Not Binding Operating and Assembly Instruction
Progressive Cavity Pump

This operating and assembly instruction is only for general information.

Type
BCSB 1-6 to 75-6LT
1 Safety ........................................................................................................................................... 1
  1.1 General notes
  1.2 Safety and warning notes
    1.2.1 Warning notes
    1.2.2 Danger symbols
    1.2.3 Information symbols
  1.3 Dangers that can be caused by the machine
  1.4 Qualification of the personnel
  1.5 Authorised people
    1.5.1 Tasks and information for the owner/operators
    1.5.2 Safety notes for maintenance, inspection and assembly work
  1.6 Personal protective equipment
  1.7 Safety and protective devices
  1.8 Foreseeable misuse
  1.9 Designated use
  1.10 Warranty

2 Description of the pump ...................................................................................................................... 5
  2.1 General description
  2.2 Mode of action and pumping principle of the pump
  2.3 Constructive design

3 Technical Data ..................................................................................................................................... 6

4 Transport, Intermediate storage, Disposal .......................................................................................... 8
  4.1 Safety
  4.2 Transport
    4.2.1 Dimensions, weight and centre of gravity
    4.2.2 Symbol
    4.2.3 Lashing points (AP) for lifting devices
    4.2.4 Unpacking the machine
  4.3 Temporary storage/corrosion protection
  4.4 Disposal
5 Assembly / Installation
5.1 Mounting tools / lifting gear
5.2 Space requirement
   5.2.1 Dimension for stator replacement
5.3 Assembly of the complete mounted pump
5.4 Power supply of the pump
5.5 Pipelines
   5.5.1 Suction and pressure connection
   5.5.2 Pipeline dimensions
   5.5.3 Residue-free pipelines
   5.5.4 Tension-free assembly

6 Commissioning / De-Commissioning
6.1 Commissioning report
   6.1.1 Checking pipelines
   6.1.2 Protective devices on the pump
   6.1.3 Electrical / hydraulic connections
   6.1.4 Direction of rotation check
   6.1.5 Additional devices - optional
6.2 Measures before commissioning
   6.2.1 Checking pipelines
   6.2.2 Protective devices on the pump
   6.2.3 Electrical / hydraulic connections
   6.2.4 Direction of rotation check
   6.2.5 Additional devices - optional
6.3 Initial commissioning/repeated commissioning
   6.3.1 Avoiding dry running of the pump
   6.3.2 Pressure in the suction and pressure connection
6.4 De-commissioning
   6.4.1 Switching off the pump
   6.4.2 Emptying the pump
   6.4.3 Dismantling the pump
   6.4.4 Preservation/storage of the pump

7 Maintenance
7.1 Preventative measures
   7.1.1 Pump down-time
7.2 Lubrication
   7.2.1 Joint grease
7.3 Inspection
7.4 Cleaning of CS pumps

8 Malfunctions, causes, rectification

9 Pump Dismantling / Reassembly
9.1 Pump Dismantling / Reassembly
   9.1.1 Prepare the pump for dismantling
   9.1.2 Dismantling
   9.1.3 Reassembly
Index

9.2 Rotating unit – individual parts ................................................................. 29
  9.2.1 Dismantling
  9.2.2 Rotating unit (RTE) - prepare individual parts for reassembly
  9.2.3 Rotating unit (RTE) - individual parts - reassembly

9.3 Holding band - assembly ................................................................................ 33
  9.3.1 Prepare the holding band
  9.3.2 Check the holding band
  9.3.3 Assembling the holding band
  9.3.4 Correct tension for the holding band (HBD)
  9.3.5 Cant up the holding band
  9.3.6 Shear the holding band
  9.3.7 Check the holding band after assembly

9.4 Mechanical seal ................................................................................................. 35
  9.4.1 Safety
  9.4.2 Application conditions and material version

10 Spare parts ........................................................................................................... 36
  10.1 Order template for spare parts ................................................................. 38

11 Special tools ........................................................................................................ 41

12 Related documents ............................................................................................. 42

13 Appendix ............................................................................................................ 44
  13.1 Manufacturer's documents / suppliers

Subsidiaries
1.1 General notes

- Always keep the operating and maintenance instructions close by the machine.
- If problems cannot be solved with reference to the operating and maintenance instructions, please contact the manufacturer.

Observe the following points in addition to these operating and maintenance instructions:

- Prohibition, warning and mandatory signs, warning notes on the machine
- Relevant laws and ordinances
- Statutory provisions on accident prevention
- Corresponding harmonised standards and regulations

1.2 Safety and warning notes

- Comply with safety and warning notes for safe and efficient use of the product.

Signal words for specific dangers and (possible) consequences are explained below. These are supplemented by symbols (pictograms) if necessary.

1.2.1 Warning notes

<table>
<thead>
<tr>
<th>Signal Word</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOTICE</td>
<td>Caution for machine! Possible danger. Material damage can occur.</td>
</tr>
<tr>
<td>CAUTION</td>
<td>Caution for people and machine! Possible danger. Minor injury or damage to property can occur.</td>
</tr>
<tr>
<td>WARNING</td>
<td>Warning for people! Possible danger. Death or serious injury can occur.</td>
</tr>
<tr>
<td>DANGER</td>
<td>Danger for people! Possible danger. Immediate risk of severe or fatal injury.</td>
</tr>
</tbody>
</table>

1.2.2 Danger symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
</table>
### 1.2.3 Information symbols

**NOTICE**

Ensure environmental protection.  
Wear eye protection.

- Instruction to act/take measures
- List item

### 1.3 Dangers that can be caused by the machine

seepex machines are built in accordance with the state of the art.  
Nevertheless, there is a residual risk, because the machine works with:

- Mechanical movements that pose a danger
- Electrical voltages and currents

We have used design measures and applied safety technology to minimise the risk to the health of people posed by this danger.

### 1.4 Qualification of the personnel

This handbook is intended for:

- Owner
- Operators
- Setters
- Maintenance personnel

### 1.5 Authorised people

People authorised to undertake operation, set up and maintenance are instructed and trained specialists employed by the owner/manufacturer.

Detailed technical knowledge is essential for performing any work on the machine.

**i**

The owner is responsible for:

- Personnel training
- Compliance with safety regulations
- Compliance with operating and maintenance instructions

The operator must:

- Have received instruction
- Read and understood the relevant parts of the operating instructions before starting work
- Know the safety devices and regulations
1.5.1 Tasks and information for the owner/operators

➢ Regularly check and maintain the machine, replacing all parts in good time which no longer guarantee safe operation.
➢ It is essential to comply with the procedure described in the operating instructions for shutting down the machine.
• On completion of work, attach all safety and protective devices and make sure they are functioning.

1.5.2 Safety notes for maintenance, inspection and assembly work

➢ Do not work on the machine or system unless it is stationary and depressurised.
➢ Switch off the master switch and pull out the power plug before starting work on live components.
➢ Comply with the procedure for shutting down the machine as described in the Shut-down chapter.
➢ Decontaminate (de-toxify) machines that are used for pumping media that can be harmful to health.
➢ Refer to the Initial start-up chapter before repeated start-up of the machine.

1.6 Personal protective equipment

➢ Wear personal protective equipment and/or additional equipment for your own safety.
➢ Avoid/limit risks by the use of collective technical protective equipment or by organisational measures at work.

1.7 Safety and protective devices

➢ Prior to start-up, bolt seepex machines onto a concrete foundation so as to ensure stability.
➢ Starting and stopping devices must be clearly recognisable. Take appropriate measures to avoid defects.
• No protective device is necessary for checking and/or setting the shaft seal.
• Hot surfaces are identified with a danger symbol on the machine.

1.8 Foreseeable misuse

Serious personal injury and damage to property can be caused by:
• Incorrect use
• Incorrect installation or operation of the machine
• Impermissible removal of necessary protective equipment
1.9 Designated use

- Only use seepex machines if they are in perfect condition and in compliance with the operating and maintenance instructions.
- Do not start up the machine unless the system in which the machine is installed is in accordance with the provisions of the applicable guidelines and statutory regulations.
- Equivalent sustained sound pressure level at workplaces of operating personnel C75 dB (A). Cavitation-free operation of the machine and screwed connection to concrete foundation are essential.
- seepex machines are components that are exclusively intended for pumping media in accordance with the technical data (→ chapter 3). Written approval must be obtained from the manufacturer before other media are pumped.
- Refer to the information on the type plate and the operating instructions for technical data (→ chapter 3), and comply with them.
- The operating instructions are assigned to the seepex machine based on the commission number.

1.10 Warranty

- Warranty in accordance with our terms and conditions of delivery and order confirmation.
- It is a condition of the machine warranty that the machine must correspond to the listed operating instructions in accordance with the type plate/data sheet.
- All wearing parts are excluded from the warranty.
- These operating instructions are subject to copyright. Reproduction is not permitted and will be punished. Contravention will be pursued through the courts.
2.1 General description

Seepex pumps are members of the group of rotating displacement pumps.

- Characteristic features
  - Special configuration/arrangement of the rotor and stator pumping elements.
  - Motion sequence

2.2 Mode of action and pumping principle of the seepex pump

- Sealing bands are produced through geometric design/contact of both conveying elements.
- Sealing bands ensure a perfect fit between the suction and pressure side.

Result:
- Increased pump suction.
- Higher pressure build-up independent of speed possible.

2.3 Constructive design

<table>
<thead>
<tr>
<th>No.</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANT</td>
<td>Drive</td>
</tr>
<tr>
<td>200</td>
<td>Lantern</td>
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<td>400</td>
<td>Coupling rod</td>
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<tr>
<td>SEA</td>
<td>Shaft seal</td>
</tr>
<tr>
<td>500</td>
<td>Suction casing</td>
</tr>
<tr>
<td>600</td>
<td>Rotor</td>
</tr>
<tr>
<td>RTE</td>
<td>Rotating unit</td>
</tr>
<tr>
<td>601</td>
<td>Stator</td>
</tr>
<tr>
<td>700</td>
<td>Pressure branch</td>
</tr>
</tbody>
</table>
3.1 Data sheet

3.2 Characteristic Curves

3.3 Declaration

• Data sheet, characteristic curves and declarations are commission specific documents and not part of this not binding operating and assembly instruction.
4.1 Safety

**CAUTION**

**Damage to property/injuries due to incorrect transport**
Slight injury or damage to property can occur
➢ Comply with the safety notes and transport notes on the packaging.
➢ Use suitable means of transport, lifting devices and tools.
➢ Use protective equipment.

4.2 Transport

4.2.1 Dimensions, weights and center of gravity
➢ Note the dimensional drawing (→ chapter 5.6).

4.2.2 Symbols

- Meaning of symbol

![Symbols](image)

- Top
- Fragile item
- Against moisture protect
- Centre of gravity
- Lashing points

4.2.3 Sling points (AP) for lifting devices

**WARNING**

**Warning of suspended load.**
Death of serious injury can occur.
➢ Use the lashing points (AP) for lifting devices.
➢ Note the centre of gravity (→ dimensional drawing, chapter 5.6).

Lifting machine

 Industry trucks

4.2.4 Unpacking the machine

➢ Comply with the symbols and notices on the packaging.
➢ Remove the screwed connection between the machine and packaging.
➢ Remove the machine with a lifting machine/industrial truck.

4.3 Temporary storage/Corrosion protection

- All seepex machines have corrosion protection applied as standard prior to transport.
4 Transport, Intermediate storage, Disposal

### NOTICE

**Damage to property if corrosion protection is missing**

Property damage can occur due to corrosion.

- Temporary storage must be in a dry, enclosed, frost-free room in order to provide protection against ambient influences.
- Contact seepex regarding the necessary corrosion protection for temporary storage.

### 4.4 Disposal

**NOTICE**

**Environmental protection**

Material damage can occur.

- Drain the pumping medium and dispose of it in accordance with the regulations.
- Dispose of the machine with regard to its composition and existing regulations.
5.1 Mounting tools / lifting gear

**CAUTION**

Pump falling over.
Slight injury or damage to property can occur.
- Adhere to the lifting tool’s starting point.
- Pay attention to the dimensions, weight and centre of gravity of the pump.
- Use suitable mounting tools/lifting gear.

5.2 Space requirement

The required space should be determined by considering the following factors:
- Dimensions and weight.
- Requisite transport and lifting equipment.
- Pipe routing – dismantling (dimension for stator replacement).

5.2.1 Dimension for stator replacement (P)

- Refer to the dimensional drawing.

5.3 Assembly of the complete mounted pump

- Assemble according to technical data (→ chapter 3.).
- Note dimensional drawing.

**Tension-free mounting of the pump**

- Balance unevenness with suitable supports.
  - Applies to mounting on foundations/load-bearing elements.
  - Total areas of all pump bearing areas are resting on the surface.

**Correct position of the drives**

- All drives are set up ready for operation and mounted.
- Correct displacements of the drive during transport/installation of the pump by adjusting/fixing the drive.

**CAUTION**

Safety protection equipment.
Slight injury or damage to property may result.
- Connect safety protection equipment and activate.
5.4 Power supply of the seepex pump

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
</table>
| Supply voltage and power frequency.  
Death or serious injury will result.  
➢ Heed type plate on the pump.  
➢ Pay attention to manufacturer's directions (→ chapter 13.).  
➢ Pay attention to safety regulations. |

5.5 Pipelines

5.5.1 Suction and pressure connection

• Refer to the dimensional drawing for the position, nominal width and standard.  
• Note direction of rotation/flow direction.

5.5.2 Pipeline dimensions

• Adhere to specifications regarding pressure in the pressure respectively suction connection.  
• Note technical data (→ chapter 3.).  
• Nominal width of suction pipe = nominal width of suction connection of pumps.

5.5.3 Residue-free pipelines

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
</table>
| Damage to property through assembly residue.  
No claims under guarantee if violated.  
➢ Keep all pipe work free of foreign objects.  
➢ Remove weld spatters, screws, steel chips etc. |

5.5.4 Tension-free assembly

➢ Assemble pipelines and other components in a tension-free manner on the pump.
Master Copy

6.1 Commissioning report

Send commissioning report online to www.seepex.com

Must be specified with every order!

Commission: ________________________________ Model: ________________________________

From:
Contact person: .............................................
Tel.: ...........................................................
Fax: ..........................................................
E-mail: .....................................................

Customer Service: Germany
seepex GmbH
Postfach 10 15 64
D-46215 Bottrop
service@seepex.com
Phone: +49 2041.996-231
Fax: +49 2041.996-431

Address of plant:

Rest of Europe
Phone: +49 2041.996-224
Fax: +49 2041.996-424

Outside Europe
Phone: +49 2041.996-120
Fax: +49 2041.996-432

Delivery date:

Date of installation:

Assembly check carried out on:

Please enter operational data:

Conveying liquid:

Temperature:

Fuse level/motor protection or power consumption

Frequency control

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>no</td>
<td>yes</td>
</tr>
</tbody>
</table>

If yes:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplied by seepex</td>
<td>Supplied by customer</td>
</tr>
</tbody>
</table>

Frequency:

Speed:

Power consumption:

Place, date ________________________________
Signature / company stamp ________________________________
6.2 Measures before commissioning

➢ Note the technical data (→ chapter 3.).

6.2.1 Checking pipelines

➢ Check flange screwed connections (SCH).

➢ Check threaded connections (G).

### NOTICE

Ensure the liquid can flow through without obstruction. Malfunction and/or irreparable damage to the pump.

➢ Open all shut-off elements before switching on the pump.

6.2.2 Protective devices on the pump

### DANGER

Missing protective device.
Danger of pulling in and crushing.

➢ Equip the pump with a protective device. Protective devices provided for preventing contact with surfaces or moving parts must be regarded as suitable if contact is not possible in a test involving a test finger, with regard to the penetration possibility, strength and shock resistance.

➢ Comply with national protection regulations.

➢ In pumps with an open suction flange/feed hopper, attach touch protection. These safety clearances protect those persons who are attempting to reach danger areas without additional help and under the conditions defined for various situations of reaching up, reaching under or reaching through.

In shaft seals, touch protection is only necessary if there are components on the rotating shaft.

6.2.3 Electrical/hydraulic connections

### DANGER

Dangerous voltage.
Death or serious injury can occur.

➢ Note safety regulations.

➢ Disconnect motor from all sources of energy.

➢ Secure electrical connections against restarting.
6.2.4 Direction of rotation check

- The pump direction of rotation determines the flow direction of the pumping medium.
- Note the direction of rotation arrow on the type plate.

6.2.5 Additional devices - optional

- Refer to additional devices (→ chapter 12.1).

6.3 Initial commissioning/repeated commissioning

- Start up the pump.

**NOTICE**

Dry running of the pump.
Malfunction and/or irreparable damage to the pump.

- Fill the suction casing with liquid in order to lubricate the pumping elements.

6.3.1 Avoid dry running of the pump

**NOTICE**

High temperature between rotor and stator.
Stator material burned. Complete failure of the pump.

- Make sure that the suction-side conveying capacity does not cavitate.
- If this cannot be guaranteed on the machine side, assemble a seepex dry running protection (TSE).

6.3.2 Pressure in the suction and pressure connection

**CAUTION**

High pressure.
Malfunction and/or irreparable damage to the shaft seal or pump.

- Maintain pressure in the suction connection in accordance with the technical data (→ chapter 3.).

Recommendation:

- Assemble an oil-filled contact pressure gauge to monitor and deactivate the pump.
6.4 De-commissioning

Protect the pump and additional devices against the following:

- Frost
- Deposit of solids
- Sedimentation from the liquid
- Corrosion of parts that come into contact with the medium

6.4.1 Switching off the pump

**DANGER**

Dangerous voltage.
Death or serious injury can occur.

- Note safety regulations.
- Disconnect motor from all sources of energy.
- Secure electrical connections against restarting.

6.4.2 Emptying the pump

**CAUTION**

Liquid draining out.
Minor injury or damage to property can occur.

- Wear suitable protective clothing.
- Refer to the technical data (→ chapter 3.) for the corresponding configuration of the pump housing.

To drain the pump:

- If the pump housing has screwed plugs, remove the screwed plugs.
- Drain using a connection branch (suction casing, pressure branch) if the pump housing is coated or the housing does not have screwed plugs.
- Drain the residual liquid from the pump housing.
- Drain the pipelines on the suction and pressure sides, or shut off behind the pump connections.
6.4.3 Removing the pump

WARNING
Risk of pump tipping or falling. Death or serious injury can occur.
- Support the drive unit to guarantee stability.

Pipeline dismantling
- Remove flange bolts (SCH) and flange seals (DFL).
  with/without base plate
- Remove bolts (SCH) from the pump feet.

Pipeline dismantling
- Remove threaded connections (G).
  with/without base plate
- Remove bolts (SCH) from the pump feet.

6.4.4 Preservation/storage of the pump

NOTICE
Damage to property due to lack of corrosion protection. Property damage can occur due to corrosion.
- Contact seepex to discuss suitable preservation measures.
  - State the commission number of the pump.
7.1 Preventive measures

The maintenance personnel must have these operating instructions, follow them and also require corresponding qualifications.

---

**DANGEROUS**

**Dangerous voltage.**
Death or serious injury can occur.
- Note safety regulations.
- Disconnect pump from all sources of energy.
- Secure electrical connections against restarting.

---

7.1.1 Pump down-time

**NOTICE**

**Pump down-time.**
Production failure due to wear.
- Acquisition of a set of wearing parts and a set of gaskets.

---

7.2 Lubrication

![Diagram of pump components](image)

<table>
<thead>
<tr>
<th>No.</th>
<th>Denomination</th>
<th>Lubricant</th>
<th>Lubricant change in operating hours</th>
<th>Fill volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pin joint</td>
<td>seepex special grease *</td>
<td>10000 h</td>
<td>*</td>
</tr>
<tr>
<td>2</td>
<td>Pin joint</td>
<td>seepex special grease *</td>
<td>10000 h</td>
<td>*</td>
</tr>
<tr>
<td>3</td>
<td>Drive</td>
<td>Refer to manufacturer's documentation (chapter 13,..)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Conveying medium</th>
<th>***</th>
<th>***</th>
</tr>
</thead>
</table>

---

* Type and filling quantities are commission specific information.
### 7.2.1 Joint grease

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
</table>
| **Other grease types.**  
Malfunction and/or irreparable damage to the joints or the pump.  
➤ Exclusively use seepex special grease. |

### 7.3 Inspection

<table>
<thead>
<tr>
<th>Component</th>
<th>Interval</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joints</td>
<td>Every 10,000 operating hours</td>
<td>Renew joint grease</td>
</tr>
<tr>
<td>Stator</td>
<td>Every week</td>
<td>Visual check for leaks</td>
</tr>
<tr>
<td>Shaft seal</td>
<td>Every week</td>
<td>Visual check for leaks</td>
</tr>
<tr>
<td>Drive unit</td>
<td>Every 3000 operating hours, at least every 6 months</td>
<td>Comply with manufacturer's documentation</td>
</tr>
</tbody>
</table>
7.4 Cleaning of CS pumps

7.4.1 Application

- seepex pumps of the CS range can be universally implemented in the food, beverage, pharmaceutical, cosmetic and chemical industries.
- They meet the highest standards in terms of quality, hygienic design, and careful product conveyance.
- The pumps can be cleaned and disinfected in a circular or flow process without having to be dismantled.

7.4.2 Observed guidelines

- seepex pumps of the CS range are certified in accordance with 3-A Sanitary Standards (USA) (model designations: BCSO, BTCS, MDC, MDTC) and designed according to the EHEDG guideline.
- In addition to AISI 300 series stainless steels, FDA-compliant non-metallic materials are also used.
- For pumps with closed joints, joint grease with a declaration of conformity in accordance with NSF-H1 is used (NSF = The Public Health and Safety Company, USA).

7.4.3 Assembly construction

<table>
<thead>
<tr>
<th>Item</th>
<th>Denomination</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANT</td>
<td>Drive</td>
</tr>
<tr>
<td>200</td>
<td>Lantern</td>
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<tr>
<td>307</td>
<td>Plug-in shaft</td>
</tr>
<tr>
<td>400</td>
<td>Coupling rod</td>
</tr>
<tr>
<td>SEA</td>
<td>Shaft seal</td>
</tr>
<tr>
<td>500</td>
<td>Suction casing</td>
</tr>
<tr>
<td>600</td>
<td>Rotor</td>
</tr>
<tr>
<td>RTE</td>
<td>Rotating unit</td>
</tr>
<tr>
<td>601</td>
<td>Stator</td>
</tr>
<tr>
<td>700</td>
<td>Pressure branch</td>
</tr>
<tr>
<td>CIP</td>
<td>CIP connection</td>
</tr>
</tbody>
</table>
7.4.4 Designs

7.4.4.1 BCSO, MDC ranges

- Rotating unit (RTE) with open joints.
- Certified in accordance with 3-A Sanitary Standards and designed according to EHEDG guidelines.
- Conveying capacities: BCSO 30 l/h - 130 m³/h; MDC range 0.5 l/h - 500 l/h.
- Pressures: up to 24 bar.

7.4.4.2 BSCB range

- Rotating unit (RTE) with closed pin joints.
- Conveying capacities: 30 l/h - 130 m³/h.
- Pressures: up to 24 bar.

7.4.4.3 BTCS, MDTC ranges

- Feed hopper pump with cylindrical/conical compression zone and a feed screw for conveying highly viscous products with low flowability.
- Rotating unit (RTE) with open joints, optionally with closed joints.
- Certified in accordance with 3-A Sanitary Standards (open joint design) and designed according to EHEDG guidelines.
- Conveying capacities: BTCS range 30 l/h - 130 m³/h; MDTC range 0.5 l/h - 500 l/h.
- Pressures: up to 24 bar.

7.4.5 Benefits and properties

- Pump housings which are almost dead space free prevent product deposits.
- High-quality surfaces of inner parts which come into contact with the product allow residue-free cleaning.
- Easy maintenance due to plug-in between rotating unit and drive.
- Mechanical seals, which are adapted to the particular application, ensure a hygienic shaft seal.
- Stator material and secondary seals with FDA approval guarantee high product safety.
- A tangentially aligned flushing connection (optional) enables extensive residual draining of the pump.
- Flushing with high flow speed within the suction casing enables residue-free cleaning.
- Disinfection can be carried out using steam, superheated steam or chemical disinfectant.
7.4.6 Cleaning processes (CIP/SIP)

General
- Production installations in the food, beverage, pharmaceutical, cosmetic and chemical industries are often equipped with automated cleaning systems.
- **CIP** stands for "Cleaning in Place"
  - This means that the respective installation equipment does not have to be disassembled or dismantled for cleaning.
  - High flow speed flushing within the casing parts of the pump enables residue-free cleaning.
- **SIP** stands for "Sterilisation in Place"
  - Thermal or chemical disinfectants, i.e. lowering the total germ level to a very low amount without disassembling or dismantling the pump.
  - Disinfectants, hot water or steam can be used as a medium.
7.4.6.1 Cleaning recommendations for CIP

- Flush the pump thoroughly before commissioning it for the first time.
- Clean the pump so that it conforms to the required hygiene regulations.
- Perform customer installation according to the figure in chapter 7.4.6.
- Install the pump so that it can be cleaned residue-free at the application location.
- Flushing processes must be carried out at a sufficient flow speed. Recommended flow speed is at least 1.5 m/s.
- During the individual flushing processes, operate the pump for max. 5 min using a low rotation speed. Then convey the cleaning agent through the bypass line while the pump is switched off.
- Use a suitable cleaning agent.

### NOTICE

**Operating the pump for a longer period (> 5 min./flushing process) during the cleaning process**

Damage to property can occur.

- Operate the pump for max. 5 minutes using a low rotation speed.
- Then convey the cleaning agent through the bypass line while the pump is switched off.
  - Observe figure in chapter 7.4.6.

7.4.6.2 Recommended cleaning process

<table>
<thead>
<tr>
<th>Item</th>
<th>Cleaning process</th>
<th>Cleaning agent</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Preparation</td>
<td></td>
<td>Extensive draining of the pump before the cleaning process, avoid dry running</td>
</tr>
<tr>
<td>2.</td>
<td>Pre-flushing</td>
<td>Fresh water</td>
<td>Removal of loose, adherent dirt components</td>
</tr>
<tr>
<td>3.</td>
<td>Alkaline flushing</td>
<td>Sodium hydroxide solution max. 1.5% at 60-80°C</td>
<td>Removing and washing away adherent contamination</td>
</tr>
<tr>
<td>4.</td>
<td>Intermediate flushing</td>
<td>Fresh water</td>
<td>Flushing out cleaning agent and residual dirt</td>
</tr>
<tr>
<td>5.</td>
<td>Acidic flushing</td>
<td>Nitric acid/peracetic acid max 1% at 50-70%</td>
<td>Disinfection; removing, washing away adherent contamination</td>
</tr>
<tr>
<td>6.</td>
<td>Post-flushing</td>
<td>Fresh water</td>
<td>Flushing out residual cleaning agent</td>
</tr>
</tbody>
</table>

### NOTICE

**Application of other cleaning agents**

Damage to property can occur.

- Consult with seepex
7.4.6.3 Cleaning recommendations for SIP

- Clean the pump so that it conforms to the required hygiene regulations.
- Perform customer installation according to the figure in chapter 7.4.6.
- Install the pump so that it can be cleaned residue-free at the application location.
- For SIP processes with disinfectants or hot water, proceed in the same way as for CIP processes.
  - Cleaning recommendations can be found in chapter 7.4.6.1.
- For SIP processes with steam, the steam should only be conveyed through the bypass line.
  - Do not operate the pump at the same time.

Thermal disinfection

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disinfection with hot water or steam</td>
</tr>
<tr>
<td>Minor injuries can occur.</td>
</tr>
<tr>
<td>Burns due to contact with hot surfaces.</td>
</tr>
<tr>
<td>➢ Observe appropriate protective measures.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disinfection with steam</td>
</tr>
<tr>
<td>Damage to property can occur.</td>
</tr>
<tr>
<td>➢ Only convey steam through the bypass line.</td>
</tr>
<tr>
<td>Do not operate the pump at the same time.</td>
</tr>
<tr>
<td>➢ Observe figure in chapter 7.4.6.</td>
</tr>
</tbody>
</table>

Chemical disinfection

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disinfection with chemical agents</td>
</tr>
<tr>
<td>Minor injuries can occur due to contact with cleaning agents.</td>
</tr>
<tr>
<td>➢ Observe notes from the manufacturer.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating the pump for a longer period (&gt; 5 min./flushing process) during the cleaning process</td>
</tr>
<tr>
<td>Damage to property can occur.</td>
</tr>
<tr>
<td>➢ Operate the pump for max. 5 minutes using a low rotation speed.</td>
</tr>
<tr>
<td>➢ Then convey the cleaning agent through the bypass line while the pump is switched off.</td>
</tr>
<tr>
<td>➢ Observe figure in chapter 7.4.6.</td>
</tr>
</tbody>
</table>
Malfunctions, causes, rectification

Refer to technical data (chapter 3.) for application range of the pump.

<table>
<thead>
<tr>
<th>Malfunction</th>
<th>Causes</th>
<th>Rectification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump is not sucking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump pumping unevenly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conveying capacity is not achieved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure head is not reached</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump does not start up</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump seized / pump does not pump</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump is loud when running</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor gets too hot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Premature stator wear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft seal is leaky</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td>Static friction between stator/rotor too great.</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td>Apply lubricant (liquid soap) between stator and rotor.</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td>Incorrect direction of rotation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check direction of rotation and swap over motor connections if necessary.</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>Suction pipe or shaft seal leaking.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eliminate leaks.</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>Suction head too great.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check the suction head, if necessary increase pipe cross section on suction pipe and use a larger filter, open suction-side valve fully.</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>Viscosity of conveying product too great.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check/adapt (data sheet).</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>Pump rotation speed incorrect.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Correct rotation speed (data sheet).</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>Rotation speed too low.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increase rotation speed for low-viscosity media/large suction volume.</td>
</tr>
<tr>
<td>Malfunction</td>
<td>Causes</td>
<td>Rectification</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>---------------------------------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>Pump is not sucking</td>
<td>Rotation speed too high.</td>
<td>Reduce rotation speed for high-viscosity media, risk of cavitation.</td>
</tr>
<tr>
<td>Pump pumping unevenly</td>
<td>Joint play too large.</td>
<td>Check mounting of coupling rod bushing.</td>
</tr>
<tr>
<td>Conveying capacity is not achieved</td>
<td>Foreign objects in pump.</td>
<td>Dismantle pump, remove foreign bodies, replace defective parts.</td>
</tr>
<tr>
<td>Pressure head is not reached</td>
<td>Stator/rotor worn.</td>
<td>Dismantle pump and renew defective parts.</td>
</tr>
<tr>
<td>Pump does not start up</td>
<td>Joint parts worn.</td>
<td>Renew joint parts, use seepex pin joint grease.</td>
</tr>
<tr>
<td>Pump seized / pump does not pump</td>
<td>Suction pipe blocked.</td>
<td>Clean the suction pipe.</td>
</tr>
<tr>
<td>Motor gets too hot</td>
<td>Temperature of pumping liquid too high.</td>
<td>Check temperature, use an undersize rotor.</td>
</tr>
<tr>
<td>Shaft seal is leaky</td>
<td>Gland packing too firm/worn.</td>
<td>Loosen packing gland or tighten. Renew unusable packing rings.</td>
</tr>
<tr>
<td></td>
<td>Solid content and/or grain size too great.</td>
<td>Reduce pump speed, install screen with permitted mesh width. Increase liquid proportion.</td>
</tr>
<tr>
<td></td>
<td>Sedimentation/gumming of solids when pump stationary.</td>
<td>Rinse through and clean the pump immediately.</td>
</tr>
<tr>
<td></td>
<td>Conveying product hardens when the temperature drops below a certain limit.</td>
<td>Heat the pump.</td>
</tr>
<tr>
<td></td>
<td>Stator swollen and unable to withstand conveying product.</td>
<td>Select a suitable stator material, use an undersize rotor.</td>
</tr>
<tr>
<td></td>
<td>Bearings in pump drive housing or drive unit defective.</td>
<td>Renew bearings.</td>
</tr>
<tr>
<td></td>
<td>Mechanical seal defective.</td>
<td>Check sliprings and O-rings for wear/resistance, renew if necessary.</td>
</tr>
</tbody>
</table>
9.1 Pump Dismantling / Reassembly

Range: BCSB
Size: 025-12 to 1-6L, 1-6 to 75-6LT

9.1.1 Prepare the pump for dismantling

- **DANGER**
  - Dangerous voltage.
  - Death or serious injury can occur.
  - Note safety regulations.
  - Disconnect pump from all sources of energy.
  - Secure electrical connections against restarting.

- Empty pipelines.
- Allow pipelines to cool down.
- Remove pipeline connections (suction side/pressure side).
- Note decommissioning (chapter 6._).

9.1.2 Dismantling

- **WARNING**
  - Tilting or falling pump.
  - Death or serious injury can result.
  - Attach lantern (200) to secure the pump.

9.1.2.1 Pressure branch (700) - dismantling

- Prop up stator (601) with support (S).
9.1.2.2 Stator (601) - dismantling

- Lift/slide splash ring (310).
- Push out plug-in shaft pin (309) horizontally.
- Turn plug-in shaft pin (309) upwards.

9.1.2.3 Suction casing (500) - dismantling

- Provide rotor (600) with protective cover (SH).
- Prop up rotor (600) with support (S).
- Remove plug-in shaft pin (309).
- Dismantle the suction casing (500).

9.1.2.4 Rotating unit (RTE) – dismantling

**With flush connection**

- Remove the flush connection (SSÜ) on the casing of the shaft seal (SEA).
- Pull the rotating unit (RTE) with shaft seal (SEA) off from the output shaft of the drive (ANT).
- Dismantle shaft seal (SEA).
  - Note dismantling shaft seal (chapter 9._).
Without flush connection

Tool (W10/ dismantling of the plug-in shaft)

- Pull rotating unit (RTE) with shaft seal (SEA) off from the output shaft of the drive (ANT).
- Dismantle shaft seal (SEA).
  - Note dismantling shaft seal (chapter 9._).

9.1.2.5 Rotor (600), coupling rod (400), plug-in shaft (307) - dismantling

- Dismantling joint (G)
  - Note rotating unit – individual parts (chapter 9._).

9.1.2.6 Lantern (200)/drive (ANT) - dismantling

9.1.3 Reassembly

**WARNING**

Tilting or falling pump.
Death or serious injury can result.

- Attach lantern (200) to secure the pump.

**CAUTION**

Risk of fingers being crushed.
Slight injury may result.

- Do not grasp between connections.

9.1.3.1 Lantern (200)/drive (ANT) - reassembly

- Clean the flange bearing surfaces (FLS), bolt circle (ZD) and output shaft of the drive (ANT).
9.1.3.2 Rotor (600), coupling rod (400), plug-in shaft (307) - reassembly

- Joint (G) reassembly
  - Note rotating unit - individual parts (chapter 9._).

9.1.3.3 Rotating unit (RTE) - reassembly

- Assemble shaft seal casing (SEA).
  - Note reassembly shaft seal (chapter 9._).
- Moisten splash ring (310)/plug-in shaft (307) with joint grease.
- Slide splash ring (310) onto plug-in shaft (307).
  - Observe fitting position of splash ring (see writing on splash ring).
- Apply antiseize graphite petroleum to the output shaft of drive (ANT).
- Slide on rotating unit (RTE).

With flush connection

- Mount the flush connection.

9.1.3.4 Suction casing (500) - reassembly

- Provide rotor (600) with protective cover (SH).
- Prop up rotor (600) with support (S).
- Slide on casing gasket (501).
- Mount suction casing (500) and adjust (using spirit level).
- Secure the suction casing (500) with hexagon nut (509 and 624).
9.1.3.5 Stator (601) - reassembly

- Insert plug-in shaft pin (309).
- Twist plug-in shaft pin (309) upwards.

- Insert plug-in shaft pin (309).
- Twist plug-in shaft pin (309) upwards.

- Add lubricant (GM) to the opening on the pressure branch side between the rotor (600) and stator (601).
- Turn stator (601) in the “right” rotating direction and slide onto rotor (600).
- Prop up stator (601) with support (S).
- Slide in plug-in shaft pin (309).
- Pay attention to the position of the splash ring (310).
- Insert the splash ring collar at a distance of 0.5 mm from the lantern (200).

9.1.3.6 Pressure branch (700) - reassembly

- Tighten the tie bolts (602) evenly.
9.2 Rotating unit individual parts

9.2.1 Dismantling

9.2.1.1 Holding band (406, 407) - dismantling

**CAUTION**

*Danger of injury.*
Parts might be thrown out.
- Wear safety glasses.
- Detach holding band loop (SCL).
  - Use suitable tool (WH).
- Push out parts of holding band loop (SCL).
- Remove holding band (406, 407).
- Pull back universal joint sleeve (405).

9.2.1.2 Retaining sleeve (401) - dismantling

- Knock back retaining sleeve (401).
  - Use suitable tool (WM).

9.2.1.3 Detach joint

- Tool (W5/drift)

- Eject coupling rod pins (402).
9.2.2 Rotating unit (RTE) - prepare individual parts for reassembly

9.2.2.1 Rotor (600)

- Remove any damage.
- Clean rotor (600).

Press in guide bushings (403) (depth = 2/3).
  - Use tool (W4).

9.2.2.2 Coupling rod (400)

- Clean the coupling rod (400).
- Examine bore head for wear.
  - If wearing is detected on the bore head, replace the coupling rod (400).
9.2.2.3 Plug-in shaft (307)

- Remove any damage.
- Clean rotor (600).

Tool (W4/assembly mandrel)

- Press in guide bushings (403) (depth = 2/3).
  - Use tool (W4).

9.2.3 Rotating unit (RTE) - individual parts - reassembly

**NOTICE**

Malfunction of the joints.
Malfunction and/or destruction of joints.

- Replace coupling rod pins (402) and guide bushings (403) jointly.

9.2.3.1 Coupling rod (400) - reassembly

- Slide the universal joint sleeve (405) and holding bands (406, 407) onto coupling rod (400).
- Fit the diameter and width of the holding band of the universal joint sleeve.
- Fill the joint head with seepex joint grease.

Rotor (600)

- Insert coupling rod pins (402).
- Slide on retaining sleeve (401).
- Connect rotor/coupling rod.

Tool (W5/drift)

- Slide in the coupling rod pins (402).
- Knock the guide bushings (403) in.
  - Use tool (W5).
Plug-in shaft (307)

- Insert coupling rod pins (402).
- Slide on retaining sleeve (401).
- Connect plug-in shaft/coupling rod.

9.2.3.2 Retaining sleeve (401) - reassembly

- Slide in the coupling rod pins (402).
- Knock the guide bushings (403) in.
  - Use tool (W5).

Rotor (600) unhardened material

- Secure retaining sleeve (401) in a displaced manner (2x180°).
  - Use suitable tool (WK).

Rotor (600) hardened material

- Secure retaining sleeve (401) in a displaced manner (2x180°).
  - Use suitable tool (WK).
9.2.3.3 Universal joint sleeve (405) - reassembly

- Moisten the surface of coupling rod (400) / inner surface of universal joint sleeve (405) with joint grease (maintenance → chapter 7).
- Slide on universal joint sleeve (405).
- Remove air from the inside of the joint.
  - Use suitable tool (WS).

- Assemble the holding band.
  - Holding band assembly (→ chapter 9).
9.3 Holding band - assembly

9.3.1 Prepare the holding band

➢ Only use prefabricated double-band holding bands.

9.3.2 Check the holding band

- Bent-over holding band (HBD) is in contact with holding band loop (SCL) to avoid damaging universal joint sleeve.

➢ Press on holding band (HBD) using tool (WZ) if necessary.

9.3.3 Assemble the holding band

➢ Use tool (W3/mounting tool)

➢ Feed holding band into tool (W3).

➢ Hold ends of holding band with the eccentric lever (EX).

➢ Turn the crank (KU) until the holding band is strained and lies against the holding band loop (SCL).

➢ Carefully pull the holding band together until it is in contact with the circular groove of universal joint sleeve.

9.3.4 Correct tension of holding band (HBD)

Correct
The holding band (HBD) has drawn in the out shape of the universal joint sleeve and is firmly seated.

Incorrect
The holding band (HBD) is too loose, can slip off.

Incorrect
The holding band (HBD) is too tight, universal joint sleeve will be damaged/sheared off.
9.3.5 Cant up the holding band

- Swivel mounting tool (W3) approx. 60° upwards.
- Loosen crank (KU) by a half turn.
- Swivel cutting lever (SH) forward until the pressure piece is lying behind the holding band loop (SCL).

9.3.6 Shear the holding band (material: 1.4301; 1.4401)

- Hit the cutting lever (SH) with the inside of your hand.
  - Cant up and shear the end of the holding band behind the loop (SCL).
  - Carefully straighten up the holding band (HBD) if it rises up on the sheared side.

**NOTICE**

Universal joint seal damage.
Pin joint grease can emerge.

- Avoid hammering or striking.

9.3.7 Check the holding band after assembly

- The holding band must lie in the groove of the universal joint sleeve.
- Replace the holding band if the holding band slips back through the loop.
Dismantling / Reassembly

9.4 / 9.5 Shaft sealing

9.4.1 Safety

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shaft seal is leaky.</strong></td>
</tr>
<tr>
<td>Leakage may escape into the atmosphere.</td>
</tr>
<tr>
<td>➢ Take safety measures to protect persons and the environment.</td>
</tr>
<tr>
<td>➢ Wear suitable protective clothing.</td>
</tr>
<tr>
<td>➢ Dispose of leakage appropriately.</td>
</tr>
<tr>
<td>➢ Note applicable regulations when handling hazardous substances.</td>
</tr>
</tbody>
</table>

9.4.2 Operating conditions and material combination

- Adjust to the relevant application
10.1 Spare parts list
### Spare parts

**Version for copying**

#### 10.1 Spare parts list

Spare parts can be ordered online or requested from [www.seepex.com](http://www.seepex.com/)

<table>
<thead>
<tr>
<th>Type:</th>
<th>BC 1-6 to 52-6L</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C 1-6 to 52-6L</td>
</tr>
<tr>
<td></td>
<td>BCSB 1-6 to 52-6L</td>
</tr>
<tr>
<td></td>
<td>with pin joint</td>
</tr>
</tbody>
</table>

**Request Order**

- **Sender:**
  - Contact: .........................................................
  - Tel.: ................................................................
  - Fax: ...............................................................
  - E-mail: ...........................................................

**Customer service:**

- seeepex GmbH
- Postfach 10 15 64
- D-46215 Bottrop
- service@seepex.com

**Delivery address:**

- Germany
  - Tel +492041.996-231
  - Fax +492041.996-431
- Rest of Europe
  - Tel +492041.996-224
  - Fax +492041.996-424
- Outside Europe
  - Tel +492041.996-120
  - Fax +492041.996-432

<table>
<thead>
<tr>
<th>No.</th>
<th>Quantity</th>
<th>Component</th>
<th>Material</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Minor set of wearing parts</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>330</td>
<td>1</td>
<td>Mechanical seal</td>
<td>according to data sheet (chapter 3.1)</td>
<td></td>
</tr>
<tr>
<td>601</td>
<td>1</td>
<td>Stator</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Major set of wearing parts</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>307</td>
<td>1</td>
<td>Plug-in shaft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>330</td>
<td>1</td>
<td>Mechanical seal</td>
<td>according to data sheet (chapter 3.1)</td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>1</td>
<td>Coupling rod with coupling rod bushings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>402</td>
<td>2</td>
<td>Coupling rod pin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>403</td>
<td>4</td>
<td>Guide bushing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>405</td>
<td>2</td>
<td>Universal joint sleeve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>406</td>
<td>2</td>
<td>Holding band, large</td>
<td></td>
<td></td>
</tr>
<tr>
<td>407</td>
<td>2</td>
<td>Holding band, small</td>
<td></td>
<td></td>
</tr>
<tr>
<td>600</td>
<td>1</td>
<td>Rotor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>601</td>
<td>1</td>
<td>Stator</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Place, date

Signature / company stamp
### Spare parts

**Version for copying**

<table>
<thead>
<tr>
<th>No.</th>
<th>Quantity</th>
<th>Component</th>
<th>Material</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Set of gaskets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>310</td>
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<td>Splash ring</td>
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<td><strong>Plug-in shaft &amp; shaft seal</strong></td>
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<td>307</td>
<td></td>
<td>Plug-in shaft</td>
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<td>309</td>
<td></td>
<td>Plug-in shaft pin</td>
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<tr>
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<td></td>
<td>Splash ring</td>
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<td>according to data sheet (chapter 3.1)</td>
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<td><strong>Coupling rod &amp; joint parts</strong></td>
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<td>400</td>
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<td>Coupling rod with coupling rod bushings</td>
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<tr>
<td>401</td>
<td></td>
<td>Retaining sleeve</td>
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<td>402</td>
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<td>Coupling rod pin</td>
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<td>403</td>
<td></td>
<td>Guide bushing</td>
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<td>405</td>
<td></td>
<td>Universal joint sleeve</td>
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<td></td>
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<tr>
<td>406</td>
<td></td>
<td>Holding band, large</td>
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<tr>
<td>407</td>
<td></td>
<td>Holding band, small</td>
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<td>401-407</td>
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<td>Complete set of joint parts</td>
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<td><strong>Conveying elements</strong></td>
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<td>600</td>
<td></td>
<td>Rotor</td>
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<td>601</td>
<td></td>
<td>Stator</td>
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<td><strong>Miscellaneous parts</strong></td>
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<td>Casing gasket</td>
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<tr>
<td>098</td>
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<td>Pin joint grease</td>
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<td>1 cartridge = 300 g (approx. 315 cm³)</td>
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<td>Grease quantity according to maintenance</td>
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<td>(chapter 7.0)</td>
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_____________________________ ______________________________
Place, date Signature / company stamp
### Special tools

Spare parts can be ordered online or requested from www.seepex.com. Must be specified with every order!

#### Commission: **Mark tool:**

<table>
<thead>
<tr>
<th>Tool no.</th>
<th>Packing gland</th>
<th>Stator</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
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<td></td>
</tr>
<tr>
<td>W2</td>
<td></td>
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</tbody>
</table>

**Denomination:**
- Packing puller
- Chain wrench plus spare chain

**Order no.**
- PKZ
- KRZ

#### For installation of: **Holding band**

<table>
<thead>
<tr>
<th>Tool no.</th>
<th>Holding band</th>
<th>Rotating unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>W3</td>
<td></td>
<td>W10</td>
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</tbody>
</table>

**Denomination:**
- Mounting tool
- Dismantling tool

**Order no.**
- MHB
- AZV

<table>
<thead>
<tr>
<th>Customer service:</th>
<th>Tel</th>
<th>Fax</th>
<th>Delivery address:</th>
</tr>
</thead>
<tbody>
<tr>
<td>seepex GmbH</td>
<td>+492041.996-231</td>
<td>+492041.996-431</td>
<td></td>
</tr>
<tr>
<td>Postfach 10 15 64</td>
<td>+492041.996-224</td>
<td>+492041.996-424</td>
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<tr>
<td>D-46215 Bottrop</td>
<td>+492041.996-120</td>
<td>+492041.996-432</td>
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<tr>
<td><a href="mailto:service@seepex.com">service@seepex.com</a></td>
<td></td>
<td></td>
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</table>

**Germany**
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**Contact:** .........................................................
**Tel.:** .........................................................
**Fax:** ..........................................................
**E-mail:** ..........................................................

**Fax:** ...............................................................

**For installation of:**

- Packing gland
- Stator
- Holding band
- Rotating unit
- Plug-in shaft
12.1 Accessories/Technical information

- Accessories and technical information are commission specific documents not part of this not binding operating and assembly instruction.
13.1 Manufacturer's and supplier's documents

- Manufacturer's and supplier's documents are commission specific documents and not part of this not binding operating and assembly instruction.
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