

Heat Transfer Fluid / Hot Water Pump

HPK-L

Product Generation B

Installation/Operating Manual



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Installation/Operating Manual HPK-L

Original operating manual

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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

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. (⇒ Section 7.5.5, Page 58)

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 dimensions 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 included in agreed 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 This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
	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.



2 Safety

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.

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.

- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.3, Page 42)
- 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 35)

2.8 Unauthorised modes of operation

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

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

2.9 Explosion protection



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

Pumps/Pump sets must not be used in potentially explosive atmospheres unless marked as explosion-proof **and** identified as such in the data sheet.

Special conditions apply to the operation of explosion-proof pump sets in accordance with 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 of the pump is only assured if the pump 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 has its own marking. The marking is maintained on the condition that the temperatures the pump causes to develop at the motor flange and motor shaft are permitted by the motor manufacturer.

The motors fitted by KSB on pumps with ATEX certification meet this condition.

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

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.

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	Maximum 400 °C ³⁾
T2	280 °C
T3	185 °C
T4	120 °C
T5	85 °C
T6	Only after consultation with 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 A special design is required to comply with the requirements of temperature class T6 in the bearing area.

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 41) 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 41) can be used to check whether an additional heat build-up may lead to a dangerous temperature increase at the pump surface.

² Subject to further limitations for mechanical seal temperature rise

³ Depending on the material variant

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.

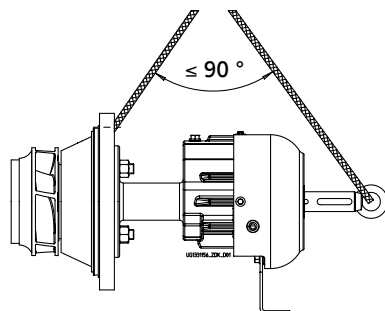


Fig. 1: Transporting the back pull-out unit

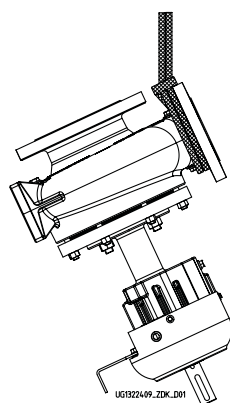


Fig. 2: Transporting the pump

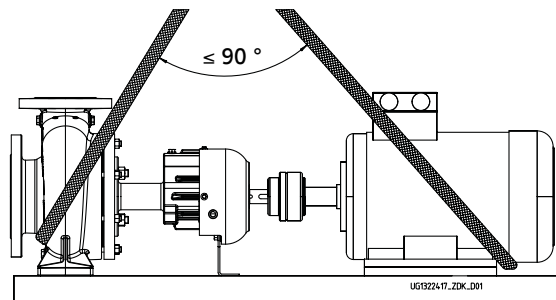


Fig. 3: Transporting the pump set

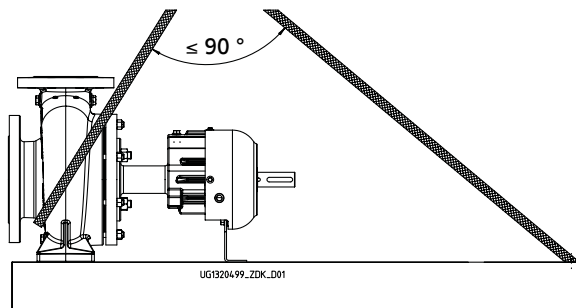


Fig. 4: Transporting the pump on the baseplate

	CAUTION Risk of pump (set) or bare shaft end hitting other objects Damage to the ceramic plain bearing! ▷ Secure them properly.
--	---

3.3 Storage/preservation

	CAUTION Damage during storage due to humidity, dirt or vermin Corrosion/contamination of pump (set)! ▷ For outdoor storage cover the pump (set) and accessories with waterproof material and protect against condensation.
---	--

	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 42)

3.4 Return to supplier

1. Drain the pump as per operating instructions.
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, the pump must also be neutralised, and anhydrous inert gas must be blown through the pump 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 69)



NOTE

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

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

- Heat transfer fluid / hot water pump

Pump for handling hot water and organic or synthetic heat transfer fluids in piping or tank systems.

Standard design for plants (large heating systems, forced circulation boilers, district heating systems, etc).

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

Table 5: Designation example

Position																															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
H	P	K	L	0	5	0	-	0	3	2	-	2	5	0	1	E	G	B	S		X	W		W	0	0	7	5	4		B
See name plate and data sheet																						See data sheet									

Table 6: Designation key

Position	Code	Description
1-4	Pump type	
	HPKL	HPK-L
5-16	Size, e.g.	
	050	Nominal suction nozzle diameter [mm]
	032	Nominal discharge nozzle diameter [mm]
	2501	Nominal impeller diameter [mm]
17	Pump casing material / Casing cover material	
	E	GP240GH+N/ A216 Gr. WCB P250GH / 1.7335/P355NL1 (Europe) GP240GH+N / A216 Gr. WCB (Asia)
	S	GP240GH+N/ A216 Gr. WCB EN-GJS-400-18-LT
	Y	1.7706 P250GH / 1.7335/P355NL1
	Z	1.7706 EN-GJS-400-18-LT
18	Impeller material	
	C	Stainless steel 1.4408 / A743 Gr. CF8M
	E	Steel GP240GH+N / A216 Gr WCB
	G	Grey cast iron EN-GJL-250 / A 48 CL 35B
19-21	Shaft seal type	
	BS	Single mechanical seal, dead-end arrangement, air-cooled
	TL	Tandem mechanical seals, dead-end arrangement, air-cooled
22	Design	
	-	Standard
	X	Non-standard (BT3D, BT3)
23	Fluid handled	
	O	Heat transfer fluids
	W	Hot water
24	-	
25	Bearing bracket design	
	W	Bearing bracket for heat transfer applications

Position	Code	Description
26-29	Motor rating P_N [kW]	
	0007	0,75
	...	...
	1320	132,00
30	Number of motor poles	
31-32	Product generation	
	A	HPK-L 2001
	B	HPK-L 2013 Global Pump

4.4 Name plate

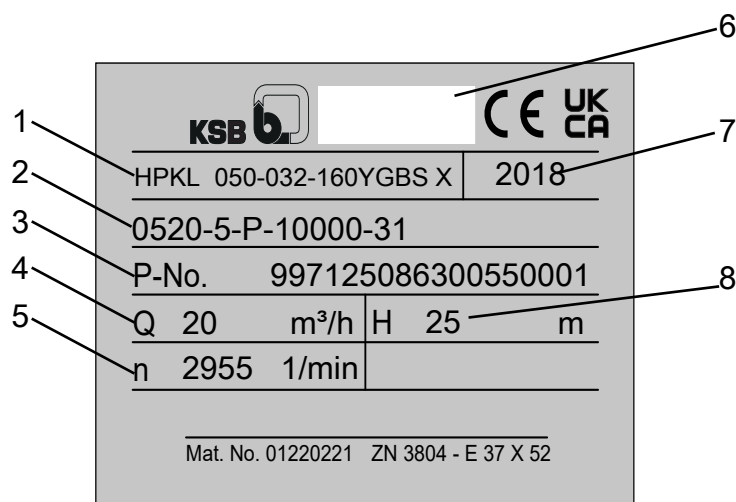


Fig. 5: Name plate (example)

1	Type series, size, material	2	Customer-specific information (optional)
3	KSB order number and order item number	4	Flow rate
5	Speed	6	Manufacturer's name and address
7	Year of construction	8	Head

4.5 Design details

Design

- Volute casing pump
- Horizontal installation
- Back pull-out design
- Single-stage
- Technical requirements to ISO 5199
- Dimensions and ratings to ISO 2858 complemented by pumps of nominal sizes DN 25, DN 200 and above

Pump casing

- Single or double volute, depending on the pump size
- Radially split volute casing
- Volute casing with integrally cast pump feet
- Replaceable casing wear rings

Shaft seal

- KSB mechanical seal, optimised for installation in an HPK-L pump, with integrated shaft sleeve (standard Europe)
- Optional commercial single mechanical seals with replaceable shaft sleeve (standard Asia/Americas)
- Versions with two mechanical seals can be supplied for heat transfer applications.

Impeller type

- Closed radial impeller with multiply curved vanes

Bearings

Bearings:

- Version with single mechanical seal
 - Radial bearing: plain bearing, product-lubricated
 - Fixed bearings: two angular ball bearings, grease-packed
- Version with two mechanical seals
 - Radial bearing: plain bearing, product-lubricated
 - Fixed bearing: one deep groove ball bearing or one four-point bearing (depending on the pump size), grease-packed

Bearing bracket designation Example: CS50

Table 7: Bearing bracket designation

Code	Description
CS	Bearing bracket
50	Size

Table 8: Bearings used

Design	Bearing bracket	Plain bearing	Ball bearing
One mechanical seal	CS40	SSiC	2x7307
	CS50	SSiC	2x7307
	CS60	SSiC	2x7309
	CS80	SSiC	2x7313
Two mechanical seals	CS40	SSiC	1x6307 or QJ307
	CS50	SSiC	1x6307 or QJ307
	CS60	SSiC	1x6309
	CS80	SSiC	1x6313 or QJ313

4.6 Configuration and function

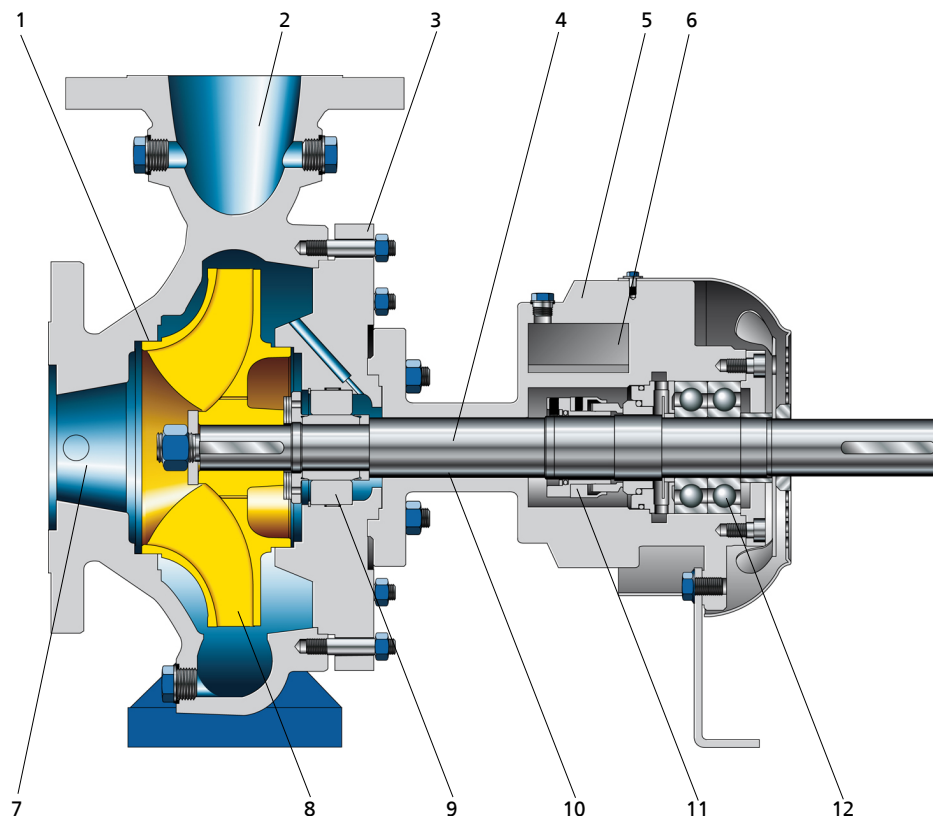


Fig. 6: Sectional drawing

1	Clearance gap	2	Discharge nozzle
3	Casing cover	4	Drive shaft
5	Bearing bracket	6	Venting chamber
7	Suction nozzle	8	Impeller
9	Plain bearing, pump end	10	Cooling distance
11	Shaft seal	12	Rolling element bearing, drive 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 drive shaft (4) enters the hydraulic system through the casing cover (3). The pump-end plain bearing is located in the casing cover (9). The fluid is guided along the cooling distance (10) to the mechanical seal chamber. Here, the patented VenJet contour separates any gases contained in the fluid and collects them in the venting chamber (6). The mechanical seal chamber is sealed towards the drive-end rolling element bearings (12) by a mechanical seal (11). Pump sets with two mechanical seals are fitted with an unpressurised quench liquid supply between the two mechanical seals. In the event of leakage of the inboard mechanical seal, the quench liquid prevents "cracking" at the sealing gap and transports any leaked fluid to the quench liquid supply system. The cooling distance, mechanical seal chamber and rolling element bearing support are integrated in the bearing bracket (5), which is connected to the casing cover.

Sealing The pump is sealed by a KSB mechanical seal as standard. A standardised mechanical seal with shaft sleeve is available as an option.

4.7 Noise characteristics

Table 9: Surface sound pressure level L_{pA} ^{4) 5)}

P_N	Pump			Pump set		
	960 rpm, 760 rpm	1450 rpm	2900 rpm	960 rpm, 760 rpm	1450 rpm	2900 rpm
[kW]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1,5	52	53	54	56	58	63
2,2	53	55	56	58	60	66
3	55	56	57	60	62	68
4	56	58	59	61	63	69
5,5	58	59	61	62	65	71
7,5	59	61	62	64	66	72
11	61	63	64	65	68	74
15	63	65	66	67	69	75
18,5	64	66	67	68	70	76
22	65	67	68	68	71	77
30	66	68	70	70	72	78
37	67	70	71	70	73	79
45	68	71	72	71	74	80
55	69	72	73	72	74	80
75	71	73	75	73	76	81
90	71	74	76	73	76	82
110	72	75	77	74	77	82
132	73	76	78	75	77	83
160	74	77	79	75	78	84
200	75	78	80	76	79	84
250	-	79	81	-	80	85

4.8 Scope of supply

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

- Pump

Drive

- Surface-cooled IEC frame three-phase squirrel-cage motor

Coupling

- Flexible coupling with or without spacer

Contact guard

- Coupling guard

Baseplate

Europe:

- Baseplate (to ISO 3661), cast or welded, for pump and motor, in torsion-resistant design
- Channel section steel or folded steel plate

⁴ Surface sound pressure level as per ISO 3744 and DIN EN ISO 20361 ; valid for a pump operating range of $Q/Q_{BEP} = 0.8 - 1.1$ and non-cavitating operation. If noise levels are to be guaranteed: Add +3 dB for measuring and constructional tolerance.

⁵ Increase for 60 Hz operation: 3500 rpm +3 dB; 1750 rpm +1 dB; 1160 rpm ±0 dB

Asia/Americas:

- Baseplate to local KSB standard

Special accessories

- As required

4.9 Dimensions and weights

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

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 XS1 to EN 206. ▷ The mounting surface must be set, even, 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

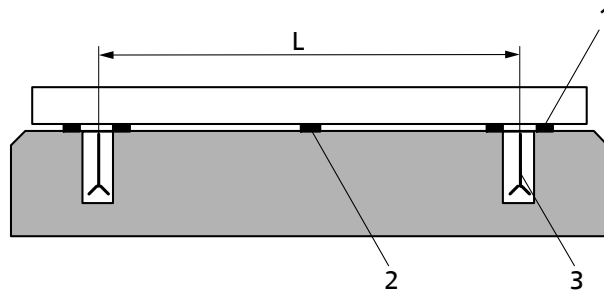


Fig. 7: Fitting the shims

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.
 7. Grout the baseplate using low-shrinkage concrete with a standard particle size and a water/cement ratio of ≤ 0.5 .
Produce flowability with the help of a solvent.
Perform secondary treatment of the concrete to EN 206.



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.

5.2.2 Installation without foundation

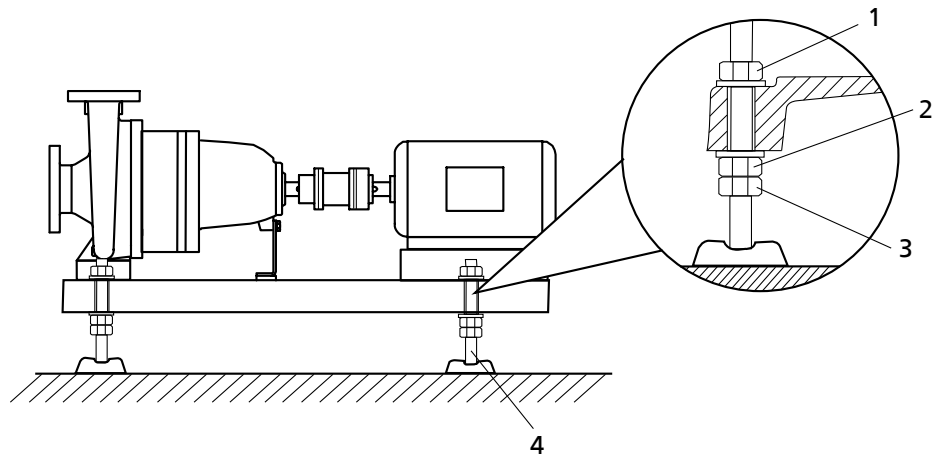


Fig. 8: Adjusting the levelling elements

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 leakage of hot, toxic, corrosive or flammable fluids! ▷ Do not use the pump as an anchorage point for the piping. ▷ Anchor the pipelines 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 48) .

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).

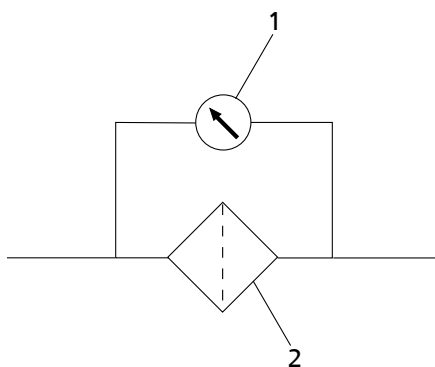


Fig. 9: Filter in the piping

1	Differential pressure gauge	2	Filter
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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.

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

The data on forces and moments apply to static piping loads only. If the limits are exceeded, they must be checked and verified.
If a computerised strength analysis is required, values are available on request only.
The values are only applicable if the pump is installed on a completely grouted baseplate and bolted to a rigid and level foundation.

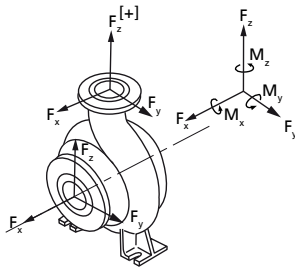


Fig. 10: Forces and moments at the pump nozzles

Table 10: Forces and moments at the pump nozzles for "Y" and "Z" variants (casing material 1.7706)

Size	Suction nozzle								Discharge nozzle							
	DN	[N]				[Nm]			DN	[N]				[Nm]		
		F _x	F _y	F _z	ΣF	M _x	M _y	M _z		F _x	F _y	F _z	ΣF	M _x	M _y	M _z
040-025-160	40	1050	850	700	1522	920	635	740	25	530	495	650	974	635	425	495
040-025-200	40	1050	850	700	1522	920	635	740	25	530	495	650	974	635	425	495
050-032-125.1	50	1350	1100	950	1984	90	705	815	32	700	605	850	1256	775	530	600
050-032-160.1	50	1350	1100	950	1984	990	705	815	32	700	605	850	1256	775	530	600
050-032-200.1	50	1350	1100	950	1984	990	705	815	32	700	605	850	1256	775	530	600
050-032-250.1	50	1350	1100	950	1984	990	705	815	32	700	605	850	1256	775	530	600
050-032-125	50	1350	1100	950	1984	990	705	815	32	700	605	850	1256	775	530	600
050-032-160	50	1350	1100	950	1984	990	705	815	32	700	605	850	1256	775	530	600
050-032-200	50	1350	1100	950	1984	990	705	815	32	700	605	850	1256	775	530	600
050-032-250	50	1350	1100	950	1984	990	705	815	32	700	605	850	1256	775	530	600
065-040-160.1	65	1750	1400	1200	2542	1150	600	850	40	850	705	1100	1553	920	635	740
065-040-250.1	65	1750	1400	1200	2542	1150	600	850	40	850	705	1100	1553	920	635	740
065-040-125	65	1750	1400	1200	2542	1150	600	850	40	850	705	1100	1553	920	635	740
065-040-160	65	1750	1400	1200	2542	1150	600	850	40	850	705	1100	1553	920	635	740
065-040-200	65	1750	1400	1200	2542	1150	600	850	40	850	705	1100	1553	920	635	740
065-040-250	65	1750	1400	1200	2542	1150	600	850	40	850	705	1100	1553	920	635	740
065-040-315	65	1750	1400	1200	2542	1150	600	850	40	850	705	1100	1553	920	635	740
080-050-315.1	80	2150	1700	1450	3101	1450	750	1100	50	1100	955	1350	1986	990	705	815
080-050-125	80	2150	1700	1450	3101	1450	750	1100	50	1100	955	1350	1986	990	705	815
080-050-160	80	2150	1700	1450	3101	1450	750	1100	50	1100	955	1350	1986	990	705	815
080-050-200	80	2150	1700	1450	3101	1450	750	1100	50	1100	955	1350	1986	990	705	815
080-050-250	80	2150	1700	1450	3101	1450	750	1100	50	1100	955	1350	1986	990	705	815
080-050-315	80	2150	1700	1450	3101	1450	750	1100	50	1100	955	1350	1986	990	705	815
100-065-125	100	2700	2150	1910	3945	2000	1000	1500	65	1400	1200	1750	2542	1150	775	850
100-065-160	100	2700	2150	1910	3945	2000	1000	1500	65	1400	1200	1750	2542	1150	775	850
100-065-200	100	2700	2150	1910	3945	2000	1000	1500	65	1400	1200	1750	2542	1150	775	850
100-065-250	100	2700	2150	1910	3945	2000	1000	1500	65	1400	1200	1750	2542	1150	775	850
100-065-315	100	2700	2150	1910	3945	2000	1000	1500	65	1400	1200	1750	2542	1150	775	850
125-080-160	125	3700	2950	2400	5306	2750	1400	2100	80	1700	1455	2150	3103	1450	815	1100
125-080-200	125	3700	2950	2400	5306	2750	1400	2100	80	1700	1455	2150	3103	1450	815	1100
125-080-250	125	3700	2950	2400	5306	2750	1400	2100	80	1700	1455	2150	3103	1450	815	1100

Size	Suction nozzle								Discharge nozzle							
	DN	[N]				[Nm]			DN	[N]				[Nm]		
		F _x	F _y	F _z	ΣF	M _x	M _y	M _z		F _x	F _y	F _z	ΣF	M _x	M _y	M _z
125-080-315	125	3700	2950	2400	5306	2750	1400	2100	80	1700	1455	2150	3103	1450	815	1100
125-080-400	125	3700	2950	2400	5306	2750	1400	2100	80	1700	1455	2150	3103	1450	815	1100
125-100-160	125	3700	2950	2400	5306	2750	1400	2100	100	2150	1910	2700	3945	2000	1000	1500
125-100-200	125	3700	2950	2400	5306	2750	1400	2100	100	2150	1910	2700	3945	2000	1000	1500
125-100-250	125	3700	2950	2400	5306	2750	1400	2100	100	2150	1910	2700	3945	2000	1000	1500
125-100-315	125	3700	2950	2400	5306	2750	1400	2100	100	2150	1910	2700	3945	2000	1000	1500
125-100-400	125	3700	2950	2400	5306	2750	1400	2100	100	2150	1910	2700	3945	2000	1000	1500
150-125-200	150	4700	3750	3100	6765	3450	1750	2650	125	2950	2400	3700	5306	2750	1400	2100
150-125-250	150	4700	3750	3100	6765	3450	1750	2650	125	2950	2400	3700	5306	2750	1400	2100
150-125-315	150	4700	3750	3100	6765	3450	1750	2650	125	2950	2400	3700	5306	2750	1400	2100
150-125-400	150	4700	3750	3100	6765	3450	1750	2650	125	2950	2400	3700	5306	2750	1400	2100
200-150-200	200	7350	5700	4700	10421	5300	2650	3850	150	3750	3100	4700	6765	3450	1750	2650
200-150-250	200	7350	5700	4700	10421	5300	2650	3850	150	3750	3100	4700	6765	3450	1750	2650
200-150-315	200	7350	5700	4700	10421	5300	2650	3850	150	3750	3100	4700	6765	3450	1750	2650
200-150-400	200	7350	5700	4700	10421	5300	2650	3850	150	3750	3100	4700	6765	3450	1750	2650
200-150-500	200	7350	5700	4700	10421	5300	2650	3850	150	3750	3100	4700	6765	3450	1750	2650
200-200-250	200	7350	5700	4700	10421	5300	2650	3850	200	5700	4700	7350	10421	5300	2650	3850
250-200-315	250	10000	8000	6700	14453	7500	3650	5700	200	5700	4700	7350	10421	5300	2650	3850
250-200-400	250	10000	8000	6700	14453	7500	3650	5700	200	5700	4700	7350	10421	5300	2650	3850
250-200-500	250	10000	8000	6700	14453	7500	3650	5700	200	5700	4700	7350	10421	5300	2650	3850
300-250-315	300	12000	10000	8000	17550	9150	4500	6900	250	8000	6700	10000	14453	7500	3650	5700

Correction coefficients depending on material and temperature (see diagram below).
No temperature-dependent correction is necessary for material 1.7706.

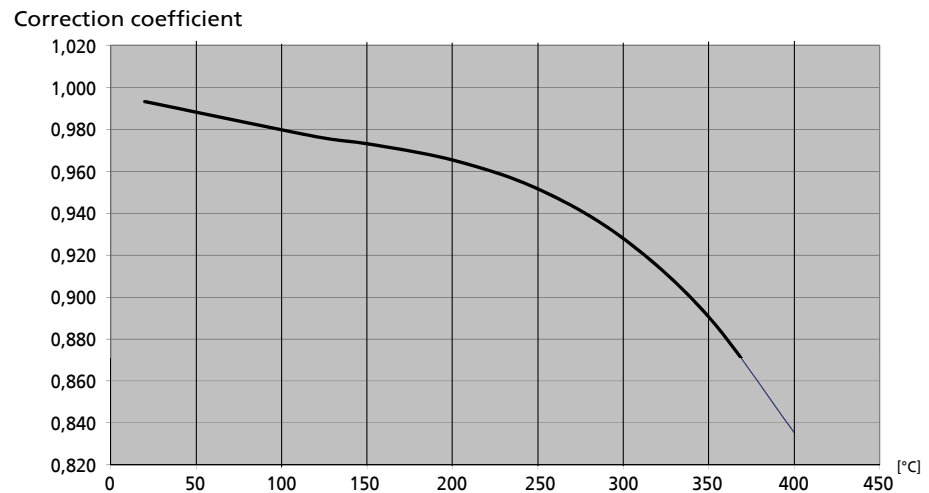


Fig. 11: Temperature correction diagram for "E" and "S" variants (casing material GP240GH+N / A216GR WCB)

5.3.3 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.
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The pump is fully functional without any external cooling system. Standard pump sets with one mechanical seal do not require any cooling liquid, barrier fluid or flushing liquid.

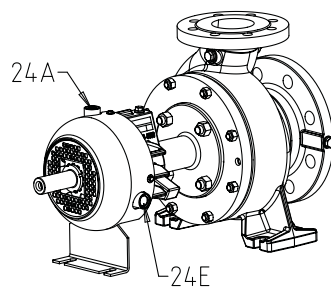


Fig. 12: Quench connections

24A	Quench outlet	24E	Quench inlet
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For pump sets with two mechanical seals in tandem arrangement, connect an unpressurised quench liquid supply to the "Quench outlet" (24E) and "Quench inlet" (24A) connections.

5.4 Enclosure/insulation

	⚠ DANGER An explosive atmosphere forms due to insufficient venting Explosion hazard! ▷ Never close or cover the perforation of the bearing bracket guards (e.g. by insulation).
	⚠ 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.

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.

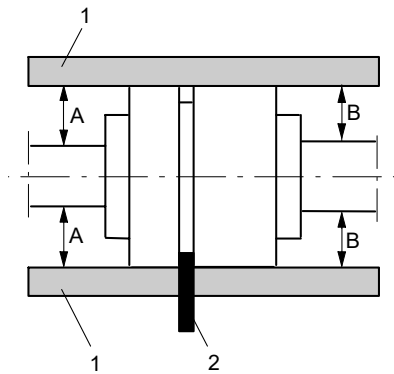


Fig. 13: Non-spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge
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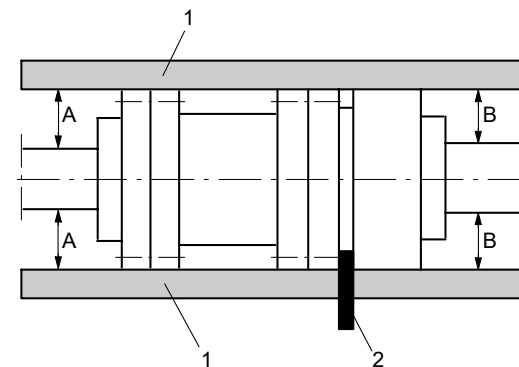


Fig. 14: Spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge
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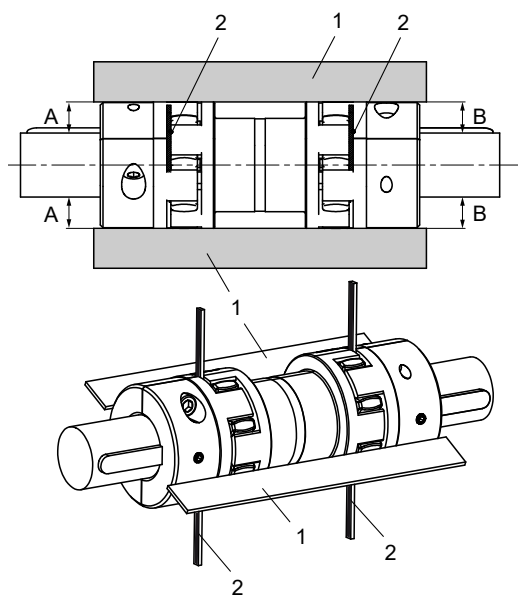


Fig. 15: Double Cardan spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge
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Table 11: Permissible alignment offset of coupling halves

Coupling type	Radial offset	Axial offset
	[mm]	[mm]
Non-spacer-type coupling (⇒ Fig. 13)	≤ 0,1	≤ 0,1
Spacer-type coupling (⇒ Fig. 14)	≤ 0,1	≤ 0,1
Double Cardan coupling (⇒ Fig. 15)	≤ 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 11) 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 11) 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

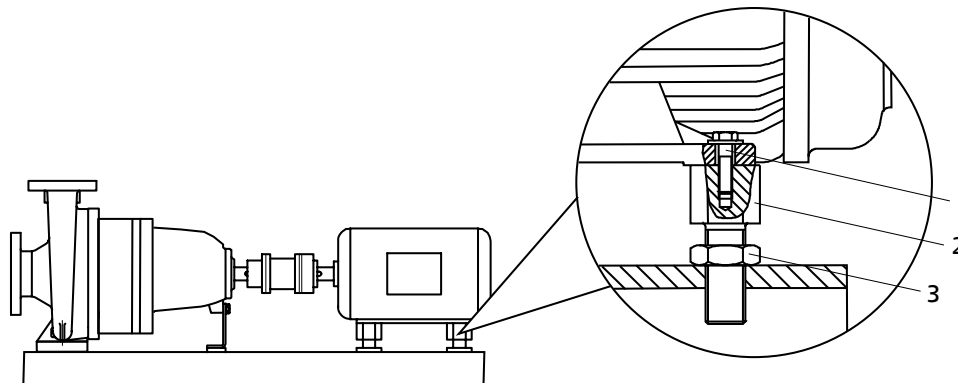


Fig. 16: Motor with adjusting screw

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.

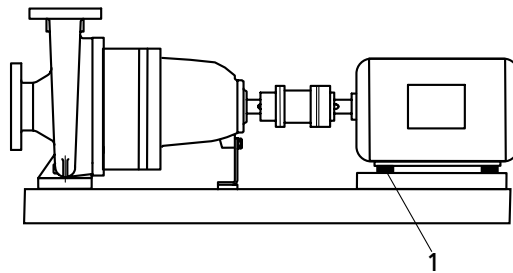


Fig. 17: Pump set with shim

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.

	⚠ 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 Danger of death from electric shock! ▷ Always have the electrical connections installed by a trained electrician. ▷ Observe regulations IEC 60364 and, for explosion-proof versions, IEC 60079 .
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	 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.

5.7.1 Setting the time relay

	CAUTION
	Switchover between star and delta on three-phase motors with star-delta starting takes too long. Damage to the pump (set)! ▷ Keep switch-over intervals between star and delta as short as possible.

Table 12: Time relay settings for star-delta starting:

Motor rating	Y time to be set
[kW]	[s]
≤ 30	< 3
> 30	< 5

5.7.2 Earthing

 	 DANGER
	Electrostatic charging Explosion hazard! Damage to the pump set! ▷ Connect the PE conductor to the earthing terminal provided. ▷ Provide for potential equalisation between the pump set and the foundation.

5.7.3 Connecting the motor

	NOTE
	In compliance with IEC 60034-8, three-phase motors are always wired for clockwise rotation (looking at the motor shaft stub). The pump's direction of rotation is indicated by an arrow on the pump.

1. Match the motor's direction of rotation to that of the pump.
2. Observe the manufacturer's product literature supplied with the motor.

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.

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 properly connected to the power supply and is equipped with all protection devices. (⇒ Section 5.7, Page 32)
- The pump, including the bearing bracket (mechanical seal chamber), has been primed with the fluid to be handled.
- The direction of rotation has been checked. (⇒ Section 5.8, Page 34)
- The lubricants have been checked. (⇒ Section 6.1.2, Page 35)
- After prolonged shutdown of the pump (set), the activities required for returning the equipment to service have been carried out. (⇒ Section 6.4, Page 43)



NOTE

Hot water shall comply with the requirements of the VdTÜV technical instruction leaflet TCH 1466/AGFW 5-15 (edition 2.89) as a minimum.
Do not exceed the following limits:

Table 13: Limits for hot water

	Limits
Electrical conductivity	< 250 µs/cm
pH at 25 °C	9-10,5
Silicates (SiO ₂)	< 10 mg/l
Solids	< 5 mg/l



NOTE

No warranty can be given for the service life of mechanical seals if hot water with an electrical conductivity exceeding 250 µs/cm or hot water of unknown water quality is handled.

For ultra-pure water (fully desalinated, demineralised water) with an electrical conductivity < 2 µs/cm, the temperature at the seal faces must be at least 20 % below the boiling point.



NOTE

When conditioners producing a greasy film on the mechanical seal faces are used, e.g. Maxigard, Antifrogen N, Preventol CI-2, KeboX, Nalfleet 9-11, no warranty can be given on the seal life because of their adverse effect on the seal. In such cases please contact KSB.

6.1.2 Filling in lubricants

Grease-lubricated bearings have been packed with grease at the factory.

6.1.3 Shaft seal

Observe the instructions on dismantling or assembly (⇒ Section 7.5, Page 53) .

When new plants are commissioned, large amounts of foreign matter in the system and a short service life of mechanical seals are to be expected during the initial phase of operation.

	NOTE Only modify the specified sealing concepts and seal types after consultation with KSB. Due to the complex conditions in hot water systems, the use of mechanical seals not approved by KSB shall not be covered by KSB's scope of warranty.
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Quench reservoir If applicable, fill the quench reservoir in accordance with the general arrangement drawing.

Double mechanical seal Prior to starting up the pump, apply barrier pressure as specified in the general arrangement drawing.

6.1.4 Quench liquid supply

Permissible quench liquids The quench liquid has to be compatible with and suitable for mixing with the fluid handled.

For synthetic thermal oils, it is advisable to use a mineral oil based thermal fluid or a different mineral oil as the quench liquid.

Heat transfer oils of the diphyl group are not suitable for use as quench liquids.

6.1.5 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 Shaft seal failure caused by insufficient lubrication Hot or toxic fluid could escape! Damage to the pump! ▷ Before starting up the pump set, vent the pump and suction line and prime both with the fluid to be handled.
	 DANGER Hot fluid spurting out of the vent chamber Burns, scalding! ▷ Always use utmost caution during the venting process and wear appropriate protective gear.

1. Vent the pump and suction line and prime both with the fluid to be handled.
2. Fully open the shut-off element in the suction line.

Venting the seal chamber In as-supplied condition, auxiliary connection 13 D for venting the seal chamber is closed with screw plug 903.85.

High-temperature pumps must be vented before they are commissioned.

For venting undo screw plug 903.85 by half a turn to one turn maximum. Leave it open until the gas has left the mechanical seal chamber and fluid starts to escape. Then, tighten the screw plug again.

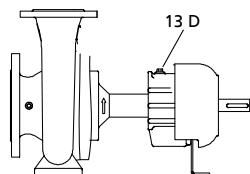


Fig. 18: Auxiliary connection 13 D

13 D	Screw plug 903.85
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NOTE

We recommend replacing the screw plug with a globe valve and drain line, so that gases and hot fluids pumped can be drained safely during the venting process.

Venting during pump operation

1. Switch off the pump and let it run down to a standstill.
2. This allows the gases to escape reliably.
3. Close the shut-off elements as required by the system configuration.
4. To vent the bearing bracket undo screw plug 903.85 in steps of approx. 1/2 turn each until no more gas escapes.

Excessive venting

Excessive venting shall be avoided, as hot product from the piping system will flow through the volute casing into the mechanical seal chamber and result in an inadmissible heat build-up in the mechanical seal. Close the vent plug as soon as no more gas escapes.

6.1.6 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 28)
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.

6.1.7 Cooling of the mechanical seal chamber

The mechanical seal chamber is integrated in the bearing bracket and cooled by the ambient temperature via cooling fins.

An integrated fan impeller ensures a continuous cooling air flow.

An unobstructed supply of cooling air to the fan hood and fan impeller must be ensured at all times!

1. In exceptional cases, the pump can be operated without the integrated fan impeller.
If the coarse dust blocks the cooling air intake, the following parts also have to be removed:
 - Fan hood 832
 - Guard 680

Cooling air flow with a cooling air velocity of at least 4 m/s must be provided in the proximity of the cooling fins.

The cooling air flow is generated by the motor cooling device or an external fan.

6.1.8 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. 10 °C/min (10 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.

6.1.9 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.
- ✓ The pump, suction line and, if applicable, inlet tank have been vented and primed with the fluid to be handled.
- ✓ The lines for priming and venting 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.

	CAUTION Misalignment of pump and coupling Damage to pump, motor and coupling! ▷ When the operating temperature has been reached, switch off the pump set and check the coupling alignment.
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5. Check the coupling alignment and re-align the coupling, if required.

6.1.10 Checking the shaft seal

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

Slight leakage at the seal is permissible and desirable.

A continuously increasing, heavily dripping leakage at the seal indicates that the seal is defective and must be replaced.

6.1.11 Shutdown

- ✓ 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.
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	NOTE If shut-off is not possible, the pump will run in reverse direction. The reverse runaway speed must be lower than the rated speed.
---	---

For prolonged shutdown periods:

1. Close the shut-off element in the suction line.
2. Close the auxiliary connections.
If the fluid to be pumped is fed in under vacuum, also supply the shaft seal with barrier fluid during standstill.
Only turn off the cooling liquid supply after the pump has cooled down.

	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 14: Permissible ambient temperatures

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

6.2.2 Minimum permissible speed

	CAUTION Plain bearing is overloaded Damage to the bearings! ▷ Never use a speed of less than 800 rpm.
---	---

6.2.3 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 15: Frequency of starts

Motor rating [kW]	Maximum frequency of starts [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.
--	---

6.2.4 Fluid handled

6.2.4.1 Flow rate

Unless specified otherwise in the characteristic curves or in the data sheets, the following applies:

- Short-time operation: $Q_{min}^{6)} = 0.1 \times Q_{BEP}^{7)}$
- Continuous operation: $Q_{min}^{6)} = 0.3 \times Q_{BEP}^{7)}$
- 2-pole operation: $Q_{max}^{8)} = 1.1 \times Q_{BEP}^{7)}$
- 4-pole operation: $Q_{max}^{8)} = 1.25 \times Q_{BEP}^{7)}$

The data refer to water and water-like fluids. Longer operating periods with these fluids and at the flow rates indicated will not cause an additional increase in the temperatures on the pump surface. However, if the physical properties of the fluids handled differ from those of water, the calculation formula below must be used to check if an additional heat build-up may lead to a dangerous temperature increase at the pump surface. If necessary, the minimum flow must be increased.

$$T_O = T_f + \Delta \vartheta$$

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

⁶ Minimum flow rate

⁷ Flow rate at best efficiency point

⁸ Maximum flow rate

Table 16: 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 and shaft seal are to be expected. In this case, reduce the commonly recommended inspection intervals.

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 pipe and stored

- ✓ The pump has been properly drained.
- ✓ The safety instructions for dismantling the pump have been observed. (⇒ Section 7.4.1, Page 49)
- ✓ 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 or 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 35) (⇒ Section 6.2, Page 40)

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇒ Section 7, Page 44)

	 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.

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.
	 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.

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

	⚠ 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 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
	Excessive temperatures as a result of bearings running hot or defective bearing seals Explosion hazard! Fire hazard! Damage to the pump set! Risk of burns! ▷ Regularly check the lubricant level. ▷ Regularly check the rolling element bearings for running noises.

	⚠ 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.

	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 40)

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 bearing temperature.
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 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

To check the clearances, remove the back pull-out unit.

If the clearance gap is larger than permitted (see the following table), replace casing wear ring 502.01 with a new one.

The clearances given refer to the diameter.

Clearances between impeller and casing/between impeller and casing wear ring

Table 17: Clearances between impeller and casing/between impeller and casing wear ring

Casing material	Clearance [mm]	
	New	Maximum permissible enlargement
E, S, Y, Z	0,3	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.
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Bearing clearances in the plain bearing

Table 18: Bearing clearances in the plain bearing

Bearing bracket	Bearing clearance [mm]
CS40	0,03 + 0,045
CS50	0,05 + 0,045
CS60	0,05 + 0,045
CS80	0,05 + 0,05

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 Lubrication and lubricant change of rolling element bearings

7.2.3.1 Grease lubrication

The bearings are supplied packed with high-quality lithium-soap grease.

7.2.3.1.1 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.
---	---

7.2.3.1.2 Grease quantities

Table 19: Grease quantity per bearing

Bearing bracket	Bearings	Grease quantity per individual bearing [g]
CS40	7307 BG/ 6307/ QJ307	6.5 - 8
CS50	7307 BG/ 6307/ QJ307	6.5 - 8
CS60	7309 BG/ 6309	13 - 15.5
CS80	7313 BG/ 6313/ QJ313	23 - 26

The grease quantity indicated must be used for each single bearing of a bearing pair.

7.2.3.1.3 Intervals

- Under suitable operating conditions the grease-lubricated bearings will run for 25,000 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 25,000 operating hours or 3 years of continuous operation.

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.

If the pump set has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump set must be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.

Use connection 6B.1 or 6B.2 to drain the fluid handled (see drawing of auxiliary connections).

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. ▷ Close the shut-off elements in the suction line and discharge line. ▷ Drain the pump and release the pump pressure. ▷ Shut off any auxiliary feed lines. ▷ 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.
	 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.

	! 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.

Observe the general safety instructions and information. (⇒ Section 7.1, Page 44)

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
	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.

	NOTE
	We recommend placing a drip pan under the pump along its entire length to collect any fluid escaping during dismantling.

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

- ✓ On pump sets without spacer-type coupling, the motor has been removed.
- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 49) to (⇒ Section 7.4.3, Page 50) have been observed/carried out.



⚠ 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. Loop a rope tightly around the neck of bearing bracket 330.
4. Undo hexagon nut 920.01 at the volute casing.
5. Pull the back pull-out unit out of the volute casing.
6. If necessary, clean the threaded holes for forcing screws 901.31 and use forcing screws.
7. Remove and dispose of joint ring 411.10.
8. Place the back pull-out unit on a clean and level surface.

7.4.5 Removing the impeller

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 49) to (⇒ Section 7.4.4, Page 50) have been observed/carried out.
 - ✓ The back pull-out unit has been placed in a clean and level assembly area.
1. Undo hexagon nut 920.95.
 2. Remove disc 550.87 from shaft 210.
 3. Pull impeller 230 off shaft 210.
 4. Remove keys 940.01.

7.4.6 Removing the plain bearing

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 49) to (⇒ Section 7.4.5, Page 51) have been observed/carried out.
1. Pull disc spring 950.23 and locking ring 515.21 off the shaft.
 2. Unscrew hexagon nuts 920.04 and pull bearing bracket 330 out of casing cover 161.
 3. Pull locking ring 515.22 and bearing sleeve 529.21 off the shaft.

7.4.7 Removing the mechanical seal

Pump set with KSB mechanical seal 4HL

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 49) to (⇒ Section 7.4.6, Page 51) have been observed/carried out.
 - ✓ The bearing bracket has been placed in a clean and level assembly area.
1. Undo the socket head cap screw or grub screw in the coupling hub and use a puller to pull the coupling half off the pump shaft. Remove key 940.02.
 2. Loosen hexagon head bolts 901.84 and remove fan hood 832.
 3. Undo hexagon socket head cap screws 914.02.
 4. Gently drive shaft 210 together with rolling element bearings 320.02, bearing cover 360.02, fan impeller 831, mating ring carrier 476 and mechanical seal 433 out of bearing bracket 330 towards the drive end.
 5. Undo grub screws 904.32.
 6. Pull mechanical seal 433.02 off shaft 210 towards the pump end.
 7. Pull mating ring carrier 476 off at the pump end together with the mating ring of the mechanical seal.
 8. Take the mating ring out of mating ring carrier 476.

Pump set with standardised mechanical seal

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 49) to (⇒ Section 7.4.6, Page 51) have been observed/carried out.
- ✓ The bearing bracket has been placed in a clean and level assembly area.
 1. Undo the socket head cap screw or grub screw in the coupling hub and use a puller to pull the coupling half off the pump shaft. Remove key 940.02.
 2. Loosen hexagon head bolts 901.84 and remove fan hood 832.
 3. Undo hexagon socket head cap screws 914.02.
 4. Gently drive shaft 210 together with rolling element bearings 320.02, bearing cover 360.02, fan impeller 831, mating ring carrier 476 and mechanical seal 433 out of bearing bracket 330 towards the drive end.
 5. Undo grub screws 904.32.
 6. Remove support disc 550.59 (CS40 and CS50 only) and O-ring 412.07.
 7. Pull shaft sleeve 523 with mechanical seal 433.02 off shaft 210 towards the pump end.
 8. Pull mating ring carrier 476 off at the pump end together with the mating ring of the mechanical seal.
 9. Take the mating ring out of mating ring carrier 476.
 10. **For pump sets with two mechanical seals in tandem arrangement only:** Unscrew the grub screw of the second mechanical seal and pull the seal off the shaft at the pump end.
 11. **For pump sets with two mechanical seals in tandem arrangement only:** Remove the second mating ring carrier 476.02 with the mating ring of the mechanical seal at the pump end.
 12. **For pump sets with two mechanical seals in tandem arrangement only:** Remove the mating ring from mating ring carrier 476.02.

7.4.8 Dismantling the bearing assembly



NOTE

The bearings are packed with grease and must not be heated up for dismantling. If heated up, they must be re-packed with grease.

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 49) to (⇒ Section 7.4.7, Page 51) have been observed and carried out.
- ✓ The shaft with the rolling element bearings has been placed in a clean and level assembly area.
 1. Unbend lock washer 931.01. Unscrew slotted round nut 920.21 (right-hand thread). Remove lock washer 931.01, fan impeller 831, bearing cover 360.02, spacer sleeve 525.24 and drive-end ring 500.32.
 2. Pull bearings 320.02, 321.02 off the shaft.
 3. **For version with one mechanical seal and shaft seal ring only:** Pull pump-end ring 500.32 off shaft 210.
 4. **For version with one mechanical seal and shaft seal ring only:** Remove O-ring 412.03 and spacer sleeve 525.03.
 5. **For version with one mechanical seal and two angular contact ball bearings only:** Remove spacer sleeve 525.03 and thrower 507.12 from shaft 210.

7.4.9 Removing the plain bearing bush

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 49) to (⇒ Section 7.4.8, Page 52) have been observed and carried out.
- ✓ The casing cover has been placed in a clean and level assembly area.
 1. Remove circlip 932.05.
 2. Completely pull bearing bush 545.21 and tolerance ring 500.61 out of the casing cover.

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.

- Sealing elements**
- **Gaskets**
 - 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).
 - **O-rings**
 - Never use O-rings that have been made by cutting an O-ring cord to size and gluing the ends together.

	CAUTION Contact of O-ring with graphite or similar material Fluid could escape! ▷ Do not coat O-ring with graphite or similar material. ▷ Use animal fats or lubricants based on silicone or PTFE.
---	--

- **Assembly adhesives**
 - For gaskets, avoid the use of assembly adhesives if possible.
 - If assembly adhesives are required, use a commercially available contact adhesive (e.g. "Pattex").
 - Only apply adhesive at selected points and in thin layers.
 - Never use quick-setting adhesives (cyanoacrylate adhesives).
 - Coat the locating surfaces of the individual components and screwed connections 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.

7.5.2 Installing the bearing assembly

Version with one mechanical seal and two angular contact ball bearings or version with two mechanical seals in tandem arrangement and one deep groove ball bearing or one four-point bearing

- ✓ 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. **For version with one mechanical seal only:** Slide thrower 507.12 onto shaft 210.
2. Slide spacer sleeve 525.03 (for CS40 - CS60 only) and ring 500.32 onto shaft 210.
3. Press ball bearing 320.02 onto the shaft as far as it will go.
The standard pump set is fitted with two angular contact ball bearings. Version with two mechanical seals are fitted with either a deep groove ball bearing or a four-point bearing, depending on the pump size.

	NOTE Angular contact ball bearings must be installed in back-to-back arrangement. Angular contact ball bearings installed in pairs must always be from the same manufacturer.
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	NOTE The bearings are packed with grease and must not be heated up for reassembly. If heated up, they must be re-packed with grease!
--	---

4. Slide spacer sleeve 525.24 onto shaft 210 and use a C-spanner to tighten slotted round nut 920.21 without lock washer 931.01. Then unscrew the slotted round nut again.
5. Slide ring 500.32, bearing cover 360.02 and fan impeller 831 onto the shaft.
6. Apply a few spots of Molykote to the contact faces of the lock washer and the locknut. Then slide on lock washer 931.01.
7. Tighten locknut 920.21 and bend over the lock washer.

Version with one mechanical seal, lip seal and one deep groove ball bearing or one four-point bearing

- ✓ 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.

	NOTE The bearings are packed with grease and must not be heated up for reassembly. If heated up, they must be re-packed with grease!
---	---

1. Slide spacer sleeve 525.03 and ring 500.32 onto shaft 210.
2. Insert O-ring 412.03 in spacer sleeve 525.03.
3. Press ball bearing 320.02/321.02 onto the shaft as far as it will go.
4. Slide spacer sleeve 525.24 onto shaft 210 and use a C-spanner to tighten slotted round nut 920.21 without lock washer 931.01. Then unscrew the slotted round nut again.
5. Slide ring 500.32, bearing cover 360.02 and fan impeller 831 onto the shaft.

6. Apply a few spots of Molykote to the contact faces of the lock washer and the locknut. Then slide on lock washer 931.01.
7. Tighten locknut 920.21 and bend over the lock washer.
8. 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 7.2.3.1.1, Page 48)

9. Grease the sealing lip of the lip seal with rolling element bearing grease
(⇒ Section 7.2.3.1.1, Page 48) .
10. Apply approx. 5 g of grease in the lower area between spacer ring 523.03 and the rear (bearing side) of lip seal 421.

7.5.3 Fitting the mechanical seal

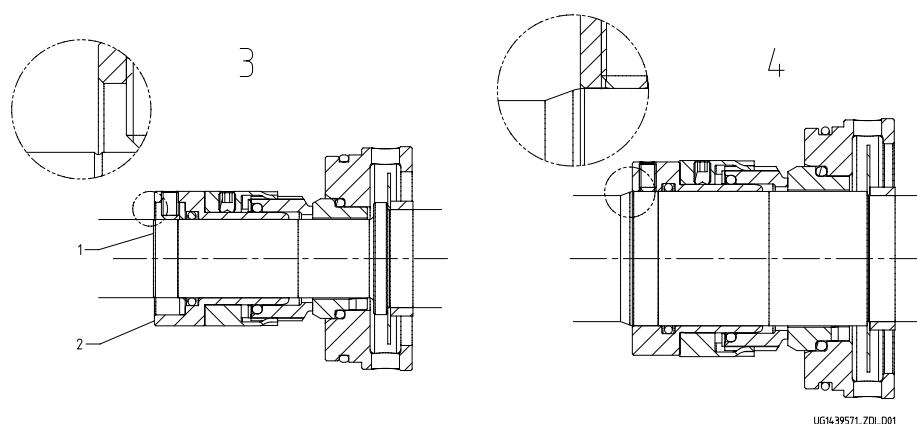


Fig. 19: Installing the mechanical seal

1	Markings on the shaft	2	Face of shaft sleeve
3	Bearing bracket CS40, CS50	4	Bearing bracket CS60, CS80

Version with KSB mechanical seal

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) to
(⇒ Section 7.5.2, Page 54) have been observed and 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.

	NOTE
	Only remove the protective wrapping of the seal faces immediately before assembly takes place.

1. Insert the mating ring and the secondary seals of the mechanical seal into mating ring carrier 476 and slide them onto the shaft from the pump end.
2. Slide the rotating components of the mechanical seal (torque-transmitting element, springs, primary ring, secondary seal, etc.) onto the shaft as a complete sub-assembly.

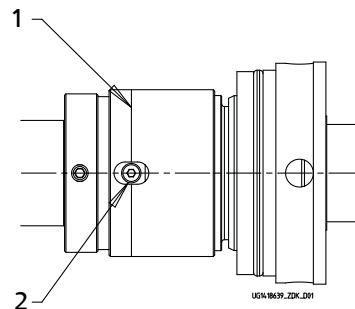


Fig. 20: Correct position of KSB mechanical seal type 4 HL

1	Markings on the mechanical seal	2	Bolt head
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3. **For CS40 and CS50:** The mechanical seal is correctly positioned on the shaft when its pump-end face (see "2" in Fig. "Installing the mechanical seal") is aligned with the mark on the shaft (see "1" in Fig. "Installing the mechanical seal").

For CS60 and CS80: On shafts without marking, align the mechanical seal with the shaft shoulder.

The mechanical seal is generally positioned correctly when the bolt head is located in the centre of the slotted hole (marking) (see Fig. "Correct position of KSB mechanical seal").

4. Tighten the grub screws with cup point evenly, alternately and gradually to the torques specified, depending on the nominal thread diameter.

Grub screws with cup point may be used without applying a thread-locking agent. Grub screws with cup point must not be re-used.

Table 20: Tightening torques for grub screws with cup point

Thread	Tightening torque [Nm]
M6	8
M8	15
M10	20

5. Verify the correct axial position of mechanical seal 433.02 on shaft 210.



CAUTION

Incorrect position of the mechanical seal

Hot fluid or steam may spurt out during operation!

- ▷ Make sure the mechanical seal is seated properly.

Version with standardised mechanical seal

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) to (⇒ Section 7.5.2, Page 54) have been observed and 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.

	NOTE

Only remove the protective wrapping of the seal faces immediately before assembly takes place.

1. **Version with mechanical seals in tandem arrangement:** Insert the mating ring of the second mechanical seal into mating ring carrier 476.02 and slide both onto the shaft from the pump end.
2. **Version with mechanical seals in tandem arrangement:** Slide the primary ring onto the shaft until it reaches the shaft shoulder. Secure it with a grub screw.
3. Insert the mating ring and the secondary seals of the mechanical seal into mating ring carrier 476 and slide them onto the shaft from the pump end.
4. Slide the rotating components of the mechanical seal (torque-transmitting element, springs, primary ring, secondary seal, etc.) onto shaft sleeve 523 as a complete sub-assembly. Slide this sub-assembly on until it will not go any further. Then lock it with the grub screws.
5. **For CS40 and CS50:** Slide shaft sleeve 523 onto shaft 210.
The shaft sleeve is correctly positioned on the shaft when its pump-end face (see "2" in Fig. "Installing the mechanical seal") is aligned with the mark on the shaft (see "1" in Fig. "Installing the mechanical seal"). Guide O-ring 412.07 and support disc 550.59 carefully along the shaft and press them into the recess of shaft sleeve 523.
For CS60 and CS80: Insert O-ring 412.07 into shaft sleeve 523. Carefully guide the shaft sleeve along the shaft.
On shafts without marking, align the mechanical seal with the shaft shoulder.
6. Screw in grub screws 904.32 by several turns to hold the support disc in place.
7. Firmly tighten all grub screws 904.32.
8. Verify the correct axial position of shaft sleeve 523 and mechanical seal 433.02 on shaft 210.

	CAUTION

Incorrect position of the mechanical seal
Hot fluid or steam may spurt out during operation!
▷ Make sure the mechanical seal is seated properly.

7.5.4 Fitting the plain bearing bush

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) to (⇒ Section 7.5.3, Page 55) have been observed and carried out.
1. If bearing bush 545.21 is replaced with a new one, a new tolerance ring 500.61 must be fitted in the corresponding groove of the casing cover.

	CAUTION

Incorrect position of the bearing bush
Excessive bearing load during operation!
▷ Check that the groove is positioned correctly.

2. Swiftly press bearing bush 545.21 evenly into the casing cover. (Risk of fractures: do not subject it to any blows.) Check that the groove of the bearing bush is positioned correctly. The bearing bush is inserted correctly when its groove is on top (12 o'clock position).
3. Insert ring 932.05 into the groove in the casing cover to secure the bearing bush axially.

7.5.5 Fitting the bearing bracket

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) to (⇒ Section 7.5.4, Page 57) been observed/carried out.
 1. Place guard 680 onto the bearing bracket.
 2. Place O-ring 412.82 on the mating ring carrier.
 3. Slide shaft 210 with all assembled components into the bearing bracket.
 4. Fasten the bearing cover with hexagon socket head cap screws 914.02.
 5. Carefully insert joint ring 411.11.
 6. Place bearing bracket 330 into casing cover 161 and firmly tighten it with nuts 920.04.

7.5.6 Fitting the plain bearing

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) to (⇒ Section 7.5.5, Page 58) have been observed/carried out.
 1. Clean all parts of plain bearing (sleeve) 310.10 and make sure that there are no dirt particles between the conical surfaces of the bearing parts. Otherwise, the parts will not be centred correctly, which will result in failure of the plain bearing.
 2. Prior to reassembly check whether the bearing parts and the impeller can be easily fitted on shaft 210.
 3. Slide locking ring 515.22, bearing sleeve 529.21, locking ring 515.21 and disc spring 950.23 onto shaft 210.
Mount disc springs 950.23 in such a way that the outside diameter of the disc spring rests against locking ring 515.21.

7.5.7 Fitting the impeller

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) to (⇒ Section 7.5.6, Page 58) have been observed/carried out.
- ✓ The bearing assembly/mechanical seal 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.
- ✓ Impeller bore, shaft and keyways are clean and free from burrs.
 1. Insert key 940.01. Guide impeller 230 onto shaft 210.
 2. Insert disc 550.87 and tighten hexagon nut 920.95 with a torque wrench.

7.5.8 Fitting the back pull-out unit

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 53) to (⇒ Section 7.5.7, Page 58) been observed/carried out.
- ✓ For back pull-out units without coupling, fit the coupling in accordance with the manufacturer's instructions.
 1. Carefully insert joint ring 411.10 into volute casing 102.
 2. Guide the back pull-out unit into volute casing 102 and tighten nut 920.01.
 3. Make sure that the rotor can easily be rotated by hand.
 4. Bolt support foot 183 to bearing bracket 330 and to the baseplate.
 5. Mount fan hood 832 and fasten it together with guard 680, using hexagon head bolts 901.84.
 6. Insert key 940.02. Fasten the coupling half on the shaft.

7.5.9 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 30)
4. Connect the motor to the power supply (refer to manufacturer's product literature).

7.6 Tightening torques

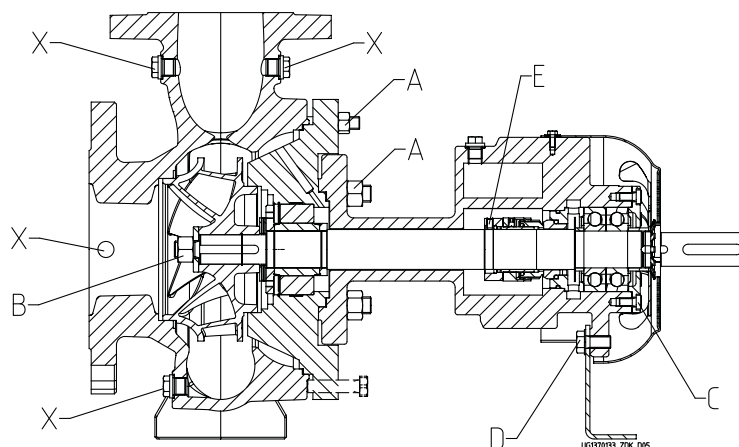


Fig. 21: Tightening points at the pump

Table 21: Tightening torques

Position	Part No.	Description	Material / stamp mark	Thread	Tightening torque ⁹⁾¹⁰⁾		
					100 %	85 %	80 %
					[Nm]	[Nm]	[Nm]
A	902.01 902.04	Stud	1.7709+QT / GA 1.7218+QT+A2D / G	M12	75	64	60
				M16	165	140	132
				M20	330	281	264
			Monix 3K / MM Monix 3K / MM (M3K)	M12	130	111	104
				M16	320	272	256
				M20	-	-	-
B	920.95	Hexagon nut	A4 / A4	M16 × 1,5	100	85	80
				M20 × 1,5	120	102	96
				M24 × 1,5	150	128	120
C	914.02	Hexagon socket head cap screw	8.8 / 8.8	M8	25	21	20
				M10	35	30	28
				M12	59	50	47
D	901.04	Hexagon head bolt		M12	90	-	-
E	904.32	Grub screw	A4-50 / -	M6	5 - 9		

⁹ These values are determined on the basis of a friction coefficient of $\mu = 0.12$.

¹⁰ After repeated tightening of the threads and in case of good lubrication the values shall be reduced by 15 to 20 %.

Position	Part No.	Description	Material / stamp mark	Thread	Tightening torque ⁹⁾¹⁰⁾		
					100 %	85 %	80 %
					[Nm]	[Nm]	[Nm]
X	903.01, 903.02, 903.03, 903.04	Screw plug		G 1/4	55		
				G 3/8	80		
				G 1/2	130		

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
- Type series
- Size
- Material variant
- Year of construction

Refer to the name plate for all data.

Also specify the following data:

- Part number and description
- 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 22: 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
		Quantity of spare parts						
210	Shaft	1	1	2	2	2	3	30 %
230	Impeller	1	1	2	2	2	3	30 %
310.10	Plain bearing (product-lubricated)	2	3	4	5	6	8	100 %
320.02	Angular contact ball bearing (set)	1	1	2	2	3	4	55 %
320.02/ 321	Rolling element bearing for two mechanical seals	1	1	2	2	3	4	55 %
330	Bearing bracket	-	-	-	-	-	1	2 %
433	Mechanical seal	1	1	2	2	2	3	25 %
502.01 ¹¹⁾	Casing wear ring	2	2	2	3	3	4	50 %
523	Shaft sleeve	1	1	1	2	2	2	20 %
545.21	Bearing bush (product-lubricated)	2	3	4	5	6	8	100 %
---	Sealing elements (set)	4	6	8	8	9	12	150 %

¹¹⁾ Optional

7.7.3 Interchangeability of pump components

Components featuring the same number in a column are interchangeable.



NOTE

Volute casing 102 and impeller 230 are not interchangeable between different pump sizes.

Table 23: Interchangeability of pump components

Size	Bearing bracket	Description																							
		Casing cover	Support foot	Shaft	Plain bearing	Rolling element bearing for single mechanical seal	Rolling element bearing for two mechanical seals	Rolling element bearing for two mechanical seals	Bearing bracket	Bearing cover	Mechanical seal	Mating ring carrier	Casing wear ring	Casing wear ring	Thrower	Shaft sleeve	Spacer sleeve	Spacer sleeve	Bearing bush	Guard	Fan impeller	Fan hood	Hexagon nut		
		Part No.																							
		161	183	210	310.10	320.02	320.02	321	330	360	433.01	433.02	476.01	476.02	502.01	502.02	507.01	523	525.03	525.24	545.21	680	831	832	920.95
040-025-160	CS40	2	2	1	1	1	-	1	1	1	1	1	1	-	-	1	1	1	1	1	1	1	1	1	
040-025-200	CS40	7	3	1	1	1	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
050-032-125	CS40	21	1	1	1	1	-	1	1	1	1	1	1	-	-	1	1	1	1	1	1	1	1	1	
050-032-125.1	CS40	2	1	1	1	1	-	1	1	1	1	1	1	-	-	1	1	1	1	1	1	1	1	1	
050-032-160.1	CS40	2	2	1	1	1	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
050-032-200.1	CS40	7	3	1	1	1	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
050-032-250.1	CS50	16	4	2	2	1	-	1	2	1	2	2	2	2	2	2	2	2	2	2	1	1	1	1	
050-032-160	CS40	2	2	1	1	1	1	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
050-032-200	CS40	7	3	1	1	1	1	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
050-032-250	CS50	16	4	2	2	1	1	-	2	1	2	2	2	6	2	2	2	2	2	2	1	1	1	1	
065-040-160.1	CS40	2	2	1	1	1	1	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
065-040-250.1	CS50	16	4	2	2	1	-	1	2	1	2	2	2	7	2	2	2	2	2	2	1	1	1	1	
065-040-125	CS40	21	1	1	1	1	-	1	1	1	1	1	1	-	-	1	1	1	1	1	1	1	1	1	
065-040-160	CS40	2	2	1	1	1	1	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
065-040-200	CS40	7	3	1	1	1	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
065-040-250	CS50	16	4	2	2	1	-	1	2	1	2	2	2	7	2	2	2	2	2	2	1	1	1	1	
065-040-315	CS50	22	5	2	2	1	1	-	2	1	2	2	2	7	3	2	2	2	2	2	1	1	1	1	
080-050-315.1	CS50	12	7	2	2	1	1	-	2	1	2	2	2	8	3	2	2	2	2	2	1	1	1	1	
080-050-125	CS40	2	2	1	1	1	-	1	1	1	1	1	1	5	1	1	1	1	1	1	1	1	1	1	
080-050-160	CS40	2	3	1	1	1	-	1	1	1	1	1	1	5	1	1	1	1	1	1	1	1	1	1	
080-050-200	CS40	7	3	1	1	1	-	1	1	1	1	1	1	5	1	1	1	1	1	1	1	1	1	1	
080-050-250	CS50	16	4	2	2	1	-	1	2	1	2	2	2	5	2	2	2	2	2	2	1	1	1	1	
080-050-315	CS50	12	7	2	2	1	1	-	2	1	2	2	2	8	3	2	2	2	2	2	1	1	1	1	

Size	Bearing bracket	Description																	
		Casing cover	Support foot	Shaft	Plain bearing	Rolling element bearing for single mechanical seal	Rolling element bearing for two mechanical seals	Rolling element bearing for two mechanical seals	Bearing bracket	Bearing cover	Mechanical seal	Mating ring carrier	Casing wear ring	Casing wear ring	Thrower	Shaft sleeve	Spacer sleeve	Spacer sleeve	Bearing bush
		Part No.	161	183	210	310.10	320.02	320.02	321	330	360	433.01	433.02	476.01	476.02	502.01	502.02	507.01	523
100-065-125	CS40	2	3	1	1	1	-	1	1	1	1	1	1	1	6	1	1	1	1
100-065-160	CS50	3	4	2	2	1	-	1	2	1	2	2	2	8	4	2	2	2	2
100-065-200	CS50	15	5	2	2	1	1	-	2	1	2	2	2	8	4	2	2	2	2
100-065-250	CS50	8	6	2	2	1	1	-	2	1	2	2	2	6	3	2	2	2	2
100-065-315	CS60	13	8	3	3	2	-	2	3	2	3	3	3	9	3	3	3	3	3
125-080-160	CS50	3	5	2	2	1	-	1	2	1	2	2	2	9	4	2	2	2	2
125-080-200	CS50	4	5	2	2	1	-	1	2	1	2	2	2	9	3	2	2	2	2
125-080-315	CS60	13	9	3	3	2	-	2	3	2	3	3	3	9	3	3	3	3	3
125-080-250	CS50	8	7	2	2	1	1	-	2	1	2	2	2	9	3	2	2	2	2
125-080-400	CS60	1	10	3	3	2	-	2	3	2	3	3	3	10	5	3	3	3	3
125-100-160	CS50	4	5	2	2	1	-	1	2	1	2	2	2	10	3	2	2	2	2
125-100-200	CS50	4	6	2	2	1	1	-	2	1	2	2	2	10	3	2	2	2	2
125-100-250	CS60	9	8	3	3	2	-	2	3	2	3	3	3	10	3	3	3	3	3
125-100-315	CS60	13	9	3	3	2	-	2	3	2	3	3	3	10	3	3	3	3	3
125-100-400	CS60	1	10	3	3	2	-	2	3	2	3	3	3	11	5	3	3	3	3
150-125-200	CS60	5	8	3	3	2	-	2	3	2	3	3	3	11	6	3	3	3	3
150-125-250	CS60	11	9	3	3	2	-	2	3	2	3	3	3	11	6	3	3	3	3
150-125-315	CS60	14	10	3	3	2	-	2	3	2	3	3	3	11	5	3	3	3	3
150-125-400	CS60	1	11	3	3	2	-	2	3	2	3	3	3	11	5	3	3	3	3
200-150-200	CS60	5	9	3	3	2	-	2	3	2	3	3	3	12	6	3	3	3	3
200-150-250	CS60	11	10	3	3	2	-	2	3	2	3	3	3	13	6	3	3	3	3
200-150-315	CS80	6	12	4	4	3	-	3	4	3	4	4	4	13	5	4	4	4	4
200-150-400	CS80	10	12	4	4	3	2	-	4	3	4	4	4	13	5	4	4	4	4
200-150-500	CS80	20	14	4	4	3	-	3	4	3	4	4	4	14	7	4	4	4	4
200-200-250	CS80	19	13	4	4	3	-	3	4	3	4	4	4	13	8	4	4	4	4
250-200-315	CS80	17	13	4	4	3	-	3	4	3	4	4	4	15	9	4	4	4	4
250-200-400	CS80	18	13	4	4	3	-	3	4	3	4	4	4	16	9	4	4	4	4
250-200-500	CS80	20	17	4	4	3	-	3	4	3	4	4	4	17	7	4	4	4	4
300-250-315	CS80	17	16	5	4	3	-	3	4	3	4	4	4	18	9	4	4	4	4

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 24: Trouble-shooting

A	B	C	D	E	F	G	H	Possible cause	Remedy ¹²⁾
X	-	-	-	-	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point. Check system for impurities. Fit a larger impeller. ¹³⁾ Increase the speed (turbine, I.C. engine).
X	-	-	-	-	-	X	X	Pump or piping are not completely vented or primed.	Vent and/or prime.
X	-	-	-	-	-	-	-	Supply line or impeller clogged	Remove deposits in the pump and/or piping.
X	-	-	-	-	-	-	-	Formation of air pockets in the piping	Alter piping layout. Fit vent valve.
X	-	-	-	-	-	X	X	Suction lift is too high/ NPSH _{available} (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.
X	-	-	-	-	-	-	-	Air intake at the shaft seal	Clean barrier fluid duct, supply external barrier fluid, if necessary, or increase barrier fluid pressure. Replace shaft seal.
X	-	-	-	-	-	-	-	Wrong direction of rotation	Check the electrical connection of the motor and the control system, if any.
X	-	-	-	-	-	-	-	Speed is too low. ¹³⁾ - Operation with frequency inverter - Operation without frequency inverter	- Increase voltage/frequency at the frequency inverter in the permissible range. - Check voltage.
X	-	-	-	-	-	X	-	Impeller	Replace worn components by new ones.

¹²⁾ Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

¹³⁾ Contact KSB.

A	B	C	D	E	F	G	H	Possible cause	Remedy ¹²⁾
-	X	-	-	-	-	X	-	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. ¹³⁾
-	X	-	-	-	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	Contact KSB.
-	X	X	-	-	-	-	-	Speed is too high.	Reduce speed. ¹³⁾
-	-	-	-	-	X	-	-	Use of unsuitable materials	Change the material combination.
-	-	-	-	X	-	-	-	Defective gasket	Fit new gasket between volute casing and discharge cover.
-	-	-	-	-	X	-	-	Worn shaft seal	Fit new shaft seal. Check flushing liquid/barrier fluid.
X	-	-	-	-	X	-	-	Score marks or roughness on shaft protecting sleeve / shaft sleeve	Fit new shaft protecting sleeve / shaft sleeve. Fit new shaft seal.
-	-	-	-	-	X	-	-	Dismantle to find out.	Repair necessary.
-	-	-	-	-	X	-	-	Vibrations during pump operation	Correct suction conditions. Re-align the pump. Re-balance the impeller. Increase pressure at the pump suction nozzle.
-	-	-	X	-	X	X	-	The pump set is misaligned.	Re-align.
-	-	-	X	-	X	X	-	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.
-	-	-	X	-	-	-	-	Insufficient or excessive quantity of lubricant or unsuitable lubricant.	Top up, reduce or change lubricant.
-	-	-	X	-	-	-	-	Non-compliance with specified coupling distance	Correct distance according to general arrangement drawing.
X	X	-	-	-	-	-	-	Motor is running on two phases only.	Replace the defective fuse. Check the electric cable connections.
-	-	-	-	-	-	X	-	Rotor out of balance	Clean the impeller. Re-balance the impeller.
-	-	-	-	-	-	X	-	Defective bearing(s)	Fit new bearing(s).
-	-	-	X	-	-	X	X	Flow rate is too low.	Increase the minimum flow rate.
-	-	-	-	-	X	-	-	Incorrect inflow of circulation liquid	Increase the free cross-section.

9 Related Documents

9.1 General assembly drawing with list of components

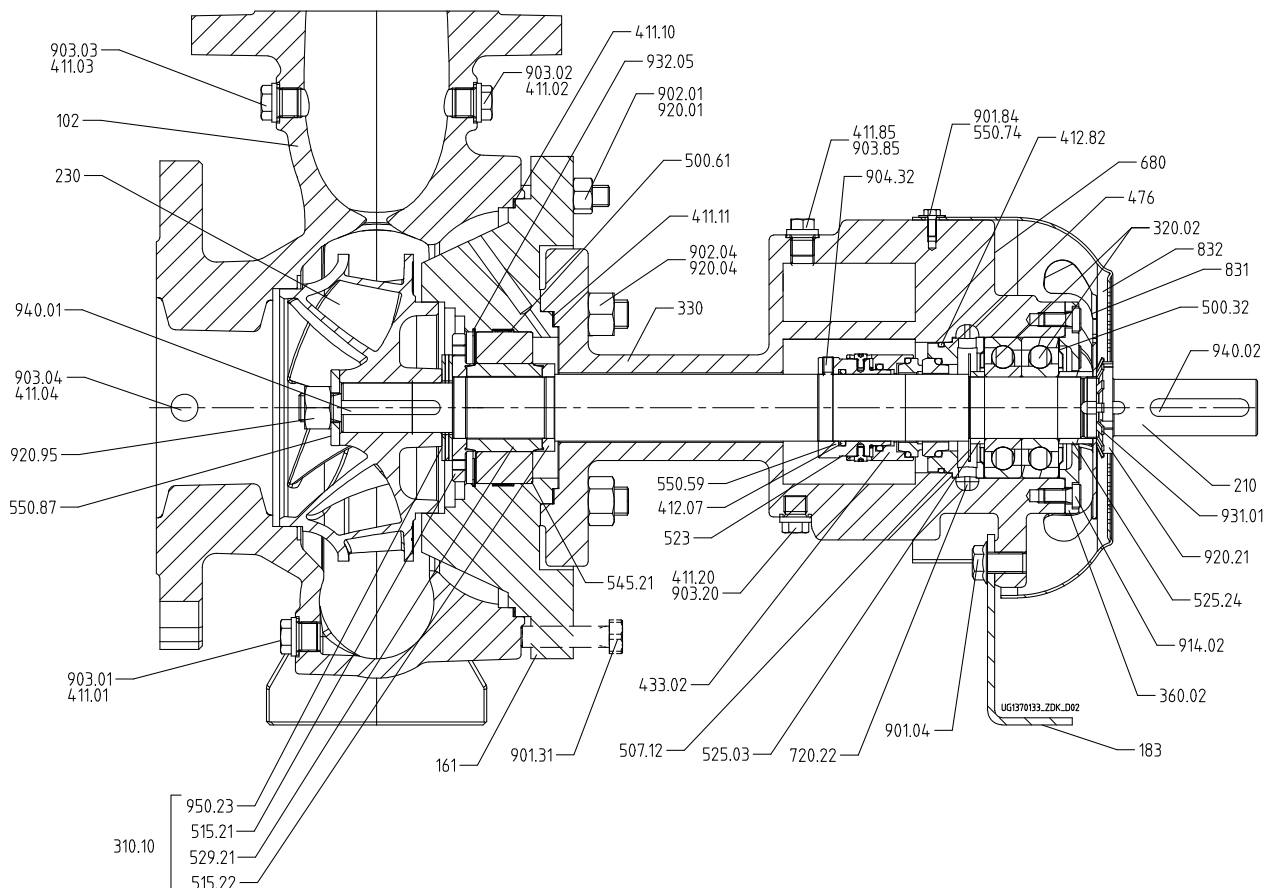
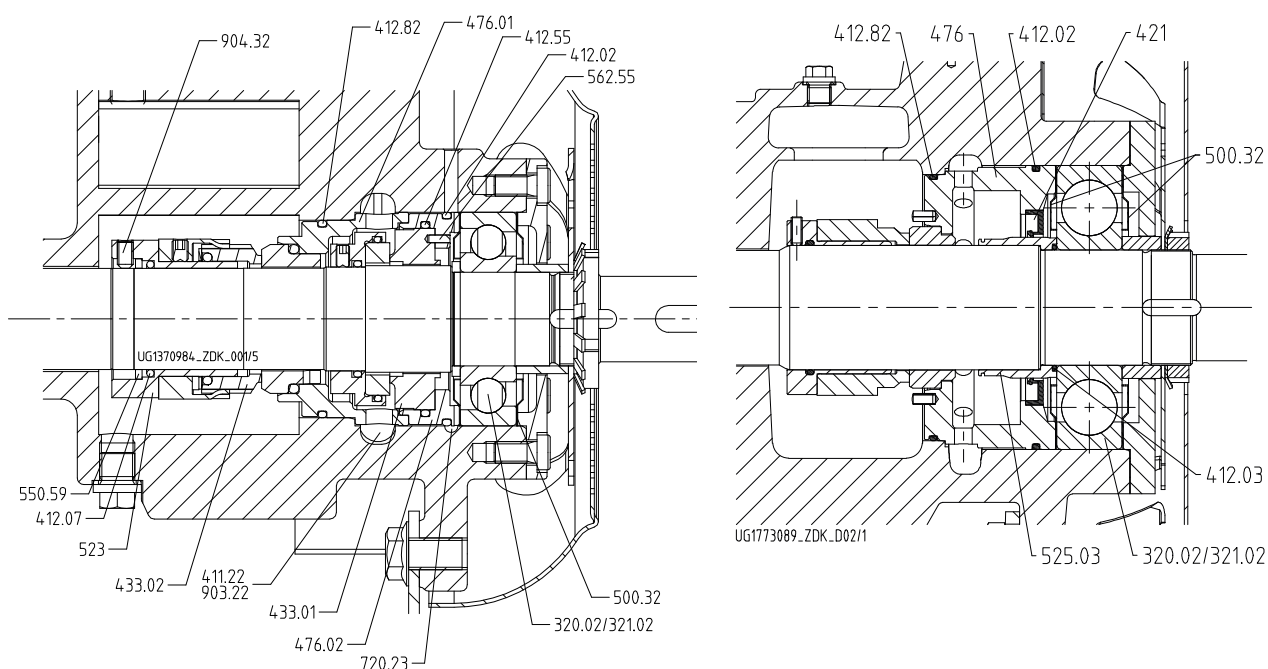
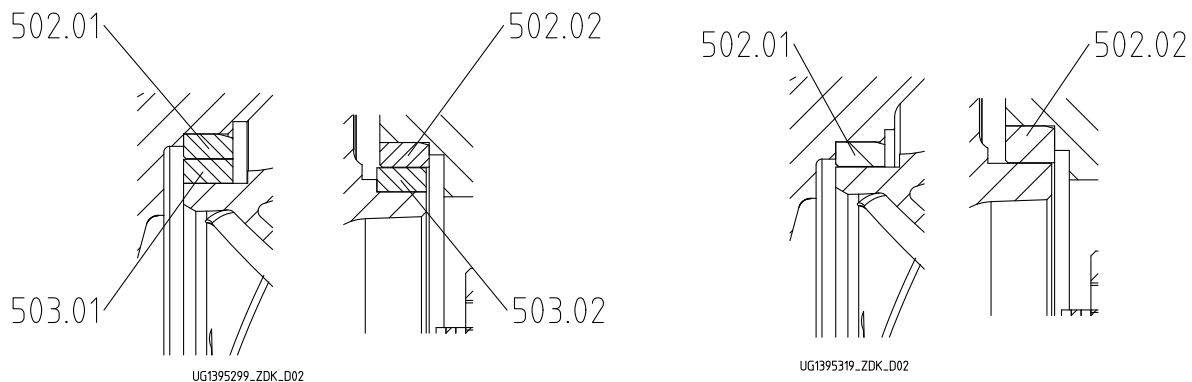


Fig. 22: General assembly drawing for version with one mechanical seal and two angular contact ball bearings



Version with two mechanical seals and one deep groove ball bearing or one four-point bearing

Version with one mechanical seal with lip seal and one deep groove ball bearing or one four-point bearing



Version with casing wear ring and impeller wear ring

Version with casing wear ring

Table 25: List of components

Part No.	Comprising	Description
102	102	Volute casing
	411.01/.02/.03/.04/.10	Joint ring
	502.01 ¹⁴⁾	Casing wear ring
	902.01	Stud
	903.01/.02/.03/.04	Screw plug
	920.01	Hexagon nut
161	161	Casing cover
	411.11	Joint ring
	500.61	Tolerance ring
	502.02 ¹⁴⁾	Casing wear ring
	545.21	Bearing bush
	901.31	Hexagon head bolt
	902.04	Stud
	920.04	Hexagon nut
	932.05	Circlip
183	183	Support foot
210	210	Shaft
	550.87	Disc
	920.21	Slotted round nut
	920.95	Hexagon nut
	931.01	Lock washer
	940.01/02	Key
230	230	Impeller
	503.01/.02 ¹⁵⁾	Impeller wear ring
310.10	310.10	Plain bearing
	515.21/.22	Locking ring
	529.21	Bearing sleeve
	950.23	Disc spring
320.02 ¹⁶⁾	320.02 ¹⁶⁾	Angular contact ball bearing
321.02 ¹⁶⁾	321.02 ¹⁶⁾	Deep groove ball bearing
330	330	Bearing bracket
360.02	360.02	Bearing cover

¹⁴⁾ For version with casing wear ring only

¹⁵⁾ For version with casing wear ring and impeller wear ring only

¹⁶⁾ Depending on the design

Part No.	Comprising	Description
411.20/.22/.35 ¹⁷⁾ /.36 ¹⁷⁾ /.55/.85	411.20/.22/.35 ¹⁷⁾ /.36 ¹⁷⁾ /.55/.85	Joint ring
412.02 ¹⁸⁾ /.03 ¹⁹⁾ /.07 ¹⁸⁾ /.55 ¹⁸⁾ /.82 ¹⁸⁾	412.02 ¹⁸⁾ /.03 ¹⁹⁾ /.07 ¹⁸⁾ /.55 ¹⁸⁾ /.82 ¹⁸⁾	O-ring
421 ²⁰⁾	421 ²⁰⁾	Lip seal
433.01	433.01	Mechanical seal
433.02	433.02	Mechanical seal
476/.01 ¹⁸⁾ /.02 ¹⁸⁾	476/.01 ¹⁸⁾ /.02 ¹⁸⁾	Mating ring carrier
500.32	500.32	Nilos ring
507.12	507.12	Thrower
523 ¹⁸⁾	523 ¹⁸⁾	Shaft sleeve
525.03/.24	525.03/.24	Spacer sleeve
550.59 ¹⁸⁾	550.59 ¹⁸⁾	Support disc
550.74	550.74	Disc
562.55 ¹⁸⁾	562.55 ¹⁸⁾	Parallel pin
680	680	Guard
720.22 ¹⁹⁾ /.23 ¹⁷⁾	720.22	Barrel nipple
720.35 ¹⁷⁾ /.36 ¹⁷⁾	720.35 ¹⁷⁾ /.36 ¹⁷⁾	Extension
831	831	Fan impeller
832	832	Fan hood
901.04/.84	901.04/.84	Hexagon head bolt
902.04	902.04	Stud
903.20/.22/.85	903.20/.22/.85	Screw plug
904.32 ¹⁸⁾	904.32 ¹⁸⁾	Grub screw
914.02	914.02	Hexagon socket head cap screw
920.04	920.04	Hexagon nut

¹⁷⁾ For version with two mechanical seals only

¹⁸⁾ Not fitted on version with KSB mechanical seal

¹⁹⁾ For version with one mechanical seal only

²⁰⁾ For version with one mechanical seal, lip seal and one bearing only

10 EU Declaration of Conformity

Manufacturer:

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

The manufacturer herewith declares that the product:

HPK-L

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 standards²¹⁾ 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

.....²²⁾.....

Name
Function
Company
Address

²¹⁾ 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.

²²⁾ A signed, legally binding EU Declaration of Conformity is supplied with the product.

11 Certificate of Decontamination

Type:
Order number /
Order item number²³⁾:
Delivery date:
Application:
Fluid handled²³⁾:

Please tick where applicable²³⁾:



Corrosive



Oxidising



Flammable



Explosive



Hazardous to health



Seriously hazardous to health



Toxic



Radioactive



Bio-hazardous



Safe

Reason for return:²³⁾
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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