

Dry-installed Close-Coupled Pump

KWP-Bloc

Installation/Operating Manual



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Installation/Operating Manual KWP-Bloc

Original operating manual

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Contents

| | | |
|----------|--|-----------|
| | Glossary | 5 |
| 1 | General..... | 6 |
| | 1.1 Principles | 6 |
| | 1.2 Installation of partly completed machinery..... | 6 |
| | 1.3 Target group..... | 6 |
| | 1.4 Other applicable documents..... | 6 |
| | 1.5 Symbols | 6 |
| | 1.6 Key to safety symbols/markings..... | 7 |
| 2 | Safety | 8 |
| | 2.1 General..... | 8 |
| | 2.2 Intended use | 8 |
| | 2.3 Personnel qualification and training..... | 9 |
| | 2.4 Consequences and risks caused by non-compliance with this manual | 9 |
| | 2.5 Safety awareness | 9 |
| | 2.6 Safety information for the operator/user | 9 |
| | 2.7 Safety information for maintenance, inspection and installation | 10 |
| | 2.8 Unauthorised modes of operation | 10 |
| | 2.9 Explosion protection | 10 |
| | 2.9.1 Marking | 10 |
| | 2.9.2 Temperature limits..... | 11 |
| | 2.9.3 Monitoring equipment..... | 12 |
| | 2.9.4 Operating limits | 12 |
| 3 | Transport/Storage/Disposal | 13 |
| | 3.1 Checking the condition upon delivery | 13 |
| | 3.2 Transport..... | 13 |
| | 3.3 Storage/preservation | 13 |
| | 3.4 Return to supplier..... | 14 |
| | 3.5 Disposal | 14 |
| 4 | Description of the Pump (Set) | 15 |
| | 4.1 General description | 15 |
| | 4.2 Product information as per Regulation No. 1907/2006 (REACH)..... | 15 |
| | 4.3 Designation..... | 15 |
| | 4.4 Name plate..... | 16 |
| | 4.5 Design details..... | 16 |
| | 4.6 Materials | 18 |
| | 4.7 Configuration and function..... | 19 |
| | 4.8 Noise characteristics | 20 |
| | 4.9 Scope of supply..... | 20 |
| | 4.10 Dimensions and weights | 20 |
| 5 | Installation at Site | 21 |
| | 5.1 Checks to be carried out prior to installation..... | 21 |
| | 5.2 Installing the pump set | 21 |
| | 5.3 Piping | 22 |
| | 5.3.1 Connecting the piping..... | 22 |
| | 5.3.2 Permissible forces and moments at the pump nozzles..... | 24 |
| | 5.4 Enclosure/insulation | 25 |
| | 5.5 Electrical connection | 25 |
| | 5.5.1 Setting the time relay | 26 |
| | 5.5.2 Connecting the motor | 26 |
| | 5.5.3 Earthing..... | 26 |
| | 5.6 Checking the direction of rotation..... | 26 |

| | | |
|-----------|---|-----------|
| 6 | Commissioning/Start-up/Shutdown | 28 |
| 6.1 | Commissioning/Start-up | 28 |
| 6.1.1 | Prerequisites for commissioning/start-up | 28 |
| 6.1.2 | Filling in the lubricant | 28 |
| 6.1.3 | Shaft seal | 29 |
| 6.1.4 | Priming and venting the pump | 30 |
| 6.1.5 | Start-up | 31 |
| 6.1.6 | Shutdown | 32 |
| 6.2 | Operating limits | 33 |
| 6.2.1 | Ambient temperature | 33 |
| 6.2.2 | Frequency of starts | 33 |
| 6.2.3 | Fluid handled | 34 |
| 6.3 | Shutdown/storage/preservation | 35 |
| 6.3.1 | Measures to be taken for shutdown | 35 |
| 6.4 | Returning to service | 35 |
| 7 | Servicing/Maintenance | 37 |
| 7.1 | Safety regulations | 37 |
| 7.2 | Servicing/Inspection | 38 |
| 7.2.1 | Supervision of operation | 38 |
| 7.2.2 | Inspection work | 40 |
| 7.2.3 | Lubrication and lubricant change | 40 |
| 7.3 | Drainage/cleaning | 42 |
| 7.4 | Dismantling the pump set | 42 |
| 7.4.1 | General information/Safety regulations | 42 |
| 7.4.2 | Preparing the pump set | 43 |
| 7.4.3 | Dismantling the motor | 43 |
| 7.4.4 | Removing the impeller | 43 |
| 7.4.5 | Removing mechanical seal MG1-G6 | 44 |
| 7.4.6 | Removing the shaft and rolling element bearings | 44 |
| 7.5 | Reassembling the pump set | 44 |
| 7.5.1 | General information/Safety regulations | 44 |
| 7.5.2 | Installing the shaft and rolling element bearing | 45 |
| 7.5.3 | Fitting the mechanical seal | 45 |
| 7.5.4 | Fitting the impeller | 46 |
| 7.5.5 | Mounting the motor | 47 |
| 7.6 | Tightening torques | 47 |
| 7.6.1 | Tightening torques for the pump | 47 |
| 7.7 | Spare parts stock | 47 |
| 7.7.1 | Ordering spare parts | 47 |
| 7.7.2 | Recommended spare parts stock for 2 years' operation to DIN 24296 | 48 |
| 7.7.3 | Interchangeability of pump components | 49 |
| 8 | Trouble-shooting | 50 |
| 9 | Related Documents | 52 |
| 9.1 | General assembly drawing with list of components | 52 |
| 9.1.1 | Horizontal installation | 52 |
| 9.1.2 | Vertical installation | 54 |
| 9.1.3 | Mechanical seal | 56 |
| 9.1.4 | List of components | 57 |
| 10 | EU Declaration of Conformity | 60 |
| 11 | Certificate of Decontamination | 61 |
| | Index | 62 |

Glossary

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.

Close-coupled design

Motor directly fitted to the pump via a flange or a drive lantern

Oil reservoir

The oil reservoir prevents the mechanical seal from running dry, for example in the event of a short period of negative pressure on the suction side.

Pool of pumps

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

Pump

Machine without drive, additional components or accessories

Pump set

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

Suction lift line/suction head line

The pipeline which is connected to the suction nozzle

1 General

1.1 Principles

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

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

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

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

1.2 Installation of partly completed machinery

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

1.3 Target group

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

1.4 Other applicable documents

Table 1: Overview of other applicable documents

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

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

1.5 Symbols

Table 2: Symbols used in this manual

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

¹ If agreed to be included in the scope of supply

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

1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

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



2 Safety

All the information contained in this section refers to hazardous situations. In addition to the present general safety information the action-related safety information given in the other sections must be observed.

2.1 General

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

2.2 Intended use

- The pump (set) must only be operated in the fields of application and within the use limits specified in the other applicable documents. (⇒ Section 1.4, Page 6)
- Only operate pumps/pump sets which are in perfect technical condition.
- Do not operate the pump (set) in partially assembled condition.
- Only use the pump to handle the fluids described in the data sheet or product literature of the pump model or variant.
- Never operate the pump without the fluid to be handled.
- Observe the minimum flow rates indicated in the data sheet or product literature (to prevent overheating, bearing damage, etc).
- Observe the minimum flow rate and maximum flow rate indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- Do not throttle the flow rate on the suction side of the pump (to prevent cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.
- Only use the respective impeller types in combination with the fluids described below.

| | | |
|---|---|---|
|  | Closed multi-channel impeller (impeller type K) | Suitable for the following fluids: Contaminated, solids-laden fluids not containing stringy material and containing no or very little entrapped gas |
|---|---|---|

2362.8/07-EN

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

2.3 Personnel qualification and training

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

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

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

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

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

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

2.5 Safety awareness

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

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

2.6 Safety information for the operator/user

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

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

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump (set) are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.3, Page 35)
- Decontaminate pumps which handle fluids posing a health hazard. (⇒ Section 7.3, Page 42)
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇒ Section 6.1, Page 28)

2.8 Unauthorised modes of operation

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

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

2.9 Explosion protection

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

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

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

Especially adhere to the sections in this manual marked with the Ex symbol and the following sections, (⇒ Section 2.9.1, Page 10) to (⇒ Section 2.9.4, Page 12)

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

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

Prevent impermissible modes of operation at all times.

2.9.1 Marking

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



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

Refer to the Temperature limits table for the maximum temperatures permitted for the individual pump variants. (⇒ Table 4)

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

Motor The motor has its own marking. The marking is maintained on the condition that the temperatures the pump causes to develop at the motor flange and motor shaft are permitted by the motor manufacturer.
The motors used by KSB on pumps with ATEX certification meet this condition.

2.9.2 Temperature limits

In normal pump operation, the highest temperatures are to be expected in the area of the rolling element bearings. 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.

The surfaces in the bearing bracket area must be freely exposed to the atmosphere.

The table (⇒ Table 4) lists the temperature classes and the resulting maximum permissible fluid temperatures. The values shown correspond to the theoretical limits. They include only a general safety margin for the mechanical seal. For single mechanical seals, the safety margin required for specific operating conditions and mechanical seal designs may be substantially higher. If operating conditions differ from those stated on the data sheet, or if different mechanical seals are used, the actual safety margin required needs to be determined individually. If in doubt please contact the manufacturer.

The temperature class specifies the maximum permissible temperature at the surface of the pump set during operation. For the permissible operating temperature of the pump in question refer to the data sheet.

Table 4: Temperature limits

| Temperature class to ISO 80079-36 | Maximum permissible fluid temperature ²⁾ |
|-----------------------------------|---|
| T1 | 100 °C ³⁾ |
| T2 | 100 °C ³⁾ |
| T3 | 100 °C ³⁾ |
| T4 | 100 °C ³⁾ |
| T5 | Only after consultation with the manufacturer |

Temperature class T4 Based on an ambient temperature of 40 °C and proper maintenance and operation, compliance with temperature class T4 is warranted in the area of the rolling element bearings. If the ambient temperature exceeds 40 °C, contact the manufacturer.

Temperature class T5 A special design is required for compliance with temperature class T5 in the bearing area.

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

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

2362.8/07-EN

²⁾ Subject to further limitations for mechanical seal temperature rise

³⁾ Due to the maximum permissible fluid temperature

2.9.3 Monitoring equipment

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

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

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

Contact KSB for further information about monitoring equipment.

2.9.4 Operating limits

The minimum flow rates indicated in (⇒ Section 6.2.3.1, Page 34) 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 34) can be used to check whether additional heat build-up may lead to a dangerous temperature increase at the pump surface.

3 Transport/Storage/Disposal

3.1 Checking the condition upon delivery

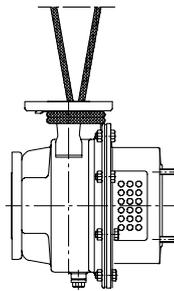
1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify KSB or the supplying dealer and the insurer about the damage in writing immediately.

3.2 Transport

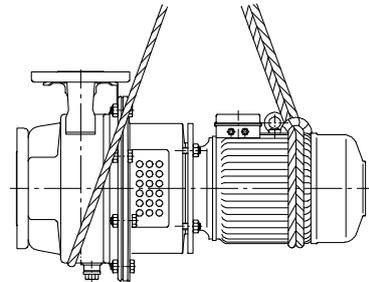
| | |
|--|--|
| | <p>! DANGER</p> |
| | <p>The pump (set) could slip out of the suspension arrangement Danger to life from falling parts!</p> <ul style="list-style-type: none"> ▷ Always transport the pump (set) in the specified position. ▷ Never attach the suspension arrangement to the free shaft end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

When transporting the pump without motor, shaft 210 must be locked.

To transport the pump/pump set suspend it from the lifting tackle as shown.



Transporting the pump



Transporting the pump set

3.3 Storage/preservation

| | |
|--|---|
| | <p>CAUTION</p> |
| | <p>Damage during storage due to humidity, dirt or vermin Corrosion/contamination of the pump (set)!</p> <ul style="list-style-type: none"> ▷ For outdoor storage cover the pump (set) or the packaged pump (set) and accessories with waterproof material. |

| | |
|--|--|
| | CAUTION |
| | <p>Wet, contaminated or damaged openings and connections Leakage or damage to the pump!</p> <ul style="list-style-type: none"> ▷ Clean and cover pump openings and connections as required prior to putting the pump into storage. |

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

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

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

For storing a pump (set) which has already been operated, the shutdown measures must be adhered to. (⇒ Section 6.3.1, Page 35)

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3, Page 42)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen also neutralise the pump and blow through with anhydrous inert gas to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
Indicate any safety measures and decontamination measures taken.
(⇒ Section 11, Page 61)

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

3.5 Disposal

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

1. 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 uncontaminated and contaminated fluids.

- Close-coupled pump with shaft seal
- Directly flanged standardised motor

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

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

4.3 Designation

Table 5: Designation example

| Position | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------------------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----------------|----|----|----|----|----|----|----|----|----|----|--|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | | |
| K | W | P | F | 1 | 2 | 5 | - | 1 | 0 | 0 | - | 0 | 2 | 5 | 0 | | G | D | N | G | 1 | 0 | A | | | | B | H | | 7 | | | | 4 |
| See name plate and data sheet | | | | | | | | | | | | | | | | | | | | | | See data sheet | | | | | | | | | | | | |

Table 6: Designation key

| Position | Code | Description |
|----------|--|--|
| 1-3 | Pump type | |
| | KWP | KWP |
| 4 | Impeller | |
| | F | Free-flow impeller |
| | K | Channel impeller |
| | O | Open impeller ⁴⁾ |
| 5-17 | Size, e.g. | |
| | 125 | Nominal suction nozzle diameter [mm] |
| | 100 | Nominal discharge nozzle diameter [mm] |
| | 0250 | Nominal impeller diameter [mm] |
| 18 | Pump casing material | |
| | D | NORIDUR 1.4593 |
| | G | Grey cast iron GJL-250 |
| 19 | Impeller material | |
| | D | NORIDUR 1.4593 |
| | N | ERN - |
| 20 | Wear plate material / wear ring material | |
| | D | NORIDUR 1.4593 |
| | N | ERN - |
| 21 | Discharge cover material | |
| | D | NORIDUR 1.4593 |
| | G | Grey cast iron GJL-250 |
| 22-23 | Design version | |
| | 10 | Version |
| 24-25 | Shaft seal operating mode | |
| | A | Single mechanical seal in A-type cover |
| 26 | Design | |

2362.8/07-EN

⁴ Available on request only

| Position | Code | Description |
|----------|----------------------------------|------------------------------------|
| 26 | _ ⁵⁾ | Standard |
| | X | Non-standard (BT3D, BT3) |
| 27-29 | Installation type | |
| | 0 | Pump only (Fig. 0 bare-shaft pump) |
| | BH | Close-coupled, horizontal |
| | BV | Close-coupled, vertical |
| 30-32 | Motor rating P _N [kW] | |
| | 7 | 7 |
| 33 | Number of motor poles | |

4.4 Name plate



Fig. 1: Name plate (example)

| | | | |
|---|---|---|--|
| 1 | Type series, size, material, and design version | 2 | Customer-specific information (optional) |
| 3 | KSB order number and KSB order item number | 4 | Flow rate |
| 5 | Speed | 6 | Year of construction |
| 7 | Head | 8 | Pump input power (optional) |
| 9 | Further required information (optional) | | |

4.5 Design details

Design

- Volute casing pump
- Radially split volute casing
- Close-coupled design
- Pump casing fitted with a wear plate
- Single-stage
- Single-suction

⁵⁾ Blank

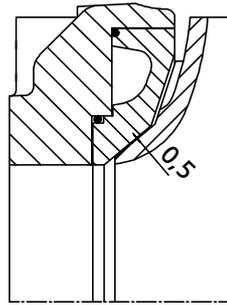


Fig. 2: Design with wear plate for: GNNG, GDNG, DDDD

- Pump casing fitted with a wear plate
- Clearances

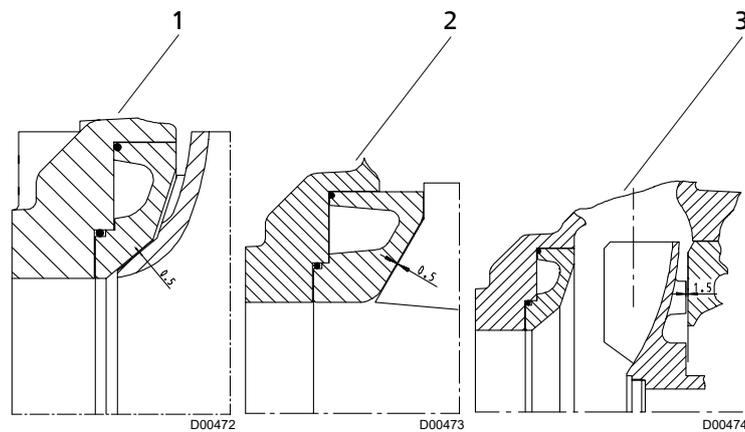


Fig. 3: Clearances

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

Installation types

- Horizontal installation
- Vertical installation

Shaft seal

- Uncooled mechanical seal with/without oil reservoir⁶⁾

Pump sets for vertical installation are generally fitted with an oil reservoir. For horizontal installation, an oil reservoir can be fitted as an option.

Only single mechanical seals are fitted in the conical discharge chamber.

Table 7: Mechanical seal makes

| Material variant of pump | Design | Supplier | Type | Material combination to EN 12756 |
|--------------------------|--------------------|------------------------|----------|--|
| GNNG GDNG DDDD | Single, unbalanced | Burgmann ⁷⁾ | MG1 - G6 | Q ₁ Q ₁ VGG |
| | | John Crane | 2100 | Q ₁ Q ₁ EGG |
| | Single, balanced | KSB | 4 KBL | Q ₅ Q ₅ VGG |
| | | | | Q ₅ Q ₅ EGG |
| | | | | U ₁ U ₁ VGG ₁ |

⁶⁾ Pump sets for vertical installation are fitted with an oil reservoir. For horizontal installation, an oil reservoir can be fitted as an option.

⁷⁾ Other mechanical seal makes to EN 12756 (DIN 24960), version I1k possible

Impeller type

- Various application-oriented impeller types (⇒ Section 2.2, Page 8)

Bearings

- Grease-packed deep groove ball bearings

Table 8: Deep-groove ball bearings

| Motor size | | Deep groove ball bearing to DIN 625 |
|------------|-----|-------------------------------------|
| from | to | |
| 90 | 112 | 6012 2RS C ₃ |
| 132 | 180 | 6312 2RS C ₃ |

Automation

Automation options:

- PumpDrive
- PumpMeter

Connections

- Suction flange with blind holes to DIN 2501, PN 10/16 with tapped blind holes of 1,25 d for hexagon head bolts
- Discharge flange with clearance holes to EN 1092-2, PN 16/21/B

4.6 Materials
Table 9: Materials depending on material variant

| Part No. | Description | Material variant | | |
|----------|--------------------------|------------------|----------------|--------------|
| | | DDDD | GDNG | GNGG |
| 101 | Pump casing | Noridur 1.4593 | EN-GJL-250 | EN-GJL-250 |
| 135.01 | Wear plate, suction side | Noridur 1.4593 | ERN | ERN |
| 146 | Intermediate lantern | EN-GJL-250 | EN-GJL-250 | EN-GJL-250 |
| 163 | Discharge cover | Noridur 1.4593 | EN-GJL-250 | EN-GJL-250 |
| 210 | Shaft | 1.4462 | 1.4021+QT700 | 1.4021+QT700 |
| 230 | Impeller | Noridur 1.4593 | Noridur 1.4593 | ERN |
| 509 | Intermediate ring | EN-GJL-250 | - | - |
| 524.01 | Shaft protecting sleeve | 1.4539 | 1.4539 | 1.4539 |
| 906 | Impeller screw | 1.4539 | C35E+N | C35E+N |

4.7 Configuration and function

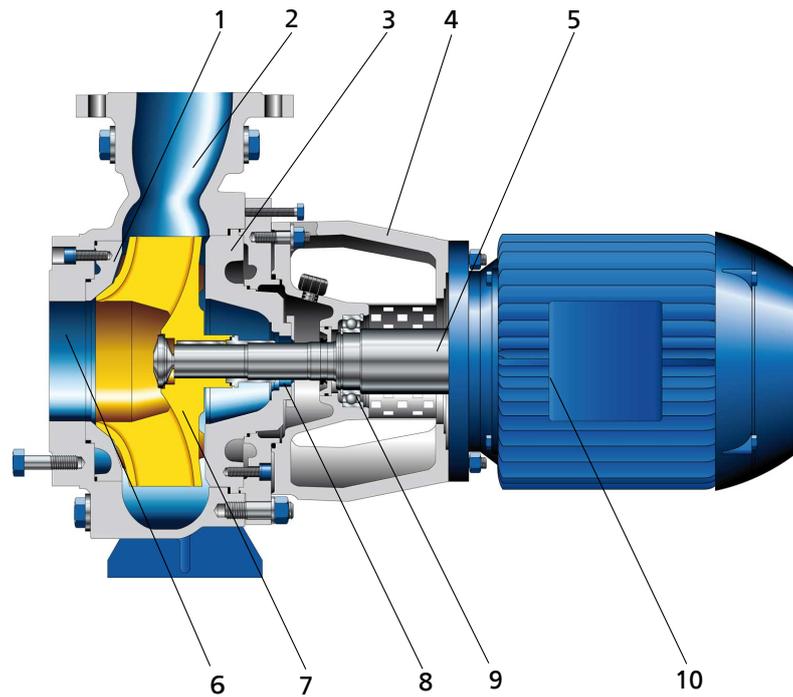


Fig. 4: Sectional drawing C₂ design

| | | | |
|---|-------------------|----|-------------------------|
| 1 | Wear plate | 2 | Casing/discharge nozzle |
| 3 | Discharge cover | 4 | Intermediate lantern |
| 5 | Shaft | 6 | Casing/suction nozzle |
| 7 | Impeller | 8 | Shaft seal chamber |
| 9 | Bearing, pump end | 10 | Motor |

Design The horizontal, non-self-priming, radially split volute casing pump in back pull-out design is designed with an axial fluid inlet and a radial outlet.

The hydraulic system and the motor are firmly connected and form a close-coupled unit. Impeller (7) and motor (10) are arranged on a common shaft (5).

Function The steadily rotating impeller (7) of the centrifugal pump transfers mechanical energy to the fluid passing through.

The fluid enters the pump axially via a suction nozzle (6) and is accelerated outward in a cylindrical flow by the rotating impeller (7). The flow profile of the pump casing converts the kinetic energy of the fluid into pressure energy. The fluid leaves the pump via the discharge nozzle (2).

The casing is fitted with a replaceable wear plate (1). The diagonal clearance gap prevents frequent deviation of the flow in the clearance gap heading in the direction of the suction nozzle. This ensures a longer service life if solids-laden fluids are handled.

The casing is closed by a discharge cover (3). The shaft (5) enters the casing via this discharge cover. A shaft seal (8) provides reliable sealing towards the atmosphere.

The shaft is supported by oil-lubricated rolling element bearings (9). The motor (10) is connected to the casing via an intermediate lantern (4).

Sealing The pump is sealed with a shaft seal.

4.8 Noise characteristics

Table 10: Surface sound pressure level L_{pA} ^{8) 9)}

| Rated power input PN [kW] | Pump set | |
|------------------------------|------------------|------------------|
| | 2900 rpm [dB] | 1450 rpm [dB] |
| 1 | 67 | 60 |
| 2 | 69 | 62 |
| 3 | 71 | 64 |
| 4 | 72 | 66 |
| 6 | 74 | 68 |
| 8 | 76 | 70 |
| 11 | 78 | 73 |
| 15 | 80 | 75 |
| 19 | 81 | 77 |
| 22 | 83 | 78 |

4.9 Scope of supply

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

- Pump
- Surface-cooled IEC three-phase current squirrel-cage motor
- Cover plates at drive lantern to EN 294

4.10 Dimensions and weights

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

⁸⁾ Surface sound pressure level as per ISO 3744 and DIN EN ISO 20361 ; valid for a pump operating range of Q/QBEP = 0.8 - 1.1 and non-cavitating operation. If noise levels are to be guaranteed: Add +3 dB for measuring and constructional tolerance.

⁹⁾ Increase for 60 Hz operation: 3500 rpm +3 dB; 1750 rpm +1 dB; 1160 rpm ±0 dB

5 Installation at Site

5.1 Checks to be carried out prior to installation

Place of installation

| | |
|--|---|
| | WARNING |
| | <p>Installation on a mounting surface which is unsecured and cannot support the load Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XC1 to EN 206-1. ▷ The mounting surface must be set, flat, and level. ▷ Observe the weights indicated. |

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

5.2 Installing the pump set

| | |
|--|--|
| | DANGER |
| | <p>Electrostatic charging due to insufficient potential equalisation Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Make sure that the connection between pump and baseplate is electrically conductive. |

Installing the pump set in a horizontal position

No special foundation is required for installation. An even slab of concrete is sufficient as an installation surface.

On pumps supplied with a mounting plate, the mounting plate can be used as a template for drilling.

The mounting plate and the foundation rails must not be set in concrete.

- ✓ The installation surface has the required strength and characteristics.
 1. Position the pump set on the anchoring holes and align it with the help of a spirit level (on the discharge nozzle).
 2. Compensate any differences in height until the discharge nozzle is in a horizontal position.
 3. Fasten the pump set.
The screws/bolts are not included in the scope of supply.

| Size | Fasteners | |
|--------------|------------------|------------------------|
| | Foundation bolts | Expanding anchor bolts |
| 065-040-0250 | M16×200 MU | - |
| 065-050-0200 | M16×200 MU | - |
| 065-050-0201 | M16×200 MU | - |
| 080-065-0200 | M16×200 MU | - |
| 080-065-0201 | M16×200 MU | - |
| 080-040-0315 | M16×200 MU | F1/18-60, Ø 18×160 |
| 080-065-0313 | M16×200 MU | F1/18-60, Ø 18×160 |
| 080-065-0315 | M16×200 MU | F1/18-60, Ø 18×160 |
| 100-080-0250 | M16×200 MU | F1/18-60, Ø 18×160 |
| 100-080-0251 | M16×200 MU | F1/18-60, Ø 18×160 |
| 100-080-0311 | M16×200 MU | F1/18-60, Ø 18×160 |

| Size | Fasteners | |
|--------------|------------------|------------------------|
| | Foundation bolts | Expanding anchor bolts |
| 100-080-0315 | M16x200 MU | F1/18-60, Ø 18x160 |
| 125-100-0250 | M16x200 MU | F1/18-60, Ø 18x160 |
| 125-100-0251 | M16x200 MU | F1/18-60, Ø 18x160 |
| 125-100-0253 | M16x200 MU | F1/18-60, Ø 18x160 |
| 125-100-0315 | M16x200 MU | F1/18-60, Ø 18x160 |

Installing the pump set in a vertical position

| | |
|--|--|
| | CAUTION |
| | <p>Ingress of leakage into the motor Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Never install the pump set with the "motor below". |

| | |
|--|---|
| | CAUTION |
| | <p>Insufficient lubrication of the mechanical seal Damage to the mechanical seal!</p> <ul style="list-style-type: none"> ▷ Pump sets which are designed for horizontal installation must never be installed in a vertical position. |

1. Check whether the pipeline can carry the weight of the pump. Install suitable supports if necessary.
2. Install the pump in the pipeline in a vertical position, with the motor on top.

5.3 Piping

5.3.1 Connecting the piping

| | |
|--|--|
| | ⚠ DANGER |
| | <p>Impermissible loads acting on the pump nozzles Danger to life from escaping hot, toxic, corrosive or flammable fluids!</p> <ul style="list-style-type: none"> ▷ Do not use the pump as an anchorage point for the piping. ▷ Anchor the pipes in close proximity to the pump and connect them properly without transmitting any stresses or strains. ▷ Observe the permissible forces and moments at the pump nozzles. ▷ Take appropriate measures to compensate for thermal expansion of the piping. |

| | |
|--|--|
| | CAUTION |
| | <p>Incorrect earthing during welding work at the piping Destruction of rolling element bearings (pitting effect)!</p> <ul style="list-style-type: none"> ▷ Never earth the electric welding equipment on the pump or baseplate. ▷ Prevent current flowing through the rolling element bearings. |

2362.8/07-EN

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

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

| | |
|--|---|
| | CAUTION |
| | <p>Welding beads, scale and other impurities in the piping Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Remove any impurities from the piping. ▷ If necessary, install a filter. ▷ Observe the information in (⇒ Section 7.2.2.1, Page 40) . |

3. If required, install a filter in the piping (see drawing: Filter in the piping).

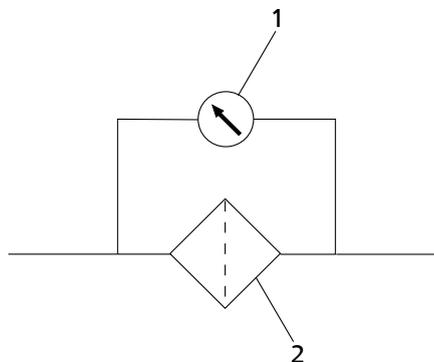


Fig. 5: Filter in the piping

| | | | |
|---|-----------------------------|---|--------|
| 1 | Differential pressure gauge | 2 | Filter |
|---|-----------------------------|---|--------|

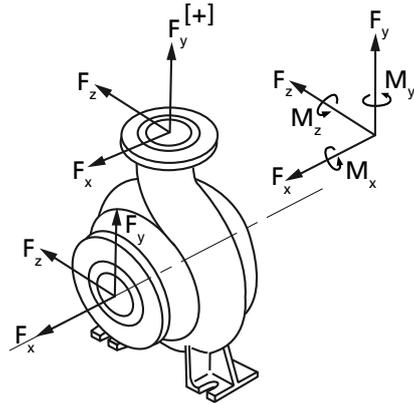
| | |
|--|--|
| | NOTE |
| | <p>Use a filter made of corrosion-resistant material. Use a filter with a filter area three times the cross-section of the piping. Conical filters have proved suitable.</p> |

4. Connect the pump nozzles to the piping.

| | |
|--|---|
| | CAUTION |
| | <p>Aggressive flushing liquid and pickling agent Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Match the cleaning operation mode and duration of flushing and pickling to the casing materials and seal materials used. |

2362.8/07-EN

5.3.2 Permissible forces and moments at the pump nozzles



The permissible resultant forces have been determined according to:

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

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

Forces and moments at the pump nozzles

The data on forces and moments apply to static piping loads only. If the limits are exceeded, they must be checked and verified.

If a computerised strength analysis is required, values are available on request only.

The values are only applicable if the pump is installed on a completely grouted baseplate and bolted to a rigid and level foundation.

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

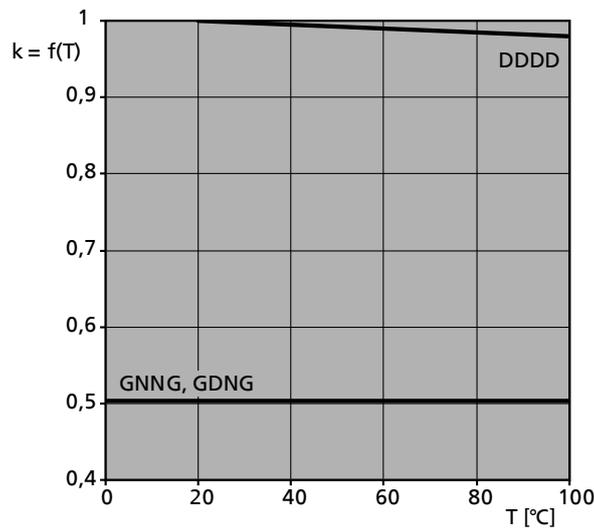


Fig. 6: Temperature correction diagram

Calculation of forces and moments for T > 20 °C

Reduction formula:

Permissible force/moment = k (T) x force/moment from table

Example:

- Material = DDDD
- T = 100°C
- k = 0.98

Table 11: Permissible forces (F) and moments (M) at the pump nozzles (material variant DDDD NORIDUR (1.4593))

| Size | Suction nozzle | | | | | | | Discharge nozzle | | | | | | | |
|--------------|----------------|----------------|----------------|------------------|----------------|----------------|----------------|------------------|---------------------|-----------------------|----------------|------------------|----------------|----------------|----------------|
| | F _x | F _y | F _z | F _{res} | M _x | M _y | M _z | F _x | F _{yTens+} | F _{yCom-pr-} | F _z | F _{res} | M _x | M _y | M _z |
| | [N] | [N] | [N] | [N] | [Nm] | [Nm] | [Nm] | [N] | [N] | [N] | [N] | [N] | [Nm] | [Nm] | [Nm] |
| 065-040-0250 | 3145 | 2065 | 2515 | 3235 | 2065 | 1525 | 1080 | 1527 | 990 | 1975 | 1255 | 1975 | 990 | 810 | 540 |
| 080-040-0315 | 3860 | 2515 | 3055 | 3950 | 2605 | 1975 | 1345 | 1527 | 990 | 1975 | 1255 | 1975 | 990 | 810 | 540 |
| 065-050-0200 | 3145 | 2065 | 2515 | 3235 | 2065 | 1525 | 1080 | 1527 | 990 | 1975 | 1255 | 1975 | 1255 | 990 | 630 |

| Size | Suction nozzle | | | | | | | Discharge nozzle | | | | | | | |
|--------------|----------------|----------------|----------------|------------------|----------------|----------------|----------------|------------------|---------------------|--------------------------|----------------|------------------|----------------|----------------|----------------|
| | F _x | F _y | F _z | F _{res} | M _x | M _y | M _z | F _x | F _{yTens+} | F _{yCom} pr- | F _z | F _{res} | M _x | M _y | M _z |
| | [N] | [N] | [N] | [N] | [Nm] | [Nm] | [Nm] | [N] | [N] | [N] | [N] | [N] | [Nm] | [Nm] | [Nm] |
| 065-050-0201 | 3145 | 2065 | 2515 | 3235 | 2065 | 1525 | 1080 | 1527 | 990 | 1975 | 1255 | 1975 | 1255 | 990 | 630 |
| 080-065-0200 | 3860 | 2515 | 3055 | 3950 | 2605 | 1975 | 1345 | 2515 | 1615 | 3145 | 2065 | 3235 | 2065 | 1525 | 1080 |
| 080-065-0201 | 3860 | 2515 | 3055 | 3950 | 2605 | 1975 | 1345 | 2515 | 1615 | 3145 | 2065 | 3235 | 2065 | 1525 | 1080 |
| 080-065-0315 | 3860 | 2515 | 3055 | 3950 | 2605 | 1975 | 1345 | 2515 | 1615 | 3145 | 2065 | 3235 | 2065 | 1525 | 1080 |
| 080-065-0313 | 3860 | 2515 | 3055 | 3950 | 2605 | 1975 | 1345 | 2515 | 1615 | 3145 | 2065 | 3235 | 2065 | 1525 | 1080 |
| 100-080-0250 | 4850 | 3145 | 3860 | 4940 | 3595 | 2695 | 1795 | 3055 | 1975 | 3860 | 2515 | 3950 | 2605 | 1975 | 1345 |
| 100-080-0251 | 4850 | 3145 | 3860 | 4940 | 3595 | 2695 | 1795 | 3055 | 1975 | 3860 | 2515 | 3950 | 2605 | 1975 | 1345 |
| 100-080-0311 | 4850 | 3145 | 3860 | 4940 | 3595 | 2695 | 1795 | 3055 | 1975 | 3860 | 2515 | 3950 | 2605 | 1975 | 1345 |
| 100-080-0315 | 4850 | 3145 | 3860 | 4940 | 3595 | 2695 | 1795 | 3055 | 1975 | 3860 | 2515 | 3950 | 2605 | 1975 | 1345 |
| 125-100-0250 | 6645 | 4310 | 5300 | 6825 | 4940 | 3770 | 2515 | 3860 | 2425 | 4850 | 3145 | 5030 | 3595 | 2695 | 1795 |
| 125-100-0251 | 6645 | 4310 | 5300 | 6825 | 4940 | 3770 | 2515 | 3860 | 2425 | 4850 | 3145 | 5030 | 3595 | 2695 | 1795 |
| 125-100-0253 | 6645 | 4310 | 5300 | 6825 | 4940 | 3770 | 2515 | 3860 | 2425 | 4850 | 3145 | 5030 | 3595 | 2695 | 1795 |
| 125-100-0315 | 6645 | 4310 | 5300 | 6825 | 4940 | 3770 | 2515 | 3860 | 2425 | 4850 | 3145 | 5030 | 3595 | 2695 | 1795 |

5.4 Enclosure/insulation

| | |
|--|---|
| | ⚠ WARNING |
| | <p>The volute casing and casing/discharge cover take on the same temperature as the fluid handled</p> <p>Risk of burns!</p> <ul style="list-style-type: none"> ▷ Insulate the volute casing. ▷ Fit protective equipment. |
| | NOTE |
| | <p>Pump casings handling fluids at temperatures below freezing point may be insulated at the site, subject to the manufacturer's prior approval.</p> |

5.5 Electrical connection

| | |
|--|---|
| | ⚠ DANGER |
| | <p>Electrical connection work by unqualified personnel</p> <p>Risk of fatal injury due to electric shock!</p> <ul style="list-style-type: none"> ▷ Always have the electrical connections installed by a trained and qualified electrician. ▷ Observe regulations IEC 60364 and, for explosion-proof models, EN 60079. |
| | ⚠ WARNING |
| | <p>Incorrect connection to the mains</p> <p>Damage to the power supply network, short circuit!</p> <ul style="list-style-type: none"> ▷ Observe the technical specifications of the local energy supply companies. |

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

| | |
|--|--|
| | NOTE |
| | Installing a motor protection device is recommended. |

5.5.1 Setting the time relay

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

Table 12: Time relay settings for star-delta starting:

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

5.5.2 Connecting the motor

| | |
|--|--|
| | NOTE |
| | <p>In compliance with IEC 60034-8, three-phase motors are always wired for clockwise rotation (looking at the motor shaft stub).</p> <p>The pump's direction of rotation is indicated by an arrow on the pump.</p> |

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

5.5.3 Earthing

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

5.6 Checking the direction of rotation

| | |
|------|--|
| | ⚠ DANGER |
| | <p>Temperature increase resulting from contact between rotating and stationary components</p> <p>Explosion hazard!</p> <p>Damage to the pump set!</p> <ul style="list-style-type: none"> ▸ Never check the direction of rotation by starting up the unfilled pump. |

| | |
|---|---|
|  | <p style="background-color: #f4a460; padding: 2px;">⚠ WARNING</p> <p>Hands inside the pump casing Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> ▷ Always disconnect the pump set from the power supply and secure it against unintentional start-up before inserting your hands or other objects into the pump. |
|  | <p style="background-color: #fff9c4; padding: 2px;">CAUTION</p> <p>Drive and pump running in the wrong direction of rotation Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Refer to the arrow indicating the direction of rotation on the pump. ▷ Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation. |

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

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

6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up

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

- The pump set has been mechanically connected as specified.
- The pump set has been properly connected to the power supply and is equipped with all protection devices. (⇒ Section 5.5, Page 25)
- The pump has been primed with the fluid to be handled. The pump has been vented.
- The direction of rotation has been checked. (⇒ Section 5.6, Page 26)
- All auxiliary connections required are connected and operational.
- The lubricants have been checked. (⇒ Section 7.2.3, Page 40)
- After prolonged shutdown of the pump (set), the activities required for returning the equipment to service have been carried out. (⇒ Section 6.4, Page 35)

6.1.2 Filling in the lubricant

- Grease-lubricated bearings
Grease-lubricated bearings have been packed with grease at the factory.
- Lubricant reservoir for mechanical seals
The oil reservoir is not filled at the factory.

For horizontal installation of the pump, an oil reservoir can be fitted as an option.

For vertical installation of the pump, an oil reservoir must be fitted.

If oil lubrication is to be implemented, fill the oil reservoir as follows, prior to commissioning of the pump set.

Oil quality see (⇒ Section 7.2.3.2.2, Page 41)

Oil quantity see (⇒ Section 7.2.3.2.3, Page 41)

| | |
|--|------------------------|
|  | <p>⚠ DANGER</p> |
| <p>Risk of potentially explosive atmosphere by incompatible fluids mixing in the auxiliary piping</p> <p>Risk of burns! Explosion hazard!</p> <p>▷ Make sure that the barrier fluid or quench liquid are compatible with the fluid handled.</p> | |

Horizontal installation

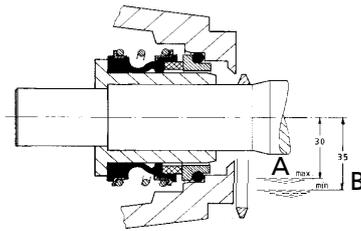


Fig. 7: Filling / topping up the oil reservoir — horizontal installation

| | | | |
|---|--------------------|---|--------------------|
| A | Maximum fill level | B | Minimum fill level |
|---|--------------------|---|--------------------|

1. Unscrew vent plug 913.
2. Fill in lubricant until the lubricant level indicator lies between the **minimum** and **maximum** markings.
3. Tighten vent plug 913.

Vertical installation

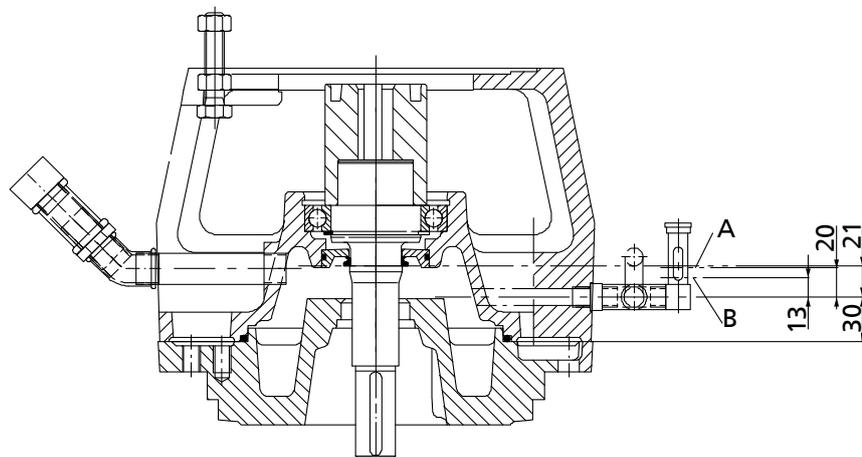


Fig. 8: Filling / topping up the oil reservoir — vertical installation

| | | | |
|---|--------------------|---|--------------------|
| A | Maximum fill level | B | Minimum fill level |
|---|--------------------|---|--------------------|

1. Unscrew vent plug 913.
2. Fill in lubricant until the lubricant level indicator lies between the **minimum** and **maximum** markings.
3. Tighten vent plug 913.

6.1.3 Shaft seal

Shaft seals are fitted prior to delivery.

Observe the instructions on dismantling (⇒ Section 7.4.5, Page 44) or assembly (⇒ Section 7.5.3, Page 45) .

6.1.4 Priming and venting the pump

| | |
|--|--|
|  | <p>⚠ DANGER</p> <p>Risk of potentially explosive atmosphere inside the pump Explosion hazard!</p> <ul style="list-style-type: none"> ▷ The pump internals in contact with the fluid to be handled, including the seal chamber and auxiliary systems, must be filled with the fluid to be handled at all times. ▷ Provide sufficient inlet pressure. ▷ Provide an appropriate monitoring system. |
|  | <p>⚠ DANGER</p> <p>Risk of potentially explosive atmosphere by incompatible fluids mixing in the auxiliary piping Risk of burns! Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Make sure that the barrier fluid or quench liquid are compatible with the fluid handled. |
|  | <p>⚠ DANGER</p> <p>Shaft seal failure caused by insufficient lubrication Hot or toxic fluid could escape! Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Before starting up the pump set, vent the pump and suction line and prime both with the fluid to be handled. |
|  | <p>CAUTION</p> <p>Increased wear due to dry running Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set without liquid fill. ▷ Never close the shut-off element in the suction line and/or supply line during pump operation. |
| <ol style="list-style-type: none"> 1. Vent the pump and suction line and prime both with the fluid to be handled. Connection 6D can be used for venting (see drawing of auxiliary connections). 2. Fully open the shut-off element in the suction line. 3. Fully open all auxiliary feed lines (barrier fluid, flushing liquid, etc.), if any. 4. Open the shut-off element, if any, in the vacuum balance line and close the vacuum-tight shut-off element, if any. | |
|  | <p>NOTE</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> |

6.1.5 Start-up

| | |
|--|---|
|   | <p>⚠ DANGER</p> <p>Non-compliance with the permissible pressure and temperature limits if the pump is operated with the suction and/or discharge line closed.</p> <p>Explosion hazard! Hot or toxic fluids escaping!</p> <ul style="list-style-type: none"> ▷ Never operate the pump with the shut-off elements in the suction line and/or discharge line closed. ▷ Only start up the pump set with the discharge-side shut-off element slightly or fully open. |
|   | <p>⚠ DANGER</p> <p>Excessive temperatures due to dry running or excessive gas content in the fluid handled</p> <p>Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set without liquid fill. ▷ Prime the pump as per operating instructions. (⇒ Section 6.1.4, Page 30) ▷ Always operate the pump within the permissible operating range. |
|  | <p>⚠ WARNING</p> <p>Unprotected rotating parts</p> <p>Risk of personal injury!</p> <ul style="list-style-type: none"> ▷ Do not touch rotating parts. ▷ When the pump is running, perform any work with utmost caution. |
|  | <p>CAUTION</p> <p>Abnormal noises, vibrations, temperatures or leakage</p> <p>Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Switch off the pump (set) immediately. ▷ Eliminate the causes before returning the pump set to service. |

- ✓ The system piping has been cleaned.
- ✓ The pump, suction line and inlet tank, if any, have been vented and primed with the fluid to be handled.
- ✓ The lines for priming and venting have been closed.
- ✓ The leakage drain hole in the lantern is open.

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

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

6.1.6 Shutdown

| | |
|--|---|
| | CAUTION |
| | <p>Heat build-up inside the pump Damage to the shaft seal!</p> <ul style="list-style-type: none"> ▷ 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 |
| | <p>If the discharge line is equipped with a non-return or check valve, the shut-off element may remain open provided that the system conditions and system regulations are considered and observed.</p> |

| | |
|--|---|
| | NOTE |
| | <p>If shut-off is not possible, the pump will run in reverse direction. The reverse runaway speed must be lower than the rated speed.</p> |

For prolonged shutdown periods:

1. Close the shut-off element in the suction line.
2. Drain the pump. (⇒ Section 7.3, Page 42)

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

6.2 Operating limits

| | |
|---|--|
|  | <p>⚠ DANGER</p> <p>Non-compliance with operating limits for pressure, temperature, fluid handled and speed Explosion hazard! Hot or toxic fluid could escape!</p> <ul style="list-style-type: none"> ▸ Comply with the operating data specified in the data sheet. ▸ Never use the pump for handling fluids it is not designed for. ▸ Avoid prolonged operation against a closed shut-off element. ▸ Never operate the pump at temperatures, pressures or rotational speeds exceeding those specified in the data sheet or on the name plate unless the written consent of the manufacturer has been obtained. |
|  | <p>⚠ DANGER</p> <p>Formation of a potentially explosive atmosphere inside the pump Explosion hazard!</p> <ul style="list-style-type: none"> ▸ When draining tanks take suitable measures to prevent dry running of the pump (e.g. fill level monitoring). |

6.2.1 Ambient temperature

| | |
|---|--|
|  | <p>CAUTION</p> <p>Operation outside the permissible ambient temperature Damage to the pump (set)!</p> <ul style="list-style-type: none"> ▸ Observe the specified limits for permissible ambient temperatures. |
|---|--|

Observe the following parameters and values during operation:

Table 13: Permissible ambient temperatures

| Permissible ambient temperature | Value |
|---------------------------------|------------------------------|
| Maximum | 50 °C 40 °C ¹⁰ |
| Minimum | See data sheet. |

6.2.2 Frequency of starts

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

The frequency of starts is determined by the maximum temperature increase of the motor. The frequency of starts depends on the power reserves of the motor in steady-state operation and on the starting conditions (DOL starting, star-delta

2362.8/07-EN

¹⁰ For compliance with 2014/34/EU (ATEX Equipment Directive). Higher ambient temperature possible in individual cases, see data sheet and name plate.

starting, moments of inertia, etc). If the start-ups are evenly spaced over the period indicated, the following limits serve as orientation for start-up with the discharge-side shut-off valve slightly open:

Table 14: Frequency of starts

| Motor rating [kW] | Maximum frequency of starts ¹¹⁾ [Starts/hour] |
|----------------------|---|
| ≤ 12 | 15 |
| 13 - 22 | 10 |

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

6.2.3 Fluid handled

6.2.3.1 Flow rate

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

- Short-time operation: $Q_{min}^{12)} = 0.1 \times Q_{BEP}^{13)}$
- Continuous operation: $Q_{min}^{12)} = 0.3 \times Q_{BEP}^{13)}$
- 2-pole operation: $Q_{max}^{14)} = 1.1 \times Q_{BEP}^{13)}$
- 4-pole operation: $Q_{max}^{14)} = 1.25 \times Q_{BEP}^{13)}$

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

$$T_o = T_f + \Delta \vartheta$$

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

Table 15: Key

| Symbol | Description | Unit |
|----------------|-----------------------------------|------------------|
| c | Specific heat capacity | J/kg K |
| g | Acceleration due to gravity | m/s ² |
| H | Pump discharge head | m |
| T _f | Fluid temperature | °C |
| T _o | Temperature at the casing surface | °C |
| η | Pump efficiency at duty point | - |
| Δϑ | Temperature difference | K |

¹¹ The values indicated must only be exceeded after consultation with the motor manufacturer or KSB.

¹² Minimum flow rate

¹³ Flow rate at best efficiency point

¹⁴ Maximum flow rate

6.2.3.2 Density of the fluid handled

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

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

6.2.3.3 Abrasive fluids

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

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump (set) remains installed

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

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

- ✓ The pump has been properly drained. (⇒ Section 7.3, Page 42)
- ✓ The safety instructions for dismantling the pump have been observed. (⇒ Section 7.4.1, Page 42)
- ✓ The permissible ambient temperature for storing the pump is observed.
 1. Spray-coat the inside wall of the pump casing and, in particular, the impeller clearance areas with a preservative.
 2. Spray the preservative through the suction nozzle and discharge nozzle. It is advisable to then close the pump nozzles (e.g. with plastic caps).
 3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil and grease, food-approved if required) to protect them against corrosion.
 - Observe the additional instructions on preservation. (⇒ Section 3.3, Page 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.

6.4 Returning to service

For returning the equipment to service observe the sections on commissioning/start-up and the operating limits. (⇒ Section 6.1, Page 28) (⇒ Section 6.2, Page 33)

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇒ Section 7, Page 37)

| | |
|---|---|
|  | <p style="background-color: #f4a460; padding: 2px;">⚠ WARNING</p> <p>Failure to re-install or re-activate protective devices Risk of injury from moving parts or escaping fluid!</p> <ul style="list-style-type: none"> ▷ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices. |
|  | <p style="background-color: #0070c0; color: white; padding: 2px;">NOTE</p> <p>If the equipment has been out of service for more than one year, replace all elastomer seals.</p> |

7 Servicing/Maintenance

7.1 Safety regulations

| | |
|--|---|
|  | <p>⚠ DANGER</p> <p>Sparks produced during servicing work Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Observe the safety regulations in force at the place of installation! ▷ Always perform maintenance work on explosion-proof pump sets outside potentially explosive atmospheres. |
|  | <p>⚠ DANGER</p> <p>Improperly serviced pump set Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Service the pump set regularly. ▷ Prepare a maintenance schedule with special emphasis on lubricants and shaft seal. |
| <p>The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.</p> | |
|  | <p>⚠ WARNING</p> <p>Unintentional starting of the pump set Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> ▷ Ensure that the pump set cannot be started unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set. |
|  | <p>⚠ DANGER</p> <p>Improper cleaning of coated pump surfaces Explosion hazard by electrostatic discharge!</p> <ul style="list-style-type: none"> ▷ When cleaning coated pump surfaces in atmospheres of Explosion group IIC, use suitable anti-static equipment. |
|  | <p>⚠ WARNING</p> <p>Fluids handled, consumables and supplies which are hot and/or pose a health hazard Risk of injury!</p> <ul style="list-style-type: none"> ▷ Observe all relevant laws. ▷ When draining the fluid take appropriate measures to protect persons and the environment. ▷ Decontaminate pumps which handle fluids posing a health hazard. |

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

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

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

Never use force when dismantling and reassembling the pump set.

7.2 Servicing/Inspection

7.2.1 Supervision of operation

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

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

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

| | |
|--|--|
| | CAUTION |
| | <p>Increased wear due to dry running Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Never operate the pump set without liquid fill. ▷ Never close the shut-off element in the suction line and/or supply line during pump operation. |
| | CAUTION |
| | <p>Impermissibly high temperature of fluid handled Damage to the pump!</p> <ul style="list-style-type: none"> ▷ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid). ▷ Observe the temperature limits in the data sheet and in the section on operating limits. (⇒ Section 6.2, Page 33) |

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

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

| | |
|--|--|
| | CAUTION |
| | <p>Operation outside the permissible bearing temperature Damage to the pump!</p> <ul style="list-style-type: none"> ▷ The bearing temperature of the pump (set) must never exceed 90 °C (measured on the inside of the lantern). |

| | |
|--|---|
| | NOTE |
| | <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 Inspection work

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

7.2.2.1 Cleaning filters

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

7.2.2.2 Checking the bearing seals

| | |
|---|---|
|  | <p>⚠ DANGER</p> <p>Excessive temperatures caused by mechanical contact Risk of explosion! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Check correct seating of axial seal rings mounted on the shaft. Only gentle contact of the sealing lip shall be established. |
|---|---|

7.2.3 Lubrication and lubricant change

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

7.2.3.1 Grease lubrication

Deep groove ball bearing 321.01 is packed with grease for life and does not require re-lubrication.

7.2.3.1.1 Intervals

- Under suitable operating conditions the grease-lubricated bearings 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) check the bearings earlier and replace them, if required.
- Replace the rolling element bearings after 15,000 operating hours or 2 years of continuous operation.

7.2.3.2 Oil reservoir (if applicable)

7.2.3.2.1 Intervals

Change to oil every 4000 operating hours but at least once a year.

7.2.3.2.2 Oil quality

Table 16: Oil quality

| Type | Specification |
|-----------------|----------------------|
| Motor oil | SAE 10 W/20 W |
| Lubricating oil | CL 32...68 DN 51 517 |

7.2.3.2.3 Oil quantity

Table 17: Oil quantity for oil reservoir

| Size | Oil quantity [l] | |
|--------------|------------------|-----------|
| | Horizontal | Vertical |
| 125-100-0250 | Approx. 0.3 | Approx. 1 |
| 080-040-0315 | Approx. 0.3 | Approx. 1 |
| 080-065-0315 | Approx. 0.3 | Approx. 1 |
| 065-040-0250 | Approx. 0.5 | Approx. 1 |
| 100-080-0250 | Approx. 0.5 | Approx. 1 |
| 100-080-0315 | Approx. 0.5 | Approx. 1 |
| 125-100-0315 | Approx. 0.5 | Approx. 1 |

7.2.3.2.4 Changing the oil

| | |
|---|-------------------------|
| | <p>⚠ WARNING</p> |
| <p>Lubricants posing a health hazard and/or hot lubricants</p> <p>Hazard to persons and the environment!</p> <ul style="list-style-type: none"> ▸ When draining the lubricant take appropriate measures to protect persons and the environment. ▸ Wear safety clothing and a protective mask if required. ▸ Collect and dispose of any lubricants. ▸ Observe all legal regulations on the disposal of fluids posing a health hazard. | |

7.3 Drainage/cleaning

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

1. Use connection 6B to drain the fluid handled (see drawing of auxiliary connections).
2. Always flush the system if it has been used for handling noxious, explosive, hot or other hazardous fluids.
Always flush and clean the pump before transporting it to the workshop.
Provide a certificate of decontamination for the pump. (⇒ Section 11, Page 61)

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

| | |
|---|---|
|  |  DANGER |
| | <p>Insufficient preparation of work on the pump (set)</p> <p>Risk of injury!</p> <ul style="list-style-type: none"> ▶ Properly shut down the pump set. ▶ Close the shut-off elements in the suction line and discharge line. ▶ Drain the pump and release the pump pressure. (⇒ Section 7.3, Page 42) ▶ Shut off any auxiliary connections. ▶ Allow the pump set to cool down to ambient temperature. |
|  |  WARNING |
| | <p>Unqualified personnel performing work on the pump (set)</p> <p>Risk of injury!</p> <ul style="list-style-type: none"> ▶ Always have repair work and maintenance work performed by specially trained, qualified personnel. |
|  |  WARNING |
| | <p>Hot surface</p> <p>Risk of injury!</p> <ul style="list-style-type: none"> ▶ Allow the pump set to cool down to ambient temperature. |
|  |  WARNING |
| | <p>Improper lifting/moving of heavy assemblies or components</p> <p>Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▶ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components. |

Always observe the safety instructions and information. (⇒ Section 7.1, Page 37)

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

For dismantling and reassembly observe the exploded views and the general assembly drawing. (⇒ Section 9.1, Page 52)

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

| | |
|---|---|
|  | NOTE |
| | All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. For contact details please refer to the enclosed "Addresses" booklet or visit " www.ksb.com/contact " on the Internet. |
|  | NOTE |
| | After a prolonged period of operation the individual components may be hard to pull off the shaft. If this is the case, use a brand name penetrating agent and/or - if possible - an appropriate puller. |

7.4.2 Preparing the pump set

1. De-energise the pump set and secure it against unintentional start-up.
2. Disconnect and remove all auxiliary pipework.
3. If an oil reservoir has been fitted, drain the oil.

7.4.3 Dismantling the motor

| | |
|--|--|
|  |  WARNING |
| | <p>Motor tipping over Risk of squashing hands and feet!</p> <ul style="list-style-type: none"> ▸ Suspend or support the motor to prevent it from tipping over. |

- ✓ The pump (set) is disconnected from the power supply.
1. Fasten a rope to motor 800 and intermediate lantern 146 and suspend it from a suitable hoisting tackle.
 2. Undo hexagon nuts 920.01.
 3. Pull motor 800 with intermediate lantern 146 and discharge cover 163 out of pump casing 101 in axial direction.
If the discharge cover is stuck, use forcing screws 901.30.
 4. Undo hexagon nut 920.04.
 5. Pull motor 800 out of intermediate lantern 146 in axial direction.

7.4.4 Removing the impeller

- ✓ The motor has been removed. (⇒ Section 7.4.3, Page 43)
1. Undo impeller screw 906.
 2. Remove O-ring 412.03.
 3. Pull impeller 230 off with an impeller removal tool.
 4. Leave key 940.01 in the keyway.
 5. Clean all components and inspect them for signs of wear.

7.4.5 Removing mechanical seal MG1-G6

- ✓ The impeller has been removed. (⇒ Section 7.4.4, Page 43)
- ✓ The oil reservoir has been drained.
 1. Remove key 940.01.
 2. Pull O-ring 412.06 and shaft protecting sleeve 524.01 with the rotating assembly of mechanical seal 433.02 off the shaft.
 3. Undo hexagon nuts 920.15 or socket head cap screws 914.22 (on pump sizes 50-200 and 65-200).
 4. Take off discharge cover 163.
 5. Remove the stationary assembly of the mechanical seal.
 6. Remove O-ring 412.08.
 7. Clean all components and inspect them for signs of wear.

7.4.6 Removing the shaft and rolling element bearings

- ✓ The mechanical seal has been removed. (⇒ Section 7.4.5, Page 44)
 1. Remove circlip 932.01.
 2. Slide joint ring 411.77 off the shaft. Remove the oil ring, if any.
 3. Remove shaft 210 with rolling element bearing 321.01 from intermediate lantern 146.
 4. Remove circlip 932.20.
 5. Pull off rolling element bearing 321.01.
 6. Remove insert ring 513.11 from intermediate lantern 146.
 7. Insert O-ring 412.11.
 8. Clean all components and inspect them for signs of wear.

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

| | |
|--|---|
| | <p>⚠ WARNING</p> |
| | <p>Improper lifting/moving of heavy assemblies or components Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▸ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components. |
| | <p>⚠ CAUTION</p> |
| | <p>Improper reassembly Damage to the pump!</p> <ul style="list-style-type: none"> ▸ Reassemble the pump (set) in accordance with the general rules of sound engineering practice. ▸ Use original spare parts only. |

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

- Sealing elements**
- **Gaskets**
 - Always use new gaskets, making sure that they are of the same thickness and material as the old ones.
 - Always fit gaskets of asbestos-free materials or graphite without using lubricants (e.g. copper grease, graphite paste).
 - **O-rings**

2362.8/07-EN

- Always use new O-rings, making sure that they are of the same thickness and material as the old ones.
- Never use O-rings that have been made by cutting an O-ring cord to size and gluing the ends together.

| | |
|---|---|
|  | CAUTION |
| | <p>Contact of O-ring with graphite or similar material Fluid could escape!</p> <ul style="list-style-type: none"> ▷ Do not coat O-ring with graphite or similar material. ▷ Use animal fats or lubricants based on silicone or PTFE. |

▪ **Assembly adhesives**

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

Tightening torques For reassembly, tighten all screws and bolts as specified in this manual.
(⇒ Section 7.6, Page 47)

7.5.2 Installing the shaft and rolling element 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 rolling element bearing 321.01 onto shaft 210.
 2. Slide on circlip 932.20.
 3. Insert O-ring 412.11.
 4. Fit insert ring 513.11.
 5. Half-fill the space between insert ring 513.11 and rolling element bearing 321.01 with a multi-purpose high-temperature resistant grease of NLGI grade 2/ KP 2 P-20.
 6. Apply a thin coat of oil to the outside diameter of rolling element bearing 321.01.
 7. Insert shaft 210 into intermediate lantern 146.
 8. Slip joint ring 411.77 onto the shaft.
 9. Insert circlip 932.01.

7.5.3 Fitting the mechanical seal

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

- For installing the mechanical seal, refer to general assembly drawing.
- Work cleanly and accurately.
- Only remove the protective wrapping of the contact faces immediately before installation takes place.
- Exclude any damage to the sealing surfaces or O-rings.

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

Installing mechanical seal MG1-G6

| | |
|---|---|
|  | <p style="background-color: #FFD700; margin: 0;">CAUTION</p> <p>Contact of O-ring with lubricant made of mineral grease or oil Damage to the O-ring!</p> <ul style="list-style-type: none"> ▷ Make sure that O-rings made of ethylene propylene rubber cannot come into contact with mineral oil or mineral grease. ▷ Make sure that O-rings made of silicone rubber cannot come into contact with silicone oil or silicone grease. |
|  | <p style="background-color: #FFD700; margin: 0;">CAUTION</p> <p>Use of grease or other permanent lubricants Hinders torque transmission! Overheating of and damage to the pump!</p> <ul style="list-style-type: none"> ▷ If required, use soft soap to reduce friction. Do not use grease or other permanent lubricants. ▷ Do not coat seal faces with grease or oil. |

- ✓ The bearing assembly and the individual parts of mechanical seal 433.02 are kept in a clean and level assembly area.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The sealing surfaces have been cleaned.
 1. Insert O-ring 412.08.
 2. Fit the mating ring
 3. Fit the oil ring, if any.
 4. Fit discharge cover 163 on intermediate lantern 146.
 5. Fasten hexagon nuts 920.15 (on pump sizes 50-200 and 65-200 socket head cap screws 914.22).
 6. Slide the rotating assembly onto shaft protecting sleeve 524.01 and fasten it.
 7. Slide O-ring 412.06 onto shaft protecting sleeve 524.01.

7.5.4 Fitting the impeller

- ✓ The assembled bearing with shaft seal as well as the individual parts are kept in a clean and level assembly area.
- ✓ All disassembled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
- ✓ The seal faces have been cleaned.
- ✓ Impeller bore, shaft and keyways are clean and free from burrs.
 1. Insert keys 940.01 into the shaft keyway.
 2. Fit the impeller with an impeller fitting and removal tool.
 3. Insert O-ring 412.03.
 4. Insert and tighten impeller screw 906.
Observe the tightening torque. (⇒ Section 7.6.1, Page 47)

7.5.5 Mounting the motor

| | |
|--|---|
| | <p>⚠ WARNING</p> |
| | <p>Motor tipping over Risk of squashing hands and feet!</p> <p>▷ Suspend or support the motor to prevent it from tipping over.</p> |

1. Generously grease the joining surfaces of the motor shaft / pump shaft 210 connection.
2. Insert motor 800 into intermediate lantern 146.
3. Tighten hexagon nut 920.04.
4. Fasten a rope to motor 800 and intermediate lantern 146 and suspend it from a suitable hoisting tackle.
5. Push motor 800 with intermediate lantern 146 and discharge cover 163 into pump casing 101.
6. Tighten hexagon nuts 920.01.

7.6 Tightening torques

7.6.1 Tightening torques for the pump

Casing bolts

Table 18: Tightening torques for bolted/screwed connections

| Materials of bolt/hexagon nut | C35E+QT | A4-70 |
|-------------------------------|---------------------|-------|
| Stamp on bolt/hexagon nut | YK/Y ¹⁵⁾ | A4-70 |
| Thread | Torque [Nm] | |
| M 6 | 5 | 7 |
| M 10 | 25 | 35 |
| M 12 | 40 | 60 |
| M 16 | 100 | 150 |

Impeller nut

Tightening torques for the impeller nut of all pump sizes: 50 Nm

7.7 Spare parts stock

7.7.1 Ordering spare parts

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

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

Refer to the name plate for all data.

2362.8/07-EN

¹⁵ Unstamped bolted/screwed connections shall be treated as material combination C35E+QT.

Also specify the following data:

- Part number and description (⇒ Section 9.1, Page 52)
- 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 19: Quantity of spare parts for recommended spare parts stock

| Part No. | Description | Number of pumps (including stand-by pumps) | | | | | | | |
|----------|---|--|---|---|---|---|---------|---------|-------------|
| | | 1 | 2 | 3 | 4 | 5 | 6 and 7 | 8 and 9 | 10 and more |
| 135.01 | Wear plate | 1 | 2 | 2 | 2 | 3 | 3 | 4 | 50% |
| 210 | Shaft with hardware | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 20% |
| 230 | Impeller | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 20% |
| 321.01 | Deep groove ball bearing | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 25% |
| 411.77 | Joint ring | 1 | 2 | 2 | 2 | 3 | 3 | 4 | 50% |
| 433.02 | Complete mechanical seal ¹⁶⁾ | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 25% |
| | Set of sealing elements | 2 | 4 | 6 | 8 | 8 | 9 | 12 | 150% |

¹⁶⁾ Includes shaft protecting sleeve 524.01

7.7.3 Interchangeability of pump components

Components featuring the same number in a column are interchangeable.

| KWP-bloc | Description | | | | | | | | | |
|--------------|-------------|-------------------------------------|-----------------|----------------|----------|---|--------|--------------------------------|-------------------------|--------|
| | Pump casing | Intermediate lantern ¹⁷⁾ | Discharge cover | Shaft* | Impeller | Deep groove ball bearing ¹⁷⁾ | V-ring | Mechanical seal ¹⁸⁾ | Shaft protecting sleeve | Spring |
| | Part No. | | | | | | | | | |
| | 101 | 146 | 163 | 210 | 230 | 321.01 | 411.77 | 433.02 | 524.01 | 950.10 |
| 065-040-0250 | 1 | 1/2 | 1 | 1/2/3/4/5 | 1 | 1/2 | 1 | 1 | 1 | 1 |
| 065-050-0200 | 3 | 1/2 | 3 | 1/2/3/4/5 | 3 | 1/2 | 1 | 1 | 1 | 1 |
| 080-065-0200 | 4 | 1/2 | 3 | 1/2/3/4/5 | 4 | 1/2 | 1 | 1 | 1 | 1 |
| 080-040-0315 | 5 | 1/2 | 4 | 10/11/12/13/14 | 5 | 1/2 | 2 | 1 | 3 | 1 |
| 080-065-0315 | 6 | 1/2 | 4 | 10/11/12/13/14 | 6 | 1/2 | 2 | 1 | 3 | 1 |
| 100-080-0250 | 7 | 1/2 | 1 | 1/2/3/4/5 | 7 | 1/2 | 1 | 1 | 1 | 1 |
| 100-080-0315 | 8 | 1/2 | 4 | 10/11/12/13/14 | 8 | 1/2 | 2 | 1 | 3 | 1 |
| 125-100-0250 | 9 | 1/2 | 5 | 10/11/12/13/14 | 9 | 1/2 | 2 | 1 | 3 | 1 |
| 125-100-0315 | 10 | 1/2 | 4 | 10/11/12/13/14 | 10 | 1/2 | 2 | 1 | 3 | 1 |

Table 20: *Shaft 210: combination of motor size and shaft number

| Motor size | Shaft number |
|------------|--------------|
| 90 | 1, 6, 10 |
| 110, 112 | 2, 7, 11 |
| 132 | 3, 8, 12 |
| 160 | 4, 9, 13 |
| 180 | 5, 14 |

¹⁷ Intermediate lantern / deep groove ball bearing: 1 = up to motor size 112; 2 = from motor size 132 to motor size 180

¹⁸ For the interchangeability of KSB mechanical seal 4KBL refer to the shaft protecting sleeve as the shaft protecting sleeve is part of the mechanical seal.

8 Trouble-shooting

| | |
|--|---|
| | WARNING |
| | <p>Improper work to remedy faults Risk of injury!</p> <p>▷ For any work performed to remedy faults, observe the relevant information given in this operating manual and/or in the product literature provided by the accessories manufacturer.</p> |

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

- A Pump delivers insufficient flow rate
- B Motor is overloaded
- C Excessive discharge pressure
- D Increased bearing temperature
- E Leakage at the pump
- F Excessive leakage at the shaft seal
- G Vibrations during pump operation
- H Impermissible temperature increase in the pump

Table 21: Trouble-shooting

| A | B | C | D | E | F | G | H | Possible cause | Remedy ¹⁹⁾ |
|---|---|---|---|---|---|---|---|--|---|
| X | - | - | - | - | - | - | - | Pump delivers against an excessively high pressure. | Re-adjust to duty point. |
| X | - | - | - | - | - | - | - | Excessively high back pressure | Check system for impurities. Fit a larger impeller. ²⁰⁾ Increase the speed. |
| X | - | - | - | - | - | X | X | Pump or piping are not completely vented or primed. | Vent and/or prime. |
| X | - | - | - | - | - | - | - | Supply line or impeller clogged | Remove deposits in the pump and/or piping. |
| X | - | - | - | - | - | - | - | Formation of air pockets in the piping | Alter piping layout. Fit vent valve. |
| - | - | - | X | - | X | X | - | 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 | - | - | - | - | - | X | X | Suction lift is too high/ NPSH _{available} (positive suction head) is too low. | Check/alter fluid level. Fully open the shut-off element in the supply line. Change suction line, if the friction losses in the suction line are too high. Check any strainers installed/suction opening. Observe permissible speed of pressure fall. |
| - | - | - | X | - | - | - | - | Increased axial thrust ²⁰⁾ | Correct the rotor adjustment. |
| X | - | - | - | - | - | - | - | Air intake at the shaft seal | Fit new shaft seal. |
| X | - | - | - | - | - | - | - | Wrong direction of rotation | Interchange two of the phases of the power cable. |
| X | X | - | - | - | - | - | - | Motor is running on two phases only. | Replace the defective fuse. Check the electric cable connections. |

¹⁹⁾ Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

²⁰⁾ Contact the manufacturer.

| A | B | C | D | E | F | G | H | Possible cause | Remedy ¹⁹⁾ |
|---|---|---|---|---|---|---|---|--|--|
| X | - | - | - | - | - | - | - | Speed 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 | X | - | Defective bearing(s) | Replace. |
| - | - | - | X | - | - | X | X | Flow rate is too low. | Increase the minimum flow rate. |
| X | - | - | - | - | - | X | - | Wear of internal components | Replace worn components by new ones. |
| - | - | - | - | - | - | X | - | Pump back pressure lower than specified in the purchase order | Re-adjust to duty point. |
| - | X | - | - | - | - | - | - | Density or viscosity of fluid handled higher than stated in purchase order | Contact the manufacturer. |
| - | - | - | - | - | X | - | - | Use of unsuitable materials | Change the material combination. |
| - | X | X | - | - | - | - | - | Speed too high | Reduce speed. ²⁰⁾ |
| - | - | - | - | X | - | - | - | Tie bolts/sealing element defective | Fit new sealing element between volute casing and discharge cover. Re-tighten the bolts. |
| - | - | - | - | - | X | - | - | Worn shaft seal | Fit new shaft seal. |
| X | - | - | - | - | X | - | - | Score marks or roughness on shaft protecting sleeve / shaft sleeve | Replace shaft protecting sleeve/shaft sleeve. Replace shaft seal. Check balancing line. Check throttling bush/throttling sleeve clearances. |
| - | - | - | - | - | X | - | - | Lack of cooling liquid or dirty cooling chamber | Increase cooling liquid quantity. Clean out cooling chamber. Purify/clean cooling liquid. |
| - | X | - | - | - | - | X | - | Pump back pressure lower than specified in the purchase order | Re-adjust to duty point. |
| - | - | - | - | - | X | - | - | Vibrations during pump operation | Correct the suction conditions. Re-align the pump set. Re-balance the impeller. Increase pressure at the pump suction nozzle. |
| - | - | - | X | - | X | X | - | The pump set is misaligned. | Re-align the pump set. |
| - | - | - | X | - | - | - | - | Insufficient or excessive quantity of lubricant or unsuitable lubricant. | Top up, reduce or change lubricant. |
| - | X | - | - | - | - | - | - | Operating voltage too low | Increase the voltage. Check voltage drop in the power cable. |
| - | - | - | - | - | - | X | - | Rotor out of balance | Clean rotor. Re-balance rotor. |

9 Related Documents

9.1 General assembly drawing with list of components

9.1.1 Horizontal installation

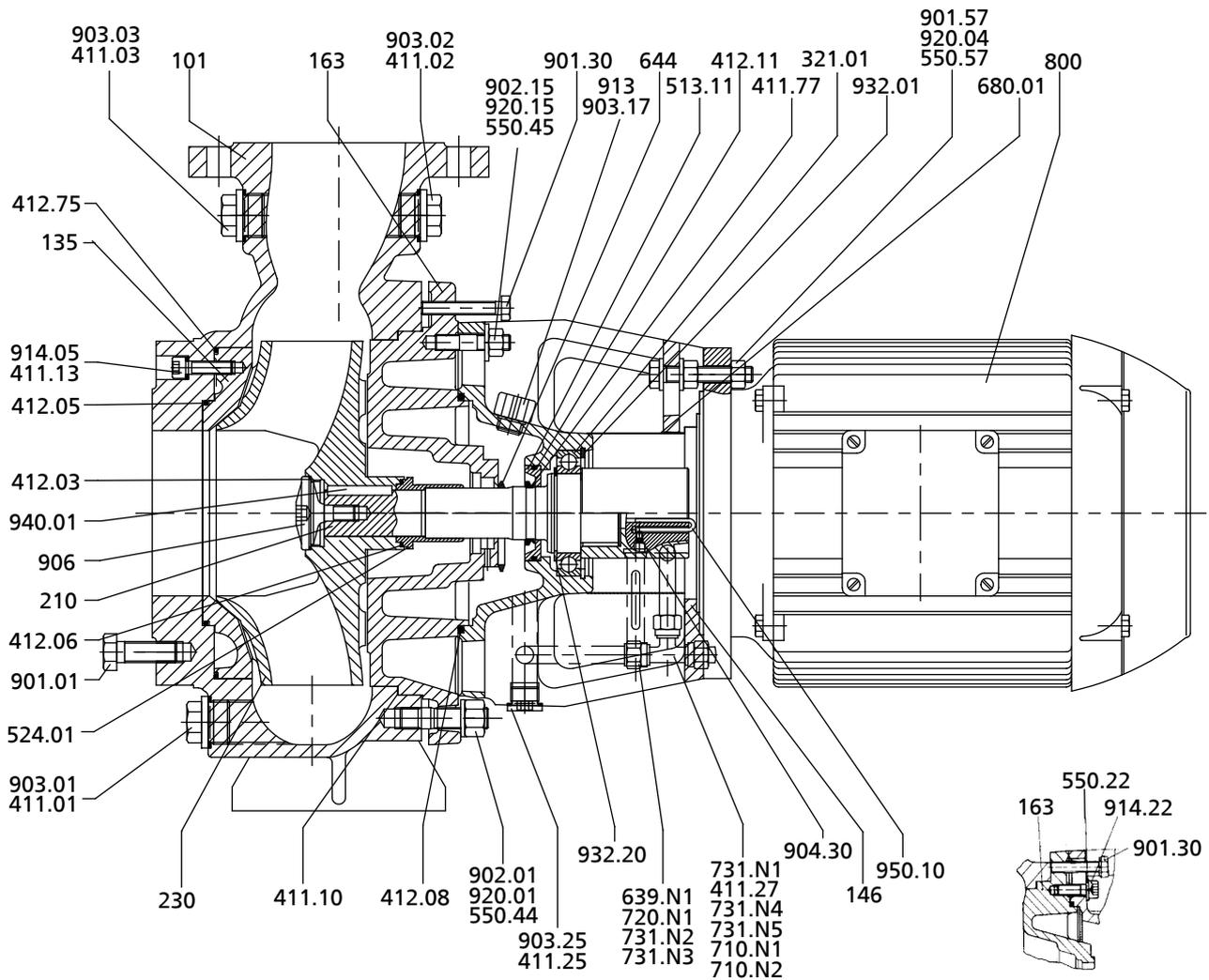


Fig. 9: General assembly drawing of variants GNNG, GDNG

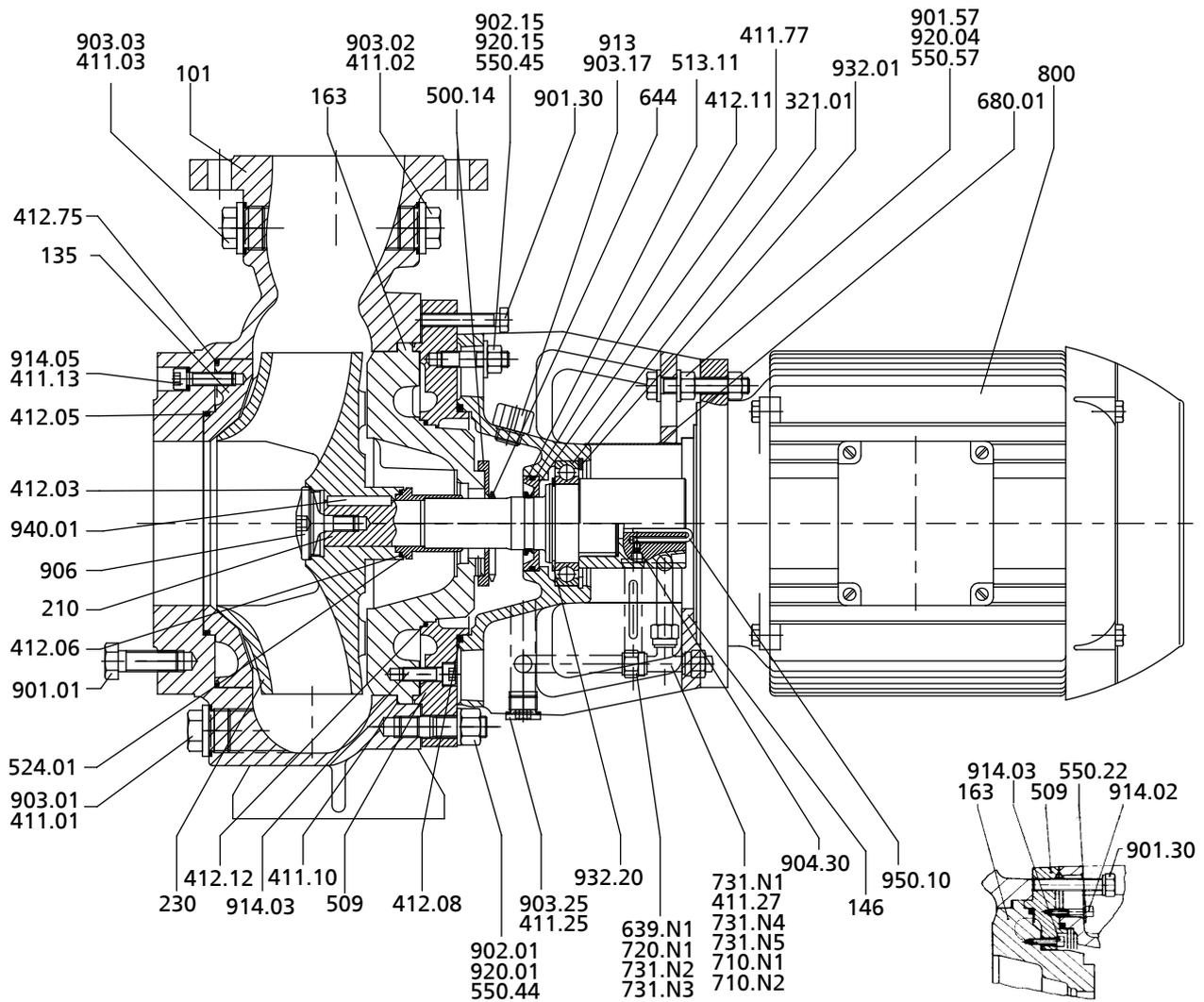


Fig. 10: General assembly drawing of variant DDDD

9.1.2 Vertical installation

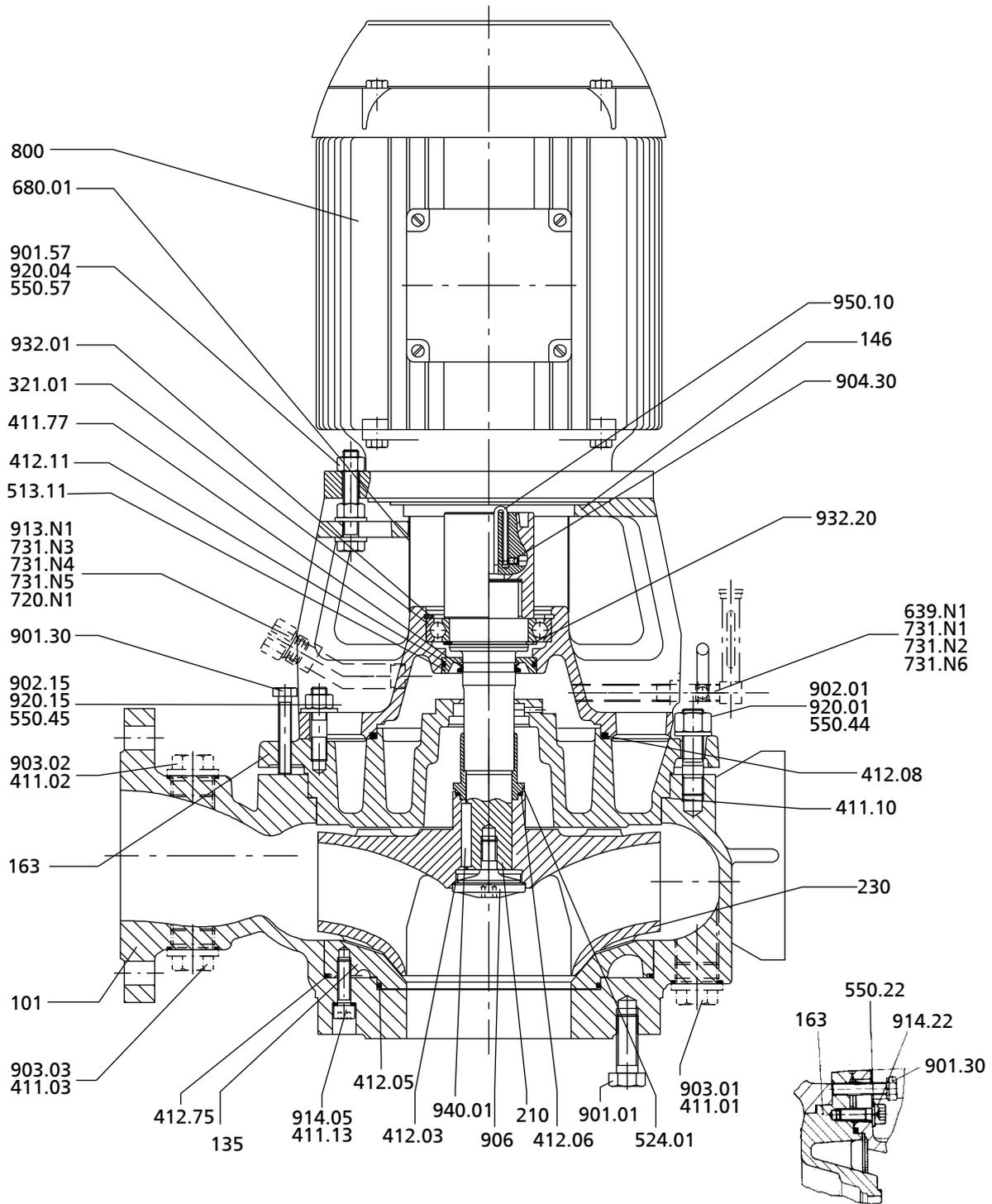


Fig. 11: General assembly drawing of variants GNNG, GDNG

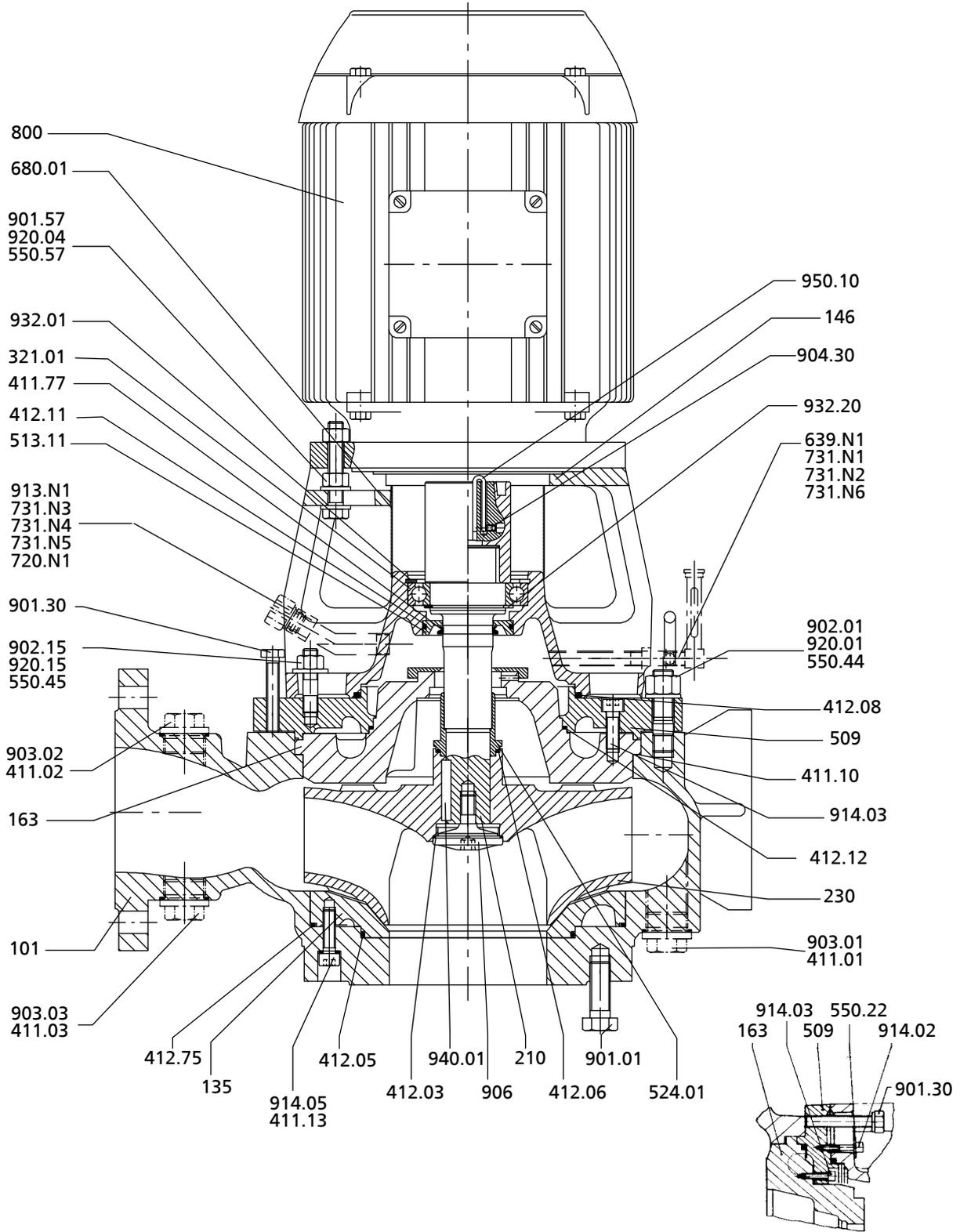


Fig. 12: General assembly drawing of variant DDDD

2362.8/07-EN

9.1.3 Mechanical seal

Mechanical seal KSB 4KBL

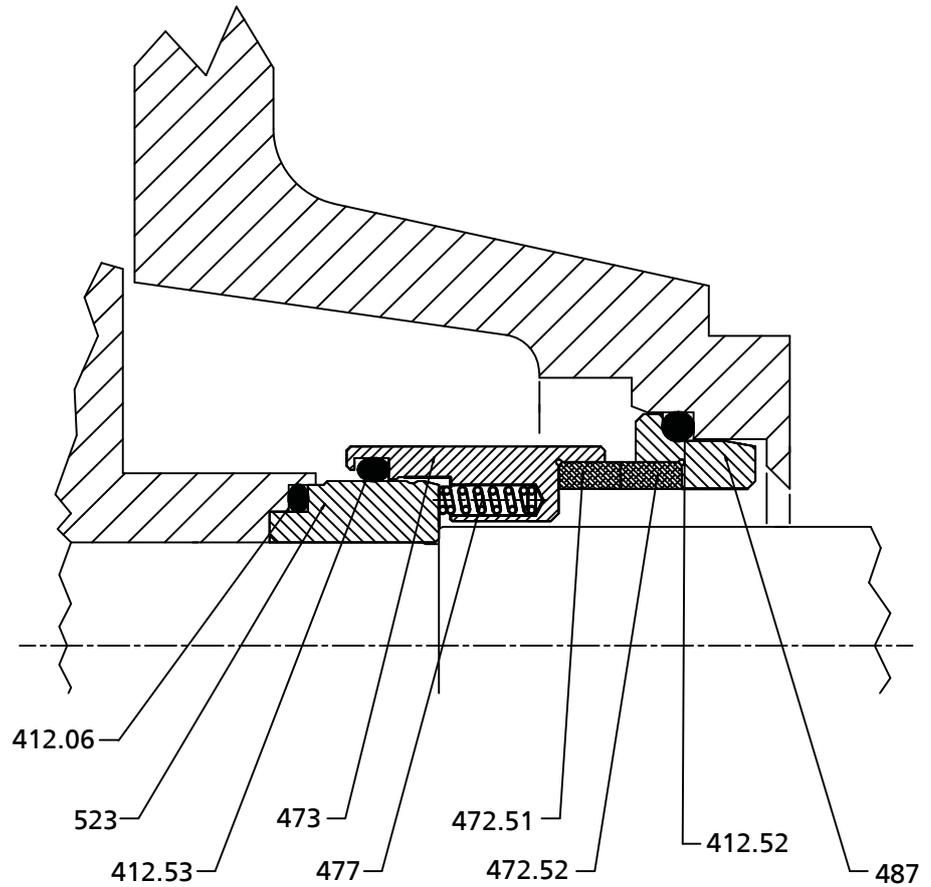


Fig. 13: Mechanical seal KSB 4KBL

Mechanical seal, Burgmann
MG1-G6

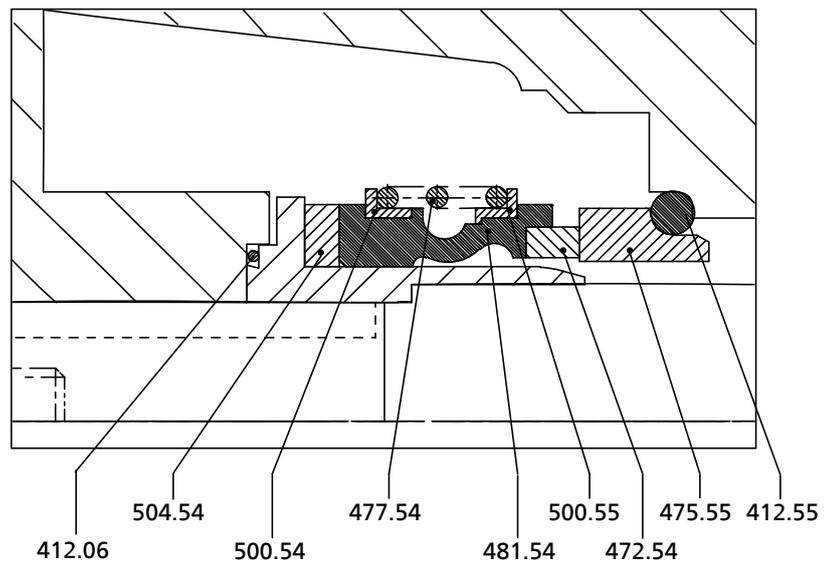


Fig. 14: Mechanical seal, Burgmann MG1-G6

Mechanical seal, John Crane 2100

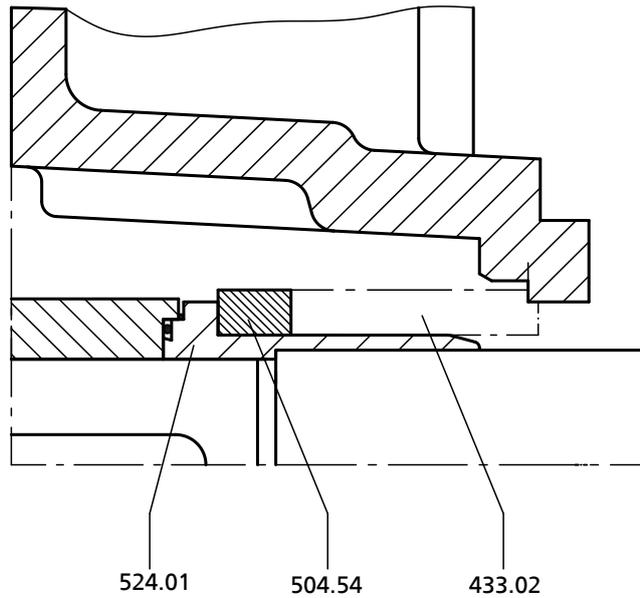


Fig. 15: Mechanical seal, John Crane 2100

9.1.4 List of components

Table 22: List of components²¹⁾

| Part No. | Comprising | Scope of supply |
|----------|--|-------------------------------|
| 101 | 101 | Pump casing |
| | 411.01 ²²⁾ /.02 ²²⁾ /.03 ²²⁾ /.10 | Joint ring |
| | 550.44 | Disc |
| | 901.01 | Hexagon head bolt |
| | 902.01 | Stud |
| | 903.01 ²²⁾ /.02 ²²⁾ /.03 ²²⁾ | Screw plug |
| | 920.01 | Hexagon nut |
| 135 | 135 | Wear plate |
| | 411.13 | Joint ring |
| | 412.05/.75 | O-ring |
| | 914.05 | Hexagon socket head cap screw |
| 146 | 146 | Intermediate lantern |
| | 550.57 | Disc |
| | 913 | Vent plug |
| | 901.57 | Hexagon head bolt |
| | 903.17/.25/.26 | Screw plug |
| | 920.04 | Hexagon nut |
| | 932.01 | Circlip |
| 163 | 163 | Discharge cover |
| | 412.08 | O-ring |
| | 550.45/.22 | Disc |
| | 901.30 | Hexagon head bolt |
| | 902.15 | Stud |
| | 920.15 | Hexagon nut |
| | 914.22 | Hexagon socket head cap screw |

2362.8/07-EN

²¹⁾ Depending on the design

²²⁾ If any

| Part No. | Comprising | Scope of supply |
|-----------------------|--|-------------------------------|
| 163 | 500.14 | Ring |
| 210 | 210 | Shaft |
| | 904.30 | Grub screw |
| | 932.20 | Circlip |
| | 940.01 | Key |
| | 950.10 | Spring |
| 230 | 230 | Impeller |
| 321.01 | 321.01 | Deep groove ball bearing |
| 411.77 | 411.77 | Joint ring |
| 504.54 ²³⁾ | 504.54 | Spacer ring |
| 509 | 509 | Intermediate ring |
| | 412.12 | O-ring |
| | 914.02/.03 | Hexagon socket head cap screw |
| 513.11 | 513.11 | Insert ring |
| | 412.11 | O-ring |
| 524.01 | 524.01 ²⁴⁾ | Shaft protecting sleeve |
| | 412.06 | O-ring |
| 639 ²⁵⁾ | 411.25/.27 | Joint ring |
| | 639.N1 | Oil level gauge, complete |
| | 644 | Lubricating ring |
| | 710.N1/.N2 | Pipe |
| | 720/731.N1 | Barrel nipple |
| | 731.N6 | Pipe union |
| | 731.N2/.N3/.N4/.N5 | Angle |
| | 903.25 | Screw plug |
| 680.01 | 680.01 | Guard |
| 800 | 800 | Motor, complete |
| 906 | 906 | Impeller screw |
| | 412.03 | O-ring |
| 99-9 | 99-9 | Set of sealing elements |
| | 411.01/.02/.03/.10/.12/.13/.16/.17/.77 | Joint ring |
| | 412.03/.05/.06/.08/.11/.75 | O-ring |

Table 23: List of components for mechanical seal 4KBL

| Part No. | Comprising | Scope of supply |
|----------|------------|-------------------------|
| 433 | 412.52/.53 | O-ring |
| | 472.51 | Primary ring |
| | 472.52 | Mating ring |
| | 473 | Primary ring carrier |
| | 477 | Spring |
| | 487 | Mating ring carrier |
| | 523 | Shaft protecting sleeve |

Table 24: List of components for mechanical seal MG1-G6

| Part No. | Comprising | Scope of supply |
|----------|------------|-----------------|
| 433 | 412.55 | O-ring |

²³ On pumps with standardised mechanical seal only

²⁴ On models with mechanical seal type 4KBL this is part of the mechanical seal.

²⁵ On pumps with oil reservoir only

| Part No. | Comprising | Scope of supply |
|----------|------------|-----------------|
| 433 | 472.54 | Primary ring |
| | 475.55 | Mating ring |
| | 477.54 | Spring |
| | 481.54 | Bellows |
| | 500.54 | Ring |
| | 500.55 | Ring |

10 EU Declaration of Conformity

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

The manufacturer herewith declares that the product:

KWP, KWPR, KWP-Bloc

KSB order number:

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

The manufacturer also declares that

- the following harmonised international standards²⁶⁾ have been applied:
 - ISO 12100
 - EN 809

Person authorised to compile the technical file:

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

The EU Declaration of Conformity was issued in/on:

Place, date

.....²⁷⁾.....

Name
Function
Company
Address

²⁶⁾ Apart from the standards listed here referring to the Machinery Directive, further standards are observed for explosion-proof versions (ATEX Directive) as applicable and are listed in the legally binding EU Declaration of Conformity.

²⁷⁾ A signed, legally binding EU Declaration of Conformity is supplied with the product.

11 Certificate of Decontamination

Type:

Order number /
Order item number²⁸⁾:

Delivery date:

Application:

Fluid handled²⁸⁾:

Please tick where applicable²⁸⁾:



Corrosive



Oxidising



Flammable



Explosive



Hazardous to health



Seriously hazardous to health



Toxic



Radioactive



Bio-hazardous



Safe

Reason for return:²⁸⁾

Comments:

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

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

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

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

- No special safety precautions are required for further handling.
- The following safety precautions are required for flushing fluids, fluid residues and disposal:

.....
.....

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

.....
Place, date and signature

.....
Address

.....
Company stamp

2362.8/07-EN

²⁸⁾ Required field

Index

A

Abrasive fluids 35
 Applications 8
 Automation 18

B

Bearing temperature 39
 Bearings 18

C

Certificate of Decontamination 61
 Commissioning 28
 Configuration and function 19
 Connections 18

D

Design 16
 Direction of rotation 27
 Dismantling 43
 Disposal 14

E

Event of damage 6
 Ordering spare parts 47
 Explosion protection 10, 26, 30, 31, 33, 37, 38, 40

F

Filter 23, 40
 Flow rate 34
 Fluid handled
 Density 35
 Frequency of starts 33, 34

G

Grease lubrication
 Intervals 41

H

Horizontal installation 29

I

Impeller type 18
 Installation
 without foundation 21
 Installation at site 21
 Installation types 17
 Intended use 8
 Interchangeability of pump components 49

K

Key to safety symbols/markings 7

L

List of components 57

M

Maintenance 38
 Materials 18
 Monitoring equipment 12

N

Name plate 16
 Noise characteristics 20

O

Oil lubrication
 Oil quality 41
 Oil reservoir 28
 Operating limits 33
 Order number 6
 Other applicable documents 6

P

Partly completed machinery 6
 Permissible forces and moments at the pump
 nozzles 24
 Piping 23
 Preservation 14, 35
 Priming and venting 30
 Product description 15

R

Reassembly 43
 Return to supplier 14
 Returning to service 35

S

Safety 8
 Safety awareness 9
 Scope of supply 20
 Shaft seal 17
 Shutdown 35
 Spare part
 Ordering spare parts 47
 Start-up 31
 Storage 14, 35

T

Temperature limits 11
 Tightening torques 47
 Transport 13
 Trouble-shooting
 Causes and remedies 50

V

Vertical installation 29

W

Warnings 7

Warranty claims 6



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2362.8/07-EN (01317103)