

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 line 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**

Pumps which are purchased and stored independently of their later use

**Suction lift line/suction head line**

The line which is connected to the suction nozzle

# 1 General

## 1.1 Principles

This operating manual is supplied as an integral part of the type series and variants indicated on the front cover. The 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 uniquely identify the pump (set) and serve as identification for all further business processes.

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

Noise characteristics (⇒ Section 4.7 Page 18)

## 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 2.4 Page 9)

## 1.4 Other applicable documents

**Table 1:** Overview of other applicable documents

Document	Contents
Data sheet	Description of the technical data of the pump (set)
General arrangement drawing/ outline drawing	Description of mating and installation dimensions for the pump (set), weights
Drawing of auxiliary connections	Description of auxiliary connections
Hydraulic characteristic curve	Characteristic curves showing head, NPSH required, efficiency and power input
General assembly drawing <sup>1)</sup>	Sectional drawing of the pump
Sub-supplier product literature <sup>1)</sup>	Operating manuals and other documentation for accessories and integrated machine parts
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
Drawing for assembly <sup>1)</sup>	Sectional drawing of the installed shaft seal


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

## 1.5 Symbols

**Table 2:** Symbols used in this manual

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

<sup>1)</sup> If agreed upon in scope of supply

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








## 2 Safety

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



### 2.1 Key to safety symbols/markings

**Table 3:** Definition of safety symbols/markings

Symbol	Description
	<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> This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
	<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 EC Directive 94/9/EC (ATEX).
	<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.

### 2.2 General

This manual contains general installation, operating and maintenance instructions that must be observed to ensure safe pump operation and prevent personal injury and damage to property.

The safety information in all sections of this manual must be complied with.

This manual must be read and completely understood by the specialist personnel/operators responsible prior to installation and commissioning.

The contents of this manual must be available to the specialist personnel at the site at all times.

Information attached directly to the pump must always be complied with and be 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 in this manual.

### 2.3 Intended use

#### Prevention of foreseeable misuse

- Never open discharge-side shut-off elements further than permitted.
  - The maximum flow rate specified in the data sheet or product literature would be exceeded.
  - Risk of cavitation damage



- Never exceed the permissible operating limits specified in the data sheet or product literature regarding pressure, temperature, etc.
- Observe all safety information and instructions in this manual.

### 2.4 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.

### 2.5 Consequences and risks caused by non-compliance with this manual

- Non-compliance with this operating manual 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

### 2.6 Safety awareness

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

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

### 2.7 Safety information for the operator/user

- The operator shall fit contact guards for hot, cold and moving parts and check that the guards function properly.
- Do not remove any 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 shutting down 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.

## 2.8 Safety information for maintenance, inspection and installation work

- Modifications or alterations of the pump are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts authorised by the manufacturer. The use of other parts can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that all maintenance, inspection and installation work is 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.
- The pump casing must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.1.7 Page 38) (⇒ Section 6.3 Page 41)
- Decontaminate pumps which handle fluids posing a health hazard. (⇒ Section 7.3 Page 46)
- As soon as the work has been completed, re-install and/or re-activate any safety-relevant and protective devices. Before returning the product to service, observe all instructions on commissioning.

## 2.9 Unauthorised modes of operation

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

The warranty relating to the operating reliability and safety of the supplied pump (set) is only valid if the equipment is used in accordance with its intended use. (⇒ Section 2.3 Page 8)

## 2.10 Explosion protection



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

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

Special conditions apply to the operation of explosion-proof pump sets to EC Directive 94/9/EC (ATEX).

Especially adhere to the sections in this manual marked with the Ex symbol and the following sections (⇒ Section 2.10.1 Page 10) to (⇒ Section 2.10.4 Page 11) .

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

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

Prevent impermissible modes of operation at all times.

### 2.10.1 Marking

<b>Pump</b>	The marking on the pump refers to the pump part only. Example of such marking: II 2 G c TX Refer to the Temperature Limits table for the temperatures permitted for the individual pump variants. (⇒ Section 2.10.2 Page 10)
<b>Shaft coupling</b>	An EC manufacturer's declaration is required for the shaft coupling; the shaft coupling must be marked accordingly.
<b>Motor</b>	The motor must be considered separately.

### 2.10.2 Temperature limits

In normal pump operation, the highest temperatures are to be expected on 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 below lists the temperature classes and the resulting theoretical temperature limits of the fluid handled (a possible temperature rise in the shaft seal area has already been taken into account).

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 EN 13463-1	Maximum permissible fluid temperature
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

Compliance with temperature class T5 is warranted for the area of the rolling element bearings based on an ambient temperature of 40°C, assuming that the pump set is properly serviced and operated and that the surfaces in the bearing area are freely exposed to the atmosphere.

#### Temperature class T6

If temperature class T6 has to be complied with, special measures may have to be taken with regard to the bearing temperatures.

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, if there is no data sheet or if the pump is part of a pool of pumps, contact KSB for the maximum permissible operating temperature.

### 2.10.3 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 on monitoring equipment.

### 2.10.4 Operating limits



The minimum flows indicated in (⇒ Section 6.2.3.1 Page 40) 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 40) can be used to check whether additional heat build-up may lead to a dangerous temperature increase at the pump surface.

### 3 Transport/Temporary 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 (as applicable) and the insurer about the damage in writing immediately.

#### 3.2 Transport

	<div data-bbox="491 533 1450 589"> <b>DANGER</b></div> <p data-bbox="491 593 1182 651"><b>The pump (set) could slip out of the suspension arrangement</b> Danger to life from falling parts!</p> <ul data-bbox="507 660 1404 880" 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>▷ Give due attention to the weight data and the centre of gravity.</li><li>▷ Observe the applicable local health and safety regulations.</li><li>▷ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.</li></ul>
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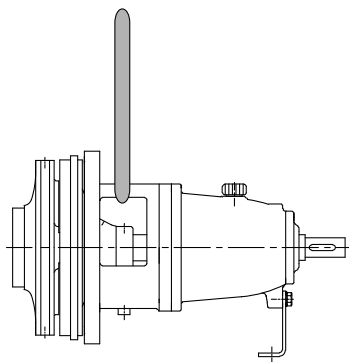


Fig. 1: Transporting the back pull-out unit

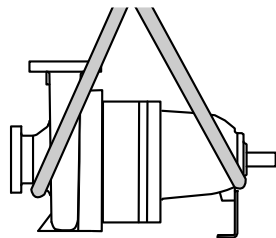


Fig. 2: Transporting the pump

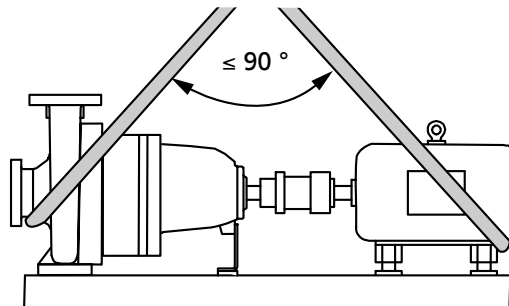
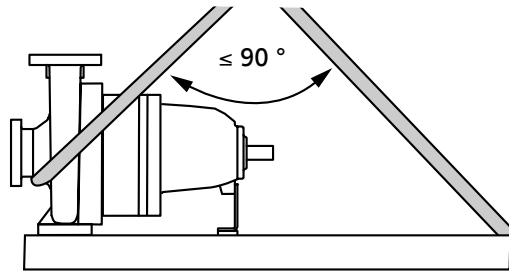




Fig. 3: Transporting the pump set



**Fig. 4:** Transporting the pump on the baseplate

### 3.3 Storage/preservation

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

	<p><b>CAUTION</b></p> <p><b>Damage during storage by humidity, dirt, or vermin</b> Corrosion/contamination of the pump (set)!</p> <ul style="list-style-type: none"> <li>▸ For outdoor storage cover the packed or unpacked pump (set) and accessories with waterproof material.</li> </ul>
	<p><b>CAUTION</b></p> <p><b>Wet, contaminated or damaged openings and connections</b> Leakage or damage to the pump set!</p> <ul style="list-style-type: none"> <li>▸ Only remove caps/covers from the openings of the pump set at the time of installation.</li> </ul>

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, observe the instructions in (⇒ Section 6.3.1 Page 41) .

### 3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3 Page 46)
2. Always flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump set has handled fluids whose residues could lead to corrosion in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump set 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 (set).  
Always indicate any safety and decontamination measures taken. (⇒ Section 11 Page 71)

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

## 3.5 Disposal

	 <b>WARNING</b>
	<p><b>Fluids, consumables and supplies which are hot and/or pose a health hazard</b> Hazard to persons and the environment!</p> <ul style="list-style-type: none"><li>▷ Collect and properly dispose of flushing fluid and any residues of the fluid handled.</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 as per Regulation No. 547/2012 (for water pumps with a maximum shaft power of 150 kW) implementing "Ecodesign" Directive 2009/125/EC

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

### 4.3 Designation

Example: ETNY 050-032-160 SG XDB08YA2

Table 5: Key to the designation

Code	Description
ETNY	Type series
ETNY	= Etanorm SYT
050	Nominal suction nozzle diameter [mm]
032	Nominal discharge nozzle diameter [mm]
160	Nominal impeller diameter [mm]
S	Casing material
S	= nodular cast iron
E	= cast steel
G	Impeller material if different from casing material
G	= cast iron
C	= stainless steel
X	Special design
<sup>2)</sup>	= standard design
X	= special design
D	Casing cover
D	= casing cover for SYT
B	Sealing system
B	= dead-end
08	Seal code
08	= AQ <sub>1</sub> VGG
Y	Long-coupled design
Y	= variant for heat transfer fluids
A	Scope of supply
A	= pump only (Fig. 0)
2	Shaft unit
2	= WS_25_LS

<sup>2)</sup> Not specified

#### 4.4 Name plate

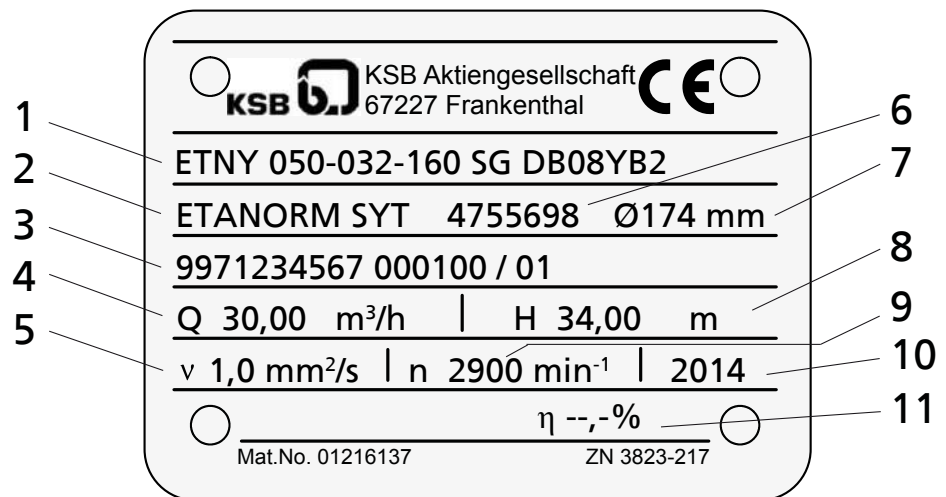


Fig. 5: Etanorm SYT name plate (example)

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

##### Impeller type

- Closed radial impeller with multiply curved vanes

##### Shaft seal

- Single mechanical seal to EN 12756
- Double mechanical seal to EN 12756

##### Bearings

- Drive end: rolling element bearing
- Pump end: plain bearing



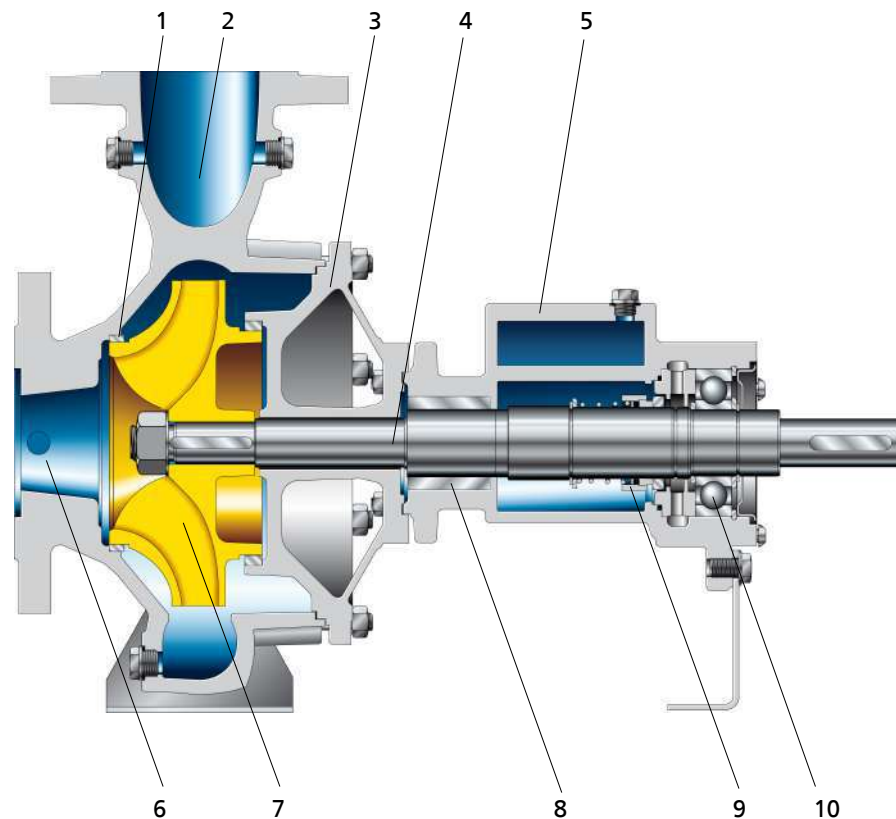
### Bearings used

**Table 6:** Overview

Version	Bearing bracket	Pump end	Drive end
<b>Plain bearing (standard)</b> Lubrication by the fluid pumped	WS_25_LS	Carbon (KHK)	-
	WS_35_LS	Carbon (KHK)	-
	WS_55_LS	Carbon (KHK)	-
<b>Plain bearing (option)</b> Lubrication by the fluid pumped	WS_25_LS	SiC / SiC	-
	WS_35_LS	SiC / SiC	-
	WS_55_LS	SiC / SiC	-
<b>Rolling element bearing</b> Grease lubrication Grease-packed for life (high melting point grease)	WS_25_LS	-	6306-2RS/ C3 PCP-LLG
	WS_35_LS	-	6309-2RS/ C3 PCP-LLG
	WS_55_LS	-	6311-2RS/ C3 PCP-LLG

- Grease lubrication for drive-end deep groove ball bearing
- Lubrication by the fluid pumped for pump-end carbon bearing or SiC/SiC bearing

### 4.6 Configuration and function



**Fig. 6:** Sectional drawing

1	Clearance gap	2	Discharge nozzle
3	Casing cover	4	Shaft
5	Bearing bracket	6	Suction nozzle
7	Impeller	8	Plain bearing
9	Shaft seal	10	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 (6) and is accelerated outward by the rotating impeller (7). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid is pumped to the discharge nozzle (2), where it leaves the pump. The clearance gap (1) prevents any fluid from flowing back from the casing to the suction nozzle. At the rear side of the impeller, the shaft (4) enters the casing via the casing cover (3). The shaft passage through the bearing bracket is sealed to atmosphere with a shaft seal (9). The shaft runs in a plain bearing and a rolling element bearing (8 and 10); the bearings are supported by a bearing bracket (5) linked with the pump casing and/or casing cover.
- Sealing** The pump is sealed by a standardised mechanical seal.  
If the pump is fitted with a double mechanical seal, the pump is connected to a quench pot. The unpressurised quench liquid supply serves to prevent any leakage of the pumped fluid 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 7:** Surface sound pressure level  $L_{pA}$ <sup>3)4)</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	55	56	66
1,1	49	50	52	56	57	66
1,5	51	52	54	56	58	67
2,2	53	54	56	58	59	67
3	54	55	57	59	60	68
4	56	57	59	60	61	68
5,5	58	59	61	61	62	70
7,5	59	60	62	63	64	71
11	61	62	64	64	65	73
15	63	64	66	66	67	74
18,5	64	65	67	67	68	75
22	65	66	68	68	69	76
30	66	67	70	69	70	77
37	67	68	71	70	71	78
45	68	69	72	71	73	78
55	69	70	73	72	74	79
75	-	72	75	-	75	80
90	-	73	76	-	76	81
110	-	74	77	-	77	81

### 4.8 Dimensions and weights

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

### 4.9 Scope of supply

- Pump
- Baseplate
- Coupling
- Coupling guard



<sup>3)</sup> Spatial average; as per ISO 3744 and EN 12639; valid for pump operation in the  $Q/Q_{opt} = 0.80 - 1.1$  range and for non-cavitating operation. If noise levels are to be guaranteed: Add +3 dB for measuring and constructional tolerance.

<sup>4)</sup> Increase for 60 Hz operation: 3500 rpm: +3 dB, 1750 rpm: +1 dB

- Drive
- Quench pot with pipework (optional)
- Special accessories as required


## 5 Installation at Site

### 5.1 Safety regulations

	<p><b>⚠ DANGER</b></p> <p><b>Improper installation in potentially explosive atmospheres</b> Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▸ Comply with the applicable local explosion protection regulations.</li> <li>▸ Observe the information in the data sheet and on the name plates of pump and motor.</li> </ul>
	<p><b>⚠ DANGER</b></p> <p><b>Risk of ignition by frictional sparks</b> Risk of explosion!</p> <ul style="list-style-type: none"> <li>▸ Choose a coupling guard material that is non-sparking in the event of mechanical contact (see DIN EN 13463-1).</li> <li>▸ If any coupling parts are made of aluminium, a brass coupling guard must be used.</li> </ul>

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


#### Place of installation

	<p><b>⚠ WARNING</b></p> <p><b>Installation on 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 206-1.</li> <li>▸ The mounting surface must have set and must be completely horizontal and even.</li> <li>▸ Observe the weights indicated.</li> </ul>
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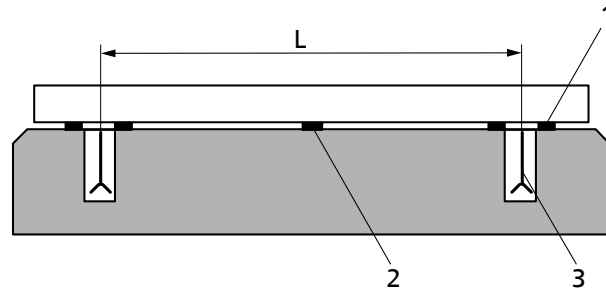
1. Check the structural requirements.  
All structural work required must have been prepared in accordance with the dimensions stated in the outline drawing/general arrangement drawing.

### 5.3 Installing the pump set

Always install the pump set in horizontal position.

	<p><b>⚠ DANGER</b></p> <p><b>Excessive temperatures due to improper installation</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▸ Install the pump in horizontal position to ensure self-venting of the pump.</li> </ul>
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### 5.3.1 Installation on the foundation



**Fig. 7: Fitting the shims**

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

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



#### NOTE

For baseplates more than 400 mm wide it is recommended to grout the baseplate with low-shrinkage concrete.



#### NOTE

For baseplates made of grey cast iron it is recommended to grout the baseplate with low-shrinkage concrete.



#### NOTE

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



#### NOTE

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

### 5.3.2 Installation without foundation

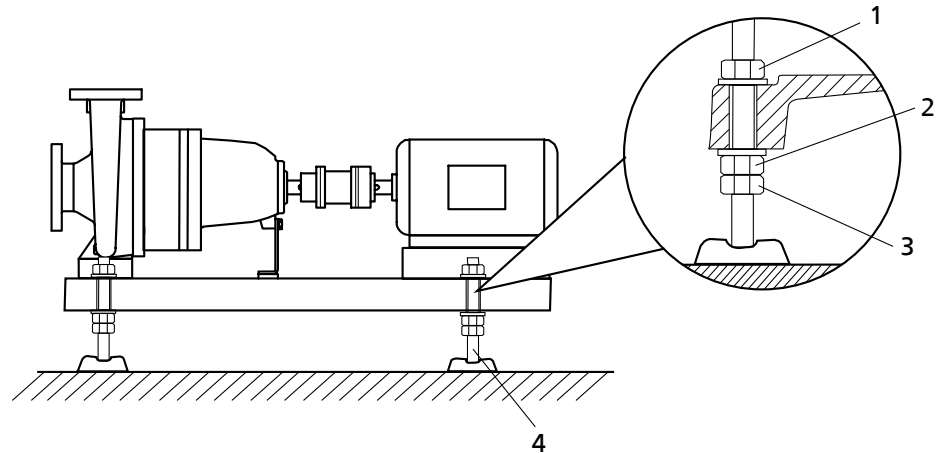





Fig. 8: Adjusting the levelling elements

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 bolts and locknuts (1, 3) of the machine mounts (4).
- 3. Turn the adjusting nut (2) until any differences in height have been compensated.
- 4. Re-tighten the locknuts (1, 3) at the machine mounts (4).

## 5.4

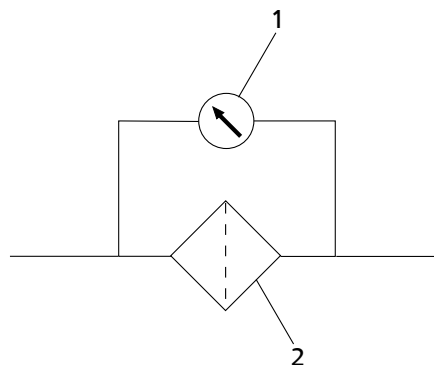
### 5.4.1 Connecting the piping

	<div style="background-color: #f06292; 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 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 thermal expansion of the piping.</li> </ul>
	<div style="background-color: #ffc107; padding: 5px;"><b>CAUTION</b></div> <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>
	<div style="background-color: #007bff; color: white; padding: 5px;"><b>NOTE</b></div> <p>It is recommended to install check and shut-off elements in the system, depending on the type of plant and pump. However, such elements must not obstruct proper drainage or hinder disassembly of the pump.</p>

- ✓ The suction lift line has been laid with a rising slope, the suction head line with a downward slope towards the pump.
  - ✓ A flow stabilisation section having a length equivalent to at least twice the diameter of the suction flange has been provided upstream of the suction flange.
  - ✓ The nominal diameters of the pipelines are equal to or greater than the nominal diameters of the pump nozzles.
  - ✓ Adapters to larger nominal diameters are designed with a diffuser angle of approx. 8° to avoid excessive pressure losses.
  - ✓ The pipelines have been anchored in close proximity to the pump and connected without transmitting any stresses or strains.
1. Thoroughly clean, flush and blow through all vessels, pipelines and connections (especially of new installations).
  2. Before installing the pump in the piping, remove the flange covers on the suction and discharge nozzles of the pump.



	<div style="background-color: yellow; padding: 5px;"><b>CAUTION</b></div> <p><b>Welding beads, scale and other impurities in the piping</b> Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Free the piping from any impurities.</li> <li>▷ If necessary, install a filter.</li> <li>▷ Comply with the instructions set out in (⇒ Section 7.2.2.3 Page 45) .</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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	<div style="background-color: #0056b3; color: white; padding: 5px;"><b>NOTE</b></div> <p>It is recommended to install a fine filter made of corrosion-resistant material for the run-in phase of the system. Use a filter with a filter area three times the cross-section of the piping. Conical filters have proved suitable.</p>
	<div style="background-color: #0056b3; color: white; padding: 5px;"><b>NOTE</b></div> <p>Use a filter with laid-in wire mesh of 0.5 mm x 0.25 mm (mesh size x wire diameter) made of corrosion-resistant material. Use a filter with a filter area three times the cross-section of the piping. Conical filters have proved suitable.</p>

5. Connect the pump nozzles to the piping.



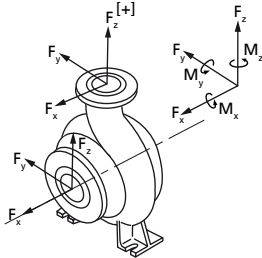
**CAUTION**

**Aggressive flushing and pickling agents**  
Damage to the pump!

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

#### 5.4.2 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 8:** Forces and moments at the pump nozzles for 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	713	651	578	1126	615	430	492	40	393	369	455	706	479	325	369
065-040-200	65	713	651	578	1126	615	430	492	40	393	369	455	706	479	325	369
065-040-250	65	713	651	578	1126	615	430	492	40	393	369	455	706	479	325	369
065-040-315	65	713	651	578	1126	615	430	492	40	393	369	455	706	479	325	369
065-050-160	65	713	651	578	1126	615	430	492	50	651	578	713	1126	615	437	492
065-050-200	65	713	651	578	1126	615	430	492	50	651	578	713	1126	615	437	492
065-050-250	65	713	651	578	1126	615	430	492	50	651	578	713	1126	615	437	492
065-050-315	65	713	651	578	1126	615	430	492	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)

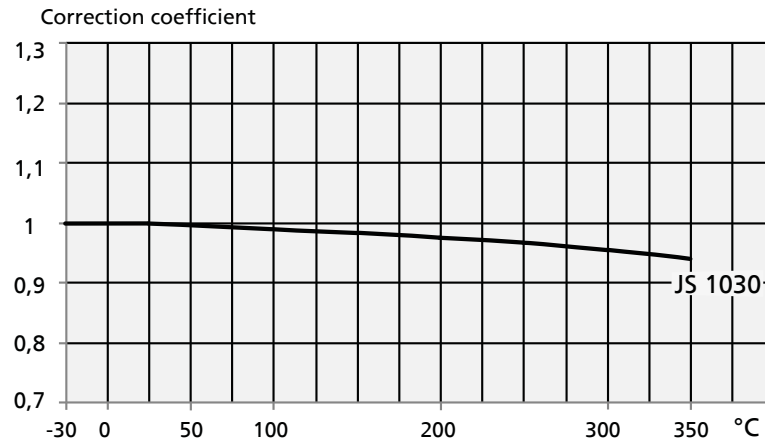


Fig. 11: Temperature correction diagram for casing material JS 1030

Table 9: 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
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)

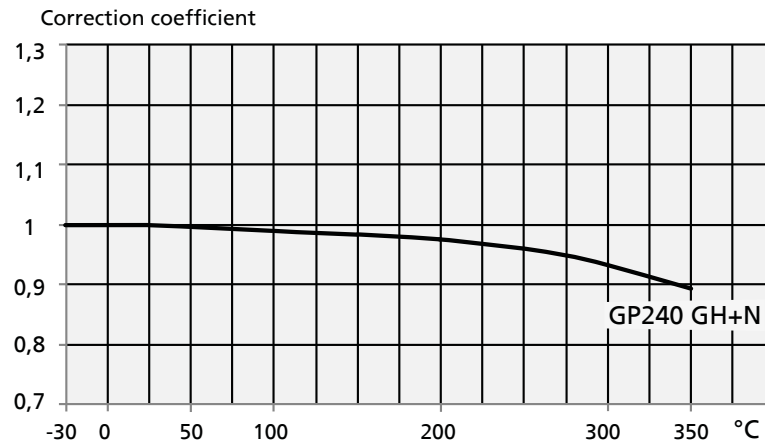


Fig. 12: Temperature correction diagram for casing material GP240 GH+N

#### 5.4.3 Vacuum balance line



#### NOTE

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

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.

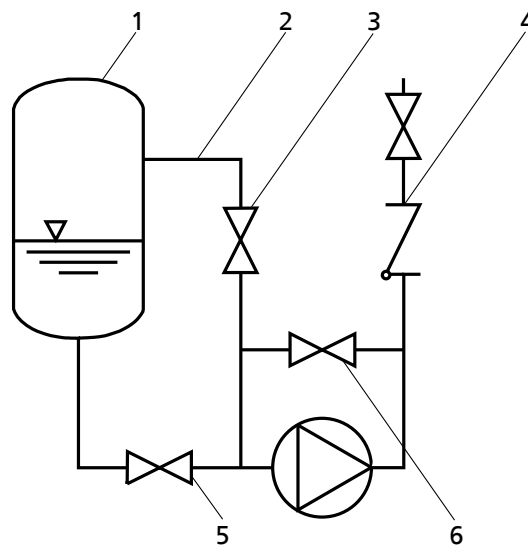


Fig. 13: Vacuum balance system



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



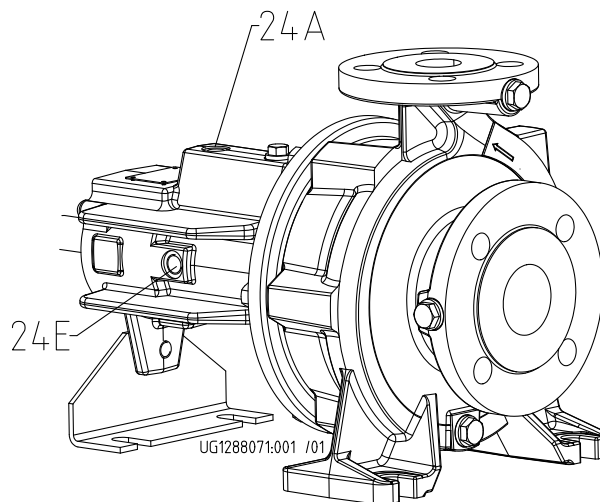
#### NOTE

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

#### 5.4.4 Auxiliary connections

	<p><b>⚠ DANGER</b></p> <p><b>Risk of potentially explosive atmosphere by mixing of incompatible fluids in the auxiliary piping</b>  <b>Risk of burns!</b>  <b>Explosion hazard!</b></p> <ul style="list-style-type: none"> <li>Make sure that the barrier fluid and quench liquid are compatible with the fluid pumped.</li> </ul>
	<p><b>⚠ WARNING</b></p> <p><b>Failure to use or incorrect use of auxiliary connections (e.g. barrier fluid, flushing liquid, etc.)</b>  <b>Risk of injury from escaping fluid!</b>  <b>Risk of burns!</b>  <b>Malfunction of the pump!</b></p> <ul style="list-style-type: none"> <li>Refer to the general arrangement drawing, the piping layout and pump markings (if any) for the quantity, dimensions and locations of auxiliary connections.</li> <li>Use the auxiliary connections provided.</li> </ul>

#### Double mechanical seal

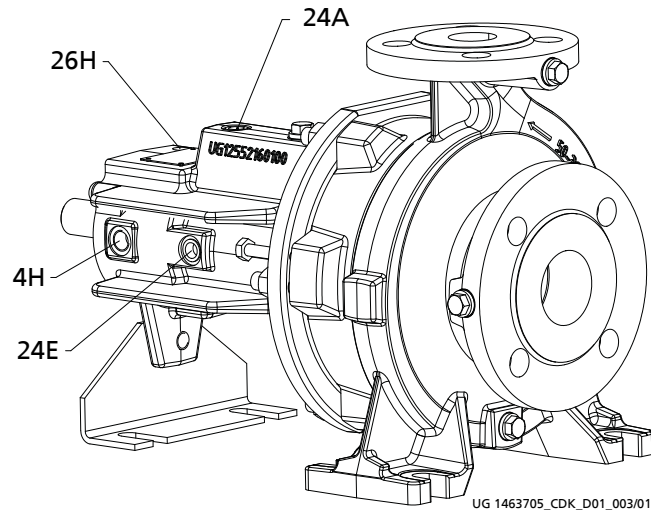


**Fig. 14:** Connections 24E and 24A

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

### Double mechanical seal and monitoring equipment

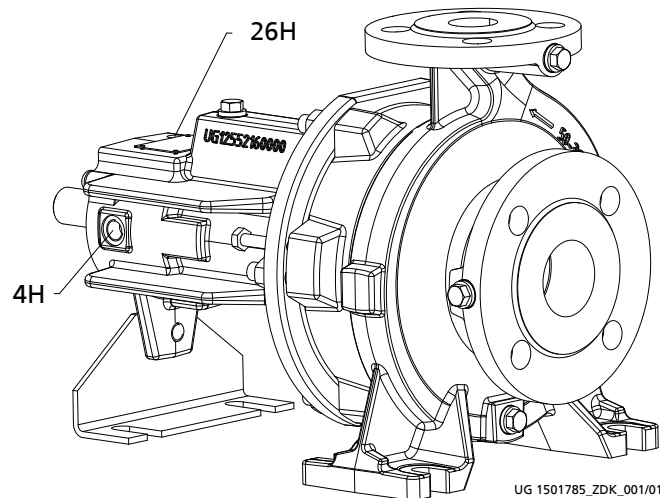


**Fig. 15:** Connections 24E, 24A, 4H and 26H

24 A	Quench liquid outlet	24 E	Quench liquid inlet
4H	Temperature measurement	26H	Shock pulse measurement

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

### Single mechanical seal and monitoring equipment






**Fig. 16:** Connections 4H and 26H




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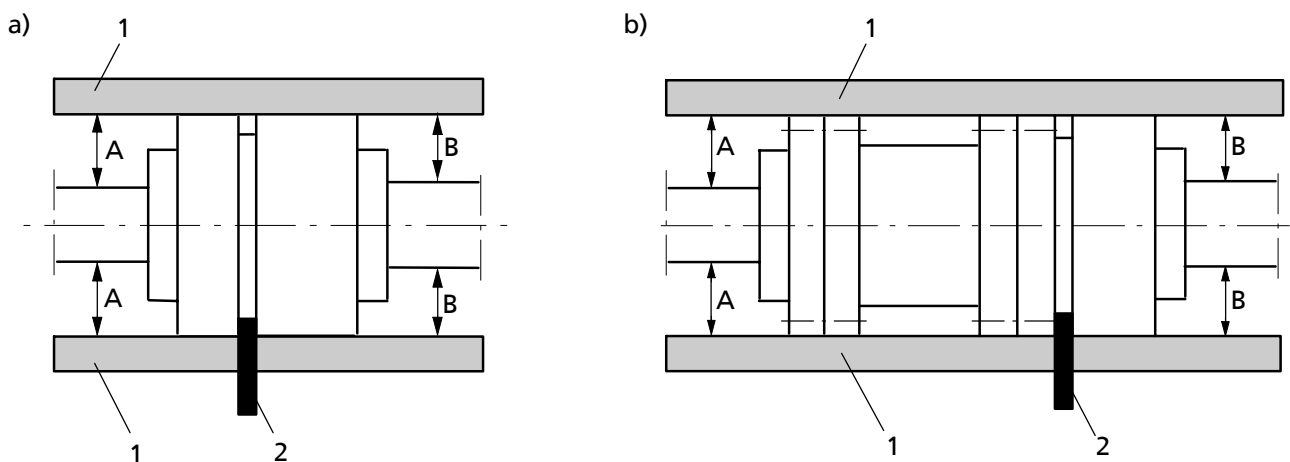
For designs with single mechanical seal and monitoring equipment, use connections 4H and 26H to connect the pump set to the monitoring equipment. Connect the monitoring equipment in accordance with the manufacturer's instructions.

### 5.5 Enclosure/insulation

	<p><b>⚠ DANGER</b></p> <p><b>An explosive atmosphere could form due to insufficient venting</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>Make sure the space between the casing cover/discharge cover and the bearing cover is sufficiently vented.</li> </ul>
	<p><b>⚠ WARNING</b></p> <p><b>The volute casing and casing/discharge cover take on the same temperature as the fluid handled</b> Risk of burns!</p> <ul style="list-style-type: none"> <li>Insulate the volute casing.</li> <li>Fit protective equipment.</li> </ul>
	<p><b>CAUTION</b></p> <p><b>Heat build-up in the bearing bracket</b> Damage to the bearing!</p> <ul style="list-style-type: none"> <li>Never insulate the bearing bracket, bearing bracket lantern and casing cover.</li> </ul>

### 5.6 Checking the coupling alignment

  	<p><b>⚠ DANGER</b></p> <p><b>Inadmissible temperatures at the coupling or bearings due to misalignment of the coupling</b> Explosion hazard! Risk of burns!</p> <ul style="list-style-type: none"> <li>Make sure that the coupling is correctly aligned at all times.</li> </ul>
	<p><b>CAUTION</b></p> <p><b>Misalignment of pump and motor shafts</b> Damage to pump, motor and coupling!</p> <ul style="list-style-type: none"> <li>Always check the coupling after the pump has been installed and connected to the piping.</li> <li>Also check the coupling of pump sets supplied with pump and motor mounted on the same baseplate.</li> </ul>



**Fig. 17:** Checking the coupling alignment: Coupling without spacer sleeve (a) or Coupling with spacer sleeve (b)

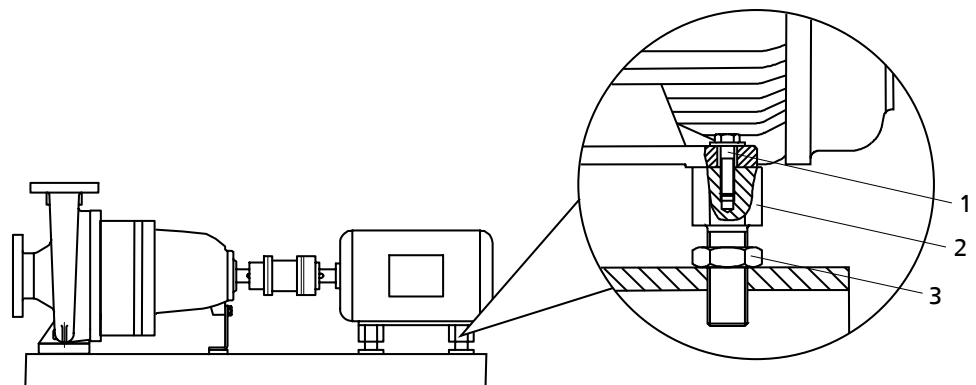
1	Straight-edge	2	Gauge
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- ✓ The coupling guard and its footboard, if any, have been removed.
1. Loosen the support foot and re-tighten it without transmitting any stresses and strains.
2. Place the straight-edge axially on both coupling halves.
3. 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.  
The radial and axial deviation between the two coupling halves must not exceed 0.1 mm, during standstill as well as at operating temperature and 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.  
The radial and axial deviation between the two coupling halves must not exceed 0.1 mm, during standstill as well as at operating temperature and under inlet pressure.
5. If alignment is correct, re-install the coupling guard and its footboard, if any.

### 5.7 Aligning the pump and motor

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



#### 5.7.1 Motors with adjusting screw



**Fig. 18:** Motor with adjusting screw

1	Hexagon head bolt	2	Adjusting screw
3	Locknut		

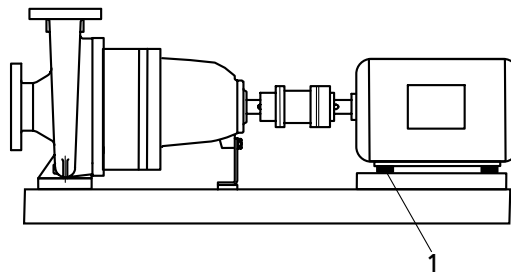
- ✓ The coupling guard and the footboard for the coupling guard, if any, have been removed.
1. Check the coupling alignment.
2. Unscrew the hexagon head bolts (1) at the motor and the locknuts (3) at the baseplate.
3. Turn the adjusting screws (2) by hand or by means of an open-jawed wrench until the 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 that the coupling and shaft can easily be rotated by hand.

	<b>⚠ WARNING</b>
	<b>Unprotected rotating coupling</b> Risk of injury by rotating shafts! <ul style="list-style-type: none"> <li>▶ Always operate the pump set with a coupling guard.</li> <li>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>
	<b>⚠ DANGER</b>
	<b>Risk of ignition by frictional sparks</b> Explosion hazard! <ul style="list-style-type: none"> <li>▶ Choose a coupling guard material that is non-sparking in the event of mechanical contact (see DIN EN 13463-1).</li> </ul>

6. Re-install the coupling guard and the footboard for the coupling guard, if any.
7. Check the distance between coupling and coupling guard.  
The coupling and coupling guard must not come into contact.


### 5.7.2 Motors without levelling screw


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



**Fig. 19:** Pump set with shim


1	Shim
✓	<p>The coupling guard and the footboard for the coupling guard, if any, have been removed.</p> <ol style="list-style-type: none"> <li>1. Check the coupling alignment.</li> <li>2. Unscrew the hexagon head bolts at the motor.</li> <li>3. Insert shims underneath the motor feet until the difference in shaft centreline height has been compensated.</li> <li>4. Re-tighten the hexagon head bolts.</li> <li>5. Check that the coupling and shaft can easily be rotated by hand.</li> </ol>


	<b>⚠ WARNING</b>
	<b>Unprotected rotating coupling</b> Risk of injury by rotating shafts! <ul style="list-style-type: none"> <li>▶ Always operate the pump set with a coupling guard.</li> <li>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>


	<b>⚠ DANGER</b>
	<b>Risk of ignition by frictional sparks</b> Explosion hazard! <ul style="list-style-type: none"> <li>Choose a coupling guard material that is non-sparking in the event of mechanical contact (see DIN EN 13463-1).</li> </ul>

- Re-install the coupling guard and the footboard for the coupling guard, if any.
- Check the distance between coupling and coupling guard.  
The coupling and coupling guard must not come into contact.


### 5.8 Electrical connection

	<b>⚠ DANGER</b>
	<b>Incorrect electrical installation</b> Explosion hazard! <ul style="list-style-type: none"> <li>For electrical installation, also observe the requirements of IEC 60079-14.</li> <li>Always use a motor protection switch for explosion-proof motors.</li> </ul>


	<b>⚠ DANGER</b>
	<b>Work on the pump set by unqualified personnel</b> Danger of death from electric shock! <ul style="list-style-type: none"> <li>Always have the electrical connections installed by a trained and qualified electrician.</li> <li>Observe regulations IEC 60364 and, for explosion-proof models, EN 60079.</li> </ul>

	<b>⚠ WARNING</b>
	<b>Incorrect connection to the mains</b> Damage to the mains network, short circuit! <ul style="list-style-type: none"> <li>Observe the technical specifications of the local energy supply companies.</li> </ul>

- Check the available mains voltage against the data on the motor name plate.
- Select an appropriate start-up method.

	<b>NOTE</b>
	A motor protection device is recommended.

#### 5.8.1 Setting the time relay



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

**Table 10:** Time relay settings for star-delta starting:


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




### 5.8.2 Earthing

 	<div style="background-color: #f06292; padding: 5px;"><b>⚠ DANGER</b></div> <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 foundation.</li> </ul>
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### 5.8.3 Connecting the motor


	<div style="background-color: #ffc107; padding: 5px;"><b>CAUTION</b></div> <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>
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	<div style="background-color: #007bff; color: white; padding: 5px;"><b>NOTE</b></div> <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>
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1. Match the motor's direction of rotation to that of the pump.
2. Observe the manufacturer's product literature supplied with the motor.

### 5.9 Checking the direction of rotation

 	<div style="background-color: #f06292; padding: 5px;"><b>⚠ DANGER</b></div> <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>
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	<div style="background-color: #ffc107; padding: 5px;"><b>⚠ WARNING</b></div> <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>
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	<div style="background-color: #ffc107; padding: 5px;"><b>CAUTION</b></div> <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>
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	<b>CAUTION</b>
	<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

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

Before starting up the pump set make sure that the following requirements are met:

- The pump set has been properly connected to the electric power supply and is equipped with all protection devices.
- The pump and the bearing bracket have been primed with the fluid to be handled. (⇒ Section 6.1.3 Page 35)
- The quench system, if any, has been filled with the quench liquid. (⇒ Section 6.1.2 Page 35)
- The direction of rotation has been checked. (⇒ Section 5.9 Page 33)
- All auxiliary connections required are connected and operational.
- The lubricants have been checked. (⇒ Section 7.2.3 Page 45)
- After prolonged shutdown of the pump (set), the activities described in (⇒ Section 6.4 Page 41) have been carried out.

#### 6.1.2 Quench liquid supply





##### Permissible quench liquids


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


For synthetic thermal oils, it is advisable to use a mineral oil based thermal fluid or a different mineral oil as the quench liquid.

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


#### 6.1.3 Priming and venting the pump


	<div style="background-color: #f4a460; padding: 5px;"><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>▷ Before starting up the pump, vent the suction line and the pump and prime them with the fluid to be handled.</li> </ul>
  	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Risk of potentially explosive atmosphere by mixing of incompatible fluids in the auxiliary piping</b> Risk of burns! Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Make sure that the barrier fluid and quench liquid are compatible with the fluid pumped.</li> </ul>
	<div style="background-color: #f4a460; padding: 5px;"><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>

	<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>
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	<p><b>NOTE</b></p> <p>In the run-in phase of the system, it is recommended to vent the pump repeatedly via the screw plug on the bearing bracket.</p>
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1. Remove screw plug 903.85 (connection 6D) to prime and vent the bearing housing.
2. Vent the pump and suction line and prime both with the fluid to be handled. The pump can be primed with the fluid handled from the system via the inlet line.
3. Fully open the shut-off element in the suction line.
4. Fully open all auxiliary feed lines (barrier fluid, flushing liquid, etc.), if any.
5. Open the shut-off element, if any, in the vacuum balance line and close the vacuum-tight shut-off element, if any. (⇒ Section 5.4.3 Page 26)


	<p><b>⚠ WARNING</b></p> <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>
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	<p><b>NOTE</b></p> <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>
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6. Close the vent hole (connection 6D.1) with screw plug 903.85.

#### 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 5.6 Page 29)
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.

	<p><b>NOTE</b></p> <p>The coupling alignment check must be repeated after the pump has reached operating temperature.</p>
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### 6.1.5 Start-up

	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <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! Leakage of hot or toxic fluids!</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>
	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <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>
	<div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <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>
	<ul style="list-style-type: none"> <li>✓ The system piping has been cleaned.</li> <li>✓ The pump, suction line and inlet tank, if any, have been vented and primed with the fluid to be handled.</li> <li>✓ The filling and venting lines have been closed.</li> </ul>
	<div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <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>
	<ol style="list-style-type: none"> <li>1. Fully open the shut-off element in the suction head/suction lift line.</li> <li>2. Close or slightly open the shut-off element in the discharge line.</li> <li>3. Start up the motor.</li> <li>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.</li> </ol>
	<div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <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>
	<ol style="list-style-type: none"> <li>5. Check the coupling alignment and re-align the coupling, if required.</li> </ol>

### 6.1.6 Checking the shaft seal

#### Mechanical seal

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



#### NOTE

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 should therefore also be replaced as a precaution. This is particularly important when the pump is handling synthetic heat transfer fluids.

### 6.1.7 Shutdown



#### CAUTION

##### Heat build-up inside the pump

Damage to the shaft seal!

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

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



#### NOTE

If the discharge line is equipped with a check valve, the shut-off element in the discharge line may remain open, provided the site's requirements and regulations are taken into account and observed.

For prolonged shutdown periods:

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




#### CAUTION

##### Risk of freezing during prolonged pump shutdown periods

Damage to the pump!

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

## 6.2 Operating limits



	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Non-compliance with operating limits for pressure, temperature, fluid handled and speed</b> Explosion hazard! Hot or toxic fluid could escape!</p> <ul style="list-style-type: none"> <li>▸ Comply with the operating data indicated 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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### 6.2.1 Ambient temperature


Observe the following parameters and values during operation:

**Table 11:** Permissible ambient temperatures

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

	<div style="background-color: #f4a460; padding: 5px;"><b>CAUTION</b></div> <p><b>Operation outside the permissible ambient temperature</b> Damage to the pump (set)!</p> <ul style="list-style-type: none"> <li>▸ Observe the specified limits for permissible ambient temperatures.</li> </ul>
	<div style="background-color: #0070c0; color: white; padding: 5px;"><b>NOTE</b></div> <p>After commissioning, increased temperatures may occur at grease-lubricated rolling element bearings due to the running-in process. The final bearing temperature is only reached after a certain period of operation (up to 48 hours depending on the conditions).</p>

### 6.2.2 Frequency of starts

	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Excessive surface temperature of the motor</b> Explosion hazard! Damage to the motor!</p> <ul style="list-style-type: none"> <li>▸ In case of explosion-proof motors, observe the frequency of starts specified in the manufacturer's product literature.</li> </ul>
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The frequency of starts is usually determined by the maximum temperature increase of the motor. This largely depends on the power reserves of the motor in steady-state operation and on the starting conditions (DOL, star-delta, 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 gate valve slightly open:

**Table 12:** Frequency of starts

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

**CAUTION****Re-starting while motor is still running down**

Damage to the pump (set)!

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

**6.2.3 Fluid handled****6.2.3.1 Flow rate****Table 13:** Flow rate

Temperature range (t)	Minimum flow rate	Maximum flow rate
-30 to +350 °C	≈ 25 % of Q <sub>Opt</sub>	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 14:** Key

Symbol	Description	Unit
c	Specific heat capacity	J/kg K
g	Gravitational constant	m/s <sup>2</sup>
H	Pump discharge head	m
T <sub>f</sub>	Fluid temperature	°C
T <sub>O</sub>	Temperature at the casing surface	°C
η	Pump efficiency at duty point	-
Δϑ	Temperature difference	K

**6.2.3.2 Density of the fluid handled**

The pump input power changes in proportion to the density of the fluid handled.

**CAUTION****Impermissibly high density of the fluid handled**

Motor overload!

- ▷ Observe the information on fluid density indicated in the data sheet.
- ▷ Make sure the motor has sufficient power reserves.

**6.2.3.3 Abrasive fluids**

Do not exceed the maximum permissible solids content specified in the data sheet. When the pump handles fluids containing abrasive substances, increased wear of the hydraulic system, plain bearing and shaft seal are to be expected. In this case, reduce the intervals commonly recommended for servicing and maintenance.

**6.2.4 Permissible speed****Table 15:** Permissible speed for pump control systems with continuously variable speed adjustment

n <sub>min</sub> [rpm]	n <sub>max</sub> [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 operation check run of the pump.
- 1. Start up the pump (set) regularly between once a month and once every three months for approximately five minutes during prolonged shutdown periods. 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 46) and the safety instructions for dismantling the pump have been observed. (⇒ Section 7.4.1 Page 46)
- 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 and discharge nozzles. It is advisable to close the pump nozzles (e.g. with plastic caps or similar).
- 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 (⇒ Section 3.3 Page 13) .



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.

Observe any additional instructions and information provided. (⇒ Section 3 Page 12)

### 6.4 Returning to service


For returning the pump to service observe the sections on commissioning/start-up and the operating limits.



In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇒ Section 7 Page 42)

	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <div style="padding: 5px;"> <b>Failure to re-install or re-activate protective devices</b>  Risk of personal injury from moving parts or escaping fluid! <ul style="list-style-type: none"> <li>▸ As soon as the work is complete, re-install and/or re-activate any safety-relevant and protective devices.</li> </ul> </div>
	<div style="background-color: #0072bc; color: white; padding: 5px;"><b>NOTE</b></div> <div style="padding: 5px;"> If the pump has been out of service for more than one year, replace all elastomer seals. </div>


## 7 Servicing/Maintenance


### 7.1 Safety regulations


	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Sparks produced during servicing work</b> Explosion hazard!</p> <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>
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 	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Improperly serviced pump set</b> Explosion hazard! Damage to the pump set!</p> <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>
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The operator ensures that all maintenance, inspection and installation work is performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.

	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Unintentional starting of pump set</b> Risk of injury by moving parts!</p> <ul style="list-style-type: none"> <li>▷ Make sure that the pump set cannot be started up unintentionally.</li> <li>▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.</li> </ul>
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	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Fluids and supplies posing a health hazard and/or hot fluids or supplies</b> Risk of injury!</p> <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>
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	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Insufficient stability</b> Risk of crushing hands and feet!</p> <ul style="list-style-type: none"> <li>▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tipping or falling over.</li> </ul>
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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.

	<div style="background-color: #0070c0; color: white; padding: 5px;"><b>NOTE</b></div> <p>All maintenance, service and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached "Addresses" booklet or on the Internet at "<a href="http://www.ksb.com/contact">www.ksb.com/contact</a>".</p>
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Never use force when dismantling and reassembling the pump set.

## 7.2


### 7.2.1 Supervision of operation


	<div style="background-color: #f4a460; padding: 5px;"><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 style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Incorrectly serviced shaft seal</b> Explosion hazard! Leakage of hot, toxic fluids! Damage to the pump set! Risk of burns! Fire hazard!</p> <ul style="list-style-type: none"> <li>▸ Regularly service the shaft seal.</li> </ul>
  	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Excessive temperatures as a result of bearings running hot or defective bearing seals</b> Explosion hazard! Fire hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▸ Regularly check the rolling element bearings for running noises.</li> </ul>
	<div style="background-color: #f4d03f; padding: 5px;"><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 style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <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.</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 seals 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 the 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.

	<b>NOTE</b>
	<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>

	<b>NOTE</b>
	<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>

- Monitor the temperature of the rolling element bearings.  
The bearing temperature must not exceed 90 °C (measured on the outside of the bearing bracket).

	<b>CAUTION</b>
	<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 never exceed 90 °C (measured on the outside of the bearing bracket).</li> </ul>

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

## 7.2.2

### 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 16:** 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 17:** 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**

We recommend using Petro-Canada Peerless LLG high-temperature grease or an equivalent product for lubrication. Under unfavourable operating conditions, e.g. high room temperature, high atmospheric humidity, dust-laden air, aggressive atmosphere etc., check the bearings earlier and, if required, clean and re-lubricate them, preferably with Petro-Canada Peerless LLG.


**7.2.3.2 Intervals**

Under normal operating conditions the grease-packed rolling element bearing will run for 15,000 operating hours. 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, consumables and supplies which are hot and/or pose a health hazard</b> Hazard to persons and the environment!</p> <ul style="list-style-type: none"> <li>▷ Collect and properly dispose of flushing fluid and any residues of the fluid handled.</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 auxiliary connections).
2. Always flush the pump 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.

### 7.4 Dismantling the pump set

#### 7.4.1 General information/Safety regulations


	<b>⚠ WARNING</b>
	<p><b>Unqualified personnel performing work on the pump (set)</b> Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Always have repair and maintenance work performed by specially trained, qualified personnel.</li> </ul>
	<b>⚠ WARNING</b>
	<p><b>Hot surface</b> Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Allow the pump set to cool down to ambient temperature.</li> </ul>
	<b>⚠ WARNING</b>
	<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>


Observe the general safety instructions and information. (⇒ Section 7.1 Page 42)


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 case of damage you can always contact our service staff.

	<b>NOTE</b>
<p>All maintenance, service and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached "Addresses" booklet or on the Internet at "<a href="http://www.ksb.com/contact">www.ksb.com/contact</a>".</p>	


	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Insufficient preparation of work on the pump (set)</b> Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Properly shut down the pump set. (⇒ Section 6.1.7 Page 38)</li> <li>▷ Close the shut-off elements in suction and discharge line.</li> <li>▷ Drain the pump and release the pump pressure. (⇒ Section 7.3 Page 46)</li> <li>▷ Close any auxiliary connections.</li> <li>▷ Allow the pump set to cool down to ambient temperature.</li> </ul>
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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 46) to (⇒ Section 7.4.3 Page 47) 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 tipping over</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 tipping over.
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.

	<p><b>⚠ WARNING</b></p> <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 46) to (⇒ Section 7.4.4 Page 47) 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 Removing the shaft seal

##### 7.4.6.1 Removing the shaft assembly from the bearing bracket — all bearing bracket sizes

- ✓ The notes and steps stated in (⇒ Section 7.4.1 Page 46) to (⇒ Section 7.4.5 Page 48) have been observed/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.

	<p><b>⚠ WARNING</b></p> <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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3. Remove and dispose of joint ring 411.15.
4. Remove bearing cover 360.
5. Remove circlip 932.02.
6. Press shaft 210 out of bearing bracket 330.

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

- ✓ The notes and steps stated in (⇒ Section 7.4.1 Page 46) to (⇒ Section 7.4.6.1 Page 48) have been observed/carried out.
1. Remove circlip 932.80 and support disc 550.21.
  2. Pull bearing 321 off shaft 210.
  3. Remove support disc 550.90 and mating ring carrier 476.
  4. Press the mating ring of mechanical seal 433 out of mating ring carrier 476.



5. Remove the rotating assembly of mechanical seal 433 (primary ring) from shaft 210.

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

- ✓ The notes and steps stated in (⇒ Section 7.4.1 Page 46) to (⇒ Section 7.4.6.1 Page 48) have been observed/carried out.
1. Remove circlip 932.17 and support disc 550.53.
  2. Remove the rotating assembly of mechanical seal 433 (primary ring) from shaft 210.
  3. Remove mating ring carrier 476.
  4. Press the mating ring of mechanical seal 433 out of mating ring carrier 476.

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

- ✓ The notes and steps stated in (⇒ Section 7.4.1 Page 46) to (⇒ Section 7.4.6.1 Page 48) have been observed/carried out.
1. Remove circlip 932.80 and support disc 550.21.
  2. Pull bearing 321 off shaft 210.
  3. Remove support disc 550.90 and mating ring carrier 476.02.
  4. Press the mating ring of mechanical seal 433.02 out of mating ring carrier 476.02.
  5. Remove spacer sleeve 525.
  6. Remove the rotating assembly of mechanical seal 433.02 (primary ring) from shaft 210.
  7. Remove circlip 932.54 and support disc 550.54.
  8. Remove mating ring carrier 476.01.
  9. Press the mating ring of mechanical seal 433.01 out of mating ring carrier 476.01.
  10. Remove the rotating assembly of mechanical seal 433.01 (primary ring) from shaft 210.

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

- ✓ The notes and steps stated in (⇒ Section 7.4.1 Page 46) to (⇒ Section 7.4.6.1 Page 48) have been observed/carried out.
1. Remove circlip 932.17 and support disc 550.53.
  2. Remove the rotating assembly of mechanical seal 433.01 (primary ring) from shaft 210.
  3. Remove mating ring carrier 476.01.
  4. Press the mating ring of mechanical seal 433.01 out of mating ring carrier 476.01.
  5. Remove spacer sleeve 525.
  6. Remove circlip 932.54 and support disc 550.54.
  7. Remove the rotating assembly of mechanical seal 433.02 (primary ring) from shaft 210.
  8. Remove mating ring carrier 476.02.
  9. Press the mating ring of mechanical seal 433.02 out of mating ring carrier 476.02.

### 7.4.7 Removing the plain bearing

#### Removing the carbon bearing



- ✓ The notes and steps stated in (⇒ Section 7.4.1 Page 46) to (⇒ Section 7.4.6.1 Page 48) 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 46) to (⇒ Section 7.4.6.1 Page 48) 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

### 7.5.1 General information/Safety regulations

	<p><b>⚠ WARNING</b></p> <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>
	<p><b>CAUTION</b></p> <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>

<b>Sequence</b>	Always reassemble the pump in accordance with the corresponding general assembly drawing or exploded view.
<b>Seal elements</b>	<p>Check O-rings for any damage and replace by new O-rings, if required.</p> <p>Always use new gaskets, making sure that they have the same thickness as the old ones.</p> <p>Always fit gaskets of asbestos-free materials or graphite without using lubricants (e.g. copper grease, graphite paste).</p>
<b>Assembly adhesives</b>	<p>Avoid the use of assembly adhesives, if possible.</p> <p>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).</p> <p>Only apply adhesive at selected points and in thin layers.</p> <p>Never use quick-setting adhesives (cyanoacrylate adhesives).</p> <p>Coat the locating surfaces of the individual components with graphite or similar before reassembly.</p>
<b>Tightening torques</b>	For reassembly, tighten all screws and bolts as specified in this manual.

### 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.

#### Installing the mechanical seal

##### 7.5.3 Installing the shaft 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: yellow; 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 water 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 in mating ring carrier 476.
2. Carefully insert the mating ring of mechanical seal 433 into mating ring carrier 476.  
Make sure to apply pressure evenly.
3. For WE 35: fit circlip 932.17 and support disc 550.53.
4. Slide the rotating assembly of the mechanical seal (primary ring) onto shaft 210.
5. Fit mating ring carrier 476 together with O-ring 412.55.
6. Fit support disc 550.90.
7. Press radial ball bearing 321 onto the shaft and secure it with support disc 550.21 and circlip 932.80.

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

1. Clean the mating ring location in mating ring carrier 476.
2. Carefully insert the mating ring of mechanical seal 433 into mating ring carrier 476.  
Make sure to apply pressure evenly.

3. Fit mating ring carrier 476 together with O-ring 412.55.
4. Slide the rotating assembly of the mechanical seal (primary ring) onto shaft 210.
5. Fit support disc 550.53 and circlip 932.17.

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

1. Clean the mating ring location of mating ring carriers 476.01 and 476.02.
2. Insert the mating rings of mechanical seals 433.01 and 433.02 into mating ring carriers 476.01 and 476.02.  
Make sure to apply pressure evenly.
3. For WE 35: fit circlip 932.17 and support disc 550.53.
4. Slide the rotating assembly of mechanical seal 433.01 (primary ring) onto shaft 210.
5. Fit mating ring carrier 476.01 with O-ring 412.52.
6. Fit circlip 932.54 and support disc 550.54.
7. Slide the rotating assembly of mechanical seal 433.02 (primary ring) onto shaft 210.
8. Fit spacer sleeve 525.
9. Fit mating ring carrier 476.02 together with O-ring 412.55.
10. Fit support disc 550.90.
11. Press radial ball bearing 321 onto the shaft and secure it with support disc 550.21 and circlip 932.80.

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

1. Clean the mating ring location of mating ring carriers 476.01 and 476.02.
2. Insert the mating rings of mechanical seals 433.01 and 433.02 into mating ring carriers 476.01 and 476.02.  
Make sure to apply pressure evenly.
3. Fit mating ring carrier 476.02 together with O-ring 412.55.
4. Slide the rotating assembly of mechanical seal 433.02 (primary ring) onto shaft 210.
5. Fit circlip 932.54 and support disc 550.54.
6. Fit spacer sleeve 525 with mating ring carrier 476.01 and O-ring 412.52.
7. Slide the rotating assembly of mechanical seal 433.01 (primary ring) onto shaft 210.
8. Fit circlip 932.17 and support disc 550.53.

#### **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.

#### **7.5.4 Fitting the impeller**

- ✓ The notes and steps stated in (⇒ Section 7.5.1 Page 50) to (⇒ Section 7.5.3 Page 51) 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>5)</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 back pull-out unit

	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Back pull-out unit tipping over</b> Risk of crushing hands and feet!</p> <p>▷ Suspend or support the bearing bracket at the pump end.</p>
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- ✓ The notes and steps stated in (⇒ Section 7.5.1 Page 50) to (⇒ Section 7.5.4 Page 52) 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 tipping over 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.

#### 7.5.6 Mounting the motor

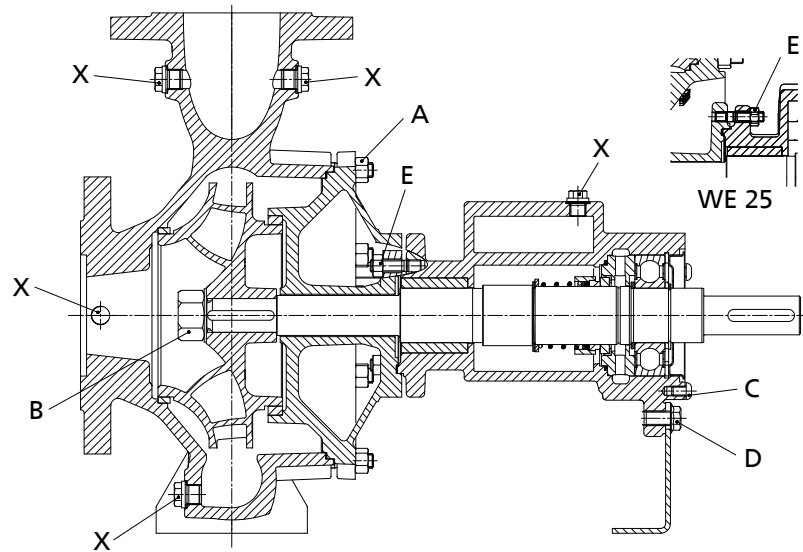
	<div style="background-color: #0072bc; color: white; padding: 5px;"><b>NOTE</b></div> <p>Steps 1 and 2 do not apply to versions with spacer-type coupling.</p>
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- 1. Shift the motor to connect it to the pump via the coupling.
- 2. Fasten the motor to the baseplate.
- 3. Align pump and motor. (⇒ Section 5.7 Page 30)
- 4. Connect the motor to the power supply (refer to manufacturer's product literature).

<sup>5)</sup> If any

## 7.6 Tightening torques

### 7.6.1 Tightening torques for the pump

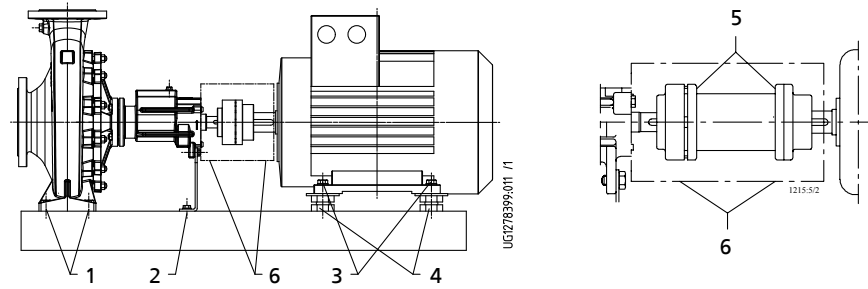


**Fig. 20:** Tightening points at the pump

**Table 18:** Tightening torques for bolted/screwed connections at the pump

Location	Thread	Nominal value [Nm]
A	M12	55
	M16	130
B	M12 x 1,5	55
	M24 x 1,5	130
	M30 x 1,5	170
C	M8	20
	M10	38
D	M12	90
	M16	130
E	M8	20
	M10	38
X	1/4	55
	3/8	80
	1/2	130

### 7.6.2 Tightening torques for the pump set



**Fig. 21:** Tightening points at the pump set

**Table 19:** Tightening points at the pump set

Position	Thread	Rated torque [Nm]	Comments
1	M12	30	Pump on baseplate
	M16	75	
	M20	75	
2	M12	30	Adjusting screws in baseplate
3	M24 x 1,5	140	
	M36 x 1,5	140	
4	M6	10	Motor on baseplate or motor on adjusting screws or shims
	M8	10	
	M10	15	
	M12	30	
	M16	75	
	M20	140	
5	M6	13	Coupling (only for spacer-type coupling made by Flender)
	M8	18	
	M10	44	
6	M6	10	Coupling guard

## 7.7

### 7.7.1 Ordering spare parts

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

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

Refer to the name plate for all data.

Also specify the following data:

- Part No. and description (⇒ Section 9.1 Page 60)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

### 7.7.2 Recommended spare parts stock for 2 years' operation to DIN 24296

**Table 20:** Quantity of spare parts for recommended spare parts stock

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
210	Shaft	1	1	1	2	2	2	20 %
230	Impeller	1	1	1	2	2	2	20 %
310	Plain bearing	2	3	4	5	7	9	100 %
321	Radial ball bearing	1	1	2	2	2	3	25 %
330	Bearing bracket <sup>6)</sup>	-	-	-	-	-	1	2
433	Mechanical seal <sup>7)</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	O-ring <sup>8)</sup>	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 21:** Interchangeability of pump components

Etanorm SYT	Bearing bracket	Description										
		Casing cover	Support foot	Shaft	Impeller	Plain bearing	Deep groove ball bearing	Bearing bracket	Mechanical seal <sup>9)</sup>	Mating ring carrier	Casing wear ring, suction side	Casing wear ring, discharge side
		Part No.										
		161	183	210	230	310	321	330	433	476	502.01	502.02
040-025-160	WS_25_LS	1	2	1	O	1	1	1	1	1	10	X
040-025-200	WS_25_LS	2	3	1	O	1	1	1	1	1	10	3
050-032-125.1	WS_25_LS	1	1	1	O	1	1	1	1	1	1	X
050-032-160.1	WS_25_LS	1	2	1	O	1	1	1	1	1	1	X
050-032-200.1	WS_25_LS	2	3	1	O	1	1	1	1	1	1	3
050-032-160	WS_25_LS	1	2	1	O	1	1	1	1	1	11	X
050-032-200	WS_25_LS	2	3	1	O	1	1	1	1	1	11	3
050-032-250	WS_25_LS	3	4	1	O	1	1	1	1	1	11	10
065-040-160	WS_25_LS	1	2	1	O	1	1	1	1	1	12	3
065-040-200	WS_25_LS	2	3	1	O	1	1	1	1	1	12	3
065-040-250	WS_25_LS	3	4	1	O	1	1	1	1	1	2	10
065-040-315	WS_35_LS	7	7	2	O	2	2	2	2	2	2	13

<sup>6)</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 412.55, mechanical seal 433, mating ring carrier 476, disc 550.21/.53/.90, stud 902.15, screw plug 903.85, pan head screw 914, hexagon nut 920.15/.95, spring washer 930.95, circlip 932.02/.17/.80, key 940.01/.02

<sup>7)</sup> For double mechanical seals double the quantity.

<sup>8)</sup> For double mechanical seal: parts 412.52 and 412.55

<sup>9)</sup> Single mechanical seal 433 not interchangeable with double mechanical seal 433.01/.02




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

Table 22: Key to the symbols

Symbol	Description
O	Components differ
X	Component not fitted

<sup>9)</sup> Single mechanical seal 433 not interchangeable with double mechanical seal 433.01/02

## 8 Trouble-shooting

	<div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Improper work to remedy faults</b> Risk of injury!</p> <p>► For any work to remedy faults observe the relevant information in this manual or in the relevant accessory manufacturer's documentation.</p>
-----------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

If problems occur that are not described in the following table, consultation with KSB's customer 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 23:** Trouble-shooting

A	B	C	D	E	F	G	H	Possible cause	Remedy <sup>10)</sup>
X	-	-	-	-	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point. Check system for impurities. Fit a larger impeller. <sup>11)</sup> Increase the speed (turbine, I.C. engine).
X	-	-	-	-	-	X	X	Pump or piping are not completely vented or primed.	Vent and/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>11)</sup>
-	X	-	-	-	-	-	-	Density or viscosity of fluid handled higher than stated in purchase order	Contact KSB.
-	X	X	-	-	-	-	-	Speed is too high.	Reduce speed. <sup>11)</sup>
-	-	-	-	X	-	-	-	Defective gasket	Fit new gasket between volute casing and discharge cover or between discharge cover and bearing bracket.

<sup>10)</sup> Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

<sup>11)</sup> Contact KSB.

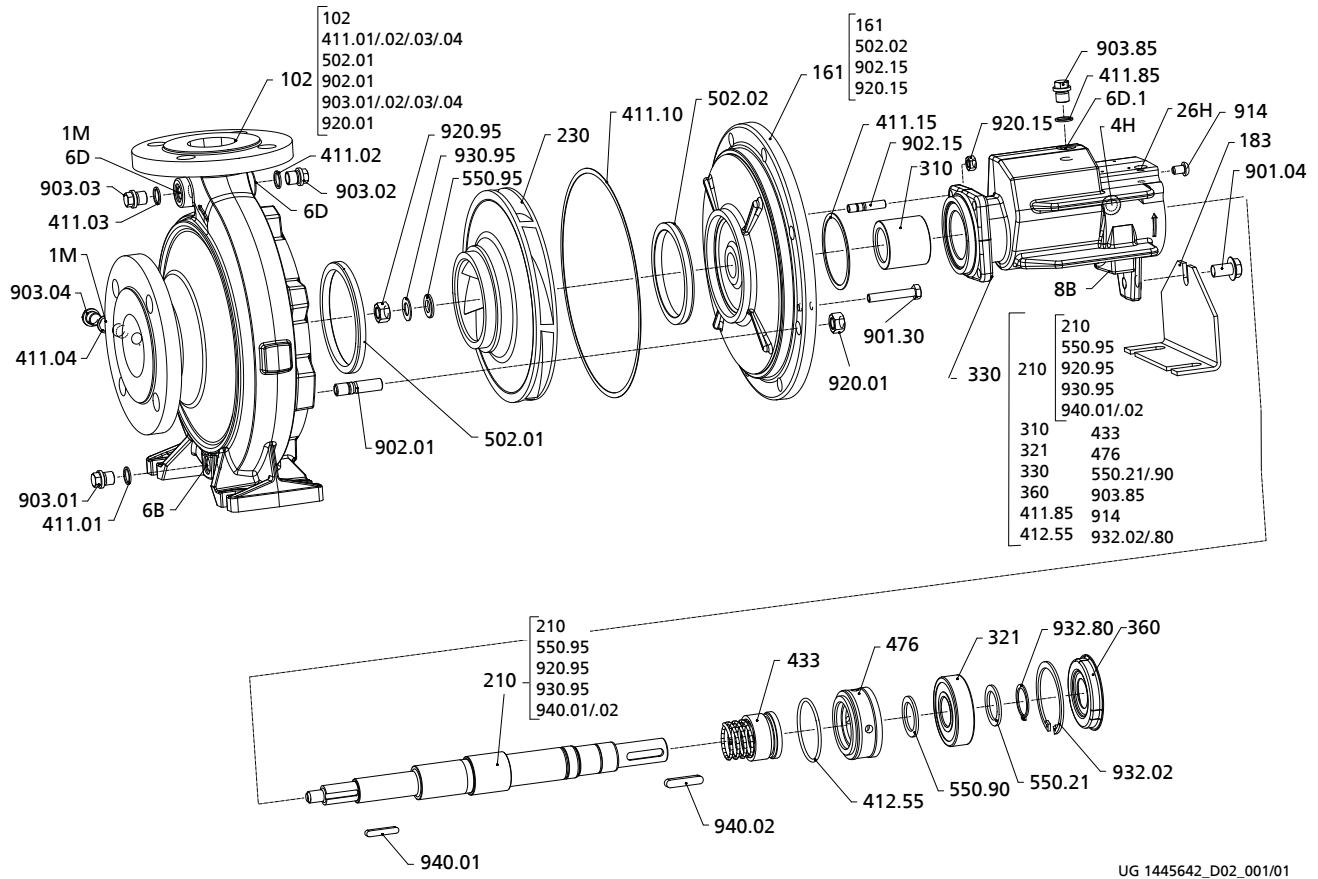
A	B	C	D	E	F	G	H	Possible cause	Remedy <sup>10)</sup>
-	-	-	-	X	-	-	-	Gasket not pre-loaded sufficiently	Increase pre-loading of gasket at operating temperature: 1. Close the valves on the discharge and suction side. 2. Allow the pump set to cool down to a temperature below the boiling point of the fluid handled. 3. Re-tighten hexagon nuts 920.1 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 suction conditions. Re-align the pump set. Re-balance the impeller. Increase pressure at the pump suction nozzle.
-	-	-	X	-	X	X	-	Pump set is misaligned.	Re-align pump set.
-	-	-	X	-	X	X	-	Pump is warped or sympathetic vibrations in the piping.	Check the piping connections and secure fixing of pump; if required, reduce distances between the pipe clamps. Fix the pipelines using anti-vibration material.
-	-	-	X	-	-	-	-	Increased axial thrust <sup>11)</sup>	Clean balancing holes in the impeller. Replace the casing wear rings.
-	-	-	X	-	-	-	-	Non-compliance with specified coupling distance	Correct the distance according to general arrangement drawing.
X	X	-	-	-	-	-	-	Motor is running on two phases only.	Replace the defective fuse. Check the electric cable connections.
-	-	-	-	-	-	X	-	Rotor out of balance	Clean the impeller. Re-balance the impeller.
-	-	-	-	-	-	X	-	Defective bearing(s)	Replace.
-	-	-	X	-	-	X	X	Flow rate is too low.	Increase the minimum flow rate.

<sup>10)</sup> Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

## 9 Related Documents

### 9.1 Exploded views and lists of components

#### 9.1.1 Etanorm SYT, bearing bracket WS\_25\_LS



UG 1445642\_D02\_001/01

**Fig. 22:** Exploded view of an Etanorm SYT, bearing bracket WS\_25\_LS

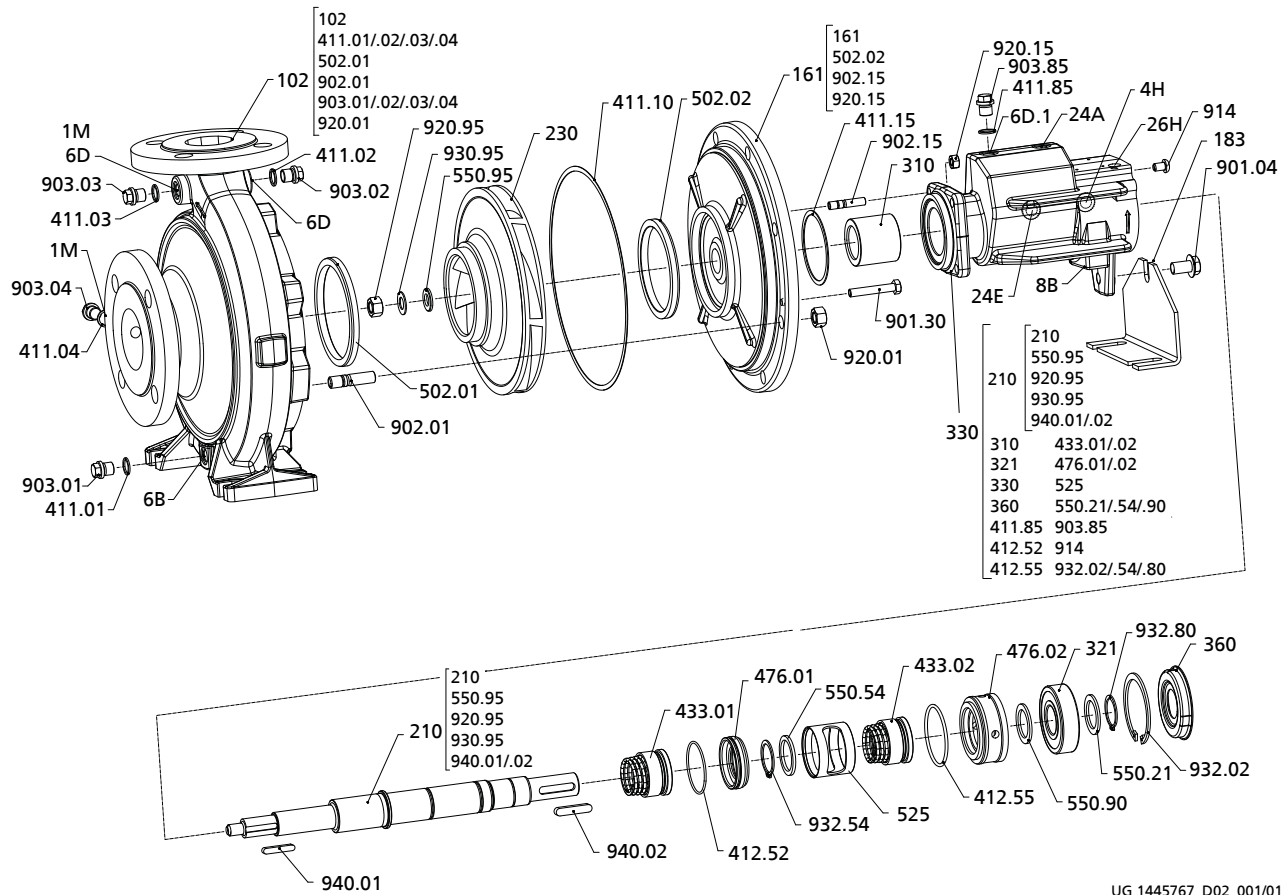
**Table 24:** List of components

Part No.	Description	Part No.	Description
102	Volute casing	902.01/.15	Stud
161	Casing cover	903.01/.02/.03/.04/.85	Screw plug
183	Support foot	914	Pan head screw
210	Shaft	920.01/.15/.95	Nut
230	Impeller	930.95	Spring washer
310	Plain bearing	932.02/.80	Circlip
321	Radial ball bearing	940.01/.02	Key
330	Bearing bracket		
360	Bearing cover	<b>Connections</b>	
411.01/.02/.03/.04/.10/.15/.85	Joint ring	1M	Pressure gauge connection
412.55	O-ring	4H	Connection for temperature measurement
433	Mechanical seal	6B	Fluid drain
476	Mating ring carrier	6D, 6D.1	Fluid priming and venting
502.01/.02 <sup>12)</sup>	Casing wear ring	8B	Leakage drain

<sup>12)</sup> 502.02 not fitted on sizes 040-025-160, 050-032-125.1, 050-032-160.1, 050-032-160

Part No.	Description	Part No.	Description
550.21/.90/.95	Disc	26H	Connection for shock pulse measurement
901.04/.30	Hexagon head bolt		

### 9.1.2 Etanorm SYT; bearing bracket WS\_25\_LS with double mechanical seal



UG 1445767\_D02\_001/01

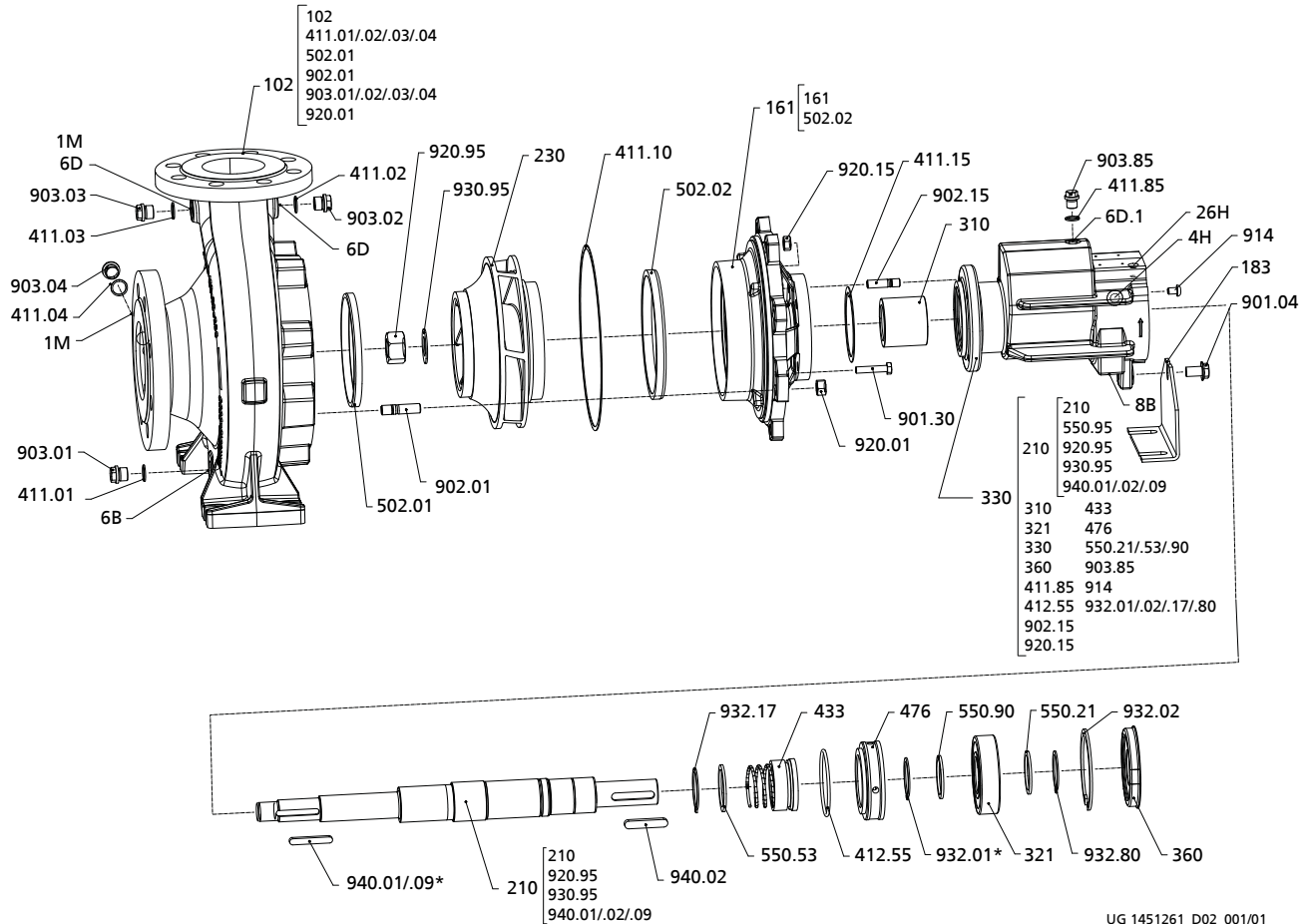
**Fig. 23:** Exploded view of an Etanorm SYT; bearing bracket WS\_25\_LS with double mechanical seal

**Table 25:** List of components

Part No.	Description	Part No.	Description
102	Volute casing	902.01/.15	Stud
161	Casing cover	903.01/.02/.03/.04/.85	Screw plug
183	Support foot	914	Pan head screw
210	Shaft	920.01/.15/.95	Nut
230	Impeller	930.95	Spring washer
310	Plain bearing	932.02/.54/.80	Circlip
321	Radial ball bearing	940.01/.02	Key
330	Bearing bracket		
360	Bearing cover		
411.01/.02/.03/.04/.10/.15/.85	Joint ring	<b>Connections</b>	
412.52/.55	O-ring	1M	Pressure gauge connection
433.01/.02	Mechanical seal	4H	Connection for temperature measurement
476.01/.02	Mating ring carrier	6B	Fluid drain
502.01/.02 <sup>13)</sup>	Casing wear ring	6D, 6D.1	Fluid priming and venting
525	Spacer sleeve	8B	Leakage drain
550.21/.54/.90/.95	Disc	24A	Quench liquid outlet
901.04/.30	Hexagon head bolt	24E	Quench liquid inlet
		26H	Connection for shock pulse measurement

<sup>13)</sup> 502.02 not fitted on sizes 040-025-160, 050-032-125.1, 050-032-160.1, 050-032-160

### 9.1.3 Etanorm SYT, bearing brackets WS\_35\_LS / WS\_55\_LS



**Fig. 24:** Exploded view of an Etanorm SYT, bearing brackets WS\_35\_LS / WS\_55\_LS

\* For WS55 only

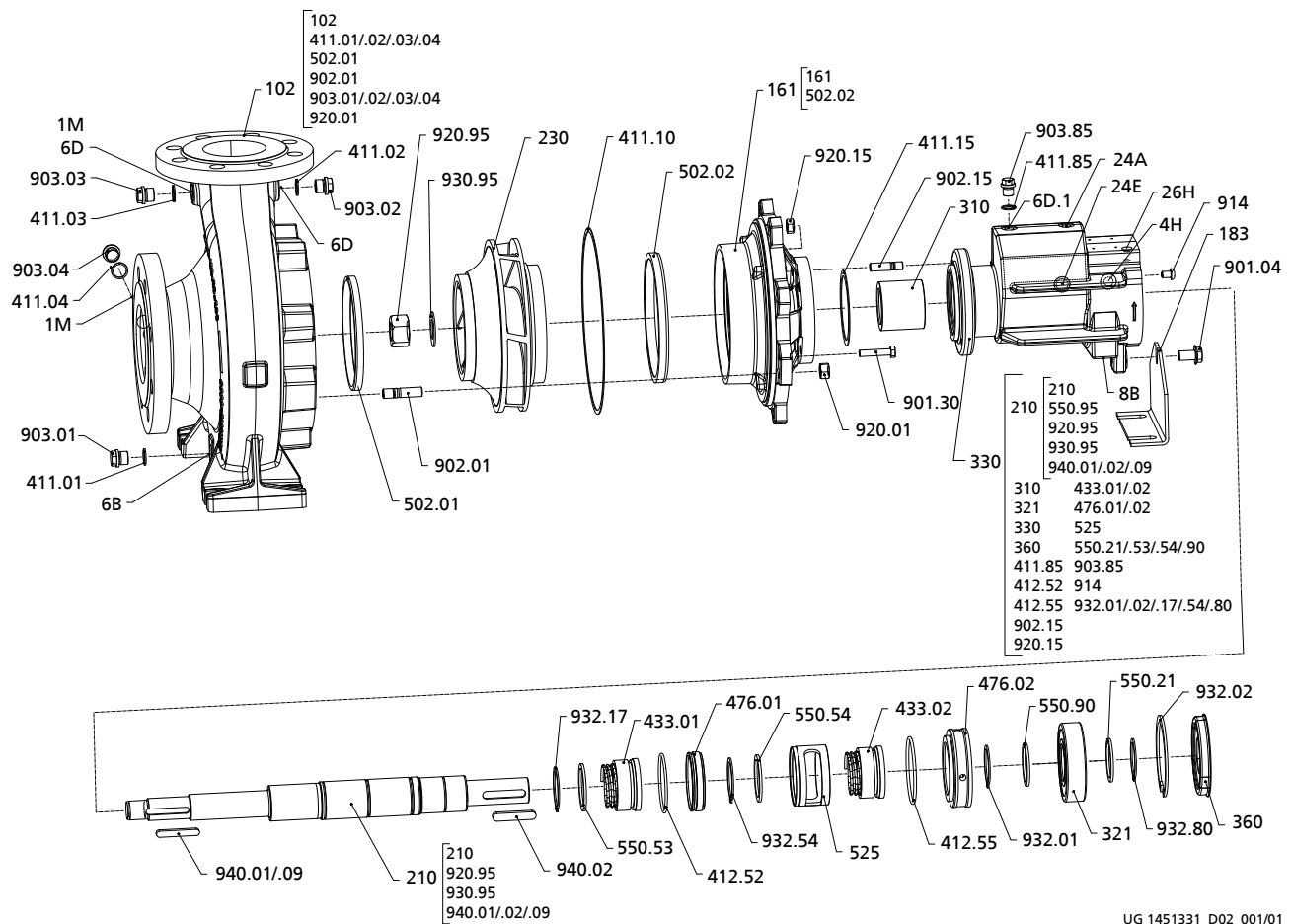
**Table 26:** List of components

Part No.	Description	Part No.	Description
102	Volute casing	902.01/.15	Stud
161	Casing cover	903.01/.02/.03/.04/.85	Screw plug
183	Support foot	914	Pan head screw
210	Shaft	920.01/.15/.95	Nut
230	Impeller	930.95	Spring washer
310	Plain bearing	932.01 <sup>14)</sup> /.02/.17/.80	Circlip
321	Radial ball bearing	940.01/.02/.09 <sup>15)</sup>	Key
330	Bearing bracket		
360	Bearing cover	<b>Connections</b>	
411.01/.02/.03/.04/.10/.15/.85	Joint ring	1M	Pressure gauge connection
412.55	O-ring	4H	Connection for temperature measurement
433	Mechanical seal	6B	Fluid drain
476	Mating ring carrier	6D, 6D.1	Fluid priming and venting
502.01/.02	Casing wear ring	8B	Leakage drain
550.21/.53/.90	Disc	26H	Connection for shock pulse measurement
901.04/.30	Hexagon head bolt		

<sup>14)</sup> 932.01 for bearing bracket WS\_55\_LS only

<sup>15)</sup> 940.09 for bearing bracket WS\_55\_LS only

### 9.1.4 Etanorm SYT, bearing brackets WS\_35\_LS / WS\_55\_LS with double mechanical seal



UG 1451331\_D02\_001/01

**Fig. 25:** Exploded view of an Etanorm SYT, bearing brackets WS\_35\_LS / WS\_55\_LS with double mechanical seal

**Table 27:** List of components

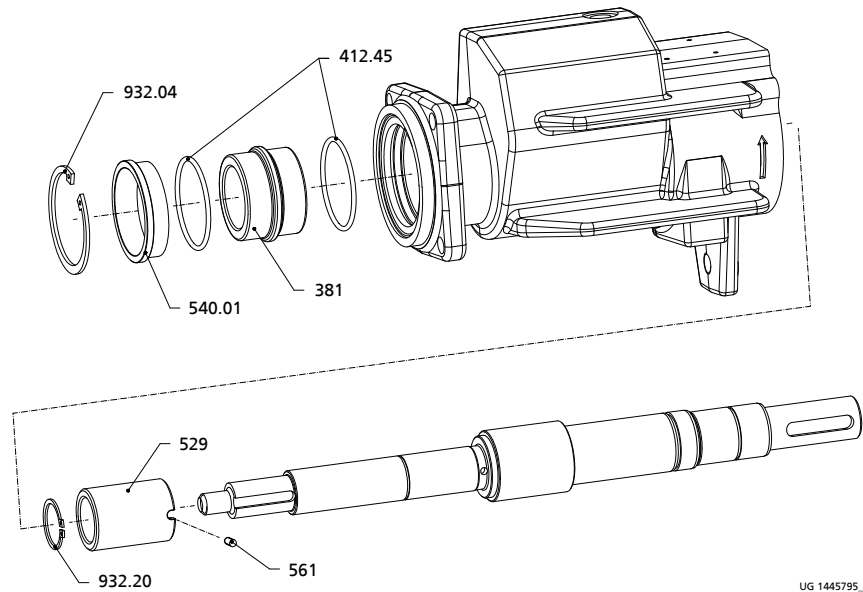
Part No.	Description	Part No.	Description
102	Volute casing	902.01/.15	Stud
161	Casing cover	903.01/.02/.03/.04/.85	Screw plug
183	Support foot	914	Pan head screw
210	Shaft	920.01/.15/.95	Nut
230	Impeller	930.95	Spring washer
310	Plain bearing	932.01 <sup>16)</sup> /.02/.17/.54/.80	Circlip
321	Radial ball bearing	940.01/.02/.09 <sup>17)</sup>	Key
330	Bearing bracket		
360	Bearing cover		
411.01/.02/.03/.04/.10/.15/.85	Joint ring	<b>Connections</b>	
412.52/.55	O-ring	1M	Pressure gauge connection
433.01/.02	Mechanical seal	4H	Connection for temperature measurement
476.01/.02	Mating ring carrier	6B	Fluid drain
502.01/.02	Casing wear ring	6D, 6D.1	Fluid priming and venting
525	Spacer sleeve	8B	Leakage drain
550.21/.53/.54/.90	Disc	24A	Quench liquid outlet
901.04/.30	Hexagon head bolt	24E	Quench liquid inlet
		26H	Connection for shock pulse measurement

<sup>16)</sup> 932.01 for bearing bracket WS\_55\_LS only

<sup>17)</sup> 940.09 for bearing bracket WS\_55\_LS only



### 9.1.5 Etanorm SYT, bearing brackets WS\_25\_LS / WS\_55\_LS with SiC plain bearing



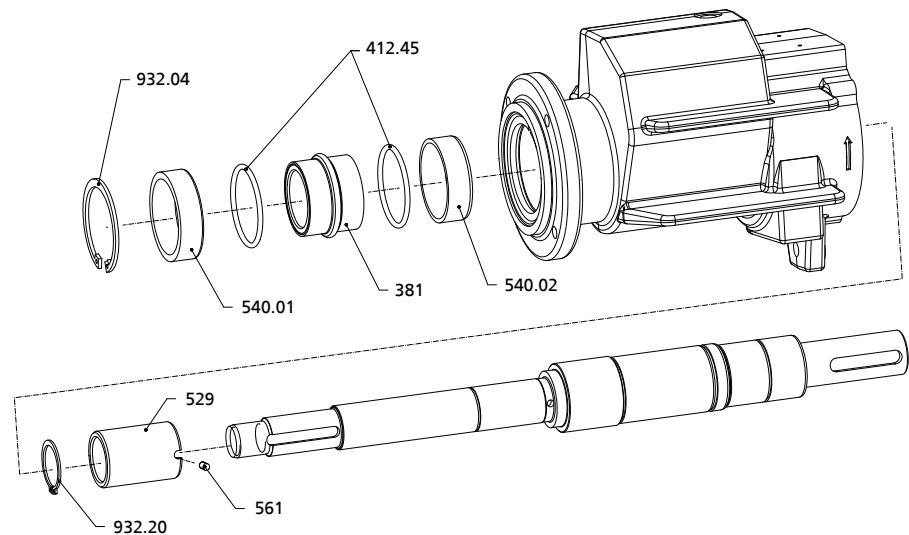
UG 1445795\_D02\_001/01

**Fig. 26:** Exploded view of an Etanorm SYT, bearing brackets WS\_25\_LS / WS\_55\_LS with SiC plain bearing

**Table 28:** List of components

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

### 9.1.6 Etanorm SYT, bearing bracket WS\_35\_LS with SiC plain bearing



UG 1451348\_D02\_001/01

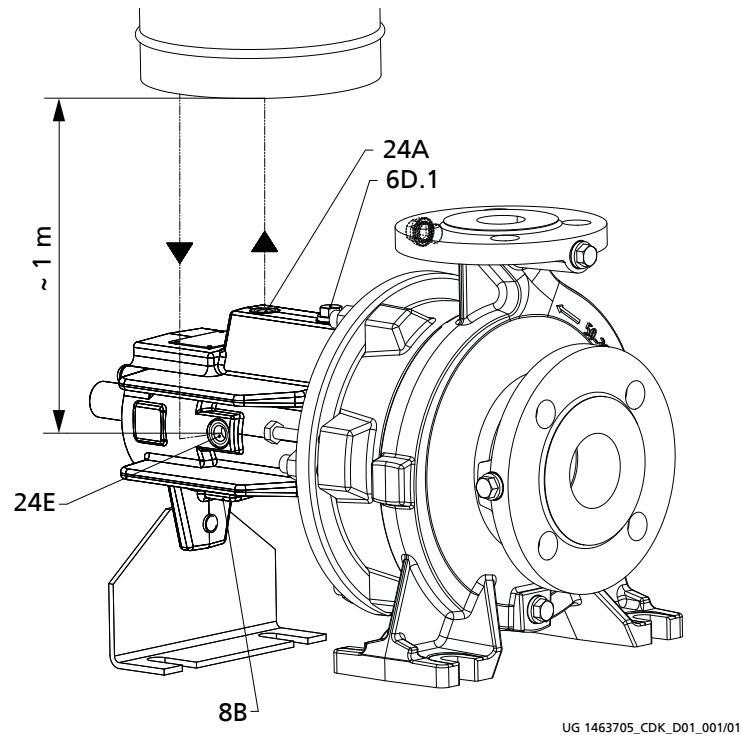
**Fig. 27:** Exploded view of an Etanorm SYT, bearing bracket WS\_35\_LS with SiC plain bearing

**Table 29:** List of components

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

## 9.2 Examples of mechanical seal connections

### 9.2.1 Auxiliary connections for double mechanical seal

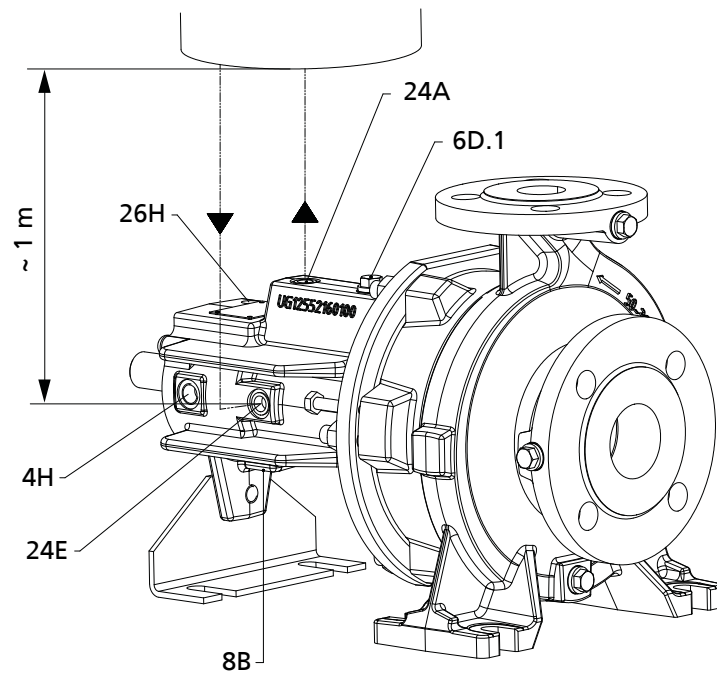


**Fig. 28:** Auxiliary connections for double mechanical seal

**Table 30:** Overview

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

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



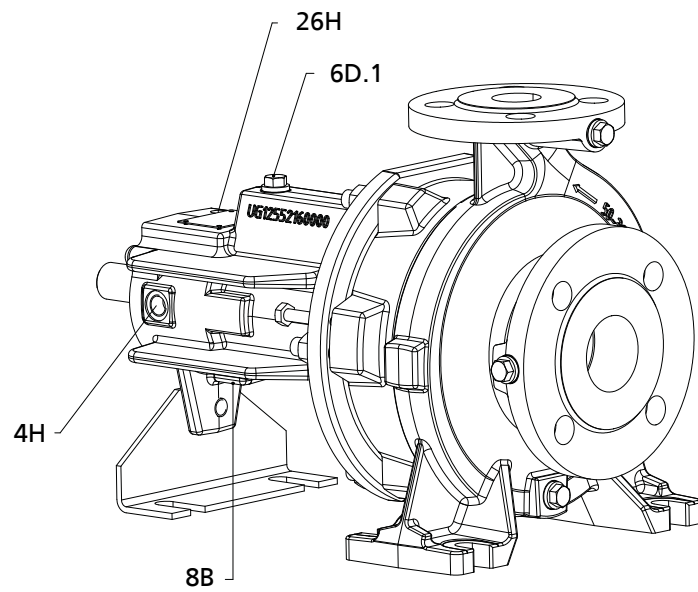
UG 1463705\_CDK\_D01\_002/01

**Fig. 29:** Auxiliary connections for double mechanical seal and monitoring equipment

**Table 31:** Overview

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

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



UG 1501785\_ZDK\_002/01

**Fig. 30:** Auxiliary connections for single mechanical seal and monitoring equipment

**Table 32:** Overview

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

## 10 EC Declaration of Conformity

Manufacturer: **KSB Aktiengesellschaft**  
**Johann-Klein-Straße 9**  
**67227 Frankenthal (Germany)**

The manufacturer herewith declares that the product:

**Etabloc, Etabloc SYT, Etaline, Etaline SYT, Etaline Z,  
Etachrom NC, Etachrom BC, Etanorm, Etanorm SYT,  
Etanorm GPV/CPV, Etaprime L, Etaprime B/BN, Vitachrom**

KSB order number: .....

- is in conformity with the provisions of the following Directives as amended from time to time:
  - Pump (set): Machinery Directive 2006/42/EC

The manufacturer also declares that

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

Person authorised to compile the technical file:

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

The EC Declaration of Conformity was issued in/on:

Place, date

.....<sup>18)</sup>.....

Name  
Function  
Company  
Address

---

<sup>18)</sup> A signed, legally binding declaration of conformity is supplied with the product.

## 11 Certificate of Decontamination

Type: .....  
Order number/ .....  
Order item number<sup>19)</sup>: .....

Delivery date: .....

Field of application: .....

Fluid handled<sup>19)</sup>: .....

Please tick where applicable<sup>19)</sup>:



☐ Radioactive



☐ Explosive



☐ Corrosive



☐ Toxic



☐ Harmful



☐ Bio-hazardous



☐ Highly flammable



☐ Safe

Reason for return<sup>19)</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, biological and radioactive substances.

For seal-less pumps, the rotor has been removed from the pump for cleaning. 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 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>19)</sup> Required fields

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**KSB Aktiengesellschaft**

67225 Frankenthal • Johann-Klein-Str. 9 • 67227 Frankenthal (Germany)

Tel. +49 6233 86-0 • Fax +49 6233 86-3401

[www.ksb.com](http://www.ksb.com)