Dry-installed Volute Casing Pump

KWP

Bearing Brackets P03ax to P12sx

Installation/Operating Manual

Legal information/Copyright

Installation/Operating Manual KWP

Original operating manual

Contents

Glossary

Back pull-out design

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

Back pull-out unit

Pump without pump casing; partly completed machinery

Certificate of decontamination

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

Discharge line

The pipeline which is connected to the discharge nozzle

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

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1 General

1.1 Principles

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

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

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

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

1.2 Installation of partly completed machinery

To install partly completed machinery supplied by 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 10)

1.4 Other applicable documents

Table 1: Overview of other applicable documents

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

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

1.5 Symbols

Table 2: Symbols used in this manual

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

1 If agreed to be included in the scope of supply

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

1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

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

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

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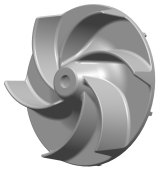
	Open multi-vane impeller (impeller type O)	**Suitable for the following fluids:** uncontaminated or slightly contaminated fluids with little entrapped gas as well as fluids liable to form deposits and bunch
	Free-flow impeller (impeller type F)	**Suitable for the following fluids:** Fluids containing coarse solids and stringy material as well as fluids with entrapped gas and entrapped air

2.3 Personnel qualification and training

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

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

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

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

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

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

2.5 Safety awareness

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

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

2.6 Safety information for the operator/user

- Fit protective equipment (e.g. contact guards) supplied by the operator for hot, cold or moving parts, and check that the equipment functions properly.
- Do not remove any protective equipment (e.g. contact guards) during operation.
- Provide the personnel with protective equipment and make sure it is used.

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- Contain leakages (e.g. at the shaft seal) of hazardous fluids handled (e.g. explosive, toxic, hot) so as to avoid any danger to persons and the environment. Adhere to all relevant laws.
- Eliminate all electrical hazards. (In this respect refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)
- If stopping the pump does not increase potential risk, fit an emergency-stop control device in the immediate vicinity of the pump (set) during pump set installation.

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump (set) are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇨ Section 6.3, Page 54)
- Decontaminate pumps which handle fluids posing a health hazard. (⇨ Section 7.3, Page 62)
- 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 45)

2.8 Unauthorised modes of operation

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

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

2.9 Explosion protection

DANGER

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

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

Special conditions apply to the operation of explosion-proof pump sets to EU Directive 2014/34/EU (ATEX).

Especially adhere to the sections in this manual marked with the Ex symbol and the following sections, (⇨ Section 2.9.1, Page 11) to (⇨ Section 2.9.4, Page 13)
The explosion-proof status is only assured if the product is used in accordance with its intended use.
Never operate the product outside the limits stated in the data sheet and on the name plate.
Prevent impermissible modes of operation at all times.

2.9.1 Marking

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

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

Refer to the Temperature limits table for the maximum temperatures permitted for the individual pump variants. (⇨ Section 2.9.2, Page 12)

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 for the maximum permissible operating temperature.

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2 Subject to further limitations for mechanical seal temperature rise

3 Depending on the material variant

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

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 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.

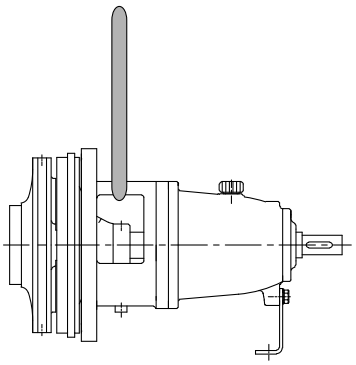

Fig. 1: Transporting the back pull-out unit

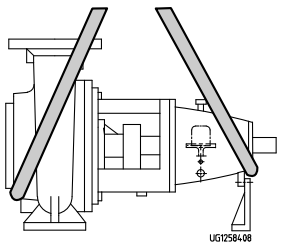

Fig. 2: Transporting the pump

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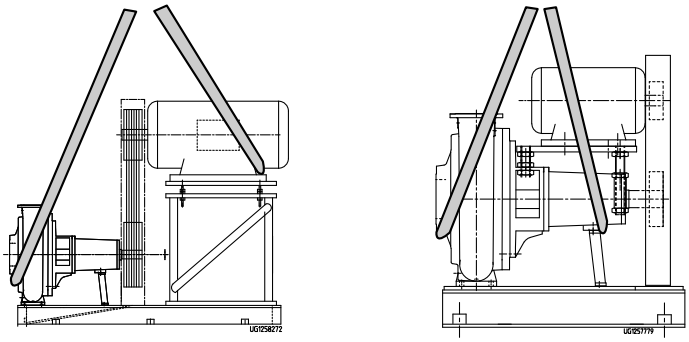

Fig. 3: Transporting a pump set with belt drive (figures 3Z and 4H)

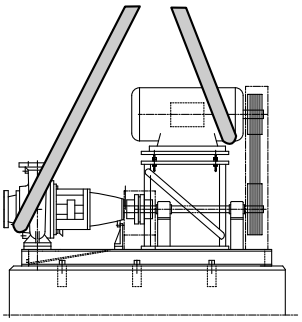

Fig. 4: Pump set on baseplate with counter shaft and belt drive (figure 3H)

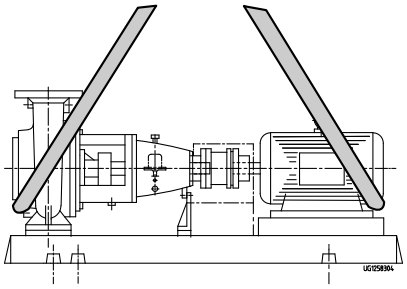

Fig. 5: Transporting a pump set on a baseplate (figure 3)

3.3 Storage/preservation

CAUTION

Damage during storage due to humidity, dirt or vermin

Corrosion/contamination of the pump (set)!

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

CAUTION

Wet, contaminated or damaged openings and connections

Leakage or damage to the pump!

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

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

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

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

For storing a pump (set) which has already been operated, the shutdown measures must be adhered to. (⇨ Section 6.3.1, Page 54)

3.4 Return to supplier

1. Drain the pump as per operating instructions.
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen also neutralise the pump and blow through with anhydrous inert gas to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
   Indicate any safety measures and decontamination measures taken.
   (⇨ Section 11, Page 96)

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/m³.

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

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

4.3 Designation

Table 5: Designation example

Position																														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
K	W	P	F	1	2	5	-	1	0	0	-	0	2	5	0		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		
	F	Vortex impeller	
	K	Channel impeller	
	O	Open impeller	
5-17	Size, e.g.		
	125	Nominal suction nozzle diameter [mm]	
	100	Nominal discharge nozzle diameter [mm]	
	0250	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 / -
	O	NORICLOR	1.4573
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
	O	NORICLOR	1.4573
20	Wear plate material / wear ring material		
	D	NORIDUR	1.4593
	H	NORIHARD NH 15 3	-

Position	Code	Description	
20	K[4)]	CeramikPolySiC	-
	M	NORICROM	1.4475
	N	ERN	-
	U	NORIDUR DAS	1.4593
	O	NORICLOR	1.4573
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
	O	NORICLOR	1.4573
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)	
	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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4 K defines a suction cover in GJS-400-18-LT/ CeramikPolySiC for pumps without a separate wear plate.
5 Blank

4.4 Name plate

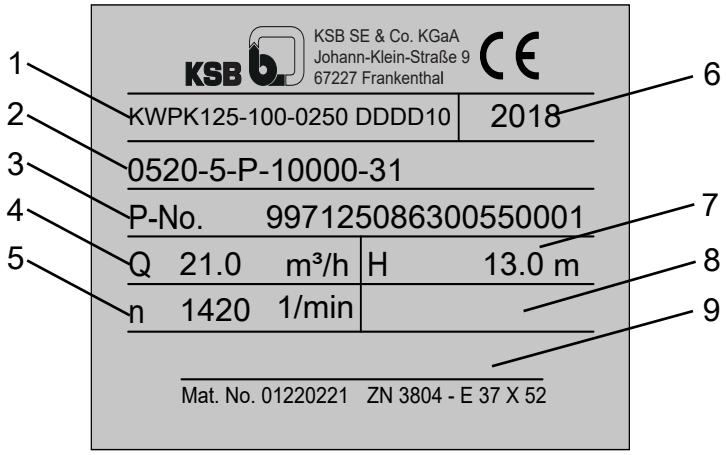

Fig. 6: Name plate (example)

1	Type series, size, material, and design variant	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 (optional)
9	Further required information (optional)		

4.5 Design

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
- Volute casing (with casing wear ring, if applicable) and casing cover
- Pump casing fitted with a wear plate[6)]
- Discharge cover available in the following versions:

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6 Some sizes with casing wear ring (250-250-315, 300-300-400, 350-350-400, 400-400-500)

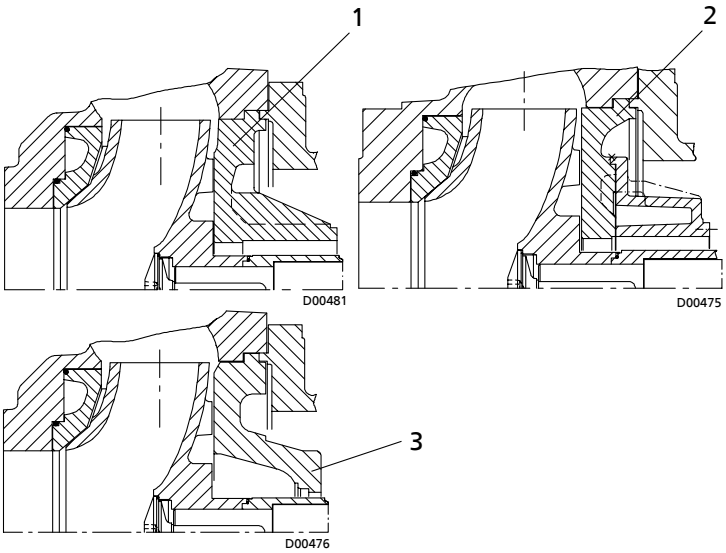

Fig. 7: Discharge cover versions

1	Discharge cover with integrally cast stuffing box housing (cylindrical cover); material variants: GNNG, GDNG, DDDD	2	Discharge cover with bolted-on stuffing box housing (cylindrical cover, split); material variants: GHHH, HHHH
3	For mechanical seal: discharge cover with conical seal chamber (A-type cover); material variants: GNNG, GDNG, DDDD, DKKM, GHHH, HHHH		

Impeller type

- Various application-oriented impeller types (⇨ Section 2.2, Page 9)
- Back vanes reduce axial thrust.

Bearings

- 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[7)]	Drive end[8)]
P03ax	NU 409	2 x 7309 B-UA
P04ax	NU 411	2 x 7311 B-UA
P05ax	NU 413	2 x 7313 B-UA
P06x	NU 413	2 x 7313 B-UA
P08sx	NU 416	2 x 7319 B-UA
P10ax	NU 324	2 x 7224 B-UA
P12sx	NU 324	2 x 7224 B-UA

Shaft seal

- Gland packing
- Shaft equipped with replaceable shaft protecting sleeve in the shaft seal area

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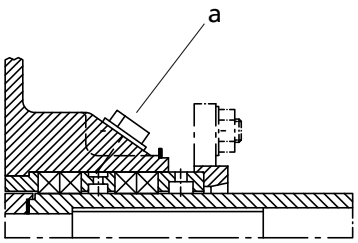
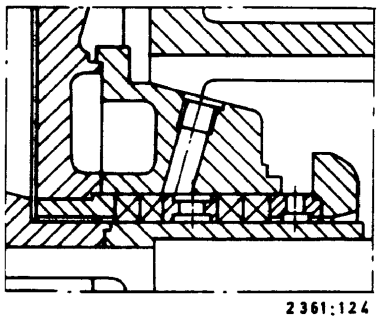
7 To DIN 5412
8 To DIN 628



Uncooled gland packing with a) connection for barrier fluid or flushing liquid (connections 10 A.1 and 10 E.1)



Cooled gland packing

- Single mechanical seal / double mechanical seal

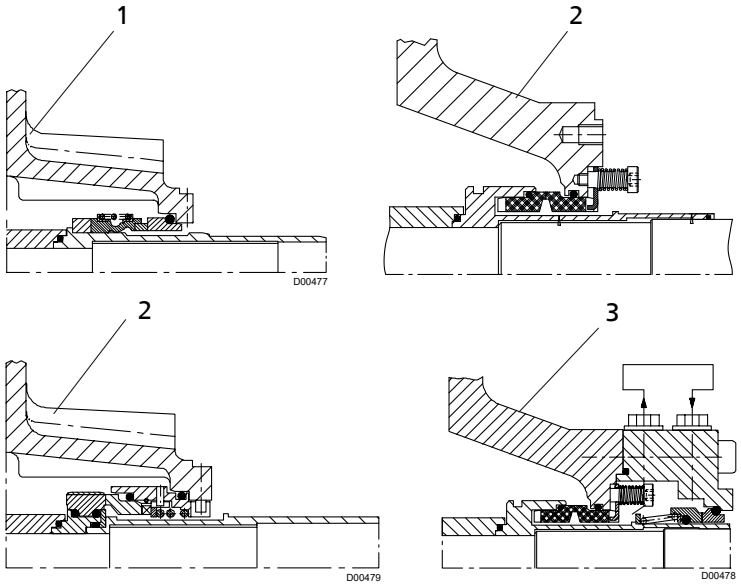


Fig. 8: Mechanical seals in conical seal chamber (A-type)

1	Single mechanical seal, unbalanced	2	Single mechanical seal with spring-loaded stationary assembly
3	Mechanical seal in tandem arrangement, with quench		

Drive

- Electric motor connected to the pump via a coupling or belt drive

4.6 Materials

Example of material designation: DMKM

Table 8: Material designation key

Code	Description		
D	Casing material		
		G	GJL-250 [9)]
		H	NORIHARD NH 15 3
		D	NORIDUR 1.4593
		K	CeramikPolySiC®
M	Impeller material		

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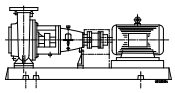
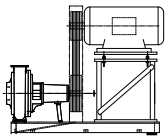
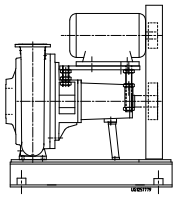
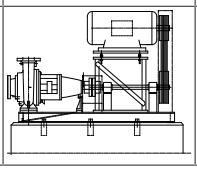
Code	Description		
M		H	NORIHARD NH 15 3
		D	NORIDUR 1.4593
		U	NORIDUR 1.4593 DAS
		K	CeramikPolySiC®
		M	NORICROM 1.4475
		N	ERN
K	Wear plate material		
		H	NORIHARD NH 15 3
		U	NORIDUR 1.4593 DAS
		N	ERN
		D	NORIDUR 1.4593
		K	CeramikPolySiC®
M	Discharge cover material		
		G	GJL-250 [10)]
		H	NORIHARD 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
Figure 3Z		Pump set with belt drive. Motor bracket positioned in front of the pump
Figure 4H		Pump set with belt drive. Motor support plate positioned on the pump.
Figure 3H		Pump set with belt drive and countershaft. Motor bracket positioned over countershaft.

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4.8 Configuration and function

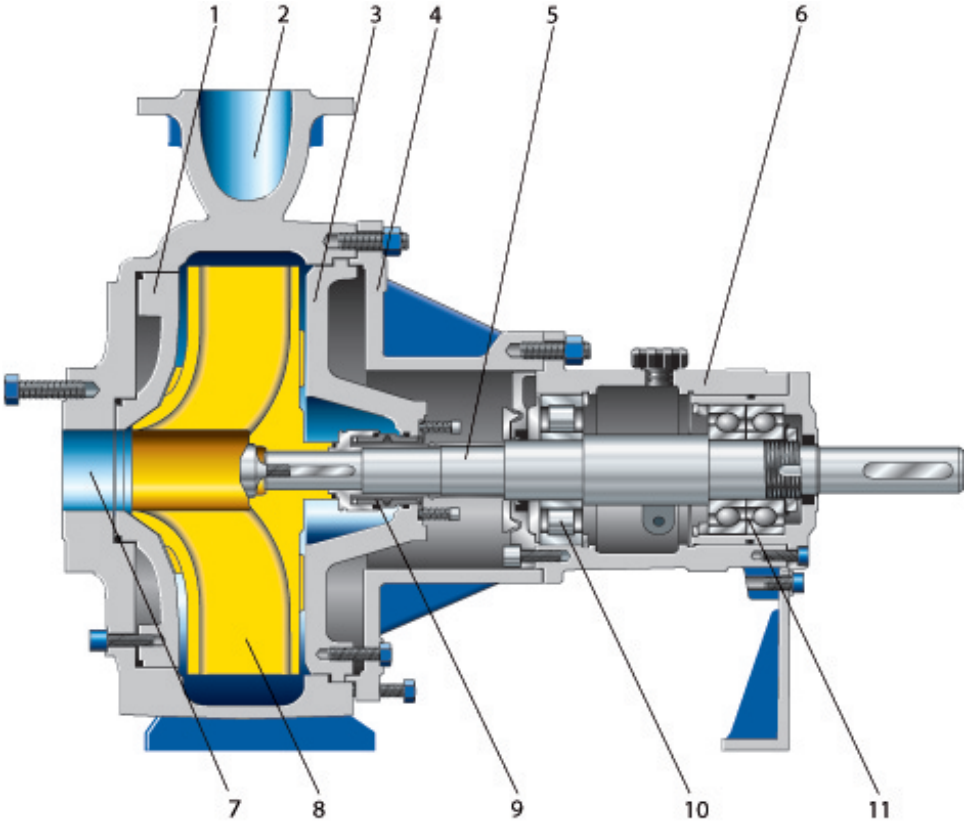

Fig. 9: Sectional drawing

1	Wear plate	2	Casing/discharge nozzle
3	Discharge cover	4	Bearing bracket lantern
5	Shaft	6	Bearing bracket
7	Casing/suction nozzle	8	Impeller
9	Shaft seal	10	Rolling element bearing, pump end
11	Rolling element bearing, drive 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 radial 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 (7) and is accelerated outward by the rotating impeller (8). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid leaves the pump via the discharge nozzle (2).

The casing is fitted with a replaceable wear plate (1). The diagonal clearance gap prevents frequent deflection of the clearance gap 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 gap can be set to an optimum width.

The casing is closed by a discharge cover (3). The shaft (5) enters the casing via this cover. A shaft seal (9) provides reliable sealing towards the atmosphere.

The shaft is supported by oil lubricated rolling element bearings (10 and 11). The bearing bracket (6) is connected to the casing via a bearing bracket lantern (4).

Sealing The pump is sealed by a shaft seal. Variants:

- Mechanical seal (single seal or in tandem arrangement)
- Gland packing with connection for barrier fluid or flushing liquid in the cylindrical seal chamber

4.9 Noise characteristics

Table 10: Surface sound pressure level L_{pA} [dB][11) 12)]

Rated power input PN [kW]	Pump			Pump set[13)]		
	2900 rpm	1450 rpm	960/760 rpm	2900 rpm	1450 rpm	960/760 rpm
1,1	54	52	51	63	57	55
2,2	55	53	52	65	59	53
3	57	55	54	67	61	59
4	58	57	55	69	62	61
5,5	60	58	57	70	64	63
7,5	61	59	58	71	65	64
11	63	61	60	73	67	66
15	64	62	61	74	68	67
18,5	65	63	62	75	69	68
22	66	64	63	75	69	68
30	67	65	64	76	71	69
37	68	66	65	77	71	70
45	69	67	66	77	72	71
55	70	68	67	78	73	71
75	-	69	68	-	74	72
90	-	70	69	-	74	73
110	-	71	70	-	75	73
132	-	72	71	-	75	74
160	-	73	72	-	76	74
200	-	75	74	-	76	75
250	-	76	75	-	80	79

4.10 Scope of supply

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

- Pump
- Surface-cooled IEC three-phase current squirrel-cage motor
- Belt drive or flexible coupling with or without spacer
- Belt guard / coupling guard to EN 294
- Baseplate (to ISO 3661), cast or welded, for pump and motor, in torsion-resistant design

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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11 Surface sound pressure level as per and ; 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.

12 Increase for 60 Hz operation: 1750 rpm +1 dB, 1160 rpm ±0 dB

13 For belt-driven pump sets add 2 dB.

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 XC1 to EN 206-1.
- The mounting surface must be set, flat, and level.
- Observe the weights indicated.

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

5.3 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.

5.3.1 Installation on the foundation

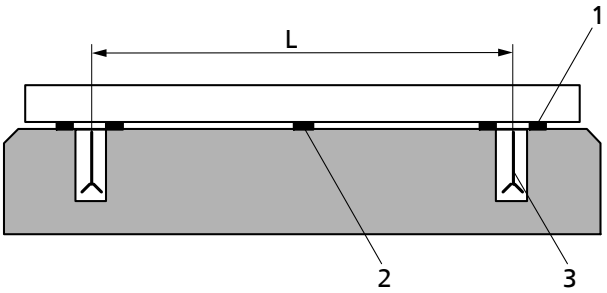

Fig. 10: Fitting the shims

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

✓ The foundation has the required strength and characteristics.

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

1. Position the pump set on the foundation and level it with the help of a spirit level placed on the shaft and discharge nozzle.
   Permissible deviation: 0.2 mm/m
2. Use shims (1) for height compensation if necessary.
   Always fit shims, if any, immediately to the left and right of the foundation bolts (3) between the baseplate/foundation frame and the foundation.
   For a bolt-to-bolt distance (L) > 800 mm fit additional shims (2) halfway between the bolt holes.
   All shims must lie perfectly flush.
3. Insert the foundation bolts (3) into the holes provided.
4. Use concrete to set the foundation bolts (3) into the foundation.
5. Wait until the concrete has set firmly, then level the baseplate.
6. Tighten the foundation bolts (3) evenly and firmly.
7. Grout the baseplate using low-shrinkage concrete with a standard particle size and a water/cement ratio of ≤ 0.5.
   Produce flowability with the help of a solvent.
   Perform secondary treatment of the concrete to EN 206.

NOTE

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

NOTE

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

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5.3.2 Installation without foundation

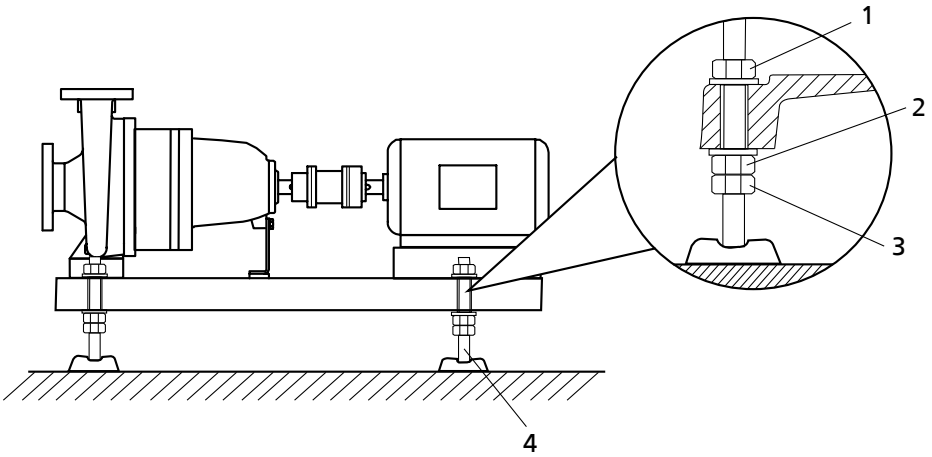

Fig. 11: Adjusting the levelling elements

1, 3	Locknut	2	Adjusting nut
4	Machine mount		

✓ The installation surface has the required strength and characteristics.

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

5.4 Piping

5.4.1 Connecting the piping

DANGER

Impermissible loads acting on the pump nozzles

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

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

CAUTION

Incorrect earthing during welding work at the piping

Destruction of rolling element bearings (pitting effect)!

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

NOTE

Installing check 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 59) .

3. Check that the inside of the pump is free from any foreign objects. Remove any foreign objects.
4. If required, install a filter in the piping (see drawing: Filter in the piping).

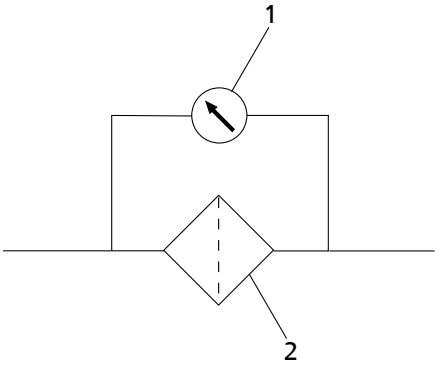

Fig. 12: Filter in the piping

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.

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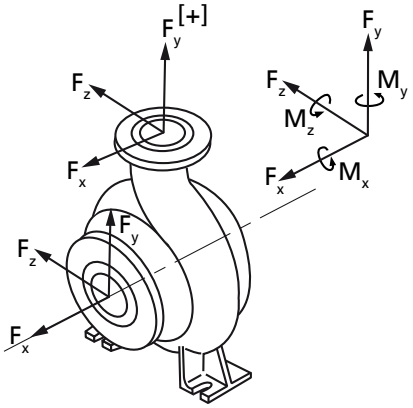
	**CAUTION** **Aggressive flushing liquid and pickling agent** Damage to the pump! ▷ Match the cleaning operation mode and duration of flushing and pickling to the casing materials and seal materials used.

5.4.2 Permissible forces and moments at the pump nozzles



The permissible resultant forces have been determined according to:

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

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

Forces and moments at the pump nozzles

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

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

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

For material variant DDDD and temperatures >20 °C reduce the values given in (⇨ Section 5.4.2.1, Page 31) in accordance with the following diagram:

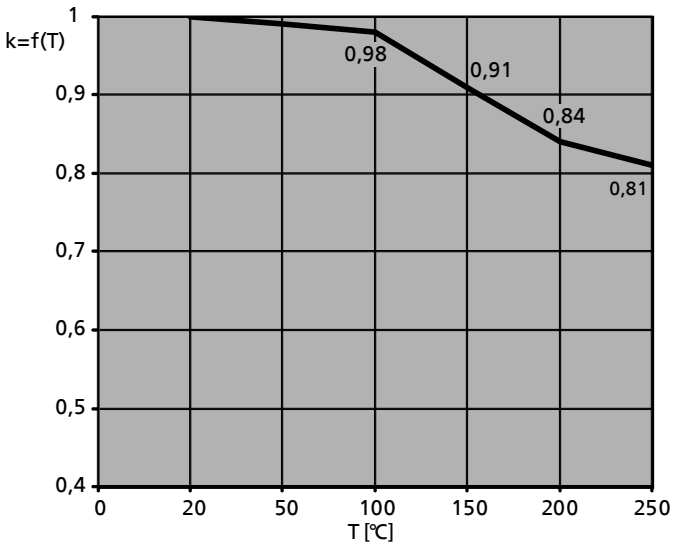


Fig. 13: Correction coefficient for material variant DDDD

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

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5.4.2.1 Material variants DDDD, DUUD, DKKM, DMKM (NORIDUR 1.4593)

Table 11: Material variants DDDD, DUUD, DKKM, DMKM (NORIDUR 1.4593): 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]
065-040-0250	3145	2065	2515	3235	1527	990	1975	1255	1975	2065	1525	1080	990	810	540
080-040-0315	3860	2515	3055	3950	1527	990	1975	1255	1975	2605	1975	1345	990	810	540
065-050-0200	3145	2065	2515	3235	1975	1255	2425	1615	2515	2065	1525	1080	1255	990	630
065-050-0201	3145	2065	2515	3235	1975	1255	2425	1615	2515	2065	1525	1080	1255	990	630
080-050-0400	3860	2515	3055	3950	1975	1255	2425	1615	2515	2605	1975	1345	1255	990	630
080-065-0200	3860	2515	3055	3950	2515	1615	3145	2065	3235	2605	1975	1345	2065	1525	1080
080-065-0201	3860	2515	3055	3950	2515	1615	3145	2065	3235	2605	1975	1345	2065	1525	1080
080-065-0313	3860	2515	3055	3950	2515	1615	3145	2065	3235	2605	1975	1345	2065	1525	1080
080-065-0315	3860	2515	3055	3950	2515	1615	3145	2065	3235	2605	1975	1345	2065	1525	1080
080-065-0400	3860	2515	3055	3950	2515	1615	3145	2065	3235	2605	1975	1345	2065	1525	1080
100-080-0250	4850	3145	3860	4940	3055	1975	3860	2515	3950	3595	2695	1795	2605	1975	1345
100-080-0251	4850	3145	3860	4940	3055	1975	3860	2515	3950	3595	2695	1795	2605	1975	1345
100-080-0311	4850	3145	3860	4940	3055	1975	3860	2515	3950	3595	2695	1795	2605	1975	1345
100-080-0315	4850	3145	3860	4940	3055	1975	3860	2515	3950	3595	2695	1795	2605	1975	1345
100-080-0400	4850	3145	3860	4940	3055	1975	3860	2515	3950	3595	2695	1795	2605	1975	1345
100-080-0403	4850	3145	3860	4940	3055	1975	3860	2515	3950	3595	2695	1795	2605	1975	1345
125-080-0500	6645	4310	5300	6825	3055	1975	3860	2515	3950	4940	3770	2515	2605	1975	1345
125-100-0250	6645	4310	5300	6825	3860	2425	4850	3145	5030	4940	3770	2515	3595	2695	1795
125-100-0251	6645	4310	5300	6825	3860	2425	4850	3145	5030	4940	3770	2515	3595	2695	1795
125-100-0253	6645	4310	5300	6825	3860	2425	4850	3145	5030	4940	3770	2515	3595	2695	1795
125-100-0315	6645	4310	5300	6825	3860	2425	4850	3145	5030	4940	3770	2515	3595	2695	1795
125-100-0400	6645	4310	5300	6825	3860	2425	4850	3145	5030	4940	3770	2515	3595	2695	1795
125-100-0403	6645	4310	5300	6825	3860	2425	4850	3145	5030	4940	3770	2515	3595	2695	1795
150-125-0500	8445	5570	6735	8710	5300	3325	6645	4310	6825	6200	4760	3145	4940	3770	2515
150-125-0503	8445	5570	6735	8710	5300	3325	6645	4310	6825	6200	4760	3145	4940	3770	2515
150-150-0311	8445	5570	6735	8710	6735	4220	8445	5570	8710	6200	4760	3145	6200	4760	3145
150-150-0315	8445	5570	6735	8710	6735	4220	8445	5570	8710	6200	4760	3145	6200	4760	3145
150-150-0400	8445	5570	6735	8710	6735	4220	8445	5570	8710	6200	4760	3145	6200	4760	3145
150-150-0403	8445	5570	6735	8710	6735	4220	8445	5570	8710	6200	4760	3145	6200	4760	3145
200-200-0320	13205	8445	10240	13295	10240	6380	13205	8445	13295	9520	6915	4760	9520	6915	4760

14 For temperatures >20 °C: adjust the values in accordance with the associated temperature correction diagram (correction coefficient for material variant DDDD).

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]
200-200-0400	13205	8445	10240	13295	10240	6380	13205	8445	13295	9520	6915	4760	9520	6915	4760
200-200-0403	13205	8445	10240	13295	10240	6380	13205	8445	13295	9520	6915	4760	9520	6915	4760
200-200-0500	13205	8445	10240	13295	10240	6380	13205	8445	13295	9520	6915	4760	9520	6915	4760
200-200-0501	13205	8445	10240	13295	10240	6380	13205	8445	13295	9520	6915	4760	9520	6915	4760
200-200-0503	13205	8445	10240	13295	10240	6380	13205	8445	13295	9520	6915	4760	9520	6915	4760
250-250-0315	17965	12035	14370	18770	14370	8980	17965	12035	18770	13470	10240	6555	13470	10240	6555
250-250-0400	17965	12035	14370	18770	14370	8980	17965	12035	18770	13470	10240	6555	13470	10240	6555
250-250-0403	17965	12035	14370	18770	14370	8980	17965	12035	18770	13470	10240	6555	13470	10240	6555
250-250-0500	17965	12035	14370	18770	14370	8980	17965	12035	18770	13470	10240	6555	13470	10240	6555
250-250-0503	17965	12035	14370	18770	14370	8980	17965	12035	18770	13470	10240	6555	13470	10240	6555
250-250-0630	17965	12035	14370	18770	14370	8980	17965	12035	18770	13470	10240	6555	13470	10240	6555
250-250-0634	17965	12035	14370	18770	14370	8980	17965	12035	18770	13470	10240	6555	13470	10240	6555
300-300-0400	21555	14370	17965	22995	17965	11045	21555	14370	22995	16435	12395	8085	16435	12395	8085
300-300-0500	21555	14370	17965	22995	17965	11045	21555	14370	22995	16435	12395	8085	16435	12395	8085
300-300-0503	21555	14370	17965	22995	17965	11045	21555	14370	22995	16435	12395	8085	16435	12395	8085
350-350-0400	23980	15630	19220	24790	19220	12035	23980	15630	24790	17155	12845	8445	17155	12845	8445
350-350-0500	23980	15630	19220	24790	19220	12035	23980	15630	24790	17155	12845	8445	17155	12845	8445
350-350-0630	23980	15630	19220	24790	19220	12035	23980	15630	24790	17155	12845	8445	17155	12845	8445
350-350-0633	23980	15630	19220	24790	19220	12035	23980	15630	24790	17155	12845	8445	17155	12845	8445
400-400-0500	24580	16750	20170	26210	20170	13300	24580	16750	26210	20375	15540	10825	20375	15540	10825
400-400-0533	24580	16750	20170	26210	20170	13300	24580	16750	26210	20375	15540	10825	20375	15540	10825
400-400-0583	24580	16750	20170	26210	20170	13300	24580	16750	26210	20375	15540	10825	20375	15540	10825
500-400-0710	25580	18635	21755	28645	20170	13300	24580	16750	26210	25050	19420	14285	20375	15540	10825
500-400-0713	25580	18635	21755	28645	20170	13300	24580	16750	26210	25050	19420	14285	20375	15540	10825
500-500-0544	25580	18635	21755	28645	21755	16600	25580	18635	28645	25050	19420	14285	25050	19420	14285
500-500-0630	25580	18635	21755	28645	21755	16600	25580	18635	28645	25050	19420	14285	25050	19420	14285
500-500-0633	25580	18635	21755	28645	21755	16600	25580	18635	28645	25050	19420	14285	25050	19420	14285
500-500-0637	25580	18635	21755	28645	21755	16600	25580	18635	28645	25050	19420	14285	25050	19420	14285
600-600-0663	26405	20170	23050	30625	23050	19900	26405	20170	30625	29340	23145	17995	29340	23145	17995
600-600-0669	26405	20170	23050	30625	23050	19900	26405	20170	30625	29340	23145	17995	29340	23145	17995

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

Table 12: Material variants GNNG, GHHH, GDNG, HHHH (grey cast iron, NORIHARD): permissible forces and moments at the pump nozzles[15)]

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]
065-040-0250	1750	1150	1400	1800	850	550	1100	700	1100	1150	850	600	550	450	300
080-040-0315	2150	1400	1700	2200	850	550	1100	700	1100	1450	1100	750	550	450	300
065-050-0200	1750	1150	1400	1800	1100	700	1350	900	1400	1150	850	600	700	550	350
065-050-0201	1750	1150	1400	1800	1100	700	1350	900	1400	1150	850	600	700	550	350
080-050-0400	2150	1400	1700	2200	1100	700	1350	900	1400	1450	1100	750	700	550	350
080-065-0200	2150	1400	1700	2200	1400	900	1750	1150	1800	1450	1100	750	1150	850	600
080-065-0201	2150	1400	1700	2200	1400	900	1750	1150	1800	1450	1100	750	1150	850	600
080-065-0313	2150	1400	1700	2200	1400	900	1750	1150	1800	1450	1100	750	1150	850	600
080-065-0315	2150	1400	1700	2200	1400	900	1750	1150	1800	1450	1100	750	1150	850	600
080-065-0400	2150	1400	1700	2200	1400	900	1750	1150	1800	1450	1100	750	1150	850	600
100-080-0250	2700	1750	2150	2750	1700	1100	2150	1400	2200	2000	1500	1000	1450	1100	750
100-080-0251	2700	1750	2150	2750	1700	1100	2150	1400	2200	2000	1500	1000	1450	1100	750
100-080-0311	2700	1750	2150	2750	1700	1100	2150	1400	2200	2000	1500	1000	1450	1100	750
100-080-0315	2700	1750	2150	2750	1700	1100	2150	1400	2200	2000	1500	1000	1450	1100	750
100-080-0400	2700	1750	2150	2750	1700	1100	2150	1400	2200	2000	1500	1000	1450	1100	750
100-080-0403	2700	1750	2150	2750	1700	1100	2150	1400	2200	2000	1500	1000	1450	1100	750
125-080-0500	3700	2400	2950	3800	1700	1100	2150	1400	2200	2750	2100	1400	1450	1100	750
125-100-0250	3700	2400	2950	3800	2150	1350	2700	1750	2800	2750	2100	1400	2000	1500	1000
125-100-0251	3700	2400	2950	3800	2150	1350	2700	1750	2800	2750	2100	1400	2000	1500	1000
125-100-0253	3700	2400	2950	3800	2150	1350	2700	1750	2800	2750	2100	1400	2000	1500	1000
125-100-0315	3700	2400	2950	3800	2150	1350	2700	1750	2800	2750	2100	1400	2000	1500	1000
125-100-0400	3700	2400	2950	3800	2150	1350	2700	1750	2800	2750	2100	1400	2000	1500	1000
125-100-0403	3700	2400	2950	3800	2150	1350	2700	1750	2800	2750	2100	1400	2000	1500	1000
150-125-0500	4700	3100	3750	4850	2950	1850	3700	2400	3800	3450	2650	1750	2750	2100	1400
150-125-0503	4700	3100	3750	4850	2950	1850	3700	2400	3800	3450	2650	1750	2750	2100	1400
150-150-0311	4700	3100	3750	4850	3750	2350	4700	3100	4850	3450	2650	1750	3450	2650	1750
150-150-0315	4700	3100	3750	4850	3750	2350	4700	3100	4850	3450	2650	1750	3450	2650	1750
150-150-0400	4700	3100	3750	4850	3750	2350	4700	3100	4850	3450	2650	1750	3450	2650	1750
150-150-0403	4700	3100	3750	4850	3750	2350	4700	3100	4850	3450	2650	1750	3450	2650	1750
200-200-0320	7350	4700	5700	7400	5700	3550	7350	4700	7400	5300	3850	2650	5300	3850	2650

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

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]
200-200-0400	7350	4700	5700	7400	5700	3550	7350	4700	7400	5300	3850	2650	5300	3850	2650
200-200-0403	7350	4700	5700	7400	5700	3550	7350	4700	7400	5300	3850	2650	5300	3850	2650
200-200-0500	7350	4700	5700	7400	5700	3550	7350	4700	7400	5300	3850	2650	5300	3850	2650
200-200-0501	7350	4700	5700	7400	5700	3550	7350	4700	7400	5300	3850	2650	5300	3850	2650
200-200-0503	7350	4700	5700	7400	5700	3550	7350	4700	7400	5300	3850	2650	5300	3850	2650
250-250-0315	10000	6700	8000	10450	8000	5000	10000	6700	10450	7500	5700	3650	7500	5700	3650
250-250-0400	10000	6700	8000	10450	8000	5000	10000	6700	10450	7500	5700	3650	7500	5700	3650
250-250-0403	10000	6700	8000	10450	8000	5000	10000	6700	10450	7500	5700	3650	7500	5700	3650
250-250-0500	10000	6700	8000	10450	8000	5000	10000	6700	10450	7500	5700	3650	7500	5700	3650
250-250-0503	10000	6700	8000	10450	8000	5000	10000	6700	10450	7500	5700	3650	7500	5700	3650
250-250-0630	10000	6700	8000	10450	8000	5000	10000	6700	10450	7500	5700	3650	7500	5700	3650
250-250-0634	10000	6700	8000	10450	8000	5000	10000	6700	10450	7500	5700	3650	7500	5700	3650
300-300-0400	12000	8000	10000	12800	10000	6150	12000	8000	12800	9150	6900	4500	9150	6900	4500
300-300-0500	12000	8000	10000	12800	10000	6150	12000	8000	12800	9150	6900	4500	9150	6900	4500
300-300-0503	12000	8000	10000	12800	10000	6150	12000	8000	12800	9150	6900	4500	9150	6900	4500
350-350-0400	13350	8700	10700	13800	10700	6700	13350	8700	13800	9550	7150	4700	9550	7150	4700
350-350-0500	13350	8700	10700	13800	10700	6700	13350	8700	13800	9550	7150	4700	9550	7150	4700
350-350-0630	13350	8700	10700	13800	10700	6700	13350	8700	13800	9550	7150	4700	9550	7150	4700
350-350-0633	13350	8700	10700	13800	10700	6700	13350	8700	13800	9550	7150	4700	9550	7150	4700
400-400-0500	13900	10750	11950	16070	11950	6915	13900	10750	16070	9700	7950	6900	9700	7950	6900
400-400-0533	13900	10750	11950	16070	11950	6915	13900	10750	16070	9700	7950	6900	9700	7950	6900
400-400-0583	13900	10750	11950	16070	11950	6915	13900	10750	16070	9700	7950	6900	9700	7950	6900
500-400-0710	16600	13450	14950	21110	11950	6915	13900	10750	16070	14450	11800	10250	9700	7950	6900
500-400-0713	16600	13450	14950	21110	11950	6915	13900	10750	16070	14450	11800	10250	9700	7950	6900
500-500-0544	16600	13450	14950	21110	14950	8600	16600	13450	21110	14450	11800	10250	14450	11800	10250
500-500-0630	16600	13450	14950	21110	14950	8600	16600	13450	21110	14450	11800	10250	14450	11800	10250
500-500-0633	16600	13450	14950	21110	14950	8600	16600	13450	21110	14450	11800	10250	14450	11800	10250
500-500-0637	16600	13450	14950	21110	14950	8600	16600	13450	21110	14450	11800	10250	14450	11800	10250
600-600-0663	19900	16150	17950	24140	17950	10345	19900	16150	24140	20200	16600	14400	20200	16600	14400

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.

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

Unprotected rotating pulleys

Risk of injury by rotating pulleys!

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

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 / belt drive

After the pump set has been installed (⇨ Section 5.3, Page 25) and connected to the piping (⇨ Section 5.4, Page 27) , check the coupling alignment or belt drive.

5.6.1 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.

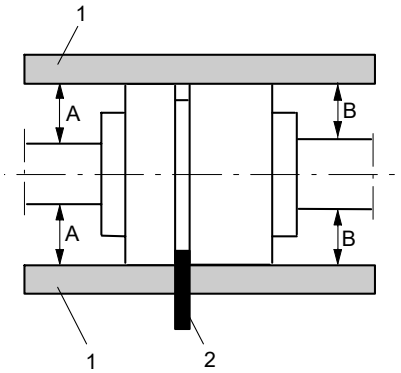

Fig. 14: Non-spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

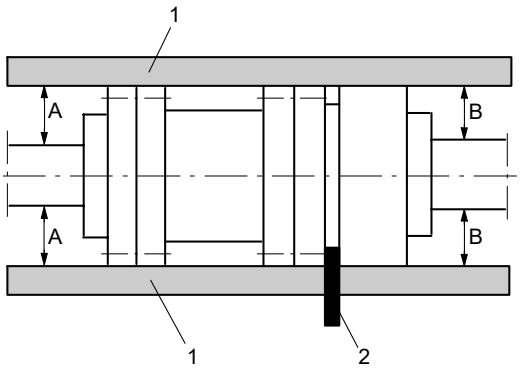

Fig. 15: Spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

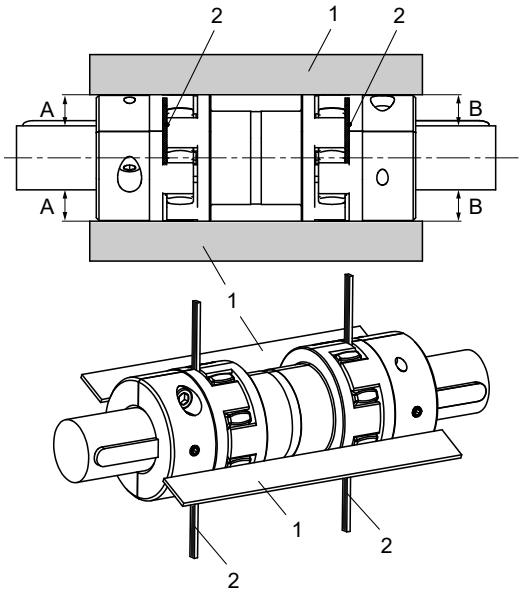

Fig. 16: Double Cardan spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

Table 13: Permissible alignment offset of coupling halves

Coupling type	Radial offset [mm]	Axial offset [mm]
Non-spacer-type coupling (⇨ Fig. 14)	≤ 0,1	≤ 0,1
Spacer-type coupling (⇨ Fig. 15)	≤ 0,1	≤ 0,1
Double Cardan coupling (⇨ Fig. 16)	≤ 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.

5.6.2 Checking the belt drive

CAUTION

Poorly checked, inaccurately aligned motor connection

Increased wear, insufficient power transmission, loud running noises!

- ▹ Always use clean pulleys without any signs of wear.
- ▹ Align the shaft end of pump/motor flush with the pulleys.
- ▹ For multiple V-belt drives: Use V-belts of equal lengths.
- ▹ Tension the V-belts properly.

5.6.2.1 Checking the pulleys and V-belts

✓ The information on checking the belt drive has been observed. (⇨ Section 5.6.2, Page 38)

1. Remove the belt guard.
2. Check the pulleys and the V-belts.
   - ⇨ The V-belts are not worn.
   - ⇨ All V-belts of a multiple V-belt drive have the same length.
3. Replace any pulleys worn as a result of burrs or rust.
4. Clean any dirty pulleys and remove burrs if necessary.

NOTE

If V-belts need to be replaced, always replace the entire set of belts.

5.6.2.2 Checking the alignment of pump and motor shaft

✓ The notes and steps stated in (⇨ Section 5.6.2, Page 38) to (⇨ Section 5.6.2.1, Page 38) have been observed/carried out.

1. Measure the distance between the shaft stubs in two points with a straight-edge.
   The shafts are correctly aligned if the distances measured in both points are equal (parallel axes).
2. If the distances differ, align the motor bracket by turning threaded rods 904.23/904.24 until equal distances are measured in both points.

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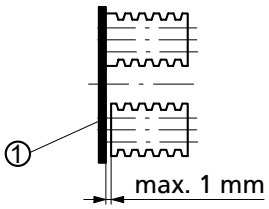

Fig. 17: Checking the pulley alignment

5.6.2.3 Checking the alignment of the pulleys

✓ The notes and steps stated in (⇨ Section 5.6.2.1, Page 38) to (⇨ Section 5.6.2.2, Page 38) have been observed/carried out.

✓ Required tools: wedge gauge, straight-edge

1. Place the straight-edge (1) vertically on both pulleys.
2. Leave the straight-edge (1) in this position and turn the measuring point by hand.
3. Adjust the alignment, if required. (⇨ Section 7.5.9, Page 79)
4. Re-fit the belt guard.

5.6.2.4 Checking the belt tension

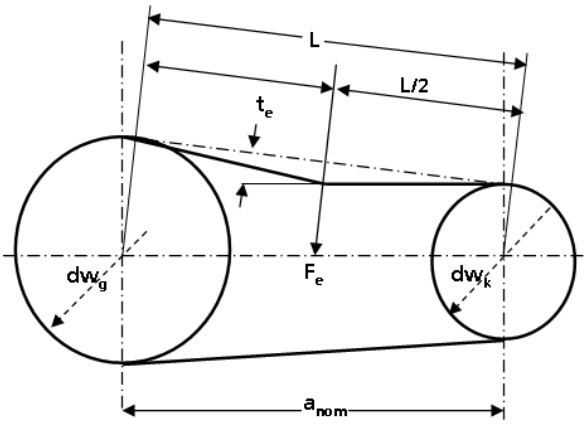

Fig. 18: Tension check for V-belts

✓ The notes and steps stated in (⇨ Section 5.6.2, Page 38) to (⇨ Section 5.6.2.3, Page 39) have been observed/carried out.

1. Check the V-belt tension with a belt tension measuring tool (measuring tool not included in the scope of supply).
2. If the tension is incorrect, tension the V-belt. (⇨ Section 5.7.3, Page 41)

Tension forces for V-belts

Table 14: Form for tension forces

Characteristic	Value	Unit
Test force [F_e]	.....	N
Deflection distance of individual belts [t_e]	.....	mm
The set of V-belts consists of: ▪ Number of belts: ▪ Dimension: ▪ Effective length [LW]	....	 mm
Diameter of large pulley [dw_g]	.....	mm
Diameter of small pulley [dw_k] Speed [n]	....	mm rpm
Distance between pulleys [$a_{nom.}$]	.....	mm

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.

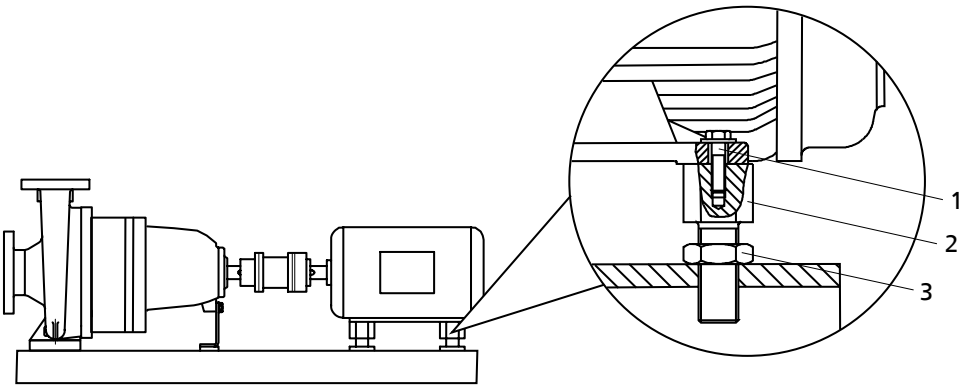

Fig. 19: Motor with adjusting screw

1	Hexagon head bolt	2	Adjusting screw
3	Lock nut		

✓ The coupling is misaligned (⇨ Section 5.6.1, Page 36) .

✓ 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 '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.

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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.

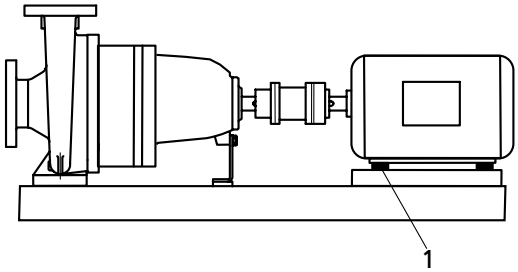

Fig. 20: Pump set with shim

1	Shim

✓ Misalignment of the coupling (⇨ Section 5.6.1, Page 36) .

✓ 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 '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.

5.7.3 Pump sets with belt drive

CAUTION

Incorrect tension

Insufficient power transmission! Increased wear of the V-belt!

- ▹ Always ensure correct tensioning of the V-belt.

✓ The belt guard has been removed.

✓ The tension of the V-belt is too low or too high (⇨ Section 5.6.2.4, Page 39) .

1. Move motor bracket 81-54.01 up or down by turning threaded rods 904.23/904.24 until the V-belt is tensioned correctly.
   Tension forces (⇨ Section 5.6.2.4, Page 39)
2. Check the V-belt tension with a belt tension measuring tool (measuring tool not included in the scope of supply).
3. Check the tension again between ½ hour and 1 hour after initial operation.

4. If the tension is too low or too high, re-adjust the motor bracket and check the tension again.

⚠ WARNING

Unprotected rotating pulleys

Risk of injury by rotating pulleys!

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

5. Re-fit the belt guard.
6. Check the distance between V-belt and belt guard.
   The belt guard must not touch the V-belt.

5.8 Electrical connection

⚠ DANGER

Electrical connection work by unqualified personnel

Risk of fatal injury due to electric shock!

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

⚠ 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 15: Time relay settings for star-delta starting:

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

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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.

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6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up

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

- The pump set has been mechanically connected as specified.
- The pump set has been properly connected to the power supply and is equipped with all protection devices. (⇨ Section 5.8, Page 42)
- The pump has been filled with the fluid handled and vented. (⇨ Section 6.1.4, Page 47)
- The direction of rotation has been checked. (⇨ Section 5.9, Page 43)
- All auxiliary connections required are connected and operational.
- 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 55)

6.1.2 Filling in lubricants

Oil-lubricated bearings

Fill the bearing bracket with lubricating oil.
Oil quality see
Oil quantity see (⇨ Section 7.2.3.1.3, Page 61)

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.

NOTE

If no constant level oiler is provided on the bearing bracket, the oil level can be read in the middle of the oil level gauge arranged at the side of the bearing bracket (optional).

Figure 4H: If access to the vent nozzle is difficult or impossible, the oil can be filled in through the connection elbow of the constant level oiler.

Make sure that the indicated oil level is within the scale.

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.

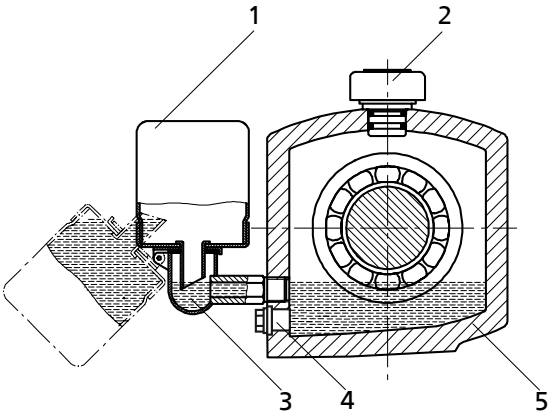

Fig. 21: Bearing bracket with constant level oiler

1	Constant level oiler	2	Vent plug
3	Connection elbow of the constant level oiler	4	Screw plug
5	Bearing bracket		

1. Pull out the vent plug (2).
2. Hinge down the reservoir of the constant level oiler (1) from the bearing bracket (5) and hold it in this position.
3. Fill in oil through the hole for the vent plug until the oil reaches the connection elbow of the constant level oiler (3).
4. Completely fill the reservoir of the constant level oiler (1).
5. Snap the constant level oiler (1) back into its operating position.
6. Fit the vent plug (2) again.
7. After approximately 5 minutes, check the oil level in the glass reservoir of the constant level oiler (1).
   The oil reservoir must be properly filled at all times to provide a constant oil level. Repeat steps 1 - 6, if necessary.
8. To check the function of the constant level oiler (1), slowly drain some oil via the screw plug (4) until air bubbles can be seen in the oil reservoir.

NOTE

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

6.1.3 Preparing the shaft seal

Shaft seals are fitted prior to delivery.
Observe the instructions on dismantling (⇨ Section 7.4.6, Page 66) or assembly (⇨ Section 7.5.4, Page 71) .

Quench reservoir If applicable, fill the quench reservoir in accordance with the general arrangement drawing.

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

Gland packing Cool the gland packing to the following criteria:

Table 16: Cooling the gland packing

Characteristic	Value
Fluid temperature	≥ 105 °C
	≥ 90 °C and contaminated fluids

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Characteristic	Value
Cooling water quantity at an inlet temperature of 20 °C	0.5 to 5 l/min[16)]
Connections	See general arrangement drawing.

Double mechanical seal

Prior to starting up the pump, apply barrier pressure or supply flushing/quench liquid as specified in the general arrangement drawing.

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.

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.

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.

16 Depending on the fluid temperature

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 / belt guard and, if applicable, the coupling guard footboard.
2. Check the coupling/belt drive alignment, re-align if necessary.
   (⇨ Section 5.6, Page 36) or (⇨ Section 5.7, Page 40)
3. Check proper functioning of coupling, shaft and belt drive.
   Check that the coupling / shaft can be easily rotated by hand.
4. Fit the coupling guard / belt guard and, if applicable, the coupling guard footboard.
5. Check the distance between the coupling and the coupling guard / between the pulleys and the belt guard.
   The coupling guard must not touch the coupling, the belt guard must not touch the pulleys.

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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 47)
- Always operate the pump within the permissible operating range.

CAUTION

Abnormal noises, vibrations, temperatures or leakage

Damage to the pump!

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

✓ The system piping has been cleaned.

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

✓ The lines for priming and venting have been closed.

CAUTION

Start-up against open discharge line

Motor overload!

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

1. Fully open the shut-off element in the suction head/suction lift line.
2. Close or slightly open the shut-off element in the discharge line.
3. Start up the motor.

4. Immediately after the pump has reached full rotational speed, slowly open the shut-off element in the discharge line and adjust it to comply with the duty point.

CAUTION

Misalignment of pump and belt drive

Damage to pump, motor and belt drive!

- ▹ When the operating temperature has been reached, switch off the pump set and check the belt drive alignment.

5. Check the alignment of coupling and belt drive, if any, and re-align if necessary.

6.1.8 Checking the shaft seal

Mechanical seal

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

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.

Gland packing

The gland packing must drip slightly during operation.

Continuously check the throughflow of any barrier fluid and flushing liquid connections provided.

DANGER

Excessive temperatures caused by gland packings

Hot or toxic fluids escaping!

Damage to the pump!

- ▹ Gland packings must be packed properly.
- ▹ If the gland packing has been tightened to the limit, the gland has to be completely repacked.

Pure graphite packing

If pure graphite packing rings are used, there must always be some leakage.

Table 17: Leakage rate of the pure graphite packing (rings)

Quantity	Values
Minimum	10 cm^3/min
Maximum	20 cm^3/min

Adjusting the leakage

Prior to commissioning

1. Only lightly tighten the nuts of the gland follower by hand.
2. Use a feeler gauge to verify that the gland follower is mounted centred and at a right angle to the shaft.

⇨ The gland must leak after the pump has been primed.

After five minutes of operation

⚠ WARNING

Unprotected rotating parts

Risk of personal injury!

- ▷ Do not touch rotating parts.
- ▷ When the pump is running, perform any work with utmost caution.

The leakage can be reduced.

1. Tighten the nuts on the gland follower by 1/6 turn.
2. Monitor the leakage for another five minutes.

Excessive leakage:
Repeat steps 1 and 2 until the minimum value has been reached.

Not enough leakage:
Slightly loosen the nuts at the gland follower.

No leakage:
Immediately switch off pump set!
Loosen the gland follower and repeat commissioning.

Checking the leakage

After the leakage has been adjusted, monitor the leakage for about two hours at maximum fluid temperature.
Check that enough leakage occurs at the gland packing at minimum fluid pressure.

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

NOTE

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

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:

1. Close the shut-off element in the suction line.
2. Close any auxiliary connections.
   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.

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 18: Permissible ambient temperatures

Permissible ambient temperature	Value
Maximum	50 °C 40 °C[17)]
Minimum	See data sheet.

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17 For compliance with 2014/34/EU (ATEX Equipment Directive). Higher ambient temperature possible in individual cases, see data sheet and name plate.

6.2.2 Frequency of starts

DANGER

Excessive surface temperature of the motor

Explosion hazard!

Damage to the motor!

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

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

Table 19: 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:

Unless specified otherwise in the characteristic curves, the following applies:

- Short-time duty
  - **For sizes < DN 600:** Q_{min} [18] = 0.1×Q_{BEP} [19]
  - **For sizes ≥ DN 600:** Q_{min} [18] = 0.4×Q_{BEP} [19]
- Continuous duty
  - **For sizes ≤ DN 125:** Q_{min} [18] = 0.2×Q_{BEP} [19]
  - **For sizes ≥ DN 150:** Q_{min} [18] = 0.3×Q_{BEP} [19]
  - **For 2-pole operation:** Q_{max} [20] = 1.1×Q_{BEP} [19]
  - **For 4-pole operation:** Q_{max} [20] = 1.25×Q_{BEP} [19]

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

18 Minimum flow rate

19 Best efficiency point

20 Maximum flow rate

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 20: Key

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

6.2.3.2 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}

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump (set) remains installed

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

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

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

✓ The pump has been properly drained. (⇨ Section 7.3, Page 62)

✓ The safety instructions for dismantling the pump have been observed.

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

1. Spray-coat the inside wall of the pump casing and, in particular, the impeller clearance areas with a preservative.
2. Spray the preservative through the suction nozzle and discharge nozzle.
   It is advisable to then close the pump nozzles (e.g. with plastic caps).
3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil and grease, food-approved if required) to protect them against corrosion.
   Observe the additional instructions on preservation. (⇨ Section 3.3, Page 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 45) (⇨ Section 6.2, Page 52)

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇨ Section 7, Page 56)

⚠ WARNING

Failure to re-install or re-activate protective devices

Risk of injury from moving parts or escaping fluid!

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

NOTE

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

7 Servicing/Maintenance

7.1 Safety regulations

DANGER

Improper cleaning of coated pump surfaces

Explosion hazard by electrostatic discharge!

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

DANGER

Sparks produced during servicing work

Explosion hazard!

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

DANGER

Improperly serviced pump set

Explosion hazard!

Damage to the pump set!

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

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 please refer to the enclosed "Addresses" booklet or visit "www.ksb.com/contact" on the Internet.

Never use force when dismantling and reassembling the pump set.

7.2 Servicing/Inspection

7.2.1 Supervision of operation

⚠ DANGER

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 52)

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. (⇨ Section 6.1.2, Page 45)
- Check the shaft seal. (⇨ Section 6.1.8, Page 50)
- 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 Visual inspection through the inspection hole (optional)

If there are problems with clogging, the inside of the casing and the impeller can be checked via the inspection hole.

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.

⚠ WARNING

Hands or foreign objects in the pump casing

Risk of injuries, damage to the pump!

- ▷ Check that the inside of the pump is free from any foreign objects. Remove any foreign objects.
- ▷ Never insert your hands or any other objects into the pump, if the pump set has not been disconnected from the power supply and secured against unintentional start-up.

If a problem has occurred which requires visual inspection, observe the following instructions:

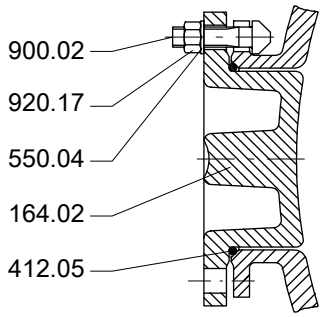

Fig. 22: Inspection hole in the casing

Opening the inspection hole

- Close the shut-off element on the suction side.
- Switch off the drive and make sure it cannot be re-started unintentionally.
- Close the shut-off element on the discharge side.
- Open the drain plug (auxiliary connection 6B).
- Collect and dispose of any liquid residues.
- Loosen nuts 920.17 at the inspection hole. Remove inspection cover 164.02.
- Perform a visual inspection with a lamp or similar.

Closing the inspection hole

- Fit new O-ring 412.05.
- Fit inspection cover 164.02.
- Fit discs 550.04 and nuts 920.17 on screws 900.02. Tighten the nuts.
- Observe the instructions on commissioning/start-up.

7.2.2.5 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.

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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 21: Oil change intervals

Oil change	Interval[21]	
	Bearing bracket up to P04ax	Bearing bracket from P05ax
Change of initial oil fill	After 300 operating hours	After 300 operating hours
Further oil changes	Every 6000 operating hours[22]	Every 8000 operating hours[22]

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

7.2.3.1.2 Oil quality

Table 22: Lubricant characteristics

Code	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[23]	0-175 °C

7.2.3.1.3 Oil quantity

Table 23: Standard bearing assembly

Bearing bracket	Rolling element bearing		Oil quantity [l]
	Pump end[24]	Drive end[25]	
P03ax	NU 409	2 x 7309 B-UA	0,5
P04ax	NU 411	2 x 7311 B-UA	0,6
P05ax	NU 413	2 x 7313 B-UA	1,8
P06x	NU 413	2 x 7313 B-UA	1,8
P08sx	NU 416	2 x 7319 B-UA	4,5
P10ax	NU 324	2 x 7224 B-UA	4
P12sx	NU 324	2 x 7224 B-UA	4

21 At temperatures up to 90 °C at the bearing

22 At least once a year

23 For ambient temperatures below 0 °C use a different suitable type of lubricating oil. Contact KSB.

24 To DIN 5412

25 To DIN 628

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.

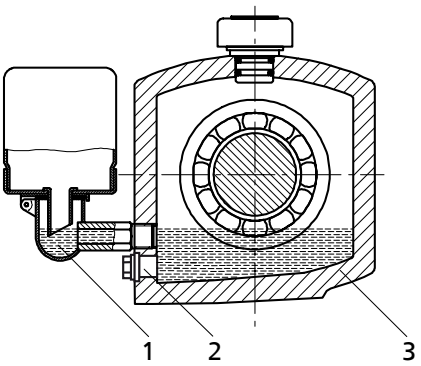

Fig. 23: Bearing bracket with constant level oiler

1	Constant level oiler	2	Screw plug
3	Bearing bracket		

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

1. Place the container underneath the screw plug.
2. Undo the screw plug (2) at the bearing bracket (3) and drain the oil.
3. Once the bearing bracket (3) has been drained, fit and tighten the screw plug (2) again.
4. Re-fill with oil.

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.

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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.

⚠ DANGER

Insufficient preparation of work on the pump (set)

Risk of injury!

- ▷ Properly shut down the pump set.
- ▷ Close the shut-off elements in the suction line and discharge line.
- ▷ Drain the pump and release the pump pressure.
- ▷ Shut off any auxiliary connections.
- ▷ Allow the pump set to cool down to ambient temperature.

⚠ 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.

NOTE

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

NOTE

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

Observe the safety instructions and information. (⇨ Section 7.1, Page 56)

For any work on the motor, observe the manufacturer's original operating manual.

For dismantling and reassembly observe the general assembly drawing.[26)]. (⇨ Section 9.1, Page 87)

26 In the case of any deviations or if you have any queries, contact KSB Service.

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 coupling guard or belt guard.
4. Remove the coupling spacer, if any.
5. Drain the oil fill of oil-lubricated bearings (⇨ Section 7.2.3.1.4, Page 62) .

7.4.3 Dismantling the motor

⚠ WARNING

Motor tipping over

Risk of squashing hands and feet!

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

Version with coupling

NOTE

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

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 63) to (⇨ Section 7.4.2, Page 64) have been observed and carried out.

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

Version with belt drive

1. Disconnect the motor from the power supply.
2. Lower motor support plate 81-54.01 by turning threaded rods 904.23/904.24 and nuts 920.63/920.64 until the V-belts slacken.
3. Remove the V-belts.
4. Undo and remove hexagon bolts 901.62 and discs 550.62 fastening the motor to the motor bracket.
5. Lift the motor off the motor bracket.
6. Undo hexagon nuts 920.23/920.24 at the pump or motor stand (Figure 3Z).
7. Remove the motor bracket from the pump or baseplate (Figure 3Z) and set it down.
8. Undo bushing 540.02 at pump-end V-belt pulley 882.01.
9. Remove V-belt pulley 882.01 from shaft 210.

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7.4.4 Removing the back pull-out unit

⚠ WARNING

Back pull-out unit tilting

Risk of squashing hands and feet!

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

✓ The steps and notes stated in (⇨ Section 7.4.1, Page 63) to (⇨ Section 7.4.3, Page 64) have been observed and carried out.

✓ On pump sets with a belt drive or pump sets with a coupling without spacer sleeve, the motor has been removed.

1. Loop a rope tightly around bearing bracket lantern 344.
2. Unbolt and remove support foot 183 from the baseplate.
3. Undo hexagon nuts 920.01 at the volute casing.
4. Pull the back pull-out unit out of volute casing 101.

NOTE

Use forcing screws 901.31 to facilitate disassembly.

Clean the threads of the forcing screws before using them.

5. Carefully place the back pull-out unit on a clean and level surface.
6. Remove and dispose of joint ring 411.10.

7.4.5 Dismantling the impeller

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®.

Bearing brackets P03ax, P04ax, P05ax, P06x

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 63) to (⇨ Section 7.4.4, Page 65) have been observed/carried out.

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

1. Undo impeller screw 906 (right-hand thread).[27)]
2. Remove and dispose of O-ring 412.03.
3. Remove impeller 230 with an impeller removal tool.[27)]
4. Place impeller 230 on a clean and level surface.
5. Remove keys 940.01 from shaft 210.

27 A special tool is available as an accessory.

Bearing brackets P08sx, P10ax, P12sx

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 63) to (⇨ Section 7.4.4, Page 65) have been observed/carried out.

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

1. Remove impeller hub cap 260.01.[27)]
2. Remove and dispose of O-ring 412.03.
3. Bend open lock washer 931.02.
4. Undo hexagon head bolt 901.87.
5. Remove the lock washer and disc 550.87.
6. Remove impeller 230 with an impeller removal tool.[27)]
7. Place impeller 230 on a clean and level surface.
8. Remove keys 940.01 from shaft 210.

7.4.6 Removing the shaft seal

7.4.6.1 Dismantling the mechanical seal – type 4K

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 63) to (⇨ Section 7.4.5, Page 65) have been observed and carried out.

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

✓ The impeller and keys have been removed from the pump shaft.

1. Position the bearing vertically by clamping it at the drive-end shaft end.
2. Pull shaft sleeve 523 with mating ring 475.52 of the mechanical seal and O-ring 412.06 off the shaft using an extractor in the removal groove in the shaft sleeve.
3. Pull mating ring 475.52 of the mechanical seal out of shaft sleeve 523.
4. Undo hexagon head bolts 901.22. Remove discharge cover 163 with joint ring 411.10 as well as the primary ring with the secondary seal and the spring arrangement from the bearing bracket lantern.
5. Press primary ring 472.53 with secondary seal 412.51 out of discharge cover 163.
6. Undo hexagon socket head cap screws 914 with springs 477 and thrust ring 474.53.

7.4.6.2 Dismantling the gland packing

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 63) to (⇨ Section 7.4.5, Page 65) have been observed/carried out.

✓ The back pull-out unit is kept in a clean and level assembly area.

1. Undo hexagon nuts 920.02 at gland follower 452.01.
2. Remove gland follower 452.01.
   Watch discs 550.01.
3. Undo hexagon head bolts 901.22. Then remove discharge cover 163 from bearing bracket lantern 344.
4. Remove discharge cover 163 with gland packing and drip plate 463.01.
5. Remove the gland packing from the packing chamber.
6. Press out neck bush 456.01.

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7.4.7 Dismantling the bearings

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 63) to (⇨ Section 7.4.6, Page 66) have been observed/carried out.

1. Undo hexagon nuts 920.04 and remove bearing bracket lantern 344.
2. Pull shaft protecting sleeve 524.01 with O-ring 412.06 off shaft 210.
3. Bend open and pull off thrower 507.01
4. Undo the hexagon socket head cap screw in the coupling hub.
5. Pull the coupling hub off shaft 210 with a puller.
6. Remove key 940.02.
7. Undo hexagon socket head cap screws 914.01/914.02. Then remove bearing cover 360.01 with gasket 400.01 and shaft seal ring 421.01 at the pump end.

NOTE

Bearing brackets P08sx, P10ax, P12sx only

- ▹ Remove V-ring 411.77.
- ▹ Undo hexagon socket head cap screws 914.01.
- ▹ Remove bearing cover 360.01 with gasket 400.01, thrower 507.11 and O-ring 412.36.

8. Use grub screws 904.01 (for bearing brackets P08sx/P10ax/P12sx: forcing screws 901.91) to carefully drive shaft 210 with bearing carrier 382, angular contact ball bearing 320.02 and the inner ring of cylindrical roller bearing 322.01 out of bearing bracket 330 towards the drive end.
9. Place shaft 210 with rolling element bearings on a suitable surface.
10. Remove support disc 550.23 and circlips 932.01/932.03.
11. Bearing brackets P08sx/P10ax/P12sx: remove V-ring 411.78.
12. Remove the outer ring of cylindrical roller bearing 322.01 (roller cage) from bearing bracket 330.
13. Pull bearing carrier 382 with O-ring 412.02 and shaft seal ring 421.01 off angular contact ball bearing 320.02.
14. Bend open lock washer 931.01.
15. Undo keywayed nut 920.21 (right-hand thread!)
16. Remove lock washer 931.01.
17. Bearing brackets P08sx/P10ax/P12sx: remove thrower 507.12.

⚠ WARNING

Hot surfaces due to heating of components for assembly/dismantling

Risk of burns!

- ▹ Wear heat-resistant protective gloves.
- ▹ Remove flammable substances from the danger zone.

18. Heat up angular contact ball bearing 320.02 and the inner ring of cylindrical roller bearing 322.01 to 80 °C, and pull them off shaft 210.

7.4.8 Removing the wear plate

NOTE

Wear plates made of CeramikPolySiC® are permanently fastened to pump casing 101 and have to be dismantled from pump casing 101 for replacement.

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®.

Sizes KWPK 250-250-315, 300-300-400, 350-350-400 and 400-400-500 are equipped with a casing wear ring instead of a wear plate.

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 63) to (⇨ Section 7.4.7, Page 67) have been observed/carried out.

1. Unscrew hexagon head bolts 901.03 or hexagon socket head cap screws 914.05.
2. Remove joint rings 411.13.
3. Remove wear plate 135.01 with O-rings 412.25/412.75.

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

CAUTION

Improper reassembly

Damage to the pump!

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

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

Sealing elements

- **Gaskets**
  - Always use new gaskets, making sure that they have the same thickness as the old ones.
  - Always fit gaskets of asbestos-free materials or graphite without using lubricants (e.g. copper grease, graphite paste).
- **O-rings**
  - Never use O-rings that have been made by cutting an O-ring cord to size and gluing the ends together.
- **Packing rings**
  - Always use pre-compressed packing rings.

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CAUTION

Contact of O-ring with graphite or similar material

Fluid could escape!

- ▷ Do not coat O-ring with graphite or similar material.
- ▷ Use animal fats or lubricants based on silicone or PTFE.

- **Assembly adhesives**
  - For gaskets, avoid the use of assembly adhesives if possible.
  - If assembly adhesives are required, use a commercially available contact adhesive (e.g. "Pattex").
  - Only apply adhesive at selected points and in thin layers.
  - Never use quick-setting adhesives (cyanoacrylate adhesives).
  - Coat the locating surfaces of the individual components and screwed connections with graphite or similar before reassembly.
  - Prior to reassembly, screw back any forcing screws and adjusting screws.

Tightening torques For reassembly, tighten all screws and bolts as specified in this manual.

7.5.2 Fitting the wear plate

NOTE

Wear plates made of CeramikPolySiC® are permanently fastened to pump casing 101 and have to be dismantled from pump casing 101 for replacement.

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®.

Sizes KWPK 250-250-315, 300-300-400, 350-350-400 and 400-400-500 are equipped with a casing wear ring instead of a wear plate.

- ✓ The individual parts have been placed in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
- ✓ The notes and steps stated in (⇨ Section 7.1, Page 56) have been observed/ carried out.

1. Fit O-rings 412.25/412.75 on wear plate 135.01.
2. Insert wear plate 135.01 into the pump casing.
3. Screw wear plate 135.01 to the pump casing with hexagon head bolts 914.05 or hexagon socket head cap screws 914.05 and O-rings 412.05/.75 or joint rings 411.13.
   Tightening torque (⇨ Section 7.6.1, Page 80)

7.5.3 Fitting the bearings

- ✓ The individual parts have been placed in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
- ✓ The notes and steps stated in (⇨ Section 7.5.1, Page 68) to (⇨ Section 7.5.2, Page 69) have been observed/carried out.

⚠ WARNING

Hot surfaces due to heating of components for assembly/dismantling

Risk of burns!

- ▹ Wear heat-resistant protective gloves.
- ▹ Remove flammable substances from the danger zone.

1. Heat up angular contact ball bearing 320.02 and the inner ring of cylindrical roller bearing 322.01 to approx. 80 °C in an oil bath.
2. Bearing brackets P10ax/P12sx: fit bush 500.21 on the shaft.
3. Slide angular contact ball bearing 320.02 and the inner ring of cylindrical roller bearing 322.01 onto shaft 210 until they will not go any further.

NOTE

Angular contact ball bearings must be installed in back-to-back arrangement. Angular contact ball bearings installed in pairs must always be from the same manufacturer.

4. Use a C-spanner to tighten slotted round nut 920.21 without lock washer 931.01.
5. Let angular contact ball bearing 320.02 cool down to approximately 5 °C above ambient temperature.
6. Re-tighten slotted round nut 920.21, then unscrew it again.
7. Apply a few spots of a suitable lubricant (e.g. Molykote) to the contact faces of lock washer 931.01 and slotted round nut 920.21.
8. Bearing brackets P08sx/P10ax/P12sx: remove disc 507.12.
9. Fit lock washer 931.01.
10. Tighten slotted round nut 920.21.
11. Bend over lock washer 931.01.
12. Pull bearing carrier 382 onto angular contact ball bearing 320.02.
13. Fit support disc 550.23.
    Bearing brackets P10ax/P12sx: When replacing the bearings, check and adjust the width of the support discs before installing the new bearings.
14. Fit circlips 932.01/932.03 in the bearing bracket / bearing carrier.
15. Fit the outer ring of angular contact ball bearing 322.01.
16. Carefully slide pre-assembled shaft 210 with bearing carrier 382, O-ring 412.02 and lip seal 421.02 from the drive end into bearing bracket 330 until it will not go any further.
    Verify that the oil return bores are positioned correctly.
17. Tighten hexagon socket head cap screws 914.02 (bearing brackets P08sx/P10ax/P12sx: hexagon head bolt 901.95).
    Tightening torque (⇨ Section 7.6.1, Page 80)
18. Insert studs 902.04.

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19. Bearing brackets P08sx/P10ax/P12sx : fit V-ring 411.78 and hexagon forcing screws 901.91.
    Make sure the external surfaces of V-rings 411.77/.78 are flush with the external surface of the bearing cover/bearing carrier.
20. Fit O-ring 412.36 and disc 507.11.
21. Fit pump-end bearing cover 360.01 with joint ring 400.01.
    Take care not to damage lip seal 421.01.
    Bearing brackets P08sx/P10ax/P12sx: Fit V-ring 411.77 instead of lip seal.
22. Tighten hexagon socket head cap screws 914.01 at the pump end.
    Tightening torque (⇨ Section 7.6.1, Page 80)
23. Fit bearing bracket lantern 344 with studs 902.04.
24. Tighten hexagon nuts 920.04 at the flange of bearing bracket 330.
25. Fit keys 940.02.
26. Slide the coupling hub onto the shaft end.
27. Secure the coupling hub with an adjusting screw.
28. Fit thrower 507.01, if any.

7.5.4 Fitting the shaft seal

7.5.4.1 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 seal faces immediately before installation takes place.
- Prevent any damage to the seal faces or O-rings.
- After inserting the mating ring, 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 measures to protect the surface of the shaft protecting sleeve from damage.
- On pumps with double mechanical seal, properly vent the mechanical seal chamber and apply the required pressure specified in the general arrangement drawing (also during standstill).
- Quench liquid supply must also be ensured during pump standstill.

Installing the mechanical seal, type 4 K

✓ The bearing assembly and the individual parts of mechanical seal 433 have been placed in a clean and level assembly area.

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

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

✓ The sealing surfaces have been cleaned.

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 68) to (⇨ Section 7.5.3, Page 70) have been observed/carried out.

1. Insert thrust ring 474 into the turned recess on the rear side of the discharge cover.
2. Slide springs 477 onto hexagon socket head cap screws 914.
3. Apply a thread-locking agent to the threads of hexagon socket head cap screws 914 (recommended).

Table 24: Tightening torques of hexagon socket head cap screws 914

Seal size	Thread	Tightening torque [Nm]
Small seal sizes	M6	8
Large seal sizes	M10	20

4. Thread hexagon socket head cap screws 914 with fitted springs 477 through the holes in thrust ring 474 and fasten them in the pump cover.
   Make sure that thrust ring 474 can move freely. When tightening the screws, make sure not to block the axial movement of the thrust ring.
   Tightening torque (⇨ Table 24)

CAUTION

Contact of O-ring with lubricant made of mineral grease or oil

Damage to the O-ring!

- ▷ Make sure that O-rings made of ethylene propylene rubber cannot come into contact with mineral oil or mineral grease.
- ▷ Make sure that O-rings made of silicone rubber cannot come into contact with silicone oil or silicone grease.

5. Coat O-ring 412.51 and the O-ring seat on primary ring 472.51 with a suitable lubricant.
6. Insert O-ring 412.51 into the groove of the discharge cover.
7. Carefully install primary ring 472.51.
   Make sure that thrust ring 474 can move freely. When tightening the screws, make sure not to block the axial movement of the thrust ring.
8. Mount the complete discharge cover with joint ring 411.10 on bearing bracket lantern 344.
9. Tighten hexagon head bolts 901.22.
   Tightening torque (⇨ Section 7.6.1, Page 80)
10. Insert O-ring 412.52 for mating ring 475.52 into shaft sleeve 523.

CAUTION

Use of grease or other permanent lubricants

Torque transmission impeded / overheating of and damage to the pump!

- ▷ Never use grease or other permanent lubricants for fitting the torque-transmitting elements of a mechanical seal.
- ▷ Use soft soap to reduce any friction caused during assembly.
- ▷ Never coat the mechanical seal faces with grease or oil.

11. Carefully press in mating ring 475.52.
12. For bearing brackets P08sx/P10ax/P12sx (mechanical seal sizes 80, 100, 120):
    Fit two torque-transmitting pins into the mating ring location of shaft sleeve 523.
    Make sure the two pins will engage in the recesses provided in the mating ring.
13. Dry and clean the seal faces (e.g. with acetone).
14. Slide shaft sleeve 523 with mating ring 475.52 onto pump shaft 210 until it abuts against the shaft shoulder.

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7.5.4.2 Packing the gland

Gland packing chamber

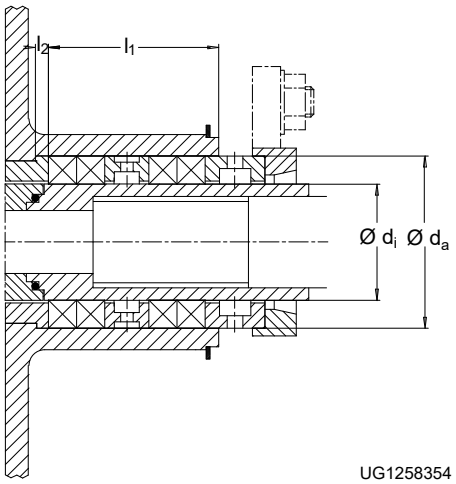

Fig. 24: Dimensions of the packing chamber / Number of packing rings

Table 25: Gland packing chamber

Bearing bracket	Gland packing chamber					Number of packing rings	
	$Ød_i$	$Ød_a$	□	l_1	l_2	with lantern ring	without lantern ring
P03ax	45	65	10	64	8	4[28)]	6
P04ax	55	75	10	64	8	4[28)]	6
P05ax	70	95	12,5	79	8	4[28)]	6
P06x	80	105	12,5	79	10	4[28)]	6
P08sx	100	132	16	103	10	4[28)]	6
P10ax	120	152	16	103	7	4[28)]	6
P12sx	140	172	16	103	7	4[28)]	6

28 For model 4 (see illustration "Available models"): 1 spacer ring and 3 packing rings

Models

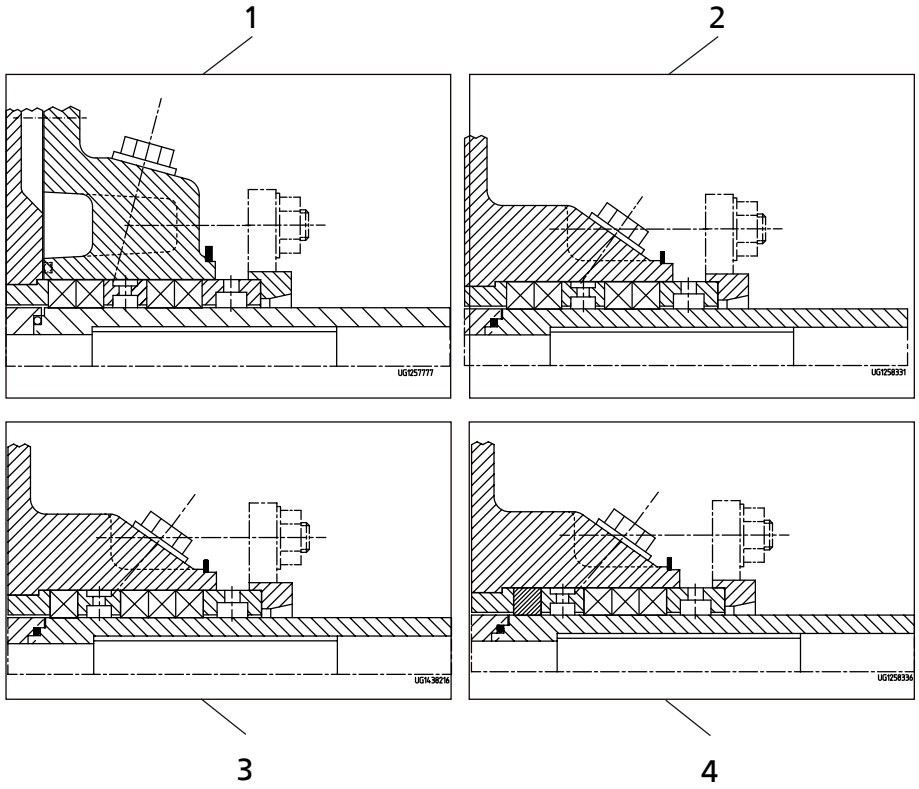

Fig. 25: Available models

1	P3 arrangement Gland packing with barrier fluid connection[29)]	2	P3 arrangement Gland packing with barrier fluid connection[30)]
3	P6 arrangement Gland packing with barrier fluid connection	4	P4 arrangement Gland packing with flushing liquid connection

Procedure

For variants with pure graphite packings see supplementary operating instructions. Always use pre-compressed packing rings.

- ✓ The bearing assembly as well as the individual parts are kept in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
- ✓ The notes and steps stated in (⇨ Section 7.5.1, Page 68) to (⇨ Section 7.5.3, Page 70) have been observed/carried out.

1. Screw stuffing box housing 451.01 (if any) to discharge cover 163. Tightening torque (⇨ Section 7.6.1, Page 80)
2. Press neck bush 456.01 into the discharge cover.
3. For packings with barrier fluid connection (see illustration "Available models" 1, 2 and 4) also fit lantern ring 458.01 in its specified location.
4. Insert the first packing ring, ensuring that its cut edge is in a horizontal position.
5. Hold the packing ring in place and slide shaft protecting sleeve 524 (chamfered side first) into the gland packing chamber from the pump end.
6. Slightly expand the inside diameter of the packing ring by moving shaft protecting sleeve 524 back and forth. Then pull out the shaft protecting sleeve. Insert each subsequent packing ring separately with its joint offset by approx.

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29 For material variants GHHH and HHHH
30 For all material variants except GHHH, HHHH

90° in relation to the previous one. Repeat the expansion procedure.
Insert lantern ring 458.01, if any, in its specified location (see illustration "Available models").
When the last packing ring has been inserted, shaft protecting sleeve 524 remains in the packing chamber.

7. Insert stuffing box ring 454.01 so that the joint face is in vertical position to gland follower 452.01.
8. Fit gland follower 452.01 and lightly fasten it by hand with the two hexagon nuts 920.02; watch discs 550.01.
9. Install the completely packed discharge cover 163 with joint ring 411.10 and shaft protecting sleeve 524 in the pump and screw it to bearing bracket lantern 344.
10. Tighten hexagon head bolts 901.22.
Tightening torque (⇨ Section 7.6.1, Page 80)

7.5.5 Fitting the impeller

Bearing brackets P03ax, P04ax, P05ax, P06x

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®.

✓ The bearing assembly with the shaft seal and the individual parts have been placed in a clean and level assembly area.
✓ All dismantled parts have been cleaned and checked for wear.
✓ Any damaged or worn parts have been replaced by original spare parts.
✓ The sealing surfaces have been cleaned.
✓ Impeller bore, shaft and keyways are clean and free from burrs.
✓ The notes and steps stated in (⇨ Section 7.5.1, Page 68) to (⇨ Section 7.5.4, Page 71) have been observed and carried out.

1. Insert keys 940.01 into the shaft keyway.
2. Fit O-ring 412.06 on shaft protecting sleeve 524.01.
3. Mount the impeller with an impeller fitting and removal tool[31)].
4. Insert O-ring 412.03.
5. Insert and tighten impeller screw 906.[31)]
Tightening torque (⇨ Section 7.6.1, Page 80)
6. Check the axial rotor adjustment and correct if necessary.
Make sure the distance between the back vane/impeller 230 and discharge cover 163 is ≤ 1.5 mm.

Bearing brackets P08sx, P10ax, P12sx

✓ The bearing assembly/mechanical seal as well as the individual parts have been placed in a clean and level assembly area.
✓ All dismantled parts have been cleaned and checked for wear.
✓ Any damaged or worn parts have been replaced by original spare parts.

31 A special tool is available as an accessory.

✓ The sealing surfaces have been cleaned.

✓ Impeller bore, shaft and keyways are clean and free from burrs.

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 68) to (⇨ Section 7.5.4, Page 71) have been observed and carried out.

1. Insert keys 940.01 into the shaft keyway.
2. Fit O-ring 412.06 on shaft protecting sleeve 524.01.
3. Mount the impeller with an impeller fitting and removal tool[31)].
4. Fit disc 550.87 and lock washer 931.02.
5. Tighten hexagon head bolt 901.87.
   Tightening torque (⇨ Section 7.6.1, Page 80)
6. Fit impeller hub cap 260 with O-ring 412.03.[31)]
7. Check the axial rotor adjustment and correct if necessary.
   Make sure the distance between the back vane/impeller 230 and discharge cover 163 is ≤ 1.5 mm.

7.5.6 Installing the back pull-out unit

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®.

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 68) to (⇨ Section 7.5.5, Page 75) have been observed/carried out.

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

✓ The sealing surfaces have been cleaned.

✓ For back pull-out units without coupling, fit the coupling in accordance with the manufacturer's instructions.

1. Mount support foot 183.
2. If required, suspend or support the back pull-out unit to prevent it from tipping over.
3. Slide the back pull-out unit with new gasket 411.10 into pump casing 101.
   Make sure that the impeller does not abut against the wear plate.
4. Tighten nuts 920.01.
5. Bolt support foot 183 to the baseplate.

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7.5.7 Adjusting the diagonal gap

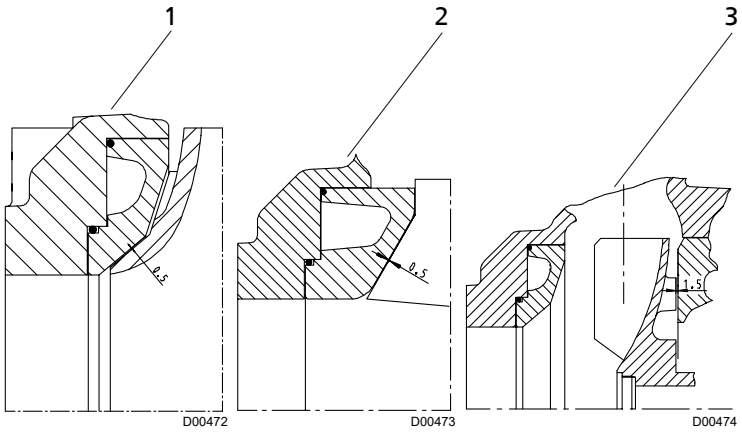

Fig. 26: KWP clearances

1	Impeller type K	2	Impeller type O
3	Impeller type F		

Table 26: Clearances between impeller and wear plate / between back vane and discharge cover

Impeller type	Nominal diameter of the discharge nozzle	Clearance
KWP K	< DN 300	0.50 mm + 0.1
	DN 300 to DN 600	0.60 mm + 0.1
KWP O	-	0.50 mm + 0.1
KWP F	-	1.50 mm + 0.1

NOTE

If the clearance indicated is exceeded by more than 0.5 mm the diagonal gap must be re-adjusted as described below.

Closed impeller (KWP K) and open impeller (KWP O)

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 68) to (⇨ Section 7.5.6, Page 76) have been observed/carried out.

1. Undo grub screws 904.01 or (for bearing brackets P10ax, P12sx) hexagon head bolts 901.91.
2. Use hexagon socket head cap screws 914.02 to shift the bearing carrier together with the rotor towards the pump end until they rest against wear plate 135.01.
3. Measure the axial clearance between bearing bracket 330 and bearing carrier 382.
4. Undo hexagon socket head cap screws 914.02 or (for bearing brackets P10ax, P12sx) hexagon head bolts 901.95.
5. Use grub screws 904.01 or (for bearing brackets P10ax, P12sx) hexagon head bolts 901.91 to pull the rotor back out towards the drive.
6. Adjust the clearance between the impeller and the wear plate as indicated.
7. **Bearing brackets P03ax, P04ax, P05ax, P06x**
   Lock the rotor in position by tightening hexagon socket head cap screws 914.02. The adjusted clearance remains secured by the grub screws.
   Bearing bracket P08sx
   Lock the rotor in position by tightening hexagon head bolts 901.95. The adjusted clearance remains secured by grub screws 904.01.
   Make sure the remaining gap between the bearing bracket and the bearing carrier is free from grease. Then close it with acrylate sealant.
   Bearing brackets P10ax, P12sx
   Fasten the rotor by inserting shims 89-4.12 at bolts 901.95.

Tighten hexagon head bolts 901.95.
The adjusted clearance remains secured by hexagon head bolts 901.91.
Make sure the remaining gap between the bearing bracket and the bearing carrier is free from grease. Then close it with acrylate sealant.
Tightening torque (⇨ Section 7.6.1, Page 80)

Free flow impeller (KWP F)

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 68) to (⇨ Section 7.5.6, Page 76) have been observed/carried out.

1. Undo hexagon socket head cap screws 914.02.
2. Screw in grub screws 904.01 to pull back the rotor until it will not go any further (impeller back vanes at discharge cover 163).
3. Measure the axial clearance between bearing bracket 330 and bearing carrier 382.
4. Undo grub screws 904.01 and use hexagon socket head cap screws 914.02 to move the rotor 1.5 mm towards the pump end.
5. Lock the rotor in position by tightening grub screws 904.01.
   Tightening torque (⇨ Section 7.6.1, Page 80)

Remaining steps to be completed (for all impeller types)

1. Fit forcing screws 901.30 on bearing bracket lantern 344 and forcing screws 901.31 on discharge cover 330.
2. For components which are not rotation-symmetrical, fit guard 680.11 (perforated plate) to bearing bracket lantern 344.
   Threaded holes 12 x M6 x 10 are provided.

7.5.8 Mounting the motor

Version with coupling

NOTE

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

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 68) to (⇨ Section 7.5.7, Page 77) have been observed/carried out.

1. Shift the motor to align and connect it with the pump via (⇨ Section 5.7, Page 40) the coupling.
2. Fasten the motor to the baseplate.
3. Align the pump and motor. (⇨ Section 5.7, Page 40)
4. Connect the motor to the power supply (refer to manufacturer's product literature).

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Version with belt drive

⚠ WARNING

Motor tipping over

Risk of squashing hands and feet!

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

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 68) to (⇨ Section 7.5.7, Page 77) have been observed/carried out.

1. Position motor support plate 81-54.01 on pump or baseplate.
2. Install motor support plate with threaded rods and hexagon nuts 920.23/920.24 on pump or baseplate.
3. Position and align the motor on the motor support plate.
4. Fasten the motor with hexagon bolts 901.62 and discs 550.6.

7.5.9 Fitting the belt drive

CAUTION

Poorly checked, inaccurately aligned motor connection

Increased wear, insufficient power transmission, loud running noises!

- ▹ Always use clean pulleys without any signs of wear.
- ▹ Align the shaft end of pump/motor flush with the pulleys.
- ▹ For multiple V-belt drives:
  - If replacing V-belts always replace the entire set of V-belts.
  - Use V-belts of the same length.
- ▹ Only pull on V-belts if this is possible without using any force.
- ▹ Only pull on V-belts by hand. Do not use any tools (e.g. levers).
- ▹ Tension the V-belts properly (⇨ Section 5.6.2, Page 38) .

CAUTION

Swelling of V-belts due to aggressive ambient conditions

Reduced service life of V-belts!

- ▹ Protect V-belts suitably from oil mist, dripping oil and other chemical influences.

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 68) to (⇨ Section 7.5.8, Page 78) (⇨ Section 7.5.8, Page 78) have been observed and carried out.

1. Use bush 540.02 to fit V-belt pulley 882.01 on pump shaft 210.
2. Use bush 540.03 to fit V-belt pulley 882.02 on the motor shaft.
3. Align V-belt pulleys 882.01/882.02 so that they are flush with each other. (⇨ Section 5.6.2, Page 38)
4. Move fully threaded studs 590.23/590.24 and hexagon nuts 920.63/64 to position motor support plate 81-54.01 in such a way that the V-belts can be pulled onto pulleys 882.01/882.02 without any force.
5. Pull V-belts on V-belt pulleys 882.01/882.02.
   The use of belt wax or similar is not necessary.
6. Tension the V-belts. (⇨ Section 5.6.2, Page 38) (⇨ Section 5.7.3, Page 41)
7. Fit the belt guard.
8. Connect the motor to the power supply (refer to manufacturer's product literature).

7.6 Tightening torques

7.6.1 Tightening torques for the pump

Casing bolts

CAUTION

Use of impact screw drivers 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 27: Tightening torques for bolted/screwed connections[32)33)]

Material	C35E+QT/ C35+N-A2A	A4-70/ A4-70	8.8 A2A/ 8
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

Impeller screw

Table 28: Tightening torques for the impeller screw (part No. 906 and 901.87)

Bearing assembly	Tightening torque M_A [Nm]	
	Bearing brackets P03ax … P12sx Version with hexagon head or socket pin wrench	Bearing brackets P03ax … P06ax Version with hexagon socket head
P03ax	80	50
P04ax	80	50
P05ax	140	100
P06x	260	190
P08sx/P10ax/P12sx	360	-

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32 The values indicated are valid for unlubricated bolts/screws at room temperature.

33 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
- Type series
- Size
- Material variant
- 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 87)
- 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 29: 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[34)]	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	Angular contact ball bearing (set)	1	1	1	2	2	2	3	25%
322.01	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 [35)]	1	1	1	2	2	2	3	25%
	Primary ring[35)]	1	2	3	4	5	6	7	90%
	Mating ring[35)]	1	2	3	4	5	6	7	90%
	Secondary seal at mating ring[35)]	1	2	3	4	5	7	9	100%
	Secondary seal at primary ring[35)]	1	2	3	4	5	7	9	100%
	Spring (set)[35)]	1	1	1	1	1	2	2	20%
For variants with gland packing									
456.01	Neck bush	1	1	1	2	2	2	3	30%
461.01	Gland packing (set)	2	4	4	6	6	6	8	100%
524.01	Shaft protecting sleeve	1	2	2	2	3	3	4	50%

34 For KWP 250-250-315, 300-300-400, 350-350-400 und 400-400-500: casing wear ring instead of wear plate

35 Optional

7.7.3 Interchangeability of pump components

Components featuring the same number in a column are interchangeable.

Table 30: Interchangeability of pump components

Size	Description																
	Pump casing	Wear plate, suction side	Discharge cover	Shaft	Impeller	Rolling element bearing	Bearing bracket	Bearing bracket lantern	Stuffing box housing	Gland follower	Stuffing box ring	Lantern ring	Gland packing	Casing wear ring	Thrower	Shaft protecting sleeve	Impeller screw
	Part number																
	101	135.01	163	210	230	320/ 322	330	344	451.01	452.01	454.01	458.01	461	502.01	507	524.01	906
Bearing bracket P03ax																	
065-040-0250	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	1
065-050-0200	2	2	2	1	2	1	1	2	1	1	1	1	1	-	1	1	1
065-050-0201	2	2	2	1	33	1	1	2	1	1	1	1	1	-	1	1	1
080-065-0200	3	3	2	1	3	1	1	2	1	1	1	1	1	-	1	1	1
080-065-0201	3	3	2	1	34	1	1	2	1	1	1	1	1	-	1	1	1
100-080-0250	4	4	1	1	4	1	1	1	1	1	1	1	1	-	1	1	1
100-080-0251	4	4	1	1	35	1	1	1	1	1	1	1	1	-	1	1	1
Bearing bracket P04ax																	
080-040-0315	5	5	3	2	5	2	2	3	2	2	2	2	2	-	2	2	2
080-050-0400	6	6	4	2	6	2	2	4	2	2	2	2	2	-	2	2	2
080-065-0315	7	7	3	2	7	2	2	3	2	2	2	2	2	-	2	2	2
080-065-0313	7	30	3	2	36	2	2	3	2	2	2	2	2	-	2	2	2
080-065-0400	8	8	4	2	8	2	2	4	2	2	2	2	2	-	2	2	2
100-080-0315	9	9	3	2	9	2	2	3	2	2	2	2	2	-	2	2	2
100-080-0311	9	9	3	2	37	2	2	3	2	2	2	2	2	-	2	2	2
125-100-0250	10	10	5	2	10	2	2	1	2	2	2	2	2	-	2	2	2
125-100-0251	10	10	5	2	38	2	2	1	2	2	2	2	2	-	2	2	2
125-100-0253	10	31	5	2	39	2	2	1	2	2	2	2	2	-	2	2	2
125-100-0315	11	11	3	2	11	2	2	3	2	2	2	2	2	-	2	2	2
Bearing bracket P05ax																	
100-080-0400	12	12	6	3	12	3	3	5	3	3	3	3	3	-	3	3	3
100-080-0403	12	32	6	3	40	3	3	5	3	3	3	3	3	-	3	3	3
125-100-0400	13	13	6	3	13	3	3	5	3	3	3	3	3	-	3	3	3
125-100-0403	13	33	6	3	41	3	3	5	3	3	3	3	3	-	3	3	3
150-150-0315	16	16	7	3	16	3	3	6	3	3	3	3	3	-	3	3	3
150-150-0311	16	16	7	3	42	3	3	6	3	3	3	3	3	-	3	3	3
150-150-0400	17	17	6	3	17	3	3	5	3	3	3	3	3	-	3	3	3
200-200-0320	18	18	7	3	18	3	3	6	3	3	3	3	3	-	3	3	3
Bearing bracket P06x																	
125-080-0500	19	19	8	4	19	4	4	7	4	4	4	4	4	-	4	4	4
150-125-0500	20	20	9	4	20	4	4	7	4	4	4	4	4	-	4	4	4
150-125-0503	20	34	9	4	43	4	4	7	4	4	4	4	4	-	4	4	4
200-200-0400	21	21	10	4	21	4	4	5	4	4	4	4	4	-	4	4	4
200-200-0403	21	35	10	4	44	4	4	5	4	4	4	4	4	-	4	4	4
250-250-0315	22	-	11	4	22	4	4	6	4	4	4	4	4	33	4	4	4
Bearing bracket P08sx																	
200-200-0500	23	22	12	4	23	5	5	8	5	5	5	5	5	-	5	5	5
200-200-0501	33	36	12	4	45	5	5	8	5	5	5	5	5	-	5	5	5
200-200-0503	23	37	12	4	46	5	5	8	5	5	5	5	5	-	5	5	5
250-250-0400	24	23	13	4	24	5	5	9	5	5	5	5	5	-	5	5	5
250-250-0403	24	38	13	4	47	5	5	9	5	5	5	5	5	-	5	5	5
250-250-0500	25	24	12	4	25	5	5	8	5	5	5	5	5	-	5	5	5

Size	Description																
	Pump casing	Wear plate, suction side	Discharge cover	Shaft	Impeller	Rolling element bearing	Bearing bracket	Bearing bracket lantern	Stuffing box housing	Gland follower	Stuffing box ring	Lantern ring	Gland packing	Casing wear ring	Thrower	Shaft protecting sleeve	Impeller screw
	Part number																
	101	135.01	163	210	230	320/ 322	330	344	451.01	452.01	454.01	458.01	461	502.01	507	524.01	906
250-250-0503	25	39	12	4	48	5	5	8	5	5	5	5	5	-	5	5	5
250-250-0505	25	40	12	4	49	5	5	8	5	5	5	5	5	-	5	5	5
250-250-0630	26	25	14	4	26	5	5	9	5	5	5	5	5	-	5	5	5
250-250-0634	26	41	14	4	50	5	5	9	5	5	5	5	5	-	5	5	5
300-300-0400	27	-	13	4	27	5	5	9	5	5	5	5	5	34	5	5	6
300-300-0500	28	26	12	4	28	5	5	8	5	5	5	5	5	-	5	5	5
300-300-0503	33	42	12	4	51	5	5	8	5	5	5	5	5	-	5	5	5
350-350-0400	29	-	13	4	29	5	5	9	5	5	5	5	5	35	5	5	5
350-350-0500	30	27	12	4	30	5	5	8	5	5	5	5	5	-	5	5	5
350-350-0503	30	43	12	4	52	5	5	8	5	5	5	5	5	-	5	5	5
350-350-0504	30	44	12	4	53	5	5	8	5	5	5	5	5	-	5	5	5
350-350-0630	31	28	14	4	31	5	5	9	5	5	5	5	5	-	5	5	5
350-350-0633	31	45	14	4	54	5	5	9	5	5	5	5	5	-	5	5	5
400-400-0500	32	29	12	4	32	5	5	8	5	5	5	5	5	-	5	5	5
400-400-0503	32	46	12	4	55	5	5	8	5	5	5	5	5	-	5	5	5
Bearing bracket P10ax																	
200-200-0500	23	22	15	5	56	6	6	8	6	6	6	6	6	-	6	6	5
200-200-0501	33	36	15	5	57	6	6	8	6	6	6	6	6	-	6	6	5
200-200-0503	23	37	15	5	58	6	6	8	6	6	6	6	6	-	6	6	5
250-250-0400	24	23	16	5	59	6	6	9	6	6	6	6	6	-	6	6	5
250-250-0403	24	38	16	5	60	6	6	9	6	6	6	6	6	-	6	6	5
250-250-0500	25	24	15	5	61	6	6	8	6	6	6	6	6	-	6	6	5
250-250-0503	25	39	15	5	62	6	6	8	6	6	6	6	6	-	6	6	5
250-250-0505	25	40	15	5	63	6	6	8	6	6	6	6	6	-	6	6	5
250-250-0630	26	25	17	5	64	6	6	10	6	6	6	6	6	-	6	6	5
250-250-0634	26	41	17	5	65	6	6	10	6	6	6	6	6	-	6	6	5
300-300-0400	27	-	16	5	66	6	6	9	6	6	6	6	6	34	6	6	6
300-300-0500	28	26	15	5	67	6	6	8	6	6	6	6	6	-	6	6	5
300-300-0503	33	42	15	5	68	6	6	8	6	6	6	6	6	-	6	6	5
350-350-0400	29	-	16	5	69	6	6	9	6	6	6	6	6	35	6	6	7
350-350-0500	30	27	15	5	70	6	6	8	6	6	6	6	6	-	6	6	5
350-350-0503	30	43	15	5	71	6	6	8	6	6	6	6	6	-	6	6	5
350-350-0504	30	44	15	5	72	6	6	8	6	6	6	6	6	-	6	6	5
350-350-0630	31	28	17	5	73	6	6	10	6	6	6	6	6	-	6	6	5
350-350-0633	31	45	17	5	74	6	6	10	6	6	6	6	6	-	6	6	5
400-400-0500	32	-	15	5	75	6	6	8	6	6	6	6	6	36	6	6	5
400-400-0503	32	-	15	5	76	6	6	8	6	6	6	6	6	37	6	6	5
400-400-0533	34	47	20	5	77	6	6	11	6	6	6	6	6	-	6	6	5
400-400-0583	35	48	21	5	78	6	6	10	6	6	6	6	6	-	6	6	5
500-400-0710	36	49	22	5	79	6	6	10	6	6	6	6	6	-	6	6	5
500-400-0713	36	50	22	5	80	6	6	10	6	6	6	6	6	-	6	6	5
500-500-0544	37	51	23	5	81	6	6	10	6	6	6	6	6	-	6	6	5
500-500-0630	38	52	17	5	82	6	6	10	6	6	6	6	6	-	6	6	5
500-500-0633	38	53	17	5	83	6	6	10	6	6	6	6	6	-	6	6	5
500-500-0634	38	54	17	5	84	6	6	10	6	6	6	6	6	-	6	6	5
500-500-0635	38	55	17	5	85	6	6	10	6	6	6	6	6	-	6	6	5
500-500-0637	38	56	17	5	86	6	6	10	6	6	6	6	6	-	6	6	5

Size	Description																
	Pump casing	Wear plate, suction side	Discharge cover	Shaft	Impeller	Rolling element bearing	Bearing bracket	Bearing bracket lantern	Stuffing box housing	Gland follower	Stuffing box ring	Lantern ring	Gland packing	Casing wear ring	Thrower	Shaft protecting sleeve	Impeller screw
	Part number																
	101	135.01	163	210	230	320/ 322	330	344	451.01	452.01	454.01	458.01	461	502.01	507	524.01	906
Bearing bracket P12sx																	
200-200-0500	23	22	18	6	87	6	6	8	7	7	7	7	7	-	7	7	5
200-200-0501	33	36	18	6	88	6	6	8	7	7	7	7	7	-	7	7	5
200-200-0503	23	37	18	6	89	6	6	8	7	7	7	7	7	-	7	7	5
250-250-0500	25	24	18	6	90	6	6	8	7	7	7	7	7	-	7	7	5
250-250-0505	25	39	18	6	91	6	6	8	7	7	7	7	7	-	7	7	5
250-250-0503	25	40	18	6	92	6	6	8	7	7	7	7	7	-	7	7	5
250-250-0630	26	25	19	6	93	6	6	10	7	7	7	7	7	-	7	7	5
250-250-0634	26	41	19	6	94	6	6	10	7	7	7	7	7	-	7	7	5
300-300-0500	28	26	18	6	95	6	6	8	7	7	7	7	7	-	7	7	5
300-300-0503	33	42	18	6	96	6	6	8	7	7	7	7	7	-	7	7	5
350-350-0500	30	27	18	6	97	6	6	8	7	7	7	7	7	-	7	7	5
350-350-0503	30	43	18	6	98	6	6	8	7	7	7	7	7	-	7	7	5
350-350-0504	30	44	18	6	99	6	6	8	7	7	7	7	7	-	7	7	5
350-350-0630	31	28	19	6	100	6	6	10	7	7	7	7	7	-	7	7	5
350-350-0633	31	45	19	6	101	6	6	10	7	7	7	7	7	-	7	7	5
400-400-0500	32	-	18	6	102	6	6	8	7	7	7	7	7	36	7	7	5
400-400-0503	32	-	18	6	103	6	6	8	7	7	7	7	7	37	7	7	5
400-400-0533	34	47	24	6	104	6	6	11	7	7	7	7	7	-	7	7	5
400-400-0583	35	48	25	6	105	6	6	10	7	7	7	7	7	-	7	7	5
500-400-0710	36	49	26	6	106	6	6	10	7	7	7	7	7	-	7	7	5
500-400-0713	36	50	26	6	107	6	6	10	7	7	7	7	7	-	7	7	5
500-500-0544	37	51	27	6	108	6	6	10	7	7	7	7	7	-	7	7	5
500-500-0630	38	52	19	6	109	6	6	10	7	7	7	7	7	-	7	7	5
500-500-0633	38	53	19	6	110	6	6	10	7	7	7	7	7	-	7	7	5
500-500-0634	38	54	19	6	111	6	6	10	7	7	7	7	7	-	7	7	5
500-500-0635	38	55	19	6	112	6	6	10	7	7	7	7	7	-	7	7	5
500-500-0637	38	56	19	6	113	6	6	10	7	7	7	7	7	-	7	7	5
600-600-0663	39	57	28	7	114	6	6	10	-	-	-	-	-	-	7	8	5
600-600-0669	39	57	28	7	115	6	6	10	-	-	-	-	-	-	7	8	5

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 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 31: Trouble-shooting

A	B	C	D	E	F	G	H	Possible cause	Remedy[36)]
✗	-	-	-	-	-	-	-	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[37)]	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.

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

37 Contact KSB.

A	B	C	D	E	F	G	H	Possible cause	Remedy[36)]
✗	-	-	-	-	-	✗	-	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 P03ax to P06x

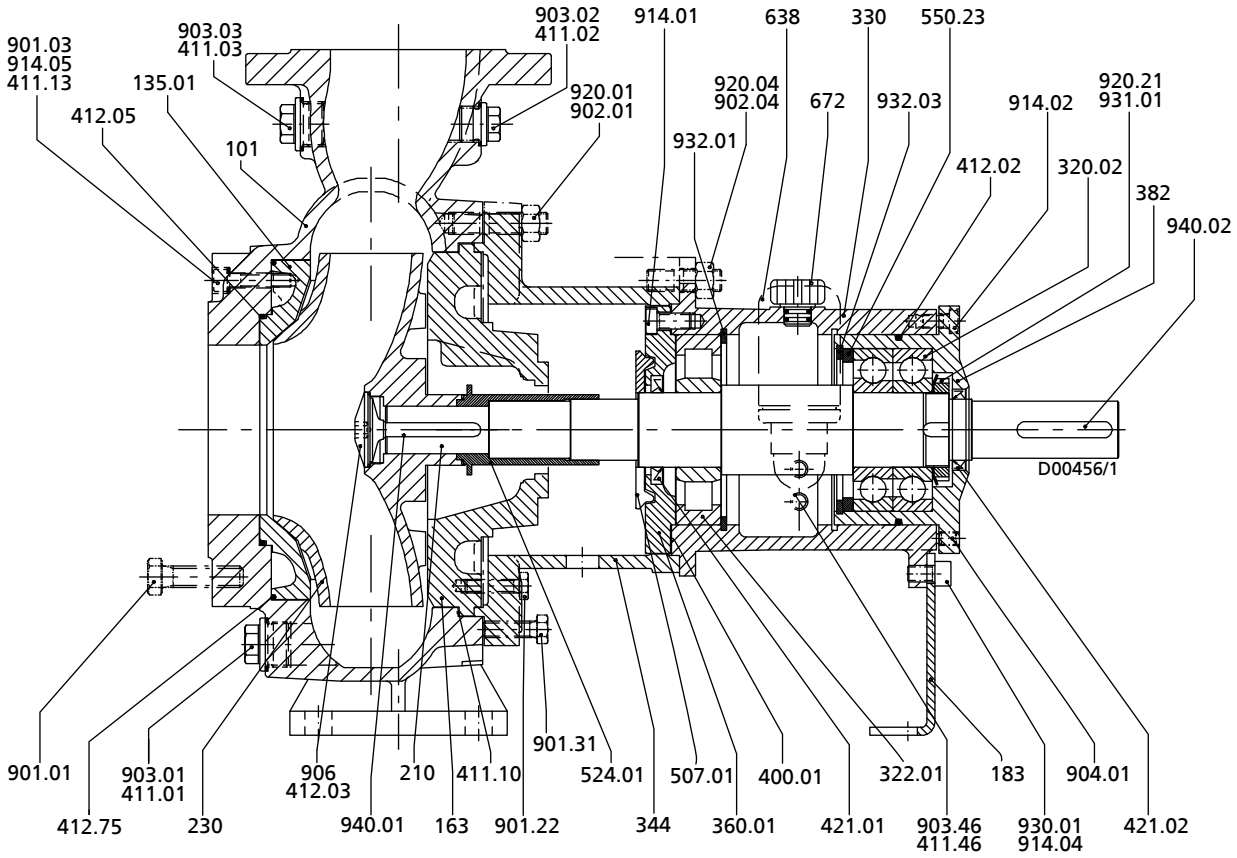

Fig. 27: General assembly drawing of pump with bearing bracket P03ax to P06x

Table 32: List of components

Part No.	Description	Part No.	Description
101	Pump casing	507.01	Thrower
135.01[38)]	Wear plate	524.01	Shaft protecting sleeve
163	Discharge cover	550.23	Disc
183	Support foot	638	Constant level oiler
210	Pump shaft	672	Vent
230	Impeller	901.01/.03/.22/.31	Hexagon head bolt
320.02	Rolling element bearings	902.01/.04	Stud
322.01	Radial roller bearing	903.01/.02/.03/.46	Screw plug
330	Bearing bracket	904.01	Grub screw
344	Bearing bracket lantern	906	Impeller screw
360.01	Bearing cover	914.01/.02/.04/.05	Hexagon socket head cap screw
382	Bearing carrier	920.01/.04/.21	Nut
400.01	Gasket	930.01	Safety device
411.01/.02/.03/.10/.13/.46	Joint ring	931.01	Lock washer

38 Sizes KWPK 250-250-315, 300-300-400, 350-350-400 and 400-400-500 are equipped with a casing wear ring 502.01 instead of a wear plate.

Part No.	Description	Part No.	Description
412.02/.03/.05/.75	O-ring	932.01/.03	Circlip
421.01/.02	Lip seal	940.01/.02	Key

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9.1.2 Pump with bearing bracket P08sx to P12sx

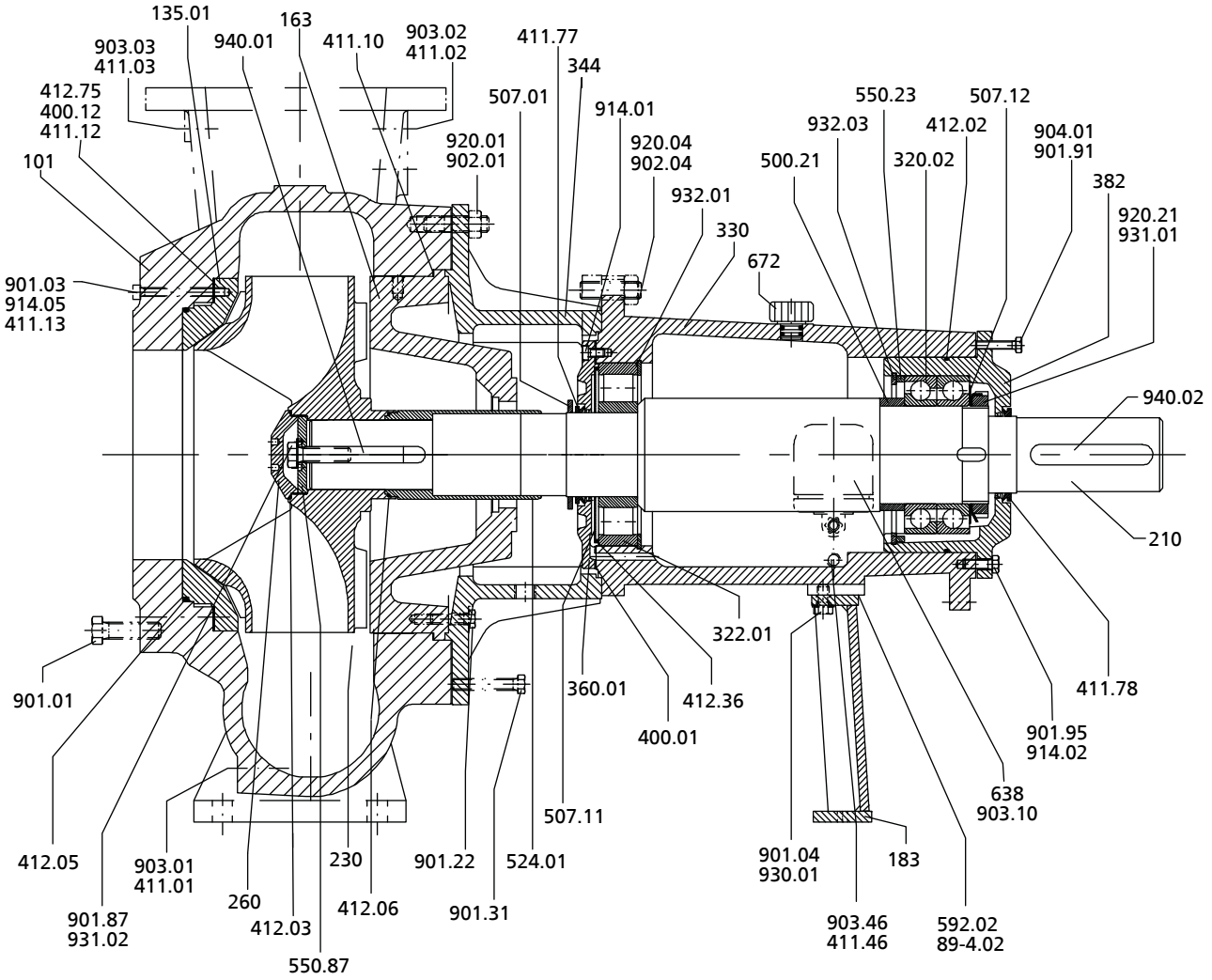

Fig. 28: General assembly drawing of pump with bearing bracket P08sx to P12sx

Table 33: List of components

Part No.	Description	Part No.	Description
101	Pump casing	507.01/.11/.12	Thrower
135.01	Wear plate	524.01	Shaft protecting sleeve
163	Discharge cover	550.23/.87	Disc
183	Support foot	592.02	Base
210	Pump shaft	638	Constant level oiler
230	Impeller	672	Vent
260	Impeller hub cap	89-4.02	Shim
320.02	Rolling element bearings	901.01/.03/.04/.22/.31./87 /.91/.95	Hexagon head bolt
322.01	Radial roller bearing	902.01/.04	Stud
330	Bearing bracket	903.01/.02/.03/.10/.46	Screw plug
344	Bearing bracket lantern	904.01	Grub screw
360.01	Bearing cover	914.01/.02/.05	Hexagon socket head cap screw
382	Bearing carrier	920.01/.04/.21	Nut
400.01/.12	Gasket	930.01	Safety device
411.01/.02/.03/.10/.12/.13 /.46/.77/.78	Joint ring	931.01./02	Lock washer

Part No.	Description	Part No.	Description
412.02/.03/.05/.06/.36/.75	O-ring	932.01/.03	Circlip
500.21	Ring	940.01/.02	Key

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9.1.3 Pump with bearing bracket P10ax to P12sx: sizes 500-400-710 and 500-400-713

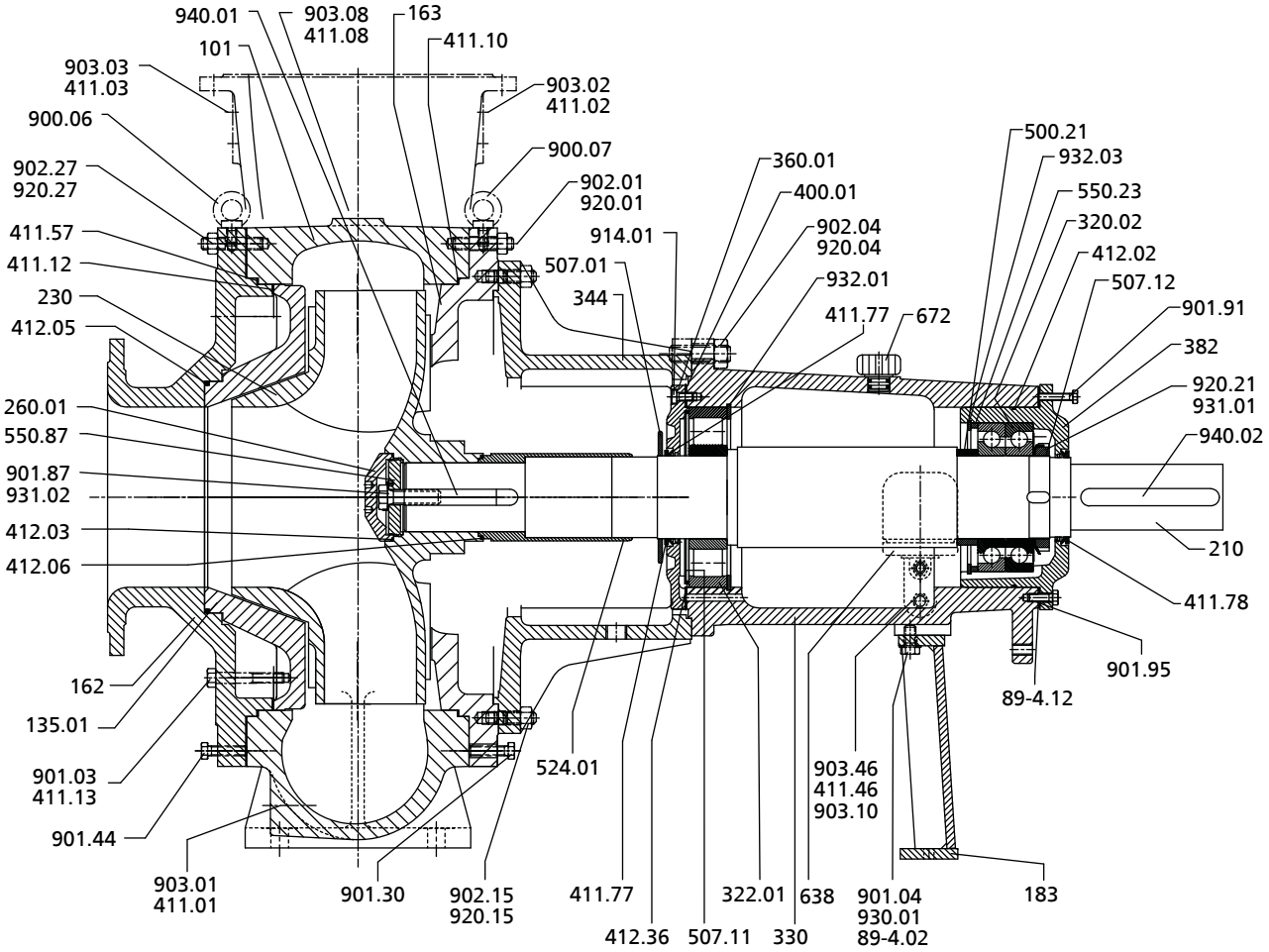

Fig. 29: General assembly drawing of pump with bearing bracket P10ax to P12sx: sizes 500-400-710 and 500-400-713

Table 34: List of components

Part No.	Description	Part No.	Description
101	Pump casing	507.01/.11/.12	Thrower
135.01	Wear plate	524.01	Shaft protecting sleeve
162	Suction cover	550.23/.87	Disc
163	Discharge cover	638	Constant level oiler
183	Support foot	672	Vent
210	Shaft	89-4.02/.12	Shim
230	Impeller	900.06/.07	Screw
260.01	Impeller hub cap	901.03/.04/.30/.44/.87/.91 /.95	Hexagon head bolt
320.02	Rolling element bearings	902.01/.04/.15/.27	Stud
322.01	Radial roller bearing	903.01/.02/.03/.08/.10/.46	Screw plug
330	Bearing bracket	914.01	Hexagon socket head cap screw
344	Bearing bracket lantern	920.01/.04/.15/.21/.27	Nut
360.01	Bearing cover	930.01	Safety device
400.01	Gasket	931.01/.02	Lock washer
411.01/.02/.03/.08/.10/.12 /.13/.46/.57/.77/.78	Joint ring	932.01/.03	Circlip
412.02/.03/.05/.06/.36	O-ring	940.01/.02	Key
500.21	Ring		

9.1.4 Pump with bearing bracket P12sx: sizes 500-500-544, 600-660-663 and 600-600-669

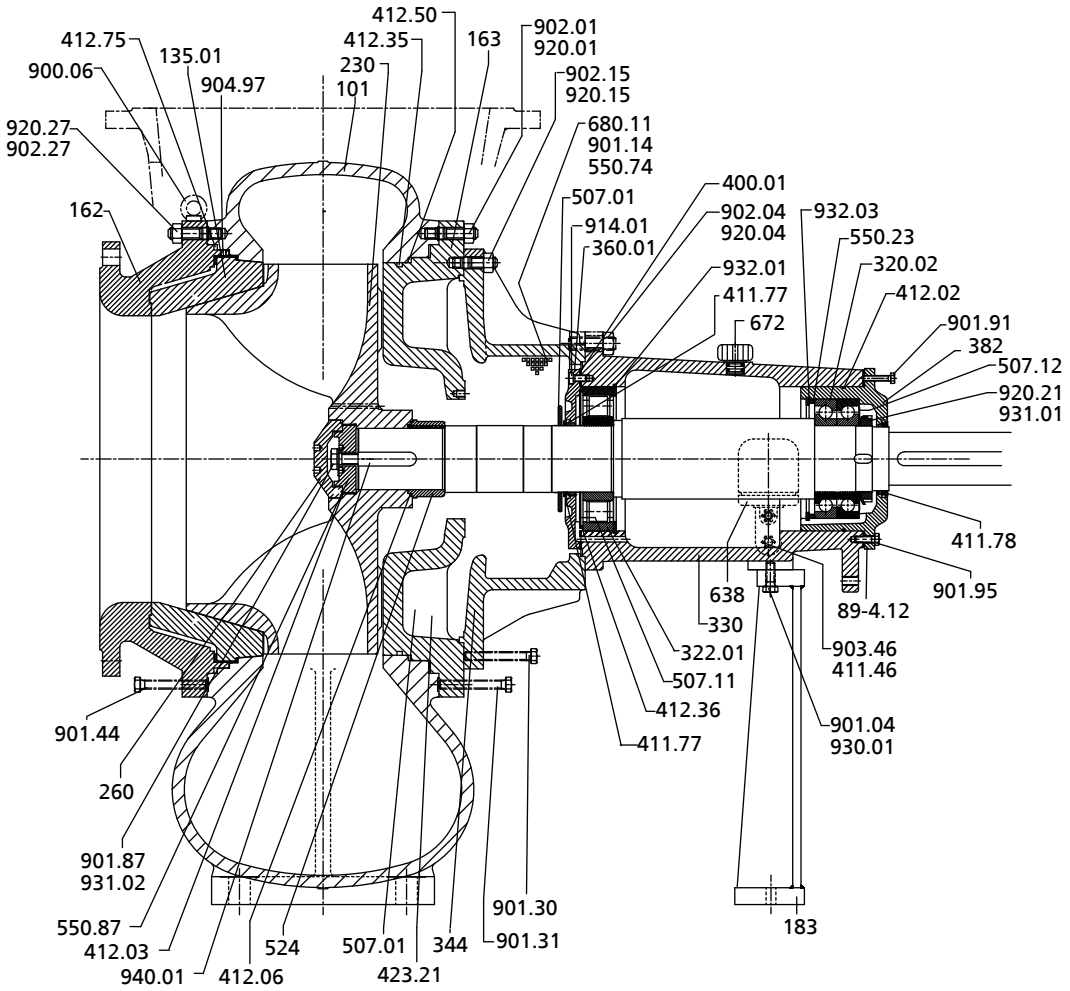

Fig. 30: General assembly drawing of pump with bearing bracket P12sx: sizes 500-500-544, 600-660-663 and 600-600-669

Table 35: List of components

Part No.	Description	Part No.	Description
101	Pump casing	524	Shaft protecting sleeve
135.01	Wear plate	550.23/.74/.87	Disc
162	Suction cover	638	Constant level oiler
163	Discharge cover	672	Vent
183	Support foot	680.11	Guard
230	Impeller	89-4.12	Shim
260	Impeller hub cap	900.06	Screw
320.02	Rolling element bearings	901.04/.14/.30/.31/.44/.87 /.91/.95	Hexagon head bolt
322.01	Radial roller bearing	902.01/.04/.15/.27	Stud
330	Bearing bracket	903.46	Screw plug
344	Bearing bracket lantern	904.97	Grub screw
360.01	Bearing cover	914.01	Hexagon socket head cap screw
382	Bearing carrier	920.01/.04/.15/.21/.27	Nut
400.01	Gasket	930.01	Safety device
411.46/.77/.78	Joint ring	931.01/.02	Lock washer

Part No.	Description	Part No.	Description
412.02/.03/.06/.35/.36/.50 /.75	O-ring	932.01/.03	Circlip
423.21	Labyrinth ring	940.01	Key
507.01/.11/.12	Thrower		

9.1.5 Shaft seals

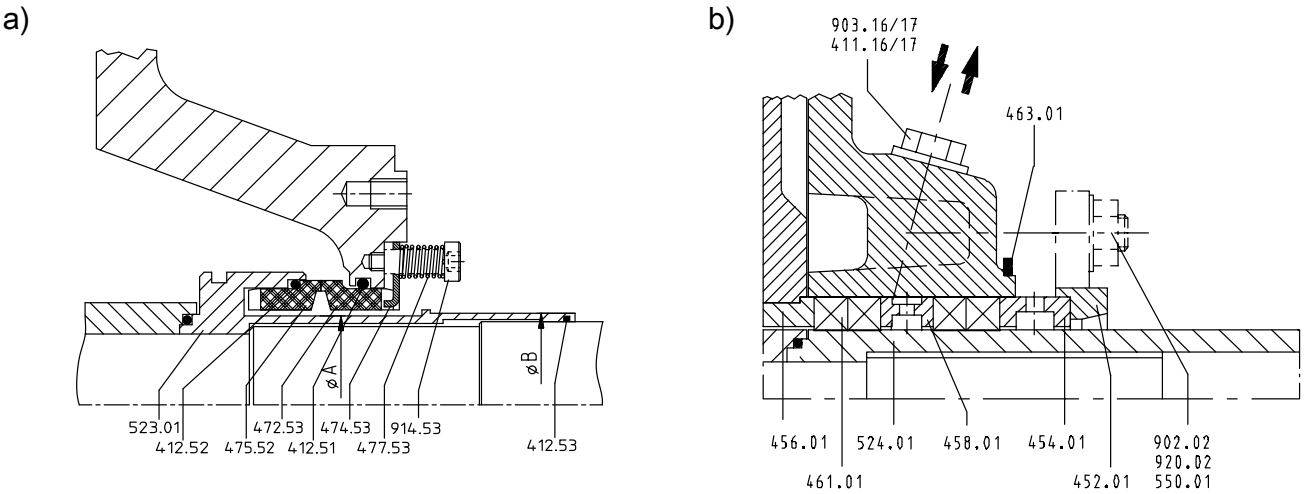

Fig. 31: Shaft seal P03ax to P12sx: a) 4K mechanical seal; b) coolable gland packing

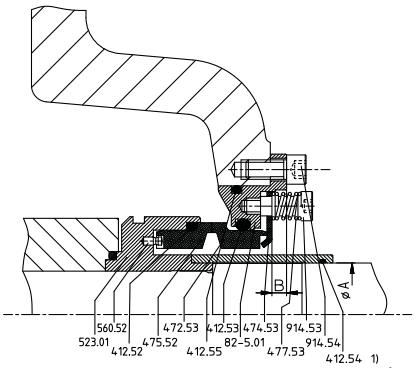

Fig. 32: 4K-120M mechanical seal[39)]

Table 36: List of components

Part No.	Description	Part No.	Description
411.16/.17	Joint ring	475.52	Mating ring
412.51/.52/.53/.54/.55	O-ring	477.53	Spring
452.01	Gland follower	524.01	Shaft protecting sleeve
454.01	Stuffing box ring, split	550.01	Disc
456.01	Neck bush	560.52	Pin
458.01	Lantern ring, split	82-5.01	Adapter
461.01	Packing ring	902.02	Stud
463.01	Drip plate	903.16/.17	Screw plug
472.53	Primary ring	914.53/.54	Hexagon socket head cap screw
474.53	Thrust ring	920.02	Hexagon nut

39 Only for sizes 600-600-663 and 600-600-669

10 EU Declaration of Conformity

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

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): 2006/42/EC Machinery Directive

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 EU Declaration of Conformity was issued in/on:

Place, date

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

Name

Function

Company
Address

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

41 A signed, legally binding EU 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

2361.8/14-EN

42 Required field

Index

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2361.8/14-EN (01317114)

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