

**Operating and Maintenance Instructions  
with Dismounting and Mounting Instructions**

**Eccentric Screw Pumps  
Series ANP, ANBP, ASP, ASBP**

VM No.: 745.0001 GB  
Edition: 06.01  
Ident No.: 124 201

**Retain  
for future  
use!**

Order No.:

Ident No. of pump:

Machine No.:

Pump type:

**Operating data, dimensions and other additional information can be found in the order-specific part of the documentation.**



These Operating and Maintenance Instructions contain information from the pump manufacturer. They may need to be supplemented by instructions of the operator company for its personnel. These instructions do not take account of specific information relating to operation and maintenance of the process plant into which the pump is integrated. Such information can only be given by the persons responsible for construction and planning of the plant (plant manufacturer).

**Such specific instructions relating to operation and maintenance of the process plant into which the pump is integrated have priority over the instructions of the pump manufacturer. The plant manufacturer must on principle observe the limits of use!**

**Refer to the operating instructions of the plant manufacturer!**

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**Important note:**

This operating manual is to be supplemented by the order-related informations.

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1. General

1.1 Application and range of utilization

The eccentric screw pumps are self-priming, rotary positive-displacement pumps for handling and dosing low to high-viscosity, neutral or aggressive, pure or abrasive, gaseous liquids or liquids which tend to froth, even with fibre and solids contents.

**ATTENTION** The range of utilization is to be taken from the order data sheet.

1.2 Performance data

The exact performance data applying to the pump are to be taken from the order data sheet.

1.3 Warranty

Our liability for shortcomings in the supply is laid down in our delivery conditions. No liability will be undertaken for any damages caused by non-compliance with the operating instructions and service conditions.

If at any later date the operating conditions happen to change (e.g. different liquid pumped, speed, viscosity, temperature or pressure conditions), it must be checked by us from case to case and confirmed, if necessary, whether the pump is suited for these purposes. In case no special agreements were made, pumps supplied by us may, during the warranty period, be opened or varied only by us or our authorized contractual service stations; otherwise, our liability for any defects will cease.

1.4 Testing

Prior to leaving our factory, all pumps are subjected to a leakage and performance test. Only properly operating pumps leave the factory achieving the performances assured by us. Thus, compliance with the following operating instructions ensures proper operation.

2. Safety

These operating instructions contain basic hints to be observed in case of installation, operation and maintenance. Therefore, prior to mounting and commissioning, these operating instructions must by all means be read by the fitter as well as the pertinent expert personnel/customer and must always be available at the place of installation of the machine/plant.

Not only are the general safety hints listed under this main item „Safety“ to be observed, but also the special safety hints such as for private use added to the other main items.

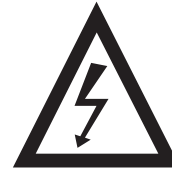
2.1 Marking of hints in the operating instructions

The safety hints contained in these operating instructions which, in case of non-compliance, may cause danger to personnel, are particularly marked with the general danger symbol



Safety sign according to DIN 4844-W9

in case of warning against electric voltage with



Safety sign according to DIN 4844-W8

For safety hints, non-compliance with which may cause dangers to the machine and its functions, the word



is added.

Hints directly attached to the machine such as

- Directional marker
- Sign for fluid connections

must by all means be observed and maintained in completely legible condition.

2.2 Personnel qualification and personnel training

The personnel for operation, maintenance, inspection and mounting must have the corresponding qualification for these operations. Range of liability, competence and the supervision of the personnel must be exactly controlled by the customer. If the personnel do not have the required knowledge, same must be trained and instructed. If required, this may be effected by the manufacturer/supplier on behalf of the machine customer. In addition, it must be ensured by the customer that the contents of the operating instructions are fully understood by the personnel.

2.3 Dangers in case of non-compliance with the safety hints

Non-compliance with the safety hints may result in danger not only to persons, but also to environment and machine. Non-compliance with the safety hints may lead to the loss of any claims for damages.

In detail, non-compliance may, **for example**, entail the following dangers:

- Failure of important functions of the machine/plant
- Failure of specified methods for maintenance and servicing
- Danger to persons by electrical, mechanical and chemical influences
- Danger to the environment by leakage of dangerous substances

2.4 Responsible working

The safety hints mentioned in these operating instructions, the current national rules for the prevention of accidents as well as any internal working, operating and safety regulations of the owner must be observed.

2.5 Safety hints for the user/operator

- If hot or cold machine parts lead to dangers, these parts must be protected against accidental contact at the site.
- Protection against accidental contact for moving parts (e.g. coupling) must not be removed when the machine is in operation.

- Leakages (e.g. of the shaft seal) of dangerous materials to be handled (e.g. explosive, toxic, hot) must be discharged so as not to result in danger to persons and the environment. Legal stipulations are to be observed.
- Dangers by electrical energy are to be excluded (for details with regard hereto, please refer e.g. to the regulations of the VDE and the local energy supply associations).

**2.6 Safety hints for maintenance, inspection and mounting operations**

The customer shall see to it that all maintenance, inspection and mounting operations are performed by authorized and qualified expert personnel who have sufficiently informed themselves by thoroughly studying the operating instructions. Basically, operations at the machine must be performed during standstill only. The mode of operation for stopping the machine described in the operating instructions must by all means be observed. Pumps or aggregates handling noxious liquids must be decontaminated. Prior to restarting, the items listed in the Section „Initial Start-Up“ are to be observed.

**2.7 Arbitrary reconstruction and spare parts production**

Reconstruction of or changes to the machine are only admissible after consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer serve safety purposes. The use of other parts may cancel the liability for the consequences resulting therefrom.

**2.8 Inadmissible modes of operation**

The operating safety of the machine supplied is only ensured with due application according to Section 1 of the operating instructions. The limit values given in the data sheet must by no means be exceeded.

**3. Transportation and intermediate storage**

**3.1 Packing**

The symbols applied to the packing must be observed. During transportation and storage, suction and discharge side and auxiliary connections of the pump must be closed with plugs. During installation of the pump aggregate, the plugs must be removed.

**3.2 Transportation**

Due to their weight, eccentric screw pumps and all pump aggregates are transported to the place of installation by means of a lifting appliance. When transporting the pumps by means of a crane, the sling ropes must be placed safely around the suction casing. In case of complete pump aggregates, a rope must be additionally fixed to the drive motor. The sling ropes must be placed around the pump and/or the pump aggregate so that when being lifted, they are in exact balance. Crane installation and the sling ropes must be sufficiently sized. The sling ropes must not be fixed to the suspension eyes of the motor.

**3.3 Preservation and storage of eccentric screw pumps**

Please refer to our document VM 2102 GB/...

**4. Description**

**4.1 Structural design**

Self-priming, two-stage eccentric screw pump. Rotor and stator are the conveying elements. The drive torque is transmitted by the drive shaft and/or hollow shaft and the coupling rod onto the rotor. Discharge casing, stator and suction casing are held together by external casing connecting screws (tie rods). The shaft sealing or mechanical seal housing is arranged between discharge casing and bearing bracket and/or lantern.

**4.1.1 Bearing and lubrication**

The coupling rod on both sides with liquid-tight encapsulated pin joints. Lubrication by joint oil. Bearing of the drive shaft of series ANP, ASP is in the bearing bracket by grease-lubricated grooved ball bearings. Bearing of the drive/hollow shaft of series ANBP, ASBP is in the reinforced bearings of the drive.

**4.1.2 Shaft seal**

By uncooled stuffing box or by uncooled maintenance-free, non-balanced, single or double-acting mechanical seal.

**4.1.3 Dimensions/branch position/flanges**

The dimensions of the pump and/or pump aggregate, the branch position and flange dimensions are to be taken from the tables of dimensions.

**4.2 Mode of operation**

Self-priming, rotary positive-displacement pump, the conveying elements of which are the rotating eccentric screw (rotor) and the fixed stator. Both meet in the cross-section at two points each which, regarded over the length of the conveying elements, form two sealing lines. The contents of the tight chambers formed as the rotor rotates are shifted axially and completely continuously from the suction to the discharge side of the pump. There is no turbulence despite the rotor rotation. The constant chamber volume excludes squeezing thus ensuring an extremely gentle low-pulsation delivery.

**4.3 Aggregate construction**

**4.3.1 Drive**

By non-explosion-proof or explosion-proof electric motors, geared motors or variable-speed geared motors. Other drive variants (e.g. via V-belt) are possible.

**4.3.2 Shaft coupling and protection against accidental contact**

Shaft coupling according to DIN 740 in case of series ANP and ASP. A protection against accidental contact **according to DIN EN 809** is attached as soon as the scope of supply comprises pump, base plate, shaft coupling and drive. **According to the rules for the prevention of accidents, the pump may be operated only with a protection against accidental contact according to DIN EN 809.** If a protection against accidental contact is not supplied, it must be installed by the customer.

**4.3.3 Base plate**

The pumps of horizontal installation, together with the drive are, as a rule, mounted on a common base plate. Base plates are provided of stainless steel.



**5. Installation/mounting**

**5.1 Installation**

The pumps may be installed horizontally or vertically with bearing and/or drive upwards.

**5.2 Foundation**

The foundation design depends on the size of the pump and/or the pump aggregate and the local installation conditions. For exact data on the pump and aggregate dimensions, please refer to our tables of dimensions. The foundation may be designed as concrete foundation or load-carrying foundation frame, for example of the steel type.

All foundation designs are subject to the following: The foundation must be designed so that it can take the weight of the pump aggregate on the entire surface.

**5.3 Base plate**

The base plate must be fixed on the foundation, stress-free.

**5.4 Coupling**

A pump aggregate supplied complete was carefully mounted at the factory. As the pump and the drive are fixed on the base plate, re-alignment of the coupling is not required.

**5.5 Assembly of pump and drive**

The aggregate being completed at the place of service only, the coupling must be assembled as follows:

1. Cover pump and drive shaft end with a filmy coat of molybdenum disulfite (e.g. Molykote), and insert keys.
2. By means of a mounting device, push pump and motor-side coupling halves on until the shaft end is flush with the coupling hub.  
If no mounting device is available, heating of the coupling halves to approx. 100°C (without rubber buffers) facilitates mounting.
3. By means of a grub screw according to DIN 916, fix coupling halves axially.
4. When assembling the pump and motor, geared motor and/or variable-speed gear it must be ensured that the coupling halves are accurately aligned. Depending on the size of coupling, the distance between the coupling halves must be 2–8 mm.



5. Mount protection against accidental contact according to DIN EN 809.

**5.6 Drive by V-belt drive**

In case of a V-belt reduction from the drive to the pump, make sure that the two V-belt pulleys are aligned in parallel.

The V-belt pulleys must be pushed onto the shaft ends as far as possible. It must be possible to regulate the tension of the V-belts sufficiently by means of a motor rocker or by means of tensioning rails. They must be slightly retightened after a short running-in period.

**ATTENTION** Excessive tensioning will destroy the anti-friction bearings of the pump. Our separate instructions – V-belt drive – VM 706.0001 GB / Ident No. 133586 must be complied with.

**5.7 Space required for maintenance and servicing**

**ATTENTION** The pump must be accessible from all sides allowing necessary visual inspections to be performed.

For maintenance and service operations, sufficient space must be provided, especially for the replacement

of the conveying elements. Stator and rotor dismantling dimensions are given in the pump and/or pump aggregate table of dimensions. In addition, see to it that all pipelines can be readily mounted and dismantled.

**5.8 Laying of pipelines**

**5.8.1 Nominal diameters**

The nominal diameters of the suction and discharge lines should be designed according to the nominal pump branch diameters. In case of considerable deviations, especially on the suction side, please contact the factory.

**5.8.2 Supports and flange connections**

By way of the flange connections, the pipelines must be connected to the pump, stress-free. They must be supported close to the pump and should allow of easy screwing to avoid deformations. After the screws have been slackened, the flanges must neither be inclined nor springy nor rest on top of one another under pressure. Any thermal stresses that may occur at the pipelines must be kept away from the pump by taking appropriate measures, e.g. by the installation of compensators.

**5.8.3 Cleaning of pipelines prior to attachment**

Prior to mounting the pump, the suction-side pipelines, slides and valves must by all means be flushed and/or cleaned.

Items left over from assembly operations, e.g. screws, nuts, welding beads, pieces of steel etc. will destroy the pump internals. Any guarantee claims will expire if and when damages are caused by such items.

**5.9 Laying of auxiliary pipelines for additional facilities**

All auxiliary pipelines for the supply of the shaft seal and the possible double shell casing for heating and cooling of the pump are to be connected, stress-free and sealing.

In case of double-acting mechanical seal (design: G08, G09), the lines for the sealing liquid are to be laid with the largest possible flow cross section. The sealing liquid outlet is at the highest connection of the mechanical seal housing.

The flow direction of the flushing and sealing liquid is shown by means of arrows in the sectional drawings.

In order to ensure automatic ventilation, the lines must be laid continuously ascending, short and promoting easy flow.

Air bag formation and gas bubble formation are to be avoided, if required, ventilation connections must be provided. The heating/cooling liquid outlet must be connected at the highest connection of the double shell casing, if any.

**5.10 Safety and control devices**

**5.10.1 Pressure gauge and vacuum gauge**

A pressure gauge and vacuum gauge must be connected to the discharge and suction line.

**5.10.2 Safety element in the discharge line**

If a shut-off element is fitted in the discharge line or if there is a possibility of the discharge line becoming blocked, a safety element must be provided. For example: by-pass with built-in relief valve, bursting disk, motor protection switch, etc.



**Eccentric screw pumps are positive-displacement pumps and can theoretically generate an infinitely high pressure.**



With the discharge line closed, e.g. by clogging or by incidental closing of a valve, the pressure generated by the pump may reach a multiple of the admissible pressure of the plant. This may, for example, lead to the bursting of lines which must be absolutely avoided especially when handling dangerous products. Thus, appropriate safety devices must also be installed in the plant (e.g. pressure switches).

### 5.11 Electric connections



Connection of the power supply cables of the coupled drive motor must be effected by an electrical expert according to the switching diagram of the motor manufacturer. For these purposes, the current VDE regulations and the regulations of the local energy supply association are to be observed. Danger by electrical energy must be excluded.

## 6. Starting/stopping

### 6.1 Preparation for starting

#### 6.1.1 Filling the pump with liquid

**ATTENTION** Do not allow the pump to run when dry! For initial start-up and after longer shut-down periods, the pump must be filled with liquid.

Even a few revolutions without liquid can damage the stator. It is for this reason that the suction casing must be filled with water or the medium to be pumped in order to lubricate the stator and rotor before start-up. After a longer shut-down period, i.e. when it is to be assumed that the remaining liquid in the pump will have evaporated, or after a repair, the filling procedure must be repeated.

After filling, the pump is self-priming. Venting is unnecessary as a mixture of liquid and gas can be handled without any trouble.

#### 6.1.2 Switching in the additional facilities for shaft seals (if provided)

If the pumps are charged with a sealing/quench liquid, the stop valves, prior to initial start-up of the pump, must be opened and set to the pressures listed below.

##### – Supply of the stuffing box with flushing or sealing liquid (Designs P02, P03, P04).

**Note:** For maintaining their function, stuffing boxes with flushing or lantern rings require a flushing/sealing liquid.

The required flushing and/or sealing liquid pressure in case of pumps with stuffing box is for stuffing box designs

- P02 = 0.1 up to 0.5 bar  
(above internal suction casing pressure)
- P03 = 0.5 bar  
(above internal suction casing pressure)
- P04 = 0 up to 0.5 bar

(For flushing and sealing liquid, please refer to Section 6.1.3 below).

##### – Supply of the single-acting, non-balanced mechanical seal with throttled sealing liquid outlet (Designs G04 ... G07)

**Note:** For maintaining their function, these mechanical seals require a flushing liquid which dissipates the generated frictional heat and limits the penetration of the liquid to be pumped into the sealing chamber.

The required flushing liquid pressure is 0.1 up to 0.5 bar above the internal suction casing pressure (for flushing liquid, please refer to Section 6.1.3 below).

##### – Supply of the double-acting non-balanced mechanical seal (Designs G08, G09)

**Note:** For maintaining their function, these mechanical seals require a sealing liquid which serves to dissipate the generated frictional heat and to avoid penetration of the liquid to be pumped into the sealing gap.

**ATTENTION** Prior to each start-up, the circulation of the sealing liquid must be ensured. The sealing liquid pressure must be approx. 1.5 to 2 bar above the pressure in the suction casing. The flow rate must be regulated so that the outlet temperature of approx. 60°C is not exceeded and is at least 30 K below the boiling temperature at operating pressure (for sealing liquid, please refer to Section 6.1.3 below).

#### 6.1.3 Quality and properties of the flushing/sealing liquid

**ATTENTION** Any liquid may be used as sealing/flushing liquid in consideration of the corrosion resistance of all contacted parts and the consistency with the medium to be sealed. The liquid must be free from solids, must not tend to sedimentations, should have the highest possible boiling point as well as a good heat conductivity and low viscosity. Clean water of low hardness meets these demands to a high degree.

#### 6.1.4 Switching in the additional facility for heating or cooling the suction casing (double shell casing)

If the pumps are equipped with this additional facility, any and all stopping devices for heating or cooling systems must be opened. The below-mentioned pressure and temperature limits must be observed.

##### – Supply of the cooled or heated suction casing (double shell casing) with appropriate liquid medium

**Only liquid media** may be used as heating or cooling liquid in consideration of the corrosion resistance of all contacted parts.

The maximum heating or cooling liquid pressure is 6 bar.

The maximum heating temperature must not exceed 150°C in case of bearings B and C as well as 100°C in case of bearing E, and the cooling temperature not be fallen below –40°C.

**Note:** For the design temperature, please refer to the order data sheet.



#### 6.1.5 Break-away of the pump

When starting up for the first time or after a longer shut-down period, ensure that the pump can be turned easily by the prime mover. If this is not readily possible, e.g. due to a high degree of adhesion between the rotor and stator when brand new, movement can be assisted by using a suitable tool within the key area of the drive shaft or at the hollow shaft behind the shaft seal.

**ATTENTION** The drive/hollow shaft must not be damaged when doing so.

#### 6.1.6 Control of the sense of rotation

The normal sense of pump rotation is anti-clockwise, looking from the drive unit towards the hollow/drive shaft. In this case, the suction connection is on the shaft seal side so that the shaft seal is relieved. In special cases, e.g. when drawing from a vacuum or when handling substances which cannot tolerate any gas inclusions, the pump rotates clockwise. Thus, the suction and discharge sides are reversed.

**ATTENTION** The sense of pump rotation must correspond to the directional marker „n“ in the pump name plate. Wrong sense of rotation may result in damages to the pump. For the control of the sense of rotation, the motor on/off switch is to be touched only briefly.

**6.2 Starting**

**6.2.1 Start-up**

All shut-off elements on the suction and discharge sides must be opened before starting up.

**6.2.2 Drive**

Switch motor in.

**ATTENTION** Consider product-specific particularities of the drive. **Please refer to the operating instructions of the drive manufacturer.**

**6.2.3 Checking the delivery values**

After the drive has reached its operating speed, the inlet pressure and pump outlet pressure must be checked via the vacuum gauge and pressure gauge.

The motor must not be overloaded. The power consumption can be checked by means of an ammeter. In this connection, temperature and viscosity of the liquid to be handled must be checked. The values read must be checked against the order data sheet and/or acceptance report.

**6.2.4 Protection against dry running**

If no further fluid to be pumped arrives at the suction side, the thermal energy generated in the conveying elements of the eccentric screw pump due to dry friction and churning work is no more sufficiently dissipated as a result of which the stator elastomer is thermally destroyed already after a short period of time. For the conveying elements to be protected, various dry running protection systems are available, adapted to the respective operating conditions (please contact factory).

**6.3 Stopping**

**6.3.1 Shut-down**

Switch motor off.

**6.3.2 Measures in case of a longer shut-down period**

If a longer shut-down period is projected and there is a danger of frost, the pump must be drained. For these purposes, screw screw plug (502) out of the suction casing (505). Thereafter, the pump must be preserved (please refer to Section 3.3. above).

**7. Maintenance/servicing**

**7.1 Maintenance**

– For maintenance and service operations, the details listed under Section 2. Safety are to be observed. Regular control and maintenance of the pump and drive will extend the service life.

**7.1.1 General control**

1. Do not allow the pump to run when dry.
2. The drive motor must not be overloaded.
3. Check suction and discharge lines for tightness.
4. During operation, an installed stuffing box must be slightly dripping.  
An installed mechanical seal must not have any heavy leakage.
5. Observe pressure and temperature monitoring instruments, and check against the order data sheet and/or acceptance report.

6. Observe additional facilities such as flushing or sealing of the shaft seal, if provided.

7. Observe additional facilities for heating or cooling of the suction casing, if provided.

**7.1.2 Maintenance of components**

**7.1.2.1 Joints of the coupling rod**

The joints of the coupling rod are lubricated with Allweiler Spezialgelenköl Type B or Öl ET 1510 ISO 460 of Tribol Lubricants GmbH, Mönchengladbach, Germany; if the pumps are used for foodstuffs, with Allweiler Spezialgelenköl Type BL or Öl 1810/460 of Tribol Lubricants GmbH, Mönchengladbach, Germany.

**ATTENTION** Other lubricants were not tested by us and can, therefore, not be recommended by us!

The joints are lubricated for life. However, if the pump must be opened for any other purposes, we recommend to check the cover sleeve for tightness and to change the joint oil after 8,000 working hours. For the change of the joint oil, please refer to the Dismounting and Mounting Instructions.

**7.1.2.2 Bearing of the drive shaft and lubrication of the bearing**

The anti-friction bearings of series ANP and ASP are lubricated for life with grease „SKF Alfabub LGMT3“ or the like suited up to 120°C.

**7.1.2.3 Shaft seal**

Shaft sealing is either via a stuffing box or a mechanical seal.

● **Stuffing box**

Increased leakages, if any, at the stuffing box during the first operating hours normally disappear automatically during the running-in period.

If necessary, slightly tighten hexagon nuts (202) at the gland (203).

Please note that the stuffing box must be slightly leaking. This causes dissipation of the frictional heat generated at the sealing surface.

If the leakage losses increase excessively, and if leakage cannot even be reduced by repeated slight tightening of the hexagon nuts (202), the packing rings have lost their elasticity of shape and must be replaced.

– **Dismounting the old packing rings and cleaning the shaft sealing housing**

Following the pressure relief of the pump and after removal of the gland, the old packing rings can be removed. A packing puller with flexible shaft serves as tool. Thereafter, the stuffing box chamber and the drive shaft and/or hollow shaft must be carefully cleaned within the area of the packing rings. Worn drive shafts and/or hollow shafts must be replaced (refer to the Dismounting and Mounting Instructions).

– **Mounting the packing rings**

**ATTENTION** In principle, only such packing rings are to be installed which correspond to the required operating conditions of the pump.

Dimensions of the packing rings for ring blanks:  $\varnothing$  37/25 x 6

Dimensions of the packing rings as blanks  $L_M$  x s: 104.2 x 6

**For cutting purposes**, we recommend the straight cut perpendicular to the shaft. In order to achieve a gap-free parallel position of the cut ends when closing

the packing ring, the cutting angle should be approx. 20° to both cutting ends (please refer to Figure 1 below).

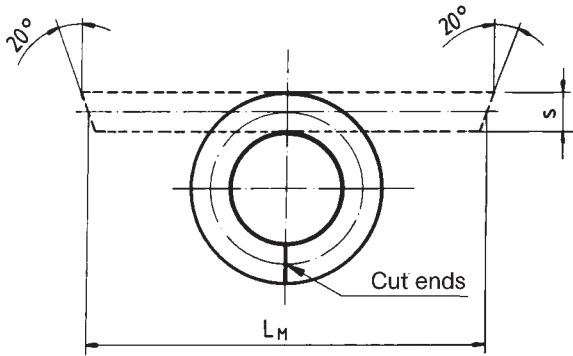


Figure 1: Cutting of packing rings

**Pre-pressed packing rings or ring blanks** must be carefully untwisted axially and radially to such a degree only that they can just be pushed over the shaft. Bending-up the rings may result in damage by breaking. During installation in the packing chamber, the packing rings must be carefully re-bent into angular shape. During this process, the kerfs must be set off by 90°. By means of the gland, each ring must be individually pushed into the stuffing box chamber with the cut ends foremost. Lantern ring or flushing ring must be installed consistently.

**ATTENTION** Pointed items must never be used for these purposes as there is a danger of shaft damage and deformation of the packing materials.

**Commissioning of the stuffing box after re-packing**  
Prior to commissioning, the stuffing box must be only slightly tightened. During pump starting, 50 to 200 drops in a minute are admissible as seepage quantity. During the starting process of approx. 30 minutes, a minimum leakage of 2 to 20 drops in a minute must be set by gradually and evenly tightening the gland (203) by means of the hexagon nuts (202).

**ATTENTION** During this process, the stuffing box temperature must not rise abnormally. Approx. 20 to 60°C above the temperature of the liquid pumped are admissible. In case of a sudden temperature rise, the gland must be immediately slackened and the running-in procedure repeated. The seepage can be drained through the threaded hole provided in the collecting trough of the bearing bracket.



Personal injuries and environmental damages resulting from the leakage of dangerous materials must be excluded.

● **Mechanical seal**

Non-balanced mechanical seals are used in any material combinations and models. The mechanical seal is maintenance-free.

In case of heavy leakage due to wear, the mechanical seal must be replaced (please refer to the Dismounting and Mounting Instructions).

**ATTENTION** As dry running of a mechanical seal must be avoided, the pump may be started in a filled condition only and, if provided, with the additional facilities switched in (please refer to Section 6.1.2 above).

**7.1.2.4 V-belt drive**

Please refer to our maintenance instructions for V-belt drive with tensioning device VM 706.0001 GB – Ident No. 133586.

**7.1.2.5 Drive motors and (variable-speed) gears**

Please refer to the manufacturers' operating and maintenance instructions.

**7.2 Servicing (Dismounting and Mounting Instructions)**

**General**

On request, trained service engineers will be at your disposal for mountings and repairs.



In case of repairs performed by the customer's own personnel or our trained mechanics, it must be ensured that the pump is completely empty and clean.

This applies in particular to pumps which, in case of repair, are sent to our factory or to one of our contractual repair shops.

In protection of our staff and for reasons of environmental protection, we have to refuse to accept for repair any pumps filled with liquid pumped. Otherwise, we will have to charge the customer/operator with the costs for an ecologically acceptable waste disposal.

In case of repair of pumps operated with dangerous materials ① and/or liquids harmful to the environment, the customer/operator must advise hereof his own and/or our local mounting personnel or, in case of return, our factory and/or contractual service shop of his own accord. In such a case, evidence of the liquid handled, e.g. in the form of a DIN safety data sheet will have to be presented to us when requesting a service engineer.

① **Dangerous materials are:**

- Toxic substances
- Substances detrimental to health
- Caustic substances
- Irritants
- Explosive materials
- Fire-promoting, highly, easily and normally inflammable materials
- Carcinogenic substances
- Foetopathic substances
- Genes-changing substances
- Substances which are dangerous to human beings in any other way

When working locally, the customer's own and/or our mounting personnel must be referred to dangers which may be caused in connection with repairs.

The most important dismounting and mounting operations are described in these instructions. The mounting steps described in the individual sections must be consistently observed.

**7.2.1 Dismounting the eccentric screw pump**

Prior to commencing the dismounting, the following operations must be performed:

- Disconnect power supply cable from the motor. Motor must not be capable of being started.
- All shut-off elements in the supply and discharge line must be closed.
- Drain the liquid to be pumped from the suction casing. For these purposes, screw out screw plug (502).

**Note:** Use collecting tank.



- Dismount protection against accidental contact.
- Dismount supply and discharge line as well as all auxiliary pipelines.
- Loosen screws at the pump feet, and screw out.

- Eject coupling rod pin (301).
- By means of a brass ejector, drive out the two bushes for coupling rod pin (303) by one half. For these purposes, incline coupling rod (307) (please refer to Figure 4 below).

**7.2.1.1 Dismounting the stator**

- Remove hexagon nuts (609) and washers (610) from the tie rods (611).
- Withdraw discharge casing (504).
- Remove tie rods (611).
- Withdraw stator (402) from rotor (401).  
**Note:** In case of stiffness, turn stator (402) simultaneously by means of chain tongs. For these purposes, fix drive shaft (118) and/or hollow shaft (125).
- For stators of plastic or metal, remove stator gaskets (403) and (404).

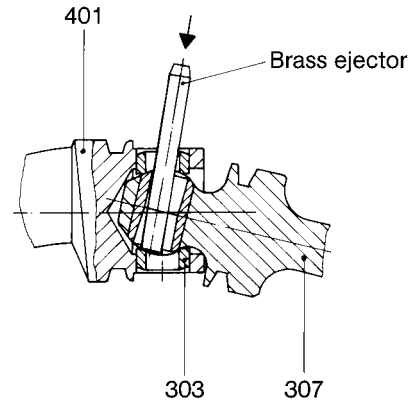


Figure 4: Dismounting the bushes for coupling rod pin.

**7.2.1.2 Dismounting the rotor and rotor-side joint**

Dismounting of the rotor and the rotor-side joint is effected following the dismounting of the stator (402). Please refer to Section 7.2.1.1 above.

- Withdraw suction casing (505) over the rotor (401). In doing so, see to it that the precision-machined rotor is not damaged.
- Remove gasket for suction casing (501).
- Cut buckle on clamping band (306) with a metal saw, and with a screw driver, press out to both sides. Remove clamping band (306) from the cover sleeve (308) (please refer to Figure 2 below).

- Remove rotor (401) from the coupling rod (307).
- By means of a brass mandrel, completely drive bush for coupling rod pin (303) out of the rotor (401).

**7.2.1.3 Dismounting the coupling rod and the drive-side joint**

Dismounting of the coupling rod and the drive-side joint is effected following the dismounting of the stator (402) and the rotor (401). Please refer to Sections 7.2.1.1 and 7.2.1.2 above.

- Dismount drive-side joint as described under Section 7.2.1.2 above.
- Withdraw coupling rod (307) from the drive shaft (118) and/or hollow shaft (125).
- By means of a brass mandrel, completely drive bush for coupling rod pin (303) out of the drive shaft (118) and/or hollow shaft (125).

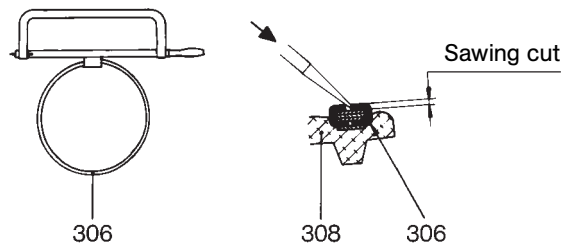


Figure 2: Removal of the clamping band.

**7.2.1.4 Dismounting the shaft seal and drive/hollow shaft**

**Note:** In case of pumps with shaft seal by stuffing box, the packing rings can be exchanged without dismounting the drive and/or hollow shaft, as described under Section 7.1.2.3 above. Dismounting of the drive and/or hollow shaft is required whenever the pump is equipped with a mechanical seal. In case of damages to the drive and/or hollow shaft within the area of the shaft seal, the pump must also be dismounted, as described hereinafter.

- Dismount stator (402) (please refer to Section 7.2.1.1 above).
- Withdraw suction casing (505) over the rotor (401). In doing so, see to it that the precision-machined rotor is not damaged.
- Remove gasket for suction casing (501).



- By means of a screw driver, lift cover sleeve (308) and withdraw axially towards the coupling rod (307).
- Collect oil filling in a tank.
- Drive retaining sleeve (304) over the collar of the coupling rod (307). In doing so, do not deflect coupling rod (307) (please refer to Figure 3 below).

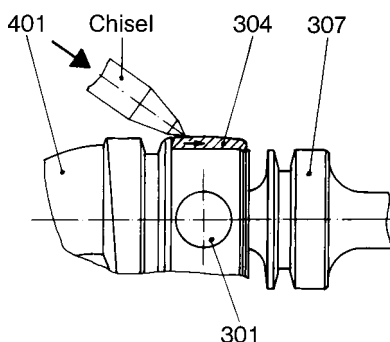


Figure 3: Dismounting the retaining sleeve.

● **Dismounting the stub shaft**

- Remove locking device for the retaining pin (124), if provided.
- Eject retaining pin (123) from the hollow shaft (125).
- Eject hollow shaft (125) with all parts of the shaft seal out of the bearing bracket (110) and/or lantern (122).

● **Dismounting the drive shaft**

- Withdraw coupling half and/or V-belt pulley, and remove key (101).
- Pull flinger ring (114) against gland (203).
- Loosen circlip (127) and pull out of the groove.
- Eject drive shaft (118) with all mounted parts out of the bearing bracket (110).
- Withdraw radial bearing (103).
- Remove spacer sleeve (102).
- Remove drive-side circlip (121) and spacer ring (129).
- Withdraw axial bearing (104).
- Remove pump-side circlip (121).
- Withdraw flinger ring (114).

● **Dismounting the stuffing box**

- Remove self-locking hexagon nut (202) and gland (203).
- Pull shaft sealing housing (204) from the drive shaft (118) and/or hollow shaft (125).
- Remove stuffing box packing (207) in case of model P02 including flushing ring (208), and in case of models P03 and P04 including lantern ring (209) from the shaft sealing housing (204).

● **Dismounting the mechanical seal, single-acting**

- Withdraw mechanical seal housing (214) with atmosphere-side stationary seal ring of the mechanical seal (219) from the drive shaft (118) and/or hollow shaft (125).
- Note:** Particularly see to it that the casing with stationary seal ring of the mechanical seal is withdrawn concentrically and not canted to avoid damages to the stationary seal ring.
- Press stationary seal ring of the mechanical seal and O-ring out of the mechanical seal housing (214). See to uniform pressure distribution.
  - Drive out locking pin (220).
  - Undo grub screws, if provided, in the rotating part of the mechanical seal (219), and withdraw mechanical seal from the drive shaft (118) and/or hollow shaft (125).

**ATTENTION** Before undoing the grub screws, mark or measure the position of the mechanical seal on the hollow shaft or drive shaft. Do not push O-rings over the pressure marks caused by the screws!

● **Dismounting the mechanical seal, single-acting with throttled sealing water outlet**

- Dismounting as for mechanical seal, single-acting.
- Remove mechanical seal cover (215) and O-ring (218).

● **Dismounting the mechanical seal, double-acting**

- Withdraw mechanical seal housing (214) with atmosphere-side stationary seal ring of the mechanical seal (219) from the drive shaft.
- Note:** Particularly see to it that the casing with stationary seal ring of the mechanical seal is withdrawn concentrically and not canted to avoid damages to the stationary seal ring.

- Remove O-ring (218).
- Undo grub screws in the rotating part of the mechanical seal (219) and pull off mechanical seal from the drive shaft (118).

**ATTENTION** Before undoing the grub screws, mark or measure the position of the mechanical seal on the shaft wear sleeve or drive shaft. Do not push O-rings over the pressure marks caused by the screws!

- Pull off mechanical seal cover (215) with product-side stationary seal ring of the mechanical seal (219) from the drive shaft (118).

**Note:** Particularly see to it that the mechanical seal cover with stationary seal ring of the mechanical seal is withdrawn concentrically and not canted to avoid damages to the stationary seal ring.

- Press stationary seal rings of the mechanical seals and O-rings out of the mechanical seal housing (214) and mechanical seal cover (215). See to uniform pressure distribution.

- Remove locking pin (220).

**7.2.2 Mounting the eccentric screw pump**

**General**

Mounting of the individual pump components is effected after careful cleaning analogously in reverse order.

**7.2.2.1 Mounting the shaft seal**

● **Mounting the stuffing box**

- Push shaft sealing housing (204) onto the hollow shaft (125) and/or drive shaft (118).
- In case of model P02 including flushing ring (208) and in case of models P03 and P04 including lantern ring (209), install stuffing box packing (207) in the shaft sealing housing (204). Please also refer to Section 7.1.2.3 – Mounting new packing rings.

● **Mounting the mechanical seal, general**

Mechanical seals are high-quality precision parts. The mounting instructions of the mechanical seal manufacturers must be observed. Careful handling and extreme cleanliness during mounting are a condition of proper functioning. To facilitate mounting, surfaces on which O-rings are sliding, may be lubricated with lubricants such as silicon oil, Polydiol or soft soap.

**ATTENTION** Do not use ordinary oil.  
**Note:** See to it that the parts sliding on each other are only exchanged in pairs. When using double PTFE-coated O-rings, see to it that the joint of the outer coating points against the mounting direction as otherwise, opening and/or withdrawal of the coating may be effected (please refer to Figure 5 below).

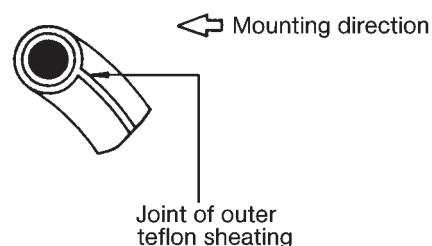


Figure 5: Joint of the outer coating points against the mounting direction.

● **Mounting the mechanical seal, single-acting**

- Drive locking pin (220) into the mechanical seal housing (214).
- Concentrically press stationary seal ring of the mechanical seal (219) with O-ring into the cleaned mechanical seal housing (214).  
**Note:** See to uniform pressure distribution and locking pin. Locking pin (220) must not protrude to the inside.
- Push rotating part of the mechanical seal (219) onto the drive shaft (118) and/or hollow shaft (125).  
**Note:** Observe exact installation dimension and/or position of the mechanical seal as marked for dismounting.
- Insert grub screws, if provided, in the rotating part of the mechanical seal (219) with screw locking agent Loctite No. 241 or similar, and tighten.
- Push mechanical seal housing (214) with stationary seal ring of the mechanical seal (219) over the drive shaft (118) and/or hollow shaft (125).  
**Note:** When pushing the mechanical seal housing onto the drive shaft, see to it that the mechanical seal housing is not canted to avoid damages to the stationary seal ring of the mechanical seal.

● **Mounting the mechanical seal, single-acting with throttled sealing water outlet**

- Push mechanical seal cover (215) with O-ring (218) over the drive shaft (118) and/or hollow shaft (125).
- Mounting the mechanical seal as for mechanical seal, single-acting.

● **Mounting the mechanical seal, double-acting**

- Beat locking pin (220) into the mechanical seal cover (215), and mount O-ring (218).
- Concentrically press stationary seal ring of the mechanical seal (219) with O-ring into the mechanical seal cover (215).  
**Note:** See to uniform pressure distribution and locking pin. Locking pin (220) must not protrude to the inside.
- Push mechanical seal cover (215) over the drive shaft (118).
- Subsequent mounting of the mechanical seal is effected as described under Section – **Mounting the mechanical seal, single-acting.**

**7.2.2.2 Mounting the drive shaft**

**Note:** The pumps are provided with ball bearings lubricated for life. For re-mounting, the ball bearings must be provided with a sufficient grease filling.

- If required, carefully clean ball bearings with Diesel fuel. The contact faces being bright and undamaged, the ball bearings (103) and (104) can be re-used. If this is not the case, the ball bearings must be replaced.
- Fill ball bearings (103) and (104) with bearing grease. The grease filling is applied as described below.
  1. Fill hollow spaces between the rolling bodies up to approx. 30 to 50% with grease.
  2. Scrape off excessive grease (most suitably with your fingers, do not use any metallic object).

**Bearing greases**

For the lubrication of the ball bearings it is recommend to use the below-listed bearing greases or equivalent. The order of producers is no quality ranking.

Producer	Brand name	Designation to DIN 51825
AGIP	Agip GR MU3	K3K-20
ARAL	Aralub HL3	K3K-20
BP	BP Energrease LS3	K3K-20
ESSO	BEACON 3	K3N-30
Fuchs	RENOLIT FWA 220	K3N-20
Klüber	MICROLUBE GL 263	K3N-20
Mobil-Oil	Mobilux 3	K3K-20
Shell	Shell Alvania Fett R3	K3N-30
SKF	SKF-Fett LGMT3	K3K-30

If the listed bearing greases are not available, we recommend in any case a multi-purpose grease on lithium basis.

Grease mixture with grease grades of different basic oils and thickeners leads to a reduction of the lubricating properties and must therefore be avoided.

- Push flinger ring (114) on.
- Insert pump-side circlip (121).
- By means of a suitable pipe length, press greased axial bearing (104) with sealing washer to the outside over the inner bearing ring onto the drive shaft (118). Slightly oil bearing surface previously.
- Insert spacer ring (129) and drive-side circlip (121).
- Mount spacer sleeve (102), and fill the chamber between spacer sleeve (102) and drive shaft (118) approx. 90% with bearing grease.
- By means of a suitable pipe length, drive greased radial bearing (103) with sealing washer to the outside over the inner bearing ring onto the drive shaft (118). Slightly oil bearing surfaces previously.
- By means of a suitable pipe length, press drive shaft (118) with all mounted parts over the outer bearing ring into the bearing bracket (110). Slightly oil bearing surfaces previously.
- Insert circlip (127).
- Push flinger ring (114) against the bearing.
- Insert key (101) in the drive shaft (118) and lock by two punch marks on the front side.

**7.2.2.3 Mounting the hollow shaft**

**ATTENTION** Prior to mounting the hollow shaft (125), coat the entire surface of the drive shaft (118) and/or shaft of the drive with Klüber paste 46 MR 401 of Klüber, Munich. Mount hollow shaft (125), insert retaining pin (123) and secure with locking device for retaining pin (124), if any.

**7.2.2.4 Mounting the rotor and rotor-side joint**

- With a brass drift, drive bushes for coupling rod pin (303) half-way into rotor (401).

- Push clamping bands (306), cover sleeves (308) and retaining sleeve (304) onto the shank of the coupling rod (307).
- Push coupling rod (307) into the head of the rotor (401).
- Push coupling rod pin (301) into the coupling rod (307), and drive in bushes for coupling rod pin (303) completely.
- Polish retaining sleeve (304) at the outside diameter, if necessary, with emery, and mount on the head of the rotor (401).
- Following mounting of the retaining sleeve (304), secure same against axial displacement on the head of the rotor (401).

**ATTENTION** For these purposes, drive face of the retaining sleeve (304) into the groove at the head of the rotor (401) with one punch mark (please refer to Figure 6 below).

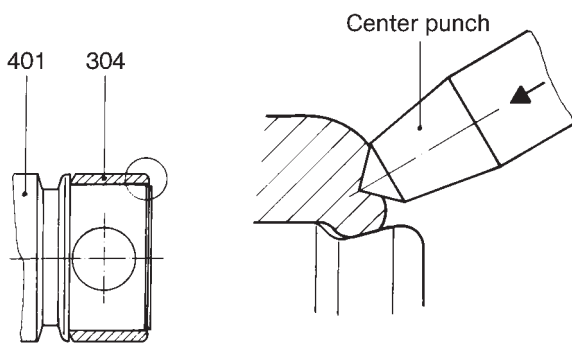


Figure 6: Locking the retaining sleeve.

- Mount cover sleeve (308) with screw driver, lift top with screw driver, run spray pipe of the oil can under the sleeve and fill the space in the joint with Allweiler Spezialgelenköl Type B or Öl ET 1510 ISO 460 of Tribol Lubricants GmbH, Mönchengladbach, Germany. If used for foodstuffs, with Allweiler Spezialgelenköl Type BL or Öl 1810 / 460 of Tribol Lubricants GmbH, Mönchengladbach, Germany. Filling quantity 4 cm<sup>3</sup>.
- Check whether bent loop of the clamping band (306) rests against the clamping band buckle. If not, press against by means of commercial flat pliers (please refer to Figure 7 below).

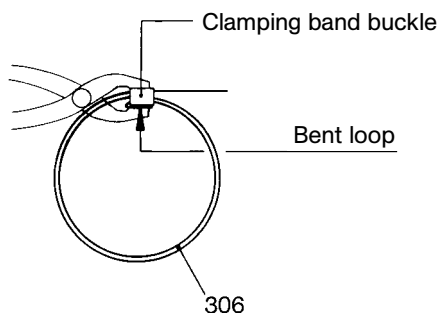


Figure 7: Press clamping band loop against clamping band buckle.

- Place clamping bands (306) in the surrounding grooves of the cover sleeve (308), and clamp.  
**Note:** For these purposes, the clamping tool bearing the designation PoK-It II must be used:

**Note:** Proper clamping of the clamping bands (306) is shown in Figure 8 below.

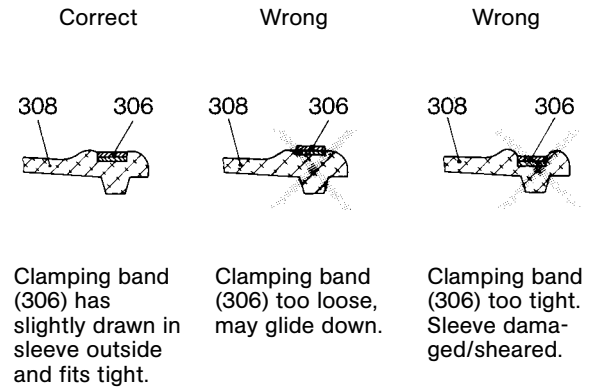


Figure 8: Clamping of clamping bands.

- When using clamping tool PoK-It II, bend clamping band (306) after clamping at the clamping band buckle by swinging the clamping tool so that the band cannot glide back through the buckle. After bending at the clamping band buckle, the clamping band must be sheared with sheet metal shears and the cutting edges deburred (please refer to Figure 9 below).

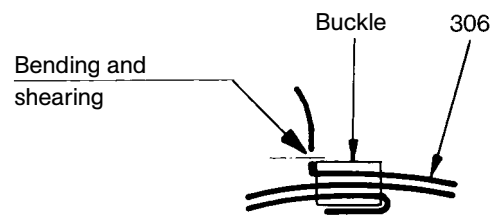


Figure 9: Bending and shearing of the clamping band.

**ATTENTION** Check whether the clamping band is bent so that it cannot glide back through the clamping band buckle (please refer to Figure 9 above). If this was not achieved, the clamping band must be removed and replaced by a new one.

### 7.2.2.5 Mounting the coupling rod and the drive-side joint

- Mount drive-side joint as described under Section 7.2.2.4 above against the drive shaft (118) and/or hollow shaft (125).
- In doing so, push coupling rod into the joint head of the drive shaft (118) and/or hollow shaft (125).
- Secure retaining sleeve (304) as depicted with a center punch mark.
- Mount cover sleeve (308), fill joint space with joint lubricant (305) and fix clamping bands as described.
- Insert gasket for suction casing (501).
- Push suction casing (505) over the rotor (401). In doing so, make sure that the precision-machined rotor is not damaged.

### 7.2.2.6 Mounting the stator

- Prior to mounting, coat stator (402) and rotor (401) with lubricant (silicon oil, Polydiol, soft soap or the like).

**ATTENTION** Do not use ordinary oil.



- In case of stators of plastic or metal, insert stator gaskets (403) and (404).  
**Note:** In case of stators of plastic, the stator gasket (403) with O-ring must always be on the discharge side.
- Mount stator (402) on the rotor (401).  
**Note:** In case of stiffness, simultaneously turn stator (402) by means of chain tongs. For these purposes, fix drive shaft (118) and/or hollow shaft (125).
- Screw up discharge casing (504), stator (402), suction casing (505) and bearing bracket (110) and/or lantern (122) with the tie rods (611) and hexagon nuts (609).  
**Note:** Prior to tightening the hexagon nuts (609), align connecting flange of the suction casing (505). Mind proper position of the connections in the shaft sealing housing (204) and/or shaft sealing housing (214). Please refer to our tables of dimensions.

### 7.3 Spare parts/replacement parts

In the following sectional drawings with parts lists, all pumps mentioned are represented with the various shaft seal and bearing designs. The parts marked in the parts list can be provided as spare parts/replacement parts.

Recommended spare parts/replacement parts:  
R = large repair kit  
r = small repair kit



For reasons of operating safety, only original spare parts delivered by us should be kept on stock and installed. In this connection, we refer to the statements made under Section 2.7 above.

For spare parts/replacement parts orders, the following must be quoted:

**Machine numbers**  
**Abbreviation of pump**  
**Part number**  
**Denomination and part quantity**  
**or Ident No. and quantity**

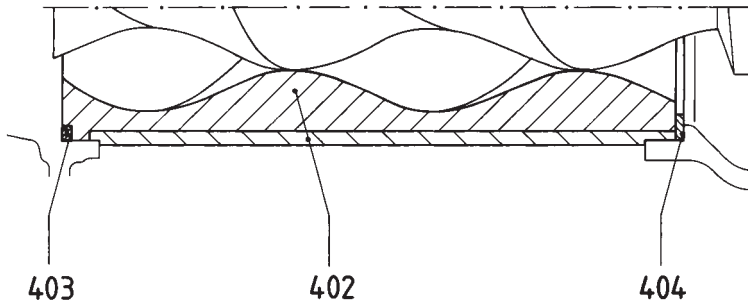
**Note:** The machine number and the abbreviation of the pump are engraved on the name plate.

**Note:** The Ident No. and quantity can be seen from the attached separate spare parts list.

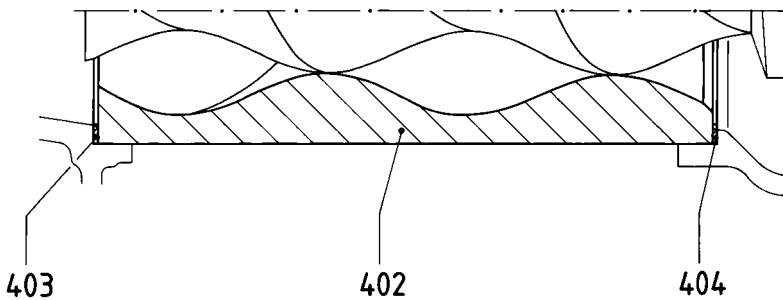
**7.4 Sectional drawings with list of components and recommended spare parts**

Part No.	Denomination	Qty.	Part No.	Denomination	Qty.
101	Key	1	219	Mechanical seal	R 1
102	Spacer sleeve	1	220	Locking pin	1
103	Radial bearing	R 1	301	Coupling rod pin	R, r 2
104	Axial bearing	R 1	303	Bush for coupling rod pin	R, r 4
107	Bearing grease	R 1 <sup>①</sup>	304	Retaining sleeve	R, r 2
110	Bearing bracket	1	305	Joint lubricant	R, r
114	Flinger ring	1	306	Clamping band	R, r 4
118	Drive shaft	R 1	307	Coupling rod	R, r 1
121	Circlip	2	308	Cover sleeve	R, r 2
122	Lantern	1	401	Rotor	R, r 1
123	Retaining pin	1	402	Stator	R, r 1
124	Locking device for retaining pin	1	403	Stator gasket, discharge side	R, r 1
125	Hollow shaft	R 1	404	Stator gasket, suction side	R, r 1
127	Circlip	1	501	O-ring to the suction casing	R, r 1
129	Spacer ring	3	502	Screw plug	1
141	Lubricating paste	R, r 1	503	Sealing ring	R 1
201	Stud bolt	2	504	Discharge casing	1
202	Self-locking nut	2	505	Suction casing	1
203	Gland half	2	601	Name plate	1
204	Shaft sealing housing	1	602	Round head grooved pin	4
207	Stuffing box packing	R, r 1	603	Information plate: Commissioning	1
208	Flushing ring	1	604	Information plate: Suction	1
209	Lantern ring	1	605	Information plate: Discharge	1
212	Screw plug	1	609	Hexagon nut	4
213	Sealing ring	1	610	Washer	4
214	Mechanical seal housing	1	611	Tie rod	4
215	Mechanical seal cover	1			
218	O-ring	R 1			

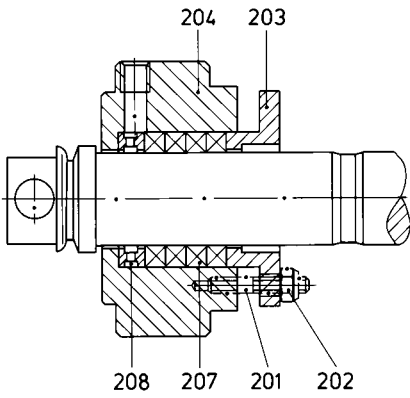
① Please refer to Section 7.2.2.2



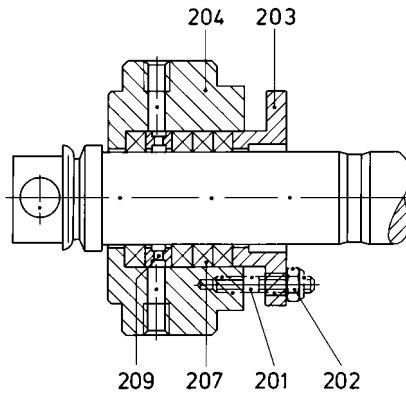
Stator of plastic



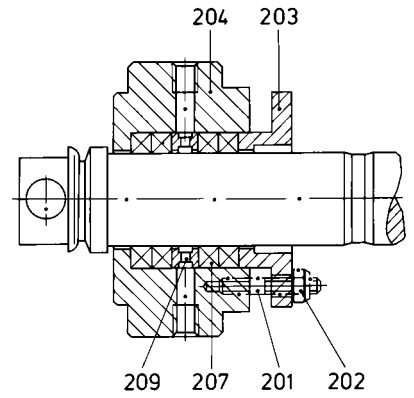
Stator of metal



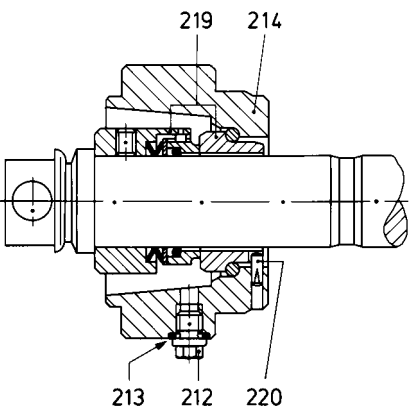
**P02** Stuffing box with flushing ring



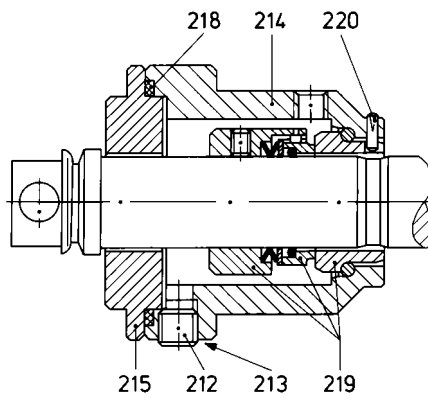
**P03** Stuffing box with internal lantern ring



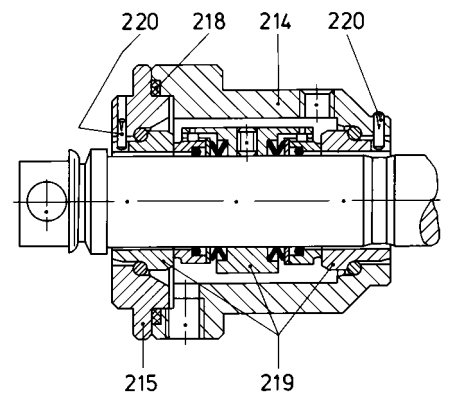
**P04** Stuffing box with external lantern ring



**G00 to G03** Mechanical seal, single-acting, unbalanced, direction-independent (depicted: design **G02**)



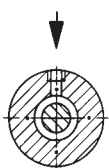
**G04 to G07** Mechanical seal, single-acting, unbalanced, direction-independent, with throttled sealing liquid outlet into the pump chamber (depicted: design **G06**)



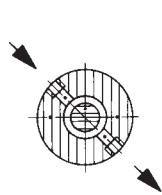
**G08 and G09** Mechanical seal, double-acting, unbalanced, direction-independent (depicted: design **G09**)

Auxiliary connections  
Arrangement of the auxiliary connections at the shaft seals  
(as seen from the drive)

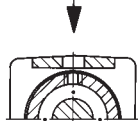
Auxiliary connections for double shell for heating or cooling



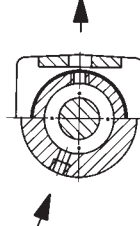
Stuffing box  
P02



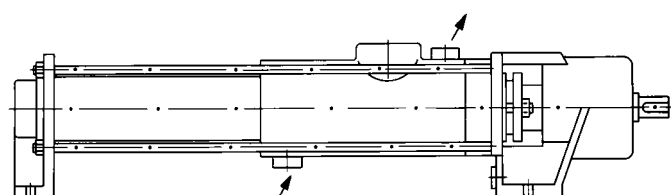
Stuffing boxes  
P03 and P04



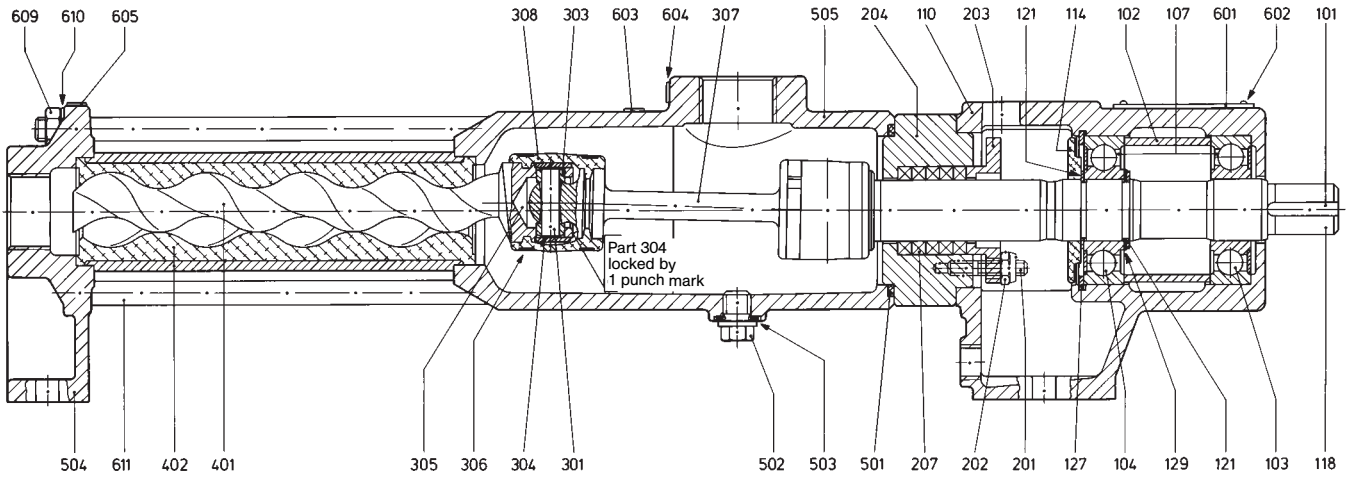
Mechanical seals  
G04 to G07



Mechanical seals  
G08 and G09



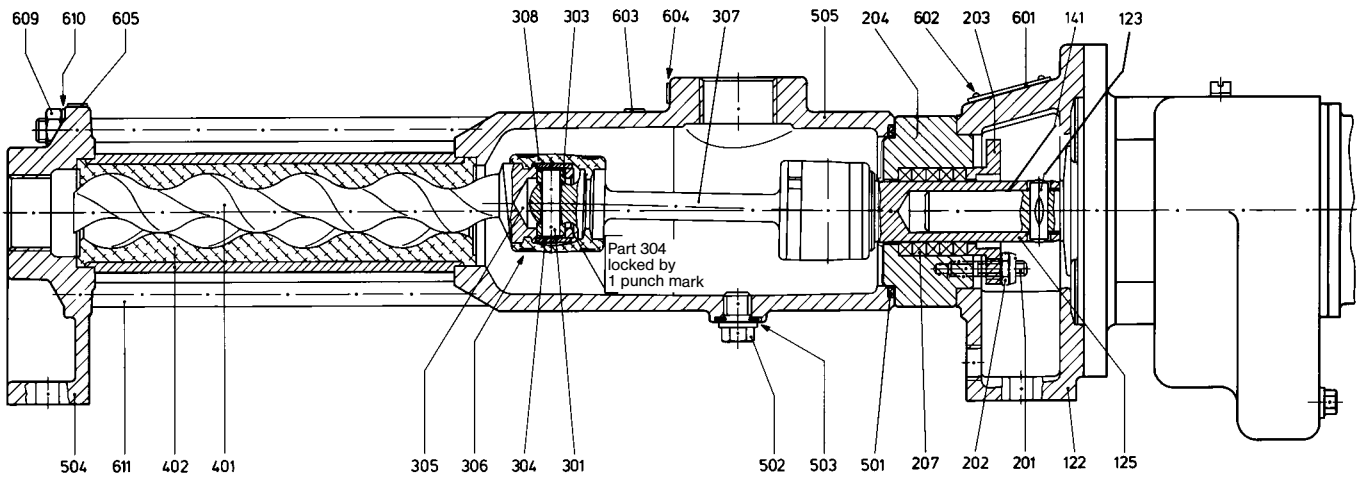
**Sectional drawing for series ANP**



Bearing: **B** (lubricated for life)  
 Shaft seal: **P01** Stuffing box of standard design (without lantern ring/without flushing).

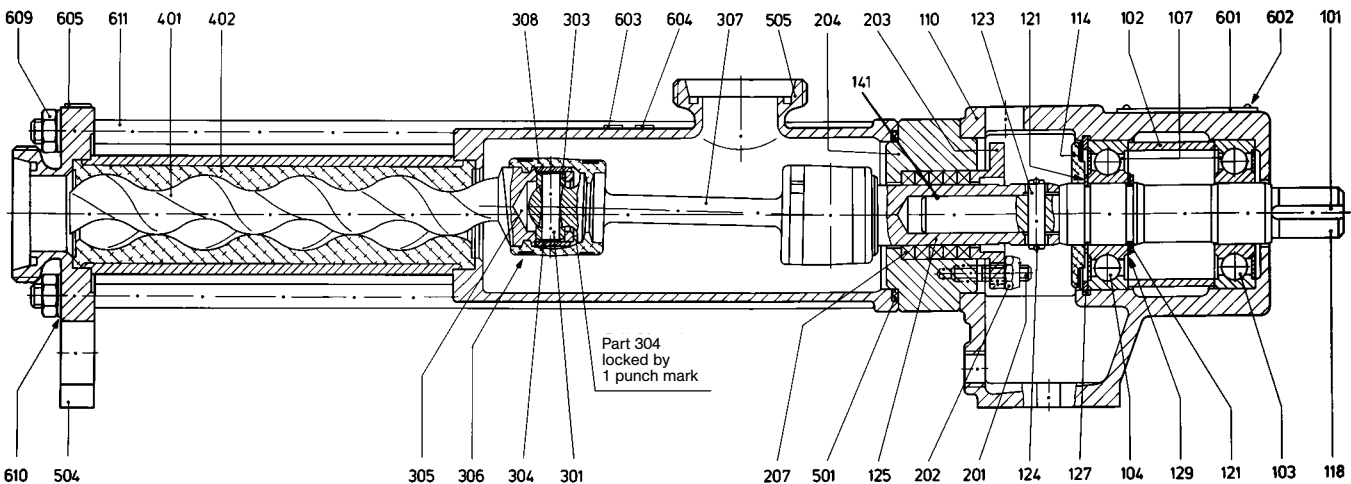
**Sectional drawing for series ANBP**

The sectional drawing of the pumps of series ASBP is similar.



Bearing: **E** (external bearing in the drive aggregate)  
 Shaft seal: **P01** Stuffing box of standard design (without lantern ring/without flushing).

**Sectional drawing for series ASP**



Bearing: **C** (lubricated for life)  
 Shaft seal: **P01** Stuffing box of standard design (without lantern ring/flushing).





8. Operating troubles – causes and remedial action

No.	Operating troubles										Causes and remedial action
	Pump does not start	Pump does not prime	Delivery is not obtained	Pressure head is not obtained	Irregular pump delivery	Pump operates noisily	Pump is seized or does not deliver	Motor gets too warm	Stator wears prematurely	Shaft seal leaky	
	a	b	c	d	e	f	g	h	i	k	
											ALLWEILER eccentric screw pumps operate trouble-free at any time provided they are applied according to the operating conditions mentioned in our order confirmation and if the operation manual is complied with.
1	●							●			Pressing between stator/rotor still too high (new condition) or stator too narrow. Crank pump by hand with auxiliary tool.
2		●									Check sense of rotation against arrow on pump, in case of wrong sense of rotation, change motor poles.
3		●	●		●	●	●				Check suction pipeline and shaft seal for tightness.
4		●	●		●	●					Check suction head – increase suction line cross section, if necessary – install greater filters – open suction valve completely.
5		●	●		●						Check viscosity of liquid pumped.
6	●		●					●			Check pump speed – control speed and power consumption of drive motor – check voltage and frequency.
7			●		●						Avoid air inclusions in the liquid to be pumped.
8	●		●				●	●	●		Check pressure head – open valve in discharge line completely, remove obstruction in discharge line.
9		●	●		●		●		●		Pump runs completely or partly dry. Check whether liquid pumped on suction side is sufficient.
10		●	●								Increase speed in case of liquid media and great suction volume.
11		●			●	●					Reduce speed in case of viscous media – cavitation hazard.
12						●					Check longitudinal play of coupling rod pins.
13	●	●	●				●		●		Check whether foreign bodies in pump. Disassemble pump, remove foreign bodies, replace defective parts.
14		●	●	●			●				Stator and rotor worn, disassemble pump, replace defective parts.
15		●	●			●	●				Joint parts (f, g) and/or drive shaft or hollow shaft (b, c) worn: Disassemble pump, replace defective parts.
16		●	●				●		●		Suction line completely or partly clogged.
17	●	●					●	●	●		Check temperature of liquid pumped – stator expansion too great – stator seized on rotor – stator perhaps burnt.
18	●	●	●					●		●	Stuffing box packing: Replace unserviceable rings (b, c, k), loosen stuffing box (a, h), tighten gland (b, c, k).
19	●	●					●		●		Solids content and/or grain size too great – reduce speed: Install strainer with admissible mesh size in front of pump.
20	●	●							●	●	Solids settle during pump shut-down and harden. Flush pump immediately, disassemble and clean, if necessary.
21	●	●					●		●	●	Medium hardens if a certain temperature limit is fallen below – heat pump.
22						●		●			Align coupling accurately.

Subject to technical alterations.