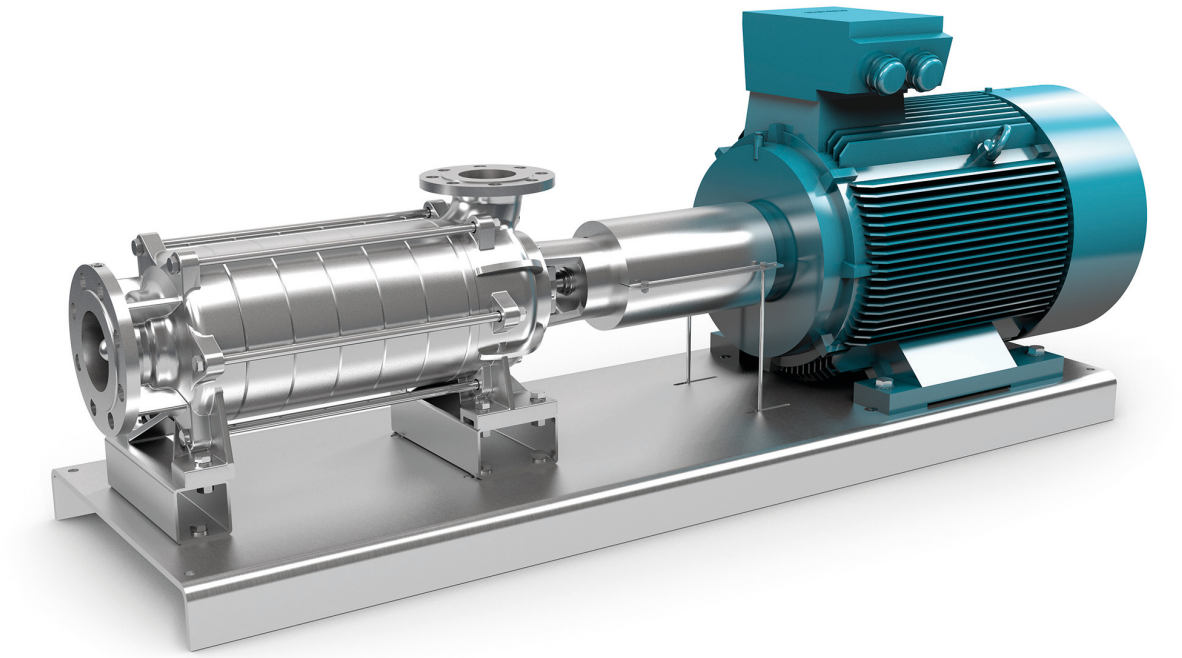
Multistage pumps
NHE/NHKE 100 ATEX

Operating instructions



Translation of the original operating instructions
Please read and retain

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102284_1 · EN | NHE/NHKE ATEX

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Contents

1 Introduction

1.1 Addresses

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1.2 Applicable documents

The overall documentation encompasses the following other applicable documents:

- Data sheet
- Hydraulic water characteristic curve
- Dimension sheet/installation plan
- Supplier documentation for assemblies from external suppliers
- Test certificates, if included in the scope of delivery of external suppliers and contractually agreed
- Acceptance test certificates, if contractually agreed
- Further documents, if contractually agreed.

1.3 About these operating instructions

In these operating instructions, safety information is contained in the 'Safety' chapters and in the warnings that can occur in all chapters.

The warnings are subdivided into hazard levels and are identified as follows:

⚠ WARNING

This warning indicates a possibly hazardous situation. Failure to observe this warning can result in death or severe physical injuries.

⚠ CAUTION

This warning indicates a possibly hazardous situation. Failure to observe this warning can result in moderate or slight physical injuries.

NOTICE

This warning constitutes a warning concerning property damage.

A pump assembly always consists of the pump and a motor. For simplification, the term **pump** is used in the operating instructions.

The pump is intended for installation in machines or systems. For simplification, the word **system** is used in the operating instructions.

1.4 Signs on the pump

The signs are part of the pump. They must not be removed, painted over or rendered illegible. Damaged, illegible or missing signs must be replaced.

Signs on the pump

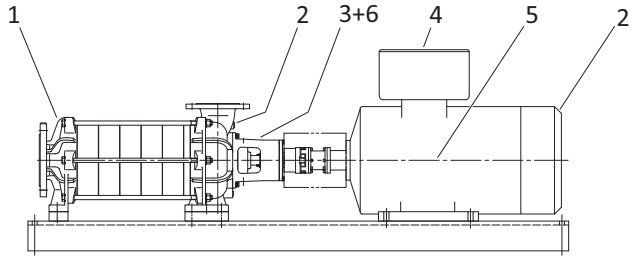

Fig. 1-1 Signs on the pump

Item	Sign	Explanation
1		**Direction of flow** The arrow indicates the specified direction of flow.
2		**Rotation direction** The arrow indicates the specified direction of rotation of the pump.
3		**Pump type plate**, see Type plate on pump, page 8.
4		**Read instructions** Requests the personnel to read the instructions before working on the pump.
5		**Motor type plate**, see Type plate on the motor, page 9.
6		**Additional ATEX sign**, see ATEX type plate on the pump casing, page 9.

Tab. 1-1 Explanations of signs

Type plate on pump

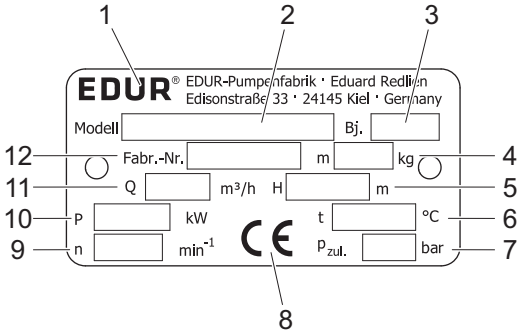

Fig. 1-2 Type plate on pump

1 Manufacturer
2 Model designation
3 Year of construction
4 Overall weight
5 Head
6 Maximum temperature of the pumped fluid
7 Maximum permissible pressure
8 CE symbol
9 Rated speed
10 Power consumption
11 Volumetric flow/delivery rate
12 Factory number/serial number

ATEX type plate on the pump casing

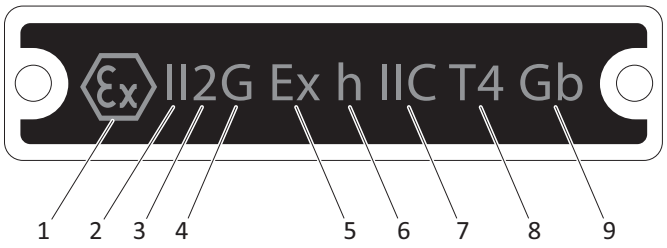

Fig. 1-3 ATEX type plate on the pump casing

1 Marking for explosion-protected operating equipment
2 Device group
3 Device category
4 Areas with an explosive gas, vapour, mist-air mixture
5 The device complies with valid EN standards
6 Ignition protection type
7 Explosion group
8 Temperature classification, maximum surface temperature
9 Equipment protection level (EPL)

Type plate on the motor

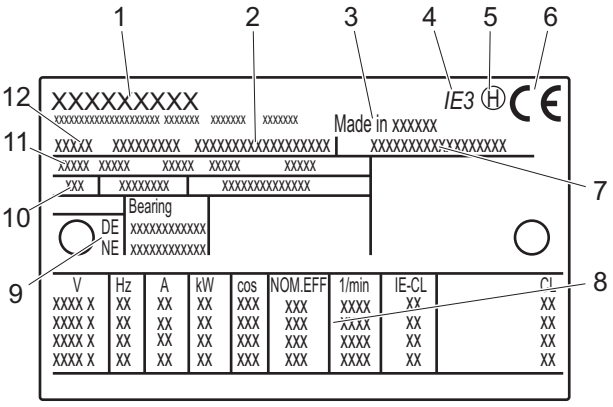

Fig. 1-4 Type plate on the motor

1 Manufacturer
2 Motor designation
3 Country of origin
4 Efficiency class
5 Balancing
6 CE symbol
7 Serial number with year of manufacture
8 Rated motor data
9 Storage
10 Weight | Insulation class | Temperature range
11 Standards | Size | Type | Protection class
12 Number of phases

The item numbers in the figure may deviate depending on the motor make.

2 Safety

2.1 Reading the operating instructions

The personnel that carries out work on the pump must have read and understood the operating instructions. The operating instructions must be available at the operating location and be retained throughout the entire service life of the pump.

The local, generally valid, statutory and other binding accident prevention and environmental protection regulations must be observed in addition to the operating instructions.

2.2 Proper use

The pump is intended for installation in machines and systems for pumping pure fluids or slightly contaminated fluids.

Possible application areas include booster stations, irrigation systems, boiler feed and condensate systems, washing systems, filter technology, water treatment and hardening systems, refrigeration technology, marine engineering or general mechanical engineering.

Each pump is built for a specific customer. The materials and seals are selected for the respective pumped fluid and the operating area. The pump may only be operated with the approved pumped fluid and within the specified limits of the operating area, see Chapter 1.2 Applicable documents, page 6.

The pump assembly is suitable for use in explosive areas. The precise explosion protection marking is shown on the type plate. The information on the type plate is explained in Chapter ATEX type plate on the pump casing, page 9.

The technical data and the explosion protection marking pursuant to Directive 2014/34/EU (ATEX) of the pump assembly and the system must match. This also includes the motor.

2.3 Improper use

The pump may only be operated in installed condition within a pipe network. Switching it on even temporarily outside of the pipe network is considered improper.

Explosion protection is only guaranteed in the case of intended use. Never exceed or undershoot the limit values indicated on the data sheet and the type plate. Always avoid impermissible operating modes.

2.4 Basic safety instructions

Installation and removal work, operation and maintenance may only be carried out by qualified specialist personnel. Qualified specialist personnel includes persons who are able to independently recognise and avoid possible hazards based on their training and experience. The owner must ensure these qualifications.

Observe all local, statutory and system-specific regulations and requirements.

Do not carry out any independent modifications or conversions. Modifications and conversions must be approved by the manufacturer.

Always operate the pump in the specified direction of rotation and with pumped fluid.

When pumping pumped fluids that pose a risk to health and the environment, observe the statutory and operational safety regulations. Avoid any risk of inhalation, swallowing or contact with eyes, skin and mucous membranes.

2.5 Specific safety instructions

2.5.1 Danger due to explosion

Special requirements apply to the operation of explosion-protected pumps. The explosion protection information must be observed.

- Work on the electrical system may only be carried out by electrically skilled persons. The electrically skilled persons must have special knowledge:
  - Ignition protection types
  - Rules and regulations for operating equipment in explosive areas
- Only pumps with a corresponding marking may be operated in explosive areas.
- Explosion protection is only guaranteed in the case of intended use. Impermissible operating modes must always be avoided.
- The conditions stated in EU Directive 2014/34/EU (ATEX) - or in comparable requirements - for operating explosion-protected pumps must be observed.

  The pump fulfils the ignition protection type constructive safety 'c' (ignition protection type 'h' on the type plate).

2.5.2 Danger due to overheating of the mechanical seal

In normal operation, the mechanical seal is not an effective ignition source. If the supply of pumped fluid is interrupted, however, dry running occurs. The mechanical seal is no longer cooled sufficiently, and the frictional heat can no longer be dissipated. This leads to the abrupt heating of the mechanical seal. As a result, the mechanical seal becomes an effective ignition source.

If the supply of pumped fluid is interrupted, switch the pump off immediately.

2.5.3 Danger due to overheating of the ball bearing

The ball bearing can overheat and therefore represent a potential ignition source that causes explosions. Observe the following safety instructions.

– Regularly check the bearing housing for signs of overheating. Discolourations and/or unusual noises can occur in the event of overheating.

  Alternatively, continuous temperature monitoring can be installed.

– In the event of signs of overheating, immediately shut down the system and have the ball bearing exchanged.

– The ball bearing has a limited service life. Observe exchange intervals, see Chapter 10.3 Maintenance schedule, page 41.

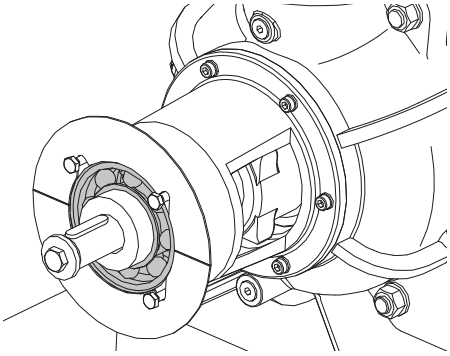

Fig. 2-1 Ball bearing

2.6 Protective devices

The owner must install the following protective devices on all pumps:

– Coupling guard (if not supplied)

– Facility for disconnecting the power supply in an emergency

– Motor protection/overload protection

The owner must install further protective devices depending on the type, the technical data and the installation location:

– Contact protection in the case of very hot or cold pumped fluids

– Soundproofing if the statutory specifications concerning noise emissions are exceeded

– Protection against weather and environmental influences,

When pumping pumped fluids that pose a risk to health and the environment, the owner must implement corresponding safety measures, e.g. installing a collection facility.

The pump must only be operated with installed and functioning protective devices.

2.7 Safety measures when operating explosion-protected pumps

The following safety measures must be implemented in order to operate explosion-protected pumps safely.

- Explosive pumped fluids can escape as a result of leaks. Escaping pumped fluid must be collected and conducted away so that no hazards for persons, systems or the environment arise.
- Observe permissible temperature classes in order to prevent excessively high surface temperatures on the pump.
- The pump assembly may only be operated within the specified limit values and in filled condition.

  If the owner of the system is unable to ensure adherence to these requirements, suitable monitoring facilities must be installed. The owner is obliged to check the necessity of additional monitoring facilities. The monitoring facilities that are used must be approved for use in the respective ex-area and may not themselves represent an ignition source.

  The following monitoring facilities are possible:

  - Temperature monitoring
  - Level monitor
  - Fill level monitor
  - Flow monitor
  - Pressure switch
- All external devices that are used in combination with a pump pursuant to Directive 2014/34/EU (ATEX) must be approved in accordance with Directive 2014/34/EU (ATEX) and be of the same or a higher standard as or than the pump.
- Prevent sparks caused by friction. Choose the material for the coupling guard so that no sparks fly in the event of mechanical contact.
- Make sure that potential equalisation is mounted on the pump to prevent electrostatic charging.

2.8 Personal protective equipment

The personal protective equipment depends on the operating location and the pumped fluid. The scope of the personal protective equipment must be defined by the owner.

The manufacturer recommends the following as the minimum requirement:

– Safety shoes
– Protective gloves
– Safety glasses (optional)
– Ear protectors (optional)

3 Technical data

The type plate and the applicable documents contain the technical data. The technical data specified here are generally valid and can deviate in individual cases.

3.1 Pump

Multistage pump	
Delivery volume	Max. 170 m^3h^{-1}
Head	Max. 300 m
Permissible pressure	Max. 40 bar
Fluid temperature range	−50 °C to 140 °C
Viscosity	≤ 115 mm^2s^{-1}
Shaft seal	Mechanical seal

Tab. 3-1 Pump technical data

3.2 Motor

IEC three-phase motor (self-cooled)	
Protection class	IP55
Insulation class	F (155°C)
Operating mode	S1 continuous operation
Ambient temperature (permissible coolant temperature)	−20 °C to 40 °C
Installation height above MSL	Max. 1000 m
Rotational speed	1,450 (1,750) rpm 2,900 (3,500) rpm
Frequency	50 (60) Hz

Tab. 3-2 Motor technical data

3.3 Noise emissions

Rated power requirement [kW]	Emission sound pressure level LpA [dB] at rotational speed	
	1,450 rpm	2,900 rpm
7.5	66	72
11.0	68	74
15.0	69	75
18.5	70	76
22.0	71	77
30.0	72	78
37.0	73	79
45.0	74	80
55.0	74	80
75.0	76	81
90.0	77	82
110.0	78	83

Tab. 3-3 Emission sound pressure level LpA

The emission sound pressure level actually determined on site may deviate significantly from the specified values due to the operating and installation conditions. The values have a measurement tolerance of ± 3 dB and cannot be guaranteed.

Increased noise emissions can occur due to cavitation, defective or worn bearings and due to vibrations. Observe installation and maintenance instructions, see Chapter 7 Installation, page 25 and Chapter 10 Maintenance, page 40.

3.4 Temperature limits

In normal operating status, the highest temperatures are to be expected on the surface of the pump casing. The maximum surface temperature that occurs at the pump casing corresponds to the temperature of the pumped fluid. The following table contains the temperature classes and the resulting theoretical limit values of the pumped fluid temperature. The temperature class indicates the maximum temperature that the surface of the pump may reach during operation.

The maximum permissible temperature of the actual pump and the motor is indicated on the pump type plate and the motor type plate. Refer to the following table for the maximum permissible temperature for the pump assembly.

Temperature classes	**Maximum permissible surface temperature [°C]**	**Shut-off temperature [°C][1]**
T1	450	350[2]
T2	300	285
T3	200	185
T4	135	120
T5	100	85
T6	85	70

[1] Measurement with resistance thermometer
[2] Operating temperature of the magnetic coupling max. 350°C

Tab. 3-4 Temperature limits depending on temperature classes

4 Design and function

4.1 Pump

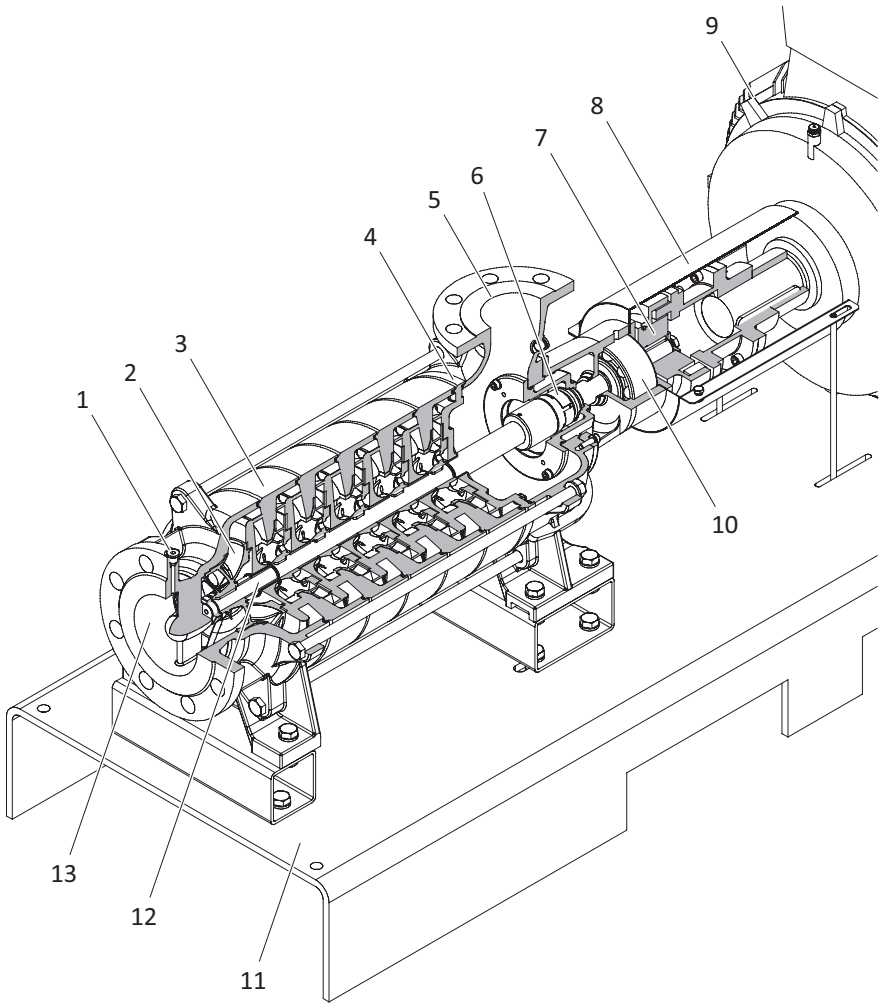

Fig. 4-1 Pump design

1 Venting screw
2 Impeller
3 Stage casing
4 End stage casing
5 Pressure fitting
6 Shaft seal
7 Coupling
8 Coupling guard
9 Motor
10 Ball bearing
11 Base plate
12 Shaft
13 Suction nozzle

The pumps transfer energy from the pump to the pumped fluid through fluidic processes.

The characteristic feature is the successively arranged impellers, through which the pumped fluid flows in sequence.

By means of an energy gradient, the pumped fluid flows via the suction nozzle into the pump, where it encounters the rotating impellers of the first stage. The impeller is driven by the motor. The motor drives the impeller via a shaft with a coupling. The vanes of the impeller apply force onto the pumped fluid and increase its angular momentum. Energy is transferred to the pumped fluid and the pressure and absolute velocity increase. The energy content that is present in kinetic form in the increased absolute velocity is transformed into additional static pressure energy by means of a diffuser element. Guide vanes are used as the diffuser element. Together, the impeller and diffuser element are referred to as the pump's hydraulic system.

In the flow channels of the casing, the pumped fluid is delivered from the diffuser element, through which it previously flowed, to the impeller inlet of the downstream stage. The above described energy transfer process is then repeated.

To maintain the flow, an energy gradient must also be present at the pressure nozzle. Losses in the system caused by friction or leakages increase the pump's power consumption.

The shaft seal prevents the pumped fluid from escaping at the rotating shaft. The venting screws are used to release trapped air.

The pump and motor are mounted on a common base plate. The design of the casing is dependent on the specific type and the number of stages. In the multistage pump, a stage is the name given to the unit consisting of the impeller, diffuser element and casing. The inlet casing with suction nozzle is located upstream of the first stage. The final stage always contains the delivery casing with pressure nozzle.

The spare part drawing shows the detailed design of the pump. The spare part drawing can be downloaded in the service area of the EDUR homepage, www.edur.com.

4.2 Shaft seal

The shaft seal seals the rotating shaft from the pumped fluid.

4.2.1 Relieved mechanical seal

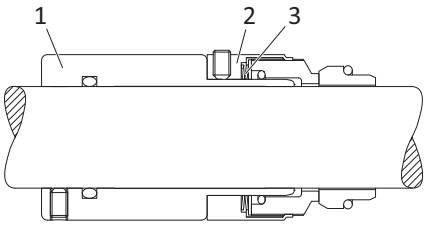

Fig. 4-2 Design of the relieved mechanical seal with sinusoidal spring

1 Relief sleeve
2 Drive collar
3 Sinusoidal spring

Relieved mechanical seals with a sinusoidal spring **(3)** are a special type of mechanical seal and are independent of the direction of rotation. Due to the relief sleeve **(1)**, not all of the hydraulic pressure acts on the sliding surfaces. The torque is transferred via a fixed drive collar **(2)**.

4.3 Expansion stages

The pumps can be supplied in the following expansion stages.

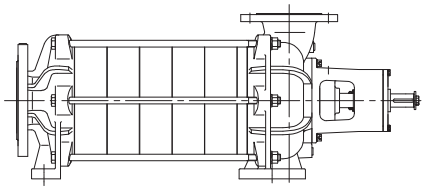

Fig. 4-3 Expansion stage N, pump with free shaft end

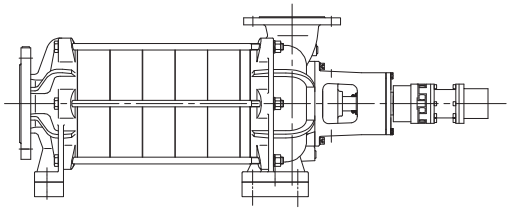

Fig. 4-4 Expansion stage NK, pump with coupling, without coupling guard

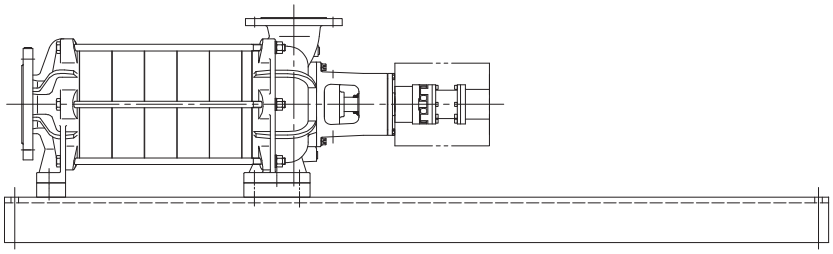

Fig. 4-5 Expansion stage G, pump with coupling, mounted on base plate, with coupling guard

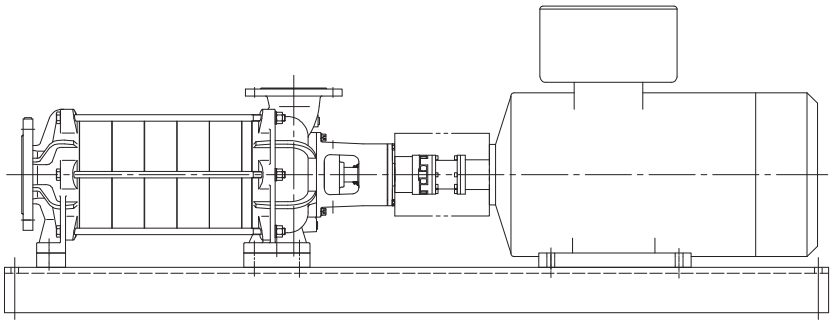

Fig. 4-6 Expansion stage A, pump coupled to motor, mounted on base plate, with coupling guard

4.4 Coupling

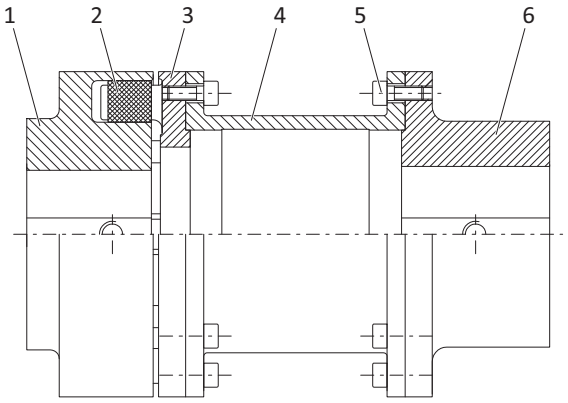

Fig. 4-7 Expansion of elastic coupling

1 Pump-side half of the coupling
2 Coupling package (elastomer elements)
3 Cam ring
4 Spacer
5 Bolt
6 Motor-side half of the coupling

The coupling transfers the torque from the motor shaft to the pump shaft. The coupling package (elastomer elements) compensates the shaft offset and dampens the vibrations and jolts.

5 Transport

5.1 Safety during transport

Improper transport can lead to personal injury and property damage. Observe the following safety instructions.

- Transport must only be carried out by qualified and trained personnel.
- Transport the pump in the horizontal position only.
- Use suitable lifting and lashing equipment. Observe the weight data on the type plate and the packaging.
- Do not use the ring bolts on the motor. The ring bolts on the motor are only designed for the weight of the motor.
- Do not remain beneath suspended loads.
- Make sure that nobody remains in the danger zone.
- Wear safety shoes.
- Only use the approved lifting equipment, see the following chapter.

5.2 Transporting the pump with a crane

Any variant not shown here is not permissible.

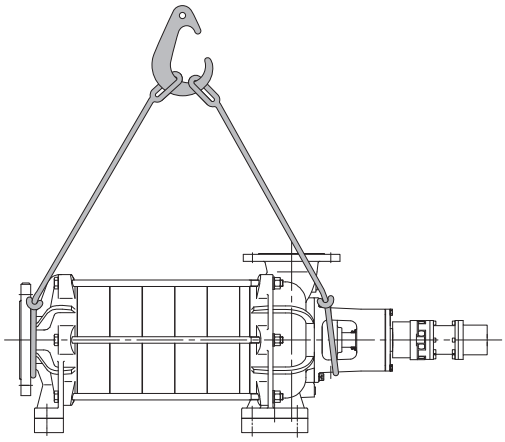

Fig. 5-1 Pump without motor and not mounted on a base plate

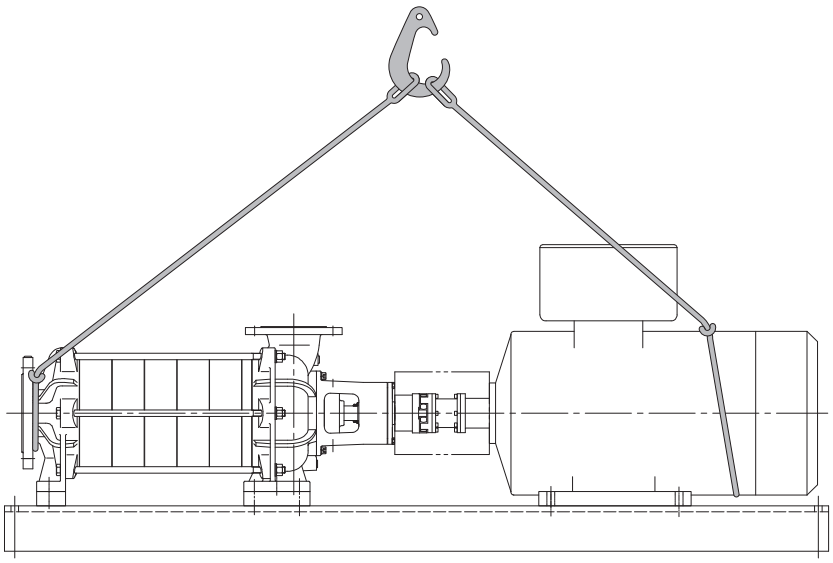

Fig. 5-2 Pump with motor mounted on a base plate

1. Fasten lashing equipment to the pump, see figure.
2. Raise the pump carefully and transport it to the destination location.
3. Put the pump down carefully.
4. Remove the lashing equipment.

5.3 Transporting the pump with an industrial truck

Pump secured on transport pallet

The pump is secured on a transport pallet for shipping. After delivery, the pump can be transported on the pallet and with the packaging using a suitable industrial truck.

If the pump is transported again at a later date, it can again be placed on a transport pallet and secured to the pallet.

Pump without transport pallet

Any variant not shown here is not permissible.

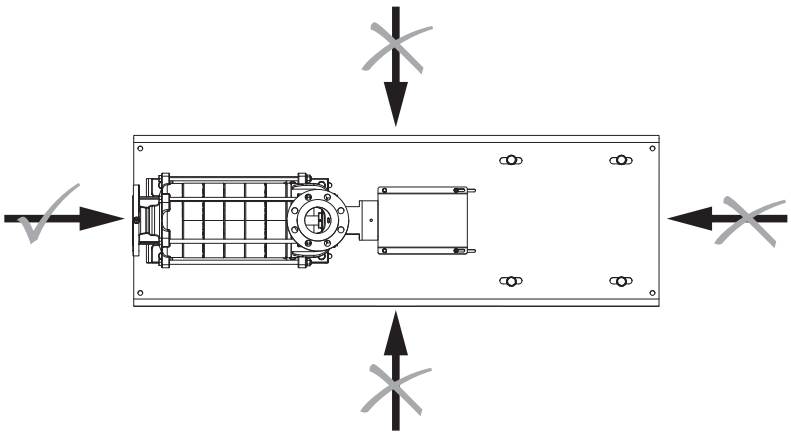

Fig. 5-3 Pump without motor on a base plate measuring 650 mm in width

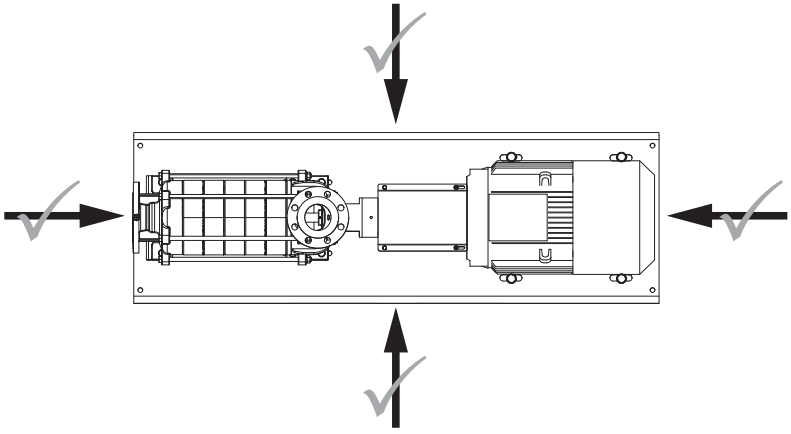

Fig. 5-4 Pump with motor on a base plate measuring 650 mm in width

6 Storage

6.1 Safety during storage

Improper storage can lead to damage to the pump and to environmental pollution. Observe the following safety instructions.

– Corrosion protection agents can be dangerous to health and the environment. Collect corrosion protection and cleaning agents and dispose of them properly. Observe the safety instructions on the corrosion protection agent packaging.

– Wear protective gloves.

Store the pump under the conditions specified here.

– The storage location must be covered, dry, well ventilated, frost-free and as vibration-free as possible.

– The humidity should be constant.

– Store the pump horizontally.

– Preserve the pump if it is stored for a long time. Tightly seal the suction and pressure nozzles. Check the corrosion protection every 3 months.
– Rotate the shaft by hand once a month, e.g. rotate the fan on the motor.
– If stored for more than two years, check the motor shaft bearings before installation and exchange them if necessary. If stored for more than four years, check the motor shaft bearings before installation and generally exchange them.

6.2 Removing preserving agents

The pump is preserved on delivery. Depending on storage, the preservation lasts for six to 12 months.

Oils and waxes which are applied onto the surfaces are used as corrosion protection agents. It is not necessary to remove the corrosion protection agent.

6.3 Preserving the pump

The pump must be preserved after removal and prior to renewed storage. The corrosion protection agent to be used is dependent on the materials that are used and the operating conditions. Oils or waxes are suitable as corrosion protection agents. If you are uncertain which to choose, contact the manufacturer.

The preservation must be checked approx. every 3 months and refreshed if necessary.

⚠ WARNING

Risk of contamination when pumping pumped fluids that can be dangerous to health and the environment

Pumped fluids that can be dangerous to health and the environment can chemically burn, poison or otherwise injure persons and damage the environment.

– Completely decontaminate the pump prior to preservation.

⚠ WARNING

Risk of contamination due to corrosion protection agents that can be dangerous to health and the environment

Corrosion protection agents that can be dangerous to health and the environment can chemically burn, poison or otherwise injure persons and damage the environment.

– Observe the safety data sheet.
– Avoid direct contact with the corrosion protection agent.
– Wear safety gloves and safety glasses.

NOTICE

Damage to the sealing elements

Oils and greases can damage sealing elements with elastomers made of EP rubber.

– Avoid contact with oils and greases.

Prerequisites

- The pump has been removed, cleaned and decontaminated if necessary.

Procedure

1. Firmly screw in the venting screw(s) and drain screw(s).
2. Remove the pump according to the instructions in Chapter 10.4.5 Removing the shaft seal, page 45, steps 1. to 13. Do not remove the shaft seal.
3. Install the pump according to the instructions in Chapter 10.4.6.3 Installing the casing, page 50. In this process, evenly and sparingly apply corrosion protection agent onto all metal surfaces in the interior in stages using a brush or an atomiser.
4. Seal the suction and pressure nozzles.

7 Installation

7.1 Safety during installation

Improper installation can lead to personal injury and property damage. Observe the following safety instructions.

– Installation must only be carried out by qualified and trained personnel.

– Observe the requirements for the installation location, see Chapter 7.2 Requirements for the installation site, page 26.

– Carry out installation in voltage-free condition.

– Observe the direction of flow.

– Secure the pipes and pump to prevent stumbling, and provide a safety area if necessary.

– Pay attention to noise emissions and fit soundproofing if necessary.

Observe the approved installation position, see figure. Any other installation position requires the approval of the manufacturer. Improper installation results in the risk of leaks at the feed lines and the risk of tearing off the pipe.

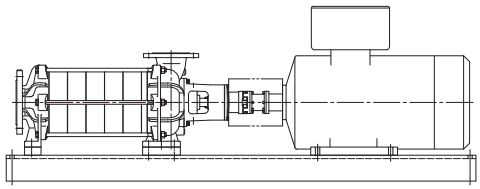

Fig. 7-1 Approved installation position

7.2 Requirements for the installation site

The installation location must meet the following requirements:

- The atmosphere must not be explosive.
- The installation location should be dust-free and not corrosive.
- The pump must be freely accessible for monitoring, servicing, maintenance, installation and removal.
- A sufficient air supply must be ensured for cooling the motor. The motor fan must not be blocked. Impermissible heating can cause damage to the motor.
- The pump must be protected against environment influences such as wind, rain, frost or sand.

The foundations must meet the following requirements:

- The foundations must be horizontal, flat, clean and free of oil.
- The foundations must be able to absorb the deadweight of the pump assembly and all operating forces.
- They must be sufficiently strong to ensure a functional set-up.
- Structural stability must be guaranteed during operation.

7.3 Requirements for the pipe system

The criteria listed in the following must be observed when designing the pipe system to ensure trouble-free and efficient pump operation:

- Route pressure and suction lines as per the respectively valid regulations and the relevant accident prevention regulations.
- Do not place strain on the pump due to the weight of the pipes.
- Never use the pump as a point for fixing the pipes.
- The pipe system must not cause any forces or torques (torsion, thermal expansion) to act on the pump that are higher than the permissible forces and torques, see Chapter 7.4 Permissible forces and torques, page 28.
- Provide suitable compensators to reduce the stresses that occur due to temperature fluctuations and vibrations.

- Provide slide gate valves close to the pump in the pressure and suction lines for maintenance work.
- Provide a non-return valve to avoid reverse flows.
- Providing a foot valve in the suction line for self-priming pumps during suction mode is recommended to prevent the pump and suction line from running empty during standstill.
- Use a suction strainer or filter to keep impurities in the pumped fluid away from the pump. No air from the fluid level or swirled-up dirt from the 'sump' may enter the suction line via the suction strainer in this case. Regularly clean the suction strainer and filter.
- Dimension the rated pipe widths comparatively large. Using rated widths that correspond at least to those of the pump connections is recommended.
- Design fittings so that they constrict the full pipe cross-section as little as possible.
- Always design the suction line as short and straight as possible in order to minimise pressure losses and achieve a high $NPSH_A$.
- Route the suction line without raised points in order to avoid gas accumulations.
- Position unavoidable pipe bends on one level only in order to avoid extensive pipe flow turbulence.
- Wherever possible, design cross-section extensions with an extension angle of < 8° to minimise pressure losses and prevent flow separation.
- Provide a straight pipe section with a length that is five times the inner diameter of the suction flange as a settling section between the suction flange and upstream fittings, cross-section changes or pipe deflections in order to avoid additional pressure losses and cavitation in the event of flow onto the pump impeller. Shorter settling sections are possible but can affect the hydraulic performance of the pump and/or lead to cavitation.
- Route the suction line to the pump with a descent of at least 10° for admission mode, and an ascent of at least 10° for suction mode, to avoid air pocket formation.
- Guarantee that the fluid level in the suction vessel is located a vertical distance of at least four times the inner diameter of the suction line above the inlet into the suction line in order to avoid air-sucking surface vortices.
- Round the transition from the suction vessel to the suction line or provide it with a chamfer to avoid cavitation in the pump inlet. This particularly applies in the case of pumped fluids that are close to or in boiling state.
- In the case of a pumped fluid that is close to or in boiling state, first route the suction line downstream of the suction vessel downwards over the longest possible section in order to prevent pumped fluid degassing.

7.4 Permissible forces and torques

The force and torque data apply to static pipe loads.

Information

Forces and torques for materials that are not listed will be provided on request.

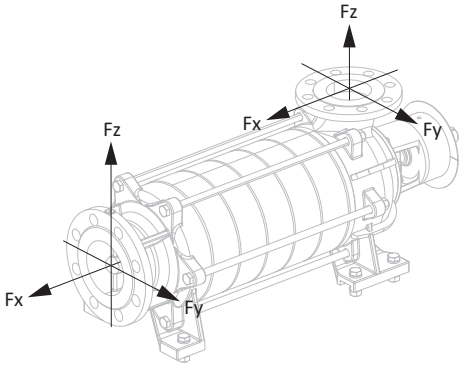

Fig. 7-2 Permissible forces and torques

Forces and torques for cast iron (0.6025) at 20°C

	Pressure fitting						**Suction nozzle**				
	Forces [N]						**Forces [N]**				
∅ DN	**Fy**	**Fz**	**Fx**	**∑F***	**∑M***	**∅ DN**	**Fy**	**Fz**	**Fx**	**∑F***	**∑M***
100	945	1175	1050	1840	910	**125**	1245	1120	1380	2170	1067

*∑F and ∑M are vector sums of the forces and torques

Tab. 7-1 Forces and torques for cast iron

7.5 Requirements for the electrical connection

The following requirements must be observed when connecting the motor:

– To protect the pump and the motor, always install overload protection, e.g. a motor circuit breaker. Operation without overload protection is impermissible.

– Observe the connection values and circuit type on the motor type plate. The specified voltage must not be exceeded.

– Earth the pipes and pump.

Information

The power must be reduced as specified by the motor supplier if the pump is operated at ambient temperatures over 40°C or at installation heights over 1000 m (above MSL).

The motor limiting data with regard to the insulation material class and degree of protection must be adhered to.

The enclosed, separate operating manual must be observed for other motors that are supplied.

Tightening torques for terminal board connections on the motor

Thread	Tightening torque [Nm]
M4	0.8 to 1.2
M5	1.8 to 2.5
M6	2.7 to 4.0
M8	5.5 to 8.0
M10	9.0 to 13.0
M12	14.0 to 20.0
M16	27.0 to 40.0

Tab. 7-2 Tightening torques depending on the thread

7.6 Complete pump

Upon delivery of the expansion stages N, NK and G, the pumps need to be completed before installation.

In all cases, the pump and motor must be mounted on a common base plate.

7.6.1 Requirements for the base plate

Base plates provided by the customer must meet the following requirements.

The base plate and the pump support should be configured so that the forces and torques occurring can be absorbed, see Chapter 7.4 Permissible forces and torques, page 28. The configuration needs to ensure that the maximum offset values between the motor and pump shaft are observed. Misalignment due to mechanical forces – for example, heat expansion or hydraulic pipeline thrust – has to be minimised as far as possible.

The base plate must cover the area under the support structure of the pump and motor. The underside of welded base plates must be reinforced under the pump and motor mount with cross members that are welded on.

7.6.2 Notes for fitting the coupling

A coupling can be provided by the customer for pumps with a free shaft end (expansion stage N). The coupling used needs to meet the requirements of the pump. The following section provides important information on the selection and assembly of a coupling.

Only elastic couplings may be used.

The coupling hub should be at least 58 mm long and have a bore diameter of Ø32 mm H7. The key groove must comply with DIN 6885-1. The coupling must be secured/pre-tensioned at the front. The tightening torque for the screw fastening on the front is 45 to 50 Nm.

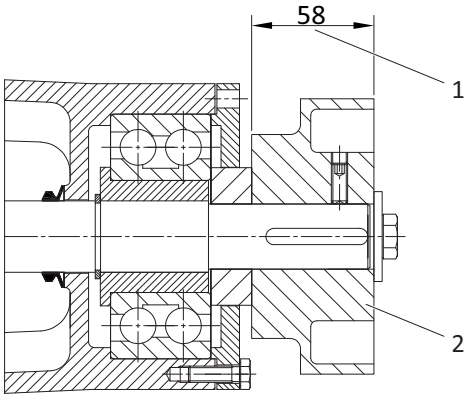

Fig. 7-3 Example for assembly of the coupling hub

1 Hub length
2 Coupling hub

A spacer washer can be used for shorter coupling hubs. The required hub length is reduced as a result.

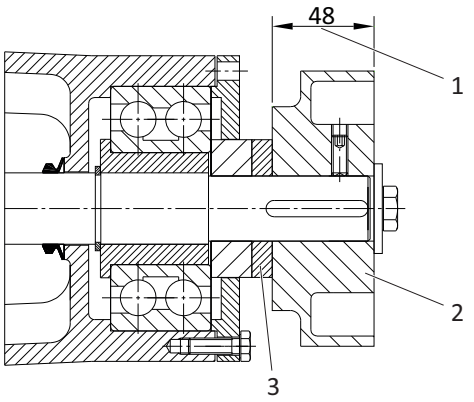

Fig. 7-4 Example for assembly of the coupling hub with spacer washer

1 Hub length
2 Coupling hub
3 Spacer washer

7.6.3 Mount motor

If the pump is supplied without a motor, the motor must be connected to the pump.

⚠ WARNING

Weight of the pump

There is a risk of crushing and abrasions during installation.

– Note the weight of the pump and the motor.
– Always raise the pump and the motor with a second person or transport them using suitable lifting equipment.
– Wear protective gloves and safety shoes.
– Always mount the pump and motor horizontally.

NOTICE

Improper installation

The pump can be damaged due to improper installation.

– During installation, keep all contact surfaces clean and free from foreign objects.
– Do not scratch contact surfaces.
– Observe tightening torques, see Chapter 10.4.1 Tightening torques, page 42.

Prerequisite

- The pump and motor are mounted on the base plate. The screws required for this are just loosely fitted.

Procedure

1. Push the pump and motor along the slots to the outside.

   NOTE! Continue with step 10 for versions with pre-assembled, pump-side coupling half.

2. Unscrew the threaded pins from the coupling halves far enough so that they do not collide with the keys.

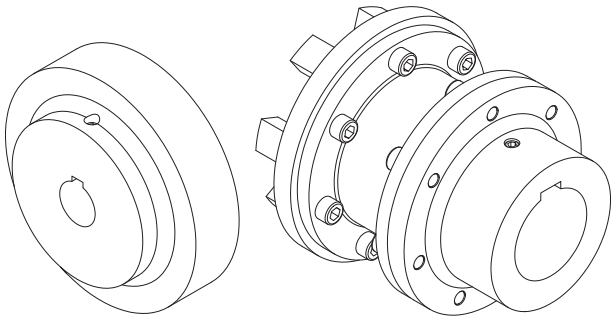

Fig. 7-5 Pump-side and motor-side halves of the coupling with spacer and cam ring

3. Clean the shaft ends.

4. Fit the keys at both ends of the shaft.

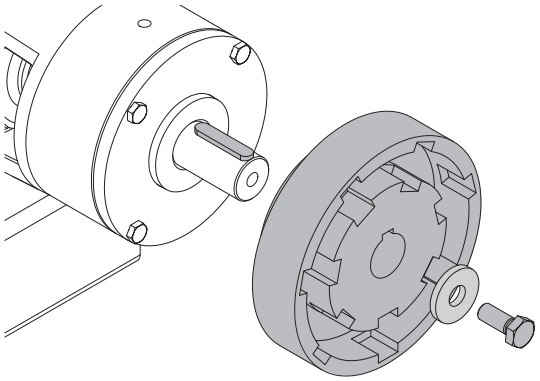

Fig. 7-6 Pump shaft and pump-side half of the coupling

5. Apply MoS2 lubrication paste (e.g. Microgleit LP 405) to the shaft ends.
6. If necessary, push a spacer washer onto the pump shaft, see Chapter 7.6.2 Notes for fitting the coupling, page 29.
7. Push the pump-side half of the coupling onto the pump shaft so it is flush.

   ATTENTION! The coupling half can be heated to a maximum of 150°C to make it easier to push on. Remove coupling package (elastomer elements) before heating.
8. Screw in the fastening screw with the washer and tighten to the specified tightening torque.
9. Screw in the threaded pin and tighten to the specified tightening torque.
10. Push the spacer sleeve onto the motor shaft up to the shaft join stop.

    NOTE! The motor-side half of the coupling can also be fitted without a spacer sleeve. The spacer sleeve is only used as a stop for the motor-side half of the coupling.

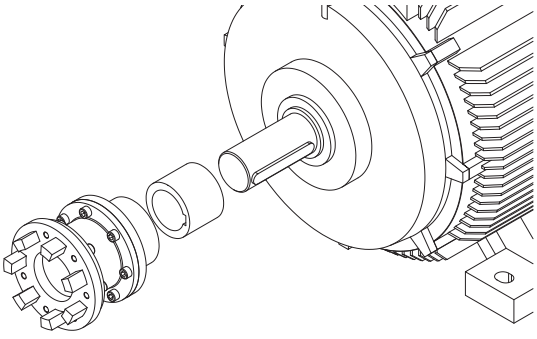

Fig. 7-7 Motor-side coupling half (unit consisting of half of coupling, spacer and cam ring) and spacer sleeve

11. Push the motor-side coupling half (unit consisting of half of coupling, spacer and cam ring) onto the motor shaft so it is flush.

    ATTENTION! The coupling half can be heated to a maximum of 150°C to make it easier to push on.

    NOTE! Greater radial runout divergence can occur due to unfavourable addition of the individual axial and radial runout divergences of the motor-side coupling parts. The radial runout divergence can be reduced by changing the bolt-on position of the coupling parts.

12. Screw in the threaded pin and tighten to the specified tightening torque.

13. ATTENTION! The coupling package (elastomer elements) can be damaged by higher temperatures. If the coupling halves were heated before being pushed on, they must first cool down. The temperature must be less than 80°C.

    Insert the coupling package (elastomer elements) into the pump-side half of the coupling.

14. Tighten the screws to the specified tightening torque.

15. Move the motor and pump along the slots until the cams engage in the coupling package (elastomer elements).

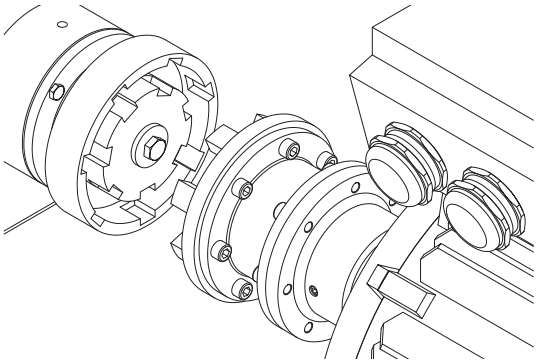

Fig. 7-8 Pump-side and motor-side halves of the coupling

16. Push the motor and pump further until the specified gap measurement ΔKa is almost reached.

17. Align motor and pump shaft, see Chapter 7.8 Align the shafts., page 35.

18. Tighten the screws on the motor and pump feet to the specified tightening torque.

19. Check the alignment of the motor and pump shaft and align again if necessary. Repeat the alignment process until the permissible offset values are met.

20. Install the coupling guard.

7.7 Installing the pump

⚠ WARNING

Weight of the pump

There is a risk of crushing and abrasions during installation.

– Note the weight of the pump.
– Transport the pump using suitable lifting equipment.
– Wear protective gloves and safety shoes.

NOTICE

Checking the direction of rotation without pumped fluid

Operation without a pumped fluid is impermissible. Dry running for even a short time to check the direction of rotation can damage the mechanical seal.

– Fill and ventilate the pump before checking the direction of rotation.

Prerequisite

- Corrosion protection agent has been removed if necessary.
- Flange covers have been removed.
- The pump and motor are mounted on a common base plate.
- The system is voltage-free and secured to prevent reactivation.
- There are no foreign objects in the pump.

Procedure

1. Position the pump at the installation location.
2. Align the pump.
3. Bolt the base plate to the foundation.
4. If the pump housing has two pump feet, loosen the pump foot from the suction casing. This prevents thermally related tensions.
5. Check the shaft alignment and set if necessary, see Chapter 7.8 Align the shafts., page 35.

   WARNING! Install the coupling guard again after aligning the shaft. There is a risk of injury.
6. Connect pipes.
7. Connect the motor according to the wiring diagram.
8. Protect cable glands to prevent dust and moisture from entering.

9. Fill and ventilate the pump.
10. Check the direction of rotation.

    Briefly switch on the motor and immediately switch it off again. Monitor the direction of rotation of the fan impeller. The direction of rotation must correspond to the direction of rotation arrow. If the direction of rotation is incorrect, check the electrical connection on the motor, and also check the switchgear if necessary.

7.8 Align the shafts.

The motor shaft and the pump shaft are connected by the coupling. Ideally, both shafts are exactly on one axis. However, in practice, offset values result. These offset values must lie within permissible limits. If the limits are exceeded, higher mechanical loading results and thus greater wear.

The offset values must be checked after each time the pump is installed, and be corrected as necessary.

The permissible offset values depend on the size. The following details apply to all couplings that are supplied with the pump. If a coupling provided by the customer is used, the permissible offset values should be taken from the coupling documentation.

A straightedge can be used to determine angular and radial offset. A feeler gauge is used for the axial offset.

The offset values can be calculated precisely with a laser measuring instrument.

The pump and motor are moved on the base plate for adjustment. If necessary, spacers can be added to the motor or pump foot.

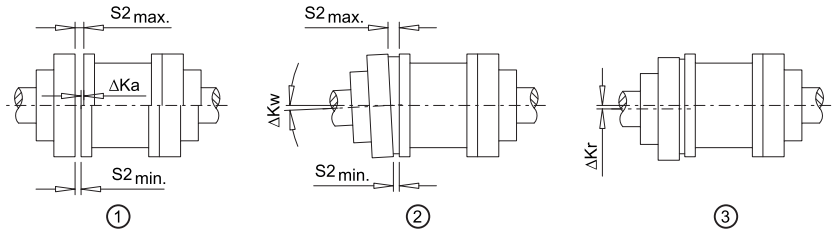

Fig. 7-9 Offset values

1 Axial offset, ΔKa
2 Angular offset, ΔKw
3 Radial offset, ΔKr

Axial offset, ΔKa

Set the axial offset ΔKa to a value within the permissible tolerance ranges of the measurement S2.

HDS 135	S2 = 5mm
HDS 172	S2 = 6 mm

Angular offset, ΔKw

Calculate value ΔS2 ($\Delta S2 = S2_{max} - S2_{min}$). The calculated value ΔS2 may not exceed the value $\Delta S2_{perm}$.

HDS 135 $\Delta S2_{perm}$ = 0.15 mm (3,000 rpm)
HDS 172 $\Delta S2_{perm}$ = 0.20 mm (3,000 rpm)

Radial offset, ΔKr

Calculate value ΔKr. The calculated value KR may not exceed the value ΔKr_{perm}.

HDS 135 ΔKr_{perm} = 0.15 mm (3,000 rpm)
HDS 172 ΔKr_{perm} = 0.20 mm (3,000 rpm)

8 Removal

8.1 Safety during removal

Improper removal can lead to personal injury and property damage. Observe the following safety instructions.

– Removal must only be carried out by qualified and trained personnel.
– Carry out removal in voltage-free and unpressurised condition.
– Observe the statutory regulations when pumping pumped fluids that can be dangerous to health and the environment.
– Carry out removal carefully. Do not use force.

8.2 Removing the pump

⚠ WARNING

Weight of the pump
There is a risk of crushing and abrasions during removal.
– Note the weight of the pump.
– Transport the pump using suitable lifting equipment.
– Wear protective gloves and safety shoes.
– Secure the pump to prevent it from tipping during removal.

⚠ WARNING

Risk of contamination when pumping pumped fluids that can be dangerous to health and the environment

Pumped fluids that can be dangerous to health and the environment can chemically burn, poison or otherwise injure persons and damage the environment.

– Avoid direct contact with the pumped fluid.
– Wear personal protective equipment. If necessary, wear a protective mask.
– Collect escaping pumped fluid and dispose of it properly.
– Decontaminate and flush the pipe system and pump.

Prerequisites

- The system/pump is switched off and depressurised.
- The pipe system and pump have been flushed and decontaminated if necessary.
- The pump is at ambient temperature.

Procedure

1. Close the slide gate valves in the pressure and suction lines.
2. Switch off the pump's voltage and secure it to prevent reactivation.
3. Disconnect the electrical connections and secure the cable ends.
4. Remove the earthing from the pump.
5. Place a collection container for collecting the pumped fluid or the flushing fluid beneath the pump.
6. Unscrew the drain screw.
7. Unscrew the venting screw.
8. Drain the pumped fluid or flushing fluid into a collection container.
9. Screw in the drain and venting screws.
10. Release the pressure-side flange connection.
11. Release the suction-side flange connection.
12. If present, release the fasteners on the foundation.
13. Lift the pump with the motor out from the pipe system.
14. Place the pump down on a horizontal, firm surface and secure it to prevent tipping.
15. Preserve the pump if it is stored for a long time, see Chapter 6.3 Preserving the pump, page 24.

9 Operation

9.1 Safety during operation

Improper operation can lead to personal injury and property damage. Observe the following safety instructions.

- Only operate the pump in flawless condition. Immediately shut off the system and secure it to prevent reactivation in the event of damage, leaks, overheating, unusual vibrations and noises.
- Only operate the pump within the pipe system.
- Only operate the pump when all safety devices are installed and functional.
- The pump can become extensively heated due to pumping hot pumped fluids. Do not touch the pump during operation. Wear protective gloves when working in the vicinity of the pump.
- The pump's noise emissions can exceed the statutory limit values. Wear ear protectors when remaining in the vicinity of the running pump.
- Exceeding the permissible pressure and temperature range can lead to leaks and cause the pump to burst. Adhere to the pump's pressure and temperature range, see type plate and chapter 1.2 Applicable documents, page 6.
- In the event of a fire, a hot pump can burst due to the use of cold extinguishing agent. Do not unnecessarily cool the pump excessively when extinguishing.
- Damage to or destruction of direction of rotation-dependent shaft seals if the pump is operated with the incorrect direction of rotation. Operate the pump in the specified direction of rotation.
- Damage to the shaft seal if the pump is operated without pumped fluid. Fill and ventilate the pump before commissioning it.
- Damage to or destruction of direction of rotation-dependent shaft seals if reverse flows rotate the impeller counter to the specified direction of rotation. Prevent reverse flows.

9.2 Safety when operating explosion-protected pumps

The following safety information must be observed when operating explosion-protected pumps. Non-observance can lead to the escape of pumped fluids that are harmful to health and the environment and to explosions.

- Impermissible operating modes can lead to potential ignition sources. The operating limits with respect to the delivery volume, rotational speed, density, head, working temperature and motor output may not be exceeded. The pump may only be operated with the approved pumped fluid.

– Dry running can lead to the exceedance of the permissible temperature limits.

  Always operate the pump filled and completely ventilated.

  NOTE! Dry running can also occur with an excessively high gas content in the pumped fluid. Operation outside of the specified operating parameters can also lead to dry running as a result of evaporation or cavitation.

– Ensure a sufficiently high supply pressure.

– Operation against closed slide gate valves can lead to the exceedance of the permissible pressure and temperature limits.

  Do not operate the pump against closed slide gate valves.

– An excessively high motor switching frequency can lead to increased surface temperatures on the motor.

  Observe information on the switching frequency in the manufacturer's documentation.

– Defective bearings and bearing seals can lead to overheating.

  Regularly check running noises. Immediately shut down the system and secure it to prevent reactivation in the event of overheating, unusual vibrations and noises.

– When draining tanks and/or containers, implement suitable measures (e.g. fill level monitoring) to protect the pump from dry running.

9.3 Initial commissioning

Prerequisite

- The pipe system and pump have been flushed.

Procedure

1. Fill the suction line and pump with pumped fluid. Ventilate the suction line and pump.
2. Completely open the slide gate valve on the suction line.
3. Open the slide gate valve in the pressure line slightly.

   NOTE! Starting up against a closed non-return valve is possible.

4. Switch on the motor.

   The pump now pumps against the slightly open slide gate valve in the pressure line.

5. Immediately after reaching the operating speed, slowly regulate the slide gate valve in the pressure line to the operating point.

9.4 Operation

The pump is usually controlled by the overall system's central control system. The following points must be taken into consideration during operation:

– Regulating the pump output via the suction-side slide gate valve can cause damage to the pump and the shaft seals. Regulate the pump output exclusively using the pressure-side slide gate valve.

– If the slide gate valve in the pressure line is closed abruptly or for a long time during operation, this can lead to pressure surges in the pump and therefore to damage to the pump and/or the system. Do not close the slide gate valve in the pressure line abruptly during operation.

– Do not operate the pump against the closed slide gate valve.

– Pumps that are not required (redundancy) must be switched on 1x a week, as the impeller can otherwise seize and shaft seal leaks can develop.

– Check shut-down pumps for damage before recommissioning.

9.5 Ending operation

Procedure

1. Close the slide gate valve in the pressure line.

   If a non-return valve is installed and there is sufficient back-pressure in the pressure line, the slide gate valve can remain open.

2. Switch off the pump motor.

3. Close the slide gate valve in the suction line to prevent running empty.

   Drain the pump completely at temperatures below freezing or in the event of long down times.

10 Maintenance

10.1 Safety during maintenance

Improper maintenance can lead to personal injury and property damage. Observe the following safety instructions.

– Perform all maintenance work at the specified intervals.

– Maintenance work must only be carried out by qualified and trained personnel.

– When replacing components, use only original spare parts or spare parts approved by the manufacturer.

– Carry out maintenance work only when the pump has been depressurised and drained.
– Perform maintenance work in voltage-free condition. Secure the system to prevent reactivation.
– When pumping hot or very cold pumped fluids, wait until the pump has reached the ambient temperature.
– Close the slide gate valves at the suction nozzle and the pressure nozzle.
– Completely drain the pump casing before opening the pump. Collect the pumped fluid in suitable containers. Exercise particular care with pumped fluids that pose a risk to health and the environment. Wear personal protective equipment. If necessary, wear a protective mask.
– Decontaminate the pump prior to maintenance work in the case of pumped fluids that pose a risk to health and the environment. Document decontamination.
– Note the weight of the pump. There is a risk of crushing and abrasions. Use suitable lifting equipment. Wear protective gloves and safety shoes.
– Observe tightening torques, see Chapter 10.4.1 Tightening torques, page 42.

10.2 Explosion protection information

Explosion protection information

Special requirements apply to the maintenance of explosion-protected pump assemblies. Non-observance leads to a risk of explosion. Observe the following explosion protection information.

– Perform the maintenance work under the exclusion of an explosive atmosphere.
– Avoid the occurrence of sparks.
– Avoid electrostatic discharge.
– Observe the local safety regulations.

10.3 Maintenance schedule

Assembly	Maintenance activity	Interval
Pump	Check delivery data (pressure, delivery volume).	Daily
	Check pump operation (smooth, vibration-free).	Daily
	Check pump for leaks (casing and shaft seal).	Daily
	Check that screws are firmly seated, tighten if necessary, see Chapter 10.4.1 Tightening torques, page 42. WARNING! Check only when the pump has been switched off.	Every 6 months

Assembly	Maintenance activity	Interval
Motor	Check power consumption.	Daily
	Check shaft bearings (temperature, vibrations).	Daily
	Exchange shaft bearings.	After 20,000 hours of operation, but after 3 years at the latest
Coupling	Check the backlash of the coupling, see Chapter 10.4.4, page 44.	3 months after initial commissioning Then annually
Pump and motor	Remove dust, dirt and deposits. WARNING! Clean only when the pump has been switched off.	Depending on the degree of soiling
	Check earthing and potential equalisation.	Daily
Ball bearing	Check the bearing housing for signs of overheating. WARNING! In the event of discolourations and/or unusual noises, immediately shut down the system and have the ball bearing exchanged.	Daily
	Exchange ball bearing	After 20,000[1] hours of operation

[1] At a temperature over 70°C, the service life of the ball bearing is halved per 15°C temperature increase.
Example:
Temperature ≤ 70°C, service life 20,000 hours of operation
Temperature = 85°C, service life 10,000 hours of operation

Tab. 10-1 Maintenance activities and intervals

10.4 Maintenance work

10.4.1 Tightening torques

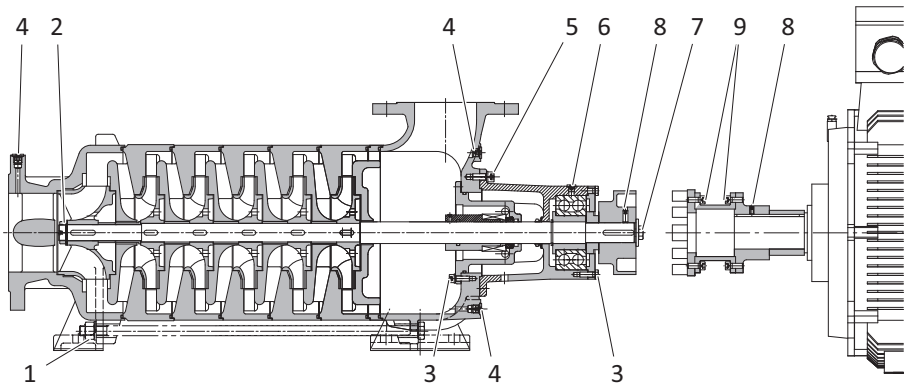

Fig. 10-1 Tightening torques

Item	Thread	Tightening torque [Nm]
1	M16	200
2	M26 × 1.25	55
3	M8	25
4	G¼	20
5	M10	50
6	G⅛	20
7	M12	45 to 50
8	M8	8
	M10	15
9	M8	17.5
	M10	35

Tab. 10-2 Tightening torques depending on the thread

10.4.2 Use auxiliary structure

The removal and fitting of assemblies is possible when the pump is in horizontal or vertical position. The manufacturer recommends the vertical position as the individual components are easier to access. With vertical removal, an auxiliary structure should be used that secures the pump against tipping over. The auxiliary structure is not supplied. The following figure shows an example of such an auxiliary structure including the dimensions.

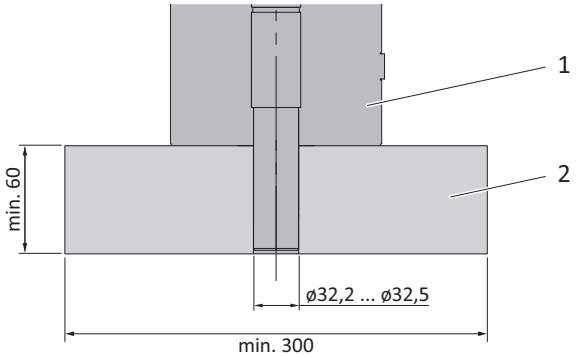

Fig. 10-2 Auxiliary structure for vertical removal and fitting

1 Pump without coupling half
2 Auxiliary structure

When an auxiliary structure is used, the pump-side half of the coupling must be removed. The pump may not be standing on the coupling half.

10.4.3 Exchanging shaft bearings

Defective and worn shaft bearings lead to consequential damage. Vibrations, increased noise emissions and increased power consumption with otherwise constant operating conditions indicate wear.

The temperature of the shaft bearing must not exceed 90°C (measured at the motor, outer side, and on the pump bearing housing).

The shaft bearings have lifetime lubrication, are maintenance-free and cannot be re-lubricated. Under normal operating conditions, the shaft bearings should be exchanged after 20,000 hours of operation, but after 3 years at the latest. In the case of high ambient temperatures, corrosive or very dusty environments, the shaft bearings must be checked more frequently and exchanged earlier if necessary.

To exchange the shaft bearings, contact the motor manufacturer or commission a specialist workshop.

10.4.4 Check the backlash

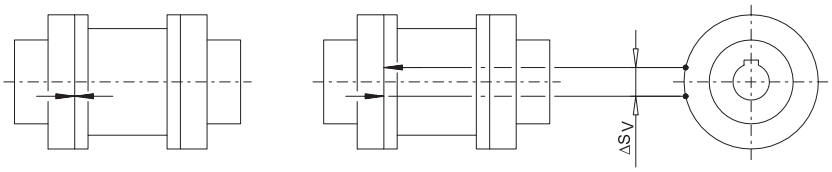

Fig. 10-3 Check the backlash

Size	Maximum permissible backlash ΔSv [mm]
HDS 135	10.5
HDS 172	9.0

Prerequisites

- The pump assembly is switched off and secured to prevent reactivation.

Procedure

1. Remove the coupling guard.
2. Turn the motor-side coupling half up to the stop.
3. Put marking on both coupling halves, see figure.
4. Turn the motor-side coupling half in the opposite direction up to the stop.

   The markings will move apart as a result. The distance between the markings is the backlash ΔSv.
5. If the value is smaller than the permissible backlash, the coupling guard can be fitted and the pump assembly put into operation.

   If the value is greater than the permissible backlash, shut off the pump assembly and contact the service department.

10.4.5 Removing the shaft seal

Removing the shaft seal is similar on all pumps. The example shown here can be applied to all pumps. Refer to the spare part drawing for the specific design.

The numbers in **bold** print in the legend correspond to the part numbers on the spare part drawing.

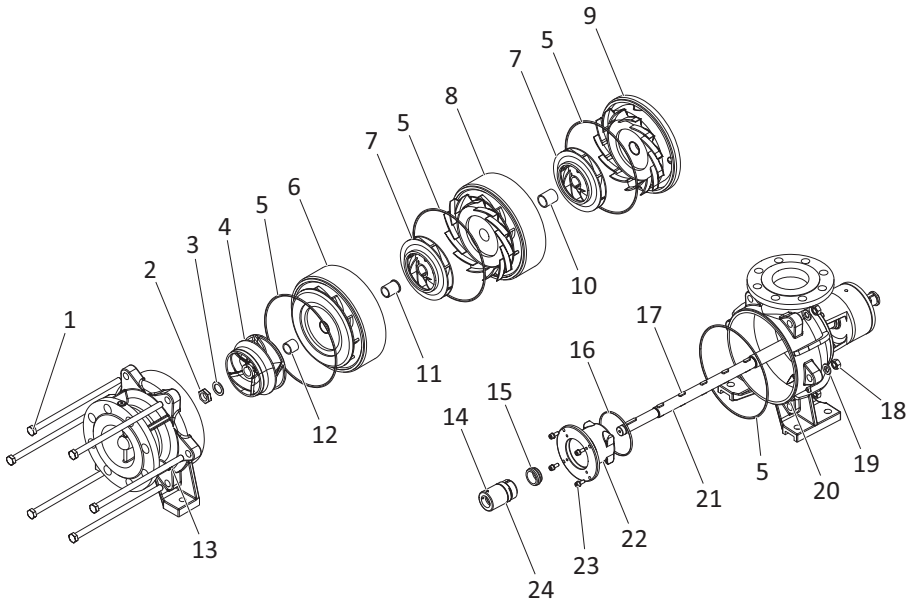

Fig. 10-4 Removing the shaft seal, example

1 **905** Connecting screw
2 **922** Impeller nut
3 **930** Tooth lock washer
4 **230.1** Impeller
5 **412** O-ring
6 **108.1** Stage casing
7 **230** Impeller
8 **108** Stage casing
9 **117** End stage casing
10 **525.1** Spacer sleeve
11 **525** Spacer sleeve
12 **545** Spacer sleeve
13 **106** Suction casing
14 **904** Threaded pin
15 **433** Counter ring
16 **412.1** O-ring
17 **940** Key
18 **920** Nut
19 **554** Washer
20 **107** Delivery casing
21 **210** Shaft
22 **476** Counter ring carrier
23 **914** Allen screw
24 Shaft seal consisting of **523** relief sleeve, **412.2** O-ring and **433** mechanical seal

NOTICE

Improper removal

Improper removal can cause damage to the sealing surfaces.

– Work with particular caution.
– Avoid damaging the sealing surfaces.

Prerequisite

- The pump has been cleaned and decontaminated if necessary.
- The pump has been separated from the motor.
- The pump has been separated from the base plate.
- NOTE! Only applies to vertical removal.

  The pump-side half of the coupling has been removed. The pump is standing vertically and is secured to prevent tipping, see Chapter 10.4.2 Use auxiliary structure, page 43.

Procedure

1. Release the connecting screws **(1)** and remove the suction casing **(13)**.
2. Remove the O-ring **(5)**.
3. Unscrew the impeller nut **(2)** and remove together with the tooth lock washer **(3)**.
4. Remove the impeller **(4)**.

   Screw forcing bolts into the threaded holes to release the impeller if it is seized.

   NOTE! The first impeller of the NHKE does not have any threaded holes for forcing screws.
5. Remove the spacer sleeve **(12)**.
6. Remove the key(s) **(17)** from the shaft **(21)**.
7. Remove the stage casing **(6)**.
8. Press the spacer sleeve **(11)** out of the stage casing **(6)**.
9. Remove the O-ring **(5)**.
10. Remove the impeller **(7)**.

    Screw forcing bolts into the threaded holes to release the impeller if it is seized.
11. Remove the key(s) **(17)** from the shaft **(21)**.
12. Remove the stage casing **(8)**.
13. Press the spacer sleeve **(10)** out of the stage casing **(8)**.
14. Repeat steps 9. to 13. for all stage casings.

15. Remove the O-ring **(5)**.
16. Remove the impeller **(7)**.

    Screw forcing bolts into the threaded holes to release the impeller if it is seized.
17. Remove the key(s) **(17)** from the shaft **(21)**.
18. Remove the end stage casing **(9)**.
19. Mark the position of the relief sleeve **(24)** on the shaft **(21)**.
20. Loosen the threaded pins **(14)**.
21. Carefully pull the shaft seal consisting of **523** relief sleeve, **412.2** O-ring and **433** mechanical seal (rotating part) off the shaft **(21)**.
22. Loosen and remove the Allen screws **(23)**.
23. Remove the counter ring carrier **(22)**.

    NOTE! The counter ring carrier has threaded holes for screws to enable the counter ring carrier to be pulled out.
24. Press the counter ring **(15)** out of the counter ring seat **(22)**.

10.4.6 Installing the shaft seal

Installing the shaft seal is similar on all pumps. The following chapters describe the installation of the different types of shaft seals. Refer to the spare part drawing for the specific design.

NOTICE

Damaged and contaminated sealing elements
Improper installation can damage or contaminate sealing elements and sealing surfaces. This can result in leaks.
– Work with particular caution and pay attention to cleanliness.
– Do not touch sliding surfaces with fingers.
– Avoid damaging the sealing elements and sealing surfaces.
– Use only undamaged components.
– Sealing elements with elastomers made of EP rubber must be free of oil and grease. Prevent contact with oils and greases.

To install the shaft seal, the pump should be positioned vertically on the motor and secured to prevent tipping. If necessary, use an auxiliary structure, see Chapter 10.4.2 Use auxiliary structure, page 43.

Moisten the elastomers of the sealing elements with low-surface-tension water.

10.4.6.1 Relieved mechanical seal

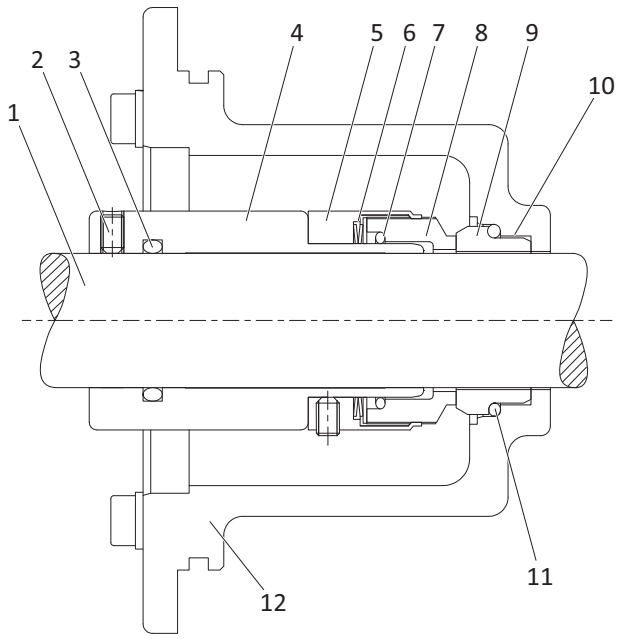

Fig. 10-5 Design of the relieved mechanical seal with sinusoidal spring

1 Shaft
2 Threaded pin
3 O-ring
4 Relief sleeve
5 Drive collar
6 Sinusoidal spring
7 O-ring
8 Sliding ring
9 Counter ring
10 Counter ring seat in the counter ring carrier
11 O-ring
12 Counter ring carrier

10.4.6.2 Installing the relieved mechanical seal

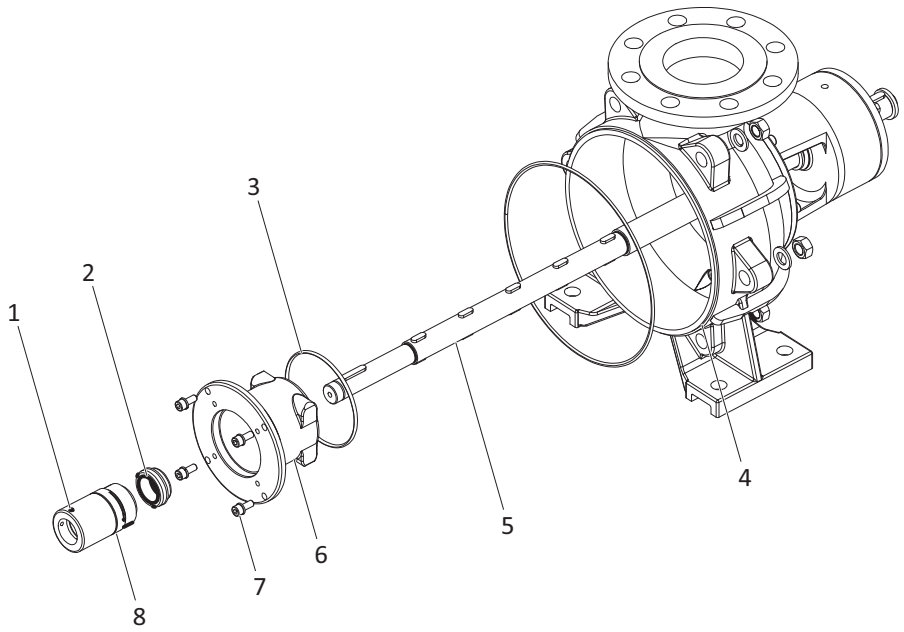

Fig. 10-6 Installing the relieved mechanical seal

1 **904** Threaded pin
2 **433** Counter ring for the mechanical seal (fixed part)
3 **412.1** O-ring
4 **106** Delivery casing
5 **210** Shaft
6 **476** Counter ring carrier
7 **914** Allen screw
8 Shaft seal consisting of **523** relief sleeve, **412.2** O-ring and **433** mechanical seal (rotating part)

A suitable plastic tube can make it easier to push on the components.

Prerequisite

- NOTE! Only applies to vertical installation.

  The pump is secured to prevent tipping, see Chapter 10.4.2 Use auxiliary structure, page 43.

Procedure

1. Carefully press the counter ring **(2)** together with the O-ring into the counter ring seat in the counter ring carrier **(6)**.
2. Carefully push the counter ring carrier **(6)** over the shaft **(5)** and insert it into the delivery casing **(4)**.
3. Screw in the Allen screws **(7)** and only tighten them slightly at first.
4. Tighten the opposing Allen screws **(7)** to the specified tightening torque in each case.
5. Push the entire rotating unit **(8)** onto the shaft **(5)**.

6. Coat the threaded pin(s) **(1)** with screw locking fluid (e.g. Weicon AN302-42) and screw in. Do not tighten yet.
7. Press the rotating unit in the direction of the counter ring seat onto the shaft up to the marking and tighten the threaded pin(s) **(1)** to the specified tightening torque.
8. Continue with Chapter 10.4.6.3 Installing the casing, page 50.

10.4.6.3 Installing the casing

Installing the casing is similar on all pumps. The example shown here can be applied to all pumps. Refer to the spare part drawing for the specific design.

The numbers in **bold** print in the legend correspond to the part numbers on the spare part drawing.

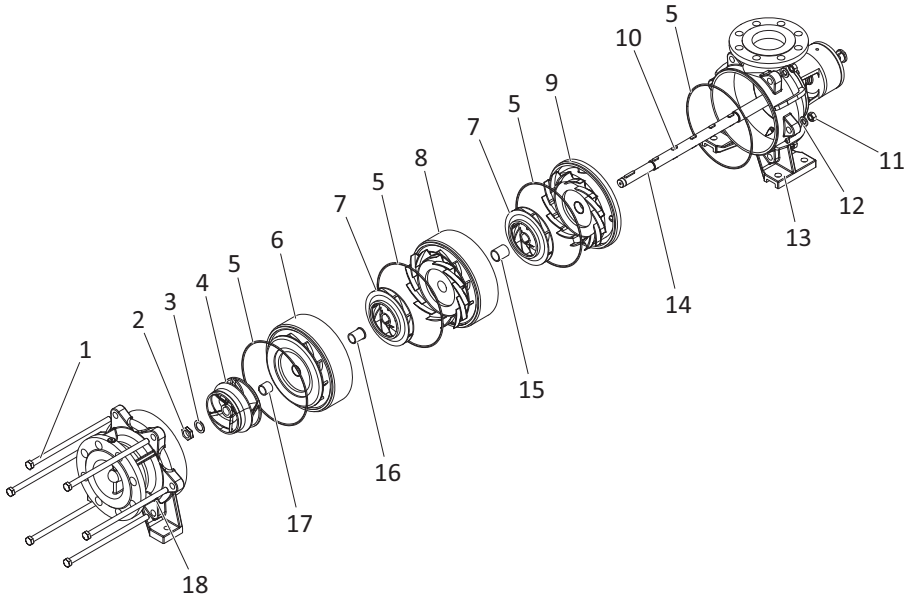

Fig. 10-7 Installing the casing, example

1 **905** Connecting screw
2 **922** Impeller nut
3 **930** Tooth lock washer
4 **230.1** Impeller
5 **412** O-ring
6 **108.1** Stage casing
7 **230** Impeller
8 **108** Stage casing
9 **117** End stage casing
10 **940** Key
11 **920** Nut
12 **554** Washer
13 **106** Delivery casing
14 **210** Shaft
15 **525.1** Spacer sleeve
16 **525** Spacer sleeve
17 **545** Spacer sleeve
18 **106** Suction casing

NOTICE

Improper installation

Improper fitting can cause damage to the sealing surfaces.

– Work with particular caution.
– Avoid damaging the sealing surfaces.

Prerequisite

- The delivery casing and the shaft seal are installed.
- The sealing elements and sealing surfaces do not reveal any damage and have been cleaned.

Procedure

1. Set up the pump vertically. Secure the pump to prevent it from tipping. If necessary, use an auxiliary structure to achieve the necessary stability, see Chapter 10.4.2 Use auxiliary structure, page 43.
2. First stretch the new O-ring **(5)** and insert it into the O-ring groove in the end stage casing **(9)**.
3. Place the end stage casing **(9)** on the delivery casing **(13)**.
4. Press the key **(10)** into the key groove located directly on the delivery casing.
5. Push the impeller **(7)** onto the shaft **(14)**.

   NOTE! Depending on the number of stages, the design can also consist of just the end stage casing. In this case, installation is continued with step 18.
6. First stretch the new O-ring **(5)** and insert it into the O-ring groove of the stage casing **(8)**.
7. Place the stage casing **(8)** onto the end stage casing **(9)**.
8. Insert the spacer sleeve **(15)** into the stage casing **(8)**.
9. Press a further key **(10)** into the next key groove.
10. Push a further impeller **(7)** onto the shaft **(14)**.
11. Repeat steps 6. to 10. for each additional stage casing.
12. First stretch the new O-ring **(5)** and insert it into the O-ring groove of the stage casing **(8)**.
13. Insert the spacer sleeve **(16)** on the rear side of the stage casing **(6)**.
14. Place the stage casing **(6)** on the stage casing **(8)**.
15. Push the spacer sleeve **(17)** over the shaft **(14)** until it rests on the spacer sleeve **(16)**.
16. Press a further key **(10)** into the next key groove.
17. Push the impeller **(4)** onto the shaft **(14)**.

18. First stretch the new O-ring **(5)** and insert it into the O-ring groove of the suction casing **(18)**.
19. Place the suction casing **(18)** onto the stage casing **(6)** or the end stage casing **(9)**.
20. Screw in the connecting screws **(1)** with washers **(12)** and nuts **(11)** and only tighten slightly at first.
21. Tighten the opposite connecting screws to the specified tightening torque in each case.

11 Faults

11.1 Safety during fault rectification

Improper fault rectification can lead to personal injury and property damage. Observe the following safety instructions.

- Fault rectification must only be carried out by qualified and trained personnel.
- When replacing components, use only original spare parts or spare parts approved by the manufacturer.
- Carry out fault rectification only when the pump has been depressurised and drained.
- Carry out fault rectification in voltage-free condition. Secure the system to prevent reactivation.
- When pumping hot or very cold pumped fluids, wait until the pump has reached the ambient temperature.
- Before opening the pump, close the slide gate valve at the suction nozzle and the pressure nozzle.
- Completely drain the pump casing before opening the pump. Collect the pumped fluid in suitable containers. Exercise particular care with pumped fluids that pose a risk to health and the environment. Wear personal protective equipment. If necessary, wear a protective mask.
- Decontaminate the pump prior to fault rectification in the case of pumped fluids that pose a risk to health and the environment. Document decontamination.

11.2 Fault table

Contact the manufacturer in the event of faults that are not listed here.

Fault	Cause	Fault rectification
Pump blocked	Bearing damage on the motor shaft	– Exchange shaft bearings.
	Impeller blocked	– Remove deposits and foreign objects from the interior of the pump.
Head/delivery rate too low	Pump and/or suction line not completely ventilated or filled	– Ventilate and fill pump and/or suction line.
	Suction head too high/system NPSH value too low	– Completely open the slide gate valve in the suction line. – Check the foot valve/suction strainer. – Increase the fluid level if necessary.
	Gas content in the pumped fluid too high	– Re-seal the suction line. – Check the suction strainer. – Increase the fluid level if necessary.
	Air pocket formation in the suction line	– Change the suction line. – Install a vent valve.
	Incorrect direction of rotation	– Check the electrical connection, change if necessary.
	Pump component wear	– Exchange components.
	Rotational speed too low	– Contact the manufacturer.
	Density/viscosity of the pumped fluid higher than specified in the order confirmation	– Contact the manufacturer.
Pump not running smoothly	Suction head too high/system NPSH value too low	– Completely open the slide gate valve in the suction line. – Check the foot valve/suction strainer. – Increase the fluid level if necessary.
	Air pocket formation in the suction line	– Change the suction line. – Install a vent valve.
	Pump running outside of the characteristic curve	– Re-regulate the operating point.
	Forces from the pipe system are acting on the pump	– Check pipe connections, the pump fastening and the pipe clamp mounting spacing, and correct if necessary.
Leaks on casing parts	Connecting screws loosened	– Tighten the connecting screws.
	Shaft seal worn	– Renew the shaft seal.

Fault	Cause	Fault rectification
Drive overloaded	Pump running outside of the characteristic curve	– Re-regulate the operating point.
	Rotational speed too high	– Contact the manufacturer.
	Density/viscosity of the pumped fluid higher than specified in the order confirmation	– Contact the manufacturer.
Shaft seal leaking extensively	Shaft seal worn	– Renew the shaft seal.
Motor protection tripping	Pump running outside of the characteristic curve	– Re-regulate the operating point.
	Rotational speed too high	– Contact the manufacturer.
	Density/viscosity of the pumped fluid higher than specified in the order confirmation	– Contact the manufacturer.
	Motor protection device not set correctly or defective	– Check the motor protection device, exchange if necessary.
Pump becomes hot	Suction head too high/system NPSH value too low	– Completely open the slide gate valve in the suction line. – Check the foot valve/suction strainer. – Increase the fluid level if necessary.
	Gas content in the pumped fluid too high	– Re-seal the suction line. – Check the suction strainer. – Increase the fluid level if necessary.
	Air pocket formation in the suction line	– Change the suction line. – Install a vent valve.
	Delivery rate too low	– Re-regulate the operating point.

Tab. 11-1 Causes and rectification of faults

12 Disposal

12.1 Safety during disposal

Improper disposal can lead to personal injury and property damage. Observe the following safety instructions.

- Disposal must only be carried out by qualified and trained personnel.
- Decontaminate the pump prior to disposal in the case of pumped fluids that pose a risk to health and the environment. Document decontamination.
- Note the weight of the pump and the individual components. There is a risk of crushing and abrasions. Use suitable lifting equipment. Wear protective gloves and safety shoes.
- Observe the statutory regulations concerning the disposal of industrial waste.

12.2 Disposing of the pump

Prerequisite

- The pump has been cleaned thoroughly and decontaminated if necessary.

Procedure

1. Properly disassemble the pump.
2. Separate components according to materials, e.g.:
   - Metal
   - Plastic
   - Electrical scrap
   - Greases and lubricants
3. Dispose of components according to local specifications or send for controlled disposal. Send reusable materials for recycling.

12.3 Returning

If necessary, the pump can be sent to the manufacturer for maintenance. The address can be found on the cover of these operating instructions.

Prerequisite

- The pump has been cleaned thoroughly and decontaminated if necessary.

Procedure

1. Fill in the certificate of unobjectionability completely.
2. Properly seal the pump openings.
3. Package the pump on a pallet for safe transport.
4. Send the pump and the certificate of unobjectionability to the manufacturer.

Information

Pumps without a certificate of unobjectionability will not be opened by the manufacturer.

13 Annex

13.1 Content of the declaration of conformity

EU Declaration of Conformity
according to EC Machinery Directive 2006/42/EC, Annex II, 1 A

We,

EDUR-Pumpenfabrik
Eduard Redlien GmbH & Co. KG
Edisonstraße 33
24145 Kiel
Germany

hereby declare that the machine designated in the following complies with the fundamental health and safety requirements of the EC Directive.

Designation of the machine:

NHE 100
NHKE 100

The precise type designation is located on the pump type plate.

Model designation and factory number, see cover sheet.

Applied harmonised standards:

DIN EN ISO 12100:2011
DIN EN 809:2012

Representative for compiling the relevant technical documents:

Tjark Kaeding (Head of Technical Department)
EDUR-Pumpenfabrik, Edisonstraße 33, 24145 Kiel, Germany

EU Declaration of Conformity
within the meaning of the EU ATEX Directive 2014/34/EU, Annex VIII

We,

EDUR-Pumpenfabrik
Eduard Redlien GmbH & Co. KG
Edisonstraße 33
24145 Kiel
Germany

hereby declare that the supplied version of the machine designated in the following complies with the regulations of the following European Directives:

2014/34/EU, Annex VII

Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres.

Designation of the machine:

NHE 100
NHKE 100

The precise type designation is located on the pump type plate. Model designation and factory number, see cover sheet.

ATEX marking:

⟨Ex⟩ II2G Ex h IIC T3 Gb, ⟨Ex⟩ II2G Ex h IIC T4 Gb

Compliance with the regulations of this Directive is demonstrated through adherence to the following standards:

DIN EN 1127-1:2019, DIN EN ISO 13237:2012, DIN EN ISO 80079-36:2016
DIN EN ISO 80079-37:2016

This declaration becomes invalid in the event of a change to the machine that is not coordinated with us.

The documentation required pursuant to 2014/34/EU Annex VIII is deposited with the following notified body:

Physikalisch-Technische Bundesanstalt
P.O. Box 3345
38023 Braunschweig
Germany

Representative for compiling the relevant technical documents:

Tjark Kaeding (Head of Technical Department)
EDUR-Pumpenfabrik, Edisonstraße 33, 24145 Kiel, Germany

13.2 Content of the declaration of incorporation

Declaration of incorporation
according to EC Machinery Directive 2006/42/EC, Annex II, 1 B

We,

EDUR-Pumpenfabrik
Eduard Redlien GmbH & Co. KG
Edisonstraße 33
24145 Kiel
Germany

that the incomplete machine designated in the following:

Designation of the machine:

NHE 100
NHKE 100

The precise type designation is located on the pump type plate.

Model designation and factory number, see cover sheet.

the following fundamental requirements of EC Machinery Directive 2006/42/EC, Annex I, are contained:

1.1.1.; 1.1.2.; 1.1.3.; 1.1.5.

Applied harmonised standards:

DIN EN ISO 12100: 2011
DIN EN 809: 2012

This incomplete machine may only be commissioned when it has been determined that the machine into which this incomplete machine is to be incorporated complies with the provisions of the Machinery Directive.

Representative for compiling the relevant technical documents:

Tjark Kaeding (Head of Technical Department)
EDUR-Pumpenfabrik, Edisonstraße 33, 24145 Kiel, Germany

13.3 Certificate of unobjectionability

The certificate of unobjectionability can also be downloaded in the service area of the EDUR homepage, www.edur.com.

CERTIFICATE OF UNOBJECTIONABILITY

Please complete this form in detail and attach it to the pump to be repaired.

This certificate of unobjectionability being sent by us, the signer,
with the pump and its component parts for inspection-/repair order,

Model:

Serial number:

Date of delivery:

Reason for inspection-/repair order:

Range of application:

Pumped medium:

☐ was **not** used for / in liquids hazardous to health or environment. Before dispatch / delivery the pump was drained carefully and cleaned inside and outside. During further handling particular safety measures will not be necessary.

☐ was used for / in liquids hazardous to health or environment.

- ☐ Before dispatch / delivery the pump was drained carefully and cleaned inside and outside. During further handling particular safety measures will **not** be necessary.
- ☐ Before dispatch / delivery the pump was drained carefully and cleaned inside and outside. Following safety measures will be necessary with regard to the pumped liquid and rinsing liquids:

Please attach the safety data sheet.

We confirm that the before mentioned information is correct and complete and that the dispatch / delivery is made according to the legal requirements.

Company name and address:

Phone:

Telefax:

E-Mail:

Name:

Position:

Date:

Company stamp/Signature:

Please use this delivery address for shipping units to us:
EDUR-Pumpenfabrik Eduard Redlien GmbH & Co. KG • Marie-Curie-Straße 15 • 24145 Kiel, Germany

Index

S

T

U

W

Manufacturer

EDUR-Pumpenfabrik
Eduard Redlien GmbH & Co. KG
Edisonstraße 33
24145 Kiel
Germany

+49 431 689868
info@edur.de
www.edur.com

Delivery address for returns

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Germany

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