

Self-priming Pump

Etaprime L

Installation/Operating Manual



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Installation/Operating Manual Etaprime L

Original operating manual

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Glossary

Back pull-out design

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

Back pull-out unit

Pump without pump casing; partly completed machinery

Certificate of decontamination

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

Discharge line

The pipeline which is connected to the discharge nozzle

Hydraulic system

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

Pool of pumps

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

Pump

Machine without drive, additional components or accessories

Pump set

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

Self-priming ability

Ability of a filled pump to evacuate a suction line, i.e. to self-prime from an unfilled suction line.

Suction lift line/suction head line

The pipeline which is connected to the suction nozzle

1 General

1.1 Principles

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

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

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

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

1.2 Installation of partly completed machinery

To install partly completed machinery supplied by KSB refer to the sub-sections under Servicing/Maintenance. (⇒ Section 7.5.5, Page 60)

1.3 Target group

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

1.4 Other applicable documents

Table 1: Overview of other applicable documents

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


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

1.5 Symbols

Table 2: Symbols used in this manual








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

¹ If included in agreed scope of supply

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

1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
 DANGER	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
 WARNING	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
 CAUTION	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	Explosion protection This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with the <i>Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016</i> .
	General hazard In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	Electrical hazard In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	Machine damage In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.



2 Safety

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

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

2.1 General

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

2.2 Intended use

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

2.3 Personnel qualification and training

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

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

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

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

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

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

2.5 Safety awareness

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

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

2.6 Safety information for the operator/user

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

2.7 Safety information for maintenance, inspection and installation

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

- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.1.7, Page 40) (⇒ Section 6.3, Page 43)
- Decontaminate pumps which handle fluids posing a health hazard. (⇒ Section 7.3, Page 52)
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇒ Section 6.1, Page 33)

2.8 Unauthorised modes of operation

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

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

2.9 Explosion protection



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

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

Special conditions apply to the operation of explosion-proof pump sets in accordance with the UK's *Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016*.

Especially adhere to the sections in this manual marked with the Ex symbol and the following sections, (⇒ Section 2.9.1, Page 11) to (⇒ Section 2.9.4, Page 12)

The explosion-proof status of the pump is only assured if the pump is used in accordance with its intended use.

Never operate the product outside the limits stated in the data sheet and on the name plate.

Prevent impermissible modes of operation at all times.

2.9.1 Marking

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

Example of such marking:

II 2G Ex h IIC T5-T1 Gb

Refer to the Temperature limits table for the maximum temperatures permitted for the individual pump variants.

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	Temperature limit of the pump
T2	280 °C
T3	185 °C
T4	120 °C
T5	85 °C
T6	Only after consultation with the manufacturer

If the pump is to be operated at a higher temperature, if there is no data sheet or if the pump is part of a pool of pumps, contact KSB for the maximum permissible operating temperature.

Motor supplied by the operator

If a pump is supplied without motor (as part of a pool of pumps), the motor specified in the pump data sheet must meet the following conditions:

- The permissible temperature limits at the motor flange and motor shaft must be higher than the temperatures generated by the pump.
- Contact the manufacturer for the actual pump temperatures.

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



² Subject to further limitations for mechanical seal temperature rise

3 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

	<div style="background-color: #e67e22; color: white; padding: 5px; border: 1px solid black;">  DANGER </div> <p>The pump (set) could slip out of the suspension arrangement Danger to life from falling parts!</p> <ul style="list-style-type: none"> ▷ 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 suspend it from the lifting tackle as shown.

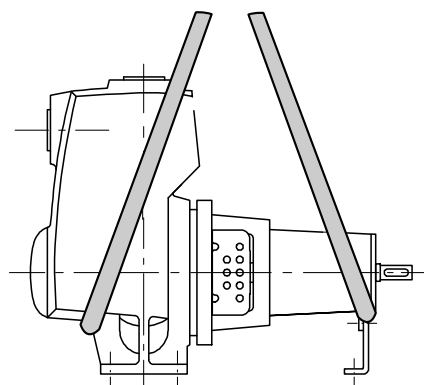


Fig. 1: Transporting the pump

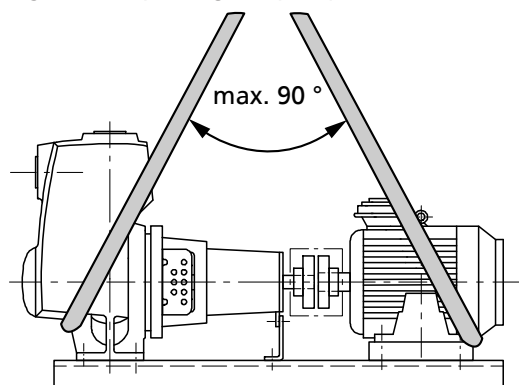


Fig. 2: Transporting the complete pump set

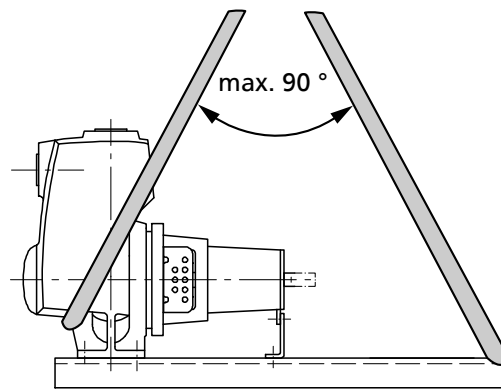




Fig. 3: Transporting the pump on the baseplate

3.3 Storage/preservation

	<p>CAUTION</p> <p>Damage during storage due to humidity, dirt or vermin Corrosion/contamination of pump (set)!</p> <p>▷ For outdoor storage cover the pump (set) and accessories with waterproof material and protect against condensation.</p>
	<p>CAUTION</p> <p>Wet, contaminated or damaged openings and connections Leakage or damage to the pump!</p> <p>▷ Clean and cover pump openings and connections as required prior to putting the pump into storage.</p>

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 43)

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3, Page 52)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
Indicate any safety measures and decontamination measures taken.
(⇒ Section 11, Page 74)

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

3.5 Disposal

	<div data-bbox="507 235 703 286"> WARNING</div> <p data-bbox="496 300 1378 358">Fluids handled, consumables and supplies which are hot and/or pose a health hazard</p> <p data-bbox="496 367 956 396">Hazard to persons and the environment!</p> <ul data-bbox="520 407 1414 517" style="list-style-type: none">▸ 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

- Self-priming pump

The pump is designed for handling clean or contaminated fluids in waste water management, on construction sites, in agriculture, in the general or chemical industry, in the petroleum, food processing and canning industry and for circulating solvents and cleaning agents with a viscosity of up to 50 mm²/s. A solids content of up to 3 % is permissible, but the fluid handled must not contain long fibres.

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
E	T	P	L	0	8	0	-	0	8	0	-	2	0	0		G	C	X	I	1	0	D	3	0	1	8	5	2			B
See name plate and data sheet																								See data sheet							

Table 6: Designation key

Position	Code	Description
1-4	Pump type	
	ETPL	Etaprime with bearing bracket
5-16	Size, e.g.	
	080	Nominal suction nozzle diameter [mm]
	080	Nominal discharge nozzle diameter [mm]
	200	Nominal impeller diameter [mm]
17	Pump casing material	
	G	Cast iron EN-GJL-250 / A48CL35
	C	Stainless steel 1.4408 / A743CF8M
18	Impeller material	
	G	Cast iron EN-GJL-250
	C	Stainless steel 1.4408
19	Design	
	_)3)	Standard
	X	Non-standard (BT3D, BT3)
20	Shaft seal type	
	I	Single mechanical seal, internal circulation (conical seal chamber only)
	D	Double mechanical seal in back-to-back arrangement
	T	Double mechanical seal in tandem arrangement with internal circulation
21-22	Seal code, single mechanical seal	
	01	Q1Q1VGG
	08	AQ1VGG ⁴⁾
	09	U3U3VGG
	10	Q1Q1X4GG

³ Blank

⁴ BQVGG for shaft unit 17

Position	Code	Description
21-22	11	BQ1EGG
23	Scope of supply	
	A	Pump only (Fig. 0 bare-shaft pump)
	B	Pump, baseplate
	C	Pump, baseplate, coupling, coupling guard
	D	Pump, baseplate, coupling, coupling guard, motor
24	Shaft unit	
	1	Shaft unit 17
	2	Shaft unit 25
	3	Shaft unit 35
25-28	Motor rating P_N [kW]	
	0011	1,10
	0075	7,50
	0185	18,50
29	Number of motor poles	
30-31	Explosion protection	
	ex	With explosion-proof motor
	... ³⁾	Without explosion-proof motor
32	Product generation	
	B	Etaprime Global Pump

4.4 Name plate

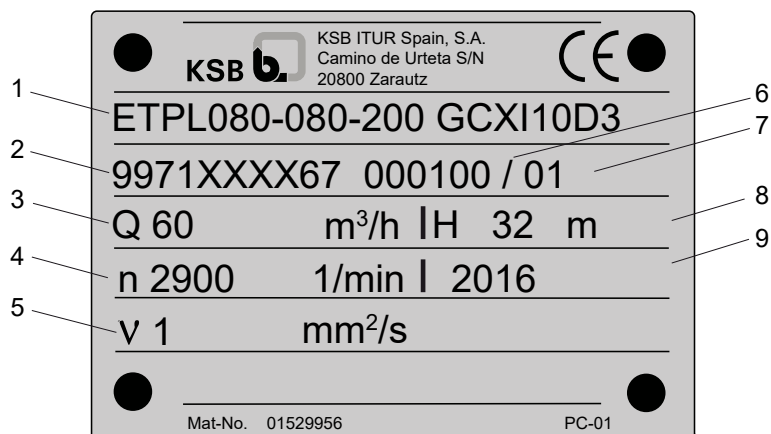


Fig. 4: Etaprime L name plate (example)

1	Type series, size and version	2	KSB order number (ten digits)
3	Flow rate	4	Rotational speed
5	Kinematic viscosity of the fluid handled	6	Order item number (six digits)
7	Consecutive number (two digits)	8	Head
9	Year of construction		

4.5 Design details

Design

- Volute casing pump
- Back pull-out design (from size 40-40-140)
- Horizontal installation

- Self-priming
- Single-stage
- Single-suction

Pump casing

- Radially split volute casing
- Volute casing with integrally cast pump feet (from pump size 40-40-140)

Drive

- KSB IEC frame standardised IE3 motor (from 0.75 kW)
- 230/400 V up to 2.2 kW and 400/690 V from 3 kW
- Rated voltage (60 Hz) 3~ 440 - 480 V ≥ 2.41 hp (1.80 kW)
- Type of construction IM B3
- Enclosure IP55
- Thermal class F with temperature sensor, 3 PTC thermistors
- Duty type: continuous duty S1

Shaft seal

- Shaft equipped with replaceable shaft protecting sleeve in the shaft seal area
- Single mechanical seals and double mechanical seals to EN 12756

Impeller type

- Open multi-vane impeller

Bearings

- Various application-oriented bearings

4.6 Design and function

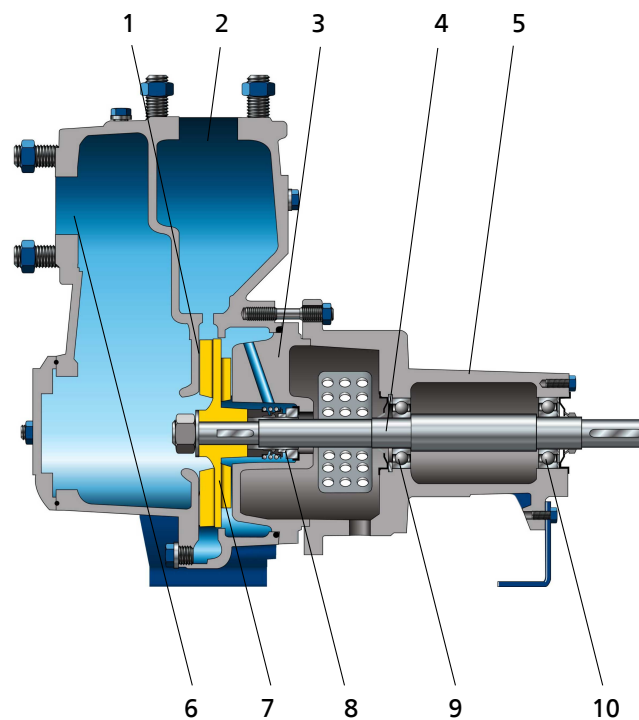


Fig. 5: Sectional drawing

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, motor end

Design The pump is designed with an axial fluid inlet and a radial outlet. The pump section 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 hydraulic system via the casing cover (3). The shaft passage through the casing cover is sealed to atmosphere with a dynamic 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. The filled pump is self-priming.

Sealing The pump is sealed by a standardised mechanical seal.

4.7 Noise characteristics

Table 7: Surface sound pressure level L_{pA} ⁵⁾

Rated power input P_N [kW]	Pump				Pump set			
	1450 rpm [dB]	1750 rpm [dB]	2900 rpm [dB]	3500 rpm [dB]	1450 rpm [dB]	1750 rpm [dB]	2900 rpm [dB]	3500 rpm [dB]
0,37	59	60	-	-	60	61	-	-
0,55	60	61	70	-	61	62	73	-
0,75	-	-	71	74	-	-	74	77
1,1	-	-	72	75	-	-	75	78
1,5	62	63	73	76	63	64	76	79
2,2	66	67	74	77	67	68	77	80
3	66	67	75	-	67	68	78	-
4	67	68	75	78	68	69	78	81
5,5	70	71	76	79	71	72	79	82
7,5	70	71	78	81	71	72	81	84
11	72	73	78	81	73	74	81	84
15	-	-	79	82	-	-	82	85
18,5	-	-	79	82	-	-	82	85
22	-	-	80	83	-	-	83	86
30	-	-	80	83	-	-	83	86
37	-	-	83	86	-	-	86	89

4.8 Dimensions and weights

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

⁵⁾ Surface sound pressure level as per ISO 3744 and DIN EN ISO 20361 ; valid for a pump operating range of $Q/Q_{BEP} = 0.8 - 1.1$ and non-cavitating operation. If noise levels are to be guaranteed: Add +3 dB for measuring and constructional tolerance.

4.9 Scope of supply



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

- Pump
- Baseplate
- Coupling
- Coupling guard
- Drive

5 Installation at Site

5.1 Checks to be carried out prior to installation





Place of installation

	 WARNING
	<p>Installation on a mounting surface which is unsecured and cannot support the load Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XS1 to BS 206 . ▷ The mounting surface must be set, even, and level. ▷ Observe the weights indicated.

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

5.2 Installing the pump set

Always install the pump set in a horizontal position.

	 DANGER <p>Excessive temperatures due to improper installation Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Install the pump in a horizontal position to ensure self-venting of the pump.
	 DANGER <p>Electrostatic charging due to insufficient potential equalisation Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Make sure that the connection between pump and baseplate is electrically conductive.

5.2.1 Installation on the foundation

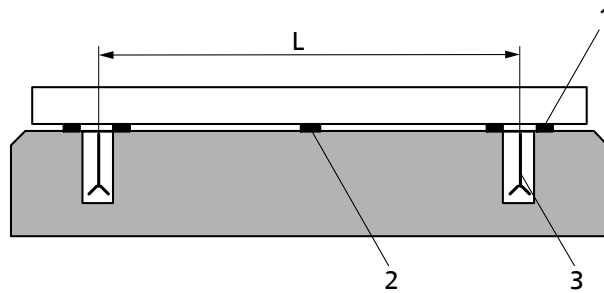


Fig. 6: Fitting the shims

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

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

	NOTE
	For optimum smooth running, baseplates should be grouted with low-shrinkage concrete in the following cases: - For all vibration-critical applications - Baseplates with a width > 400 mm - Baseplates made of grey cast iron
	NOTE
	For low-noise operation contact the manufacturer to check whether the pump set can be installed on anti-vibration mounts.
	NOTE
	Expansion joints can be fitted between the pump and the suction line or discharge line.

5.2.2 Installation without foundation

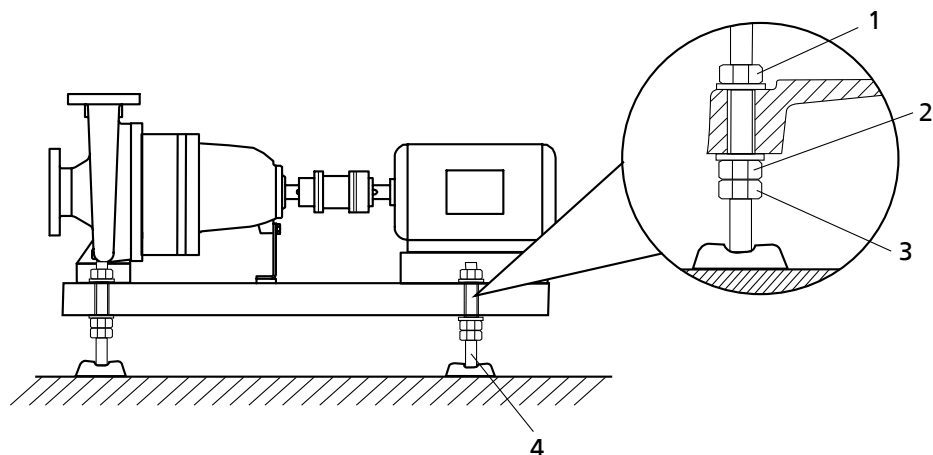


Fig. 7: Adjusting the levelling elements


1, 3	Locknut	2	Adjusting nut
4	Machine mount		

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


5.3 Piping

5.3.1 Connecting the piping

	<div style="background-color: #e67e22; color: white; padding: 5px;">! DANGER</div> <p>Impermissible loads acting on the pump nozzles Danger to life from leakage of hot, toxic, corrosive or flammable fluids!</p> <ul style="list-style-type: none"> ▷ 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. (⇒ Section 5.3.2, Page 25) ▷ Take appropriate measures to compensate for thermal expansion of the piping.
	<div style="background-color: #f1c40f; color: black; padding: 5px;">CAUTION</div> <p>Incorrect earthing during welding work at the piping Destruction of rolling element bearings (pitting effect)!</p> <ul style="list-style-type: none"> ▷ Never earth the electric welding equipment on the pump or baseplate. ▷ Prevent current flowing through the rolling element bearings.
	<div style="background-color: #2980b9; color: white; padding: 5px;">NOTE</div> <p>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.</p>

	<p>CAUTION</p> <p>When handling gaseous fluids or fluids which tend to froth, the pump will not be self-priming.</p> <p>Pump is running, but does not deliver!</p> <ul style="list-style-type: none"> ▷ Install a check valve in the suction line.
---	---

- ✓ 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 pipes are equal to or greater than the nominal diameters of the pump nozzles.
 - ✓ Adapters to larger nominal diameters are designed with a diffuser angle of approx. 8° to avoid excessive pressure losses.
 - ✓ The pipelines have been anchored in close proximity to the pump and connected without transmitting any stresses or strains.
1. Before installing the pump in the piping, remove the flange covers on the suction and discharge nozzles of the pump.

	<p>CAUTION</p> <p>Welding beads, scale and other impurities in the piping</p> <p>Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Remove any impurities from the piping. ▷ If necessary, install a filter. ▷ Observe the information in (⇒ Section 7.2.2.3, Page 48) .
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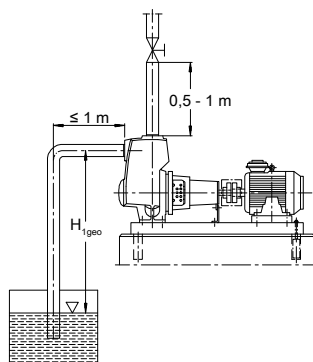




Fig. 8: Distances of suction and discharge lines

	<p>NOTE</p> <p>Use a filter with laid-in wire mesh (mesh width 0.5 mm, wire diameter 0.25 mm) of corrosion-resistant material.</p> <p>Use a filter with a filter area three times the cross-section of the piping.</p> <p>Conical filters have proved suitable.</p>
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2. Connect the pump nozzles to the piping.
Observe the distances stated above (see illustration: Distances of suction and discharge lines).



CAUTION

Aggressive flushing liquid and pickling agent

Damage to the pump!

► Match the cleaning operation mode and duration of flushing and pickling to the casing materials and seal materials used.

5.3.2 Permissible forces and moments at the pump nozzles

The data on forces and moments apply to static pipelines only. The values are only applicable if the pump is installed on a baseplate and bolted to a rigid and level foundation.

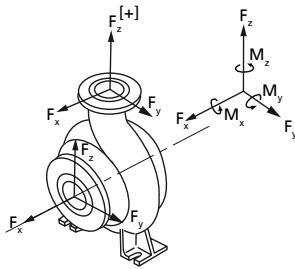


Fig. 9: Forces and moments at the pump nozzles




Table 8: Forces and moments at the pump nozzles for casing material G (EN-GJL-250/A48CL35B)

Size	Suction nozzle								Discharge nozzle							
	DN	F _x	F _y	F _z	ΣF	M _x	M _y	M _z	DN	F _x	F _y	F _z	ΣF	M _x	M _y	M _z
	[mm]	[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]	[mm]	[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
25-25-100	25	300	265	250	472	315	210	245	25	265	250	300	472	315	210	245
32-32-120	32	370	320	300	574	390	265	300	32	320	300	370	574	390	265	300
40-40-110	40	450	400	350	696	450	320	370	40	400	350	450	696	450	320	370
40-40-140	40	450	400	350	696	450	320	370	40	400	350	450	696	450	320	370
50-50-130	50	580	530	470	916	500	350	400	50	530	470	580	916	500	350	400
50-50-160	50	580	530	470	916	500	350	400	50	530	470	580	916	500	350	400
65-65-150	65	740	650	600	1153	530	390	420	65	650	600	740	1153	530	390	420
65-65-180	65	740	650	600	1153	530	390	420	65	650	600	740	1153	530	390	420
80-80-170	80	880	790	720	1385	560	400	460	80	790	720	880	1385	560	400	460
80-80-190	80	880	790	720	1385	560	400	460	80	790	720	880	1385	560	400	460
80-80-200	80	880	790	720	1385	560	400	460	80	790	720	880	1385	560	400	460
100-100-240.1	100	1180	1050	950	1843	620	440	510	100	1050	950	1180	1843	620	440	510
100-100-240	100	1180	1050	950	1843	620	440	510	100	1050	950	1180	1843	620	440	510
125-125-260	125	1400	1250	1120	2186	740	530	670	125	1250	1120	1400	2186	740	530	670





Table 9: Forces and moments at the pump nozzles for casing material C (1.4408/ A743 GR CF8M)

Size	Suction nozzle								Discharge nozzle							
	DN	F _x	F _y	F _z	ΣF	M _x	M _y	M _z	DN	F _x	F _y	F _z	ΣF	M _x	M _y	M _z
	[mm]	[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]	[mm]	[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
32-32-120	32	780	650	500	1132	415	230	320	32	650	500	780	1132	415	230	320
40-40-110	40	970	780	650	1404	500	280	410	40	780	650	970	1404	500	280	410
40-40-140	40	970	780	650	1404	500	280	410	40	780	650	970	1404	500	280	410
50-50-130	50	1240	1010	830	1802	650	320	500	50	1010	830	1240	1802	650	320	500
50-50-160	50	1240	1010	830	1802	650	320	500	50	1010	830	1240	1802	650	320	500
65-65-150	65	1600	1300	1050	2314	1050	550	780	65	1300	1050	1600	2314	1050	550	780
65-65-180	65	1600	1300	1050	2314	1050	550	780	65	1300	1050	1600	2314	1050	550	780
80-80-170	80	2000	1550	1300	2845	1330	690	1010	80	1550	1300	2000	2845	1330	690	1010
80-80-200	80	2000	1550	1300	2845	1330	690	1010	80	1550	1300	2000	2845	1330	690	1010



5.3.3 Auxiliary connections

 	<div data-bbox="507 232 683 277">⚠ DANGER</div> <p>Risk of potentially explosive atmosphere by incompatible fluids mixing in the auxiliary piping</p> <p>Risk of burns!</p> <p>Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Make sure that the barrier fluid or quench liquid are compatible with the fluid handled.
	<div data-bbox="507 528 702 573">⚠ WARNING</div> <p>Failure to use or incorrect use of auxiliary connections (e.g. barrier fluid, flushing liquid, etc.)</p> <p>Risk of injury from escaping fluid!</p> <p>Risk of burns!</p> <p>Malfunction of the pump!</p> <ul style="list-style-type: none"> ▷ 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.

5.4 Enclosure/insulation

	<div data-bbox="507 1016 683 1061">⚠ DANGER</div> <p>Risk of potentially explosive atmosphere due to insufficient venting</p> <p>Explosion hazard!</p> <ul style="list-style-type: none"> ▷ 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).
	<div data-bbox="507 1317 702 1361">⚠ WARNING</div> <p>The volute casing and casing/discharge cover take on the same temperature as the fluid handled</p> <p>Risk of burns!</p> <ul style="list-style-type: none"> ▷ Insulate the volute casing. ▷ Fit protective equipment.
	<div data-bbox="507 1594 638 1639">CAUTION</div> <p>Heat build-up in the bearing bracket</p> <p>Damage to the bearing!</p> <ul style="list-style-type: none"> ▷ Never insulate the bearing bracket, bearing bracket lantern and casing cover.
	<div data-bbox="507 1800 587 1845">NOTE</div> <p>Pump casings handling fluids at temperatures below freezing point may be insulated at the site, subject to the manufacturer's prior approval.</p>

5.5 Checking the coupling alignment

	<p>⚠ DANGER</p> <p>Inadmissible temperatures at the coupling or bearings due to misalignment of the coupling</p> <p>Explosion hazard!</p> <p>Risk of burns!</p> <p>▷ Make sure that the coupling is correctly aligned at all times.</p>
	<p>CAUTION</p> <p>Misalignment of pump and motor shafts</p> <p>Damage to pump, motor and coupling!</p> <p>▷ Always check the coupling after the pump has been installed and connected to the piping.</p> <p>▷ Also check the coupling of pump sets supplied with pump and motor mounted on the same baseplate.</p>

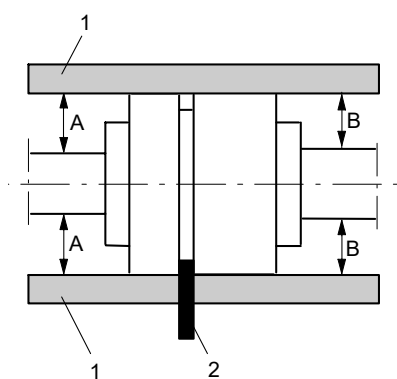


Fig. 10: Non-spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge
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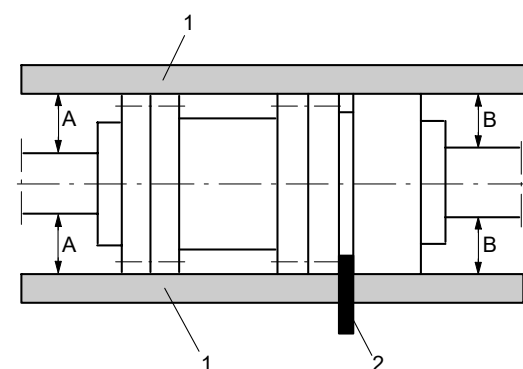


Fig. 11: Spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge
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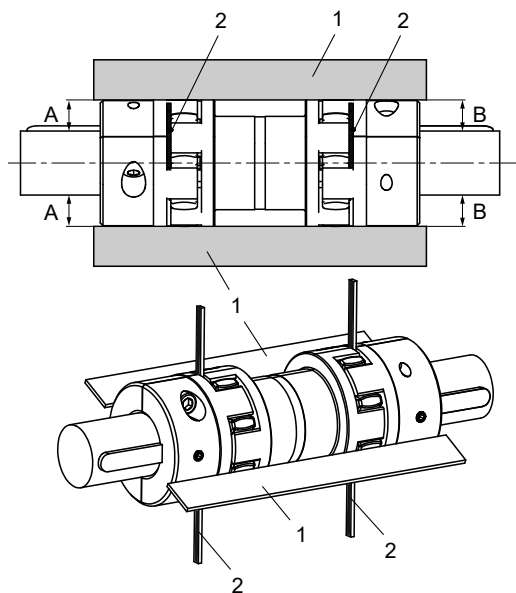


Fig. 12: Double Cardan spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge
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Table 10: Permissible alignment offset of coupling halves

Coupling type	Radial offset	Axial offset
	[mm]	[mm]
Non-spacer-type coupling (⇒ Fig. 10)	≤ 0,1	≤ 0,1
Spacer-type coupling (⇒ Fig. 11)	≤ 0,1	≤ 0,1
Double Cardan coupling (⇒ Fig. 12)	≤ 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 10) 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 10) both during standstill and at operating temperature as well as under inlet pressure.
- 5. If alignment is correct, re-install the coupling guard and its footboard, if any.

Checking the coupling alignment with a laser tool

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

5.6 Aligning the pump and motor

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

5.6.1 Motors with adjusting screw

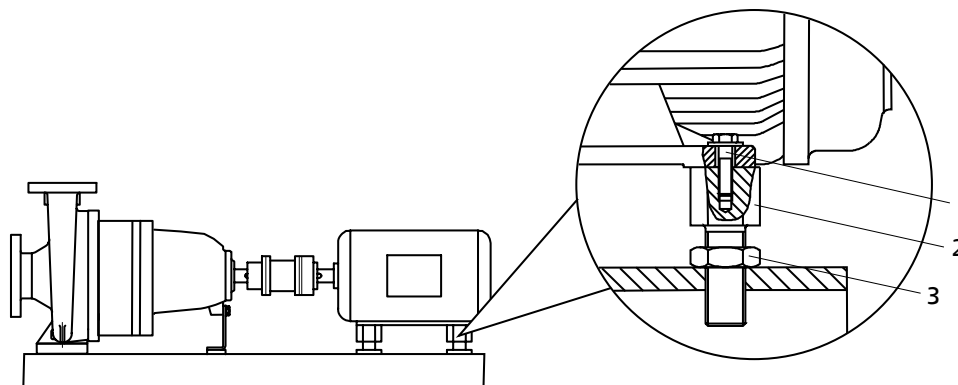


Fig. 13: Motor with adjusting screw

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.

	<p>⚠ WARNING</p> <p>Unprotected rotating coupling Risk of injury by rotating shafts!</p> <ul style="list-style-type: none"> ▷ 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.
	<p>⚠ DANGER</p> <p>Risk of ignition by frictional sparks Explosion hazard!!</p> <ul style="list-style-type: none"> ▷ Choose a coupling guard material that is non-sparking in the event of mechanical contact.

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

5.6.2 Motors without adjusting screw

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

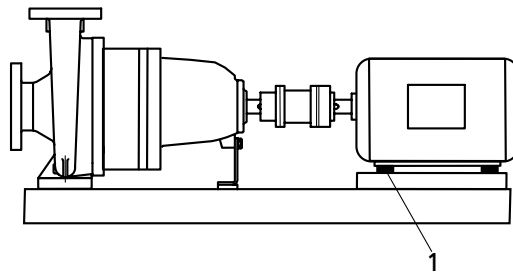


Fig. 14: Pump set with shim

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.

	<div style="background-color: #f4a460; padding: 5px;">⚠ WARNING</div> <p>Unprotected rotating coupling Risk of injury by rotating shafts!</p> <ul style="list-style-type: none"> ▷ 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.
	<div style="background-color: #e67e22; padding: 5px;">⚠ DANGER</div> <p>Risk of ignition by frictional sparks Explosion hazard!!</p> <ul style="list-style-type: none"> ▷ Choose a coupling guard material that is non-sparking in the event of mechanical contact.


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

5.7 Electrical connection

	<div style="background-color: #e67e22; padding: 5px;">⚠ DANGER</div> <p>Electrical connection work by unqualified personnel Danger of death from electric shock!</p> <ul style="list-style-type: none"> ▷ Always have the electrical connections installed by a trained electrician. ▷ Observe regulations IEC 60364 and, for explosion-proof versions, BS 60079 .
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	⚠ WARNING
	<p>Incorrect connection to the mains Damage to the power supply network, short circuit!</p> <p>▷ Observe the technical specifications of the local energy supply companies.</p>

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

	NOTE
	<p>Installing a motor protection device is recommended.</p>

5.7.1 Setting the time relay




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


Table 11: Time relay settings for star-delta starting:

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

5.7.2 Earthing







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

5.7.3 Connecting the motor

	NOTE
	<p>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.</p>

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

5.8 Checking the direction of rotation

	<div data-bbox="507 235 683 280"> DANGER</div> <p>Temperature increase resulting from contact between rotating and stationary components Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ 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.
	<div data-bbox="507 548 702 593"> WARNING</div> <p>Hands inside the pump casing Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> ▷ 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.
	<div data-bbox="507 817 638 851">CAUTION</div> <p>Incorrect direction of rotation with non-reversible mechanical seal Damage to the mechanical seal and leakage!</p> <ul style="list-style-type: none"> ▷ Separate the pump from the motor to check the direction of rotation.
	<div data-bbox="507 1023 638 1057">CAUTION</div> <p>Drive and pump running in the wrong direction of rotation Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Refer to the arrow indicating the direction of rotation on the pump. ▷ Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation.

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

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

6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up

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

- The pump set has been mechanically connected as specified.
- The pump set has been properly connected to the power supply and is equipped with all protection devices. (⇒ Section 5.7, Page 30)
- The pump has been primed with the fluid to be handled. The pump has been vented. (⇒ Section 6.1.3, Page 34)
- The direction of rotation has been checked. (⇒ Section 5.8, Page 32)
- 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 43)

6.1.2 Filling in the lubricants

Grease-lubricated bearings

Grease-lubricated bearings have been packed with grease.

Oil-lubricated bearings



Fill the bearing bracket with lubricating oil.

Oil quality see (⇒ Section 7.2.3.1.2, Page 49)

Oil quantity see (⇒ Section 7.2.3.1.3, Page 50)

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

- ✓ The constant level oiler has been fitted.

	<div style="background-color: #005596; color: white; padding: 5px;">NOTE</div> <p>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.</p>
	<div style="background-color: #FFD700; color: black; padding: 5px;">CAUTION</div> <p>Insufficient quantity of lubricating oil in the reservoir of the constant level oiler Damage to the bearings!</p> <ul style="list-style-type: none"> ▷ Regularly check the oil level. ▷ Always fill the oil reservoir completely.

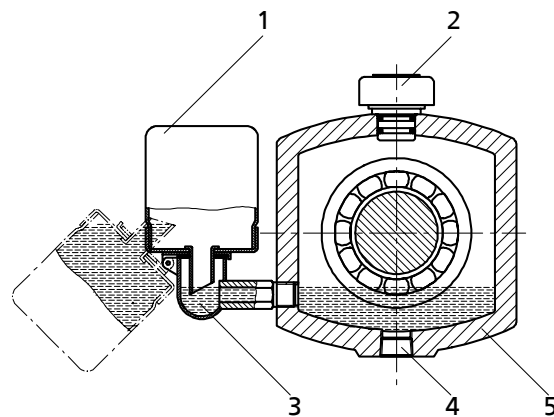


Fig. 15: Bearing bracket with constant level oiler

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 ensure that the correct oil level is maintained. 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 Priming and venting the pump







⚠ DANGER

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

Explosion hazard!

Damage to the pump set!

- ▷ Prime the pump as per operating instructions.


 	<div style="background-color: #e67e22; color: white; padding: 5px;">⚠ DANGER</div> <p>Risk of potentially explosive atmosphere by incompatible fluids mixing in the auxiliary piping Risk of burns! Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Make sure that the barrier fluid or quench liquid are compatible with the fluid handled.
	<div style="background-color: #e67e22; color: white; padding: 5px;">⚠ DANGER</div> <p>Shaft seal failure caused by insufficient lubrication Hot or toxic fluid could escape! Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Before starting up the pump set, prime the pump with the fluid to be handled.
	<div style="background-color: #f1c40f; padding: 5px;">CAUTION</div> <p>Increased wear due to dry running Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set without liquid fill. ▷ Never close the shut-off element in the suction line and/or supply line during pump operation.





1. Prime the pump with the fluid to be handled.
Connection 6D can be used for venting (see drawing of auxiliary connections).
2. Completely open the shut-off element in the suction line.
3. Fully open all auxiliary feed lines (barrier fluid, flushing liquid, etc.), if any.


6.1.4 Final check


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

6.1.5 Start-up

	<div style="background-color: #e67e22; color: white; padding: 5px;">⚠ DANGER</div> <p>Formation of a potentially explosive atmosphere inside the pump Explosion hazard!</p> <ul style="list-style-type: none"> ▷ The fluid for priming the pump must not be combustible. ▷ When the fluid for priming the pump is taken from a potentially explosive atmosphere, make sure that no potentially explosive atmosphere can enter the pump.
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	<div data-bbox="507 190 683 235">⚠ DANGER</div> <p>Non-compliance with the permissible pressure and temperature limits if the pump is operated with the suction and/or discharge line closed.</p> <p>Explosion hazard! Hot or toxic fluids escaping!</p> <ul style="list-style-type: none"> ▷ 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.
	<div data-bbox="507 560 683 604">⚠ DANGER</div> <p>Excessive temperatures due to dry running or excessive gas content in the fluid handled</p> <p>Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set without liquid fill. ▷ Prime the pump as per operating instructions. (⇒ Section 6.1.3, Page 34) ▷ Always operate the pump within the permissible operating range.
	<div data-bbox="507 916 638 960">CAUTION</div> <p>Abnormal noises, vibrations, temperatures or leakage</p> <p>Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Switch off the pump (set) immediately. ▷ Eliminate the causes before returning the pump set to service.
<ul style="list-style-type: none"> ✓ The system piping has been cleaned. ✓ The pump has been vented and primed with the fluid to be handled. ✓ The lines for priming and venting have been closed. ✓ If a check valve is installed in the suction line: The volute casing and the suction line have been primed with the fluid to be handled. ✓ The pump can be started up against a closed valve. ✓ If no check valve is installed in the suction line: The volute casing has been primed with the fluid to be handled. ✓ No back pressure on the discharge side. ✓ The shut-off element is open. 	
	<div data-bbox="507 1581 638 1626">CAUTION</div> <p>Start-up against open discharge line</p> <p>Motor overload!</p> <ul style="list-style-type: none"> ▷ Make sure the motor has sufficient power reserves. ▷ Use a soft starter. ▷ Use speed control.



 **DANGER**

Seal leakage at operating temperature
Hot or toxic fluid may escape!

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

1. When the operating temperature has been reached and/or in the event of leakage, switch off the pump set and re-tighten the screwed connections between lantern and casing.
2. Check the coupling alignment and re-align the coupling if required.

Priming time

For a 1-metre horizontal length of the suction line and DN suction line = DN pump, the priming times are as follows.

Table 12: Priming time in [seconds] at a static suction lift $H_{1\text{geo}}$ of ... m, depending on the speed, 50 Hz

Size	Shaft unit	n = 2900 rpm						n = 1450 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	40	145	415	-	-	-	130	-	-	-	-	-	-	-
032-032-120	17	30	90	135	190	255	360	100	210	-	-	-	-	-	-
040-040-110	17	60	100	215	420	-	-	120	-	-	-	-	-	-	-
040-040-140	25	30	70	125	220	355	600	130	-	-	-	-	-	-	-
050-050-130	25	50	120	195	260	345	440	210	410	-	-	-	-	-	-
050-050-160	25	30	70	105	170	265	430	210	430	-	-	-	-	-	-
065-065-150	25	60	120	165	260	375	570	190	350	540	-	-	-	-	-
065-065-180	35	30	50	75	100	145	200	90	140	220	370	-	-	-	-
080-080-170	35	50	100	135	180	225	310	110	180	280	480	-	-	-	-
080-080-190	35	40	70	105	160	185	240	100	110	200	310	-	-	-	-
080-080-200	35	30	50	75	105	155	200	70	110	190	270	320	420	-	-
100-100-240.1	35	30	70	95	120	150	190	130	150	220	300	440	-	-	-
100-100-240	35	35	70	85	110	160	-	110	160	270	480	-	-	-	-
125-125-260	35	35	80	105	130	160	190	60	70	110	160	200	330	430	610

Table 13: Priming time in [seconds] at a static suction lift $H_{1\text{geo}}$ of ... m, depending on the speed, 60 Hz

Size	Shaft unit	n = 3500 rpm						n = 1750 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	30	85	135	-	-	-	70	170	-	-	-	-	-	-
032-032-120	17	20	60	105	140	175	250	80	150	260	-	-	-	-	-
040-040-110	17	30	85	125	200	265	470	90	180	-	-	-	-	-	-
040-040-140	25	25	50	85	120	145	230	80	150	200	-	-	-	-	-
050-050-130	25	30	90	140	190	245	300	130	240	380	-	-	-	-	-
050-050-160	25	25	55	75	150	215	280	130	260	480	-	-	-	-	-
065-065-150	25	40	80	125	170	225	370	140	260	350	430	-	-	-	-
065-065-180	35	20	40	65	90	105	150	80	110	170	220	330	-	-	-
080-080-170	35	30	80	105	130	165	220	90	130	200	320	480	-	-	-
080-080-190	35	30	55	75	100	125	160	80	100	130	160	210	390	-	-
080-080-200	35	25	40	55	80	125	160	60	100	160	230	280	350	-	-
100-100-240.1	35	25	60	85	115	145	180	90	110	140	210	260	400	-	-
100-100-240	35	25	70	85	100	155	360	80	100	140	200	300	-	-	-
125-125-260	35	-	-	-	-	-	-	50	60	80	115	170	220	300	400

Table 14: Priming time in [seconds] at a static suction lift $H_{1\text{geo}}$ of ... m, depending on the speed, 50 Hz

Size	Shaft unit	n = 2900 rpm						n = 1450 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	40	145	415	-	-	-	130	-	-	-	-	-	-	-
032-032-120	17	30	90	135	190	255	360	100	210	-	-	-	-	-	-
040-040-110	17	60	100	215	420	-	-	120	-	-	-	-	-	-	-
040-040-140	25	30	70	125	220	355	600	130	-	-	-	-	-	-	-
050-050-130	25	50	120	195	260	345	440	210	410	-	-	-	-	-	-
050-050-160	25	30	70	105	170	265	430	210	430	-	-	-	-	-	-
065-065-150	25	60	120	165	260	375	570	190	350	540	-	-	-	-	-
065-065-180	35	30	50	75	100	145	200	90	140	220	370	-	-	-	-
080-080-170	35	50	100	135	180	225	310	110	180	280	480	-	-	-	-
080-080-190	35	40	70	105	160	185	240	100	110	200	310	-	-	-	-
080-080-200	35	30	50	75	105	155	200	70	110	190	270	320	420	-	-
100-100-240.1	35	30	70	95	120	150	190	130	150	220	300	440	-	-	-
100-100-240	35	35	70	85	110	160	-	110	160	270	480	-	-	-	-
125-125-260	35	35	80	105	130	160	190	60	70	110	160	200	330	430	610

Table 15: Priming time in [seconds] at a static suction lift $H_{1\text{geo}}$ of ... m, depending on the speed, 60 Hz

Size	Shaft unit	n = 3500 rpm						n = 1750 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	30	85	135	-	-	-	70	170	-	-	-	-	-	-
032-032-120	17	20	60	105	140	175	250	80	150	260	-	-	-	-	-
040-040-110	17	30	85	125	200	265	470	90	180	-	-	-	-	-	-
040-040-140	25	25	50	85	120	145	230	80	150	200	-	-	-	-	-
050-050-130	25	30	90	140	190	245	300	130	240	380	-	-	-	-	-
050-050-160	25	25	55	75	150	215	280	130	260	480	-	-	-	-	-
065-065-150	25	40	80	125	170	225	370	140	260	350	430	-	-	-	-
065-065-180	35	20	40	65	90	105	150	80	110	170	220	330	-	-	-
080-080-170	35	30	80	105	130	165	220	90	130	200	320	480	-	-	-
080-080-190	35	30	55	75	100	125	160	80	100	130	160	210	390	-	-
080-080-200	35	25	40	55	80	125	160	60	100	160	230	280	350	-	-
100-100-240.1	35	25	60	85	115	145	180	90	110	140	210	260	400	-	-
100-100-240	35	25	70	85	100	155	360	80	100	140	200	300	-	-	-
125-125-260	35	-	-	-	-	-	-	50	60	80	115	170	220	300	400

Table 16: Priming time in [seconds] at a static suction lift $H_{1\text{geo}}$ of ... m, depending on the speed, 50 Hz

Size	Shaft unit	n = 2900 rpm						n = 1450 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	40	145	415	-	-	-	130	-	-	-	-	-	-	-
032-032-120	17	30	90	135	190	255	360	100	210	-	-	-	-	-	-
040-040-110	17	60	100	215	420	-	-	120	-	-	-	-	-	-	-
040-040-140	25	30	70	125	220	355	600	130	-	-	-	-	-	-	-
050-050-130	25	50	120	195	260	345	440	210	410	-	-	-	-	-	-
050-050-160	25	30	70	105	170	265	430	210	430	-	-	-	-	-	-
065-065-150	25	60	120	165	260	375	570	190	350	540	-	-	-	-	-
065-065-180	35	30	50	75	100	145	200	90	140	220	370	-	-	-	-
080-080-170	35	50	100	135	180	225	310	110	180	280	480	-	-	-	-
080-080-190	35	40	70	105	160	185	240	100	110	200	310	-	-	-	-
080-080-200	35	30	50	75	105	155	200	70	110	190	270	320	420	-	-
100-100-240.1	35	30	70	95	120	150	190	130	150	220	300	440	-	-	-

Size	Shaft unit	n = 2900 rpm						n = 1450 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
100-100-240	35	35	70	85	110	160	-	110	160	270	480	-	-	-	-
125-125-260	35	35	80	105	130	160	190	60	70	110	160	200	330	430	610

Table 17: Priming time in [seconds] at a static suction lift $H_{1\text{geo}}$ of ... m, depending on the speed, 60 Hz

Size	Shaft unit	n = 3500 rpm						n = 1750 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	30	85	135	-	-	-	70	170	-	-	-	-	-	-
032-032-120	17	20	60	105	140	175	250	80	150	260	-	-	-	-	-
040-040-110	17	30	85	125	200	265	470	90	180	-	-	-	-	-	-
040-040-140	25	25	50	85	120	145	230	80	150	200	-	-	-	-	-
050-050-130	25	30	90	140	190	245	300	130	240	380	-	-	-	-	-
050-050-160	25	25	55	75	150	215	280	130	260	480	-	-	-	-	-
065-065-150	25	40	80	125	170	225	370	140	260	350	430	-	-	-	-
065-065-180	35	20	40	65	90	105	150	80	110	170	220	330	-	-	-
080-080-170	35	30	80	105	130	165	220	90	130	200	320	480	-	-	-
080-080-190	35	30	55	75	100	125	160	80	100	130	160	210	390	-	-
080-080-200	35	25	40	55	80	125	160	60	100	160	230	280	350	-	-
100-100-240.1	35	25	60	85	115	145	180	90	110	140	210	260	400	-	-
100-100-240	35	25	70	85	100	155	360	80	100	140	200	300	-	-	-
125-125-260	35	-	-	-	-	-	-	50	60	80	115	170	220	300	400

Table 18: Priming time in [seconds] at a static suction lift $H_{1\text{geo}}$ of ... m, depending on the speed, 50 Hz

Size	Shaft unit	n = 2900 rpm						n = 1450 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	40	145	415	-	-	-	130	-	-	-	-	-	-	-
032-032-120	17	30	90	135	190	255	360	100	210	-	-	-	-	-	-
040-040-110	17	60	100	215	420	-	-	120	-	-	-	-	-	-	-
040-040-140	25	30	70	125	220	355	600	130	-	-	-	-	-	-	-
050-050-130	25	50	120	195	260	345	440	210	410	-	-	-	-	-	-
050-050-160	25	30	70	105	170	265	430	210	430	-	-	-	-	-	-
065-065-150	25	60	120	165	260	375	570	190	350	540	-	-	-	-	-
065-065-180	35	30	50	75	100	145	200	90	140	220	370	-	-	-	-
080-080-170	35	50	100	135	180	225	310	110	180	280	480	-	-	-	-
080-080-190	35	40	70	105	160	185	240	100	110	200	310	-	-	-	-
080-080-200	35	30	50	75	105	155	200	70	110	190	270	320	420	-	-
100-100-240.1	35	30	70	95	120	150	190	130	150	220	300	440	-	-	-
100-100-240	35	35	70	85	110	160	-	110	160	270	480	-	-	-	-
125-125-260	35	35	80	105	130	160	190	60	70	110	160	200	330	430	610

Table 19: Priming time in [seconds] at a static suction lift $H_{1\text{geo}}$ of ... m, depending on the speed, 60 Hz

Size	Shaft unit	n = 3500 rpm						n = 1750 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
025-025-100	17	30	85	135	-	-	-	70	170	-	-	-	-	-	-
032-032-120	17	20	60	105	140	175	250	80	150	260	-	-	-	-	-
040-040-110	17	30	85	125	200	265	470	90	180	-	-	-	-	-	-
040-040-140	25	25	50	85	120	145	230	80	150	200	-	-	-	-	-
050-050-130	25	30	90	140	190	245	300	130	240	380	-	-	-	-	-
050-050-160	25	25	55	75	150	215	280	130	260	480	-	-	-	-	-
065-065-150	25	40	80	125	170	225	370	140	260	350	430	-	-	-	-
065-065-180	35	20	40	65	90	105	150	80	110	170	220	330	-	-	-

Size	Shaft unit	n = 3500 rpm						n = 1750 rpm							
		2 m	4 m	5 m	6 m	7 m	8 m	1 m	2 m	3 m	4 m	5 m	6 m	7 m	8 m
080-080-170	35	30	80	105	130	165	220	90	130	200	320	480	-	-	-
080-080-190	35	30	55	75	100	125	160	80	100	130	160	210	390	-	-
080-080-200	35	25	40	55	80	125	160	60	100	160	230	280	350	-	-
100-100-240.1	35	25	60	85	115	145	180	90	110	140	210	260	400	-	-
100-100-240	35	25	70	85	100	155	360	80	100	140	200	300	-	-	-
125-125-260	35	-	-	-	-	-	-	50	60	80	115	170	220	300	400

6.1.6 Checking the shaft seal

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

Double mechanical seal

⚠ DANGER

Excessive temperature of barrier fluid (pumps with double mechanical seal)
Explosion hazard!
Excessive surface temperature

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

6.1.7 Shutdown

CAUTION

Heat build-up inside the pump
Damage to the shaft seal!

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

CAUTION

Backflow of fluid handled is not permitted
Motor or winding damage! Mechanical seal damage!

- Close the shut-off elements.


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

NOTE


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


For prolonged shutdown periods:

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


	<p>CAUTION</p> <p>Risk of freezing during prolonged pump shutdown periods Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Drain the pump and the cooling/heating chambers (if any) or otherwise protect them against freezing.
---	--

6.2 Operating limits

	<p>! DANGER</p> <p>Non-compliance with operating limits for pressure, temperature, fluid handled and speed Explosion hazard! Hot or toxic fluid could escape!</p> <ul style="list-style-type: none"> ▷ 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.
---	--

	<p>! DANGER</p> <p>Formation of a potentially explosive atmosphere inside the pump Explosion hazard!</p> <ul style="list-style-type: none"> ▷ When draining tanks take suitable measures to prevent dry running of the pump (e.g. fill level monitoring).
--	--

6.2.1 Ambient temperature


	<p>CAUTION</p> <p>Operation outside the permissible ambient temperature Damage to the pump (set)!</p> <ul style="list-style-type: none"> ▷ Observe the specified limits for permissible ambient temperatures.
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Observe the following parameters and values during operation:

Table 20: Permissible ambient temperatures

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


6.2.2 Frequency of starts

	<p>! DANGER</p> <p>Excessive surface temperature of the motor Explosion hazard! Damage to the motor!</p> <ul style="list-style-type: none"> ▷ In case of explosion-proof motors, observe the frequency of starts specified in the manufacturer's product literature.
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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 21: Frequency of starts

Shaft unit ⁶⁾	Maximum frequency of starts	
	Impeller material G (EN-GJL-250/A48CL35B)	Impeller material C (1.4408/A743 GR CF8M)
	[Starts/hour]	[Starts/hour]
17	6	6
25	12	6
35	12	6

	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

Table 22: Flow rate

Minimum flow rate	Maximum flow rate
≈ 15 % of Q _{Opt} ⁷⁾	See hydraulic characteristic curves

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

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

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

Table 23: 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	-
Δϑ	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.

⁶ Shaft unit see data sheet.

⁷ Best efficiency point

	<div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <p>Impermissibly high density of the fluid handled Motor overload!</p> <ul style="list-style-type: none"> ▷ Observe the information about fluid density in the data sheet. ▷ Make sure the motor has sufficient power reserves.
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6.2.3.3 Abrasive fluids

When the pump handles fluids containing abrasive substances, increased wear of the hydraulic system and the shaft seal are to be expected. In this case, reduce the commonly recommended inspection intervals.

The fluid handled may contain abrasive particles up to a maximum content of 5 g/dm³ and a maximum particle size of 0.5 mm.

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump (set) remains installed

- ✓ Sufficient fluid is supplied for the functional check run of the pump.
- 1. For prolonged shutdown periods, start up the pump (set) regularly between once a month and once every three months for approximately five minutes.
 - ⇒ This will prevent the formation of deposits within the pump and the pump intake area.

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


- ✓ The pump has been properly drained. (⇒ Section 7.3, Page 52)
 - ✓ The safety instructions for dismantling the pump have been observed. (⇒ Section 7.4.1, Page 52)
 - ✓ The permissible ambient temperature for storing the pump is observed.
 - 1. Spray-coat the inside wall of the pump casing and, in particular, the impeller clearance areas with a preservative.
 - 2. Spray the preservative through the suction nozzle and discharge nozzle. It is advisable to then close the pump nozzles (e.g. with plastic caps)
 - 3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil or grease, food-approved, if required) to protect them against corrosion.
- Observe the additional instructions on preservation. (⇒ Section 3.3, Page 14)

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

6.4 Returning to service

For returning the equipment to service observe the sections on commissioning/start-up and the operating limits. (⇒ Section 6.1, Page 33) (⇒ Section 6.2, Page 41)

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇒ Section 7, Page 45)












	<div style="background-color: #FFA500; padding: 5px;">! WARNING</div> <p>Failure to re-install or re-activate protective devices Risk of injury from moving parts or escaping fluid!</p> <ul style="list-style-type: none"> ▷ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices.
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**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

	<div data-bbox="507 315 683 360">  DANGER </div> <div data-bbox="496 378 991 409"> Improper cleaning of coated pump surfaces </div> <div data-bbox="496 414 991 443"> Explosion hazard by electrostatic discharge! </div> <div data-bbox="517 454 1404 512"> <ul style="list-style-type: none"> ▷ When cleaning coated pump surfaces in atmospheres of Explosion group IIC, use suitable anti-static equipment. </div>
	<div data-bbox="507 551 683 595">  DANGER </div> <div data-bbox="496 613 943 645"> Sparks produced during servicing work </div> <div data-bbox="496 649 699 678"> Explosion hazard! </div> <div data-bbox="517 689 1436 790"> <ul style="list-style-type: none"> ▷ 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. </div>
 	<div data-bbox="507 831 683 875">  DANGER </div> <div data-bbox="496 893 836 925"> Improperly serviced pump set </div> <div data-bbox="496 929 699 958"> Explosion hazard! </div> <div data-bbox="496 965 788 994"> Damage to the pump set! </div> <div data-bbox="517 1005 1430 1106"> <ul style="list-style-type: none"> ▷ Service the pump set regularly. ▷ Prepare a maintenance schedule with special emphasis on lubricants, shaft seal and coupling. </div>
	<div data-bbox="507 1249 703 1294">  WARNING </div> <div data-bbox="496 1312 940 1341"> Unintentional starting of the pump set </div> <div data-bbox="496 1348 1139 1377"> Risk of injury by moving components and shock currents! </div> <div data-bbox="517 1388 1414 1487"> <ul style="list-style-type: none"> ▷ 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. </div>
	<div data-bbox="507 1525 703 1570">  WARNING </div> <div data-bbox="496 1588 1378 1646"> Fluids handled, consumables and supplies which are hot and/or pose a health hazard </div> <div data-bbox="496 1653 654 1682"> Risk of injury! </div> <div data-bbox="517 1693 1430 1834"> <ul style="list-style-type: none"> ▷ 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. </div>

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

	⚠ WARNING
	Insufficient stability Risk of crushing hands and feet! <ul style="list-style-type: none"> ▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tilting or tipping over.


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



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



Never use force when dismantling and reassembling the pump set.




7.2 Servicing/Inspection

7.2.1 Supervision of operation

	⚠ DANGER
	Risk of potentially explosive atmosphere inside the pump Explosion hazard! <ul style="list-style-type: none"> ▷ The pump internals in contact with the fluid to be handled, including the seal chamber and auxiliary systems, must be filled with the fluid to be handled at all times. ▷ Provide sufficient inlet pressure. ▷ Provide an appropriate monitoring system.


 	⚠ DANGER
	Incorrectly serviced shaft seal Explosion hazard! Hot, toxic fluid escaping! Damage to the pump set! Risk of burns! Fire hazard! <ul style="list-style-type: none"> ▷ Regularly service the shaft seal.


 	⚠ DANGER
	Excessive temperatures as a result of bearings running hot or defective bearing seals Explosion hazard! Fire hazard! Damage to the pump set! Risk of burns! <ul style="list-style-type: none"> ▷ Regularly check the lubricant level. ▷ Regularly check the rolling element bearings for running noises.

	<div data-bbox="507 190 683 235">⚠ DANGER</div> <p>Incorrectly serviced barrier fluid system Explosion hazard! Fire hazard! Damage to the pump set! Hot and/or toxic fluids escaping!</p> <ul style="list-style-type: none"> ▷ Regularly service the barrier fluid system. ▷ Monitor the barrier fluid pressure.
	<div data-bbox="507 548 639 593">CAUTION</div> <p>Increased wear due to dry running Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ 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.
	<div data-bbox="507 824 639 869">CAUTION</div> <p>Impermissibly high temperature of fluid handled Damage to the pump!</p> <ul style="list-style-type: none"> ▷ 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 41)



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

- The pump must run quietly and free from vibrations at all times.
- In case of oil lubrication, ensure the oil level is correct. (⇒ Section 6.1.2, Page 33)
- Check the shaft seal. (⇒ Section 6.1.6, Page 40)
- Check the static sealing elements for leakage.
- Check the rolling element bearings for running noises.
Vibrations, noise and an increase in current input occurring during unchanged operating conditions indicate wear.
- Monitor the correct functioning of any auxiliary connections.
- Monitor the stand-by pump.
To make sure that stand-by pumps are ready for operation, start them up once a week.
- Monitor the bearing temperature.
The bearing temperature must not exceed 90 °C (measured on the outside of the bearing bracket).

	<div data-bbox="507 1702 639 1747">CAUTION</div> <p>Operation outside the permissible bearing temperature Damage to the pump!</p> <ul style="list-style-type: none"> ▷ The bearing temperature of the pump (set) must never exceed 90 °C (measured on the outside of the bearing bracket).
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	<p>NOTE</p> <p>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).</p>
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7.2.2 Inspection work

	<p>⚠ DANGER</p> <p>Excessive temperatures caused by friction, impact or frictional sparks Explosion hazard! Fire hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Regularly check the coupling guard, plastic components and other guards of rotating parts for deformation and sufficient distance from rotating parts.
	<p>⚠ DANGER</p> <p>Electrostatic charging due to insufficient potential equalisation Explosion hazard!</p> <ul style="list-style-type: none"> ▷ 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

For checking the clearances remove the impeller, if required.

(⇒ Section 7.4.5, Page 54)

If the axial clearance is larger or smaller than permitted (see the following table), re-adjust it in accordance with the table below.


The clearance gaps indicated refer to the axial clearance between the impeller vanes and the pump casing.

Table 24: Clearance gap between impeller face and volute casing wall


Impeller material	Permissible clearance	
	New	Maximum
G (EN-GJL-250/A48CL35B)	0.2 mm	0.5 mm
C (1.4408/A743 GR CF8M)	0.2 - 0.3 mm	0.7 mm

If the maximum clearance is exceeded, insert a disc with a thickness of 0.1 mm and adjust the clearance to the as-new value.


7.2.2.3 Cleaning filters

	<p>CAUTION</p> <p>Insufficient inlet pressure due to clogged filter in the suction line Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Monitor contamination of filter with suitable means (e.g. differential pressure gauge). ▷ Clean filter at appropriate intervals.
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7.2.2.4 Checking the bearing seals

	<div style="background-color: #e67e22; color: white; padding: 5px;">⚠ DANGER</div> <p>Excessive temperatures caused by mechanical contact Risk of explosion! Damage to the pump set!</p> <p>▸ Check correct seating of axial seal rings mounted on the shaft. Only gentle contact of the sealing lip shall be established.</p>
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7.2.3 Lubrication and lubricant change of rolling element bearings

	<div style="background-color: #e67e22; color: white; padding: 5px;">⚠ DANGER</div> <p>Excessive temperatures as a result of bearings running hot or defective bearing seals Explosion hazard! Fire hazard! Damage to the pump set!</p> <p>▸ Regularly check the condition of the lubricant.</p>
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7.2.3.1 Oil lubrication

The rolling element bearings are usually lubricated with mineral oil.

7.2.3.1.1 Intervals

Table 25: Oil change intervals

Oil change	Interval
Change of initial oil fill	After 300 operating hours
Further oil changes	Every 3000 operating hours ⁸⁾

7.2.3.1.2 Oil quality

Table 26: Oil quality⁹⁾

Designation	Symbol to DIN 51502	Properties	
Lubricating oil C 46 CL 46 CLP 46	□	Kinematic viscosity at 40 °C	46 ± 4 mm²/s
		Flash point (to Cleveland)	+175 °C
		Solidification point (pour point)	-15 °C
		Application temperature ¹⁰⁾¹¹⁾	Higher than permissible bearing temperature

⁸ At least once a year

⁹ To DIN 51517

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


¹¹ For ambient temperatures below -10 °C use a different suitable type of lubricating oil. Contact KSB.

7.2.3.1.3 Oil quantity

Table 27: Oil quantity per oil-lubricated DIN 625 radial ball bearing

Part No.	Description	Shaft unit ¹²⁾	Code	Oil quantity per bearing bracket [l]
321	Radial ball bearing	25	6305 C3	0.2
		35	6307 C3	0.35

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.

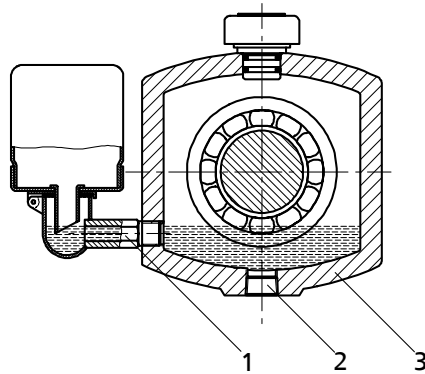


Fig. 16: Bearing bracket with constant level oiler

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 33)

7.2.3.2 Grease lubrication

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

7.2.3.2.1 Intervals

Under normal conditions the grease-lubricated bearings will run for 15,000 operating hours or 2 years. 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 relubricate them if required.

¹²⁾ Shaft unit see data sheet.

7.2.3.2.2 Grease quality

Optimum grease properties for rolling element bearings

Table 28: Grease quality to DIN 51825

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

- Free of resin and acid
- Not liable to crumble
- Rust-preventive characteristics


If required, the bearings may be lubricated with greases of other soap bases. Make sure to remove any old grease and rinse the bearings thoroughly.

7.2.3.2.3 Grease quantity

Table 29: Grease quantity per grease-lubricated DIN 625 radial ball bearing

Shaft unit ¹³⁾	Code	Grease quantity per bearing [gram]
17	3203 C3	2,5
	6203 2RS	2,5
25	6305 2Z C3	5
35	6307 2Z C3	10

7.2.3.2.4 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. Remove the outer cover plate of each bearing with a suitable tool. Dispose of the cover plates.
- 2. Only half-fill the bearing cavities with grease.

Continue using the bearings without the outer cover plates (variant Z C3).

¹³ Shaft unit see data sheet.









7.3 Drainage/cleaning

	 WARNING
	<p>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</p> <p>Hazard to persons and the environment!</p> <ul style="list-style-type: none"> ▷ Collect and properly dispose of flushing fluid and any fluid residues. ▷ Wear safety clothing and a protective mask if required. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.

1. Use connection 6B to drain the fluid handled (see drawing of auxiliary connections).
2. Always flush the system if it has been used for handling noxious, explosive, hot or other hazardous fluids.
Always flush and clean the pump before transporting it to the workshop.
Provide a certificate of decontamination for the pump. (⇒ Section 11, Page 74)

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations



	 DANGER
	<p>Insufficient preparation of work on the pump (set)</p> <p>Risk of injury!</p> <ul style="list-style-type: none"> ▷ Properly shut down the pump set. (⇒ Section 6.1.7, Page 40) ▷ Close the shut-off elements in the suction line and discharge line. ▷ Drain the pump and release the pump pressure. (⇒ Section 7.3, Page 52) ▷ Shut off any auxiliary feed lines. ▷ Allow the pump set to cool down to ambient temperature.
	 WARNING
	<p>Unqualified personnel performing work on the pump (set)</p> <p>Risk of injury!</p> <ul style="list-style-type: none"> ▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.
	 WARNING
	<p>Hot surface</p> <p>Risk of injury!</p> <ul style="list-style-type: none"> ▷ Allow the pump set to cool down to ambient temperature.
	 WARNING
	<p>Improper lifting/moving of heavy assemblies or components</p> <p>Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

Always observe the safety instructions and information. (⇒ Section 7.1, Page 45)

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

For dismantling and reassembly observe the exploded views and the general assembly drawing. (⇒ Section 9.1, Page 66)



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

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

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 50)


7.4.3 Removing the motor

	<p>NOTE</p> <p>On pump sets with spacer-type couplings, the back pull-out unit can be removed while the motor remains bolted to the baseplate.</p>
	<p>WARNING</p> <p>Motor tipping over Risk of crushing hands and feet!</p> <ul style="list-style-type: none"> ▷ 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 52) to (⇒ Section 7.4.3, Page 53) have been observed/carried out.
- ✓ On pump sets without spacer-type coupling, the motor has been removed.

	<div style="background-color: #f4a460; padding: 5px; border: 1px solid black;"> <p>! WARNING</p> </div> <p>Back pull-out unit tilting Risk of crushing hands and feet!</p> <p>▷ Suspend or support the bearing bracket at the pump end.</p>
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1. If required, suspend or support bearing bracket 330 or bearing housing 350 to prevent them from tipping over.
2. Unbolt support foot 183 from the baseplate.
3. Undo nut 920.01 at the volute casing.
4. Use forcing screws 901.30 (for bolted casing covers) or 901.31 (for clamped casing covers) to remove the back pull-out unit from its seat in the volute casing. Pull the back pull-out unit completely out of the volute casing.
5. Remove and dispose of O-ring 412.35.
6. 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 52) to (⇒ Section 7.4.4, Page 53) have been observed/carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
 1. Undo impeller nut 920.95 (right-hand thread).
 2. Remove impeller 230 with an impeller removal tool.
 3. Place impeller 230 on a clean and level surface.
 4. Remove key 940.01 from shaft 210.
 5. Pull spacer discs 550.02/550.04 off the shaft.

7.4.6 Dismantling the mechanical seal

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 52) to (⇒ Section 7.4.5, Page 54) have been observed/carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
 1. Remove the rotating assembly of the mechanical seal (primary ring) from shaft sleeve 523.
 2. Undo nuts 920.15 (if any) at casing cover 161.
 3. **For models with a clamped casing cover:** Undo transport locks 901.98 and remove cover plates 81-92.01 and 81-92.02 with transport locks 901.98 and lock washers 554.98. Remove casing cover 161 from bearing bracket 330.
For models with a bolted casing cover: Use forcing screws 901.31 to remove casing cover 161 from bearing bracket 330.
 For the casing cover of variant C a commercially available eye nut (DIN 582) can be fitted on stud 902.99 to facilitate dismantling.
 The eye nut must be removed again after the casing cover has been reassembled.

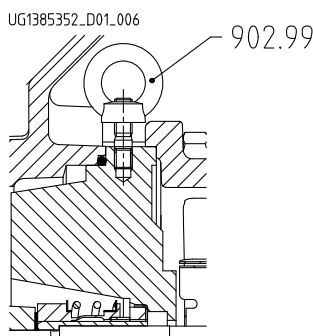


Fig. 17: Eye nut as dismantling aid

4. Remove the stationary assembly of the mechanical seal (mating ring) from casing cover 161 or bearing housing 350.
5. Pull shaft sleeve 523 (if any) off shaft 210.
6. Remove and dispose of gasket 400.75.

7.4.7 Dismantling the bearings

Oil lubrication


- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 52) to have been observed and carried out.
- ✓ The bearing bracket has been placed in a clean and level assembly area.
 1. Undo the grub screw in the coupling hub.
 2. Pull the coupling hub off pump shaft 210 with a puller or, for split-hub coupling designs, undo the screws and take off the hub halves.
 3. Remove key 940.02.
 4. Remove thrower 507.01.
 5. Undo hexagon head bolts 901.01 and 901.02.
 6. Remove pump-end bearing cover 360.01 with gasket 400.01 and drive-end bearing cover 360.02 with gasket 400.02.
 7. Press shaft 210 out of the shaft seat.
 8. Remove radial ball bearings 321.01 and 321.02, and place them on a clean and level surface.
 9. Dispose of gaskets 400.01 and 400.02.


Grease lubrication

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 52) to have been observed and carried out.
- ✓ The bearing bracket has been placed in a clean and level assembly area.
 1. Undo the grub screw in the coupling hub.
 2. Pull the coupling hub off pump shaft 210 with a puller or, for split-hub coupling designs, undo the screws and take off the hub halves.
 3. Remove key 940.02.
 4. Remove axial seal rings 411.77 and 411.78.
 5. Remove pump-end bearing cover 360.01 and drive-end bearing cover 360.02.
 6. Remove circlips 932.01 and 932.02.
 7. Press shaft 210 out of the bearing seats.
 8. Remove radial ball bearings 321.01 and 321.02, and place them on a clean and level surface.

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

	<div style="background-color: #f4a460; padding: 5px;">⚠ WARNING</div> <p>Improper lifting/moving of heavy assemblies or components Personal injury and damage to property!</p> <p>▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.</p>
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	<div style="background-color: #FFD700; padding: 5px;">CAUTION</div> <p>Improper reassembly Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Reassemble the pump (set) in accordance with the general rules of sound engineering practice. ▷ Use original spare parts only.
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- Sequence** Always reassemble the pump in accordance with the corresponding general assembly drawing or exploded view.
- Sealing elements** Check O-rings for any damage and replace by new O-rings if required.
Always use new gaskets, making sure that they have the same thickness as the old ones.
Always fit gaskets of asbestos-free materials or graphite without using lubricants (e.g. copper grease, graphite paste).
- Assembly aids** Avoid the use of assembly adhesives if possible.
Should an assembly adhesive be required after all, use a commercially available contact adhesive (e.g. Pattex) or sealant (e.g. HYLOMAR or Eppl 33).
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 with graphite or similar before reassembly.
Prior to reassembly, screw back any forcing screws and adjusting screws.
- Tightening torques** For reassembly, tighten all screws and bolts as specified in this manual.
(⇒ Section 7.6, Page 60)

7.5.2 Installing the bearings

Oil lubrication

- ✓ The individual parts have been placed in a clean and level assembly area.
 - ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The sealing surfaces have been cleaned.
1. Press radial ball bearings 321.01 and 321.02 onto shaft 210.
 2. Slide the pre-assembled shaft into bearing bracket 330.
 3. Insert new gaskets 400.01 and 400.02.
 4. Fasten bearing covers 360.01 and 360.02 with hexagon head bolts 901.01 and 901.02. Watch lip seals 421.01 and 421.02.
 5. Fit thrower 507.01.
 6. Insert key 940.02.
 7. Fit the coupling hub on pump shaft 210. For split-hub coupling designs, fit the hub halves on pump shaft 210. Fit and tighten the screws clamping the hub halves together. Observe the tightening torques. (⇒ Section 7.6, Page 60)
 8. Secure the coupling hub with a grub screw.

Grease lubrication

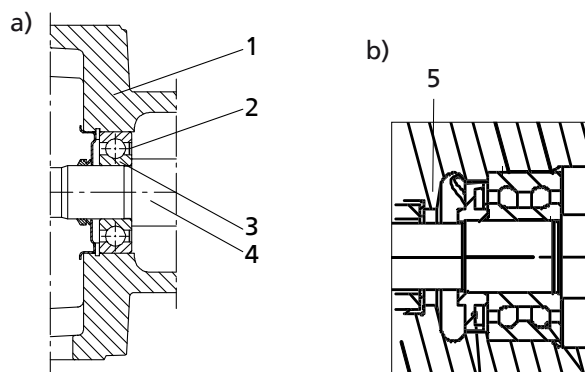


Fig. 18: Installing the radial ball bearing a) shaft units 25 and 35 b) shaft unit 17

1	Bearing bracket	2	Cover plate
3	Radial ball bearing	4	Shaft
5	Bearing housing		

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


1. Press radial ball bearings 321.01 and 321.02 onto shaft 210.
Make sure the bearing side with the shield rests against the shaft shoulder (see illustration: Installing the radial ball bearings).
2. Slide the pre-assembled shaft into bearing bracket 330.
3. Fit circlips 932.01 and 932.02.
4. Fit bearing covers 360.01 and 360.02.
5. Fit axial sealing rings 411.77 and 411.78.
6. Insert key 940.02.
7. Fit the coupling hub on pump shaft 210. For split-hub coupling designs, fit the hub halves on pump shaft 210. Fit and tighten the screws clamping the hub halves together. Observe the tightening torques. (⇒ Section 7.6, Page 60)
8. Secure the coupling hub with a grub screw.

7.5.3 Installing the mechanical seal

Installing the mechanical seal

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

- Work cleanly and accurately.
- Only remove the protective wrapping of the contact faces immediately before installation takes place.
- Prevent any damage to the sealing surfaces or O-rings.
- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 55) to (⇒ Section 7.5.2, Page 56) have been observed/carried out.
- ✓ The bearing assembly as well as the individual parts have been placed in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
- 1. Clean shaft sleeve 523 (if any), and touch up any score marks or scratches with a polishing cloth.
If score marks or scratches are still visible, fit new shaft sleeve 523.
- 2. Slide shaft sleeve 523 (if any) onto shaft 210 with new gasket 400.75.
- 3. Clean the mating ring location in casing cover 161.

	<p style="text-align: center;">CAUTION</p> <p>Elastomers in contact with oil/grease Shaft seal failure!</p> <ul style="list-style-type: none"> ▷ Use water as assembly lubricant. ▷ Never use oil or grease as assembly lubricant.
---	--

4. Carefully insert the mating ring into casing cover 161 and/or bearing housing 350 (as applicable).
 Make sure that pressure is applied evenly.
5. On variants with a bolted casing cover, loosen but do not remove forcing screws 901.31.
6. Place casing cover 161 into the locating fit of bearing bracket 330.
7. On models with a clamped casing cover, fasten cover plates 81-92.01 and 81-92.02 with transport locks 901.98 and lock washers 554.98. The casing cover is now fastened to the bearing bracket.
 For the casing cover of variant C a commercially available eye nut (DIN 582) can be fitted on stud 902.99 to facilitate assembly.
 The eye nut must be removed again after the casing cover has been reassembled.

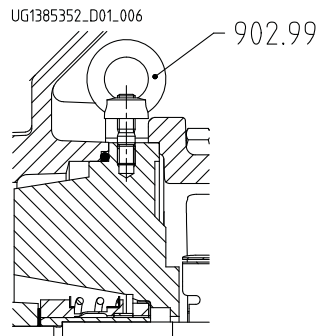



Fig. 19: Eye nut as assembly aid

8. Fit and tighten nuts 920.15, if any.

	<p style="text-align: center;">NOTE</p> <p>To reduce friction forces when assembling the seal, wet the shaft sleeve and the location of the stationary ring with water.</p>
---	--

9. Fit the rotating assembly of the mechanical seal (primary ring) on shaft sleeve 523.

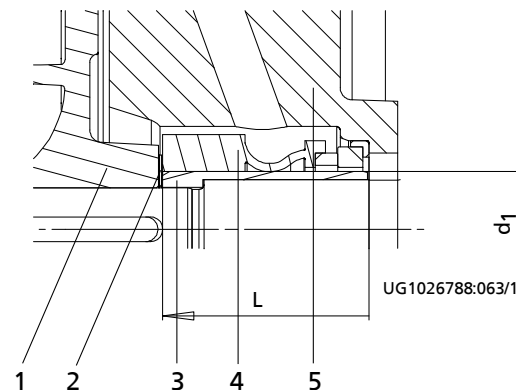


Fig. 20: Mechanical seal chamber




1	Impeller	2	Spacer discs
3	Shaft sleeve	4	Mechanical seal
5	Casing cover		

Table 30: Installation dimensions of the mechanical seal

Shaft unit ¹⁴⁾	Installation dimension d ₁	Installation dimension L
17	16 mm	l _{1K} = 35
25	28 mm	l _{1N} = 50
35	38 mm	l _{1N} = 55

7.5.4 Fitting the impeller

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 55) to (⇒ Section 7.5.3, Page 57) have been observed/carried out.
- ✓ The assembled bearing bracket as well as the individual parts have been placed in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
 1. Slide the spacer discs onto the shaft. (Always use the same number and type of spacer discs as originally fitted at the factory!)
 2. Insert key 940.01 and slide impeller 230 onto shaft 210.
 3. Fasten impeller nut 920.95, spring washer 930.95 and disc 550.95, if any. (See table: Tightening torques of screwed connections at the pump (⇒ Section 7.6, Page 60)).
 4. Observe, check and re-adjust the axial clearance. (⇒ Section 7.2.2.2, Page 48)

	<div style="background-color: #e67e22; color: white; padding: 5px;">⚠ DANGER</div> <p>Excessive temperatures caused by mechanical contact Risk of explosion! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Check correct seating of axial joint rings mounted on the shaft. Only gentle contact shall be established between the sealing lip and the shaft. ▷ Observe, check and re-adjust the axial clearance. (⇒ Section 7.2.2.2, Page 48)
	<div style="background-color: #f1c40f; color: black; padding: 5px;">CAUTION</div> <p>Rubbing contact between impeller and volute casing Damage to the impeller, casing, mechanical seal and bearing!</p> <ul style="list-style-type: none"> ▷ Observe, check and re-adjust the axial clearance. (⇒ Section 7.2.2.2, Page 48)
	<div style="background-color: #2980b9; color: white; padding: 5px;">NOTE</div> <p>Always check the clearance gap.</p>

¹⁴ Shaft unit see data sheet.

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 55) to (⇒ Section 7.5.4, Page 59) 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. Loosen but do not remove forcing screws 901.30 or 901.31.
 2. If required, prevent the back pull-out unit from tipping over, e.g. by suspending or supporting it. Then guide it into volute casing 102 with new O-ring 412.35.
 3. Tighten nut 920.01 at the volute casing.
 4. Fasten support foot 183 (if any) to the baseplate with a foundation bolt.

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 5.6, Page 28)
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

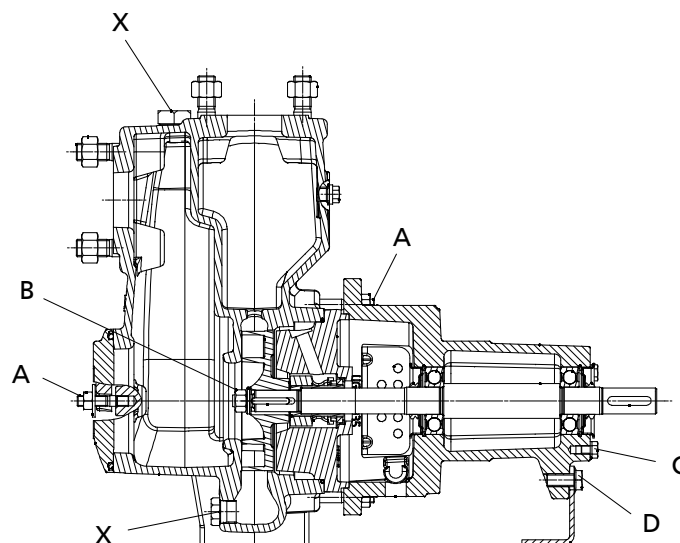


Fig. 21: Tightening points

Table 31: Tightening torques for bolted/screwed connections at the pump

Position	Thread size	Rated torque [Nm]
A	M8	20
	M12	55
B	M12 x 1,5	55
	M24 x 1,5	130
	M30 x 1,5	170
C	M8	20
	M10	38
D	M12	90
X	1/8	25
	1/4	55
	3/8	80
	1/2	130
	3/4	220

7.6.2 Tightening torques for the pump set

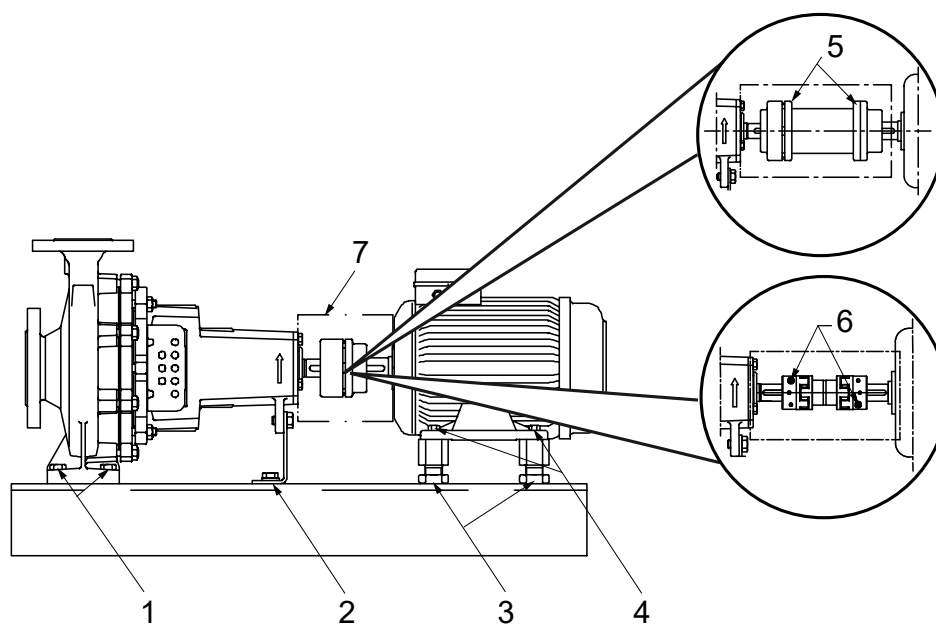


Fig. 22: Position of bolts/screws at the pump set

Table 32: Tightening torques for bolted/screwed connections at the pump set

Position	Thread size	Tightening torque	Notes
		[Nm]	
1	M12	30	Pump on baseplate
	M16	75	
	M20	75	
2	M12	30	Adjusting screws in baseplate
3	M24 x 1,5	140	
	M36 x 1,5	140	
4	M6	10	Motor on baseplate or motor on adjusting screws or bases
	M8	10	
	M10	15	

Position	Thread size	Tightening torque	Notes
		[Nm]	
4	M12	30	Motor on baseplate or motor on adjusting screws or bases
	M16	75	
	M20	140	
	M24	140	
5	M6	13	Coupling (only for spacer-type coupling made by Flender)
	M8	18	
	M10	44	
6	M8	34	Coupling (only for double Cardan spacer-type coupling and split-hub coupling design, make: KTR)
	M10	67	
	M12	115	
	M16	290	
	M20	560	
7	M6	10	Coupling guard

7.7 Spare parts stock

7.7.1 Ordering spare parts

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

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

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

Also specify the following data:

- Part number and description (⇒ Section 9.1, Page 66)
- 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 33: 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 %
321.01/02	Deep groove ball bearing (set)	1	1	2	2	2	3	25 %
330 ¹⁵⁾	Bearing bracket	-	-	-	-	-	1	2
350 ¹⁶⁾	Bearing housing	-	-	-	-	-	1	2
400.75 ¹⁵⁾	Gasket	4	6	8	8	9	12	15 %

¹⁵⁾ For shaft units 25 and 35 (shaft unit see data sheet)

¹⁶⁾ For shaft unit 17 (shaft unit see data sheet)

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
412.35/.65 ¹⁵⁾	O-ring	4	6	8	8	9	12	15 %
433.01	Mechanical seal	1	1	2	2	2	3	25 %
523 ¹⁵⁾	Shaft sleeve	2	2	2	3	3	4	50 %

7.7.3 Interchangeability of Etaprime L and Etaprime B pump components

Components featuring the same number in a column are interchangeable.

Table 34: Interchangeability of Etaprime L and Etaprime B pump components and interchangeability of components among each other



Size	Shaft unit	Description								
		Volute casing	Casing cover	Shaft	Impeller	Radial ball bearing	Radial ball bearing	Bearing housing	Mechanical seal	Shaft sleeve
		Part No.								
		102	161	210	230	321.01	321.02	350	433.01	523
025-025-100	17	○*	✗	1	○*	1	2	1	1*	✗
032-032-120	17	○*	✗	1	○*	1	2	1	1*	✗
040-040-110	17	○*	✗	1	○*	1	2	1	1*	✗
040-040-140	25	○*	○*	2	○*	✗	3	✗	2*	1*
050-050-130	25	○*	○*	2	○*	✗	3	✗	2*	1*
050-050-160	25	○*	1*	2	○*	✗	3	✗	2*	1*
065-065-150	25	○*	1*	2	○*	✗	3	✗	2*	1*
065-065-180	35	○*	○*	3	○*	✗	4	✗	3*	2*
080-080-170	35	○*	○*	3	○*	✗	4	✗	3*	2*
080-080-190	35	○*	○*	3	○*	✗	4	✗	3*	2*
080-080-200	35	○*	○*	3	○*	✗	4	✗	3*	2*
100-100-240.1	35	1*	○*	3	○*	✗	4	✗	3*	2*
100-100-240 ¹⁷⁾	35	1	○	3	○	✗	4	✗	3	2
125-125-260 ¹⁷⁾	35	○	○	3	○	✗	4	✗	3	2

Table 35: Symbols key

Symbol	Description
*	Component interchangeable with Etaprime B
○	Components differ
✗	Component not fitted

¹⁷⁾ Not available as Etaprime B

8 Trouble-shooting

	 WARNING
	Improper work to remedy faults Risk of injury! <p>► 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.</p>

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 36: Trouble-shooting

A	B	C	D	E	F	G	H	Possible cause	Remedy ¹⁸⁾
X	-	-	-	-	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point. Check system for impurities. Fit a larger impeller. ¹⁹⁾ Increase the speed (turbine, I.C. engine).
X	-	-	-	-	-	X	X	Pump and/or piping are not completely vented or primed.	Vent and/or prime.
X	-	-	-	-	-	-	-	Supply line or impeller clogged	Remove deposits in the pump and/or piping.
X	-	-	-	-	-	-	-	Formation of air pockets in the piping	Alter piping layout. Fit vent valve.
X	-	-	-	-	-	X	X	Suction lift is too high/NPSH _{available} (positive suction head) is too low.	Check/alter fluid level. Install pump at a lower level. Fully open the shut-off element in the suction line. Change suction line, if the friction losses in the suction line are too high. Check any strainers installed/suction opening. Observe permissible speed of pressure fall.
X	-	-	-	-	-	-	-	Air intake at the shaft seal	Clean flushing liquid duct, supply external flushing liquid, if necessary, or increase flushing liquid pressure. Replace shaft seal.
X	-	-	-	-	-	-	-	Wrong direction of rotation	Interchange two of the phases of the power cable.
X	-	-	-	-	-	-	-	Speed is too low ¹⁹⁾ - Operation with frequency inverter - Operation without frequency inverter	- Increase voltage/frequency at the frequency inverter in the permissible range. - Check voltage.
X	-	-	-	-	-	X	-	Wear of internal components	Replace worn components by new ones.
-	X	-	-	-	-	X	-	Pump back pressure is lower than specified in the purchase order.	Re-adjust to duty point. In the case of persistent overloading, turn down impeller. ¹⁹⁾

¹⁸⁾ Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

¹⁹⁾ Contact the manufacturer.

A	B	C	D	E	F	G	H	Possible cause	Remedy ¹⁸⁾
-	X	-	-	-	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	Contact the manufacturer.
-	-	-	-	-	X	-	-	Use of unsuitable shaft seal materials	Change the material combination. ¹⁹⁾
-	X	X	-	-	-	-	-	Speed is too high.	Reduce speed. ¹⁹⁾
-	-	-	-	X	-	-	-	Tie bolts/sealing element defective	Fit new sealing element between pump casing and casing cover / discharge cover. Re-tighten the bolts.
-	-	-	-	-	X	-	-	Worn shaft seal	Fit new shaft seal. Check flushing liquid/barrier fluid.
X	-	-	-	-	X	-	-	Score marks or roughness on shaft sleeve	Fit new shaft sleeve. Fit new shaft seal.
-	-	-	-	-	X	-	-	Dismantle to find out.	Correct. Fit new shaft seal, if required.
-	-	-	-	-	X	-	-	Vibrations during pump operation	Correct the suction conditions. Re-align the pump set. Re-balance the impeller. Increase pressure at the pump suction nozzle.
-	-	-	X	-	X	X	-	Pump set is misaligned.	Re-align pump set.
-	-	-	X	-	X	X	-	Pump is warped or sympathetic vibrations in the piping.	Check the piping connections and secure fixing of pump; if required, reduce distances between the pipe clamps. Fix the pipelines using anti-vibration material.
-	-	-	X	-	-	-	-	Insufficient or excessive quantity of lubricant or unsuitable lubricant.	Top up, reduce or change lubricant.
-	-	-	X	-	-	-	-	Non-compliance with specified coupling distance	Correct the distance according to general arrangement drawing.
X	X	-	-	-	-	-	-	Motor is running on two phases only.	Replace the defective fuse. Check the electric cable connections.
-	X	-	-	-	-	-	-	Operating voltage is too low.	Increase the voltage.
-	-	-	-	-	-	X	-	Rotor out of balance	Clean the impeller. Re-balance the impeller.
-	-	-	-	-	-	X	-	Defective bearing(s)	Replace.
-	-	-	X	-	-	X	X	Flow rate is too low.	Increase the minimum flow rate.
-	-	-	-	-	X	-	-	Incorrect inflow of circulation liquid	Increase the free cross-section.

9 Related Documents

9.1 Sectional drawing and list of components

9.1.1 Etaprime G and C, threaded connection, with bearing housing (SU 17)

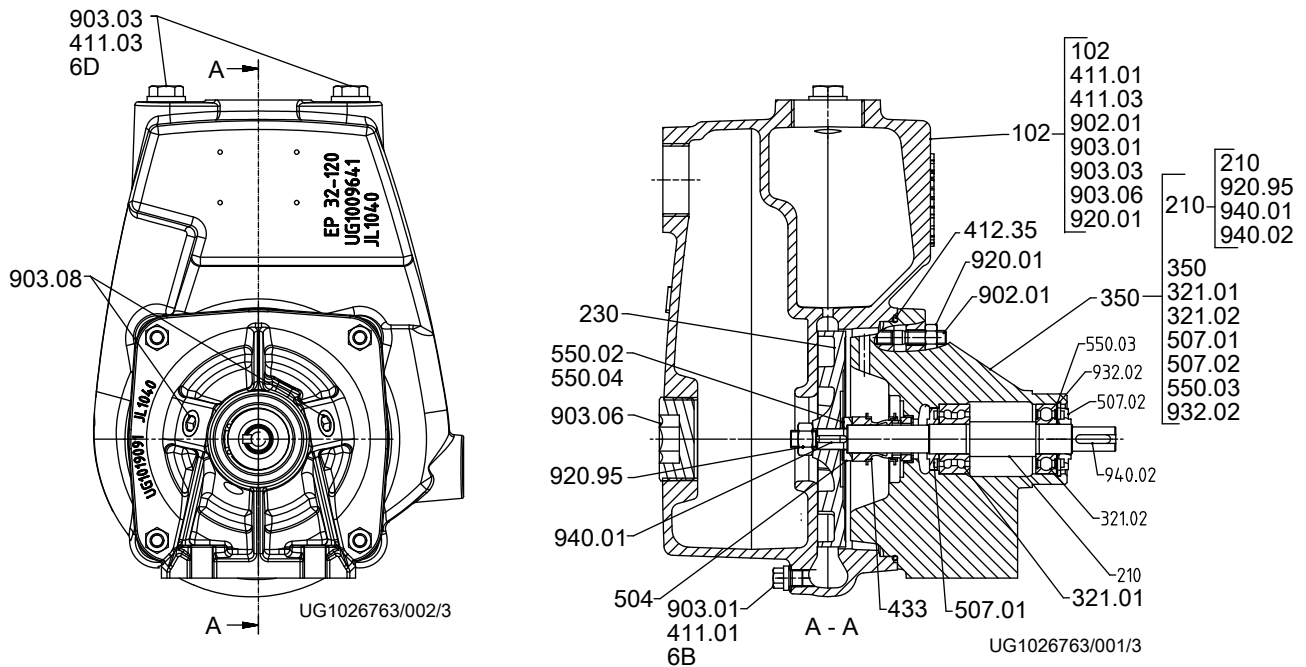


Fig. 23: Model with single mechanical seal

[Supplied in packaging units only

Table 37: List of components

Part No.	Description	Part No.	Description
102	Volute casing	504	Spacer ring
210	Shaft	507.01/.02	Thrower
230	Impeller	550.02/.03/.04	Disc
321.01/.02	Radial ball bearing	902.01	Stud
350	Bearing housing	903.01/.03/.06/.08	Screw plug
411.01/.03	Joint ring	920.01/.95	Nut
412.35	O-ring	932.02	Circlip
433	Mechanical seal	940.01/.02	Key

Table 38: Connections

Part No.	Description	Part No.	Description
6B	Fluid drain	6D	Fluid priming and venting

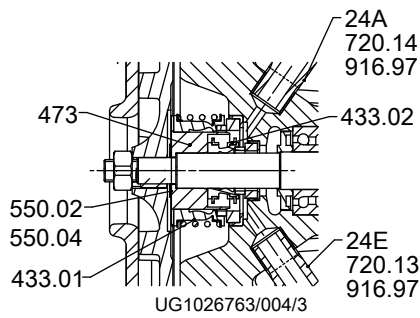


Fig. 24: Model with double mechanical seal in tandem arrangement (SU 17)

Table 39: List of components

Part No.	Description	Part No.	Description
433.01/02	Mechanical seal	720.13/14	Barrel nipple
473	Primary ring carrier	916.97	Plug
550.02/04	Disc		

Table 40: List of components

Part No.	Description	Part No.	Description
24A	Quench liquid outlet	24E	Quench liquid inlet

9.1.2 Etaprime G and C, flanged connection, with bearing bracket/grease lubrication (SU 25 and SU 35)

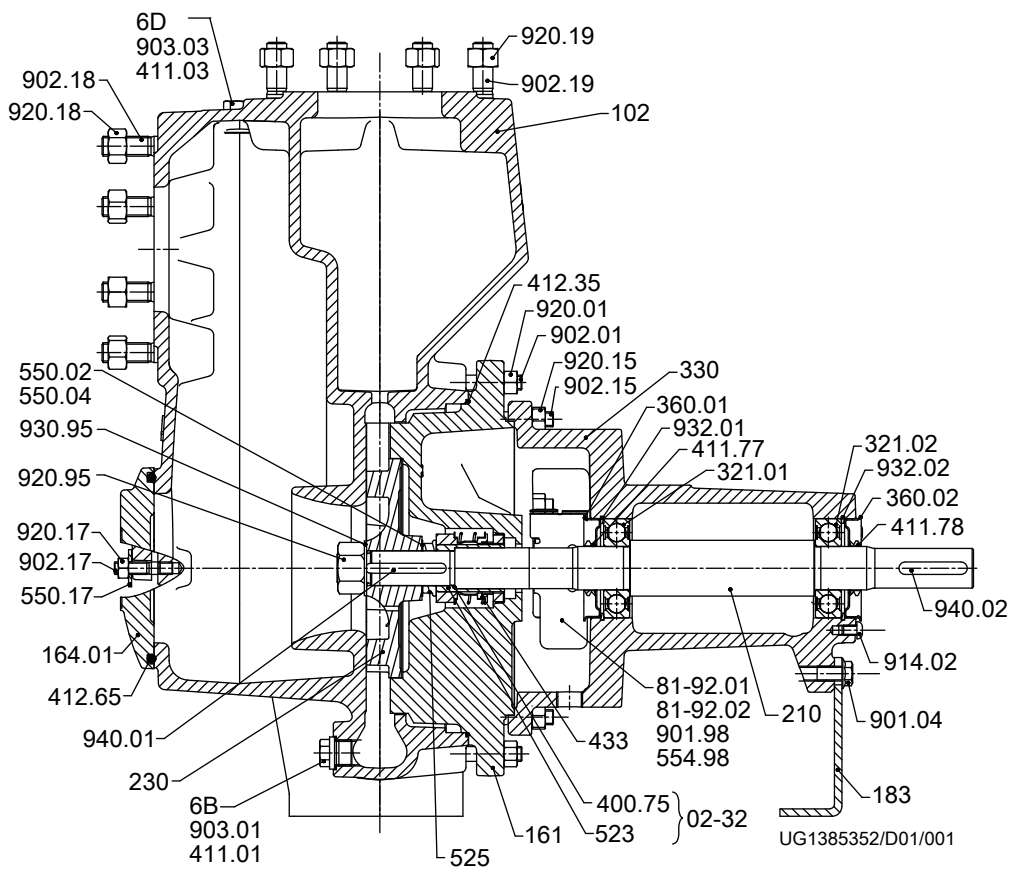


Fig. 25: Model with single mechanical seal

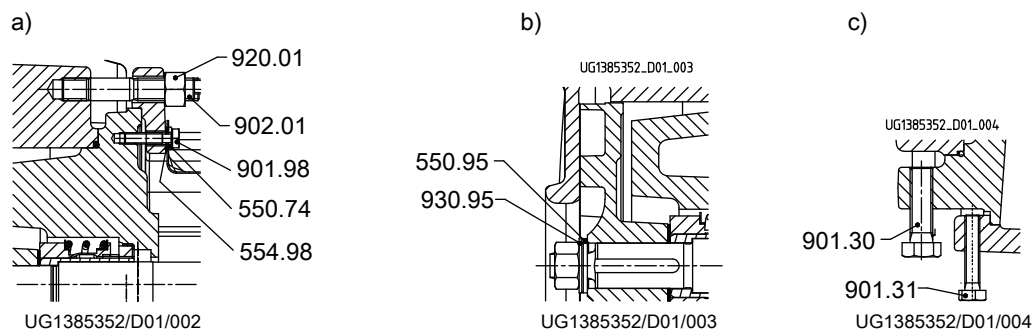


Fig. 26: a) Clamped casing cover, b) impeller fastening elements for shaft unit 25, c) Position of forcing screws

Table 41: List of components

Part No.	Description	Part No.	Description
102	Volute casing	525 ²⁰⁾	Spacer sleeve
161	Casing cover	550.02/.04/.17/.74	Disc
164.01	Inspection cover	550.95 ²¹⁾	Disc
183	Support foot	554.98	Lock washer
210	Shaft	81-92.01/.02	Cover plate
230	Impeller	901.04/.30/.31/.98	Hexagon head bolt
321.01/.02	Radial ball bearing	902.01/.15/.17/.18/.19	Stud
330	Bearing bracket	903.01/.03	Screw plug
360.01/.02	Bearing cover	914.02	Pan head screw
400.75	Gasket	920.01/.05/.15/.17/.18/.19/.95	Nut
411.01/.03/.77/.78	Joint ring	930.95	Safety device
412.35/.65	O-ring	932.01/.02	Circlip
433	Mechanical seal	940.01/.02	Key
523	Shaft sleeve		

Table 42: Connections

Part No.	Description	Part No.	Description
6B	Fluid drain	6D	Fluid priming and venting

²⁰⁾ For SU 35 only; shaft unit see data sheet.

²¹⁾ For SU 25 only; shaft unit see data sheet.

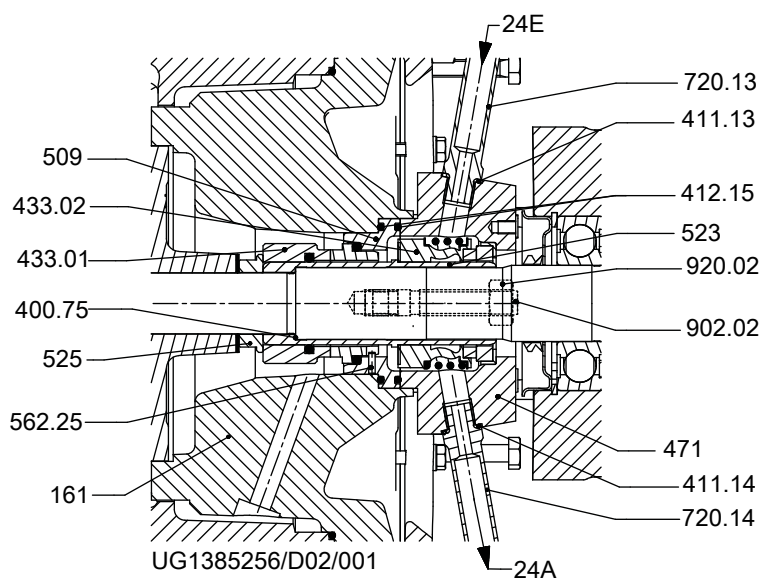


Fig. 27: Model with double mechanical seal in tandem arrangement (SU 25/35)

Table 43: List of components

Part No.	Description	Part No.	Description
161	Casing cover	523	Shaft sleeve
400.75	Gasket	525	Spacer sleeve
412.15	O-ring	562.25	Parallel pin
411.13/.14	Joint ring	720.13/.14	Spacer
433.01/.02	Mechanical seal	902.02	Stud
471	Seal cover	920.02	Hexagon nut
509	Intermediate ring		

Table 44: Connections

Part No.	Description	Part No.	Description
24A	Quench liquid outlet	24E	Quench liquid inlet

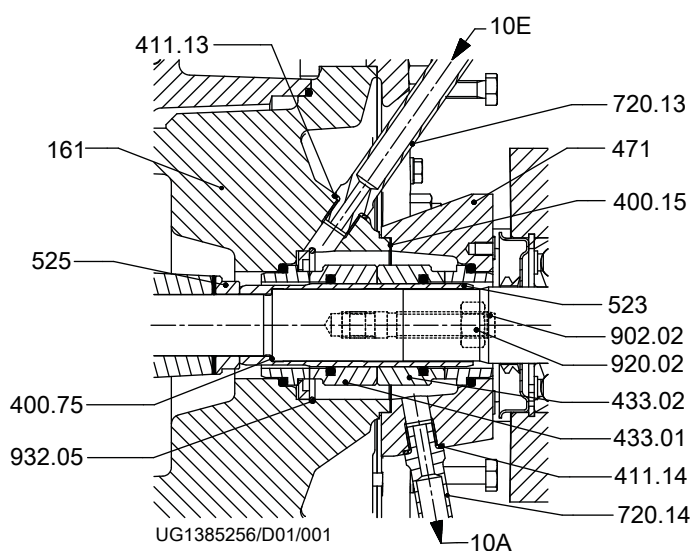


Fig. 28: Model with double mechanical seal in back-to-back arrangement (SU 25/35)

Table 45: List of components

Part No.	Description	Part No.	Description
161	Casing cover	525 ²²⁾	Spacer sleeve
400.15 ²³⁾ /.75	Gasket	720.13/.14	Spacer
411.13/.14	Joint ring	902.02	Stud
433.01/.02	Mechanical seal	920.02	Hexagon nut
471	Seal cover	932.05	Circlip
523	Shaft sleeve		

Table 46: Connections

Part No.	Description	Part No.	Description
10A	Barrier fluid outlet	10E	Barrier fluid inlet

²²⁾ For SU 35 only; shaft unit see data sheet.

²³⁾ For shaft unit 25: joint ring 411.15 (shaft unit see data sheet)

9.1.3 Etaprime G and C, flanged connection, with bearing bracket/oil lubrication (SU 25 and SU 35)

Design of pump and mechanical seal as described on (⇒ Section 9.1.2, Page 67)
Difference: oil-lubricated bearing bracket instead of grease-lubricated bearing bracket.

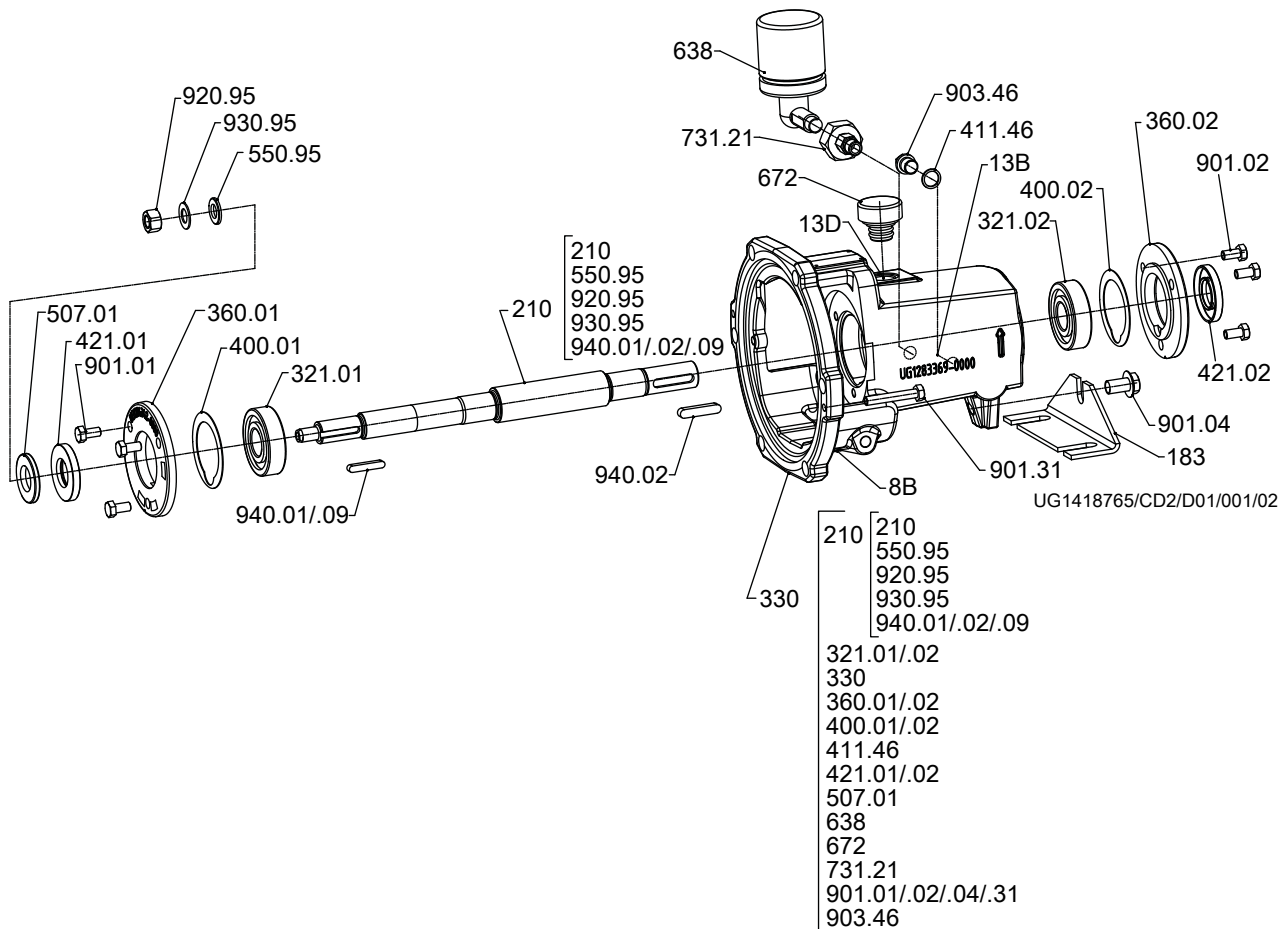


Fig. 29: Model with oil lubrication and constant level oiler

[Supplied in packaging units only

Table 47: List of components²⁴⁾

Part No.	Description	Part No.	Description
183	Support foot	550.95 ²⁵⁾	Disc
210	Shaft	638	Constant level oiler
330	Bearing bracket	672	Vent
321.01/02	Deep groove ball bearing	731.21	Pipe union
360.01/02	Bearing cover	901.01/02/04/31	Hexagon head bolt
400.01/02	Gasket	903.46	Screw plug
411.46	Joint ring	920.95	Hexagon nut
421.01/02	Lip seal	930.95	Spring washer
507.01	Thrower	940.01/02/09 ²⁶⁾	Key

²⁴⁾ Some individual components might not be applicable, depending on the size and shaft material.

²⁵⁾ For shaft unit 25 only

²⁶⁾ For shaft units 55 and 60 only

Table 48: Connections

Part No.	Description	Part No.	Description
8B	Leakage drain	13D	Oil filling and venting
13B	Oil drain		

10 UK Declaration of Conformity

Manufacturer: **KSB ITUR Spain, S.A.**
Camino de Urteta, s/n
20800 Zarautz (Spain)

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

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

Etaprime L, Etaprime B

KSB order number:

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
 - Pump (set): Supply of Machinery (Safety) Regulations 2008
 - Electrical components²⁷⁾: The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

The manufacturer also declares that

- the following harmonised international standards²⁸⁾ have been applied:
 - ISO 12100
 - EN 809

Person authorised to compile the technical file:

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

Place, date

.....²⁹⁾.....

Name
Function
Company
Address

²⁷⁾ Where applicable

²⁸⁾ Apart from the standards listed here referring to the *Supply of Machinery (Safety) Regulations 2008*, further standards are observed for explosion-proof versions (*Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016*) as applicable and are listed in the legally binding UK Declaration of Conformity.

²⁹⁾ A signed, legally binding UK Declaration of Conformity is supplied with the product.

11 Certificate of Decontamination

Type:
Order number /
Order item number³⁰⁾:
Delivery date:
Application:
Fluid handled³⁰⁾:

Please tick where applicable³⁰⁾:



Corrosive



Oxidising



Flammable



Explosive



Hazardous to health



Seriously hazardous to health



Toxic



Radioactive



Bio-hazardous



Safe

Reason for return:³⁰⁾
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

³⁰⁾ Required field

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