

Operating and Maintenance Instructions with Disassembly and Assembly Instructions

Progressive cavity pumps Series AEB.E, AEB.N, AEB.H, AEB.L, AEDB.E, AEDB.N

Design IE

Pump operating data according to the order data sheet

Order no.:

Pump ident. no.:

Machine no.:

Pump type:

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1. General

1.1 Application and operating range

Progressive cavity pumps are rotary self-priming displacement pumps for pumping and metering low and high viscous liquids, neutral or aggressive, clean or abrasive liquids, liquids containing gases or which tend to froth, including liquids containing fibrous and solid material.

ATTENTION For the operating range, please refer to the order data sheet.

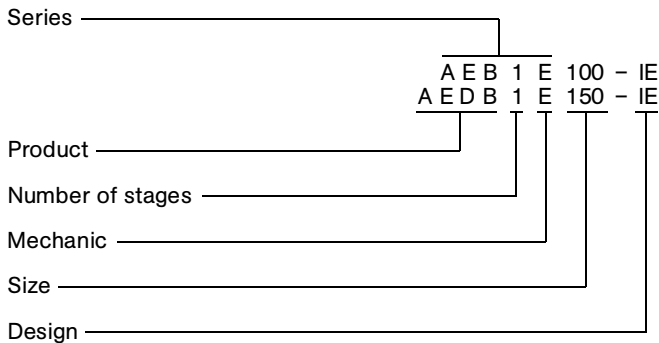
1.2 Performance data

The precise performance data of the pump can be taken from the order data sheet and from the nameplate.

1.3 Abbreviated type coding

The following scheme is used for the abbreviated type coding of the progressive cavity pumps:

Example:



The abbreviated type coding is stamped on the nameplate of the pump.

1.4 Warranty

Our liability for shortcomings in the supply is stated in our terms of delivery. No liability will be accepted for damages arising from non-compliance with the operating instructions and operating conditions.

If, at any later date, the operating conditions are changed (e.g. different liquid pumped, speed, viscosity, temperature or pressure conditions), it must be checked and, if necessary, confirmed by us, in individual cases, whether the pump is suitable for this purpose. Unless any special agreements have been made, during the warranty period, pumps supplied by us may only be opened or modified by us or one of our authorised service centres. Otherwise, our liability for any defects will be invalidated.

1.5 Testing

Prior to leaving our factory, all pumps are subjected to a leak and performance test. Only perfectly operating pumps, which achieve the guaranteed performance, leave the factory. Compliance with the following operating instructions will thus ensure trouble-free operation.

2. Safety

These operating instructions contain basic information that must be observed during installation, operation and maintenance. Therefore, prior to final installation and commissioning, these operating instructions must be read by the installation engineer, as well as by the supervising personnel/operator, and must always be available at the place of installation of the machine/plant.

Not only is the general safety information listed under the main heading of „Safety“ to be observed, but also the special safety hints provided under other main headings, e.g. for private use.

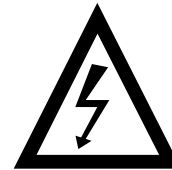
2.1 Marking of hints in the operating instructions

The safety hints contained in these operating instructions, relating to situations which may cause danger to personnel in the event of non-compliance, are specially marked with the general hazard symbol



Safety symbol according to DIN 4844-W9

And, for warnings relating to electrical voltage, with



Safety symbol according to DIN 4844-W8

1.4 Warranty

For safety hints where non-compliance may cause danger to the machine and its operation, the word



is used.

Safety hints attached directly to the machine, such as, for example:

- Rotation arrow
- Labels for fluid connections

must always be observed and kept in completely legible condition.

2.2 Qualification and training of personnel

Personnel engaged in operation, maintenance, inspection and assembly must have appropriate qualifications for these tasks. Area of responsibility, competence and supervision of personnel must be precisely controlled by the user. Personnel with inadequate knowledge must receive training and instruction. If required, this can be provided on behalf of the user by the manufacturer/supplier. In addition, the user must ensure that the contents of the operating instructions are fully understood by the personnel.

2.3 Dangers in the event of non-compliance with the safety information

Non-compliance with the safety information may result in danger not only to persons, but also to equipment and the environment. Non-compliance with the safety information may also lead to the loss of any damage compensation claims.

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

- Failure of important functions of the machine/plant
- Failure of specified procedures for maintenance and servicing
- Danger to persons due to electrical, mechanical and chemical influences
- Danger to the environment due to leakage of hazardous substances.

2.4 Safety-conscious working

The safety hints provided in this operating manual, the current national accident prevention regulations, as well as the user's in-house operating and safety regulations, must be observed.

2.5 Safety hints for the user/operator

- If hot or cold machine parts are dangerous, these parts must be protected against accidental contact on site.
- Guards for moving parts must not be removed when the machine is in operation.
- Leakages (e.g. from the shaft seal) of hazardous pumping liquids (e.g. explosive, toxic, hot) must be drained in such a way that no danger is caused to persons or the environment. Legal regulations must be observed.
- Provisions must be taken against electrical hazards (for details please refer to the regulations of the VDE and the local electricity board).

2.6 Safety hints for maintenance, inspection and assembly

The user must ensure that all maintenance, inspection and assembly tasks are performed by authorised and qualified expert personnel, who have adequately informed themselves by thoroughly studying the operating instructions.

On principle, work on the machine must only be performed when the machine is at a standstill. The procedure for shutting down the machine as described in the operating instructions must be observed without fail. Pumps or units handling noxious liquids must be decontaminated.

Before re-starting, the items listed in the „Commissioning“ section must be observed.

2.7 Unauthorised modifications and genuine spare parts

Modifications or changes to the machine are only permissible after consultation with the manufacturer. Safety can only be ensured by using genuine spare parts and accessories authorised by the manufacturer. The use of other parts may invalidate the manufacturer's liability for consequences that subsequently arise.

2.8 Unacceptable modes of operation

Reliable and safe operation is only guaranteed if the machine is used as intended, in accordance with Section 1 of the operating instructions. The limits given on the data sheet must not be exceeded in any circumstances.

3. Transportation and intermediate storage

3.1 Packing

The graphic symbols on the packaging must be observed.

During transport and storage, the suction and discharge and the auxiliary connections of the pump must be plugged. The plugs must be removed when the pump unit is installed.

3.2 Transportation

Due to their weight, lifting equipment must be used to transfer progressive cavity pumps and all pump units to their final location.

When transporting pumps by crane, the sling ropes must be securely positioned around the suction casing. In the case of complete pump units, an additional rope must be fastened onto the drive motor.

The sling ropes must be positioned around the pump and pump unit in such a way that precise balance is ensured when lifting.

The crane and the sling ropes must be of adequate dimensions. The sling ropes must not be fastened at the lifting eyes of the motor.

3.3 Preservation and storage of progressive cavity pumps

Please refer to our information sheet, VM 2102/...

4. Description

4.1 Design features

Self-priming, single or double stage progressive cavity pump. The pumping elements consist of a rotor and a stator. The drive torque is transmitted to the rotor via a hollow shaft and a coupling rod.

The discharge casing, stator and suction casing are held together by external housing connection screws (clamp bolts).

Between the suction casing and the motor bracket is a gland housing or mechanical seal housing.

4.1.1 Bearings and lubrication

Coupling rod with liquid-tight encapsulated universal joints on either end. Lubrication by joint oil.

The drive shaft/hollow shaft is supported by reinforced bearings in the drive.

4.1.2 Shaft seal

By uncooled or cooled gland packing or by uncooled or cooled, maintenance-free, single or double-acting mechanical seal.

4.1.3 Dimensions/connections/flanges

The dimensions of the pump or pump unit, connection positions and the flange dimensions can be taken from the dimensional or general arrangement drawings.

4.2 Operation

Rotary, self-priming, positive displacement pump. The pumping elements are formed by a rotating eccentric screw (the rotor) and the fixed stator. In any cross-sectional plane, the elements are in contact with one another at two points in the case of the AEB.E, AEB.N, AEB.H and AEB.L (1) series, and, in the case of the AEDB.E and AEDB.N (2), at three points. Viewed along the length of the pumping elements, these points form two (in the case of the first series) or three (in the case of the second series) lines of seal. The material contained in the sealed cavities that are formed as the rotor

turns is displaced axially and with complete continuity from the suction to the delivery end of the pump. Despite the rotation of the rotor, no turbulence is produced. The constant volume of the cavities means that there are no pressurising forces, thus guaranteeing an extremely gentle, low-surge pumping action.

4.3 Unit assembly

4.3.1 Drive

By explosion proof or non-explosion proof electric motors, gear motors or variable gear motors.

4.3.2 Base plate

Pumps for horizontal installation are usually mounted on a common base plate with the drive. Fabricated steel base plates are provided.

5. Installation/Mounting

5.1 Installation

The pumps can be installed horizontally or vertically, with bearings arranged at the top.

5.2 Foundation

The design of the foundation depends on the size of the pump and/or pump unit and the mounting conditions on site.

Dimensional details of the pumps and pump units can be taken from our dimensional or general arrangement drawings.

The foundation can be executed in concrete or as a stable frame, e.g. in fabricated steel structure.

For all types of foundation, it is essential that the foundation is designed to accept the weight of the pump unit over the entire surface.

5.3 Base plate

The base plate must be secured to the foundation in a stress-free manner.

5.4 Space requirements for maintenance and servicing

ATTENTION The pump must be accessible from all sides, allowing necessary inspections to be performed with ease.

Sufficient space must be provided for maintenance and servicing operations, especially for the replacement of pumping elements. The space required for removing the stator and rotor is given in the pump or pump unit dimensional or general arrangement drawings. In addition, it must be ensured that all piping can be removed and replaced without obstruction.

5.5 Installation of pipework

5.5.1 Nominal diameters

The nominal diameters of the suction and discharge pipes should be designed in accordance with the nominal diameters of the pump flanges. In the event of severe deviations, especially on the suction side, the factory must be consulted.

5.5.2 Supports and flange connections

The pipework must be connected in a stress-free manner, via the flange connections, to the pump. Supports should be provided close to the pump, and the connections should be easy to make, in order to prevent

any distortion. After loosening the bolts, the flanges should be neither skewed nor springy, nor should they rest on each other under pressure. Appropriate measures (e.g. the installation of compensators) must be taken to keep any thermal stress occurring in the pipework away from the pump.

5.5.3 Cleaning the pipework before connection

The suction pipework, the gate valves and shut-off valves must be flushed and/or cleaned before installation of the pump.

Items left over from installation, such as screws, nuts, welding beads, metal items, etc. will damage the internal elements of the pump. Any damage caused by such items is not covered by our warranty.

5.6 Installation of auxiliary pipework for accessories

All auxiliary pipework for feeding the shaft seal and, where appropriate, the double shell casing for heating and cooling the pump, must be connected without stress or leakage.

The pipes for the quench liquid in the case of a single-action mechanical seal with quench (type G0Q) and the sealing liquid in the case of a double-action mechanical seal (type G0D) should be installed with as large a flow cross-section as possible. The quench or sealing liquid emerges at the uppermost connection of the mechanical seal.

The flow direction for the flushing, sealing and quench liquid is indicated by arrows in the cross-sectional drawings.

In order to ensure self-venting, the pipes must be installed with a gradient, with low flow resistance and kept as short as possible.

The formation of air pockets or gas bubbles must be prevented. Venting connections must be provided if necessary. The heating/cooling liquid outlet must be connected at the uppermost connection of the double shell casing, if fitted.

5.7 Safety and control devices

5.7.1 Pressure gauges and vacuum gauges

Pressure gauges and vacuum gauges must be connected to the suction and discharge pipes.

5.7.2 Safety devices in the discharge pipelines

If a shut-off valve is installed in the discharge pipeline or if it is possible for the discharge pipeline to become clogged, a safety device should be provided, e.g. a bypass line with a built-in pressure relief valve, bursting discs, motor protection switch, etc.



Progressive cavity pumps are positive displacement pumps which, theoretically, can generate an infinitely high pressure.

If a discharge pipe is closed, e.g. due to clogging or accidental closing of a valve, the pressure generated by the pump may far exceed the permissible pressure for the plant. This may, for example, lead to bursting of the pipelines, which must be avoided at all costs, particularly when hazardous products are being handled. Appropriate safety devices (e.g. pressure switches) must therefore be installed.

5.8 Electrical connections



The connection of the power supply cable for the drive motor must be performed by a qualified electrician, in accordance with the motor manufacturer's wiring diagram. The current VDE regulations and the regulations of the local electricity board must also be observed. Danger due to electricity must be prevented.

6. Commissioning/Decommissioning

6.1 Preparation for commissioning

6.1.1 Filling the pump with liquid

ATTENTION The pump must not run dry! The pump must be filled with liquid for initial start-up and after prolonged standstill periods. Just a few revolutions without liquid may cause damage to the stator. For this reason, prior to start-up, the suction casing must be filled with water or pumping liquid, in order to lubricate the stator and the rotor. After a prolonged standstill, i.e. if it is to be assumed that the liquid remaining in the pump has evaporated, or after a repair, the filling process must be repeated.

After filling, the pump self-primers. Venting is not required, as a liquid/gas mixture can be easily handled.

6.1.2 Opening the auxiliary shaft seal systems (if provided)

If the pumps are charged with a flushing/sealing or quench liquid, before initial start-up the existing shut-off valves must be opened and adjusted to the pressures listed below.

– Supply of flushing or sealing liquid to the gland packings (types P02, P03, P04)

Note: To maintain their function, gland packings with a flushing or lantern ring require a flushing or sealing liquid.

The flushing or sealing liquid pressure required for pumps with gland packings are as follows, for the various shaft seal designs:

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

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

– Supply of single action unbalanced mechanical seal with throttle ring (types G0S and G0T)

Note: To maintain their function, these mechanical seals require a flushing liquid to dissipate any frictional heat and restrict the penetration of the pumped liquid into the seal area.

The necessary flushing liquid pressure is 0.1 to 0.5 bar above the suction pressure (for the flushing liquid, please refer to Section 6.1.3).

– Supply of double action unbalanced mechanical seal (type G0D)

Note: To maintain their function, these mechanical seals require a sealing liquid to dissipate any frictional heat and prevent the penetration of the pumped liquid into the seal area.

ATTENTION Before each start-up, it must be ensured that the sealing liquid is circulating properly.

The sealing liquid pressure must be approx. 1.5 to 2 bar above the pressure in the suction casing. The rate of flow 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 working pressure (for sealing liquid, please refer to Section 6.1.3).

– Supply of single action mechanical seal with quench (type G0Q)

The area between the stationary seal face of the mechanical seal and the shaft seal ring must be

charged with quench liquid. The maximum permissible difference between the quench liquid pressure and the pressure in the suction casing is $p = 0.5$ bar. The maximum quench liquid pressure is 3 bar (for quench liquid, please refer to Section 6.1.3).

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

ATTENTION Any liquid can be used as a flushing/sealing or quench liquid; however, the corrosion resistance of all wetted parts and compatibility with the medium to be sealed must be taken into account. The liquid must be free from solids and must not tend towards sedimentation. It should have the highest possible boiling point, excellent thermal conductivity and low viscosity. Clean, soft water meets these requirements to a high degree.

6.1.4 Opening of the auxiliary heating or cooling unit of the gland housing and/or of the suction casing (double casing)

If the pumps are equipped with this additional feature, all of the heating or cooling system shut-off devices must be opened. The pressure and temperature limits given below must be observed:

– Supply of cooled or heated gland housing and/or suction casing (double casing) with appropriate liquid



All liquids used as heating or cooling liquids must take account of the corrosion resistance of the wetted parts.

The maximum heating or cooling liquid pressure is 6 bar.

The maximum heating temperature must not exceed 100°C and the cooling temperature must not fall below -40°C.

Note: The design temperature can be taken from the order data sheet.

6.1.5 Releasing the pump

In the event of a re-start or after a prolonged standstill, it should be ensured that the pump is rotated easily by the drive unit. If this is not possible, e.g. because of the high degree of adhesion between the rotor and the stator, it is possible to provide assistance using an appropriate tool on the hollow shaft behind the shaft seal.

ATTENTION The hollow shaft must not be damaged during this process.

6.1.6 Control of the direction of rotation

The normal direction of rotation of the pump is anti-clockwise, looking from the drive towards the hollow shaft. The suction connection is located on the shaft seal side, therefore the shaft seal is balanced. In special cases, e.g. with vacuum suction or when pumping media that will not bear gas inclusions, the pump operates in the clockwise direction, in which case the suction and delivery sides are exchanged.

ATTENTION The direction of rotation of the pump must correspond with the rotation arrow „n“ on the pump name plate. Incorrect direction of rotation can result in damage to the pump. To check the direction of rotation, briefly activate the on/off switch of the motor.

6.2 Commissioning

6.2.1 Start-up

Prior to start-up, all shut-off devices installed in the suction and discharge pipes must be open.

6.2.2 Drive

Switch motor on.

ATTENTION Be aware of product-specific peculiarities of the drive. **Please refer to the drive manufacturer's operating instructions.**

6.2.3 Checking the pump performance

When the drive reaches its operating speed, suction and discharge pressure must be checked using a vacuum gauge and a pressure gauge.

The motor must not be overloaded. The power consumption can be checked by means of an ammeter. The temperature and viscosity of the pumping liquid must also be checked. The recorded values must be checked against the order data sheet or performance test report.

6.2.4 Protection against dry running

If there is an interruption in the flow on the suction side of the progressive cavity pump, the thermal energy in the pump elements caused by dry friction and flexing work is not sufficiently transferred. This leads to the thermal destruction of the stator elastomer within a very short space of time. A range of dry run protection devices, suited to the specific operating conditions, is available for the protection of the pump elements (please consult the factory).

6.3 Decommissioning

6.3.1 Shut-down

Switch the motor off.

6.3.2 Measures for prolonged shut-down periods

If a longer shut-down period is planned and there is a danger of frost, the pump must be drained. In order to do this, remove the screw plug (502) from the suction casing (505). The pump must then be preserved (see Section 3.3).

7. Maintenance/Service

7.1 Maintenance

– The information given in Section 2 „Safety“ is to be observed during maintenance and service operations. Regular monitoring and servicing of the pump and drive will prolong their service life.

7.1.1 General monitoring

1. The pump must not run dry.
2. The drive motor must not be overloaded.
3. Check suction and discharge pipelines for leaks.
4. An installed gland packing must drip slightly during operation.
An installed mechanical seal must have no substantial leakage.
5. Pressure and temperature monitoring devices must be observed and compared with the order data sheet and/or performance test report.
6. Monitor auxiliary shaft seal systems, such as flushing, sealing or quenching (if provided).
7. Monitor auxiliary heating or cooling systems in the gland housing and/or suction casing (if provided).

7.1.2 Maintenance of components

7.1.2.1 Universal joints on the coupling rod

The universal joints on the coupling rod are lubricated with ALLWEILER special joint oil Type B or ET 1510 ISO 460 oil from Tribol Lubricants GmbH, Mönchengladbach. Pumps used in the foodstuffs sector are lubricated with ALLWEILER special joint oil Type BL or 1810/460 oil from Tribol Lubricants GmbH, Mönchengladbach.

ATTENTION We have not tested other lubricants and we cannot therefore recommend them!

The joints are lubricated for life. However, if the pump must be opened for other reasons, we recommend that the tightness of the joint packing is checked and that the joint oil is changed after 8000 operating hours. The table in Section 7.1.2.4 gives the joint oil quantities in cubic centimetres, depending on the pump size. When changing the joint oil, please refer to the disassembly and assembly instructions.

7.1.2.2 Shaft seal

The shafts are sealed either by a gland packing or a mechanical seal.

● Gland packing

Increased leakage from the gland packing during the initial operating hours usually diminishes of its own accord during the running-in period.

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

It should be noted that the gland packing should leak slightly. This ensures that the frictional heat generated at the sealing surface is dissipated.

If the leakage increases excessively and cannot be reduced by repeated, slight tightening of the hexagonal nuts (202), the packing rings have lost their elasticity and must be replaced.

– Removing the old packing rings and cleaning the gland housing

After reducing the pump pressure and removing the gland, the old packing rings can be removed by means of a packing puller tool with a flexible shaft. The gland area and the hollow shaft rings must then be carefully cleaned in the area around the packing rings. Worn hollow shafts must be replaced (please see disassembly and assembly instructions).

– Fitting the packing rings

ATTENTION Basically, the packing rings fitted must be suitable for the operating conditions of the pump.

The dimensions and required quantity of pre-pressed packing rings and rings or sections cut to size can be taken from the table in Section 7.1.2.4.

When cutting to size, we recommend a straight cut perpendicular to the shaft. In order to obtain gap-free, parallel contact of the cut packing ring ends, the cutting angle should be approx. 20° to both cut ends (see Figure 1).

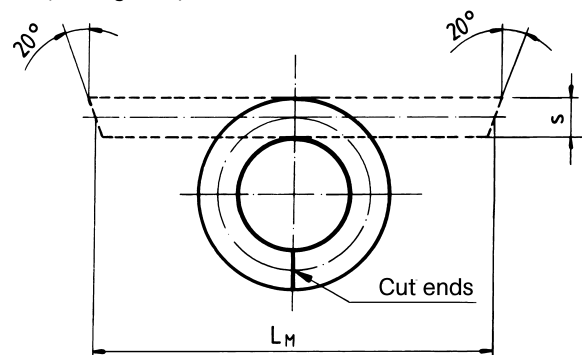


Figure 1: Cutting packing rings to size

Pre-pressed packing rings or rings cut to size must carefully be opened axially and radially just far enough for them to be pushed over the shaft. Bending the rings up may result in damage due to buckling.

When fitting in the packing area, the packing rings must be carefully bent back into their ring shape. The cut joints must be staggered by 90°. Each ring must be pushed into the gland housing with the cut ends first, with the assistance of the gland. Lantern rings or flushing rings are to be fitted in the correct sequence.

ATTENTION Sharp tools must never be used for installation, as there is a danger of damaging the shaft and deforming the packing material.

– **Commissioning the gland packing after re-packing**

The gland packing should only be lightly tightened before commissioning. During pump start-up, a leakage rate of 50 to 200 drops per minute is permitted.

Within 30 minutes of start-up, the leakage must be gradually and evenly reduced to a minimum of 2 to 20 drops per minute by adjusting the gland (203) by means of the hexagonal nuts (202).

ATTENTION During this process the temperature the gland packing must not rise abnormally. Approx. 20 to 60°C above the temperature of the liquid pumped is permissible. If the temperature rises suddenly, the gland must be slackened immediately, and the start-up procedure repeated. The leakage can be drained via the tapped hole located in the drip pan of the motor bracket.



Damage to people and the environment due to leakage of hazardous materials must be prevented.

● **Mechanical seal**

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

In the event of severe leakage due to wear, the mechanical seal must be replaced (please see disassembly and assembly instructions).

ATTENTION As dry running of mechanical seals must be avoided, the pump must only be started in filled condition and with auxiliary devices connected, if provided (please see Section 6.1.2).

7.1.2.3 Drive motors and variable speed gears

Please see manufacturer's operating and maintenance instructions.

7.1.2.4 Packing ring dimensions (re. Section 7.1.2.2), joint lubricant quantities (re. Section 7.1.2.1)

	Pump size							
	50	100	200	380 550	750 1000	1450	2700	
Pump series	AEB1E	50	100	200	380 550	750 1000	1450	2700
	AEDB1E	75	150	300	560	1200	2300	4250
	AEB2E	50	100	200	380	750	1450	2700
	AEB1N	25	50	100	200	380	750	1450
	AEB2N	25	50	100	200	380	750	1450
	AEDB2N	38	75	150	300	560	1200	2300
	AEB1L	99	199	400	720	1560	-	-
	AEB.H	12	25	50	100	200	-	-
Number of packing rings for design P01 ①		6	6	6	6	6	6	6
Dimensions of packing rings for cut rings		∅37 / 25 x 6	∅42 / 30 x 6	∅51 / 35 x 8	∅59 / 43 x 8	∅73 / 53 x 10	∅80 / 60 x 10	∅99 / 75 x 12
Dimensions of packing rings for cut rings L _M x S		104,2 x 6	121 x 6	144,5 x 8	171,4 x 8	211,8 x 10	235,3 x 10	292,5 x 12
Oil quantity in cm ³ per joint		10	18	37	52	87	169	290

① With shaft seal designs P02, P03 and P04, the quantity is reduced by one piece.

7.2 Servicing (disassembly and assembly instructions)

General

Trained service engineers will be available for installations and repairs on request.



When repairs are performed by the user's own personnel or by our service engineers, it is essential that the pump is completely drained and cleaned.

This applies particularly to pumps that are returned for repair to our factory or to one of our authorised service centres.

In order to protect our staff and for the sake of environmental protection, repairs on pumps filled with pumping liquid will be refused. Otherwise, we will have to charge the customer/user for the costs of ecological waste disposal.

If repairs are required on pumps that have handled hazardous materials(1) and/or liquids that are harmful to the environment, the customer/user must voluntarily inform his own or our installation personnel of this on site. This also applies if such a pump is returned to our factory or to one of our authorised service centres. In this case, evidence of the liquid pumped, for example in the form of a DIN safety data sheet, must be submitted to us when the request for a service engineer is made.

① Hazardous materials include:

- Toxic substances
- Substances that are damaging to health
- Caustic substances
- Irritants
- Explosive materials
- Combustible, highly, easily and normal flammable materials
- Carcinogenic substances
- Foetopathic substances
- Gene-changing substances
- Substances that are dangerous for human beings in any other way

For all work executed on site, the user's own personnel and/or our service engineers must be alerted to dangers that may arise in connection with repairs.

The most important disassembly and assembly operations are described in these instructions. The assembly steps described in the individual sections must be consistently followed.

7.2.1 Disassembly of the progressive cavity pump

Before commencing disassembly, the following operations must be performed:

- Disconnect the power supply cable to the motor. It must not be possible to start the motor.
- Close all shut-off devices in the suction and discharge lines.
- Drain the pumped liquid from the suction casing by removing the screw plug (502).
Note: Use a drip pan to collect the drained liquid.
- Disconnect the suction and discharge pipelines as well as all auxiliary piping.
- Unscrew the bolts at the pump feet.

7.2.1.1 Removal of the stator

- Remove hexagon nuts (609) and washers (610) from the connecting bolts (611).

- Pull off the discharge housing (504).
- Remove connecting bolts (611) and stays (612), if provided.
- Pull the stator (402) off the rotor (401).
Note: If difficulty is experienced, rotate the stator (402) with a chain wrench at the same time. In order to do this, secure the hollow shaft (125).
- With plastic or metal stators, remove the stator gaskets (403) and (404).

7.2.1.2 Disassembly of the rotor and the joint on the rotor side

The rotor and the rotor-side joint are disassembled after removal of the stator (402). Please see Section 7.2.1.1.

- Remove hexagon nuts (607) and serrated lock washers (608) as well as hexagon head bolts (606).
- Pull off the suction casing (505) over the rotor (401), taking care that the precision-machined rotor is not damaged in the process.
- Remove the suction casing gasket (501).
- Cut the lock on the clamping band (306) with a metal saw and press out on both sides using a screwdriver. Remove the clamping band (306) from the cover sleeve (308) (see Figure 2).

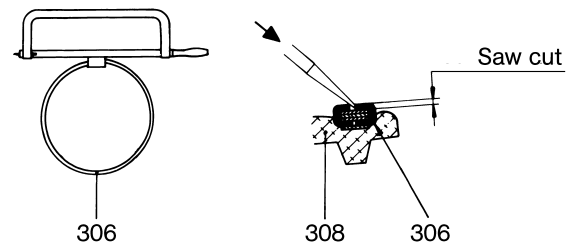


Figure 2: Removing the clamping band.

- Lift the cover sleeve (308) with a screwdriver and pull it off axially in the direction of the coupling rod (307).
- Drain the oil content into a container.
- Drive the retaining sleeve (304) over the flange of the coupling rod (307). Do not twist the coupling rod (307) in the process (see Figure 3).

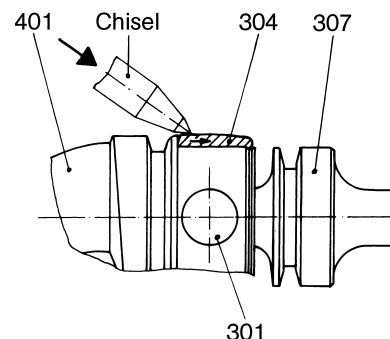


Figure 3: Removing the retaining sleeve.

- Push out the coupling rod pins (301).
- Drive both guide bushes (303) halfway out using a tapered brass drift. To do this, tilt the coupling rod (307) (see Figure 4).

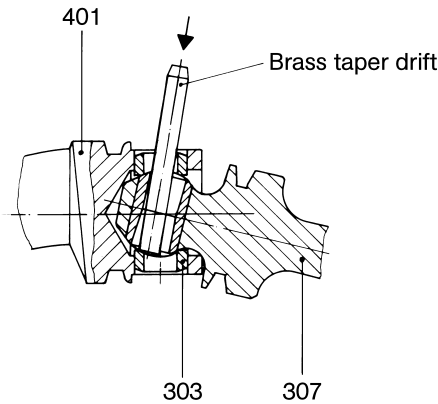


Figure 4: Removing the guide bushes

- Pull the rotor (401) from the coupling rod (307).
- Press out the coupling rod bush (302) from the coupling rod (307).
- Drive the guide bushes (303) completely out of the rotor (401) using a tapered brass drift.

7.2.1.3 Disassembly of the coupling rod and the joint on the drive side

The coupling rod and the drive-side joint are disassembled after removal of the stator (402) and the rotor (401). See sections 7.2.1.1 and 7.2.1.2.

- Disassemble the drive-side joint as described in Section 7.2.1.2.
- Pull the coupling rod (307) off the hollow shaft (125).
- Press out the coupling rod bush (302) from the coupling rod (307).
- Drive the guide bushes (303) completely out of the hollow shaft (125) using a tapered brass drift.

7.2.1.4 Removal of the shaft seal and the hollow shaft

Note: For pumps with a shaft seal provided by gland packing, the packing rings can be changed, as described in Section 7.1.2.2, without removing the hollow shaft. It is only necessary for the hollow shaft to be removed if the pump is equipped with a mechanical seal. In cases where the hollow shaft has been damaged in the area of the shaft seal, the pump must likewise be disassembled, as described below.

- Remove stator (402) (see Section 7.2.1.1).
- Remove hexagon nut (607) and serrated lock washer (608) as well as hexagon head bolt (606).
- Pull the suction casing (505) off over the rotor (401). Take care that the precision-machined rotor surface is not damaged in the process.
- Remove the suction casing gasket (501).
- Remove the splash ring (123) from the clamp set (123).
- Loosen the clamp screws of the clamp set (123) uniformly and **sequentially**.

If necessary, rotate the hollow shaft (125) in order to do this. If the outer ring of the clamp set is not automatically released from the inner ring, a few clamp screws can be unscrewed and inserted into the adjacent pull-off threads. Release can now be easily achieved.



Never unscrew the clamp screws completely (danger of accidents).

- Pull the hollow shaft (125), together with all parts of the shaft seal and the clamp set (123), from the motor bracket (122).
- Pull the clamp set (123) from the hollow shaft (125).

● Disassembly of the gland packing

- Remove the hexagon nut (202) and gland (203).
- Pull the gland housing (204) from the hollow shaft (125).
- Remove the gland packing (207) from the gland housing (204). For shaft seal type P02 also remove the flushing ring (208), and for types P03 and P04 also remove the lantern ring (209).

● Disassembly of the single action mechanical seal

- Pull the mechanical seal housing (214), together with the atmospheric-side stationary seal face of the mechanical seal (219), from the hollow shaft (125). **Note:** Particular care should be taken to ensure that the housing, together with the stationary seal face, is pulled off concentrically, without tilting, in order to avoid damaging the stationary seal face.
- Press the stationary seal face and the O-ring out of the mechanical seal housing (214). Ensure that the pressure is evenly distributed.
- Drive out the retaining pin (220).
- Loosen the grub screws, if fitted, in the rotating part of the mechanical seal housing (219), and pull the mechanical seal from the hollow shaft (125).

ATTENTION Before loosening the grub screws, mark or measure the position of the mechanical seal housing on the hollow shaft. Do not push the O-rings over the drag marks made by the grub screws.

● Disassembly of the single action mechanical seal with throttle ring

- Remove the hexagon head bolts (245).
- Pull the mechanical seal housing (214), together with the atmospheric-side stationary seal face of the mechanical seal (219), from the hollow shaft (125). **Note:** Particular care should be taken to ensure that the housing, together with the stationary seal face, is pulled off concentrically, without tilting, in order to avoid damaging the stationary seal face.
- Pull off the O-ring (218).
- Press the stationary seal face and the O-ring out of the mechanical seal housing (214). Ensure that the pressure is evenly distributed.
- Drive out the retaining pin (220).
- Loosen the grub screws in the rotating part of the mechanical seal (219) and pull the mechanical seal from the hollow shaft (125).

ATTENTION Before loosening the grub screws, mark or measure the position of the mechanical seal housing on the hollow shaft. Do not push the O-rings over the drag marks made by the grub screws

- Pull the mechanical seal cover (215) with the throttle ring (234) from the hollow shaft (125).
- Undo the throttle ring (234) and remove together with the O-ring (235).
- Pull the retaining pins (236) from the mechanical seal cover (215).

● **Disassembly of single action mechanical seal with quench**

- Pull the mechanical seal housing (214), together with the atmospheric-side stationary seal face of the mechanical seal (219), from the hollow shaft (125).
Note: Particular care should be taken to ensure that the housing, together with the stationary seal face, is pulled off concentrically, without tilting, in order to avoid damaging the stationary seal face.
- Press the stationary seal face and the O-ring out of the mechanical seal housing (214). Ensure that the pressure is evenly distributed.
- Drive out the retaining pin (220).
- Loosen the grub screws, if fitted, in the rotating part of the mechanical seal (219) and pull the mechanical seal from the hollow shaft (125).

ATTENTION Before loosening the grub screws, mark or measure the position of the mechanical seal housing on the hollow shaft. Do not push the O-rings over the drag marks made by the grub screws.

- Press out the shaft seal (232).

● **Disassembly of double action mechanical seal**

- Remove hexagon head bolts (245).
- Pull the mechanical seal housing (214), together with the atmospheric-side stationary seal face of the mechanical seal (219), from the hollow shaft (125).
Note: Particular care should be taken to ensure that the housing, together with the stationary seal face, is pulled off concentrically, without tilting, in order to avoid damaging the stationary seal face.
- Pull off the O-ring (218).
- Loosen the grub screws in the rotating part of the mechanical seal (219) and pull the mechanical seal from the hollow shaft (125).

ATTENTION Before loosening the grub screws, mark or measure the position of the mechanical seal housing on the hollow shaft. Do not push the O-rings over the drag marks made by the grub screws.

- Pull the mechanical seal cover (215), together with the product-side stationary seal face of the mechanical seal (219), from the hollow shaft (125).
Note: Particular care should be taken to ensure that the mechanical seal cover, together with the stationary seal face, is pulled off concentrically, without tilting, in order to avoid damaging the stationary seal face.
- Press the stationary seal faces and O-rings out of the mechanical seal housing (214) and mechanical seal cover (215). Ensure that the pressure is evenly distributed.
- Remove the retaining pins (220) and (236).

7.2.2 **Assembly of the progressive cavity pump**

General

After careful cleaning, the particular pump parts are assembled accordingly in reverse order.

7.2.2.1 **Installation of the shaft seal**

● **Installation of the gland packing**

- Slide the gland housing (204) onto the hollow shaft (125).
- Insert the gland packing (207) into the gland housing (204). For shaft seal type P02, also insert the flushing ring (208), and for types P03 and P04, also insert the lantern ring (209).
Please see also Section 7.1.2.2, „Fitting new packing rings“.

● **Installation of the mechanical seal (general)**

Mechanical seals are high quality, precision-machined parts. The mechanical seal manufacturer's assembly instructions must be observed. Careful handling and extreme cleanliness during installation are essential for proper functioning. To facilitate assembly, surfaces over which O-rings slide can be lubricated with a suitable lubricant, for example, silicon oil, Polydiol or soft soap.

ATTENTION Do not use ordinary oil.
Note: Parts that slide on top of one another must always be exchanged in pairs. When using double PTFE sheathed O-rings, please ensure that the joint of the outer sheathing faces in the correct direction for assembly, as otherwise the sheathing may open or be pulled off (see Figure 5).

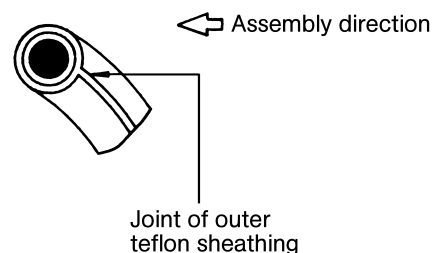


Figure 5: Joint of outer teflon sheathing faces in the correct direction for assembly.

● **Installation of single action mechanical seal**

- Drive retaining pin (220) into the mechanical seal housing (214).
- Press the stationary seal face (219), together with the O-ring, concentrically into the cleaned seal housing (214).
Note: Ensure that the pressure is evenly distributed and that the retaining pin (220) does not protrude inside the mechanical seal housing.
- Push the rotating part of the mechanical seal (219) over the hollow shaft (125).
Note: Precisely observe the installation dimension and/or position of the mechanical seal as marked during disassembly.
- Insert the grub screws (if provided) into the rotating part of the mechanical seal (219), using a liquid retention agent such as Loctite no. 241, and tighten.
- Push the mechanical seal housing (214) together with the stationary seal face (219) over the hollow shaft (125).
Note: Care should be taken not to tilt the mechanical seal housing when pushing it onto the hollow shaft, in order to avoid damaging the stationary seal face.

● **Installation of single action mechanical seal with throttle ring**

- Press the throttle ring (234), together with the O-ring (235), concentrically into the mechanical seal cover (215).
Note: Ensure that the pressure is evenly distributed.
- Using a drift, drive the retaining pin (236) into the mechanical seal cover (215). The retaining pin must not protrude inside the housing.
- Push the mechanical seal cover (215) over the hollow shaft (125).
- The subsequent procedure for installing the mechanical seal is as described in the section, „**Installation of single action mechanical seal**“.
- Pull the O-ring (218) onto the mechanical seal housing (214).
- Push the mechanical seal housing (214), together with the stationary seal face (219), over the hollow shaft (125) and secure with the hexagon head bolts (245) at the mechanical seal cover.

● **Installation of single action mechanical seal with quench**

The installation procedure for the mechanical seal is as described in the section, „**Installation of single action mechanical seal**“.

- Drive in the retaining pin (220) with the assistance of a sealing agent (251) such as Loctite no. 640.
- Press the shaft seal ring (232) into the cleaned mechanical seal housing (214). Do not lubricate the sealing lip.
Note: The sealing lip of the shaft seal ring must always be turned towards the side to be sealed (pointing inwards).
A suitable press plunger is used to insert the shaft seal ring. It must be ensured that the pressure is applied as close as possible to the external diameter of the shaft seal ring.

ATTENTION The mechanical seal housing (214), with the shaft seal ring (232) fitted, must first of all be reversed, with the shaft seal ring in front, when it is pushed onto the hollow shaft (125), in order to expand the sealing lip of the shaft seal ring. After expansion, the mechanical seal housing (214) must be pulled off the hollow shaft (125), and within a short period of time pushed onto the hollow shaft (125) again, in the correct position and with the flange side in front.

● **Installation of double action mechanical seal**

- Drive the retaining pin (236) into the mechanical seal cover (215).
- Press the stationary seal face (219), together with the O-ring, concentrically into the mechanical seal cover (215).
Note: Ensure that the pressure is evenly distributed and that the retaining pin does not protrude inside the housing.
- Push the mechanical seal cover (215) over the hollow shaft (125).
- The subsequent procedure for installing the mechanical seal is as described in the section „**Installation of single action mechanical seal**“.
- Pull the O-ring (218) onto the mechanical seal housing (214).

- Push the mechanical seal housing (214), together with the stationary seal face (219), over the hollow shaft (125) and secure with hexagon head bolts (245) at the mechanical seal cover (215).

● **Installation of the hollow shaft**

- The clamp sets (123) are delivered ready for installation. They should not, therefore, be disassembled before initial installation.
- Clamp sets (123) that have been removed do not need to be disassembled and re-lubricated before re-installation.
- Only clean and re-lubricate the clamp set (123) if it is contaminated.
- A solid lubricant with a friction coefficient of $\mu = 0.04$ must be used.

Lubricant	Type / Manufacturer
Molykote 321 R (anti-friction agent)	Spray / Dow Corning
Molykote Spray (Powder-spray)	Spray / Dow Corning
Molykote G Rapid	Spray or paste / Dow Corning
Aemasol MO 19 R	Spray or paste / A.C. Matthes
Molykombin UMFT 1	Spray / Klüber Lubric.
Unimoly P 5	Powder / Klüber Lubric.

- If the conical surfaces are damaged, the clamp set must be replaced.
- Grease the clamp bolt threads and the contact surface of the heads with Molykote. Tighten the clamp bolts manually, until the bolt heads are in full contact with the inner ring of the clamp set.

ATTENTION Do not tighten the clamp bolts until the hollow shaft (125) has been pushed over the shaft of the drive.

ATTENTION Clean and **degrease** the shaft of the drive and the bore of the hollow shaft (125).

- Slide the splash ring (123) onto the hollow shaft (125).
- Lightly grease the seat of the clamp set (123) on the hollow shaft (125) and push the clamp set (123) onto the hollow shaft (125) as far as the stop.
- Push the hollow shaft (125) onto the drive shaft as far as the stop.
- Tighten the bolts of the clamp set (123) successively in several turns, rotating the hollow shaft if necessary.

ATTENTION All clamp bolts must be tightened until the front surfaces of the outer and inner rings are flush and the fastening torque of the bolts increases sharply (see operational condition in Figure 6). The permissible fastening torque is marked on the clamp set (123).

- Push coupling rod pins (301) into the coupling rod bush (302) and drive in guide bushes (303) completely.
- If necessary, emery the outside of the retaining sleeve (304) and pull it over the head of the rotor (401) or the hollow shaft (125).
- After installing the retaining sleeve (304), secure it against axial movement on the head of the rotor (401) or hollow shaft (125).

ATTENTION To do this, drive the face of the retaining sleeve (304) into the groove on the head of the rotor (401) or hollow shaft (125) using a centre punch (see Figure 8).

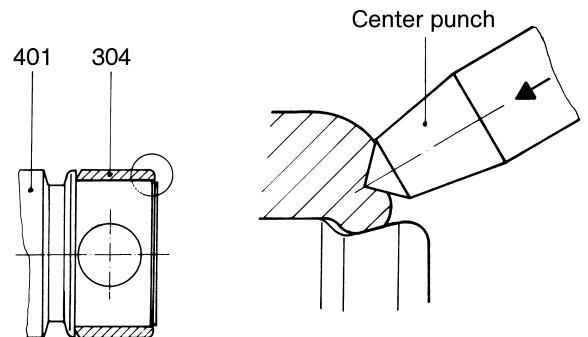


Figure 8: Securing the retaining sleeve

Figure 6: Clamp set assembly

- Correct positioning of the clamp set (123) on the hollow shaft (125) must be checked, in accordance with Figure 6, item X.
- Pull the splash ring (123) onto the clamp set (123) (please see Section 7.2.2.2, Assembly of the rotor and the joints).

7.2.2.2 Installation of the rotor and the joint

- Drive the guide bushes (303) halfway into the rotor (401) and the hollow shaft (125) using a tapered brass drift.
- Press the coupling rod bush (302) into the coupling rod (307) so that the longitudinal axis of the oval hole (marked with two notches) coincides with the longitudinal axis of the coupling rod, and the coupling rod bush extends from the coupling rod symmetrically on both sides (see Figure 7).

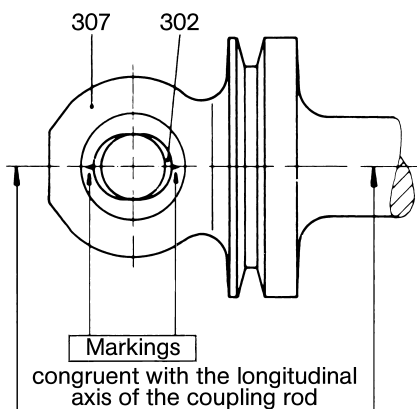


Figure 7: Inserting the coupling rod bush

- Push clamping bands (306), cover sleeves (308) and retaining sleeve (304) onto the shaft of the coupling rod (307).
- Push the coupling rod (307) into the head of the rotor (401) or the hollow shaft (125).

- Raise the cover sleeve (308) by lifting at the top with a screwdriver, guide the oil can spray pipe beneath the sleeve, and fill the joint area with ALLWEILER special joint oil Type B or ET 1510 ISO 460 oil from Tribol Lubricants GmbH, Mönchengladbach. For use in the food industry, fill with ALLWEILER Special Joint Oil Type BL or 1810/460 oil from Tribol Lubricants GmbH, Mönchengladbach. For filling quantities, please see the table in Section 7.1.2.4.
- Check that the bent loop of the clamping band (306) is resting against the clamping band lock. If not, press it against the lock with a pair of standard flat pliers (see Figure 9).

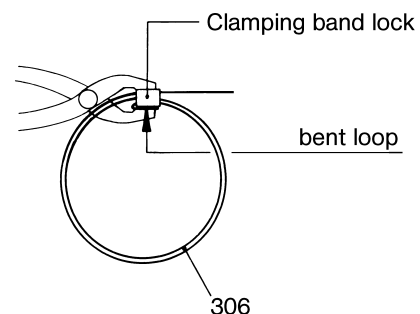


Figure 9: Press bent loop of clamping band against the clamping band lock.

- Place the clamping bands (306) in the grooves of the cover sleeve (308) and tighten.
Note: Please use the clamping tools listed below for this purpose:

For pump sizes smaller than/the same as
AEB1N 200, AEB2N 200, AEDB2N 300
AEB1E 380, AEB2E 380, AEDB1E 560
AEB1L 720, AEB.H 100
use clamping tool type PoK-It II.

For pump sizes larger than/the same as
AEB1N 380, AEB2N 380, AEDB2N 560
AEB1E 750, AEB2E 750, AEDB1E 1200
AEB1L 1560, AEB.H 200
use a Band-It clamping tool together with adapter J050.

The above-mentioned tools may be obtained from us.
To clamp the clamping bands, proceed as follows:

● **Clamping with Band-It clamping tool and J050 adapter**

- Use the adapter to insert the end of the clamping band (306) into the clamping tool, as far as the clamping band lock.
- Hold the band end with the eccentric lever of the clamping tool and tighten the clamping band (306) by turning the crank (Figure 10).

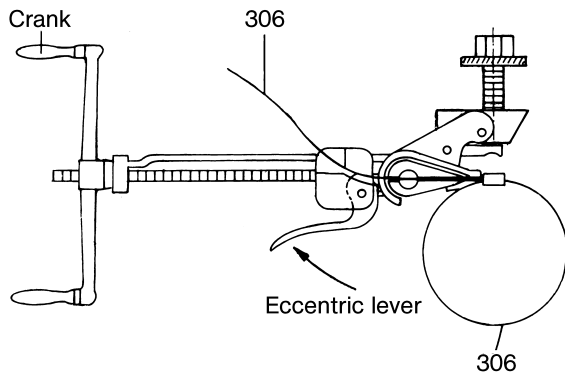


Figure 10: Clamping the clamping band using the Band-It clamping tool and the J050 adapter.

Note: The correct method of clamping the clamping bands (306) is shown in Figure 11.

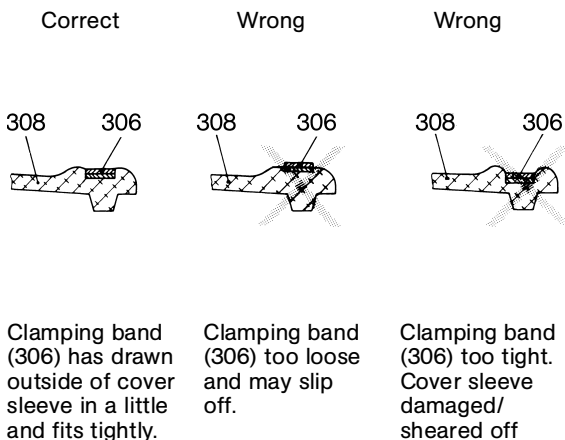


Figure 11: Clamping the clamping bands.

- Check that the clamping band (306) fits into the groove of the cover sleeve (308) around the entire circumference.
- Slowly pivot the clamping tool upwards by approx. 60°, until the shearing hook grips behind the clamping band lock (see Figure 12).
- Tighten the pressure screws manually, until the clamping band is firmly clamped.

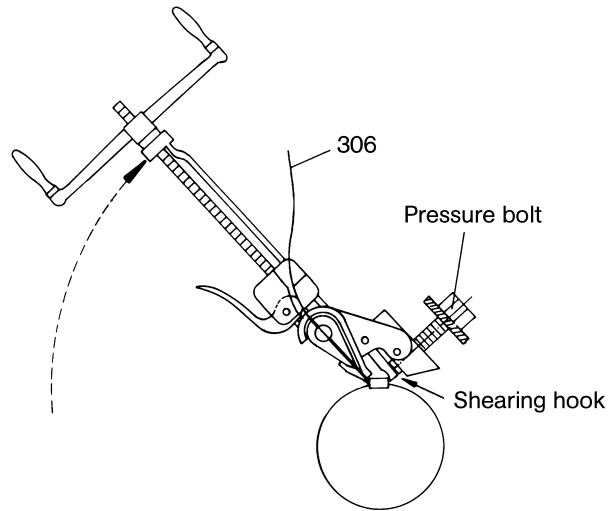


Figure 12: Shearing off the clamping bands.

- Turn pressure screw clockwise with a spanner or a ratchet until the clamping band shears off.

ATTENTION If the clamping band is slightly raised on the sheared side, careful alignment is required in order to compensate. Hammering or beating the clamping band lock is not permissible, as this could cause damage to the cover sleeve.

Note: Clamping bands manufactured in Hastelloy cannot be sheared off with the clamping tool. After bending at the clamping band lock, the clamping band must be sheared off using sheet metal shears and the cut edges de-burred (see Figure 13).

● **Clamping with the PoK-It II clamping tool**

- When using the PoK-It II clamping tool, bend the clamping band (306) at the clamp lock after tightening by pivoting the clamping tool upwards, so that the band cannot slip back through the lock. After bending at the clamp lock, the clamping band must be sheared off with sheet metal shears and the cut edges de-burred (see Figure 13).

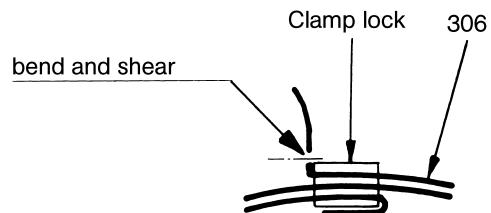


Figure 13: Bending and shearing the clamping band

ATTENTION Check that the clamping band is sufficiently bent to prevent it from slipping back through the clamp lock (see Figure 13). If this is not the case, remove the clamping band and replace with a new one.

7.2.2.3 Installation of the stator

- Before installation, lubricate the stator (402) and rotor (401) with a sliding agent (silicon oil, Polydiol, soft soap or similar).

ATTENTION Do not use ordinary oil.

- For plastic or metal stators, insert stator gaskets (403) and (404).

Note: With plastic stators, the stator gasket (403) and the O-ring must always be located on the discharge side.

- Pull the stator (402) over the rotor (401).

Note: If difficulty is experienced, rotate the stator (402) at the same time, using a chain wrench. Secure the hollow shaft (125) in order to do this.

- Bolt together the discharge casing (504), the stator (402) and the suction casing (505) with the connecting bolts (611) and hexagon nuts (609). Uniformly tighten the hexagon head bolts.

Part no.	Description	Quantity
122	Motor bracket	1
123	Clamp set	1
125	Hollow shaft	R 1
201	T-head bolt	2
202	Self locking nut	2
203	Gland	1
204	Gland housing	1
207	Gland packing	R, r ①
208	Flushing ring	1
209	Lantern ring	1
212	Screw plug	1
213	Sealing tape	1
214	Mechanical seal housing	1
215	Mechanical seal cover	1
218	O-ring	R 1
219	Mechanical seal	R 1
220	Retaining pin	1
232	Shaft seal ring	R 1
234	Throttle ring	R 1
235	O-ring	R 1
236	Retaining pin	R 2
245	Hexagon head bolt	3
251	Sealing agent	1

7.3 Spare parts/replacement parts

The following cross-sectional drawings, with parts list, show all specified pumps with the various shaft seal and bearing designs.

The parts marked in the parts list can be provided as spare/replacement parts.

Recommended spare parts/reserve parts:

R = large repair kit

r = small repair kit



For safety reasons, only genuine spare parts supplied by us should be stocked and used. In this connection, please also refer to the information given in Section 2.7.

When ordering spare parts/reserve parts, please indicate the following:

Serial no.

Abbreviated type coding of the pump

Part no.

Description and quantity

or ident. no. and quantity

Note: The serial number and the abbreviated type coding of the pump are stamped on the name plate.

Note: The ident. no. and the piece number are also shown on the attached separate spare parts list.

301	Coupling rod pin	R, r 2
302	Coupling rod bush	R, r 2
303	Guide bush	R, r 4
304	Retaining sleeve	R, r 2
305	Joint oil	R, r ①
306	Clamping band	R, r 4
307	Coupling rod	R, r 1
308	Cover sleeve	R, r 2
401	Rotor	R, r 1
402	Stator	R, r 1
403	Stator gasket, discharge side	R, r 1
404	Stator gasket, suction side	R, r 1
501	Suction casing gasket	R, r 1
502	Screw plug	1
503	Seal ring	R 1 ③
504	Discharge casing	1 ③
505	Suction casing	1
506	Suction casing cover	2
507	Gasket	R 2
508	Stud	8
509	Nut	8
512	Reducing flange	1
513	O-ring	R 1
525	Washer	8
601	Name plate	1
602	Dome headed groove pin	4
603	Commissioning label	1
604	Suction label	1
605	Discharge label	1
606	Hexagon head bolt	4
607	Hexagon nut	4
608	Serrated lock washer	4
609	Hexagon nut	4
610	Washer	4
611	Connecting bolt	4
612	Stay	1 ②
613	Hexagon nut	2 ④

Recommended spare parts:

R = large repair kit

r = small repair kit

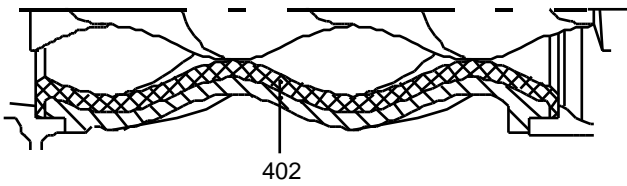
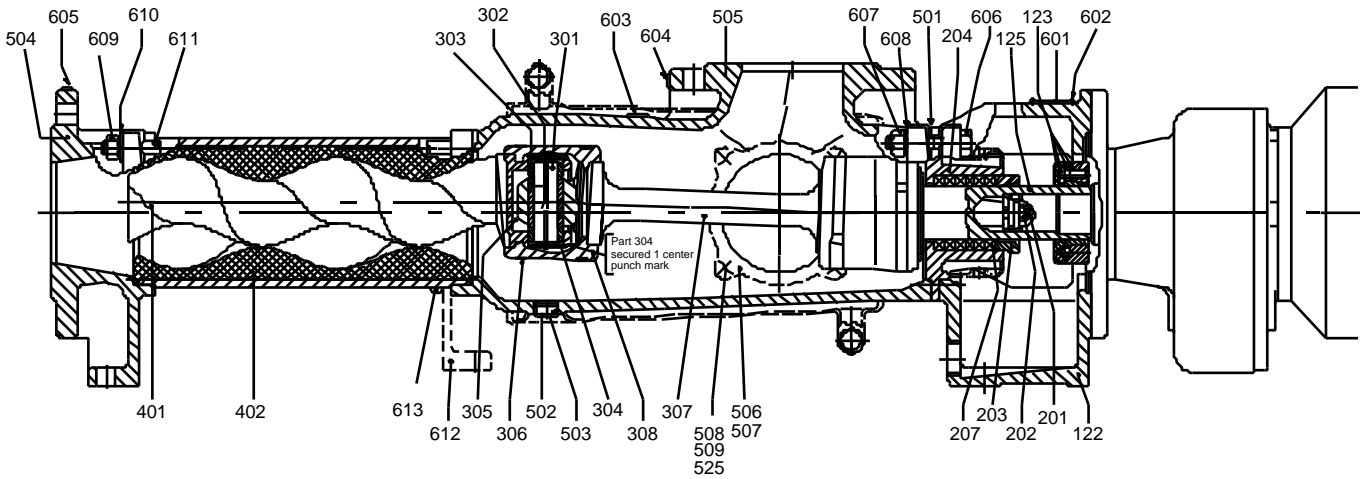
① See Section 7.1.2.4

② 2 pieces for AEB4H 100-IE, AEB4H 200-IE

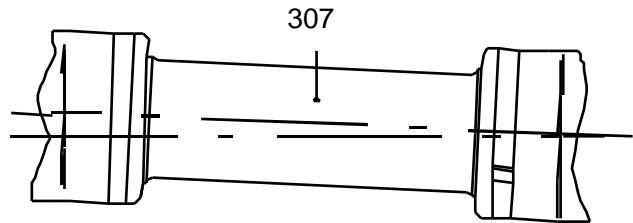
③ 2 pieces for connection piece positions 2 and 4

④ 4 pieces for AEB4H 100-IE, AEB4H 200-IE

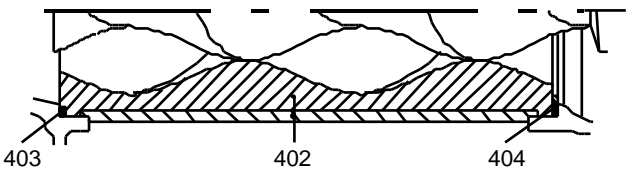
7.4 Sectional drawing with list of components and recommended spare parts / replacement parts for Series AEB.E, AEB.N, AEB.H, AEB.L, AEDB.E, AEDB.N, design IE



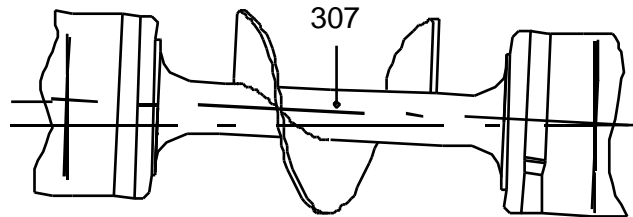
Stator with irregular elastomer wall thickness



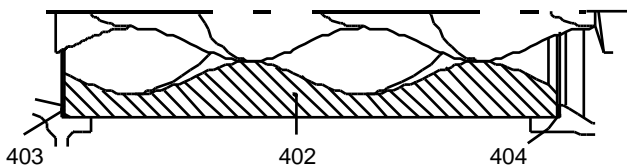
Winding protection on joint shaft



Stator of plastic material

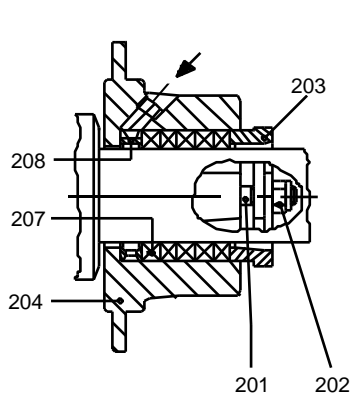
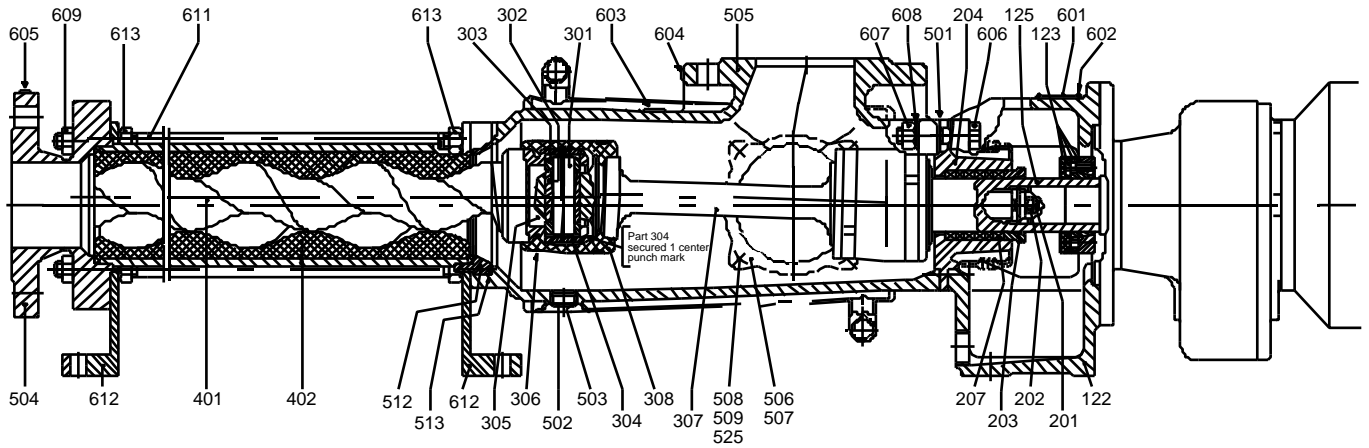


Worm on joint shaft

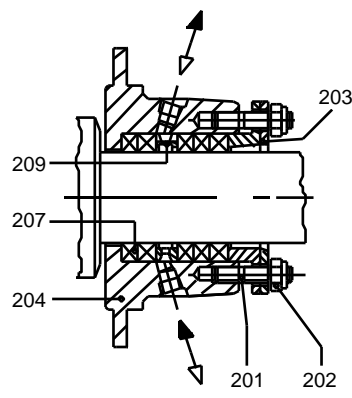


Stator of metal

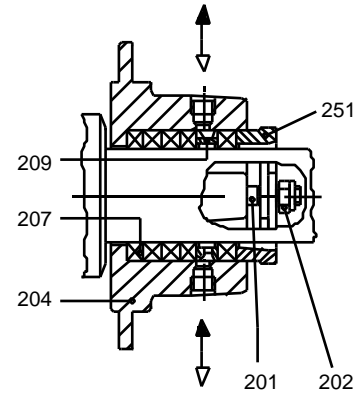
Sectional drawing for series AEB.H



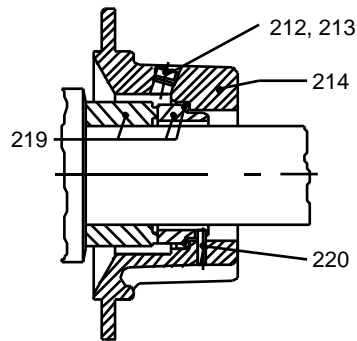
P02 Stuffing box with flushing ring



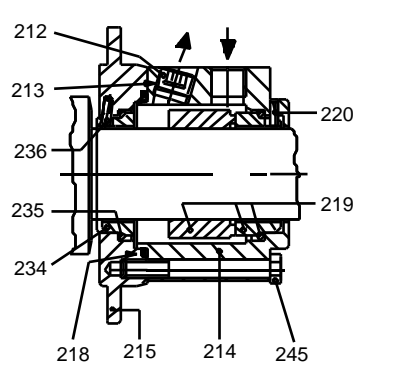
P03 Stuffing box with internal sealing chamber ring



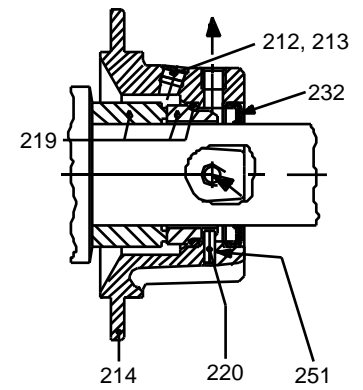
P04 Stuffing box with external sealing chamber ring



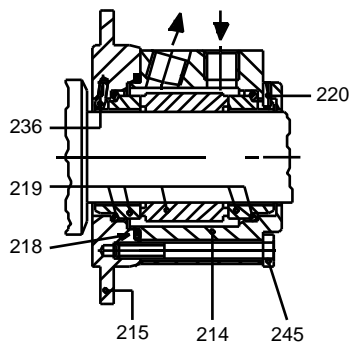
G0K and G0N mechanical seal, single-acting



G0S and G0T mechanical seal, single-acting with throttling ring



G0Q mechanical seal, single-acting with quench



G0D mechanical seal, double-acting

8. Operating problems – causes and remedies

No.	Operating problems										Causes and remedies
	Pump does not start	Pump does not prime	Flow rate too low	Diff. head not reached	Flow rate fluctuates	Pump is noisy or does not discharge	Pump has seized	Motor over-heating	Stator wears too fast	Shaft seal leaks	
	a	b	c	d	e	f	g	h	i	k	
											ALLWEILER progressive cavity pumps will operate satisfactorily at all times if they are used in accordance with the operating conditions given in our order acknowledgement and if the operating instructions are observed.
1	●							●			Too high adhesive forces between rotor and stator in new condition or after prolonged standstill. Rotate pump by hand or appropriate tool.
2		●									Check sense of rotation against rotation arrow on pump. Change poles on the electric motor if necessary.
3		●	●		●	●	●				Check suction piping and shaft seal for leaks.
4		●	●		●	●					Check suction head – if necessary, increase diameter of suction pipe – instal larger filters – fully open suction valve.
5		●	●		●						Check viscosity of liquid pumped.
6	●		●					●			Check pump speed – check speed and amperage of the electric motor – check voltage and frequency.
7			●		●						Avoid airlocks in the liquid pumped.
8	●		●				●	●	●		Check differential head – open discharge valve – remove blockage in discharge pipeline.
9		●	●		●		●		●		Pump runs partially or completely dry. Check availability of liquid pumped on suction side.
10		●	●								Increase pump speed for low viscous liquids and high suction lift.
11		●			●	●					Reduce pump speed for high viscous liquids – danger of cavitation.
12						●					Check radial clearance of the coupling rod pins – coupling rod bush probably incorrectly installed.
13	●	●	●				●		●		Check pump for foreign matter, disassemble pump, remove foreign matter, replace damaged parts.
14		●	●	●			●				Stator and rotor excessively worn, disassemble pump, replace defective parts.
15		●	●			●	●				Joint internals (f, g) and/or hollow shaft worn, disassemble pump, replace defective parts.
16		●	●				●		●		Suction pipework partially or wholly blocked
17	●	●					●	●	●		Check temperature of liquid pumped – thermal stator expansion too high – stator seized on rotor – stator possibly burnt out.
18	●	●	●					●		●	Gland packing: Replace worn packing rings (b, c, k) – loosen gland (a, h) – tighten gland (b, c, k)
19	●	●					●		●		Solid content too high and/or too large solids – reduce speed – instal upstream strainer with appropriate mesh size.
20	●	●							●	●	Solids settle and harden after pump shut-down: Immediately rinse the pump – disassemble and clean if necessary.
21	●	●					●		●	●	Pumped liquid hardenes if temperature falls below a certain limit – heat trace the pump.

Subject to technical alterations.

ALLWEILER AG 

Werk Bottrop

Postfach 2001 23
D-46223 Bottrop
Kirchhellener Ring 77-79
D-46244 Bottrop
Germany
Phone (02045) 966-60
Fax (02045) 966-679
Railway station
D-45127 Essen
Internet: <http://www.allweiler.de>