

Thermal Oil / Hot Water Pump

**Etanorm SYT**

**Installation/Operating Manual**



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Installation/Operating Manual Etanorm SYT

Original operating manual

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## Glossary

### Back pull-out design

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

### Back pull-out unit

Pump without pump casing; partly completed machinery

### Certificate of decontamination

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

### Discharge line

The pipeline which is connected to the discharge nozzle

### Hydraulic system

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

### Pool of pumps

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

### Pump

Machine without drive, additional components or accessories

### Pump set

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

### Suction lift line/suction head line

The pipeline which is connected to the suction nozzle

## 1 General

### 1.1 Principles

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

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

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

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

### 1.2 Installation of partly completed machinery

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

### 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 <sup>1)</sup>	Sectional drawing of the pump
Sub-supplier product literature <sup>1)</sup>	Operating manuals and other product literature describing accessories and integrated machinery components
Spare parts lists <sup>1)</sup>	Description of spare parts
Piping layout <sup>1)</sup>	Description of auxiliary piping
List of components <sup>1)</sup>	Description of all pump components
Assembly drawing <sup>1)</sup>	Sectional drawing of the installed shaft seal

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

<sup>1</sup> If included in agreed scope of supply








## 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. 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
 <b>DANGER</b>	<b>DANGER</b> This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
 <b>WARNING</b>	<b>WARNING</b> This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
 <b>CAUTION</b>	<b>CAUTION</b> This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	<b>Explosion protection</b> This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with the UK regulation titled Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016.
	<b>General hazard</b> In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	<b>Electrical hazard</b> In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	<b>Machine damage</b> 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.
- 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 variant.
- 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 6.1.8, Page 43) (⇒ Section 6.3, Page 46)
- Decontaminate pumps which handle fluids posing a health hazard. (⇒ Section 7.3, Page 53)
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇒ Section 6.1, Page 39)

## 2.8 Unauthorised modes of operation

Never operate the pump (set) outside the limits stated in the data sheet and in this 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 symbol opposite and the following sections, (⇒ Section 2.9.1, Page 11) to (⇒ Section 2.9.4, Page 12)

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

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

Prevent impermissible modes of operation at all times.

### 2.9.1 Marking

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

Example of such marking:

II 2G Ex h IIC T5-T1 Gb

Refer to the Temperature limits table for the maximum temperatures permitted for the individual pump variants. (⇒ Section 2.9.2, Page 11)

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

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

**Motor** The motor must be considered separately.

### 2.9.2 Temperature limits

In normal pump operation, the highest temperatures are to be expected at the surface of the pump casing, at the shaft seal and in the bearing areas.

The surface temperature at the pump casing corresponds to the temperature of the fluid handled. If the pump is heated in addition, the operator of the system is responsible for observing the specified temperature class and fluid temperature (operating temperature).

The table (⇒ Table 4) lists the temperature classes and the resulting maximum permissible temperature limits of the fluid handled. 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 <sup>2)</sup>
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

In the following cases, and if ambient temperatures are higher, contact the manufacturer.

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

**Temperature class T6** If temperature class T6 must be complied with, special measures may be required with regard to bearing temperature.

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

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

### 2.9.3 Monitoring equipment

The pump (set) must only be operated within the limits specified in the data sheet and on the name plate.

If the system operator cannot warrant compliance with these operating limits, appropriate monitoring devices must be used.

Check whether monitoring equipment is required to ensure that the pump set functions properly.

Contact KSB for further information about monitoring equipment.

### 2.9.4 Operating limits

The minimum flow rates indicated in (⇒ Section 6.2.3.1, Page 45) 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 45) can be used to check whether an additional heat build-up may lead to a dangerous temperature increase at the pump surface.

<sup>2</sup> 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;">  <b>DANGER</b> </div> <p><b>The pump (set) could slip out of the suspension arrangement</b>            Danger to life from falling parts!</p> <ul style="list-style-type: none"> <li>▷ Always transport the pump (set) in the specified position.</li> <li>▷ Never attach the suspension arrangement to the free shaft end or the motor eyebolt.</li> <li>▷ Observe the information about weights, centre of gravity and fastening points.</li> <li>▷ Observe the applicable local accident prevention regulations.</li> <li>▷ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.</li> </ul>
-----------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

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

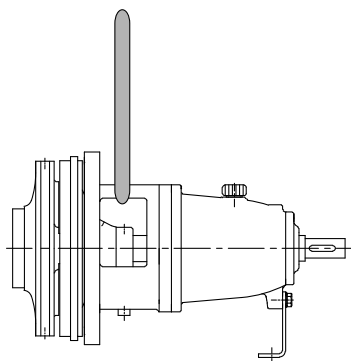


Fig. 1: Transporting the back pull-out unit

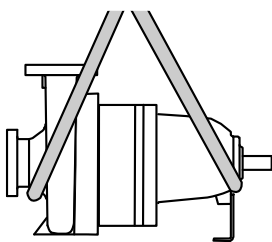


Fig. 2: Transporting the pump

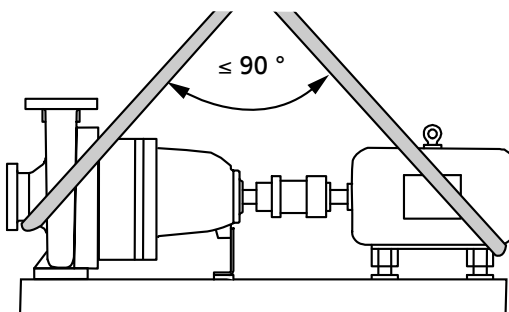


Fig. 3: Transporting the pump set

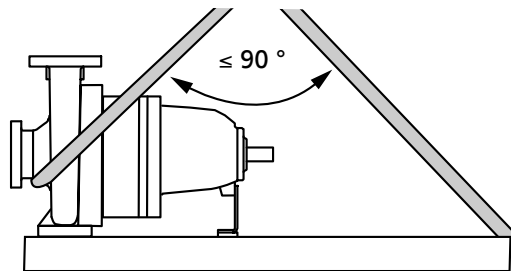




Fig. 4: Transporting the pump on the baseplate

### 3.3 Storage/preservation

	<p><b>CAUTION</b></p> <p><b>Damage during storage due to humidity, dirt or vermin</b> 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><b>CAUTION</b></p> <p><b>Wet, contaminated or damaged openings and connections</b> 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 46)

### 3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3, Page 53)
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 88)

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

## 3.5 Disposal

	<div data-bbox="507 232 703 282"> <b>WARNING</b></div> <p data-bbox="496 297 1378 356"><b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</b></p> <p data-bbox="496 362 956 394">Hazard to persons and the environment!</p> <ul data-bbox="518 403 1414 515" style="list-style-type: none"><li>▷ Collect and properly dispose of flushing fluid and any fluid residues.</li><li>▷ Wear safety clothing and a protective mask if required.</li><li>▷ Observe all legal regulations on the disposal of fluids posing a health hazard.</li></ul>
-----------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

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

Pump for handling liquids in heat transfer systems (DIN 4754) or for hot water circulation.

### 4.2 Product information

#### 4.2.1 Product information as per Ecodesign for Energy-Related Products Regulations 2010

- This product is designed for use above 120 °C only.
- Further technical data see data sheet.

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

For information as per European chemicals regulation (EC) No. 1907/2006 (REACH) see <https://www.ksb.com/en-global/company/corporate-responsibility/reach>.

### 4.3 Designation

**Table 5:** Designation example

Position																																				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
E	T	N	Y	0	5	0	-	0	3	2	-	1	2	5	1	S	G	S	D	B	0	8	L	D	2	0	0	7	5	2	B	P	D	2	E	
See name plate and data sheet																										See data sheet										

**Table 6:** Designation key

Position	Code	Description
1-4	Pump type	
	ETNY	Etanorm SYT
5-16	Size, e.g.	
	050	Nominal suction nozzle diameter [mm]
	032	Nominal discharge nozzle diameter [mm]
	1251	Nominal impeller diameter [mm]
17	Pump casing material	
	E	Cast steel GP240GH+N / A216 Gr. WCB
	S	Nodular cast iron EN-GJS-400-15
18	Impeller material	
	C	Stainless steel 1.4408 / A743 CF8M
	G	Cast iron EN-GJL-250/A48 Cl. 35B
19	Design	
	D	DNV GL (BT3)
	S	Standard
	X	Non-standard (BT3D, BT3)
20	Casing cover	
	D	Casing cover
21	Shaft seal type	
	B	Dead-end arrangement
22-23	Seal code, single mechanical seal	
	08	AQ1V7GG NU033M0-4EYS
	Seal code, double mechanical seal in tandem arrangement	
	25	AQ1V7GG KU033M0-4EYT
	AQ1V7GG	KU033M0-4EYT

Position	Code	Description
24	Bearing bracket	
	L	Version for heat transfer fluid, with leakage barrier
	Y	Version for heat transfer fluid
25	Scope of supply	
	A	Pump only (Fig. 0)
	B	Pump, baseplate
	C	Pump, baseplate, coupling, coupling guard
	D	Pump, baseplate, coupling, coupling guard, motor
	E	Back pull-out unit
26	Shaft unit	
	2	Shaft unit 25, bearing bracket LS (standard)
	3	Shaft unit 35, bearing bracket LS (standard)
	5	Shaft unit 55, bearing bracket LS (standard)
27-30	Motor rating $P_N$ [kW]	
	0075	0,75
	...	...
	1320	132,00
31	Number of motor poles	
32	Product generation	
	B	Etanorm SYT 2014
33-36	Design	
	-	Fixed speed version
	PD2	Variable speed version, with PumpDrive 2
	PD2E	Variable speed version, with PumpDrive 2 Eco

#### 4.4 Name plate

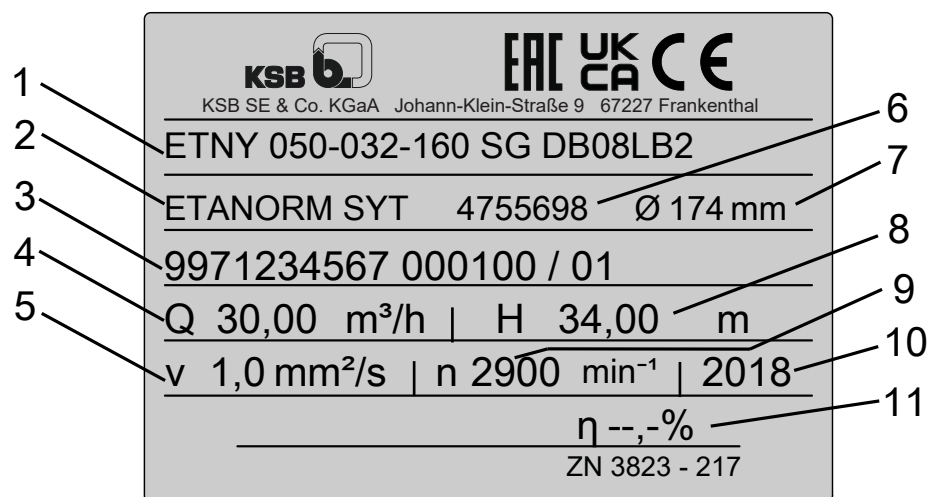


Fig. 5: Name plate (example)

1	Type series code, size and version	2	Type series
3	KSB order No., order item No. and consecutive No.	4	Flow rate

5	Kinematic viscosity of the fluid handled	6	Material number (if applicable)
7	Impeller diameter	8	Head
9	Speed	10	Year of construction
11	Efficiency (see data sheet)		

## 4.5 Design details

### Design

- Volute casing pump
- Horizontal installation
- Back pull-out design
- Single-stage
- Dimensions and ratings to EN 733

### Pump casing

- Radially split volute casing
- Volute casing with integrally cast pump feet
- Replaceable casing wear rings

### Shaft seal

- KSB single mechanical seal
- KSB double mechanical seal
- To EN 12756

### Impeller type

- Closed radial impeller with multiply curved vanes

### Bearings

Drive end:

- Grease-packed deep groove ball bearing

Pump-end:

- Carbon bearing / SiC/SiC bearing lubricated by fluid handled

### Automation

Automation options:

- PumpDrive (motor-mounted model)<sup>3)</sup>
- PumpDrive (mounting variants: wall-mounted, cabinet-mounted)<sup>4)</sup>
- KSB SuPremE

### Bearings used

**Table 7:** Overview

Version	Bearing bracket	Pump end	Drive end
Standard plain bearing (lubricated by fluid handled)	WS_25_LS	Carbon (KHK)	-
	WS_35_LS	Carbon (KHK)	-
	WS_55_LS	Carbon (KHK)	-
Optional plain bearing (lubricated by fluid handled)	WS_25_LS	SiC / SiC	-
	WS_35_LS	SiC / SiC	-

<sup>3</sup> For fluid temperatures ≤ 140°C only

<sup>4</sup> For fluid temperatures > 140°C only

Version	Bearing bracket	Pump end	Drive end
Optional plain bearing (lubricated by fluid handled)	WS_55_LS	SiC / SiC	-
Rolling element bearing (grease-packed for life, Klüber Asonic HQ 72-102)	WS_25_LS	-	DIN 625
	WS_35_LS	-	DIN 625
	WS_55_LS	-	DIN 625

#### Static sealing elements

between:

- Volute casing and discharge cover
- Discharge cover and bearing bracket

#### 4.6 Configuration and function

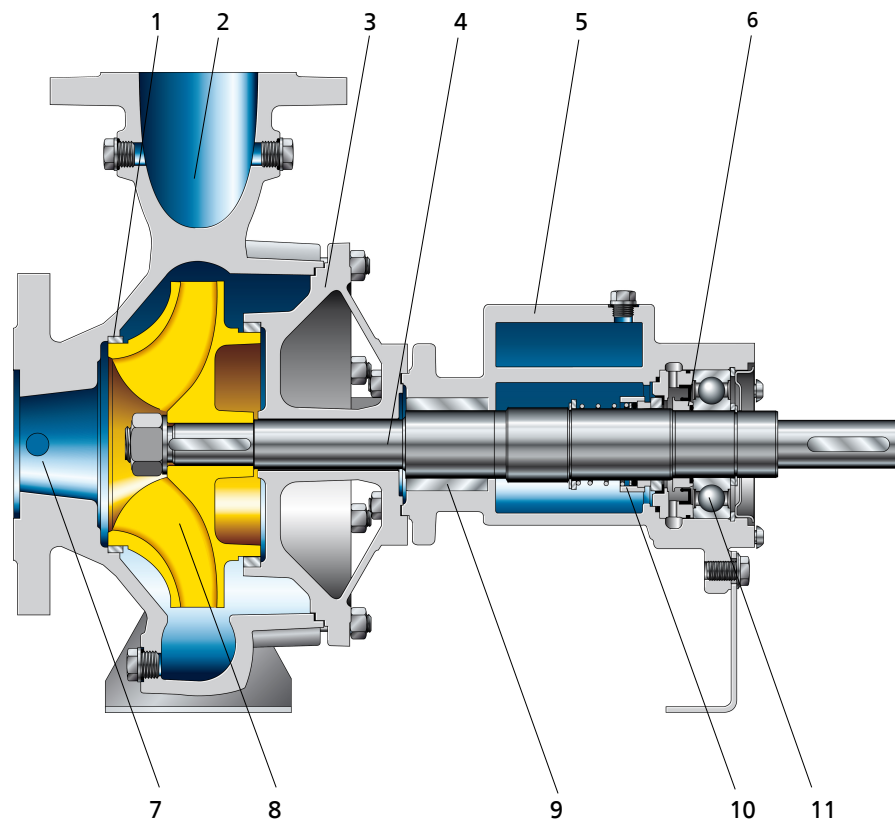


Fig. 6: Sectional drawing

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

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

**Function** The fluid enters the pump axially via the suction nozzle (7) and is accelerated outward by the rotating impeller (8). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid is pumped to the discharge nozzle (2), where it leaves the pump. The clearance gap (1) prevents any fluid from flowing back from the casing to the suction nozzle. At the rear side of the impeller, the shaft (4) enters the hydraulic system via the casing cover (3). The

shaft passage through the bearing bracket is sealed to atmosphere with a shaft seal (10). The shaft runs in a plain bearing and a rolling element bearing (9 and 11); the bearings are supported by a bearing bracket (5) joined to the pump casing and/or casing cover.

**Sealing** The pump is sealed by a reinforced mechanical seal with standardised installation dimensions.

If the pump is fitted with a double mechanical seal, the pump is connected to a quench pot. The quench liquid supplied from the quench pot serves to prevent any leakage of the fluid handled to atmosphere. It also prevents any contact between the fluid and the lubricating grease of the rolling element bearing, especially for fluids which have a tendency to creep.

#### 4.7 Noise characteristics

**Table 8:** Surface sound pressure level  $L_{pA}$ <sup>5) 6)</sup>

Rated power input $P_N$ [kW]	Pump			Pump set		
	960 rpm [dB]	1450 rpm [dB]	2900 rpm [dB]	960 rpm [dB]	1450 rpm [dB]	2900 rpm [dB]
0,55	46	47	48	54	55	64
0,75	48	48	50	56	57	64
1,1	49	50	52	59	60	64
1,5	51	52	54	59	60	69
2,2	53	54	56	63	64	69
3	54	55	57	63	64	71
4	56	57	59	61	62	73
5,5	58	59	61	67	68	72
7,5	59	60	62	67	68	72
11	61	62	64	68	69	75
15	63	64	66	68	69	75
18,5	64	65	67	69	70	75
22	65	66	68	71	72	78
30	66	67	70	70	71	79
37	67	68	71	70	71	79
45	68	69	72	71	73	79
55	69	70	73	72	74	79
75	-	72	75	-	75	82
90	-	73	76	-	76	82
110	-	74	77	-	77	82

#### 4.8 Dimensions and weights

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

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

<sup>6)</sup> Increase for 60 Hz operation: 3500 rpm +3 dB, 1750 rpm +1 dB



### 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
- Quench pot with pipework (optional)



#### Special accessories

- As required

## 5 Installation at Site

### 5.1 Checks to be carried out prior to installation





#### Place of installation

	 <b>WARNING</b>
	<p><b>Installation on a mounting surface which is unsecured and cannot support the load</b> Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XC1 to EN 206.</li> <li>▷ The mounting surface must be set, even, and level.</li> <li>▷ Observe the weights indicated.</li> </ul>

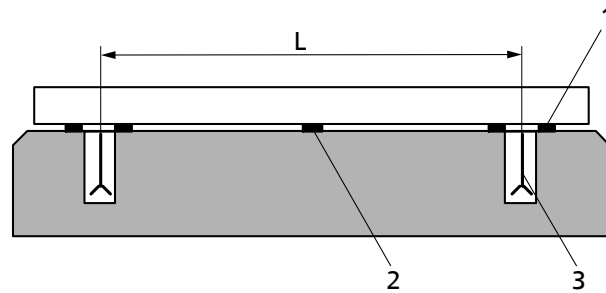
1. Check the structural requirements.  
All structural work required must have been prepared in accordance with the dimensions stated in the outline drawing/general arrangement drawing.

### 5.2 Installing the pump set

Always install the pump set in a horizontal position.

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

### 5.2.1 Installation on the foundation



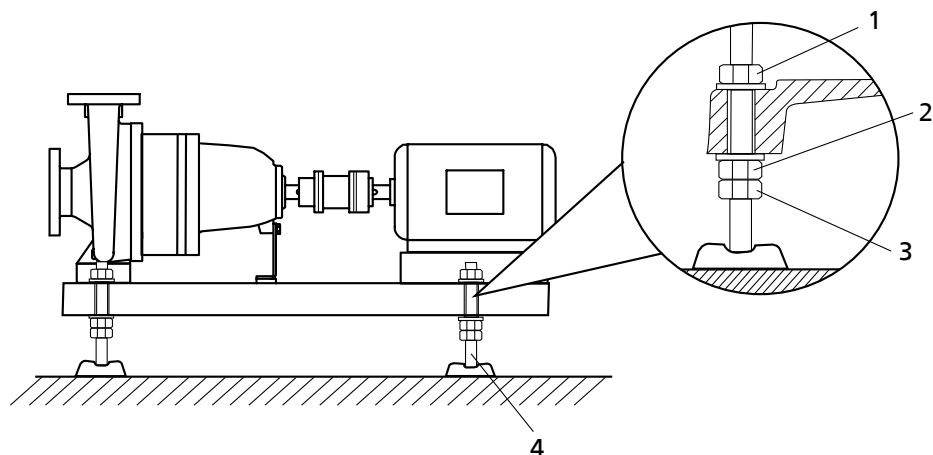
**Fig. 7: Fitting the shims**

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

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

	<b>NOTE</b>
	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
	<b>NOTE</b>
	For low-noise operation contact the manufacturer to check whether the pump set can be installed on anti-vibration mounts.
	<b>NOTE</b>
	Expansion joints can be fitted between the pump and the suction line or discharge line.

### 5.2.2 Installation without foundation



**Fig. 8:** Adjusting the levelling elements



1, 3	Locknut	2	Adjusting nut
4	Machine mount		


✓ The installation surface has the required strength and characteristics.


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

## 5.3 Piping


### 5.3.1 Connecting the piping

	<div style="background-color: #f4a460; padding: 5px;"><b>! DANGER</b></div> <p><b>Impermissible loads acting on the pump nozzles</b>            Danger to life from leakage of hot, toxic, corrosive or flammable fluids!</p> <ul style="list-style-type: none"> <li>▷ Do not use the pump as an anchorage point for the piping.</li> <li>▷ Anchor the pipelines in close proximity to the pump and connect them properly without transmitting any stresses or strains.</li> <li>▷ Observe the permissible forces and moments at the pump nozzles.</li> <li>▷ Take appropriate measures to compensate for thermal expansion of the piping.</li> </ul>
	<div style="background-color: #f4a460; padding: 5px;"><b>! WARNING</b></div> <p><b>Incorrect sealing element between suction flange and piping</b>            Risk of injury from improper sealing!</p> <ul style="list-style-type: none"> <li>▷ Never use spiral wound gaskets, type ASME B16.20, at suction-side DN 80 flange, drilled to ASME / NPS 4.</li> </ul>

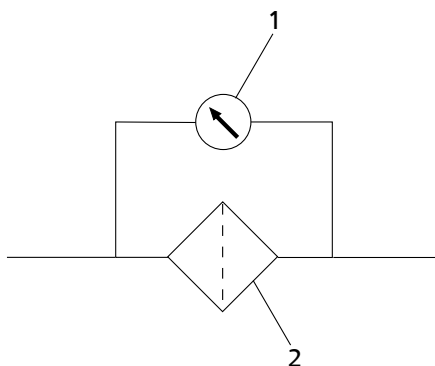
	<p><b>CAUTION</b></p> <p><b>Incorrect earthing during welding work at the piping</b> Destruction of rolling element bearings (pitting effect)!</p> <ul style="list-style-type: none"> <li>▷ Never earth the electric welding equipment on the pump or baseplate.</li> <li>▷ Prevent current flowing through the rolling element bearings.</li> </ul>
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	<p><b>NOTE</b></p> <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>
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- ✓ Suction lift lines have been laid with a rising slope, suction head lines with a downward slope towards the pump.
  - ✓ A flow stabilisation section having a length equivalent to at least twice the diameter of the suction flange has been provided upstream of the suction flange.
  - ✓ The nominal diameters of the pipelines are at least equal to the nominal diameters of the pump nozzles.
  - ✓ Adapters to larger nominal diameters are designed with a diffuser angle of approx. 8° to avoid excessive pressure losses.
  - ✓ The pipelines have been anchored in close proximity to the pump and connected without transmitting any stresses or strains.
1. Thoroughly clean, flush and blow through all vessels, pipelines and connections (especially of new installations).
  2. Before installing the pump in the piping, remove the flange covers on the suction nozzle and discharge nozzle of the pump.

	<p><b>CAUTION</b></p> <p><b>Weld beads, scale and other impurities in the piping</b> Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Remove any impurities from the piping.</li> <li>▷ If necessary, install a filter.</li> <li>▷ Observe the information in (⇒ Section 7.2.2.3, Page 52) .</li> </ul>
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3. Check that the inside of the pump is free from any foreign objects. Remove any foreign objects.
4. If required, install a filter in the piping (see drawing: Filter in the piping).



**Fig. 9: Filter in the piping**

1	Differential pressure gauge	2	Filter
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	NOTE
	Installing a fine filter of corrosion-resistant material for the run-in phase of the system is recommended. Use a filter with a filter area three times the cross-section of the piping. Conical filters have proved suitable.

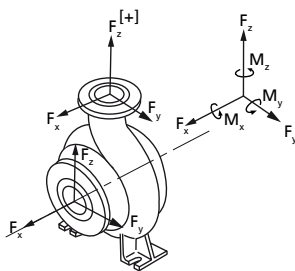
	NOTE
	Use a filter with laid-in wire mesh (mesh width 0.5 mm, wire diameter 0.25 mm) of corrosion-resistant material. Use a filter with a filter area three times the cross-section of the piping. Conical filters have proved suitable.

5. Connect the pump nozzles to the piping.

	CAUTION
	<b>Aggressive flushing liquid and pickling agent</b> 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. 10:** Forces and moments at the pump nozzles

**Table 9:** Forces and moments at the pump nozzles for pump casing material JS 1030 / A536 Gr. 60-40-18

Size	Suction nozzle								Discharge nozzle							
	DN	Fx	Fy	Fz	ΣF	Mx	My	Mz	DN	Fx	Fy	Fz	ΣF	Mx	My	Mz
		[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]		[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
040-025-160	40	553	492	430	856	553	393	455	25	325	307	369	580	387	258	301
040-025-200	40	553	492	430	856	553	393	455	25	325	307	369	580	387	258	301
050-032-125.1	50	713	651	578	1126	615	430	492	32	393	369	455	706	479	325	369
050-032-160.1	50	713	651	578	1126	615	430	492	32	393	369	455	706	479	325	369
050-032-200.1	50	713	651	578	1126	615	430	492	32	393	369	455	706	479	325	369
050-032-160	50	713	651	578	1126	615	430	492	32	393	369	455	706	479	325	369
050-032-200	50	713	651	578	1126	615	430	492	32	393	369	455	706	479	325	369
050-032-250	50	713	651	578	1126	615	430	492	32	393	369	455	706	479	325	369
065-040-160	65	910	799	738	1418	651	479	516	40	492	430	553	856	553	393	455
065-040-200	65	910	799	738	1418	651	479	516	40	492	430	553	856	553	393	455
065-040-250	65	910	799	738	1418	651	479	516	40	492	430	553	856	553	393	455
065-040-315	65	910	799	738	1418	651	479	516	40	492	430	553	856	553	393	455
065-050-160	65	910	799	738	1418	651	479	516	50	651	578	713	1126	615	437	492
065-050-200	65	910	799	738	1418	651	479	516	50	651	578	713	1126	615	437	492
065-050-250	65	910	799	738	1418	651	479	516	50	651	578	713	1126	615	437	492

Size	Suction nozzle								Discharge nozzle							
	DN	Fx	Fy	Fz	ΣF	Mx	My	Mz	DN	Fx	Fy	Fz	ΣF	Mx	My	Mz
		[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]		[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
065-050-315	65	910	799	738	1418	651	479	516	50	651	578	713	1126	615	437	492
080-065-160	80	1082	971	885	1703	688	492	565	65	799	738	910	1418	651	479	516
080-065-200	80	1082	971	885	1703	688	492	565	65	799	738	910	1418	651	479	516
080-065-250	80	1082	971	885	1703	688	492	565	65	799	738	910	1418	651	479	516
080-065-315	80	1082	971	885	1703	688	492	565	65	799	738	910	1418	651	479	516
100-080-160	100	1451	1291	1168	2266	762	541	627	80	971	885	1082	1703	688	492	565
100-080-200	100	1451	1291	1168	2266	762	541	627	80	971	885	1082	1703	688	492	565
100-080-250	100	1451	1291	1168	2266	762	541	627	80	971	885	1082	1703	688	492	565
100-080-315	100	1451	1291	1168	2266	762	541	627	80	971	885	1082	1703	688	492	565
125-100-160	125	1722	1537	1377	2688	910	651	824	100	1291	1168	1451	2266	762	541	627
125-100-200	125	1722	1537	1377	2688	910	651	824	100	1291	1168	1451	2266	762	541	627
125-100-250	125	1722	1537	1377	2688	910	651	824	100	1291	1168	1451	2266	762	541	627
125-100-315	125	1722	1537	1377	2688	910	651	824	100	1291	1168	1451	2266	762	541	627
150-125-200	150	2152	1968	1722	3387	1082	750	885	125	1537	1377	1722	2688	910	651	824
150-125-250	150	2152	1968	1722	3387	1082	750	885	125	1537	1377	1722	2688	910	651	824
150-125-315	150	2152	1968	1722	3387	1082	750	885	125	1537	1377	1722	2688	910	651	824
150-125-400	150	2152	1968	1722	3387	1082	750	885	125	1537	1377	1722	2688	910	651	824
200-150-315	200	2890	2583	2337	4526	1414	984	1143	150	1968	1722	2152	3387	1082	750	885
200-150-400	200	2890	2583	2337	4526	1414	984	1143	150	1968	1722	2152	3387	1082	750	885

Correction coefficients by temperature (see the following diagram)

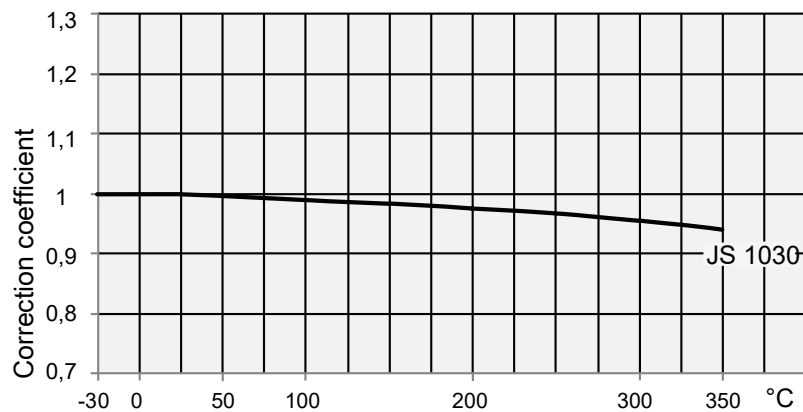


Fig. 11: Temperature correction diagram for pump casing material JS 1030

Table 10: Forces and moments at the pump nozzles for casing material GP 240 GH+N

Size	Suction nozzle								Discharge nozzle							
	DN	Fx	Fy	Fz	ΣF	Mx	My	Mz	DN	Fx	Fy	Fz	ΣF	Mx	My	Mz
		[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]		[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
040-025-160	40	1047	842	702	1516	540	302	442	25	496	442	648	928	399	199	302
040-025-200	40	1047	842	702	1516	540	302	442	25	496	442	648	928	399	199	302
050-032-125.1	50	1339	1090	896	1946	702	345	540	32	702	540	842	1222	448	248	345
050-032-160.1	50	1339	1090	896	1946	702	345	540	32	702	540	842	1222	448	248	345
050-032-200.1	50	1339	1090	896	1946	702	345	540	32	702	540	842	1222	448	248	345
050-032-160	50	1339	1090	896	1946	702	345	540	32	702	540	842	1222	448	248	345
050-032-200	50	1339	1090	896	1946	702	345	540	32	702	540	842	1222	448	248	345
050-032-250	50	1339	1090	896	1946	702	345	540	32	702	540	842	1222	448	248	345
065-040-160	65	1728	1404	1134	2499	1134	594	842	40	842	691	1080	1534	540	302	448
065-040-200	65	1728	1404	1134	2499	1134	594	842	40	842	691	1080	1534	540	302	448

Size	Suction nozzle								Discharge nozzle							
	DN	Fx	Fy	Fz	ΣF	Mx	My	Mz	DN	Fx	Fy	Fz	ΣF	Mx	My	Mz
		[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]		[N]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
065-040-250	65	1728	1404	1134	2499	1134	594	842	40	842	691	1080	1534	540	302	448
065-040-315	65	1728	1404	1134	2499	1134	594	842	40	842	691	1080	1534	540	302	448
065-050-160	65	1728	1404	1134	2499	1134	594	842	50	1080	896	1350	1947	702	345	540
065-050-200	65	1728	1404	1134	2499	1134	594	842	50	1080	896	1350	1947	702	345	540
065-050-250	65	1728	1404	1134	2499	1134	594	842	50	1080	896	1350	1947	702	345	540
065-050-315	65	1728	1404	1134	2499	1134	594	842	50	1080	896	1350	1947	702	345	540
080-065-160	80	2160	1674	1404	3072	1436	745	1090	65	1404	1134	1728	2499	1134	594	853
080-065-200	80	2160	1674	1404	3072	1436	745	1090	65	1404	1134	1728	2499	1134	594	853
080-065-250	80	2160	1674	1404	3072	1436	745	1090	65	1404	1134	1728	2499	1134	594	853
080-065-315	80	2160	1674	1404	3072	1436	745	1090	65	1404	1134	1728	2499	1134	594	853
100-080-160	100	2700	2106	1728	3835	1998	972	1512	80	1674	1404	2106	3034	1458	745	1080
100-080-200	100	2700	2106	1728	3835	1998	972	1512	80	1674	1404	2106	3034	1458	745	1080
100-080-250	100	2700	2106	1728	3835	1998	972	1512	80	1674	1404	2106	3034	1458	745	1080
100-080-315	100	2700	2106	1728	3835	1998	972	1512	80	1674	1404	2106	3034	1458	745	1080
125-100-160	125	3672	2916	2376	5256	2700	1404	2106	100	2160	1728	2700	3865	1998	972	1512
125-100-200	125	3672	2916	2376	5256	2700	1404	2106	100	2160	1728	2700	3865	1998	972	1512
125-100-250	125	3672	2916	2376	5256	2700	1404	2106	100	2160	1728	2700	3865	1998	972	1512
125-100-315	125	3672	2916	2376	5256	2700	1404	2106	100	2160	1728	2700	3865	1998	972	1512
150-125-200	150	4644	3726	3078	6702	3456	1728	2646	125	2916	2376	3672	5256	2754	1404	2052
150-125-250	150	4644	3726	3078	6702	3456	1728	2646	125	2916	2376	3672	5256	2754	1404	2052
150-125-315	150	4644	3726	3078	6702	3456	1728	2646	125	2916	2376	3672	5256	2754	1404	2052
150-125-400	150	4644	3726	3078	6702	3456	1728	2646	125	2916	2376	3672	5256	2754	1404	2052
200-150-315	200	7290	5670	4644	10337	5238	2646	3834	150	3726	3078	4644	6702	3402	1728	2646
200-150-400	200	7290	5670	4644	10337	5238	2646	3834	150	3726	3078	4644	6702	3402	1728	2646

Correction coefficients by temperature (see the following diagram)

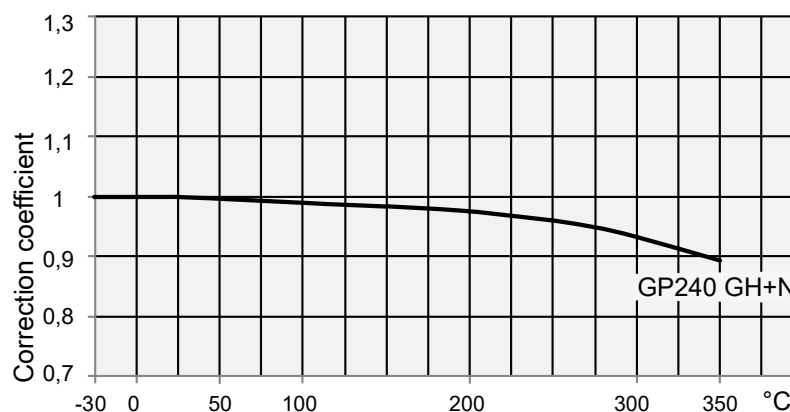


Fig. 12: Temperature correction diagram for pump casing material GP240 GH+N

### 5.3.3 Vacuum balance line



#### NOTE

Where fluid has to be pumped out of a vessel under vacuum, installing a vacuum balance line is recommended.

The following rules apply to vacuum balance lines:

- Minimum nominal line diameter 25 mm.
- The line extends above the highest permissible fluid level in the vessel.



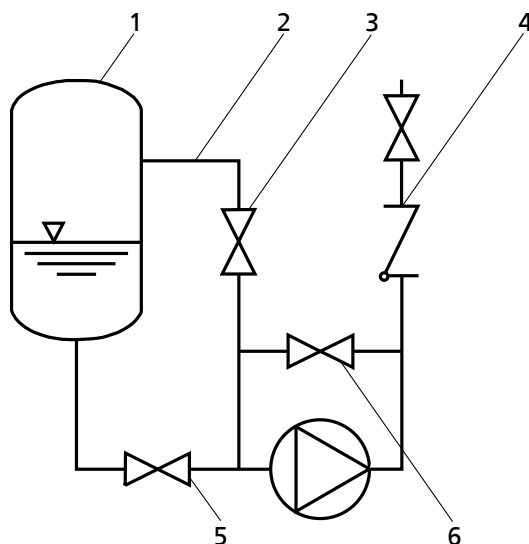


Fig. 13: Vacuum balance system

1	Vessel under vacuum	2	Vacuum balance line
3	Shut-off element	4	Swing check valve
5	Main shut-off element	6	Vacuum-tight shut-off element



#### NOTE

An additional line fitted with a shut-off valve (from the pump discharge nozzle to the balance line) facilitates venting of the pump before start-up.

#### 5.3.4 Auxiliary connections



#### DANGER

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

Risk of burns!

Explosion hazard!

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



#### WARNING

**Failure to use or incorrect use of auxiliary connections (e.g. barrier fluid, flushing liquid, etc.)**

Risk of injury from escaping fluid!

Risk of burns!

Malfunction of the pump!

- ▷ Refer to the general arrangement drawing, the piping layout and pump markings (if any) for the quantity, dimensions and locations of auxiliary connections.
- ▷ Use the auxiliary connections provided.

### Double mechanical seal

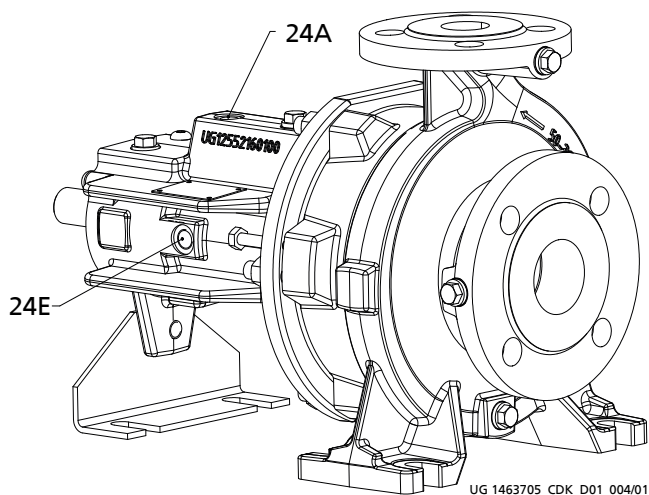


Fig. 14: Connections 24E and 24A

24A	Quench fluid outlet	24E	Quench fluid inlet
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For designs with double mechanical seal, use connections 24A and 24E to connect the pump set to the unpressurised quench system. Connect the quench system in accordance with the manufacturer's instructions.

### Double mechanical seal and monitoring equipment

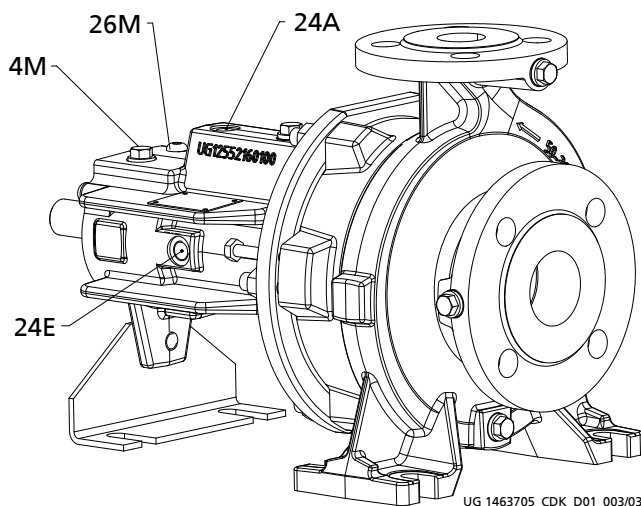


Fig. 15: Connections 24E, 24A, 4M and 26M

24A	Quench fluid outlet	24E	Quench fluid inlet
4M	Temperature measurement	26M	Shock pulse measurement

For designs with double mechanical seal and monitoring equipment, use connections 24A and 24E to connect the pump set to the unpressurised quench system and connections 4M and 26M to connect the pump set to the monitoring equipment. Connect the quench system and the monitoring equipment in accordance with the manufacturers' instructions.

### Single mechanical seal and monitoring equipment

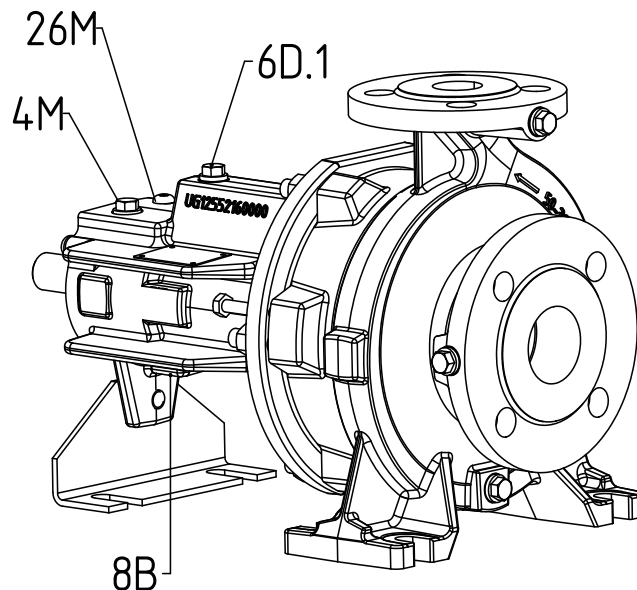


Fig. 16: Connections 4M and 26M

4M	Temperature measurement	26M	Shock pulse measurement
8B	Leakage drain		

For designs with single mechanical seal and monitoring equipment, use connections 4M and 26M to connect the pump set to the monitoring equipment. Connect the monitoring equipment in accordance with the manufacturer's instructions.



#### NOTE

Connecting a pipe to connection 8B (leakage drain) is recommended to guide the mechanical seal leakage into a collecting container.

### 5.3.5 Quench piping



#### NOTE

Insulating the rising pipe of the quench system is recommended to prevent the rising quench fluid from cooling down and to maintain the thermosyphon effect.

### 5.4 Enclosure/insulation



#### ⚠ DANGER

**An explosive atmosphere could form due to insufficient venting**  
Explosion hazard!



- ▷ Make sure the space between the casing cover/discharge cover and the bearing cover is sufficiently vented.






#### ⚠ WARNING

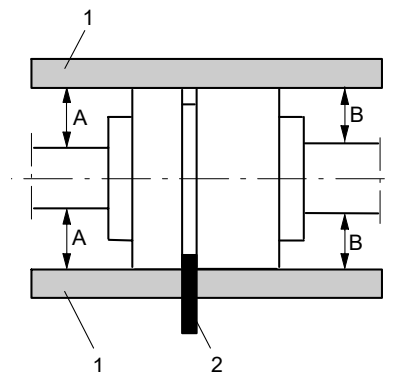
**The volute casing and casing/discharge cover take on the same temperature as the fluid handled**  
Risk of burns!

- ▷ Insulate the volute casing.
- ▷ Fit protective equipment.

	<b>CAUTION</b>
	<p><b>Heat build-up in the bearing bracket</b> Damage to the bearing!</p> <p>▷ Never insulate the bearing bracket, bearing bracket lantern and casing cover.</p>
	<b>NOTE</b>
	<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

 	<b>! DANGER</b>
	<p><b>Inadmissible temperatures at the coupling or bearings due to misalignment of the coupling</b> Explosion hazard! Risk of burns!</p> <p>▷ Make sure that the coupling is correctly aligned at all times.</p>
	<b>CAUTION</b>
	<p><b>Misalignment of pump and motor shafts</b> 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. 17:** Non-spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge
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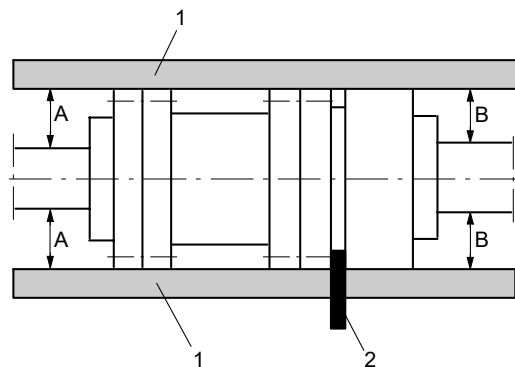


Fig. 18: Spacer-type coupling, checking the coupling alignment

1	Straight edge	2	Gauge
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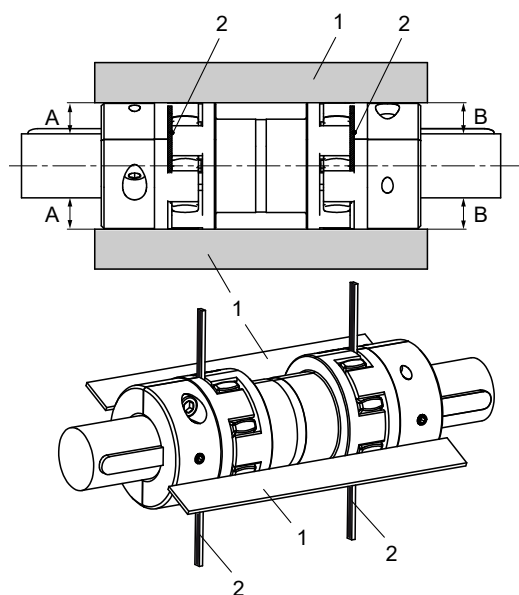


Fig. 19: Double Cardan spacer-type coupling, checking the coupling alignment

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

Coupling type	Radial offset	Axial offset
	[mm]	[mm]
Non-spacer-type coupling (⇒ Fig. 17)	≤ 0,1	≤ 0,1
Spacer-type coupling (⇒ Fig. 18)	≤ 0,1	≤ 0,1
Double Cardan coupling (⇒ Fig. 19)	≤ 0,5	≤ 0,5

- ✓ The coupling guard and its footboard, if any, have been removed.
- 1. Loosen the support foot and re-tighten it without transmitting any stresses and strains.
- 2. Place the straight edge axially on both coupling halves.
- 3. Leave the straight edge in this position and turn the coupling by hand.  
The coupling is aligned correctly if the distances A and B to the respective shafts are the same at all points around the circumference.  
Observe the permissible radial offset in coupling half alignment (⇒ Table 11) both during standstill and at operating temperature as well as under inlet pressure.
- 4. Check the distance (dimension see general arrangement drawing) between the two coupling halves around the circumference.  
The coupling is correctly aligned if the distance between the two coupling halves is the same at all points around the circumference.

Observe the permissible axial offset in coupling half alignment (⇒ Table 11) both during standstill and at operating temperature as well as under inlet pressure.

5. If alignment is correct, re-install the coupling guard and its footboard, if any.

#### Checking the coupling alignment with a laser tool

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

### 5.6 Aligning the pump and motor

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

#### 5.6.1 Motors with adjusting screw

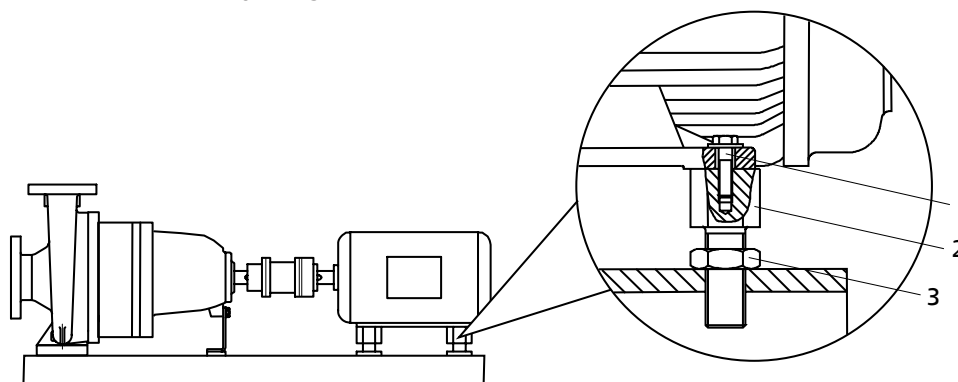



Fig. 20: Motor with adjusting screw

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.

	<b>! WARNING</b>
	<p><b>Unprotected rotating coupling</b> Risk of injury by rotating shafts!</p> <ul style="list-style-type: none"> <li>▷ 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!</li> <li>▷ Observe all relevant regulations for selecting a coupling guard.</li> </ul>

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

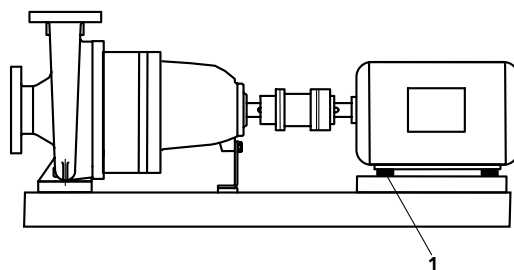




Fig. 21: Pump set with shim

1	Shim
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- ✓ 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: #f1c40f; color: white; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Unprotected rotating coupling</b> Risk of injury by rotating shafts!</p> <ul style="list-style-type: none"> <li>▷ 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!</li> <li>▷ Observe all relevant regulations for selecting a coupling guard.</li> </ul>
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	<div style="background-color: #e67e22; color: white; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Risk of ignition by frictional sparks</b> Explosion hazard!!</p> <ul style="list-style-type: none"> <li>▷ Choose a coupling guard material that is non-sparking in the event of mechanical contact.</li> </ul>
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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

 	<p><b>⚠ DANGER</b></p> <p><b>Electrical connection work by unqualified personnel</b>          Danger of death from electric shock and explosion!</p> <ul style="list-style-type: none"> <li>▶ Always have the electrical connections installed by an electrically qualified person.</li> <li>▶ Observe regulations IEC 60364 and, for explosion-proof versions, EN 60079 .</li> </ul>
	<p><b>⚠ WARNING</b></p> <p><b>Incorrect connection to the mains</b>          Damage to the power supply network, short circuit!</p> <ul style="list-style-type: none"> <li>▶ Observe the technical specifications of the local energy supply companies.</li> </ul>
	<p><b>NOTE</b></p> <p>Installing a motor protection device is recommended.</p>

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



#### 5.7.1 Setting the time relay

	<p><b>CAUTION</b></p> <p><b>Switchover between star and delta on three-phase motors with star-delta starting takes too long.</b>          Damage to the pump (set)!</p> <ul style="list-style-type: none"> <li>▶ Keep switch-over intervals between star and delta as short as possible.</li> </ul>
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**Table 12:** Time relay settings for star-delta starting:



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

#### 5.7.2 Earthing

 	<p><b>⚠ DANGER</b></p> <p><b>Electrostatic charging</b>          Explosion hazard!          Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▶ Connect the PE conductor to the earthing terminal provided.</li> <li>▶ Provide for potential equalisation between the pump set and the foundation.</li> </ul>
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### 5.7.3 Connecting the motor

	<p><b>CAUTION</b></p> <p><b>Excessive temperature due to insufficient cooling</b> Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▶ Only use electric motors whose cooling air flows in axial direction towards the pump end.</li> <li>▶ Ensure an air velocity <math>\geq 3</math> m/s measured in the area of the bearing end plate on the drive side.</li> <li>▶ If the pump is driven by a combustion engine, only use engines whose cooling air is sucked in or blown out via the coupling/flywheel.</li> </ul>
	<p><b>NOTE</b></p> <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

	<p><b>⚠ DANGER</b></p> <p><b>Temperature increase resulting from contact between rotating and stationary components</b> Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▶ Never check the direction of rotation by starting up the unfilled pump set.</li> <li>▶ Separate the pump from the motor to check the direction of rotation.</li> </ul>
	<p><b>⚠ WARNING</b></p> <p><b>Hands inside the pump casing</b> Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> <li>▶ 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.</li> </ul>
	<p><b>CAUTION</b></p> <p><b>Incorrect direction of rotation with non-reversible mechanical seal</b> Damage to the mechanical seal and leakage!</p> <ul style="list-style-type: none"> <li>▶ Separate the pump from the motor to check the direction of rotation.</li> </ul>
	<p><b>CAUTION</b></p> <p><b>Drive and pump running in the wrong direction of rotation</b> Damage to the pump!</p> <ul style="list-style-type: none"> <li>▶ Refer to the arrow indicating the direction of rotation on the pump.</li> <li>▶ Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation.</li> </ul>

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

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

## 6 Commissioning/Start-up/Shutdown

### 6.1 Commissioning/Start-up

#### 6.1.1 Prerequisites for commissioning/start-up

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

- The pump set has been properly connected mechanically.
- The pump and the bearing bracket have been primed with the fluid to be handled. (⇒ Section 6.1.3, Page 39)
- The pump set has been properly connected to the power supply and is equipped with all protection devices. (⇒ Section 5.7, Page 36)
- If applicable, the quench system is filled with quench fluid.
- The direction of rotation has been checked. (⇒ Section 5.8, Page 37)
- All auxiliary connections required are connected and operational. (⇒ Section 5.3.4, Page 29)
- The lubricants have been checked. (⇒ Section 7.2.3, Page 52)
- After prolonged shutdown of the pump (set), the activities required for returning the equipment to service have been carried out. (⇒ Section 6.4, Page 47)

#### 6.1.2 Quench liquid supply





##### Permissible quench liquids










The quench liquid must be compatible with and suitable for mixing with the fluid handled.

For synthetic heat transfer oils, a mineral oil based thermal fluid or another mineral oil must be used as a quench liquid.

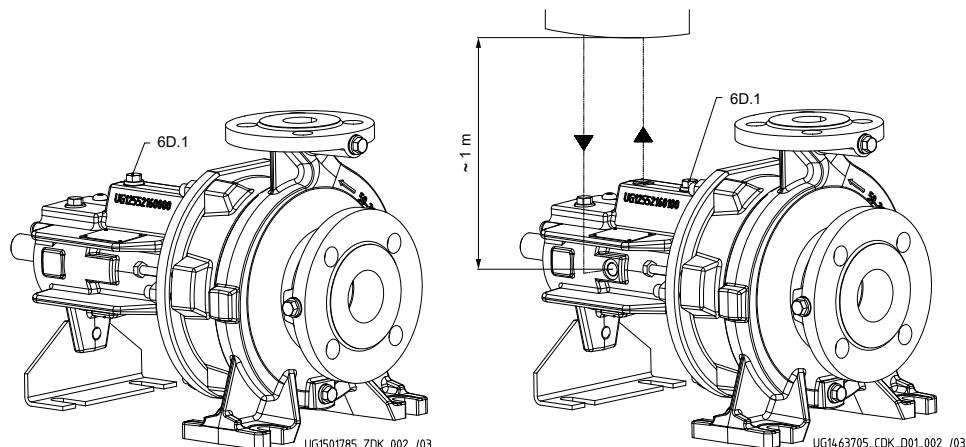
Heat transfer oils of the diphyl group are not suitable for use as quench liquids.

#### 6.1.3 Priming and venting the pump

	<div data-bbox="507 1216 683 1261">  <b>DANGER</b> </div> <p><b>Risk of potentially explosive atmosphere inside the pump</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ 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.</li> <li>▷ Provide sufficient inlet pressure.</li> <li>▷ Provide an appropriate monitoring system.</li> </ul>
	<div data-bbox="507 1563 683 1608">  <b>DANGER</b> </div> <p><b>Risk of potentially explosive atmosphere by incompatible fluids mixing in the auxiliary piping</b> Risk of burns! Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Make sure that the barrier fluid or quench liquid are compatible with the fluid handled.</li> </ul>

	<div data-bbox="507 192 683 237"> <b>DANGER</b></div> <p><b>Shaft seal failure caused by insufficient lubrication</b> Hot or toxic fluid could escape! Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Before starting up the pump set, vent the pump and suction line and prime both with the fluid to be handled.</li> </ul>
	<div data-bbox="507 468 639 501"><b>CAUTION</b></div> <p><b>Increased wear due to dry running</b> Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump set without liquid fill.</li> <li>▷ Never close the shut-off element in the suction line and/or supply line during pump operation.</li> </ul>
	<div data-bbox="507 743 587 777"><b>NOTE</b></div> <p>In the run-in phase of the system, venting the pump repeatedly via the screw plug on the bearing bracket is recommended.</p> <ol style="list-style-type: none"> <li>1. Remove screw plug 903.85 (connection 6D.1) to prime the bearing housing. Fill the bearing housing with the fluid. Then fit and tighten screw plug 903.85.</li> <li>2. To vent the bearing housing, slowly open screw plug 903.85 (connection 6D.1) by no more than half a turn to a full turn. Leave the screw plug open until the gas has left the bearing housing and liquid starts to escape. Then, tighten screw plug 903.85 again.</li> <li>3. Vent the pump and suction line and prime both with the fluid to be handled. The pump can be primed with the fluid to be handled from the system via the inlet line.</li> <li>4. Fully open the shut-off element in the suction line.</li> <li>5. Fully open all auxiliary feed lines (barrier fluid, flushing liquid, etc.), if any.</li> <li>6. Fully open the shut-off element in the vacuum balance line, if any. Also, if applicable, close the vacuum-tight shut-off element. (⇒ Section 5.3.3, Page 28)</li> </ol>
	<div data-bbox="507 1352 683 1397"> <b>DANGER</b></div> <p><b>Hot fluid spurting out of the vent chamber</b> Burns, scalding!</p> <ul style="list-style-type: none"> <li>▷ Always use utmost caution during the venting process and wear appropriate protective gear.</li> </ul>
	<div data-bbox="507 1588 703 1632"> <b>WARNING</b></div> <p><b>Hot water escaping under pressure when the vent plug is opened</b> Risk of electric shock! Risk of scalding!</p> <ul style="list-style-type: none"> <li>▷ Protect the electric components against escaping fluid.</li> <li>▷ Wear protective clothing (e.g. gloves).</li> </ul>
	<div data-bbox="507 1877 587 1910"><b>NOTE</b></div> <p>For design-inherent reasons some unfilled volume in the hydraulic system cannot be excluded after the pump has been primed for commissioning/start-up. However, once the motor is started up the pumping effect will immediately fill this volume with the fluid handled.</p>

7. Close the vent hole (connection 6D.1) with screw plug 903.85.



**Fig. 22: Auxiliary connection 6D.1**

6D.1	Screw plug 903.85
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#### NOTE

Replacing the screw plug with a globe valve and vent line is recommended, so that gases and hot fluids handled can be drained safely during the venting process.

#### Venting during operation

1. Switch off the pump and let it run down to a standstill.
2. This allows the gases to escape reliably.
3. Close the shut-off elements as required by the system configuration.
4. To vent the bearing bracket open screw plug 903.85 by 1/2 turn to maximum 1 turn until no more gas escapes.
5. When no more gas escapes, close the screw plug again.

#### Excessive venting

1. Prevent excessive venting.
  - ⇒ Hot fluid handled will flow from the piping system through the volute casing into the mechanical seal chamber and result in an inadmissible heat build-up in the mechanical seal.
2. When no more gas escapes, close the screw plug again.

#### 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 32)
3. Check proper functioning of coupling/shaft. Check that coupling/shaft can be easily rotated by hand.
4. Fit the coupling guard and its footboard, if any.
5. Check the distance between coupling and coupling guard. The coupling guard must not touch the coupling.



#### NOTE

The coupling alignment check must be repeated after the pump has reached operating temperature.

### 6.1.5 Keeping warm / heating up the pump (set)

	CAUTION
	<p><b>Pump blockage</b> Damage to the pump!</p> <ul style="list-style-type: none"> <li>▸ Prior to pump start-up, heat up the pump as described in the manual.</li> </ul>

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

- Make sure that the temperature is increased continuously.
- Heating speed: max. 5 °C/min (5 K/min)






**Fluid temperatures above 150 °C**

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


**Temperature difference**

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


### 6.1.6 Start-up

	 <b>DANGER</b>
	<p><b>Non-compliance with the permissible pressure and temperature limits if the pump is operated with the suction and/or discharge line closed.</b> Explosion hazard! Hot or toxic fluids escaping!</p> <ul style="list-style-type: none"> <li>▸ Never operate the pump with the shut-off elements in the suction line and/or discharge line closed.</li> <li>▸ Only start up the pump set with the discharge-side shut-off element slightly or fully open.</li> </ul>
	<p><b>Excessive temperatures due to dry running or excessive gas content in the fluid handled</b> Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▸ Never operate the pump set without liquid fill.</li> <li>▸ Prime the pump as per operating instructions.</li> <li>▸ Always operate the pump within the permissible operating range.</li> </ul>
	CAUTION
	<p><b>Abnormal noises, vibrations, temperatures or leakage</b> Damage to the pump!</p> <ul style="list-style-type: none"> <li>▸ Switch off the pump (set) immediately.</li> <li>▸ Eliminate the causes before returning the pump set to service.</li> </ul>

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

	CAUTION
	<p><b>Start-up against open discharge line</b> Motor overload!</p> <ul style="list-style-type: none"> <li>▷ Make sure the motor has sufficient power reserves.</li> <li>▷ Use a soft starter.</li> <li>▷ Use speed control.</li> </ul>


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

	CAUTION
	<p><b>Misalignment of pump and coupling</b> Damage to pump, motor and coupling!</p> <ul style="list-style-type: none"> <li>▷ When the operating temperature has been reached, switch off the pump set and check the coupling alignment.</li> </ul>


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


#### 6.1.7 Checking the shaft seal

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


	NOTE
	<p>Mechanical seal failure may result in the fluid handled penetrating into the rolling element bearing, where it may damage the grease fill. Whenever fluid leakage occurs, the rolling element bearing and the shaft seal ring should therefore also be replaced as a precaution. This is particularly important when the pump is handling synthetic heat transfer fluids.</p>

#### 6.1.8 Shutdown

	CAUTION
	<p><b>Heat build-up inside the pump</b> Damage to the shaft seal!</p> <ul style="list-style-type: none"> <li>▷ 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.</li> </ul>


	CAUTION
	<p><b>Backflow of fluid handled is not permitted</b> Motor and/or winding damage! Mechanical seal damage!</p> <ul style="list-style-type: none"> <li>▷ Close the shut-off elements.</li> </ul>

- ✓ 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.



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

 	<p><b>⚠ DANGER</b></p> <p><b>Non-compliance with operating limits for pressure, temperature, fluid handled and speed</b></p> <p>Explosion hazard! Hot or toxic fluid could escape!</p> <ul style="list-style-type: none"> <li>▷ Comply with the operating data specified in the data sheet.</li> <li>▷ Never use the pump for handling fluids it is not designed for.</li> <li>▷ Avoid prolonged operation against a closed shut-off element.</li> <li>▷ 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.</li> </ul>
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	<p><b>⚠ DANGER</b></p> <p><b>Formation of a potentially explosive atmosphere inside the pump</b></p> <p>Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ When draining tanks take suitable measures to prevent dry running of the pump (e.g. fill level monitoring).</li> </ul>
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### 6.2.1 Ambient temperature

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



**Table 13:** Permissible ambient temperatures

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


### 6.2.2 Frequency of starts

	 <b>DANGER</b>
	<p><b>Excessive surface temperature of the motor</b></p> <p>Explosion hazard!</p> <p>Damage to the motor!</p> <p>▷ In case of explosion-proof motors, observe the frequency of starts specified in the manufacturer's product literature.</p>

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 14:** Frequency of starts

Impeller material	Maximum number of starts
	[ Starts/hour]
G (JL1040/ A48CL35B)	15
C (1.4408/ A743 GR CF8M)	6

	<b>CAUTION</b>
	<p><b>Re-starting while motor is still running down</b></p> <p>Damage to the pump (set)!</p> <p>▷ Do not re-start the pump set before the pump rotor has come to a standstill.</p>

### 6.2.3 Fluid handled

#### 6.2.3.1 Flow rate

**Table 15:** Flow rate

Temperature range (t)	Minimum flow rate	Maximum flow rate
-30 to +350 °C	≈ 25 % 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 16:** Key


Symbol	Description	Unit
c	Specific heat capacity	J/kg K
g	Acceleration due to gravity	m/s <sup>2</sup>

<sup>7</sup> Best efficiency point

Symbol	Description	Unit
H	Pump discharge head	m
$T_f$	Fluid temperature	°C
$T_o$	Temperature at the casing surface	°C
$\eta$	Pump efficiency at duty point	-
$\Delta\vartheta$	Temperature difference	K

### 6.2.3.2 Density of the fluid handled

The power input of the pump set will change in proportion to the density of the fluid handled.

	<b>CAUTION</b>
	<p><b>Impermissibly high density of the fluid handled</b></p> <p>Motor overload!</p> <ul style="list-style-type: none"> <li>▷ Observe the information about fluid density in the data sheet.</li> <li>▷ Make sure the motor has sufficient power reserves.</li> </ul>

### 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/dm<sup>3</sup> and a maximum particle size of 0.5 mm.

### 6.2.4 Permissible speed

**Table 17:** Permissible speed for pump control systems with continuously variable speed adjustment

$n_{min}$ [rpm]	$n_{max}$ [rpm]
800	-

## 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 53)
  - ✓ The safety instructions for dismantling the pump have been observed. (⇒ Section 7.4.1, Page 53)
  - ✓ The permissible ambient temperature for storing the pump is observed.
    1. Spray-coat the inside wall of the pump casing and, in particular, the impeller clearance areas with a preservative.
    2. Spray the preservative through the suction nozzle and discharge nozzle. It is advisable to then close the pump nozzles (e.g. with plastic caps).
    3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil and 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 39) (⇒ Section 6.2, Page 44)


In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇒ Section 7, Page 48)

	<b>! WARNING</b>
	<b>Failure to re-install or re-activate protective devices</b> Risk of injury from moving parts or escaping fluid! ▷ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices.
	<b>NOTE</b>
	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"> <b>DANGER</b></div> <div data-bbox="496 378 991 409"><b>Improper cleaning of coated pump surfaces</b></div> <div data-bbox="496 414 991 443">Explosion hazard by electrostatic discharge!</div> <div data-bbox="517 454 1406 512"> <ul style="list-style-type: none"> <li>▷ When cleaning coated pump surfaces in atmospheres of Explosion group IIC, use suitable anti-static equipment.</li> </ul> </div>
	<div data-bbox="507 551 683 595"> <b>DANGER</b></div> <div data-bbox="496 613 943 645"><b>Sparks produced during servicing work</b></div> <div data-bbox="496 649 699 678">Explosion hazard!</div> <div data-bbox="517 689 1437 790"> <ul style="list-style-type: none"> <li>▷ Observe the safety regulations in force at the place of installation!</li> <li>▷ Always perform maintenance work at an explosion-proof pump (set) outside of potentially explosive atmospheres.</li> </ul> </div>
 	<div data-bbox="507 831 683 875"> <b>DANGER</b></div> <div data-bbox="496 893 836 925"><b>Improperly serviced pump set</b></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"> <li>▷ Service the pump set regularly.</li> <li>▷ Prepare a maintenance schedule with special emphasis on lubricants, shaft seal and coupling.</li> </ul> </div>
<p>The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.</p>	
	<div data-bbox="507 1245 703 1290"> <b>WARNING</b></div> <div data-bbox="496 1308 940 1339"><b>Unintentional starting of the pump set</b></div> <div data-bbox="496 1344 1139 1373">Risk of injury by moving components and shock currents!</div> <div data-bbox="517 1384 1414 1485"> <ul style="list-style-type: none"> <li>▷ Ensure that the pump set cannot be started unintentionally.</li> <li>▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.</li> </ul> </div>
	<div data-bbox="507 1525 703 1570"> <b>WARNING</b></div> <div data-bbox="496 1588 1378 1646"><b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</b></div> <div data-bbox="496 1650 654 1680">Risk of injury!</div> <div data-bbox="517 1691 1430 1832"> <ul style="list-style-type: none"> <li>▷ Observe all relevant laws.</li> <li>▷ When draining the fluid take appropriate measures to protect persons and the environment.</li> <li>▷ Decontaminate pumps which handle fluids posing a health hazard.</li> </ul> </div>

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


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.



	<b>NOTE</b>
	All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached Addresses booklet or visit <a href="https://www.ksb.com/en-global/contact">https://www.ksb.com/en-global/contact</a> .



Never use force when dismantling and reassembling the pump set.



## 7.2 Servicing/inspection

### 7.2.1 Supervision of operation

	<b>⚠ DANGER</b>
	<b>Risk of potentially explosive atmosphere inside the pump</b> Explosion hazard! <ul style="list-style-type: none"> <li>▷ 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.</li> <li>▷ Provide sufficient inlet pressure.</li> <li>▷ Provide an appropriate monitoring system.</li> </ul>


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


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

	<p><b>CAUTION</b></p> <p><b>Increased wear due to dry running</b> Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump set without liquid fill.</li> <li>▷ Never close the shut-off element in the suction line and/or supply line during pump operation.</li> </ul>
	<p><b>CAUTION</b></p> <p><b>Impermissibly high temperature of fluid handled</b> Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).</li> <li>▷ Observe the temperature limits in the data sheet and in the section on operating limits. (⇒ Section 6.2, Page 44)</li> </ul>


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

- The pump must run quietly and free from vibrations at all times.
- Check the shaft seal.
- Check the static sealing elements for leakage.
- Check the 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.
- Check the quench liquid level.  
Make sure the quench pot always contains sufficient quench liquid.

	<p><b>NOTE</b></p> <p>If the liquid level in the quench pot rises, fluid from the pump has mixed with the quench liquid, which indicates leakage at the pump-end mechanical seal. During start-up it is normal for the liquid level in the quench pot to rise until the operating temperature has been reached.</p>
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	<p><b>NOTE</b></p> <p>If the liquid level in the quench pot drops rapidly, this indicates leakage at the drive-end mechanical seal. In this case, the quench liquid could mix with the grease of rolling element bearing 321 and affect lubrication. Check the rolling element bearing and replace it if required.</p>
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- Monitor the temperature of the rolling element bearings.  
Set the alert temperature of the bearing monitoring equipment to 115 °C. At a bearing temperature of 120 °C switch off the pump.

	<p><b>CAUTION</b></p> <p><b>Operation outside the permissible bearing temperature</b> Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ The rolling element bearing temperature of the pump (set) must not continuously exceed 115 °C (measured on the outside of the bearing bracket).</li> </ul>
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**NOTE**

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

**7.2.2 Inspection work****⚠ DANGER**

**Excessive temperatures caused by friction, impact or frictional sparks**

Explosion hazard!

Fire hazard!

Damage to the pump set!

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

**⚠ DANGER**

**Electrostatic charging due to insufficient potential equalisation**

Explosion hazard!

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

**7.2.2.1 Checking the coupling**

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

**7.2.2.2 Checking the clearances****Clearances between impeller and casing**

For checking the clearances remove the impeller, if required.

If the clearance is larger than permitted (see the following table), fit new casing wear rings 502.1 and/or 502.2.

The clearances given refer to the diameter.

**Table 18:** Clearances between impeller and casing and/or between impeller and casing cover

Impeller material	Permissible clearances [mm]	
	New	Maximum
G (JL1040/ A48CL35B)	0,3	0,9
C (1.4408/ A743 GR CF8M)	0,5	1,5

**NOTE**


If the clearances given are exceeded by more than 1 mm (referring to the diameter) replace the affected components or restore the original clearance by means of a casing wear ring.  
Contact KSB.

## Plain bearing clearances

**Table 19:** Plain bearing clearances

Bearing bracket	Permissible clearances [mm]	
	New	Maximum permissible enlargement
WS_25_LS	0,08 - 0,13	0,35
WS_35_LS	0,08 - 0,13	0,4
WS_55_LS	0,08 - 0,13	0,4

### 7.2.2.3 Cleaning filters





**CAUTION**

**Insufficient inlet pressure due to clogged filter in the suction line**  
Damage to the pump!

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

### 7.2.3 Lubricating the rolling element bearing



 **DANGER**

**Excessive temperatures as a result of bearings running hot or defective bearing seals**  
Explosion hazard!  
Fire hazard!  
Damage to the pump set!

- ▷ Regularly check the bearing seal.

The bearings are delivered packed for life with a special high-temperature grease.

#### 7.2.3.1 Grease quality

The pump may only be operated with Klüber Asonic HQ 72-102 high-temperature grease. Other grease qualities are not approved for use.

Under unfavourable operating conditions, e.g.:

- High room temperature
- High atmospheric humidity
- Dust-laden air
- Aggressive atmosphere
- Etc.

the bearings must be checked earlier and replaced if required.

#### 7.2.3.2 Intervals



Under normal conditions the grease-lubricated bearing 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 rolling element bearing earlier and replace it, if required.



### 7.2.4 Lubricating the plain bearing

The pump-end plain bearing is lubricated by the fluid handled. It is maintenance-free.







### 7.3 Drainage/cleaning


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

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 88)

### 7.4 Dismantling the pump set

#### 7.4.1 General information/Safety regulations

	 <b>DANGER</b>
	<p><b>Insufficient preparation of work on the pump (set)</b></p> <p>Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Properly shut down the pump set. (⇒ Section 6.1.8, Page 43)</li> <li>▷ Close the shut-off elements in the suction line and discharge line.</li> <li>▷ Drain the pump and release the pump pressure. (⇒ Section 7.3, Page 53)</li> <li>▷ Shut off any auxiliary feed lines.</li> <li>▷ Allow the pump set to cool down to ambient temperature.</li> </ul>
	 <b>WARNING</b>
	<p><b>Unqualified personnel performing work on the pump (set)</b></p> <p>Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.</li> </ul>
	 <b>WARNING</b>
	<p><b>Hot surface</b></p> <p>Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Allow the pump set to cool down to ambient temperature.</li> </ul>

	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Improper lifting/moving of heavy assemblies or components</b> Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.</li> </ul>
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Always observe the safety instructions and information. (⇒ Section 7.1, Page 48)

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

For dismantling and reassembly observe the exploded views and the general assembly drawing.

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


	<div style="background-color: #0070c0; color: white; padding: 5px;"><b>NOTE</b></div> <p>All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached Addresses booklet or visit <a href="https://www.ksb.com/en-global/contact">https://www.ksb.com/en-global/contact</a>.</p>
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	<div style="background-color: #0070c0; color: white; padding: 5px;"><b>NOTE</b></div> <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>
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#### 7.4.2 Preparing the pump set

1. Interrupt the power supply and secure the pump against unintentional start-up.
2. Disconnect and remove all auxiliary pipework.
3. Remove the coupling guard.
4. Remove the coupling spacer, if any.

#### 7.4.3 Removing the motor


	<div style="background-color: #0070c0; color: white; padding: 5px;"><b>NOTE</b></div> <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>
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	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Motor tipping over</b> Risk of crushing hands and feet!</p> <ul style="list-style-type: none"> <li>▷ Suspend or support the motor to prevent it from tipping over.</li> </ul>
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1. Disconnect the motor from the power supply.
2. Unbolt the motor from the baseplate.
3. Shift the motor to separate it from the pump.

#### 7.4.4 Removing the back pull-out unit

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 53) to (⇒ Section 7.4.3, Page 54) have been observed/carried out.
- ✓ On pump sets without spacer-type coupling, the motor has been removed.

	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Back pull-out unit tilting</b> Risk of crushing hands and feet!</p> <ul style="list-style-type: none"> <li>▷ Suspend or support the bearing bracket at the pump end.</li> </ul>
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1. If required, suspend or support bearing bracket 330 to prevent it from tilting.
2. Unbolt support foot 183 from the baseplate.
3. Undo nuts 920.01 at the volute casing.
4. Use forcing screws 901.30 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 joint ring 411.10.

	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Thin metal foil used as carrier material in joint rings</b> Risk of injury (cuts)!</p> <ul style="list-style-type: none"> <li>▷ Wear protective clothing.</li> <li>▷ Always use an appropriate tool to remove joint rings.</li> </ul>
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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 53) to (⇒ Section 7.4.4, Page 54) have been observed/carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
  1. 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 keys 940.01 and 940.09 (if any) from shaft 210.



#### 7.4.6 Dismantling the coupling

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 53) to (⇒ Section 7.4.5, Page 55) 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.

#### 7.4.7 Removing the shaft seal

##### 7.4.7.1 Removing the shaft assembly from the bearing bracket (all bearing bracket sizes)

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 53) to (⇒ Section 7.4.5, Page 55) have been observed and carried out.
- ✓ The back pull-out unit has been placed in a clean and level assembly area.
  1. Undo nuts 920.15.
  2. Pull bearing bracket 330 out of casing cover 161.

	<div style="background-color: #f4a460; padding: 5px; border: 1px solid black; margin-bottom: 5px;">  <b>WARNING</b> </div> <p><b>Thin metal foil used as carrier material in joint rings</b></p> <p>Risk of injury (cuts)!</p> <ul style="list-style-type: none"> <li>▷ Wear protective clothing.</li> <li>▷ Always use an appropriate tool to remove joint rings.</li> </ul>
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3. Remove and dispose of joint ring 411.15.
4. Unscrew hexagon socket head cap screws 914.33, if fitted, from bearing cover 360.
5. Remove bearing cover 360.
6. Remove circlip 932.02.
7. Press shaft 210 out of bearing bracket 330.

#### 7.4.7.1.1 Removing single mechanical seals — bearing brackets WS\_25\_LS and WS\_35\_LS

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 53) to (⇒ Section 7.4.7.1, Page 55) have been observed and carried out.
1. Remove circlip 932.80 and disc 550.21.
  2. Pull radial ball bearing 321 off shaft 210.
  3. Remove mating ring carrier 476 with the mating ring of mechanical seal 433, O-ring 412.48/.55, lip seal 421.55 and spacer ring 504.01 with O-ring 412.69 completely from shaft 210.
  4. Remove lip seal 421.55 from mating ring carrier 476 and dispose of it.
  5. Remove O-ring 412.69 from spacer ring 504.01 and dispose of it.
  6. Remove O-ring 412.48/.55 from mating ring carrier 476 and dispose of it.
  7. Press the mating ring of mechanical seal 433 out of mating ring carrier 476.
  8. Undo the grub screws of mechanical seal 433.
  9. Remove the rotating assembly of mechanical seal 433 (primary ring) from shaft 210.

#### 7.4.7.1.2 Removing single mechanical seals — bearing bracket WS\_55\_LS

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 53) to (⇒ Section 7.4.7.1, Page 55) have been observed and carried out.
1. Remove circlip 932.17 and disc 550.53.
  2. Undo the grub screws of mechanical seal 433.
  3. Remove the rotating assembly of mechanical seal 433 (primary ring) from shaft 210.
  4. Remove mating ring carrier 476 with the mating ring of mechanical seal 433, O-ring 412.48/.55 and lip seal 421.55 completely from shaft 210.
  5. Remove O-ring 412.48/.55 from mating ring carrier 476 and dispose of it.
  6. Remove lip seal 421.55 from mating ring carrier 476 and dispose of it.
  7. Press the mating ring of mechanical seal 433 out of mating ring carrier 476.

#### 7.4.7.1.3 Removing double mechanical seals — bearing brackets WS\_25\_LS and WS\_35\_LS

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 53) to (⇒ Section 7.4.7.1, Page 55) have been observed and carried out.
1. Remove circlip 932.80 and disc 550.21.
  2. Pull radial ball bearing 321 off shaft 210.
  3. Remove mating ring carrier 476.02 with the mating ring of mechanical seal 433.02, O-ring 412.48/55, lip seal 421.55 and spacer ring 504.01 with O-ring 412.69 completely from shaft 210.
  4. Remove lip seal 421.55 from mating ring carrier 476.02 and dispose of it.
  5. Remove O-ring 412.69 from spacer ring 504.01 and dispose of it.
  6. Remove O-ring 412.48/55 from mating ring carrier 476.02 and dispose of it.
  7. Press the mating ring of mechanical seal 433.02 out of mating ring carrier 476.02.
  8. Remove spacer sleeve 525.
  9. Undo the grub screws of mechanical seal 433.02.
  10. Remove the rotating assembly of mechanical seal 433.02 (primary ring) from shaft 210.
  11. Remove circlip 932.54 and disc 550.54.
  12. Remove mating ring carrier 476.01 with O-ring 412.52.
  13. Remove O-ring 412.52 from mating ring carrier 476.01 and dispose of it.
  14. Press the mating ring of mechanical seal 433.01 out of mating ring carrier 476.01.
  15. Undo the grub screws of mechanical seal 433.01.
  16. Remove the rotating assembly of mechanical seal 433.01 (primary ring) from shaft 210.

#### 7.4.7.1.4 Removing double mechanical seals — bearing bracket WS\_55\_LS

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 53) to (⇒ Section 7.4.7.1, Page 55) have been observed and carried out.
1. Remove circlip 932.17 and disc 550.53.
  2. Undo the grub screws of mechanical seal 433.01.
  3. Remove the rotating assembly of mechanical seal 433.01 (primary ring) from shaft 210.
  4. Remove mating ring carrier 476.01 with the mating ring of mechanical seal 433.01 and O-ring 412.52.
  5. Press the mating ring of mechanical seal 433.01 out of mating ring carrier 476.01.
  6. Remove O-ring 412.52 from the mating ring carrier and dispose of it.
  7. Remove spacer sleeve 525.
  8. Remove circlip 932.54 and disc 550.54.
  9. Undo the grub screws of mechanical seal 433.02.
  10. Remove the rotating assembly of mechanical seal 433.02 (primary ring) from shaft 210.
  11. Remove mating ring carrier 476.02 with the mating ring of mechanical seal 433.02, O-ring 412.48/55 and lip seal 421.55 completely from the shaft.
  12. Remove lip seal 421.55 from mating ring carrier 476.02 and dispose of it.
  13. Remove O-ring 412.48/55 from mating ring carrier 476.02 and dispose of it.
  14. Press the mating ring of mechanical seal 433.02 out of mating ring carrier 476.02.

### 7.4.8 Removing the plain bearing

#### Removing the carbon bearing



- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 53) to (⇒ Section 7.4.7.1, Page 55) have been observed/carried out.
- 1. Press plain bearing 310 out of bearing bracket 330 from the drive end.

#### Removing the SiC bearing

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 53) to (⇒ Section 7.4.7.1, Page 55) have been observed/carried out.
- 1. Remove circlip 932.20.
- 2. Pull bearing sleeve 529 off shaft 210.
- 3. Remove circlip 932.04.
- 4. Press bush 540.01 and bearing cartridge 381 out of bearing bracket 330 from the drive end.
- 5. For bearing bracket WS\_35\_LS: remove bush 540.02 from bearing bracket 330.

### 7.5 Reassembling the pump set

#### 7.5.1 General information/Safety regulations

	<div style="background-color: #f4a460; padding: 5px;"><b>WARNING</b></div> <p><b>Improper lifting/moving of heavy assemblies or components</b> Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.</li> </ul>
	<div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Improper reassembly</b> Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Reassemble the pump (set) in accordance with the general rules of sound engineering practice.</li> <li>▷ Use original spare parts only.</li> </ul>

**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 64)

### 7.5.2 Fitting the plain bearing


#### Fitting the carbon bearing


- ✓ The individual parts have been placed in a clean and level assembly area.
  - ✓ All dismantled parts have been cleaned and checked for wear.
  - ✓ Any damaged or worn parts have been replaced by original spare parts.
  - ✓ The sealing surfaces have been cleaned.
1. Press plain bearing 310 carefully into bearing bracket 330 until it will not go any further.

#### Fitting the SiC bearing

- ✓ The individual parts have been placed in a clean and level assembly area.
  - ✓ All dismantled parts have been cleaned and checked for wear.
  - ✓ Any damaged or worn parts have been replaced by original spare parts.
  - ✓ The sealing surfaces have been cleaned.
1. Slide bearing sleeve 529 onto shaft 210.
  2. Fit circlip 932.20.
  3. Fit O-rings 412.45 at both sides of bearing cartridge 381.
  4. For bearing bracket WS\_35\_LS: fit bush 540.02.
  5. Carefully press bearing bush 381 into bearing bracket 330.
  6. Fit bush 540.01.
  7. Fit circlip 932.04.

### 7.5.3 Installing the shaft seal


	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Excessive temperatures caused by defective bearing seal</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Grease lip seal 421.55 with the Klüber Asonic HQ 72-102 grease supplied. (⇒ Section 7.5.3.1, Page 60) to (⇒ Section 7.5.3.4, Page 62)</li> </ul>
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	<div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Use of non-original spare parts</b> Damage to the pump set! Loss of warranty!</p> <ul style="list-style-type: none"> <li>▷ Only use original KSB spare parts. This applies especially to the replacement of the bearing, mechanical seals, static sealing elements and lip seal.</li> </ul>
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#### 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.

	<div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Elastomers in contact with oil/grease</b> Shaft seal failure!</p> <ul style="list-style-type: none"> <li>▷ Use Anticorit BML3 as assembly lubricant.</li> <li>▷ Never use oil or grease as assembly lubricant.</li> </ul>
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### 7.5.3.1 Installing single mechanical seals — bearing brackets WS\_25\_LS and WS\_35\_LS

1. Clean the mating ring location of the mechanical seal and the lip seal location in mating ring carrier 476.
2. Grease the face of spacer ring 504.01 that will be in contact with lip seal 421.55 with the supplied grease (Klüber Asonic HQ 72-102).
3. Insert spacer ring 504.01 in mating ring carrier 476.
4. Wet the outside diameter of lip seal 421.55 with a water/soap mixture. Grease the sealing lip with the grease supplied (Klüber Asonic HQ 72-102).
5. Press lip seal 421.55 into mating ring carrier 476.
6. Wet the mating ring location of the mechanical seal in mating ring carrier 476 with a water/soap mixture.
7. Clean the seal face of the mating ring of mechanical seal 433 with a clean cloth.
8. Applying uniform pressure, carefully press the mating ring of mechanical seal 433 into mating ring carrier 476.
9. Clean O-rings 412.48/.55 with a clean cloth. Check for any damage.
10. Fit O-rings 412.48/.55 in mating ring carrier 476.
11. Apply the remaining grease (Klüber Asonic HQ 72-102) between spacer ring 504.01 and the rear of lip seal 421.55. Make sure that no grease enters the O-ring groove in spacer ring 504.01.
12. Clean O-ring 412.69 with a clean cloth. Check for any damage.
13. Pull O-ring 412.69 onto spacer ring 504.01.
14. **For WS 35\_LS:** Fit circlip 932.17 and disc 550.53.
15. Clean the primary ring of mechanical seal 433 with a clean cloth.
16. Slide the rotating assembly of mechanical seal 433 onto shaft 210.
17. Slide mating ring carrier 476 with the mating ring of mechanical seal 433, lip seal 421.55, O-rings 412.48/.55 and spacer ring 504.01 incl. O-ring 412.69 onto shaft 210.
18. Press radial ball bearing 321 onto shaft 210 and secure it with disc 550.21 and circlip 932.80.
19. Tighten the grub screws of mechanical seal 433. Observe the tightening torques. (⇒ Section 7.6.3, Page 67)

### 7.5.3.2 Installing single mechanical seals — bearing bracket WS\_55\_LS

- ✓ Deep groove ball bearing 321, discs 550.21/.90 and circlips 932.01/.80 have been fitted on shaft 210.
1. Clean the mating ring location of the mechanical seal and the lip seal location in mating ring carrier 476.
  2. Wet the outside diameter of lip seal 421.55 with a water/soap mixture. Grease the sealing lip with the grease supplied (Klüber Asonic HQ 72-102).
  3. Press lip seal 421.55 into mating ring carrier 476.
  4. Clean O-ring 412.48 with a clean cloth. Check for any damage.
  5. Pull O-ring 412.48 onto mating ring carrier 476.
  6. Wet the mating ring location of the mechanical seal in mating ring carrier 476 with a water/soap mixture.
  7. Clean the seal face of the mating ring of mechanical seal 433 with a clean cloth.
  8. Applying uniform pressure, carefully press the mating ring of mechanical seal 433 into mating ring carrier 476.
  9. Clean O-ring 412.55 with a clean cloth. Check for any damage.
  10. Pull O-ring 412.55 onto mating ring carrier 476.
  11. Apply the remaining grease (Klüber Asonic HQ 72-102) to the lower area on the rear side of lip seal 421.55.



12. Slide mating ring carrier 476 with the mating ring of mechanical seal 433, lip seal 421.55 and O-rings 412.48/.55 onto shaft 210.
13. Clean the primary ring of mechanical seal 433 with a clean cloth.
14. Slide the rotating assembly of mechanical seal 433 onto shaft 210.
15. Fit disc 550.53 and circlip 932.17.
16. Tighten the grub screws of mechanical seal 433. Observe the tightening torques. (⇒ Section 7.6.3, Page 67)

### 7.5.3.3 Installing double mechanical seals — bearing brackets WS\_25\_LS and WS\_35\_LS

1. Clean the mating ring location of the mechanical seal and the lip seal location in mating ring carrier 476.01/.02.
2. Grease the face of spacer ring 504.01 that will be in contact with lip seal 421.55 with the supplied grease (Klüber Asonic HQ 72-102).
3. Insert spacer ring 504.01 in mating ring carrier 476.02.
4. Wet the outside diameter of lip seal 421.55 with a water/soap mixture. Grease the sealing lip with the grease supplied (Klüber Asonic HQ72-102).
5. Press lip seal 421.55 into mating ring carrier 476.02.
6. Wet the mating ring location of the mechanical seal in mating ring carrier 476.02 with a water/soap mixture.
7. Clean the seal face of the mating ring of mechanical seal 433.02 with a clean cloth.
8. Applying uniform pressure, carefully press the mating ring of mechanical seal 433.02 into mating ring carrier 476.02.
9. Clean O-rings 412.48/.55 with a clean cloth. Check for any damage.
10. Fit O-rings 412.48/.55 in mating ring carrier 476.02.
11. Apply the remaining grease (Klüber Asonic HQ 72-102) between spacer ring 504.01 and the rear of lip seal 421.55. Make sure that no grease enters the O-ring groove in spacer ring 504.01.
12. Clean O-ring 412.69 with a clean cloth. Check for any damage.
13. Pull O-ring 412.69 onto spacer ring 504.01.
14. Wet the mating ring location of the mechanical seal in mating ring carrier 476.01 with a water/soap mixture.
15. Clean the seal face of the mating ring of mechanical seal 433.01 with a clean cloth.
16. Applying uniform pressure, carefully press the mating ring of mechanical seal 433.01 into mating ring carrier 476.01.
17. Clean O-ring 412.52 with a clean cloth. Check for any damage.
18. Pull O-ring 412.52 onto mating ring carrier 476.01.
19. **For WS 35\_LS:** Fit circlip 932.17 and disc 550.53.
20. Clean the primary ring of mechanical seal 433.01 with a clean cloth.
21. Slide the rotating assembly of mechanical seal 433.01 onto shaft 210.
22. Fit mating ring carrier 476.01 with the mating ring of mechanical seal 433.01 and O-ring 412.52.
23. Fit circlip 932.54 and disc 550.54.
24. Tighten the grub screws of mechanical seal 433.01. Observe the tightening torques. (⇒ Section 7.6.3, Page 67)
25. Clean the primary ring of mechanical seal 433.02 with a clean cloth.
26. Slide the rotating assembly of mechanical seal 433.02 onto shaft 210.
27. Tighten the grub screws of mechanical seal 433.02. Observe the tightening torques. (⇒ Section 7.6.3, Page 67)

28. Fit spacer sleeve 525.
29. Slide mating ring carrier 476.02 with the mating ring of mechanical seal 433.02, lip seal 421.55, O-rings 412.48/55 and spacer ring 504.01 incl. O-ring 412.69 onto shaft 210.
30. Press radial ball bearing 321 onto shaft 210 and secure it with disc 550.21 and circlip 932.80.

#### 7.5.3.4 Installing double mechanical seals — bearing bracket WS\_55\_LS

- ✓ Deep groove ball bearing 321, discs 550.21/90 and circlips 932.01/80 have been fitted on shaft 210.
1. Clean the mating ring location of the mechanical seal and the lip seal location in mating ring carrier 476.01/02.
  2. Wet the outside diameter of lip seal 421.55 with a water/soap mixture. Grease the sealing lip with the grease supplied (Klüber Asonic HQ 72-102).
  3. Press lip seal 421.55 into mating ring carrier 476.02.
  4. Clean O-ring 412.48 with a clean cloth. Check for any damage.
  5. Pull O-ring 412.48 onto mating ring carrier 476.02.
  6. Wet the mating ring location of the mechanical seal in mating ring carrier 476.02 with a water/soap mixture.
  7. Clean the seal face of the mating ring of mechanical seal 433.02 with a clean cloth.
  8. Applying uniform pressure, carefully press the mating ring of mechanical seal 433.02 into mating ring carrier 476.02.
  9. Clean O-ring 412.55 with a clean cloth. Check for any damage.
  10. Pull O-ring 412.55 onto mating ring carrier 476.02.
  11. Apply the remaining grease (Klüber Asonic HQ 72-102) to the lower area on the rear side of lip seal 421.55.
  12. Slide mating ring carrier 476.02 with the mating ring of mechanical seal 433.02, lip seal 421.55 and O-rings 412.48/55 onto shaft 210.
  13. Clean the primary ring of mechanical seal 433.02 with a clean cloth.
  14. Slide the rotating assembly of mechanical seal 433.02 onto shaft 210.
  15. Fit disc 550.54 and circlip 932.54.
  16. Tighten the grub screws of mechanical seal 433.02. Observe the tightening torques. (⇒ Section 7.6.3, Page 67)
  17. Fit spacer sleeve 525.
  18. Wet the mating ring location of the mechanical seal in mating ring carrier 476.01 with a water/soap mixture.
  19. Clean the seal face of the mating ring of mechanical seal 433.01 with a clean cloth.
  20. Applying uniform pressure, carefully press the mating ring of mechanical seal 433.01 into mating ring carrier 476.01.
  21. Clean O-ring 412.52 with a clean cloth. Check for any damage.
  22. Pull O-ring 412.52 onto mating ring carrier 476.01.
  23. Slide mating ring carrier 476.01 with the mating ring of mechanical seal 433.01 and O-ring 412.52 onto the shaft.
  24. Fit disc 550.53 and circlip 932.17.
  25. Tighten the grub screws of mechanical seal 433.01. Observe the tightening torques. (⇒ Section 7.6.3, Page 67)

### 7.5.3.5 Installing the shaft assembly in the bearing bracket (all bearing bracket sizes)

1. Carefully press the shaft assembly into bearing bracket 330.
2. Fit circlip 932.02.
3. Fit bearing cover 360.
4. If applicable, fasten bearing cover 360 to bearing bracket 330 with hexagon socket head cap screws 914.33. Observe the tightening torques.  
(⇒ Section 7.6.1, Page 64)

### 7.5.4 Fitting the impeller

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 58) to (⇒ Section 7.5.3, Page 59) 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. Insert keys 940.01 and 940.09<sup>8)</sup>. Slide impeller 230 onto shaft 210.
  2. Fasten impeller nut 920.95, spring washer 930.95 and disc 550.95, if any. Observe the tightening torques!

### 7.5.5 Installing the coupling

- ✓ The notes and steps stated in (⇒ Section 7.5.1, Page 58) to (⇒ Section 7.5.4, Page 63) have been observed and carried out.
  - ✓ The individual parts have been placed in a clean and level assembly area.
  - ✓ All dismantled parts have been cleaned and checked for wear.
  - ✓ Any damaged or worn parts have been replaced by original spare parts.
1. Insert key 940.02.
  2. 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 64)
  3. Secure the coupling hub with a grub screw.

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<sup>8</sup> If any

### 7.5.6 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 58) to (⇒ Section 7.5.4, Page 63) 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. Insert new joint ring 411.10 into volute casing 102.
  2. Loosen but do not remove forcing screws 901.30.
  3. Prevent the back pull-out unit from tilting as required, e.g. by suspending or supporting it. Then insert it into volute casing 102.
  4. Tighten nut 920.01 at the volute casing. Observe the tightening torques!
  5. Bolt support foot 183 to the baseplate.

### 7.5.7 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 34)
4. Connect the motor to the power supply (refer to manufacturer's product literature).

### 7.6 Tightening torques

#### 7.6.1 Tightening torques for the pump

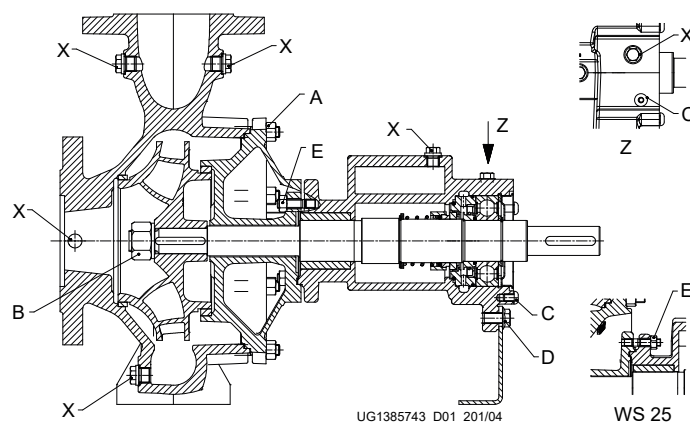


Fig. 23: Tightening points at the pump

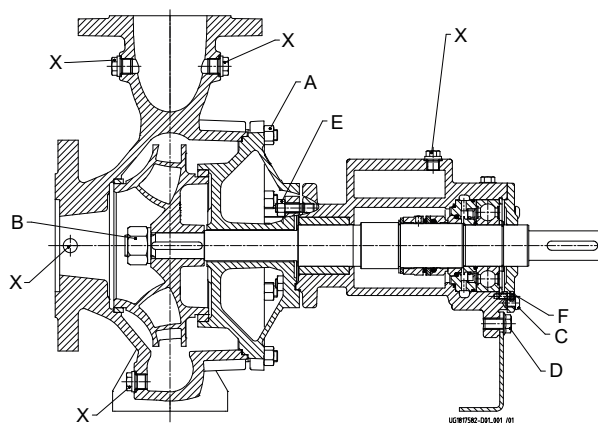
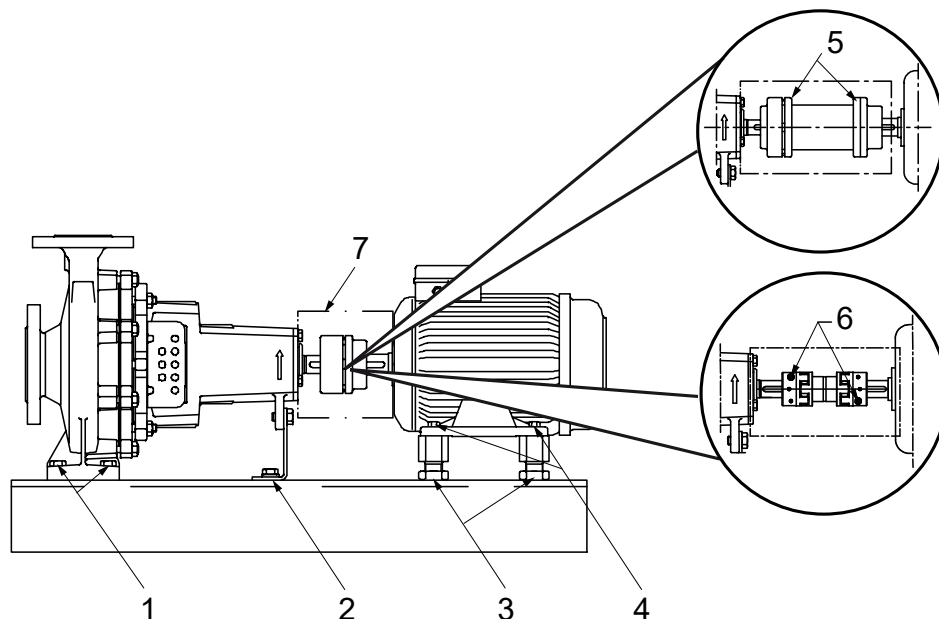


Fig. 24: Tightening points at the pump (special design)

Table 20: Tightening torques

Position	Thread	Tightening torques
		[Nm]
A	M12	55
	M16	130
B	M12×1,5	55
	M24×1,5	200
	M30×1,5	300
C	M8	20
	M10	38
D	M12	90
E	M8	20
	M10	38
F	M6	10
X	1/4	55
	3/8	80
	1/2	130

### 7.6.2 Tightening torques for the pump set



**Fig. 25:** Position of bolts/screws at the pump set

**Table 21:** 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 × 1,5	140	
	M36 × 1,5	140	
4	M6	10	Motor on baseplate or motor on adjusting screws or bases
	M8	10	
	M10	15	
	M12	30	
	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

### 7.6.3 Tightening torques for the mechanical seal

**Table 22:** Tightening torques for bolted/screwed connections at the mechanical seal

Thread	Type of mechanical seal	Tightening torques
		[Nm]
M5	-	4
M6	4EYS033	5
	4EYS048	7
	4EYT033	5
	4EYT048	7
M8	-	15
M10	-	20
M12	-	25

## 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.

Also specify the following data:

- Part No. and description (⇒ Section 9.1, Page 72)
- 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

	 <b>DANGER</b>
	<p><b>Use of non-authorised spare parts</b></p> <p>Explosion hazard!</p> <p>Damage to the pump set!</p> <p>Damage will not be covered by the scope of warranty!</p> <p>► Only use original KSB spare parts. This applies especially to the replacement of the bearing, mechanical seal, static sealing elements and lip seal.</p>

**Table 23:** Quantity of spare parts for recommended spare parts stock

Part number	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 %
310	Plain bearing	2	3	4	5	7	9	100 %

Part number	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
321	Radial ball bearing	1	1	2	2	2	3	25 %
330	Bearing bracket <sup>9)</sup>	-	-	-	-	-	1	2
433	Mechanical seal <sup>10)</sup>	1	1	2	2	2	3	25 %
502.01/.02	Casing wear ring	2	2	2	3	3	4	50 %
411.10/.15	Joint ring	4	6	8	8	9	12	150 %
412.48/.52 <sup>11)</sup> /.55/.69	O-ring	4	6	8	8	9	10	100 %
421.55	Lip seal	4	6	8	8	9	10	100 %
-	Torque-transmitting coupling elements (set)	1	1	2	2	3	4	30 %

### 7.7.3 Interchangeability of pump components

Components featuring the same number in a column are interchangeable.

Table 24: Symbols key

Symbol	Description
O	Components differ
X	Component not fitted

Table 25: Interchangeability of pump components

Size	Bearing bracket	Description															
		Casing cover		Support foot		Shaft	Impeller	Plain bearing		Deep groove ball bearing		Bearing bracket	Lip seal	Mechanical seal <sup>(2)</sup>	Mating ring carrier	Casing wear ring, suction side	Casing wear ring, discharge side
Part No.																	
161	183	210	230	310	321	330	421.55	433	476	502.01	502.02						
040-025-160	WS_25_LS	1	2	1	O	1	1	1	1	1	1	10	X				
040-025-200	WS_25_LS	2	3	1	O	1	1	1	1	1	1	10	3				
050-032-125.1	WS_25_LS	1	1	1	O	1	1	1	1	1	1	1	X				
050-032-160.1	WS_25_LS	1	2	1	O	1	1	1	1	1	1	1	X				
050-032-200.1	WS_25_LS	2	3	1	O	1	1	1	1	1	1	1	3				
050-032-160	WS_25_LS	1	2	1	O	1	1	1	1	1	1	11	X				
050-032-200	WS_25_LS	2	3	1	O	1	1	1	1	1	1	11	3				

<sup>9)</sup> Complete bearing bracket WS\_35\_LS. Example of a pump set with single mechanical seal and carbon plain bearing comprising: shaft 210, plain bearing 310, radial ball bearing 321, bearing bracket 330, bearing cover 360, joint ring 411.85, O-ring 412.48/.55/.69, lip seal 421.55, mechanical seal 433, mating ring carrier 476, spacer ring 504.01, disc 550.21/.53, stud 902.15, screw plug 903.85, pan head screw 914, hexagon nut 920.15/.95, Nordlock washer 930.95, circlip 932.02/.17/.80, key 940.01/.02

<sup>10)</sup> For double mechanical seals double the quantity.



<sup>11)</sup> For double mechanical seal add 412.52.



Size	Bearing bracket	Description											
		Casing cover	Support foot	Shaft	Impeller	Plain bearing	Deep groove ball bearing	Bearing bracket	Lip seal	Mechanical seal <sup>12)</sup>	Mating ring carrier	Casing wear ring, suction side	Casing wear ring, discharge side
		Part No.											
		161	183	210	230	310	321	330	421.55	433	476	502.01	502.02
050-032-250	WS_25_LS	3	4	1	0	1	1	1	1	1	1	11	10
065-040-160	WS_25_LS	1	2	1	0	1	1	1	1	1	1	12	3
065-040-200	WS_25_LS	2	3	1	0	1	1	1	1	1	1	12	3
065-040-250	WS_25_LS	3	4	1	0	1	1	1	1	1	1	2	10
065-040-315	WS_35_LS	7	7	2	0	2	2	2	2	2	2	2	13
065-050-160	WS_25_LS	1	3	1	0	1	1	1	1	1	1	3	3
065-050-200	WS_25_LS	2	3	1	0	1	1	1	1	1	1	3	3
065-050-250	WS_25_LS	3	4	1	0	1	1	1	1	1	1	3	10
065-050-315	WS_35_LS	7	7	2	0	2	2	2	2	2	2	4	11
080-065-160	WS_25_LS	4	3	1	0	1	1	1	1	1	1	4	5
080-065-200	WS_25_LS	0	4	1	0	1	1	1	1	1	1	4	5
080-065-250	WS_35_LS	6	5	2	0	2	2	2	2	2	2	5	11
080-065-315	WS_35_LS	7	7	2	0	2	2	2	2	2	2	6	11
100-080-160	WS_25_LS	4	4	1	0	1	1	1	1	1	1	6	5
100-080-200	WS_35_LS	5	0	2	0	2	2	2	2	2	2	6	11
100-080-250	WS_35_LS	6	5	2	0	2	2	2	2	2	2	6	11
100-080-315	WS_35_LS	7	6	2	0	2	2	2	2	2	2	6	11
125-100-160	WS_35_LS	5	5	2	0	2	2	2	2	2	2	7	11
125-100-200	WS_35_LS	5	5	2	0	2	2	2	2	2	2	7	11
125-100-250	WS_35_LS	6	7	2	0	2	2	2	2	2	2	7	11
125-100-315	WS_35_LS	7	6	2	0	2	2	2	2	2	2	7	11
150-125-200	WS_35_LS	0	6	2	0	2	2	2	2	2	2	8	9
150-125-250	WS_35_LS	0	6	2	0	2	2	2	2	2	2	8	9
150-125-315	WS_55_LS	8	9	3	0	2	3	3	3	2	3	8	12
150-125-400	WS_55_LS	9	8	3	0	2	3	3	3	2	3	8	12
200-150-315	WS_55_LS	8	9	3	0	2	3	3	3	2	3	9	12
200-150-400	WS_55_LS	10	8	3	0	2	3	3	3	2	3	9	12

<sup>12)</sup> Single mechanical seal 433 not interchangeable with double mechanical seal 433.01/02

## 8 Trouble-shooting

	 <b>WARNING</b>
	<b>Improper work to remedy faults</b> 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 26:** Trouble-shooting

A	B	C	D	E	F	G	H	Possible cause	Remedy <sup>13)</sup>
X	-	-	-	-	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point. Check system for impurities. Fit a larger impeller. <sup>14)</sup> Increase the speed (turbine, I.C. engine).
X	-	-	-	-	-	X	X	Pump and/or piping are not completely vented or primed.	Vent or prime. Clean vent hole.
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/NPSHavailable (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	-	-	-	-	-	-	-	Wrong direction of rotation	Interchange two of the phases of the power cable.
X	-	-	-	-	-	-	-	Speed is too low. - 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. <sup>14)</sup>
-	X	-	-	-	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	Contact KSB.

<sup>13</sup> Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

<sup>14</sup> Contact KSB.

A	B	C	D	E	F	G	H	Possible cause	Remedy <sup>13)</sup>
-	X	X	-	-	-	-	-	Speed is too high.	Reduce speed. <sup>14)</sup>
-	-	-	-	X	-	-	-	Defective gasket	Fit new gasket between volute casing and discharge cover and/or between discharge cover and bearing bracket.
-	-	-	-	X	-	-	-	Gasket not pre-loaded sufficiently	Increase pre-loading of gasket at operating temperature: 1. Close the valves on the discharge and suction side. 2. Allow the pump set to cool down to a temperature below the boiling point of the fluid handled. 3. Re-tighten hexagon nuts 920.01 and 920.15 at the discharge cover. 4. Start up the pump set.
-	-	-	-	-	X	-	-	Worn shaft seal	Fit new shaft seal. Check flushing liquid/barrier fluid.
-	-	-	-	-	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 the 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	-	-	-	-	Increased axial thrust <sup>14)</sup>	Clean balancing holes in the impeller. Replace the casing wear rings.
-	-	-	X	-	-	-	-	Non-compliance with specified coupling distance	Correct the distance according to the general arrangement drawing.
X	X	-	-	-	-	-	-	Motor is running on 2 phases only.	Replace the defective fuse. Check the electric cable connections.
-	-	-	-	-	-	X	-	Rotor out of balance	Clean the impeller. Re-balance the impeller.
-	-	-	-	-	-	X	-	Defective bearing(s)	Replace.
-	-	-	X	-	-	X	X	Flow rate too low	Increase the minimum flow rate.

## 9 Related Documents

### 9.1 Exploded views and lists of components

#### 9.1.1 Version with bearing bracket WS\_25\_LS

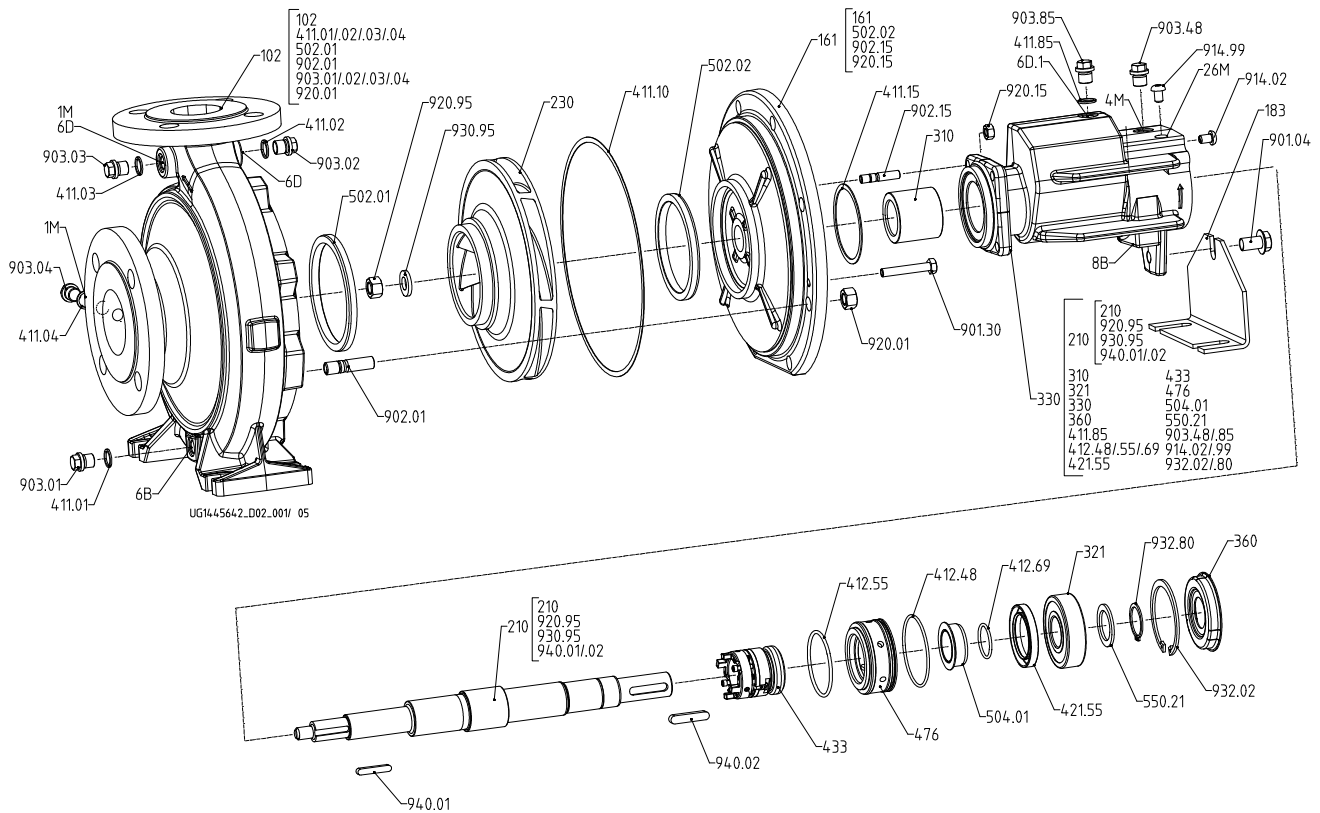


Fig. 26: Exploded view of an Etanorm SYT, bearing bracket WS\_25\_LS

Table 27: List of components

Part No.	Description	Part No.	Description
102	Volute casing	476	Mating ring carrier
161	Casing cover	502.01/02 <sup>15)</sup>	Casing wear ring
183	Support foot	504.01	Spacer ring
210	Shaft	550.21	Disc
230	Impeller	901.04/30	Hexagon head bolt
310	Plain bearing	902.01/15	Stud
321	Radial ball bearing	903.01/02/03/04/48/85	Screw plug
330	Bearing bracket	914.02/99	Hexagon socket head cap screw
360	Bearing cover	920.01/15/95	Nut
411.01/02/03/04/10/15/85	Joint ring	930.95	Safety device
412.48/55/69	O-ring	932.02/80	Circlip
421.55	Lip seal	940.01/02	Key
433	Mechanical seal		

<sup>15</sup> 502.02 not fitted on sizes 040-025-160, 050-032-125.1, 050-032-160.1, 050-032-160

### 9.1.2 Version with bearing bracket WS\_25\_LS (special design)

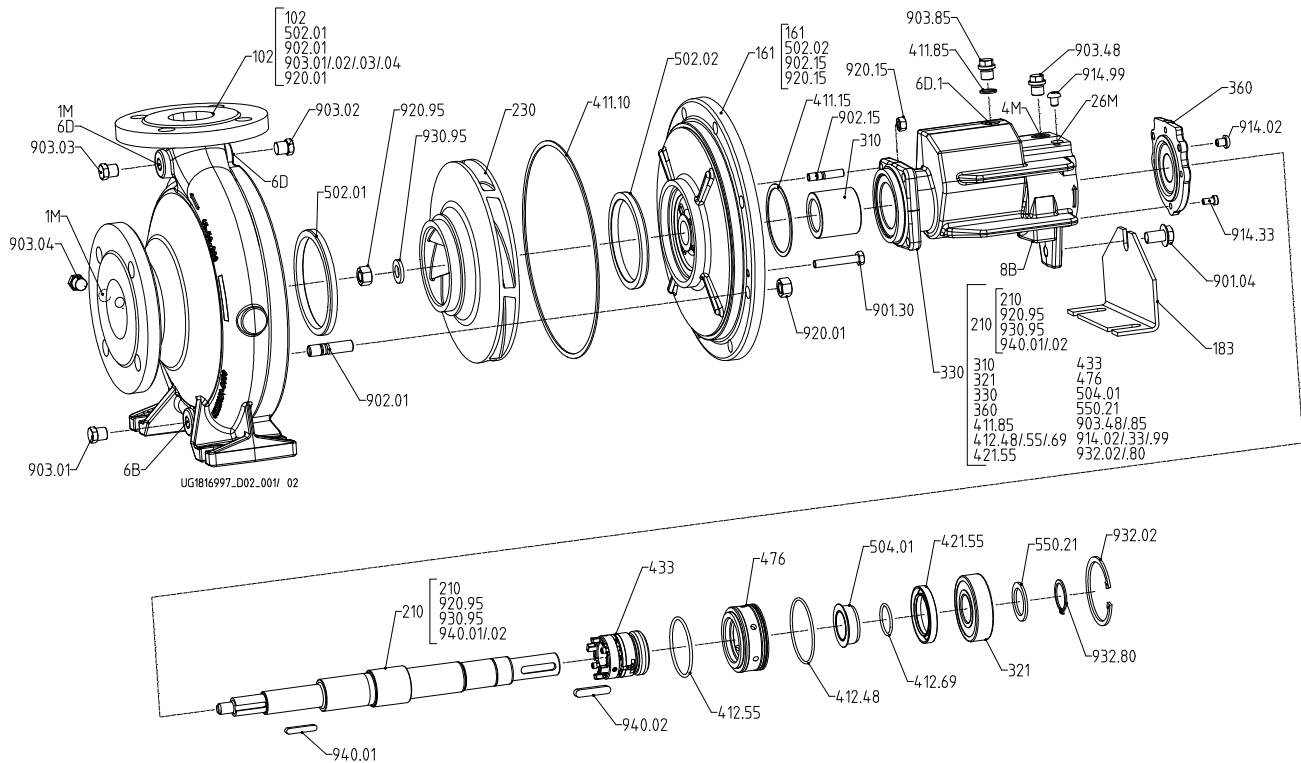


Fig. 27: Exploded view of an Etanorm SYT, bearing bracket WS\_25\_LS (special design)

Table 28: List of components

Part No.	Description	Part No.	Description
102	Volute casing	476	Mating ring carrier
161	Casing cover	502.01/.02 <sup>16)</sup>	Casing wear ring
183	Support foot	504.01	Spacer ring
210	Shaft	550.21	Disc
230	Impeller	901.04/.30	Hexagon head bolt
310	Plain bearing	902.01/.15	Stud
321	Radial ball bearing	903.01/.02/.03/.04/.48/.85	Screw plug
330	Bearing bracket	914.02/.33/.99	Hexagon socket head cap screw
360	Bearing cover	920.01/.15/.95	Nut
411.10/.15/.85	Joint ring	930.95	Safety device
412.48/.55/.69	O-ring	932.02/.80	Circlip
421.55	Lip seal	940.01/.02	Key
433	Mechanical seal		

<sup>16)</sup> 502.02 not fitted on sizes 040-025-160, 050-032-125.1, 050-032-160, 050-032-160.1

### 9.1.3 Version with bearing bracket WS\_25\_LS with double mechanical seal

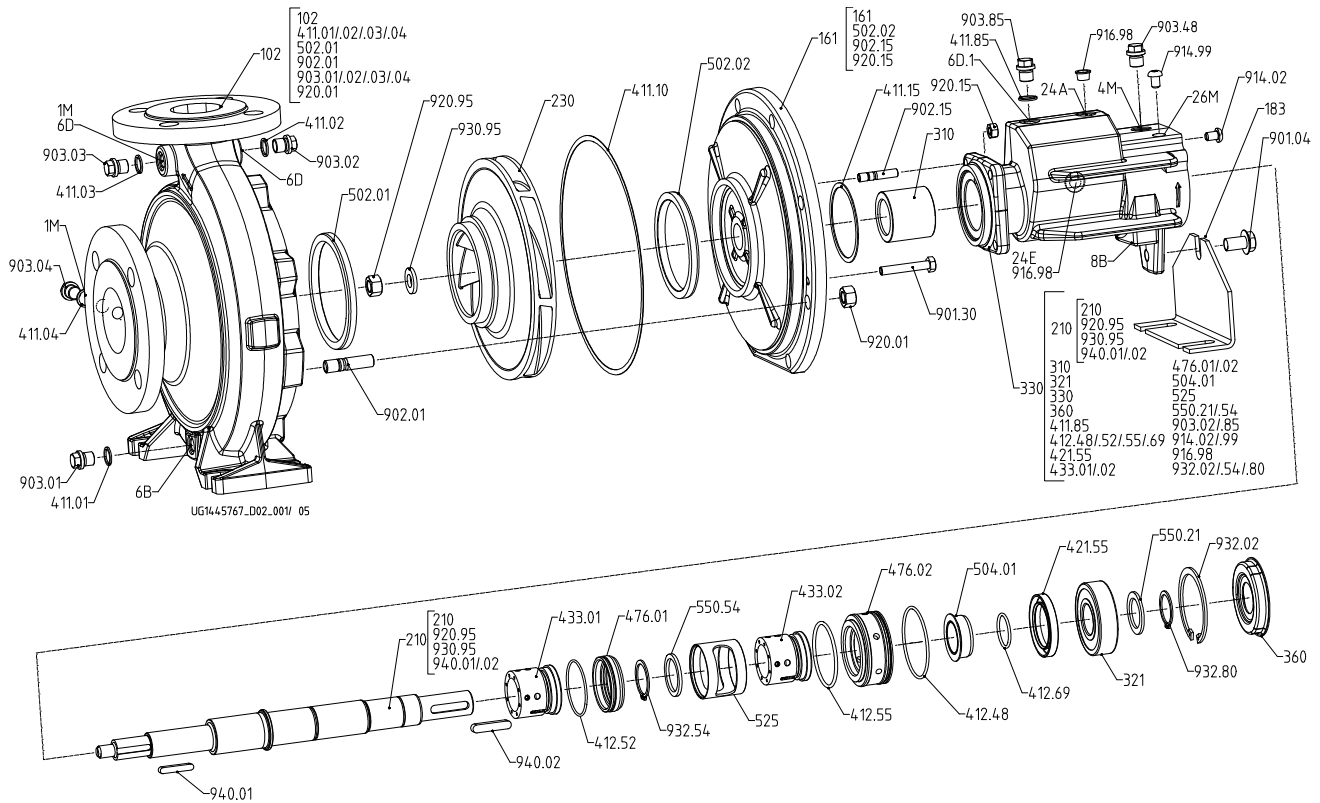


Fig. 28: Exploded view of an Etanorm SYT; bearing bracket WS\_25\_LS with double mechanical seal

Table 29: List of components

Part No.	Description	Part No.	Description
102	Volute casing	502.01/02 <sup>17)</sup>	Casing wear ring
161	Casing cover	504.01	Spacer ring
183	Support foot	525	Spacer sleeve
210	Shaft	550.21/54	Disc
230	Impeller	901.04/30	Hexagon head bolt
310	Plain bearing	902.01/15	Stud
321	Radial ball bearing	903.01/02/03/04/48/85	Screw plug
330	Bearing bracket	914.02/99	Hexagon socket head cap screw
360	Bearing cover	916.98	Plug
411.01/02/03/04/10/15/85	Joint ring	920.01/15/95	Nut
412.48/52/55/69	O-ring	930.95	Safety device
421.55	Lip seal	932.02/54/80	Circlip
433.01/02	Mechanical seal	940.01/02	Key
476.01/02	Mating ring carrier		

<sup>17</sup> 502.02 not fitted on sizes 040-025-160, 050-032-125.1, 050-032-160.1, 050-032-160

### 9.1.4 Version with bearing bracket WS\_25\_LS with double mechanical seal (special design)

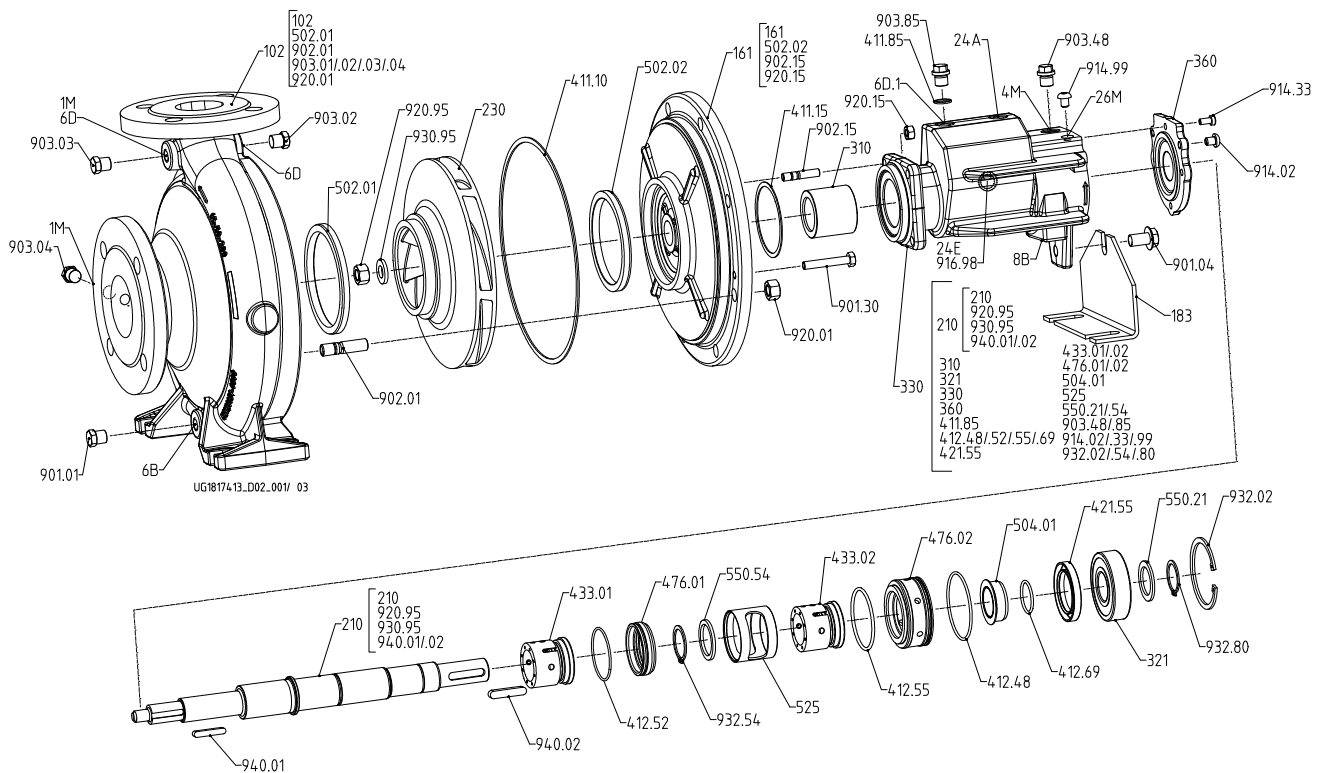


Fig. 29: Exploded view of an Etanorm SYT; bearing bracket WS\_25\_LS with double mechanical seal (special design)

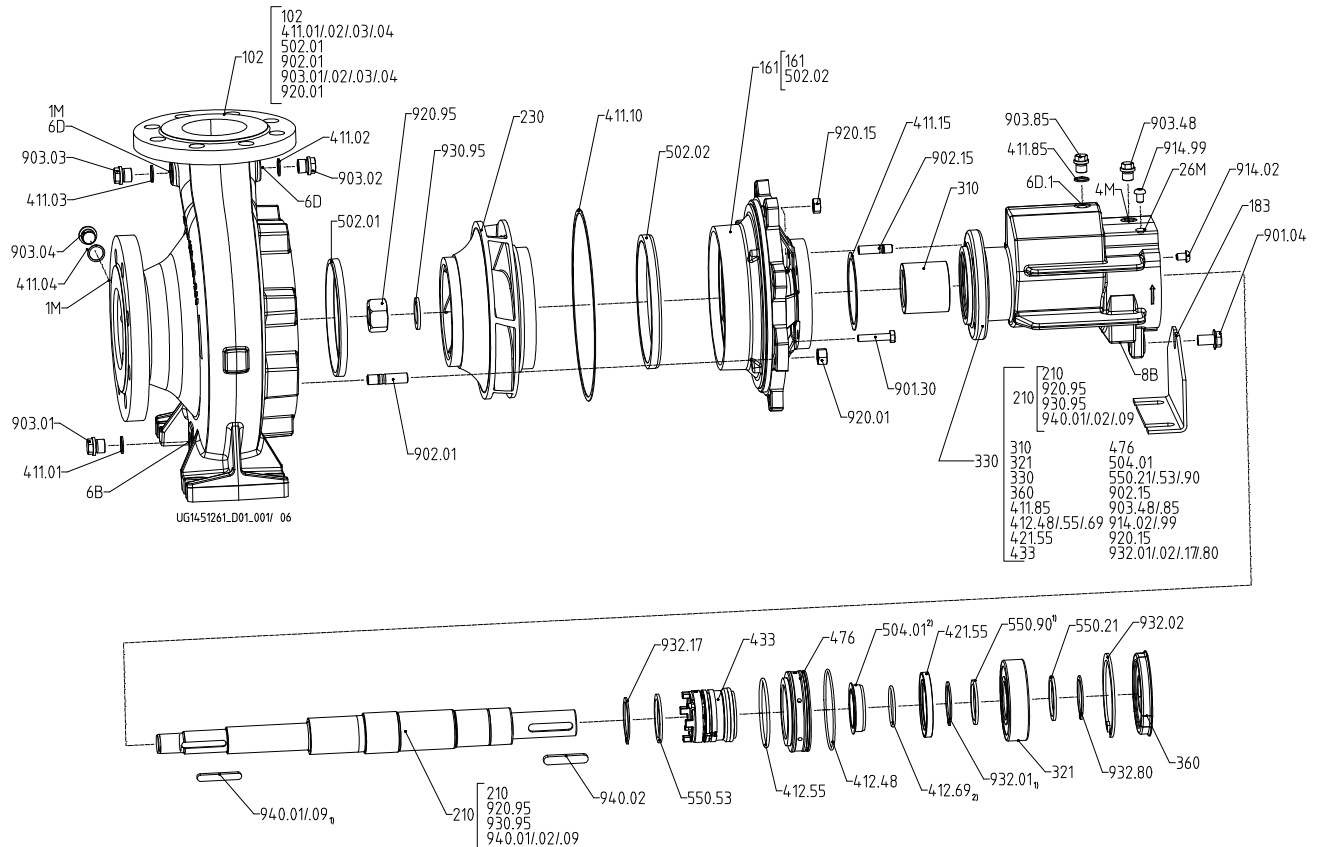
Table 30: List of components

Part No.	Description	Part No.	Description
102	Volute casing	502.01/02 <sup>18)</sup>	Casing wear ring
161	Casing cover	504.01	Spacer ring
183	Support foot	525	Spacer sleeve
210	Shaft	550.21/54	Disc
230	Impeller	901.04/30	Hexagon head bolt
310	Plain bearing	902.01/15	Stud
321	Radial ball bearing	903.01/02/03/04/48/85	Screw plug
330	Bearing bracket	914.02/33/99	Hexagon socket head cap screw
360	Bearing cover	916.98	Plug
411.10/15/85	Joint ring	920.01/15/95	Nut
412.48/52/55/69	O-ring	930.95	Safety device
421.55	Lip seal	932.02/54/80	Circlip
433.01/02	Mechanical seal	940.01/02	Key
476.01/02	Mating ring carrier		

<sup>18)</sup> 502.02 not fitted on sizes 040-025-160, 050-032-125.1, 050-032-160, 050-032-160.1



### 9.1.5 Version with bearing brackets WS\_35\_LS / WS\_55\_LS



**Fig. 30:** Exploded view of an Etanorm SYT, bearing brackets WS\_35\_LS / WS\_55\_LS

<sup>1)</sup> For WS\_55 only

<sup>2)</sup> For WS\_35 only

**Table 31:** List of components

Part No.	Description	Part No.	Description
102	Volute casing	476	Mating ring carrier
161	Casing cover	502.01/02	Casing wear ring
183	Support foot	504.01 <sup>19)</sup>	Spacer ring
210	Shaft	550.21/53/90 <sup>20)</sup>	Disc
230	Impeller	901.04/30	Hexagon head bolt
310	Plain bearing	902.01/15	Stud
321	Radial ball bearing	903.01/02/03/04/48/85	Screw plug
330	Bearing bracket	914.02/99	Hexagon socket head cap screw
360	Bearing cover	920.01/15/95	Nut
411.01/02/03/04/10/15/85	Joint ring	930.95	Safety device
412.48/55/69	O-ring	932.01 <sup>21)</sup> /02/17/80	Circlip
421.55	Lip seal	940.01/02/09 <sup>22)</sup>	Key
433	Mechanical seal		

<sup>19)</sup> 504.01 for bearing bracket WS\_35\_LS only

<sup>20)</sup> 550.90 for bearing bracket WS\_55\_LS only

<sup>21)</sup> 932.01 for bearing bracket WS\_55\_LS only

<sup>22)</sup> 940.09 for bearing bracket WS\_55\_LS only



Exploded view diagram of a mechanical assembly, likely a pump or valve, showing various components and their assembly sequence. The diagram includes a main assembly view at the top and a detailed view of a shaft assembly at the bottom.

**Main Assembly View Components:**

- 102: 502.01, 902.01, 903.01/02/03/04, 920.01
- 1M, 6D, 903.03, 903.04, 1M, 903.01, 6B
- 903.02, 6D, 502.01, 920.95, 930.95, 230, 411.10, 502.02, 161, 502.02
- 920.15, 411.15, 902.15, 310, 901.30, 920.01
- 903.85, 411.85, 6D.1, 4M, 903.48, 914.99, 26M, 360, 914.33, 914.02
- 8B, 901.04, 183

**Assembly Codes (Top):**

- UG1817053..D02..001/ 02
- 210: 920.95, 930.95, 940.01/02/09
- 310, 321, 330, 360, 411.85, 412.48/55/69, 421.55, 433
- 476, 504.01, 550.21/53/90, 902.15, 903.48/85, 914.02/33/99, 920.15, 932.01/02/17/80

**Shaft Assembly View Components:**

- 940.01/09<sub>n</sub>, 210, 940.02, 550.53, 412.55, 412.48, 412.69<sub>n</sub>, 421.55, 550.90<sub>n</sub>, 550.21, 932.02, 932.80, 932.01<sub>n</sub>, 321

**Assembly Codes (Bottom):**

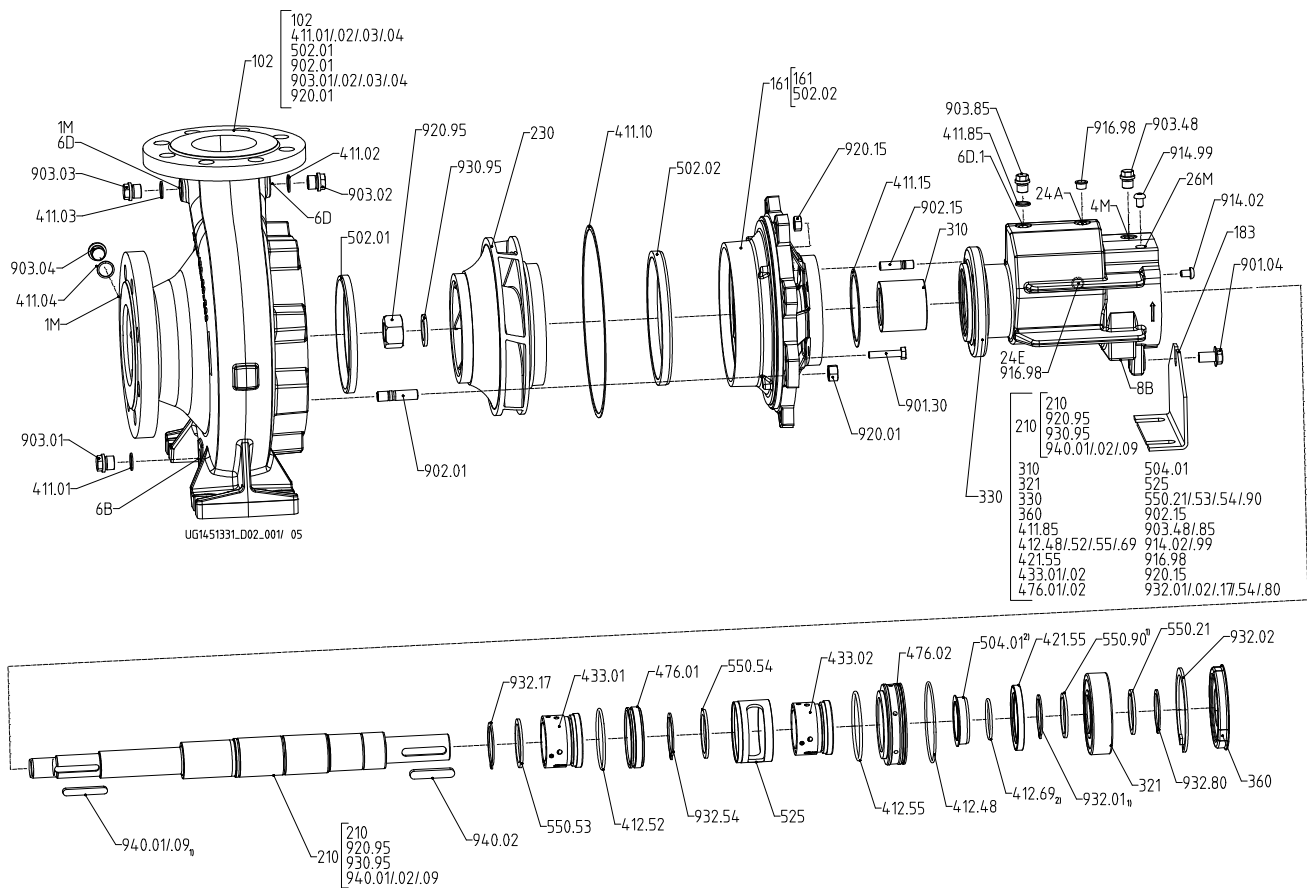
- 210: 920.95, 930.95, 940.01/02/09

- 1) For WS\_55 only
- 2) For WS\_35 only

Part No.	Description	Part No.	Description
102	Volute casing	476	Mating ring carrier
161	Casing cover	502.01/.02	Casing wear ring
183	Support foot	504.01 <sup>23)</sup>	Spacer ring
210	Shaft	550.21/.53/.90 <sup>24)</sup>	Disc
230	Impeller	901.04/.30	Hexagon head bolt
310	Plain bearing	902.01/.15	Stud
321	Radial ball bearing	903.01/.02/.03/.04/.48/.85	Screw plug
330	Bearing bracket	914.02/.33/.99	Hexagon socket head cap screw
360	Bearing cover	920.01/.15/.95	Nut
411.10/.15/.85	Joint ring	930.95	Safety device
412.48/.55/.69	O-ring	932.01 <sup>25)</sup> /.02/.17/.80	Circlip
421.55	Lip seal	940.01/.02/.09 <sup>26)</sup>	Key
433	Mechanical seal		

26 940.09 for bearing bracket WS\_55\_LS only

### 9.1.7 Version with bearing brackets WS\_35\_LS / WS\_55\_LS with double mechanical seal



**Fig. 32:** Exploded view of an Etanorm SYT, bearing brackets WS\_35\_LS / WS\_55\_LS with double mechanical seal

<sup>1)</sup> For WS\_55 only

<sup>2)</sup> For WS\_35 only

**Table 33:** List of components

Part No.	Description	Part No.	Description
102	Volute casing	502.01/02	Casing wear ring
161	Casing cover	504.01 <sup>27)</sup>	Spacer ring
183	Support foot	525	Spacer sleeve
210	Shaft	550.21/53/54/90 <sup>28)</sup>	Disc
230	Impeller	901.04/30	Hexagon head bolt
310	Plain bearing	902.01/15	Stud
321	Radial ball bearing	903.01/02/03/04/48/85	Screw plug
330	Bearing bracket	914.02/99	Hexagon socket head cap screw
360	Bearing cover	916.98	Plug
4.11.01/02/03/04/10/15/85	Joint ring	920.01/15/95	Nut
4.12.48/52/55/69 <sup>29)</sup>	O-ring	930.95	Safety device
4.21.55	Lip seal	932.01 <sup>30)</sup> /02/17/54/80	Circlip
4.33.01/02	Mechanical seal	940.01/02/09 <sup>31)</sup>	Key
4.76.01/02	Mating ring carrier		

<sup>27)</sup> 504.01 for bearing bracket WS\_35\_LS only

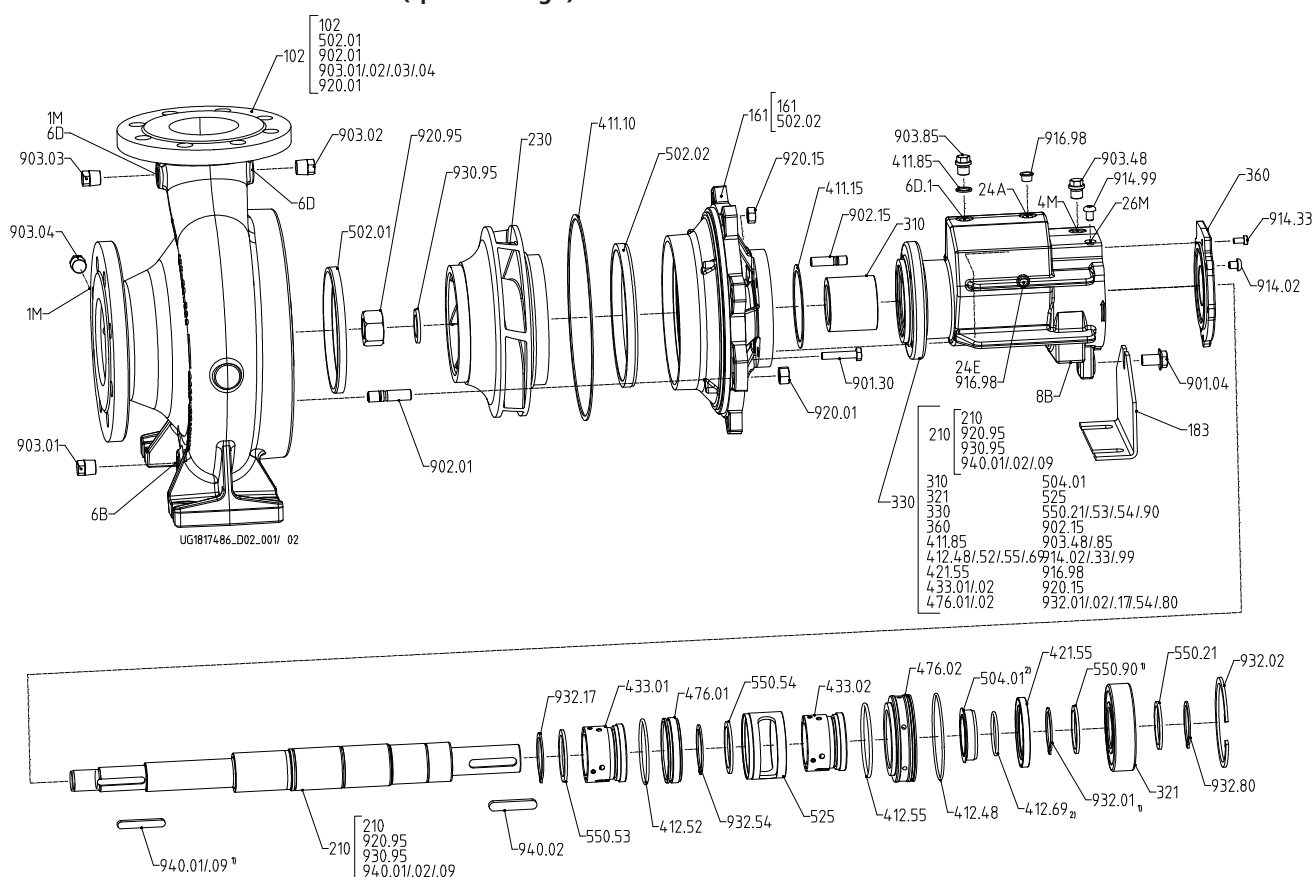
<sup>28)</sup> 550.90 for bearing bracket WS\_55\_LS only

<sup>29)</sup> 4.12.69 for bearing bracket WS\_35\_LS only

<sup>30)</sup> 932.01 for bearing bracket WS\_55\_LS only

<sup>31)</sup> 940.09 for bearing bracket WS\_55\_LS only

### 9.1.8 Version with bearing brackets WS\_35\_LS / WS\_55\_LS with double mechanical seal (special design)



**Fig. 33:** Exploded view of Etanorm SYT; bearing bracket WS\_35\_LS / WS\_55\_LS with double mechanical seal (special design)

1) For WS\_55 only

2) For WS\_35 only

### Table 34: List of components

Part No.	Description	Part No.	Description
102	Volute casing	502.01/.02	Casing wear ring
161	Casing cover	504.01 <sup>32)</sup>	Spacer ring
183	Support foot	525	Spacer sleeve
210	Shaft	550.21/.53/.54/.90 <sup>33)</sup>	Disc
230	Impeller	901.04/.30	Hexagon head bolt
310	Plain bearing	902.01/.15	Stud
321	Radial ball bearing	903.01/.02/.03/.04/.48/.85	Screw plug
330	Bearing bracket	914.02/.33/.99	Hexagon socket head cap screw
360	Bearing cover	916.98	Plug
411.10/.15/.85	Joint ring	920.01/.15/.95	Nut
412.48/.52/.55/.69 <sup>34)</sup>	O-ring	930.95	Safety device
421.55	Lip seal	932.01 <sup>35)</sup> /.02/.17/.54/.80	Circlip

<sup>32</sup> 504.01 for bearing bracket WS\_35\_LS only

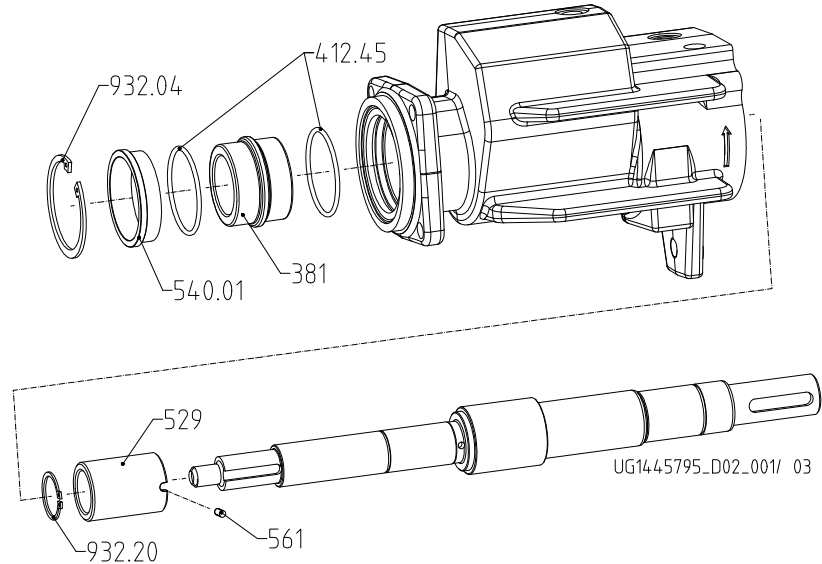
<sup>33</sup> 550.90 for bearing bracket WS\_55\_LS only

<sup>34</sup> 412.69 for bearing bracket WS\_35\_LS only

<sup>35</sup> 932.01 for bearing bracket WS\_55\_LS only

Part No.	Description	Part No.	Description
433.01/02	Mechanical seal	940.01/02/09 <sup>36)</sup>	Key
476.01/02	Mating ring carrier		

### 9.1.9 Version with bearing brackets WS\_25\_LS / WS\_55\_LS with SiC plain bearing

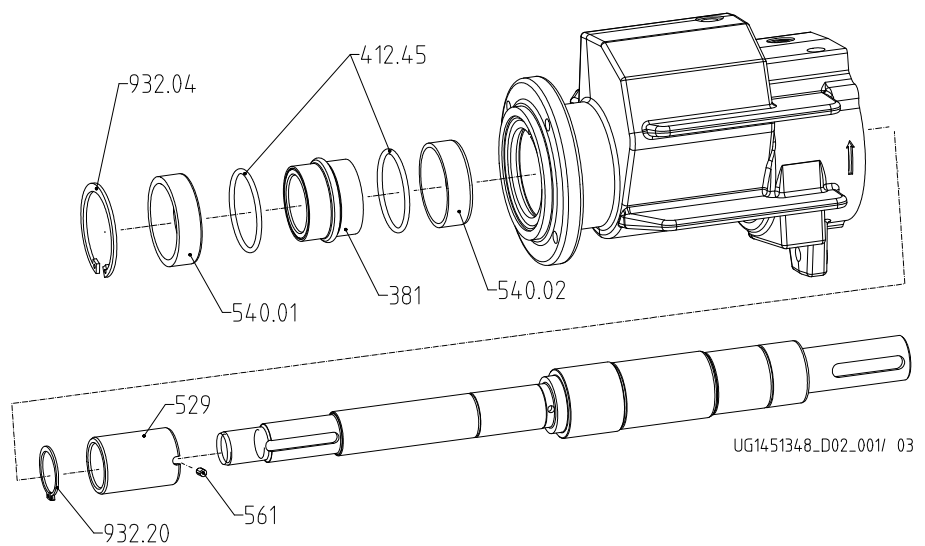


**Fig. 34:** Exploded view of Etanorm SYT, bearing brackets WS\_25\_LS / WS\_55\_LS with SiC plain bearing

**Table 35:** List of components

Part No.	Description	Part No.	Description
381	Bearing cartridge	540.01	Bush
412.45	O-ring	561	Grooved pin
529	Bearing sleeve	932.04/20	Circlip

### 9.1.10 Version with bearing bracket WS\_35\_LS with SiC plain bearing



**Fig. 35:** Exploded view of Etanorm SYT, bearing bracket WS\_35\_LS with SiC plain bearing

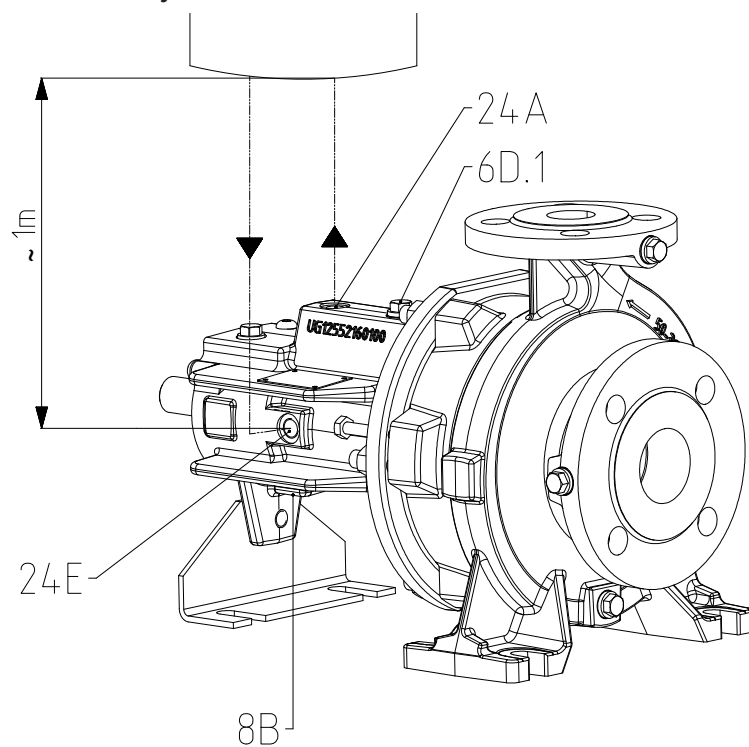
<sup>36)</sup> 940.09 for bearing bracket WS\_55\_LS only

**Table 36:** List of components

Part No.	Description	Part No.	Description
381	Bearing cartridge	540.01/.02	Bush
412.45	O-ring	561	Grooved pin
529	Bearing sleeve	932.04/.20	Circlip

## 9.2 Examples of mechanical seal connections

### 9.2.1 Auxiliary connections for double mechanical seal



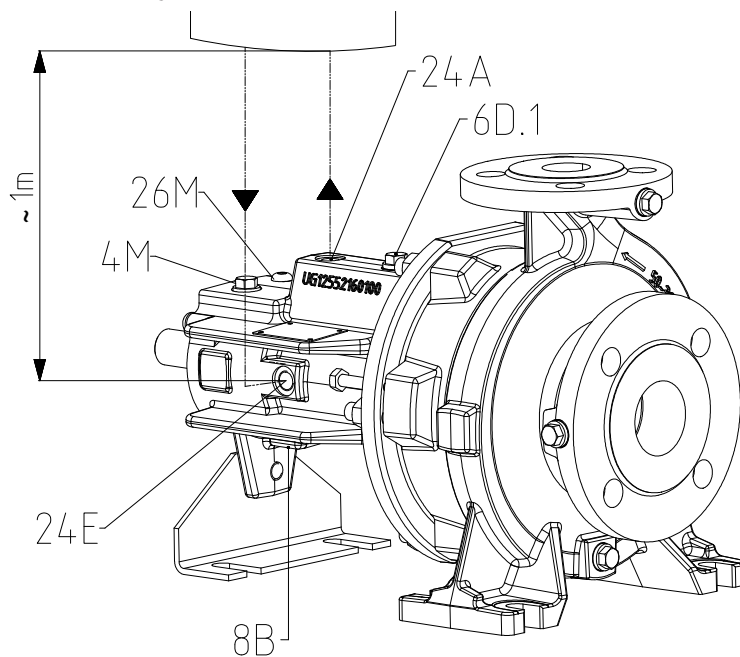
UG1463705\_CDK..D01..001 /02

**Fig. 36:** Connections for double mechanical seal

**Table 37:** Overview

Connection	Description
6D.1	Fluid priming and venting
8B	Leakage drain
24A	Quench fluid outlet
24E	Quench fluid inlet

### 9.2.2 Auxiliary connections for double mechanical seal and monitoring equipment



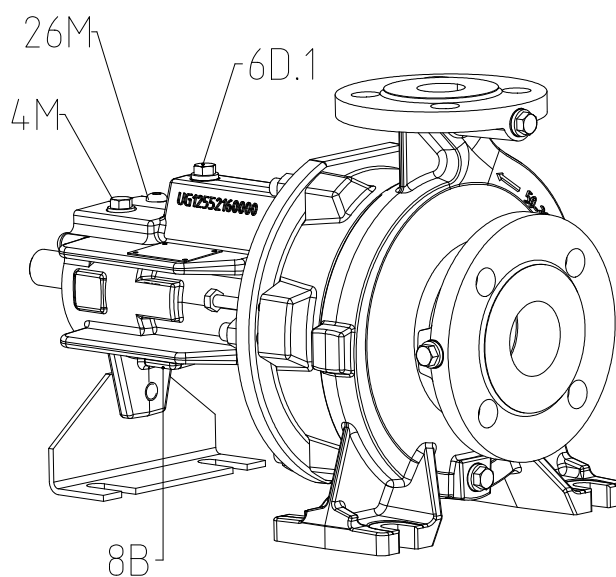
UG1463705\_CDK\_D01\_002 / 03

**Fig. 37:** Connections for double mechanical seal and monitoring equipment

**Table 38:** Overview

Connection	Description
4M	Temperature measurement
6D.1	Fluid priming and venting
8B	Leakage drain
24A	Quench liquid outlet
24E	Quench liquid inlet
26M	Shock pulse measurement

### 9.2.3 Auxiliary connections for single mechanical seal and monitoring equipment



UG1501785\_ZDK\_002 / 03


**Fig. 38:** Connections for single mechanical seal and monitoring equipment

Table 39: Overview

Connection	Description
4M	Temperature measurement
6D.1	Fluid priming and venting
8B	Leakage drain
26M	Shock pulse measurement



### 9.3 Spare parts list

	<div style="background-color: #FFD700; padding: 5px;"><b>CAUTION</b></div> <p><b>Use of non-original spare parts</b>  Damage to the pump set!  Loss of warranty!</p> <p>► Only use original KSB spare parts. This applies especially to the replacement of the bearing, mechanical seals, static sealing elements and lip seal.</p>
-----------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

#### Regions

- A = Europe, Middle East, North Africa
  - A1 = Default material variant
  - A2 = Optional material variant
- B = India
  - B1 = Default material variant
  - B2 = Optional material variant

**Table 40:** Mechanical seal order information

Mechanical seal	Bearing bracket	KSB Mat. No.	Region
Single mechanical seal	WS_25_LS	01909209	A, B
	WS_35_LS	01888678	A, B
	WS_55_LS	01888678	A, B
Double mechanical seal	WS_25_LS	01909212	A, B
	WS_35_LS	01909211	A, B
	WS_55_LS	01909211	A, B

**Table 41:** Rolling element bearing order information

Bearing	Bearing bracket	KSB Mat. No.	Region
Rolling element bearing: grease-packed for life (Klüber Asonic HQ 72-102)	WS_25_LS	01718585	A, B
	WS_35_LS	01718586	A, B
	WS_55_LS	01718587	A, B

**Table 42:** Joint ring order information

Size	Shaft unit	KSB Mat. No. for joint ring		Region	KSB Mat. No. for joint ring		Region
		Volute casing / discharge cover	Discharge cover / bearing bracket		Volute casing / discharge cover	Discharge cover / bearing bracket	
040-025-160	WS_25_LS	01140539	01185070	A	01236497	01340727	B
040-025-200	WS_25_LS	01140541	01185070	A	01236491	01340727	B
050-032-125.1	WS_25_LS	01140539	01185070	A	01236497	01340727	B
050-032-160.1	WS_25_LS	01140539	01185070	A	01236497	01340727	B
050-032-200.1	WS_25_LS	01140541	01185070	A	01236491	01340727	B
050-032-160	WS_25_LS	01140539	01185070	A	01236497	01340727	B
050-032-200	WS_25_LS	01140541	01185070	A	01236491	01340727	B
050-032-250	WS_25_LS	01140542	01185070	A	01236494	01340727	B
065-040-160	WS_25_LS	01140539	01185070	A	01236497	01340727	B
065-040-200	WS_25_LS	01140541	01185070	A	01236491	01340727	B
065-040-250	WS_25_LS	01140542	01185070	A	01236494	01340727	B
065-040-315	WS_35_LS	01140543	01185071	A	01236493	01375365	B
065-050-160	WS_25_LS	01140539	01185070	A	01236497	01340727	B
065-050-200	WS_25_LS	01140541	01185070	A	01236491	01340727	B

Size	Shaft unit	KSB Mat. No. for joint ring		Region	KSB Mat. No. for joint ring		Region
		Volute casing / discharge cover	Discharge cover / bearing bracket		Volute casing / discharge cover	Discharge cover / bearing bracket	
065-050-250	WS_25_LS	01140542	01185070	A	01236494	01340727	B
065-050-315	WS_35_LS	01140543	01185071	A	01236493	01375365	B
080-065-160	WS_25_LS	01140539	01185070	A	01236497	01340727	B
080-065-200	WS_25_LS	01140541	01185070	A	01236491	01340727	B
080-065-250	WS_35_LS	01140542	01185071	A	01236494	01375365	B
080-065-315	WS_35_LS	01140543	01185071	A	01236493	01375365	B
100-080-160	WS_25_LS	01140539	01185070	A	01236497	01340727	B
100-080-200	WS_35_LS	01140541	01185071	A	01236491	01375365	B
100-080-250	WS_35_LS	01140542	01185071	A	01236494	01375365	B
100-080-315	WS_35_LS	01140543	01185071	A	01236493	01375365	B
125-100-160	WS_35_LS	01140541	01185071	A	01236491	01375365	B
125-100-200	WS_35_LS	01140541	01185071	A	01236491	01375365	B
125-100-250	WS_35_LS	01140542	01185071	A	01236494	01375365	B
125-100-315	WS_35_LS	01140543	01185071	A	01236493	01375365	B
150-125-200	WS_35_LS	01140541	01185071	A	01236491	01375365	B
150-125-250	WS_35_LS	01140542	01185071	A	01236494	01375365	B
150-125-315	WS_55_LS	01140543	01140538	A	01236493	01375366	B
150-125-400	WS_55_LS	01140544	01140538	A	01236492	01375366	B
200-150-315	WS_55_LS	01140543	01140538	A	01236493	01375366	B
200-150-400	WS_55_LS	01140544	01140538	A	01236492	01375366	B

**Table 43:** Lip seal and grease order information

Bearing bracket	KSB Mat. No.		Region
	Lip seal	Grease (Klüber Asonic HQ 72-102)	
WS_25_LS	01193174	01719747	A, B
WS_35_LS	01654740	01719747	A, B
WS_55_LS	00143831	01719747	A, B

## 10 UK Declaration of Conformity

Manufacturer:

**KSB SE & Co. KGaA**  
**Johann-Klein-Straße 9**

**67227 Frankenthal (Germany)**

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

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

**Etabloc, Etabloc SYT, Etaline, Etaline SYT, Etaline Z, Etachrom B,  
 Etachrom L, Etanorm, Etanorm SYT, Etanorm V, 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 components<sup>37)</sup>: The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

The manufacturer also declares that

- the following *designated standards*<sup>38)</sup> 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

.....<sup>39)</sup>.....

Name  
 Function  
 Company  
 Address

<sup>37)</sup> Where applicable

<sup>38)</sup> 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.

<sup>39)</sup> A signed, legally binding UK Declaration of Conformity is supplied with the product.

## 11 Certificate of Decontamination

Type: .....  
Order number /  
Order item number<sup>40)</sup>: .....  
Delivery date: .....  
Application: .....  
Fluid handled<sup>40)</sup>: .....

Please tick where applicable<sup>40)</sup>:



Corrosive



Oxidising



Flammable



Explosive



Hazardous to health



Seriously hazardous to health



Toxic



Radioactive



Bio-hazardous



Safe

Reason for return:<sup>40)</sup> .....  
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

<sup>40)</sup> Required field

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