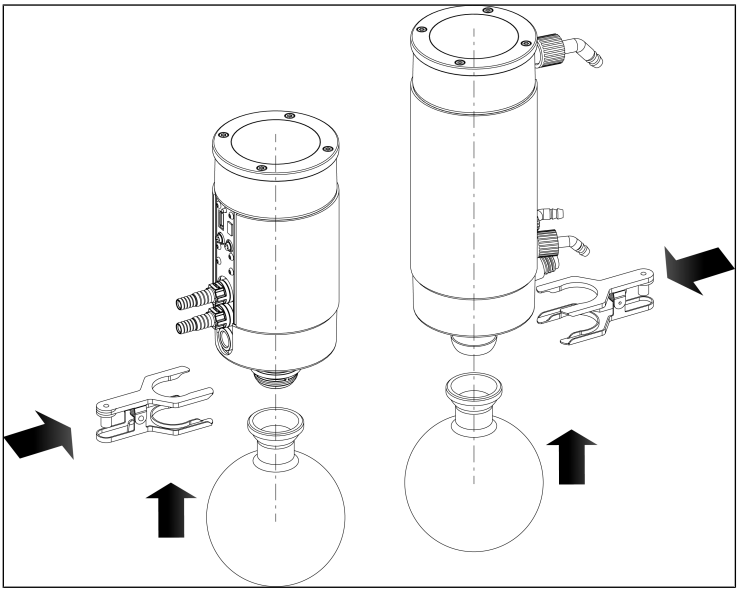

Fig.8: Mount collection flask

Pump discharge

5. At the pneumatic outlet of the vacuum system, safely discharge the pump discharge.
6. Install the coolant supply and coolant drain on the condenser (see **12**).
7. Plug the plug of the power cable into a properly installed, grounded socket.

8.3 Switching the vacuum controller on and off

Switching on the vacuum controller

To switch the vacuum controller on, press the rotary/push knob (Fig. 4/**3**) for about 5 seconds.

i It takes about 20 seconds for the vacuum controller to fully power up.

Switching off the vacuum controller

To switch the vacuum controller off, press the rotary/push knob (Fig. 4/**3**) for about 2 seconds.

A new view appears on the touchscreen.

To switch off completely, press the key (Fig. 9/1).

1 Switching the vacuum controller off

2 Canceling the switch-off procedure

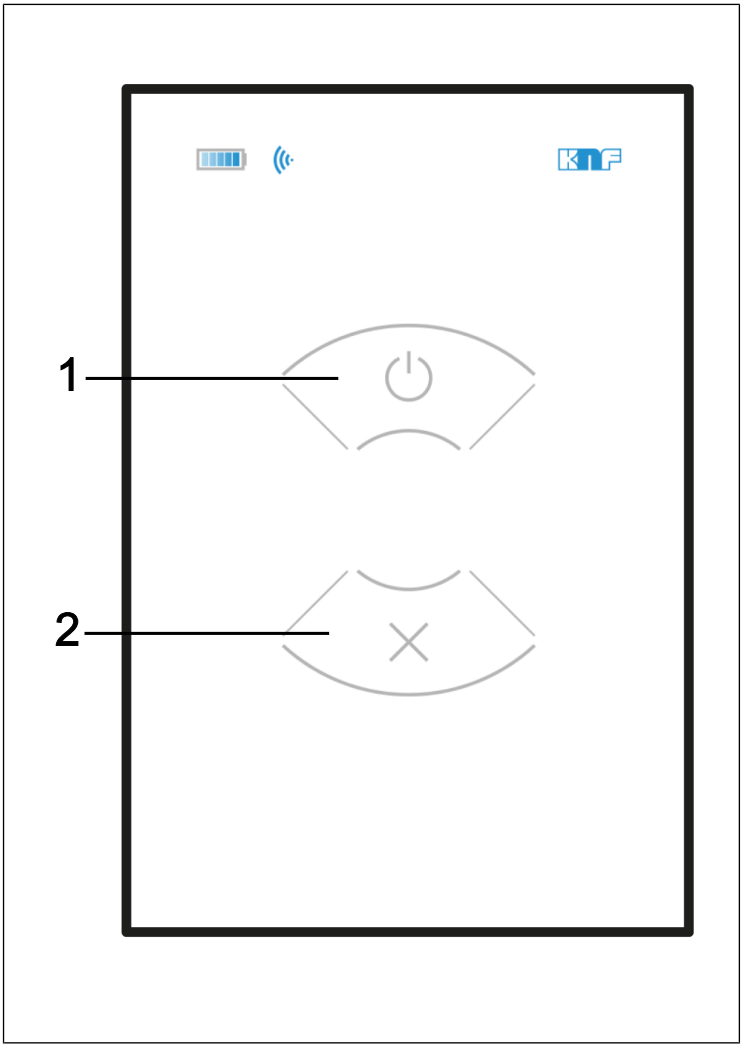

Fig.9: Switching the vacuum controller off

8.4 Connecting the vacuum controller to the vacuum system

Connecting the vacuum controller via Bluetooth

Plug a Bluetooth stick into the rear of the vacuum controller. To do this, remove the cover on the rear of the vacuum controller. Then you can plug the Bluetooth stick in and place the cover in position again (see Fig. 10).

Plug the other Bluetooth stick into the connector provided for this purpose on the vacuum system (see Fig. 23/**2**).

i The Bluetooth sticks are designed specifically for the vacuum controller and the vacuum system and must not be mixed up. For this reason they are placed in labeled pouches. When using them, ensure that the correct sticks are plugged into the vacuum controller and the vacuum system respectively.

i A PC can be connected via a mini-USB port in parallel with the Bluetooth connection.

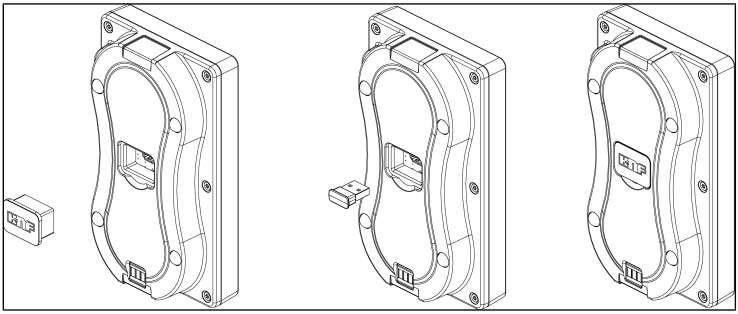

Fig.10: Plugging Bluetooth stick into vacuum controller

Connecting the vacuum controller via cable

Connect a USB A cable to the vacuum controller. This can be connected to the vacuum system via the mini-USB port.

i When the vacuum controller is connected to the vacuum system with a cable, the mini-USB port cannot be used to connect a PC. To connect PC, the USB cable between the vacuum controller and the vacuum system must be removed.

9 Operation

9.1 Information on switching the vacuum system on and off

Switch on vacuum system

The vacuum system must not start up against positive pressure when switched on. This also applies during operation after a brief power interruption. If a vacuum system runs against pressure, the pump can block, whereupon the blocking protection (drive) is triggered and the vacuum system switches off.

→ Ensure that no pressure is present in the lines when switching on.

→ Switch on the vacuum system with the power switch (see Fig. 11).

→ Start the pump operation of the vacuum system by pressing the *START* ▶ button on the vacuum controller.

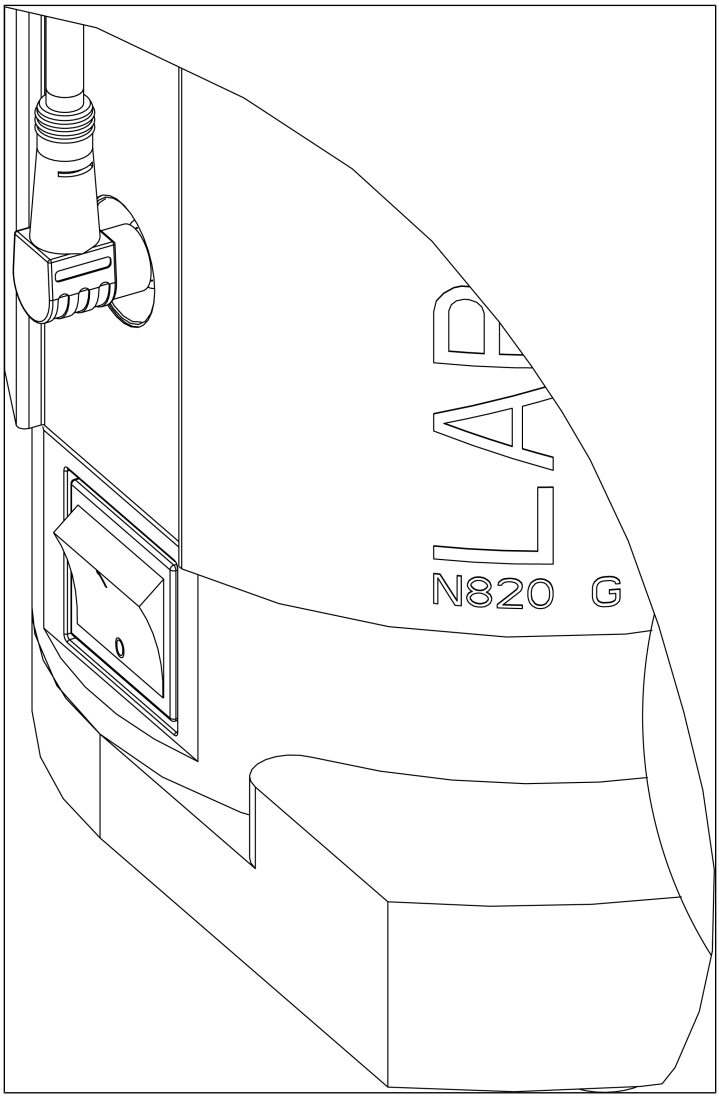

Fig.11: Switch vacuum system on and off with power switch

Emergency stop

The vacuum system can be stopped immediately with the rotary/push knob (see Fig. 12). If the emergency stop is actuated, the light ring (**10**/*6.1 SC820G, SC840G [▷ 31]*) lights up continuous red.

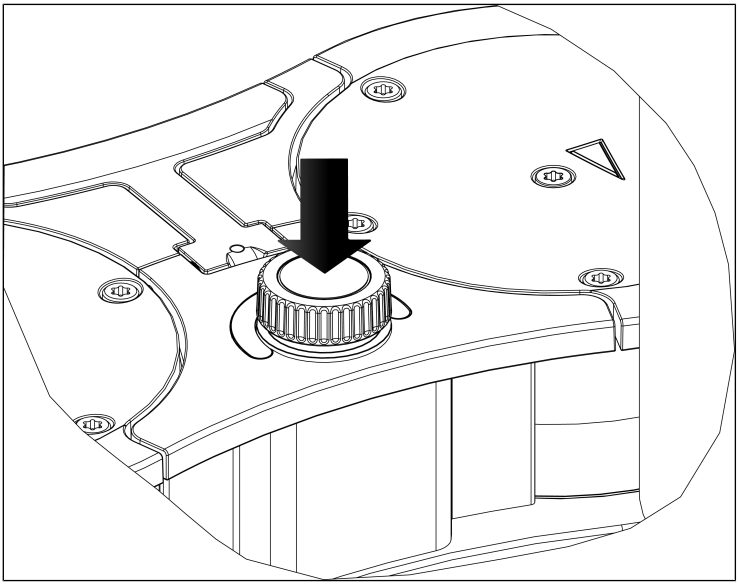

Fig.12: Emergency stop of the vacuum system pumping operation with rotary/push knob

Switch off vacuum system/take out of operation

→ When transferring aggressive media, flush the vacuum system before switching off to extend the service life of the diaphragm (see Chapter *10 Servicing [▷ 73]*).

→ Stop the pump operation of the vacuum system by pressing the *STOP* button on the vacuum controller.

→ Switch off the vacuum system with the power switch (see **6/**Fig. 3).

→ Establish normal atmospheric pressure in the lines (relieve pump pneumatically).

→ Pull mains plug of vacuum system out of socket.

Transport of vacuum system

NOTICE

Damage may occur due to incorrect or improper transport

If the collection flasks remain mounted during transport of the vacuum system, they can be damaged by careless handling when the vacuum system is set down.

→ Remove the collection flasks before transporting the vacuum system.

→ If there are liquids in the collection flasks, empty them or dispose of the liquids in an environmentally friendly manner.

→ Store the collection flasks in a safe location.

→ Reassemble the collection flasks after transport.

Status display (see 10/*6.1 SC820G, SC840G [▷ 31]*)

→ Lights up pink if the vacuum system was switched on.

→ Illuminates red if there is a fault:

Signal duration	Fault type
100% ON (continuous light)	Drive blocked
100% ON (continuous light)	Emergency stop pressed
50% ON; 50% OFF	Temperature too high (drive)
90% ON, 10% OFF	Other fault

Tab.20: Fault signal via status display

For further information, see Chapter *12 Troubleshooting [▷ 93]*.

9.2 Operating the vacuum system

9.2.1 Operation with vacuum controller

9.2.1.1 General functions and displays

EN

1 Touchscreen
2 Charging cradle
3 Rotary/push knob
4 Connection socket
5 Charging contacts

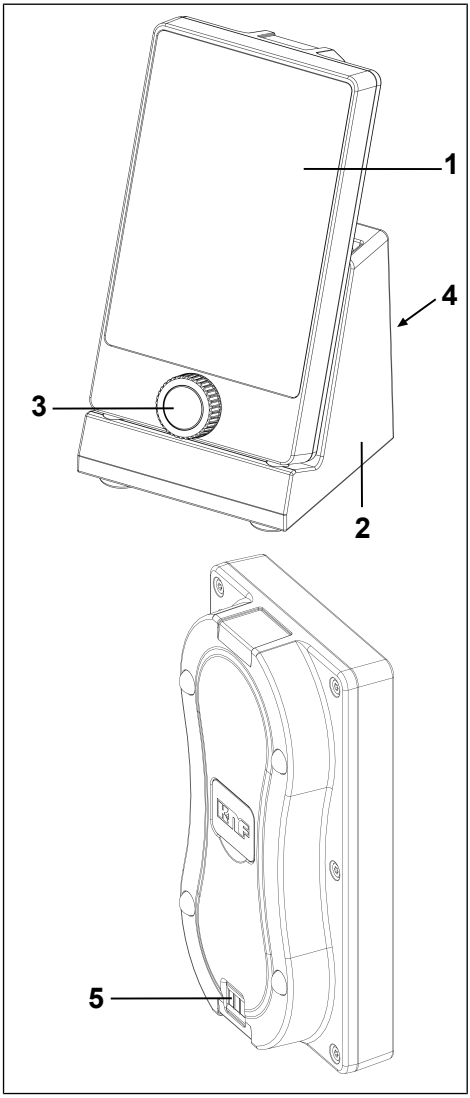

Fig.13: Vacuum controller

The vacuum system is operated from the vacuum controller with the aid of

- → a rotary knob (Fig. 13/**3**) and
- → a touchscreen (Fig. 13/**1**).

The rotary knob has the following functions:

- → Rotate: Change the pump output or adjust the setpoint pressure (depending on the mode selected).
  Change the setpoint settings:
  - → CW: Decrease
  - → CCW: Increase
- → Press: Interrupt the active process and switch to manual process control (in this case, pressing begins evacuation).
  Different functions can be initiated depending on whether the knob is pressed briefly or for a longer time:
  - → Press briefly:
    Starts a process **or** stops the current pumping phase and switches to temporary pressure regulation at the current pressure value
  - → Press for longer:
    Pressing for a longer period during temporary pressure regulation initiates a manual evacuation instruction until the rotary/push knob is released again. The new pressure value is used as the new setpoint value for temporary pressure regulation.

Contents of the touchscreen:

- → Displays of the most important process variables (Fig. 14);
- → Menus for selecting the mode (Fig. 15/**1**).
- → Menus for selecting the unit for the pressure display (Fig. 16/**4**).
- → Operating buttons (Fig. 15) with the functions:
  - → Starting and stopping a process (**4**);
  - → Opening and closing the venting valve (**2**);
  - → Opening and closing the coolant valve (accessory) of the condenser (**3**).

Removing and returning the vacuum controller

Removing the vacuum controllerfrom the charging cradle:
Take the vacuum controller out of the charging cradle.

Returning the vacuum controller to the cradle:
Place the vacuum controller in the support for the vacuum controller (Fig. 13/**2**) with the underside facing down. An acoustic signal is emitted and the border around the battery symbol pulsates.

i When the vacuum controller is in the holder, the vacuum controller's rechargeable batteries are automatically recharged. This takes place whether the vacuum controller is switched on or off. Ensure that the vacuum controller is positioned properly in the charging cradle.

i Check that the vacuum controller and the vacuum system are paired every time before using the vacuum controller. To do this, use the paging function (see "CALLING THE VACUUM SYSTEM").

1 Battery:
-Charge status
-Charge function

2 Connection to the vacuum system
-Direct connection
-Wireless connection

3 Actual pressure in selected pressure unit

4 Only in *Automatic* mode:
Automatic with pressure reduction
-grayed out: automatic pressure reduction inactive
-highlighted: automatic pressure reduction active

5 Settings

6 Process time

7 Pump performance as a percentage or setpoint pressure in selected pressure unit (depending on the mode)

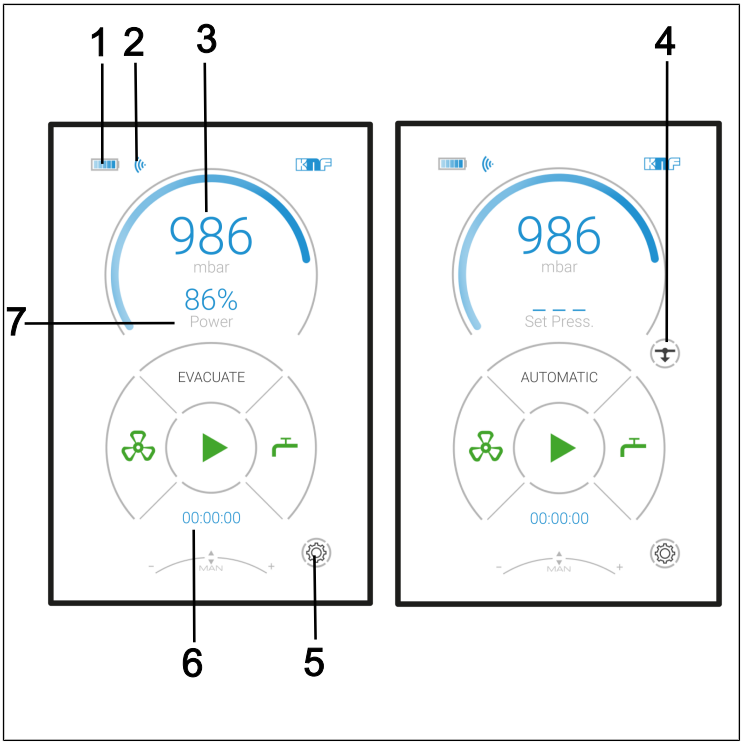

Fig.14: Displays on the touchscreen

1 Mode menu

2 Button venting valve:
Green = Close
Red = Open

3 Button for coolant valve (accessory) on the condenser:
Green = Close
Red = Open

4 Button for the process:
Green = Start
Red = Stop

5 Button for automatic pressure reduction:
Press = End
(the current pressure is adopted as the setpoint pressure)

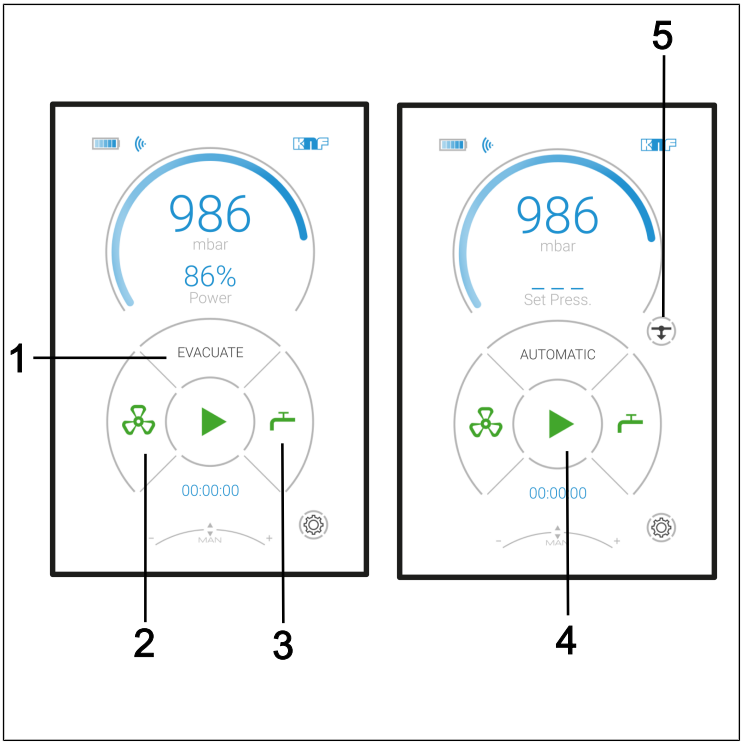

Fig.15: Menus and buttons on the touchscreen

1 Language selection menu
2 Select background color menu
3 Adjust brightness menu (levels 1 to 10)
4 Pressure unit menu
5 MAC address of the connected Bluetooth subscriber
6 Switch acoustic signal on and off menu

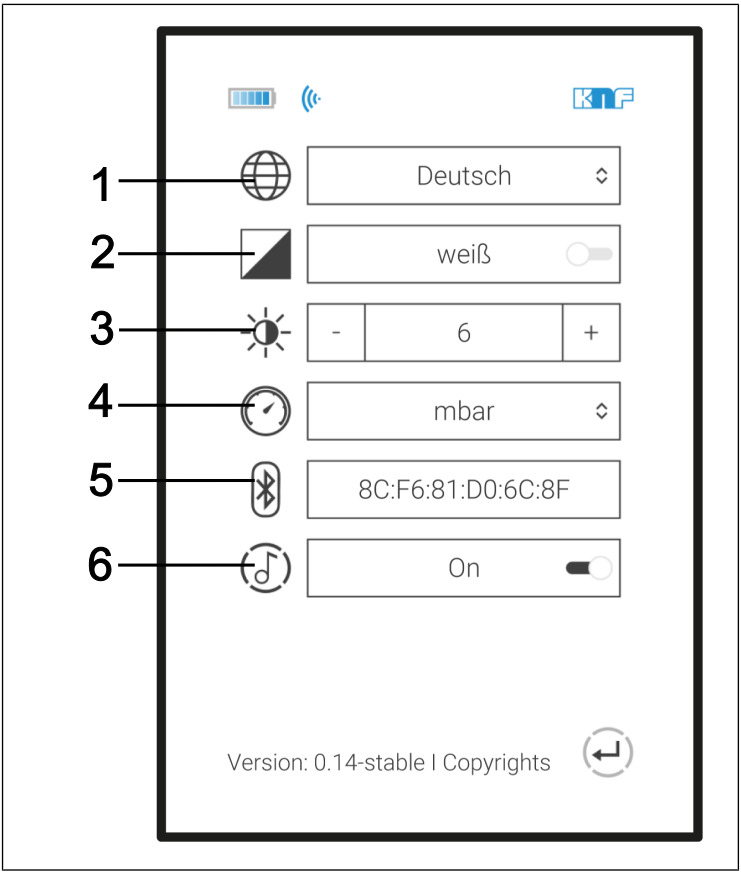

Fig.16: Menu: Settings

9.2.1.2 Operation

Menu language

To select the menu language, go to Settings (Fig. 14/**5**).

In Settings (Fig. 16), you can choose from the following menu languages: German, English, French, Italian, Spanish and Dutch (Fig. 17).

Fig.17: Language selection

Pressure unit

The display of the process pressure on the vacuum controller can be selected to appear in mbar, bar, hPa, Torr or Hg (see Fig. 18).

The pressure unit can be selected by going to Settings (Fig. 16) and selecting the Pressure unit menu there (Fig. 16/**4**).

Fig.18: Pressure unit menu

Modes

The current mode is displayed on the touchscreen of the vacuum controller. Pressing this row of the touchscreen opens the menu for changing the mode (see Fig. 19).

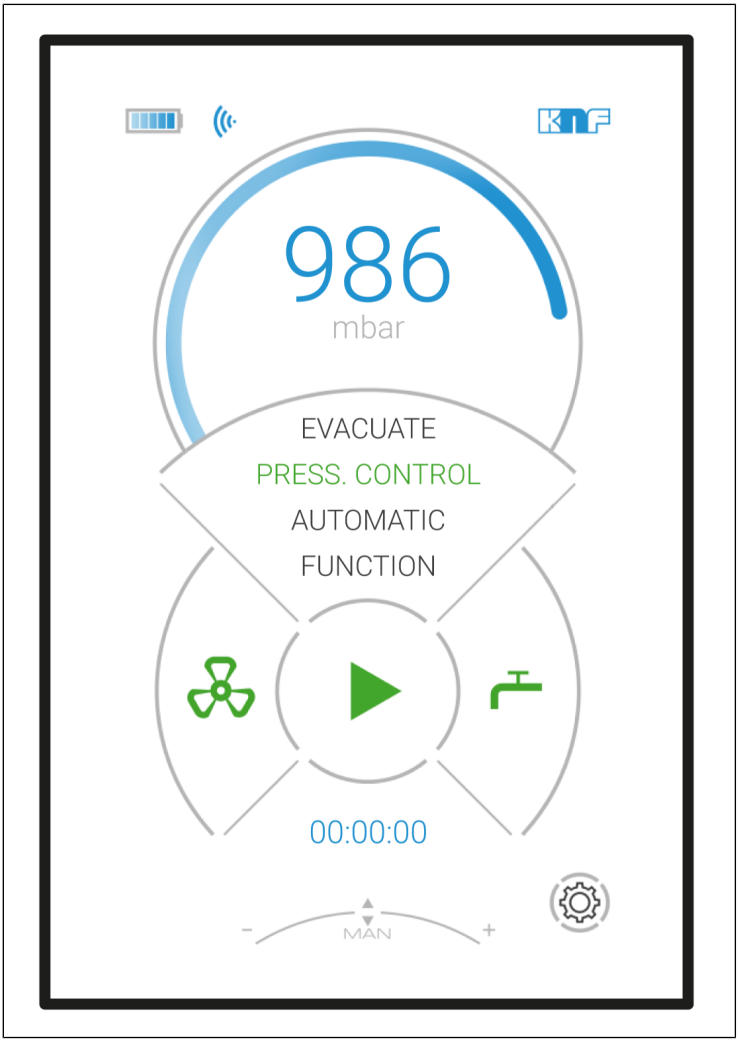

Fig.19: Selecting the mode

Switching to manual process control (using rotary/push knob)

→ Brief press of the rotary/push knob:
If the rotary knob is pressed briefly during an active process the process switches to "temporary pressure regulation".

Within manual process control

→ Pressing (long press) the rotary/push knob:
Vacuum system evacuates.

→ Release:
The current pressure is adopted as setpoint pressure.

→ Rotate:
Changing the setpoint pressure

→ To end "temporary pressure regulation", the process must be stopped by pressing the symbol (Fig. 14/**4**).

Starting and stopping a process

Press the *START* (Fig. 15/**4**) button to start a process.

Press the *STOP* (Fig. 15/**4**) button to stop a process.

Opening and closing the venting valve

WARNING

Personal injury due to poisoning or explosion and damage to vacuum system

→ Make certain that when the vacuum system is vented no reactive of explosive mixtures can be created through the air inlet.

Press the *OPEN* button to open the venting valve (Fig. 15/**2**).

i If the *OPEN* button is pressed for longer than 3 seconds, the venting valve remains open.
When the venting valve is activated, the symbol is red and rotates (CCW).

If the vent valve is permanently open (*CLOSE* button appears in the display), it can be closed again by pressing the *CLOSE* (Fig. 15/**2**) button.

Opening and closing the coolant valve (accessory)

Press the *OPEN* button for (Fig. 15/**3**) to open the coolant valve on the condenser.

Press the *CLOSE* button for (Fig. 15/**3**) to close the coolant valve on the condenser.

EN

Entering values in Evacuate mode

Adjust the pump performance by turning the rotary/push knob.

Entering values in pressure control mode

Adjust the setpoint pressure by turning the rotary/push knob.

Entering values in Automatic mode

No value entries can be made.

If a boiling point is detected in *Automatic* mode, the process remains at the detected boiling point (actual pressure) and switches to a temporary pressure regulation mode. If pressure reduction (Fig. 14/**4**) is inactive, regulation remains permanently at the detected boiling point. If pressure reduction (Fig. 14/**4**) is active, an attempt is made to approach the next boiling point after about 30 seconds. When pressure reduction is active, this process is repeated continuously (see Fig. 20).

Screen 1 Start *Automatic* mode

Screen 2 Detect boiling point; subsequent regulation to this pressure

Screen 3 Automatic pressure reduction

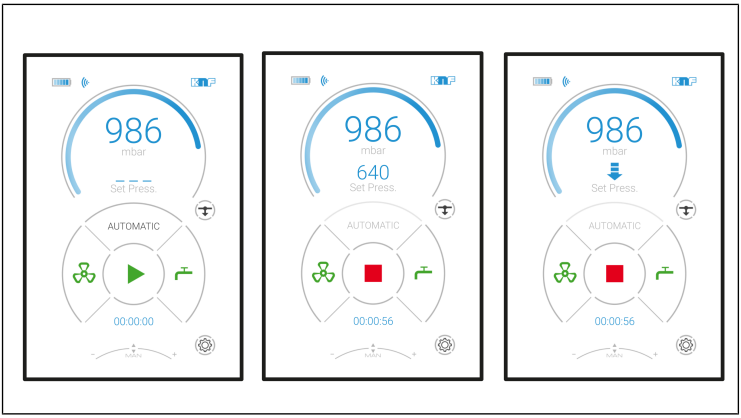

Fig.20: Automatic function workflow

If the rotary/push knob is pressed during automatic pressure reduction, the current actual pressure is adopted as the new setpoint pressure and is adjusted by the vacuum system. The current setpoint pressure appears in the display instead of the arrow.

If automatic pressure reduction (Fig. 14/**4**) is then activated again, the arrow spears in the display again after about 25 seconds.

Entering values in Function mode

An individual work process can be defined in Function mode. For this, the individual "operating points" can be programmed in one after the other and then started. After starting, the pump works through the individual operating points in order and with the desired time intervals.

1 View for entering the current reference point

2 Changing the reference point table

3 Current reference point table

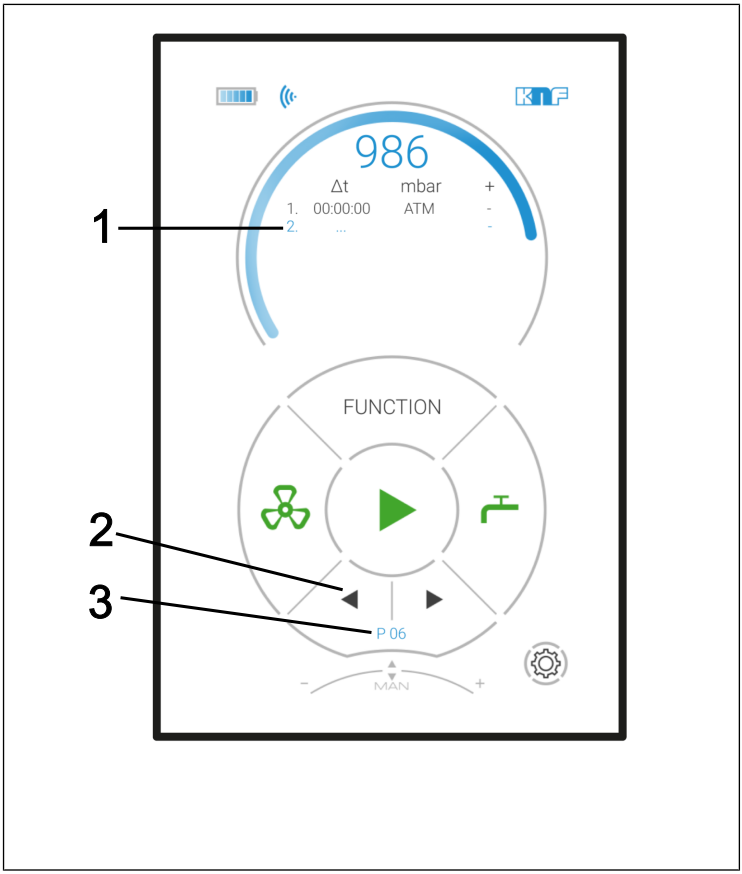

Fig.21: Menu in Function mode

Entering reference points (up to 10):

1. Time interval after previous reference point: Δ t
2. Setpoint pressure: p (mbar) / p (bar) / p (hPa) / p (Torr)
3. Additional options (Column "+") for influencing the function process sequence:

→ CV1: Open coolant valve (accessory);

→ CV0: Close coolant valve (accessory)

→ S: Jump - The system is evacuated/vented to the desired pressure as quickly as possible.

→ A: Automatic - Find boiling pressure automatically

i If the set limit pressure is reached without steam pressure, the program jumps to the next function step.

→ A+: Automatic Plus - Find boiling pressure automatically followed by pressure reduction.

Row selection (see Fig. 21):

→ Change row:
Turn the rotary/push knob.

→ Select the row for editing:
Press the rotary/push knob.

Editing a selected row

→ Change column
(e.g. from Δt to p (mbar):
Press the rotary/push knob.

→ Change entry:
Turn the rotary/push knob.

i After the last column (+), the display automatically returns to the row selection and jumps to the next row.

i If no entry is made for more than 3 seconds in Edit mode, the display automatically returns to the row selection.

i The function values of the reference point table are stored in the vacuum system's internal memory when the process is started and available for use again when the system is restarted.

i Changes to the function values (reference point table) are adopted directly by any PC software that is being used at the same time.

Repetitions / Deletion of reference points:

The following symbols can be rotated into view below the value 00:00:00 in the column for time intervals:

→ ↻ = Repetition. Repeats all operating points that were defined previously in the desired repetition sequences.

→ **...** = Deletion of the reference point.

In both cases, all subsequent reference points are deleted automatically.

Calling saved reference point tables:

→ Press the button for reference point table selection (arrow in Fig. 21/**2**) and select the desired reference point table. The reference point table saved with that number is now visible.

i Up to 10 different reference point tables can be saved and called up again as needed. The number in the display (Fig. 21/**3**) shows the currently selected reference point table.

Paging the vacuum system (Paging)

If the Paging button (Fig. 23/**1**) on the vacuum system is pressed and held for about 5 seconds, the vacuum controller responds to the vacuum system Paging button with an acoustic signal (see Chapter *9.2.2 Operation without the vacuum controller [▷ 72]*).

i Note that paging only works if the vacuum controller is connected to the pump and switched on.

Wireless connection missing

If there is no wireless connection between the vacuum controller and the associated vacuum system (e.g., if the vacuum system is not switched on of the wireless connection is being established or malfunctioning), the "No connection" symbol (see Fig. 22) appears in the display on the vacuum controller.

To remedy this, see Chapter *12 Troubleshooting [▷ 93]*.

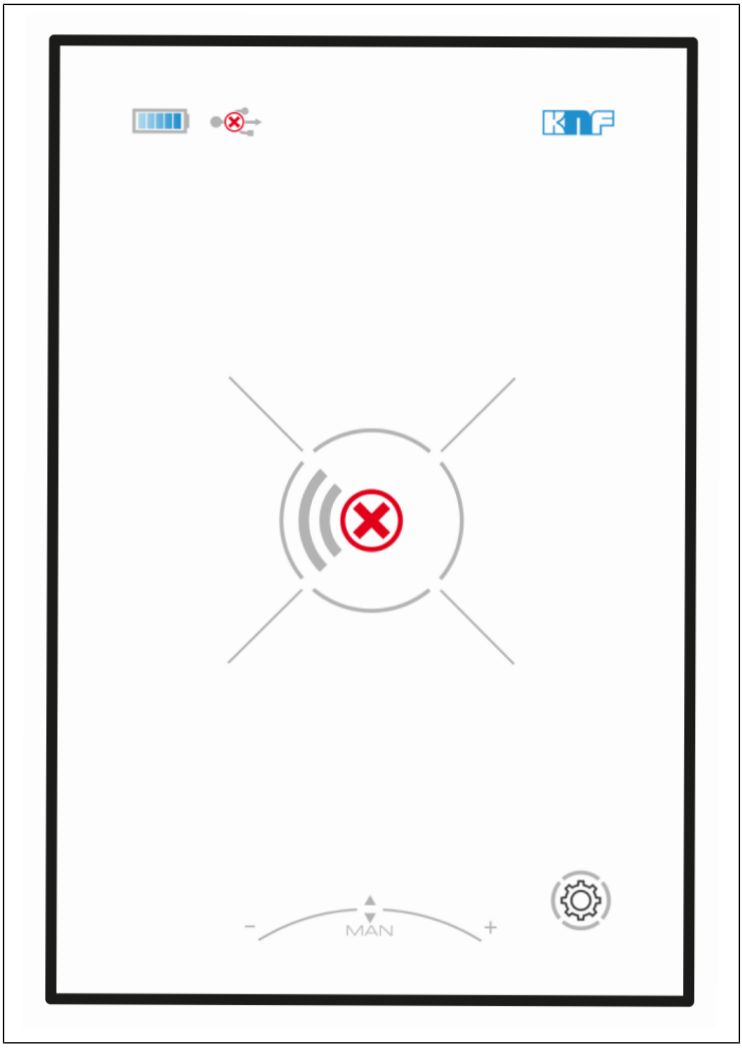

Fig.22: "No connection" display

Pairing the vacuum controller with the pump (Pairing)

1. Go to Settings on the vacuum controller (see Fig. 14/**5**).
2. Press the displayed MAC address of the connected Bluetooth device (Fig. 16/**6**).

3. Press the Pairing button (Fig. 23/**1**) on the pump for about 10 seconds.
   The pump and the vacuum controller connect to each other.

9.2.1.3 Changing the batteries in the vacuum controller

Quantity	Material/tools
1	TORX screwdriver TX10

Tab.21: Material/tools

CAUTION

ESD-sensitive components (ESDS)

Failure to comply with the ESD protection instructions according to IEC 61340-5-1 may result in a partial or even complete malfunction of the vacuum controller.

→ The vacuum controller must only be used in an ESD protected area (EPA) by qualified persons in accordance with IEC 61340-5-1.

4. Loosen the six housing screws on the underside of the vacuum controller.
5. Remove the rear cover.
6. Replace the rechargeable batteries.
   Ensure the correct polarity of the batteries.

i For information about the specification of the required batteries, see Chapter *5 Technical data [▷ 25]*.

i Never use new batteries together with used batteries. All batteries must always be replaced at the same time.

7. Put the cover back on.
8. Dispose of old batteries in accordance with the regulations in force.

9.2.2 Operation without the vacuum controller

If the vacuum controller has been removed, the following action can be carried out directly at the vacuum system (Fig. 23):

→ Page vacuum controller (Paging); the vacuum controller responds with a signal tone (**1**).

1 Calling the vacuum controller (paging) / Pairing the vacuum controller with the pump (Pairing)

2 Bluetooth / USB

3 Pump connection

4 Coolant valve (accessory) connection of the condenser

5 Venting / inert gas connection

6 Inlet

7 Mini-USB
- Cable connection to handheld terminal
- Cable connection to PC

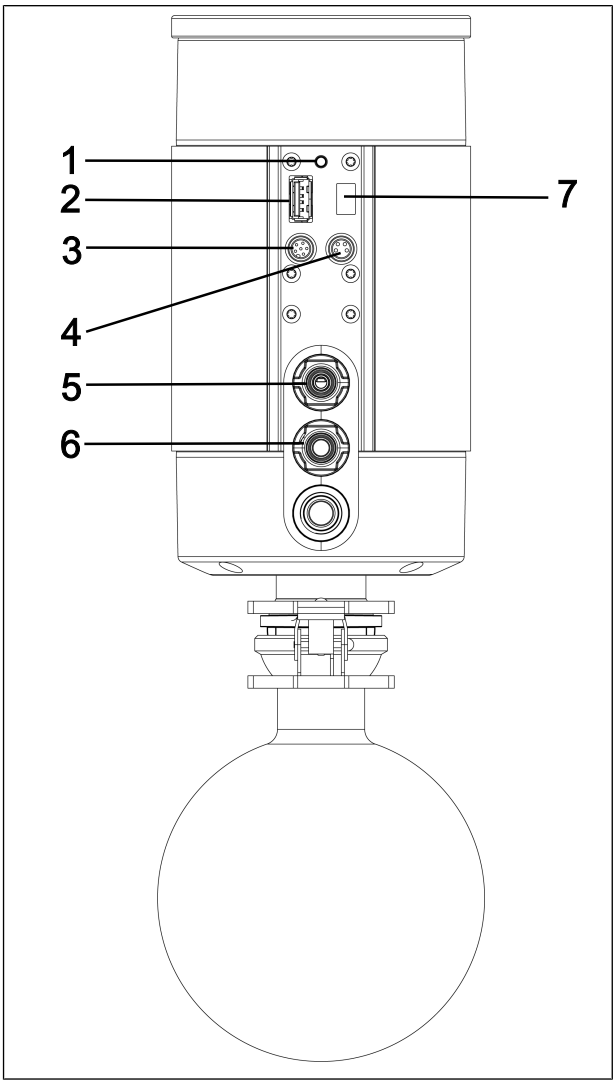

Fig.23: Separator SC

10 Servicing

NOTICE

Servicing the pump

Damage to the pumps can result from failure to observe the applicable legal regulations and procedures for the location or intervention by untrained or uninstructed personnel.

→ Servicing may only be performed according to the legal regulations (e.g. work safety, environmental protection) and provisions.

→ Servicing may only be performed by specialized personnel or trained and instructed personnel.

10.1 Servicing schedule

WARNING

Risk of explosion from formation of explosive atmosphere

Leaky connections can result in dangerous explosive atmospheres.

→ Ensure that diaphragms and valve plates/seals are installed undamaged, cleanly and correctly.

→ Check the pneumatic connections of the vacuum system for leaks.

→ Work with care during maintenance work.

→ Replace defective parts immediately.

WARNING

Risk of injury when not using genuine spare parts.

Failure to use genuine spare parts will result in a loss of vacuum system functionality and safety.
The validity of the CE conformity is rendered void if genuine spare parts are not used.

→ Use only genuine spare parts from KNF when performing servicing work.

Component	Servicing interval
Vacuum system	→ Perform periodic inspections for external damage or leakage. → Periodically check for noticeable changes to noises and vibrations.
Diaphragm and valve plates/ seals	→ At the latest, replace when the performance decreases.

Tab.22: Servicing plan

10.2 Cleaning

NOTICE

During cleaning work, ensure that no fluids enter the interior of the housing.

10.2.1 Flush vacuum system

WARNING

Risk of explosion by flushing the vacuum system with air

→ When using the vacuum system with explosive media, only permit specialized personnel to flush the pump with inert gas.

WARNING

Potential exists for personal injury due to poisoning or explosion and damage to vacuum system.

→ When flushing the vacuum system with inert gas, ensure that the gas ballast valve is closed and that no reactive or explosive mixtures form.

→ Flush the vacuum system with air for about 5 minutes before switching it off under atmospheric conditions (ambient pressure) (if necessary for safety reasons: with an inert gas).

10.2.2 Clean vacuum system

→ Clean the vacuum system exterior only with a damp cloth and non-flammable cleaning agents.

→ If compressed air is available, blow out the parts.

10.3 Replace diaphragm, valve plates/seals and O-rings

Requirements

	Necessary requirements
Vacuum system	- Vacuum system switched off and mains plug pulled out of socket - Vacuum system cleaned and free of hazardous materials - Hoses removed from pneumatic inlet and outlet

Material and tools

Quantity	Material
1	TORX® T20 screwdriver with torque indicator
1	Open-end wrench, size 14
1	TORX® screwdriver T25 with torque indicator (only for SC840G)
1	Spare parts set (see Chapter *11 Spare parts and accessories [▷ 90]*)
1	Felt-tip pen

Tab.23:

Information on the procedure

→ Always replace diaphragms, valve plates/seals, and O-rings together to maintain the performance of the pump.

→ Replace the diaphragms and valve plates/seals of the individual pump heads one after the other.

→ As standard, only the elastomer parts of the pump are replaced during servicing. For servicing of the complete vacuum system, please refer to Chapter Change O-rings on the complete vacuum system (optional).

CAUTION

Risk of injury due to moving parts

If the vacuum system is not properly disconnected from the mains, the vacuum system may restart if the on/off switch is pressed.

→ Pull mains plug out of the socket.

WARNING

Health hazard due to hazardous substances in vacuum system

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

→ Wear protective equipment if necessary, e.g. protective gloves, safety glasses.

→ Clean the vacuum system by taking appropriate measures.

Preparatory steps

1. Remove the collection flasks (**4** and **5**/Fig. 3).
2. Remove the signal cable (**7**/Fig. 3).
3. Loosen the union screw of the hose connection (**1**/Fig. 24) from the vacuum system component.

i If necessary, use a size 14 open-end wrench to loosen the union screw of the separator hose connection (**1**/Fig. 24).

1 Hose connection AS

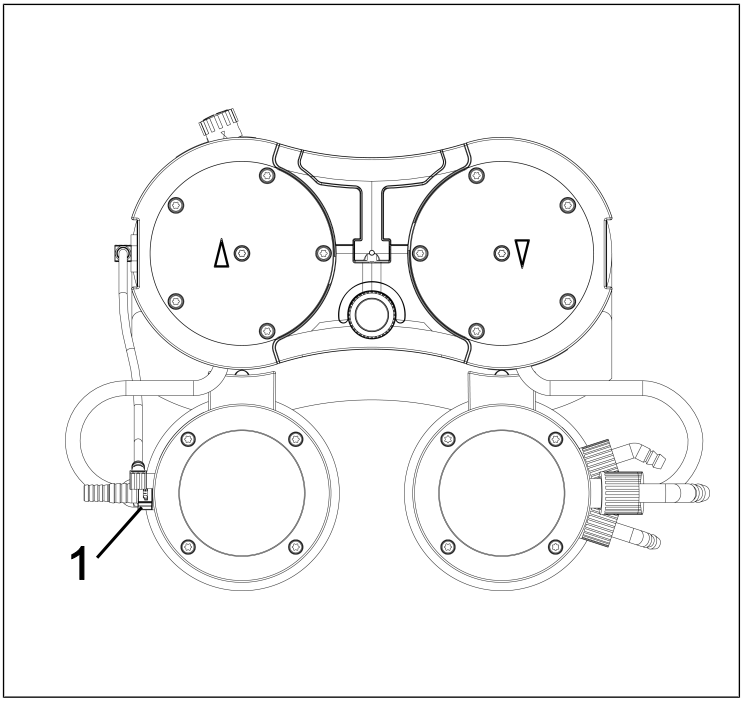

Fig.24: Loosen hose connection

4. Remove the union nut of the hose connection (**5**/Fig. 25) from the vacuum system components.
5. Set the handle (**1**/Fig. 25) to a vertical position.
6. Loosen the two screws (**2**/Fig. 25) of the handle cover (**3**/Fig. 25).
7. Remove the handle cover (**3**/Fig. 25).
8. Loosen the 10 external head screws (**4**/Fig. 25) on both pump heads.

9. Remove the 10 external head screws (**4**/Fig. 25) from both pump heads.

i The two internal head screws (**1**/Fig. 26) remain tightened for the time being.

1 Handle
2 Screw
3 Handle cover
4 Head screw
5 HLK hose connection

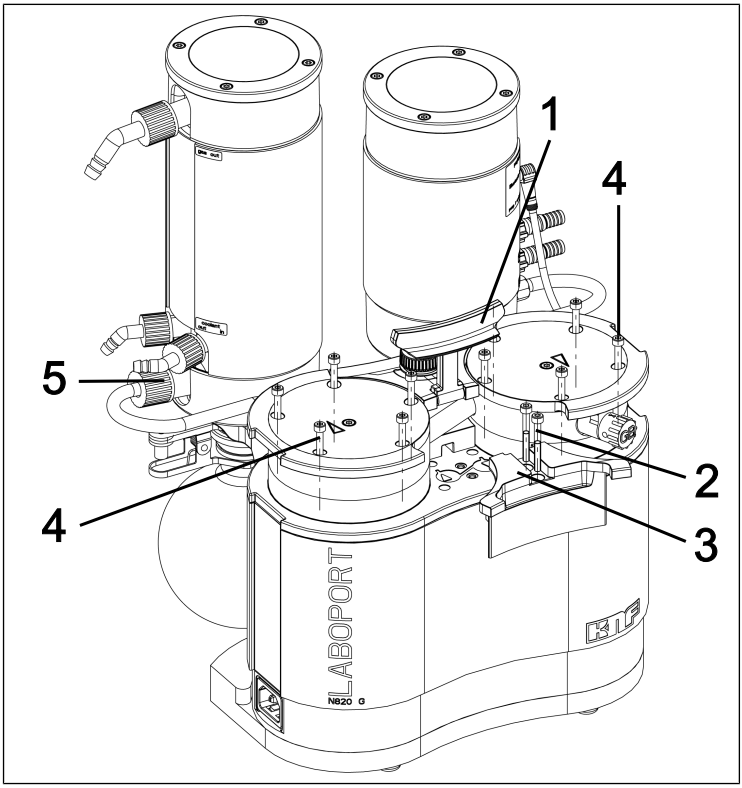

Fig.25: Remove handle cover

EN

Removing pump head

1 Cap screw
2 Pressure plate
3 Head cover
4 Valve plates/ Seals
5 Locating pin
6 Intermediate plate
7 Diaphragm
8 Shim rings

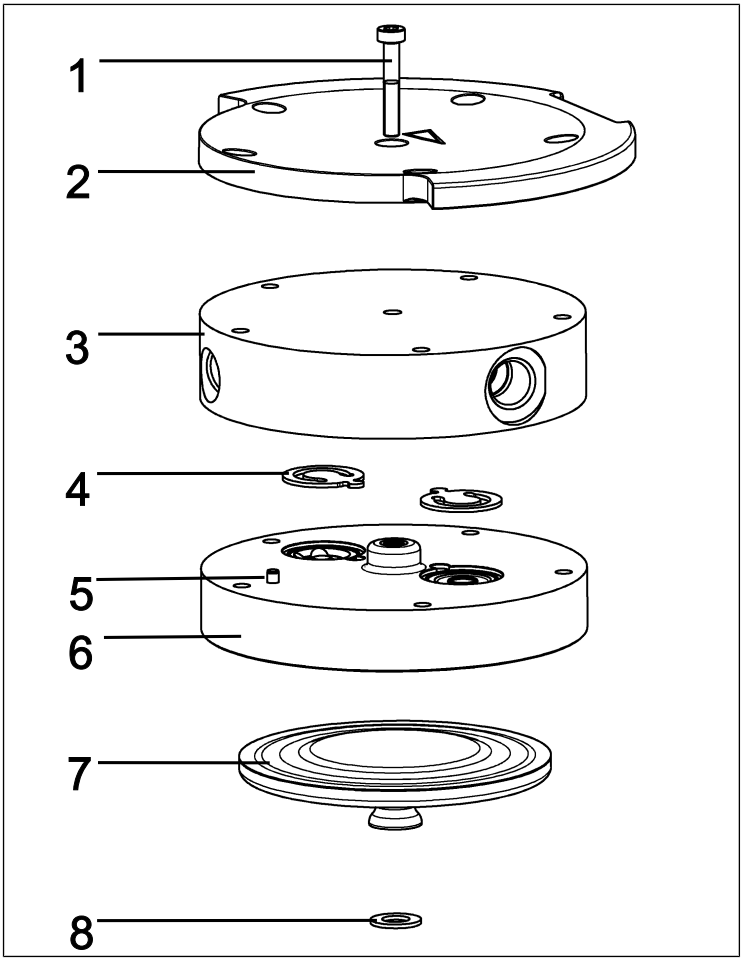

Fig.26: Pump head (pump N820 shown)

i The following item numbers refer to Fig. 26, unless specified otherwise.

1. Mark the pressure plate (**2**), head plate (**3**) and intermediate plate (**6**) with a continuous pencil stroke. This prevents the parts from being incorrectly mounted later on.
2. Remove the external screws (**4**/Fig. 25) of the pump heads.

3. Carefully remove the pump heads to the side (see Fig. 27).

i The pneumatic connections remain mounted in the pump heads.

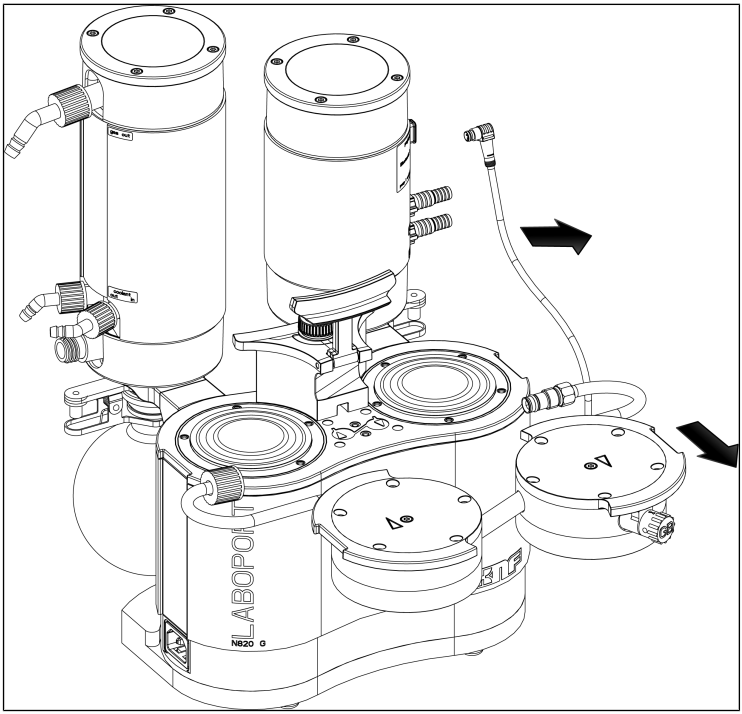

Fig.27: Remove pump heads

Replacing the diaphragm

i On the pump, the diaphragms (**7**) are changed successively to ensure that the shim rings (**8**) are used in the same quantity as previously.

1. Press down one diaphragm (**7**) so that the other diaphragm is in the upper change point.
2. Carefully turn the upper diaphragm (**7**) counterclockwise by hand and remove it.

EN

Make sure that the shim rings located between the diaphragm and connecting rod do not fall into the pump housing.
Remove any shim rings adhering to the diaphragms and fit them on the associated connecting rod thread.
Prerequisite for ensuring the pneumatic performance of the pump is that the same number of shim rings be mounted as before.

3. Screw in the new diaphragm (**7**) by hand and tighten it by hand.
   Be careful not to press the diaphragm (**7**) downwards.
4. Perform steps 1 – 3 for the second pump head.
5. Dispose of the replaced diaphragms (**7**) properly.

Change O-rings

1 Head screw
2 Pressure plate
3 Head plate
9 Gas ballast
10 Connection tube
11 Hose connection AS
12 Hose connection HLK
13 Gas ballast O-ring
14 Connection tube O-ring

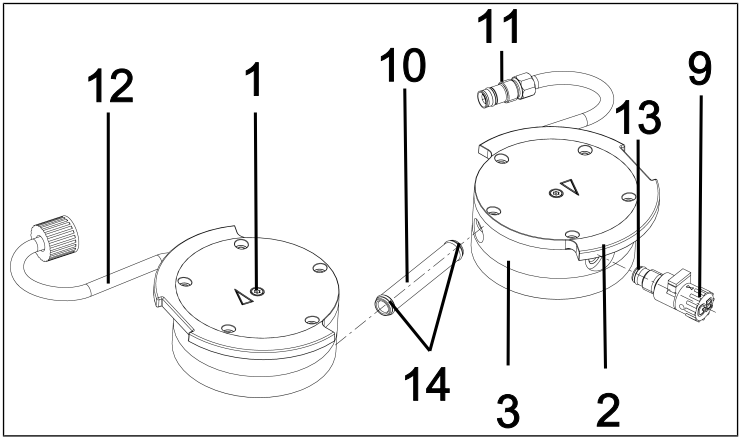

Fig.28: Changing O-rings

1. Pull the two pump heads apart.
2. Pull the connection tube (**10**/Fig. 28) out of the head plate (**3**).

The two hose connections (**11**) and (**12**) remain mounted in the head plates.

3. Replace the two O-rings (**14**) on the connection tube (**10**/ Fig. 28).

> **i** If the O-rings (**14**) cannot be taken out of the connection tube (**10**/Fig. 28), press them together gently and remove them with pliers if necessary.

4. Loosen the internal head screw (**1**) on both pump heads.
5. Remove the two pressure plates (**2**) together with the two internal head screws (**1**).
6. Unscrew the gas ballast (**9**/Fig. 28) from the head plate (**3**).
7. Replace the O-ring (**13**) on the gas ballast (**9**/Fig. 28).
8. Screw the gas ballast (**9**/Fig. 28) into the corresponding head plate (**3**) as far as it will go. Then turn it back again until the surface is oriented upwards.
9. Dispose of the replaced O-rings properly.

Replacing valve plates/seals

> **i** With the pump, the valve plates/seals (**4**) are replaced successively.

1. Remove the head plate (**3**) from the intermediate plate (**6**).
2. Remove the old valve plates/seals (**4**).
3. Carefully clean the intermediate plate (**6**) (if there are deposits on it).
4. Insert the new valve plates/seals (**4**) into the corresponding seats on the intermediate plate (**6**).

> **i** The valves and O-rings for the pressure side and suction side are identical; the same applies for the top and bottom of the valves and O-rings.

5. Perform steps 1 – 4 for the second pump head.
6. Dispose of the replaced valve plates/seals (**4**) properly.
7. Insert the connection tube (**10**/Fig. 28) back into both head plates (**3**).

Fitting the pump head

1. Move the diaphragms (**7**) to the center position.

EN

2. Press down on the edge of both diaphragms (**7**) all the way around.
3. Place the head plate (**3**) on the intermediate plate (**6**) in line with the locating pin (**5**).
4. Place the pressure plate (**2**) on the head plate (**3**) according to the pencil line.
5. Tighten the internal head screw (**1**) in the center of the pressure plate (tightening torque: 1 Nm).
6. Perform steps 3 - 5 for the second pump head.
7. Place the two pump heads (consisting of head plate (**3**), intermediate plate (**6**) with valve plates/seals (**4**) and pressure plate (**2**)) together with the connection tube on the pump housing according to the pencil line (see Fig. 29).

i Make sure that the hose connection (**11**) is inserted straight into the separator connection.

8. Screw in the union screw of the hose connection (**11**) 1-2 turns by hand.

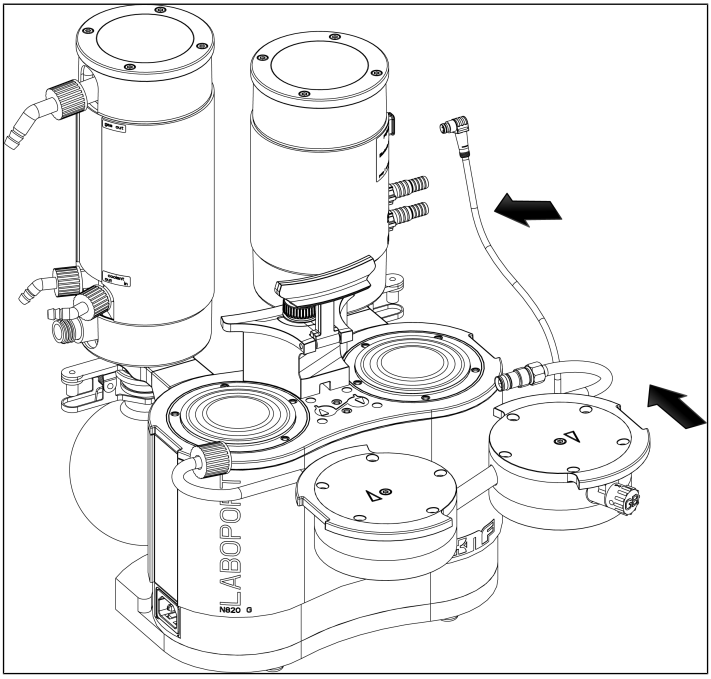

Fig.29: Mounting the pump head

9. Insert the 10 external screws (**4**/Fig. 25) in the pump head and tighten them in a crosswise pattern (tightening torque: SC820G: 4 Nm; SC840G: 5 Nm)

i If the external screws (**4**/Fig. 25) cannot be inserted into the pump head, loosen the internal head screw (**1**) and check the seating of the head plate (**3**) on the intermediate plate (**6**).

10. Screw in the union screw of the separator hose connection (**1**/Fig. 24) on the separator connection as far as it will go.

i If necessary, use a size 14 open-end wrench to tighten the union screw of the separator hose connection (**1**/Fig. 24)

11. Hand-tighten the union nut of the hose connection (**5**/Fig. 25) on the high-performance condenser (**2**/Fig. 3).

Final steps

WARNING

Risk of explosions from leaks

→ Before recommissioning the vacuum system, check the pump heads and pneumatic connections for leaks. Leaks may lead to a risk of explosion.

1. Mount the handle cover (**3**/Fig. 25).
2. Tighten the screws (**2**/Fig. 25) of the handle cover (**3**/Fig. 25) (tightening torque: 2 Nm).
3. Connect the signal cable to the pump (see Fig. 3/**7**) and the separator (Fig. 23/**3**) (see Fig. 7).
   Make sure that the cable is passed through under the hose connection when connecting it.
4. Install the collection flasks (**4** and **5**/Product description SH820G).

WARNING

Risk of injury and poisoning from leaks

→ Before recommissioning the vacuum system, check the pump heads and pneumatic connections for leaks. Leaks can cause poisoning, chemical burns or similar injuries.

5. Before integrating the vacuum system into your application, perform a function check:
   → Connect the vacuum system electrically.
   → Check the vacuum system for functionality (incl. ultimate vacuum).
   → Disconnect the vacuum system electrically and pneumatically again.
6. Integrate the vacuum system into your application:
   → Connect the lines on the pneumatic inlet and outlet to the vacuum system.
   → Connect the vacuum system electrically.
   → Check the vacuum system for functionality.

10.4 Change O-rings on the complete vacuum system (optional)

i As already described in Chapter *10.3 Replace diaphragm, valve plates/seals and O-rings [▷ 76]*, only the elastomer parts of the pump are changed as standard during servicing. The additional O-ring replacement for servicing of a complete vacuum system is described below. For this purpose, you will need the appropriate spare parts set for the complete vacuum system (see Chapter *11.1 Spare parts [▷ 90]*).

1. Disassemble the pump heads as described in Chapter *10.3 Replace diaphragm, valve plates/seals and O-rings [▷ 76]* (sections: Initial steps and Removing pump head).

Change O-rings on the hose connections

1. Loosen the two union screws on the hose connections (**11**) and (**12**) and pull the hose connections out of the head plates (**3**).

i If necessary, use a size 14 open-end wrench to loosen the union screws.

11 AS hose connection
12 HLK hose connection
15 O-ring
16 O-ring
17 O-ring
18 O-ring
19 O-ring
20 AS hose connector

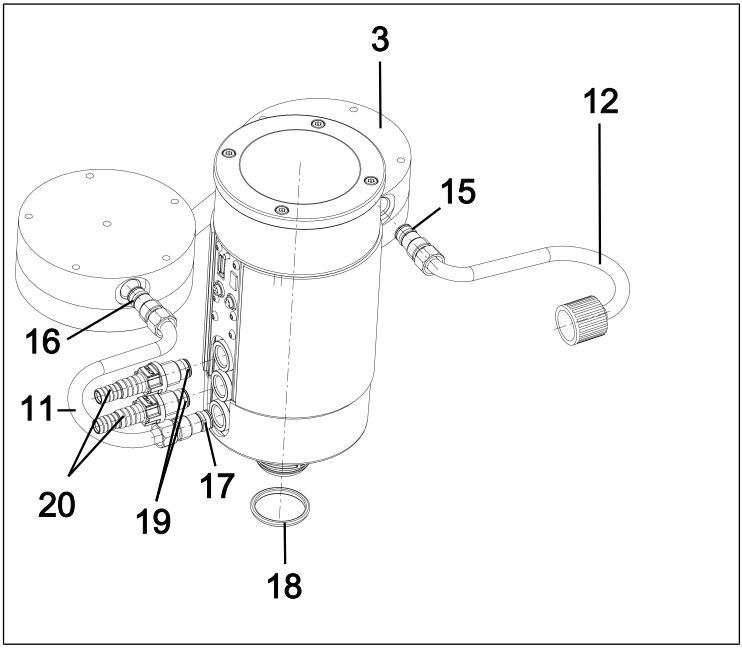

Fig.30: Changing O-rings

2. Change the O-rings (**16**) and (**17**) on the separator hose connection (**11**).
3. Change the O-ring (**15**) on the high-performance condenser hose connection (**12**).

i When changing the O-rings, make sure that the new O-rings are positioned correctly (between sleeve (**22**) and sliding washer (**21**; see Fig. 31).

21 Sliding washer
22 Sleeve
X O-ring (15, 16, 17)

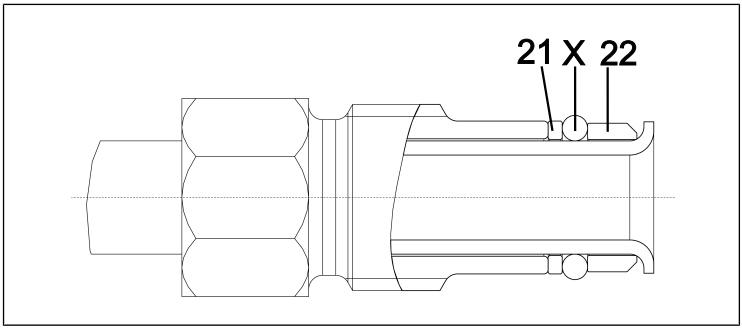

Fig.31: Correct position of O-ring

4. Screw the two hose connections (**11**) and (**12**) back into the head plates.
5. Fully tighten the union screws on the hose connections (**11**) and (**12**).

i To ensure the tightness of the hose connections, the union nuts of the hose connections must be tightened all the way.
If necessary, use a size 14 open-end wrench to tighten the union screws.

6. Mount the pump heads as described in Chapter *10.3 Replace diaphragm, valve plates/seals and O-rings [▷ 76]* (section: Fit pump head).
7. Dispose of the replaced O-rings properly.

Change O-ring on separator adapter

1. Unscrew the separator hose connector (**20**) from the separator adapter (**9**/Fig. 3).
2. Change the O-ring (**19**) of the hose connector (**20**).
3. Screw the hose connector (**20**) back into the separator adapter as far as it will go.
4. Loosen the flask clamp (**3**/Fig. 3) and remove the collection flask (**4**/Fig. 3) from the separator adapter (**10**/Fig. 3).
5. Change the O-ring (**18**) of the separator adapter.
6. Dispose of the replaced O-rings properly.

11 Spare parts and accessories

To order spare parts and accessories, please contact your KNF sales partner or KNF Customer Service (contact data: see www.knf.com).

11.1 Spare parts

Spare parts for standard servicing of the pump (see *10.3 Replace diaphragm, valve plates/seals and O-rings [▷ 76]*)

Pump spare parts	Item number*	Quantity
Diaphragm	(6/Fig. 26)	2
Valve plates/seals	(4/Fig. 26)	4
Connection tube O-ring (Ø 10 x 1.8; FFPM)	(14/Fig. 28)	2
Gas ballast valve O-ring (Ø 8 x 1.8; FFPM)	(13/Fig. 28)	1

Tab.24: Pump spare parts
**See Chapter 10.3 Replace diaphragm, valve plates/seals and O-rings [▷ 76]*

Spare parts set	Order number
Pump SC820G	331051
Pump SC840G	331052

Tab.25: Pump spare parts

Spare parts for optional servicing of the complete vacuum system (see *10.4 Change O-rings on the complete vacuum system (optional) [▷ 87]*)

System spare parts	Item number*	Quantity
AS hose connection O-ring (Ø 10 x 1.8; FPM)	(16/Fig. 30), (17/Fig. 30)	2
HLK hose connection O-ring (Ø 10 x 1.8; FPM)	(15/Fig. 30)	1
AS hose connector O-ring (Ø 10 x 1.8; FPM)	(19/Fig. 30)	2
Separator adapter O-ring (Ø 28 x 2.65; FPM)	(18/Fig. 30)	1

Tab.26: System spare parts
**See Chapter 10.4 Change O-rings on the complete vacuum system (optional) [▷ 87]*

Spare parts set	Order number
System SC820G*	338823
System SC840G*	338824

Tab.27: Spare parts set
**includes in each case the spare parts set for the pump + additional O-rings for optional servicing of the complete vacuum system*

11.2 Accessories

Accessories	Order number
Wrench for hose connector	316279
Collection flask	047729
After-condenser with overpressure relief valve	114855
Hose connector with O-ring (FPM)	323609
Hose connector (Hose ID 10; PP)	026237
Red screw connection cap, GL18 (for hose connector ID-026237)	025980
Hose connector (Hose ID 8; PP)	025981
Red screw connection cap, GL14 (for hose connector ID-025981)	025982
Hose connection AS	329998
HLK hose connection	317157
Flask clamp	025968
Charging cradle incl. power adapter	336784
Battery set for vacuum controller (see *9.2.1.3 Changing the batteries in the vacuum controller [▷ 71]*)	339004

Tab.28: Accessories

12 Troubleshooting

DANGER

Danger to life from electric shock

→ Have all work on the vacuum system performed only by an authorized specialist.

→ Before working on the vacuum system: Disconnect the vacuum system from the power supply.

→ Check and ensure that no voltage is present.

EN

→ Check the vacuum system (see tables below).

Vacuum system is switched on, but the power switch is not illuminated.	
Cause	**Troubleshooting**
Power adapter not plugged in.	→ Connect the vacuum system to a properly installed grounded socket using the power cord.
No voltage in the electrical mains.	→ Check the circuit breaker for the room and switch it on if necessary.

Tab.29: Troubleshooting: Vacuum system is switched on, but the power switch is not illuminated

Insufficient vacuum is achieved despite operation of the pump.	
Cause	**Troubleshooting**
Recipient leaking.	→ Close the gas inlet on a trial basis. If the pump now reaches sufficient vacuum, the leakage of the recipient is confirmed. → Establish tightness of the recipient.
O-ring on the mount of the collection flask is not seated correctly.	→ Align the O-ring. → If the O-ring is defective, replace it (for order number, see Chapter Spare parts).
Hose connection leaking.	→ Check the correct fit of the hoses on the hose connectors. → Change the leaking hoses. → Change the damaged hose connectors.
Condensation has collected in the pump head.	→ Separate the source of the condensation from the pump. → Flush the pump with air at atmospheric pressure for a few minutes (if necessary for safety reasons: with an inert gas). → If present, open the gas ballast and flush the pump head.
Gas outlet obstructed at the high-performance condenser.	Risk of bursting of high-performance condenser! → Eliminate the obstruction of the gas outlet.
Diaphragms or valve plates/seals are worn.	→ Replace the diaphragm and the valve plates/seals (see Chapter Replace diaphragm, valve plates/ seals and O-rings).
Replaced diaphragm and valve plates/seals.	→ Ensure that shim rings were fitted on the diaphragm thread. → Check the hoses for leaks. → If necessary, carefully tighten the outer screws and the pressure plate in a crosswise pattern.
Gas ballast still open	→ Connect the gas ballast.
Union screw on the hose connection not tightened enough.	→ Check the seating of the union screw. → Tighten the union screw with a size 14 open-end wrench.

Tab.30: Troubleshooting: Sufficient vacuum is not achieved despite running pump

Pump does not start when starting a process despite required pressure reduction.	
Cause	**Troubleshooting**
Overtemperature protection of the vacuum system has been triggered	→ Disconnect the vacuum system from the electrical mains. → Allow the pump to cool down. → Determine the cause of the overheating and rectify.

Tab.31: Troubleshooting: Pump does not start when starting a process despite required pressure reduction

Vacuum system does not pump	
Cause	**Troubleshooting**
Connections or lines are blocked.	→ Check the connections and lines. → Remove the blockage.
External valve is closed or filter clogged.	→ Check external valves and filters.

Tab.32: Troubleshooting: Vacuum system does not pump

Flow rate, pressure or vacuum too low **The vacuum system does not reach the performance stated in the technical data or data sheet.**	
Cause	**Troubleshooting**
There is overpressure on the pressure side and at the same time vacuum or pressure above atmospheric pressure on the suction side.	→ Change the pneumatic conditions.
Pneumatic lines or connection parts have insufficient cross-sections or are constricted.	→ Disconnect the pump from the system to determine the output values. → Eliminate any constriction (e.g. valve). → Use lines or connection parts with a larger cross-section if necessary.
Leaks occur at pneumatic connections, lines or pump head.	→ Ensure the correct seating of the hoses on the hose connectors. → Ensure that the pneumatic connections are correctly mounted. → Replace the leaky hoses. → Eliminate the leaks.
Pneumatic connections or lines are completely or partially clogged.	→ Check the pneumatic connections and lines. → Remove any parts or particles that are causing blockages.
Head parts are soiled.	→ Clean the head components.
Rotary/push knob is not set to max. speed.	→ Set the rotary/push knob to max. speed.

Tab.33: Troubleshooting: Flow rate, pressure or vacuum too low

Vacuum system is switched on and not running; status display is not illuminated	
Cause	**Troubleshooting**
Vacuum system is not connected to the electrical mains.	→ Connect the vacuum system to the electrical mains.
No voltage in the electrical mains.	→ Check the circuit breaker for the room and switch it on if necessary.

Tab.34: Troubleshooting: Vacuum system is switched on and not running; status display is not illuminated

Vacuum system is switched on and not running; status display flashes red (50% ON, 50% OFF)	
Cause	**Troubleshooting**
Pump has overheated, overtemperature protection has tripped.	→ Pull mains plug of vacuum system out of socket. → Allow the pump to cool down. → Determine the cause of the overheating and rectify.

Tab.35: Troubleshooting: Vacuum system is switched on but not running; status display is flashing red

Vacuum system is switched on but not running; status display is illuminated red (100% ON)	
Cause	**Troubleshooting**
Drive of the pump has blocked.	→ Pull mains plug of vacuum system out of socket. → Allow the pump to cool down. → Determine the cause of the blockage and rectify.

Tab.36: Troubleshooting: Vacuum system is switched on but not running; status display is illuminated red

Vacuum system is switched on and not running; status display flashes red (90% ON, 10% OFF)	
Cause	**Troubleshooting**
Other fault	→ Pull mains plug of vacuum system out of socket. → Allow the pump to cool down. → Contact KNF Customer Service.

Tab.37: Troubleshooting: Vacuum system is switched on but not running; status display is flashing red

Fault	Cause
Vacuum controller display does not light up.	Vacuum controller not switched on.
	Batteries in the vacuum controller dead.
The message "No connection" appears permanently in the display of the vacuum controller; if a button on the touchscreen is pressed, a warning signal is emitted.	Vacuum system switched off.
	The vacuum controller belongs to a different vacuum pump system SC800G.
	Wireless connection failed.
	Wireless module faulty.
Vacuum pump system does not respond to entries on the vacuum controller when it has been removed, although the "No connection" message disappears and the pressure display appears.	The vacuum controller belongs to a different vacuum pump system SC800G, which is in use.
Vacuum controller emits an acoustic signal.	Batteries almost dead.
The maximum operating time of the vacuum controller is significantly reduced by wireless operation.	Batteries have reached the end of their service life.
Pressure display returns implausible values.	The pressure unit in the display was changed.
	Leaks in the system.
	Recalibration of the pressure sensor necessary.

Tab.38: Troubleshooting: Vacuum controller

Fault cannot be rectified

If you are unable to identify any of the specified causes, send the vacuum system to KNF Customer Service (contact data: see www.knf.com).

1. Flush the vacuum system with air for a few minutes (if necessary for safety reasons: with inert gas) at atmospheric pressure to free the pump head of dangerous or aggressive gases (see Chapter *10.2.1 Flush vacuum system [▷ 75]*).
2. Clean the vacuum system (see Chapter *10.2.2 Clean vacuum system [▷ 76]*).
3. Send the vacuum system together with completed Health and Safety Clearance and Decontamination Form to KNF, specifying the pumped medium.

13 Returns

Preparing for return

1. Flush the vacuum system with air for a few minutes (if necessary for safety reasons: with inert gas) at atmospheric pressure to free the pump head of dangerous or aggressive gases (see Chapter *10.2.1 Flush vacuum system [▷ 75]*).

i Please contact your KNF sales partner if the vacuum system cannot be flushed due to damage.

2. Remove the vacuum system.
3. Clean the vacuum system (see Chapter *10.2.2 Clean vacuum system [▷ 76]*).
4. Send the vacuum system together with the completed Health and Safety Clearance and Decontamination Form to KNF, stating the nature of the transferred medium.
5. Pack the device securely to prevent further damage to the product. If necessary, request original packaging for a fee.

Returns

KNF shall undertake to repair the vacuum system only under the condition that the customer presents a certificate regarding the medium that is pumped and the cleaning of the vacuum system. It is also possible to return old devices. Please follow the instructions at knf.com/repairs here.

Contact your KNF sales partner directly if you require additional support for your return service.

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