Hygienic pump in close-coupled design

Vitachrom

Installation/Operating Manual
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Installation/Operating Manual Vitachrom

Original operating manual

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Glossary

**Back pull-out unit**
Pump without pump casing; partly completed machinery

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

**CIP (Cleaning in Place)**
Procedure during which the inside of the pump is cleaned with a cleaning agent with the pump running. The pump does not need to be dismantled.

**Close-coupled design**
Motor directly fitted to the pump via a flange or a drive lantern

**Discharge line**
The line which is connected to the discharge nozzle

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

**Pool of pumps**
Pumps which are purchased and stored independently of their later use

**Pump**
Machine without drive, additional components or accessories

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

**Quench liquid supply**
Unpressurised liquid between the inboard and outboard shaft seal

**SIP (Steaming in Place)**
Procedure during which the inside of the pump is sterilised with steam with the pump running. The pump does not need to be dismantled.

**Suction lift line/suction head line**
The line which is connected to the suction nozzle
1 General

1.1 Principles
This operating manual is supplied as an integral part of the type series and variants indicated on the front cover. The manual describes the proper and safe use of this equipment in all phases of operation.

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

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

Noise characteristics (⇨ Section 4.7 Page 18)

1.2 Installation of partly completed machinery
To install partly completed machinery supplied by KSB refer to the sub-sections under Servicing/Maintenance. (⇨ Section 7.5.4 Page 42)

1.3 Target group
This operating manual is aimed at the target group of trained and qualified specialist technical personnel. (⇨ Section 2.4 Page 9)

1.4 Other applicable documents
Table 1: Overview of other applicable documents

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

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

1.5 Symbols
Table 2: Symbols used in this manual

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>Conditions which need to be fulfilled before proceeding with the step-by-step instructions</td>
</tr>
<tr>
<td>⊳</td>
<td>Safety instructions</td>
</tr>
<tr>
<td>⇔</td>
<td>Result of an action</td>
</tr>
<tr>
<td>⇦</td>
<td>Cross-references</td>
</tr>
</tbody>
</table>

1) If agreed upon in scope of supply
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Step-by-step instructions</td>
</tr>
<tr>
<td>2.</td>
<td>Note Recommendations and important information on how to handle the product</td>
</tr>
</tbody>
</table>
2 Safety

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

2.1 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>DANGER</td>
</tr>
<tr>
<td></td>
<td>This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.</td>
</tr>
<tr>
<td>!</td>
<td>WARNING</td>
</tr>
<tr>
<td></td>
<td>This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.</td>
</tr>
<tr>
<td>CAUTION</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CAUTION</td>
</tr>
<tr>
<td></td>
<td>This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.</td>
</tr>
<tr>
<td>![Ex]</td>
<td>Explosion protection</td>
</tr>
<tr>
<td></td>
<td>This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with EC Directive 94/9/EC (ATEX).</td>
</tr>
<tr>
<td>![Ex]</td>
<td>General hazard</td>
</tr>
<tr>
<td></td>
<td>In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.</td>
</tr>
<tr>
<td>![Ex]</td>
<td>Electrical hazard</td>
</tr>
<tr>
<td></td>
<td>In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.</td>
</tr>
<tr>
<td>![Ex]</td>
<td>Machine damage</td>
</tr>
<tr>
<td></td>
<td>In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.</td>
</tr>
</tbody>
</table>

2.2 General

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

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

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

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

Information attached directly to the pump must always be complied with and be kept in a perfectly legible condition at all times. This applies to, for example:

- Arrow indicating the direction of rotation
- Markings for connections
- Name plate

The operator is responsible for ensuring compliance with all local regulations not taken into account in this manual.

2.3 Intended use

- The pump (set) must only be operated within the operating limits described in the other applicable documents.
- Only operate pumps/pump sets which are in perfect technical condition.
- Do not operate the pump (set) in partially assembled condition.
- Only use the pump 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 maximum flow rates 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.

Prevention of foreseeable misuse
• Never open the discharge-side shut-off elements further than permitted.
  – The maximum flow rates specified in the product literature or data sheet would be exceeded.
  – Risk of cavitation damage
• Never exceed the permissible operating limits specified in the data sheet or product literature regarding pressure, temperature, etc.
• Observe all safety information and instructions in this manual.

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

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

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

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

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

2.6 Safety awareness
In addition to the safety information contained in this manual and the intended use, the following safety regulations shall be complied with:
• Accident prevention, health and safety regulations
• Explosion protection regulations
• Safety regulations for handling hazardous substances
• Applicable standards, directives and laws
2.7 Safety information for the operator/user

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

2.8 Safety information for maintenance, inspection and installation work

▪ Modifications or alterations of the pump are only permitted with the manufacturer's prior consent.
▪ Use only original spare parts or parts authorised by the manufacturer. The use of other parts can invalidate any liability of the manufacturer for resulting damage.
▪ The operator ensures that all maintenance, inspection and installation work is performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
▪ Only carry out work on the pump (set) during standstill of the pump.
▪ The pump casing must have cooled down to ambient temperature.
▪ Pump pressure must have been released and the pump must have been drained.
▪ When taking the pump set out of service always adhere to the procedure described in the manual. (⇨ Section 6.1.5 Page 28) (⇨ Section 6.3 Page 32)
▪ Decontaminate pumps which handle fluids posing a health hazard.
▪ As soon as the work has been completed, re-install and/or re-activate any safety-relevant and protective devices. Before returning the product to service, observe all instructions on commissioning.

2.9 Unauthorised modes of operation

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

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

2.10 Explosion protection

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

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

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

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

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

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

Prevent impermissible modes of operation at all times.

! DANGER
2.10.1 Marking

**Pump**

The marking on the pump refers to the pump part only. Example of such marking: II 2 G c TX

Refer to the Temperature Limits table for the temperatures permitted for the individual pump variants. (⇨ Section 2.10.2 Page 11)

**Shaft coupling**

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

**Motor**

The motor must be considered separately.

2.10.2 Temperature limits

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

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

The table below lists the temperature classes and the resulting theoretical temperature limits of the fluid handled. (A possible temperature rise in the shaft seal area has already been taken into account).

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

### Table 4: Temperature limits

<table>
<thead>
<tr>
<th>Temperature class as per EN 13463-1</th>
<th>Max. permissible fluid temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>Temperature limit of the pump</td>
</tr>
<tr>
<td>T2</td>
<td>280 °C</td>
</tr>
<tr>
<td>T3</td>
<td>185 °C</td>
</tr>
<tr>
<td>T4</td>
<td>120 °C</td>
</tr>
<tr>
<td>T5</td>
<td>85 °C</td>
</tr>
<tr>
<td>T6</td>
<td>Only after consultation with the manufacturer</td>
</tr>
</tbody>
</table>

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.

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

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

2.10.3 Monitoring equipment

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

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

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

Contact KSB for further information on monitoring equipment.

2.10.4 Operating limits

The minimum flows indicated in (⇨ Section 6.2.5.1 Page 31) 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 6.2.5.1 Page 31) can be used to check whether additional heat build-up may lead to a dangerous temperature increase at the pump surface.
3 Transport/Temporary Storage/Disposal

3.1 Checking the condition upon delivery
1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify KSB or the supplying dealer (as applicable) and the insurer about the damage in writing immediately.

3.2 Transport

*WARNING*

The pump (set) could slip out of the suspension arrangement
Danger to life from falling parts!
▷ Always transport the pump (set) in the specified position.
▷ Never attach the suspension arrangement to the free shaft end or the motor eyebolt.
▷ Give due attention to the weight data and the centre of gravity.
▷ Observe the applicable local health and safety regulations.
▷ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.

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

![Fig. 1: Transporting the pump (with angle foot, for motors ≤ 4 kW)](image)

![Fig. 2: Transporting the pump (for motors ≥ 5.5 kW)](image)

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

*CAUTION*

Damage during storage by humidity, dirt, or vermin
Corrosion/contamination of the pump (set)
▷ For outdoor storage cover the packed or unpacked pump (set) and accessories with waterproof material.
CAUTION

Wet, contaminated or damaged openings and connections
Leakage or damage to the pump set!
▷ Only remove caps/covers from the openings of the pump set at the time of installation.

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 32)

3.4 Return to supplier

1. Drain the pump as per operating instructions. (☞ Section 7.3 Page 36)

2. Always flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.

3. If the pump set has handled fluids whose residues could lead to corrosion in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump set must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.

4. Always complete and enclose a certificate of decontamination when returning the pump (set).
Always indicate any safety and decontamination measures taken. (☞ Section 11 Page 64)

NOTE

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

3.5 Disposal

WARNING

Fluids, consumables and supplies which are hot and/or pose a health hazard
Hazard to persons and the environment!
▷ Collect and properly dispose of flushing fluid and any residues of the fluid handled.
▷ 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

- Close-coupled pump with shaft seal
  Hygienic pump for handling fluids in the food and beverages industry.

4.2 Designation

Example: VC100-200/2202T11M1DMO

Table 5: Key to the designation

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VC</td>
<td>Type series (full name: Vitachrom)</td>
</tr>
<tr>
<td>100</td>
<td>Nominal suction nozzle diameter [mm]</td>
</tr>
<tr>
<td></td>
<td>Nominal discharge nozzle diameter [mm]</td>
</tr>
<tr>
<td>200</td>
<td>Nominal impeller diameter, maximum (approximate)</td>
</tr>
<tr>
<td>220</td>
<td>Motor rating x 10, e.g. 22 kW</td>
</tr>
<tr>
<td>2</td>
<td>2-pole motor of 2900 rpm</td>
</tr>
<tr>
<td>T11</td>
<td>Type of mechanical seal, e.g. tandem arrangement, material pair inboard BQ1E1GG</td>
</tr>
<tr>
<td>M</td>
<td>Connection, e.g. M = hygienic pipe union to DIN 11851</td>
</tr>
<tr>
<td>1</td>
<td>Material of O-rings for casing, impeller nut and shaft, e.g. EPDM</td>
</tr>
<tr>
<td>D</td>
<td>Material of impeller and discharge cover, e.g. D = DIN 1.4409</td>
</tr>
<tr>
<td>M</td>
<td>Type of installation, e.g. M = motor feet</td>
</tr>
<tr>
<td>O</td>
<td>Motor shroud, e.g. O = without shroud</td>
</tr>
</tbody>
</table>

4.3 Name plate

![Name plate Vitachrom (example)](image)

Fig. 3: Name plate Vitachrom (example)

<table>
<thead>
<tr>
<th>1</th>
<th>Type series, size and version</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>KSB order number (ten digits)</td>
</tr>
<tr>
<td>3</td>
<td>Flow rate</td>
</tr>
<tr>
<td>4</td>
<td>Speed</td>
</tr>
<tr>
<td>5</td>
<td>Kinematic viscosity of the fluid handled</td>
</tr>
<tr>
<td>6</td>
<td>Order item number (six digits)</td>
</tr>
<tr>
<td>7</td>
<td>Consecutive number (two digits)</td>
</tr>
<tr>
<td>8</td>
<td>Head</td>
</tr>
<tr>
<td>9</td>
<td>Year of construction</td>
</tr>
</tbody>
</table>

4.4 Design details

Design

- Close-coupled design
- Horizontal installation
- Single-stage
• Wetted components made of stainless steel 1.4404/1.4409
• Highly suitable for CIP/SIP routines
• Pump version with inducer for fluids pumped from vessels under vacuum (pump sizes 65-160-IND, 80-250-IND and 80-250.1-IND only) and for low NPSH values.

**Pump casing**
• Annular casing

**Drive**
• Surface-cooled KSB squirrel-cage motor
• Type of construction: V 15/B 35
• IP55 enclosure
• Thermal class F, 3 PTC resistors
• Mode of operation: continuous operation S1
• Winding
  
  Up to 2.2 kW: 220-240 V/380-420 V
  From 3 kW: 380-420 V/660-725 V
• Winding 60 Hz: 440-480 V

**Explosion-proof design:**
• KSB surface-cooled IEC frame three-phase current squirrel-cage motor
  
<table>
<thead>
<tr>
<th>Winding</th>
<th>50 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 1.85 kW: 220-240 V/380-420 V</td>
<td></td>
</tr>
<tr>
<td>2.5 kW and higher: 380-420 V/660-725 V</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of construction</th>
<th>Up to 3.3 kW: IM V1</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.6 kW and higher: IM V15</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Enclosure</th>
<th>IP55 or IP54</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Type of protection</th>
<th>EExe II and EExde II</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode of operation</td>
<td>Continuous operation S1</td>
</tr>
</tbody>
</table>

**Shaft seal**
• Single mechanical seal surrounded by fluid handled to EN 12756, hygienic or sterile design
  
  **Hygienic design:** inboard seal with spring surrounded by fluid handled, uni-directional
  
  **Sterile design:** inboard seal with covered spring, polished surface, bi-directional
• Double mechanical seal in tandem arrangement with quench supply

**Impeller type**
• Semi-open multi-vane impeller

**Bearings**
• Grease-lubricated bearings sealed for life

**Connections**
Axial suction nozzle, tangential discharge nozzle
Adjustable through 360°

**Standard:**
• Threaded connection to DIN 11851
• Flange to EN 1092-1

**Alternative:**
• Flange to DIN 11864-2-NF-A
• Flange to EN 1092-1-F
• Flange to APV-FN
• Threaded connection to DIN 11864-1-GS-A
• Threaded connection to ISO 2853
• SMS thread
4.5

4.6 Configuration and function

Fig. 4: Vitachrom sectional drawing

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clearance gap</td>
</tr>
<tr>
<td>2</td>
<td>Discharge nozzle</td>
</tr>
<tr>
<td>3</td>
<td>Discharge cover</td>
</tr>
<tr>
<td>4</td>
<td>Shaft</td>
</tr>
<tr>
<td>5</td>
<td>Motor housing</td>
</tr>
<tr>
<td>6</td>
<td>Suction nozzle</td>
</tr>
<tr>
<td>7</td>
<td>Impeller</td>
</tr>
<tr>
<td>8</td>
<td>Shaft seal</td>
</tr>
<tr>
<td>9</td>
<td>Drive lantern</td>
</tr>
<tr>
<td>10</td>
<td>Rolling element bearings</td>
</tr>
<tr>
<td>11</td>
<td>Rolling element bearings</td>
</tr>
</tbody>
</table>

Design  The pump is designed with an axial fluid inlet and a radial outlet. The hydraulic system is rigidly connected to the motor via a stub shaft.

Function  The fluid enters the pump via a suction nozzle (6) and is accelerated outward in a radial 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 is pumped to the discharge nozzle (2), where it leaves the pump. The clearance gap (1) prevents any fluid from flowing back from the casing into the inlet. The hydraulic system is closed with a casing cover (3) at the rear side of the impeller; the shaft (4) enters the casing via the casing cover (3). The shaft passage through the casing cover is sealed to the atmosphere with a dynamic shaft seal (8). The shaft runs in rolling element bearings (10 and 11), which are supported by a motor housing (5) linked with the pump casing and/or casing cover via a drive lantern.

Sealing  The pump is sealed by a standardised mechanical seal (option: two mechanical seals in tandem arrangement).
4.7 Noise characteristics

Table 6: Surface sound pressure level $L_{PA}^{2)}$

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>60</td>
<td>61</td>
<td>67</td>
<td>70</td>
</tr>
<tr>
<td>2.2</td>
<td>62</td>
<td>63</td>
<td>69</td>
<td>72</td>
</tr>
<tr>
<td>3</td>
<td>64</td>
<td>65</td>
<td>70</td>
<td>73</td>
</tr>
<tr>
<td>4</td>
<td>66</td>
<td>67</td>
<td>72</td>
<td>75</td>
</tr>
<tr>
<td>5.5</td>
<td>68</td>
<td>69</td>
<td>74</td>
<td>77</td>
</tr>
<tr>
<td>7.5</td>
<td>70</td>
<td>71</td>
<td>76</td>
<td>79</td>
</tr>
<tr>
<td>11</td>
<td>73</td>
<td>74</td>
<td>78</td>
<td>81</td>
</tr>
<tr>
<td>15</td>
<td>75</td>
<td>76</td>
<td>80</td>
<td>83</td>
</tr>
<tr>
<td>18.5</td>
<td>76</td>
<td>77</td>
<td>82</td>
<td>85</td>
</tr>
<tr>
<td>22</td>
<td>80</td>
<td>81</td>
<td>84</td>
<td>87</td>
</tr>
<tr>
<td>30</td>
<td>81</td>
<td>82</td>
<td>86</td>
<td>89</td>
</tr>
<tr>
<td>37</td>
<td>-</td>
<td>-</td>
<td>88</td>
<td>91</td>
</tr>
<tr>
<td>45</td>
<td>-</td>
<td>-</td>
<td>90</td>
<td>93</td>
</tr>
<tr>
<td>55</td>
<td>-</td>
<td>-</td>
<td>92</td>
<td>95</td>
</tr>
<tr>
<td>75</td>
<td>-</td>
<td>-</td>
<td>95</td>
<td>98</td>
</tr>
<tr>
<td>90</td>
<td>-</td>
<td>-</td>
<td>97</td>
<td>100</td>
</tr>
</tbody>
</table>

4.8 Scope of supply

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

- Pump
- Drive
- Accessories, e.g.:
  - Pump foot or vertically adjustable ball feet.
  - Motor shroud (only in combination with adjustable ball feet).
  - Mechanical seals in tandem arrangement (quench design)

4.9 Dimensions and weights

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

---

2) Spatial average; as per ISO 3744 and EN 12639; valid for pump operation in the $Q/Qopt = 0.8 - 1.1$ range and for non-cavitating operation. If noise levels are to be warranted, add +3 dB for measuring and constructional tolerance.
5 Installation at Site

5.1 Safety regulations

**DANGER**

Improper installation in potentially explosive atmospheres
Explosion hazard!
Damage to the pump set!
▷ Comply with the applicable local explosion protection regulations.
▷ Observe the information in the data sheet and on the name plates of pump and motor.

5.2 Checks to be carried out prior to installation

**WARNING**

Installation on mounting surface which is unsecured and cannot support the load
Personal injury and damage to property!
▷ Use a concrete of compressive strength class C12/15 which meets the requirements of exposure class XC1 to EN 206-1.
▷ The mounting surface must have set and must be completely horizontal and even.
▷ 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.

5.3 Installing the pump set

**CAUTION**

Ingress of leakage into the motor
Damage to the pump!
▷ Never install the pump set with the "motor below".

**Fastening**

Table 7: Fastening

<table>
<thead>
<tr>
<th>Motor size</th>
<th>Type of fastening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 112 M</td>
<td>Angle foot</td>
</tr>
<tr>
<td>All motor sizes</td>
<td>Motor feet</td>
</tr>
<tr>
<td>All motor sizes</td>
<td>Ball feet</td>
</tr>
</tbody>
</table>

**NOTE**

For installation on motor feet of motor sizes 132 or 160, the motor feet must be shimmed (20 mm shim height).

1. Position the pump set on the foundation and fasten it.
   (See table on Fastening.)
2. Place a spirit level on the discharge nozzle to align the pump set.
5.4 Piping

5.4.1 Connecting the piping

**DANGER**

**Impermissible loads acting on the pump nozzles**
Danger to life from leakage of hot, toxic, corrosive or flammable fluids!

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

**CAUTION**

**Incorrect earthing during welding work at the piping**
Destruction of rolling element bearings (pitting effect)!

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

**NOTE**

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

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

1. Thoroughly clean, flush and blow through all vessels, pipelines and connections (especially of new installations).
2. Before installing the pump in the piping, remove the flange covers on the suction and discharge nozzles of the pump.

**CAUTION**

**Welding beads, scale and other impurities in the piping**
Damage to the pump!

▷ Free the piping from any impurities.
▷ If necessary, install a filter.
▷ Comply with the instructions set out in (⇨ Section 7.2.2.2 Page 36).

3. If required, install a filter in the piping (see drawing: Filter in the piping).
4. **Connect the pump nozzles to the piping.**

**CAUTION**

Aggressive flushing and pickling agents
Damage to the pump!
▷ Match the cleaning operation mode and duration for flushing and pickling service to the casing and seal materials used.

5.4.2 **Permissible forces and moments at the pump nozzles**

No piping-induced forces and moments (from warped pipelines or thermal expansion, for example) must act on the pump.

The discharge and suction-side pipes must be anchored in such a way that no forces and moments may act on the discharge and suction nozzle of the pump casing. Otherwise, there is a risk of the impeller rubbing against the pump casing on the suction-side, due to the narrow clearance between the impeller and the suction-side floor of the pump casing.

5.4.3 **Vacuum balance line**

**NOTE**

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

The following rules apply to vacuum balance lines:

• Minimum nominal line diameter 25 mm.
• The line extends above the highest permissible fluid level in the vessel.
Fig. 6: Vacuum balance system

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vessel under vacuum</td>
</tr>
<tr>
<td>2</td>
<td>Vacuum balance line</td>
</tr>
<tr>
<td>3</td>
<td>Shut-off element</td>
</tr>
<tr>
<td>4</td>
<td>Swing check valve</td>
</tr>
<tr>
<td>5</td>
<td>Main shut-off element</td>
</tr>
<tr>
<td>6</td>
<td>Vacuum-tight shut-off element</td>
</tr>
</tbody>
</table>

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

5.4.4 Auxiliary connections

CAUTION

Failure to use or incorrect use of auxiliary connections (quench liquid) Malfunction of the pump!

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

▷ Use the auxiliary connections provided.

If a shaft seal with quench is used, fit the quench pot in the immediate vicinity of the pump set approximately 1 metre above the pump centreline. Fluid circulation is ensured by thermosyphon effect or forced circulation.

Suitable fittings are available as accessories. When mounting the fittings comply with the instructions provided by the fitting manufacturers.

Quench fluid supply

- Pipe to DIN 2391
- Compression-type fitting to DIN 2353

Suitable fittings are available as accessories. When mounting the fittings comply with the instructions provided by the fitting manufacturers.

NOTE

The quench liquid feed line must be laid with a continuously rising slope towards the quench pot.

Arrangement

Fit the quench pot (available as accessory) in the immediate vicinity of the pump set approximately one metre above the pump centreline. Fluid circulation is ensured by thermosyphon effect or forced circulation.
### 5.5 Enclosure/insulation

<table>
<thead>
<tr>
<th>DANGER</th>
<th>Risk of potentially explosive atmosphere due to insufficient venting</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️</td>
<td>Explosion hazard!</td>
</tr>
<tr>
<td>▶️ Make sure the space between the casing cover/discharge cover and the bearing cover is sufficiently vented.</td>
<td></td>
</tr>
<tr>
<td>▶️ Never close or cover the perforation of the bearing bracket guards (e.g. by insulation).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WARNING</th>
<th>The volute casing and casing/discharge cover take on the same temperature as the fluid handled</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>Risk of burns!</td>
</tr>
<tr>
<td>▶️ Insulate the volute casing.</td>
<td></td>
</tr>
<tr>
<td>▶️ Fit protective equipment.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAUTION</th>
<th>Heat build-up in the bearing bracket</th>
</tr>
</thead>
<tbody>
<tr>
<td>☢️</td>
<td>Damage to the bearing!</td>
</tr>
<tr>
<td>▶️ Never insulate the bearing bracket, bearing bracket lantern and casing cover.</td>
<td></td>
</tr>
</tbody>
</table>

### 5.6 Electrical connection

<table>
<thead>
<tr>
<th>DANGER</th>
<th>Incorrect electrical installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️</td>
<td>Explosion hazard!</td>
</tr>
<tr>
<td>▶️ For electrical installation, also observe the requirements of IEC 60079-14.</td>
<td></td>
</tr>
<tr>
<td>▶️ Always use a motor protection switch for explosion-proof motors.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DANGER</th>
<th>Electrical connection work by unqualified personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️</td>
<td>Danger of death from electric shock!</td>
</tr>
<tr>
<td>▶️ Always have the electrical connections installed by a trained and qualified electrician.</td>
<td></td>
</tr>
<tr>
<td>▶️ Observe regulations IEC 60364 and, for explosion-proof models, EN 60079.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WARNING</th>
<th>Incorrect connection to the mains</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️</td>
<td>Damage to the mains network, short circuit!</td>
</tr>
<tr>
<td>▶️ Observe the technical specifications of the local energy supply companies.</td>
<td></td>
</tr>
</tbody>
</table>

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

| NOTE | A motor protection device is recommended. |
5.6.1 Setting the time relay

**CAUTION**

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

| Table 8: Time relay settings for star-delta starting: |
|-----------------|------------------|
| Motor rating     | Y time to be set |
| ≤ 30 kW         | < 3 s            |
| > 30 kW         | < 5 s            |

5.6.2 Connecting the motor

**NOTE**

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

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

5.6.3 Earthing

**DANGER**

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

5.7 Checking the direction of rotation

**DANGER**

Temperature increase resulting from contact between rotating and stationary components
Explosion hazard!
Damage to the pump set!
▷ Never check the direction of rotation by starting up the unfilled pump set.
▷ Separate the pump from the motor to check the direction of rotation.

**WARNING**

Hands inside the pump casing
Risk of injuries, damage to the pump!
▷ Always disconnect the pump set from the power supply and secure it against unintentional start-up before inserting your hands or other objects into the pump.
<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect direction of rotation with non-reversible mechanical seal</td>
</tr>
<tr>
<td>Damage to the mechanical seal and leakage!</td>
</tr>
<tr>
<td>▷ Separate the pump from the motor to check the direction of rotation.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive and pump running in the wrong direction of rotation</td>
</tr>
<tr>
<td>Damage to the pump!</td>
</tr>
<tr>
<td>▷ Refer to the arrow indicating the direction of rotation on the pump.</td>
</tr>
<tr>
<td>▷ Check the direction of rotation. If required, check the electrical connection and correct the direction of rotation.</td>
</tr>
</tbody>
</table>

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

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

6.1 Commissioning/start-up

6.1.1 Prerequisites for commissioning/start-up
Before commissioning/starting up the pump set, make sure that the following conditions are met:

▪ The pump set has been properly connected to the electric power supply and is equipped with all protection devices.
▪ The pump has been primed with the fluid to be handled. The pump has been vented. (⇨ Section 6.1.2 Page 26)
▪ The direction of rotation has been checked. (⇨ Section 5.7 Page 24)
▪ All auxiliary connections required are connected and operational.
▪ The lubricants have been checked.
▪ After prolonged shutdown of the pump (set), the activities required for returning the pump (set) to service have been carried out. (⇨ Section 6.4 Page 32)
▪ The lock washers, if any, have been removed from the shaft groove.

6.1.2 Priming and venting the pump

DANGER
Risk of potentially explosive atmosphere inside the pump
Explosion hazard!
▷ Before starting up the pump, vent the suction line and the pump and prime them with the fluid to be handled.

CAUTION
Increased wear due to dry running
Damage to the pump set!
▷ Never operate the pump set without liquid fill.
▷ Never close the shut-off element in the suction line and/or supply line during pump operation.

1. Vent the pump and suction line and fill them with the fluid to be handled.
2. Fully open the shut-off element in the suction line.
3. Fully open all auxiliary feed lines (barrier fluid, flushing liquid, etc), if applicable.

NOTE
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.
6.1.3 Start-up

**DANGER**
Non-compliance with the permissible pressure and temperature limits if the pump is operated with the suction and/or discharge line closed. 
Explosion hazard! Leakage of hot or toxic fluids!
- Never operate the pump with the shut-off elements in the suction line and/or discharge line closed.
- Only start up the pump set with the discharge-side shut-off element slightly or fully open.

**DANGER**
Excessive temperatures due to dry running or excessive gas content in the fluid handled 
Explosion hazard! Damage to the pump set!
- Never operate the pump set without liquid fill.
- Prime the pump as per operating instructions.
- Always operate the pump within the permissible operating range.

**CAUTION**
Abnormal noises, vibrations, temperatures or leakage 
Damage to the pump!
- Switch off the pump (set) immediately.
- Eliminate the causes before returning the pump set to service.

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

**CAUTION**
Start-up against open discharge line 
Motor overload!
- Make sure the motor has sufficient power reserves.
- Use a soft starter.
- Use speed control.

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

6.1.4 Checking the shaft seal

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

**CAUTION**

Heat build-up inside the pump
Damage to the shaft seal!
- Depending on the type of installation, the pump set requires sufficient after-run time – with the heat source switched off – until the fluid handled has cooled down.

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

**NOTE**

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

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

**CAUTION**

Risk of freezing during prolonged pump shutdown periods
Damage to the pump!
- Drain the pump and the cooling/heating chambers (if any) or otherwise protect them against freezing.

6.1.6 Quench liquid supply

**Permissible quench liquids**
The quench liquid should preferably form a solution with the pumped fluid and be environmentally compatible.

Typical quench liquids:
- Water with a conductivity of 100-800 µS/cm
- Water/glycol mixtures
- Glycerine

**Temperature and pressure limits**

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>-10 °C and</td>
<td>60 °C</td>
</tr>
<tr>
<td>T_{Melting}</td>
<td>+10 °C</td>
<td>T_{Boiling} -10 °C</td>
</tr>
<tr>
<td>Pressure</td>
<td>Ambient pressure</td>
<td>0.5 bar gauge pressure</td>
</tr>
</tbody>
</table>

**One-way quench**
The one-way quench supply should be adjusted to a constant flow ≥ 0.3 l/min.

3) Make sure the circulation line diameter is ≥ ¼”.
4) Depending on quench liquid used.
6.2 Operating limits

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

Explosion hazard!
Hot or toxic fluid could escape!

▷ Comply with the operating data indicated 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.

6.2.1 Ambient temperature

**CAUTION**

Operation outside the permissible ambient temperature

Damage to the pump (set)!

▷ Observe the specified limits for permissible ambient temperatures.

Observe the following parameters and values during operation:

**Table 10: Permissible ambient temperatures**

<table>
<thead>
<tr>
<th>Permissible ambient temperature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>40 °C</td>
</tr>
<tr>
<td>Minimum</td>
<td>See data sheet.</td>
</tr>
</tbody>
</table>

6.2.2 Frequency of starts

**DANGER**

Excessive surface temperature of the motor

Explosion hazard!
Damage to the motor!

▷ In case of explosion-proof motors, observe the frequency of starts specified in the manufacturer’s product literature.

The start-up frequency is usually determined by the maximum temperature increase of the motor. This largely depends on the power reserves of the motor in steady-state operation and on the starting conditions (DOL, star-delta, moments of inertia, etc). If the start-ups are evenly spaced over the period indicated, the pump set can be started up six times per hour (h) with the discharge-side gate valve slightly open.

**CAUTION**

Re-starting while motor is still running down

Damage to the pump (set)!

▷ Do not re-start the pump set before the pump rotor has come to a standstill.
6.2.3 Cleaning in place (CIP)

CAUTION

Elastomers do not have sufficient resistance
Damage to the pump!
▷ Effect cleaning/sterilisation only if the elastomer components used in the pump (e.g. O-rings, mechanical seals) are made of EPDM or other approved materials.

Application

CIP may be effected with the pump running or with the pump stopped.

Cleaning agents

When CIP cleaning a system where the pump set is installed, make sure to comply with the concentration limits, temperature limits and contact times given below for the cleaning agents and disinfectants:

Table 11: Cleaning agents for CIP

<table>
<thead>
<tr>
<th>Cleaning agents</th>
<th>Concentration (% b.w.)</th>
<th>Temperature t [°C]</th>
<th>Contact time [h]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydroxide (soda lye)</td>
<td>5</td>
<td>90</td>
<td>-</td>
</tr>
<tr>
<td>Phosphoric acid</td>
<td>3</td>
<td>90</td>
<td>≤ 1</td>
</tr>
<tr>
<td>Hot water</td>
<td>-</td>
<td>90</td>
<td>-</td>
</tr>
<tr>
<td>Lye (alkaline)</td>
<td>5</td>
<td>90</td>
<td>-</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>2</td>
<td>50</td>
<td>≤ 0.5</td>
</tr>
<tr>
<td>Peracetic acid or hydrogen peroxide</td>
<td>0.5</td>
<td>40</td>
<td>≤ 0.5</td>
</tr>
</tbody>
</table>

6.2.4 Steaming in place (SIP)

WARNING

Pump casing takes on the same temperature as the sterilisation fluid
Risk of burns!
▷ Fit additional protective devices.
▷ Observe the general safety rules and regulations for steam applications.

CAUTION

Elastomers do not have sufficient resistance
Damage to the pump!
▷ Effect cleaning/sterilisation only if the elastomer components used in the pump (e.g. O-rings, mechanical seals) are made of EPDM or other approved materials.

CAUTION

SIP with the pump running
Damage to the mechanical seals!
▷ Effect SIP (cleaning using superheated steam) only if the pump set has been switched off.

Application

Use SIP only with the pump set switched off.

Limits

Table 12: SIP — requirements for steaming in place (SIP)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum temperature of saturated steam (SIP)</td>
<td>140 °C</td>
</tr>
<tr>
<td>Absolute pressure</td>
<td>3 bar</td>
</tr>
</tbody>
</table>
6.2.5 Fluid handled

6.2.5.1 Flow rate

Table 13: Flow rate

<table>
<thead>
<tr>
<th>Temperature range (t)</th>
<th>Minimum flow rate</th>
<th>Maximum flow rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>-30 to +70 °C</td>
<td>≈ 15 % of ( Q_{\text{opt}} )</td>
<td>See hydraulic curves</td>
</tr>
<tr>
<td>&gt; 70 to +110 °C</td>
<td>≈ 25 % of ( Q_{\text{opt}} )</td>
<td></td>
</tr>
</tbody>
</table>

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

\[
T_O = T_f + \Delta \theta
\]

\[
\Delta \theta = \frac{g \times H}{c \times \eta} \times (1 - \eta)
\]

Table 14: Key

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( c )</td>
<td>Specific heat capacity</td>
<td>J/kg K</td>
</tr>
<tr>
<td>( g )</td>
<td>Gravitational constant</td>
<td>m/s²</td>
</tr>
<tr>
<td>( H )</td>
<td>Pump discharge head</td>
<td>m</td>
</tr>
<tr>
<td>( T_f )</td>
<td>Fluid temperature</td>
<td>°C</td>
</tr>
<tr>
<td>( T_O )</td>
<td>Temperature at the casing surface</td>
<td>°C</td>
</tr>
<tr>
<td>( \eta )</td>
<td>Pump efficiency at duty point</td>
<td>-</td>
</tr>
<tr>
<td>( \Delta \theta )</td>
<td>Temperature difference</td>
<td>K</td>
</tr>
</tbody>
</table>

6.2.5.2 Density of the fluid handled

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

**CAUTION**

Impermissibly high density of the fluid handled

Motor overload!

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

6.2.5.3 Viscosity of the fluid handled

The discharge head, flow rate and power input of the pump are influenced by the viscosity of the fluid handled.

**CAUTION**

The fluid handled has a higher viscosity than permitted.

Risk of motor overload!

▷ Observe the viscosity limits for the fluid handled given in the data sheet.
▷ Make sure the motor has sufficient power reserves.

6.2.5.4 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 operation check run of the pump.

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

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

✓ The pump has been properly drained and the safety instructions for dismantling the pump have been observed. (⇨ Section 7.4.1 Page 37)

1. Spray-coat the inside wall of the pump casing, and in particular the impeller clearance areas, with a preservative.

2. Spray the preservative through the suction and discharge nozzles. It is advisable to close the pump nozzles (e.g. with plastic caps or similar).

3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil and grease, food-approved if required) to protect them against corrosion. 

   Observe the additional instructions (⇨ Section 3.3 Page 13).

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

Observe any additional instructions and information provided. (⇨ Section 3 Page 13)

6.4 Returning to service

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

In addition, carry out all servicing/maintenance operations before returning the pump (set) to service. (⇨ Section 7 Page 33)

WARNING

Failure to re-install or re-activate protective devices

Risk of personal injury from moving parts or escaping fluid!

✓ As soon as the work is complete, re-install and/or re-activate any safety-relevant protective devices.

NOTE

If the pump has been out of service for more than one year, replace all elastomer seals.
7 Servicing/Maintenance

7.1 Safety regulations

DANGER
Sparks produced during servicing work
Explosion hazard!
▷ Observe the safety regulations in force at the place of installation!
▷ Always perform maintenance work on explosion-proof pump sets outside potentially explosive atmospheres.

DANGER
Improperly serviced pump set
Explosion hazard!
Damage to the pump set!
▷ Service the pump set regularly.
▷ Prepare a maintenance schedule with special emphasis on lubricants and shaft seal.

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

WARNING
Unintentional starting of pump set
Risk of injury by moving parts!
▷ Make sure that the pump set cannot be started up unintentionally.
▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.

WARNING
 Fluids, consumables and supplies which are hot and/or pose a health hazard
Risk of injury!
▷ Observe all relevant laws.
▷ When draining the fluid take appropriate measures to protect persons and the environment.
▷ Decontaminate pumps which handle fluids posing a health hazard.

WARNING
Insufficient stability
Risk of crushing hands and feet!
▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tipping or falling over.

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

NOTE
All maintenance, service and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached “Addresses” booklet or on the Internet at “www.ksb.com/contact”.

Never use force when dismantling and reassembling the pump set.
### 7.2 Servicing/inspection

#### 7.2.1 Supervision of operation

**DANGER**

**Risk of potentially explosive atmosphere inside the pump**

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

**DANGER**

**Incorrectly serviced shaft seal**

Explosion hazard!
Leakage of hot, toxic fluids!
Damage to the pump set!
Risk of burns!
Fire hazard!
- Regularly service the shaft seal.

**DANGER**

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

Explosion hazard!
Fire hazard!
Damage to the pump set!
- Regularly check the rolling element bearings for running noises.

**DANGER**

**Incorrectly serviced barrier fluid system**

Explosion hazard!
Fire hazard!
Damage to the pump set!
Leakage of hot and/or toxic fluids!
- Regularly service the barrier fluid system.
- Monitor the barrier fluid pressure.

**CAUTION**

**Increased wear due to dry running**

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

**CAUTION**

**Impermissibly high temperature of fluid handled**

Damage to the pump!
- Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).
- Observe the temperature limits in the data sheet and in the section on operating limits.
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. (⇨ Section 6.1.4 Page 27)
- Check the static seals 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 the 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 at the motor housing).

**CAUTION**

**Operation outside the permissible bearing temperature**

Damage to the pump!

- The bearing temperature of the pump (set) must never exceed 90 °C (measured on the outside of the motor housing).

**NOTE**

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

### 7.2.2 Inspection work

**DANGER**

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

Explosion hazard! 
Fire hazard! 
Damage to the pump set!

- Regularly check the cover plates, plastic components and other guards of rotating parts for deformation and sufficient distance from rotating parts.

#### 7.2.2.1 Checking the clearances

✓ Noise and vibrations suggest that the rotating impeller vanes touch the pump casing.

1. Dismantle the pump casing. (⇨ Section 7.4 Page 37)
2. Examine the pump casing and impeller vanes for signs of seizure or rubbing contact.
3. Smoothen any signs of seizure or rubbing contact using a polishing cloth.
4. Remove any burrs from the impeller vane.
5. Re-adjust the axial clearance (distance between casing and impeller). 
   Values see below 
   Procedure (⇨ Section 7.5.6 Page 44)
6. Fit the pump casing. 
   Tightening torque (⇨ Section 7.6.1 Page 45) 
   Procedure
Table 15: Axial Clearance

<table>
<thead>
<tr>
<th>Axial Clearance</th>
<th>Axial Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>New (default setting)</td>
<td>0.7 mm</td>
</tr>
<tr>
<td>Maximum permissible enlargement</td>
<td>1.0 mm</td>
</tr>
</tbody>
</table>

7.2.2.2 Cleaning filters

**CAUTION**

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

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

7.2.2.3 Checking the quench liquid

Periodically check the quench liquid for contamination. Drain the quench liquid, if required. Clean the quench system and fill with new quench liquid.

7.2.2.4 Cleaning the strainer

To prevent contaminants from entering the valves and the mechanical seal (particularly during commissioning), an additional strainer has been installed in the quench piping.

**CAUTION**

Mechanical seals are not flushed sufficiently
Damage to the pump!

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

Table 16: Cleaning intervals

<table>
<thead>
<tr>
<th>Cleaning</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Following commissioning</td>
<td>Daily</td>
</tr>
<tr>
<td>After third check</td>
<td>Specify suitable interval as a function of the degree of contamination.</td>
</tr>
</tbody>
</table>

7.3 Drainage/cleaning

**WARNING**

Fluids, consumables and supplies which are hot and/or pose a health hazard
Hazard to persons and the environment!

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

1. Use the relevant pump connections to drain the fluid handled.

---

6) Between pump casing and impeller vane
2. Always flush the pump, in particular if it has been used to handle harmful, explosive and hot fluids or other fluids posing a high risk. Always flush and clean the pump before transporting it to the workshop. Provide a cleaning record for the pump.

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

WARNING
Unqualified personnel performing work on the pump (set)
Risk of injury!
▷ Always have repair and maintenance work performed by specially trained, qualified personnel.

WARNING
Hot surface
Risk of injury!
▷ Allow the pump set to cool down to ambient temperature.

WARNING
Improper lifting/moving of heavy assemblies or components
Personal injury and damage to property!
▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

Observe the general safety instructions and information. (☞ Section 7.1 Page 33)
For any work on the motor, observe the instructions of the relevant motor manufacturer.
For dismantling and reassembly observe the exploded views and the general assembly drawing.
In case of damage you can always contact our service staff.

NOTE
All maintenance, service and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached “Addresses” booklet or on the Internet at “www.ksb.com/contact”.

DANGER
Insufficient preparation of work on the pump (set)
Risk of injury!
▷ Properly shut down the pump set. (☞ Section 6.1.5 Page 28)
▷ Close the shut-off elements in suction and discharge line.
▷ Drain the pump and release the pump pressure.
▷ Close any auxiliary connections.
▷ Allow the pump set to cool down to ambient temperature.

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. Reduce pressure in the piping by opening a consumer installation.
3. Disconnect and remove all auxiliary pipework.

7.4.3 Removing the complete pump set from the piping
1. Disconnect the discharge and suction nozzles from the piping.
2. Depending on the pump/motor size, unscrew the bolts that fix the support foot and/or motor foot to the foundation.
3. Remove the complete pump set from the piping.
Alternative: Leave pump casing 101 installed in the piping. Undo terminal clamp 81-44. Pull the remaining pump set out towards the back (back pull-out design).

7.4.4 Dismantling the motor

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor tipping over</td>
</tr>
<tr>
<td>Risk of crushing hands and feet!</td>
</tr>
</tbody>
</table>
▷ Suspend or support the motor to prevent it from tipping over.

✓ The notes and steps stated in (⇨ Section 7.4.1 Page 37) to (⇨ Section 7.4.3 Page 38) have been observed/carried out.
1. Depending on the pump/motor size, unscrew the bolts that fix the motor foot to the foundation.
2. Undo nuts 920.01.
3. Remove cover plates 68-3 from drive lantern 341.
4. Undo hexagon head bolts 901.3.
5. Insert both lockwashers 931 into the groove in shaft 210.
6. Tighten hexagon head bolts 901.3, if fitted.
7. Remove the motor.

7.4.5 Removing the back pull-out unit

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back pull-out unit tipping over</td>
</tr>
<tr>
<td>Risk of squashing hands and feet!</td>
</tr>
</tbody>
</table>
▷ Suspend or support the back pull-out unit at the pump end.

✓ The notes and steps stated in (⇨ Section 7.4.1 Page 37) to (⇨ Section 7.4.4 Page 38) have been observed/carried out.
1. If required, suspend or support the back pull-out unit to prevent it from tipping over.
2. Undo nut 920.02 (with bolted discharge cover) or 901.02 (with clamped discharge cover) at the volute casing.
3. Pull the back pull-out unit out of the volute casing.
4. Remove and dispose of O-ring 412.01.
5. Place the back pull-out unit on a clean and level surface.

7.4.6 Removing the impeller
✓ The notes and steps stated in (⇨ Section 7.4.1 Page 37) to (⇨ Section 7.4.5 Page 38) have been observed/carried out.
✓ The back pull-out unit is kept in a clean and level assembly area.
1. Undo impeller nut 922.01 (right-hand thread).
2. Remove O-ring 412.02 from impeller nut.
3. Remove impeller 230.01 with an impeller removal device.
4. Place impeller 230.01 on a clean and level surface.
5. Remove key 940.01 from shaft 210.01.
6. Remove O-ring 412.03 from impeller hub and/or pull V-ring 411.05 off shaft 210.01.

7.4.7 Removing the mechanical seal

✓ The notes and steps stated in (☞ Section 7.4.1 Page 37) to (☞ Section 7.4.6 Page 38) have been observed/carried out.
✓ The back pull-out unit is kept in a clean and level assembly area.

1. Remove the rotating part of the mechanical seal (spring-loaded ring) from impeller 230.01.
2. Remove second mechanical seal (rotating assembly), if any, from shaft 210.01.
3. Unscrew hexagon nuts 920.07, if fitted, on drive lantern 341.
4. Remove discharge cover 163.01 from drive lantern 341.
5. Remove the stationary assembly of the mechanical seal (seat ring 433.01) from discharge cover 163.01.
6. Remove stationary assembly of the second mechanical seal 433.02, if any, from discharge cover 163.01.

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

**WARNING**

Improper lifting/moving of heavy assemblies or components
Personal injury and damage to property!
▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

**CAUTION**

Improper reassembly
Damage to the pump!
▷ Reassemble the pump (set) in accordance with the general rules of sound engineering practice.
▷ Use original spare parts only.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Sealing elements</th>
<th>Assembly adhesives</th>
<th>Tightening torques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always reassemble the pump in accordance with the corresponding general assembly drawing or exploded view.</td>
<td>Always use new O-rings.</td>
<td>Avoid the use of assembly adhesives, if possible.</td>
<td>For reassembly, tighten all screws and bolts as specified in this manual.</td>
</tr>
</tbody>
</table>
7.5.2 Installing the mechanical seal

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

- Work cleanly and accurately.
- Only remove the protective wrapping of the contact faces immediately before installation takes place.
- Prevent any damage to the sealing surfaces or O-rings.
- The notes and steps stated in Section 7.5.1 Page 39 have been observed/carry out.
- The assembled bearing 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.
- The sealing surfaces have been cleaned.

1. Clean the seat ring locations in discharge cover 163.01.

CAUTION

Elastomers in contact with oil/grease
Shaft seal failure!
▷ Use water as assembly lubricant.
▷ Never use oil or grease as assembly lubricant.

2. Carefully insert seat ring and second seat ring, if any. Make sure that pressure is applied evenly.
3. Fit discharge cover 163.01 in the recess of drive lantern 341. Please note:
   - Single mechanical seal: Turn the discharge cover so that one of the quench connection holes (R 1/8) points downwards.
   - Double mechanical seal: Fit the discharge cover so that the quench connections are in horizontal position on both sides, and the quench lines can be connected through the openings in the drive lantern.
4. Fit and tighten nuts 920.07, if any.

NOTE

Use water as a lubricant to reduce friction losses when assembling the seal.

5. Slip secondary mechanical seal, if any, on shaft 210.01.
6. Slip V-Ring 411.05, if any, on shaft 210.01.
7. Insert keys 940.01 into the shaft keyway.
8. Insert O-ring 412.03 in impeller.
9. Slip rotating assembly of the primary mechanical seal 433.01 onto impeller 230.
10. Slip impeller 230 onto shaft 210.01.
11. Insert O-ring 412.02 in impeller nut.
12. Fit and tighten impeller nut 922.

7.5.2.1 Seal sizes for double mechanical seals

<table>
<thead>
<tr>
<th>Size</th>
<th>Sealing element</th>
<th>Nominal impeller diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>[mm]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>125</td>
</tr>
<tr>
<td>50</td>
<td>Primary seal</td>
<td>KU038R</td>
</tr>
<tr>
<td></td>
<td>Secondary seal</td>
<td>KU022SO</td>
</tr>
<tr>
<td>Size</td>
<td>Sealing element</td>
<td>Nominal impeller diameter [mm]</td>
</tr>
<tr>
<td>------</td>
<td>-----------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>125</td>
</tr>
<tr>
<td>65</td>
<td>Primary seal</td>
<td>KU038R</td>
</tr>
<tr>
<td></td>
<td>Secondary seal</td>
<td>KU022SO</td>
</tr>
<tr>
<td>80</td>
<td>Primary seal</td>
<td>KU038R</td>
</tr>
<tr>
<td></td>
<td>Secondary seal</td>
<td>KU022SO</td>
</tr>
<tr>
<td>100</td>
<td>Primary seal</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Secondary seal</td>
<td>-</td>
</tr>
<tr>
<td>125</td>
<td>Primary seal</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Secondary seal</td>
<td>-</td>
</tr>
</tbody>
</table>
### 7.5.2.2 Material code for single and double mechanical seals

**Table 18: Material code**

<table>
<thead>
<tr>
<th>Variant code</th>
<th>Primary seal</th>
<th>Secondary seal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I01/T11 I06/T16</td>
<td>T11, T12, T13, T14, T15, T16, T17, T18, T19, T20, T31</td>
</tr>
<tr>
<td></td>
<td>I03/T13 I08/T18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I02/T12 I07/T17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I04/T14 I09/T19</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I10/T20 I21/T31</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code sequence</th>
<th>Description</th>
<th>Code to DIN EN 12756</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Primary ring</td>
<td>B Q12 B Q12 Q22 Q12 B</td>
</tr>
<tr>
<td>2</td>
<td>Mating ring</td>
<td>Q1 Q1 Q1 Q1 Q2 Q1 Q1</td>
</tr>
<tr>
<td>3</td>
<td>Secondary seals</td>
<td>E1-04 E1-04 V26 V26 E1-04 M1 E</td>
</tr>
<tr>
<td>4</td>
<td>Spring</td>
<td>G G G G G G G G</td>
</tr>
<tr>
<td>5</td>
<td>Other components</td>
<td>G G G G G G G</td>
</tr>
</tbody>
</table>

**Table 19: Key to materials**

<table>
<thead>
<tr>
<th>Code</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Carbon, resin-impregnated (FDA-approved)</td>
</tr>
<tr>
<td>Q1/Q12</td>
<td>Silicon carbide, sintered without pressure (FDA-approved)</td>
</tr>
<tr>
<td>Q2/Q22</td>
<td>Silicon carbide, reaction-bonded (FDA-approved)</td>
</tr>
<tr>
<td>E1-04</td>
<td>EPDM (FDA-approved, 3-A, USP VI)</td>
</tr>
<tr>
<td>V26</td>
<td>FPM (FDA-approved, 3-A, USP VI)</td>
</tr>
<tr>
<td>M1</td>
<td>PTFE (FDA-approved)</td>
</tr>
<tr>
<td>G</td>
<td>CrNiMo steel</td>
</tr>
</tbody>
</table>

### 7.5.3 Fitting the impeller

- The notes and steps stated in (⇨ Section 7.5.1 Page 39) to (⇨ Section 7.5.2 Page 40) have been observed/carried out.
- The pre-assembled unit (motor, shaft, drive lantern, discharge cover) 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 sealing surfaces have been cleaned.
  1. Insert O-ring 412.03, if fitted, in impeller 230.
  2. Slip V-Ring 411.05, if any, on shaft 210.01.
  3. Insert key 940.01 into shaft 210.01.
  4. Slip rotating assembly of the primary mechanical seal 433.01 onto impeller hub 230.
  5. Slip impeller 230 onto shaft 210.01.
  6. Insert O-ring 412.02 in impeller nut.
  7. Fit and tighten impeller nut 922. Tightening torque (⇨ Section 7.6.1 Page 45)

### 7.5.4 Installing the back pull-out unit

**WARNING**

Back pull-out unit tipping over
Risk of squashing hands and feet!

- Suspend or support the back pull-out unit at the pump end.
- The notes and steps stated in (⇨ Section 7.5.1 Page 39) to (⇨ Section 7.5.3 Page 42) have been observed/carried out.
- Any damaged or worn parts have been replaced by original spare parts.

7) DIN EN 12756
✓ The sealing surfaces have been cleaned.
1. If required, suspend or support the back pull-out unit to prevent it from tipping over.
2. If required, fit new O-rings 412.01 into the recess of discharge cover 163.01.
3. Push the back pull-out unit into pump casing 103.
4. Depending on the pump size and motor size, fit support foot 183.
5. Tighten hexagon nut 920.02 and hexagon head bolt 901.02 at the pump casing.
   Tightening torque (☞ Section 7.6.1 Page 45)

7.5.5 Mounting the motor

DANGER
Incorrect shaft connection
Explosion hazard!
☞ Connect the shafts between pump and motor as described in this manual.

Fig. 7: Fitting the motor shaft stub on the shaft

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shaft slot</td>
</tr>
<tr>
<td>2</td>
<td>Keyway of the motor shaft end</td>
</tr>
<tr>
<td>3</td>
<td>Slot of the taper lock ring</td>
</tr>
<tr>
<td>4</td>
<td>Taper lock ring</td>
</tr>
<tr>
<td>5</td>
<td>Motor shaft</td>
</tr>
<tr>
<td>6</td>
<td>Shaft</td>
</tr>
</tbody>
</table>

✓ The notes and steps stated in (☞ Section 7.5.1 Page 39) to (☞ Section 7.5.4 Page 42) have been observed/carried out.
1. Slip the motor shaft end on shaft 210.01.
2. Make sure that the shaft slot of shaft 210.01 aligns with the slot of taper lock ring 515.01, and that they are located opposite the keyway of the motor shaft end.
   (see illustration: Fitting the motor stub shaft on the shaft)
7.5.6 Adjusting the clearance gaps

![Diagram of pump casing and impeller with clearance gap marked]

**Fig. 8: Axial clearance between pump casing and impeller**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Casing wall</td>
</tr>
<tr>
<td>2</td>
<td>Impeller</td>
</tr>
<tr>
<td>3</td>
<td>Axial clearance</td>
</tr>
<tr>
<td></td>
<td>Clearance gap: 0.7 mm</td>
</tr>
</tbody>
</table>

**DANGER**

Incorrect axial clearance
Explosion hazard!

▷ Re-adjust axial clearance between pump casing and impeller whenever assembly/installation work is carried out.

⇨ Use one of the methods described below to adjust the axial clearance.

**Adjusting the clearance gap using a depth gauge**

✓ The notes and steps stated in (⇨ Section 7.5.1 Page 39) to (⇨ Section 7.5.5 Page 43) have been observed/carried out.

1. Firmly bolt casing 103.01 to drive lantern 341.01 or discharge nozzle 163.01. Tightening torque (⇨ Section 7.6.1 Page 45)
2. Shift the shaft in such a way that the impeller will run freely without rubbing on the casing when it is turned by hand several times. This marks the "O" position which serves as starting point for setting the actual clearance.
3. Introduce the depth gauge through the suction nozzle.
4. Set an axial distance of 0.7 mm between the inner pump wall (suction side) and the front edge of the impeller vanes by shifting the shaft towards the back.
5. Firmly fix the impeller using clamping ring 515.01 and hexagon socket head cap screw 914.01. Make sure that the shaft slot of shaft 210.01 aligns with the slot of taper lock ring 515.01, and that they are located opposite the keyway of the motor shaft end. Starting torque (⇨ Section 7.6.1 Page 45)

**Adjusting the clearance gap using a spacer plate**

✓ The notes and steps stated in (⇨ Section 7.5.1 Page 39) to (⇨ Section 7.5.5 Page 43) have been observed/carried out.

1. Spacer plate (0.7 mm thickness) Clamp between impeller and casing.
2. Firmly bolt casing 103.01 to drive lantern 341.01 or discharge nozzle 163.01. 
   Tightening torque (→ Section 7.6.1 Page 45)
3. Slip the impeller onto the spacer plate.
4. Firmly fix the impeller using clamping ring 515.01 and hexagon socket head cap 
   screw 914.01. 
   Make sure that the shaft slot of shaft 210.01 aligns with the slot of taper lock 
   ring 515.01, and that they are located opposite the keyway of the motor shaft 
   end.
5. Dismantle the pump casing
6. Remove the spacer plate.
7. Fit the pump casing

7.5.7 Checking inducer run-out
On inducer version only:
✓ The notes and steps stated in (→ Section 7.5.1 Page 39) bis (→ Section 7.5.6 Page 
   44) have been observed/carried out.
1. Once clamping ring 515.01 has been tightened, check inducer run-out. 
   Maximum run-out: 0.15 mm

7.6 Tightening torques

7.6.1 Tightening torques for the pump set

Fig. 9: Tightening points

Spacer plates can be purchased from KSB.
Table 20: Tightening torques for bolted/screwed connections at the pump

<table>
<thead>
<tr>
<th>Position</th>
<th>Thread</th>
<th>Nominal value [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>M10</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>M12</td>
<td>55</td>
</tr>
<tr>
<td>B</td>
<td>M10</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>M12</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>M16</td>
<td>130</td>
</tr>
<tr>
<td>C</td>
<td>M12 x 1.5</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>M24 x 1.5</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>M30 x 1.5</td>
<td>170</td>
</tr>
<tr>
<td>D</td>
<td>M6</td>
<td>For clamping ring</td>
</tr>
<tr>
<td></td>
<td>M8</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>M10</td>
<td>53</td>
</tr>
<tr>
<td>E</td>
<td>M8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M10</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>M12</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>M16</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>M20</td>
<td>250</td>
</tr>
</tbody>
</table>

7.7 Spare parts stock

7.7.1 Ordering spare parts
Always quote the following data when ordering replacement or spare parts:
- Order number
- Order item number
- Consecutive number
- Type series
- Size
- Material variant
- Seal code
- Year of construction

Refer to the name plate for all data. (⇨ Section 4.3 Page 15)
Also specify the following data:
- Part No. and description (⇨ Section 9.1 Page 50)
- 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 21: Quantity of spare parts for recommended spare parts stock

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Number of pumps (including stand-by pumps)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>210.01</td>
<td>Shaft</td>
<td>1</td>
</tr>
<tr>
<td>230.01</td>
<td>Impeller</td>
<td>1</td>
</tr>
<tr>
<td>412.01</td>
<td>O-ring (casing)</td>
<td>2</td>
</tr>
<tr>
<td>412.02</td>
<td>O-ring (impeller nut)</td>
<td>2</td>
</tr>
<tr>
<td>412.03</td>
<td>O-ring (impeller)</td>
<td>2</td>
</tr>
<tr>
<td>433.01</td>
<td>Mechanical seal (primary)</td>
<td>2</td>
</tr>
<tr>
<td>433.02</td>
<td>Mechanical seal (secondary)</td>
<td>2</td>
</tr>
<tr>
<td>411.01</td>
<td>Joint ring (suction side)</td>
<td>2</td>
</tr>
<tr>
<td>411.02</td>
<td>Joint ring (discharge side)</td>
<td>2</td>
</tr>
</tbody>
</table>
# 8 Trouble-shooting

#### WARNING

**Improper work to remedy faults**  
Risk of injury!  
▷ For any work to remedy faults observe the relevant information in this manual or in the relevant accessory manufacturer's documentation.

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

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>Possible cause</th>
<th>Remedy(^9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Pump delivers against an excessively high pressure.</td>
<td>Re-adjust to duty point. Check system for impurities. Fit a larger impeller.(^{10}). Increase the speed (turbine, I.C. engine).</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>Pump or piping are not completely vented or primed.</td>
<td>Vent and/or prime.</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Supply line or impeller clogged</td>
<td>Remove deposits in the pump and/or piping.</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Formation of air pockets in the piping</td>
<td>Alter piping layout. Fit vent valve.</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Pump is warped or sympathetic vibrations in the piping.</td>
<td>Check the piping connections and secure fixing of pump; if required, reduce distances between the pipe clamps. Fix the pipelines using anti-vibration material.</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>Suction lift is too high/(NPSH_{\text{available}}) (positive suction head) is too low.</td>
<td>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.</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Wrong direction of rotation</td>
<td>Interchange two of the phases of the power cable.</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Motor is running on two phases only.</td>
<td>Replace the defective fuse. Check the electric cable connections.</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Defective bearing(s)</td>
<td>Replace.</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>Flow rate is too low.</td>
<td>Increase the minimum flow rate.</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>Wear of internal components</td>
<td>Replace worn components by new ones.</td>
</tr>
<tr>
<td>-</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Pump back pressure is lower than specified in the purchase order.</td>
<td>Re-adjust to duty point.</td>
</tr>
</tbody>
</table>

---

\(^9\) Pump pressure must be released before attempting to remedy faults on parts which are subjected to pressure.  
\(^{10}\) Contact KSB.
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>Possible cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>Density or viscosity of fluid handled higher than stated in purchase order</td>
<td>Contact KSB.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>Defective gasket</td>
<td>Fit new gasket between pump casing and discharge cover.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>Worn shaft seal</td>
<td>Fit new shaft seal.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>Score marks or roughness on shaft</td>
<td>Fit new shaft. Fit new shaft seal.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>Vibrations during pump operation</td>
<td>Correct the suction conditions. Increase the pressure at the pump suction nozzle.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>Insufficient or excessive quantity of lubricant or unsuitable lubricant.</td>
<td>Top up, reduce or change lubricant.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>Rotor out of balance</td>
<td>Clean rotor. Re-balance rotor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>Incorrect setting of motor protection switch</td>
<td>Check setting. Fit new motor protection switch.</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>Axial clearance (specified = 0.7 mm) is too narrow.</td>
<td>Adjust axial clearance to 0.7 mm (minimum).</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>Axial clearance is too large.</td>
<td>Adjust axial clearance to 0.7 mm.</td>
</tr>
</tbody>
</table>

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

9.1 Exploded view / List of components

9.1.1 Vitachrom standard design

The standard design (without inducer) of the Vitachrom hygienic pump is available in two size groups which differ in design details.

Size group I
- 50-125, 50-160, 50-200
- 65-125, 65-160, 65-200
- 80-125, 80-160

Size group II
- 50-250
- 65-250
- 80-250
- 100-200
- 125-200
Fig. 10: Exploded view

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>68-3</td>
<td>Cover plate</td>
<td>801</td>
<td>Flanged motor</td>
</tr>
<tr>
<td>103</td>
<td>Pump casing</td>
<td>89-4</td>
<td>Shim</td>
</tr>
<tr>
<td>163</td>
<td>Discharge cover</td>
<td>891</td>
<td>Baseframe</td>
</tr>
<tr>
<td>182.01</td>
<td>Angle foot&lt;sup&gt;1&lt;/sup&gt;</td>
<td>901.01</td>
<td>Hexagon head bolt (foot)</td>
</tr>
<tr>
<td>182.02</td>
<td>Ball foot</td>
<td>901.02</td>
<td>Hexagon head bolt (casing)</td>
</tr>
<tr>
<td>210</td>
<td>Shaft</td>
<td>901.04</td>
<td>Hexagon head bolt (plate)</td>
</tr>
<tr>
<td>230</td>
<td>Impeller, open</td>
<td>902.01</td>
<td>Stud (motor)</td>
</tr>
<tr>
<td>341</td>
<td>Drive lantern</td>
<td>904.01</td>
<td>Grub screw (foot)</td>
</tr>
<tr>
<td>411.01</td>
<td>Joint ring (suction side)</td>
<td>914.01</td>
<td>Hexagon socket head cap screw (shaft)</td>
</tr>
<tr>
<td>411.02</td>
<td>Joint ring (discharge side)</td>
<td>914.02</td>
<td>Hexagon socket head cap screw (shroud)</td>
</tr>
<tr>
<td>412.01</td>
<td>O-ring (casing)</td>
<td>920.01</td>
<td>Hexagon nut (motor)</td>
</tr>
<tr>
<td>412.02</td>
<td>O-ring (impeller nut)</td>
<td>920.02</td>
<td>Hexagon nut (casing)</td>
</tr>
<tr>
<td>412.03</td>
<td>O-ring (impeller)</td>
<td>920.04</td>
<td>Hexagon nut (plate)</td>
</tr>
<tr>
<td>433.01</td>
<td>Mechanical seal (primary)</td>
<td>920.05</td>
<td>Hexagon nut (foot)</td>
</tr>
<tr>
<td>433.02</td>
<td>Mechanical seal (secondary)</td>
<td>920.06</td>
<td>Cap nut (foot)</td>
</tr>
<tr>
<td>515</td>
<td>Taper lock ring</td>
<td>922</td>
<td>Impeller nut</td>
</tr>
<tr>
<td>561</td>
<td>Half round head grooved pin</td>
<td>940.01</td>
<td>Key (impeller)</td>
</tr>
<tr>
<td>680</td>
<td>Motor shroud</td>
<td>970.01</td>
<td>Name plate</td>
</tr>
<tr>
<td>720</td>
<td>Nipple joint</td>
<td>970.03</td>
<td>Information plate (rotational arrow)</td>
</tr>
</tbody>
</table>

<sup>1</sup> Support foot up to motor size 112 M
Fig. 11: Standard design with angle/motor foot
Fig. 12: Standard design with ball feet

From motor size 225M:

Fig. 13: Intermediate ring 509.01 and hexagon socket head cap screw 914.03 from motor size 225M
9.1.1.2 Size group II

Fig. 14: Exploded view

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>68-3</td>
<td>Cover plate</td>
<td>731.01/02</td>
<td>Pipe union&lt;sup&gt;13&lt;/sup&gt;</td>
</tr>
<tr>
<td>103.01</td>
<td>Pump casing</td>
<td>801</td>
<td>Flanged motor</td>
</tr>
<tr>
<td>163.01</td>
<td>Discharge cover</td>
<td>89-4</td>
<td>Shim</td>
</tr>
<tr>
<td>182.01</td>
<td>Angle foot&lt;sup&gt;12&lt;/sup&gt;</td>
<td>891</td>
<td>Baseframe</td>
</tr>
<tr>
<td>182.02</td>
<td>Ball foot</td>
<td>901.02</td>
<td>Hexagon head bolt (casing)</td>
</tr>
<tr>
<td>210.01</td>
<td>Shaft</td>
<td>901.04</td>
<td>Hexagon head bolt (motor foot)</td>
</tr>
<tr>
<td>230.01</td>
<td>Impeller, open</td>
<td>902.01</td>
<td>Stud (drive lantern)</td>
</tr>
<tr>
<td>341.01</td>
<td>Drive lantern</td>
<td>902.06</td>
<td>Stud (discharge cover)</td>
</tr>
<tr>
<td>411.01</td>
<td>Joint ring (suction side)</td>
<td>902.07</td>
<td>Stud (for angle foot)</td>
</tr>
<tr>
<td>411.02</td>
<td>Joint ring (discharge side)</td>
<td>904.01</td>
<td>Grub screw (ball foot)</td>
</tr>
<tr>
<td>411.03/04</td>
<td>Joint ring (quench connection)&lt;sup&gt;13&lt;/sup&gt;</td>
<td>914.01</td>
<td>Hexagon socket head cap screw (taper lock ring)</td>
</tr>
<tr>
<td>411.05</td>
<td>Joint ring (V-ring)&lt;sup&gt;14&lt;/sup&gt;</td>
<td>914.02</td>
<td>Hexagon socket head cap screw (ball foot)</td>
</tr>
<tr>
<td>412.01</td>
<td>O-ring (casing)</td>
<td>920.01</td>
<td>Hexagon nut (motor)</td>
</tr>
<tr>
<td>412.02</td>
<td>O-ring (impeller nut)</td>
<td>920.02</td>
<td>Cap nut (pump casing)</td>
</tr>
<tr>
<td>433.01</td>
<td>Mechanical seal (primary)</td>
<td>920.04</td>
<td>Hexagon nut (ball foot)</td>
</tr>
<tr>
<td>433.02</td>
<td>Mechanical seal (secondary)&lt;sup&gt;13&lt;/sup&gt;</td>
<td>920.06</td>
<td>Cap nut (ball foot)</td>
</tr>
<tr>
<td>515.01</td>
<td>Taper lock ring</td>
<td>920.07</td>
<td>Hexagon nut (drive lantern)</td>
</tr>
</tbody>
</table>

<sup>12</sup> Support foot up to motor size 112 M

<sup>13</sup> On pumps with double mechanical seal only

<sup>14</sup> Not fitted on pumps with double mechanical seal
<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>550.01</td>
<td>Adjusting washer</td>
<td>922.01</td>
<td>Impeller nut</td>
</tr>
<tr>
<td>680.01</td>
<td>Motor shroud&lt;sup&gt;15)&lt;/sup&gt;</td>
<td>940.01</td>
<td>Key (impeller)</td>
</tr>
</tbody>
</table>

<sup>15)</sup> Only in connection with ball foot 182.2

**Fig. 15:** Standard design with angle/motor foot
Fig. 16: Standard design with ball feet

Fig. 17: Intermediate ring 509.01 and hexagon socket head cap screw 914.03 from motor size 225M
9.1.2 Vitachrom with inducer

Fig. 18: Size 65-160-Ind
### Fig. 19: Size 80-250-Ind

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>68-3</td>
<td>Cover plate</td>
<td>731.01/02 Pipe union&lt;sup&gt;13&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>103.01</td>
<td>Pump casing</td>
<td>801</td>
<td>Flanged motor</td>
</tr>
<tr>
<td>163.01</td>
<td>Discharge cover</td>
<td>89-4</td>
<td>Shim</td>
</tr>
<tr>
<td>182.01</td>
<td>Angle foot&lt;sup&gt;16&lt;/sup&gt;</td>
<td>891</td>
<td>Baseframe</td>
</tr>
<tr>
<td>182.02</td>
<td>Ball foot</td>
<td>901.02</td>
<td>Hexagon head bolt (casing)</td>
</tr>
<tr>
<td>210.01</td>
<td>Shaft</td>
<td>901.04</td>
<td>Hexagon head bolt (motor foot)</td>
</tr>
<tr>
<td>230.01</td>
<td>Impeller, open</td>
<td>902.01</td>
<td>Stud (drive lantern)</td>
</tr>
<tr>
<td>341.01</td>
<td>Drive lantern</td>
<td>902.06</td>
<td>Stud (discharge cover)</td>
</tr>
<tr>
<td>411.01</td>
<td>Joint ring (suction side)</td>
<td>902.07</td>
<td>Stud (for angle foot)</td>
</tr>
<tr>
<td>411.02</td>
<td>Joint ring (discharge side)</td>
<td>904.01</td>
<td>Grub screw (ball foot)</td>
</tr>
<tr>
<td>411.03/04</td>
<td>Joint ring (quench connection)&lt;sup&gt;17&lt;/sup&gt;</td>
<td>914.01</td>
<td>Hexagon socket head cap screw (taper lock ring)</td>
</tr>
<tr>
<td>411.05</td>
<td>Joint ring (V-ring)&lt;sup&gt;18&lt;/sup&gt;</td>
<td>914.02</td>
<td>Hexagon socket head cap screw (ball foot)</td>
</tr>
<tr>
<td>412.01</td>
<td>O-ring (casing)</td>
<td>920.01</td>
<td>Hexagon nut (motor)</td>
</tr>
<tr>
<td>412.02</td>
<td>O-ring (impeller nut)</td>
<td>920.02</td>
<td>Cap nut (pump casing)</td>
</tr>
<tr>
<td>433.01</td>
<td>Mechanical seal (primary)</td>
<td>920.04</td>
<td>Hexagon nut (ball foot)</td>
</tr>
<tr>
<td>433.02</td>
<td>Mechanical seal (secondary)&lt;sup&gt;13&lt;/sup&gt;</td>
<td>920.06</td>
<td>Cap nut (ball foot)</td>
</tr>
<tr>
<td>515.01</td>
<td>Taper lock ring</td>
<td>920.07</td>
<td>Hexagon nut (drive lantern)</td>
</tr>
<tr>
<td>550.01</td>
<td>Adjusting washer</td>
<td>922.01</td>
<td>Impeller nut</td>
</tr>
<tr>
<td>680.01</td>
<td>Motor shroud&lt;sup&gt;19&lt;/sup&gt;</td>
<td>940.01</td>
<td>Key (impeller)</td>
</tr>
</tbody>
</table>

<sup>16</sup> Support foot up to motor size 112 M

<sup>17</sup> On pumps with double mechanical seal only

<sup>18</sup> Not fitted on pumps with double mechanical seal

<sup>19</sup> Only in connection with ball foot 182.2
9.1.3 Mechanical seal variants

Single mechanical seal

Fig. 20: Single mechanical seal a) with O-ring (size group I) b) with V-ring (size group II)

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>103</td>
<td>Circular casing</td>
<td>412.03</td>
<td>O-ring (size group I only)</td>
</tr>
<tr>
<td>163</td>
<td>Discharge cover</td>
<td>433.01</td>
<td>Mechanical seal (inboard)</td>
</tr>
<tr>
<td>210</td>
<td>Shaft</td>
<td>922</td>
<td>Impeller nut</td>
</tr>
<tr>
<td>230</td>
<td>Impeller</td>
<td>24A</td>
<td>Quench liquid outlet (G1/8)</td>
</tr>
<tr>
<td>411.05</td>
<td>V-ring (size group II)</td>
<td>24E</td>
<td>Quench liquid inlet (G1/8)</td>
</tr>
<tr>
<td>412.02</td>
<td>O-ring</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

20) Size group I only
21) To ISO 228/1
22) Size group II only
Double mechanical seal in tandem arrangement

Fig. 21: Double mechanical seal a) with O-ring (size group I) b) with V-ring (size group II)

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>103</td>
<td>Circular casing</td>
<td>412.03</td>
<td>O-ring</td>
</tr>
<tr>
<td>163</td>
<td>Discharge cover</td>
<td>433.01</td>
<td>Mechanical seal (inboard)</td>
</tr>
<tr>
<td>210</td>
<td>Shaft</td>
<td>433.02</td>
<td>Mechanical seal (outboard)</td>
</tr>
<tr>
<td>230</td>
<td>Impeller</td>
<td>922</td>
<td>Impeller nut</td>
</tr>
<tr>
<td>411.05</td>
<td>V-ring</td>
<td>24A</td>
<td>Quench liquid outlet (G1/8&quot;)</td>
</tr>
<tr>
<td>412.02</td>
<td>O-ring</td>
<td>24E</td>
<td>Quench liquid inlet (G1/8&quot;)</td>
</tr>
</tbody>
</table>

Supply systems for mechanical seals in tandem arrangement: (⇨ Section 9.1.4 Page 61)

Anti-rotation device

Fig. 22: Single or double mechanical seal a) without anti-rotation device, b) with anti-rotation device

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>163.02</td>
<td>Discharge cover</td>
<td>562</td>
<td>Parallel pin of anti-rotation device</td>
</tr>
</tbody>
</table>

23) To ISO 228/1
9.1.4 Supply system for mechanical seals in tandem arrangement
Quench pot

Fig. 23: Supply system with quench pot

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Primary mechanical seal (inboard)</td>
</tr>
<tr>
<td>2</td>
<td>Secondary mechanical seal (outboard)</td>
</tr>
<tr>
<td>3</td>
<td>Filling up quench liquid</td>
</tr>
<tr>
<td>4</td>
<td>Difference in height between pump shaft and quench pot approx. 1.5 m</td>
</tr>
<tr>
<td>5</td>
<td>Quench liquid inlet Connection 24E</td>
</tr>
<tr>
<td>6</td>
<td>Quench liquid outlet Connection 24A</td>
</tr>
</tbody>
</table>
### Fig. 24: Quench piping for one-way quench supply system

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>782.01</td>
<td>Foot</td>
<td>733.01</td>
<td>Pipe clamp</td>
</tr>
<tr>
<td>411.01</td>
<td>Joint ring</td>
<td>740.01</td>
<td>Strainer</td>
</tr>
<tr>
<td>550.01</td>
<td>Disc</td>
<td>741.01</td>
<td>Needle valve</td>
</tr>
<tr>
<td>550.02</td>
<td>Disc</td>
<td>741.02</td>
<td>Solenoid valve</td>
</tr>
<tr>
<td>550.03</td>
<td>Disc</td>
<td>757.01</td>
<td>Throttle</td>
</tr>
<tr>
<td>719.01</td>
<td>Corrugated pipe hose</td>
<td>901.01</td>
<td>Hexagon head bolt</td>
</tr>
<tr>
<td>720.01</td>
<td>Nipple joint</td>
<td>901.02</td>
<td>Hexagon head bolt</td>
</tr>
<tr>
<td>720.02</td>
<td>Nipple joint</td>
<td>920.01</td>
<td>Nut</td>
</tr>
<tr>
<td>731.01</td>
<td>Reducing nipple</td>
<td>24A</td>
<td>Quench outlet</td>
</tr>
<tr>
<td>731.02</td>
<td>Socket</td>
<td>24E</td>
<td>Quench inlet</td>
</tr>
</tbody>
</table>
10 EC Declaration of Conformity

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

The manufacturer herewith declares that the product:


KSB order number: .................................................................

▪ is in conformity with the provisions of the following Directives as amended from time to time:

The manufacturer also declares that

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

Person authorised to compile the technical file:

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

The EC Declaration of Conformity was issued in/on:

Place, date

............................................................... 24)

Name
Function
Company
Address

24) A signed, legally binding declaration of conformity is supplied with the product.
11 Certificate of Decontamination

Type: ................................................................................................................................
Order number/Order item number: ................................................................................................................................
Delivery date: ................................................................................................................................
Field of application: ................................................................................................................................
Fluid handled: ................................................................................................................................

Please tick where applicable:
- ☐ Radioactive
- ☐ Explosive
- ☐ Corrosive
- ☐ Toxic
- ☐ Harmful
- ☐ Bio-hazardous
- ☐ Highly flammable
- ☐ Safe

Reason for return:

Comments:

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

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

For seal-less pumps, the rotor has been removed from the pump for cleaning. In cases of containment shroud leakage, the outer rotor, bearing bracket lantern, leakage barrier and bearing bracket or intermediate piece have also been cleaned.

For canned motor pumps, the stator space has been examined for fluid leakage; if fluid handled has penetrated the stator space, it has been removed.

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

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

Place, date and signature
Address
Company stamp

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