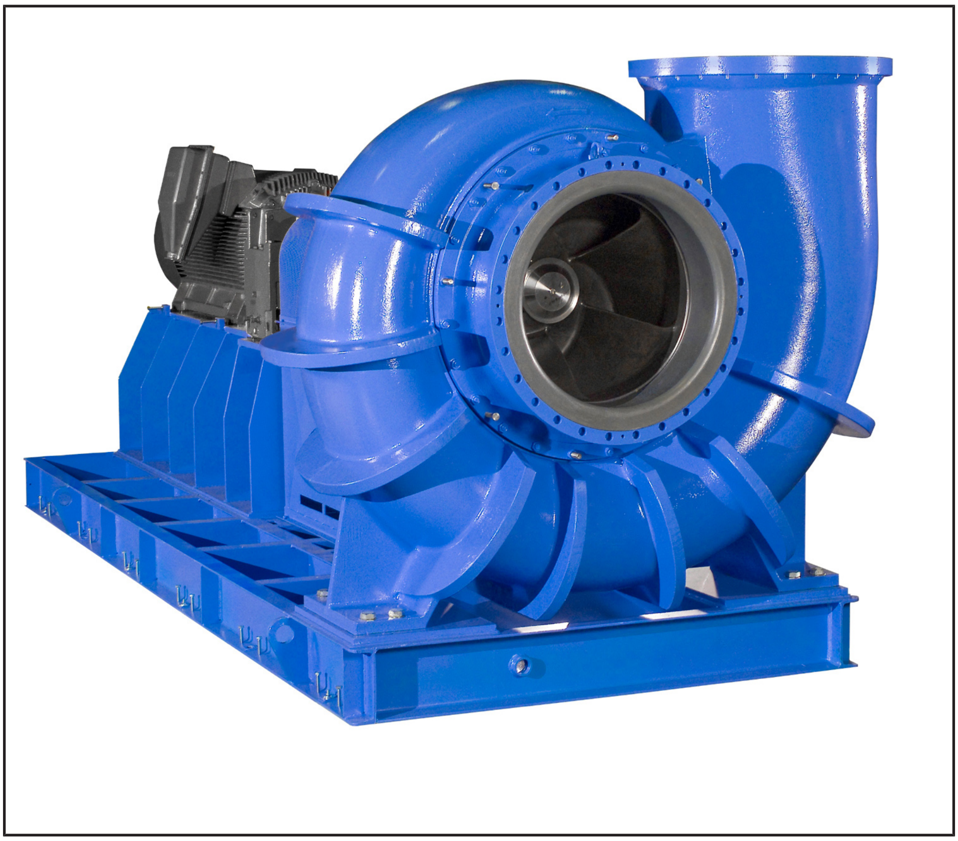
Dry-installed Volute Casing Pump

KWP

Bearing Brackets: P16ax to P20sx

Installation/Operating Manual



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CA

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Installation/Operating Manual KWP

Original operating manual

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Glossary

Absorber recirculation pump
Recirculation pump for handling limestone suspension in a flue gas desulphurisation plant

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

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

1 General

1.1 Principles

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

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

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

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

1.2 Installation of partly completed machinery

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

1.3 Target group

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

1.4 Other applicable documents

Table 1: Overview of other applicable documents

Document	Contents
Data sheet	Description of the technical data of the pump (set)
General arrangement drawing / outline drawing	Description of mating 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

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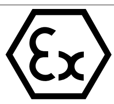
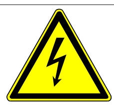
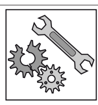
Symbol	Description
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
DANGER	**DANGER** This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
WARNING	**WARNING** This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
CAUTION	**CAUTION** This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	**Explosion protection** This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with the UK regulation titled Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016.
	**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

DANGER

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

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

2.1 General

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

2.2 Intended use

- The pump (set) must only be operated in the fields of application and within the use limits specified in the other applicable documents. (⇨ Section 1.4, Page 7)
- Only operate pumps/pump sets which are in perfect technical condition.
- Do not operate the pump (set) in partially assembled condition.
- Only use the pump to handle the fluids described in the data sheet or product literature of the pump model or variant.
- Never operate the pump without the fluid to be handled.
- Observe the minimum flow rates indicated in the data sheet or product literature (to prevent overheating, bearing damage, etc).
- 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).
- 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.
- Only use the respective impeller types in combination with the fluids described below.

	Closed multi-channel impeller (impeller type K)	**Suitable for the following fluids:** Contaminated, solids-laden fluids not containing stringy material and containing no or very little entrapped gas

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.

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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.

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- 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 45)
- Decontaminate pumps which handle fluids posing a health hazard. (⇨ Section 7.3, Page 52)
- 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 37)

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.

2.9 Explosion protection

DANGER

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 the UK's *Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016*.

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 must be considered separately.

2.9.2 Temperature limits

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

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

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 6.2.3.1, Page 44) 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 6.2.3.1, Page 44) can be used to check whether an additional heat build-up may lead to a dangerous temperature increase at the pump surface.

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2 Subject to further limitations for mechanical seal temperature rise

3 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.

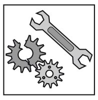
3.2 Transport

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.



CAUTION

Improper transport of components made of CeramikPolySiC®

Damage to component!

- ▷ Never suspend impellers or other components made of CeramikPolySiC® from steel ropes or chains.
- ▷ Always use suitable lifting tackle (e.g. straps, loops) for transporting impellers or other components made of CeramikPolySiC®.

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

NOTE

For transporting sizes 800-900-883, 900-900-1133, 900-900-1134, 900-900-1137, 900-900-1138 and 900-900-1139 use the lifting lugs provided (2 lifting lugs M36×50-20.0, 10 tonnes).

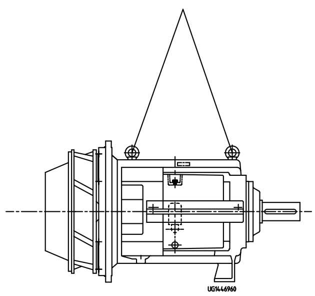


Fig. 1: Transporting the back pull-out unit

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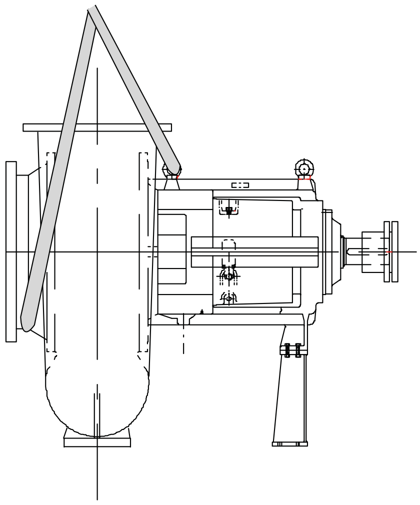


Fig. 2: Transporting the pump

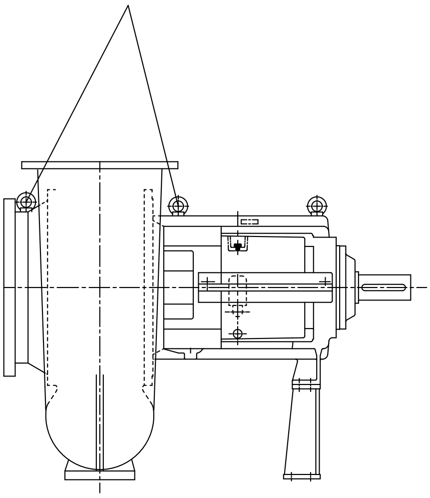


Fig. 3: Transporting the pump (800-900-883, 900-900-1133, 900-900-1134, 900-900-1137, 900-900-1138, 900-900-1139)

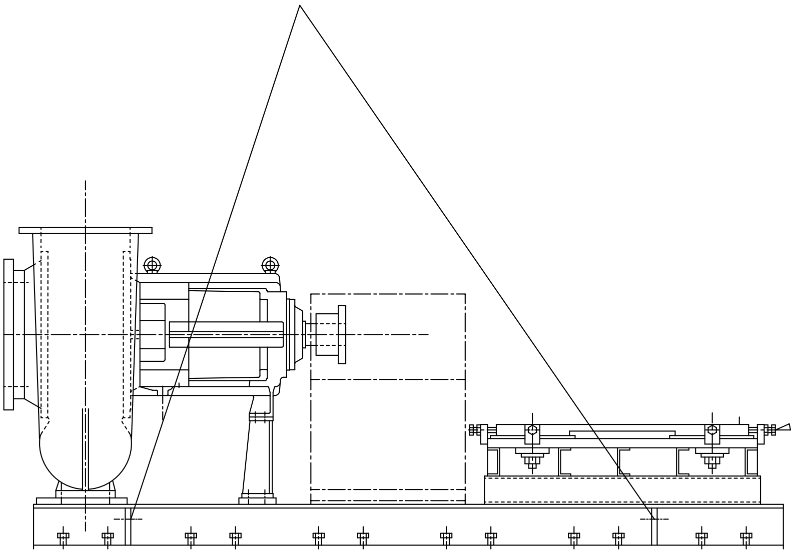


Fig. 4: Transporting the pump on a baseplate

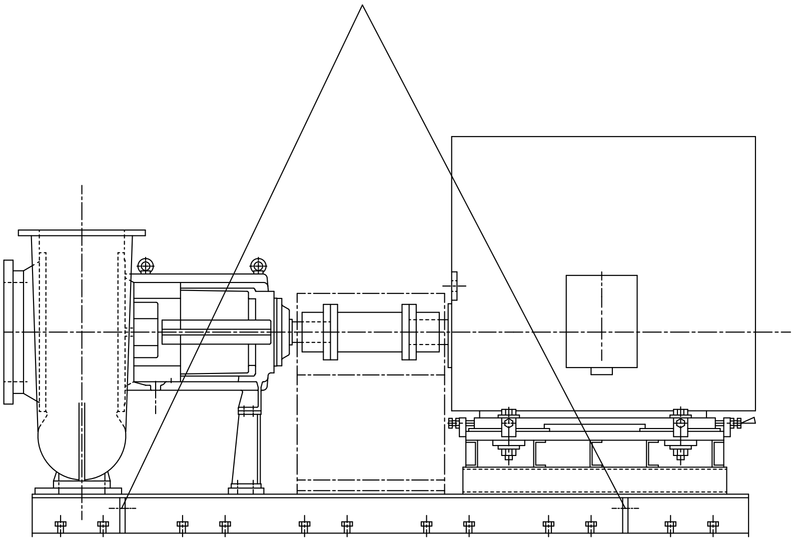
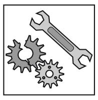


Fig. 5: Transporting the pump set on a baseplate

3.3 Storage/preservation

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

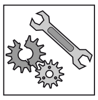


CAUTION

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.

Store the pump (set) in a dry, protected room where the atmospheric humidity is as constant as possible.

Manually rotate the shaft by 1/2 turn at least once a week, e.g. via the motor fan.

If properly stored indoors, the equipment 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, observe the instructions in (⇨ Section 6.3.1, Page 45) .

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇨ Section 7.3, Page 52)
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 84)

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	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.

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4 Description of the Pump (Set)

4.1 General description

- Dry-installed volute casing pump

Pump for handling pre-treated sewage, waste water, all types of slurries without stringy material and pulps up to 5 % bone dry with a maximum density of 2000 kg/m^3.

4.2 Product information

4.2.1 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	33
K	W	P	K	8	0	0	-	8	0	0	-	0	9	3	4		G	N	N	G	1	0	P	4	X	3	N	H		5	5	4
See name plate and data sheet																							See data sheet									

Table 6: Designation key

Position	Code	Description	
1-3	Pump type		
	KWP	KWP	
4	Impeller		
	K	Channel impeller	
5-17	Size, e.g.		
	800	Nominal suction nozzle diameter [mm]	
	800	Nominal discharge nozzle diameter [mm]	
	0934	Nominal impeller diameter [mm]	
18	Pump casing material		
	D	Noridur	1.4593
	G	Grey cast iron	GJL-250
	H	NORIHARD NH 15 3	-
	K	Nodular cast iron / CeramikPolySiC	GJS-400-18-LT
19	Impeller material		
	D	Noridur	1.4593
	H	NORIHARD NH 15 3	-
	K	CeramikPolySiC	-
	M	NORICROM	1.4475
	N	ERN	-
	U	NORIDUR DAS	1.4593
20	Wear plate material / wear ring material		
	D	NORIDUR	1.4593
	H	NORIHARD NH 15 3	-
	K[4)]	CeramikPolySiC	-
	M	NORICROM	1.4475

4 K defines a suction cover in GJS-400-18-LT/ CeramikPolySiC for pumps without a separate wear plate.

Position	Code	Description	
20	N	ERN	-
	U	NORIDUR DAS	1.4593
21	Discharge cover material		
	D	NORIDUR	1.4593
	G	Grey cast iron	GJL-250
	H	NORIHARD NH 15 3	-
	K	CeramikPolySiC	-
	M	NORICROM	1.4475
22-23	Design version		
	10	10	
	11	11	
24-25	Shaft seal operating mode		
	A	Single mechanical seal in A-type cover	
	CA	Single cartridge seal	
	CBA	Double cartridge seal, with barrier fluid	
	DR	Double mechanical seal in cylindrical cover, with barrier fluid	
	P3	Gland packing (arrangement I = 2/1/2) for barrier fluid	
	P6	Gland packing (arrangement II = 1/1/3) for barrier fluid	
	P4	Gland packing (arrangement IIa = -/1/3) for flushing liquid	
	TA	Double mechanical seal in A-type cover, unpressurised	
	TS	Double mechanical seal in A-type cover, with barrier fluid	
26	Design		
	-[5]	Standard	
	X	Non-standard (BT3D, BT3)	
27-29	Installation type		
	0	Pump only (Fig. 0 bare-shaft pump)	
	3N	Pump, motor, baseplate, non-spacer-type coupling (Fig. 3E)	
	3NH	Pump, motor, baseplate, spacer-type coupling (Fig. 3E)	
	BH	Close-coupled, horizontal	
	BV	Close-coupled, vertical	
30-32	Motor rating P_N [kW]		
	055	55	
	132	132	
33	Number of motor poles		

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5 Blank

4.4 Name plate

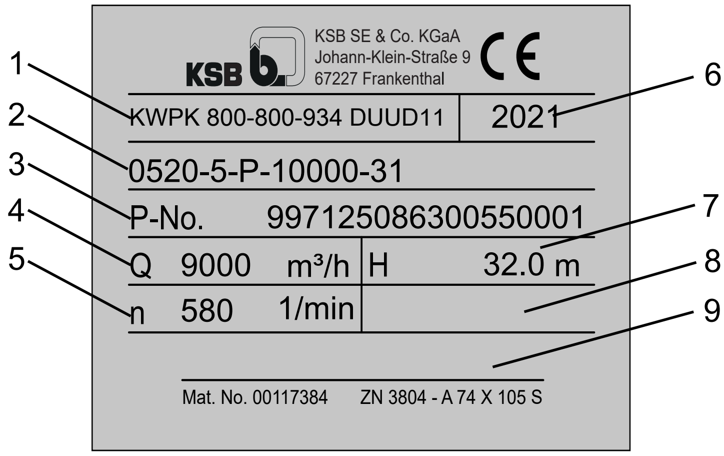

Fig. 6: Name plate (example)

1	Type series, size, material	2	Customer-specific information (optional)
3	KSB order and order item number	4	Flow rate
5	Speed	6	Year of construction
7	Head	8	Pump input power or blank
9	Further required information		

4.5 Design details

Design

- Volute casing pump
- Horizontal installation
- Back pull-out design
- Single-stage
- Single-suction

Pump casing

- Radially split volute casing
- Volute casing with integrally cast pump feet
- Pump casing with suction cover (partly with wear plate)
- Single-piece discharge cover

Impeller type

- Closed channel impeller (⇨ Section 2.2, Page 9)
- Back vanes reduce axial thrust.

Bearing assembly

- Oil-lubricated rolling element bearings
- Back pull-out design with axially adjustable pump rotor to adjust the clearance between impeller and wear plate

Bearings used

Table 7: Standard bearings

Bearing bracket	Rolling element bearings		
	Pump end[6]	Drive end[6]	Drive end
P16ax	NU 232 EC3	NU 232 EC3	QJ 328-N2[7]
P20sx	NU 240 E	NJ 238 E	29340-E1[8]

Shaft seal

- Single mechanical seal
- Shaft equipped with replaceable shaft protecting sleeve in the shaft seal area

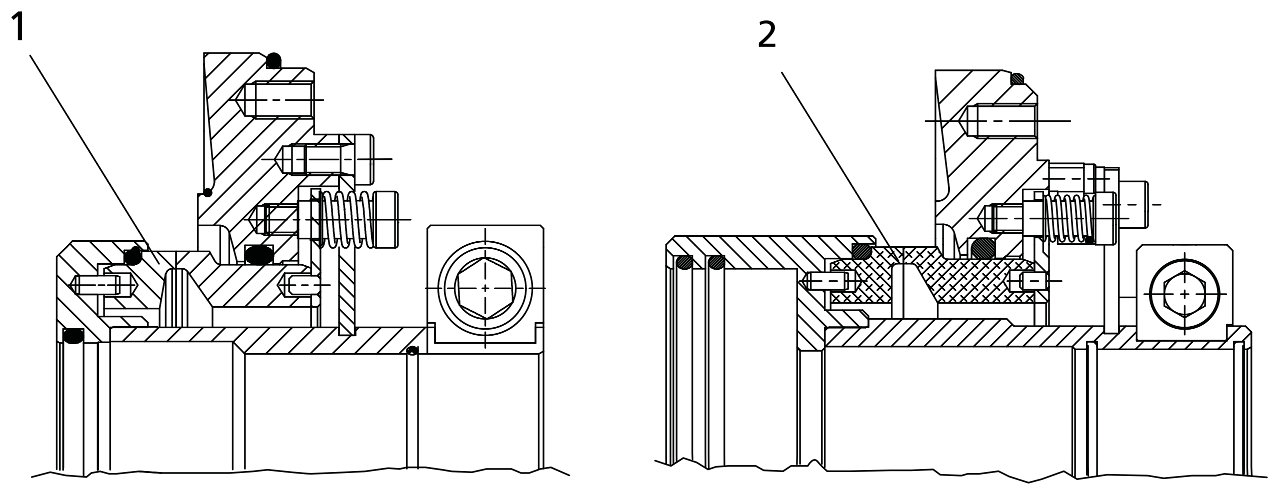

Fig. 7: Mechanical seals in conical seal chamber (A-type)

1	Single mechanical seal, balanced, with spring-loaded stationary assembly, bi-directional, for P16ax/P20sx V10	2	Single mechanical seal, balanced, with spring-loaded stationary assembly, bi-directional, for P20sx V11

Drive

- Electric motor connected to the pump via a coupling

4.6 Materials

Example of material designation: DMKM

Table 8: Key to the material designation

Code	Description	
D	Casing material	
	G	GJL-250 [9]
	H	NORIHARD NH 15 3
	D	NORIDUR 1.4593
	K	JS1025/ CeramikPolySiC®
M	Impeller material	
	N	ERN
	D	NORIDUR 1.4593
	U	NORIDUR 1.4593 DAS
	K	CeramikPolySiC®
	M	NORICROM 1.4475

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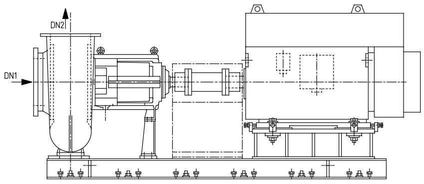
6 To DIN 5412
7 To DIN 628
8 To DIN 728
9 Formerly JL1040

Code	Description		
M		H	NORIHARD NH 15 3
K	Wear plate material		
		N	ERN
		H	NORIHARD NH 15 3
		D	NORIDUR 1.4593
		U	NORIDUR 1.4593 DAS
		K[10]	CeramikPolySiC®
M	Discharge cover material		
		G	GJL-250 [11]
		H	NORIHARD NH 15 3
		D	NORIDUR 1.4593
		M	NORICROM 1.4475
		K	CeramikPolySiC®

The following material combinations can be implemented (not available for all sizes): GNNG, GDNG, DDDD, DUUD, DKKM, DMKM, GHHH, HHHH, KUKK, KKKK

4.7 Installation types

Table 9: Installation types

Installation type	Illustration	Description
Figure 3		Pump set with directly coupled motor

10 K defines a suction cover in JS1025/ CeramikPolySiC® for pumps without a separate wear plate
11 Formerly JL1040

4.8 Configuration and function

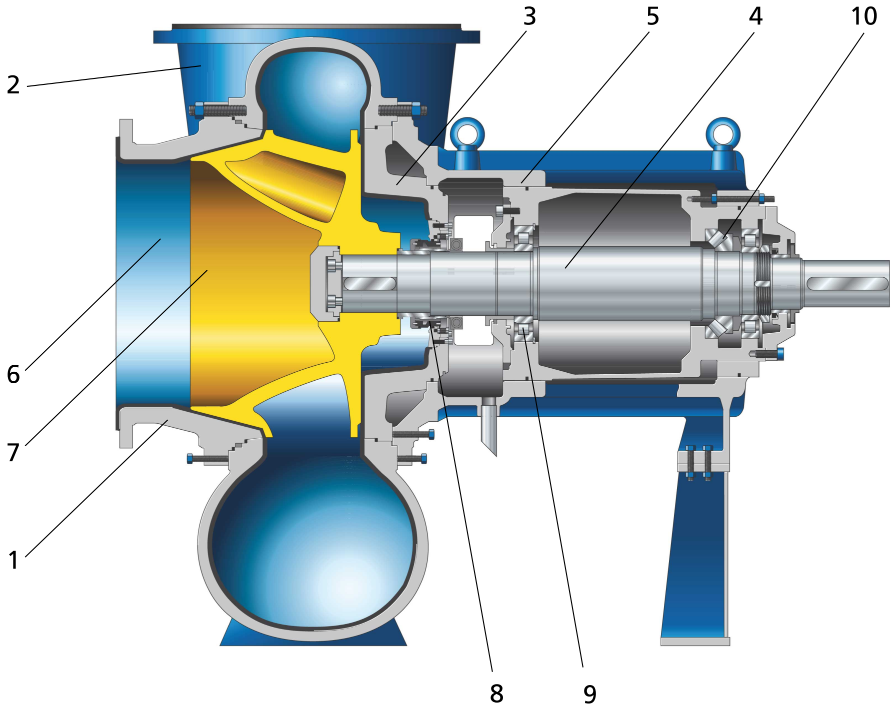


Fig. 8: Sectional drawing

1	Suction cover	2	Casing/discharge nozzle
3	Discharge cover	4	Shaft
5	Bearing bracket	6	Casing/suction nozzle
7	Impeller	8	Shaft seal
9	Rolling element bearing, pump end	10	Rolling element bearing, motor end

Design The horizontal, non-self-priming, radially split volute casing pump in back pull-out design is designed with an axial fluid inlet and a tangential outlet. The rotor runs in an axially adjustable bearing assembly and is connected to the motor by a shaft coupling.

Function The uniformly rotating impeller of the centrifugal pump transfers mechanical energy to the fluid passing through the pump.

The fluid enters the pump axially via the suction nozzle (6) and is accelerated outward by the rotating impeller (7). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid leaves the pump via the discharge nozzle (2).

The casing is fitted with a replaceable suction cover (1). The diagonal clearance prevents frequent deflection of the clearance flow heading in the direction of the suction nozzle. This ensures a longer service life if solids-laden fluids are handled. Owing to the axially adjustable bearing assembly, the clearance can be set to an optimum width.

The casing is closed by a discharge cover (3). The shaft (4) enters the casing via this cover. A shaft seal (8) provides reliable sealing to atmosphere.

The shaft is supported by oil lubricated rolling element bearings (9 and 10). The bearing bracket (5) is directly connected to the casing.

Sealing The pump is sealed by a shaft seal installed in a conical seal chamber:
single mechanical seal

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4.9 Noise characteristics

Table 10: Surface sound pressure level L_{pA}[12)]

Rated power input	Pump				
	420 rpm	480 rpm	580 rpm	725 rpm	960 rpm
PN [kW]	[dB]	[dB]	[dB]	[dB]	[dB]
550 kW	73	76	79	83	87
600 kW	74	76	80	84	88
650 kW	74	77	80	84	88
750 kW	75	78	81	85	90
800 kW	76	78	82	85	90
900 kW	77	79	82	86	-
1000 kW	77	80	83	87	-
1200 kW	79	81	84	-	-
1700 kW	81	84	-	-	-

4.10 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

- Baseplate (to ISO 3661), cast or welded, for pump and motor, in torsion-resistant design

Special accessories

- As required

4.11 Dimensions and weights

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

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

5 Installation at Site

5.1 Safety regulations

DANGER

Excessive temperatures in the shaft seal area

Explosion hazard!

- Never operate a pump (set) with gland packing in potentially explosive atmospheres.

NOTE

Operating pump sets with gland packings in combination with a frequency inverter / variable speed system is not recommended.

5.2 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.

5.3 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.

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5.3.1 Installation on a foundation

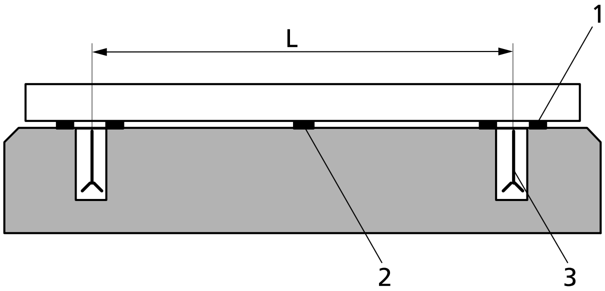

Fig. 9: Fitting the shims

L	Bolt-to-bolt distance	1	Shim
2	Shim if L > 1000 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.

✓ The recommendations for preparing and processing concrete (⇨ Section 9.2, Page 81) have been observed.

✓ On sizes 800-934, 800-935 and 800-939 the supportive structures (wood / 60 mm) have been removed from underneath the casing and the bearing bracket foot.

1. Position the pump set with the baseplate on the foundation and level it with the help of a precision spirit level placed on the shaft and discharge nozzle.
   Permissible deviation: 0.2 mm/m.
2. Use enough shims (1) to fully compensate any height difference.
   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) > 1000 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.

NOTE

Always perform the alignment check on machined surfaces.

5. Wait until the concrete has set firmly, then level the baseplate.
6. Tighten the foundation bolts (3) evenly and firmly.
7. Check the alignment of pump, gear unit (if any) and motor. Re-align them, if necessary.
8. Grout the baseplate including the structure for the drive or drive/gear unit using low-shrinkage concrete with a standard particle size and a water/cement ratio ≤ 0.5. Avoid cavities.
   Produce flowability with the help of a solvent.
   Perform secondary treatment of the concrete to DIN 1045.

NOTE

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

5.4 Piping

5.4.1 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 valves and shut-off valves in the system is recommended, depending on the type of plant. 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 equal to or greater than the nominal diameters of the pump nozzles.
- ✓ Adapters to larger nominal diameters are designed with a diffuser angle of approx. 8° to avoid excessive pressure losses.
- ✓ The pipelines have been anchored in close proximity to the pump and connected without transmitting any stresses or strains.

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.

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 7.2.2.2, Page 50) .

3. Check that the inside of the pump is free from any foreign objects. Remove any foreign objects.

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4. If required, install a filter in the piping (see drawing: Filter in the piping).

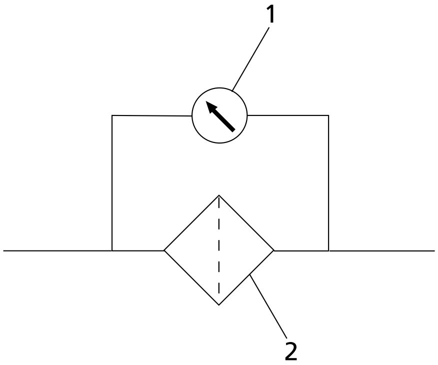


Fig. 10: Filter in the piping

1	Differential pressure gauge	2	Filter

NOTE

Use a filter made 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.

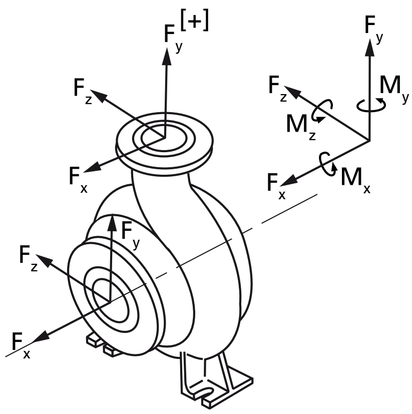
CAUTION

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.

5.4.2 Permissible forces and moments at the pump nozzles



Forces and moments at the pump nozzles

The permissible resultant forces have been determined according to:

$$F_{res\ D} \leq \sqrt{F_x^2 + F_z^2}$$

$$F_{res\ S} \leq \sqrt{F_y^2 + F_z^2}$$

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.

Correction coefficients depending on material and temperature (see diagram below).

Material variants DDDD, DUUD, DKKM, DMKM: temperature-dependent correction coefficients

For material variants DDDD, DUUD, DKKM and DMKM and temperatures > 20 °C reduce the values given in (⇨ Section 5.4.2.1, Page 28) in accordance with the following diagram:

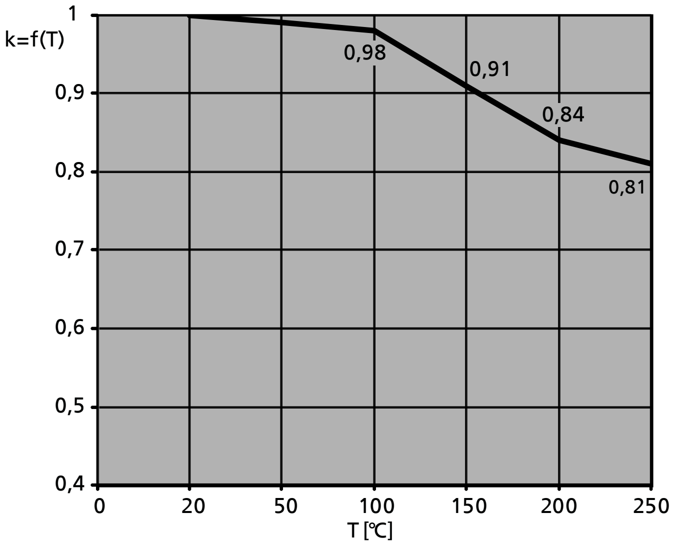


Fig. 11: Example of correction coefficients for material variant DDDD

Calculation of forces and moments for T > 20 °C

Reduction formula:

Permissible force/moment = k (T) x force/moment from table

Example:

- Material = DDDD
- T = 100°C
- k = 0.98

5.4.2.1 Material variants DDDD, DUUD, DMKM, DKKM (NORIDUR)

Table 11: Material variants DDDD, DUUD, DMKM, DKKM (NORIDUR): permissible forces and moments at the pump nozzles[13]

Size	Forces									Moments					
	Suction nozzle				Discharge nozzle					Suction nozzle			Discharge nozzle		
	F_x [N]	F_y [N]	F_z [N]	F_{res} [N]	F_x [N]	F_{yTens+} [N]	$F_{yCompr-}$ [N]	F_z [N]	F_{res} [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]	M_x [Nm]	M_y [Nm]	M_z [Nm]
500-400-710	25580	18635	21755	28645	20170	13300	24580	16750	26210	25050	19420	14285	20375	15540	10825
500-400-713	25580	18635	21755	28645	20170	13300	24580	16750	26210	25050	19420	14285	20375	15540	10825
500-500-633	25580	18635	21755	28645	21755	16600	25580	18635	28645	25050	19420	14285	25050	19420	14285
500-500-637	25580	18635	21755	28645	21755	16600	25580	18635	28645	25050	19420	14285	25050	19420	14285
600-600-824	26405	20170	23050	30625	23050	19900	26405	20170	30625	29340	23145	17995	29340	23145	17995
600-600-825	26405	20170	23050	30625	23050	19900	26405	20170	30625	29340	23145	17995	29340	23145	17995
600-600-829	26405	20170	23050	30625	23050	19900	26405	20170	30625	29340	23145	17995	29340	23145	17995
700-700-923	27100	21470	24145	32310	24145	23130	27100	21470	32310	33240	26725	21960	33240	26725	21960
800-700-953	27700	22595	25095	33765	24145	23130	27100	21470	32310	36700	30150	26200	33240	26725	21960
800-700-959	27700	22595	25095	33765	24145	23130	27100	21470	32310	36700	30150	26200	33240	26725	21960
800-900-883	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
800-800-934	27700	22595	25095	33765	25095	26350	27700	22595	33765	36700	30150	26200	36700	30150	26200
800-800-935	27700	22595	25095	33765	25095	26350	27700	22595	33765	36700	30150	26200	36700	30150	26200
800-800-939	27700	22595	25095	33765	25095	26350	27700	22595	33765	36700	30150	26200	36700	30150	26200
900-900-1133	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
900-900-1134	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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13 For temperatures > 20 °C: adjust the values in accordance with the associated temperature correction diagram (correction coefficient for material variants DDDD, DUUD, DMKM, DKKM (NORIDUR)).

Size	Forces									Moments					
	Suction nozzle				Discharge nozzle					Suction nozzle			Discharge nozzle		
	F_x [N]	F_y [N]	F_z [N]	F_{res} [N]	F_x [N]	F_{yTens+} [N]	$F_{yCompr-}$ [N]	F_z [N]	F_{res} [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]	M_x [Nm]	M_y [Nm]	M_z [Nm]
900-900-1138	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
900-900-1139	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

5.4.2.2 Material variants GNNG, GHHH, GDNG, HHHH, KUKK, KKKK (grey cast iron, NORIHARD)

Table 12: Material variants GNNG, GHHH, GDNG, HHHH, KUKK, KKKK (grey cast iron, NORIHARD): permissible forces and moments at the pump nozzles[14)]

Size	Forces									Moments					
	Suction nozzle				Discharge nozzle					Suction nozzle			Discharge nozzle		
	F_x [N]	F_y [N]	F_z [N]	F_{res} [N]	F_x [N]	F_{yTens+} [N]	$F_{yCompr-}$ [N]	F_z [N]	F_{res} [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]	M_x [Nm]	M_y [Nm]	M_z [Nm]
500-400-710	16600	13450	14950	21110	11950	6915	13900	10750	16070	14450	11800	10250	9700	7950	6900
500-400-713	16600	13450	14950	21110	11950	6915	13900	10750	16070	14450	11800	10250	9700	7950	6900
500-500-633	16600	13450	14950	21110	14950	8600	16600	13450	21110	14450	11800	10250	14450	11800	10250
500-500-637	16600	13450	14950	21110	14950	8600	16600	13450	21110	14450	11800	10250	14450	11800	10250
600-600-824	19900	16150	17950	24140	17950	10345	19900	16150	24140	20200	16600	14400	20200	16600	14400
600-600-825	19900	16150	17950	24140	17950	10345	19900	16150	24140	20200	16600	14400	20200	16600	14400
600-600-829	19900	16150	17950	24140	17950	10345	19900	16150	24140	20200	16600	14400	20200	16600	14400
700-700-923	23130	18820	20900	28120	20900	12025	23130	18820	28120	27030	22190	19280	27030	22190	19280
800-700-953	26350	21490	23870	32110	20900	12025	23130	18820	28120	34910	28680	24920	27030	22190	19280
800-700-959	26350	21490	23870	32110	20900	12025	23130	18820	28120	34910	28680	24920	27030	22190	19280
800-900-883	26350	21490	23870	32110	26830	15365	29550	24160	36100	34910	28680	24920	43840	36020	31310
800-800-934	26350	21490	23870	32110	23870	13700	26350	21490	32110	34910	28680	24920	34910	28680	24920
800-800-935	26350	21490	23870	32110	23870	13700	26350	21490	32110	34910	28680	24920	34910	28680	24920
800-800-939	26350	21490	23870	32110	23870	13700	26350	21490	32110	34910	28680	24920	34910	28680	24920
900-900-1133	29550	24160	26830	36100	26830	15365	29550	24160	36100	43840	36020	31310	43840	36020	31310
900-900-1134	29550	24160	26830	36100	26830	15365	29550	24160	36100	43840	36020	31310	43840	36020	31310
900-900-1137	29550	24160	26830	36100	26830	15365	29550	24160	36100	43840	36020	31310	43840	36020	31310
900-900-1138	29550	24160	26830	36100	26830	15365	29550	24160	36100	43840	36020	31310	43840	36020	31310
900-900-1139	29550	24160	26830	36100	26830	15365	29550	24160	36100	43840	36020	31310	43840	36020	31310

5.4.3 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.

14 Application range: up to 200 °C (without reduction); for other sizes please contact KSB

	⚠ WARNING
	Failure to use or incorrect use of auxiliary connections (e.g. barrier fluid, flushing liquid, etc.) Risk of injury from escaping fluid! Risk of burns! Malfunction of the pump! ▷ Refer to the general arrangement drawing, the piping layout and pump markings (if any) for the quantity, dimensions and locations of auxiliary connections. ▷ Use the auxiliary connections provided.

5.5 Enclosure/insulation

	⚠ DANGER
	Risk of potentially explosive atmosphere due to insufficient venting Explosion hazard! ▷ Make sure the space between the casing cover/discharge cover and the bearing cover is sufficiently vented. ▷ Never close or cover the perforation of the bearing bracket guards (e.g. by insulation).

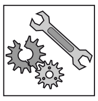
	⚠ WARNING
	The volute casing and casing/discharge cover take on the same temperature as the fluid handled Risk of burns! ▷ Insulate the volute casing. ▷ Fit protective equipment.

	CAUTION
	Heat build-up in the bearing bracket Damage to the bearing! ▷ Never insulate the bearing bracket, bearing bracket lantern and casing cover.

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

5.6 Checking the coupling alignment

	⚠ DANGER
	Inadmissible temperatures at the coupling or bearings due to misalignment of the coupling Explosion hazard! Risk of burns! ▷ Make sure that the coupling is correctly aligned at all times.



CAUTION

Misalignment of pump and motor shafts

Damage to pump, motor and coupling!

▷ Always check the coupling after the pump has been installed and connected to the piping.

▷ Also check the coupling of pump sets supplied with pump and motor mounted on the same baseplate.

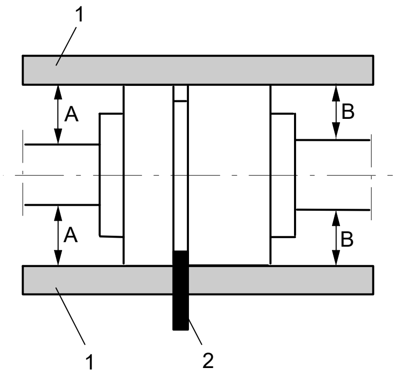


Fig. 12: Non-spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

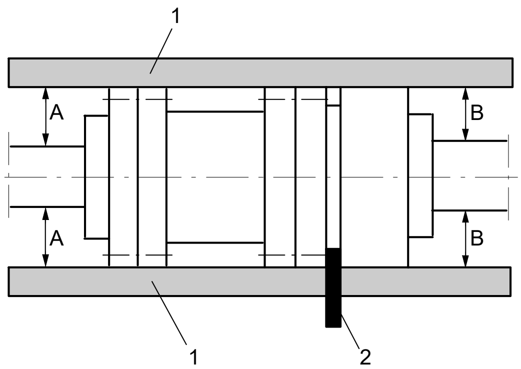


Fig. 13: Spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

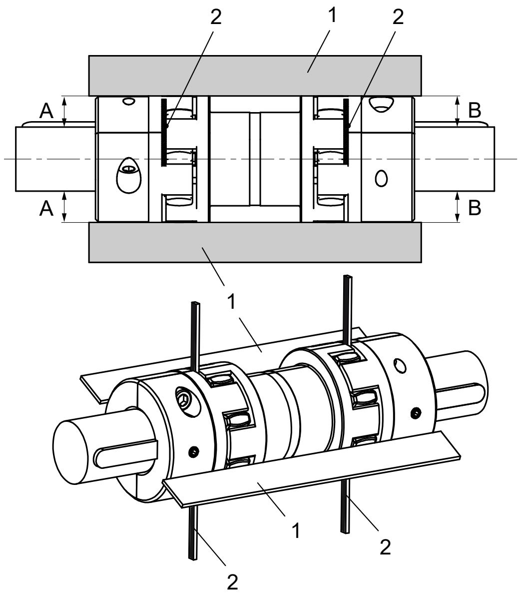


Fig. 14: Double Cardan spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

Table 13: Permissible alignment offset of coupling halves

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

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

1. Loosen the support foot and re-tighten it without transmitting any stresses and strains.
2. Place the straight edge axially on both coupling halves.
3. Leave the straight edge in this position and turn the coupling by hand.
   The coupling is aligned correctly if the distances A and B to the respective shafts are the same at all points around the circumference.
   Observe the permissible radial offset in coupling half alignment (⇨ Table 13) 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 13) 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.

5.7 Aligning the pump and motor

5.7.1 Motors with adjusting screw

Any differences in shaft centre height between the pump and motor are adjusted with adjusting screws.

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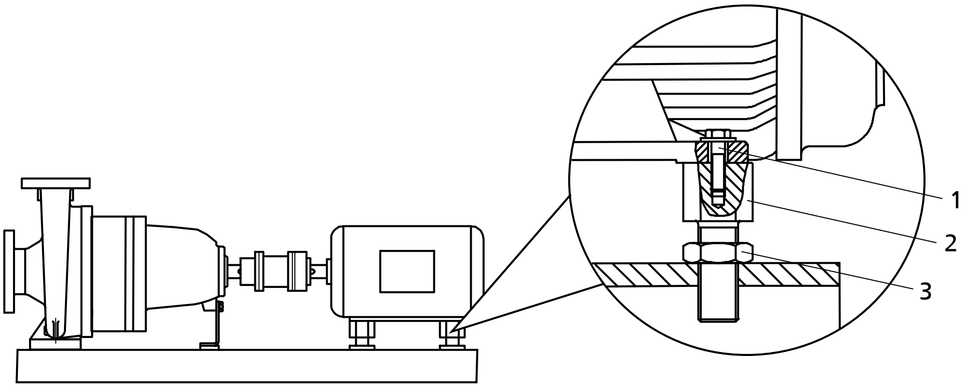

Fig. 15: Motor with adjusting screw

1	Hexagon head bolt	2	Adjusting screw
3	Lock nut		

✓ The coupling is misaligned (⇨ Section 5.6, Page 30) .

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

1. Unscrew the hexagon head bolts (1) at the motor and the locknuts (3) at the baseplate.
2. 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.
3. Re-tighten the hexagon head bolts (1) at the motor and the locknuts (3) at the baseplate.
4. 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.

5. Re-install the coupling guard and footboard, if any.
6. Check the distance between coupling and coupling guard.
   The coupling guard must not touch the coupling.

5.7.2 Motors without adjusting screw

Any differences in shaft centre height between the pump and the motor are compensated by means of shims.

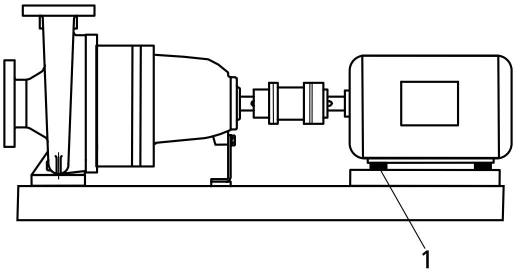

Fig. 16: Pump set with shim

1	Shim

✓ Misalignment of the coupling (⇨ Section 5.6, Page 30) .

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

1. Unscrew the hexagon head bolts at the motor.
2. Insert shims (1) underneath the motor feet until the difference in shaft centre height has been compensated.
3. Re-tighten the hexagon head bolts.
4. Check that the coupling and 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.

5. Reinstall the coupling guard and footboard, if any.
6. Check the distance between coupling and coupling guard.
The coupling guard must not touch the coupling.

5.8 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, EN 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.

5.8.1 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 14: Time relay settings for star-delta starting:

Motor rating	Y time to be set
≤ 30 kW	< 3 s
> 30 kW	< 5 s
> 75 kW	To be assessed at the site

5.8.2 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.

5.8.3 Earthing

⚠ DANGER

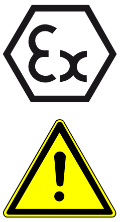
Electrostatic charging

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.

5.9 Checking the direction of rotation



⚠ DANGER

Temperature increase resulting from contact between rotating and stationary components

Explosion hazard!

Damage to the pump set!

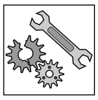
- ▷ Never check the direction of rotation by starting up the unfilled pump set.
- ▷ Separate the pump from the motor to check the direction of rotation.

⚠ 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.

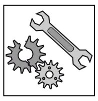


CAUTION

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 mechanically connected as specified.
- The pump set has been properly connected to the power supply and is equipped with all protection devices. (⇨ Section 5.8, Page 34)
- The pump has been primed with the fluid to be handled. The pump has been vented. (⇨ Section 6.1.4, Page 39)
- The direction of rotation has been checked. (⇨ Section 5.9, Page 36)
- All auxiliary connections required are connected and operational. (⇨ Section 5.4.3, Page 29)
- The lubricants have been checked.
- After prolonged shutdown of the pump (set), the activities required for returning the equipment to service have been carried out. (⇨ Section 6.4, Page 45)

6.1.2 Filling in the lubricant

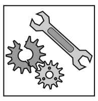
Oil-lubricated bearings

Fill the bearing bracket with lubricating oil.

- Oil quality (⇨ Section 7.2.3.1.2, Page 51)
- Oil quantity (⇨ Section 7.2.3.1.3, Page 52)

Filling the constant level oiler with lubricating oil (oil-lubricated bearings only)

✓ The constant level oiler is screwed into the upper tapping hole of the bearing bracket.



CAUTION

Insufficient quantity of lubricating oil in the reservoir of the constant level oiler

Damage to the bearings!

▷ Regularly check the oil level.

▷ Always fill the oil reservoir completely.

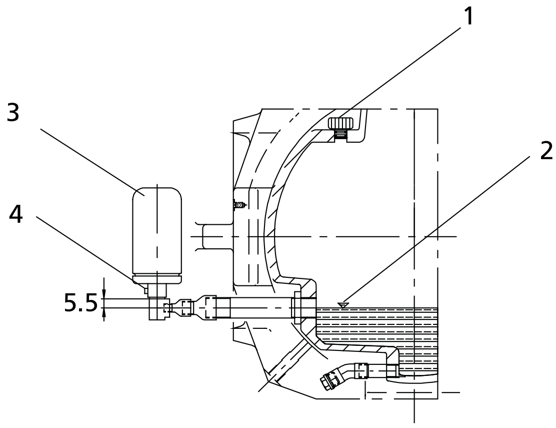


Fig. 17: Bearing bracket with constant level oiler

1	Vent plug	2	Oil level in bearing bracket and connection elbow
3	Constant level oiler	4	Setting screw for adjusting the oil level

1. Adjust the oil level to 5.5 mm by means of the setting screw (4).
2. Pull out the vent plug (1).
3. Squeeze the clips at the constant level oiler (3) together. Pull the reservoir of the constant level oiler up and out of the connection elbow.
4. Fill in oil through the hole for the vent plug until the oil level reaches the connection elbow of the constant level oiler.

NOTE

The oil level shall always be below the level of the vent opening arranged at the top edge of the connection elbow. The seat must be completely dry.

5. Fill the reservoir of the constant level oiler (3) to its maximum and insert it into the connection elbow.
6. Fit the vent plug (1).
7. After approximately 5 minutes, check the oil level in the glass reservoir of constant level oiler (3).
   The oil reservoir must be properly filled at all times to provide a constant oil level. Repeat steps 1 - 6, if necessary.

NOTE

An excessively high oil level can lead to a temperature rise and to leakage of the fluid handled or oil.

6.1.3 Shaft seal

CAUTION

Air in the mechanical seal area

Insufficient lubrication!

Mechanical seal failure!

▷ Never start up the pump with the clearance between impeller and casing only partially filled.

Shaft seals are fitted prior to delivery.
Observe the instructions on dismantling or assembly .

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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.

External liquid feed Apply the quantities and pressures specified in the data sheet and the general arrangement drawing.

Prime the pump and the seal chamber with the fluid handled. The conical seal chamber is self-venting. The mechanical seal is operational.

- To ensure trouble-free continuous operation, the pressure at the seal must be at least 0.2 bar above the atmospheric pressure in normal operation.
- For temperatures exceeding 20 °C a sufficient vapour pressure margin must be ensured.
- The seal must not be subjected to low pressure when the pump is running in reverse rotation.
- Avoid operation outside the specified pressure range as well as surge pressures from the piping system.
- The mechanical seal must be permanently surrounded by the fluid handled in order to build up a lubricating film in the sealing gap and to dissipate heat.

Supply line The operational reliability of the mechanical seal will be increased if any leakage of the fluid handled into the area between the shaft sleeve and the primary/mating ring is removed by periodic flushing. For this purpose, a periodic flushing facility can be permanently connected to a water tap by a 10 mm or 12 mm pipe.

6.1.4 Priming and venting the pump

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.

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.

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.
3. Fully open all auxiliary connections (barrier fluid, flushing liquid, etc).

6.1.5 Water cooling

CAUTION

Deposit-forming, aggressive cooling water

Damage to the pump!

▷ Observe the cooling water quality.

Observe the following quality data of the cooling water:

- Not deposit-forming
- Not aggressive
- Free from suspended solids
- Hardness on average 5 °dH (~1 mmol/l)
- pH > 8
- Conditioned and neutral with regard to mechanical corrosion
- Inlet temperature t_{inl}=10 to 30 °C
  Outlet temperature t_{outl}= 45 °C max.

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 5.6, Page 30)
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 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. (⇨ Section 6.1.4, Page 39)

▷ Always operate the pump within the permissible operating range.

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CAUTION

Abnormal noises, vibrations, temperatures or leakage

Damage to the pump!

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

- ✓ The system piping has been cleaned.
- ✓ Pump, suction line and inlet tank, if any, have been vented and primed with the fluid to be pumped.
- ✓ The lines for priming and venting have been closed.

1. Fully open the shut-off element in the suction head/suction lift line.
2. **Single-pump operation:** Slightly open the shut-off element in the discharge line (start-up also possible against open discharge line).
   Pumps operating in parallel: Close the shut-off element in the discharge line.

CAUTION

Start-up against open discharge line

Motor overload!

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

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 (operation against closed shut-off element: 60 seconds maximum).

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.

5. Check the coupling alignment and re-align the coupling, if required.

6.1.8 Checking the shaft seal

Mechanical seal

The mechanical seal only leaks slightly or invisibly (as vapour) during operation.

Residues will collect in the atmosphere-side seal area, depending on the contents of fluid to be sealed off. They must be removed by regular flushing with clean water. The free movement of the primary ring must not be impaired by solid deposits.

Double mechanical seal

⚠ DANGER

Excessive temperature of barrier fluid (pumps with double mechanical seal)

Explosion hazard!

Excessive surface temperature

- ▷ For pumps with double mechanical seal, make sure that the barrier fluid's temperature does not exceed 60 °C.

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6.1.9 Shutdown

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

✓ On pump sets with double mechanical seal, apply the required pressure specified in the general arrangement drawing to the mechanical seal chamber also during standstill.

✓ Quench liquid supply must also be ensured during pump standstill.

1. **Single-pump operation:** Close the shut-off element (if any) in the discharge line (shutdown also possible with open discharge line.)(Operation against closed shut-off element: 60 seconds maximum)
   Pumps operating in parallel: Close the shut-off element in the discharge line. (Operation against closed shut-off element: 60 seconds maximum)
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.

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.

CAUTION

Risk of freezing during pump shutdown

Damage to the pump!

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

For prolonged shutdown periods / shutdown > 24 hours for absorber recirculation pumps:

1. Close the shut-off element in the suction line.
2. Close any auxiliary lines.
   If the fluid to be handled is fed in under vacuum, also supply the shaft seal with barrier fluid during standstill.
   Only turn off the cooling liquid supply after the pump has cooled down.
3. Drain the pump. (⇨ Section 7.3, Page 52)
4. **For absorber recirculation pumps only:**
   Fill pumps with water up to 500 mm above the discharge nozzle flange.

Absorber recirculation pumps

If all of the following prerequisites are met, absorber recirculation pumps do not necessarily need to be filled with water:

- Discharge-side shut-off elements are provided at the site, which definitely prevent flue gas from entering the pumps during standstill.
- The fluid handled complies with the specified composition.
  - The fluid handled must not contain ferritic particles (e.g. particles abraded from the balls of ball mills, or other rust particles) as this could cause corrosion.
  - The actual maximum particle size must match the data in the data sheet. Impermissibly large particles will form deposits on the suction-side sealing clearance and lead to damage during start-up.
- The sediment is resuspendable and must not fill the pump any further than the lower edge of the suction nozzle to protect the mechanical seal.

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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 15: Permissible ambient temperatures

Permissible ambient temperature	Value
Maximum	50 °C 40 °C[15]
Minimum	See data sheet.

6.2.2 Frequency of starts

⚠ DANGER

Excessive surface temperature of the motor

Explosion hazard!

Damage to the motor!

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

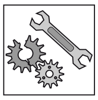
The frequency of starts is determined by the maximum temperature increase of the motor. The frequency of starts depends on the power reserves of the motor in steady-state operation and on the starting conditions (DOL starting, star-delta

15 For compliance with UK *Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016*. Higher ambient temperature possible in individual cases, see data sheet and name plate.

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 16: Frequency of starts

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



CAUTION

Re-starting while motor is still running down

Damage to the pump (set)!

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

6.2.3 Fluid handled

6.2.3.1 Flow rate

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

- Short-time operation: Q_{min}[16] $= 0.4 \times Q_{BEP}$[17]
- Continuous operation: Q_{min}[16] $= 0.5 \times Q_{BEP}$[17]
- 6-pole operation: Q_{max}[18] $= 1.1 \times Q_{BEP}$[17]
- 8-pole operation: Q_{max}[18] $= 1.25 \times Q_{BEP}$[17]

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.

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

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

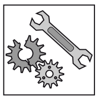
Table 17: Key

Symbol	Description	Unit
c	Specific heat capacity	J/kg K
g	Acceleration due to gravity	m/s²
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

16 Minimum flow rate
17 Best efficiency point
18 Maximum flow rate

6.2.3.2 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.

6.2.3.3 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.

Permissible operating range for highly abrasive fluids: Q= 0.8 ... 1.1 x Q_{BEP}

6.2.3.4 Oxidation air in the fluid handled

The pump can handle an air content of 5 % in the limestone suspension without any negative impacts on the shaft seal and the pump operation.

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. (⇨ Section 7.3, Page 52)

✓ The safety instructions for dismantling the pump have been observed. (⇨ Section 7.4.1, Page 53)

✓ 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 15)

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 37) (⇨ Section 6.2, Page 43)

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇨ Section 7, Page 47)

	⚠ **WARNING**
	Failure to re-install or re-activate protective devices Risk of injury from moving parts or escaping fluid! ▷ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices.

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

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7 Servicing/Maintenance

7.1 Safety regulations

DANGER

Improper cleaning of coated pump surfaces

Explosion hazard by electrostatic discharge!

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

DANGER

Sparks produced during servicing work

Explosion hazard!

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

DANGER

Improperly serviced pump set

Explosion hazard!

Damage to the pump set!

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

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

WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

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

WARNING

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

Risk of injury!

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

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	⚠ **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**
	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**
	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
	Incorrectly serviced barrier fluid system Explosion hazard! Fire hazard! Damage to the pump set! Hot and/or toxic fluids escaping! ▷ Regularly service the barrier fluid system. ▷ Monitor the barrier fluid pressure.

	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 43)

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

- The pump must run quietly and free from vibrations at all times.
- In case of oil lubrication, ensure the oil level is correct.
- 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.
- Cooling system
  Take the pump out of service at least once a year to thoroughly clean the cooling system.
- Monitor the stand-by pump.
  To make sure that the 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).

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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 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.

7.2.2.3 Checking the bearing seals

⚠ DANGER

Excessive temperatures caused by mechanical contact

Risk of explosion!

Damage to the pump set!

▷ Check correct seating of axial seal rings mounted on the shaft.
Only gentle contact of the sealing lip shall be established.

7.2.2.4 Periodic flushing of the mechanical seal (recommended)

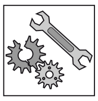
Residues will collect in the atmosphere-side seal area, depending on the contents of fluid to be sealed off. These residues must be removed by regular flushing with clean water. This will prevent the free movement of the primary ring from being impaired by solid deposits.

Prior to every flushing procedure, the gap between the rotating shaft sleeve and the thrust ring must be visually inspected. Any leakage or leakage residues / crystals must be reported to the responsible KSB service centre immediately.

- Recommended interval during continuous operation: every 2 weeks, 10 minutes at 10 l/minute
- Flushing liquid: clean process water, maximal contamination of 50 µm
- Flushing pressure 2 – 4 bar

Flushing shall be performed before and after any pump shutdown of more than 2 days.

7.2.2.5 Checking the diagonal clearance



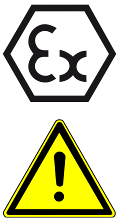
CAUTION

Non-compliance with the clearances between impeller and suction liner/plate

Damage to components/linings!

- ▷ Check diagonal clearance once every 6 months of operation.
- ▷ Observe the specified clearances. (⇨ Table 22) .

7.2.3 Lubrication and lubricant change of rolling element bearings



DANGER

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

Explosion hazard!

Fire hazard!

Damage to the pump set!

- ▷ Regularly check the condition of the lubricant.

7.2.3.1 Oil lubrication

The rolling element bearings are lubricated with mineral oil.

7.2.3.1.1 Intervals

Table 18: Oil change intervals

Oil change	Interval[19]
Change of initial oil fill	Every 8000 operating hours[20]
Further oil changes	Every 8000 operating hours[20]

If the oil is contaminated, change the oil more frequently, as required.

7.2.3.1.2 Oil quality

Table 19: Lubricant characteristics

Description	Properties	
Lubricating oil CL68 or CLP68 to DIN 51517	Kinematic viscosity at 40 °C	68±6 mm^2/s
	Flash point (to Cleveland)	+175 °C
	Solidification point (pour point)	-9 °C
	Application temperature[21]	0-175 °C

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19 At temperatures up to 90 °C at the bearing

20 At least once a year

21 For ambient temperatures below 0 °C use a different suitable type of lubricating oil. Contact the manufacturer.

7.2.3.1.3 Oil quantity

Table 20: Oil quantity

Bearing bracket	Oil quantity [l]
P16ax	14
P20sx	24

7.2.3.1.4 Changing the oil

⚠ WARNING

Lubricants posing a health hazard and/or hot lubricants

Hazard to persons and the environment!

- ▷ When draining the lubricant take appropriate measures to protect persons and the environment.
- ▷ Wear safety clothing and a protective mask if required.
- ▷ Collect and dispose of any lubricants.
- ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.

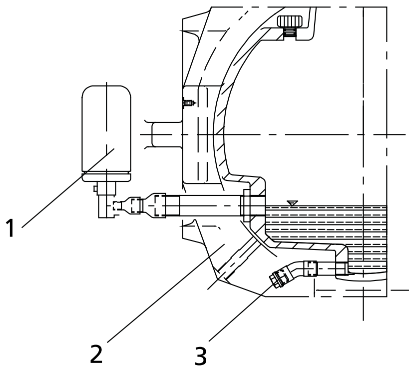

Fig. 18: Bearing bracket with constant level oiler

1	Constant level oiler	2	Bearing bracket
3	Screw plug		

✓ A suitable container for the used oil is on hand.

1. Place the container underneath the screw plug (3).
2. Undo the screw plug (3) at the bearing bracket and drain the oil.
3. Once the bearing bracket (2) has been drained, re-insert and re-tighten the screw plug (3).
4. Re-fill with oil. (⇨ Section 6.1.2, Page 37)

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 to drain the fluid handled (see drawing of auxiliary connections).

For wear reasons, pump casings made of abrasion-resistant materials cannot be provided with a drain hole.

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

⚠ 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.

Observe the general safety instructions and information. (⇨ Section 7.1, Page 47)

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. (⇨ Section 9.1, Page 71)

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.

⚠ 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. (⇨ Section 7.3, Page 52)

▷ Shut off any auxiliary feed lines.

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

CAUTION

Improper removal/fitting of fragile, shock-sensitive CeramikPolySiC® components or linings

Damage to the components/linings!

- ▷ Never use a hammer on components made of CeramikPolySiC®, apply blows or press them down with force.
- ▷ Always use suitable lifting tackle (e.g. straps, loops) for transporting components made of CeramikPolySiC®.
- ▷ Never use chains to transport components made of CeramikPolySiC®.

NOTE

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

7.4.2 Preparing the pump set

1. De-energise the pump set and secure it against unintentional start-up.
2. Disconnect and remove all auxiliary pipework.
3. Remove the pump-end coupling guard.
4. Remove the coupling spacer, if any.
5. Drain the oil fill of oil-lubricated bearings. (⇨ Section 7.2.3.1.4, Page 52)
6. Remove guard 680.11 at the lantern.
7. Axially fasten the mechanical seal with locking device 96-3.
8. Undo clamping ring 515.
9. Remove the constant level oiler including the piping.

7.4.3 Removing the motor

NOTE

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

⚠ WARNING

Motor tipping over

Risk of crushing hands and feet!

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

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

7.4.4 Removing the back pull-out unit

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 53) to (⇨ Section 7.4.3, Page 54) have been observed/carried out.

✓ On pump sets with a non-spacer-type coupling, the motor has been removed.

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⚠ WARNING

Back pull-out unit tilting

Risk of squashing hands and feet!

▷ Suspend or support the back pull-out unit at the pump end.

1. Fasten the lifting tackle to eyebolts 900.41 or 59-47.41 (on sizes 800-900-883, 900-900-1133, 900-900-1134, 900-900-1138, 900-900-1139) of the back pull-out unit.
2. Undo bolted connection 901.64/920.64 at support foot 183. Support foot 183 remains bolted to the baseplate.
3. Undo by approximately 10 mm screws 901.36/901.37 fastening the bearing carrier.
4. Undo hexagon nuts 920.01 at the volute casing.

NOTE

Use forcing screws 901.31 to facilitate disassembly.

Clean the threads of the forcing screws before using them.

5. Use forcing screws 901.31 to press the back pull-out unit out of volute casing 101.

CAUTION

Incorrect dismantling

Damage to the CeramikPolySiC® lining!

▷ Prevent the discharge cover from jamming when pulling the pump rotor out of the casing.

6. Place the back pull-out unit on a clean and level surface. The bearing bracket flange and the integrally cast support foot are of the same constructional height.
7. Remove and dispose of joint ring 411.10, if any

7.4.5 Removing the impeller

NOTE

Impeller 230 can also be removed without removing the back pull-out unit. After removing suction cover 162, the impeller can be pulled out towards the inlet side.

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 53) to (⇨ Section 7.4.4, Page 54) have been observed/carried out.

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

1. Loosen hexagon head bolt 901.87 and remove sealing elements 400.65.
2. Remove impeller hub cap 260.01 with the corresponding tool[22] (see supplementary operating instructions).
3. Remove and dispose of O-ring 412.03.
4. Undo hexagon socket head cap screws 914.12.
5. Remove disc 550.87.
6. Remove impeller 230 with the impeller fitting and removal tool[22] (see supplementary operating instructions).
7. Place impeller 230 on a clean and level surface.

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22 Special tool (available as accessory)

8. Remove keys 940.1 from shaft 210.
9. Remove shaft protecting sleeve 524.01 (if any) from the shaft.

7.4.6 Removing the mechanical seal

	NOTE
	Prior to dismantling discharge cover 163, the mechanical seal is removed towards the impeller end. The back pull-out unit may remain installed.

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 53) to (⇨ Section 7.4.5, Page 55) have been observed/carried out.

1. Rotate locking device 96-3 to insert it into the shaft groove.
2. Undo screwed connection 914.53 to undo clamping ring 515.
3. Undo hexagon socket head cap screw 914.03.
4. Use forcing screws 901.21 (not available for V11) to remove the cartridge seal from the discharge cover.

7.4.7 Removing the discharge cover

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 53) to (⇨ Section 7.4.6, Page 56) have been observed/carried out.

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

1. Screw eyebolts into the drilled M16 holes on the outside diameter of the discharge cover. Use the eyebolts to attach the discharge cover to the lifting equipment.
2. Remove hexagon nut 920.15 and hexagon head bolt 901.22.
3. Use forcing screws 901.30 to remove discharge cover 163.
4. Set the discharge cover down on a clean and level assembly surface.

7.4.8 Dismantling the bearings

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 53) to (⇨ Section 7.4.7, Page 56) have been observed/carried out.

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

1. Pull the pump-end coupling half off with a puller.
2. Remove key 940.02.
3. Remove throwers 507.01 and 507.02.
4. Move complete bearing carrier 382 in bearing bracket 330 axially towards the pump end until hexagon nut 920.23 (on the outside) is aligned with bolt 563.23.
5. Fasten the bearing carrier with nut 920.23 (on the inside).
6. Screw the M24 eyebolt into the pump-side shaft end.
7. Slightly lift the back pull-out unit with the drive-side shaft end pointing downwards.
8. Set the bearing down in a vertical position with the drive-side shaft end down. Suitably secure the bearing bracket against tilting and slipping.
9. Remove hexagon nut 920.23 (on the outside).
10. Undo bolts 901.94.
11. Remove bearing cover 360.01 with forcing screws 901.89.
    (Use the 2 M16 eyebolts for attaching lifting tackle)
12. Pull complete bearing carrier 382 vertically upwards and out of bearing bracket 330.
13. Set bearing carrier 382 down in a horizontal position.

14. Undo hexagon socket head cap screw 914.36/.37 (fastening the bearing carrier). Remove discs 550.36/37.
15. Set bearing bracket 330 down in a horizontal position.
16. Screw the M24 eyebolt into the drive-side shaft end. Secure bearing carrier 382 in a vertical position on a workbench or similar.
17. Undo bolts 901.95.
18. Remove bearing cover 360.02 with forcing screws 901.91.
19. Pull out shaft 210 with the rolling element bearing. Place it on a clean and level assembly surface.
20. **For bearing bracket P16ax:** Remove the outer rings of cylindrical roller bearings 322.01 and 322.02.
    For bearing bracket P20sx: Remove the outer rings of cylindrical roller bearing 322.01 and spherical thrust roller bearing 324.03. Remove springs 950.01.
21. Remove circlip 932.01.
22. Remove bushes 540.22/23.
23. Remove hexagon nuts 920.21 and lock washer 931.01.
24. **For bearing bracket P16ax:** Remove rolling element bearing 320.03 and the inner ring of cylindrical roller bearing 322.02 with a puller.
    For bearing bracket P20sx: Remove rolling element bearing 322.02 and spherical thrust roller bearing 324.03 with disc 550.26.
25. Pull the inner ring of cylindrical roller bearing 322.01 off the shaft with a puller.

7.4.9 Removing the suction cover

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 53) to (⇨ Section 7.4.8, Page 56) have been observed/carried out.

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

1. Attach lifting tackle to eyebolt 900.06 of complete suction cover 162.
2. Undo hexagon nuts 920.27.
3. Use forcing screws 901.44 to remove complete suction cover 162 (on individual pump sizes suction cover 162 with wear plate 135.01).
4. **Only for sizes with wear plate 135.01 made of CeramicPolySiC®:** Prior to removing the suction cover / wear plate assembly completely from pump casing 101, evenly tighten grub screws 904.97 (6x).
5. **For metal wear plate 135.01:** Undo hexagon head bolts 901.03/411.13. and remove the wear plate.
6. Place the suction cover with the suction flange down on a clean and level assembly surface.

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.

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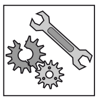
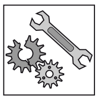


CAUTION

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.



CAUTION

Improper removal/fitting of fragile, shock-sensitive CeramikPolySiC® components or linings

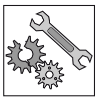
Damage to the components/linings!

- ▷ Never use a hammer on components made of CeramikPolySiC®, apply blows or press them down with force.
- ▷ Always use suitable lifting tackle (e.g. straps, loops) for transporting components made of CeramikPolySiC®.
- ▷ Never use chains to transport components made of CeramikPolySiC®.

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 aids**
  - 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 adhesives 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.

Tightening torques For reassembly, tighten all screws and bolts as specified in this manual. (⇨ Section 7.6, Page 66)

7.5.2 Preparing the pump casing

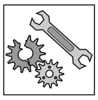
As an assembly aid, position four extended studs each on the two casing sides with the studs opposing each other.

1. Screw studs 902.01/27 into pump casing 101.

7.5.3 Preparing and fitting the suction cover

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 57) to (⇨ Section 7.5.2, Page 58) have been observed/carried out.

1. Provide the single-piece suction cover with eyebolt 900.06 and forcing screws 901.44.
2. Insert O-ring 412.25/.75 into suction cover 162.
3. **Version with additional suction-side wear plate 135.01 made of ceramic material:** Insert wear plate 135.01 into suction cover 162. Evenly tighten grub screws 904.97.
   Version with additional suction-side wear plate 135.01 made of metal: Insert wear plate 135.01 with O-ring 412.05 and gasket 411.12 into the suction cover. Tighten hexagon head bolts 901.03 / 411.04.
4. Screw in eyebolt 900.06 and fit forcing screws 901.44.



CAUTION

Incorrect assembly

Damage to the ceramic wear plate!

▹ Once wear plate 135.01 has been inserted into pump casing 101, undo grub screws 904.97 by one turn.

5. Insert suction cover 162 or the complete suction cover assembly into pump casing 101. Tighten hexagon nut 920.27.

7.5.4 Fitting the shaft

Version with bearing bracket P16ax

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 57) to (⇨ Section 7.5.3, Page 59) have been observed/carried out.

1. Heat up the inner ring of rolling element bearing 322.01 to approximately 100 °C.
2. Lock inner ring 322.02 with the assembling sleeve[23] and slotted round nut 920.21.
3. Fasten four-point bearing 320.03 with slotted round nut 920.21 without lock washer.
4. Undo slotted round nut 920.21. Fit it again together with lock washer 931.01.

Version with bearing bracket P20sx

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 57) to (⇨ Section 7.5.3, Page 59) have been observed/carried out.

1. Heat up the inner ring of rolling element bearing 322.01 to approximately 100 °C.
2. Heat up complete spherical thrust roller bearing 324.03 except its outer ring to 80 °C. Lock it with disc 550.26, assembling sleeve[23] and slotted round nut 920.21.
3. Heat up rolling element bearing 322.02 to 80 °C. Fasten it with slotted round nut 920.21 without lock washer.
4. Undo slotted round nut 920.21. Fit it again together with lock washer 931.01.

[23] Special tool

7.5.5 Fitting the bearing carrier

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 57) to (⇨ Section 7.5.4, Page 59) have been observed/carried out.

1. Insert circlip 932.01.
2. Fit the outer ring of angular contact ball bearing 322.01.
3. **Only for versions with bearing bracket P16ax:** Slide on the outer ring of rolling element bearing 322.02.
4. Place bearing carrier 382 in a vertical position with the motor end on top.
5. **Only for versions with bearing bracket P20sx:** Insert springs 950.01 and the outer ring of spherical thrust roller bearing 324.03.
6. Insert pre-assembled shaft 210 into bearing carrier 382.

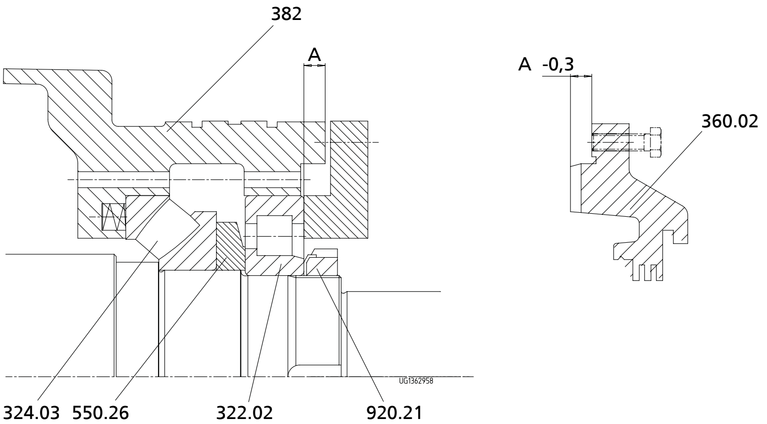


Fig. 19: Adjusting the bearing carrier for P20sx

7. **Only for versions with bearing carrier P20sx:** Measure dimension A. Reduce the length of the shoulder of bearing cover 360.02 with the bearing fit to A - 0.3 mm.
8. Insert bush 540.23 with V-ring 411.78 and O-ring 412.43.
9. Insert and fit O-ring 412.22 into bearing cover 360.02. Verify that the oil return bores/grooves are facing downwards.
10. Tighten hexagon head bolts 901.91.
11. Secure thrower 507.02 and grub screws 904.44 with Loctite 242. Use an assembly tool[24] (see supplementary operating instructions), if required.
12. Fit keys 940.02 and secure them with adhesive tape.
13. Fit discs 550.36/37 (2 each). Verify that the disc grooves are horizontally aligned. Drill a hole 1xM4x10 into bearing carrier 382 for fastening purposes.
14. Insert O-rings 412.81/82. Fill the turned grooves between the O-rings with grease (2k DIN 51825).
15. Apply Loctite 270 to bolt 563.23. Screw the bolt into bearing carrier 382.
16. Fit pump-end hexagon nut 920.23.

7.5.6 Installing the bearing carrier in the bearing bracket

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 57) to (⇨ Section 7.5.5, Page 60) have been observed/carried out.

1. Screw eyebolt 900.41 into the pump-side shaft end of pre-assembled bearing carrier 382. Suspend bearing carrier 382 from the lifting equipment.
2. Insert pre-assembled bearing carrier 382 into the vertically positioned bearing bracket 330 (with the motor end down). Observe the position of bolts 563.23 (asymmetrical).
   Provide a suitable opening in the workbench to insert the shaft and support the shaft shoulder.

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[24] Special tool (available as accessory)

Verify that the integrally cast arrow in bearing cover 360.02 is located at the top. The integrally cast support foot of bearing bracket 330 is located at the bottom.

3. Slide bush 540.22 with O-ring 412.42 and V-ring 411.77 onto the shaft.
4. Fit bearing cover 360.01 with O-ring 412.24. Verify that the oil return bores are positioned at the bottom.
5. Tighten hexagon head bolts 901.89.
6. Fit thrower 507.01; use the corresponding special tool[25)] (see supplementary operating instructions), if required.
7. Secure grub screws 904.31 with Loctite 242.
8. Place the bearing in a horizontal position.

7.5.7 Fitting the discharge cover

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 57) to (⇨ Section 7.5.6, Page 60) have been observed/carried out.

1. Fit studs 902.15. Insert 4 extended studs into the 4 sides as an assembly aid.
2. Insert O-rings 412.01, 412.12 (only for discharge cover in JS1025/ CermaikPolySiC®).
3. Install the completely assembled mechanical seal. Verify that clamping ring 515 at the shaft sleeve / shaft has been completely undone. Verify that this area of the shaft and shaft sleeve is completely grease-free.
4. Fasten discharge cover 163 to bearing bracket 330 with hexagon nuts 920.15. Recommendation: Set bearing bracket 330 down in a vertical position. Attach lifting tackle to the two eyebolts of the discharge cover. Lift the discharge cover in a horizontal position together with the assembled mechanical seal and mount it on the bearing bracket via the shaft stump.

7.5.8 Installing the mechanical seal

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

- For installing the mechanical seal, proceed as shown in the seal installation drawing.
- Work cleanly and accurately.
- Only remove the protective wrapping of the contact faces immediately before installation takes place.
- Prevent any damage to the sealing surfaces or O-rings.
- After inserting the stationary ring of the mechanical seal, check that it is plane-parallel in relation to the casing part.
- The surface of the shaft protecting sleeve must be absolutely clean and smooth, and the sleeve's mounting edge must be chamfered.
- When sliding the rotating assembly onto the shaft protecting sleeve, take appropriate steps to protect the surface of the shaft protecting sleeve from damage.
- Check the complete mechanical seal for any damage. If necessary, replace the mechanical seal.
- Damage to the O-rings must be prevented by breaking all sharp edges and removing any burrs in the installation area of the mechanical seal.
- Verify the mating dimensions.
- Never use force during installation.

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[25] Special tool (available as accessory)

Installation tolerances

- Shaft run-out: 0.05 mm
- Axial bearing clearance: 0.2 mm
- Surface quality in the area of the static O-ring seal: 1.6 µm as a minimum
- Vibration velocity: v ≤ 4.5 mm/s

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 57) to (⇨ Section 7.5.7, Page 61) have been observed and carried out.

✓ The contact surfaces have been cleaned and checked for any damage.

✓ Perpendicularity and run-out in relation to shaft axis have been checked.

CAUTION

Overheating of and damage to the mechanical seal

▷ Never coat seal faces with grease or oil.

▷ Never allow rings made of ethylene propylene rubber to come into contact with mineral oil or mineral grease.

▷ O-rings made silicone rubber are not resistant to silicone oil or silicone grease.

✓ A thin coat of grease has been applied to O-rings for static sealing.

✓ Clamping ring 515 of the mechanical seal has been undone. Assembly fixtures 96-3 have been engaged in shaft sleeve 523.

1. **For versions with a discharge cover with CeramikPolySiC lining**: Coat the outside of seal cover 471 with an elastic sealant on MS polymer basis (e.g. Henkel Teroson – MS polymer 931, white).
   For versions with a metallic or completely ceramic discharge cover: Insert O-ring 412.12 into discharge cover 163.
2. Check O-ring 412.56 on seal cover 471.
3. Align the cartridge seal with the pump cover, making sure that the flange bolt holes and connection holes are properly aligned.
4. Check O-rings 412.54/.55.

CAUTION

Incorrect assembly

Damage to the mechanical seal!

▷ The shaft must be absolutely grease-free in the area of clamping ring 515.

5. Gently guide the cartridge seal along the shaft.
6. Press the cartridge seal into discharge cover 163.
7. Tighten screw 914.03.
8. **Only for versions with a discharge cover made of CeramikPolySiC®:** Fit disc 550.01.
9. Evenly tighten the clamping ring with hexagon socket head cap screw 914.53 (for the tightening torque see stamp on clamping ring 515, sectional drawing or documentation).
10. Rotate assembly fixtures 96-3 to disengage them, and fasten them in this position.
11. Rotate the shaft by hand to check that it turns smoothly.

7.5.8.1 Connecting the supply lines of the mechanical seal (optional)

The operational reliability of the mechanical seal will be increased if any leakage of the fluid handled into the area between the shaft sleeve and the primary/mating ring is removed by periodic flushing. For this purpose, a periodic flushing facility can be permanently connected to a water tap by a 10 mm or 12 mm pipe.

7.5.9 Fitting the impeller

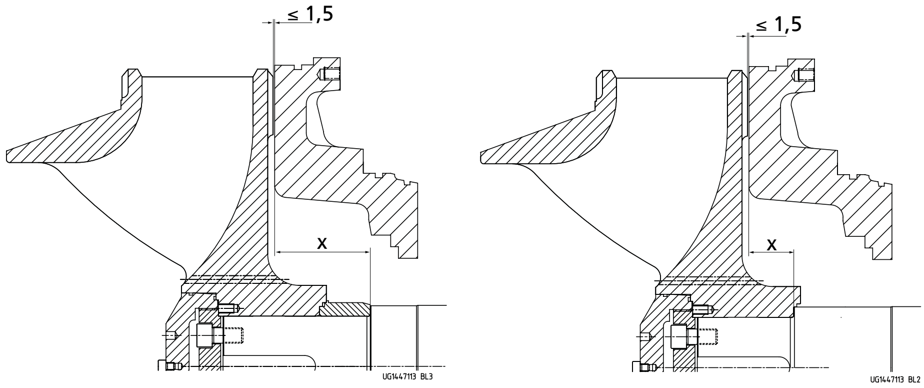

Fig. 20: Adjusting the axial clearance

Table 21: Shaft position

Bearing bracket	Dimension x [mm]	
	Version 10	Version 11
P16ax	152,5	-
P20sx	211,5	111,5

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 57) to (⇨ Section 7.5.8, Page 61) have been observed/carried out.

1. Adjust the shaft position to match axial dimension x (see table Shaft position).
2. Fit shaft protecting sleeve 524.01 and O-ring 412.06.
3. Insert keys 940.01 into the shaft.
4. Fit impeller 230 with the impeller fitting and removal tool[26)] (see supplementary operating instructions).
5. Insert disc 550.87 and fasten hexagon socket head cap screws 914.12.
6. Screw on impeller hub cap 260 with O-rings 412.03/.46 using the corresponding tool[26)] (see supplementary operating instructions).
7. Press in the two elastomer plugs. Screw hexagon head bolt 901.87 into the impeller hub cap.
8. Verify the shaft position. Distance between impeller 230 and discharge cover 163: ≤ 1.5 mm

7.5.10 Installing the back pull-out unit

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 57) to (⇨ Section 7.5.9, Page 63) have been observed/carried out.

1. Support foot 183 has been fitted on the baseplate. (Otherwise fasten it to the bearing bracket.)
2. Insert O-rings 412.35/50 into discharge cover 163.

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26 Special tool (available as accessory)

> **CAUTION**
>
> **Improper removal/fitting of fragile, shock-sensitive CeramikPolySiC® components or linings**
>
> Damage to the components/linings!
>
> ▷ Never use a hammer on components made of CeramikPolySiC®, apply blows or press them down with force.
>
> ▷ Always use suitable lifting tackle (e.g. straps, loops) for transporting components made of CeramikPolySiC®.
>
> ▷ Never use chains to transport components made of CeramikPolySiC®.

3. Carefully guide the pre-assembled pump rotor into pump casing 101. Rest the pump rotor on support foot 183. Impeller 230 must not touch suction cover 162.
4. Tighten hexagon nut 920.01.

7.5.11 Adjusting the diagonal clearance

> **CAUTION**
>
> **Non-compliance with the clearances between impeller and suction liner/plate**
>
> Damage to components/linings!
>
> ▷ Check diagonal clearance once every 6 months of operation.
>
> ▷ Observe the specified clearances. (⇨ Table 22) .

The clearance between impeller 230 and wear plate 135.01 or suction cover 162 has to be adjusted to the defined values. (⇨ Table 22)

As some shaft deflection occurs during standstill, measure the clearances on the two opposite sides. The sum of these two clearances must equal twice the required clearance width.

Table 22: Axial movement, rotor adjustment

Size	Version	Bearing bracket	Clearance width s [mm]	Clearance angle [°]	Axial movement
500-400-710	10	P16ax	0,5	30	1,0
500-400-713					
500-500-633			0,7	30	1,4
500-500-637					
600-600-824				20	2,0
600-600-825					
600-600-829					
700-700-923	10 / 11	P20sx	0,7	25	1,7
800-700-953				20	2,0
800-700-959					
900-900-1133					
900-900-1134					
900-900-1137					
900-900-1138					
900-900-1139					
800-800-934				14,5	2,8
800-800-935					
800-800-939					
800-900-883					

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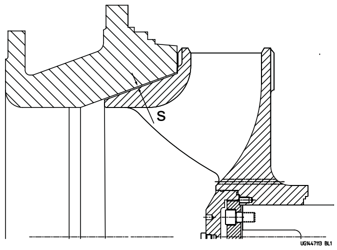

Fig. 21: Adjusting the diagonal clearance

- ✓ The notes and steps stated in (⇨ Section 7.5.1, Page 57) to (⇨ Section 7.5.11, Page 64) have been observed and carried out.
- ✓ Clamping ring 515 of the mechanical seal has been undone. Assembly fixtures 96-3 have been positioned in shaft sleeve 523.

1. Slide the back pull-out unit towards the suction side as far as it will go.
2. Slide the back pull-out unit back to establish the defined clearance. (⇨ Table 22)
3. Tighten hexagon nuts 920.23.
4. Fasten the pump-end bearing carrier and motor-end bearing carrier with one hexagon head bolt 901.36 / 901.37 and one nut 920.37 / 920.36 each.
5. Fasten the pre-assembled mechanical seal to shaft 230 with clamping ring 515. (⇨ Section 7.5.8, Page 61)
6. Disengage assembly fixtures 96-3 to undo the axial lock.
7. Fit forcing screws 901.30 /.31 at bearing bracket 330.
8. Fit forcing screws 901.94 at bearing cover 360.01.
9. Fit forcing screws 901.95 at bearing cover 360.02.
10. Fasten measuring nipple SPM 720 (if any) at bearing bracket 330.
11. Fit vent plug 672.

7.5.12 Fitting the piping

Oil drain piping

- ✓ The notes and steps stated in (⇨ Section 7.5.1, Page 57) to (⇨ Section 7.5.11, Page 64) have been observed/carried out.

1. Seal pipe bend 731.31, hexagon nipple 720.42 and plug 903.46 with Teflon tape.

Piping of the constant level oiler

- ✓ The notes and steps stated in (⇨ Section 7.5.1, Page 57) to (⇨ Section 7.5.11, Page 64) have been observed/carried out.

1. Fasten hexagon nipple 720.11 with sockets 731.11/12 and counter nut 920.11. Verify that the installation position is horizontal.
2. Install and adjust constant level oiler 638.
3. Check the oil level.

Table 23: Oil level measured from the pump shaft centreline

Bearing bracket	Level measured from pump shaft centreline [mm]
P16ax	111
P20sx	135

Leakage drain piping

- ✓ The notes and steps stated in (⇨ Section 7.5.1, Page 57) to (⇨ Section 7.5.11, Page 64) have been observed/carried out.

1. Fit pipe 710.22 / 710.62 / hexagon nipple 720.62.

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7.5.13 Mounting the guard

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 57) to (⇨ Section 7.5.12, Page 65) have been observed/carried out.

1. Mount guard 680.11 (perforated plate) at bearing bracket 330. To do so, drill threaded holes 12xM6x10. Fit the section for the oil leakage drain during assembly.

7.5.14 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.
4. Connect the motor to the power supply (refer to manufacturer's product literature).

7.6 Tightening torques

CAUTION

Use of an impact screw driver on Norihard casings (NH 153)

Damage to screws/bolts and threads!

▹ Never use an impact screw driver.

▹ Make sure that the studs can be screwed in easily for the entire length of the thread.

Table 24: Tightening torques for bolted/screwed connections[27)][28)]

Material	**C35E+QT/C35+N**	**A4-70/A4-70**	**8.8 A2A/08**
Stamp mark	**YK/Y**	**A4-70/A4-70**	**8.8 / 8**
Thread	**Tightening torques [Nm]**		
M8	-	16	23
M10	-	30	46
M12	40	55	80
M16	100	140	190
M20	190	200	380
M24	330	455	660

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27 For unlubricated bolts/screws at room temperature

28 After repeated tightening of the threads and in case of good lubrication reduce the values by 15 to 20 %.

7.7 Spare parts stock

7.7.1 Ordering spare parts

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

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

Refer to the name plate for all data. (⇨ Section 4.4, Page 19)

Also specify the following data:

- Part number and description (⇨ Section 9.1, Page 71)
- 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 25: Quantity of spare parts for recommended spare parts stock

Part No.	Description	Number of pumps (including stand-by pumps)							
		1	2	3	4	5	6 and 7	8 and 9	10 and more
135.01	Wear plate[29]	1	2	2	2	3	3	4	50%
210	Shaft	1	1	1	1	2	2	2	20%
230	Impeller	1	1	1	1	2	2	2	20%
320.02 or 324.03	Fixed bearing	1	1	1	2	2	2	3	25%
322.01	Cylindrical roller bearing	1	1	1	2	2	2	3	25%
322.02	Cylindrical roller bearing	1	1	1	2	2	2	3	25%
330	Bearing bracket, complete	-	-	-	-	-	-	1	2
-	Sealing elements for pump casing (set)	2	4	6	8	8	9	12	150%
For variants with mechanical seal									
433.01	Mechanical seal, complete [30]	1	1	1	2	2	2	3	25%
	Primary ring[30]	1	2	3	4	5	6	7	90%
	Mating ring[30]	1	2	3	4	5	6	7	90%
	Secondary seal at mating ring[30]	1	2	3	4	5	7	9	100%
	Secondary seal at primary ring[30]	1	2	3	4	5	7	9	100%
	Spring (set)[30]	1	1	1	1	1	2	2	20%

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29 If any
30 Optional

7.7.3 Interchangeability of pump components

Components featuring the same number in a column are interchangeable.

Table 26: Interchangeability of pump components

Size	Version	Description													
		Pump casing	Suction cover (with wear plate)	Discharge cover	Shaft	Impeller	Impeller hub cap	Bearing cover (pump end)	Bearing cover (drive end)	Rolling element bearing (P16ax)	Rolling element bearing (P20sx)	Bearing bracket	Bearing carrier	Shaft protecting sleeve	Disc (fastening the impeller)
		Part number													
		101	162	163	210	230	260	360.01	360.02	320/322	322/324	330	382	524	550.87
Bearing bracket P16ax															
500-400-710	10	1	1	1	3	9	2	3	1	2	-	1	2	3	2
500-400-713	10	1	2	1	3	10	2	3	1	2	-	1	2	3	2
500-500-633	10	2	3	2	4	11	3	3	1	2	-	2	2	4	2
500-500-637	10	2	4	2	4	12	3	3	1	2	-	2	2	4	2
600-600-824	10	3	5	3	5	13	4	3	1	2	-	3	2	5	2
600-600-825	10	3	6	3	5	14	4	3	1	2	-	3	2	5	2
600-600-829	10	3	5	3	5	26	4	3	1	2	-	3	2	5	2
Bearing bracket P20sx															
700-700-923	10	4	7	4	6	15	5	4	2	-	3	4	3	6	3
700-700-923	11	4	7	5	7	15	5	4	2	-	3	5	3	-	3
800-700-953	10	5	8	6	6	16	6	4	2	-	3	6	3	6	3
800-700-953	11	5	8	7	7	16	6	4	2	-	3	7	3	-	3
800-700-959	10	5	8	6	6	17	6	4	2	-	3	6	3	6	3
800-700-959	11	5	8	7	7	26	7	4	2	-	3	7	3	-	3
800-900-883	10	6	9	8	8	18	8	4	2	-	3	8	3	6	3
800-900-883	11	6	10	9	9	18	8	4	2	-	3	9	3	-	3
800-800-934	10	7	9	8	6	19	10	4	2	-	3	8	3	6	3
800-800-934	11	7	10	9	7	19	10	4	2	-	3	9	3	-	3
800-800-935	11	7	10	9	7	20	10	4	2	-	3	9	3	-	3
800-800-939	10	7	9	8	6	21	10	4	2	-	3	8	3	6	3
800-800-939	11	7	10	9	7	27	11	4	2	-	3	9	3	6	3
900-900-1133	10	8	11	10	8	22	9	4	2	-	3	10	3	6	3
900-900-1133	11	8	12	11	9	22	9	4	2	-	3	11	3	-	3
900-900-1134	11	8	14	11	9	23	9	4	2	-	3	11	3	-	3
900-900-1137	11	8	14	11	9	27	10	4	2	-	3	11	3	-	3
900-900-1138	10	8	13	10	8	24	10	4	2	-	3	10	3	6	3
900-900-1138	11	8	14	11	9	24	10	4	2	-	3	11	3	-	3
900-900-1139	10	8	11	10	8	25	10	4	2	-	3	10	3	6	3
900-900-1139	11	8	12	11	9	25	12	4	2	-	3	11	3	-	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 27: Trouble-shooting

A	B	C	D	E	F	G	H	Possible cause	Remedy[31]
✗	-	-	-	-	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point.
✗	-	-	-	-	-	-	-	Excessively high back pressure	Check system for impurities. Increase speed (turbine, I.C. engine).
✗	-	-	-	-	-	✗	✗	Pump or piping are not completely vented or primed.	Vent and/or prime.
✗	-	-	-	-	-	-	-	Supply line or impeller clogged	Remove deposits in the pump and/or piping.
✗	-	-	-	-	-	-	-	Formation of air pockets in the piping	Alter piping layout. Fit vent valve.
-	-	-	✗	-	✗	✗	-	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.
✗	-	-	-	-	-	✗	✗	Suction lift is too high/ $NPSH_{available}$ (positive suction head) is too low.	Check/alter fluid level. Fully open the shut-off element in the supply 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.
-	-	-	✗	-	-	-	-	Increased axial thrust[32]	Correct rotor adjustment.
✗	-	-	-	-	-	-	-	Air intake at the shaft seal	Fit new shaft seal.
✗	-	-	-	-	-	-	-	Wrong direction of rotation	Check the electrical connection of the motor and the control system, if any.
✗	✗	-	-	-	-	-	-	Motor is running on two phases only.	Replace the defective fuse. Check the electric cable connections.
✗	-	-	-	-	-	-	-	Speed is too low.	Increase speed.
-	-	-	-	-	-	✗	-	Defective bearing(s)	Replace.
-	-	-	✗	-	-	✗	✗	Flow rate is too low.	Increase the minimum flow rate.

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

32 Contact KSB.

A	B	C	D	E	F	G	H	Possible cause	Remedy[31)]
✗	-	-	-	-	-	✗	-	Wear of internal components	Replace worn components by new ones.
-	✗	-	-	-	-	✗	-	Pump back pressure is lower than specified in the purchase order.	Re-adjust to duty point.
-	✗	-	-	-	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	Contact KSB.
-	-	-	-	-	✗	-	-	Use of unsuitable materials	Change the material combination.
-	✗	✗	-	-	-	-	-	Speed is too high.	Reduce speed.
-	-	-	-	✗	-	-	-	Tie bolts/sealing element defective	Fit new seal between volute casing and discharge cover. Re-tighten the bolts.
-	-	-	-	-	✗	-	-	Worn shaft seal	Fit new shaft seal.
✗	-	-	-	-	✗	-	-	Score marks or roughness on shaft protecting sleeve / shaft sleeve	Replace shaft protecting sleeve/shaft sleeve. Replace shaft seal. Check balancing line. Check throttling bush/throttling sleeve clearances.
-	-	-	-	-	✗	-	-	Lack of cooling liquid or dirty cooling chamber	Increase cooling liquid quantity. Clean out cooling chamber. Purify/clean cooling liquid.
-	-	-	-	-	✗	-	-	Stuffing box cover and/or seal cover have been tightened incorrectly; wrong packing material.	Correct.
-	-	-	-	-	✗	-	-	Vibrations during pump operation	Correct the suction conditions. Re-align the pump set. Re-balance the impeller. Increase pressure at the pump suction nozzle.
-	-	-	✗	-	✗	✗	-	The pump set is misaligned.	Check the coupling; realign if required.
-	-	-	✗	-	-	-	-	Insufficient or excessive quantity of lubricant or unsuitable lubricant.	Top up, reduce or change lubricant.
-	-	-	✗	-	-	-	-	Non-compliance with specified coupling distance	Correct the distance according to general arrangement drawing.
-	✗	-	-	-	-	-	-	Operating voltage is too low.	Increase the voltage. Check voltage drop in the power cable.
-	-	-	-	-	-	✗	-	Rotor out of balance	Clean rotor. Re-balance rotor.

9 Related Documents

9.1 General assembly drawing with list of components

9.1.1 Pump with bearing bracket P16ax V10

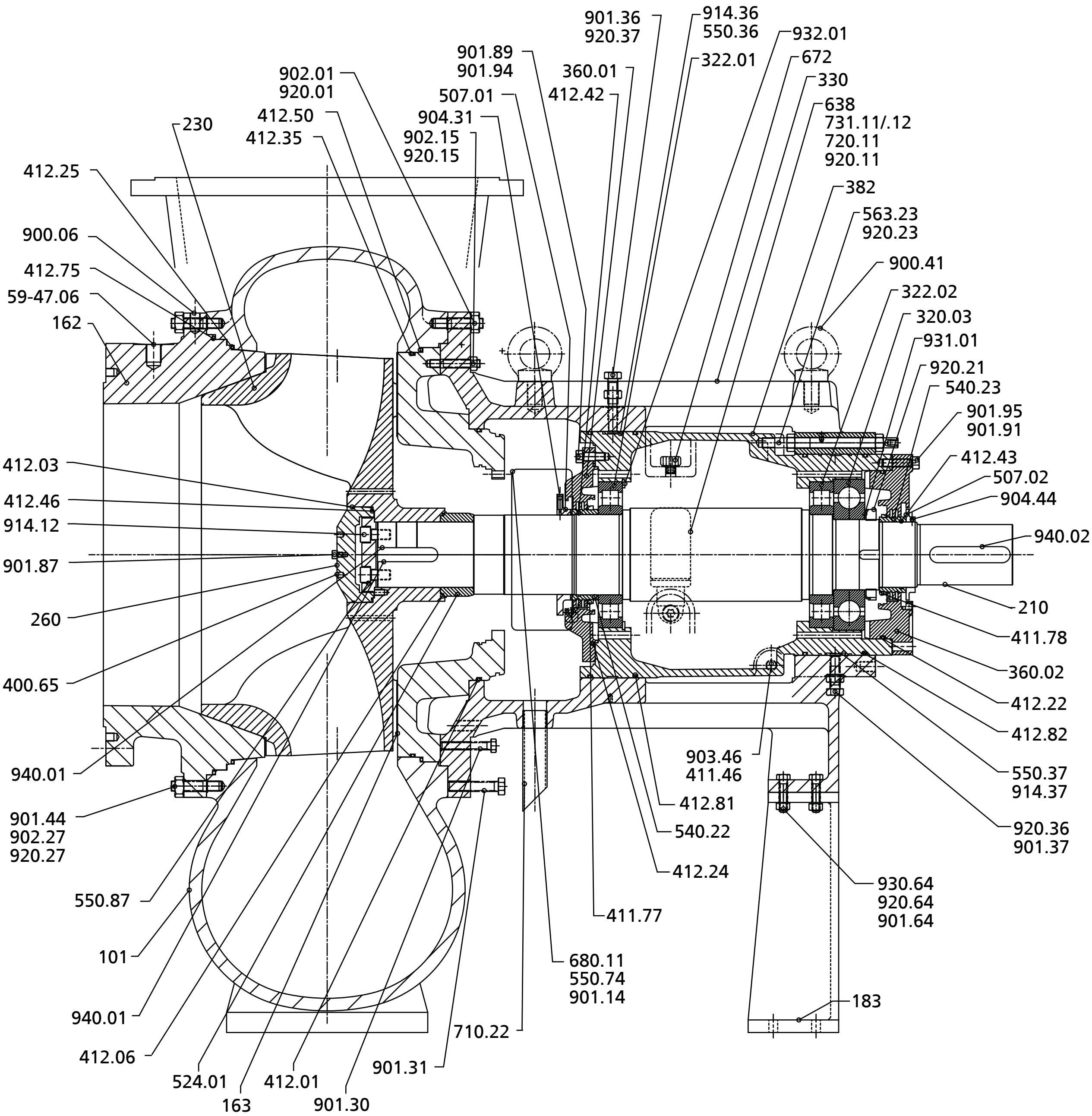

Fig. 22: General assembly drawing of pump with bearing bracket P16ax V10

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Table 28: List of components

Part No.	Description	Part No.	Description
101	Pump casing	563.23	Bolt/stud
162	Suction cover	59-47.06	Lifting lug
163	Discharge cover	638	Constant level oiler
183	Support foot	672	Vent
210	Shaft	680.11	Guard
230	Impeller	710.22	Pipe

Part No.	Description	Part No.	Description
260	Impeller hub cap	720.11	Fitting
320.03	Rolling element bearing	731.11/.12	Pipe union
322.01/.02	Radial roller bearing	900.06/.41	Screw
330	Bearing bracket	901.14/.30/.31/.36/.37/.44 /.64/.87/.89/.91/.94/.95	Hexagon head bolt
360.01/.02	Bearing cover	902.01/.15/.27	Stud
382	Bearing carrier	903.46	Screw plug
400.65	Gasket	904.31/.44	Grub screw
411.46/.77/.78	Joint ring	914.12/.36/.37	Hexagon socket head cap screw
412.01/.03/.06/.22/.24/.25 /.35/.42/.43/.46/.50/.75/.8 1/.82	O-ring	920.01/.11/.15/.21/.23/.27 /.36/.37/.64	Nut
507.01/.02	Thrower	930.64	Safety device
524.01	Shaft protecting sleeve	931.01	Lock washer
540.22/.23	Bush	932.01	Circlip
550.36/.37/.74/.87	Disc	940.01/.02	Key

9.1.2 Pumps with bearing bracket P16ax V10 (sizes 500-400-0710, 500-400-0713, 500-500-0633, 500-500-0637)

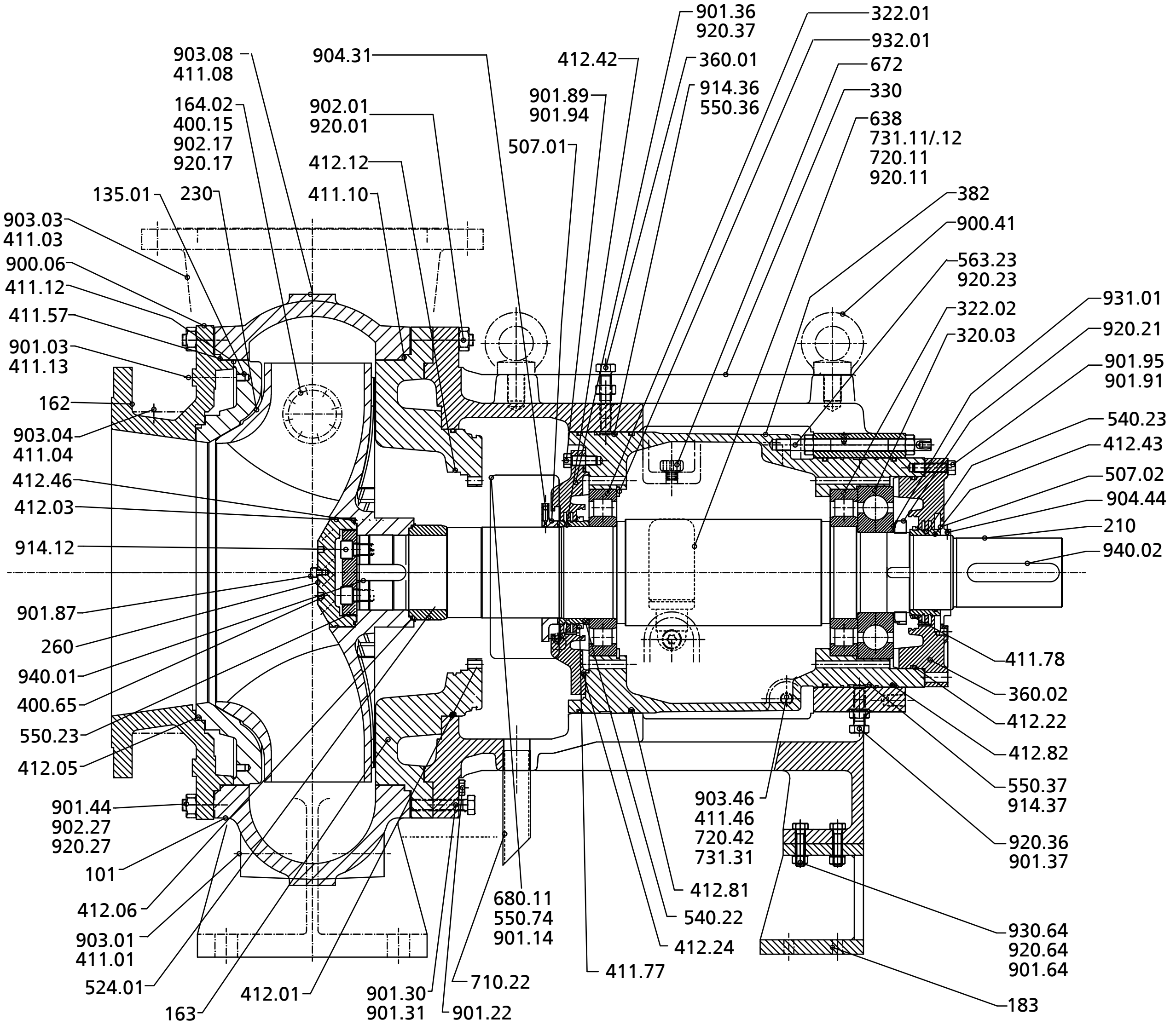

Fig. 23: General assembly drawing of pump with bearing bracket P16ax V10 (sizes 500-400-0710, 500-400-0713, 500-500-0633, 500-500-0637)

Table 29: List of components

Part No.	Description	Part No.	Description
101	Pump casing	550.23/.36/.37/.74	Disc
135.01	Wear plate	563.23	Pin
162	Suction cover	638	Constant level oiler
163	Discharge cover	672	Vent
164.02	Inspection cover	680.11	Guard
183	Support foot	710.22	Pipe
210	Shaft	720.11/.42	Special pipe part
230	Impeller	731.11/.12/.31	Pipe union
260	Impeller hub cap	900.06/.41	Bolt
320.03	Rolling element bearings	901.03/.14/.22/.30/.31/.36 /.37/.44/.64/.87/.89/.91/.9 4/.95	Hexagon head bolt
322.01/.02	Radial roller bearing	902.01/.17/.27	Stud
330	Bearing bracket	903.01/.03/.04/.08/.46	Screw plug

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Part No.	Description	Part No.	Description
360.01/.02	Bearing cover	904.31/.44	Grub screw
382	Bearing carrier	914.12/.36/.37	Hexagon socket head cap screw
400.15/.65	Gasket	920.01/.11/.17/.21/.23/.27 /.36/.37/.64	Nut
411.01/.03/.04/.08/.10/.12 /.46/.57/.77/.78	Seal ring	930.64	Safety device
412.01/.03/.05/.06/.12/.22 /.24/.42/.43/.46/.81/.82	O-ring	931.01	Lock washer
507.01/.02	Thrower	932.01	Circlip
524.01	Shaft protecting sleeve	940.01/.02	Key
540.22/.23	Bush		

9.1.3 Pump with bearing bracket P20sx V10

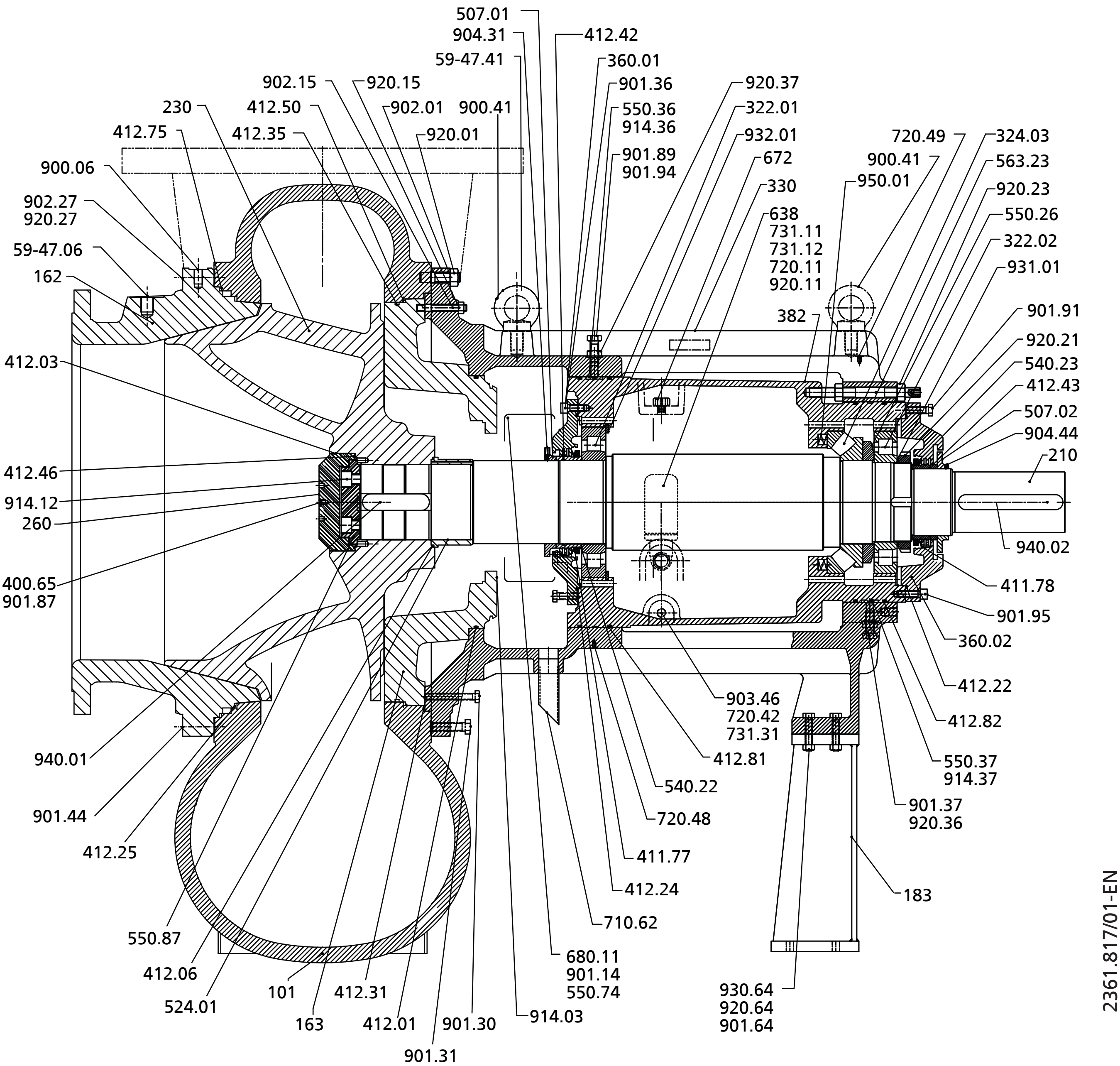

Fig. 24: General assembly drawing of pump with bearing bracket P20sx V10

Table 30: List of components

Part No.	Description	Part No.	Description
101	Pump casing	59-47.06/.41	Lifting lug
162	Suction cover	638	Constant level oiler
163	Discharge cover	672	Vent
183	Support foot	680.11	Guard
210	Shaft	710.62	Pipe
230	Impeller	720.11/.42/.48/.49	Fitting
260	Impeller hub cap	731.11/.12/.31	Pipe union
322.01/.02	Radial roller bearing	900.06/.41	Screw
324.03	Thrust roller bearing	901.14/.30/.31/.36/.37/.44 /.64/.87/.89/.91/.94/.95	Hexagon head bolt
330	Bearing bracket	902.01/.15/.27	Stud
360.01/.02	Bearing cover	903.46	Screw plug
382	Bearing carrier	904.31/.44	Grub screw
400.65	Gasket	914.03/.12/.36/.37	Hexagon socket head cap screw
411.77/.87	Joint ring	920.01/.11/.15/.21/.23/.27 /.36/.37/.64	Nut
412.01/.03/.06/.22/.24/.25 /.31/.35/.42/.43/.46/.50/.7 5/.81/.82	O-ring	930.64	Safety device
507.01/.02	Thrower	931.01	Lock washer
524.01	Shaft protecting sleeve	932.01	Circlip
540.22/.23	Bush	940.01/.02	Key
550.26/.36/.37/.74/.87	Disc	950.01	Spring
563.23	Bolt/stud		

9.1.4 Pump with bearing bracket P20sx V11

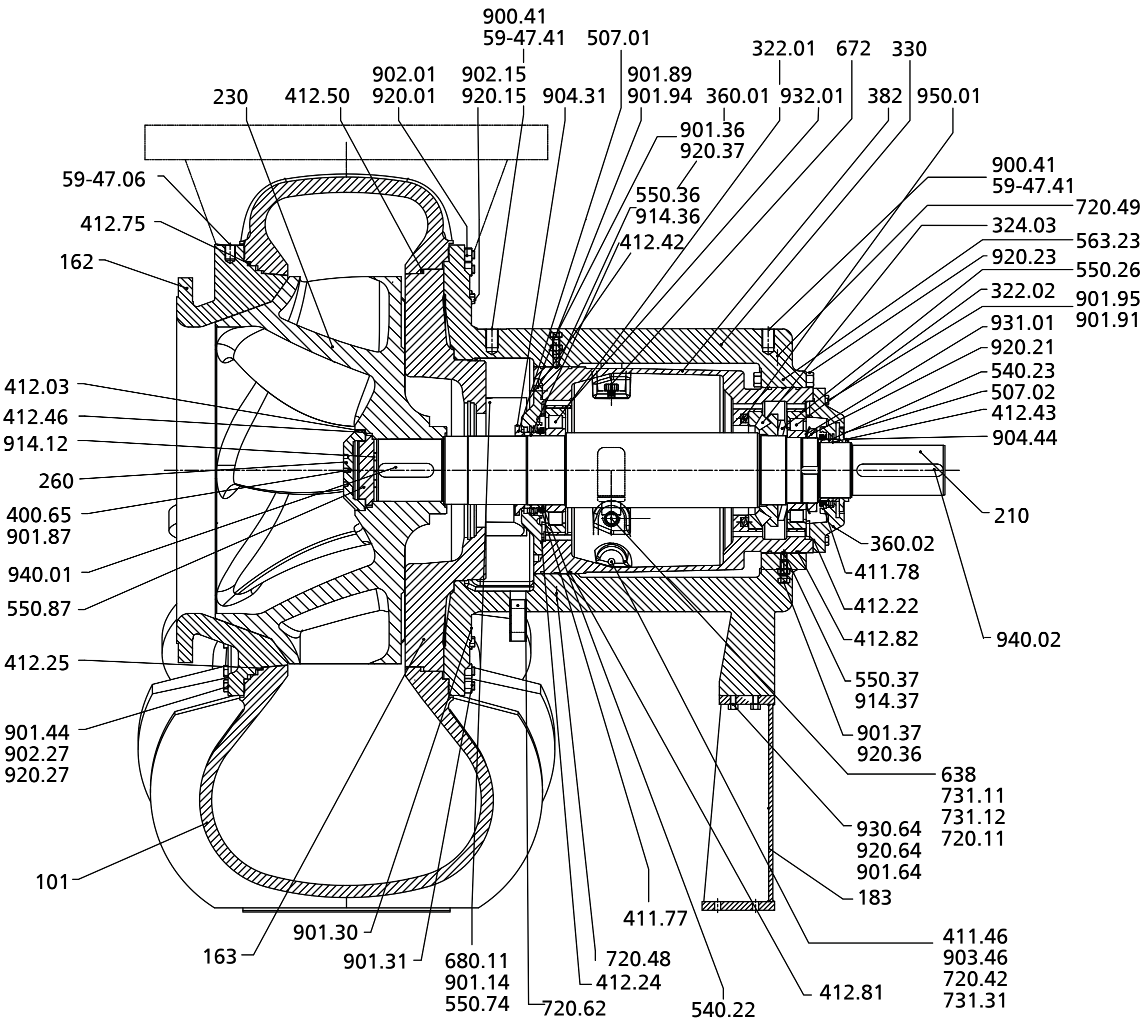

Fig. 25: General assembly drawing of pump with bearing bracket P20sx V11

Table 31: List of components

Part No.	Description	Part No.	Description
101	Pump casing	59-47.06/.41	Lifting lug
162	Suction cover	638	Constant level oiler
163	Discharge cover	672	Vent
183	Support foot	680.11	Guard
210	Shaft	720.11/.42/.48/.49/.62	Special pipe part
230	Impeller	731.11/.12/.31	Pipe union
260	Impeller hub cap	900.41	Bolt
322.01/.02	Radial roller bearing	901.14/.30./31/.36/.37/.44 /.64/.87/.89/.91/.94/.95	Hexagon head bolt
324.03	Thrust roller bearing	902.01/.15/.27	Stud
330	Bearing bracket	903.46	Screw plug
360.01/.02	Bearing cover	904.31/.44	Grub screw
382	Bearing carrier	914.12/.36/.37	Hexagon socket head cap screw
400.65	Gasket	920.01/.15/.21/.23/.27/.36 /.37/.64	Nut
411.46/.77/.78	Seal ring	930.64	Safety device
412.03/.22/.24/.25/.42/.43 /.46/.50/.75/.81/.82	O-ring	931.01	Lock washer

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Part No.	Description	Part No.	Description
507.01/.02	Thrower	932.01	Circlip
540.22/.23	Bush	940.01/.02	Key
550.26/.36/.37/.74/.87	Disc	950.01	Spring
563.23	Pin		

9.1.5 Shaft seals

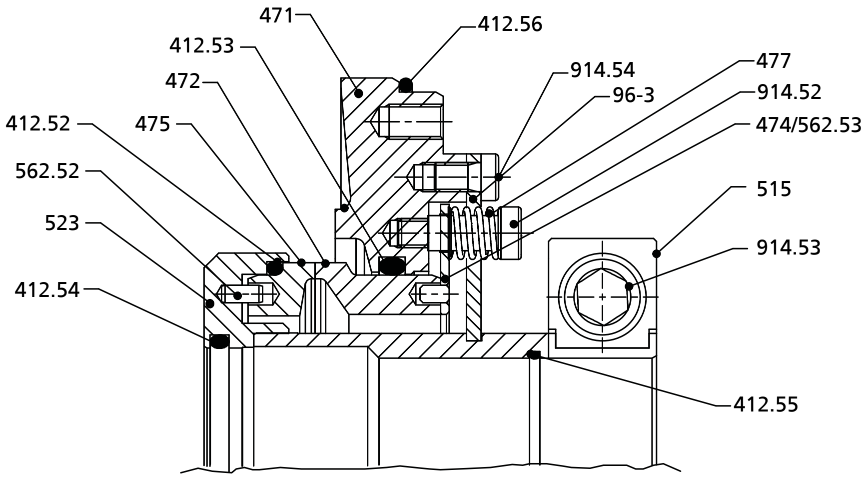

Fig. 26: Mechanical seals 4K-160 and 4K-200

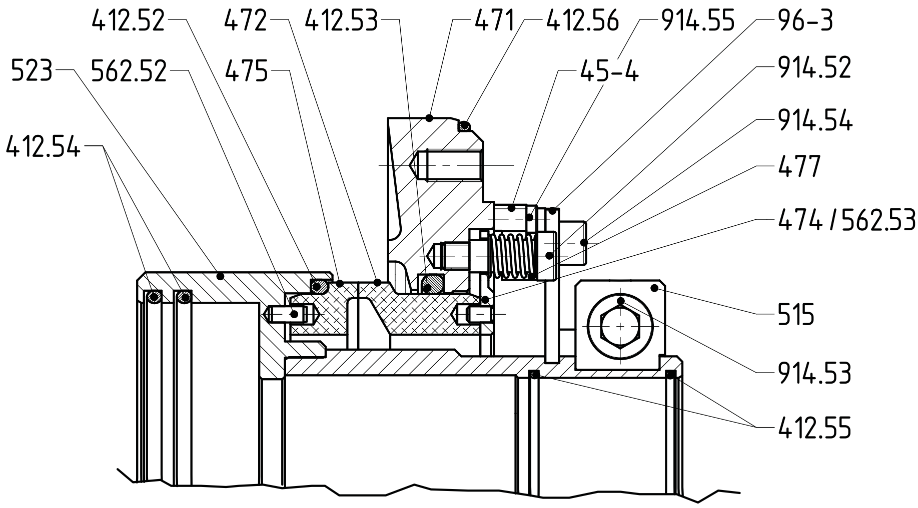

Fig. 27: Mechanical seal 4K-253

9.1.6 Shaft seal installation accessories

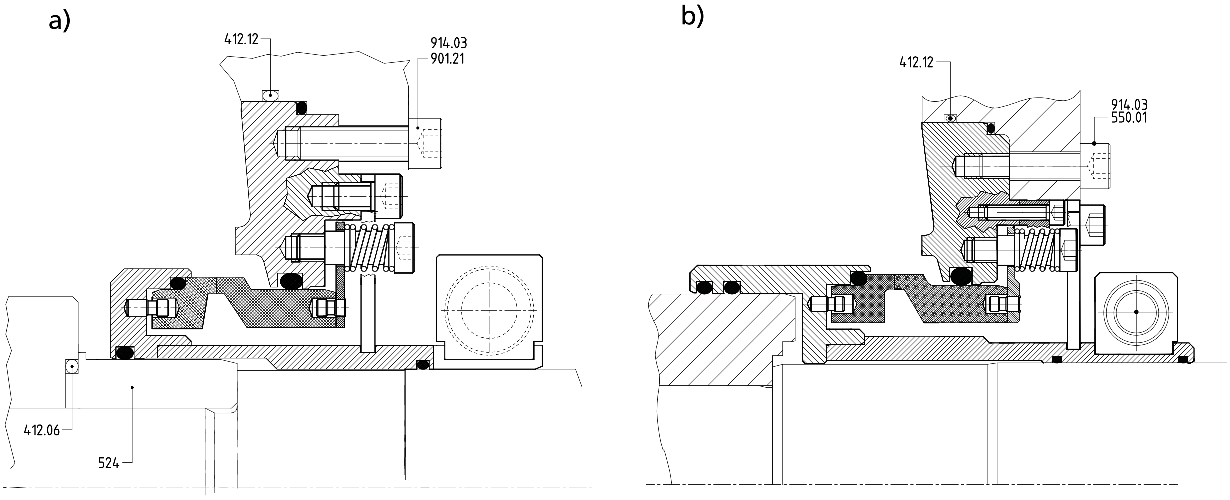

Fig. 28: Installation accessories a) Mechanical seal 4K-160/-200 (for V10) b) Mechanical seal 4K-253 (for V11)

9.1.7 List of components

Table 32: List of components[33]

Part No.	Comprising	Description
101	101	Pump casing
	411.01/.03/.08	Joint ring
	902.01/.27	Stud
	903.01/.03/.08	Screw plug
	920.01/.27	Hexagon head bolt
135.01	135.01	Wear plate
	411.12/.13	Joint ring
	412.05	O-ring
	901.03	Hexagon head bolt
162	162	Suction cover
	411.57	Joint ring
	412.25/.75	O-ring
	59-47.06[34]	Lifting lug
	900.06[35]	Eyebolt
	904.97	Grub screw
163	163	Discharge cover
	412.12/.50	O-ring
	902.15	Stud
	920.15	Hexagon nut
183	183	Support foot
	901.64	Hexagon head bolt
	920.64	Hexagon nut
	930.64	Spring washer
210	210	Shaft
	940.01/.02	Key
230	230	Impeller

33 Depending on the design
34 For P20sx only
35 For P16ax only

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Part No.	Comprising	Description
230	412.03[36]	O-ring
260	260	Impeller hub cap
	400.65	Sealing element
	412.03/.46	O-ring
	550.87	Disc
	901.87	Hexagon head bolt
	914.12	Hexagon socket head cap screw
330	330	Bearing bracket
	59-47.41[34]	Lifting lug
	720.62	Hexagon nipple
	900.41[35]	Eyebolt
	901.30/.31	Hexagon head bolt
382	382	Bearing carrier
	322.01/.02	Cylindrical roller bearing
	320.03[35]	Angular contact ball bearing
	324.03[34]	Spherical thrust roller bearing
	360.01/.02	Bearing cover
	411.46/.77/.78	V-ring
	412.22/.24/.42/.43/.81/.82	O-ring
	507.01/.02/.99	Thrower
	540.22/.23	Bush
	550.36/.37	Disc
	563.23	Pin
	638	Constant level oiler
	672	Vent plug
	720.11/.42	Hexagon nipple
	731.11/.12/.31	Socket
	901.36/.37/.89/.91/.94/.95/.99	Hexagon head bolt
	903.46	Screw plug
	904.31/.44	Grub screw
	914.36/.37	Hexagon socket head cap screw
	920.21/.23/.36/.37	Hexagon nut
	931.01	Lock washer
	932.01	Circlip
	950.01	Compression spring
433.02	433.02	Mechanical seal
	412.52/.53/.54/.55/.56	O-ring
	45-4	Spacer
	471	Seal cover
	472	Primary ring
	474	Thrust ring
	475	Mating ring
	477	Spiral spring
	515	Clamping ring
	523	Shaft sleeve
	562.52/.53	Parallel pin
	550.01	Disc

36 Except for P20sx V11

Part No.	Comprising	Description
433.02	914.03/.52/.53/.54/.55	Hexagon socket head cap screw
	96-3	Assembly fixture
524.01[36)]	524.01	Shaft protecting sleeve
680.11	680.11	Guard
	550.74	Disc
	901.14	Hexagon head bolt
710.22	710.22	Pipe

9.2 Recommendations for preparing and processing concrete for grouting the foundation frame

General

Use factory-produced, ready-made concrete to DIN EN 206-1/ DIN 1045 which is processed at the site of use in a flowable consistency. Apply suitable measures to produce and process a concrete which does not tend to segregate and is non-shrinking in its pre-hardened condition, and which has low shrinkage characteristics in hardened condition.

Concrete properties

Table 33: Quality requirements for producing concrete

Characteristic	Value
Cement	Portland cement CEM1 - 32.5 R to DIN EN 197-1
Aggregate	Sand, gravel, chips to DIN EN 12620
Granulometric composition	Particle-size distribution range 3 A/B, maximum particle size 32 to DIN 1045
Admixtures	Approved melamine resin base fluxing agent
Water/cement factor	≤ 0.45
Compressive strength	C20/25 to DIN EN 206-1
Consistency at the building site	Concrete consistency without fluxing agent Plastic consistency range a[37)] = 36 - 40 cm
Consistency at the building site	Concrete consistency after fluxing agent has been added Flowable consistency range a[37)] = 50 - 55 cm

For the right dose of fluxing agent refer to the Guideline for Flow Concrete by the German Committee for Structural Concrete and the technical instruction leaflet of the fluxing agent producer.

Processing

Preparation

- Free the installation surface, the existing foundation, anchor bolt holes etc. in the vertical and horizontal surfaces from oil, dust, dirt, concrete residues and fine mortar of little strength. Thoroughly clean these areas with water, soak them, let the surfaces dry again and remove all surface water.
- Also free the bottom of the machinery, the anchor bolts and the crane rails from oil, grease and dust.
- Protect the parts and foundations, etc. to be grouted from high heat and frost.
- Adjust the parts to be grouted. Lightly oil any adjustment tools which will be removed later.

Shuttering (if required)

- Verify that the shuttering is tightly sealed and does not give way. If necessary, replace or seal the shuttering.
- Prevent water from being absorbed by wooden shuttering by soaking the shuttering beforehand or by using suitable separating agents.

Producing the processing consistency

- Immediately before pouring the concrete, produce a processing consistency (flowable consistency range): a[37)] = 50 - 55 cm) with a fluxing agent in accordance with the Guideline for Flow Concrete by the German Committee for Structural Concrete.

Transport

- Chute
- Crane bucket
- Concrete pump

Pouring process

- Pour the concrete without interruptions.

Compacting

- Vent the concrete by rodding and/or lightly shaking/vibrating it.

[37] Dimension "a" is the propagation value which can be determined by means of a propagation test (to DIN 1048).

Curing

After grouting, prevent evaporation of water from free surfaces. To do so, a foil or a wet textile fabric can be placed on the concrete as soon as the concrete has become mat (approximately 30 to 60 minutes after grouting).

Table 34: Minimum curing time

Ambient conditions	Concrete temperature or mean air temperature	Curing time in days[38]
Favourable ▪ protected from direct sun exposure ▪ and wind ▪ continuous relative humidity ≥ 80 %	≥ 10 °C	2
	> 10 °C	4
Normal ▪ medium sun exposure ▪ and/or wind ▪ and/or relative humidity ≥ 50 %	≥ 10 °C	3
	< 10 °C	6
Unfavourable ▪ strong sun exposure ▪ and/or strong winds ▪ and/or relative humidity < 50 %	≤ 10 °C	4
	> 10 °C	8

Load

The strength development of concrete depends on the temperature. At lower temperatures the strength develops slower, which means it takes longer until the concrete can be subjected to any loads.

Finish seal

After curing, the concrete surface can be sealed in the same way as the foundation surfaces. Observe the technical instruction leaflet of the concrete sealant. Concrete which is produced and processed in accordance with these recommendations is resistant against very strong chemical attacks in accordance with DIN 4030.

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38 Extend the curing time as follows: In the event of frost, add the number of frost days. If retarded concrete is used, add the retardation period. If fly ash has been taken into account in the cement content or water/cement factor, add 2 days.

10 UK Declaration of Conformity

Manufacturer:

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

This UK Declaration of Conformity is issued under the sole responsibility of the manufacturer.

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

KWP, KWPR, KWP-Bloc

KSB order number: ....

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
  - Pump (set): Supply of Machinery (Safety) Regulations 2008
  - Electrical components[39]: The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

The manufacturer also declares that

- the following harmonised international standards[40] 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 UK Declaration of Conformity was issued in/on:

Place, date

..............................[41]..............................

Name

Function

Company
Address

[39] Where applicable

[40] Apart from the standards listed here referring to the *Supply of Machinery (Safety) Regulations 2008*, further standards are observed for explosion-proof versions (*Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016*) as applicable and are listed in the legally binding UK Declaration of Conformity.

[41] A signed, legally binding UK Declaration of Conformity is supplied with the product.

11 Certificate of Decontamination

Type: ....

Order number /
Order item number[42]: ....

Delivery date: ....

Application: ....

Fluid handled[42]: ....

Please tick where applicable[42]:

☐ Corrosive	☐ Oxidising	☐ Flammable	☐ Explosive	☐ Hazardous to health
☐ Seriously hazardous to health	☐ Toxic	☐ Radioactive	☐ Bio-hazardous	☐ Safe

Reason for return:[42]: ....

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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42 Required field

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