Thermal Oil / Hot Water Pump

Etanorm-RSY

Installation/Operating Manual

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Installation/Operating Manual Etanorm-RSY

Original operating manual

Contents

Glossary

Back pull-out design

The complete back pull-out unit can be pulled out without having to remove the pump casing from the piping.

Back pull-out unit

Pump without pump casing; partly completed machinery

Certificate of decontamination

A certificate of decontamination is enclosed by the customer when returning the product to the manufacturer to certify that the product has been properly drained to eliminate any environmental and health hazards arising from components in contact with the fluid handled.

Discharge line

The pipeline which is connected to the discharge nozzle

Hydraulic system

The part of the pump in which the kinetic energy is converted into pressure energy

Pool of pumps

Customers/operators' pumps which are purchased and stored regardless of their later use.

Pump

Machine without drive, additional components or accessories

Pump set

Complete pump set consisting of pump, drive, additional components and accessories

Suction lift line/suction head line

The pipeline which is connected to the suction nozzle

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1 General

1.1 Principles

This operating manual is valid for the type series and variants indicated on the front cover.

The operating manual describes the proper and safe use of this equipment in all phases of operation.

The name plate indicates the type series and size, the main operating data, the order number and the order item number. The order number and order item number clearly identify the pump set and serve as identification for all further business processes.

In the event of damage, immediately contact your nearest KSB service facility to maintain the right to claim under warranty.

1.2 Installation of partly completed machinery

To install partly completed machinery supplied by KSB refer to the sub-sections under Servicing/Maintenance.

1.3 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel. (⇨ Section 2.3, Page 9)

1.4 Other applicable documents

Table 1: Overview of other applicable documents

Document	Contents
Data sheet	Description of the technical data of the pump (set)
General arrangement drawing/ outline drawing	Description of mating and installation dimensions for the pump (set), weights
Drawing of auxiliary connections	Description of auxiliary connections
Hydraulic characteristic curve	Characteristic curves showing head, NPSH required, efficiency and power input
General assembly drawing[1)]	Sectional drawing of the pump
Sub-supplier product literature[1)]	Operating manuals and other product literature describing accessories and integrated machinery components
Spare parts lists[1)]	Description of spare parts
Piping layout[1)]	Description of auxiliary piping
List of components[1)]	Description of all pump components
Assembly drawing[1)]	Sectional drawing of the installed shaft seal

For accessories and/or integrated machinery components observe the relevant manufacturer's product literature.

1.5 Symbols

Table 2: Symbols used in this manual

Symbol	Description
✓	Conditions which need to be fulfilled before proceeding with the step-by-step instructions
▷	Safety instructions
⇨	Result of an action
⇨	Cross-references

1 If agreed to be included in the scope of supply

Symbol	Description
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
DANGER	**DANGER** This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
WARNING	**WARNING** This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
CAUTION	**CAUTION** This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	**Explosion protection** This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with EU Directive 2014/34/EU (ATEX).
	**General hazard** In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	**Electrical hazard** In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	**Machine damage** In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.

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2 Safety

DANGER

All the information contained in this section refers to hazardous situations.

In addition to the present general safety information the action-related safety information given in the other sections must be observed.

2.1 General

- This operating manual contains general installation, operating and maintenance instructions that must be observed to ensure safe operation of the system and prevent personal injury and damage to property.
- Comply with all the safety instructions given in the individual sections of this operating manual.
- The operating manual must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.
- The contents of this operating manual must be available to the specialist personnel at the site at all times.
- Information and markings attached directly to the product must always be complied with and kept in a perfectly legible condition at all times. This applies to, for example:
  - Arrow indicating the direction of rotation
  - Markings for connections
  - Name plate
- The operator is responsible for ensuring compliance with all local regulations not taken into account.

2.2 Intended use

- The pump (set) must only be operated in the fields of application and within the use limits specified in the other applicable documents. (⇨ Section 1.4, Page 7)
- Only operate pumps/pump sets which are in perfect technical condition.
- Do not operate the pump (set) in partially assembled condition.
- Only use the pump (set) to handle the fluids described in the data sheet or product literature of the pump model.
- Never operate the pump (set) without the fluid to be handled.
- Observe the minimum flow rate and maximum flow rate indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- Always operate the pump (set) in the direction of rotation it is intended for.
- Do not throttle the flow rate on the suction side of the pump (to prevent cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.

2.3 Personnel qualification and training

All personnel involved must be fully qualified to transport, install, operate, maintain and inspect the machinery this manual refers to.

The responsibilities, competence and supervision of all personnel involved in transport, installation, operation, maintenance and inspection must be clearly defined by the operator.

Deficits in knowledge must be rectified by means of training and instruction provided by sufficiently trained specialist personnel. If required, the operator can commission the manufacturer/supplier to train the personnel.

Training on the pump (set) must always be supervised by technical specialist personnel.

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2.4 Consequences and risks caused by non-compliance with this manual

- Non-compliance with these operating instructions will lead to forfeiture of warranty cover and of any and all rights to claims for damages.
- Non-compliance can, for example, have the following consequences:
  - Hazards to persons due to electrical, thermal, mechanical and chemical effects and explosions
  - Failure of important product functions
  - Failure of prescribed maintenance and servicing practices
  - Hazard to the environment due to leakage of hazardous substances

2.5 Safety awareness

In addition to the safety information contained in this operating manual and the intended use, the following safety regulations shall be complied with:

- Accident prevention, health regulations and safety regulations
- Explosion protection regulations
- Safety regulations for handling hazardous substances
- Applicable standards, directives and laws

2.6 Safety information for the operator/user

- Fit protective equipment (e.g. contact guards) supplied by the operator for hot, cold or moving parts, and check that the equipment functions properly.
- Do not remove any protective equipment (e.g. contact guards) during operation.
- Provide the personnel with protective equipment and make sure it is used.
- Contain leakages (e.g. at the shaft seal) of hazardous fluids handled (e.g. explosive, toxic, hot) so as to avoid any danger to persons and the environment. Adhere to all relevant laws.
- Eliminate all electrical hazards. (In this respect refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)
- If stopping the pump does not increase potential risk, fit an emergency-stop control device in the immediate vicinity of the pump (set) during pump set installation.

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump (set) are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.

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- When taking the pump set out of service always adhere to the procedure described in the manual. (⇨ Section 6.1.7, Page 36) (⇨ Section 6.3, Page 39)
- Decontaminate pumps which handle fluids posing a health hazard.
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇨ Section 6.1, Page 33)

2.8 Unauthorised modes of operation

Never operate the pump (set) outside the limits stated in the data sheet and in this manual.

The warranty relating to the operating reliability and safety of the supplied pump (set) is only valid if the equipment is used in accordance with its intended use. (⇨ Section 2.2, Page 9)

2.9 Explosion protection

DANGER

Always observe the information on explosion protection given in this section when operating the product in potentially explosive atmospheres.

Only pumps/pump sets marked as explosion-proof **and** identified as such in the data sheet may be used in potentially explosive atmospheres.

Special conditions apply to the operation of explosion-proof pump sets to EU Directive 2014/34/EU (ATEX).
Especially adhere to the sections in this manual marked with the Ex symbol and the following sections, (⇨ Section 2.9.1, Page 11) to (⇨ Section 2.9.4, Page 12)
The explosion-proof status is only assured if the product is used in accordance with its intended use.
Never operate the product outside the limits stated in the data sheet and on the name plate.
Prevent impermissible modes of operation at all times.

2.9.1 Marking

Pump The marking on the pump refers to the pump part only.

Example of such marking:
II 2G Ex h IIC T5-T1 Gb

Refer to the Temperature limits table for the maximum temperatures permitted for the individual pump variants. (⇨ Section 2.9.2, Page 11)

The pump complies with the requirements of type of protection constructional safety "c" to ISO 80079-37.

Shaft coupling An EC manufacturer's declaration is required for the shaft coupling; the shaft coupling must be marked accordingly.

Motor The motor must be considered separately.

2.9.2 Temperature limits

In normal pump operation, the highest temperatures are to be expected at the surface of the pump casing, at the shaft seal and in the bearing areas.
The surface temperature at the pump casing corresponds to the temperature of the fluid handled. If the pump is heated in addition, the operator of the system is responsible for observing the specified temperature class and fluid temperature (operating temperature).

The table (⇨ Table 4) lists the temperature classes and the resulting maximum permissible fluid temperatures. The values shown correspond to the theoretical limits. They include only a general safety margin for the mechanical seal. For single mechanical seals, the safety margin required for specific operating conditions and mechanical seal designs may be substantially higher. If operating conditions differ from those stated on the data sheet, or if different mechanical seals are used, the actual safety margin required needs to be determined individually. If in doubt please contact the manufacturer.

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The temperature class specifies the maximum permissible temperature at the surface of the pump set during operation.

For the permissible operating temperature of the pump in question refer to the data sheet.

Table 4: Temperature limits

Temperature class to ISO 80079-36	Maximum permissible fluid temperature[2)]
T1	Temperature limit of the pump
T2	280 °C
T3	185 °C
T4	120 °C
T5	85 °C
T6	Only after consultation with the manufacturer

In the following cases, and if ambient temperatures are higher, contact the manufacturer.

Temperature class T5 Based on an ambient temperature of 40 °C and proper maintenance and operation, compliance with temperature class T5 is warranted in the area of the rolling element bearings. If the ambient temperature exceeds 40 °C, contact the manufacturer.

Temperature class T6 If temperature class T6 must be complied with, special measures may be required with regard to bearing temperature.

Misuse, malfunctions or non-compliance with the instructions may result in substantially higher temperatures.

If the pump is to be operated at a higher temperature, the data sheet is missing or if the pump is part of a pool of pumps, contact KSB for the maximum permissible operating temperature.

2.9.3 Monitoring equipment

The pump (set) must only be operated within the limits specified in the data sheet and on the name plate.
If the system operator cannot warrant compliance with these operating limits, appropriate monitoring devices must be used.
Check whether monitoring equipment is required to ensure that the pump set functions properly.

Contact KSB for further information about monitoring equipment.

2.9.4 Operating limits

The minimum flow rates indicated in (⇨ Section 6.2.4.1, Page 38) refer to water and water-like fluids handled. Longer operating periods with these fluids and at the flow rates indicated will not cause an additional increase in the temperatures at the pump surface. However, if the physical properties of the fluids handled are different from water, it is essential to check whether an additional heat build-up may occur and if the minimum flow rate must therefore be increased. The calculation formula in (⇨ Section 6.2.4.1, Page 38) can be used to check whether additional heat build-up may lead to a dangerous temperature increase at the pump surface.

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2 Subject to further limitations for mechanical seal temperature rise

3 Transport/Storage/Disposal

3.1 Checking the condition upon delivery

1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify KSB or the supplying dealer and the insurer about the damage in writing immediately.

3.2 Transport

DANGER

The pump (set) could slip out of the suspension arrangement

Danger to life from falling parts!

- Always transport the pump (set) in the specified position.
- Never attach the suspension arrangement to the free shaft end or the motor eyebolt.
- Observe the information about weights, centre of gravity and fastening points.
- Observe the applicable local accident prevention regulations.
- Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.

To transport the pump/pump set or back pull-out unit suspend it from the lifting tackle as shown.

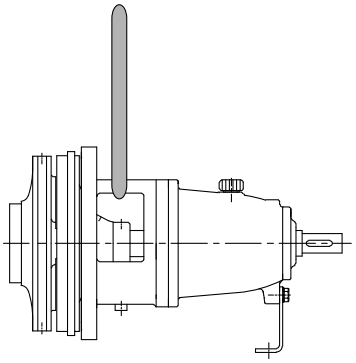

Fig. 1: Transporting the back pull-out unit

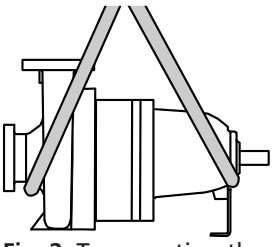

Fig. 2: Transporting the pump

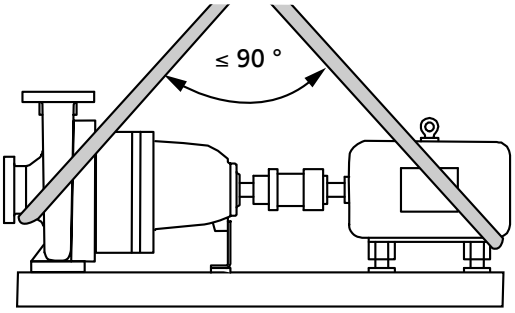

Fig. 3: Transporting the pump set

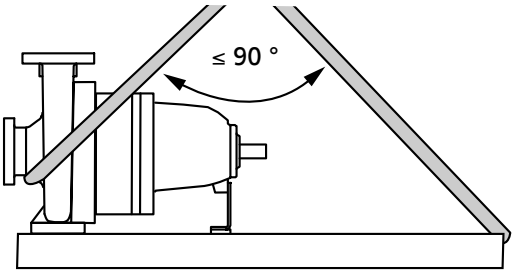

Fig. 4: Transporting the pump on the baseplate

3.3 Storage/preservation

CAUTION

Damage during storage due to humidity, dirt or vermin

Corrosion/contamination of the pump (set)!

- ▷ For outdoor storage cover the pump (set) or the packaged pump (set) and accessories with waterproof material.

CAUTION

Wet, contaminated or damaged openings and connections

Leakage or damage to the pump!

- ▷ Clean and cover pump openings and connections as required prior to putting the pump into storage.

If commissioning is to take place some time after delivery, we recommend that the following measures be taken for pump (set) storage.

- Store the pump (set) in a dry, protected room where the atmospheric humidity is as constant as possible.
- Rotate the shaft by hand once a month, e.g. via the motor fan.

If properly stored indoors, the pump set is protected for a maximum of 12 months. New pumps/pump sets are supplied by our factory duly prepared for storage.

For storing a pump (set) which has already been operated, the shutdown measures must be adhered to. (⇨ Section 6.3.1, Page 39)

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇨ Section 7.3, Page 46)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen also neutralise the pump and blow through with anhydrous inert gas to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
   Indicate any safety measures and decontamination measures taken.
   (⇨ Section 11, Page 67)

NOTE

If required, a blank certificate of decontamination can be downloaded from the following web site: www.ksb.com/certificate_of_decontamination

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3.5 Disposal

⚠ WARNING

Fluids handled, consumables and supplies which are hot and/or pose a health hazard

Hazard to persons and the environment!

- ▷ Collect and properly dispose of flushing fluid and any fluid residues.
- ▷ Wear safety clothing and a protective mask if required.
- ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.

1. Dismantle the pump (set).
   Collect greases and other lubricants during dismantling.
2. Separate and sort the pump materials, e.g. by:
   - Metals
   - Plastics
   - Electronic waste
   - Greases and other lubricants
3. Dispose of materials in accordance with local regulations or in another controlled manner.

4 Description of the Pump (Set)

4.1 General description

Pump for handling liquids in heat transfer systems (DIN 4754) or for hot water circulation.

4.2 Product information as per Regulation No. 1907/2006 (REACH)

For information as per chemicals Regulation (EC) No. 1907/2006 (REACH), see https://www.ksb.com/ksb-en/About-KSB/Corporate-responsibility/reach/ .

4.3 Designation

Example: EN-RSY 125-500/2

Table 5: Designation key

Code	Description	
Etanorm-RSY	Type series	
	R	Extended selection chart
	S	Casing made of nodular cast iron
	Y	Long-coupled design: for heat transfer fluids and hot water
125	Nominal discharge nozzle diameter [mm]	
500	Nominal impeller diameter [mm]	
/2	Hydraulic system	
	-[3)]	Single-stage
	.1	Single-stage, modified version
	/2	Two stages

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[3] Blank

4.4 Name plate

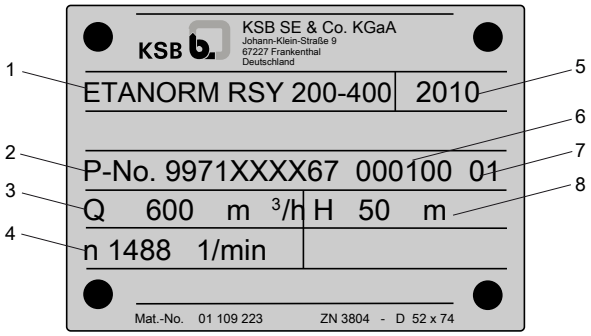

Fig. 5: Name plate (example) Etanorm-RSY

1	Type series, size and version	2	KSB order number (ten digits)
3	Flow rate	4	Speed
5	Year of construction	6	Order item number (six digits)
7	Consecutive number (two digits)	8	Head

4.5 Design details

Design

- Horizontal installation
- Volute casing pump
- Radially split volute casing
- Volute casing with integrally cast pump feet
- Baseframe made of welded channel sections
- Back pull-out design
- Axial thrust balanced by discharge-side casing wear ring and balancing holes
- Replaceable casing wear rings
- Single-stage

Size 125-500/2:

- Two stages

≤ DN 200:

- Dimensions and ratings to EN 733

Shaft seal

- Cartridge seal
- Standardised mechanical seal to EN 12756

Impeller type

- Closed radial impeller with multiply curved vanes

Bearings

Drive end:

- Grease-packed rolling element bearings sealed for life

Pump-end:

Direction of rotation

- Clockwise, viewed from the drive end.

Drive

- KSB SuPremE
- Efficiency class IE4/IE5 to IEC TS 60034-30-2:2016

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4.6 Configuration and function

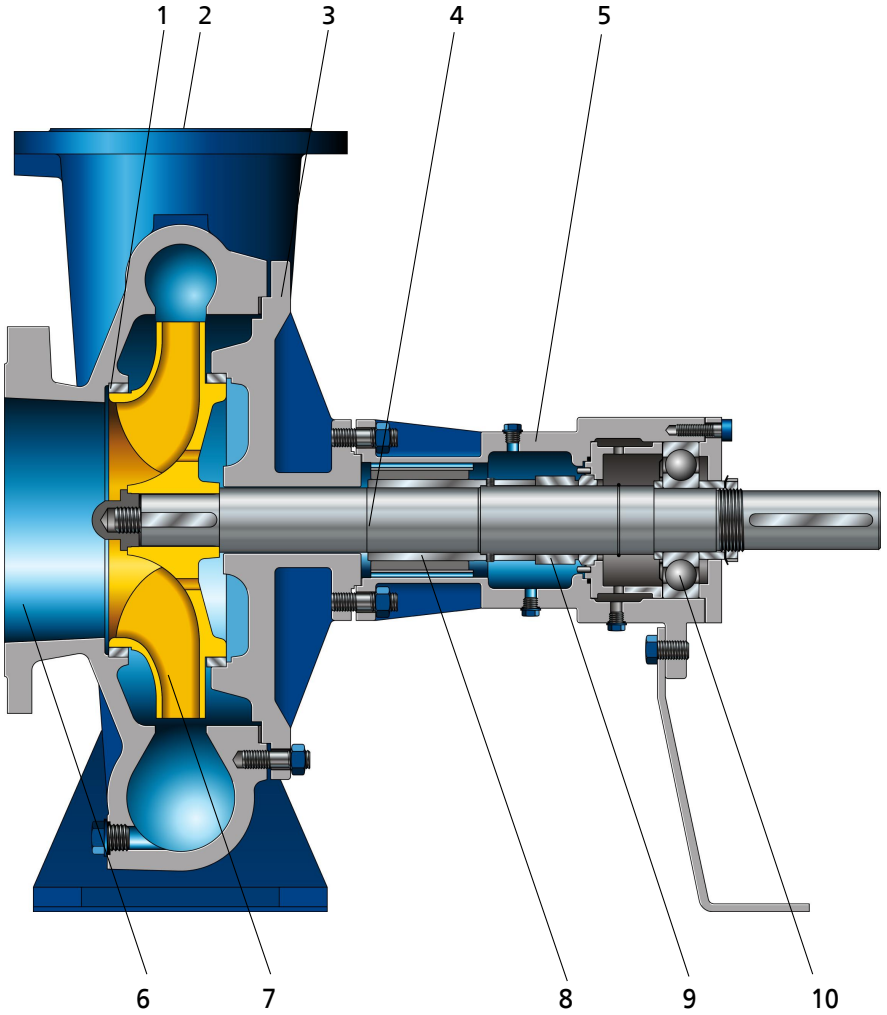

Fig. 6: Sectional drawing

1	Clearance gap	2	Discharge nozzle
3	Casing cover	4	Shaft
5	Bearing bracket	6	Suction nozzle
7	Impeller	8	Plain bearing
9	Shaft seal	10	Rolling element bearing, motor end

Design The pump is designed with an axial fluid inlet and a radial outlet. The hydraulic system runs in its own bearings and is connected to the motor by a shaft coupling.

Function The fluid enters the pump axially via the suction nozzle (7) and is accelerated outward by the rotating impeller (8). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid is pumped to the discharge nozzle (2), where it leaves the pump. The clearance gap (1) prevents any fluid from flowing back from the casing to the suction nozzle. At the rear side of the impeller, the shaft (4) enters the hydraulic system via the casing cover (3). The shaft passage through the bearing bracket is sealed to atmosphere with a shaft seal (10). The shaft runs in a plain bearing and a rolling element bearing (9 and 11); the bearings are supported by a bearing bracket (5) joined to the pump casing and/or casing cover.

Sealing The pump is sealed by a standardised mechanical seal.

4.7 Noise characteristics

Table 6: Surface sound pressure level L_{pA} [4) 5)]

P_N	Pump	Pump set
	1450 rpm	1450 rpm
[kW]	[dB]	[dB]
15	64	69
19	65	69
22	66	70
30	67	71
37	69	72
45	70	73
55	71	74
75	72	75
90	73	76
110	74	76
132	76	79
160	76	79
200	77	80
250	78	81
315	79	82
400	79	82

4.8 Scope of supply

Depending on the model, the following items are included in the scope of supply:

- Pump
- Drive
- Baseplate
- Coupling
- Coupling guard

4.9 Dimensions and weights

For dimensions and weights please refer to the general arrangement drawing/outline drawing of the pump/pump set.

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4 Surface sound pressure level as per ISO 3744 and DIN EN ISO 20361 ; valid for a pump operating range of Q/QBEP = 0.8 - 1.1 and non-cavitating operation.

5 For measuring and constructional tolerance, add 1 dB for n ≤ 1750 rpm and 3 dB for n > 1750 rpm.

5 Installation at Site

5.1 Checks to be carried out prior to installation

Place of installation

⚠ WARNING

Installation on a mounting surface which is unsecured and cannot support the load

Personal injury and damage to property!

- ▷ Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XC1 to EN 206-1.
- ▷ The mounting surface must be set, flat, and level.
- ▷ Observe the weights indicated.

1. Check the structural requirements.
   All structural work required must have been prepared in accordance with the dimensions stated in the outline drawing/general arrangement drawing.

5.2 Installing the pump set

Always install the pump set in a horizontal position.

⚠ DANGER

Excessive temperatures due to improper installation

Explosion hazard!

- ▷ Install the pump in a horizontal position to ensure self-venting of the pump.

⚠ DANGER

Electrostatic charging due to insufficient potential equalisation

Explosion hazard!

- ▷ Make sure that the connection between pump and baseplate is electrically conductive.

5.2.1 Installation on the foundation

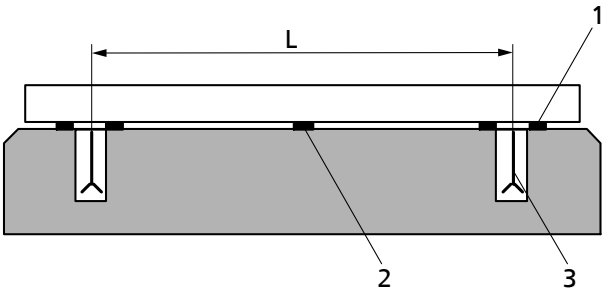

Fig. 7: Fitting the shims

L	Bolt-to-bolt distance	1	Shim
2	Shim if (L) > 800 mm	3	Foundation bolt

✓ The foundation has the required strength and characteristics.

✓ The foundation has been prepared in accordance with the dimensions given in the outline drawing/general arrangement drawing.

1. Position the pump set on the foundation and level it with the help of a spirit level placed on the shaft and discharge nozzle.
   Permissible deviation: 0.2 mm/m
2. Use shims (1) for height compensation, if necessary.
   Always fit shims, if any, immediately to the left and right of the foundation bolts (3) between the baseplate/foundation frame and the foundation.
   For a bolt-to-bolt distance (L) > 800 mm fit additional shims (2) halfway between the bolt holes.
   All shims must lie perfectly flush.
3. Insert the foundation bolts (3) into the holes provided.
4. Use concrete to set the foundation bolts (3) into the foundation.
5. Wait until the concrete has set firmly, then level the baseplate.
6. Tighten the foundation bolts (3) evenly and firmly.

NOTE

For optimum smooth running, baseplates should be grouted with low-shrinkage concrete in the following cases:
- For all vibration-critical applications
- Baseplates with a width > 400 mm
- Baseplates made of grey cast iron

NOTE

For low-noise operation contact the manufacturer to check whether the pump set can be installed on anti-vibration mounts.

NOTE

Expansion joints can be fitted between the pump and the suction line or discharge line.

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5.2.2 Installation without foundation

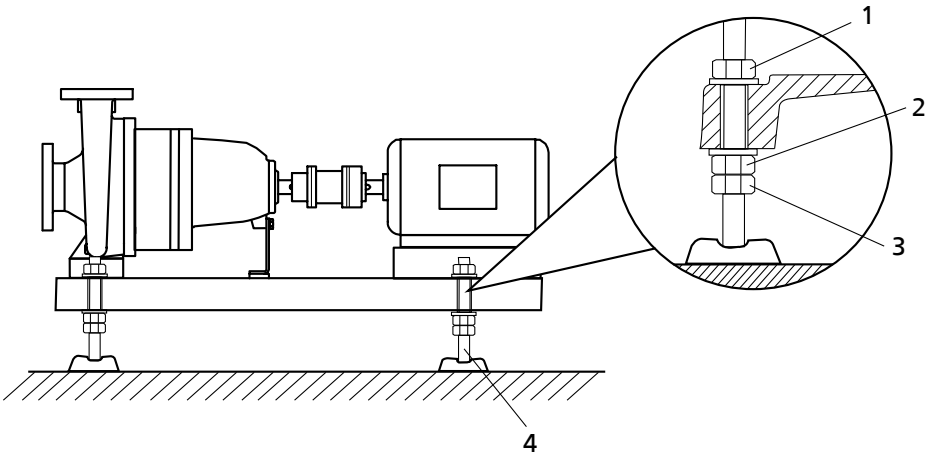

Fig. 8: Adjusting the levelling elements

1, 3	Locknut	2	Adjusting nut
4	Machine mount		

✓ The installation surface has the required strength and characteristics.

1. Position the pump set on the machine mounts (4) and align it with the help of a spirit level (on the shaft/discharge nozzle).
2. To adjust any differences in height, loosen the locknuts (1, 3) of the machine mounts (4).
3. Turn the adjusting nut (2) until any differences in height have been compensated.
4. Re-tighten the locknuts (1, 3) at the machine mounts (4).

5.3 Piping

5.3.1 Connecting the piping

DANGER

Impermissible loads acting on the pump nozzles

Danger to life from escaping hot, toxic, corrosive or flammable fluids!

- ▹ Do not use the pump as an anchorage point for the piping.
- ▹ Anchor the pipes in close proximity to the pump and connect them properly without transmitting any stresses or strains.
- ▹ Observe the permissible forces and moments at the pump nozzles.
- ▹ Take appropriate measures to compensate for thermal expansion of the piping.

CAUTION

Incorrect earthing during welding work at the piping

Destruction of rolling element bearings (pitting effect)!

- ▹ Never earth the electric welding equipment on the pump or baseplate.
- ▹ Prevent current flowing through the rolling element bearings.

NOTE

Installing check and shut-off elements in the system is recommended, depending on the type of plant and pump. However, such elements must not obstruct proper drainage or hinder disassembly of the pump.

- ✓ Suction lift lines have been laid with a rising slope, suction head lines with a downward slope towards the pump.
- ✓ A flow stabilisation section having a length equivalent to at least twice the diameter of the suction flange has been provided upstream of the suction flange.
- ✓ The nominal diameters of the pipelines are at least equal to the nominal diameters of the pump nozzles.
- ✓ Adapters to larger diameters have a diffuser angle of approximately 8° to prevent excessive pressure losses.
- ✓ The pipelines have been anchored in close proximity to the pump and connected without transmitting any stresses or strains.

CAUTION

Welding beads, scale and other impurities in the piping

Damage to the pump!

- ▷ Remove any impurities from the piping.
- ▷ If necessary, install a filter.
- ▷ Observe the information in (⇨ Section 7.2.2.3, Page 45) .

1. Thoroughly clean, flush and blow through all vessels, pipelines and connections (especially of new installations).
2. Before installing the pump in the piping, remove the flange covers on the suction and discharge nozzles of the pump.
3. Check that the inside of the pump is free from any foreign objects. Remove any foreign objects.
4. If required, install a filter in the piping (see figure: Filter in the piping).

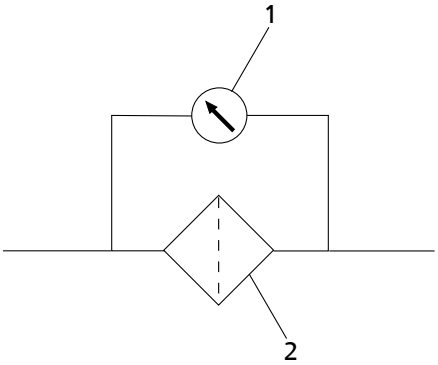

Fig. 9: Filter in the piping

1	Differential pressure gauge	2	Filter

NOTE

Use a filter with laid-in wire mesh (mesh width 0.5 mm, wire diameter 0.25 mm) of corrosion-resistant material.
Use a filter with a filter area three times the cross-section of the piping.
Conical filters have proved suitable.

5. Connect the pump nozzles to the piping.

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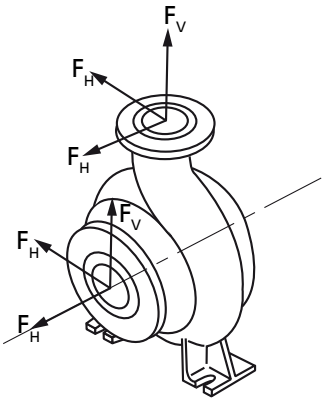
	**CAUTION** **Aggressive flushing liquid and pickling agent** Damage to the pump! ▷ Match the cleaning operation mode and duration of flushing and pickling to the casing materials and seal materials used.

5.3.2 Permissible forces and moments at the pump nozzles



$$\left[\frac{\sum |F_V|}{|F_{Vmax}|}\right]^2 + \left[\frac{\sum |F_H|}{|F_{Hmax}|}\right]^2 + \left[\frac{\sum |M_t|}{|M_{tmax}|}\right]^2 \leq 1$$

Fig. 10: Forces and moments at the pump nozzles

The following condition must be met:

$\sum|F_V|$, $\sum|F_H|$, and $\sum|M_t|$ are the sums of the absolute values of the respective loads acting on the nozzles. Neither the load direction nor the load distribution among the nozzles are taken into account in these sums.

Table 7: Forces and moments at the pump nozzles depending on the fluid temperature[6)]

Size	t = 20 °C			t = 300 °C		
	F_{Vmax}	F_{Hmax}	M_{tmax}	F_{Vmax}	F_{Hmax}	M_{tmax}
	[kN]	[kN]	[kNm]	[kN]	[kN]	[kNm]
125	3,8	5,3	1,45	3,28	4,58	1,25
150	4,2	5,9	2,2	3,63	5,1	1,9
200	6,0	8,4	3,6	5,18	7,25	3,1
250	7,5	10,5	5,7	6,48	9,1	4,9
300	7,5	10,5	9,3	6,48	9,1	8,0
350	7,5	10,5	12,9	6,68	9,1	11,1

5.3.3 Vacuum balance line

	**NOTE** Where fluid has to be pumped out of a vessel under vacuum, installing a vacuum balance line is recommended.

The following rules apply to vacuum balance lines:

- Minimum nominal line diameter 25 mm.
- The line extends above the highest permissible fluid level in the vessel.

6 The indicated values apply to nodular cast iron EN-GJS-400-18-LT.

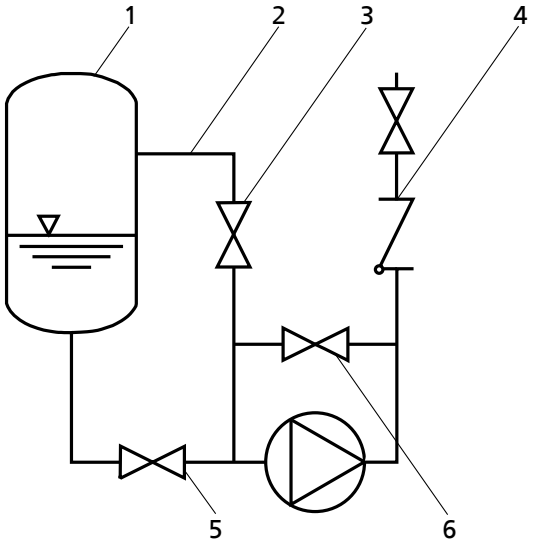


Fig. 11: Vacuum balance system

1	Vessel under vacuum	2	Vacuum balance line
3	Shut-off element	4	Swing check valve
5	Main shut-off element	6	Vacuum-tight shut-off element

NOTE

An additional line fitted with a shut-off valve (from the pump discharge nozzle to the balance line) facilitates venting of the pump before start-up.

5.3.4 Auxiliary connections

DANGER

Risk of potentially explosive atmosphere by incompatible fluids mixing in the auxiliary piping

Risk of burns!

Explosion hazard!

- Make sure that the barrier fluid or quench liquid are compatible with the fluid handled.

WARNING

Failure to use or incorrect use of auxiliary connections (e.g. barrier fluid, flushing liquid, etc.)

Risk of injury from escaping fluid!

Risk of burns!

Malfunction of the pump!

- Refer to the general arrangement drawing, the piping layout and pump markings (if any) for the quantity, dimensions and locations of auxiliary connections.
- Use the auxiliary connections provided.

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5.4 Enclosure/insulation

DANGER

An explosive atmosphere could form due to insufficient venting

Explosion hazard!

- ▷ Make sure the space between the casing cover/discharge cover and the bearing cover is sufficiently vented.

WARNING

The volute casing and casing/discharge cover take on the same temperature as the fluid handled

Risk of burns!

- ▷ Insulate the volute casing.
- ▷ Fit protective equipment.

CAUTION

Heat build-up in the bearing bracket

Damage to the bearing!

- ▷ Never insulate the bearing bracket, bearing bracket lantern and casing cover.

NOTE

Pump casings handling fluids at temperatures below freezing point may be insulated at the site, subject to the manufacturer's prior approval.

5.5 Checking the coupling alignment

DANGER

Inadmissible temperatures at the coupling or bearings due to misalignment of the coupling

Explosion hazard!

Risk of burns!

- ▷ Make sure that the coupling is correctly aligned at all times.

CAUTION

Misalignment of pump and motor shafts

Damage to pump, motor and coupling!

- ▷ Always check the coupling after the pump has been installed and connected to the piping.
- ▷ Also check the coupling of pump sets supplied with pump and motor mounted on the same baseplate.

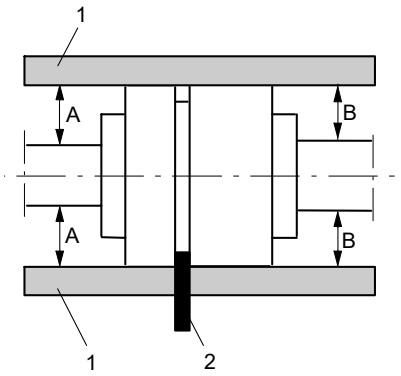

Fig. 12: Non-spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

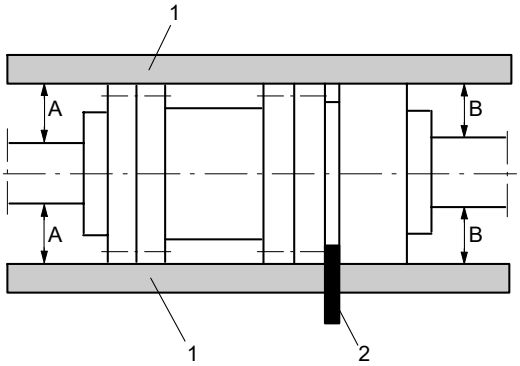

Fig. 13: Spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

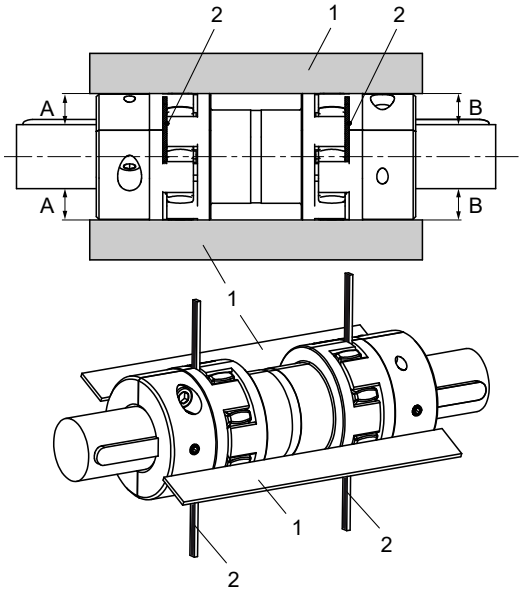

Fig. 14: Double Cardan spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

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Table 8: Permissible alignment offset of coupling halves

Coupling type	Radial offset [mm]	Axial offset [mm]
Non-spacer-type coupling (⇨ Fig. 12)	≤ 0,1	≤ 0,1
Spacer-type coupling (⇨ Fig. 13)	≤ 0,1	≤ 0,1
Double Cardan coupling (⇨ Fig. 14)	≤ 0,5	≤ 0,5

✓ The coupling guard and its footboard, if any, have been removed.

1. Loosen the support foot and re-tighten it without transmitting any stresses and strains.
2. Place the straight edge axially on both coupling halves.
3. Leave the straight edge in this position and turn the coupling by hand.
   The coupling is aligned correctly if the distances A and B to the respective shafts are the same at all points around the circumference.
   Observe the permissible radial offset in coupling half alignment (⇨ Table 8) both during standstill and at operating temperature as well as under inlet pressure.
4. Check the distance (dimension see general arrangement drawing) between the two coupling halves around the circumference.
   The coupling is correctly aligned if the distance between the two coupling halves is the same at all points around the circumference.
   Observe the permissible axial offset in coupling half alignment (⇨ Table 8) both during standstill and at operating temperature as well as under inlet pressure.
5. If alignment is correct, re-install the coupling guard and its footboard, if any.

Checking the coupling alignment with a laser tool

Coupling alignment may also be checked with a laser tool. Observe the documentation provided by the manufacturer of the measuring instrument.

5.6 Aligning the pump and motor

After having installed the pump set and connected the piping, check the coupling alignment and, if required, re-align the pump set (at the motor).

5.6.1 Motors with adjusting screw

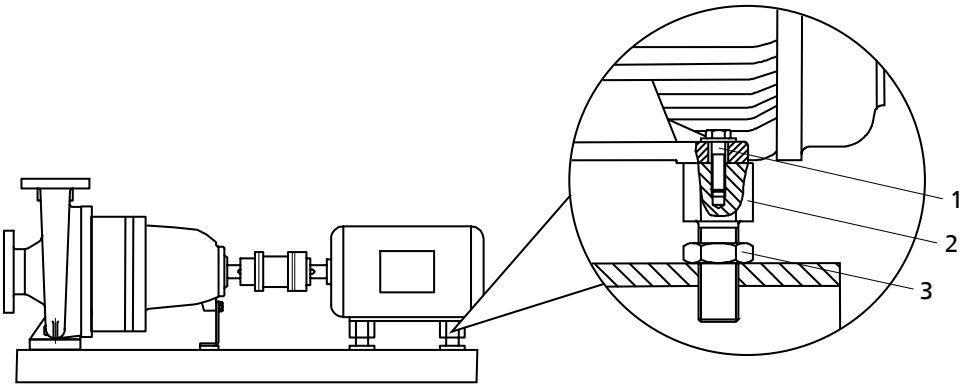

Fig. 15: Motor with adjusting screw

1	Hexagon head bolt	2	Adjusting screw
3	Locknut		

✓ The coupling guard and its footboard, if any, have been removed.

1. Check the coupling alignment.
2. Unscrew the hexagon head bolts (1) at the motor and the locknuts (3) at the baseplate.
3. Turn the adjusting screws (2) by hand or by means of an open-end wrench until the coupling alignment is correct and all motor feet rest squarely on the baseplate.

4. Re-tighten the hexagon head bolts (1) at the motor and the locknuts (3) at the baseplate.
5. Check proper functioning of coupling/shaft.
   Check that coupling/shaft can easily be rotated by hand.

⚠ WARNING

Unprotected rotating coupling

Risk of injury by rotating shafts!

- ▷ Always operate the pump set with a coupling guard.
  If the customer specifically requests not to include a coupling guard in KSB's delivery, then the operator must supply one!
- ▷ Observe all relevant regulations for selecting a coupling guard.

⚠ DANGER

Risk of ignition by frictional sparks

Explosion hazard!!

- ▷ Choose a coupling guard material that is non-sparking in the event of mechanical contact.

6. Fit the coupling guard and its footboard, if any.
7. Check the distance between coupling and coupling guard.
   The coupling guard must not touch the coupling.

5.6.2 Motors without adjusting screw

Any differences in the centreline heights of the pump and motor shafts are compensated by means of shims.

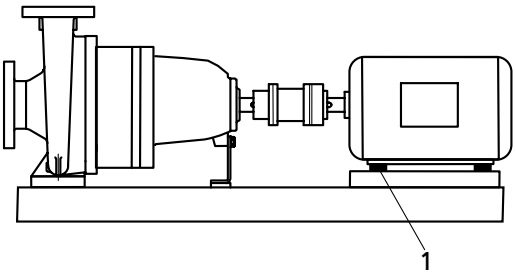

Fig. 16: Pump set with shim

1	Shim

✓ The coupling guard and its footboard, if any, have been removed.

1. Check the coupling alignment.
2. Loosen the hexagon head bolts at the motor.
3. Insert shims underneath the motor feet until the difference in shaft centreline height has been compensated.
4. Re-tighten the hexagon head bolts.
5. Check proper functioning of coupling/shaft.
   Check that coupling/shaft can easily be rotated by hand.

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WARNING

Unprotected rotating coupling

Risk of injury by rotating shafts!

- Always operate the pump set with a coupling guard.
  If the customer specifically requests not to include a coupling guard in KSB's delivery, then the operator must supply one!
- Observe all relevant regulations for selecting a coupling guard.

DANGER

Risk of ignition by frictional sparks

Explosion hazard!!

- Choose a coupling guard material that is non-sparking in the event of mechanical contact.

6. Fit the coupling guard and its footboard, if any.
7. Check the distance between coupling and coupling guard.
   The coupling guard must not touch the coupling.

5.7 Electrical connection

DANGER

Electrical connection work by unqualified personnel

Risk of fatal injury due to electric shock!

- Always have the electrical connections installed by a trained and qualified electrician.
- Observe regulations IEC 60364 and, for explosion-proof models, EN 60079.

WARNING

Incorrect connection to the mains

Damage to the power supply network, short circuit!

- Observe the technical specifications of the local energy supply companies.

1. Check the available mains voltage against the data on the motor name plate.
2. Select an appropriate starting method.

NOTE

Installing a motor protection device is recommended.

5.8 Checking the direction of rotation

DANGER

Temperature increase resulting from contact between rotating and stationary components

Explosion hazard!

Damage to the pump set!

- Never check the direction of rotation by starting up the unfilled pump set.
- Separate the pump from the motor to check the direction of rotation.

⚠ WARNING

Hands inside the pump casing

Risk of injuries, damage to the pump!

- ▷ Always disconnect the pump set from the power supply and secure it against unintentional start-up before inserting your hands or other objects into the pump.

CAUTION

Incorrect direction of rotation with non-reversible mechanical seal

Damage to the mechanical seal and leakage!

- ▷ Separate the pump from the motor to check the direction of rotation.

CAUTION

Drive and pump running in the wrong direction of rotation

Damage to the pump!

- ▷ Refer to the arrow indicating the direction of rotation on the pump.
- ▷ Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation.

The correct direction of rotation of the motor and pump is clockwise (seen from the drive end).

1. Start the motor and stop it again immediately to determine the motor's direction of rotation.
2. Check the direction of rotation.
   The motor's direction of rotation must match the arrow indicating the direction of rotation on the pump.
3. If the motor is running in the wrong direction of rotation, check the electrical connection of the motor and switchgear, if any.

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6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up

Before commissioning/starting up the pump set, make sure that the following conditions are met:

- The pump set has been mechanically connected as specified.
- The pump set has been properly connected to the power supply and is equipped with all protection devices. (⇨ Section 5.7, Page 31)
- The pump has been filled with the fluid handled and vented.
- The direction of rotation has been checked. (⇨ Section 5.8, Page 31)
- All auxiliary connections required are connected and operational.
- The lubricants have been checked. (⇨ Section 7.2.3, Page 45)
- After prolonged shutdown of the pump (set), the activities required for returning the equipment to service have been carried out. (⇨ Section 6.4, Page 40)

6.1.2 Priming and venting the pump

⚠ DANGER

Risk of potentially explosive atmosphere inside the pump

Explosion hazard!

- ▷ The pump internals in contact with the fluid to be handled, including the seal chamber and auxiliary systems, must be filled with the fluid to be handled at all times.
- ▷ Provide sufficient inlet pressure.
- ▷ Provide an appropriate monitoring system.

⚠ DANGER

Risk of potentially explosive atmosphere by incompatible fluids mixing in the auxiliary piping

Risk of burns!

Explosion hazard!

- ▷ Make sure that the barrier fluid or quench liquid are compatible with the fluid handled.

CAUTION

Increased wear due to dry running

Damage to the pump set!

- ▷ Never operate the pump set without liquid fill.
- ▷ Never close the shut-off element in the suction line and/or supply line during pump operation.

1. Remove screw plug 903.85 (connection 6D) to prime and vent the bearing housing.
2. Vent the pump and suction line and prime both with the fluid to be handled. The pump can be primed with the fluid to be handled from the system via the inlet line.
3. Fully open the shut-off element in the suction line.
4. Fully open all auxiliary feed lines (barrier fluid, flushing liquid, etc.), if any.

5. Open the shut-off element, if any, in the vacuum balance line and close the vacuum-tight shut-off element, if any. (⇨ Section 5.3.3, Page 25)

⚠ WARNING

Hot water escaping under pressure when the vent plug is opened

Risk of electric shock!

Risk of scalding!

- ▷ Protect the electric components against escaping fluid.
- ▷ Wear protective clothing (e.g. gloves).

NOTE

For design-inherent reasons some unfilled volume in the hydraulic system cannot be excluded after the pump has been primed for commissioning/start-up. However, once the motor is started up the pumping effect will immediately fill this volume with the fluid handled.

6. Close the vent hole (connection 6D) with screw plug 903.85.

6.1.3 Final check

1. Remove the coupling guard and its footboard, if any.
2. Check the coupling alignment; re-align the coupling, if required. (⇨ Section 5.5, Page 27)
3. Check proper functioning of coupling/shaft.
   Check that coupling/shaft can be easily rotated by hand.
4. Fit the coupling guard and its footboard, if any.
5. Check the distance between coupling and coupling guard.
   The coupling guard must not touch the coupling.

NOTE

The coupling alignment check must be repeated after the pump has reached operating temperature.

6.1.4 Heating up/keeping warm the pump (set)

CAUTION

Pump blockage

Damage to the pump!

- ▷ Prior to pump start-up, heat up the pump as described in the manual.

Observe the following when heating up the pump (set) and keeping it warm:

- Make sure that the temperature is increased continuously.
- Heating speed: max. 5 °C/min (5 K/min)

Fluid temperatures above 150 °C

When the pump is used for handling fluids at temperatures above 150 °C make sure that the pump has been heated throughout before starting it up.

Temperature difference

The temperature difference between the pump's surface and the fluid handled must not exceed 100 °C (100 K) when the pump is started up.

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6.1.5 Start-up

DANGER

Non-compliance with the permissible pressure and temperature limits if the pump is operated with the suction and/or discharge line closed.

Explosion hazard!

Hot or toxic fluids escaping!

- Never operate the pump with the shut-off elements in the suction line and/or discharge line closed.
- Only start up the pump set with the discharge-side shut-off element slightly or fully open.

DANGER

Excessive temperatures due to dry running or excessive gas content in the fluid handled

Explosion hazard!

Damage to the pump set!

- Never operate the pump set without liquid fill.
- Prime the pump as per operating instructions.
- Always operate the pump within the permissible operating range.

CAUTION

Abnormal noises, vibrations, temperatures or leakage

Damage to the pump!

- Switch off the pump (set) immediately.
- Eliminate the causes before returning the pump set to service.

✓ The system piping has been cleaned.

✓ Pump, suction line and inlet tank, if any, have been vented and filled with the fluid handled.

✓ The filling and venting lines have been closed.

CAUTION

Start-up against open discharge line

Motor overload!

- Make sure the motor has sufficient power reserves.
- Use a soft starter.
- Use speed control.

1. Fully open the shut-off element in the suction head/suction lift line.
2. Close or slightly open the shut-off element in the discharge line.
3. Start up the motor.
4. Immediately after the pump has reached full rotational speed, slowly open the shut-off element in the discharge line and adjust it to comply with the duty point.

DANGER

Seal leakage at operating temperature

Hot or toxic fluid may escape!

- ▷ Once the operating temperature has been reached, re-tighten the hexagon nuts at the casing/discharge cover.
- ▷ Check the coupling alignment. Re-align the coupling if required.

5. When the operating temperature has been reached and/or in the event of leakage, switch off the pump set and re-tighten hexagon nuts 920.1 and 920.2.
6. Check the coupling alignment and re-align the coupling, if required.

6.1.6 Checking the shaft seal

Mechanical seal

The mechanical seal only leaks slightly or invisibly (as vapour) during operation. Mechanical seals are maintenance-free.

NOTE

Mechanical seal failure may result in the fluid handled penetrating into the rolling element bearing, where it may damage the grease fill. Whenever fluid leakage occurs, the rolling element bearing should therefore also be replaced as a precaution. This is particularly important when the pump is handling synthetic heat transfer fluids.

6.1.7 Shutdown

CAUTION

Heat build-up inside the pump

Damage to the shaft seal!

- ▷ Depending on the type of installation, the pump set requires sufficient after-run time – with the heat source switched off – until the fluid handled has cooled down.

CAUTION

Backflow of fluid handled is not permitted

Motor or winding damage! Mechanical seal damage!

- ▷ Close the shut-off elements.

✓ The shut-off element in the suction line is and remains open.

1. Close the shut-off element in the discharge line.
2. Switch off the motor and make sure the pump set runs down smoothly to a standstill.

NOTE

If the discharge line is equipped with a non-return or check valve, the shut-off element may remain open provided that the system conditions and system regulations are considered and observed.

For prolonged shutdown periods:

1. Close the shut-off element in the suction line.
2. Close any auxiliary lines.
   If the fluid to be handled is fed in under vacuum, also supply the shaft seal with barrier fluid during standstill.

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CAUTION

Risk of freezing during prolonged pump shutdown periods

Damage to the pump!

- ▷ Drain the pump and the cooling/heating chambers (if any) or otherwise protect them against freezing.

6.2 Operating limits

DANGER

Non-compliance with operating limits for pressure, temperature, fluid handled and speed

Explosion hazard!

Hot or toxic fluid could escape!

- ▷ Comply with the operating data specified in the data sheet.
- ▷ Never use the pump for handling fluids it is not designed for.
- ▷ Avoid prolonged operation against a closed shut-off element.
- ▷ Never operate the pump at temperatures, pressures or rotational speeds exceeding those specified in the data sheet or on the name plate unless the written consent of the manufacturer has been obtained.

DANGER

Formation of a potentially explosive atmosphere inside the pump

Explosion hazard!

- ▷ When draining tanks take suitable measures to prevent dry running of the pump (e.g. fill level monitoring).

6.2.1 Ambient temperature

CAUTION

Operation outside the permissible ambient temperature

Damage to the pump (set)!

- ▷ Observe the specified limits for permissible ambient temperatures.

Observe the following parameters and values during operation:

Table 9: Permissible ambient temperatures

Permissible ambient temperature	Value
Maximum	40 °C
Minimum	See data sheet.

NOTE

After commissioning, increased temperatures may occur at grease-lubricated rolling element bearings due to the running-in process. The final bearing temperature is only reached after a certain period of operation (up to 48 hours depending on the conditions).

6.2.2 Frequency of starts

DANGER

Excessive surface temperature of the motor

Explosion hazard!

Damage to the motor!

- In case of explosion-proof motors, observe the frequency of starts specified in the manufacturer's product literature.

The frequency of starts is determined by the maximum temperature increase of the motor. The frequency of starts depends on the power reserves of the motor in steady-state operation and on the starting conditions (DOL starting, star-delta starting, moments of inertia, etc). If the start-ups are evenly spaced over the period indicated, the following limits serve as orientation for start-up with the discharge-side shut-off valve slightly open:

Table 10: Frequency of starts

Motor rating	Maximum frequency of starts
[kW]	[Starts/hour]
≤ 12	15
≤ 100	10
> 100	5

CAUTION

Re-starting while motor is still running down

Damage to the pump (set)!

- Do not re-start the pump set before the pump rotor has come to a standstill.

6.2.3 Permissible speed

Table 11: Permissible speed for pump control systems with continuously variable speed adjustment

n_{min} [rpm]	n_{max} [rpm]
800	-

6.2.4 Fluid handled

6.2.4.1 Flow rate

Table 12: Flow rate

	Minimum flow rate	Maximum flow rate
For a short period (approximately 2 minutes)	≈ 25 % of Q_{Opt} [7)]	See hydraulic characteristic curves
Continuous duty	$Q_{Part\ load}$ ≥ 45 % of Q_{Opt} [7)]	

The calculation formula below can be used to check if an additional heat build-up could lead to a dangerous temperature increase at the pump surface.

$T_O = T_f + \Delta\vartheta$

$$\Delta\vartheta = \frac{g \times H}{c \times \eta} \times (1 - \eta)$$

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7 Best efficiency point

Table 13: Key

Symbol	Description	Unit
c	Specific heat capacity	J/kg K
g	Acceleration due to gravity	m/s^2
H	Pump discharge head	m
T_f	Fluid temperature	°C
T_O	Temperature at the casing surface	°C
η	Pump efficiency at duty point	-
$\Delta\vartheta$	Temperature difference	K

6.2.4.2 Density of the fluid handled

The power input of the pump set will change in proportion to the density of the fluid handled.

CAUTION

Impermissibly high density of the fluid handled

Motor overload!

- ▹ Observe the information about fluid density in the data sheet.
- ▹ Make sure the motor has sufficient power reserves.

6.2.4.3 Abrasive fluids

Do not exceed the maximum permissible solids content specified in the data sheet. When the pump handles fluids containing abrasive substances, increased wear of the hydraulic system, plain bearing and shaft seal are to be expected. In this case, reduce the intervals commonly recommended for servicing and maintenance.

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump (set) remains installed

✓ Sufficient fluid is supplied for the functional check run of the pump.

1. For prolonged shutdown periods, start up the pump (set) regularly between once a month and once every three months for approximately five minutes.
   ⇨ This will prevent the formation of deposits within the pump and the pump intake area.

The pump (set) is removed from the piping and stored

✓ The pump has been properly drained.

✓ The safety instructions for dismantling the pump have been observed. (⇨ Section 7.4.1, Page 46)

✓ The permissible ambient temperature for storing the pump is observed.

1. Spray-coat the inside wall of the pump casing and, in particular, the impeller clearance areas with a preservative.
2. Spray the preservative through the suction nozzle and discharge nozzle. It is advisable to then close the pump nozzles (e.g. with plastic caps).
3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil and grease, food-approved if required) to protect them against corrosion.
   Observe the additional instructions on preservation. (⇨ Section 3.3, Page 14)

If the pump set is to be stored temporarily, only preserve the wetted components made of low-alloy materials. Commercially available preservatives can be used for this purpose. Observe the manufacturer's instructions for application/removal.

6.4 Returning to service

For returning the equipment to service observe the sections on commissioning/start-up and the operating limits. (⇨ Section 6.1, Page 33) (⇨ Section 6.2, Page 37)

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇨ Section 7, Page 41)

⚠ WARNING

Failure to re-install or re-activate protective devices

Risk of injury from moving parts or escaping fluid!

- ▹ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices.

NOTE

If the equipment has been out of service for more than one year, replace all elastomer seals.

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7 Servicing/Maintenance

7.1 Safety regulations

DANGER

Improper cleaning of coated pump surfaces

Explosion hazard by electrostatic discharge!

- When cleaning coated pump surfaces in atmospheres of Explosion group IIC, use suitable anti-static equipment.

DANGER

Sparks produced during servicing work

Explosion hazard!

- Observe the safety regulations in force at the place of installation!
- Always perform maintenance work at an explosion-proof pump (set) outside of potentially explosive atmospheres.

DANGER

Improperly serviced pump set

Explosion hazard!

Damage to the pump set!

- Service the pump set regularly.
- Prepare a maintenance schedule with special emphasis on lubricants, shaft seal and coupling.

The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.

WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

- Ensure that the pump set cannot be started unintentionally.
- Always make sure the electrical connections are disconnected before carrying out work on the pump set.

WARNING

Fluids handled, consumables and supplies which are hot and/or pose a health hazard

Risk of injury!

- Observe all relevant laws.
- When draining the fluid take appropriate measures to protect persons and the environment.
- Decontaminate pumps which handle fluids posing a health hazard.

⚠ WARNING

Insufficient stability

Risk of crushing hands and feet!

- ▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tilting or tipping over.

A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation of the pump, pump set and pump parts with a minimum of servicing/maintenance expenditure and work.

NOTE

All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. For contact details please refer to the enclosed "Addresses" booklet or visit "www.ksb.com/contact" on the Internet.

Never use force when dismantling and reassembling the pump set.

7.2 Servicing/Inspection

7.2.1 Supervision of operation

⚠ DANGER

Incorrectly serviced shaft seal

Explosion hazard!

Hot, toxic fluid escaping!

Damage to the pump set!

Risk of burns!

Fire hazard!

- ▷ Regularly service the shaft seal.

⚠ DANGER

Risk of potentially explosive atmosphere inside the pump

Explosion hazard!

- ▷ The pump internals in contact with the fluid to be handled, including the seal chamber and auxiliary systems, must be filled with the fluid to be handled at all times.
- ▷ Provide sufficient inlet pressure.
- ▷ Provide an appropriate monitoring system.

⚠ DANGER

Excessive temperatures as a result of bearings running hot or defective bearing seals

Explosion hazard!

Fire hazard!

Damage to the pump set!

- ▷ Regularly check the rolling element bearings for running noises.

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CAUTION

Increased wear due to dry running

Damage to the pump set!

- ▷ Never operate the pump set without liquid fill.
- ▷ Never close the shut-off element in the suction line and/or supply line during pump operation.

CAUTION

Impermissibly high temperature of fluid handled

Damage to the pump!

- ▷ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).
- ▷ Observe the temperature limits in the data sheet and in the section on operating limits. (⇨ Section 6.2, Page 37)

While the pump is in operation, observe and check the following:

- The pump must run quietly and free from vibrations at all times.
- Check the shaft seal.
- Check the static sealing elements for leakage.
- Check the rolling element bearings for running noises.
  Vibrations, noise and an increase in current input occurring during unchanged operating conditions indicate wear.
- Monitor the correct functioning of any auxiliary connections.
- Monitor the stand-by pump.
  To make sure that stand-by pumps are ready for operation, start them up once a week.
- Monitor the temperature of the rolling element bearings.
  The bearing temperature must not exceed 90 °C (measured on the outside of the bearing bracket).

CAUTION

Operation outside the permissible bearing temperature

Damage to the pump!

- ▷ The rolling element bearing temperature of the pump (set) must never exceed 90 °C (measured on the outside of the bearing bracket).

NOTE

After commissioning, increased temperatures may occur at grease-lubricated rolling element bearings due to the running-in process. The final bearing temperature is only reached after a certain period of operation (up to 48 hours depending on the conditions).

7.2.2 Inspection work

DANGER

Excessive temperatures caused by friction, impact or frictional sparks

Explosion hazard!

Fire hazard!

Damage to the pump set!

- ▷ Regularly check the coupling guard, plastic components and other guards of rotating parts for deformation and sufficient distance from rotating parts.

DANGER

Electrostatic charging due to insufficient potential equalisation

Explosion hazard!

- ▷ Make sure that the connection between pump and baseplate is electrically conductive.

7.2.2.1 Checking the coupling

Check the flexible elements of the coupling. Replace the relevant parts in due time if there is any sign of wear and check the alignment.

7.2.2.2 Checking the clearances

Clearances between impeller and casing

For checking the clearance gaps remove the impeller, if required.
If the clearance gap is larger than permitted (see the following tables), replace casing wear ring 502.01 and/or 502.02 for single-stage variants and fit an additional casing wear ring 502.03 and/or 502.04 for double-stage variants (125-500/2).
The clearance gaps given refer to the diameter.

Table 14: Clearance gaps between impeller and casing / between impeller and casing cover

	Permissible clearance gap [mm]
New	0.7
Maximum permissible expansion	0.9

NOTE

If the clearances given are exceeded by more than 1 mm (referring to the diameter) replace the affected components or restore the original clearance by means of a casing wear ring.
Contact KSB.

Plain bearing clearances

Table 15: Plain bearing clearances in mm

Maximum clearance	As-new clearance
0.4	0.08-0.17

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7.2.2.3 Cleaning filters

CAUTION

Insufficient inlet pressure due to clogged filter in the suction line

Damage to the pump!

- ▷ Monitor contamination of filter with suitable means (e.g. differential pressure gauge).
- ▷ Clean filter at appropriate intervals.

7.2.3 Lubricating the rolling element bearing

DANGER

Excessive temperatures as a result of bearings running hot or defective bearing seals

Explosion hazard!

Fire hazard!

Damage to the pump set!

- ▷ Regularly check the bearing seal.

The bearings are delivered packed for life with a special high-temperature grease.

7.2.3.1 Grease quality

We recommend using Petro-Canada Peerless LLG high-temperature grease or an equivalent product for lubrication. Under unfavourable operating conditions, e.g. high room temperature, high atmospheric humidity, dust-laden air, aggressive atmosphere etc., check the bearings earlier. If required, clean and re-lubricate them, preferably with Petro-Canada Peerless LLG.

Klüber Asonic HQ72-102 can be used as an alternative.

CAUTION

Mixing greases of differing soap bases

Changed lubricating qualities!

- ▷ Thoroughly clean the bearings.
- ▷ Adjust the re-lubrication intervals to the grease used.

7.2.3.2 Grease quantity

Table 16: Grease quantity per bearing in g

Bearing	Grease quantity [g]
6413	40

7.2.3.3 Intervals

- Under suitable operating conditions the grease-lubricated bearings will run for 15,000 operating hours.
- Under unfavourable operating conditions (e.g. high room temperature, high atmospheric humidity, dust-laden air, aggressive industrial atmosphere) check the bearings earlier and clean and re-lubricate them, if required.
- Replace the rolling element bearings after 15,000 operating hours or 2 years of continuous operation.

7.2.4 Lubricating the plain bearing

The pump-end plain bearing is lubricated by the fluid handled. It is maintenance-free.

7.3 Drainage/cleaning

⚠ WARNING

Fluids handled, consumables and supplies which are hot and/or pose a health hazard

Hazard to persons and the environment!

- ▷ Collect and properly dispose of flushing fluid and any fluid residues.
- ▷ Wear safety clothing and a protective mask if required.
- ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.

1. Use connections 6B and 8B to drain the fluid handled (see drawing of auxiliary connections).
2. Flush the pump if it has been used for handling noxious, explosive, hot or other hazardous fluids.
   Always flush and clean the pump before transporting it to the workshop.
   Provide a cleaning record for the pump.

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

⚠ DANGER

Insufficient preparation of work on the pump (set)

Risk of injury!

- ▷ Properly shut down the pump set. (⇨ Section 6.1.7, Page 36)
- ▷ Close the shut-off elements in the suction line and discharge line.
- ▷ Drain the pump and release the pump pressure.
- ▷ Shut off any auxiliary connections.
- ▷ Allow the pump set to cool down to ambient temperature.

⚠ WARNING

Unqualified personnel performing work on the pump (set)

Risk of injury!

- ▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.

⚠ WARNING

Hot surface

Risk of injury!

- ▷ Allow the pump set to cool down to ambient temperature.

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⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

- ▹ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

Always observe the safety instructions and information. (⇨ Section 7.1, Page 41)

For any work on the motor, observe the instructions of the relevant motor manufacturer.

For dismantling and reassembly observe the exploded views and the general assembly drawing.

In the event of damage you can always contact our service departments.

NOTE

All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. For contact details please refer to the enclosed "Addresses" booklet or visit "www.ksb.com/contact" on the Internet.

NOTE

After a prolonged period of operation the individual components may be hard to pull off the shaft. If this is the case, use a brand name penetrating agent and/or - if possible - an appropriate puller.

7.4.2 Preparing the pump set

1. Interrupt the power supply and secure the pump against unintentional start-up.
2. Disconnect and remove all auxiliary pipework.
3. Remove the coupling guard.
4. Remove the coupling spacer, if any.

7.4.3 Removing the motor

NOTE

On pump sets with spacer-type couplings, the back pull-out unit can be removed while the motor remains bolted to the baseplate.

⚠ WARNING

Motor tipping over

Risk of crushing hands and feet!

- ▹ Suspend or support the motor to prevent it from tipping over.

1. Disconnect the motor from the power supply.
2. Unbolt the motor from the baseplate.
3. Shift the motor to separate it from the pump.

7.4.4 Removing the back pull-out unit

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 46) to (⇨ Section 7.4.3, Page 47) have been observed/carried out.

✓ On pump sets without spacer-type coupling, the motor has been removed.

⚠ WARNING

Back pull-out unit tilting

Risk of crushing hands and feet!

- ▹ Suspend or support the bearing bracket at the pump end.

1. If required, suspend or support bearing bracket 330 to prevent it from tilting.
2. Unbolt support foot 183 from the baseplate.
3. Undo nuts 920.01 at the casing cover.
4. Pull the back pull-out unit out of the volute casing.
5. Remove and dispose of joint ring 411.10.

⚠ WARNING

Thin metal foil used as carrier material in joint rings

Risk of injury (cuts)!

- ▹ Wear protective clothing.
- ▹ Always use an appropriate tool to remove joint rings.

6. Place the back pull-out unit on a clean and level surface.

7.4.5 Dismantling the impeller

7.4.5.1 Single-stage version

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 46) to (⇨ Section 7.4.4, Page 47) have been observed/carried out.

✓ The back pull-out unit has been placed in a clean and level assembly area.

1. Undo impeller nut 922 (right-hand thread).
2. Remove impeller 230 with an impeller removal device.
3. Place impeller 230 on a clean and level surface.
4. Remove keys 940.01 from shaft 210.

7.4.5.2 Double-stage version (125-500/2)

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 46) to (⇨ Section 7.4.4, Page 47) have been observed/carried out.

✓ The back pull-out unit has been placed in a clean and level assembly area.

1. Undo impeller nut 922 (right-hand thread).
2. Remove impeller 230.01 with an impeller removal device.
3. Place impeller 230.01 on a clean and level surface.
4. Pull off diffuser 171.
5. Place diffuser 171 on a clean and level surface.
6. Pull off spacer sleeve 525.01.
7. Remove impeller 230.02 with an impeller removal device.
8. Remove key 940.01 from shaft 210.

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7.4.6 Removing the shaft seal

7.4.6.1 Removing the shaft assembly from the bearing bracket — carbon plain bearing

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 46) to (⇨ Section 7.4.5, Page 48) have been observed/carried out.

✓ The back pull-out unit has been placed in a clean and level assembly area.

1. Undo nuts 920.04.
2. Pull bearing bracket 330 out of casing cover 161.

⚠ WARNING

Thin metal foil used as carrier material in joint rings

Risk of injury (cuts)!

- ▹ Wear protective clothing.
- ▹ Always use an appropriate tool to remove joint rings.

3. Remove and dispose of joint ring 411.11.
4. Bend open lock washer 931.01, unscrew slotted round nut 920.21 (right-hand thread) and remove the nut.
5. Remove lock washer 931.01.
6. Remove bolts 901.02 together with bearing cover 360.02.
7. Remove spacer ring 504.02.
8. Press shaft 210 out of bearing bracket 330.

7.4.6.2 Removing the shaft assembly from the bearing bracket — SIC plain bearing

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 46) to (⇨ Section 7.4.5, Page 48) have been observed/carried out.

✓ The back pull-out unit has been placed in a clean and level assembly area.

1. Undo nuts 920.04.
2. Pull bearing bracket 330 out of casing cover 161.
3. Pull locking sleeve 531, disc spring 950.23 and taper lock ring 515.21 off shaft 230.

⚠ WARNING

Thin metal foil used as carrier material in joint rings

Risk of injury (cuts)!

- ▹ Wear protective clothing.
- ▹ Always use an appropriate tool to remove joint rings.

4. Remove and dispose of joint ring 411.11.
5. Bend back lock washer 931.01, unscrew slotted round nut 920.21 (right-hand thread) and remove the nut.
6. Remove bolts 901.02 together with bearing cover 360.02.
7. Remove spacer ring 504.02.
8. Press shaft 210 out of bearing bracket 330.
9. Pull bearing sleeve 529.22 and taper lock ring 515.22 off the shaft.

7.4.6.3 Removing the mechanical seal

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 46) to (⇨ Section 7.4.5, Page 48) have been observed/carried out.

1. Undo grub screw 904 and remove bearing sleeve 529.21.
2. Undo the grub screws of the rotating part of mechanical seal 433 (primary ring) and pull the primary ring off the shaft.
3. Remove mating ring carrier 476 and Nilos ring 500.32.
4. Press the mating ring of mechanical seal 433 out of mating ring carrier 476.
5. Pull off bearing 321.
6. Remove O-ring 412.03 and spacer sleeve 525.03.

7.4.7 Removing the plain bearing bush — carbon plain bearing

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 46) to (⇨ Section 7.4.6, Page 49) have been observed/carried out.

1. Push bearing bush 545.21 out of bearing bracket 330 from the drive end.

7.4.8 Removing the plain bearing bush — SIC bearing

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 46) to (⇨ Section 7.4.6, Page 49) have been observed/carried out.

1. Remove circlip 932.01/.02 from bearing bracket 330.
2. Push bearing bush 545.21 out of bearing bracket 330 from the drive end.
3. Remove sleeves 500.61 from bearing bracket 330.

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

- ▹ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

CAUTION

Improper reassembly

Damage to the pump!

- ▹ Reassemble the pump (set) in accordance with the general rules of sound engineering practice.
- ▹ Use original spare parts only.

Sequence Always reassemble the pump in accordance with the corresponding general assembly drawing or exploded view.

Sealing elements Check O-rings for any damage and replace by new O-rings if required.

Always use new gaskets, making sure that they have the same thickness as the old ones.

Always fit gaskets of asbestos-free materials or graphite without using lubricants (e.g. copper grease, graphite paste).

Assembly aids Avoid the use of assembly adhesives if possible.

Should an assembly adhesive be required after all, use a commercially available contact adhesive (e.g. Pattex) or sealant (e.g. HYLOMAR or Epple 33).

Only apply adhesive at selected points and in thin layers.

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Never use quick-setting adhesives (cyanoacrylate adhesives).

Coat the locating surfaces of the individual components with graphite or similar before reassembly.

Prior to reassembly, screw back any forcing screws and adjusting screws.

Tightening torques

For reassembly, tighten all screws and bolts as specified in this manual.
(⇨ Section 7.6, Page 56)

7.5.2 Installing the plain bearing bush — carbon plain bearing

- ✓ The individual parts are kept in a clean and level assembly area.
- ✓ All disassembled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.

1. Press plain bearing bush 545.21 carefully into bearing bracket 330 until it will not go any further.

7.5.3 Installing the plain bearing bush — SIC plain bearing

- ✓ The individual parts are kept in a clean and level assembly area.
- ✓ All disassembled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.

1. Fit circlip 932.02 in bearing bracket 330.
2. Insert sleeves 500.61 into bearing bracket 330.
3. Press bearing bush 545.22 into bearing bracket 330 until it will not go any further.
4. Fit circlip 932.01 in bearing bracket 330.

7.5.4 Installing the ball bearings

- ✓ The notes and steps stated in (⇨ Section 7.5.1, Page 50) to (⇨ Section 7.5.2, Page 51) and (⇨ Section 7.5.3, Page 51) have been observed/carried out.
- ✓ The individual parts have been placed in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.

1. Slide spacer ring 525.03 and O-ring 412.03 onto shaft 210.
2. Press deep groove ball bearing 321 onto the shaft.
3. Slide spacer ring 504.02 onto shaft 210 and tighten it with slotted round nut 920.21 without lock washer 931.01.
4. Remove slotted round nut 920.21 again.
5. Apply a few spots of Molykote to the contact faces of the lock washer and of the slotted round nut.
6. Fit lock washer 931.01.
7. Fit and tighten slotted round nut 920.21.
8. Bend over lock washer 931.01.

7.5.5 Installing the shaft seal

Installing the mechanical seal

The following rules must be observed when installing the mechanical seal:

- Work cleanly and accurately.
- Only remove the protective wrapping of the contact faces immediately before installation takes place.
- Prevent any damage to the sealing surfaces or O-rings.

7.5.5.1 Installing the mechanical seal — carbon plain bearing

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 50) to (⇨ Section 7.5.4, Page 51) have been observed/carried out.

✓ The individual parts have been placed in a clean and level assembly area.

✓ All dismantled parts have been cleaned and checked for wear.

✓ Any damaged or worn parts have been replaced by original spare parts.

✓ The sealing surfaces have been cleaned.

1. Clean the mating ring location in mating ring carrier 476 and insert O-ring 412.02.
2. Press lip seal 421 into mating ring carrier 476.

DANGER

Excessive temperature caused by defective bearing seal

Explosion hazard!

▷ Grease the lip seal. Observe the indicated grease quality. (⇨ Section 7.2.3.1, Page 45)

3. Grease the sealing lip of the lip seal with rolling element bearing grease (⇨ Section 7.2.3.1, Page 45) .
4. Apply approx. 5 g of grease in the lower area between spacer ring 525.03 and the rear (bearing side) of lip seal 421.
5. Carefully insert the mating ring of mechanical seal 433 into mating ring carrier 476.
   Make sure to apply pressure evenly.
6. Fit Nilos ring 500.32 and mating ring carrier 476 with O-ring 412.82.
7. Slide the rotating assembly of the mechanical seal (primary ring) onto shaft 210.
8. Fit bearing sleeve 529.21 and fasten it with grub screw 904.
9. Fasten the rotating assembly of mechanical seal 433 (primary ring) with grub screws.

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7.5.5.2 Installing the mechanical seal — SIC plain bearing

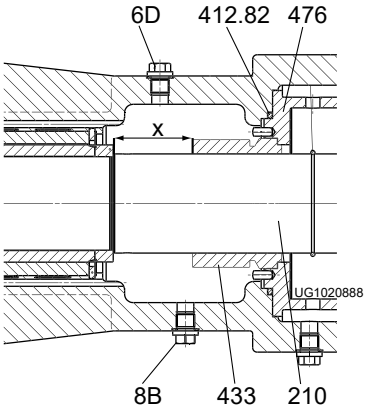

Fig. 17: Distance x

x	Distance between shaft shoulder and mechanical seal		
6D	Fluid drain	8B	Leakage drain
210	Shaft	412.82	O-ring
433	Mechanical seal	476	Mating ring carrier

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 50) to (⇨ Section 7.5.4, Page 51) have been observed/carried out.

✓ The individual parts have been placed in a clean and level assembly area.

✓ All dismantled parts have been cleaned and checked for wear.

✓ Any damaged or worn parts have been replaced by original spare parts.

✓ The sealing surfaces have been cleaned.

1. Press lip seal 421 into mating ring carrier 476.

⚠ DANGER

Excessive temperature caused by defective bearing seal

Explosion hazard!

▹ Grease the lip seal. Observe the indicated grease quality. (⇨ Section 7.2.3.1, Page 45)

2. Grease the sealing lip of the lip seal with rolling element bearing grease (⇨ Section 7.2.3.1, Page 45) .
3. Apply approx. 5 g of grease in the lower area between spacer ring 525.03 and the rear (bearing side) of lip seal 421.
4. Carefully insert the mating ring of mechanical seal 433 into mating ring carrier 476.
   Make sure to apply pressure evenly.
5. Fit Nilos ring 500.32 and mating ring carrier 476 with O-ring 412.82.
6. Slide the rotating assembly of the mechanical seal (primary ring) onto shaft 210.
7. Set dimension x = 56 mm (see the above illustration).
8. Fasten the rotating assembly of mechanical seal 433 (primary ring) with grub screws.

7.5.5.3 Installing the shaft assembly in the bearing bracket — carbon plain bearing

- ✓ The notes and steps stated in (⇨ Section 7.5.1, Page 50) to (⇨ Section 7.5.5, Page 52) have been observed/carried out.
- ✓ The individual parts have been placed in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.

1. Carefully press the shaft assembly into bearing bracket 330.
2. Slide spacer ring 504.02 onto shaft 210.
3. Fit bearing cover 360.
4. Fit hexagon head bolts 901.02.
5. Fit lock washer 931.01 and slotted round nut 920.21.
6. Fit slotted round nut 920.21.
7. Bend back lock washer 931.01.
8. Insert joint ring 411.11.
9. Fit casing cover 161 on bearing bracket 330.
10. Tighten nuts 920.04 to the torques given in this manual.

7.5.5.4 Installing the shaft assembly in the bearing bracket — SIC plain bearing

- ✓ The notes and steps stated in (⇨ Section 7.5.1, Page 50) to (⇨ Section 7.5.5, Page 52) have been observed/carried out.
- ✓ The individual parts have been placed in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.

1. Carefully press the shaft assembly into bearing bracket 330.
2. Slide spacer ring 504.02 onto shaft 210.
3. Fit bearing cover 360.
4. Fit hexagon head bolts 901.02.
5. Fit lock washer 931.01 and slotted round nut 920.21.
6. Fit slotted round nut 920.21.
7. Bend back lock washer 931.01.
8. Insert joint ring 411.11.
9. Slide taper lock ring 515.22, bearing sleeve 529.22, taper lock ring 515.21 and disc spring 950.23 onto shaft 210.
10. Insert joint ring 411.11.
11. Fit casing cover 161 on bearing bracket 330.
12. Tighten nuts 920.04 to the torques given in this manual.
13. Slide locking sleeve 531 onto shaft 210.

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7.5.6 Fitting the impeller

7.5.6.1 Single-stage version

- ✓ The notes and steps stated in (⇨ Section 7.5.1, Page 50) to (⇨ Section 7.5.5, Page 52) have been observed/carried out.
- ✓ The assembled bearing bracket as well as the individual parts are kept in a clean and level assembly area.
- ✓ All disassembled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.

1. Insert key 940.01 and push impeller 230 onto shaft 210.
2. Fasten impeller nut 922. (See table: Tightening torques for bolted/screwed connections at the pump))

7.5.6.2 Double-stage version (125-500/2)

- ✓ The notes and steps stated in (⇨ Section 7.5.1, Page 50) to (⇨ Section 7.5.5, Page 52) have been observed/carried out.
- ✓ The assembled bearing bracket as well as the individual parts have been placed in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.

1. Insert key 940.01 into shaft 210.
2. Slide impeller 230.02 onto the shaft.
3. Slide spacer sleeve 525.01 onto the shaft.
4. Slide diffuser 171 onto spacer sleeve 525.01.
5. Slide impeller 230.01 onto the shaft.
6. Fasten impeller nut 922 (right-hand thread).

7.5.7 Installing the back pull-out unit

⚠ WARNING

Back pull-out unit tilting

Risk of crushing hands and feet!

▹ Suspend or support the bearing bracket at the pump end.

- ✓ The notes and steps stated in (⇨ Section 7.5.1, Page 50) to have been observed/carried out.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
- ✓ For back pull-out units supplied without coupling: Fit the coupling in accordance with the manufacturer's instructions.

1. Insert new joint ring 411.10 into volute casing 102.
2. If required, prevent the back pull-out unit from tilting, e.g. by suspending or supporting it. Then push it into volute casing 102.
3. Tighten nut 920.01 at the volute casing. Observe the tightening torques.
4. Fasten support foot 183 to the baseplate with a foundation bolt.

7.5.8 Mounting the motor

NOTE

Steps 1 and 2 do not apply to versions with spacer-type coupling.

1. Shift the motor to connect it to the pump via the coupling.
2. Fasten the motor to the baseplate.
3. Align pump and motor. (⇨ Section 5.6, Page 29)
4. Connect the motor to the power supply (refer to manufacturer's product literature).

7.6 Tightening torques

7.6.1 Tightening torques for the pump

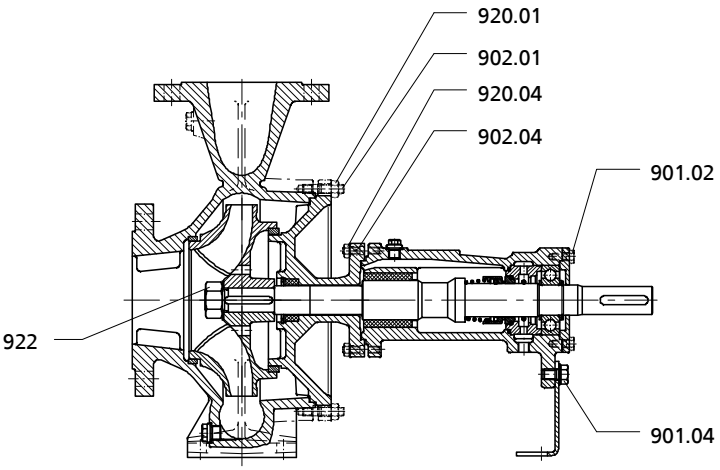

Fig. 18: Tightening points at the pump

Table 17: Tightening torques

Part No.	Description	Thread	Tightening torques[8)]
			[Nm]
901.02	Hexagon head bolt	M12	30
901.04	Hexagon head bolt	M16	75
902.01/920.01	Hexagon nut	M16	120
		M20	240
902.04/920.04	Hexagon nut	M16	120
922	Hexagon nut	M20 × 1,5	200
		M24 × 1,5	500

8 For unlubricated threads

7.6.2 Tightening torques for the pump set

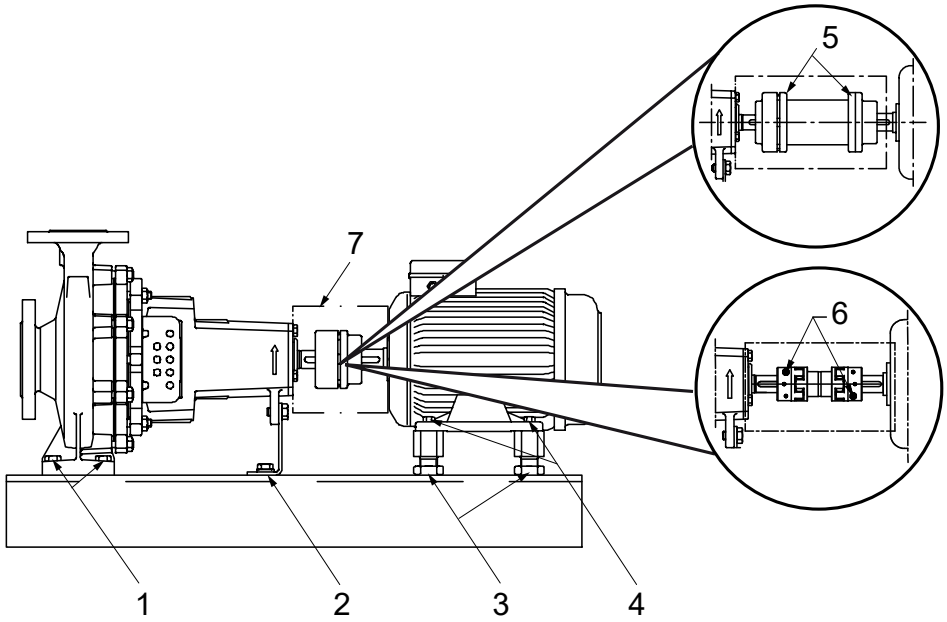

Fig. 19: Tightening points at the pump set

Table 18: Tightening torques for bolted/screwed connections at the pump set

Position	Thread	Tightening torques[9]	Comments
		[Nm]	
1	M20	140	Pump on baseplate
	M24	140	
	M 30	140	
2	M16	75	
3	M24 × 1,5	140	
4	M8	10	Motor on baseplate
	M12	30	
	M16	75	
	M20	140	
	M24	140	
5	M6	10	Coupling[10]
6	M6	13	Coupling guard
	M8	17,5	
	M10	44	
	M12	89	

9 For unlubricated threads
10 For spacer-type couplings only

7.7 Spare parts stock

7.7.1 Ordering spare parts

Always quote the following data when ordering replacement or spare parts:

- Order number
- Order item number
- Consecutive number
- Type series
- Size
- Material variant
- Seal code
- Year of construction

Refer to the name plate for all data. (⇨ Section 4.4, Page 17)

Also specify the following data:

- Part number and description (⇨ Section 9.1, Page 62)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

7.7.2 Recommended spare parts stock for 2 years' operation to DIN 24296

Table 19: Quantity of spare parts for recommended spare parts stock

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
171	Diffuser[11)]	1	1	1	2	2	2	20 %
210	Shaft	1	1	1	2	2	2	20 %
230	Impeller[12)]	1	1	1	2	2	2	20 %
321	Radial ball bearing	1	1	2	2	3	4	100 %
330	Bearing bracket	-	-	-	-	-	1	2 pcs.
400./...	Gaskets (set)	4	6	8	8	9	12	150 %
412	O-ring[11)]	4	6	8	8	9	12	150 %
433	Mechanical seal	1	1	2	2	2	3	25 %
502.01/.02	Casing wear ring	2	2	2	3	3	4	50 %
-	Torque-transmitting coupling elements (set)	1	1	2	2	3	4	30 %

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11 For Etanorm-RSY 125-500/2 only
12 Double quantity for Etanorm-RSY 125-500/2

7.7.3 Interchangeability of pump components

Components featuring the same number in a column are interchangeable.

Table 20: Interchangeability of pump components

Size	Shaft units	Description													
		Volute casing	Casing cover	Support foot (carbon bearing)	Shaft	Impeller	Deep groove ball bearing	Bearing bracket (carbon bearing)	Bearing cover (without fan)	Mechanical seal	Mating ring carrier	Casing wear ring, suction side	Casing wear ring, discharge side	Bearing sleeve (carbon bearing)	Bearing bush (carbon bearing)
		Part No.													
		102	161	183	210	230	321	330	360.02	433	476	501.01	501.02	529.21	545.21
125-500/2	65	○	○	○	○	○	1	1	1	1	1	○	○	1	1
150-500.1	65	○	1	○	1	○	1	1	1	1	1	1	1	1	1
200-330	65	○	4	○	1	○	1	1	1	1	1	○	4	1	1
200-400	65	○	○	○	1	○	1	1	1	1	1	2	2	1	1
200-500	65	○	1	○	1	○	1	1	1	1	1	○	1	1	1
250-330	65	○	○	○	1	○	1	1	1	1	1	○	4	1	1
250-400	65	○	○	○	1	○	1	1	1	1	1	○	1	1	1
250-500	65	○	2	○	1	○	1	1	1	1	1	○	1	1	1
300-360	65	○	3	○	1	○	1	1	1	1	1	○	1	1	1
300-400	65	○	3	○	1	○	1	1	1	1	1	3	1	1	1
300-500	65	○	2	○	1	○	1	1	1	1	1	3	1	1	1

8 Trouble-shooting

⚠ WARNING

Improper work to remedy faults

Risk of injury!

- ▷ For any work performed to remedy faults, observe the relevant information given in this operating manual and/or in the product literature provided by the accessories manufacturer.

If problems occur that are not described in the following table, consultation with the KSB service is required.

A Pump delivers insufficient flow rate

B Motor is overloaded

C Excessive discharge pressure

D Increased bearing temperature

E Leakage at the pump

F Excessive leakage at the shaft seal

G Vibrations during pump operation

H Impermissible temperature increase in the pump

Table 21: Trouble-shooting

A	B	C	D	E	F	G	H	Possible cause	Remedy[13)]
✗	-	-	-	-	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point. Check system for impurities. Fit a larger impeller.[14)] Increase the speed (turbine, I.C. engine).
✗	-	-	-	-	-	✗	✗	Pump or piping are not completely vented or primed.	Vent and/or prime. Clean vent hole.
✗	-	-	-	-	-	-	-	Supply line or impeller clogged	Remove deposits in the pump and/or piping.
✗	-	-	-	-	-	-	-	Formation of air pockets in the piping	Alter piping layout. Fit vent valve.
✗	-	-	-	-	-	✗	✗	Suction lift is too high/NPSHavailable (positive suction head) is too low.	Check/alter fluid level. Install pump at a lower level. Fully open the shut-off element in the suction line. Change suction line, if the friction losses in the suction line are too high. Check any strainers installed/suction opening. Observe permissible speed of pressure fall.
✗	-	-	-	-	-	-	-	Wrong direction of rotation	Interchange two of the phases of the power cable.
✗	-	-	-	-	-	-	-	Speed is too low. - Operation with frequency inverter - Operation without frequency inverter	 - Increase voltage/frequency at the frequency inverter in the permissible range. - Check voltage.
✗	-	-	-	-	-	✗	-	Wear of internal components	Replace worn components by new ones.
-	✗	-	-	-	-	✗	-	Pump back pressure is lower than specified in the purchase order.	Re-adjust to duty point. In the case of persistent overloading, turn down impeller.[14)]
-	✗	-	-	-	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	Contact KSB.

13 Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

14 Contact KSB.

A	B	C	D	E	F	G	H	Possible cause	Remedy[13)]
-	✗	✗	-	-	-	-	-	Speed is too high.	Reduce speed.[14)]
-	-	-	-	✗	-	-	-	Defective gasket	Fit new gasket between volute casing and discharge cover or between discharge cover and bearing bracket.
-	-	-	-	✗	-	-	-	Gasket not pre-loaded sufficiently	Increase pre-loading of gasket at operating temperature: 1. Close the valves on the discharge and suction side. 2. Allow the pump set to cool down to a temperature below the boiling point of the fluid handled. 3. Re-tighten hexagon nuts 920.1 and 920.2 at the discharge cover. 4. Start up the pump set.
-	-	-	-	-	✗	-	-	Worn shaft seal	Fit new shaft seal. Check flushing liquid/barrier fluid.
-	-	-	-	-	✗	-	-	Vibrations during pump operation	Correct the suction conditions. Re-align the pump set. Re-balance the impeller. Increase pressure at the pump suction nozzle.
-	-	-	✗	-	✗	✗	-	Pump set is misaligned.	Re-align the pump set.
-	-	-	✗	-	✗	✗	-	Pump is warped or sympathetic vibrations in the piping.	Check the piping connections and secure fixing of pump; if required, reduce distances between the pipe clamps. Fix the pipelines using anti-vibration material.
-	-	-	✗	-	-	-	-	Increased axial thrust[14)]	Clean balancing holes in the impeller. Replace the casing wear rings.
-	-	-	✗	-	-	-	-	Non-compliance with specified coupling distance	Correct the distance according to the general arrangement drawing.
✗	✗	-	-	-	-	-	-	Motor is running on two phases only.	Replace the defective fuse. Check the electric cable connections.
-	-	-	-	-	-	✗	-	Rotor out of balance	Clean the impeller. Re-balance the impeller.
-	-	-	-	-	-	✗	-	Defective bearing(s)	Replace.
-	-	-	✗	-	-	✗	✗	Flow rate is too low.	Increase the minimum flow rate.

9 Related Documents

9.1 General assembly drawing with list of components

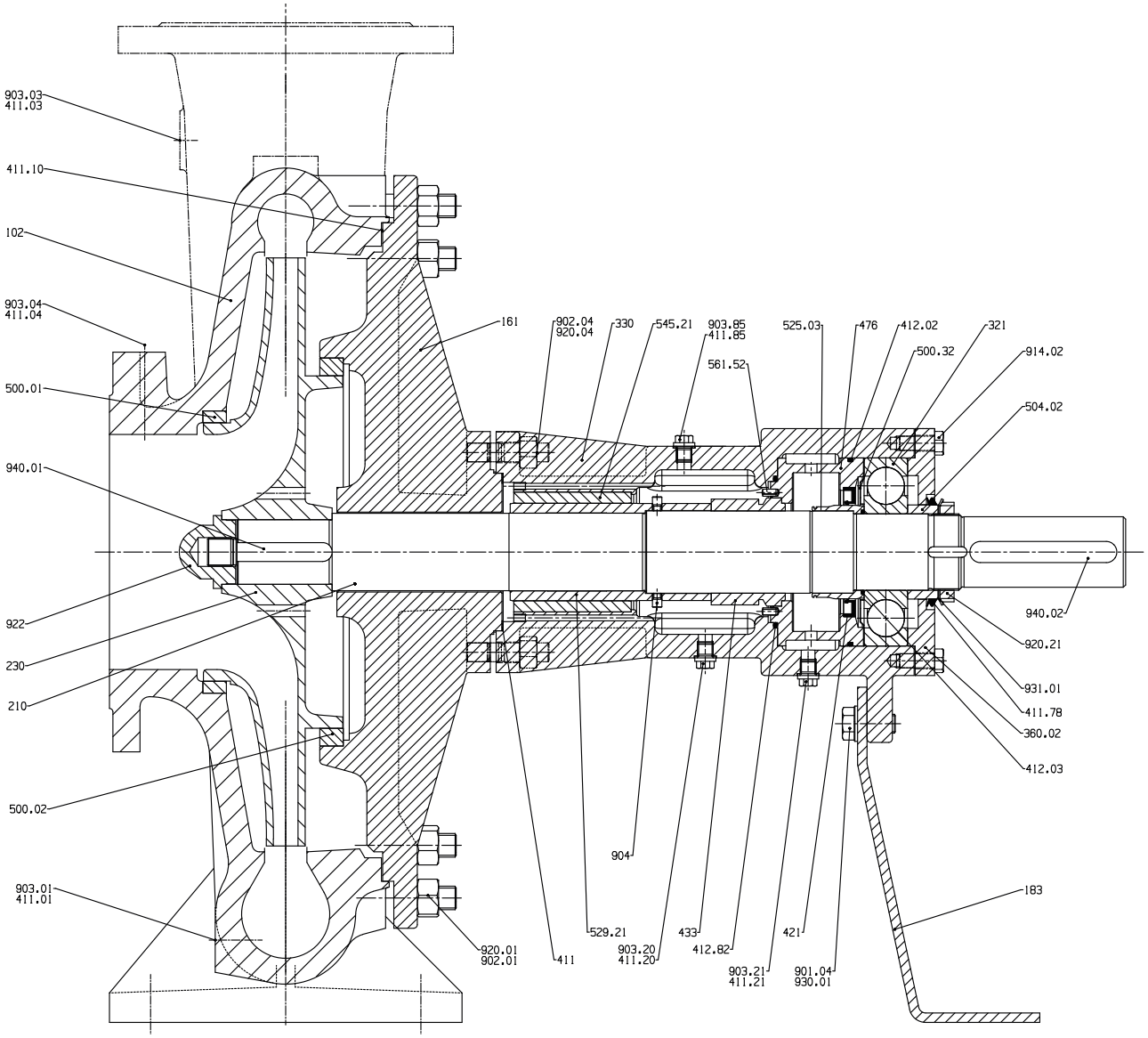
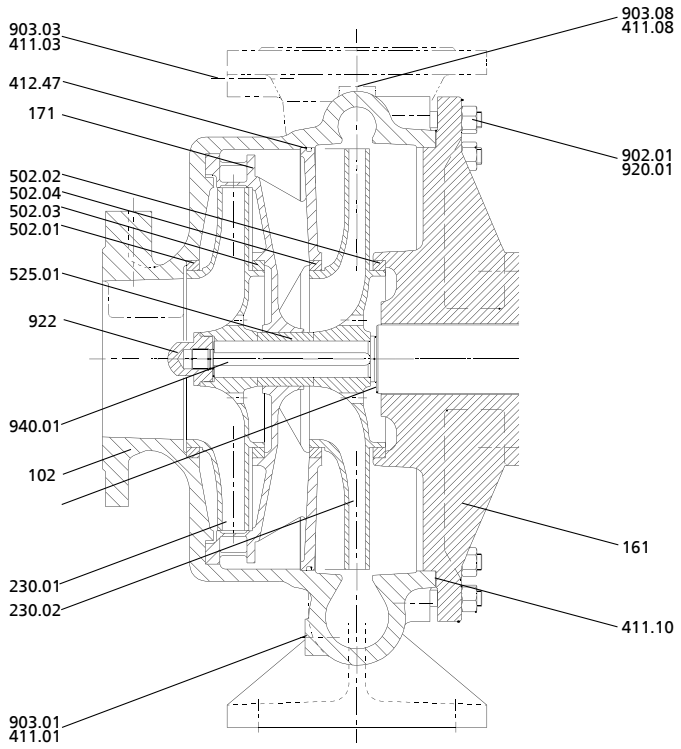
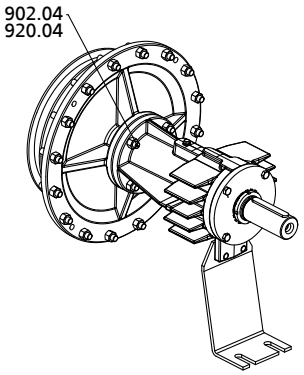


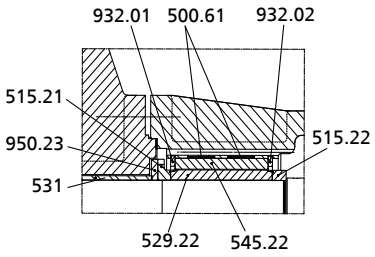
Fig. 20: General assembly drawing



Double-stage version



Back pull-out unit



Version with SiC bearing

Table 22: List of components

Part No.	Comprising	Description
102	102	Volute casing
	411.01/.03/.04/.08	Joint ring
	502.01	Casing wear ring
	902.01	Stud
	903.01/.03/.04/.08	Screw plug
	920.01	Hexagon nut
161	161	Casing cover
	411.10	Joint ring
	502.02	Casing wear ring
	920.01	Hexagon nut
	902.04	Stud
171[15)]	171	Diffuser
183	183	Support foot
	901.04	Hexagon head bolt
	550.41	Disc
210	210	Shaft
	940.01/.02	Key
	412.82	O-ring
230.01/.02[15)]	230.01/.02	Impeller
321	321	Deep groove ball bearing
330	330	Bearing bracket
330	330	Bearing bracket
	210	Shaft
	321	Deep groove ball bearing

15 For Etanorm-RSY 125-500/2 only

Part No.	Comprising	Description
330	360.02	Bearing cover
	411.11/.20/.21/.85	Sealing element
	412.02/.03/.82	O-ring
	421	Lip seal
	433	Mechanical seal
	476	Mating ring carrier
	500.32	Ring
	504.02	Spacer ring
	525.03	Spacer sleeve
	529.21	Bearing sleeve
	545.21	Bearing bush
	561.52	Grooved pin
	903.20/.21/.85	Screw plug
	920.04	Hexagon nut
	920.21	Nut
	922	Impeller nut
	940.01/.02	Key
	931.01	Lock washer
360.02	360.02	Bearing cover
	901.01/.02	Hexagon head bolt
411.01/.03/.04/.08/.10/.11/.20/.21/.85	411.01/.03/.04/.08/.10/.11/.20/.21/.85	Joint ring
412.47[15)]	412.47[15)]	O-ring
412.02/.03/82	412.02/.03/82	O-ring
421	421	Lip seal
433	433	Mechanical seal
476	476	Mating ring carrier
	561.52	Grooved pin
500.32	500.32	Nilos ring
500.61 [16)]	500.61	Tolerance sleeve
502.01/.02/.03[15)]/.04[15)]	502.01/.02/.03[15)]/.04[15)]	Casing wear ring
504.02	504.02	Spacer ring
515.21/.22 [16)]	515.21/.22 [16)]	Locking ring
525.01[15)] /.03	525.01[15)]	Spacer sleeve
529.21	529.21	Bearing sleeve
529.22 [16)]	529.22 [16)]	Bearing sleeve
531[16)]	531[16)]	Locking sleeve
545.21	545.21	Bearing bush
545.22 [16)]	545.22 [16)]	Bearing bush
550.41	550.41	Disc
561.52	561.52	Grooved pin
901.02/.04	901.02/.04	Hexagon head bolt
902.01/.04	902.01/.04	Stud
903.01/.03/.04/.08/.20/.21/.85	903.01/.03/.04/.08/.20/.21/.85	Screw plug
904	904	Grub screw
920.01/.04	920.01/.04	Hexagon nut
920.21	920.21	Nut

16 For SiC bearing only

Part No.	Comprising	Description
922	922	Impeller nut
931.01	931.01	Lock washer
932.01/.02[16)]	932.01/.02[16)]	Circlip
940.01/.02	940.01/.02	Key
950.23 [16)]	950.23 [16)]	Disc spring

10 EU Declaration of Conformity

Manufacturer: **KSB SE & Co. KGaA**
Johann-Klein-Straße 9
67227 Frankenthal (Germany)

The manufacturer herewith declares that **the product**:

Etanorm-RSY

KSB order number: .....

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
  - Pump (set): 2006/42/EC Machinery Directive

The manufacturer also declares that

- the following harmonised international standards[17)] have been applied:
  - ISO 12100
  - EN 809

Person authorised to compile the technical file:

Name
Function
Address (company)
Address (street, No.)
Address (post or ZIP code, city) (country)

The EU Declaration of Conformity was issued in/on:

Place, date

.....[18)].....

Name

Function

Company
Address

17 Apart from the standards listed here referring to the Machinery Directive, further standards are observed for explosion-proof versions (ATEX Directive) as applicable and are listed in the legally binding EU Declaration of Conformity.

18 A signed, legally binding EU Declaration of Conformity is supplied with the product.

11 Certificate of Decontamination

Type: .....

Order number /

Order item number[19]: .....

Delivery date: .....

Application: .....

Fluid handled[19]: .....

Please tick where applicable[19]:

☐ Corrosive

☐ Oxidising

☐ Flammable

☐ Explosive

☐ Hazardous to health

☐ Seriously hazardous to health

☐ Toxic

☐ Radioactive

☐ Bio-hazardous

☐ Safe

Reason for return:[19]: .....

Comments: .....

.....

The product / accessories have been carefully drained, cleaned and decontaminated inside and outside prior to dispatch / placing at your disposal.

We herewith declare that this product is free from hazardous chemicals and biological and radioactive substances.

For mag-drive pumps, the inner rotor unit (impeller, casing cover, bearing ring carrier, plain bearing, inner rotor) has been removed from the pump and cleaned. In cases of containment shroud leakage, the outer rotor, bearing bracket lantern, leakage barrier and bearing bracket or intermediate piece have also been cleaned.

For canned motor pumps, the rotor and plain bearing have been removed from the pump for cleaning. In cases of leakage at the stator can, the stator space has been examined for fluid leakage; if fluid handled has penetrated the stator space, it has been removed.

☐ No special safety precautions are required for further handling.

☐ The following safety precautions are required for flushing fluids, fluid residues and disposal:

.....

.....

We confirm that the above data and information are correct and complete and that dispatch is effected in accordance with the relevant legal provisions.

.....	.....	.....
Place, date and signature	Address	Company stamp

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19 Required field

Index

1223.8/09-EN

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W

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1223.8/09-EN (01316960)

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