

Operating and Maintenance Instructions

VM No.: 650.0022 GB
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Screw pumps
Series SN../SM..
 Design KB2, LB2, KB2QA, LB2QA

**Retain
 for future
 use!**

Order No.:

Pump Ident. No.:

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.

1 General

1.1 Pump designation

The exact designation can be found in the order-specific documents (see data sheet).

1.2 Proper use

Information on proper use of the pumps is provided in the technical data sheet.

The pumped liquid must not contain any abrasive constituents nor corrode the pump materials. In case of doubt consult the manufacturer.

1.3 Performance data

The exact performance data applicable to the pump can be taken from the order data sheet and/or acceptance test report, and are engraved on the name plate.

The pressure data indicated there apply only to approximated static pressure load. In the case of dynamic alternating pressure load, consult the manufacturer.

Note: For pressure and temperature details for heating of stuffing box, and details on the stuffing box quench, see order-specific technical data sheet.

Generally, the quenching and heating media must be compatible with the delivery medium and the pump materials.

1.4 Warranty

Our warranty for shortcomings in the supply is laid down in our delivery conditions. No liability will be undertaken for damages caused by non-compliance with the operating instructions and service conditions. If at any later date the operating conditions change (e.g. different fluid conveyed, speed, viscosity, temperature or supply conditions), it must be checked by us from case to case and confirmed, if necessary, that the pump is suited for those purposes. Where no special agreements were made, pumps supplied by us may, during the warranty period, only be opened or varied by us or our authorized contract service workshops; otherwise our liability for any defects will cease.

1.5 Testing

Prior to leaving our factory, all pumps are subjected to a thorough test run and performance test on the test stand. Only properly operating pumps, achieving the performance assured by us, leave the factory.

Thus, compliance with the following operating instructions ensures fault-free operation and full delivery.

1.6 Availability

As a matter of principle, we recommend stocking replacement pumps and withdrawable units (hydraulic action system) where the supplied pumps are a decisive factor in maintaining a production or delivery process. In this way downtimes can be avoided, or reduced to a minimum.

2 Safety

These operating instructions contain basic safety instructions for installation, operation and maintenance. It is therefore essential that they are read by fitters and all specialist staff and customer personnel prior to installation and start-up. They must always be kept at hand at the place of installation.

The special safety instructions contained in the other chapters must be observed in addition to the general safety instructions in this chapter.

2.1 Identification of safety instructions in the operating manual

The safety instructions contained in these operating instructions which represent a danger to personnel if not complied with are specially marked by the general danger symbol:



Warning symbol
as per DIN 4844–W9

Warning of danger from electric voltage is indicated as follows:



Warning symbol
as per DIN 4844–W8.

Instructions which are essential to avoid endangering the machine and its operation are marked by the word

ATTENTION

Instructions affixed directly to the machine such as

- Directional markers
- Signs for fluid connections

must always be observed and maintained in fully legible condition at all times.

2.2 Personnel qualification and training

The operating, maintenance, inspection and mounting personnel must be appropriately qualified for the duties assigned to them. The scope of their responsibilities, competency and supervisory duties must be closely controlled by the customer. If the personnel do not have the required knowledge, they must be trained and instructed. If required, this may be provided by the manufacturer/supplier on behalf of the customer. The customer must additionally ensure that personnel fully understand the content of the operating instructions.

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

Failure to comply with the safety instructions may result in danger to persons, and place the environment and the machine at risk. Non-compliance with the safety instructions will lead to the loss of any claims for damages.

Non-compliance may result in the following dangers:

- Failure of important functions of the plant
- Failure of specified methods for maintenance and servicing
- Danger to persons resulting from electrical, mechanical and chemical effects
- Danger to the environment resulting from leakage of hazardous substances

2.4 Responsible working practices

The safety instructions contained in these operating instructions, current national accident prevention regulations, as well as internal working, operating and safety rules of the customer, must be observed.

2.5 Safety instructions for the user/operator

- Hot or cold machine parts representing a danger must be protected against accidental contact on site.
- Protection against accidental contact for moving parts (such as the coupling) must not be removed while the machine is in operation.
- When operating pump aggregates in a dust-laden environment (e.g. milling, chipboard manufacture, bakeries), the surfaces of the pumps and motors must be cleaned at regular intervals, depending on local conditions, in order to maintain the cooling effect and eliminate the possibility of spontaneous combustion. Please also see explosion protection regulations (ZH 1/10).
- Leakage (e.g. from the shaft seal) of hazardous substances being handled, such as explosive, toxic or hot materials, must be discharged in such a way that no danger to persons or the environment is created. Legal regulations must be observed.
- Dangers from electrical energy must be eliminated. For details in this regard, please refer to VDE and local power company regulations.

2.6 Safety instructions for maintenance, inspection and installation

The operating company must ensure that all maintenance, inspection and installation tasks are performed by authorized and qualified specialist personnel who have thoroughly studied the operating instructions.

Work on the machine is only to be carried out when the machine is at a standstill. The procedure for shutting down the machine described in the operating instructions must always be followed.

Pumps or aggregates handling fluids which are detrimental to health must be decontaminated. All safety and protective devices must immediately be refitted and made operational on completion of the work.

The instructions under Section 6.1, "Preparation for start-up", must be observed before restarting.

2.7 Unauthorized conversion and production of replacement parts

Conversion or modification of the machines is only permissible after consultation with the manufacturer. Original replacement parts and accessories approved by the manufacturer are intrinsic to safe operation. If other parts are used the manufacturer cannot be held liable for the consequences.

2.8 Unacceptable modes of operation

The operational safety of the machine supplied is only ensured when it is used in accordance with *Section 1* of the operating instructions. The limit values given on the data sheet must not be exceeded under any circumstances.

3 Transportation and Intermediate Storage

3.1 Packaging

Attention must be paid to the figurative markings on the packaging.

The suction and pressure side and all auxiliary connections must always be closed during transportation and storage.

ATTENTION The coverings must only be removed immediately before connecting the pipeline.

3.2 Transportation

The pump or pump aggregate is to be safely transported to the place of installation, if required by means of lifting gear.



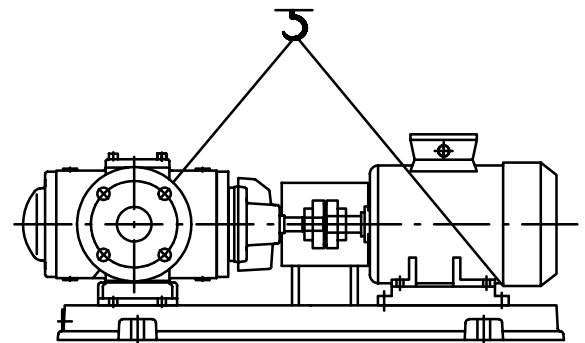
The regulations for lifting loads in accordance with VBG 9a must be observed. Crane and sling equipment must be adequately dimensioned. Sling equipment must not be secured to the lifting eyes of the motor, except as additional protection against overturning in the event of nose-heaviness.



Transportation to and at the installation site

Make sure that the unit is transported safely and in a stable position. Overturning due to nose-heaviness must be prevented.

Complete aggregates must be transported to the place of installation as shown in the illustration.



In the case of vertically and horizontally mounted flanged pump aggregates, it is advisable to attach the cables to the wall/foot lantern or intermediate fitting lantern (not shown).

Transport damage

ATTENTION Check the pump for damage on receipt. Any damage detected must be notified immediately.

3.3 Preservation and storage of the screw pumps

3.3.1 Preservation

In the case of storage or prolonged standstill, the pumps must be protected against corrosion. In those cases, an outside and inside preservation is to be provided. The durability of the protection against corrosion, which is limited in time, depends on the composition of the preservative to be applied and the storage conditions.

ATTENTION Under normal circumstances the pumps have no special preservative.

At an additional charge we can, however, supply pumps and replacement parts ex factory with a preservative adequate to the planned storage period.

We will be pleased to specify suitable preservatives for you on request.

3.3.1.1 Outside preservation

The outside preservative should be applied by painting or spraying with a spray gun.

Points of preservation:

All bright and unvarnished parts (e.g. shaft ends, couplings, flange facings, valve and manometer connections).

3.3.1.2 Inside preservation

The preservative is to be applied by filling the pump. For these purposes, the suction side of the pump must first be closed with a dummy flange. During filling, the pressure flange must be on a higher level than the suction flange. During the filling process, the shaft must be slowly cranked against the direction of rotation. Filling must be continued until the preservative reaches the sealing strip of the delivery flange, bubble-free. Then the outlet side is to be closed with a dummy flange.

Note: Not required for pumps made of stainless materials.

Points of preservation:

All bright parts inside the pump (e.g. pump casing inside, screw spindles, ball bearings, pressure-relief valves).

3.3.1.3 Monitoring of preservation

In the event of prolonged storage, the preservation of the pump must be checked by the customer at regular intervals.

Every six months the pump level must be checked; if necessary, preservative must be topped up to the sealing strip on the pressure flange.

At the same time, the packing must be checked for destruction, and repaired if necessary.

Note: Liability for damages caused by improper preservation cannot be assumed by us.

3.3.1.4 Depreservation



Prior to setting the pump in motion, the preservative applied must be removed.

Environmentally compatible disposal must be ensured.

The preservative applied for inside preservation can normally be removed by flushing the pump with the fluid to be conveyed.

Alternative, suitable solvents may be applied for removing the inside and outside preservation. Appropriate solvents are for example: petroleum, benzene, Diesel fuel, spirit, alkalis (industrial cleaners) or any other wax solvents. Steam jet cleaning devices with appropriate admixtures can also be used (allow wax solvent to act beforehand).

ATTENTION Prior to start-up after prolonged storage, all elastomers (O-rings, shaft seals) must be checked for their elasticity of shape. Embrittled elastomers must be exchanged. Elastomers of ethylene-propylene rubber (EPDM) must always be replaced. The pump must be filled with fluid to prevent seizing of the components. A pressure-relief valve attached or fitted in the pipeline must be checked for passage.

Note: If on the plant side, the pipelines, (oil) tanks or other parts are wetted with paraffin-containing preservative, the entire plant must be depreserved as paraffin is detrimental to the air separating capability of oil. This may result in unsteady operation of the pump and loud noise.

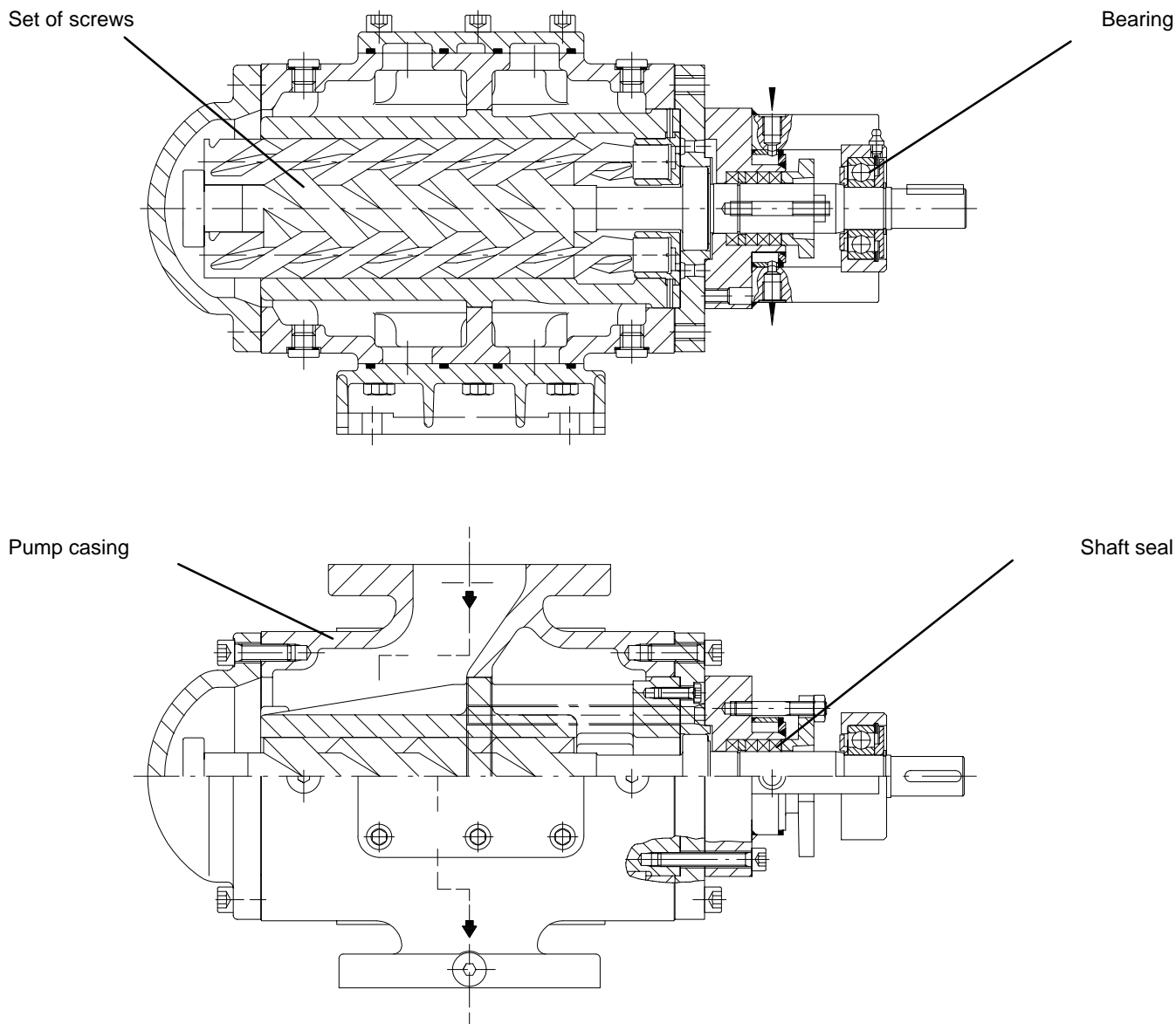
3.3.2 Storage

During storage of the pump, the suction and outlet branches and all other supply and discharge branches must always be closed with dummy flanges or dummy plugs.

Storage should be in a dry, dust-free room. During storage, the pump should be cranked at least once a month. During this process, parts such as the shaft and bearings should change their position.

4 Description / Principle design of the pump

The pictorial presentation may not correspond with the pump supplied.
The actual design will be stated in the specific order documents.



Contact protection to EN 809 by coupling guard



Pressure relief valve

For safety reasons, screw pumps must generally be equipped with a pressure relief valve. Most pumps are already equipped with a pressure relief valve when they leave the factory. The standard trigger pressure of this valve is approximately 10% above the operating pressure.



Earthing connection to EN 809 must be attached by the customer



Pumps that are supplied without a pressure relief valve must be provided with a suitable safety valve by the customer. The safety valve must be fitted in the discharge pipeline between the pump and the first shut-off device.

5 Installation/Mounting

5.1 Installation

For installation methods and locations, please see installation drawing.



Other methods of installation are not permissible without prior consultation with the manufacturer.

5.1.1 Place of installation

Temperature: min. -20 °C
 max. +40 °C

relative air humidity:
 permanent max. 85 %
 temporary max. 100 %

Installation height: max. 1000 m above NN

For data differing from this, please consult the manufacturer.

ATTENTION Intensive vibrations in the vicinity of the pump unit can lead to bearing damage and must therefore be avoided.

5.1.2 Protective devices



In order to prevent injuries due to burns, at pumping liquid temperatures higher than 60 °C protective devices in accordance with EN 809 must be provided **on site**.

5.2 Foundation

5.2.1 General

The foundation may be a floor/concrete base or a load-bearing steel foundation frame.

ATTENTION The foundations must be constructed in such a way that they can take the weight of the pump unit and all operating forces that occur.

5.2.2 Characteristics of a steel foundation frame

A steel foundation frame must be constructed in such a way that pump feet or base plate are supported evenly and can be secured with screw fixings.

ATTENTION If the base plate is only supported at four points the pump aggregate will hang down in the middle. This will affect the alignment of the coupling and may also lead to severe noise being generated.

5.2.3 Characteristics of a floor/concrete foundation

The foundation must be horizontal, flat and clean, and be capable of bearing the full load upon it.

Note: Concrete foundations must be executed with standard concrete of strength class B 25 as a minimum.

5.3 Alignment of the pump aggregate

The pump aggregate must be aligned to its pre-set height and system dimensions. This is done using suitable steel shims, arranged directly adjacent to each fixing bolt.

The overall height of the steel shims is determined by the established system dimensions of the plant. The steel shims and the base plate must be positioned evenly and securely.

If the fixing holes are more than 750 mm apart, we recommend fitting additional steel shims in the middle of the base plate.

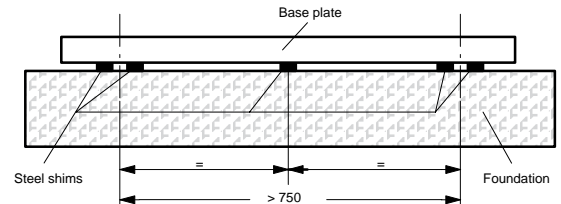


Fig. 5.1: Alignment with steel shims

Horizontal alignment of the aggregate is produced by way of flat-machined surfaces on the pump using a machine spirit level. Measurements are taken in longitudinal and transverse directions of the pump aggregate.

Permissible deviation: max. 1 mm per 1 m length.

5.3.1 Fixing the pump aggregate

In order to prevent deformation of the base plate/pump, this must first of all be screwed tightly at three points. Before tightening the rest of the screws, spacers should again be positioned around the screw, in order to balance out the unevenness of the seating.

ATTENTION The prescribed tightening torque must be observed.

Precise details on the shape and dimension of the fixing are provided in the installation drawing.

5.3.2 Checking the alignment

After aligning and tightening the screws, it must be possible to turn the pump and drive by hand, without any strain.

Note: The pump unit should not be welded to the base for technical installation reasons.

5.4 Checking the coupling alignment

5.4.1 Checking the coupling alignment in case of horizontal setup on base plate (if used)

A complete delivered pump aggregate has been carefully assembled at the factory. After proper installation, and prior to start-up of the pump aggregate, the alignment of the coupling must be checked.

The check can be made with a straight-edge and a feeler gauge, or with other suitable equipment (such as a laser alignment device).

The measurements are taken in two planes, each offset by 90°, on the circumference of the coupling.

If a height, lateral or angle offset is detected between the two coupling halves, the drive motor should be re-aligned such that the coupling halves are flush with each other (level out with flat packing shims as necessary).

The gap between the two coupling halves must be the same all round the circumference of the coupling. The specified gap is shown in the installation diagram.

The spacing between the straight-edge laid over both coupling halves and the respective shaft must be the same all round the circumference.

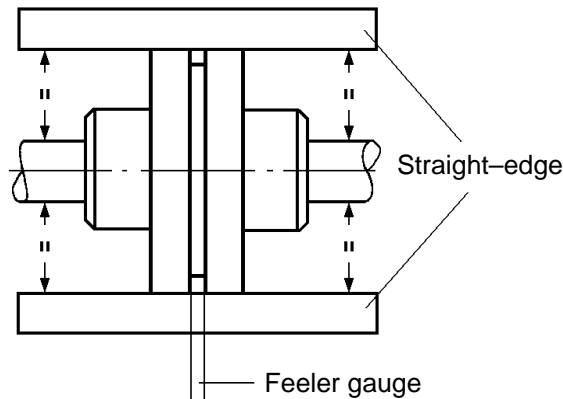


Figure 5.2: Alignment of the coupling with straight-edge and feeler gauge

For couplings with a distance piece (removable couplings) the alignment of the coupling can be checked with dial gauges.

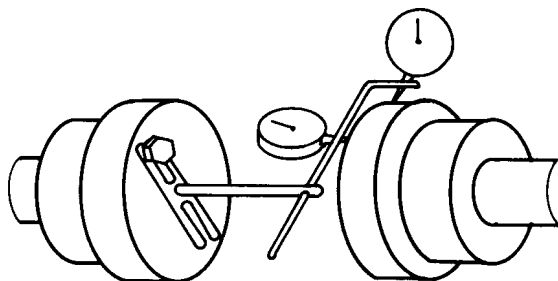


Figure 5.3: Alignment of the coupling with dial gauges

Note: The permissible axial and radial deviation, measured on the front face of the coupling and the coupling circumference respectively, may be max. 0.1 mm, but as far as possible should be kept below 0.05 mm.

When the fixing bolts have been aligned and tightened the pump/drive motor unit must be able to be spun by hand without pressure points.

ATTENTION Out-of-flush errors on the coupling may lead to heavier wear of the coupling, the anti-friction bearing and the shaft seal, and even cause the shaft end to be torn off.

5.4.2 Coupling alignment in case of flanged aggregates (if used)

In the case of pumps with flanged drive motor, the pump and motor are precisely centered in the lantern. Alignment or re-alignment of the coupling is not required.

Note: Improper handling, e.g. during transportation, may impair the alignment between the pump and the motor. In this case the pump and the motor must be returned to the factory for checking.

5.4.3 Coupling alignment of special designed couplings (if used)

Refer to the operating instructions of the coupling manufacturer.

5.5 Assembly of pump and drive motor

If the aggregate is only assembled at the place of use, the coupling is assembled as follows:

1. Coat the pump and motor shaft ends with a fine film of molybdenum disulfide (e.g. Molykote) and insert keys.
2. Push on the coupling halves on the pump and motor side with the aid of a pusher device until the shaft end is flush to the coupling hub.
If no puller is available, heating the coupling halves to approx. 100 °C (without rubber buffer) facilitates pushing.

ATTENTION The possibility of shock and stress on the pump and drive motor components must be eliminated.

3. Tighten the grub screw on both coupling hubs.
4. When assembling the pump and motor, make sure the specified gap between the coupling halves is maintained (see our installation drawings).
5. In the case of horizontally mounted pump aggregates fixed on a base plate or directly on the foundation, the coupling must be aligned as described in Section 5.4.
In the case of pump aggregates with flanged motor, the coupling does not need to be re-aligned.

6. Mount the contact protection.
According to accident prevention regulations, the pump must only be operated with a protection against accidental contact.



5.6 Space required for maintenance and repair

ATTENTION The pump must be accessible from all sides in order to be able to carry out necessary visual inspections.

Adequate space must be provided for maintenance and repair work, in particular for removal of the drive motor or of the complete pump aggregate. It must also be ensured that all pipelines can be attached and removed without hindrance.

5.7 Laying the pipelines**5.7.1 Nominal widths**

If possible, the nominal widths of the suction and pressure pipelines should be rated so that the rate of flow does not exceed a maximum of 1 m/s in the suction pipeline and 3 m/s in the pressure pipeline. If possible, suction pipelines laid "uphill" are to be avoided.

5.7.2 Change of cross-sections and directions

Sudden changes of cross-sections and directions, as well as hairpin bends, are to be avoided.

5.7.3 Supports and flange connections

The pipelines must be connected to the pump, stress-free. They must be supported close to the pump and must allow easy screwing-on to avoid twisting. When the connections are loosened the pipeline must neither be slanted nor springing, nor must it be under pressure.

Any thermal stresses occurring on the pipelines must be kept away from the pump by suitable means, e.g. installing compensators.

5.7.4 Cleaning pipelines prior to attachment

Prior to assembly, all pipeline parts and valves must be thoroughly cleaned; especially in the case of welded pipelines, burrs and welding beads must be removed. Flange gaskets must not protrude inwards. Blanking flanges, plugs, protective film and/or protective paint on flanges and seals must be removed completely. Water residues, still in the pipeline network from pressing-out or steeping for example, must be removed.

Delivery of water destroys the pump. The pump relies on the fluid being conveyed for its lubrication.

5.7.4.1 Inlet/suction conditions (NPSH)

To ensure fault-free continuous operation, the inlet and suction conditions of the plant must be appropriately adjusted to the pump demand (NPSH_{req.})

The service condition is fulfilled when the plant NPSH value (NPSH_{avail.}) is above the pump NPSH (NPSH_{req.}). The NPSH_{req.} is given in the characteristic sheets of the respective pumps

ATTENTION When pumping air-laden or volatile liquids, particular attention must be paid to the NPSH requirements of the plant.

5.7.5 Stop valves

Stop valves are to be installed in the suction and pressure pipelines close to the pump.

5.7.6 Pressure-relief valve

See Section 4.

5.7.7 Check valve

It is recommended to install a check valve between the pressure connection of the pump and the stop valve in order to prevent the pump from running dry when it is at a standstill and the pressure stop valve is open.

5.7.8 Vent valve

A vent valve must be provided at the highest point in the pressure pipeline.

5.7.9 Filtering

To protect the pump against coarse dirt contamination, we recommend as a matter of principle installing a filter in the suction pipeline, mesh width 0.6 mm.

Note: The service life of the pump is decisively influenced by the degree of dirt contamination of the fluid being conveyed, that is, by the number, size and hardness of the abrasive components.

5.7.10 Quench receiver

In complete pump aggregates the quench receiver is attached to the base plate and the inlet and outlet lines are connected to the pump cover.

If the quench receiver is supplied loose ex works, it must be installed at the installation location of the pump aggregate.

5.7.11 Auxiliary pipelines

All auxiliary pipelines for heating and quenching must be connected tension-free and sealing, as per the installation diagram.

5.8 Safety and control devices**5.8.1 Manometers**

Suitable pressure gauges are to be installed in the inlet and pressure pipelines, and in the pressurized auxiliary pipelines.

5.8.2 Safety device in the pressure pipeline

For pumps delivered without a pressure-relief valve, an overload protection must be provided in the control, or a pressure-relief valve (return valve) in the pressure pipeline (see separate Operating Instructions).

5.9 Electrical connections

The power supply cables of the coupled drive motor must be connected by a trained electrician, according to the motor manufacturer's circuit diagram. The applicable VDE regulations and local power company rules must be observed.

Danger from electrical energy must be eliminated.

6 Start-up/Shutdown

6.1 Preparation for start-up

6.1.1 Filling the pump with fluid

ATTENTION Prior to initial operation, the screw pump must be filled with fluid and bled. This at the same time provides the spindles with the sealing required for suction.

The pump must not run dry.

ATTENTION Before filling, the operator must ensure careful and thorough rinsing of the pump if the fluid to be conveyed is not chemically compatible with the test medium (see performance test report).

The fluid is filled through a bore hole in the pump casing or via the pressure pipeline. The pump must be filled with fluid until the fluid emerges free from air.

In the case of immersion pump aggregates the filling level must ensure adequate covering of the inlet rim before and during operation.



During bleeding of the pump and the plant, hazardous or environmentally harmful fluid and gas emerging must be safely collected and discharged.

6.1.2 Control of drive motor direction of rotation

The direction of rotation of the motor must match the direction of rotation arrow on the pump. The motor can be briefly switched on with the suction and pressure valves open to check the direction of rotation. If the direction of rotation is wrong there is no pump suction. This damages the pump. The direction of rotation of the three-phase motor can be reversed by swapping any two phases.

ATTENTION If the direction of rotation is to be checked before the pump is filled with fluid, the drive motor must be disconnected from the pump. The pump must not run dry.

6.1.3 Switching on any auxiliary devices

Before switching on the pump, any additional devices (e.g. heating, cooling, quench system, pressure relief system) must be set in operation and must have reached the necessary flow/temperature and pressure values.

Note: Ensure that flow/temperature and pressure values are in accordance with the order data sheet or manufacturer's operating instructions!



General pressure and temperature limits of heating/cooling/quench with steam:

Casing with heating jacket:

Steam pressure 18 bar
Steam temperature 210 °C

Casing with heating cover:

Steam pressure 18 bar
Steam temperature 210 °C

Casing with heating cartridge:

Steam pressure 18 bar
Steam temperature 210 °C

Shaft seal chamber:

Steam pressure 2 bar
Steam temperature 120 °C

Quench chamber:

Steam pressure 2 bar
Steam temperature 120 °C

6.2 Start-up

6.2.1 Starting

1. Prior to starting, the stop valves in the suction and pressure pipelines must be completely opened.

2. Where the pump is fitted with a pressure-relief valve, it is set on our test panel to respond 10% above the operating pressure. The opening pressure can be altered within narrow limits by means of an adjusting screw. The installation of a pressure-relief valve is always required when an impermissible pressure rise is possible, due to a stop device or throttle point in the pressure pipeline for example. If the pressure-relief valve has a hand-wheel regulation, the pump can be started at zero pressure. For this, the pressure-relief valve must be completely opened using the hand-wheel. The starting torque of the motor is thereby reduced.

ATTENTION When starting and stopping the pump under pressure, make sure that the speed- and viscosity-dependent pressure load is not exceeded.

If this is not ensured, the pump must be started and stopped at zero pressure. This also applies to pumps with speed-controlled drive motors.

3. During starting, a vent valve installed on the outlet side of the plant must be opened until the air has escaped from the suction side of the pump. As soon as fluid emerges the vent valve can be closed. The pump is self-priming and is automatically vented without counter-pressure.

4. The fluid level in the tank must be checked. It must be ensured that, when the plant is running, the fluid level in the tank does not fall below the minimum limit. Top up fluid as necessary.

6.2.2 Drive

Switch on the motor.

Pay attention to product-specific characteristics. Refer to the operating instructions of the drive motor manufacturer.

6.2.3 Checking the delivery values

When the motor has reached its operating speed, the inlet pressure and outlet pressure of the pump must be checked using manometers.

For pumps fitted with a hand-regulated pressure-relief valve, the hand-wheel must be closed slowly beforehand, until the pump outlet pressure is reached.

The motor must not be overloaded. The current consumption can be checked with an ammeter. In this connection, the temperature and viscosity of the fluid must also be checked. The readings must be checked against the layout or acceptance test report.

ATTENTION If there should be an inadmissible increase in pressure, mounted pressure-relief valves may shift the media from the discharge to the intake side (recirculation).

Recirculation leads to heating up of the medium. An inadmissible pressure and temperature increase can be indicated by a pressure gauge and a thermometer. Determine the cause immediately and eliminate it in order to avoid damage to the pump as the result of excessive heating up and the related drop in viscosity.

ATTENTION At no time may the permitted maximum temperature be exceeded. Sudden temperature changes are to be avoided. Within the permitted operating temperature range, the temperature gradient may not exceed 2°C/min.

6.3 Shutdown

6.3.1 Stopping and interrupting operation

1. Switch off the motor. Make sure the pump runs down smoothly and evenly.
2. If a check valve is installed in the pressure pipeline, the stop valve can remain open. If no check valve is fitted, the stop valve must be closed.
3. Stop any additional devices that are present (e.g. heating, cooling, quench system, etc.).

6.3.2 Measures in case of prolonged interruption

If a prolonged interruption is intended, the pump must be drained thoroughly via the connections on the pump casing. We recommend removing cartridge-unit pumps and immersion pumps from the tank or the plant.



Safe draining and environmentally compatible disposal of the fluid must be ensured. Preservative should then be applied to the pump (see Section 3.3).

7 Maintenance/Repair

7.1 Maintenance

- The instructions in Section 2, *Safety*, must be observed in maintenance and repair work.
- Regular monitoring and maintenance of the pump and the drive motor are essential for optimum service life and safety.

7.1.1 General monitoring

1. The pump must not run dry.
2. The drive motor must not be overloaded.
3. The suction and pressure pipelines must be checked for leaks. Air must be prevented from entering the delivery system.
4. The shaft seal must have no inadmissible leakage.
5. Changes to the normal operating data may indicate faults. The causes must be established.
6. Installed standby pumps must be started up once a week.
7. Any additional devices on the pump/shaft seal must be operated and monitored in accordance with regulations.

7.1.2 Maintenance of components

7.1.2.1 Bearing

The bearing is designed for a service life of approx. 24,000 hours under normal operating conditions. The actual usable life may be lower, due to intermittent operation, high temperature, low viscosity or the like. The running noises and the temperature in the bearing area must be checked at regular intervals. We recommend monitoring bearings by means of shock pulse measurements. If damage to a bearing is detected, the bearing must be replaced.



The bearing area can become very hot.

Risk of burning if touched!

As a precautionary measure, we recommend that the groove ball bearing is replaced every 2 years.

Pumps with special design feature "KB" and "LB" are fitted with a greasable groove ball bearing. The groove ball bearing and the bearing area in the bearing cover are adequately charged with grease at the factory. This groove ball bearing must be subsequently greased in accordance with the intervals below.

Rolling bearing greases

For the lubrication of the groove ball bearing, we recommend to use the below-listed rolling 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 Energrelase 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

In case of temperatures of the liquid pumped over 150 °C, the below-listed rolling bearing grease is to be used to increase the operating safety of the pump.

Producer	Brand name	Designation to DIN 51825
Klüber ①	AMBLYGON TA30/2	K2P-20

① Producer: KLÜBER, LUBRICATION MÜNCHEN KG
Geisenhausenerstr. 7
81379 München
Germany

If none of the listed rolling bearing greases is available, we recommend in any case a multi-purpose grease on lithium basis which corresponds to the above DIN designation.

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

Relubrication period

The relubrication period depends on the temperature of the pumped liquid and pump speed.

Temperat. of pumped liquid	Pump speed	every ... hours	at least every... month
< 100 °C	1450/1750 min ⁻¹	6000 h	6
	2900/3500 min ⁻¹	4000 h	4
> 100 bis 150 °C	1450/1750 min ⁻¹	2000 h	3
	2900/3500 min ⁻¹	700 h	1
> 150 °C	1450/1750 min ⁻¹	1200 h	2
	2900/3500 min ⁻¹	400 h	1

Grease quantity

The table below shows the allocation of the pump size to the groove ball bearing size with the grease filling in grams.

Pump size	Groove ball bearing Abbreviation	Grease quantity in grams
40	6304 J C3	8
80	6304 J C3	8
120	6305 J C3	12
210	6306 J C3	16
280	6307 J C3	18
440	6308 J C3	22
660	6309 J C3	30
940	6310 J C3	35
1300	6311 J C3	45
1700	6312 J C3	50
2200	6313 J C3	55
2900	6317 J C3	90
3600	6317 J C3	90
5300	3318 J	140

Relubrication

Relubrication is effected by means of a grease gun through the lubricating nipple (50) screwed in the bearing cover.

Relubrication must be continued for such a period of time until the old grease is displaced and fresh grease emerges at the groove ball bearing.

Horizontal foot pumps are fastened on a base plate with the coupled driving motor can be relubricated with the pump running.

Flange-mounted, cartridge-unit and plinth-mounted pumps with flange-connected fastening lantern can only be relubricated during standstill. For these purposes, the protection against accidental contact must be removed.

7.1.2.2 Shaft seal

Increased leakages, if any, at the stuffing box during the first operating hours normally disappear automatically during the running-in time. If necessary, slightly tighten hexagon nuts (39) at the gland (9).

See to it that the stuffing box must be slightly dripping. Thus, the frictional heat generated at the sealing surface is dissipated.

If leakage losses increase excessively and if even repeated slight tightening of the hexagon nuts (39) does not result in any leakage reduction, the packing rings have lost their elasticity of shape and must be replaced.



A defective shaft seal can cause uncontrolled discharge of pumping liquid.

This constitutes a hazard to people (possibility of spraying liquid) and to the environment!

7.1.2.3 Pressure-relief valve

Pressure-relief valves must be checked from time to time, in particular after prolonged downtimes, for passage and functioning. Leaking pressure-relief valves may cause damage to the pump. Damaged parts should be replaced or repaired as necessary.

7.1.2.4 Coupling

The alignment of the coupling and the condition of the flexible elements in the coupling should be checked after initial start-up and at regular intervals.

Note: Worn flexible elements must be replaced.

7.1.2.5 Drive

Refer to the operating instructions of the motor manufacturer.

7.2 Repair**General**

The system operator is responsible for ensuring that instruction in safety is provided. The personnel must be made aware of all hazards that can arise in connection with the pumped liquid or the plant.

Mounting and repair work

Trained Service fitters are available on request to carry out mounting and repair work.



For all repairs, it must be ensured that the pump is depressurised, completely drained and cool. The motor must be protected against unintended switching on. We must refuse acceptance of repair work on pumps filled with fluid, for the protection of our staff and for environmental reasons. The expenditures for disposal with respect to the environment are to be carry by the customer/operating company.

Hazardous substances

Where repairs are to be carried out on pumps which have been operated with hazardous substances ^① and/or environmentally harmful media, the customer/operator must inform its own personnel on site, or our personnel where repairs are returned to our factory or a service workshop, without being specifically requested to do so.

Together with the request for a Service fitter a verification of delivery material, for example in the form of a DIN safety data sheet, must be submitted to us. Alternatively, you can request a certificate of safety (form no. 448/191) from our Service department, filling it out truthfully, correctly and in full. Send the completed form to the center commissioned with carrying out the repair, or hand it to our Service fitter.

① Hazardous substances are:

- Toxic substances
- Health-endangering substances
- Corrosive substances
- Irritants
- Explosive substances
- Fire-inducing substances
- Highly flammable, easily flammable and normally flammable substances
- Carcinogenic substances
- Substances impairing fertility
- Genetically distorting substances
- Substances in other ways hazardous to humans



Pumps or units which pump hazardous substances or substances that are dangerous to the environment must be completely decontaminated.

7.2.1 Dismounting the screw pump

Before dismounting, the following work must be carried out:



- The power supply cable must be disconnected from the motor by an authorized electrician. Electrical danger must be eliminated! The motor must be secured against being switched on.
- Close all stop devices in the inlet and delivery pipeline, and in the auxiliary pipelines.
- Drain the fluid in flowable condition from the pump.
Note: Use a collecting tank.



- Hazardous substances and/or environmentally harmful media must be drained off and collected such that no danger to life and limb is created. Environmentally compatible disposal must be ensured.
- The pump and any auxiliary systems must be depressurized and drained.
- Allow the pump and motor to cool to ambient temperature.
- Remove the manometer cables, manometers and retaining brackets.
- Remove the contact protection.
- Remove the motor from the base plate or pump bracket where appropriate.
Note: Use suitable lifting gear.
- Remove immersion pump aggregates from the tank.
- Remove supply/suction and pressure pipelines as appropriate.
- Dismount auxiliary pipelines, if any.
- Loosen the fastening and remove the pump from the base plate or pump bracket.
Note: Use suitable lifting gear.



The pump must be dismantled by a qualified technician using the pertaining drawings.

To prevent damage, it is especially important to ensure that the components are dismantled concentrically and that they are not tilted.

Dismounting instructions:

- The fitting position of all components must be accurately marked before dismounting.

7.2.2 Mounting the screw pump



Before remounting check all parts for wear and aging and, as necessary, replace with **original replacement parts.**

Clean all parts before mounting. Always fit new gaskets.



The pump must be mounted by a qualified technician using the pertaining drawings. The prescribed tightening torque must be observed.

To prevent damage, it is especially important to ensure that the components are mounted concentrically and that they are not tilted.

Mounting instructions:

- The markings applied when dismounting must be observed. The components must be put back in their original fitting position.
- After tightening the screws it must be possible to turn the pump by hand without straining points.

7.2.3 Tightening torque

Note: With poor and lightly greased surfaces, the values must be increased by 10–15%, in order to reach the required performance.

Thread	Quality	Tightening torque [Nm]
M 4	5.6	1,1
M 6		3,9
M 8		9,8
M 10		18,6
M 12		32,3
M 16		78,4
M 20		156,8
M 24		289,1
M 27		426,3
M 30		578,2
M 4	8.8	2,5
M 6		8,8
M 8		21,6
M 10		43,1
M 12		73,5
M 16		181,3
M 20		352,8
M 24		661,5
M 27		975,1
M 30		1323,0

When the screw pump has been mounted the following work must be carried out:

- Align coupling if necessary (see Section 5.4).
- Attach supply/suction and pressure pipelines.
- Attach auxiliary pipelines of the additional devices, if any.
- Attach manometer lines, manometers and brackets to pump.
- Install immersion pump aggregate in the tank.
- Attach contact protection.



- The power supply cable must be connected to the motor by an authorized electrician. Electrical danger must be eliminated! Pay attention to direction of rotation.
- Fill pump with fluid.

Start up pump as per instructions in Section 6.

7.3 Replacement parts/spare parts

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

The drive spindle (12) and idler spindles (13) are available only as a complete spindle set.

However, for operational safety reasons, we recommend you always stock a complete cartridge–unit or standby pump.

The advantage is that in the event of a fault or damage the standby unit can replace the non–functioning unit quickly and without great effort.

When ordering spare and replacement parts, besides the **part number**, **denomination** and **quantity**, the following should also be quoted:

**Pump abbreviation,
Pump number,
Year of construction.**

This information is engraved on the name plate of the pump.

8 Störungen, Ursachen und deren Beseitigung

8.1 Störungen mit Hinweis-Nummer für Ursache und Beseitigung

Die nachfolgende tabellarische Übersicht ist als Anleitung für eventuell auftretende Störungen und deren mögliche Ursachen anzusehen. Störungen, die dem Druckbegrenzungsventil zugeordnet werden können, sind gesondert aufgeführt.

Treten Störungen auf, die hier nicht genannt sind oder sich nicht auf die angegebenen Ursachen zurückführen lassen, empfehlen wir Rückfrage im Werk, bei unseren Zweigstellen oder unseren Verkaufsbüros.



Bei der Beseitigung von Störungen muss die Pumpe drucklos und entleert sein.

Screw pump faults	Reference numbers for cause and remedial action
No pump suction and no delivery	1, 2, 3, 4, 5, 11
Delivery too low	2, 6, 7, 8, 9, 10, 11
Pump operates noisily	4, 5, 6, 7, 8, 10, 11, 12, 13
Irregular delivery	6, 7, 10
Pump gets too warm	6, 7, 11, 14, 16
Pump is seized	14, 15, 16
Motor overload	6, 13, 14, 15, 16
Pressure-relief valve faults	Reference numbers for cause and remedial action
Delivery pressure drops	17
Pressure-relief valve does not open	18
Pressure-relief valve does not close	19
Pressure-relief valve knocks	20

8.2 Causes and remedial action

Ref. no.:	Cause	Remedial action
1	Pump not filled with fluid before initial operation.	Fill pump with fluid.
2	Stop valves/sliders not open or only partially open.	Fully open stop valves/sliders during operation.
3	Motor direction of rotation wrong.	The direction of rotation of the motor must match the direction of rotation arrow on the pump. The direction of rotation can be reversed by swapping any two phases.
4	Suction pipeline or shaft seal leaky.	Retighten flange screw connections. Check shaft seal.
5	Air in suction and pressure system.	Open vent valve on pump pressure side until air has escaped. Close valve again.
6	Wrong fluid viscosity.	Check that viscosity matches entries in acceptance test report. In case of zero-pressure delivery of low-viscosity fluids, apply 1 to 2 bar to pump.
7	Pressure-relief valve leaking.	Check pressure-relief valve for passage. If necessary, regrind valve seat and/or exchange valve cone.
8	Geodetic suction head too high.	Check underpressure on suction side using connected pressure/vacuum gauge. Increase fluid level in tank, lower pump.
9	Motor speed too low.	Check speed and current consumption of motor. Check voltage and frequency against motor rating plate.
10	Air separating time in operating tank too short.	Provide better air separation in operating tank. Return lines must emerge below oil level of tank.
11	Fluid level in tank too low.	Fill tank to necessary fluid level.

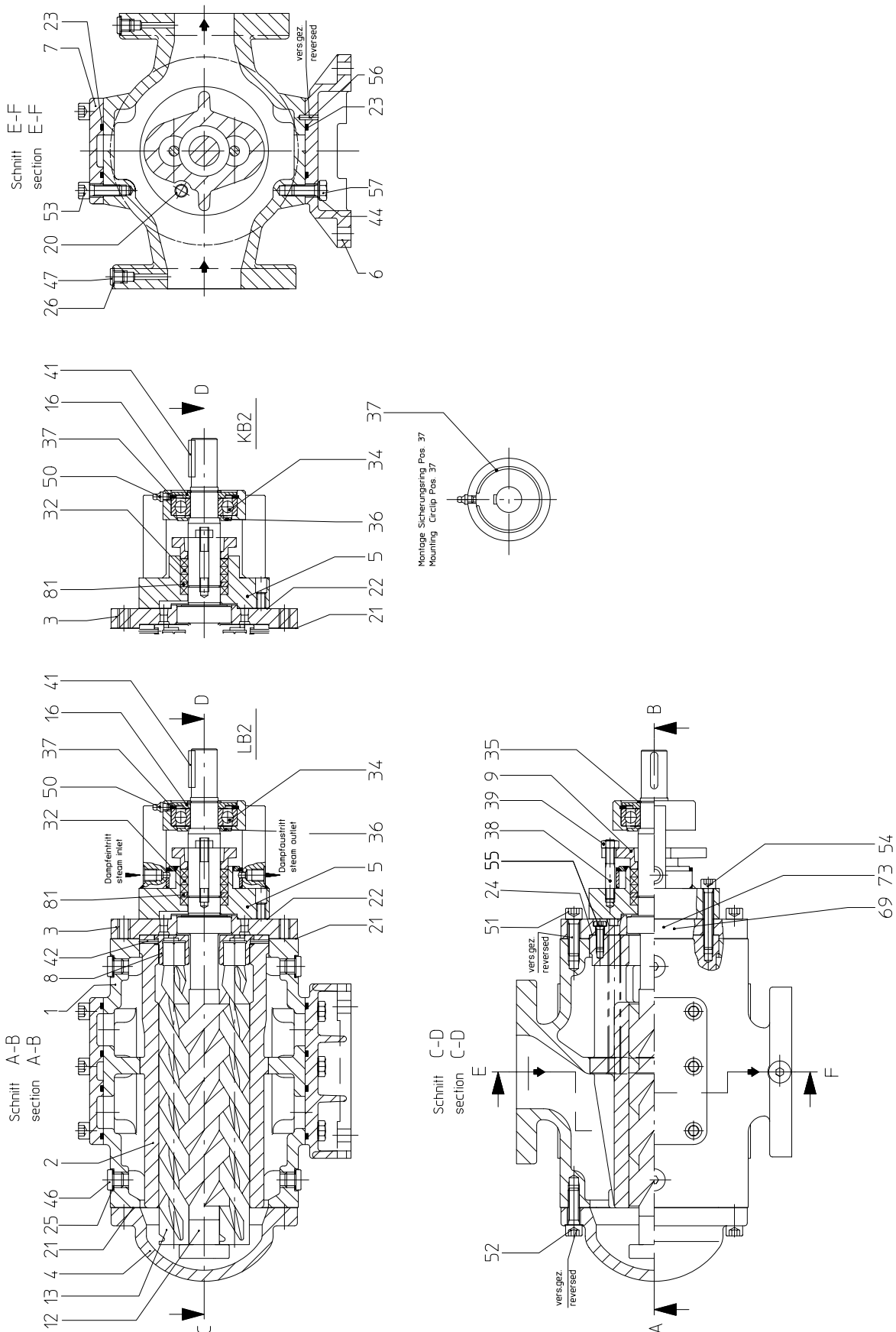
12	Flow rate in suction and pressure pipelines too high.	Flow rate in suction pipeline must not exceed max. 1 m/s, and in pressure pipeline max. 3 m/s.
13	Motor speed too high.	Check speed and current consumption. Check voltage and frequency against motor rating plate.
14	Delivery pressure too high.	Set specified delivery pressure via pressure-relief valve. Pump outlet pressure must not be exceeded.
15	Foreign bodies in pump.	Dismantle pump, remove foreign bodies and smooth damaged points with oilstone. Check suction filter and strainer.
16	Damaged ball bearing.	Replace ball bearing.
17	Pressure spring fatigued.	Install new pressure spring.
	Valve seat leaking.	Install new valve cone.
18	Pressure spring heavily pre-tensioned.	Release pressure spring using adjusting screw, and reset to required pressure.
	Valve cone stuck in valve housing.	Dismantle pressure-relief valve. Clean internal parts.
	a) Due to foreign body or b) Operating temperature of plant substantially higher than quoted on order.	Consult factory.
19	Pressure spring not pre-tensioned, or insufficiently pre-tensioned.	Turn adjusting screw to right until required operating pressure is reached.
	Valve seat leaking.	Rework or replace valve cone and valve housing.
20	Pressure-relief valve knocking.	Check overpressure with pressure valve closed. Reset valve. Opening pressure 10 % above operating pressure.

9 Associated Documentation (examples of execution)

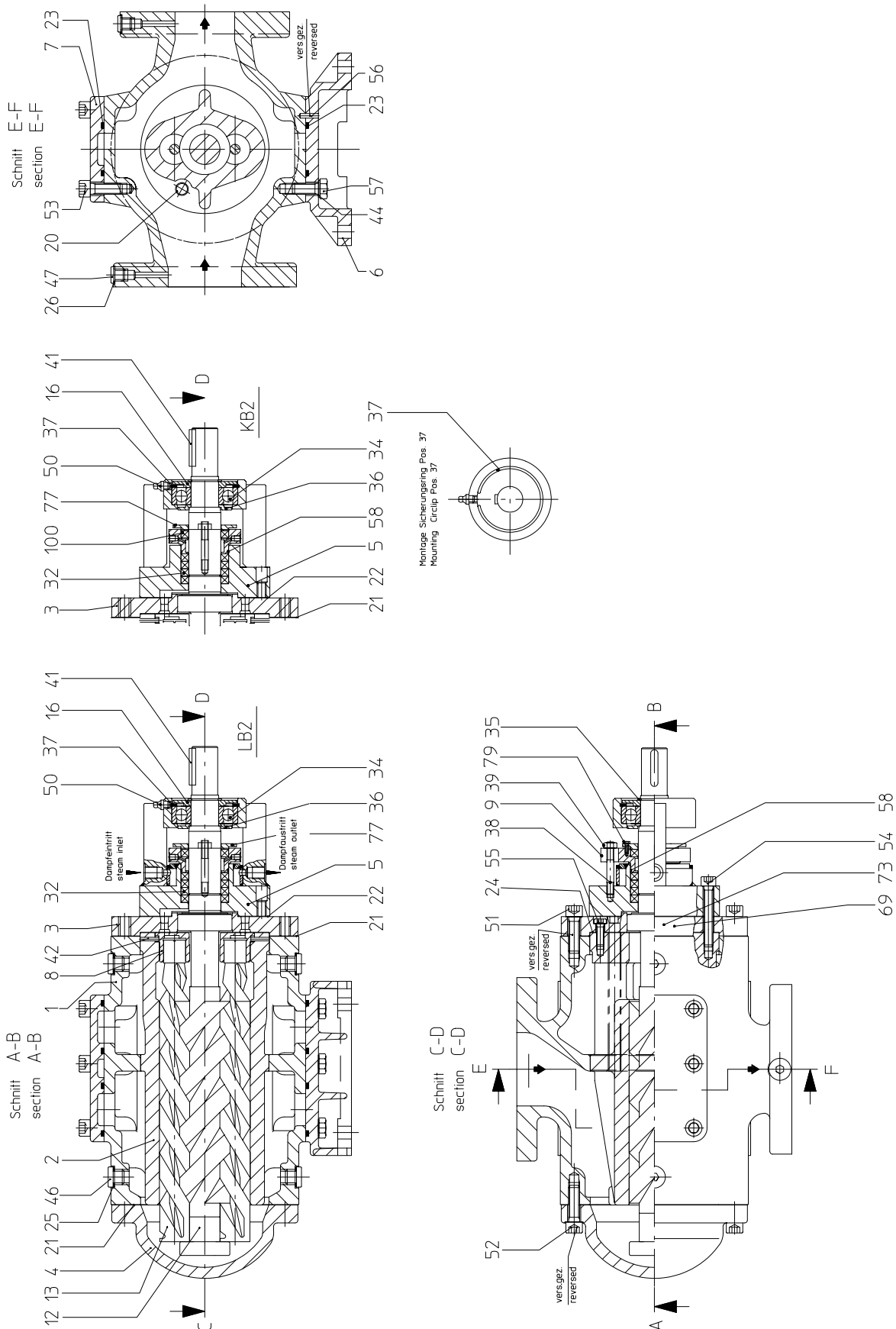
Note: The precise execution is shown in the order-specific sectional drawing.

9.1 Sectional drawing 651 0007 342

Design KB2 and LB2



9.2 Sectional drawing 651 0007 429
Design KB2 QA and LB2 QA



9.3 Order-specific Documentation

These operating instructions are supplemented by the following documents:

	Acceptance of order	No.
	Data sheet	No.
	Installation drawing	No.
	Sectional drawing	No.
	Part list	No.

Subject to technical alterations.



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