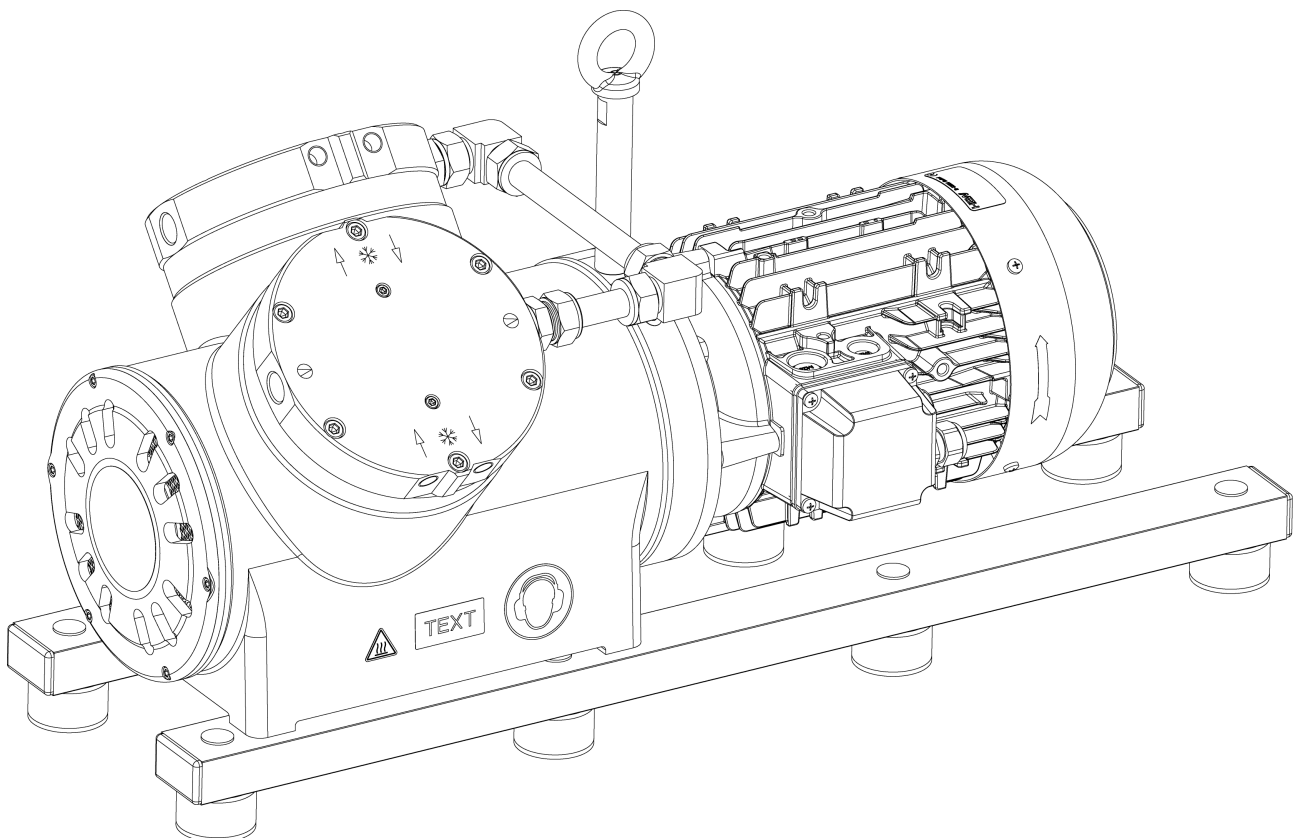


Process

N680.15
TRANSLATION OF ORIGINAL OPERATING AND
INSTALLATION INSTRUCTION
ENGLISH

DIAPHRAGM PUMP



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 About this document

1.1 Using the operating and installation instructions

The operating and installation instructions are part of the pump.

- In the event of uncertainties with regard to the content of the operating and installation instructions, please contact the manufacturer (contact data: see www.knf.com). Please have the type and serial number of the pump ready.
- Read the operating and installation instructions before you commission the pump.
- Give the operating and installation instructions only completely and unchanged to the next owner.
- Keep the operating and installation instructions within reach at all times.

Project pumps For customer-specific project pumps (pump models that begin with "PJ" or "PM"), there may be deviations from these operating and installation instructions.

- For project pumps, also observe the agreed specifications.

Optional contents Project-specific options may be included in the operating and assembly instructions. These are marked with "Optional". It is also possible that project-specific deviations are not included in the operating and assembly instructions.

1.2 Exclusion of liability

The manufacturer accepts no liability for damages and failures

- from ignoring the operating and installation instructions.
- due to changes or modifications to the device or improper handling.
- due to the use of impermissible spare parts or accessory parts.

1.3 Symbols and markings

Warning notice



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 poisonous substances
	Warning of hand injuries through crushing
	Observe the operating instructions
	General mandatory sign
	Wear hearing protection

Tab.2 Explanation of pictograms

2 Safety

i Observe the warning information in the chapters *6 Installation and connection* and *7 Operation*.

2.1 Personnel and target group

Personnel Ensure that only specialized personnel carry out work on the pumps. This applies, in particular, to mounting, connection 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 personnel	Employee
	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. A distinction is made between the following specialized personnel: C2: Skilled worker C2-Me: Skilled worker - Mechanical fitter C2-Pi: Skilled worker - Pipeline fitter C2-EL: Skilled worker - Electrician

Tab.3 Target group

Who-does-what matrix	Lifecycle phase	User personnel	Specialized personnel
	Transport		C2
	Mounting		C2-Me
	Connection		C2-Pi, C2-EL
	Commissioning	X	C2
	Operation	X	C2
	Maintenance		C2-Me
	Troubleshooting		C2C2-Pi, C2-EL
	Disposal		C2

Tab.4 Who-does-what matrix

2.2 Responsibility of the operator

The pumps are produced in accordance with the generally recognized rules of engineering, as well as the occupational health, 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 pump or other property.

Only use the pumps in perfect technical condition, for their intended use, safely and with an awareness of the dangers and in observation of the operating and installation instructions.

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

When connecting the pumps to the electrical power supply, observe the corresponding safety rules.

Make sure that no hazardous situation, physical harm or impairment of the pump can occur.

Operating parameters Only operate and install the pump under the operating parameters and operating conditions described in Chapters 2.4 *Operating conditions* and 3 *Technical data*.

2.3 Working in a safety conscious manner

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

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

When working on the pump, make sure that the pump is disconnected from the power and free of voltage.

When connecting the pump to the power supply, observe the corresponding safety rules.

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.

Ensure that the pump installation is EMC compliant such that no hazardous situations can occur.

2.4 Operating conditions

Only use the pump in perfect technical condition, for its intended purpose, safely and with an awareness of the dangers and in observation of the operating instructions.

Protect the compressors with a pressure relief device between the pressure side of the compressor and the first shut-off valve.

Only install and operate the pumps in accordance with the operating parameters and conditions described in Chapter 3 *Technical data*.

Only pumps that are fully assembled and in the condition as delivered may be operated.

Make sure that the installation location is dry and that the pump is protected from rain, splash water, gushing water, dripping water and other contamination.

Check the tightness of the connections between the pipes of the application and the pump (or the connection of the pump) at regular intervals. Leaky connections carry the risk of releasing dangerous gases and vapors from the pump system.

2.5 Media

Requirements of pumped media Before transferring a medium, check whether the medium can be transferred without risk 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 3 *Technical data*) with the medium.

Risk of dangerous gas mixtures during pump operation if diaphragm breaks: Depending on the medium being transferred, breakage of the diaphragm can result in a dangerous mixture if the medium mixes with the air in the compressor housing or the surroundings.

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

Handling of hazardous media	<p>Upon breakage of the diaphragm and/or leaks, the transferred medium mixes with the air in the surroundings and/or in the pump housing.</p> <p>Make sure that a dangerous situation cannot arise as a result.</p> <p>When pumping hazardous media, observe the safety regulations for the handling of said media.</p>
Handling of combustible media	<p>Note that the pump is not designed to be explosion-proof.</p> <p>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.</p> <p>Note that the temperature of the medium increases when the pump compresses the medium.</p> <p>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 pump. The maximum permissible operating pressure of the pump is stated in Chapter 3 <i>Technical data</i>.</p> <p>Make certain that the permissible ambient temperature (see 3 <i>Technical data</i>) is not exceeded.</p> <p>Where applicable, also take into account external energy sources (such as radiated heat sources) that could additionally heat the medium.</p> <p>In case of doubt, contact KNF Customer Service.</p>

2.6 Use

2.6.1 Proper use

The pumps are intended exclusively for transferring gases and vapors. The pumps are intended exclusively for operation in indoor areas and in non-explosive atmospheres.

Variable frequency drive	Pumps with three-phase motor are designed for operation with a variable frequency drive in the speed range 500 – 1500 rpm (50 Hz) or 600 – 1800 rpm (60 Hz) (see also Chapter 6.2 <i>Electrical connection</i>).
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2.6.2 Foreseeable misuse

The pumps must not be operated in explosive atmospheres. The pumps are not suitable for transferring the following:

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

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

This function can be made possible on a project basis following consultation with KNF Customer Service.

Do not apply positive pressure to the inlet of the pump.

This function can be made possible on a project basis following consultation with KNF Customer Service.

2.7 Directives and standards

EU/EC Directives	<p>EU Declaration of Conformity</p> <p>The pumps comply with regulations/directives:</p> <ul style="list-style-type: none"> ▪ Machinery Directive 2006/42/EC ▪ Electromagnetic Compatibility Directive 2014/30/EU ▪ Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (Annex II changed by delegated Directive (EU) 2015/863 of the Commission)
Standards	<p>The following harmonized/named standards apply:</p> <ul style="list-style-type: none"> ▪ EN ISO 12100 ▪ EN 1012-2 ▪ EN IEC 63000 ▪ EN 60034-1 ▪ EN 60034-30-1 (only pumps with three-phase motor)
China RoHS	<p>Relevant information has been provided to comply with the regulations of SJ/T 11364-2024 ("Labeling to Control Pollution Caused by Electronic Information Products") and China's administrative methods for controlling pollution caused by electronic information products.</p> <p>For detailed information, see chapter 13 <i>Appendix: China RoHS</i>.</p>

2.8 Customer service and repair

Customer service and repairs	<p>The pump is maintenance-free. However, KNF recommends periodic inspection of the pump for obvious changes in noise or vibration.</p> <p>Only have repairs to the pumps performed by qualified KNF personnel.</p> <p>Housings with electrically live components may only be opened by specialist personnel.</p> <p>Use only genuine spare parts from KNF when performing servicing work.</p>
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2.9 Disposal

Environmental protection	<p>Store the pump and all accessories in accordance with the environmental provisions. Observe national and international regulations. This applies in particular to parts that are contaminated with toxic substances.</p> <p>If you no longer need your packaging materials (e.g. for return shipment or other transport of the device), dispose of them in an environmentally friendly manner.</p> <p>Old devices must not be disposed of with household waste. Proper disposal and recycling helps to protect natural resources and the environment. The end user is responsible for disposing of old devices according to national and international regulations. Alternatively, KNF products (old devices) may also be returned to KNF for a fee (see chapter 11 <i>Returns</i>).</p>
--------------------------	---

3 Technical data

3.1 Technical data

Pump materials

Assembly	Material SP version	Material ST version
Head plate, intermediate plate	Stainless steel	Stainless steel
Diaphragm	EPDM	PTFE-coated
Valve springs	Stainless steel	Stainless steel
Valve limiter	Stainless steel	Stainless steel
Slotted cheese head screw	Stainless steel	Stainless steel
O-ring	EPDM	FPM
Conrod plate	Aluminum coated with PTFE	Aluminum coated with PTFE
Retainer plate	Stainless steel	Stainless steel
Connection	Stainless steel	Stainless steel
PTFE washer	PTFE	PTFE

Tab.5

Pneumatic values

Parameter	Value N680.15SP_	Value N680.15ST_
Max. permissible operating pressure [bar rel*] -Continuous operation	12.0	
Ultimate vacuum [mbar abs.]	<100	
Flow rate at atm. pressure [l/min]** -50 Hz -60 Hz	120 140	110 130

Tab.6 *bar rel relative to 1000 hPa

**Liters in the standard state (based on ISO 8778 and ISO 21360-1/2) (1000 hPa, 20°C)

Pneumatic connections

Pump type	Value
N680.15	G1/2*

Tab.7 *Acc. to ISO 228

Connection for water cooling (optional)

Pump type	Value
N680.15	Hose ID9

Tab.8 *Acc. to ISO 228

Other parameters

Parameter	Value
Permissible ambient temperature [°C]	+ 5 to + 40
Permissible media temperature [°C]	+ 5 to + 40
Dimensions N680.15	See Chapter Installing the pump
Gas tightness* of the pump head - .9 version (.13 version)	< 6 x 10 ⁻³ mbar l/s < 6 x 10 ⁻⁵ mbar l/s
Pump protection class (DIN EN 60529 / IEC 60529)	IP 20
Noise**	< 95 dB (A)

*Tab.9 *The gas tightness of the pump head is no longer ensured after the pump head is opened or after replacing diaphragm and valve plates/seals. A leak test can be used to determine whether the original gas tightness is achieved again.*

***Max. emission sound pressure level over the entire pressure range with gas connections attached*

Electrical data

Parameter	Value
Voltage [V]	See motor type plate
Frequency [Hz]	
Power P ₁ [W]	
Max. current draw [A]	
Motor protection class (DIN EN 60529 / IEC 60529)	
Fuse (PTC thermistor sensor)	See type plate and operating instructions for motor
Max. permissible supply voltage fluctuations	See operating instructions for motor
Relative air humidity	80% for temperatures to 31 °C, decreasing linearly to 50% at 40 °C (non-condensing).
Max. installation altitude	See operating instructions for motor

Tab.10

Weight

Pump type	Value [kg]
N680.15	Approx. 101

Tab.11

4 Product description

Design

- 1 Union nut
- 2 Connection for water cooling
- 3 Pneumatic connection
- 4 Inlet
- 5 Motor
- 6 Motor fan cowl
- 7 Electrical terminal box
- 8 Outlet

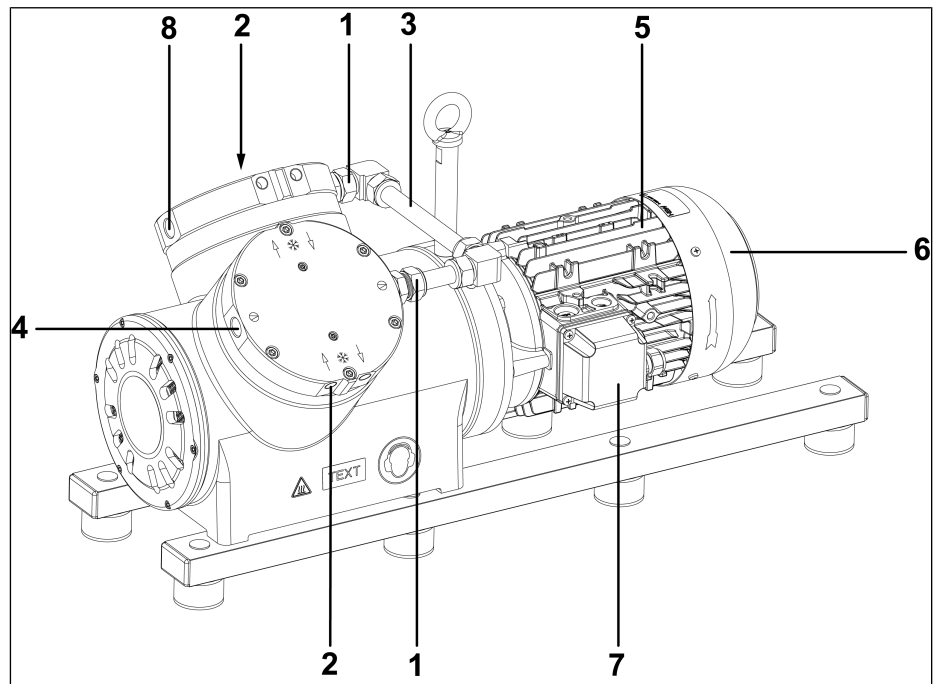


Fig.1 Design N680.15

Function of a diaphragm pump

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

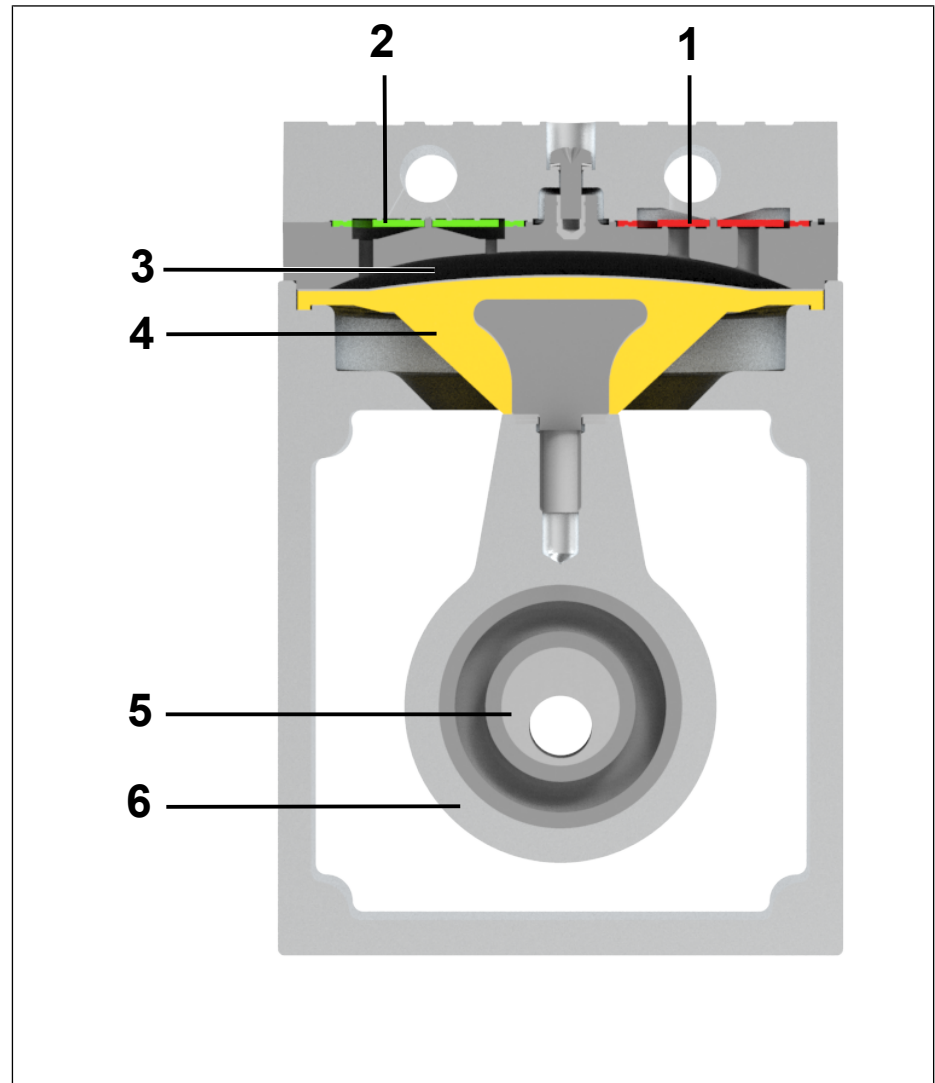


Fig.2 Function of a diaphragm pump

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.

5 Transport

General



Personal injury and/or property damage due to incorrect or improper transport of the pump

In the event of incorrect or improper transport, the pump can fall down, be damaged or injure persons.

- Use suitable auxiliary means if necessary (carrying strap, lifting gear, etc.).
- Where appropriate, wear suitable personal protective equipment (e.g., safety shoes, safety gloves).



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 pump in the original packaging to the installation location.
- Keep the original packaging of the pump (e.g. for later storage).
- Inspect the pump for transport damage after receiving it.
- Document any transport damage that has occurred.
- Remove any transport safeguards on the pump prior to commissioning.

Parameter

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

Tab.12 Transport parameters and storage parameters



Damage to the pump

Commissioning at an insufficient temperature can lead to malfunctions or damage to the pump.

- Prior to commissioning, make sure that the pump has reached the ambient temperature (3 *Technical data*).

Transporting with lifting eyebolt

1. Unscrew the M12 screw (1).

1 M12 screw

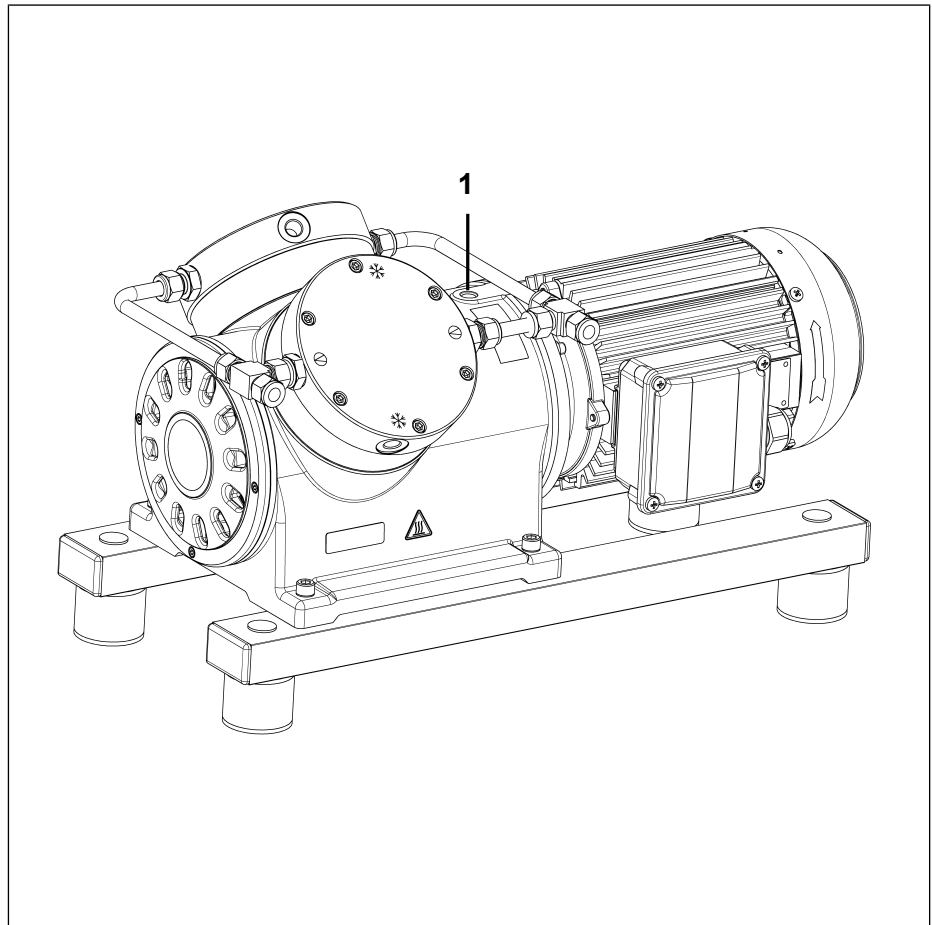


Fig.3 Unscrew the M12 screw (pump illustrated as an example)

2. Screw the transport eyebolt (2) hand-tight into the threaded hole.

i The transport eyebolt (2) is available as an accessory (see 9.2 Accessories).

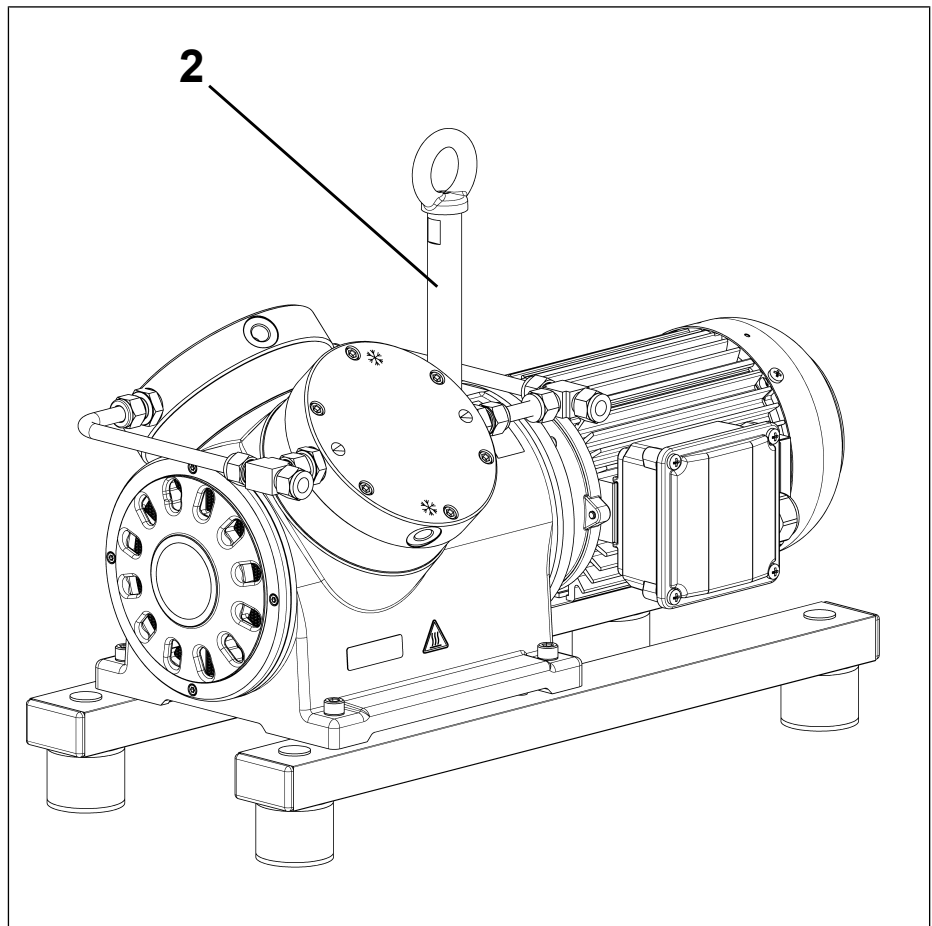
2 Lifting ring

Fig.4 Transport by the lifting ring

3. Lift the pump from the packaging with the help of lifting gear.
4. Lower the pump carefully at the installation location.
5. Remove the transport eyebolt (2).
6. Screw the M12 screw (1) back into the thread.

6 Installation and connection

Only install the pumps in accordance with the operating parameters and conditions described in Chapter 3 *Technical data*.

→ Observe the safety instructions (see Chapter 2 *Safety*).



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 3 *Technical data*) with the medium.

6.1 Installing the pump

→ Store the pump at the installation location to allow it to adapt to the ambient temperature before installation (condensation must not be allowed to form).

Mounting dimensions → For mounting dimensions, see the following figures:

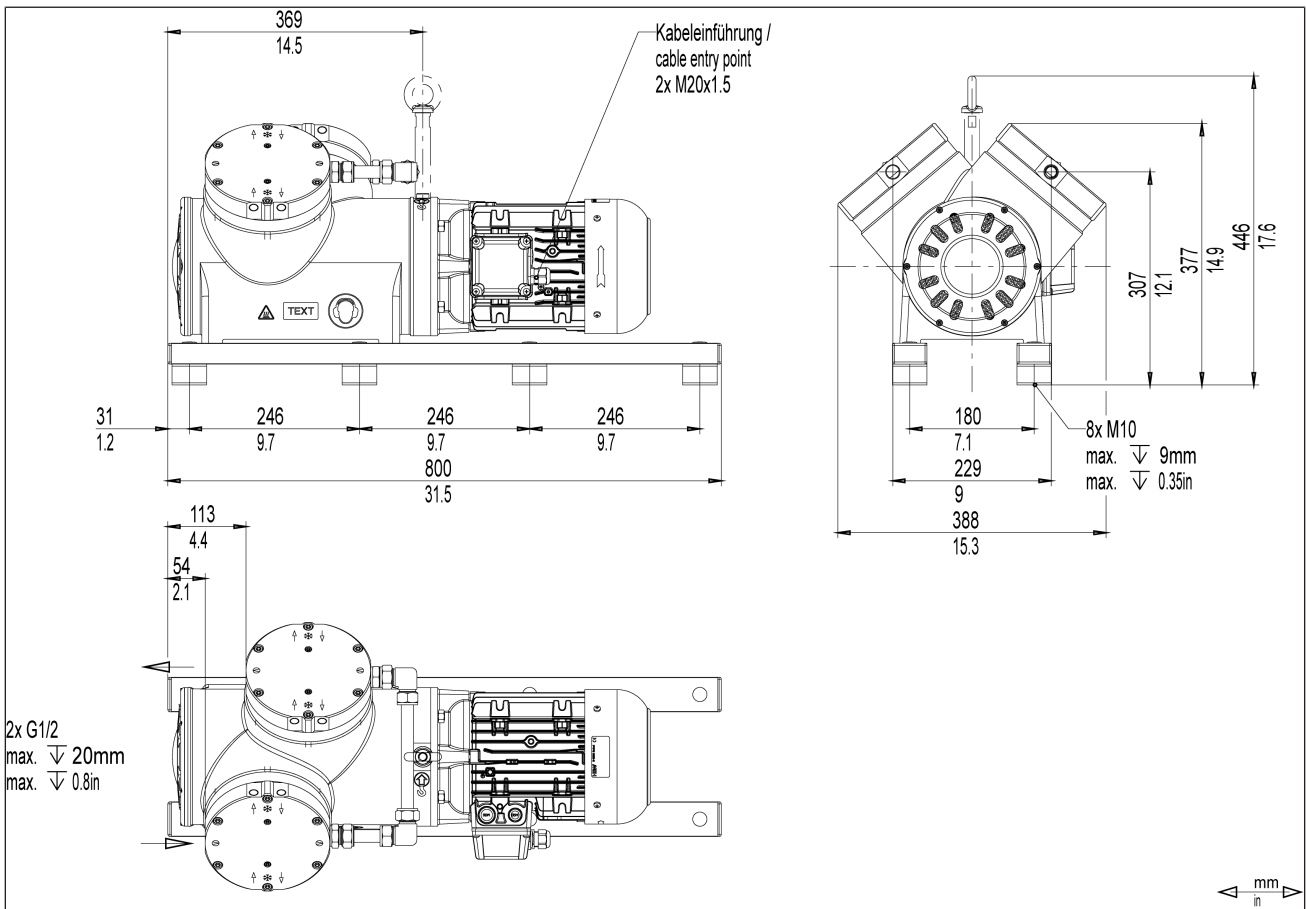


Fig.5 Mounting dimensions N680.15

Cooling air supply



Danger of burning on hot surfaces
Hot surfaces could occur if the pump overheats.

- When installing the pump, make sure that sufficient cooling air infeed and discharge is ensured.

Proximity to hot pump parts

- During installation, make sure that no combustible or thermally deformable objects are positioned in proximity to hot pump parts (head, motor).

Installation location

- Make sure that the installation location is dry and that the pump is protected from rain, spray water, splash water, dripping water and other contamination.

- Make sure the installation location allows access for servicing.

i The IP protection class of the pump motor is specified on the type plate.

- Install the pump at the highest point in the system to prevent condensate from collecting in the pump head.

- Protect the pump from dust.

- Protect the pump from vibration and impact.

Installation position

- Install the pump in the illustrated installation position. Use metal screws to fasten the pump at the indicated attachment points (see 6 *Installation and connection*).

6.2 Electrical connection



Risk of death due to electric shock
Improper electrical connection of the pump can result in electric shocks, which can lead to serious injury or even death.

- Only have the pump connected by specialized personnel.
- Only have the pump connected if the power supply is disconnected.

- For electrical connection to a power source, observe the applicable standards, regulations, directives, and technical standards.

- When connecting to a power source, carefully read and observe the motor operating instructions (including the notice on insulation resistance measurement).



Automatic restart after interruption of the power supply
If the power supply is interrupted or the thermal overload fuse of the motor is activated, the pump will automatically restart.

- Take appropriate protective measures.

- The pumps have been developed, manufactured and tested for S1 operation.
Additional operating modes can be made possible on a project-specific basis following consultation with KNF Customer Service.
 - Install a device for separating the pump motor from the electrical grid in the electrical installation (e.g. in accordance with EN 60335-1).
 - i** Refer to the type plate for the maximum current consumption of the pump.
 - Install an Emergency Off device such that it is not possible for there to be an automatic restart or for hazardous situations to persons and property to occur.
 - Install the pumps in such a way that it is not possible to touch electrically live parts (electrical connection).
- Fastening the connection cables → Fasten the connection cables so that
- the cables do not come into contact with movable or hot parts.
 - the cables cannot be worn or damaged on sharp corners or edges.
 - no tensile and pressure forces are exerted on the connection point of the cables (strain relief).
- Variable frequency drive Pumps with three-phase motor are designed for operation with a variable frequency drive in the speed range 500 – 1500 rpm (50 Hz) or 600 – 1800 rpm (60 Hz) (see also Chapter 6.2 *Electrical connection*).

Connecting the pump

1. Confirm that the power supply meets the parameters listed on the pump type plate. Refer to the pump type plate for the rated current draw.
2. Open the terminal box cover.
3. Connect the ground conductor to the pump motor.
4. Connect the electrical power cables in accordance with the operating instructions for the motor.
5. Close the terminal box cover again.

6.3 Pneumatic connection



Personal injury or property damage through ejected plugs

If not removed, the plugs on the outlet of the pump can be ejected during operation by the resulting overpressure.

→ Remove the plugs during installation.

→ Wear appropriate personal protective equipment.

- Connected components → Only connect components to the pump that are designed for the pneumatic data and thermal requirements of the pump. (see Chapter 3 *Technical data*).
- Pressure relief device → Protect the compressors by means of a pressure relief device between the pressure-side connections of the compressor and the first shut-off valve.
- Pump discharge → Discharge the possibly hot pump discharge at the pneumatic outlet of the pump safely (with regard to medium and noise).

Decoupling → KNF recommends mechanically decoupling the pump from the pipe system, e.g., through the use of flexible hoses or pipes. In this way it is possible to prevent the transfer of possible pump vibrations and noises to the system.

Connecting the pump

i A marking on the pump head indicates the flow direction.



Risk of injury due to mixing up inlet and outlet
Mixing up the inlet and outlet may cause breakage of components connected at the inlet and outlet.

→ Observe the marking of inlet and outlet on the pump head.

1. Remove the protective plugs from the connections.
2. Connect the suction line and the pressure line (for mounting dimensions, see Chapter 3 *Technical data*).
3. Lay the suction line and pressure line with a descent so that no condensate can run into the pump.

6.4 Connecting water cooling (optional)

i Water cooling (see 9.2 *Accessories*) can increase the service life of the diaphragm, particularly with high pressures or high ambient temperature.

Operating parameters

Parameter	Value
Water temperature [°C]	+ 5 to + 30
Water pressure [bar g]	< 5.0*
Water flow rate [l/min]	> 1.0

*Tab. 13 Recommended parameters for connecting the water cooling
Please contact KNF Customer Service for higher pressure requirements.

1. Connect the water cooling system to the provided hose connections.
→ Safely drain the water discharge.

i The flow direction is allowed in both directions.

Mounting dimensions For mounting dimensions, see the following dimensional drawings:

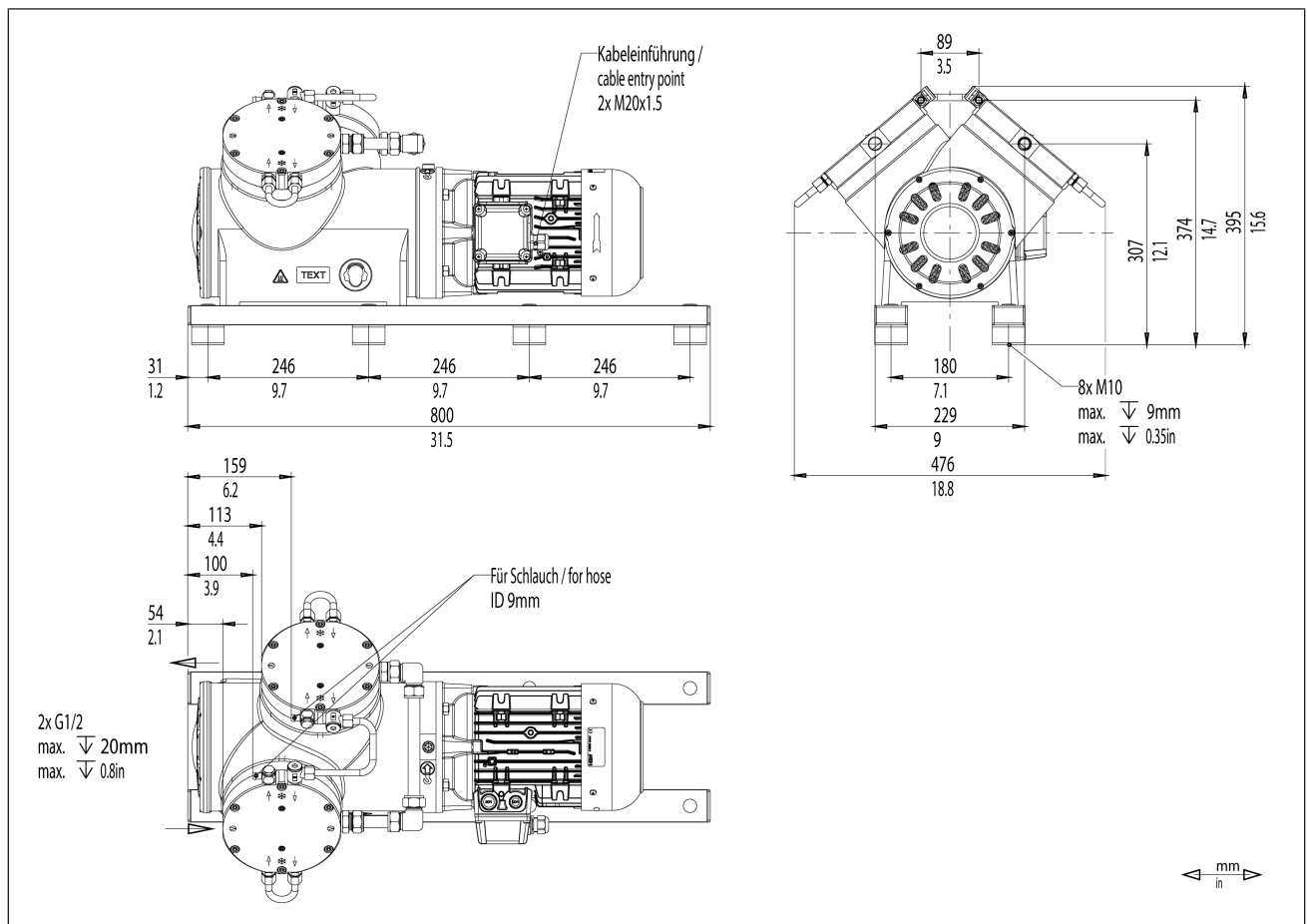


Fig.6 Mounting dimensions N680.15

7 Operation

7.1 General



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

Some pump parts may be hot during or after operation of the pump.

- Allow the pump to cool after operation.
- Take protective measures to protect against touching hot parts.



Damage to the pump due to overheating

If gases with a greater isentropic exponent than that of air (helium, argon, xenon, neon, krypton) are pumped, compressing these gases gives rise to higher gas temperatures. The higher temperatures may impair the functional capabilities of the parts of the pump that are in contact with the media and possibly also adjacent components (e.g., ball bearings). This in turn will shorten the service life of the pump.

- If necessary, contact KNF Customer Service.



Injury to eyes

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

- Do not look into the pump inlet/outlet during operation.

- Only operate the pumps under the operating parameters and operating conditions as described in Chapter 3 *Technical data*.
- Ensure the proper use of the pumps (See Chapter 2.6.1 *Proper use*).
- Rule out the possibility of foreseeable misuse of the pumps (see chapter 2.6.2 *Foreseeable misuse*).
- Observe the safety instructions (Chapter 2 *Safety*).



Risk of bursting of pump head due to excessive pressure increase

Excessive pressure increase during pump operation can cause the head to burst, resulting in material damage or personal injury.

- Do not exceed the maximum permissible operating pressure (see 3 *Technical data*).
- Monitor the pressure during operation.
- If the pressure exceeds the maximum permissible operating pressure of the pump: immediately switch off the pump and remedy the fault (see Chapter 10 *Troubleshooting*).
- Only throttle or regulate the air or gas quantity on the inlet line to prevent the maximum permissible operating pressure from being exceeded.
- If the air quantity or gas quantity on the outlet line is throttled or regulated, make sure that the maximum permissible operating pressure at the pump is not exceeded.
- Ensure that the pump outlet is not closed or restricted.



Risk of dangerous gas mixtures during pump operation if diaphragm breaks

If the diaphragm should break, the medium will mix with the air in the compressor housing or in the surroundings.

- Stop pump immediately.
- Replace the diaphragm prior to further operation (see Chapter 8 *Servicing*).



Material damage due to intake of contaminants and objects

Operation with open gas connection at the inlet can result in contaminants and objects being drawn in.

- If necessary, take protective measures against the ingress of contaminants and objects.

Pump standstill → When the pump is at a standstill, establish normal atmospheric pressure in the lines.

Vapors as medium The service life of the diaphragm can be extended, if no condensate forms in the pump. Therefore:

- Perform any work with saturated or near-saturated vapors only with a warm pump.

- KNF recommends: When pumping corrosive media, flush the pump before switching off (see Chapter 8.2.1 *Flushing the pump*) to extend the service life of the diaphragm.

7.2 Information on switching the pump on and off

Switching on the pump



Caution: Damage to hearing

When the pump is in operation, loud noises may be created (see 3 *Technical data*) (>85 dB (A)), which may lead to hearing damage.

- The pump must be disconnected from all other components when setting up.
- Do not operate the pump unless it is fully connected, or use a silencer.
- Wear personal protection equipment (e.g., hearing protection).

-
- Ensure that normal atmospheric pressure is present in the lines when switching on.

Switching off/decommissioning the pump

- Establish normal atmospheric pressure in the lines (relieve pump pneumatically).
- Recommissioning → Before recommissioning, observe the applicable standards, guidelines, regulations and technical standards at the electrical connection.
- Inspecting the pump → Inspect the pump periodically for external damage or leakage.

8 Servicing



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.

8.1 Servicing schedule



Risk of explosion if genuine spare parts are not used

If genuine spare parts are not used, the pump loses its explosion protection properties. Furthermore, the function of the pump and its safety are lost.

The validity of the conformity is rendered void if genuine spare parts are not used.

- Use only genuine spare parts from KNF when performing maintenance work.

Component	Maintenance interval
Pump	<ul style="list-style-type: none"> → Perform periodic inspections for external damage or leakage. → Perform periodic inspections for noticeable changes to noises and vibrations.
Gas connections	<ul style="list-style-type: none"> → Perform periodic inspections for external damage or leakage.
Diaphragms and valves	<ul style="list-style-type: none"> → Replace if the pressure or flow rate of the pump changes for no apparent reason. → At the latest, replace when the performance decreases.

Tab.14 Servicing schedule

8.2 Cleaning



NOTICE

Material damage due to cleaning work

Failure to observe the cleaning instructions may result in material damage to the device if liquids penetrate the inside of the housing.

- Ensure that no fluids enter the interior of the housing.

8.2.1 Flushing the pump

When transferring dangerous and environmentally hazardous media, KNF recommends flushing the pump with air at atmospheric pressure for a few minutes prior to switch-off (if necessary for safety reasons: with an inert gas) to extend the service life of the diaphragm.

- Discharge the media safely.

8.2.2 Cleaning the pump

- Requirements → Pump disconnected from mains and voltage-free



CAUTION

Risk of burns from hot pump parts

The pump head or motor may still be hot after operation of the pump.

- Allow the pump to cool after operation.



WARNING

Health hazard due to dangerous substances in the pump

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

- Wear protective equipment if necessary, e.g., protective gloves, goggles.
- Clean the pump with suitable measures.



NOTICE

Material damage due to entry of liquids

When cleaning the pump, liquids may enter the inside of the housing, which can damage the pump.

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

- Only clean the pump with a dry wiping cloth. When cleaning, use no solvents if possible as these can affect the plastic parts.
- Only use solvents during cleaning if head materials are not corroded (ensure resistance of the material).
- If compressed air is available, blow out the components.

8.3 Changing diaphragm and reed valves

- Requirements
- Disconnect the motor from the power supply network and ensure that it is voltage-free.
 - Allow the pump and the motor to cool.
 - Clean the pump and remove any hazardous materials from the pump.
 - Remove the hoses/pipes from the inlet and outlet of the pump.

With multi-headed pumps, parts of the various pump heads might become mixed up.

- Change the parts of the individual pump heads that are to be replaced one at a time.



Health hazard due to dangerous substances in the pump

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

- Wear protective equipment if necessary, e.g., protective gloves, goggles.
- Clean the pump with suitable measures.



Risk of burns from hot pump parts

The pump head or motor may still be hot after operation of the pump.

- Allow the pump to cool after operation.



For two-headed pumps:

Servicing work should generally be performed on both heads at the same time.

Spare parts

Spare part*	Item designation**	Quantity
Diaphragm	(17)	1 (per pump head)
O-ring	(10)	2 (per pump head)
O-ring (only .13)	(11)	1 (per pump head)
O-ring (only .13)	(12)	1 (per pump head)
Valve spring, suction side	(8)	1 (per pump head)
Valve spring, pressure side	(5)	1 (per pump head)
Valve limiter, suction side	(9)	1 (per pump head)
Valve limiter, pressure side	(4)	1 (per pump head)
Slotted cheese head screw	(2) and (7)	2 (per pump head)
PTFE washer (for ST head only)	(16)	1 (per pump head)

Tab.15 * According to spare parts list, Chapter 9.1 Spare parts

** According to Individual parts of the pump head

Tools and material

Quantity	Tool/material
1	Size 4 Allen key with torque indicator
1	Size 6 Allen key with torque indicator
1	Screwdriver blade width 5.5 mm
1	Open-end wrench 30 mm
1	KNF wrench for retainer plate (see 9.2 Accessories)
1	Felt-tip pen
1	Hot air gun
1	Adhesive (Delo ML5249) or comparable product

Tab.16 *According to accessory list, Chapter 9.2 Accessories

- 1 Hexagon socket head cap screw
- 2 Slotted cap screw
- 3 Head cover
- 4 Valve stopper, pressure side
- 5 Reed valve, pressure side
- 6 Hexagon socket head cap screw
- 7 Slotted cap screw
- 8 Valve stopper, suction side
- 9 Reed valve, suction side
- 10 O-ring
- 11 O-ring (only .13)
- 12 O-ring (only .13)
- 13 Shim ring(s)
- 14 Conrod plate
- 15 Retainer plate
- 16 PTFE washer (ST head only)
- 17 Diaphragm
- 18 Intermediate plate

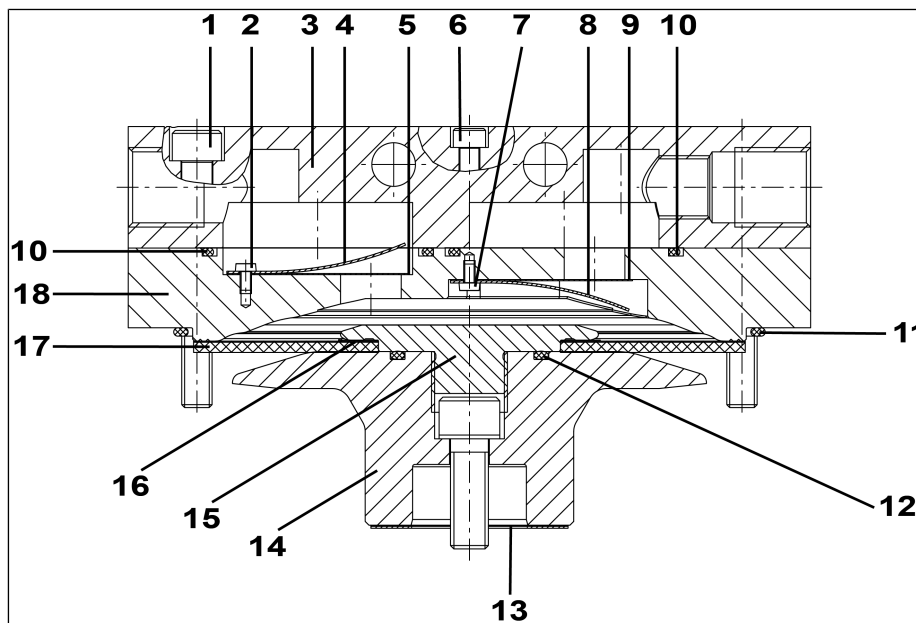


Fig.7 Components of the pump head

i The following item numbers refer to Individual parts of the pump head unless specified otherwise.

Removing the pump head

1. Accessing the fan blades:
Mark the motor fan cover with a continuous line made with a felt-tip pen (for later reassembly) and then loosen the fastening screws of the motor fan cover (see Chapter Product description) and remove the cover.
2. Only for two-headed pumps:
Remove the pneumatic connection between the pump heads; to do this, mark the union nuts according to Fig. 8 and loosen them. This helps to avoid incorrect assembly later.
3. Mark the head plate (3), intermediate plate (18) and the housing with one continuous felt-tip pen line for head 1 and with two continuous felt-tip pen lines for head 2. This helps to avoid incorrect assembly later.
4. Loosen the six hexagon socket head cap screws (1); Remove the head plate (3) and intermediate plate (18).
5. For two-headed pumps:
Carry out step 3 for the second pump head.

Changing the diaphragm

1. Heat the retainer plate (15) with a hot air gun (T=approx. 400°C) for approx. 5 minutes to approx. 100°C.

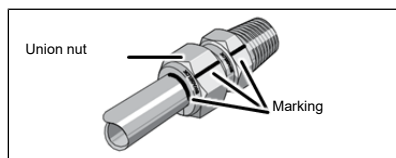


Fig.8 Marking of the union nuts



Risk of burns from hot parts

Burns may occur on skin contact with the hot retainer plate and countersunk screw or other heated pump parts.

→ Wear protective gloves.

→ Only loosen the retainer plate with face spanner wrench.

→ Only place the retainer plate and countersunk screw on a heat-resistant surface.

2. Removing the retainer plate (15):
Loosen the retainer plate from the conrod plate (14) with the wrench for retainer plate by turning counterclockwise and remove it.
3. For SP head only:
Remove the diaphragm (17).
4. For ST head only:
Remove the diaphragm (17) together with the PTFE washer (16).
5. Only .13:
Remove the O-ring (11) from the housing.
6. Only .13:
Remove the O-ring (12) from the conrod plate (14).
7. Check all parts for contamination and clean them if necessary (see Cleaning).

i There may be glue residue on the external thread of the retainer plate as well as on the internal thread of the conrod plate. Remove this.

8. Turn the fan blade to move the connection rod with conrod plate (14) to the middle position.
9. For SP head only:
Fit the new diaphragm (17) on the conrod plate (14); make certain that the inner beads on the outer and inner circumference of the diaphragm are seated in the grooves of the housing and conrod plate.
10. For ST head only:
Fit the new diaphragm (17) together with the PTFE washer (16) on the conrod plate (14).

i When fitting the diaphragm, ensure that the blue PTFE coating on the diaphragm is facing upwards.

11. Only .13:
Insert the new O-ring (11) in the housing.
12. Only .13:
Insert the new O-ring (12) in the conrod plate (14).
13. Apply the adhesive around the threaded end of the retainer plate (15) and screw the retainer plate into the connection rod.

i While screwing in, turn the retainer plate back one turn to allow the adhesive to spread onto both thread flanks (retainer plate and conrod plate).

i For ST head only:
Ensure that the PTFE washer and the diaphragm are fully embedded in the ridge on the retainer plate. Also take care that the PTFE washer and the diaphragm do not slip while they are being screwed in and are lying flush one on top of the other.

i Attention: Note the use-by-date for the adhesive.
The adhesive may lose its effectiveness after the use-by-date has passed.

14. Then securely tighten the retainer plate (**15**) with the wrench for retainer plate (tightening torque: 50 Nm).

i Attention: Observe the hardening time for the adhesive before recommissioning the pump.

The hardening time for the adhesive is approx. 24 hours.

15. For two-headed pumps:
Perform steps 1 to 12 for the second pump head.

Changing valve springs

1. Loosen the two hexagon socket head cap screws (**6**).
2. Remove the head plate (**3**) from the intermediate plate (**18**).

i Carefully set down the head plate and intermediate plate so as not to damage their sealing edges.

3. Remove the two O-rings (**10**) from the intermediate plate (**18**).
4. Remove the valve limiter (**4**) and the valve spring on the pressure side (**5**) after loosening the screw (**2**).
5. On the pressure side, assemble the new valve spring together with the valve limiter (tightening torque for screw (**2**): 1.5 Nm).
6. After loosening the screw (**7**), remove the valve limiter on the suction side (**8**) and the valve spring on the suction side (**9**) from the intermediate plate (**18**).
7. On the suction side, assemble the new valve spring together with the valve limiter (tightening torque for screw (**7**): 1.5 Nm).
8. For two-headed pumps:
Perform steps 1 to 4 for the second pump head.

Mounting the pump head

1. Insert the two new O-rings (**10**) in the intermediate plate (**18**).
2. Place the head plate (**3**) on the intermediate plate (**18**) according to the felt-tip pen marking.
3. Finger-tighten the hexagon socket head cap screws (**6**).
4. Place the pump head on the housing according to the felt-tip pen marking.
5. Screw in the hexagon socket head cap screws (**1**) one to two turns.
6. Tighten the two hexagon socket head cap screws (**6**) (tightening torque: 4 Nm).
7. Tighten the hexagon socket head cap screws (**1**) crosswise (tightening torque: 11 Nm).
8. Tighten the hexagon socket head cap screws (**1**) crosswise again until they are fully tightened (tightening torque: 11 Nm).
9. For two-headed pumps:
Perform steps 1 to 6 for the second pump head.

10. For two-headed pumps:

Mount the pneumatic connection between the pump heads. In doing so, retighten the union nuts slightly above the original position (as marked during disassembly, see Fig. 8).

i When fitting the motor fan cover, make sure that all of the screws are fitted again, the fan cover and the fan are undamaged, and the fan can rotate freely. To do this, perform a function test.

11. Function test

Perform a function test.

- Connect the suction and pressure sides to the pump.
- Electrically connect the pump.
- Test the functionality of the pump.
- Disconnect the pump electrically and pneumatically again.

12. Pump integrated in application

- Connect the suction and pressure sides to the pump.
- Electrically connect the pump.
- Test the functionality of the pump.

**NOTICE**

To ensure the required gas tightness of the pump following servicing, a leak test is to be performed.

**WARNING**

Risk of injury and poisoning from leaks

- Before recommissioning the pump, check the pump heads and pneumatic connections for leaks. Leaks may lead to poisoning, chemical burns or similar injuries.



Before recommissioning, observe the applicable standards, guidelines, regulations and technical standards at the electrical connection.

8.4 Checking and replacing sprocket on coupling

- Requirements
- Disconnect the motor from the power supply network and ensure that it is voltage-free.
 - Allow the pump and the motor to cool.

**CAUTION**

Risk of burns from hot pump parts

The pump head or motor may still be hot after operation of the pump.

- Allow the pump to cool after operation.



Personal injury and/or property damage due to incorrect or improper transport of the motor

In the event of incorrect or improper transport, the motor can fall down, be damaged or injure persons.

- Use suitable auxiliary means if necessary (carrying strap, lifting gear, etc.).
- Where appropriate, wear suitable personal protective equipment (e.g., safety shoes, safety gloves).

Tools and material

Quantity	Tool/material
1	Feeler gauge 3 mm
1	Test adapter for coupling (see Chapter 9.2 <i>Accessories</i>)
1	Phillips screwdriver PH2
1	16mm open-end wrench with torque indicator

Tab.17

Spare parts

Spare part	Item designation	Quantity
Sprocket	(4)	1

Tab.18

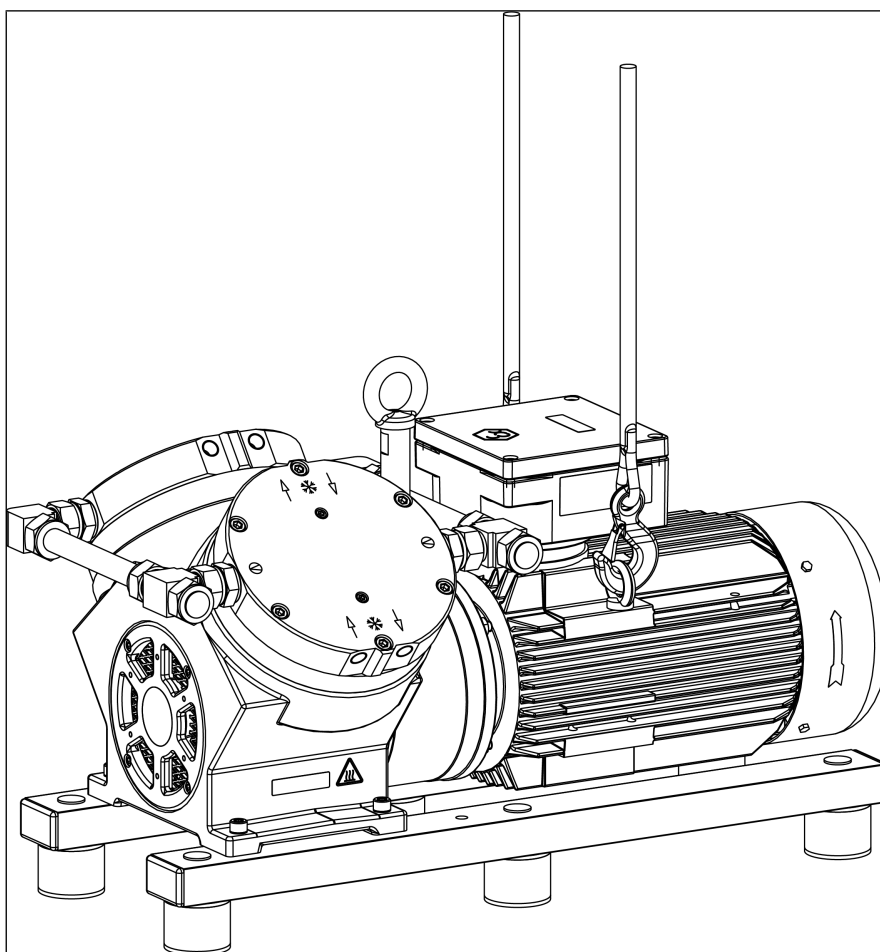


Fig.9 Lifting motor (depicted pump as an example)

- 1 Nut
- 2 Serrated washer
- 3 Motor
- 4 Sprocket
- 5 Motor-side coupling half
- 6 Pump-side coupling half
- 7 Compressor housing
- 8 Stud bolts
- 9 Motor fan cover
- 10 Fastening screw for motor fan cover

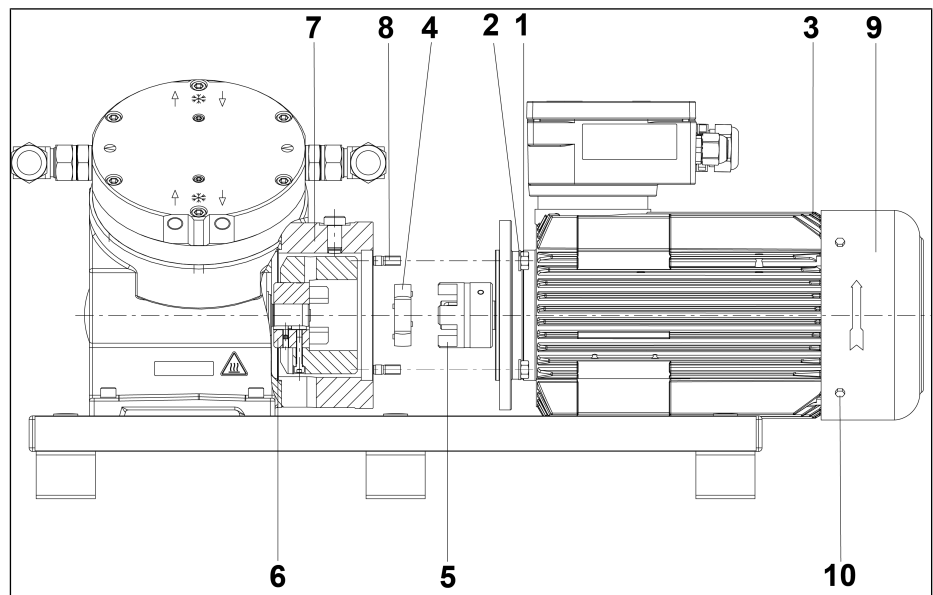


Fig.10 Replacing sprocket (depicted pump as an example)

Removing the motor

1. Attach the lifting gear (see figure for lifting motor) to the motor (3).
2. Loosen the nuts (1) that connect the motor (3) to the compressor housing (7).
3. Remove the serrated washers (2).
4. Remove the motor (3) from the compressor housing (7).

Checking the sprocket

i Observe the intervals for the periodic inspection of the coupling play (see operating instructions for the coupling).

1. Place the sprocket (4) on the motor-side coupling half (5).
2. Place the test adapter for the coupling on the motor-side coupling half (5).
3. Use the feeler gauge to check the coupling play (see operating instructions for the coupling).
4. Replace the sprocket (4) if there is too much coupling play (see operating instructions for the coupling).
5. Define the intervals for the periodic inspection of the coupling play (see operating instructions for the coupling).

Replacing the sprocket

1. Remove the worn sprocket (4) from the motor-side (5) or pump-side coupling half (6).
2. Push the new sprocket (4) onto the pump-side coupling half (6).

i The sprocket is symmetric and can be pushed on in both possible positions.

Installing the motor

1. Align the motor-side (5) and pump-side coupling halves (6) with one another.
2. Place the motor (3) on the compressor housing (7).

i Centering is performed using the four stud bolts (8) in the flange of the compressor housing (7) as well as the previously inserted sprocket.

3. Check whether the flange surface of the motor (3) and the flange surface of the compressor housing (7) lie properly on top of one another.

4. Push the 4 serrated washers (2) onto the stud bolts (8).

i Make certain that the inner diameter of the serrated washer (2) lies against the nut (1) and the outer diameter lies against the motor flange (3) (see Fig. 11).

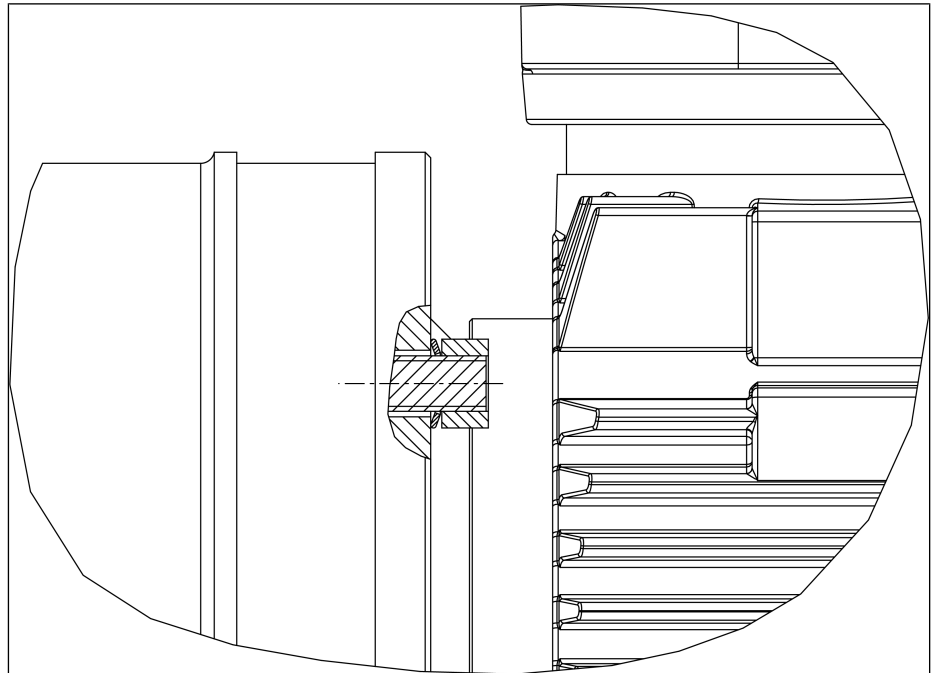


Fig.11 Alignment of the ribbed disk (2)

5. Turn the 4 nuts (1) on the stud bolts (8) and tighten them crosswise (tightening torque: 11 Nm).

Inspecting pumps

1. Mark the motor fan cowl (9) with a continuous line made with a felt-tip pen.
2. Loosen the fastening screws (10) of the motor fan cowl (9) and remove the motor fan cowl (9).
3. Check the pump for smooth running by turning the fan wheel.
4. Refit the motor fan cowl (9) according to the marking.
5. Finger-tighten the fastening screws (10) again.

i When fitting the motor fan cover, make sure that all of the screws are fitted again, the fan cover and the fan are undamaged, and the fan can rotate freely. To do this, perform a function test.

6. Function test
Perform a function test.
 - Connect the suction and pressure sides to the pump.
 - Electrically connect the pump.
 - Test the functionality of the pump.
 - Disconnect the pump electrically and pneumatically again.
7. Pump integrated in application
 - Connect the suction and pressure sides to the pump.
 - Electrically connect the pump.
 - Test the functionality of the pump.

9 Spare parts and accessories

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

9.1 Spare parts

Spare part set

A spare part set consists of:

Parts	Item number*	Quantity
Diaphragm	(17)	2
PTFE washer (ST head only)	(16)	2
Valve springs	(5), (9)	4
Valve limiter	(4), (8)	4
O-ring (D55 x 3.0)	(10)	4
Slotted cheese head screw	(2), (7)	4

Tab.19 *See Chapter 8.3 Changing diaphragm and reed valves

Spare part set	Order number
N680_ST.9E	333499
N680_SP.9E	333500
N680_ST.13E	344881
N680_SP.13E	344243

Tab.20

Spare part	Item number*	Order number
Sprocket for coupling	(4)	322343

Tab.21 *see 8.4 Checking and replacing sprocket on coupling

9.2 Accessories

Accessories	Order number
Transport eyebolt	311535
Wrench for retainer plate	128753
Test adapter for coupling	322339
Corrugated hose for pneumatic connection; Length 500 mm; G1/2"	333224
Corrugated hose for pneumatic connection; Length 500 mm; G1/2" 3.1 Certified acc. to EN 10204	333226
Water cooling connection	329236

Tab.22

10 Troubleshooting



Risk of death due to electric shock

Working on the pump connected to the power supply can result in electric shocks, which can lead to serious injury or even death.

- All work on the pump may only be performed by authorized specialized personnel.
- Before working on the pump: Disconnect the pump from the power supply.
- Check and ensure that no voltage is present.

- Allow the pump to cool before troubleshooting.
- Check the pump (see following tables).

Pump not delivering	
Cause	Troubleshooting
Pump is not connected to the electrical power supply.	→ Connect the pump to electrical power supply.
No voltage in the electrical power supply.	→ Check the circuit breaker for the room and switch it on if necessary.
Pneumatic 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.
Condensate has collected in the pump head.	→ Separate the source of the condensate from the pump. → Flush the pump with air at atmospheric pressure for a few minutes (if necessary for safety reasons: with an inert gas). → Install the pump at the highest location in the system.
Diaphragm and valves are worn or defective.	→ Replace diaphragm and valves (see Chapter 8 <i>Servicing</i>).

Tab.23 Troubleshooting: Pump not delivering

Flow rate, pressure or vacuum too low	
The pump does not reach the performance stated in the technical data or data sheet.	
Cause	Troubleshooting
Condensate has collected in the pump head.	<ul style="list-style-type: none"> → Separate the source of the condensate from the pump. → Flush the pump with air at atmospheric pressure for a few minutes (if necessary for safety reasons: with an inert gas). → Install the pump at the highest location in the system.
There is overpressure on the pressure side and at the same time vacuum or pressure above atmospheric pressure on the suction side.	<ul style="list-style-type: none"> → Change the pneumatic conditions.
Pneumatic lines or connection parts have insufficient cross-sections or are constricted.	<ul style="list-style-type: none"> → 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.	<ul style="list-style-type: none"> → Eliminate the leaks.
Pneumatic connections or lines are partially or completely blocked.	<ul style="list-style-type: none"> → Check the pneumatic connections and lines. → Remove any parts or particles that are causing blockages.
Head parts are soiled.	<ul style="list-style-type: none"> → Clean the head components.
Working diaphragm broken	<ul style="list-style-type: none"> → Stop the pump immediately. → Change the diaphragm (see <i>8 Servicing</i>).
Pump exhibiting changed running noises and vibrations.	<ul style="list-style-type: none"> → Stop the pump immediately. → Contact KNF Customer Service.
Diaphragm and valves are worn or defective.	<ul style="list-style-type: none"> → Replace diaphragm and valves (see <i>Chapter 8 Servicing</i>).

Tab.24 Troubleshooting: Flow rate, pressure or vacuum too low

Pump exhibiting changed running noises and vibrations	
Cause	Troubleshooting
Pump bearing worn or defective.	<ul style="list-style-type: none"> → Determine the cause. → Contact KNF Customer Service.
Motor worn or defective.	Contact KNF Customer Service.
Coupling worn or defective.	<ul style="list-style-type: none"> → Contact KNF Customer Service.

Tab.25 Troubleshooting: Pump exhibiting changed running noises and vibrations

Fault cannot be rectified

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

1. Flush the pump 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 8.2.1 *Flushing the pump*).
2. Clean the pump (see Chapter 8.2.2 *Cleaning the pump*).
3. Send the pump together with completed Health and Safety Clearance and Decontamination Form to KNF, specifying the pumped medium.

11 Returns

Preparing for return

1. Flush the pump 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 8.2.1 *Flushing the pump*).

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

2. Remove the pump.
3. Clean the pump (see Chapter 8.2.2 *Cleaning the pump*).
4. Send the pump 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 pump only under the condition that the customer presents a certificate regarding the medium that is pumped and the cleaning of the pump. In this case too, old devices can be returned. Please follow the instructions at [knf.com/repairs here](https://www.knf.com/repairs).

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

12 Appendix

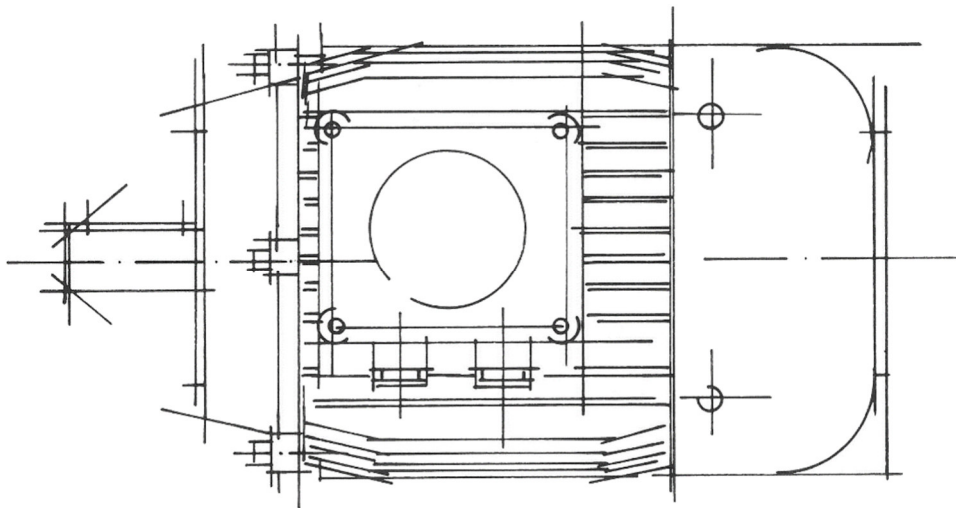
For further information, see also

- Standard_Betriebsanleitung Motor.pdf



Operating manual

Electric motor



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This issue replaces all previous issues. All
previous issues are invalid. The date of issue (⇒
foot note) is authoritative.

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1 General information

1.1 Information on this operating manual

This operating manual makes it possible to handle the machine safely and efficiently.

The manual is a component of the machine and must be kept in the direct vicinity of the plant and be accessible to staff at all times. Staff must have carefully read and understood this manual before starting all work. Adherence to all the specified safety instructions and instructions for actions in this operating manual is a fundamental requirement for working safely.

The local regulations for the prevention of accidents and the general safety regulations for the location in which the machine is used also apply.

The illustrations in this operating manual are for purposes of general understanding and may differ from the actual machine version.

1.2 Explanation of symbols

Safety instructions

The safety instructions in this manual are indicated by symbols. The safety instructions are introduced by signal words which express the extent of the risk.

It is imperative to adhere to safety instructions and act with caution in order to prevent accidents, personal injury and material damage.

**DANGER!**

... indicates an immediately dangerous situation which will lead to death or serious injuries if not avoided.

**WARNING!**

... indicates a possibly dangerous situation which may lead to death or serious injuries if not avoided.

**CAUTION!**

... indicates a possibly dangerous situation which may lead to minor or light injuries if not avoided.

**CAUTION!**

... indicates a possibly dangerous situation which may lead to material damage if not avoided.

Tips and recommendations

**NOTE!**

... draws attention to tips and recommendation and information for efficient, fault-free operation.

Special safety instructions

The following symbols are used in safety instructions in order to point out particular hazards.



... indicates risks from electrical current. Failure to observe the safety instructions will result in the risk of serious or fatal injury.

1.3 Limitation of liability

All the information and instructions in this manual have been complied in line with the valid standards and regulations, state-of-the-art technology and our many years of experience and know-how.

The manufacturer shall not be liable for damages caused by:

- Failure to observe the manual
- Improper use
- Employment of unqualified staff
- Arbitrary modifications
- Technical changes
- Use of non-approved spare parts

In case of special versions, the utilisation of additional order options or due to new technical changes, the actual scope of delivery may differ from the explanations described here and the illustrations.

The obligations agreed in the delivery contract, the General terms and Conditions and the Terms and Conditions of Delivery of the manufacturer, and the legal regulations valid at the point of completion of the contract apply.

We reserve the right to make technical changes within the scope of further development and improvement of the performance characteristics.

1.4 Copyright

This operating manual is protected by copyright and for internal use only.

The manual must not be made available to third parties, reproduced in any way (including excerpts), its content must not be utilised and/or communicated without the written approval of the manufacturer, except for internal purposes.

Failure to comply will render the offender liable for damages. We reserve the right to further claims.

1.5 Spare parts



WARNING!

The use of incorrect parts is a risk to safety.

Incorrect or faulty parts can compromise safety and cause damage, malfunctions or complete failure.

Therefore:

- Only use the manufacturer's original spare parts.

Purchase spare parts from authorised dealers or directly from the manufacturer. See page 2 for the address.

The spare parts list can be found on pages 20-21.

1.6 Warranty conditions

The warranty conditions are included in the manufacturer's General Terms and Conditions.

1.7 Customer service

Our customer service department is available to provide technical information. See page 2 for contact details.

Furthermore our staff are always interested in receiving new information and hearing of new experiences gained from the use of our products which can be used to improve our products.

2 Safety

This section provides you with an overview of all important aspects of safety required for providing staff with optimum protection as well as safe, fault-free operation.

Failure to observe the instructions and safety instructions for actions in this operating manual can cause considerable risks.

2.1 Responsibility of the user

The machine is used in the commercial field. The user of the machine is therefore subject to the legal obligations for occupational safety.

In addition to the safety instructions in this manual, the regulations for safety, accident prevention and environmental protection which apply at the location for use of the machine must also be observed. The following in particular applies:

- The user must fully acquaint himself with the valid occupational safety regulations and, in addition, carry out a risk assessment to determine the hazards which result from the particular working conditions at the location in which the machine is used. The results must be implemented as a set of operating instructions for operation of the machine.
- The user must carry out checks during the entire period of its use to determine whether the operating instructions drawn up are in line with the current regulations and adjust them as necessary.
- The user must clearly set out the responsibilities for installation, operation, maintenance and cleaning.
- The user must make sure that all staff involved with work on the machine have read and understood the manual. Furthermore, staff must be provided with training and information on the hazards at regular intervals.
- The user must provide staff with the required safety clothing and equipment.

The user is also responsible for ensuring that the machine is kept in technically perfect condition. The following applies:

- The user must make sure that the maintenance intervals described in the operating manual are adhered to.
- The user must have all the safety devices checked regularly to make sure they are complete and fully functional.

2.2 Staff requirements

2.2.1 Qualifications

**WARNING!****Risk of injuries in case of insufficiently qualified staff.**

Improper use can cause considerable personal injury and material damage.

Therefore:

- Have all tasks performed by staff with the appropriate qualifications only.

The following levels of qualification are named in the operating manual for various ranges of tasks.

■ Trained person

has been informed of the tasks with which he has been entrusted and the possible risks in case of incorrect behaviour in training measures provided by the user.

■ Specialist staff

are capable of carrying out the work with which they have been entrusted and recognising the potential risks independently because of their specialist qualifications, knowledge and experience, and knowledge of the valid regulations.

■ Qualified electrician

is capable of carrying out the work on electrical equipment and recognising and preventing the potential risks independently because of their specialist qualifications, knowledge and experience, and knowledge of the valid standards and regulations.

The qualified electrician is qualified to work in the specific area in which he works and is familiar with the relevant standards and regulations.

Staff should be made up exclusively of people who can be expected to carry out their work reliably. People whose reactions are influenced, for instance, by drugs, alcohol or medication, must not be allowed.

- When selecting staff adhere to the valid local regulations relating to age and profession.

2.2.2 Unauthorised parties



WARNING!

Danger for unauthorised parties.

Unauthorised persons who do not meet with the requirements described here, are not familiar with the hazards in the working area.

Therefore:

- Keep unauthorised persons away from the working area.
- In case of doubt, approach these persons and instruct them to leave the working area.
- Stop work until any unauthorised parties have left the working area.

2.2.3 Training

Staff must be provided with regular training by the user. Training must be logged to keep better track.

Date	Name	Type of training	Training provided by	Signature

Fig. 1

2.3 Proper use

The machine has been engineered and designed exclusively for the proper use described in this documentation.

The machine is use exclusively as a drive in commercial high voltage systems.

Proper use also includes adherence with all the stipulations of this manual.

Any other type of use, or use of the machine going beyond this use is considered improper use and can cause dangerous situations.



WARNING!

Danger from improper use.

Improper use of the machine can cause dangerous situations.

Take particular care not to use the machine as follows:

- Operation beyond the original designated application.
- Operation of machines in potentially explosive areas which do not have explosion protection markings and are thus not suitable for use in a potentially explosive atmosphere.

Claims of any kind for damages caused by improper use are null and void.

The user carries sole liability for any damages in case of improper use.

2.4 Personal safety equipment and clothing

Whilst work is being carried out, personal safety equipment and clothing must be worn in order to minimise health hazards.

- Always the safety clothing and equipment required for the respective task whilst working.
- Follow the instructions in the working area on personal safety equipment and clothing.

To be worn for all work



Occupational safety clothing

is close-fitting working clothing with a low tear strength, close-fitting sleeves and no protruding parts. It serves primarily as protection from entanglement in moving machine parts.

Do not wear rings, chains or other jewellery.



Safety shoes

to protect from heavy falling parts and from slipping on slippery surfaces.

2.5 Special hazards

The following section points out residual risks which have been determined by a risk analysis.

- Adhere to the safety instructions listed here and the warnings in other chapters in order to reduce health hazards and prevent dangerous situations.

Safety**Electrical current****DANGER!****Danger to life from electrical current.**

There is an immediate risk of fatal injury in case of contact with live parts. Damage to the insulation or individual components can mean danger to life.

Therefore:

- In case of damage to the insulation, switch off the power supply immediately and have repairs carried out.
- Have work on the electrical equipment carried out by qualified electricians only.
- When any work is carried out on the electrical equipment, disconnect it from the power and make sure it is free of voltage.
- Before carrying out maintenance, cleaning and repair work, switch off the power supply and secure it to prevent it from being switched back on.
- Do not jumper or disable any fuses or circuit breakers. When replacing fuses or circuit breakers make sure to adhere to the correct ampere rating.
- Keep moisture away from live parts. It can lead to a short circuit.

Moving parts**WARNING!****Risk of fatal injury from moving parts.**

Rotating parts and/or parts which move linearly can cause serious injuries.

Therefore:

- Do not reach into moving parts or handle moving parts during operation.
- Do not open covers during operation.
- Adhere to the follow-up time:
Before opening covers make sure that none of the parts are still moving.
- In the danger area wear close-fitting protective clothing.

Hot surfaces**CAUTION!****Risk of burns from hot surfaces.**

Contact with hot parts can cause burns.

Therefore:

- When working in the vicinity of hot parts always wear protective clothing and protective gloves.
- Before carrying out any work make sure that all components have cooled to ambient temperature.

Soiling and objects lying around**CAUTION!****Risk of stumbling due to soiling and objects left lying around.**

Soiling and objects left lying around are sources of slipping and stumbling and can cause considerable injuries.

Therefore:

- Always keep the working area clean.
- Remove any objects which are no longer required.
- Mark any possible stumbling hazards with yellow and black marker tape.

Sharp edges and corners**CAUTION!****Risk of injuries from edges and corners.**

Sharp edges and corners can cause grazes and cuts on the skin.

Therefore:

- Proceed with caution when working in the vicinity of sharp edges and corners.
- If in doubt wear protective gloves.

2.6 Safety devices

Integration into an emergency stop concept required

The machine is for use within a plant. It does not have its own control unit and does not have an independent emergency stop function.

Before the machine is put into operation install the emergency stop devices for the machine and integrate it into the plant control unit's safety chain.

Connect the emergency stop devices so that there is no chance that dangerous situations for people and objects of material value cannot arise if the energy supply is broken or the energy supply is activated after being broken.

The emergency stop devices must be freely accessible at all times.

2.7 Securing the machine to prevent it from being switched back on



DANGER!

Risk of fatal injury if the machine is switched back on without authorisation.

When working in the danger area there is a risk that the energy supply will be switched on without authorisation. This puts the life of people in the danger area at risk.

Therefore:

- Adhere to the instructions on securing the machine to prevent it from being switched on in the chapters of this manual.
- Always adhere to the procedure described below to secure the machine to prevent it from being switched back on.

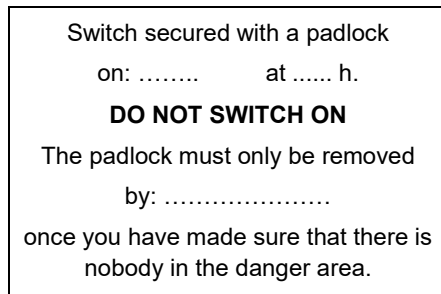


Fig. 2

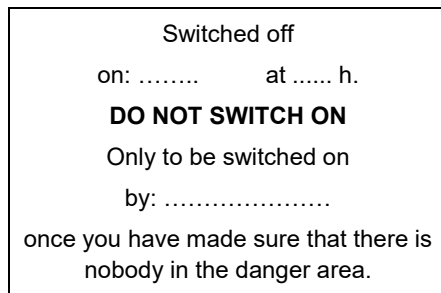


Fig. 3

Securing the machine to prevent it from being switched back on:

1. Switch off the energy supply.
2. If possible, secure the switch with a padlock and attach a clearly visible sign to the switch Fig. 2.
3. Have the key kept safely by the member of staff named on the sign.
4. If it is possible to secure a switch with a padlock, erect a sign accordingly Fig. 3.
5. Once all work has been carried out, make sure that nobody is in the danger area.
6. Make sure that all safety devices and mechanisms are installed and fully functional.
7. Do not remove the sign until you have done so.

2.8 How to act in case of hazards and accidents

Preventive measures

- Always be prepared for accidents or fires.
- Keep first aid facilities (first aid box, blankets etc.) and fire extinguishers accessible at all times.
- Familiarise staff with accident report, first aid and rescue facilities.
- Keep access routes for emergency vehicles clear.

Measures in case of accidents

- Trigger an emergency stop immediately.
- Instigate first aid measures.
- Remove any people from the danger zone.
- Inform the responsible party at the location.
- Notify emergency services.
- Clear access routes for emergency vehicles.

2.9 Environmental protection



CAUTION!

Risk of environmental damage in case of incorrect handling.

Incorrect handling of environmentally hazardous substances, in particular incorrect disposal, can cause considerable damage to the environment.

Therefore:

- Always adhere to the instructions below.
- If environmentally hazardous substances are accidentally released into the environment, take suitable measures immediately. In case of doubt inform the responsible local authority of the damage.

The following environmentally hazardous substances are used:

Lubricants



CAUTION!

Risk of environmental damage from lubricants.

Coolants and lubricants, such as grease and oils, contains toxic substances which may damage the environment.

Therefore:

- Make sure that the substances do not enter into the environment.
- Have disposal performed by a specialist company.

Valid for motors distributed in the EU market



NOTE!

The motors comply with EU Directive 2011/65/EU for the limitation of the use of certain hazardous substances in electrical and electronic devices.

Valid for motors distributed in the UK market



NOTE!

The motors comply with UK Statutory Instruments 2012 No. 3032 for the restriction of the use of certain hazardous substances in electrical and electronic devices.

3 Technical data



NOTE!

The necessary technical data can be found on the respective type plates. This information is authoritative.

Further technical data can be taken from the catalogue.

3.1 Operating conditions

Environment

Specification	Value	Unit
Temperature range	-20...+40	°C
Temperature range (optional)	-25...+60	°C
Relative air humidity, maximum	60	%
Maximum installation height above sea level	1000	m

3.2 Type plate

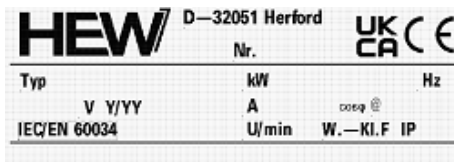


Fig. 4: Example of a type plate

The type plate is situated on the motor housing and the information it contains includes:

- Manufacturer
- CE symbol. There is an additional UKCA symbol for motors distributed in the UK market.
- Motor identification
- Performance data



NOTE!

The information on the type plate may vary depending on the type of motor.



NOTE!

There may be further signs on the machine with various pieces of information.

4 Construction and function

4.1 Overview

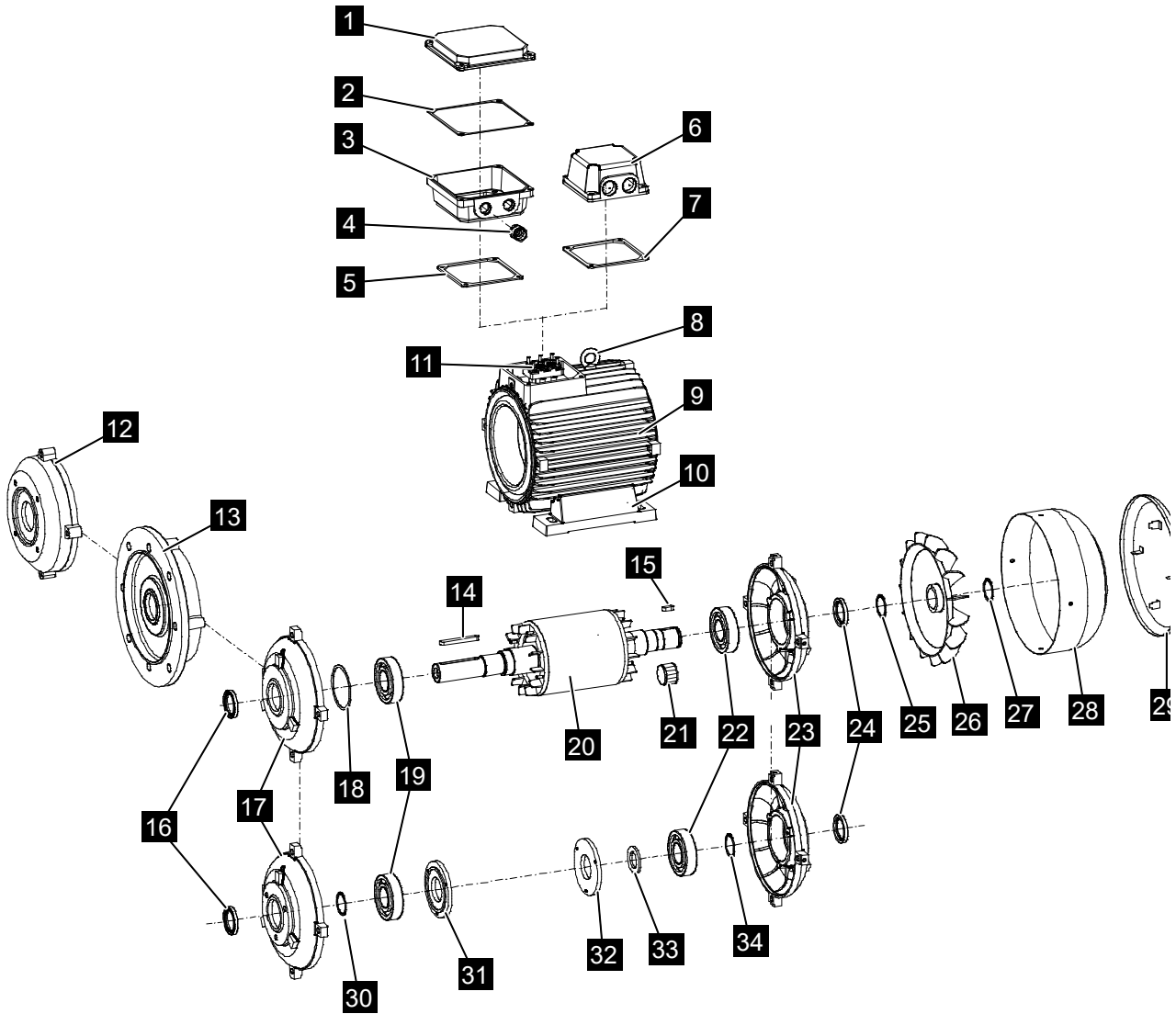


Fig. 5: Overview

1	Terminal box cover	18	Ball bearing adjusting washer
2	Terminal box cover seal	19	Rolling bearings (DS)* ¹
3	Terminal box	20	Rotor shaft, complete
4	Screwed cable gland	21	Tolerance ring (fan blade)
5	Terminal box seal	22	Rolling bearing (NS)* ²
6	Terminal box (single-piece)	23	Bearing shield (NS)* ²
7	Terminal box seal	24	Sealing ring (NS)* ²
8	Ring bolt	25	Retaining ring (fan)
9	Stator housing assembly including feet (IM B3)/ without feet (IM B5/IM B14)	26	Fan
10	Motor feet	27	Retaining ring (fan)
11	Terminal board	28	Ventilation hood
12	Flange bearing shield IM B14	29	Safety cover
13	Flange bearing shield IM B5	30	Retaining ring (rolling bearing)
14	Feather key (shaft end) - optionally	31	Bearing cap (DS)* ¹
15	Feather key (fan blade) - optionally	32	Bearing cap (NS)* ²
16	Sealing ring (DS)* ¹	33	Supporting disk
17	Bearing shield (DS) * ¹ IM B3	34	Retaining ring (rolling bearing)

*¹ (DS) = drive side

*² (NS) = non-drive side

4.2 Connections

The electrical connections are established using the terminal box. The wiring diagram is inside the terminal box.

Optionally the motors can be supplied with a motor cable instead of with a terminal box (⇒ catalogue).

4.3 Operation on the frequency converter

As well as the cooling effect of the internal fan, the noise and vibration performance also changes frequently which is caused by the harmonic content of the converter output voltage. This causes the additional losses in the motor to increase. When operating above the nominal speed the maximum speed is limited by the mechanical strain of the internal fan and the critical speed of the ball bearing.

When operating with converter the motor protection provided by the motor protection switch is no longer sufficient. Only temperature monitoring using thermal sensors (posistors or thermostatic switches) in the coil provides reliable protection.

With a supply via converter high-frequency current and voltage harmonics in the motor cables can cause electromagnetic interference emissions. You must therefore use screened supply cables.

5 Transportation, packaging and storage

Suspended loads

**WARNING!****Risk of fatal injury from suspended loads.**

When lifting loads there is a risk of fatal injuries from falling parts or parts swinging uncontrolledly.

Therefore:

- Never stand under suspended loads.
- Only use the stipulated fastening points.
- Do not fasten lifting gear to protruding machine parts or the lugs on attached parts. Make sure the fastening equipment is securely fastened.
- Only use approved lifting gear and fastening equipment with sufficient load bearing capacity.
- Do not use any torn or frayed ropes or belts.
- Do not attach ropes and belts to sharp edges and corners. Do not knot or twist them.

Off-centre centre of gravity

**WARNING!****Risk of falling due to an off-centre centre of gravity.**

Packages may have an off-centre centre of gravity. If fastened incorrectly the package may tilt and cause potentially fatal injury.

Therefore:

- Adhere to the markings on the packages.
- Attach the crane hook so that it is directly above the centre of gravity.
- Lift cautiously and observe whether the load tilts. If necessary change the fastening.

Improper transportation



CAUTION!

Risk of damage in case of improper transportation.

Improper transportation can cause considerable material damage.

Therefore:

- When unloading delivered packages and when transporting on the premises, proceed with caution and adhere to the symbols and instructions on the packaging.
- Only use the fastening points provided.
- Do not remove the packaging until shortly before installation.

5.1 Delivery inspection

Inspect the delivery for damage and to make sure it is complete immediately after receiving it.

Proceed as follows in case of visual external damage:

- Refuse delivery or accept delivery provisionally.
- Make a note of the extent of damage in the shipping documents or on the carrier's delivery note.
- Make a claim.



NOTE!

Make a claim for every discrepancy as soon as it is discovered. Claims for compensation can only be asserted within the valid claims periods.

5.2 Transportation

Fastening points

- Use suitable lifting gear.
- Use the lifting eyebolts provided on the motor.
- To transport machine sets (e.g. gear units, fan attachments etc.) only use the lifting eyebolts and lugs provided. Machine sets must not be lifted by the individual machines.
- Remove any transport safety devices which protect from bearing damage before commissioning.

Transportation, packaging and storage

Transporting packages by crane

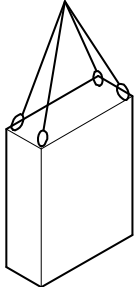


Fig. 6

Packages which have fastening eyebolts can be transported directly by crane on the following conditions:

- The crane and lifting gear must be designed for the weight of the packages.
- The operator must be authorised to operate the crane.

Fastening:

1. Fasten ropes, belts or multiple-point suspension gear Fig. 6 accordingly.
2. Make sure that the package hangs straight, paying attention to the off-centre centre of gravity as necessary.
3. Begin transportation.

Transporting pallets by crane

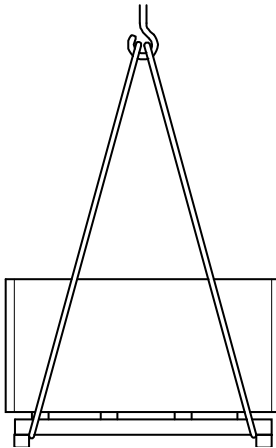


Fig. 7

Packages which are fastened to pallets can be transported by crane under the following conditions:

- The crane and lifting gear must be designed for the weight of the packages.
- The operator must be authorised to operate the crane.

Fastening:

1. Fasten ropes, belts or multiple-point suspension gear to the pallet Fig. 7 accordingly.
2. Check that the packages are not damaged by the fastening equipment. If necessary use other fastening equipment.
3. Begin transportation.

Transporting pallets by forklift

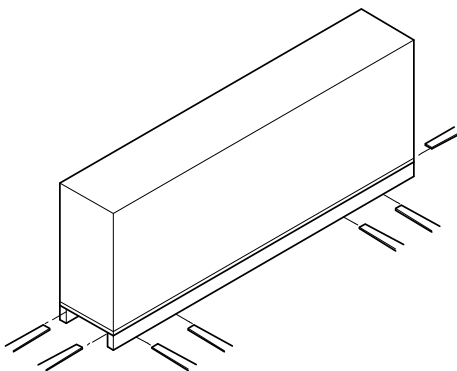


Fig. 8

Packages which are fastened to pallets can be transported by forklift under the following conditions:

- The forklift must be designed for the weight of the units for transportation.
- The driver must be authorised to drive the forklift.

Fastening:

1. Drive the forklift with the forks between or underneath the beams of the pallet.
2. Insert the forks so that they protrude on the opposite side.
3. Make sure that the pallet cannot tilt in case it has an off-centre centre of gravity.
4. Raise the package and begin transportation.

5.3 Packaging

Information on packaging

The individual packages are packaged appropriately for the expected transportation conditions. Only environmentally friendly materials have been used for packaging.

The packaging is designed to protect the individual parts from transport damage, corrosion and other damage up until they are installed. You must therefore not destroy the packaging and not remove it until shortly before installation.

Handling packaging materials

Dispose of packaging material in accordance with the respective valid laws and local regulations.



CAUTION!

Risk of environmental damage due to incorrect disposal.

Packaging materials are valuable raw materials and can be re-used in many cases or treated and recycled.

Therefore:

- Dispose of packaging material in an environmentally friendly manner.
- Adhere to the valid local regulations for disposal. Contract a specialist company to carry out disposal as necessary.

5.4 Bearings

Storing packages

Store the packages under the following conditions:

- Do not store in the open.
- Keep in a dry and dust-free environment.
- Do not expose to any corrosive media.
- Protect from sunlight.
- Make sure to store in a low-vibration environment ($v_{\text{eff}} \leq 0.2$ mm/s).
- Avoid large fluctuations in storage temperature.
- Relative air humidity: max. 60 %.
- Check the insulation resistance as necessary (⇒ chapter "Checking the insulation resistance").
- Grease or replace the rolling bearings as necessary (⇒ chapter "Maintenance").
- When storing for longer than 3 months, regularly check the general condition of all parts and the packaging. If necessary, replenish or replace the conservation.



NOTE!

In some cases there will be instructions for storage on the packages informing you of further requirements going beyond those listed here. Adhere to these instructions accordingly.

6 Installation and commissioning

6.1 Safety

Staff

- Installation and commissioning must only be performed by specialist staff with the appropriate qualifications.
- Work on the electrical equipment must only be carried out by qualified electricians.

Personal safety equipment and clothing

Wear the following safety equipment and clothing for all installation and commissioning work:

- Occupational safety clothing
- Safety shoes

Electrical equipment



DANGER!

Danger to life from electrical current.

There is a risk of fatal injury from contact with live parts. Electrical components which are switched on can carry out uncontrolled movements and cause serious injuries.

Therefore:

- Before starting work switch off the electrical power supply and secure it to prevent it from being switched back on.

Securing the machine to prevent it from being switched back on



DANGER!

Risk of fatal injury if the machine is switched back on without authorisation.

When performing installation there is a risk that the energy supply will be switched on without authorisation. This puts the life of people in the danger area at risk.

Therefore:

- Before beginning all work shut off all energy supplies and secure them to prevent them from being switched back on.

Installation and commissioning

Improper installation and commissioning



WARNING!

Risk of injuries from improper installation and commissioning.

Improper installation and commissioning can cause serious personal injury and material damage.

Therefore:

- Before starting work make sure there is sufficient space for performing the installation work.
- Handle open, sharp-edged parts with care.
- Keep the installation area clean and tidy. Loose parts and tools stacked on top of each other or parts and tools left lying around are potential sources of accidents.
- Fit parts properly. Adhere to the stipulated tightening torque values for screws.
- Secure parts to prevent them from falling or toppling.

6.2 Installation

6.2.1 Ventilation at the location for use

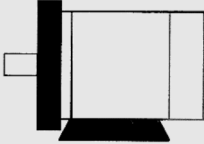
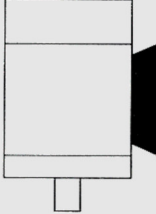
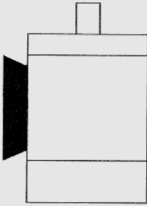
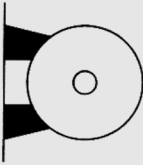
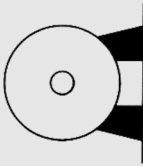

The ventilation for the motor must not be obstructed.

You must therefore adhere to the following points:

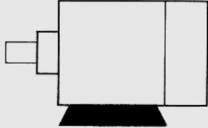
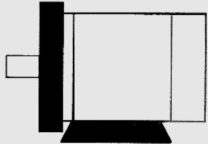
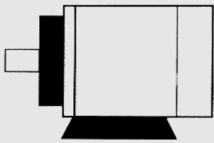
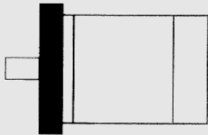



- Make sure that there is sufficient space between the motor fan and the walls and other similar obstructions.
- The clearance to obstructions must be at least $d/4$ (d = diameter of the motor).
- Make sure that the exhaust air is not sucked directly back in.
- In case of heavy soiling clean the air ways regularly.

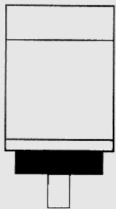
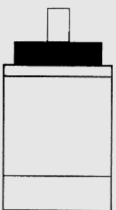
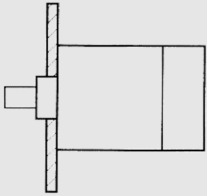
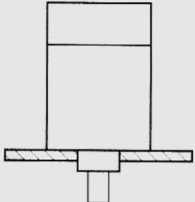
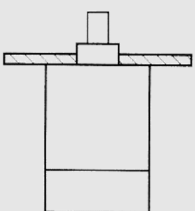
6.2.2 Types of construction as per EN 60034-7

Type of construction and IM code (international mounting) of the most frequently used versions.

Type of construction	Symbol	Explanation
IM B3 IM 1001		<ul style="list-style-type: none"> ■ 2 bearing shields ■ with feet
IM V5 IM 1011		<ul style="list-style-type: none"> ■ 2 bearing shields ■ with feet ■ Shaft end bottom ■ Fastening on the wall
IM V6 IM 1031		<ul style="list-style-type: none"> ■ 2 bearing shields ■ with feet ■ Shaft end top ■ Fastening on the wall
IM B6 IM 1051		<ul style="list-style-type: none"> ■ 2 bearing shields ■ with feet ■ Construction type IM B3 ■ Fastening on the wall ■ Feet left, viewed from drive side
IM B7 IM 1061		<ul style="list-style-type: none"> ■ 2 bearing shields ■ with feet ■ Construction type IM B3 ■ Fastening on the wall ■ Feet right, viewed from drive side
IM B8 IM 1071		<ul style="list-style-type: none"> ■ 2 bearing shields ■ with feet ■ Construction type IM B3 ■ Fastening on the ceiling

Installation and commissioning

Type of construction	Symbol	Explanation
IM B15 IM 1201		<ul style="list-style-type: none"> ■ 1 bearing shield ■ with feet ■ Construction type IM B3 ■ without bearing shield (also without rolling bearing) on drive side ■ Installation on substructure ■ Attached to front of housing on drive side
IM B35 IM 2001		<ul style="list-style-type: none"> ■ 2 bearing shields ■ with feet ■ Securing flange type A
IM B34 IM 2101		<ul style="list-style-type: none"> ■ 2 bearing shields ■ with feet ■ Securing flange type C
IM B5 IM 3001		<ul style="list-style-type: none"> ■ 2 bearing shields ■ without feet ■ Securing flange type A
IM V1 IM 3011		<ul style="list-style-type: none"> ■ 2 bearing shields ■ without feet ■ Shaft end bottom ■ Securing flange type A
IM V3 IM 3031		<ul style="list-style-type: none"> ■ 2 bearing shields ■ without feet ■ Shaft end top ■ Securing flange type A
IM B14 IM 3601		<ul style="list-style-type: none"> ■ 2 bearing shields ■ without feet ■ Securing flange type C

Type of construction	Symbol	Explanation
IM V18 IM 3611		<ul style="list-style-type: none"> ■ 2 bearing shields ■ without feet ■ Shaft end bottom ■ Securing flange type C
IM V19 IM 3631		<ul style="list-style-type: none"> ■ 2 bearing shields ■ without feet ■ Shaft end top ■ Securing flange type C
IM B9 IM 9101		<ul style="list-style-type: none"> ■ 1 bearing shield ■ without feet ■ Construction type IM B5 or IM B14 ■ without bearing shield (also without rolling bearing) on drive side ■ Attached to front of housing on drive side
IM V8 IM 9111		<ul style="list-style-type: none"> ■ 1 bearing shield ■ without feet ■ Shaft end bottom ■ Construction type IM V1 or IM V18 ■ without bearing shield (also without rolling bearing) on drive side ■ Attached to front of housing on drive side
IM V9 IM 9131		<ul style="list-style-type: none"> ■ 1 bearing shield ■ without feet ■ Shaft end top ■ Construction type IM V3 or IM V19 ■ without bearing shield (also without rolling bearing) on drive side ■ Attached to front of housing on drive side

6.2.3 Erecting the machine

**DANGER!****Risk of death due to insufficient protection classes.**

Insufficient protection classes can lead to considerable material damage, serious personal injury or even death.

Therefore:

- Do not erect machine of protection class \leq IP23 in the open.

In order to ensure that the machine runs quietly and with low vibrations make sure of the following when erecting the machine:

- the foundation must be stable
- the foundation's natural frequency with the machine must be sufficiently different to the rotary frequency and the double mains frequency
- the motors must be aligned accurately
- the drive machines must be well balanced

6.2.4 Installation

Installation varies depending on the construction type. In case you have any doubts contact the service department (⇒ page 2).

When installing, always pay attention to the following points:

- All connection elements (walls, ceilings etc .) must be of sufficient size.
- The rotor is dynamically balanced with a half feather key. Take this into account when balancing the drive element.
- Avoid incorrect belt tension (⇒ catalogue). Cover couplings and belt pulleys with a guard to protect accidental contact.
- Fit and remove drive elements (couplings, belt pulley, toothed wheels etc.) with the suitable devices.
- Tighten all screw connections with the appropriate tightening torque (⇒ chapter "Tightening torque values for screws").
- Fit construction types with the shaft ends at the bottom with a cover to prevent foreign bodies from falling into the motor's fan.
- Any condensation drain holes must be positioned at the lowest point of the motor when installed and cleaned of any impurities.
- Take generally required measures for preventing accidental contacts between drive elements

6.3 Connecting to the energy supply

Electrical current



DANGER!

Danger to life from electrical current.

There is an immediate risk of fatal injury in case of contact with live parts. Damage to the insulation or individual components can mean danger to life.

Therefore:

- In case of damage to the insulation, switch off the power supply immediately and have repairs carried out.
- Have work on the electrical equipment carried out by qualified electricians only.
- When any work is carried out on the electrical equipment, disconnect it from the power and make sure it is free of voltage.
- Before carrying out maintenance, cleaning and repair work, switch off the power supply and secure it to prevent it from being switched back on.
- Do not jumper or disable any fuses or circuit breakers. When replacing fuses or circuit breakers make sure to adhere to the correct ampere rating.
- Keep moisture away from live parts. It can lead to a short circuit.

6.3.1 Voltage, frequency and circuit

- Adhere to the wiring specification on the type plate and wiring diagram in the terminal box.
- Compare the operating voltages and supply voltages.
- Motor rated voltages and the supply voltage must not differ $\pm 5\%$; $\pm 2\%$ is permitted for the rated frequency.

Installation and commissioning

6.3.2 Checking the insulation resistance

- To be performed by a qualified electrician only

**DANGER!****Risk of death due to uncontrolled fault currents.**

Insulation faults can call potentially fatal fault currents.

Therefore:

- The value of the insulation resistance must be higher than the critical value of 0.5 MΩ.
- In case the value drops below the critical insulation resistance, take the motor out of operation and shut it down immediately.

**DANGER!****Danger to life from electrical current.**

When measuring and immediately afterwards the terminals carry partly dangerous voltages.

Therefore:

- Do not touch the terminals.
- Discharge after measuring.

Before commissioning the motor, after a longer period of storage or without use, the insulation resistance of the coils has to be determined again. When doing so, adhere to the valid standards and directives.

6.4 Commissioning

**DANGER!****Danger to life from electrical current.**

There is an immediate risk of fatal injury in case of contact with live parts.

Therefore:

- Only carry out work with the plant free of voltage.
- Secure the plant to prevent it from being switched back on.

**CAUTION!**

Risk of personal injury and/or material damage from feather keys ejected at speed.

When commissioning a motor without drive elements the feather keys may be ejected at speed.

Therefore:

- Before commissioning motors without drive elements remove or secure the feather keys beforehand.

Before commissioning make sure that:

- the minimum insulation resistance values are adhered to (⇒ chapter "Checking the insulation resistance").
- the rotor can be turned without starting up.
- the motor is properly fitted and aligned.
- any condensation drain holes are open.
- the drive elements have the right settings (e.g. belt tension for belt drive etc.)
- the drives are suitable for the conditions of use.
- all electrical connections, fastening screws and fastening elements are the right type and are tightened properly.
- the protective earth conductor connection is properly established.
- measures to prevent accidental contacts for mowing and live parts have been taken.

**NOTE!**

Commissioning is performed using the overall plant control unit (⇒ Operating manual for the complete plant).

7 Operations

7.1 General information

During operation no staff are required in the machine area or in the direct vicinity to operate it.

Operation is performed using the overall plant control unit (⇒ Operating manual for the complete plant).

7.2 Shutting down in an emergency

In danger situations machine movements must be stopped as quickly as possible and the energy supply has to be switched off.

Shutting down in an emergency

In case of danger proceed as follows:

1. Trigger an emergency stop immediately.
2. Remove any people from the danger zone and administer first aid.
3. Alert a doctor and the fire services.
4. Inform the responsible party at the location.
5. Switch off the master switch and secure it to prevent it from being switched back on.
6. Keep access routes for emergency vehicles clear.
7. If the seriousness of the emergency requires it, inform the respective authorities.
8. Have specialist staff remedy the fault.

After emergency measures



WARNING!

Risk of death from switching on prematurely.

When switching back on there is a risk of fatal injury for all people in the danger area.

Therefore:

- Before switching back on make sure that there is nobody in the danger area.

9. Before re-starting check the plant and make sure that all safety devices are installed and fully functional.

8 Faults

The following chapter describes possible causes of faults and the work to eradicate them.

In case of faults which occur several times, reduce the maintenance interval accordingly to suit the actual strain.

In case of faults which cannot be cleared using the following instructions, contact the manufacturer, see service address on page 2.

8.1 Safety

Staff

- Some tasks can only be carried out by specialist staff with special qualifications or exclusively by the manufacturer. The description of the respective individual fault makes reference to this in each case.
- Work on the electrical equipment must only be carried out by qualified electricians.

Personal safety equipment and clothing

Wear the following safety equipment and clothing for all faults work:

- Occupational safety clothing
- Safety shoes

Electrical equipment



DANGER!

Danger to life from electrical current.

There is a risk of fatal injury from contact with live parts. Electrical components which are switched on can carry out uncontrolled movements and cause serious injuries.

Therefore:

- Before starting work switch off the electrical power supply and secure it to prevent it from being switched back on.

Faults

Securing the machine to prevent it from being switched back on



DANGER!

Risk of death from switching on without authorisation.

When working to remedy faults there is a risk that the energy supply will be switched on without authorisation. This puts the life of people in the danger area at risk.

Therefore:

- Before beginning all work shut off all energy supplies and secure them to prevent them from being switched back on.

Improper eradication of faults



WARNING!

Risk of injuries from incorrectly eradicating faults.

Eradicating faults incorrectly can cause serious personal injury and material damage.

Therefore:

- Before starting work make sure there is sufficient space for performing the installation work.
- Keep the installation area clean and tidy. Loose parts and tools stacked on top of each other or parts and tools left lying around are potential sources of accidents.
- If parts have been removed, make sure they are installed properly, re-install all fastening elements and adhere to the tightening torque values for screws.

How to act in case of faults

The following basic instructions apply:

1. In case of faults which pose an immediate risk to people or objects of material value, activate the emergency stop function immediately.
2. Determine the cause of the fault.
3. If eradicating the fault requires work in the danger area, switch off the plant and secure it to prevent it from being switched back on.
4. Inform the responsible party at the location of the fault immediately.
5. Depending on the type of fault, have it remedied by specialist staff or remedy it yourself.


NOTE!

The following fault table provides information on who is authorised to remedy the fault.

8.2 Fault table

Fault	Possible cause	Remedy	To be remedied by
<ul style="list-style-type: none"> ■ Bearing is too worn 	Too much grease in the bearing	Remove excessive grease	Qualified specialist
	Bearing is soiled	Replace the bearing	Manufacturer
	Belt tension too high	Reduce belt tension	Qualified specialist
	Bearing grease dark in colour	Check for bearing currents	Qualified specialist
<ul style="list-style-type: none"> ■ Bearing is too worn ■ Motor is not running smoothly 	Coupling forces are pulling or pushing	Align the motor exactly, adjust the coupling	Qualified specialist
<ul style="list-style-type: none"> ■ Bearing is too worn ■ Bearing noises 	Not enough grease in the bearing	Lubricate as stipulated	Qualified specialist
<ul style="list-style-type: none"> ■ Bearing is too worn ■ Bearing noises ■ Motor is not running smoothly 	Motor erected incorrectly	Check the motor construction type	Qualified specialist
<ul style="list-style-type: none"> ■ Bearing noises 	Scoring on inner bearing ring, e.g. from motor starting up with bearing locked	Replace bearing, avoid vibrations when at a standstill	Manufacturer
<ul style="list-style-type: none"> ■ Motor is not running smoothly 	Imbalance due to belt pulley or coupling	Balance exactly	Manufacturer
	Machine fastening insufficient	Check machine fastening	Qualified specialist
<ul style="list-style-type: none"> ■ Motor does not start up ■ Considerable drop in speed 	Load moment too high	Check motor torque and load moment	Qualified electrician
	Supply voltage too low	Check power supply conditions	Qualified electrician

Faults

Fault	Possible cause	Remedy	To be remedied by
<ul style="list-style-type: none"> ■ Motor does not start up ■ Considerable drop in speed ■ Safety device is triggered 	Phase unbalance	Check the mains connection	Qualified electrician
<ul style="list-style-type: none"> ■ Motor does not start up ■ Motor is too warm ■ Considerable drop in speed ■ Safety device is triggered 	Incorrect circuit	Adhere to wiring diagram and type plate	Qualified electrician
<ul style="list-style-type: none"> ■ Motor is too warm ■ Considerable drop in speed ■ Safety device is triggered 	Overload	Adhere to stipulations on type plate	Qualified electrician
<ul style="list-style-type: none"> ■ Motor is too warm ■ Safety device is triggered 	Too many switching actuations	Observe rated operating mode	Qualified electrician
<ul style="list-style-type: none"> ■ Motor is too warm 	Ventilation insufficient	Check the cooling air ducts, check the direction of rotation	Qualified electrician
	Ventilation ducts soiled	Clean the ventilation ducts	Qualified specialist
<ul style="list-style-type: none"> ■ Safety device is triggered 	Coil or terminal short circuit	Measure the insulation resistance	Qualified electrician
	The start-up time has been exceeded	Check the start-up conditions	Qualified electrician

8.3 Commissioning after remedied fault

After remedying the fault carry out the following steps for re-commissioning:

1. Reset the emergency stop devices.
2. Acknowledge the fault on the control unit.
3. Make sure that there is nobody in the danger area.
4. Start by following the instructions in the chapter "Operation".

9 Maintenance

9.1 Safety

Staff

- The maintenance work described here can be carried out by the operator unless otherwise stated.
- Some maintenance tasks can only be carried out by specialist staff with special qualifications or exclusively by the manufacturer. The description of the respective individual maintenance task makes reference to this in each case.
- Work on the electrical equipment must only be carried out by qualified electricians.

Personal safety equipment and clothing

Wear the following safety equipment and clothing for all maintenance work:

- Occupational safety clothing
- Safety shoes

Electrical equipment



DANGER!

Danger to life from electrical current.

There is a risk of fatal injury from contact with live parts. Electrical components which are switched on can carry out uncontrolled movements and cause serious injuries.

Therefore:

- Before starting work switch off the electrical power supply and secure it to prevent it from being switched back on.

Maintenance

Improperly performed - maintenance work



WARNING!

Risk of injury due to improperly performed maintenance work.

Performing maintenance incorrectly can cause serious personal injury and material damage.

Therefore:

- Before starting work make sure there is sufficient space for performing the installation work.
- Keep the installation area clean and tidy. Loose parts and tools stacked on top of each other or parts and tools left lying around are potential sources of accidents.
- If parts have been removed, make sure they are installed properly, re-install all fastening elements and adhere to the tightening torque values for screws.

Securing the machine to prevent it from being switched back on



DANGER!

Risk of death from switching on without authorisation.

When performing maintenance there is a risk that the energy supply will be switched on without authorisation. This puts the life of people in the danger area at risk.

Therefore:

- Before beginning all work shut off all energy supplies and secure them to prevent them from being switched back on.

Environmental protection

Adhere to the following instructions on environmental protection when performing maintenance work:

- At all lubricating points which are supplied with lubricant by hand, remove the expelled, used or excess grease and dispose of it in accordance with the local regulations.
- Collect replaced oil in suitable containers and dispose of it in accordance with the local regulations.

9.2 Cleaning

- Do not spray electrical machines with water or other liquids.
- Check the entire route for cooling air for soiling at least once a year.

9.3 Maintenance schedule

The next sections describe maintenance work which is required to ensure optimum and fault-free operation.

If during regular checks increased wear is identified, shorten the required maintenance intervals to match the actual signs of wear.

In case you have any questions on maintenance work and intervals, contact the manufacturer, see service address on page 2.

The standard version motors are fitted with permanently lubricated bearings.

Motors from construction type 160 and above can be fitted with lubricating equipment. The lubricating intervals depend on many influence factors. The following table applies under normal operating conditions.



NOTE!

In case of questions on lubrication, contact the manufacturer.

See page 2 for contact details.

Lubricating the ball bearings - intervals in operating hours

Construction size	Quantity of grease [g]	Speed [min ⁻¹]					
		3600	3000	1800	1500	1000	500
160	25	7000	9500	14000	17000	21000	24000
180	30	6000	8000	13500	16000	20000	23000
200	40	4000	6000	11000	13000	17000	21000
225	50	3000	5000	10000	12500	16500	20000

9.4 Tightening torque values for screws



NOTE!

Replaced screws which can no longer be used with new screws of the same type and property class.

If not otherwise stated, the following tightening torque values apply for screw connections.

9.4.1 Tightening torque values for screws for electrical connections

Thread	Tightening torque value [Nm]	Thread	Tightening torque value [Nm]
M 4	1,2	M 12	15,5
M 5	2	M 16	30
M 6	3	M 20	52
M 8	6	M 24	80
M 10	10	M 30	150

9.4.2 Screw connections, property class 8.8 and A4-70



NOTE!

Only use tightening torque values for screws of property class 8.8 and A4-70 (A4-80) in high-strength parts (e.g. grey cast iron, steel).

Thread	Tightening torque value [Nm]	Thread	Tightening torque value [Nm]
M 4	2,3	M 14	105
M 5	4,6	M 16	160
M 6	7,9	M 20	330
M 8	19	M 24	560
M 10	38	M 30	1100
M 12	66	M 36	1900

9.4.3 Screw connections of property class 5.6



NOTE!

Only use tightening torque values for screws of property class 5.6, 4.6 A2 or for screws in low-strength parts (e.g. aluminium).

Thread	Tightening torque value [Nm]	Thread	Tightening torque value [Nm]
M 4	1,1	M 14	49
M 5	2,1	M 16	75
M 6	3,7	M 20	150
M 8	8,9	M 24	260
M 10	18	M 30	520
M 12	30	M 36	920

9.5 Measures on completion of maintenance

On completion of maintenance work, carry out the following steps before switching on:

1. Check that all screw connections which have been unfastened are fastened securely again.
2. Check whether all the safety devices and covers which have been removed have been properly re-installed.
3. Make sure that all tools, materials and other equipment which have been used, have been removed from the working area.
4. Clean the working area and remove any substances, e.g. liquids, processing material etc.
5. Make sure that all the plant's safety devices are in perfect working order.

10 Removal

Once the period of use has expired, the machine must be removed and disposed of in an environmentally friendly manner.

10.1 Safety

Staff

- The machine must only be removed by qualified specialist staff with the appropriate qualifications.
- Work on the electrical equipment must only be carried out by qualified electricians.

Electrical equipment



DANGER!

Danger to life from electrical current.

There is a risk of fatal injury from contact with live parts. Electrical components which are switched on can carry out uncontrolled movements and cause serious injuries.

Therefore:

- Before starting removal work switch off the electrical supply and disconnect it permanently.

Improper removal



WARNING!

Risk of injury from improper removal.

Stored residual energy, sharp parts, points and corners on and in the device or on the required tools can cause injuries.

Therefore:

- Before starting work make sure there is sufficient space.
- Handle open, sharp-edged parts with care.
- Keep the working area clean and tidy. Loose parts and tools stacked on top of each other or parts and tools left lying around are potential sources of accidents.
- Remove parts properly. Be aware that some parts have a heavy dead weight. Use lifting gear as necessary.
- Secure parts to prevent them from falling or toppling.
- In case of doubt, contact the manufacturer.

10.2 Removal

Before starting removal:

- Switch off the machine and secure it to prevent it from being switched back on.
- Physically disconnect the entire energy supply and discharge stored residual energy.
- Remove fuels and consumables and residual processing materials and dispose of them in an environmentally friendly manner.

Then clean assembly groups and parts properly and dismantle then in accordance with the local regulations for occupational safety and environmental protection.

10.3 Disposal

If no agreements have been made for return or disposal, have the dismantled components recycled:

- Have metals scrapped.
- Hand over plastic elements for recycling.
- Sort and dispose of other components according to the material properties.

**CAUTION!**

Risk of environmental damage due to incorrect disposal.

Electrical scrap, electronic components, lubricants and consumables require special waste treatment and must only be disposed of by approved specialist companies.

The local authorities or specialist disposal companies can provide information on environmentally friendly disposal.

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13 Appendix: China RoHS

For further information, see also

- [KNF Statement on China RoHS.pdf](#)

SJ-T 11364-2024 Hazardous Substance Disclosure Table / SJ-T 11364-2024 有害物质含量表

This declaration is valid for the KNF products produced by:

本声明适用于由以下KNF公司生产的产品：


KNF Neuberger GmbH

DE-79112 Freiburg

Germany

The following information has been made available to comply with SJ-T 11364-2024 the Marking for Control of Pollution Caused by Electronic Information Products as required by China's Management Methods for the Control of Pollution from Electronic and Electrical Products.

提供以下信息旨在遵守中国《电子信息产品污染控制管理办法》所要求的 SJ-T 11364-2024《电子信息产品污染控制标识》标准。

Part Name 部件名称	Hazardous Substances Table 有害物质含量表						EFUP / 环境友好使用期限 	China RoHS comment / 中国RoHS注释	EU RoHS compliant / 符合欧盟RoHS指令
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr(VI))	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)			
Pump head / 泵头	X	O	O	O	O	O	20	Lead within EU RoHS exemption limit / 铅含量在欧盟RoHS豁免限值以内	Yes / 是
Pump housing / 泵体	X	O	O	O	O	O	20	Lead within EU RoHS exemption limit / 铅含量在欧盟RoHS豁免限值以内	Yes / 是
Pump motor / 泵的电机	X	O	O	O	O	O	20	Lead within EU RoHS exemption limit / 铅含量在欧盟RoHS豁免限值以内	Yes / 是
Additional components for systems / 系统附加部件	X	O	O	O	O	O	20	Lead within EU RoHS exemption limit / 铅含量在欧盟RoHS豁免限值以内	Yes / 是
<p>O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ-T 11364-2024. 表示该有害物质在该部件所有均质材料中的含量均在 SJ-T 11364-2024 规定的限量要求以下。</p> <p>X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ-T 11364-2024. 表示该有害物质至少在该部件的某一均质材料中的含量超出 SJ-T 11364-2024 规定的限量要求。</p> <p>EFUP /环境友好使用期限: Environment Friendly Using Period / 环境友好使用期</p>									

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