Standardised Chemical Pump

MegaCPK

Installation/Operating Manual

CE

KSB

Legal information/Copyright

Installation/Operating Manual MegaCPK

Original operating manual

Subject to technical modification without prior notice.

Contents

Glossary

Back pull-out design

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

Back pull-out unit

Pump without pump casing; partly completed machinery

Certificate of decontamination

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

Discharge line

The pipeline which is connected to the discharge nozzle

Hydraulic system

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

Pool of pumps

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

Pump

Machine without drive, additional components or accessories

Pump set

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

Suction lift line/suction head line

The pipeline which is connected to the suction nozzle

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1 General

1.1 Principles

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

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

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

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

1.2 Installation of partly completed machinery

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

1.3 Target group

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

1.4 Other applicable documents

Table 1: Overview of other applicable documents

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

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

1.5 Symbols

Table 2: Symbols used in this manual

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

1 If included in agreed scope of supply

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

1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

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

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2 Safety

DANGER

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

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

2.1 General

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

2.2 Intended use

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

2.3 Personnel qualification and training

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

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

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

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

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

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

2.5 Safety awareness

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

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

2.6 Safety information for the operator/user

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

2.7 Safety information for maintenance, inspection and installation

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

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- When taking the pump set out of service always adhere to the procedure described in the manual. (⇨ Section 6.1.12, Page 45) (⇨ Section 6.3, Page 48)
- Decontaminate pumps which handle fluids posing a health hazard. (⇨ Section 7.3, Page 58)
- 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 39)

2.8 Unauthorised modes of operation

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

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

2.9 Explosion protection

DANGER

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

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

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

Especially adhere to the sections in this manual marked with the Ex symbol and the following sections, (⇨ Section 2.9.1, Page 11) to (⇨ Section 2.9.4, Page 12)
The explosion-proof status 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.

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

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

Motor The motor must be considered separately.

2.9.2 Temperature limits

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

The table (⇨ Table 4) lists the temperature classes and the resulting maximum permissible fluid temperatures. The values shown correspond to the theoretical limits. They include only a general safety margin for the mechanical seal. For single mechanical seals, the safety margin required for specific operating conditions and mechanical seal designs may be substantially higher. If operating conditions differ

from those stated on the data sheet, or if different mechanical seals are used, the actual safety margin required needs to be determined individually. If in doubt please contact the manufacturer.

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

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

Table 4: Temperature limits

Temperature class to ISO 80079-36	Maximum permissible fluid temperature[2)]
T1	Maximum 400 °C[3)]
T2	280 °C
T3	185 °C
T4	120 °C
T5	85 °C
T6	Only after consultation with the manufacturer

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

Temperature class T6 A special design is required to comply with the requirements of temperature class T6 in the bearing area.

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

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

2.9.3 Monitoring equipment

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

Contact KSB for further information about monitoring equipment.

2.9.4 Operating limits

The minimum flow rates indicated in (⇨ Section 6.2.3.1, Page 47) refer to water and water-like fluids handled. Longer operating periods with these fluids and at the flow rates indicated will not cause an additional increase in the temperatures at the pump surface. However, if the physical properties of the fluids handled are different from water, it is essential to check whether an additional heat build-up may occur and if the minimum flow rate must therefore be increased. The calculation formula in (⇨ Section 6.2.3.1, Page 47) can be used to check whether an additional heat build-up may lead to a dangerous temperature increase at the pump surface.

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2 Subject to further limitations for mechanical seal temperature rise

3 Depending on the material variant

3 Transport/Storage/Disposal

3.1 Checking the condition upon delivery

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

3.2 Transport

DANGER

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

Danger to life from falling parts!

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

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

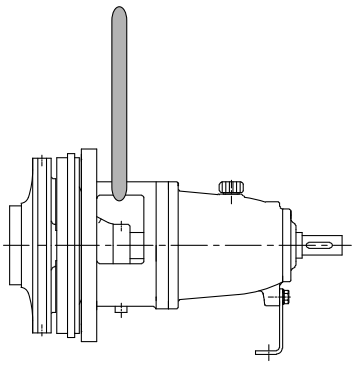

Fig. 1: Transporting the back pull-out unit

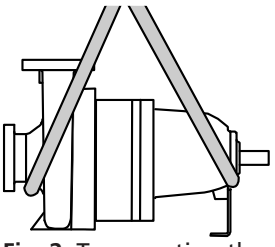

Fig. 2: Transporting the pump

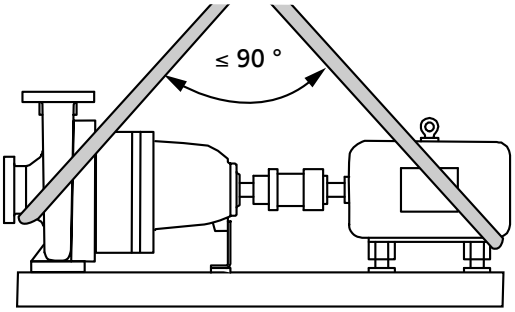

Fig. 3: Transporting the pump set

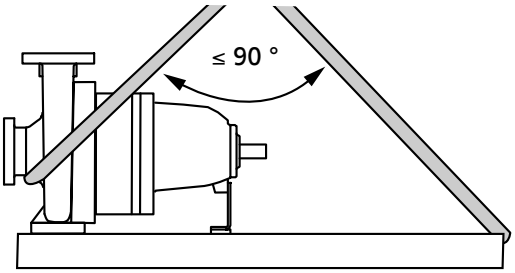

Fig. 4: Transporting the pump on the baseplate

3.3 Storage/preservation

CAUTION

Damage during storage due to humidity, dirt or vermin

Corrosion/contamination of the pump (set)!

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

CAUTION

Wet, contaminated or damaged openings and connections

Leakage or damage to the pump!

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

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

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

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

For storing a pump (set) which has already been operated, the shutdown measures must be adhered to. (⇨ Section 6.3.1, Page 48)

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇨ Section 7.3, Page 58)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
   Indicate any safety measures and decontamination measures taken.
   (⇨ Section 11, Page 83)

NOTE

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

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3.5 Disposal

⚠ WARNING

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

Hazard to persons and the environment!

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

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

4 Description of the Pump (Set)

4.1 General description

- Standardised chemical pump with shaft seal
- Pump for handling aggressive liquids in the chemical and petrochemical industries

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	34	35	36
M	C	P	K	0	5	0	-	0	3	2	-	1	2	5	1	C	D	H	I	X	N	C	E	D	1	3	2	0	6	A	P	D	2	E	M
See name plate and data sheet																						See data sheet													

Table 6: Designation key

Position	Code	Description	
1-4	Pump type		
	MCPK	MegaCPK	
5-16	Size		
	200	Nominal suction nozzle diameter [mm]	
	150	Nominal discharge nozzle diameter [mm]	
	4001	Nominal impeller diameter [mm]	
17	Pump casing material		
	C	Stainless steel	1.4408 / A743CF8M
	D	Duplex stainless steel	1.4593 / 1.4517 / A995 Gr. 1B
	E	Unalloyed steel	GP240GH + N / A216 Gr. WCB
	F	Stainless steel	1.4308 / A743 Gr. CF8
	G	Cast iron	EN-GJL-250 / A48 Cl. 35B
	O	Super duplex stainless steel	Noriclor / 1.4573 / 1.4469.09 / ASTM 995 Gr. 5A
	V	Stainless steel	1.4408
	X	Special material (e.g. chrome steel)	A743 Gr. CA6NM
18	Impeller material		
	C	Stainless steel	1.4408 / A743CF8M
	D	Duplex stainless steel	1.4593 / 1.4517 / A995 Gr. 1B
	E	Unalloyed steel	GP240GH+N / A216 GR WCB
	F	Stainless steel	1.4308 / A743 Gr. CF8
	G	Cast iron	EN-GJL-250 / A48 Cl. 35B
	O	Super duplex stainless steel	Noriclor / 1.4573 / 1.4469.09 / ASTM 995 Gr. 5A
	X	Special material (e.g. chrome steel)	A743 Gr. CA6NM
19	Heatable version and/or orifice plate		
	-[4)]	Standard	
	D	Orifice plate	

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4 Blank

Position	Code	Description
19	H	Heatable casing and heatable casing cover (welded heating chamber)
	K	Heatable or coolable casing cover (bolted heating chamber / cooling chamber)
	M	Heatable casing and heatable casing cover (bolted heating chamber)
	N	Orifice plate and heatable casing and heatable casing cover (bolted heating chamber / cooling chamber)
	P	Orifice plate and heatable or coolable casing cover (bolted heating chamber / cooling chamber)
	Z	Orifice plate and heatable casing and heatable casing cover (welded heating chamber)
20	Hydraulic system	
	-[4)]	Standard
	E	Extended-flow hydraulic system
	I	With auxiliary impeller
	L	Standard-flow hydraulic system
21	Design	
	-[4)]	Standard
	X	Non-standard (BT3D, BT3)
22	Bearing bracket	
	C	Normal, coolable (medium-duty bearing assembly)
	F	Fire-fighting system
	M	Normal (medium-duty bearing assembly)
	N	Normal (economy bearing assembly)
23-25	Seal options	
	A	A-type casing cover (conical casing cover)
	AD	A-type casing cover with throttling bush as quench seal
	AQ	A-type casing cover with lip seal as quench seal
	B	Dead-end
	BD	Dead-end, with throttling bush as quench seal
	BQ	Dead-end, with lip seal as quench seal
	CA	Cartridge seal (A-type casing cover)
	CB	Double cartridge seal, supplied with barrier fluid pressure
	CBA	Double cartridge seal, supplied with barrier fluid pressure (A-type casing cover)
	CDA	Cartridge seal with throttling bush as quench seal (A-type casing cover)
	CE	Cartridge seal with external circulation
	CED	Cartridge seal with external circulation and throttling bush as quench seal
	CEQ	Cartridge seal with external circulation and lip seal as quench seal
	CI	Cartridge seal with internal circulation
	CID	Cartridge seal with internal circulation and throttling bush as quench seal
	CIQ	Cartridge seal with internal circulation and lip seal as quench seal
	CQA	Cartridge seal with lip seal as quench seal (A-type casing cover)
	CT	Double cartridge seal with unpressurised quench fluid
	CTA	Double cartridge seal with unpressurised quench fluid (A-type casing cover)
	DB	Double mechanical seal in back-to-back arrangement

Position	Code	Description
23-25	DR	Double mechanical seal in back-to-back arrangement with pumping screw
	E	External circulation
	EB	Internal circulation with heatable seal cover and throttling bush as quench seal
	ED	External circulation with throttling bush as quench seal
	EQ	External circulation with lip seal as quench seal
	ES	Internal circulation with heatable seal cover
	F	External flushing
	FD	External flushing with throttling bush as quench seal
	FQ	External flushing with lip seal as quench seal
	I	Internal circulation
	ID	Internal circulation with throttling bush as quench seal
	IDH	Internal circulation with heatable casing cover and throttling bush as quench seal
	IH	Internal circulation with heatable casing cover
	IQ	Internal circulation with lip seal as quench seal
	IQH	Internal circulation with heatable casing cover and lip seal as quench seal
	P1	Gland packing variant with internal barrier fluid (Na)
	P2	Gland packing variant without barrier fluid (Nb)
	P3	Gland packing variant with external barrier fluid (Nc)
	TM	Mechanical seals in tandem arrangement, with barrier fluid and jacket cooling
	TR	Mechanical seals in tandem arrangement, outboard seal with pumping screw
	TS	Mechanical seals in tandem arrangement, supplied with barrier fluid pressure
26-29	Motor rating P_N [kW]	
	0007	0,75
	...	...
	1320	132
30	Number of motor poles	
31	Product generation	
	A	MegaCPK from 2012
32-35	PumpDrive	
	PDA	With PumpDrive 1st generation, Advanced
	PDB	With PumpDrive 1st generation, Basic
	PDS	With PumpDrive 1st generation, Advanced, with KSB SuPremE motor
	PD2	With PumpDrive 2nd generation
	PD2E	With PumpDrive 2nd generation, Eco
36	PumpMeter	
	M	Mit PumpMeter

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4.4 Name plate

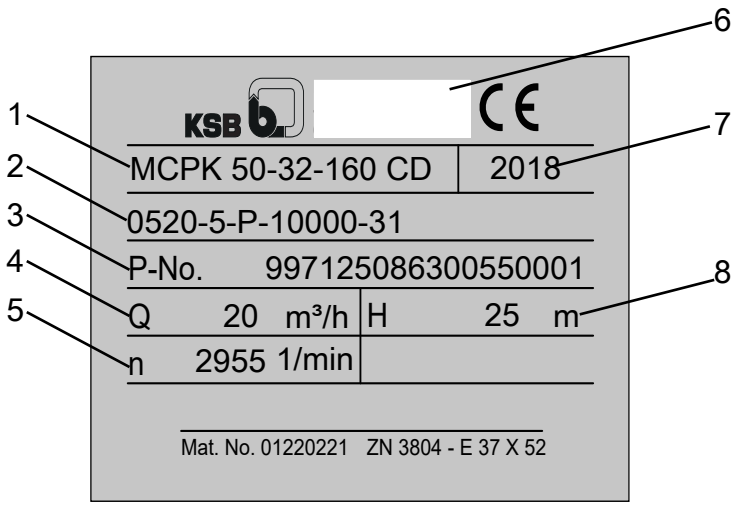

Fig. 5: Name plate (example)

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

4.5 Design details

Design

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

Pump casing

- Single or double volute, depending on the pump size
- Radially split volute casing
- Volute casing with integrally cast pump feet
- Replaceable casing wear rings (optional for pump casing material C)

Shaft seal

- Gland packing
- Single mechanical seal / double mechanical seal
- Cartridge seal
- Shaft equipped with replaceable shaft protecting sleeve in the shaft seal area

Alternative:

- Version without shaft protecting sleeve with "wet shaft" (in Europe and Northern Asia only)

Alternative:

- Version without shaft protecting sleeve with "wet shaft" (in Europe and Northern Asia only)

Impeller type

- Closed radial impeller with multiply curved vanes

Bearings:

- Medium Duty
  - Radial bearing: cylindrical roller bearing
  - Fixed bearing: paired angular contact ball bearings / double-row angular contact ball bearing
- Economy bearing assembly
  - Floating bearings: deep groove ball bearings

Lubrication:

- Oil lubrication
- Grease lubrication

Bearing bracket designation

Example: CS50E

Table 7: Bearing bracket designation

Code	Description	
CS	Bearing bracket	
50	Size code (based on dimensions of seal chamber and shaft end)	
E	Bearing design	
	E	= Economy
	-[5]	= Medium-duty

Bearing assemblies used

Table 8: Standard bearing assembly

Design	Bearing bracket	Rolling element bearings	
		Pump end	Drive end
Medium-duty (oil and grease lubrication)	CS40	NU208-E	3208
	CS50	NU310-E	2 x 7310[6]
	CS60	NU312-E	2 x 7312[6]
	CS80	NU216-E	2 x 7216[6]
Economy (oil lubrication)	CS40E	6208 C3	6208 C3
	CS50E	6310 C3	6310 C3
	CS60E	6312 C3	6312 C3
	CS80E	6216 C3	6216 C3
Economy (grease lubrication)	CS40E	6208-2Z C3	6208-2Z C3
	CS50E	6310-2Z C3	6310-2Z C3
	CS60E	6312-2Z C3	6312-2Z C3
	CS80E	6216-2Z C3	6216-2Z C3

Automation

Automation options:

- PumpDrive
- PumpMeter
- KSB Guard

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5 Blank

6 FAG designation: B-TVP-UA; SKF designation: BECBP

4.6 Configuration and function

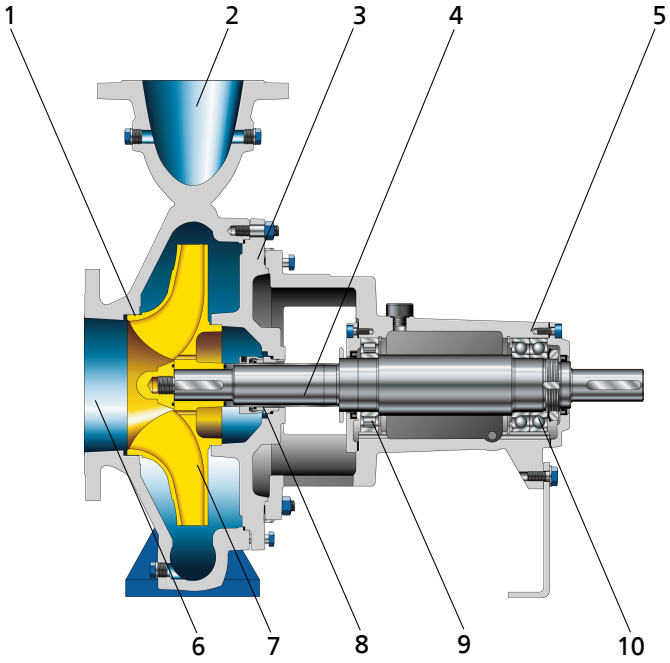

Fig. 6: Sectional drawing

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

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

Function The fluid enters the pump axially via the suction nozzle (6) and is accelerated outward by the rotating impeller (7). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid is pumped to the discharge nozzle (2), where it leaves the pump. The clearance gap (1) prevents any fluid from flowing back from the casing to the suction nozzle. At the rear side of the impeller, the shaft (4) enters the casing via the casing cover (3). The shaft passage through the cover is sealed to atmosphere with a shaft seal (8). The shaft runs in rolling element bearings (9 and 10), which are supported by a bearing bracket (5) linked with the pump casing and/or casing cover.

Sealing The pump is sealed by a shaft seal (standardised mechanical seal or gland packing).

4.7 Noise characteristics

Table 9: Surface sound pressure level L_{pA} [7) 8)]

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

4.8 Scope of supply

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

- Pump

Drive

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

Coupling

- Flexible coupling with or without spacer

Contact guard

- Coupling guard

Baseplate

- Cast or welded baseplate for the complete unit (pump and motor), in torsion-resistant design
- Channel section steel or folded steel plate

Special accessories

- As required

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

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

4.9 Dimensions and weights

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

5 Installation at Site

5.1 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.
- Check the indicated weights.

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

5.3 Installing the pump set

Always install the pump set in a horizontal position.

DANGER

Excessive temperatures due to improper installation

Explosion hazard!

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

DANGER

Electrostatic charging due to insufficient potential equalisation

Explosion hazard!

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

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5.3.1 Installation on the foundation

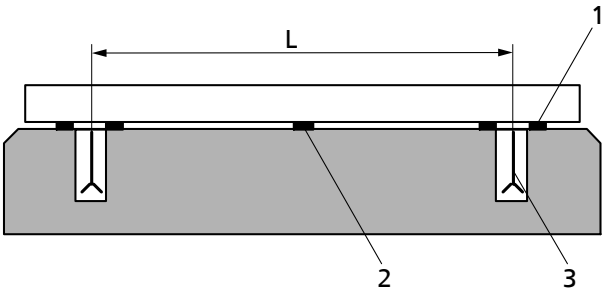

Fig. 7: Fitting the shims

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

✓ The foundation has the required strength and characteristics.

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

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

NOTE

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

NOTE

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

5.3.2 Installation without foundation (European version)

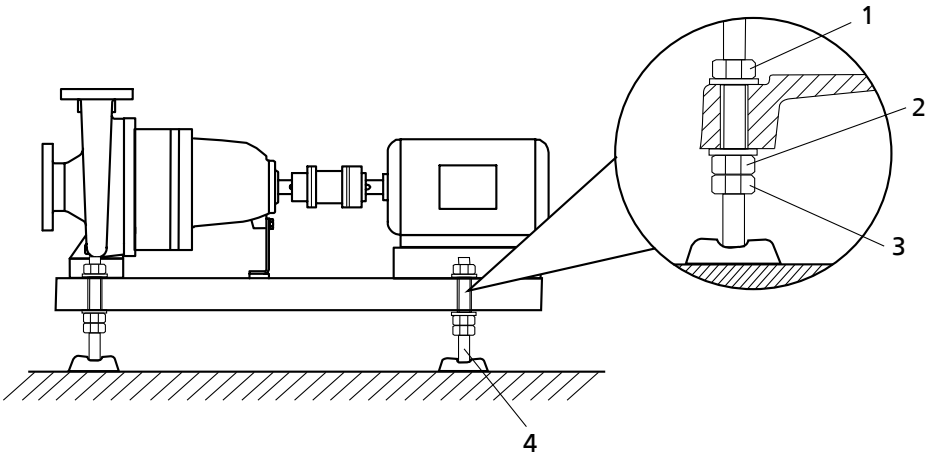

Fig. 8: Adjusting the levelling elements

1, 3	Locknut	2	Adjusting nut
4	Levelling element		

✓ 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 leakage of hot, toxic, corrosive or flammable fluids!

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

CAUTION

Incorrect earthing during welding work at the piping

Destruction of rolling element bearings (pitting effect)!

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

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NOTE

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

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

CAUTION

Welding beads, scale and other impurities in the piping

Damage to the pump!

- ▷ Remove any impurities from the piping.
- ▷ If necessary, install a filter.
- ▷ Observe the information in (⇨ Section 7.2.2.3, Page 53) .

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

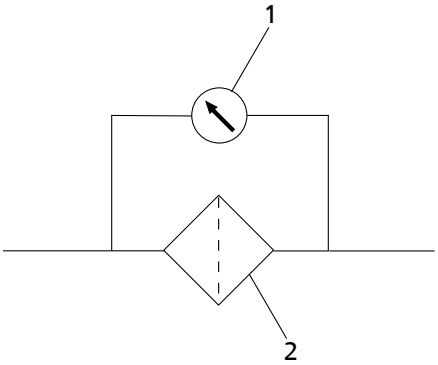

Fig. 9: Filter in the piping

1	Differential pressure gauge	2	Filter

NOTE

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

5. Connect the pump nozzles to the piping.

	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

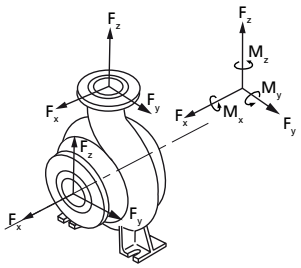

Fig. 10: Forces and moments at the pump nozzles

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.

Table 10: Forces and moments at the pump nozzles for material variant C (1.4408/A743 Gr. CF8M) at 20 °C.

Size	Suction nozzle								Discharge nozzle							
	DN	F_x [N]	F_y [N]	F_z [N]	∑F [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]	DN	F_x [N]	F_y [N]	F_z [N]	∑F [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]
040-025-160	40	970	780	650	1404	845	585	683	25	490	455	600	898	370	390	455
040-025-200	40	970	780	650	1404	845	585	683	25	460	455	600	898	370	390	455
050-032-125	50	1240	1010	878	1824	910	650	748	32	650	555	780	1157	715	490	555
050-032-125.1	50	1240	1010	878	1824	910	650	748	32	650	555	780	1157	715	490	555
050-032-160	50	1240	1010	878	1824	910	650	748	32	650	555	780	1157	715	490	555
050-032-160.1	50	1240	1010	878	1824	910	650	748	32	650	555	780	1157	715	490	555
050-032-200	50	1240	1010	878	1824	910	650	748	32	650	555	780	1157	715	490	555
050-032-200.1	50	1240	1010	878	1824	910	650	748	32	650	555	780	1157	715	490	555
050-032-250	50	1240	1010	878	1824	910	650	748	32	650	555	780	1157	715	490	555
050-032-250.1	50	1240	1010	878	1824	910	650	748	32	650	555	780	1157	715	490	555
065-040-125	65	1600	1300	1105	2339	1050	715	780	40	780	650	1000	1425	845	585	685
065-040-160	65	1600	1300	1105	2339	1050	715	780	40	780	650	1000	1425	845	585	685
065-040-160.1	65	1600	1300	1105	2339	1050	715	780	40	780	650	1000	1425	845	585	685
065-040-200	65	1600	1300	1105	2339	1050	715	780	40	780	650	1000	1425	845	585	685
065-040-200.1	65	1600	1300	1105	2339	1050	715	780	40	780	650	1000	1425	845	585	685
065-040-250	65	1600	1300	1105	2339	1050	715	780	40	780	650	1000	1425	845	585	685
065-040-250.1	65	1600	1300	1105	2339	1050	715	780	40	780	650	1000	1425	845	585	685
065-040-315	65	1600	1300	1105	2339	1050	715	780	40	780	650	1000	1425	845	585	685
080-050-125	80	2000	1550	1333	2860	1330	748	1010	50	1000	880	1250	1827	910	650	750
080-050-160	80	2000	1550	1333	2860	1330	748	1010	50	1000	880	1250	1827	910	650	750
080-050-160.1	80	2000	1550	1333	2860	1330	748	1010	50	1000	880	1250	1827	910	650	750
080-050-200	80	2000	1550	1333	2860	1330	748	1010	50	1000	880	1250	1827	910	650	750
080-050-200.1	80	2000	1550	1333	2860	1330	748	1010	50	1000	880	1250	1827	910	650	750
080-050-250	80	2000	1550	1333	2860	1330	748	1010	50	1000	880	1250	1827	910	650	750
080-050-250.1	80	2000	1550	1333	2860	1330	748	1010	50	1000	880	1250	1827	910	650	750
080-050-315	80	2000	1550	1333	2860	1330	748	1010	50	1000	880	1250	1827	910	650	750
080-050-315.1	80	2000	1550	1333	2860	1330	748	1010	50	1000	880	1250	1827	910	650	750
100-065-125	100	2500	1950	1755	3624	1850	900	1400	65	1300	1105	1600	2339	1050	715	790
100-065-160	100	2500	1950	1755	3624	1850	900	1400	65	1300	1105	1600	2339	1050	715	790
100-065-200	100	2500	1950	1755	3624	1850	900	1400	65	1300	1105	1600	2339	1050	715	790
100-065-250	100	2500	1950	1755	3624	1850	900	1400	65	1300	1105	1600	2339	1050	715	790

Size	Suction nozzle								Discharge nozzle							
	DN	F_x [N]	F_y [N]	F_z [N]	∑F [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]	DN	F_x [N]	F_y [N]	F_z [N]	∑F [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]
100-065-315	100	2500	1950	1755	3624	1850	900	1400	65	1300	1105	1600	2339	1050	715	790
125-080-160	125	3400	2700	2200	4867	2550	1250	1950	80	1550	1335	1950	2826	1350	750	1000
125-080-200	125	3400	2700	2200	4867	2550	1250	1950	80	1550	1335	1950	2826	1350	750	1000
125-080-200.1	125	3400	2700	2200	4867	2550	1250	1950	80	1550	1335	1950	2826	1350	750	1000
125-080-250	125	3400	2700	2200	4867	2550	1250	1950	80	1550	1335	1950	2826	1350	750	1000
125-080-315	125	3400	2700	2200	4867	2550	1250	1950	80	1550	1335	1950	2826	1350	750	1000
125-080-400	125	3400	2700	2200	4867	2550	1250	1950	80	1550	1335	1950	2826	1350	750	1000
125-100-160	125	3400	2700	2200	4867	2550	1250	1950	100	2000	1755	2500	3651	1850	900	1400
125-100-200	125	3400	2700	2200	4867	2550	1250	1950	100	2000	1755	2500	3651	1850	900	1400
125-100-250	125	3400	2700	2200	4867	2550	1250	1950	100	2000	1755	2500	3651	1850	900	1400
125-100-315	125	3400	2700	2200	4867	2550	1250	1950	100	2000	1755	2500	3651	1850	900	1400
125-100-400	125	3400	2700	2200	4867	2550	1250	1950	100	2000	1755	2500	3651	1850	900	1400
150-125-200	150	4300	3450	2850	6206	3200	1600	2450	125	2700	2200	3400	4867	2550	1300	1900
150-125-250	150	4300	3450	2850	6206	3200	1600	2450	125	2700	2200	3400	4867	2550	1300	1900
150-125-315	150	4300	3450	2850	6206	3200	1600	2450	125	2700	2200	3400	4867	2550	1300	1900
150-125-400	150	4300	3450	2850	6206	3200	1600	2450	125	2700	2200	3400	4867	2550	1300	1900
200-150-200	200	6750	5250	4300	9572	4850	2450	3550	150	3450	2850	4300	6206	3150	1600	2450
200-150-250	200	6750	5250	4300	9572	4850	2450	3550	150	3450	2850	4300	6206	3150	1600	2450
200-150-315	200	6750	5250	4300	9572	4850	2450	3550	150	3450	2850	4300	6206	3150	1600	2450
200-150-400	200	6750	5250	4300	9572	4850	2450	3550	150	3450	2850	4300	6206	3150	1600	2450
200-150-500	200	6750	5250	4300	9572	4850	2450	3550	150	3450	2850	4300	6206	3150	1600	2450
200-200-250	200	6750	5250	4300	9572	4850	2450	3550	200	5250	4300	6750	9572	4850	2450	3550
250-200-315	250	9200	7350	6150	13285	6900	3350	5250	200	5250	4300	6750	9572	4850	2450	3550
250-200-400	250	9200	7350	6150	13285	6900	3350	5250	200	5250	4300	6750	9572	4850	2450	3550
250-200-500	250	9200	7350	6150	13285	6900	3350	5250	200	5250	4300	6750	9572	4850	2450	3550
300-250-315	300	11000	9200	7350	16114	8400	4150	6350	250	7350	6150	9150	13250	6900	3350	5250

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

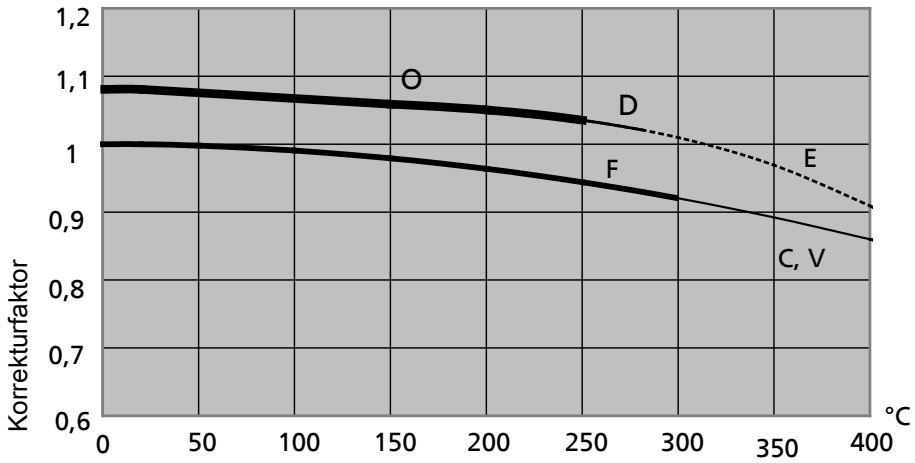

Fig. 11: Temperature correction diagram for "C, D, E, F, V, O variants" (1.4408 / A743 Gr. CF8M)

Table 11: Forces and moments at the pump nozzles for material variant G (JL1040/A48CL35B) at 20 °C

Size	Suction nozzle								Discharge nozzle							
	DN	F_x [N]	F_y [N]	F_z [N]	∑F [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]	DN	F_x [N]	F_y [N]	F_z [N]	∑F [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]
040-025-160	40	450	400	350	696	450	320	370	25	265	250	300	472	315	210	245
040-025-200	40	450	400	350	696	450	320	370	25	265	250	300	472	315	210	245
050-032-125	50	580	530	470	916	500	350	400	32	320	300	370	574	390	265	300

Size	Suction nozzle								Discharge nozzle							
	DN	F_x [N]	F_y [N]	F_z [N]	∑F [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]	DN	F_x [N]	F_y [N]	F_z [N]	∑F [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]
050-032-125.1	50	580	530	470	916	500	350	400	32	320	300	370	574	390	265	300
050-032-160	50	580	530	470	916	500	350	400	32	320	300	370	574	390	265	300
050-032-160.1	50	580	530	470	916	500	350	400	32	320	300	370	574	390	265	300
050-032-200	50	580	530	470	916	500	350	400	32	320	300	370	574	390	265	300
050-032-200.1	50	580	530	470	916	500	350	400	32	320	300	370	574	390	265	300
050-032-250	50	580	530	470	916	500	350	400	32	320	300	370	574	390	265	300
050-032-250.1	50	580	530	470	916	500	350	400	32	320	300	370	574	390	265	300
065-040-125	65	740	650	600	1153	530	390	420	40	400	350	450	696	450	320	370
065-040-160	65	740	650	600	1153	530	390	420	40	400	350	450	696	450	320	370
065-040-160.1	65	740	650	600	1153	530	390	420	40	400	350	450	696	450	320	370
065-040-200	65	740	650	600	1153	530	390	420	40	400	350	450	696	450	320	370
065-040-200.1	65	740	650	600	1153	530	390	420	40	400	350	450	696	450	320	370
065-040-250	65	740	650	600	1153	530	390	420	40	400	350	450	696	450	320	370
065-040-250.1	65	740	650	600	1153	530	390	420	40	400	350	450	696	450	320	370
065-040-315	65	740	650	600	1153	530	390	420	40	400	350	450	696	450	320	370
080-050-125	80	880	790	720	1385	560	400	460	50	530	470	580	916	500	350	400
080-050-160	80	880	790	720	1385	560	400	460	50	530	470	580	916	500	350	400
080-050-160.1	80	880	790	720	1385	560	400	460	50	530	470	580	916	500	350	400
080-050-200	80	880	790	720	1385	560	400	460	50	530	470	580	916	500	350	400
080-050-200.1	80	880	790	720	1385	560	400	460	50	530	470	580	916	500	350	400
080-050-250	80	880	790	720	1385	560	400	460	50	530	470	580	916	500	350	400
080-050-250.1	80	880	790	720	1385	560	400	460	50	530	470	580	916	500	350	400
080-050-315	80	880	790	720	1385	560	400	460	50	530	470	580	916	500	350	400
080-050-315.1	80	880	790	720	1385	560	400	460	50	530	470	580	916	500	350	400
100-065-125	100	1180	1050	950	1843	620	440	510	65	650	600	740	1153	530	390	420
100-065-160	100	1180	1050	950	1843	620	440	510	65	650	600	740	1153	530	390	420
100-065-200	100	1180	1050	950	1843	620	440	510	65	650	600	740	1153	530	390	420
100-065-250	100	1180	1050	950	1843	620	440	510	65	650	600	740	1153	530	390	420
100-065-315	100	1180	1050	950	1843	620	440	510	65	650	600	740	1153	530	390	420
125-080-160	125	1400	1250	1120	2186	740	530	670	80	790	720	880	1385	560	400	460
125-080-200	125	1400	1250	1120	2186	740	530	670	80	790	720	880	1385	560	400	460
125-080-200.1	125	1400	1250	1120	2186	740	530	670	80	790	720	880	1385	560	400	460
125-080-250	125	1400	1250	1120	2186	740	530	670	80	790	720	880	1385	560	400	460
125-080-315	125	1400	1250	1120	2186	740	530	670	80	790	720	880	1385	560	400	460
125-080-400	125	1400	1250	1120	2186	740	530	670	80	790	720	880	1385	560	400	460
125-100-160	125	1400	1250	1120	2186	740	530	670	100	1050	950	1180	1843	620	440	510
125-100-200	125	1400	1250	1120	2186	740	530	670	100	1050	950	1180	1843	620	440	510
125-100-250	125	1400	1250	1120	2186	740	530	670	100	1050	950	1180	1843	620	440	510
125-100-315	125	1400	1250	1120	2186	740	530	670	100	1050	950	1180	1843	620	440	510
125-100-400	125	1400	1250	1120	2186	740	530	670	100	1050	950	1180	1843	620	440	510
150-125-200	150	1750	1600	1400	2754	880	610	720	125	1250	1120	1400	2186	740	530	670
150-125-250	150	1750	1600	1400	2754	880	610	720	125	1250	1120	1400	2186	740	530	670
150-125-315	150	1750	1600	1400	2754	880	610	720	125	1250	1120	1400	2186	740	530	670
150-125-400	150	1750	1600	1400	2754	880	610	720	125	1250	1120	1400	2186	740	530	670
200-150-200	200	2350	2100	1900	3680	1150	800	930	150	1600	1400	1750	2754	880	610	720
200-150-250	200	2350	2100	1900	3680	1150	800	930	150	1600	1400	1750	2754	880	610	720
200-150-315	200	2350	2100	1900	3680	1150	800	930	150	1600	1400	1750	2754	880	610	720
200-150-400	200	2350	2100	1900	3680	1150	800	930	150	1600	1400	1750	2754	880	610	720
200-150-500	200	2350	2100	1900	3680	1150	800	930	150	1600	1400	1750	2754	880	610	720
200-200-250	200	2350	2100	1900	3680	1150	800	930	200	2100	1900	2350	3680	1150	800	930
250-200-315	250	3340	2980	2700	5227	1780	1260	1460	200	2100	1900	2350	3680	1150	800	930
250-200-400	250	3340	2890	2700	5227	1780	1260	1460	200	2100	1900	2350	3680	1150	800	930

Size	Suction nozzle								Discharge nozzle							
	DN	F_x [N]	F_y [N]	F_z [N]	∑F [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]	DN	F_x [N]	F_y [N]	F_z [N]	∑F [N]	M_x [Nm]	M_y [Nm]	M_z [Nm]
250-200-500	250	3340	2890	2700	5227	1780	1260	1460	200	2100	1900	2350	3680	1150	800	930
300-250-315	300	4000	3580	3220	6260	2420	1720	1980	250	2980	2700	3340	5227	1780	1260	1460

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

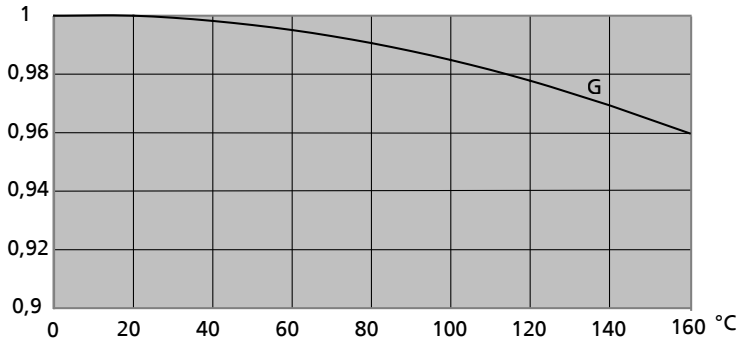

Fig. 12: Temperature correction diagram for material variant G (JL1040/ A48CL35B)

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

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 casing cover and the bearing bracket.

5.6 Checking the coupling alignment

DANGER

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

Explosion hazard!

Risk of burns!

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

CAUTION

Misalignment of pump and motor shafts

Damage to pump, motor and coupling!

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

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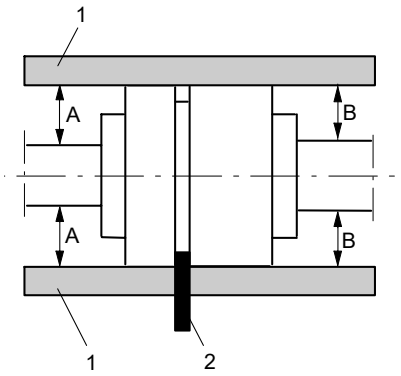

Fig. 13: Non-spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

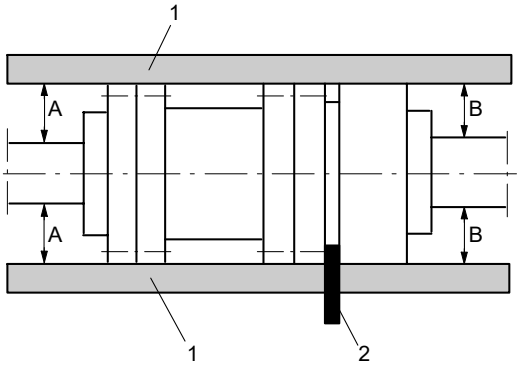

Fig. 14: Spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

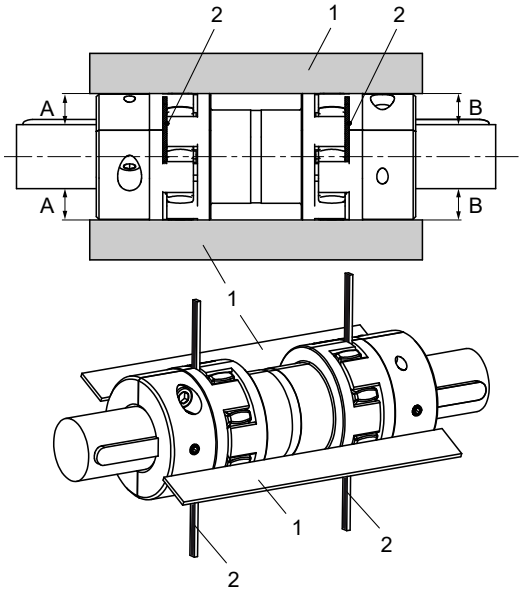

Fig. 15: Double Cardan spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge

Table 12: Permissible alignment offset of coupling halves

Coupling type	Radial offset	Axial offset
	[mm]	[mm]
Non-spacer-type coupling (⇨ Fig. 13)	≤ 0,1	≤ 0,1
Spacer-type coupling (⇨ Fig. 14)	≤ 0,1	≤ 0,1
Double Cardan coupling (⇨ Fig. 15)	≤ 0,5	≤ 0,5

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

1. Loosen the support foot and re-tighten it without transmitting any stresses and strains.
2. Place the straight edge axially on both coupling halves.
3. Leave the straight edge in this position and turn the coupling by hand.
   The coupling is aligned correctly if the distances A and B to the respective shafts are the same at all points around the circumference.
   Observe the permissible radial offset in coupling half alignment (⇨ Table 12) 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 12) both during standstill and at operating temperature as well as under inlet pressure.
5. If alignment is correct, re-install the coupling guard and its footboard, if any.

Checking the coupling alignment with a laser tool

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

5.7 Aligning the pump and motor

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

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5.7.1 Motors with adjusting screw

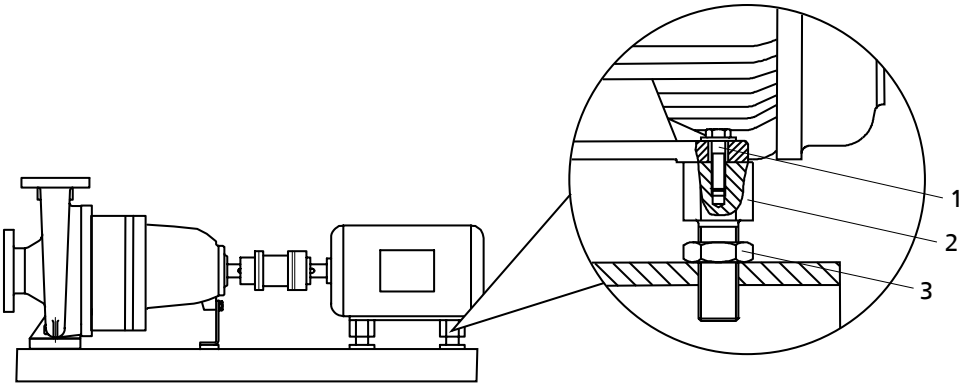

Fig. 16: Motor with adjusting screw

1	Hexagon head bolt	2	Adjusting screw
3	Locknut		

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

1. Check the coupling alignment.
2. Unscrew the hexagon head bolts (1) at the motor and the locknuts (3) at the baseplate.
3. Turn the adjusting screws (2) by hand or by means of an open-end wrench until the coupling alignment is correct and all motor feet rest squarely on the baseplate.
4. Re-tighten the hexagon head bolts (1) at the motor and the locknuts (3) at the baseplate.
5. Check proper functioning of coupling/shaft.
   Check that coupling/shaft can easily be rotated by hand.

⚠ WARNING

Unprotected rotating coupling

Risk of injury by rotating shafts!

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

⚠ DANGER

Risk of ignition by frictional sparks

Explosion hazard!!

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

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

5.7.2 Motors without adjusting screw

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

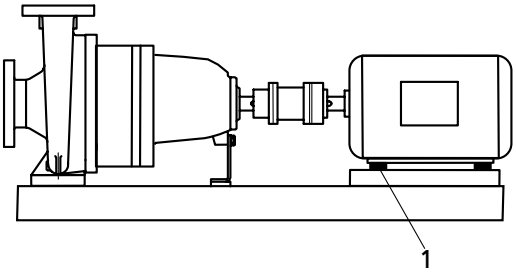

Fig. 17: Pump set with shim

1	Shim

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

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

⚠ WARNING

Unprotected rotating coupling

Risk of injury by rotating shafts!

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

⚠ DANGER

Risk of ignition by frictional sparks

Explosion hazard!!

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

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

5.8 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, EN 60079.

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⚠ WARNING

Incorrect connection to the mains

Damage to the power supply network, short circuit!

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

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

NOTE

Installing a motor protection device is recommended.

5.8.1 Setting the time relay

CAUTION

Switchover between star and delta on three-phase motors with star-delta starting takes too long.

Damage to the pump (set)!

- ▷ Keep switch-over intervals between star and delta as short as possible.

Table 13: Time relay settings for star-delta starting:

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

5.8.2 Earthing

⚠ DANGER

Electrostatic charging

Explosion hazard!

Damage to the pump set!

- ▷ Connect the PE conductor to the earthing terminal provided.
- ▷ Provide for potential equalisation between the pump set and the foundation.

5.8.3 Connecting the motor

NOTE

In compliance with IEC 60034-8, three-phase motors are always wired for clockwise rotation (looking at the motor shaft stub).

The pump's direction of rotation is indicated by an arrow on the pump.

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

5.9 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 36)
- The pump has been filled with the fluid to be handled. The pump has been vented. (⇨ Section 6.1.4, Page 41)
- The direction of rotation has been checked. (⇨ Section 5.9, Page 38)
- 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 49)

6.1.2 Filling in lubricants

Grease-lubricated bearings

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

Oil-lubricated bearings

Fill the bearing bracket with lubricating oil.
Oil quality see (⇨ Section 7.2.3.1.2, Page 54)
Oil quantity see (⇨ Section 7.2.3.1.3, Page 54)

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.

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.

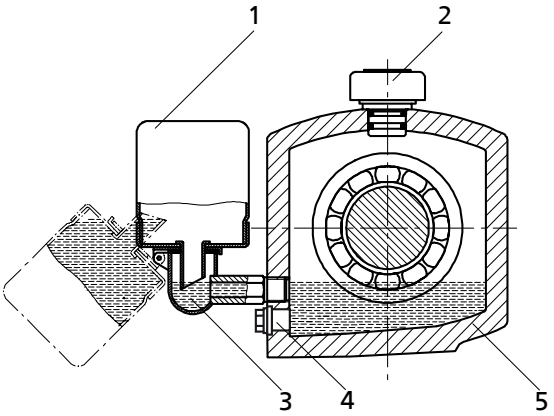

Fig. 18: Bearing bracket with constant level oiler

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 Shaft seal

Shaft seals are fitted prior to delivery.
Observe the instructions on dismantling or assembly (⇨ Section 7.5.3, Page 65) .

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

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

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

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6.1.4 Priming and venting the pump

DANGER

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

Risk of burns!

Explosion hazard!

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

DANGER

Risk of potentially explosive atmosphere inside the pump

Explosion hazard!

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

DANGER

Shaft seal failure caused by insufficient lubrication

Hot or toxic fluid could escape!

Damage to the pump!

- ▷ Before starting up the pump set, vent the pump and suction line and prime both with the fluid to be handled.

1. Vent the pump and suction line and prime both with the fluid to be handled.
2. Fully open the shut-off element in the suction line.
3. Fully open all auxiliary connections (barrier fluid, flushing liquid, etc).

6.1.5 Final check

1. Remove the coupling guard and its footboard, if any.
2. Check the coupling alignment; re-align the coupling, if required.
   (⇨ Section 5.6, Page 32)
3. Check proper functioning of coupling/shaft.
   Check that coupling/shaft can be easily rotated by hand.
4. Fit the coupling guard and its footboard, if any.
5. Check the distance between coupling and coupling guard.
   The coupling guard must not touch the coupling.

6.1.6 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_{ini}=10 to 30 °C
  Outlet temperature t_{outl}= 45 °C max.

6.1.7 Cooling of the bearing bracket (special design)

If the pump is permanently heated during standstill (above 185 °C) the bearing bracket has to be cooled.

Observe the following values for cooling the bearing bracket:

- Cooling liquid pressure: 6 bar max.
- Cooling liquid quantity: see table below.

Table 14: Cooling liquid quantity for cooling the bearing bracket

Bearing bracket	Cooling liquid quantity [l/min]
CS40	5
CS50	6
CS60	8
CS80	10

6.1.8 Heating

The pump can also be heated, if necessary. The volute casing and the casing cover have heating chambers. The heating chambers can be heated with hot water, steam or thermal oil.

Table 15: Pressure limits and temperature limits for heating chamber, heatable version

Design	Maximum temperature [°C]	Maximum pressure [bar]
Version with welded casing cover	300	20
Version with bolted casing cover	150	10

DANGER

Excessive surface temperature

Explosion hazard!

Risk of burns!

▷ Observe the permissible temperature classes.

CAUTION

Lack of heating medium

Damage to the pump!

▷ Provide sufficient quantities of a suitable heating medium.

CAUTION

Time for warming up the pump too short

Damage to the pump!

▷ Check that the pump is sufficiently warmed up throughout.

CAUTION

Impermissibly high temperature of the heating medium

Fluid handled or heating medium could escape!

- ▷ Observe the application limits of the heating media.

6.1.9 Heating up/keeping warm the pump (set)

CAUTION

Pump blockage

Damage to the pump!

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

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

- Make sure that the temperature is increased continuously.
- Heating speed: max. 10 °C/min (10 K/min)

Fluid temperatures above 150 °C

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

Temperature difference

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

6.1.10 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 41)
- ▷ Always operate the pump within the permissible operating range.

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CAUTION

Abnormal noises, vibrations, temperatures or leakage

Damage to the pump!

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

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

CAUTION

Start-up against open discharge line

Motor overload!

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

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

CAUTION

Misalignment of pump and coupling

Damage to pump, motor and coupling!

- ▷ When the operating temperature has been reached, switch off the pump set and check the coupling alignment.

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

6.1.11 Checking the shaft seal

Mechanical seal
Double mechanical seal

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

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.

Pure graphite packing

If a pure graphite packing is used, there must always be some leakage.

Table 16: Leakage rate of the pure graphite packing

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

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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.

6.1.12 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.

✓ Also ensure quench liquid supply is ON 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.

For prolonged shutdown periods:

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

CAUTION

Risk of freezing during prolonged pump shutdown periods

Damage to the pump!

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

6.2 Operating limits

DANGER

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

Explosion hazard!

Hot or toxic fluid could escape!

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

DANGER

Formation of a potentially explosive atmosphere inside the pump

Explosion hazard!

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

6.2.1 Ambient temperature

CAUTION

Operation outside the permissible ambient temperature

Damage to the pump (set)!

- ▷ Observe the specified limits for permissible ambient temperatures.

Observe the following parameters and values during operation:

Table 17: Permissible ambient temperatures

Permissible ambient temperature	Value
Maximum	50 °C 40 °C[9)]
Minimum	See data sheet.

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9 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 18: Frequency of starts

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

CAUTION

Re-starting while motor is still running down

Damage to the pump (set)!

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

6.2.3 Fluid handled

6.2.3.1 Flow rate

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

- Short-time operation: Q_{min} [10] = 0,15 × Q_{BEP} [11]
- Continuous operation: Q_{min} [10] = 0,3 × Q_{BEP} [11]
- 2-pole operation: Q_{max} [12] = 1,1 × Q_{BEP} [11]
- 4-pole operation: Q_{max} [12] = 1,25 × Q_{BEP} [11]
- 6-pole operation: Q_{max} [12] = 1,25 × Q_{BEP} [11]

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

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

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

10 Minimum flow rate

11 Best efficiency point

12 Maximum flow rate

Table 19: 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.

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump (set) remains installed

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

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

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

✓ The pump has been properly drained. (⇨ Section 7.3, Page 58)

✓ The safety instructions for dismantling the pump have been observed. (⇨ Section 7.4.1, Page 59)

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

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

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

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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 39) (⇨ Section 6.2, Page 46)

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇨ Section 7, Page 50)

⚠ 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 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

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 shaft seal

Explosion hazard!

Hot, toxic fluid escaping!

Damage to the pump set!

Risk of burns!

Fire hazard!

- ▷ Regularly service the shaft seal.

⚠ 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.

DANGER

Risk of potentially explosive atmosphere inside the pump

Explosion hazard!

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

CAUTION

Increased wear due to dry running

Damage to the pump set!

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

CAUTION

Impermissibly high temperature of fluid handled

Damage to the pump!

- ▷ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).
- ▷ Observe the temperature limits in the data sheet and in the section on operating limits. (⇨ Section 6.2, Page 46)

While the pump is in operation, observe and/or 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 39)
- Check the shaft seal. (⇨ Section 6.1.11, Page 44)
- 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 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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NOTE

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

7.2.2 Inspection work

⚠ DANGER

Excessive temperatures caused by friction, impact or frictional sparks

Explosion hazard!

Fire hazard!

Damage to the pump set!

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

⚠ DANGER

Electrostatic charging due to insufficient potential equalisation

Explosion hazard!

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

7.2.2.1 Checking the coupling

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

7.2.2.2 Checking the clearances

The back pull-out unit must be removed to check the clearances.
If the clearance is larger than permitted (see the following table), fit a new casing wear ring 502.01 and/or 502.02.
The clearances given refer to the diameter.

Table 20: Clearances between impeller and casing (cover)/between impeller and casing wear ring

Impeller material	Clearances	
	New	Maximum
G, B	0,3 mm	0,9 mm
C, D, E, F, O	0,5 mm	1,5 mm

7.2.2.3 Cleaning filters

CAUTION

Insufficient inlet pressure due to clogged filter in the suction line

Damage to the pump!

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

7.2.3 Lubrication and lubricant change of rolling element bearings

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 usually lubricated with mineral oil.

7.2.3.1.1 Intervals

Table 21: Oil change intervals

Temperature at the bearing	First oil change	All subsequent oil changes[13)]
Up to 70 °C	After 300 operating hours	Every 8,500 operating hours
70 °C - 80 °C	After 300 operating hours	Every 4,200 operating hours
80 °C - 90 °C	After 300 operating hours	Every 2,000 operating hours

7.2.3.1.2 Oil quality

Table 22: Oil quality

Description	Properties	
Lubricating oil CL46 or CLP46 to DIN 51517	Kinematic viscosity at 40 °C	46±4 mm^2/s
	Flash point (to Cleveland)	+175 °C
	Solidification point (pour point)	-15 °C
	Application temperature[14)]	Higher than permissible bearing temperature

7.2.3.1.3 Oil quantity

Table 23: Oil quantity

Bearing bracket	Oil quantity [l]
CS40	0.2
CS50	0.4
CS60	0.4
CS80	0.7

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13 At least once a year

14 For ambient temperatures below -10 °C use a suitable different type of lubricating oil. Contact KSB.

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.

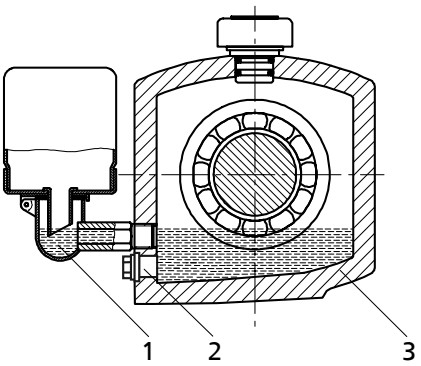

Fig. 19: Bearing bracket with constant level oiler

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, re-insert and re-tighten the screw plug (2).
4. Re-fill with oil. (⇨ Section 6.1.2, Page 39)

7.2.3.2 Grease lubrication

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

7.2.3.2.1 Intervals

- Re-lubricate the bearings once a year.
- Under unfavourable operating conditions (e.g. high room temperature, high atmospheric humidity, dust-laden air, aggressive industrial atmosphere, etc.) check the bearings earlier and clean and re-lubricate them if required.
- Replace the rolling element bearings after 25,000 operating hours or 2 years of continuous operation.

7.2.3.2.2 Grease quality

Table 24: Grease quality to DIN 51825

Soap basis	NLGI grade	Worked penetration at 25 °C in mm/10	Drop point	Temperature range
Lithium	2 to 3	220-295	≥ 175 °C	-30 °C to 120 °C

7.2.3.2.3 Grease quantities

Medium duty

Table 25: Re-lubrication quantities

Bearing assembly	Bearing + cover pump end [g]	Bearing + cover drive end [g]
CS40	5	10
CS50	15	20
CS60	15	20
CS80	15	40

Table 26: Grease quantities for new grease fill

Bearing assembly	Bearing + cover pump end [g]	Bearing + cover drive end [g]
CS40	10	20
CS50	30	40
CS60	30	40
CS80	30	80

Economy

Economy bearings are greased for life; the grease fill cannot be renewed. If necessary, replace the complete bearing.

7.2.3.2.4 Re-lubrication

CAUTION

Contaminated lubricating nipples

Contamination of the lubricating grease!

- ▷ Clean the grease lubricating nipples before re-lubricating them.

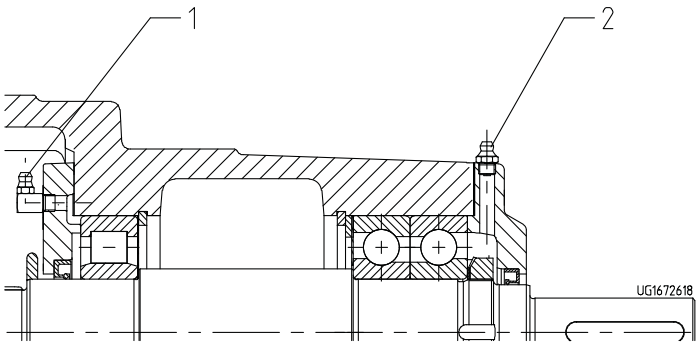

Fig. 20: Position of the lubrication nipples

1	Lubricating nipple	2	Lubricating nipple

The bearings are re-filled via lubricating nipples.

7.2.3.2.5 Changing the grease

CAUTION

Mixing greases of differing soap bases

Changed lubricating qualities!

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

✓ The pump has been dismantled for changing the grease.

1. Only half-fill the bearing cavities with grease.
2. Fill the cavities in the bearing cover until they are about 1/3 full.

7.2.4 Supervision of operation

⚠ DANGER

Incorrectly serviced shaft seal

Fire hazard!

Hot fluids escaping!

Damage to the pump set!

- ▷ Regularly service the shaft seal.

⚠ DANGER

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

Fire hazard!

Damage to the pump set!

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

⚠ DANGER

Incorrectly serviced barrier fluid system

Explosion hazard!

Fire hazard!

Damage to the pump set!

Leakage of hot and/or toxic fluids!

- ▷ Regularly service the barrier fluid system.
- ▷ Monitor the barrier fluid pressure.

⚠ WARNING

Fluids posing a health hazard

Hazard to persons and the environment!

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

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 46)

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

- The pump must run quietly and free from vibrations at all times.
- In case of oil lubrication, ensure the oil level is correct.
- Check the shaft seal.
- Check the static sealing elements for leakage.
- Check the rolling element bearings for running noises.
  Vibrations, noise and an increase in current input occurring during unchanged operating conditions indicate wear.
- Monitor the correct functioning of any auxiliary connections.
- Cooling system
  Take the pump out of service at least once a year to thoroughly clean the cooling system.
- Monitor the stand-by pump.
  To make sure that 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).

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.

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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).

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

⚠ WARNING

Unqualified personnel performing work on the pump (set)

Risk of injury!

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

⚠ WARNING

Hot surface

Risk of injury!

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

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

Observe the general safety instructions and information. (⇨ Section 7, Page 50)

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

For dismantling and reassembly refer to the general assembly drawing.

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

⚠ DANGER

Insufficient preparation of work on the pump (set)

Risk of injury!

- ▹ Properly shut down the pump set. (⇨ Section 6.1.12, Page 45)
- ▹ Close the shut-off elements in the suction line and discharge line.
- ▹ Drain the pump and release the pump pressure. (⇨ Section 7.3, Page 58)
- ▹ Shut off any auxiliary feed lines.
- ▹ Allow the pump set to cool down to ambient temperature.

7.4.2 Preparing the pump set

1. Interrupt the power supply and make sure it cannot be switched on again unintentionally.
2. Disconnect and remove all auxiliary pipework.
3. Remove the coupling guard.
4. Remove the coupling spacer if fitted.
5. Drain the oil fill of oil-lubricated bearings. (⇨ Section 7.2.3.1.4, Page 55)

7.4.3 Removing the motor

NOTE

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

⚠ WARNING

Motor tipping over

Risk of crushing hands and feet!

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

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

7.4.4 Removing the back pull-out unit

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 59) to (⇨ Section 7.4.3, Page 60) have been observed/carried out.

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

⚠ WARNING

Back pull-out unit tilting

Risk of crushing hands and feet!

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

1. If required, suspend or support bearing bracket 330 to prevent it from tilting.
2. Unbolt support foot 183 from the baseplate.
3. **Only for heated version:** Undo pipe union 731.01/.02.
4. **Only for heated version:** Remove by-pass pipe 710.02.
5. Undo hexagon nut 920.01 at the volute casing.
6. Pull the back pull-out unit out of the volute casing.
7. Remove and dispose of joint ring 411.10.
8. Place the back pull-out unit on a clean and level surface.

7.4.5 Removing the impeller

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 59) to (⇨ Section 7.4.4, Page 60) have been observed/carried out.

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

1. Undo impeller nut 922 (right-hand thread).
2. Remove impeller 230 with an impeller removal tool.
3. Place impeller 230 on a clean and level surface.
4. Remove keys 940.01 from shaft 210.
5. Remove and dispose of joint rings 411.31/411.32.

7.4.6 Dismantling the shaft seal

NOTE

On design variants with a casing cover with bolted heating chamber, the heating chamber does not need to be removed for dismantling the shaft seal.

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7.4.6.1 Removing the mechanical seal - cylindrical casing cover

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 59) to (⇨ Section 7.4.5, Page 60) have been observed/carried out.

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

1. Unscrew hexagon nuts 920.02 and slide back seal cover 471 (if fitted).
2. Undo hexagon head bolts 901.22, if any.
3. Remove casing cover 161 from bearing bracket 330.
4. Pull complete mechanical seal 433 with shaft protecting sleeve 524.01, seal cover 471 and thrower 507.01 off shaft 210.

7.4.6.2 Removing the mechanical seal - conical casing cover

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 59) to (⇨ Section 7.4.5, Page 60) have been observed/carried out.

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

1. Pull shaft sleeve 524.01 with the rotating assembly of mechanical seal 433 off the shaft.
2. Undo hexagon head bolts 901.22, if any.
3. Dismantle casing cover 161 with the stationary ring of mechanical seal 433.
4. Remove thrower 507.01.
5. Press the stationary ring of mechanical seal 433 out of casing cover 161.

7.4.6.3 Removing the gland packing

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 59) to (⇨ Section 7.4.5, Page 60) 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 and remove the gland follower.
2. Undo hexagon head bolt 901.22, if any.
3. Remove casing cover 161 from bearing bracket 330.
4. Remove stuffing box ring 454.01 and drip plate 463.01.
5. Remove packing rings 461.01 and lantern ring 458.01, if any, from the packing chamber.
6. Pull shaft protecting sleeve 524.01 and thrower 507.01 off shaft 210.

7.4.7 Dismantling the bearing assembly

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 59) to (⇨ Section 7.4.6, Page 60) have been observed and carried out.

✓ The bearing bracket has been placed in a clean and level assembly area.

1. Unscrew the hexagon socket head cap screw in the coupling hub.
2. Pull the coupling half off the pump shaft with a puller.
3. Remove key 940.02.
4. Undo screws 914.02 and remove drive-end bearing cover 360.02 and joint ring 400.02.
5. Undo screws 914.01 and remove pump-end bearing cover 360.01 and joint ring 400.01.

7.4.7.1 Dismantling the medium-duty bearing assembly

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 59) to (⇨ Section 7.4.7, Page 61) have been observed/carried out.

1. Carefully drive shaft 210 together with angular contact ball bearing 320.02 and the inner ring of cylindrical roller bearing 322.01 out of the bearing bracket towards the drive end.
2. Remove support disc 550.23 of angular contact ball bearing 320.02 from bearing bracket 330.
3. In case of grease lubrication, remove disc 550.25.
4. Remove cylindrical roller bearing 322.01 (roller cage) from bearing bracket 330.
5. In case of grease lubrication, remove disc 550.24.
6. Unbend lock washer 931.01 behind keywayed nut 920.21 on shaft 210.
7. Unscrew keywayed nut 920.21 (right-hand thread) and remove lock washer 931.01.

⚠ 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.
- ▹ Observe the applicable local occupational safety regulations and accident prevention regulations.

8. 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.
9. Dispose of joint rings 400.01/.02.

7.4.7.2 Dismantling the economy bearing assembly

✓ The notes and steps stated in (⇨ Section 7.4.1, Page 59) to (⇨ Section 7.4.7, Page 61) have been observed/carried out.

1. Carefully press shaft 210 with deep groove ball bearing 321.01/.02 out of the bearing bracket.
2. Heat up the deep groove ball bearing to 80°C and pull it off shaft 210. On grease-lubricated models, pull deep groove ball bearing 321.01/.02 off the shaft in cold condition.
3. Dispose of joint rings 400.01/.02.

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

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CAUTION

Improper reassembly

Damage to the pump!

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

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.

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 Reassambling the bearing assembly

7.5.2.1 Reassembling the medium-duty bearing assembly

- ✓ 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.

⚠ 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.
- ▷ Observe the applicable local occupational safety regulations and accident prevention regulations.

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. 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.

3. Use a C-spanner to tighten slotted round nut 920.21 without lock washer 931.01.
4. Let angular contact ball bearing 320.01 cool down to approximately 5 °C above ambient temperature.
5. Re-tighten slotted round nut 920.21 to tightening torque M1. (⇨ Section 7.6.3, Page 70) Then loosen it again.
6. 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.
7. Fit lock washer 931.01.
8. Tighten slotted round nut 920.21 to tightening torque M2 (⇨ Section 7.6.3, Page 70) .
9. Bend over lock washer 931.01.
10. Insert circlip 932.01/932.02 into the bearing bracket.
11. On grease-lubricated models, insert disc 550.24.
12. Fit cylindrical roller bearing 322.01 (roller cage) in the bearing bracket.

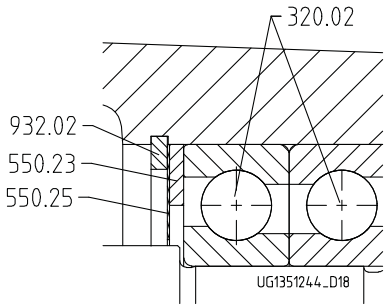

Fig. 21: Reassembling the medium-duty bearing assembly

13. On grease-lubricated models, insert disc 550.25.
14. Insert support disc 550.23 of angular contact ball bearing 320.02 into bearing bracket 330.
15. Carefully push pre-assembled shaft 210 with angular contact ball bearing 320.02 and the inner ring of cylindrical roller bearing 322.01 from the drive end into bearing bracket 330.
16. On grease-lubricated models, fill the bearings and bearing covers with grease. (⇨ Section 7.2.3.2, Page 55)

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17. Fit pump-end bearing cover 360.01 with joint ring 400.01; take care not to damage lip seal 421.01.
18. Fit drive-end bearing cover 360.02 with joint ring 400.02; take care not to damage lip seal 421.02.
19. Fit thrower 507.01 and 507.02, if applicable, and align flush with the shaft shoulder.
20. Fit key 940.02.
21. Slide the coupling hub onto the shaft end.
22. Secure the coupling hub with an adjusting screw.

7.5.2.2 Reassembling the economy bearing assembly

- ✓ 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.

⚠ 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.
- ▷ Observe the applicable local occupational safety regulations and accident prevention regulations.

1. **Oil-lubricated models:** Heat up deep groove ball bearing 321.01/.02 in an oil bath to approx. 80 °C and slide it onto shaft 210 until it will not go any further. **Grease-lubricated models:** Press deep groove ball bearing 321.01/.02 onto shaft 210 in cold condition until it will not go any further. Only apply force via the inner ring of the deep groove ball bearings.
2. Carefully slide pre-assembled shaft 210 with deep groove ball bearing 321.01/.02 into bearing bracket 330.
3. Fit pump-end bearing cover 360.01 with joint ring 400.01; take care not to damage lip seal 421.02.
4. Fit drive-end bearing cover 360.02 with joint ring 400.02; take care not to damage lip seal 421.02.
5. Fit thrower 507.01 and 507.02, if applicable, and align flush with the shaft shoulder.
6. Fit key 940.02.
7. Slide the coupling hub onto the shaft end.
8. Secure the coupling hub with an adjusting screw.

7.5.3 Fitting the shaft seal

7.5.3.1 Fitting the mechanical seal

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

- For installing the mechanical seal, proceed as shown in the seal installation drawing.
- Work cleanly and accurately.
- Only remove the protective wrapping of the contact faces immediately before installation takes place.
- Prevent any damage to the sealing surfaces or O-rings.

- After inserting the stationary ring of the mechanical seal, check that it is plane-parallel in relation to the casing part.
- The surface of the shaft protecting sleeve must be absolutely clean and smooth, and the sleeve's mounting edge must be chamfered.
- When sliding the rotating assembly onto the shaft protecting sleeve, take appropriate steps to protect the surface of the shaft protecting sleeve from damage.

7.5.3.1.1 Fitting the single mechanical seal – cylindrical casing cover

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 62) to (⇨ Section 7.5.2, Page 63) have been observed/carried out.

✓ The bearing assembly and the individual parts of mechanical seal 433 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.

1. Fit thrower 507.01, if applicable, and align flush with the shaft shoulder.
2. Fasten seal cover 471 with inserted O-ring, the stationary ring of the mechanical seal and gasket 411.05 to casing cover 161 with hexagon nut 920.02.
3. Place casing cover 161 into the locating fit of bearing bracket 330.
4. Fit and tighten hexagon head bolt 901.22, if any.
5. Fit the rotating assembly of mechanical seal 433 on shaft protecting sleeve 524.01 (observe distance B - see Supplementary Sheet of the mechanical seal).
6. Slide pre-assembled mechanical seal 433 and shaft protecting sleeve 524.01 onto shaft 210.

7.5.3.1.2 Fitting the double mechanical seal – cylindrical casing cover

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 62) to (⇨ Section 7.5.2, Page 63) have been observed/carried out.

✓ The bearing assembly and the individual parts of mechanical seal 433 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.

1. Fit thrower 507.01, if any, and align flush with the shaft shoulder.
2. Fit the rotating assembly of mechanical seals 433.01 and 433.02 on shaft protecting sleeve 524.01 (observe distance B - see Supplementary Sheet for the mechanical seal).
3. Position the stationary ring of mechanical seal 433.01 with the O-ring in casing cover 161. Fit ring and circlip, if any.
4. Position the stationary ring of mechanical seal 433.02 with the O-ring in casing cover 471.01.
5. Insert pre-assembled mechanical seals 433.01 and 433.02 and shaft protecting sleeve 524.01 in the casing cover.
6. Fit seal cover 471.01 with gasket 411.15 on the casing cover. Make sure the connection bores are positioned correctly.

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7.5.3.1.3 Fitting the mechanical seal – conical casing cover

- ✓ The notes and steps stated in (⇨ Section 7.5.1, Page 62) to (⇨ Section 7.5.2, Page 63) have been observed/carried out.
- ✓ The bearing assembly and the individual parts of mechanical seal 433 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.

1. Fit thrower 507.01, if applicable, and align flush with the shaft shoulder.
2. Carefully press the stationary ring of mechanical seal 433 with O-ring into casing cover 161.
3. Fit casing cover 161 with the inserted stationary ring of the mechanical seal into bearing bracket 330.
4. Fit and tighten hexagon head bolt 901.22, if any.
5. Fit the rotating assembly of mechanical seal 433 and spacer ring, if any, on shaft protecting sleeve 524.01 (observe distance B - see Supplementary Sheet for the mechanical seal).
6. Slide pre-assembled mechanical seal 433 and shaft protecting sleeve 524.01 onto shaft 210.

7.5.3.2 Fitting the gland packing

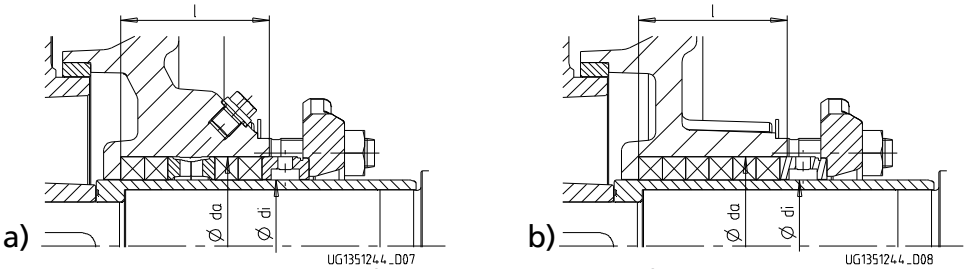

Fig. 22: Gland packing chamber a) with lantern ring and b) without lantern ring

Table 27: Gland packing chamber (dimensions in mm)

Bearing bracket	Gland packing chamber			Packing cross-section	Packing rings
	Ø d_i	Ø d_a	l		
CS40	35	51	53	8×8	4 rings and 1 lantern ring or 6 rings
CS50	45	65	64	10×10	
CS60	55	75	64	10×10	
CS80	70	95	79	12,5×12,5	

Pure graphite packings see supplementary operating instructions.

Always use pre-compressed packing rings.

- ✓ The notes and steps stated in (⇨ Section 7.5.1, Page 62) to (⇨ Section 7.5.2, Page 63) have been observed/carried out.
- ✓ 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.

1. Clamp casing cover 161 into a vice.
2. Insert the first packing ring, ensuring that its cut edge is in a horizontal position.
3. Hold the packing ring in place and slide shaft protecting sleeve 524.01 (chamfered side first) into the gland packing chamber from the pump end.

4. Slightly expand the inside diameter of the packing ring by moving shaft protecting sleeve 524.01 back and forth. Then pull out shaft protecting sleeve 524.01.
   Insert lantern ring 458, if any (see drawing above).
   Insert subsequent packing rings one at a time, with their joints staggered at approximately 90°.
   When the last packing ring has been inserted, shaft protecting sleeve 524.01 remains in the packing chamber.
5. Insert stuffing box ring 454.01 with the drilled hole down.
6. Fit gland follower 452 and lightly fasten it by hand with the two hexagon nuts 920.02; watch discs 550.01.
7. Place the entire casing cover 161 with shaft protecting sleeve 524.01 into the locating fit of bearing bracket 330.
8. Fit and tighten hexagon head bolts 901.22, if any.

7.5.4 Fitting the impeller

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 62) to (⇨ Section 7.5.3, Page 65) have been observed and carried out.

✓ The bearing assembly/mechanical seal as well as the individual parts have been placed in a clean and level assembly area.

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

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

✓ The sealing surfaces have been cleaned.

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

1. Insert keys 940.01 into the shaft keyway.
2. Insert joint ring 411.32 into shaft protecting sleeve 524.01.
3. Coat the impeller seat with a suitable lubricant.
4. Slide impeller 230 onto shaft 210.
5. Thread impeller nut 922 with inserted joint ring 411.31 onto shaft 210 and tighten (⇨ Section 7.6.4, Page 71) .

7.5.5 Installing the back pull-out unit

⚠ WARNING

Back pull-out unit tilting

Risk of crushing hands and feet!

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

✓ The notes and steps stated in (⇨ Section 7.5.1, Page 62) to (⇨ Section 7.5.4, Page 68) 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. If required, suspend or support the back pull-out unit to prevent it from tilting. Then slide it into volute casing 102 with a new gasket 411.10.
2. Tighten nut 920.01 at the volute casing.
3. Bolt support foot 183 to the baseplate.
4. **Only for heated version:** Fit by-pass pipe 710.02 with pipe union 731.01/.02.

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7.5.6 Mounting the motor

NOTE

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

1. Shift the motor to connect it to the pump via the coupling.
2. Fasten the motor to the baseplate.
3. Align pump and motor. (⇨ Section 5.7, Page 34)
4. Connect the motor to the power supply (refer to manufacturer's product literature).

7.6 Tightening torques

7.6.1 Tightening torques for the pump

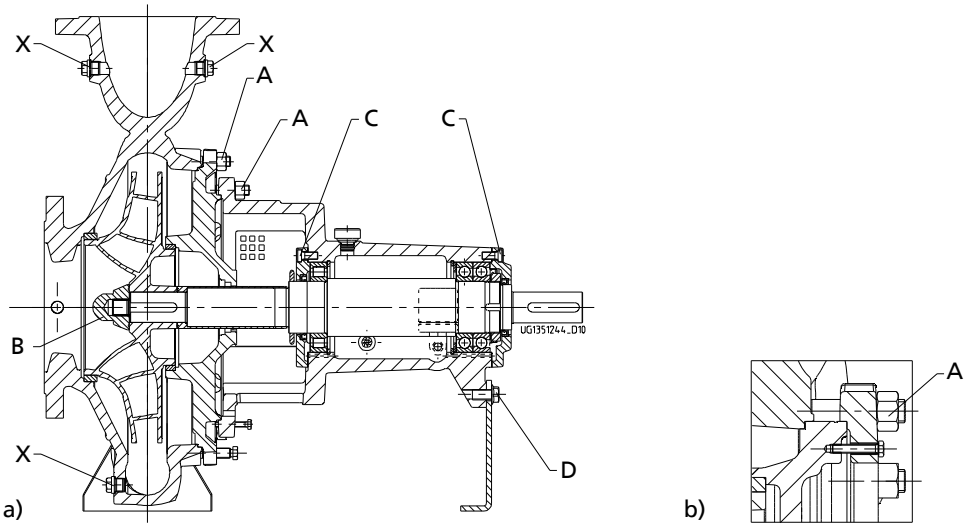

Fig. 23: a) Tightening points at the pump, b) Version with clamped casing cover

Use a torque wrench to tighten the bolted connections (902.01/920.01) between the volute casing and the bearing bracket.

Table 28: Tightening torques

Position	Thread size	Nominal value [Nm]	
		PN16 (G, C, V)[15)]	PN25 (E, D)[15)]
A	M12	50	65
	M16	125	165
B	M14x1,5 SW21 (CS40)	60	
	M16x1,5 SW24 (CS50)	125	
	M20x1,5 SW30 (CS60)	200	
	M24x1,5 SW36 (CS80)	300	
C	M8	20	
	M10	38	
	M12	55	

Position	Thread size	Nominal value [Nm]	
		PN16 (G, C, V)[15]	PN25 (E, D)[15]
D	M12	90	
	M16	210	
X	1/8	25	
	1/4	55	
	3/8	80	
	1/2	130	
	3/4	220	

7.6.2 Tightening torques for the shaft seal

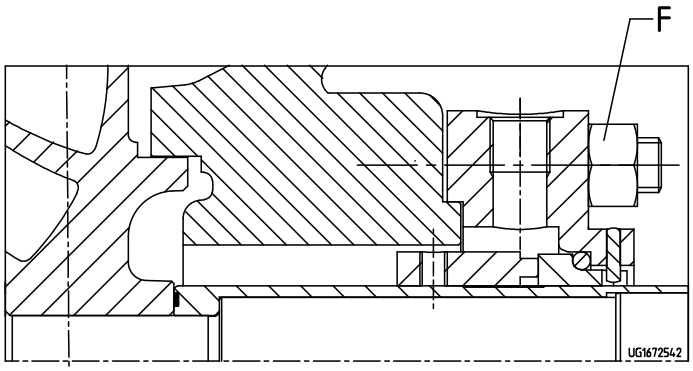

Fig. 24: Position

Table 29: Tightening torques for the shaft seal

Position	Thread	Tightening torque [Nm]
F	M 12	50
	M 16	125

7.6.3 Tightening torques for the shaft nut

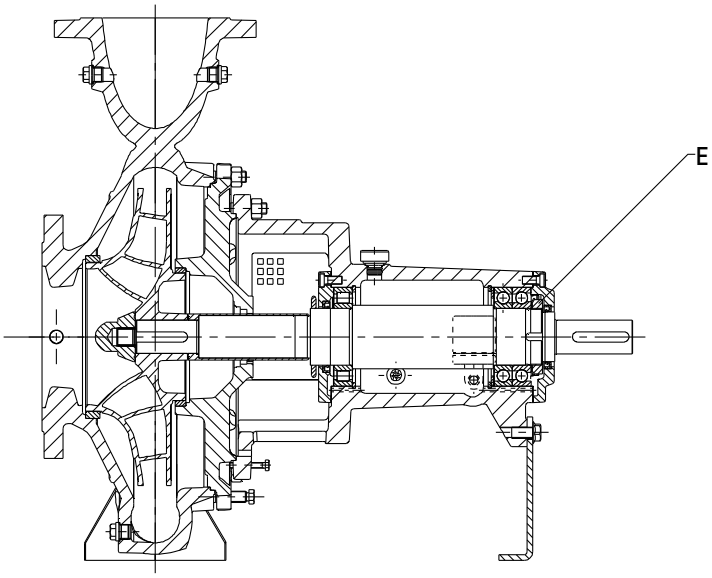

Fig. 25: Shaft nut position

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[15] Casing material: G = cast iron; C,V = stainless steel; E = unalloyed steel; D = duplex stainless steel

Table 30: Tightening torques for the shaft nut

Position	Bearing bracket	Slotted round nut	Thread	Tightening torques [Nm]	
				M1[16)]	M2[17)]
E	CS 40	KM 8	M 40x1,5	100	65
	CS 50	KM 10	M 50x1,5	150	90
	CS 60	KM 12	M 60x2	200	120
	CS 80	KM 16	M 80x2	200	120

7.6.4 Tightening torques for the pump set

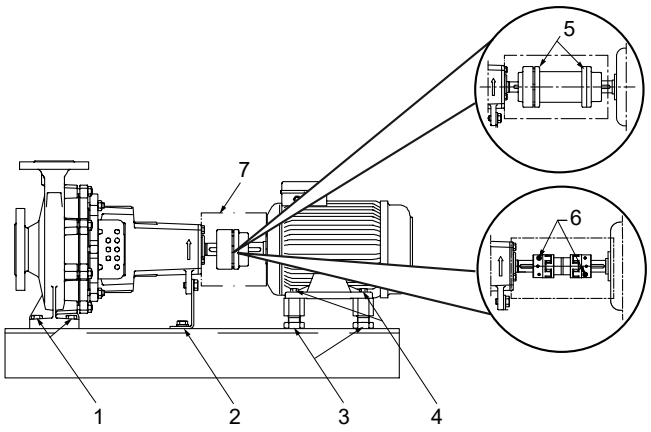

Fig. 26: Position of bolts/screws at the pump set

Table 31: Tightening torques

Position	Thread	Tightening torques	Comment
		[Nm]	
1	M12	60	Pump on baseplate
	M16	150	
	M20	250	
	M24	400	
2	M12	60	
3	M24 × 1,5	140	Adjusting screws in baseplate
	M36 × 1,5	140	
4	M8	18	Motor on adjusting screws or bases
	M10	30	
	M12	60	
	M16	150	
	M20	250	
	M24	400	
5	M6	10	Coupling guard

16 Loosen the screwed connection again after first tightening.
17 Final tightening torques

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
- 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 32: Quantity of spare parts for recommended spare parts stock

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
210	Shaft	1	1	1	2	2	2	20 %
230	Impeller	1	1	1	2	2	2	20 %
320.02	Rolling element bearing (set)	1	1	2	2	2	3	25 %
321.01	Radial ball bearing	1	1	2	2	2	3	25 %
321.02	Radial ball bearing	1	1	2	2	2	3	25 %
322.01	Radial roller bearing	1	1	2	2	2	3	25 %
502.01/.02	Casing wear ring	2	2	2	3	3	4	50 %
503.01/.02	Impeller wear ring	2	2	2	3	3	4	50 %
524.01	Shaft protecting sleeve	2	2	2	3	3	4	50 %
-	Sealing elements for pump casing (set)	4	6	8	8	9	12	150 %
-	Torque-transmitting coupling elements (set)	1	1	2	2	3	4	30 %
Versions with mechanical seal:								
433	Mechanical seal, complete	1	1	2	2	2	3	25 %
Versions with gland packing:								
461.01	Gland packing (set)	4	4	6	6	6	8	100 %

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7.7.3 Interchangeability of pump components

Components featuring the same number in a column are interchangeable.

Table 33: Interchangeability of pump components

Size	Bearing bracket	Description																									
		Casing cover	Support foot	Shaft, medium-duty	Shaft, economy	Rolling element bearing	Radial ball bearing	Radial ball bearing	Radial roller bearing	Bearing bracket	Casing wear ring[18]	Casing wear ring[18]	Casing wear ring[19]	Impeller wear ring[19]	Casing wear ring[19]	Impeller wear ring[19]	Thrower	Thrower	Shaft protecting sleeve[20]	Impeller nut	Mechanical seal	Seal cover	Gland follower	Stuffing box ring	Lantern ring	Gland packing
		Part No.																									
		161	183	210	210	320.01	321.01	321.02	322.01	330	502.01	502.02	502.01	503.01	502.02	503.02	507.01	507.02	524.01	922	433	471.07	452.01	454.01	458.01	461.01
040-025-160	CS40	1	1	1	1	1	1	1	1	1	1	-	1	1	-	-	1	1	1	1	1	1	1	1	1	1
040-025-200	CS40	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
050-032-125	CS40	1	3	1	1	1	1	1	1	1	3	-	3	3	-	-	1	1	1	1	1	1	1	1	1	1
050-032-125.1	CS40	1	3	1	1	1	1	1	1	1	2	-	2	2	-	-	1	1	1	1	1	1	1	1	1	1
050-032-160	CS40	1	1	1	1	1	1	1	1	1	3	-	3	3	1	1	1	1	1	1	1	1	1	1	1	1
050-032-160.1	CS40	1	1	1	1	1	1	1	1	1	2	-	2	2	-	-	1	1	1	1	1	1	1	1	1	1
050-032-200	CS40	2	2	1	1	1	1	1	1	1	3	1	4	4	1	1	1	1	1	1	1	1	1	1	1	1
050-032-200.1	CS40	2	2	1	1	1	1	1	1	1	2	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1
065-040-125	CS40	1	3	1	1	1	1	1	1	1	5	-	4	4	-	-	1	1	1	1	1	1	1	1	1	1
065-040-160	CS40	1	1	1	1	1	1	1	1	1	5	1	4	4	1	1	1	1	1	1	1	1	1	1	1	1
065-040-160.1	CS40	1	1	1	1	1	1	1	1	1	4	1	5	5	1	1	1	1	1	1	1	1	1	1	1	1
065-040-200	CS40	2	2	1	1	1	1	1	1	1	5	1	6	6	1	1	1	1	1	1	1	1	1	1	1	1
065-040-200.1	CS40	2	2	1	1	1	1	1	1	1	4	1	5	5	1	1	1	1	1	1	1	1	1	1	1	1
080-050-125	CS40	1	1	1	1	1	1	1	1	1	6	1	7	7	1	1	1	1	1	1	1	1	1	1	1	1
080-050-160	CS40	1	2	1	1	1	1	1	1	1	6	1	8	8	1	1	1	1	1	1	1	1	1	1	1	1
080-050-160.1	CS40	1	2	1	1	1	1	1	1	1	22	1	27	27	1	1	1	1	1	1	1	1	1	1	1	1
080-050-200	CS40	2	2	1	1	1	1	1	1	1	6	1	7	7	1	1	1	1	1	1	1	1	1	1	1	1
080-050-200.1	CS40	2	2	1	1	1	1	1	1	1	22	1	27	27	1	1	1	1	1	1	1	1	1	1	1	1
100-065-125	CS40	1	2	1	1	1	1	1	1	1	7	1	9	9	1	1	1	1	1	1	1	1	1	1	1	1
050-032-250	CS50	3	4	2	2	2	2	2	2	2	3	2	4	4	2	2	2	2	2	2	2	2	2	2	2	2
050-032-250.1	CS50	3	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
065-040-250	CS50	3	4	2	2	2	2	2	2	2	9	2	11	11	2	2	2	2	2	2	2	2	2	2	2	2
065-040-250.1	CS50	3	4	2	2	2	2	2	2	2	8	2	10	10	2	2	2	2	2	2	2	2	2	2	2	2
065-040-315	CS50	4	5	2	2	2	2	2	2	2	9	3	11	11	3	3	2	2	2	2	2	2	2	2	2	2
080-050-250	CS50	3	4	2	2	2	2	2	2	2	6	2	7	7	2	2	2	2	2	2	2	2	2	2	2	2
080-050-250.1	CS50	3	4	2	2	2	2	2	2	2	23	2	28	28	2	2	2	2	2	2	2	2	2	2	2	2
080-050-315	CS50	4	6	2	2	2	2	2	2	2	11	3	13	13	3	3	2	2	2	2	2	2	2	2	2	2
080-050-315.1	CS50	4	6	2	2	2	2	2	2	2	10	3	12	12	3	3	2	2	2	2	2	2	2	2	2	2
100-065-160	CS50	5	7	2	2	2	2	2	2	2	11	4	13	13	4	4	2	2	2	2	2	2	2	2	2	2
100-065-200	CS50	6	4	2	2	2	2	2	2	2	11	4	14	14	4	4	2	2	2	2	2	2	2	2	2	2
100-065-250	CS50	7	5	2	2	2	2	2	2	2	7	3	9	9	3	3	2	2	2	2	2	2	2	2	2	2
125-080-160	CS50	5	4	2	2	2	2	2	2	2	12	4	15	15	4	4	2	2	2	2	2	2	2	2	2	2
125-080-200	CS50	8	4	2	2	2	2	2	2	2	12	3	16	16	3	3	2	2	2	2	2	2	2	2	2	2
125-080-200.1	CS50	8	4	2	2	2	2	2	2	2	24	3	29	29	3	3	2	2	2	2	2	2	2	2	2	2
125-080-250	CS50	7	6	2	2	2	2	2	2	2	12	3	16	16	3	3	2	2	2	2	2	2	2	2	2	2

18 On pumps with casing wear ring only
19 On pumps with casing wear ring and impeller wear ring only
20 Depending on mechanical seal type

Size	Bearing bracket	Description																								
		Casing cover	Support foot	Shaft, medium-duty	Shaft, economy	Rolling element bearing	Radial ball bearing	Radial ball bearing	Radial roller bearing	Bearing bracket	Casing wear ring[18]	Casing wear ring[18]	Casing wear ring[19]	Impeller wear ring[19]	Casing wear ring[19]	Impeller wear ring[19]	Thrower	Thrower	Shaft protecting sleeve[20]	Impeller nut	Mechanical seal	Seal cover	Gland follower	Stuffing box ring	Lantern ring	Gland packing
		Part No.																								
		161	183	210	210	320.01	321.01	321.02	322.01	330	502.01	502.02	502.01	503.01	502.02	503.02	507.01	507.02	524.01	922	433	471.07	452.01	454.01	458.01	461.01
125-100-160	CS50	8	5	2	2	2	2	2	2	2	13	3	17	17	3	3	2	2	2	2	2	2	2	2	2	2
125-100-200	CS50	8	5	2	2	2	2	2	2	2	13	3	17	17	3	3	2	2	2	2	2	2	2	2	2	2
100-065-315	CS60	9	6	3	3	3	3	3	3	3	12	3	16	16	3	3	3	3	3	3	3	3	3	3	3	3
125-080-315	CS60	9	8	3	3	3	3	3	3	3	12	3	16	16	3	3	3	3	3	3	3	3	3	3	3	3
125-080-400	CS60	10	9	3	3	3	3	3	3	3	13	5	17	17	5	5	3	3	3	3	3	3	3	3	3	3
125-100-250	CS60	11	6	3	3	3	3	3	3	3	13	3	17	17	3	3	3	3	3	3	3	3	3	3	3	3
125-100-315	CS60	9	8	3	3	3	3	3	3	3	13	3	17	17	3	3	3	3	3	3	3	3	3	3	3	3
125-100-400	CS60	10	9	3	3	3	3	3	3	3	14	5	18	18	5	5	3	3	3	3	3	3	3	3	3	3
150-125-200	CS60	12	8	3	3	3	3	3	3	3	14	6	18	18	6	6	3	3	3	3	3	3	3	3	3	3
150-125-250	CS60	13	8	3	3	3	3	3	3	3	14	6	18	18	6	6	3	3	3	3	3	3	3	3	3	3
150-125-315	CS60	14	9	3	3	3	3	3	3	3	14	5	18	18	5	5	3	3	3	3	3	3	3	3	3	3
150-125-400	CS60	10	10	3	3	3	3	3	3	3	14	5	18	18	5	5	3	3	3	3	3	3	3	3	3	3
200-150-200	CS60	12	9	3	3	3	3	3	3	3	15	6	19	19	6	6	3	3	3	3	3	3	3	3	3	3
200-150-250	CS60	13	9	3	3	3	3	3	3	3	16	6	20	20	6	6	3	3	3	3	3	3	3	3	3	3
200-150-315	CS80	15	11	4	4	4	4	4	4	4	16	5	20	20	5	5	4	4	4	4	4	4	4	4	4	4
200-150-400	CS80	16	11	4	4	4	4	4	4	4	16	5	20	20	5	5	4	4	4	4	4	4	4	4	4	4
200-150-500	CS80	17	12	4	4	4	4	4	4	4	17	7	21	21	7	7	4	4	4	4	4	4	4	4	4	4
200-200-250	CS80	18	13	4	4	4	4	4	4	4	16	8	22	22	8	8	4	4	4	4	4	4	4	4	4	4
250-200-315	CS80	19	13	4	4	4	4	4	4	4	18	9	23	23	9	9	4	4	4	4	4	4	4	4	4	4
250-200-400	CS80	20	13	4	4	4	4	4	4	4	19	9	24	24	9	9	4	4	4	4	4	4	4	4	4	4
250-200-500	CS80	17	14	4	4	4	4	4	4	4	20	7	25	25	7	7	4	4	4	4	4	4	4	4	4	4
300-250-315	CS80	19	15	5	5	4	4	4	4	4	21	9	26	26	9	9	4	4	4	4	4	4	4	4	4	4

8 Trouble-shooting

⚠ WARNING

Improper work to remedy faults

Risk of injury!

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

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

A Pump delivers insufficient flow rate

B Motor is overloaded

C Excessive discharge pressure

D Increased bearing temperature

E Leakage at the pump

F Excessive leakage at the shaft seal

G Vibrations during pump operation

H Impermissible temperature increase in the pump

Table 34: Trouble-shooting

A	B	C	D	E	F	G	H	Possible cause	Remedy[21)]
✘	-	-	-	-	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point. Check system for impurities. Fit a larger impeller.[22)] Increase the 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.
✘	-	-	-	-	-	✘	✘	Suction lift is too high/$NPSH_{available}$ (positive suction head) is too low.	Check/alter fluid level. Install pump at a lower level. Fully open the shut-off element in the suction line. Change suction line, if the friction losses in the suction line are too high. Check any strainers installed/suction opening. Observe permissible speed of pressure fall.
✘	-	-	-	-	-	-	-	Air intake at the shaft seal	Clean barrier fluid duct, supply external barrier fluid, if necessary, or increase barrier fluid pressure. Replace shaft seal.
✘	-	-	-	-	-	-	-	Wrong direction of rotation	Check the electrical connection of the motor and the control system, if any.
✘	-	-	-	-	-	-	-	Speed is too low.[22)] - Operation with frequency inverter - Operation without frequency inverter	 - Increase voltage/frequency at the frequency inverter in the permissible range. - Check voltage.
✘	-	-	-	-	-	✘	-	Impeller	Replace worn components by new ones.

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

22 Contact KSB.

A	B	C	D	E	F	G	H	Possible cause	Remedy[21)]
-	✗	-	-	-	-	✗	-	Pump back pressure is lower than specified in the purchase order.	Re-adjust to duty point. In the case of persistent overloading, turn down impeller.[22)]
-	✗	-	-	-	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	Contact KSB.
-	✗	-	-	-	✗	-	-	Gland follower over-tightened or cocked	Correct.
-	✗	✗	-	-	-	-	-	Speed is too high.	Reduce speed.[22)]
-	-	-	-	✗	-	-	-	Defective gasket	Fit new gasket between volute casing and casing cover.
-	-	-	-	-	✗	-	-	Worn shaft seal	Fit new shaft seal. Check flushing liquid/barrier fluid.
✗	-	-	-	-	✗	-	-	Score marks or roughness on shaft protecting sleeve / shaft sleeve	Replace shaft protecting sleeve/shaft sleeve. Fit new shaft seal.
-	-	-	-	-	✗	-	-	Vibrations during pump operation	Correct suction conditions. Re-align the pump. Re-balance the impeller. Increase pressure at the pump suction nozzle.
-	-	-	✗	-	✗	✗	-	The pump set is misaligned.	Re-align.
-	-	-	✗	-	✗	✗	-	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.
-	-	-	✗	-	-	✗	-	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.
✗	✗	-	-	-	-	-	-	Motor is running on two phases only.	Replace the defective fuse. Check the electric cable connections.
-	-	-	-	-	-	✗	-	Rotor out of balance	Clean the impeller. Re-balance the impeller.
-	-	-	-	-	-	✗	-	Defective bearing(s)	Replace.
-	-	-	-	-	-	✗	✗	Flow rate is too low.	Increase the minimum flow rate.
-	-	-	-	-	✗	-	-	Incorrect inflow of circulation liquid	Increase the free cross-section.

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9 Related Documents

9.1 General assembly drawing with list of components

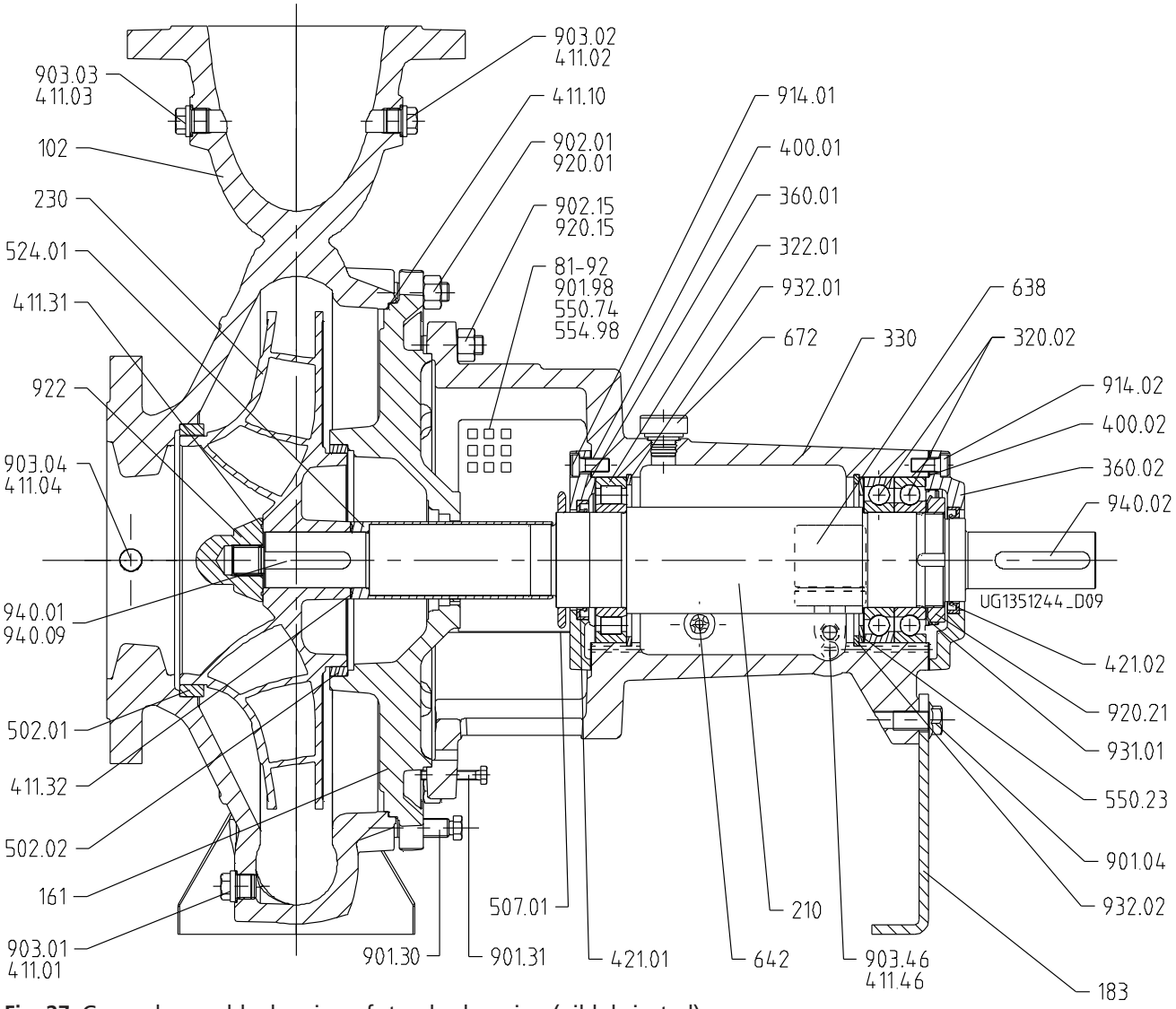
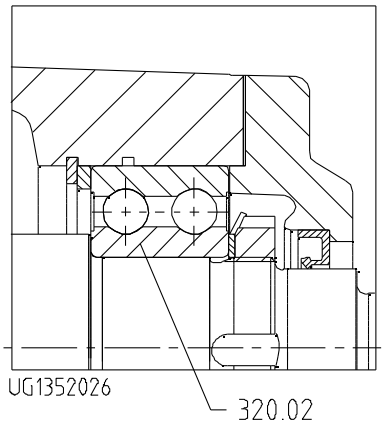
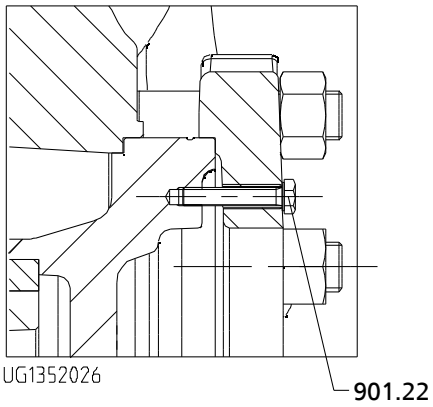


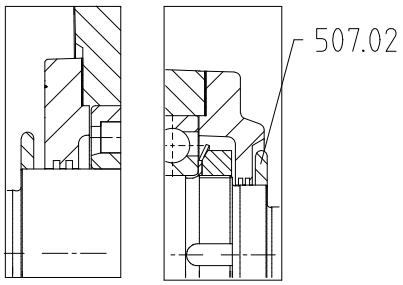
Fig. 27: General assembly drawing of standard version (oil-lubricated)



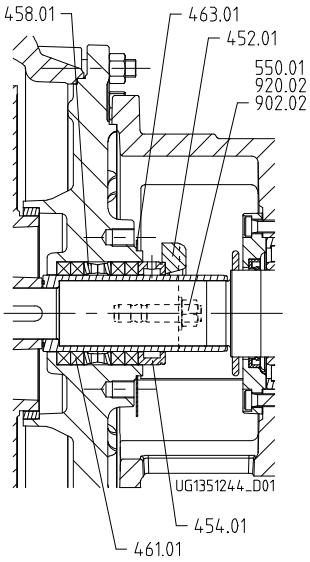
Version with bearing bracket CS40



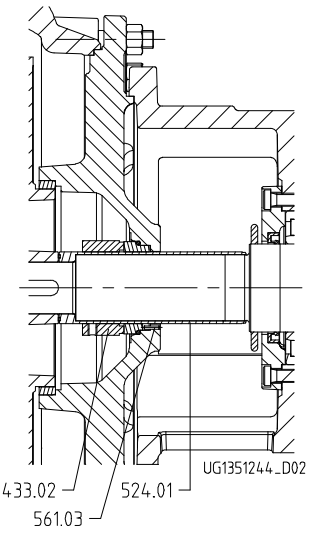
Version with clamped casing cover



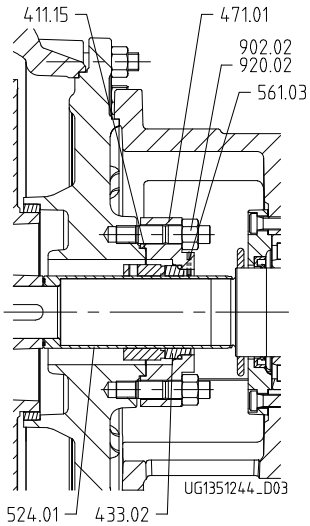
Version with labyrinth seal



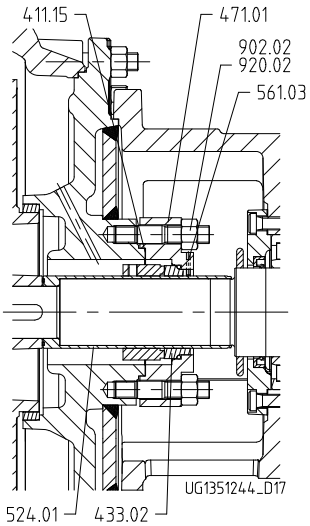
Version with gland packing



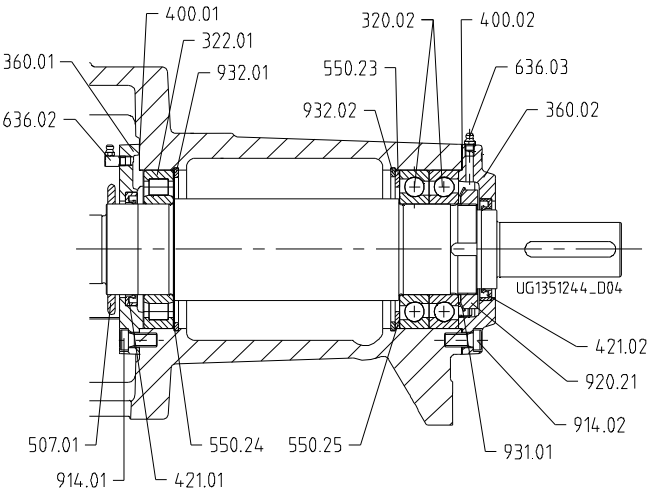
Mechanical seal with conical casing cover



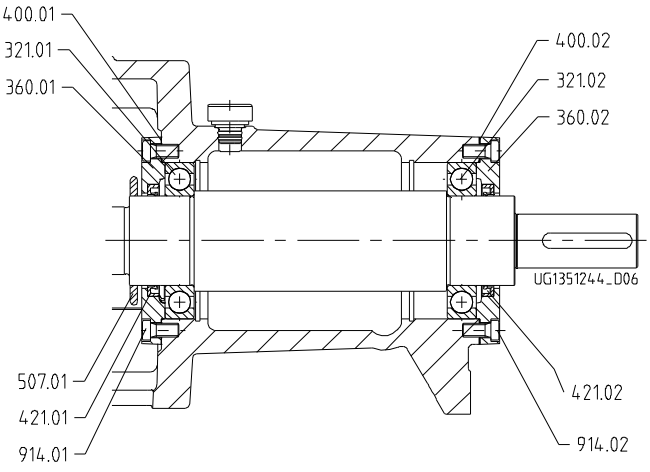
Mechanical seal with cylindrical casing cover



Mechanical seal with cylindrical casing cover (heatable version with welded casing cover)



Grease-lubricated version (medium-duty bearing assembly)



Oil-lubricated version (economy bearing assembly)

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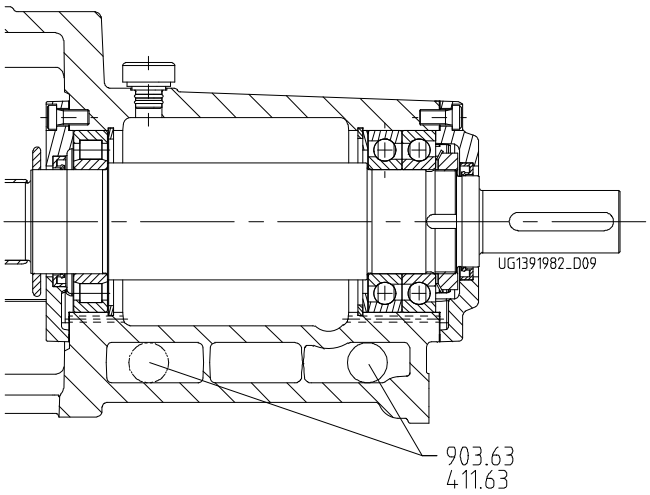
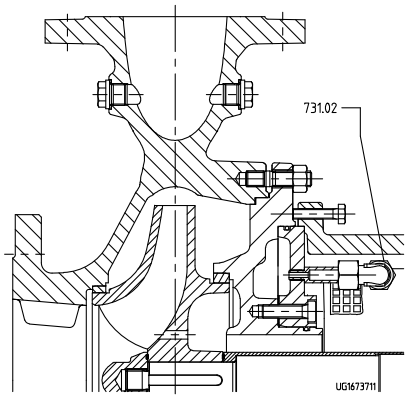
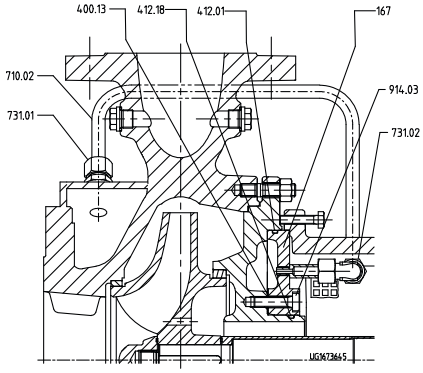


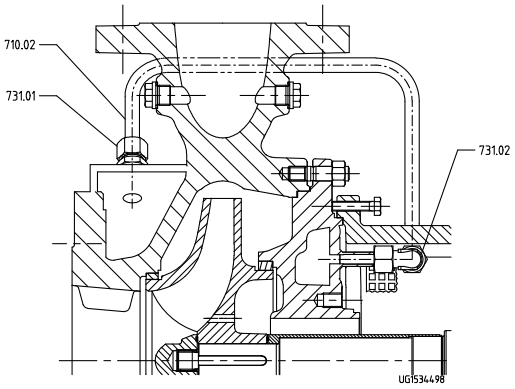
Version with coolable bearing bracket



Heatable version, only casing cover cooled/heated



Heatable version with bolted casing cover



Heatable version with welded casing cover

Table 35: List of components

Part No.	Comprising	Description
102	102	Volute casing
	411.01/.02[23]/03[23]/.04[23]/.10[24]	Joint ring
	502.01[23]	Casing wear ring
	902.01	Stud
	903.01/.02[23]/.03[23]/.04[23]	Screw plug
	920.01	Hexagon nut
161	161	Casing cover
	167[25]	Cover insert
	400.13[25]	Gasket
	412.01/.18[25]	O-ring
	502.02[23]	Casing wear ring
	901.22 [26]/31	Hexagon head bolt
	902.02	Stud
	914.03[25]	Hexagon socket head cap screw
	920.02	Hexagon nut
183	183	Support foot

23 Not on all versions

24 Joint rings 411.10 and 411.15 (411.15 for versions with mechanical seal with seal cover only) depending on the operating temperature. Order separately in spare parts order.

25 On versions with bolted casing cover only

26 On models with clamped casing cover only

Part No.	Comprising	Description
210	210	Shaft
	920.21[27)]	Slotted round nut
	931.01[27)]	Lock washer
	940.01/.02/.09[28)]	Key
230	230	Impeller
	503.01/.02[23)]	Impeller wear ring
321.01 [29)]/.02[29)]	321.01/.02	Deep groove ball bearing
322.01 [27)]	322.01	Cylindrical roller bearing
330	330	Bearing bracket
360.01	360.01	Bearing cover
360.02	360.02	Bearing cover
400.01	400.01	Gasket
400.02	400.02	Gasket
411.15[24)]	411.15	Joint ring
411.31	411.31	Joint ring
411.32	411.32	Joint ring
421.01	421.01	Lip seal
421.02	421.02	Lip seal
433.02	433.02	Mechanical seal (complete)
452.01	452.01	Gland follower
454.01	454.01	Stuffing box ring
458.01	458.01	Lantern ring
461.01	461.01	Gland packing
463.01	463.01	Drip plate
471.01	471.01	Seal cover
502.01[23)]	502.01	Casing wear ring
502.02[23)]	502.02	Casing wear ring
503.01[23)]	503.01	Impeller wear ring
503.02[23)]	503.02	Impeller wear ring
507.01	507.01	Thrower
507.02[30)]	507.02	Thrower
524.01	524.01	Shaft protecting sleeve
550.01	550.01	Disc
550.23	550.23	Disc
550.24[31)]	550.24	Disc
550.25[31)]	550.25	Disc
550.74	550.74	Disc
554.98	554.98	Washer
561.03	561.03	Grooved pin
636.02[31)]	636.02	Lubricating nipple
636.03[31)]	636.03	Lubricating nipple
638[32)32)]	638	Constant level oiler
642[32)]	642	Oil level sight glass

27 Not fitted on versions with economy bearing assembly
28 From CS 60
29 On versions with economy bearing assembly only
30 On versions with labyrinth seal only
31 On grease-lubricated versions only
32 Not applicable for grease-lubricated versions

Part No.	Comprising	Description
672[32)]	672	Vent plug
81-92	81-92	Cover plate
99-9	411.01/.02/.03/.04/.10/.15/31/.32/.46	Joint ring
	400.01/02	Gasket
901.04	901.04	Hexagon head bolt
901.30	901.30	Hexagon head bolt
901.31	901.31	Hexagon head bolt
901.32	901.32	Hexagon head bolt
901.98	901.98	Hexagon head bolt
902.15	902.15	Stud
903.46	903.46	Screw plug
914.01	914.01	Hexagon socket head cap screw
914.02	914.02	Hexagon socket head cap screw
920.15	920.15	Hexagon nut
922	922	Impeller nut
932.01	932.01	Circlip
932.02	932.02	Circlip

32) The relevant version is indicated in the product literature supplied.

10 EU Declaration of Conformity

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

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

MegaCPK (MCPK)

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[33)] have been applied:
  - ISO 12100
  - EN 809
- Applied national technical standards and specifications, in particular:
  - DIN EN ISO 5199

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

.....[34)].....

Name

Function

Company
Address

33 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.

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

11 Certificate of Decontamination

Type: .....

Order number /

Order item number[35]: .....

Delivery date: .....

Application: .....

Fluid handled[35]: .....

Please tick where applicable[35]:

☐ Corrosive

☐ Oxidising

☐ Flammable

☐ Explosive

☐ Hazardous to health

☐ Seriously hazardous to health

☐ Toxic

☐ Radioactive

☐ Bio-hazardous

☐ Safe

Reason for return:[35]: .....

Comments: .....

.....

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

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

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

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

☐ No special safety precautions are required for further handling.

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

.....

.....

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

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

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35 Required field

Index

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P

R

S

T

W

2731.8/17-EN

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