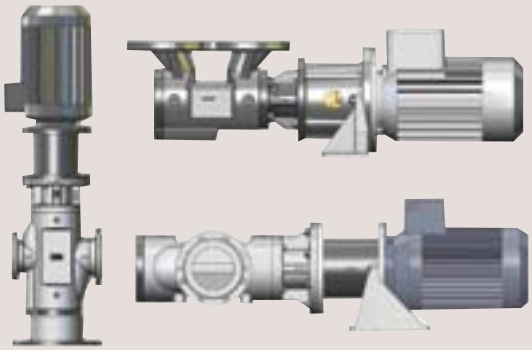
Instruction Manual

Alfa Laval Three-Screw Pumps with Magnetic Coupling - 3S Series



ESE02461-EN1 2013-05

Original manual

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The information herein is correct at the time of issue but may be subject to change without prior notice

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1 EC Declaration of conformity

The designated company

Alfa Laval
Company Name

Albuen 31, DK-6000 Kolding, Denmark
Address

+45 79 32 22 00
Phone No.

hereby declare that

Three-Screw Pump	3S	2013-05-01
Denomination	Type	Year

Is in conformity with
- Machinery Directive 2006/42/EC

and futhermore declares that if motorised the following applicable directives have been used
- Directive 2006/95/EC on low voltage
- EMC Directive 2004/108/EC

The technical construction file for this machinery has been drawn up. The signer of this declaration is authorized to compile the technical file.

Manager, Product Center Fluid Handling	Bjarne Søndergaard
Title	Name
Alfa Laval Kolding	
Company	Signature

2 Safety

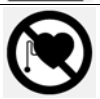
2.1 Generel information

The operating instructions form part of the pump/pump unit and must be kept for future reference. Furthermore please observe the associated documents.

2.2 Target groups

Target groups	Tasks
Operator - owner	- Keep these instructions available at the system site for future reference. - Ensure that employees read and observe these instructions and the associated documents, in particular the safety instructions and warnings. - Observe additional system - specific directives and regulations.
Specialist personnel, fitters	- Read, observe and follow these instructions and the associated documents, in particular the safety instructions and warnings.

2.3 Symbols

Symbol	Meaning
	Warning personal injury
	Notice
	Procedures mechanical installation
	Procedures electrical installation
	Chek or fault table
	Safety instructions for persons with pacemakers
▶	Request for action

2.4 Danger levels

Warning	Danger level	Consequences of non-observances	
	DANGER	Immediate threat of danger	Serious personal injury, death
	WARNING	Possible threat of danger	Serious personal injury, invalidity
	CAUTION	Potentially dangerous situation	Slight personal injury
	CAUTION	Potentially dangerous situation	Material damage

2.5 Proper use

- Use the pump solely for transporting lubricating liquids that are chemically neutral and that contain no gas or solid components.
- Use the pump only within the operating limits specified on the name plate and in the Chapter "Technical data". In the case of operating data that does not agree with the specifications on the name plate, please contact the manufacturer.
- The pump is designed specially for the operating pressure named by the customer. If the actual operating pressure deviates notably from this design pressure, damage can also arise within the specified operating limits. This applies both to notably higher as well as to notably lower operating pressures. Under no circumstances should the operating pressure drop below the minimum pressure of 2 bars. In case of any doubt, please contact the manufacturer.

2.6 Safety information

The following general safety instructions must be observed:
- No liability is accepted for damage arising through non-observance of the operating instructions. A. Read the operating instructions carefully and observe them. B. The operator-owner is responsible for the observance of the operating instructions. C. Installation, removal and installation work may only be carried out by specialist personnel. - In order for the warranty to remain valid, corrective maintenance carried out during the warranty period requires the express permission of the manufacturer. - Observe the general regulations for the prevention of accidents as well as the local safety and operating instructions. - Observe the valid national and international standards and specifications of the installation location. - In case of systems with an increased potential of danger to humans and/or machines the failure of a pump may not lead to injuries or damage to property. A. Always equip systems with an increased potential of danger with alarm equipment. B. Maintain and check the protective/alarm equipment regularly. - The pumped liquids can be dangerous (e.g. hot, dangerous to health, poisonous, combustible). Observe the safety regulations for handling dangerous materials. - Pumped liquids can be subject to high pressure and can cause damage and/or personal injury should leaks occur.

Safety instructions for magnetic coupling systems

Magnetic fields from magnetic coupling systems (MCS) can influence the function and operational safety of electrical and electronic devices. The following safety instructions must be observed:

Additional safety instructions for magnetic coupling systems:
- Keep the MCS away from pacemakers. There is a danger to life! A. Under no circumstances may persons with pacemakers perform installation, dismantling or maintenance work. - Persons with pacemakers must comply with the following safe distances to the MCS: A. 3 m distance to the openly accessible MCS. B. 1 m distance to pump units with installed MCS. - Do not bring the MCS in the immediate area of PCs, data carriers and other electronic components. - Keep the MCS away from clocks, magnetized tools and measuring equipment as well as all magnetizable parts. - Do not bring both the MCS parts together, as this can destroy the magnetic coupling system.

3 Installation

3.1 Unpacking and checking the state of delivery

1. On delivery unpack the pump/pump unit and check for damage during transportation.
2. Report damage during transportation immediately to the manufacturer.
3. Dispose of packing material in accordance with the locally applicable regulations.

3.2 Lifting the pump/pump unit

Fig. 1 Fastening hoisting equipment – Principle diagrams

DANGER Risk of injury and/or damage to equipment should the pump/pump unit fall.
▶ Use intact and correctly dimensioned hoisting equipment. ▶ Attach the hoisting equipment correspondingly. ▶ Secure motors additionally against tilting. ▶ Do not stand under raised loads.

Pump

1. Screw eye bolts into two opposing holes at the flange cover, see Fig. 1, page 8.
2. Hang the slinging devices into the eye bolts.
3. Hang the crane hook into the slinging devices and lift the pump.

Pump unit

1. Model 3SBI: Fasten the slinging devices at the pump unit at an angle between 60° and 90°, see Fig. 1, page 8. Ensure that the center of gravity of the pump unit lies between and below the attachment points. If this is not possible, take other suitable measures to prevent the pump unit from tilting.
   Model 3SVI: Sling the slinging devices around the pump bracket, see Fig. 1, page 8.
2. Secure the slinging devices against slipping, for example through screwed-in eye bolts.
3. Hang the crane hook into the slinging devices and lift the pump unit.

3.3 Storage

During the test run, the internal components of the pump are wetted with test oil, which has a preservative effect. The pipe connections are fitted with protective caps. Unless otherwise specified, the external components of the pump are preserved with a single-coat PU-based two-component paint. The preservative applied at the factory will protect the pump for about six weeks, if it is stored in a dry and clean location. The manufacturer offers a long-term preservation for storage times of up to 60 months. The pump is additionally packed in hermetically sealing anti-corrosion paper.

3.4 Preservation

Preservation has to be carried out additionally under the following conditions:

Type of delivery	Condition
Standard delivery	- Storage time exceeding six weeks - Unfavorable storage conditions such as high humidity, salty air, etc.
Delivery with long-term preservation	- Opened or damaged packaging

Tab. 1 - Check table for preservation

3 Installation

Preserving the internal surfaces of the pump

1. Close the suction connection of the pump with a blind flange.
2. Pour non-corrosive, resin-free oil into the pressure connection until it reaches approx. 2 cm under the pressure flange, while slowly turning the main screw against the direction of rotation.
3. Close the pressure connection of the pump with a blind flange.
   After about six months storage check the oil level and if necessary top up oil.

Preserving the external surfaces of the pump

Aids:

- Preservative (e.g. Castrol Rustilo DWX 33)

▶ Paint or spray the preservative onto all plain and unpainted parts.
At intervals of about six months check the preservation and if necessary repeat.

NOTE

Store the preserved pump cool and dry and protect it against direct sunlight.

Removing the preservation

Aids:

- Solvent

- Steam-jet cleaning device with wax-dissolving additives

CAUTION Risk of injury through emitted preservative oil.
▶ Wear protective clothing during all the work. ▶ Open the blind flange carefully in order to reduce any pressure that may exist in the pump. ▶ Collect the emitted preservative oil safely and dispose of it in an environmentally compatible manner.

1. Clean the outside of the pump with solvents, if necessary using a steam-jet cleaning device.
2. Remove the blind flange on the pressure side.
3. Drain the pump, collecting the preservative oil in a suitable vessel.
4. Remove the blind flange on the suction side.
5. To remove the residual oil, rinse the pump with the pumped liquid.

3.5 Disposing of the pump

Aids:

- Solvents or industrial cleaners suitable for the pumped liquid.

WARNING Danger of poisoning and environmental damage from the pumped liquid.
▶ Wear protective clothing during all the work. ▶ Before disposing collect the discharging pumped liquid and dispose of in accordance with the locally applicable regulations. ▶ Before disposing neutralize the residues of the pumped liquid.

1. Disassemble the pump.
2. Clean residues of the pumped liquid from the individual parts.
3. Separate sealing elements made of elastomers and ceramics (SiC) from the pump and dispose of them in the residual waste.
4. Recycle iron parts.

Safety instruction on installation, removal and connection

The following safety instruction must be observed during installation, removal and connection work:
▶ There is a risk of death for people with pacemakers. ▶ Under no circumstances may persons with pacemakers perform installation, removal or connection work.

3 Installation

3.6 Installation

Observe the following instructions:
- When selecting the location take the operating limits, NPSH values and ambient conditions into account, see "Technical data". - The function, safety and service life may not be impaired by humidity, temperature influences or explosive atmospheres. - During the installation ensure that all the parts can be accessed easily and that the maintenance work can be carried out easily.

Installing the pump

Screw pumps can be operated in any installation position. However, the manufacturer recommends that the pump not be mounted above the motor since pumped liquid can ingress the motor if a leak occurs.

Prerequisite:

- The pump connections are to be protected against contamination, for example by using the protective cover mounted in the factory.

CAUTION Leaking pumped liquid can damage the motor.
▶ Do not mount the pump above the motor.

CAUTION Damage to the pump and piping through insufficient fastening.
▶ Only fasten the pump on a stable bearing underground. ▶ Ensure that the fastening elements are fastened sufficiently.

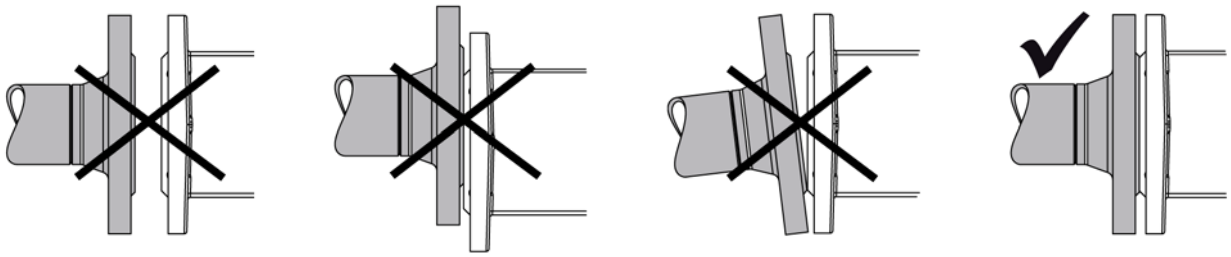
1. Place the pump in position, while ensuring that the flow direction that is marked by arrows on the flanges is correct, see Fig. 2, page 20.
2. Fasten the pump with fastening elements securely on the underground.

Protect the pump against contamination

CAUTION Damage through impurities in the pipe system.
▶ During welding work attach protective covers in front of the connecting flanges. ▶ Ensure when welding that welding beads and abrasive dust cannot get into the pipe system and the pump.

▶ After the connecting work clean the pipe system thoroughly, see "Cleaning the pipe system", page 18.

Connecting the pump to the pipe system



CAUTION Danger of damage to the device or impaired functionality through mechanical stresses.
▶ Ensure that the pump mounting on the pipe system is free of mechanical stress.

1. Turn the pump shaft or fan impeller of the motor so that smooth running of the pump is checked. If the pump cannot be turned by hand, remedy the fault before installing the pump, see "Troubleshooting".
2. During welding work attach protective covers in front of the connecting flanges.
3. Place the piping in position and support the weight of the piping.
4. Check the linear, lateral and angular offset and correct if necessary.
   If the screws tighten easily, this is a sure sign that the installation is stress-free.
5. Tighten the connecting screws in an alternating fashion with torque, see Tab. 9, page 42.

3.7 Connecting the motor

WARNING Risk of death resulting from electric shock.
▶ The motor may only be connected by anauthorized electrician. ▶ Ensure that the power supply is de-energized. ▶ Ground the pump carefully.

1. Observe the operating instructions of the motor.
2. Ensure that the operating data on the rating plate of the motor agree with the operating data of the pump and with the local power supply.
3. Connect the motor in the motor terminal block in accordance with the circuit diagram.

3.8 Removing the pump

Aids:

- Vessel to collect pumped liquid

3 Installation

DANGER Risk of death resulting from electric shock.
▶ Ensure that the power supply is de-energized. ▶ The motor may only be separated from the power supply by anauthorized electrician.

WARNING Risk of injury through emitted hot, poisonous or corrosive pumped liquid.
▶ Wear protective clothing during all the work. ▶ Before beginning work, let the pump cool down to the ambient temperature. ▶ Ensure that the pump is depressurized. ▶ Collect the pumped liquid safely and dispose of it in an environmentally compatible manner.

1. Disconnect the motor from the power supply and secure it against being switched back on.
2. Close the pressure-side and suction-side shut-off devices.
3. Empty the pump at the lower point using the draining plug. Collect the emitted pumped liquid in a suitable vessel.
4. Loosen the connecting flange.
5. Loosen the fastening of the pump unit on the foundation and dismantle the motor and pump bracket.

3.9 Heating system

The pumps can be equipped optionally with heating systems. The manufacturer recommends heating systems for high-viscosity liquids that do not flow sufficiently if not heated. This can result in excessive power consumption or to problems arising through cavitation or sealing.

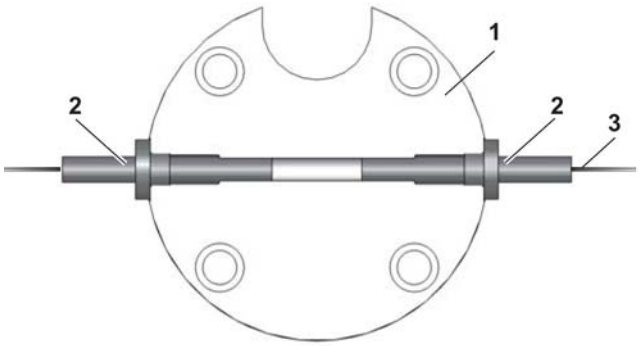
Method of heating:

- Electric heating system

- Fluid heating system

- Heating system special design

3.10 Electric heating system



1. Heating cover
2. Heating element
3. Connecting cable

Fig. 3 Electric heating system

The electric heating system consists of one or two heating elements 2 that are integratedin a heating cover 1 attached additionally to the end cover. The output of the cartridges corresponds to the radiation and convection losses of the pump in the required temperature range so that overheating is not possible.

Operating data:

- Voltage: 230 V

- Frequency: 50/60 Hz

- Wire cross-section: 2 x 1 mm²

Mounting the electric heating system

Scope of delivery:

Sizes 3S 5 – 118	Sizes 3S 160 – 2900
- 1 heating element - 1 heating cover - 4 socket screws	- 2 heating elements - 1 heating cover - 4 socket screws

Pay attention to the following when installing the heating element:
- Protect the area of the connecting head against liquid and pasty liquids (lubricants, oil, plastics, etc.) as well as their vapors, because leakage currents or flashovers otherwise occur at the emersion point of the supply line. - Protect the supply lines against mechanical vibrations in the area of the emersion from the heating element. Any vapors arising have to escape freely. - Store the heating element in an absolutely dry room or in hermetically sealed plastic bags. If the heating element has absorbed humidity, dry it for 8 hours in a drying furnace at 180°C.

1. Remove the socket screws and rating plate at the end cover of the pump.
2. Mount the heating cover to the end cover using the supplied socket screws.
3. Screw the heating element into the heating cover.
4. Mount the rating plate on the heating cover.

Connect and commission the electric heating system

Required heating-up period for temperature differences of 30°C or 50°C:

Size	Power consumption [W]	Heating-up period [min] at a temperature difference of 30°C	50°C
3S 5 – 42	1 x 100	20	35
3S 55 – 118	1 x 220	20	35
3S 160 – 275	2 x 180	25	45
3S 370 – 450	2 x 180	30	60
3S 550 – 660	2 x 250	45	75
3S 851 – 1301	2 x 250	60	90
3S 1500 – 1700	2 x 250	75	120
3S 2200 – 2900	2 x 250	90	150

Tab. 3 Heating-up period for electric heating system

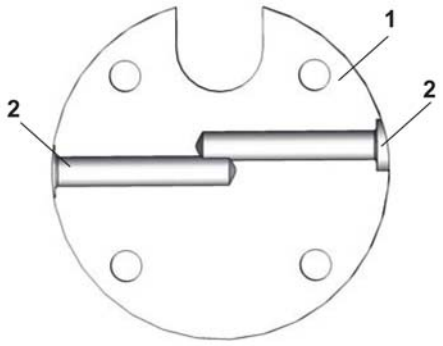
3 Installation

DANGER Risk of death resulting from electric shock.
▶ The electric heating system may only be connected by anauthorized electrician. ▶ Ensure that the power supply is de-energized during the connecting work.

WARNING Danger of the pump housing bursting and danger of injury through emitted pumped liquid through the heat expansion of the pumped liquid.
▶ Open all the valves during the heating process.

1. Connect the connecting cable of the heating element.
2. Switch on the electric heating system.

3.11 Fluid heating system



1 Heating cover
2 Pipe connections

Fig. 4 Fluid heating system

The fluid heating system consists of a heating cover **1** attached additionally to the end cover through which a heating liquid (e.g. vapor, thermal oil) flows.

Operating data:

- Maximum pressure: 16 bar

- Maximum liquid temperature: 200°C

Mounting the fluid heating system
Scope of delivery:

Sizes 3S 5 – 2900
- 1 heating cover - 4 socket screws

1. Remove the socket screws and rating plate at the end cover of the pump.
2. Mount the heating cover to the end cover using the supplied socket screws.
3. Mount the piping.
4. Mount the rating plate on the heating cover.

Commissioning the fluid heating system

Required heating-up period for the temperature difference of 50°C at a liquid temperature of 200°C:

Size	Heating-up period [min] at a temperature difference of 50°C
3S 5 – 118	20
3S 160 – 275	45
3S 370 – 450	60
3S 550 – 660	90
3S 851 – 1301	120
3S 1500 – 1700	150
3S 2200 – 2900	180

Tab. 4 Heating-up period for fluid heating system.

WARNING
Danger of the pump housing bursting and danger of injury through emitted pumped liquid through the heat expansion of the pumped liquid.

▶ Open all the valves during the heating process.

▶ Observe the permissible operating limits of the pump when setting the supplied mass flow and its temperature, see Tab. 3, page 34.

3.12 Heating system special design

Please contact the manufacturer for special designs.

4 Operation

4.1 Commissioning

The following safety instruction must be observed during commissioning:
▶ There is a risk of death for people with pacemakers.
▶ Under no circumstances may persons with pacemakers perform commissioning work.

Be sure to observe the following instructions:
▶ The pump may only be commissioned by authorized qualified personnel.
▶ Wear protective clothing during all the work.

Cleaning the pipe system

Clean the complete pipe system before commissioning in order to protect the pump. If this is to be realized by rinsing using the pump, an additional commissioning filter has to be installed before the pump.

Mesh width of the commissioning filter:

- Up to pump size 3S 275: 0.025 mm

- Above pump size 3S 275: 0.035 mm

CAUTION Damage to the device through additional pressure loss in the commissioning filter
▶ Calculate the flow resistance and determine the remaining pump intake.
▶ Monitor the suction-side pressure.
▶ Check and clean the commissioning filter regularly.

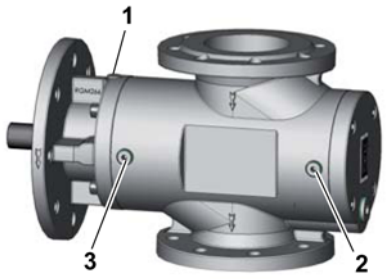
▶ Recommended rinsing duration with commissioning filter: 50 – 100 hours.

Filling the pump

There are two possible ways to fill the pump:

- via the suction or pressure connection

- via the vent holes



1. Coupling cavity vent hole
2. Pressure-side vent hole
3. Suction-side vent hole

Fig. 1 Vent holes

Filling the pump via the suction or pressure connection

WARNING Danger of injury or poisening through dangerous pumped liquids.
▶ Collect the emitted pumped liquid safely and dispose of it in an environmentally compatible manner

1. Open the vent hole **1** so that the air can escape during the filling process.
2. Open the suction- or pressure-side shut-off device and fill the pump via the suction or pressure connection until pumped liquid is emitted at the vent hole **1**.
3. During the filling process turn the pump shaft or the fan impeller of the motor by hand to speed up the filling process:
   Filling via suction connection: Turn the pump shaft in the direction of rotation of the motor.
   Filling via pressure connection: Turn the pump shaft against the direction of rotation of the motor.
4. Close the vent hole **1**.

Filling the pump via the vent hole

WARNING Danger of injury or poisoning through dangerous pumped liquids
▶ Collect the emitted pumped liquid safely and dispose of it in an environmentally compatible manner

1. Open the vent hole 1 so that the air can escape during the filling process.
2. Fill the pump via the pressure-side vent hole **2**.
3. During the filling process turn the pump shaft or the fan impeller of the motor by hand against the direction of rotation of the motor in order to speed up the filling process.
4. Close the pressure-side vent hole **2**.
5. Fill the coupling cavity of the pump via the vent hole **1** until the pumped liquid is emitted.
6. Close the vent hole **1**.

Checking the direction of rotation

The direction of rotation and the flow direction are indicated by arrows on the pump. The direction of rotation of the motor gives the direction of rotation of the pump. That is to say, the fan impeller of the motor must rotate in the direction in which the arrow on the pumpis pointing to indicate direction of rotation.

- Standard direction of rotation: Clockwise, viewed from the drive

4 Operation

1. Rotation-direction arrow
2. Arrow for flow direction

Fig. 2 Identifying direction of rotation and flow direction

CAUTION Dry running can damage pump equipment
▶ Ensure that the pump is filled properly. ▶ Switch the pump on for a maximum of 1 second and then off again immediately.

1. Switch on the power supply and then turn it off again immediately.
2. Compare the direction of rotation of the fan impeller with the arrow indicating direction of rotation on the pump flange.
3. If the directions do not match, swap over two electrical connection phases. Repeat step 1 and 2.

Commissioning the pump

Prerequisites:

- Pump set up and mounted correctly
- Motor connected correctly
- Pipe system is free of contamination
- Commissioning filter mounted, if the pipe system is to be cleaned with the pump
- Pump is filled
- Shut-off devices in the suction and pressure line opened

WARNING Risk of injury through emitted pumped liquid
▶ Wear protective clothing during all the work. ▶ Ensure that all the connections are connected sealingly.

CAUTION Dry running can damage pump equipment
▶ Ensure that the pump is filled properly. ▶ If the pump does not deliver after 10–15 seconds, abort commissioning.

1. Switch on the pump.
   The pump will deliver when the pressure on the pressure side of the pump rises or a system-side flow indicator triggers.
2. If the pump does not deliver after 10–15 seconds of operation, abort commissioning, establish the cause of the fault and only then continue the commissioning procedure. Follow the instructions in the fault table, see "Troubleshooting".
3. Run the pump for a few minutes to allow the pipe system to vent fully.
   The pipe system is fully vented when there is a smooth operating noise and a pressure gauge on the pressure side of the pump shows no more fluctuations.

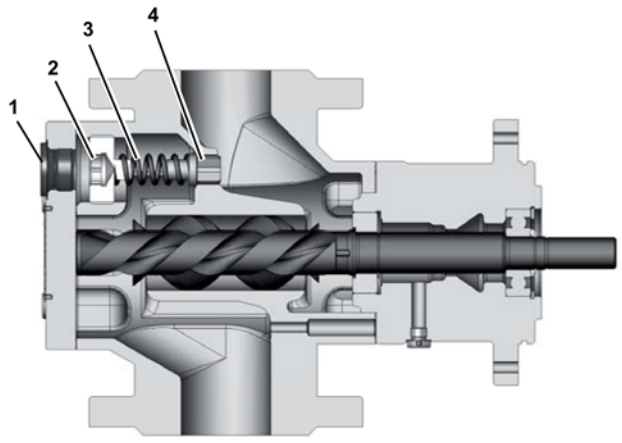
4.2 During operation

Checking the operating pressure

WARNING Stopcooks that are opened permanently can result in the pressure gauges leaking
▶ Close the pressure gauge stopcocks after completing reading.

▶ Open the pressure gauge stopcock, read the operating pressure, close the pressure gauge stopcock.

Adjusting the overflow valve



1. Screw plug
2. Adjusting screw
3. Spring
4. Valve body

Fig. 3 Overflow valve mounting position

Factory setting:

- 110 % of the nominal pressure

Aids:

- Pressure-side pressure gauge

- Allen key

WARNING Risk of injury or poisoning through emitted pumped liquid
▶ Wear protective clothing during all the work. ▶ Collect the emitted pumped liquid safely and dispose of it in an environmentally compatible manner.

1. Switch on the pump and open the screw plug **1** of the overflow valve.
2. Increase the delivery pressure step-by-step to check the opening pressure of the valve. Keep an eye on the pressure gauge and make sure that he pressure stays within the operating limits.
   When the overflow valve opening pressure is reached, the displayed pressure drops.
3. Turn the adjusting screw **2** to adjust the opening pressure:
   Turning clockwise: In crease the opening pressure
   Turning anticlockwise: Decrease the opening pressure.
4. Repeat step 3 and 4 until the desired opening pressure is reached.
5. Retighten the screw plug.

Switch off the pump

CAUTION Damage to seals through pressurizing of the pump while it is standing still.
▶ Ensure that while the pump is at a standstill, the pressure in the pump does not exceed the inlet pressure during operation.

1. Switch off the motor.
2. Close the pressure-side and suction-side shut-off devices.

4.3 Taking the pump out of operation

WARNING Risk of In jury or poisoning through emitted pumped liquid.
▶ Wear protective clothing during all the work. ▶ Collect the emitted pumped liquid safely and dispose of it in an environmentally compatible manner.

▶ Carry out the following measures during shutdowns:

Pump is	Measure
- Shut down for longer period	▶ Measures depend on pumped liquid, see Tab. 3.
- Drained	▶ Close the pressure-side and suction-side shut-off devices.
- Dismantled	▶ Disconnect the motor from the power supply and secure it against being switched back on.
- Stored	▶ Observe measures for storing and preservation, see "Storage" and "Preservation".

Tab. 2 Measures for operation interruption

Behavior of the pumped liquid	Duration of the operation interruption	
	Short	Long
- Sediment solids	▶ Rinse the pump.	▶ Rinse the pump.
- Congealed/frozen - No corrosive burden	▶ Heat or drain the pump.	▶ Drain the pump.
- Congealed/frozen - Corrosive burden	▶ Heat or drain the pump.	▶ Drain the pump. ▶ Preserve the pump.
- Remains liquid - No corrosive burden	-	-
- Remains liquid - Corrosive burden	-	▶ Drain the pump. ▶ Preserve the pump.

Tab. 3 Measures depend on behavior of the pumped liquid

▶ Drain the pump via the pressure and suction line and vent screws and screw plugs.

4.4 Recommissioning the pump

▶ Carry out all the steps as for the commissioning process, see "Commisioning".

5 Maintenance

5.1 Safety instructions

Safety instructions on maintenance and repairs

The following safety instructions must be observed during all the repair work:
▶ There is a risk of death for people with pacemakers.
▶ Under no circumstances may persons with pacemakers perform maintenance or repair work.
▶ All the work may only be carried out by authorized qualified personnel.
▶ Wear protective clothing during all the work.
▶ Switch off the motor and secure it against being switched back on.
▶ Before beginning any work let the pump/the pump unit cool down to the ambient temperature and remove it from the pipe system.
▶ Ensure that the pump is depressurized.
▶ Collect the emitted pumped liquid safely and dispose of it in an environmentally compatible manner.

5.2 Required maintenance

The service life of the pump depends to a great extent on the operating conditions. If the operating limits are observed, see Tab. 2, page 38, the pump has a service life of many years.
Signs of progressive wear of individual pump elements:

Finding	Cause	Elimination
Increased running noises	Incipient damage to bearing	Replace the bearing.
Reduction in the flow rate or pressure under constant operating conditions	Advanced wear of screws and housing	Replace the pump.

Tab. 1 Check table for required maintenance

1. Check the pump visually and acoustically every four weeks.
2. Check for signs of wear as listed in the table above and eliminate the cause.

Magnetic coupling

If the magnetic coupling is operated properly, maintenance is not required during its complete operating life.
The manufacturer recommends an inspection of the magnetic coupling during the plant revision, at the latest however after 2.5 years.

Ball bearing

The ball bearings used are lifetime lubricated. Maintenance is therefore not required. The manufacturer recommends renewing the ball bearings every 20,000 operating hours.

5.3 Replacing the magnetic coupling

Removing the magnetic coupling
Dismantling the outer rotor

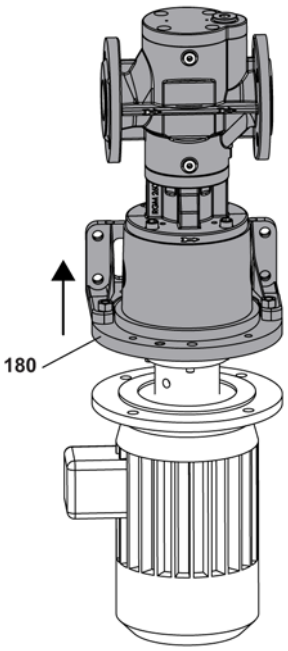


Fig. 3

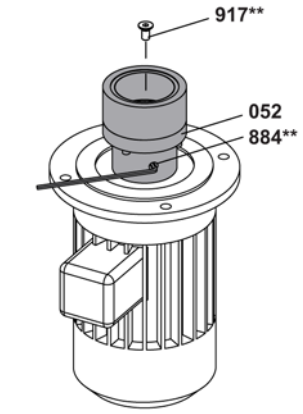


Fig. 1

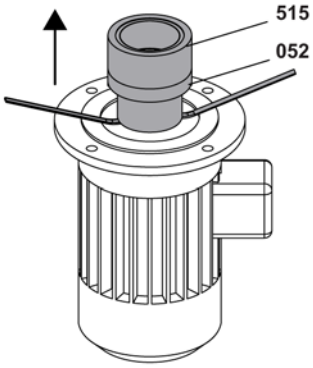


Fig. 2

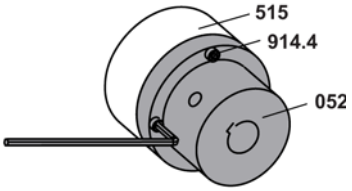


Fig. 4

052 Coupling hub
180 Pump bracket
515 Outer rotor
884* Threaded pin
914.4 Socket screws
917** Countersunk screw
** Depending on motor size

Aids:

- Wrench

- Mounting lever

DANGER Risk of injury and/or damage to equipment should the pump/pump unit fall.
▶ Lift the large pump using the crane. ▶ Do not stand under raised loads.

1. Before dismantling close the suction and pressure connection of the pump with protective caps.
2. Loosen the connecting screws between the motor and pump bracket 180 and lift the pump with pump bracket from the motor, see Fig. 3.
3. Depending on the motor size loosen the threaded pin 884** or the countersunk screw 917**, see Fig. 1.
4. Pull the coupling hub 052 and outer rotor 515 off from the motor shaft using mounting levers, see Fig. 2. Heating the coupling hub and the outer rotor to approx. 80 °C facilitates dismantling.
5. Loosen the socket screws 914.4 between the coupling hub 052 and the outer rotor 515, see Fig. 4.

5 Maintenance

Dismantling the inner rotor

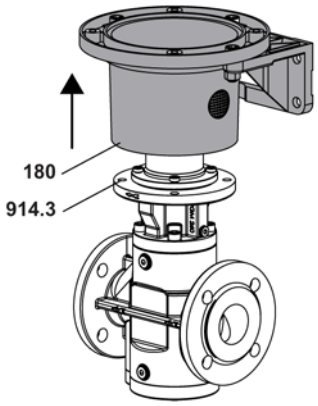


Fig. 5

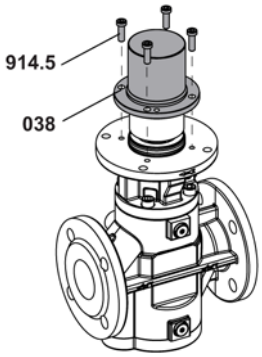


Fig. 6

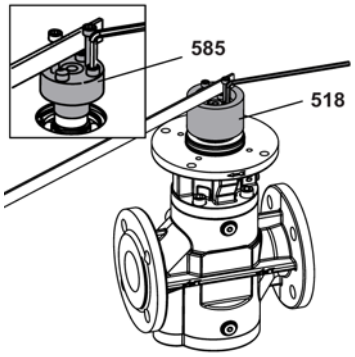


Fig. 7

038	Containment can	**518**	Inner rotor	**914.3**	Socket screw
180	Pump bracket	**585**	Tensioning element	**914.5**	Socket screw

Aids:

- Anti-rotation screw

- Allen key

1. Loosen the socket screws **914.3** between the pump and pump bracket **180** and remove the pump bracket, see Fig. 5.
2. Loosen the socket screws **914.5** between the containment can **038** and pump.
   Remove the containment can, see Fig. 6. Heating the containment can to approx. 80 °C facilitates dismantling.
3. To replace the inner rotor **518**, screw two screws into the empty threaded holes of the tensioning element **585** to prevent rotation, see Fig. 7. Then loosen the screws of the tensioning element and remove them.
4. Screw screws back into the existing threaded holes. This loosens the tensioning element from the inner rotor and from the shaft.

5.4 Installing the magnetic coupling

Mounting the inner rotor

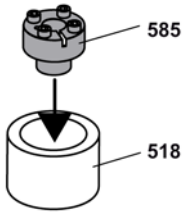


Fig. 8

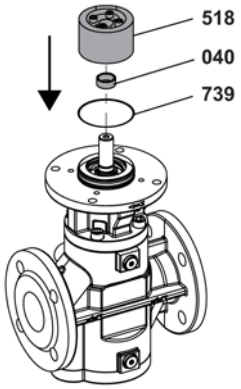


Fig. 9

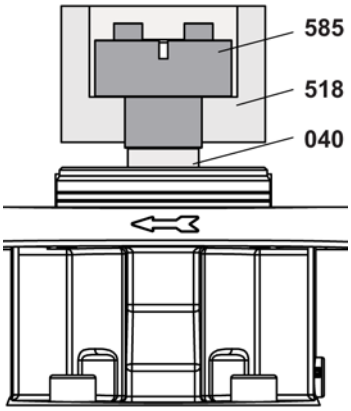


Fig. 10

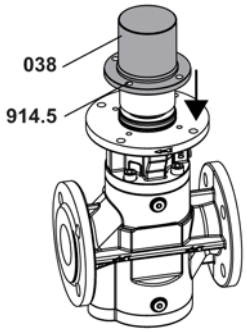


Fig. 11

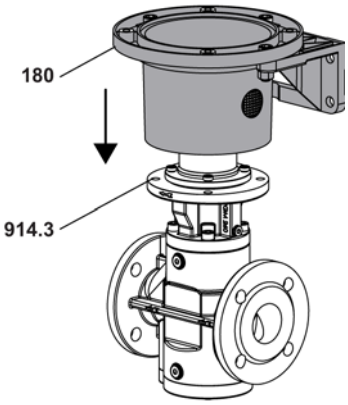


Fig. 12

038 Contaiment can
040 Distance sleeve
180 Pump bracket
518 Inner rotor
585 Tensioning element
739 O-ring
914.3 Socket screw
914.5 Socket screw

1. Carefully clean the contact surfaces of the inner rotor 518, lightly oil the tensioning element 585.
   Notice: Use only oil without molybdenum sulphide additive, e.g. multifunction spray WD-40.
2. Manually turn out the screws of the tensioning element by a few turns. Insert the tensioning element in the inner rotor see Fig. 8.
3. Carefully clean the sealing surfaces. Clean and lightly grease the o-ring 739. Insert the o-ring and slide the distance sleeve 040 onto the pump shaft, see Fig. 9.
4. Place the inner rotor with the premounted tensioning element on the pump shaft and tighten the screws of the tensioning element crosswise by hand. Heating the inner rotor to approx. 80 °C facilitates mounting.
5. Check the position of the tensioning element: The tensioning element 585 has to lie flat on the distance sleeve 040 and inner rotor 518 , see Fig. 10. Otherwise loosen the screws again and reposition the tensioning element.
6. If the position is correct, first tighten the screws of the tensioning element with half the tightening torque crosswise, see Tab. 2, page 42. Subsequently tighten several times crosswise with the full tightening torque until no screw can be turned.
   Notice: The screws are not tightened correctly until they no longer turn when being tightened with the full tightening torque!
7. Press the containment can 038 onto the pump flange and tighten the connecting screws 914.5, see Fig. 11.
8. Place the pump bracket 180 on the pump and tighten the socket screws 914.3 with torque, see Tab. 1, page 42.

5 Maintenance

Mounting the outer rotor

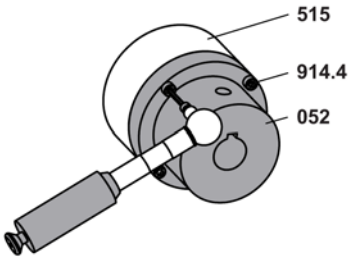


Fig. 13

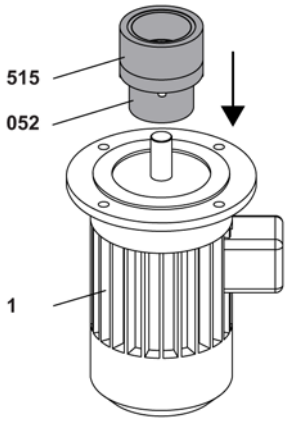


Fig. 14

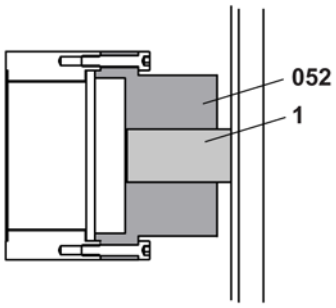


Fig. 15

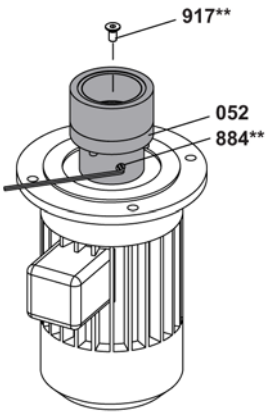


Fig. 16

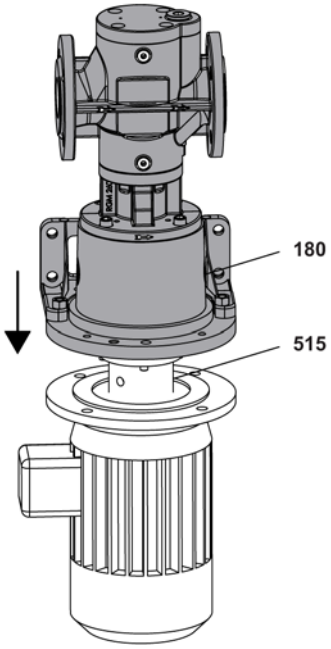


Fig. 17

052 Coupling hub
180 Pump bracket
515 Outer rotor
884** Threaded pin
914.4 Socket screw
917* Countersunk screw
1 Motor
** Depending on motor size

1. Carefully clean the outer rotor 515 with compressed air. Tighten the connecting screws 914.4 of the outer rotor and coupling hub 052 with torque, see Tab. 1, page 42.
2. Clean the shaft end of the motor 1 and apply lubricant.
3. Place the coupling hub with outer rotor on the shaft end of the motor. Heating to approx. 80 °C facilitates mounting.
4. The shaft end of the motor 1 must be flush with the front surface of the coupling hub see Fig. 15.
5. Depending on the motor size tighten the threaded pin 884** or the countersunk screw 917**.
6. Place the pump with the pump bracket on the motor, see Fig. 17. Do not use force and ensure that the outer rotor does not strike the containment can.
7. Tighten the connecting screws of the motor and pump bracket.
   Do not remove the protective cover until just before reconnecting the pump to the pipe system.

5.5 Replacing the ball bearing and screw set

Removing the ball bearing and screw set

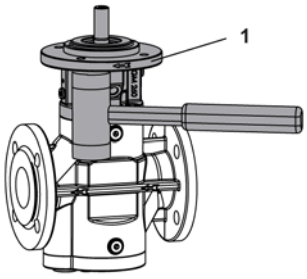


Fig. 18

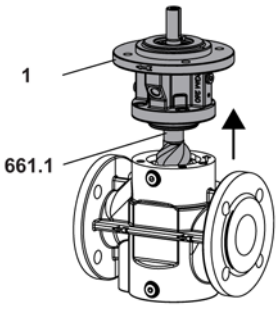


Fig. 19

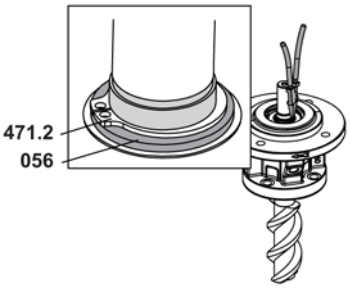


Fig. 20

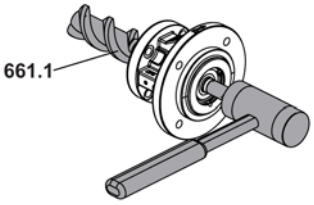


Fig. 21

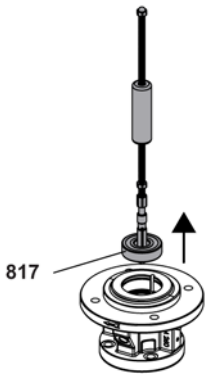


Fig. 22

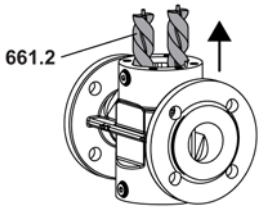


Fig. 23

056 Supporting ring
471.2 Circlip

661.1 Main screw
661.2 Idle screw

817 Ball bearing
1 Flange cover

1. Unscrew the socket screws at the flange cover 1 and loosen the flange cover using light "rebound" blows, see Fig. 18.
2. Pull the withdrawable unit out of the main screw 661.1 and the flange cover 1 out of the pump housing, see Fig. 19.
3. Remove the circlip 471.2, remove the supporting ring 056, see Fig. 20.
4. Drive the main screw 661.1 out of the ball bearing 817 with light blows from a plastic hammer, see Fig. 21.
5. Loosen the circlip 471.3 in the flange cover. Pull the ball bearing 817 out of the flange cover using a pulling-off device, see Fig. 22.
6. Remove the idle screws 661.2 from the pump housing, see Fig. 23.

5 Maintenance

Installing the ball bearing and screw set

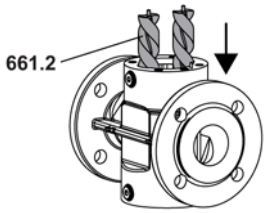


Fig. 24

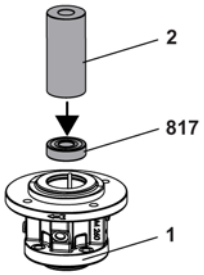


Fig. 25

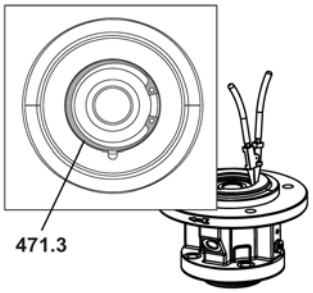


Fig. 26

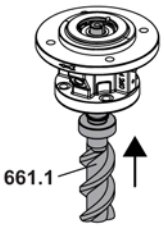


Fig. 27

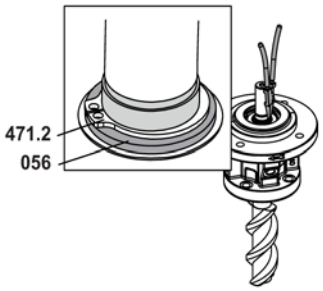


Fig. 28

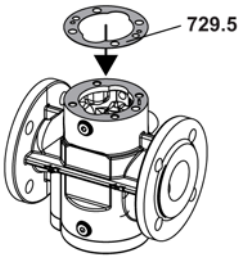


Fig. 29

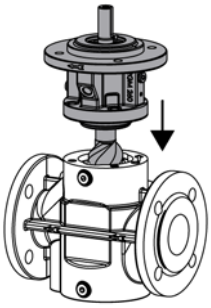


Fig. 30

056 Supporting ring
471.2 Circlip
471.3 Circlip
661.1 Main screw
661.2 Idle screw

729.5 Flat gasket
817 Ball bearing
1 Flange cover
2 Mounting sleeve ball bearing

1. Clean the fitting surfaces, clean and grease the set of screws carefully.
2. Insert the idle screws 661.2 into the pump housing, see Fig. 24.
3. Use the ball bearing mounting sleeve 2 to press the ball bearing 817 into the flange cover 1, see Fig. 25, and fasten using the circlip 471.3, see Fig. 26.
4. Press the main screw into the ball bearing in the flange cover until it stops, see Fig. 27.
5. Slide the supporting ring 056 onto the shaft. Mount the circlip 471.2, see Fig. 28.
6. Bond the new flat gasket 729.5 onto the pump housing, see Fig. 29.
7. Slide the premounted unit consisting of flange cover 1 and main screw 661.1 into the pump housing until the main screw engages into the idle screws, see Fig. 30.
8. Tighten the socket screws at the flange cover with torque, see Tab. 1, page 42.

5.6 Possible faults

Faults can have different causes. The following tables list the symptoms of a fault, the possible causes and measures for elimination.

Fault	Cause/Remedy
- No pump suction	1, 2, 3, 4, 5, 6, 7, 8, 28
- Delivery rate too low	2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 17
- Pump runs noisily	2, 3, 4, 6, 10, 11, 13, 18, 19, 20, 21, 22
- Motor overload	9, 11, 14, 21, 22
- Uneven delivery rate	2, 3, 4, 6, 11, 13, 15, 16
- Leaking magnetic coupling	24, 25
- Pump has got stuck	26, 27

5.7 Troubleshooting

No.	Cause	Remedy
1	Pump suction line closed	▶ Check shut-off devices in the suction line and open them, if necessary.
2	Suction valve or line obstructed	▶ Check the suction valve and line for clear passage.
3	Suction line or shaft seal leaks	▶ Check suction line or shaft seal for leaks. Pay particular attention to leakage at valves and connection points. If necessary, replace parts.
4	Suction head too high	▶ Reduce difference of level. - or - Reduce line lenght - or - Increase pipe diameter - or - Healt the liquid to reduce viscosity - or - Install filter with greater mesh width. Ensure that the permissible mesh width is not exceeded, see ”Cleaning the pipe system”.
5	Level of liquid in the intake container too low	▶ Top up the pumped liquid.
6	Filter/strainer soiled	▶ Clean the filter/strainer.
7	Pump intake capacity reduced by inadequate wetting	▶ Fill pump with liquid.
8	Incorrect pump direction of rotation	▶ Carry out the electrical connection so that the direction of pump rotation matches that of the arrow on the flange cover, see "Connecting the motor".
9	Differential pressure too high	▶ Check the system and reduce the differential pressure.
10	Magnetic coupling broken off	▶ Stop the pump immediately and restart it. ▶ Avoid excessive differential pressures. ▶ At repeated occurrence check whether pump has got stuck.
11	Viscosity of the pumped liquid too high	▶ Increase the temperature of the pumped liquid. - or - Reduce the rotation speed.
12	Viscosity of the pumped liquid too low	▶ Reduce the temperature of the pumped liquid. - or - Increase the rotation speed.

No.	Cause	Remedy
13	Airlock or gas in the liquid	▶ Test the pipe system for air admission and replace parts if necessary. ▶ Reduce the suction head - or - Increase the inlet pressure.
14	Motor running at wrong voltage or frequency	▶ Ensure that the motor voltage and frequency match the operating voltage. ▶ Compare the speed of the motor with the pump rating plate. If the data do not match, adjust the speed of the motor.
15	Overflow valve opens during normal operation	▶ Set the opening pressure above the value of operating pressure, see "Adjusting the overflow valve".
16	Overflow valve leaks	▶ Clean the overflow valve and if necessary, reseat.
17	Advanced wear of rotating pump components	▶ Check screw set and housing and replace if necessary.
18	Pump deflected	▶ Support the weight of the pipe system. ▶ Loosen pipe connections and mount stress-free, see "Connecting the pump to the pipe system".
19	Resonance in the system	▶ Provide a flexible bearing arrangement for the pump unit. - or - Make the connections with hoses.
20	Speed of flow in suction or pressure line too high	▶ Set the flow speed in the suction line so that it does not exceed 1 m/s. ▶ Set the flow speed in the pressure line so that it does not exceed 3 m/s.
21	Ball bearing damaged	▶ Replace the ball bearing, see "Maintenance".
22	Lack of lubrication or foreign bodies have caused superficial damage to rotating pump components	▶ Check the screw set and the housing. If necessary replace the pump with free shaft end.
23	Inlet pressure too high	▶ Reduce the inlet pressure at the system-side.
24	Thermal or chemical loading of elastomer seals exceeded	▶ Check the maximum operating temperature. ▶ Check the resistance of the elastomers with regard to the pumped liquid.
25	Containment can damaged by abrasive liquids	▶ Replace the containment can and o-ring, see "Replacing the magnetic coupling".
26	Foreign bodies in the pump	▶ Dismantle the pump and clean it. ▶ Smooth the superficial damage to the housing and the rotating parts with an oilstone. If necessary, replace the pump.
27	Dry running can damage pump equipment	▶ Dismantle the pump and clean it. ▶ Smooth the superficial damage to the housing and the rotating parts with an oil stone. If necessary, replace the pump. ▶ When resuming operation, take action to prevent dry running, see "Recommissioning the pump".
28	Pump does not vent	▶ Vent the pressure line at the highest point.

Fig. 2 Fault table

6.1 Type code

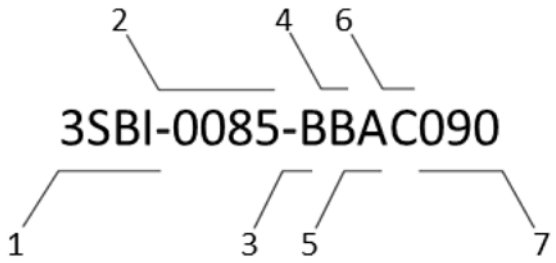


Fig. 1 Type code

Item	Designation	Type	
1	Model	3SBI	Pump with free shaft end Pump housing with flanges PN16 in inline configuration Pump unit with or without pump bracket foot
		3SBS	Pump with free shaft end Pump housing with overhead special flanges PN16 Pump unit with or without pump bracket foot
		3SBT	Pump with free shaft end Pump housing with overhead flanges PN16 Pump unit with or without pump bracket foot
		3SVI	Pump with pedestal for vertical mounting Pump housing with flanges PN16 in inline configuration Pump unit on pedestal
		3SVT	Pump with pedestal for vertical mounting Pump housing with overhead flanges PN16 Pump unit on pedestal
2	Size	Corresponds to flow rate in [l/min] at 1450 min^{-1}	
3	Shaft seal	B: Mechanical seal of hard material D: Magnetic coupling	
4	Pressure stage overflow valve	A: Pressure stage 3.0–5.9 bar B: Pressure stage 6.0–9.9 bar C: Pressure stage 10–16 bar	
5	Heating system	A: Without heating system B: Electric heating system C: Fluid heating system	
6	Completion	A: Pump with free shaft end B: With adaptor housing and coupling (flange mounted) C: With adaptor housing, coupling and foot (foot mounted) D: B with motor E: C with motor	
7	Frame size	071 080 090 100 112 132	160 180 200 225 250 280

Tab. 1 Type code

6 Technical data

6.2 Name plate

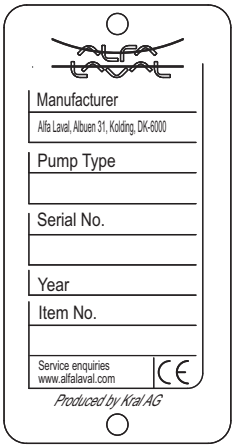


Fig.2 Name plate

6.3 Operating limits

	Size 5 - 42	55 - 118	160 - 275	370 - 450	550 - 660	851 - 1301	1500 - 1700	2200 - 2900
Operating pressure max. [bar]								
- Pump housing with PN6 flange	6							
- Pump housing with PN16 flange	16							
Temperature max. [°C]								
- Standard magnetic coupling	180							
- Magnetic coupling for high materials	250							
Temperature min. [°C]								
For pump materials	-20							
Viscosity [mm²/s]								
Min. - Max.	2 - 10000							
Rotation speed [min⁻¹]								
- At 50 Hz	2900				1450			
- At 60 Hz	3500				1750			
Feed pressure [bar]	Up to 16							

Tab. 2 Operating limits

6.4 Sound pressure level

Guide values at 1m distance, 1450 min^{-1}, 20 bar, 21 mm^2/s

	Size 5 - 20	32 - 42	55 - 118	160 - 275	370 - 450	550 - 660	851 - 1301	1500 - 1700	2200 - 2900
	Sound pressure level max. ±3 [dB(A)]								
Pump	56	59	65	71	74	71	76	78.5	80.5
Motor max.	65	66	77	79	79	67	72	76	78
Pump + motor	66	67	78	80	82	73	78	80.5	82

Tab. 3 Sound pressure level

6.5 Required NPSH values

The following table lists the required NPSH values during operation with a low-volatile liquid such as lubricating oil or hydraulic liquid. When liquids have a readily volatile component content, there quired NPSH values increase notably:
- Fuel oil requires an NPSH value of at least 6 mWC.
- In the case of liquids that contain water (e.g. heavy fuel oil) the values in the table have to increased by the vapor pressure of the water at the specified operating temperature.
The equired NPSH values also needs to be increased if there are gas contents, regardless of whether it is dissolved or not. In case of any doubt, please contact the manufacturer.

Size	Viscosity [mm²/s]	NPSH value [mWC] at Rotation speed [min⁻¹] 1450	1750	2900	3500	Size	Viscosity [mm²/s]	NPSH value [mWC] at Rotation speed [min⁻¹] 1450	1750	2900	3500
3S 5	6	2.0				3S 275	6	2.3		4.5	6.1
	37	2.0					37	2.5	2.9	5.1	7.0
	152	2.0					152	3.0	3.5	6.3	-
	380	2.0					380	3.6	4.2	-	
3S 7.5	6	2.0				3S 370	6	2.2		4.2	5.7
	37	2.0					37	2.5	2.8	4.8	6.5
	152	2.0					152	2.9	3.3	5.9	-
	380	2.0		2.3	2.6		380	3.6	4.0	-	
3S 10	6	2.0				3S 450	6	2.5	3.0	5.8	8.3
	37	2.0					37	2.8	3.3	6.7	-
	152	2.0			2.3		152	3.3	4.0	-	
	380	2.0		2.6	3.1		380	4.0	4.9	-	
3S 15	6	2.0				3S 550	6	2.4	2.8	5.0	7.1
	37	2.0					37	2.7	3.1	5.8	-
	152	2.0			2.2		152	3.2	3.7	7.2	-
	380	2.0		2.7	3.0		380	3.9	4.5	-	
3S 20	6	2.0				3S 660	6	2.8	3.4	7.4	-
	37	2.0					37	3.1	3.8	-	
	152	2.0		2.4	2.7		152	3.8	4.6	-	
	380	2.0	2.4	3.2	3.8		380	4.6	5.8	-	
3S 32	6	2.0				3S 851	6	3.2	3.7	-	
	37	2.0					37	3.5	4.1	-	
	152	2.0		2.3	2.6		152	4.1	4.4	-	
	380	2.0	2.4	3.1	3.7		380	4.8	5.8	-	
3S 42	6	2.0			2.3	3S 951	6	3.6	4.4	-	
	37	2.0		2.1	2.6		37	4.0	4.9	-	
	152	2.0		2.8	3.5		152	4.8	5.9	-	
	380	2.0	2.7	4.0	4.8		380	5.8	7.3	-	
3S 55	6	2.0				3S 1101	6	3.0	3.7	-	
	37	2.0			2.7		37	3.4	4.2	-	
	152	2.1		2.8	3.3		152	4.1	5.1	-	
	380	2.5	2.7	3.5	4.0		380	5.0	6.3	-	
3S 74	6	2.0		2.6	3.0	3S 1301	6	4.0	5.0	-	
	37	2.0		2.9	3.4		37	4.5	5.7	-	
	152	2.3	2.5	3.3	4.0		152	5.4	6.8	-	
	380	2.7	3.0	4.4	5.0		380	7.0	-		
3S 85	6	2.0		2.8	3.4	3S 1500	6	4.3	5.7	-	
	37	2.0		3.1	3.8		37	4.8	6.9	-	
	152	2.4	2.4	3.8	4.6		152	5.6	-		
	380	2.8	2.8	4.6	5.8		380	-			
3S 105	6	2.0		2.7	3.2	3S 1700	6	5.5	6.8	-	
	37	2.0	2.2	3.0	3.6		37	6.0	7.5	-	
	152	2.4	2.6	3.6	4.4		152	7.0	-		
	380	2.8	3.1	4.4	5.4		380	-			
3S 118	6	2.0		3.1	3.9	3S 2200	6	3.6	4.7	-	
	37	2.2		3.5	4.4		37	4.0	5.3	-	
	152	2.5	2.8	4.3	5.4		152	5.0	6.6	-	
	380	3.0	3.3	5.3	6.8		380	6.2	-		
3S 160	6	2.0		2.9	3.6	3S 2500	6	4.2	5.7	-	
	37	2.0		3.3	4.0		37	4.8	6.5	-	
	152	2.5	2.7	3.9	5.0		152	5.9	8.1	-	
	380	2.9	3.2	4.9	6.2		380	7.4	-		
3S 210	6	2.1		4.0	5.2	3S 2900	6	5.0	7.0	-	
	37	2.4	2.7	4.5	6.0		37	5.8	8.2	-	
	152	2.8	3.2	5.5	-		152	7.2	-		
	380	3.5	4.0	6.9	-		380	-			
3S 235	6	2.0		3.5	4.5						
	37	2.3	2.5	4.0	5.1						
	152	2.7	3.0	4.9	-						
	380	3.2	3.6	-							

Tab. 4 Required NPSH values

6 Technical data

6.6 Weights

Model 3SBI/3SBS/3SBT

Motor size	Motor weight [kg]	Magnet power [Nm]	Size 5 7.5 10	 15 20	 32 42	 55 74 85	 105 118	 160 210 235 275	 370 450	 550 660	 851 951 1101 1301	 1500 1700	 2200 2500 2900
			Weight of pump with free shaft end [kg]										
			8	8	10.5	21.5	21.5	36.5	50	85.5	154	310	430
			Weight of pump bracket with pump bracket foot, magnetic coupling and screws [kg]										
80	10	10	9.1	9.1	5.0	4.3	4.3	-					
90S	12	10	7.5	7.5	8.0	7.5	7.5	-					
		20	5.2	5.2	5.7	7.7	7.7	-					
90L	14	10	7.5	7.5	8.0	7.5	7.5	-					
		20	5.2	5.2	5.7	7.7	7.9	-					
100L	21	10	8.8	8.8	9.3	6.0	6.0	-					
		20	9.1	9.1	9.5	7.9	7.9	-					
		22	-					16.9	-				
		30	-		6.3	8.2	8.2	8.3	-				
		40	-		6.5	6.1	6.1	7.4	-				
		50	-		9.5	10.3	10.3	17.3	-				
112M	28	10	8.8	8.8	9.3	6.0	6.0	-					
		20	9.1	9.1	9.5	7.9	7.9	-					
		22	-					16.9	-				
		30	-		6.3	8.2	8.2	8.3	-				
		40	-		6.5	6.1	6.1	7.4	-				
		50	-		9.5	10.3	10.3	17.3	-				
132S	39	20	-		8.2	8.6	8.6	-					
		22	-					13.3	-				
		30	-			9.0	9.0	7.7	-				
		40	-			9.5	9.5	7.4	-				
		50	-			18.1	18.1	14.1	16.0	23.8	-		
		60	-			6.8	6.8	8.3	-				
		80	-			10.8	10.8	9.6	9.7	25.3	-		
		135	-						39.4	-			
132M	45	20	-		8.2	8.6	8.6	-					
		22	-					13.3	-				
		30	-			9.0	9.0	7.7	-				
		40	-			9.5	9.5	7.4	-				
		50	-			18.1	18.1	14.1	16.0	23.8	-		
		60	-			6.8	6.8	8.3	-				
		80	-			10.8	10.8	9.6	9.7	25.3	-		
		135	-						39.4	-			
160M	110	40	-			12.9	12.9	-					
		50	-			26.6	26.6	20.4	21.2	19.1	-		
		60	-					9.6	-				
		80	-			21.9	21.9	20.6	21.3	20.6	-		
		100	-					12.0	12.5	12.3	-		
		135	-					14.2	17.0	26.5	39.5	-	
		180	-							14.4	41.1	-	
160L	120	40	-			12.9	12.9	-					
		50	-			26.6	26.6	20.4	21.2	19.1	-		
		60	-					9.6	-				
		80	-			21.9	21.9	20.6	21.3	20.6	-		
		100	-					12.0	12.5	12.3	-		
		135	-					14.2	17.0	26.5	39.5	-	
		180	-							14.4	41.1	-	
180M	165	80	-							20.0	-		
		135	-							29.7	39.7	-	
		180	-						15.2	29.4	41.3	-	
180L	170	80	-							20.0	-		
		135	-							19.7	39.7	-	
		180	-						15.2	29.4	41.3	-	
200L	230	135	-							27.3	-		
		180	-							28.3	45.3	56.4	54.1
		275	-							45.1	48.6	57.8	56.4
		365	-								49.6	59.6	57.7
225M	280	275	-								104.7	63.6	62.0
		365	-										62.8

Tab. 5 3SBI/3SBS/3SBT weights

Model 3SVI/3SVT

Motor size	Motor weight [kg]	Magnet power [Nm]	Size 5 7.5 10	 15 20	 32 42	 55 74 85	 105 118	 160 210 235 275	 370 450	 550 660	 851 951 1101 1301	 1500 1700	 2200 2500 2900
			Weight of pump with free shaft end [kg]										
			8	8	10.5	21.5	21.5	36.5	50	85.5	154	310	430
			Weight of the pedestal [kg]										
			2.2	2.2	2.7	2.9	2.9	8.6	8.2	17.8	27.1	62.2	70.0
			Weight of pump bracket with magnetic coupling and screws [kg]										
80	10	10	6.6	6.6	4.9	4.2	4.2	-					
90S	12	10	6.6	6.6	7.1	6.5	6.5	-					
		20	5.1	5.1	5.6	7.0	7.0	-					
90L	14	10	6.6	6.6	7.1	6.5	6.5	-					
		20	5.1	5.1	5.6	7.0	7.0	-					
100L	21	10	8.2	8.2	8.7	5.9	5.9	-					
		20	8.6	8.6	9.0	7.3	7.3	-					
		22	-					16.3	-				
		30	-		6.2	7.7	7.7	8.2	-				
		40	-		6.4	6.0	6.0	7.3	-				
		50	-		9.4	10.2	10.2	16.7	-				
112M	28	10	8.2	8.2	8.7	5.9	5.9	-					
		20	8.6	8.6	9.0	7.3	7.3	-					
		22	-					16.3	-				
		30	-		6.2	7.7	7.7	8.2	-				
		40	-		6.4	6.0	6.0	7.3	-				
		50	-		9.4	10.2	10.2	16.7	-				
132S	39	20	-		7.9	8.3	8.3	-					
		22	-					13.0	-				
		30	-			8.7	8.7	7.4	-				
		40	-			9.2	9.2	7.1	-				
		50	-			17.8	17.8	13.7	15.6	23.5	-		
		60	-			6.5	6.5	8.0	-				
		80	-			10.5	10.5	9.3	9.4	25.0	-		
		135	-						39.1	-			
132M	45	20	-		7.9	8.3	8.3	-					
		22	-					13.0	-				
		30	-			8.7	8.7	7.4	-				
		40	-			9.2	9.2	7.1	-				
		50	-			17.8	17.8	13.7	15.6	23.5	-		
		60	-			6.5	6.5	8.0	-				
		80	-			10.5	10.5	9.3	9.4	25.0	-		
		135	-						39.1	-			
160M	110	40	-			11.1	11.1	-					
		50	-			24.8	24.8	18.6	19.4	18.1	-		
		60	-					8.8	-				
		80	-			20.0	20.0	18.8	19.6	19.6	-		
		100	-					11.2	11.7	11.7	-		
		135	-					13.4	16.4	25.5	38.9	-	
		180	-							13.8	40.5	-	

6 Technical data

Motor size	Motor weight [kg]	Magnet power [Nm]	Size 5 7.5 10	15 20	32 42	55 74 85	105 118	160 210 235 275	370 450	550 660	851 951 1101 1301	1500 1700	2200 2500 2900
160L	120	40	-			11.1	11.1	-					
		50	-			24.8	24.8	18.6	19.4	18.1	-		
		60	-					8.8	--				
		80	-			20.0	20.0	18.8	19.6	19.6	-		
		100	-					11.2	11.7	11.7	-		
		135	-					13.4	16.4	25.5	38.9	-	
		180	-							13.8	40.5	-	
180M	165	80	-							18.9	-		
		135	-							28.6	39.1	-	
		180	-						14.6	28.4	40.7	-	
180L	170	80	-							18.9	-		
		135	-							28.6	39.1	-	
		180	-						14.6	28.4	40.7	-	
200L	230	135	-							26.1	-		
		180	-							27.1	44.7	56.4	54.1
		275	-							44.5	48.0	57.8	56.4
		365	-								49.0	59.6	57.7
225M	280	275	-								104.7	63.6	62.0
		365	-										62.8

Tab. 6 3SVI/3SVT weights

6.7 Structure

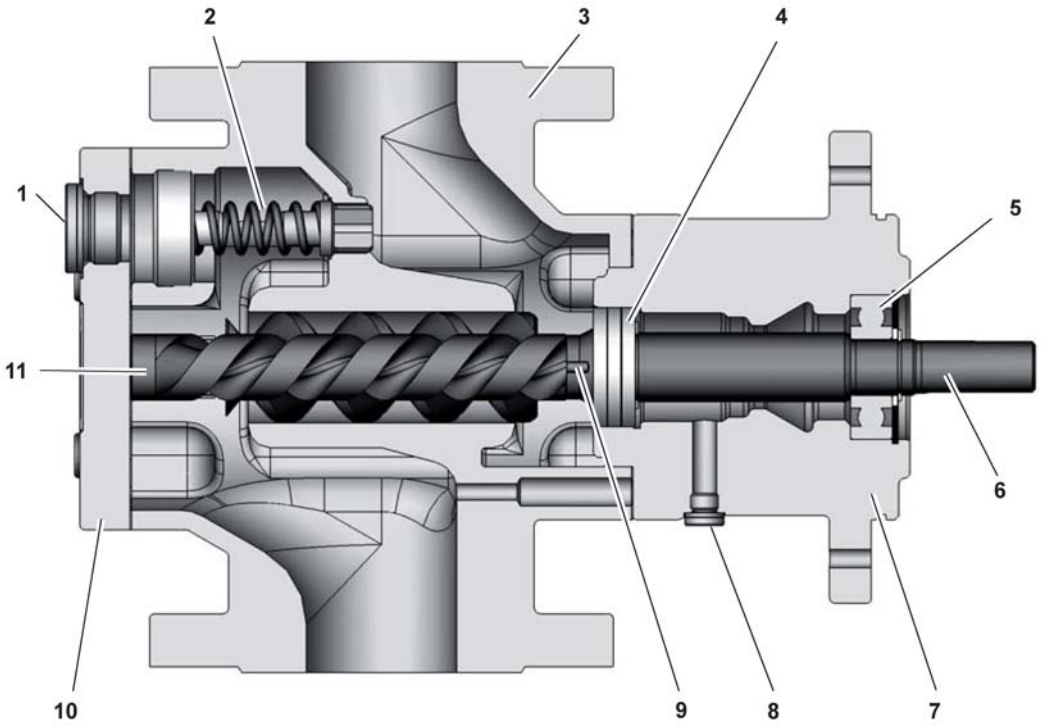


Fig. 3 Structure of 3S-pump

1. Screw plug
2. Overflow valve
3. Pump housing
4. Balancing cylinder
5. Ball bearing
6. Main screw
7. Flange cover
8. Vent hole
9. Thrust pin
10. End cover
11. Idle screw

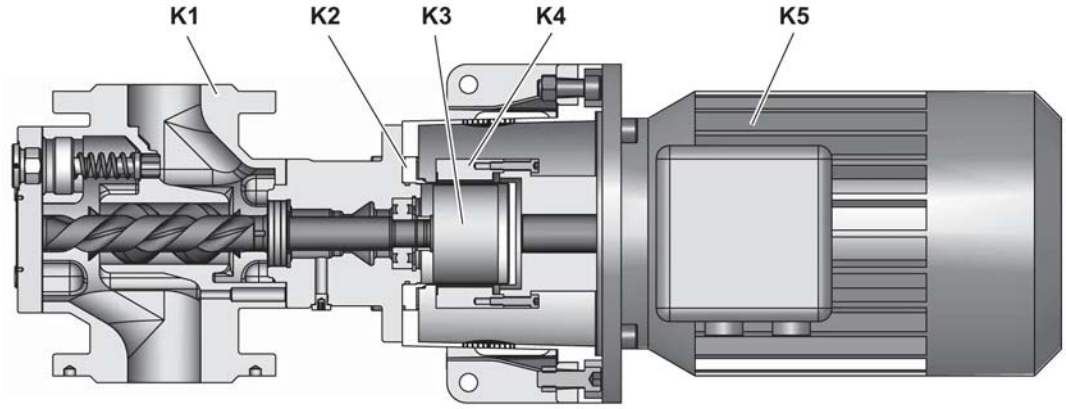


Fig. 4 Structure of 3S-pump with magnetic coupling and motor

K1 Pump
K2 Containment can
K3 Inner rotor
K4 Outer rotor
K5 Motor

6 Technical data

Screw pumps are rotating displacement pumps whose displacement effect results from the meshing of three rotating screws and the enclosing housing. The radial support of the screws is effected by the sliding contact in the housing which requires lubrication by the pumped liquid. Screw pumps are therefore not suitable for dry running and can only be used up to specific pressure and viscosity limits. Due to the narrow tolerances, pumping of suspended solids is not possible.
Axial support of the main screw is carried out by a lifetime lubricated deep-groove ball bearing. Different shaft seals are available for sealing the main screw at the outlet from the housing. In order to reduce the pressure at the shaft seal a balancing cylinder is mounted at the main screw. The sealing chamber is connected to the suction chamber though a relief line. An integrated overflow valve protects against excessive pressure that could cause housing parts to burst.

Standard direction of rotation:	Clockwise, viewed from the drive Marked on the housing by an arrow, see Fig. 2, page 20.
Direction of flow:	Marked on the housing by two arrows, see Fig. 2, page 20.

6.8 Housing variants

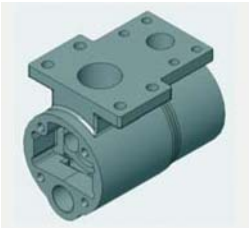
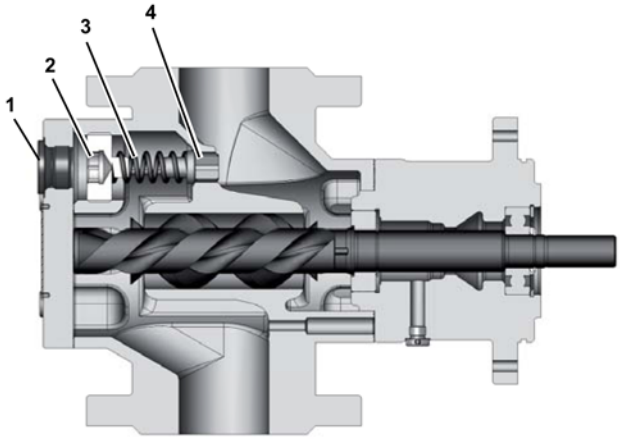
Housing	Series	Description
	3SBI / 3SVI	Pump housing with flanges PN16 in inline configuration
	3SBT/ 3SVT	Pump housing with overhead flages PN6/PN16
	3SBS	Pump housing with overhead special flanges PN16

Fig. 7 Housing variants

6.9 Magnetic coupling

Magnetic coupling
The shaft end of pump K1 is enclosed by a containment can K2, that is connected air-tight with the motor-side flange of the pump. Therefore, it is not necessary to seal a rotating free shaft end against a stationary seal housing. Special rotors equipped with powerful permanent magnets are used for transfer of torque from the motor to the pump. The inner rotor K3 is fixed at the shaft end and driven from the outer rotor K4, which in turn is fixed to the shaft of the motor K5. The torque is thus transferred contact by means of magnetic field between the outer and inner rotor.
The containment can is made of a non-magnetic stainless steel which does not impede the forming of magnetic flux lines between the rotors. The pressure discharge of the containment can occurs via a core drilled hole in the main screw. Therefore, it can be assumed that the pressure in the containment can approximately corresponds to the pressure on the suction side of the pump.

6.10 Overflow valve



1. Screw plug
2. Adjusting screw
3. Spring
4. Valve body

Fig. 5 Overflow valve mounting position

The integrated overflow valve ensures that very high pressures that could result in housing parts bursting do not result. The valve is purely there as a safety element and should not be used for control or regulation such as maintaining pressure. If the valve is kept open for too long under adverse operating conditions (high differential pressures and/or low viscosities) it will only take a few minutes for the valve and the valve seating to become damaged. As a result, the valve will leak permanently and there will be a corresponding reduction in the delivery rate. In addition to this, circulation through the overflow valve for too long heats the pump to excess. This reduces viscosity and can ultimately lead to pump failure.
It therefore has to be ensured at the system that the maximum operating pressure always lies under the operating pressure of the overflow valve.

Factory setting:
- 110% of the nominal pressure
The valve is accessible via a screw plug 1 and can be adjusted from the outside, see "Adjusting the overflow valve".

6.11 Tightening torques

Tightening torque [Nm] for screws with metric threads + head contact surfaces								with thread measured in inches Screw plugs with elastomer seal	
				+ wedge lock washers		Stainless steel screws A2 and A4			
Thread	8.8	10.9	8.8 + Alu*	8.8	Rust-prood A4-70	Property class 70	Property class 80	Thread	Galvanized + stainless steel
M 3	1.5	-	1.2	1.5	1.1	-	-	G 1/8”	13
M 4	2.9	4.1	2.3	3	2	-	-	G 1/4”	30
M 5	6.0	8.0	4.8	6.0	3.9	3.5	4.7	G 3/8”	60
M 6	9.5	14	7.6	10.3	6.9	6	8	G 1/2”	80
M 8	23.1	34	18.4	25	17	16	22	G 3/4”	120
M 10	46	68	36.8	47	33	32	43	G 1”	200
M 12	80	117	64	84	56	56	75	G 1 1/4”	400
M 14	127	186	101	133	89	-	-	G 1 1/2”	450
M 16	194	285	155	204	136	135	180		
M 18	280	390	224	284	191	-	-	* Reduced tightening torque when screwing into aluminum	
M 20	392	558	313	399	267	280	370		
M 24	675	960	540	687	460	455	605		

Tab. 9 Tightening torques

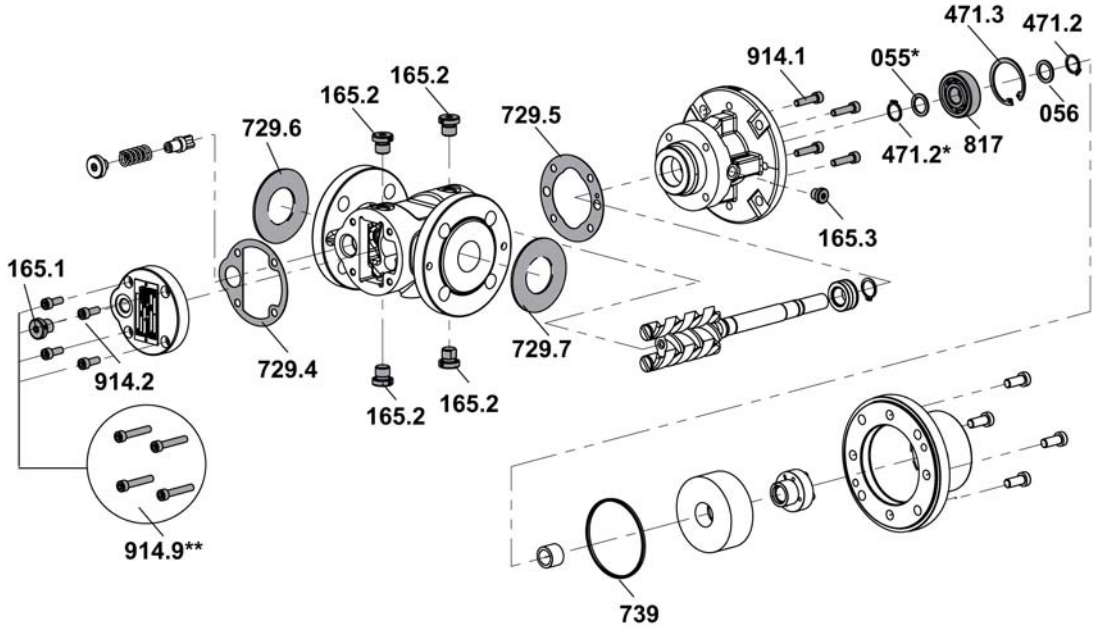
Tightening torque [Nm] for screws of tensioning elements	
Thread	12.9
M 3	1.8
M 4	4.5
M 6	16
M 8	37
M 10	73
M 12	126

Tab. 10 Tightening torques for screws of tension elements

7.1 Maintenance sets

NOTE
The maintenance sets contain only the numbered parts and are only supplied complete.

Mechanical coupling 3SBI/3SVI 5-660

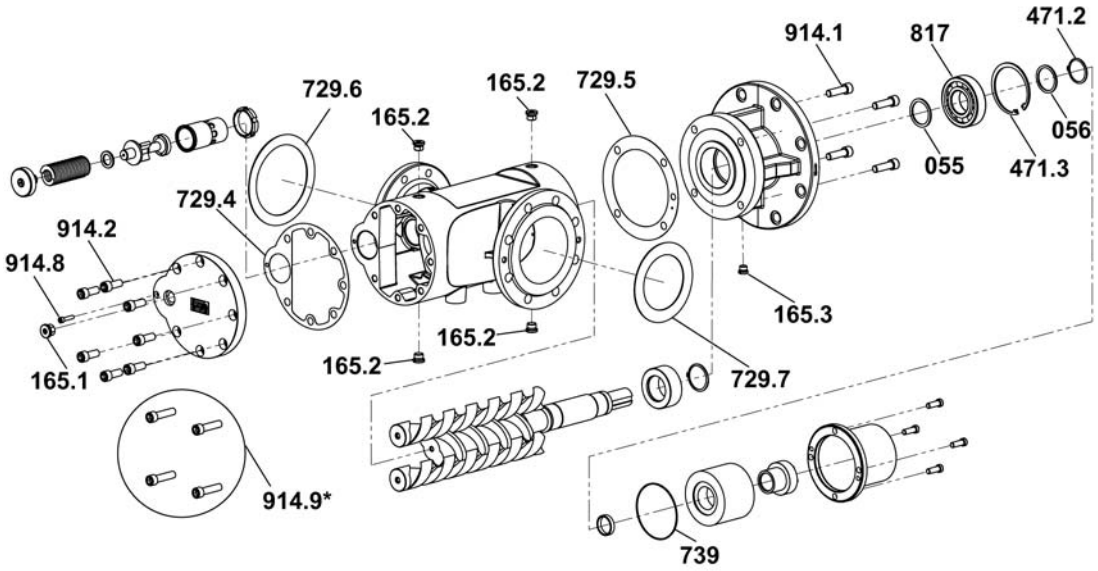


Qty.	Pos. no.	Part	Qty.	Pos. no.	Part
1	055*	Supporting ring	1	729.5	Flat gasket
1	056	Supporting ring	1	729.6	Flat gasket, suction flange
1	165.1	Screw plug	1	729.7	Flat gasket, pressure flange
1	165.2*	Screw plug	1	739	O-ring
1	165.3	Screw plug	1	817	Ball bearing
1	471.2	Circlip	4	914.1	Socket screw
1	471.2*	Circlip	4	914.2	Socket screw
1	471.3	Circlip	4	914.9**	Socket screw
1	729.4	Flat gasket	1		Mounting sleeve ball bearing

* Only for 3S 5 - 20
** Only for 3SVI: replaces 914.2

7 Spare parts

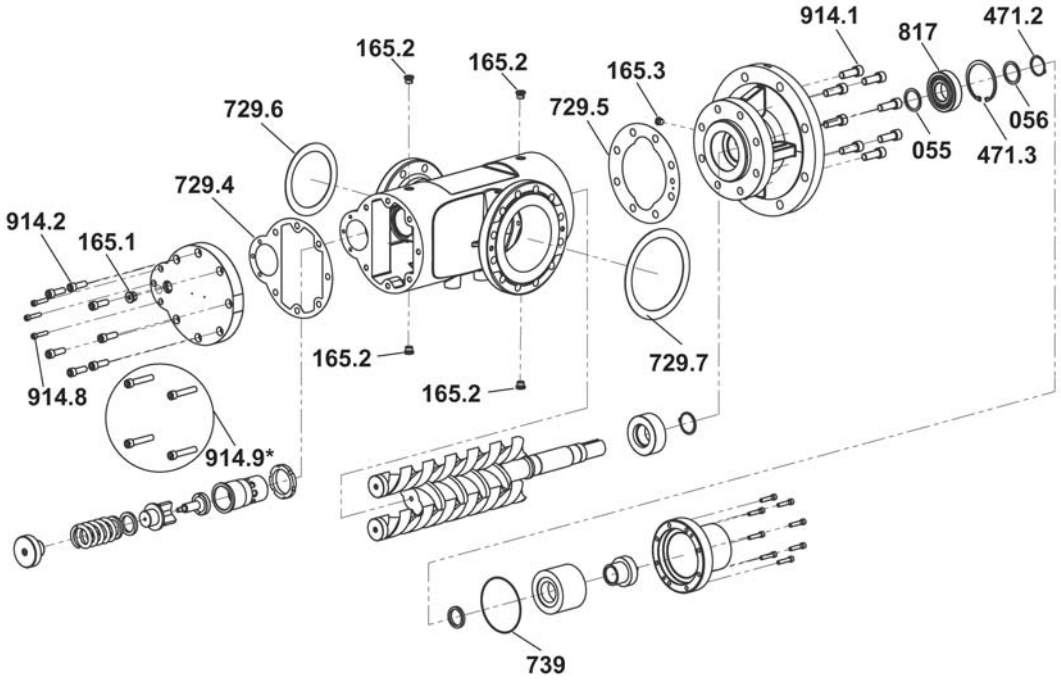
Mechanical coupling 3SBI/3SVI 851 - 1301



Qty.	Pos. no.	Part	Qty.	Pos. no.	Part
1	055	Supporting ring	1	729.6	Flat gasket, suction flange
1	056	Supporting ring	1	729.7	Flat gasket, pressure flange
1	165.1	Screw plug	1	739	O-ring
4	165.2	Screw plug	1	817	Ball bearing
1	165.3	Screw plug	4	914.1	Socket screw
1	471.2	Circlip	4	914.2	Socket screw
1	471.3	Circlip	1	914.8	Socket screw
1	729.4	Flat gasket	4	914.9*	Socket screw
1	729.5	Flat gasket	1		Mounting sleeve ball bearing

* Only for 3SVI: replaces 4 pieces 914.2

Magnetic coupling 3SBI/3SVI 1500 - 1700

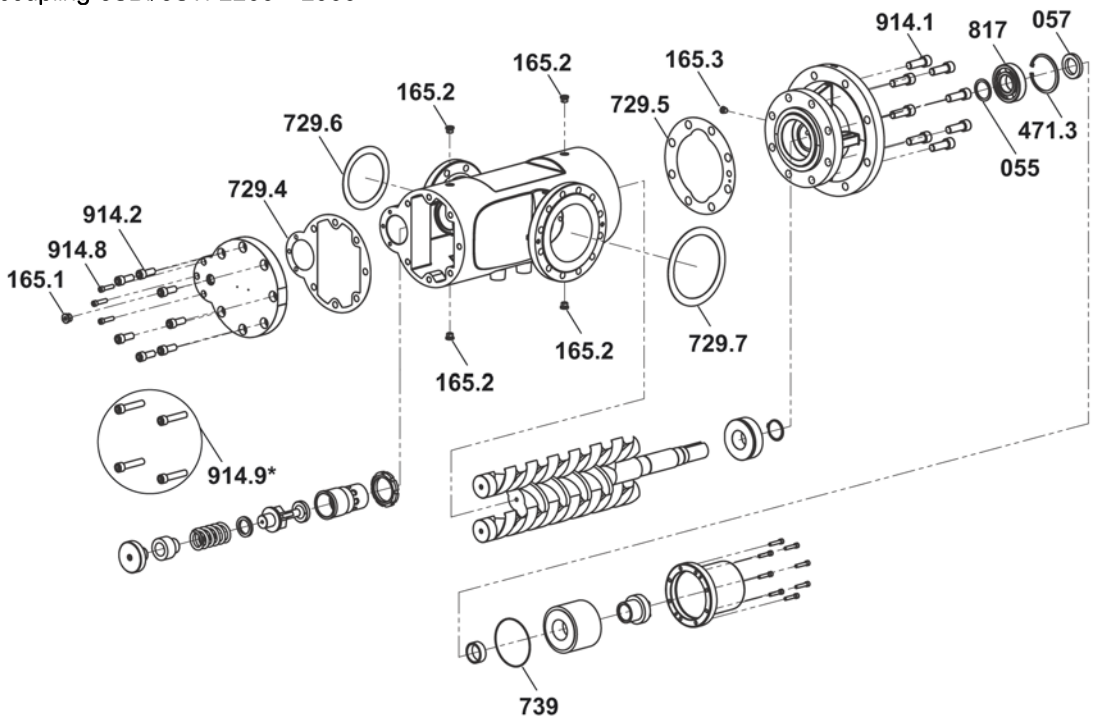


Qty.	Pos. no.	Part	Qty.	Pos. no.	Part
1	055	Supporting ring	1	729.6	Flat gasket, suction flange
1	056	Supporting ring	1	729.7	Flat gasket, pressure flange
1	165.1	Screw plug	1	739	O-ring
4	165.2	Screw plug	1	817	Ball bearing
1	165.3	Screw plug	8	914.1	Socket screw
1	471.2	Circlip	7	914.2	Socket screw
1	471.3	Circlip	3	914.8	Socket screw
1	729.4	Flat gasket	4	914.9*	Socket screw
1	729.5	Flat gasket	1		Mounting sleeve ball bearing

* Only for 3SVI: replaces 4 pieces **914.2**

7 Spare parts

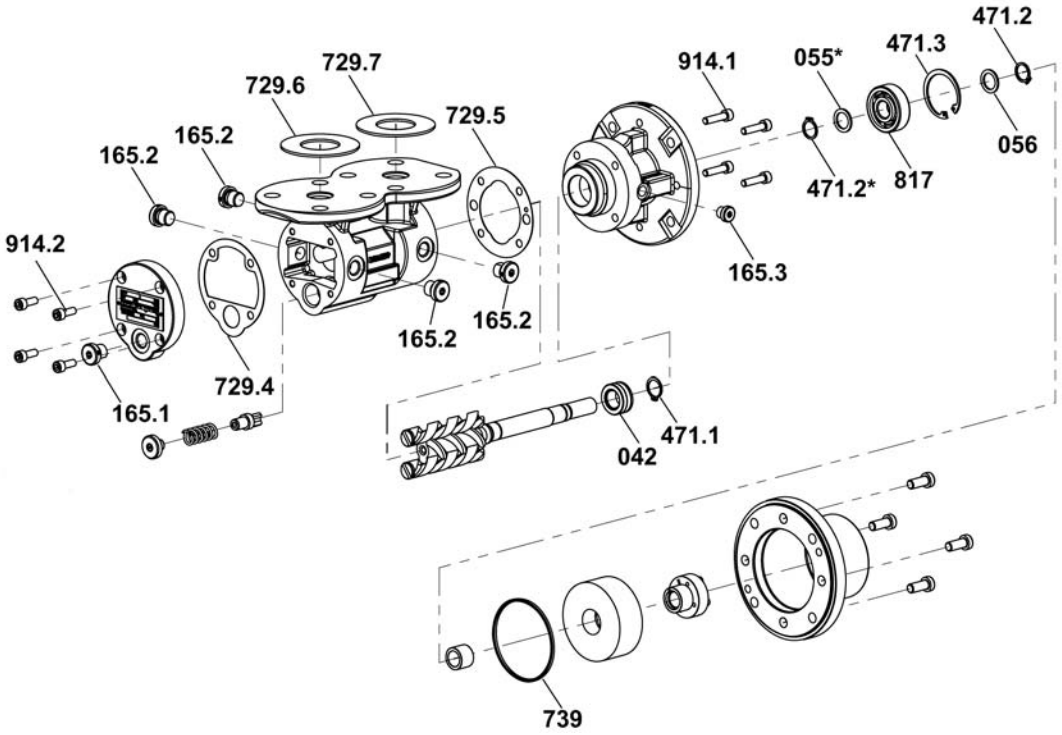
Magnetic coupling 3SBI/3SVI 2200 - 2900



Qty.	Pos. no.	Part	Qty.	Pos. no.	Part
1	055	Supporting ring	1	729.5	Flat gasket, pressure flange
1	057	Threaded ring	1	729.6	O-ring
1	165.1	Screw plug	1	817	Ball bearing
4	165.2	Screw plug	8	914.1	Socket screw
1	165.3	Screw plug	7	914.2	Socket screw
1	471.3	Circlip	3	914.8	Socket screw
1	729.4	Flat gasket	4	914.9*	Socket screw
1	729.5	Flat gasket	1		Mounting sleeve ball bearing
1	729.6	Flat gasket, suction flange			

* Only for 3SVI: replaces 4 pieces 914.2

Magnetic coupling 3SBT



Qty.	Pos. no.	Part	Qty.	Pos. no.	Part
1	042	Balancing cylinder	1	729.4	Flat gasket
1	055*	Supporting ring	1	729.5	Flat gasket
1	056	Supporting ring	1	729.6	Flat gasket, suction flange
1	165.1	Screw plug	1	729.7	Flat gasket, pressure flange
4	165.2	Screw plug	1	739	O-ring
1	165.3	Screw plug	1	817	Ball bearing
1	471.1	Circlip	4	914.1	Socket screw
1	471.2*	Circlip	4	914.2	Socket screw
1	471.2*	Circlip	1		Mounting sleeve ball bearing
1	471.3	Circlip			

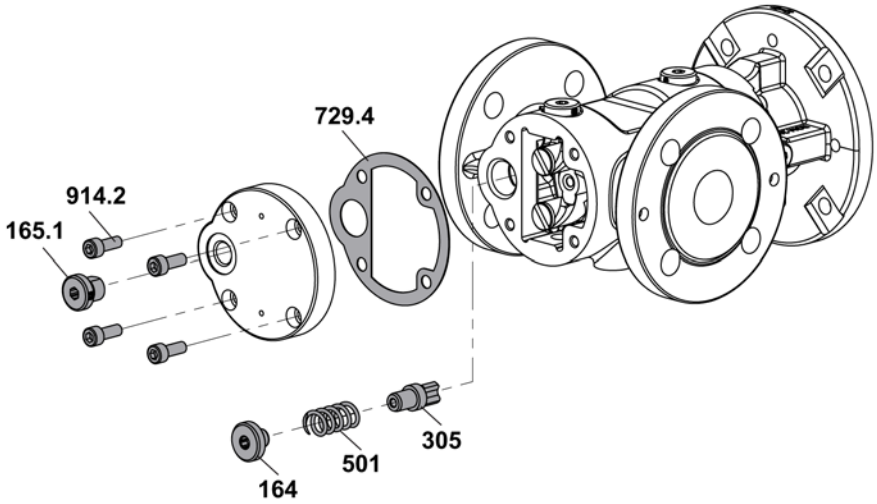
* Only for 3S 5 - 20

7 Spare parts

7.2 Repair sets

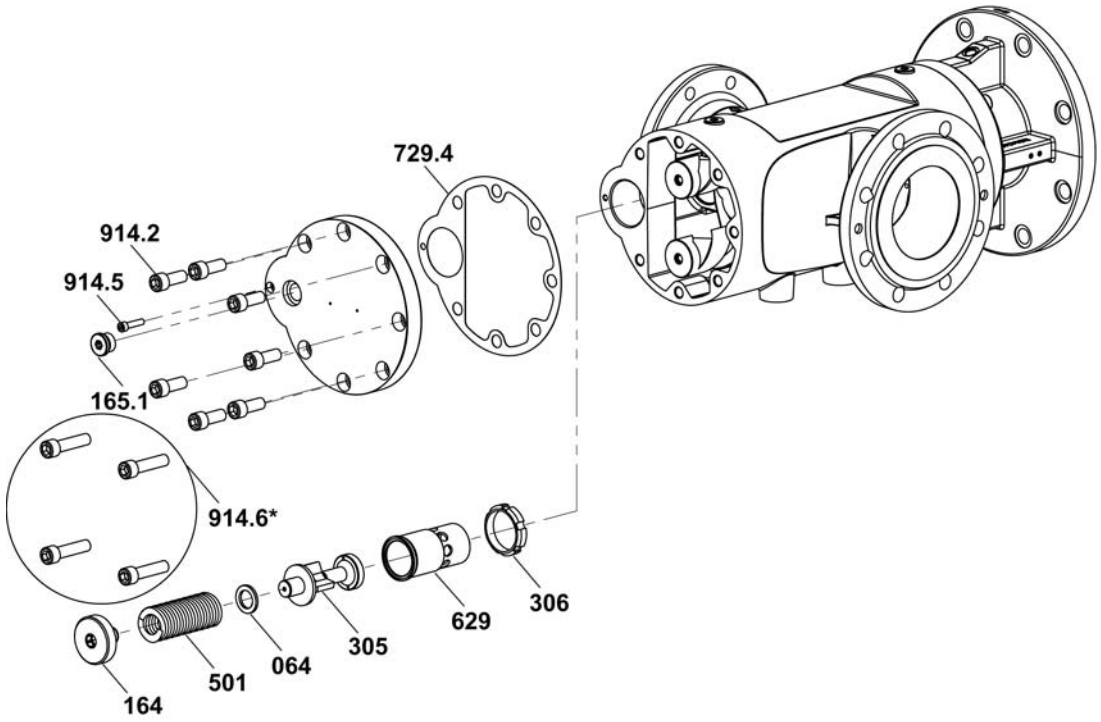
NOTE
The repair sets contain only the numbered parts and are only supplied complete.

Overflow valve 3SBI/3SVI 5 – 660



Qty.	Pos. no.	Part	Qty.	Pos. no.	Part
1	164	Adjusting screw	1	501	Spring
1	165.1	Screw plug	1	729.4	Flat gasket
1	305	Valve body	4	914.2	Socket screw

Overflow valve 3SBI/3SVI 851 – 1301

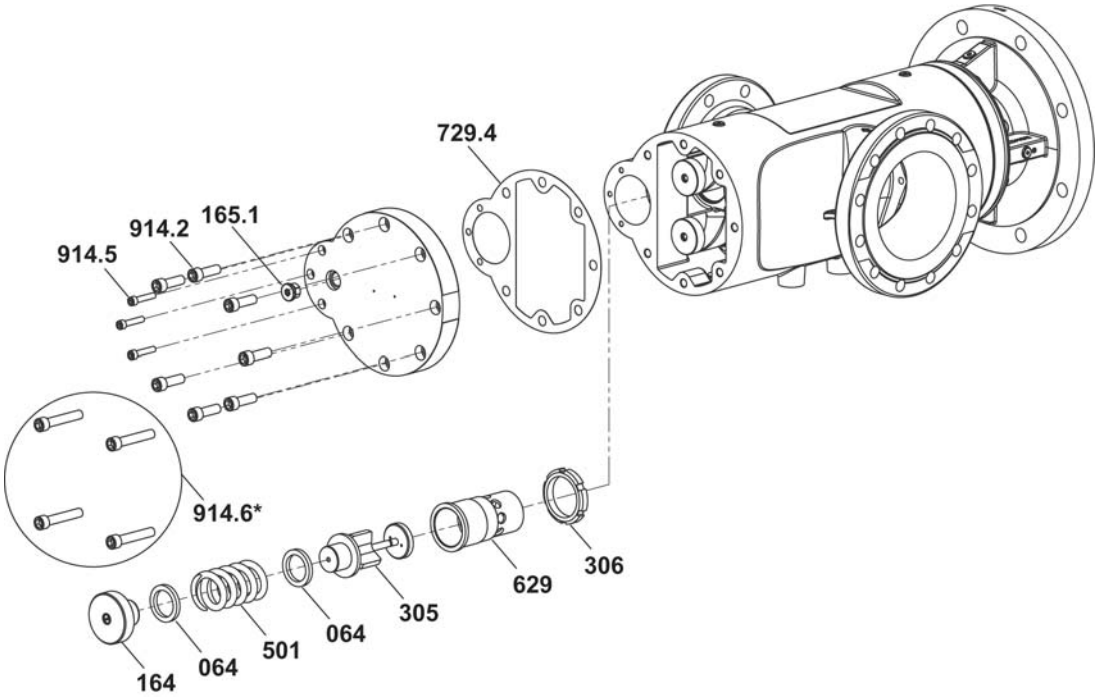


Qty.	Pos. no.	Part	Qty.	Pos. no.	Part
1	064	Supporting ring	1	629	Valve housing
1	164	Adjusting screw	1	729.4	Flat gasket
1	165.1	Screw plug	7	914.2	Socket screw
1	305	Valve body	1	914.5	Socket screw
1	306	Groove nut	4	914.6*	Socket screw
1	501	Spring			

* Only for 3SVI: replaces 4 pieces 914.2

7 Spare parts

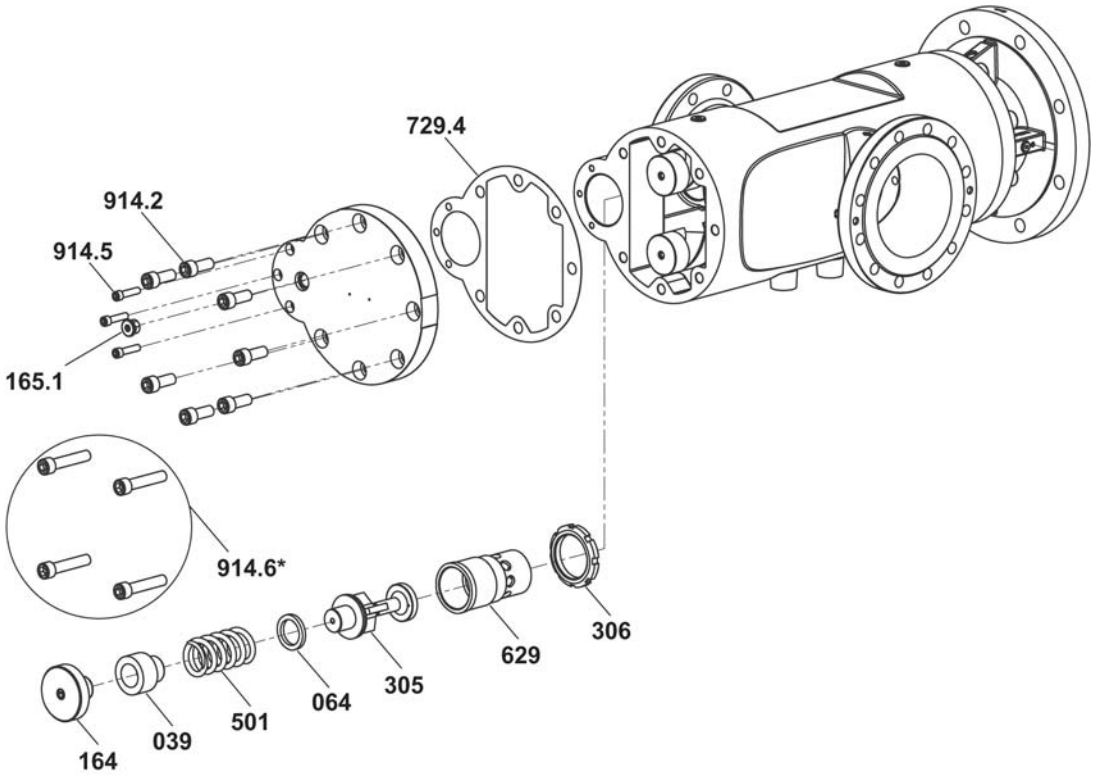
Overflow valve 3SBI/3SVI 1500 – 1700



Qty.	Pos. no.	Part	Qty.	Pos. no.	Part
2	064	Supporting ring	1	629	Valve housing
1	164	Adjusting screw	1	729.4	Flat gasket
1	165.1	Screw plug	7	914.2	Socket screw
1	305	Valve body	3	914.5	Socket screw
1	306	Groove nut	4	914.6*	Socket screw
1	501	Spring			

* Only for 3SVI: replaces 4 pieces 914.2

Overflow valve 3SBI/3SVI 2200 – 2900



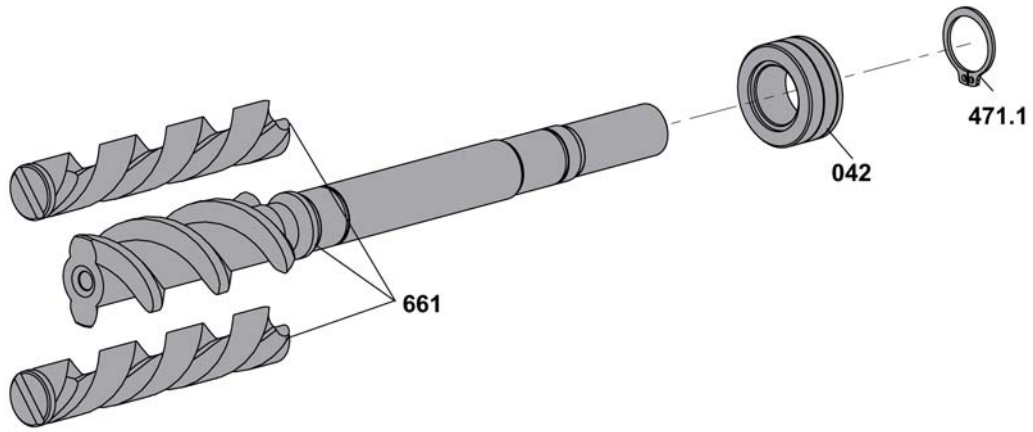
Qty.	Pos. no.	Part	Qty.	Pos. no.	Part
1	039	Sleeve	1	501	Spring
1	064	Supporting ring	1	629	Valve housing
1	164	Adjusting screw	1	729.4	Flat gasket
1	165.1	Screw plug	7	914.2	Socket screw
1	305	Valve body	3	914.5	Socket screw
1	306	Groove nut	4	914.6*	Socket screw

* Only for 3SVI: replaces 4 pieces 914.2

7 Spare parts

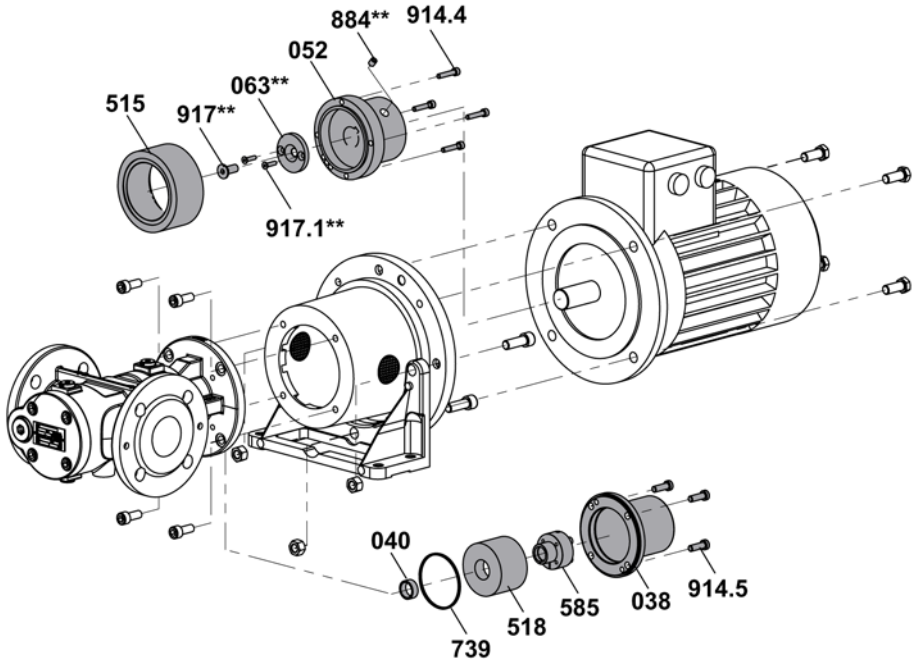
Screw set

NOTE
The repair set, screw set is only supplied in combination with a maintenance set.



Qty.	Pos. no.	Part	Qty.	Pos. no.	Part
1	042	Balancing cylinder	1	661	Screw set
1	471.1	Circlip			

Magnetic coupling 3SBI/3SVI

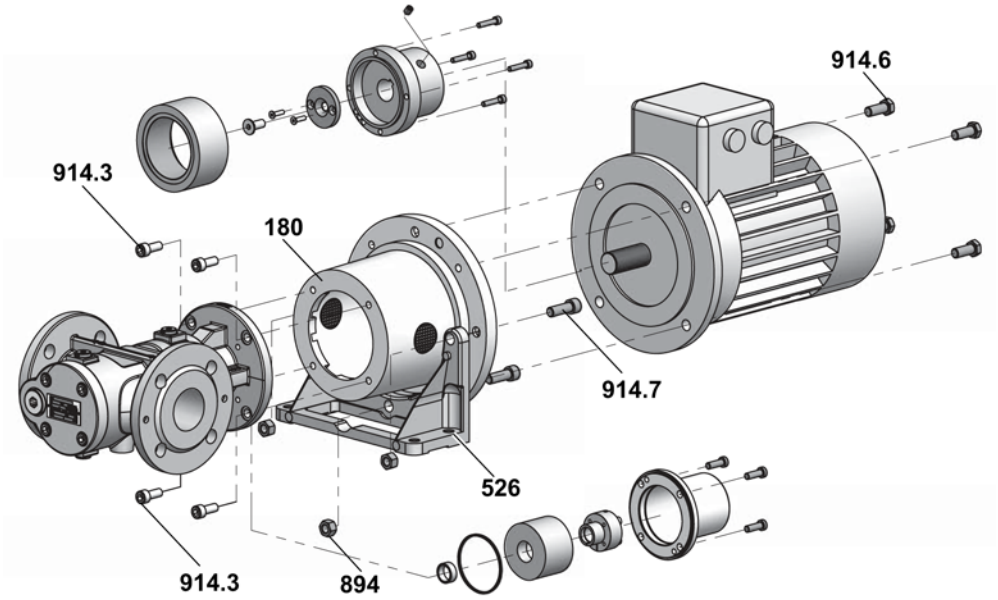


Qty.	Pos. no.	Part	Qty.	Pos. no.	Part
1	038	Containment can	1	739	O-ring
1	040	Distance sleeve	1	884**	Threaded pin
1	052	Coupling hub	4	914.4	Socket screw
1	063**	Supporting ring	4	914.5	Socket screw
1	515	Outer rotor	1	917**	Countersunk screw
1	518	Inner rotor	2	917.1**	Countersunk screw
1	585	Tensioning element			

** Depending on motor size

7.3 Completions

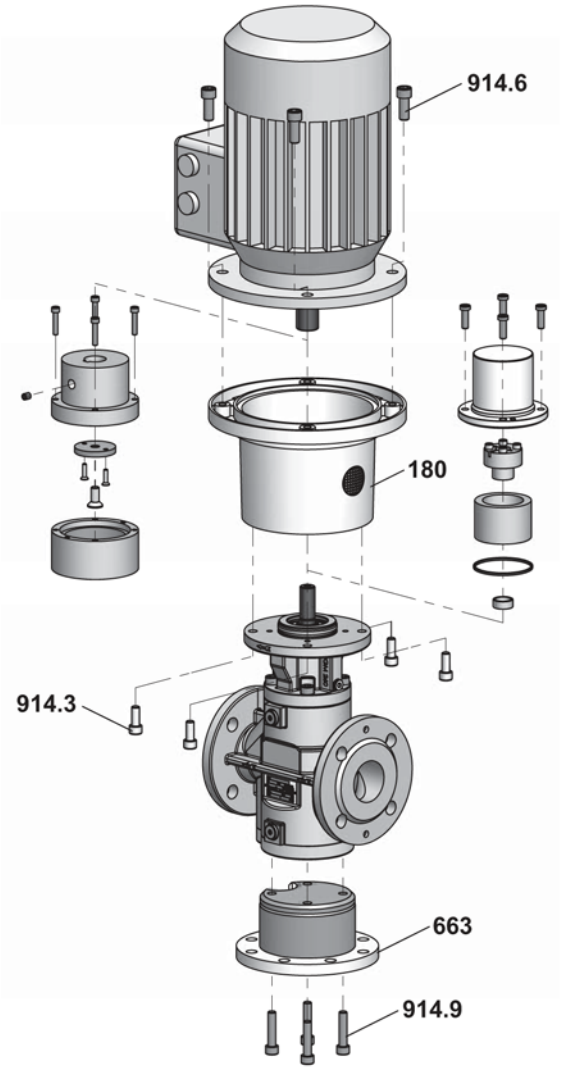
Model 3SBI



Pos. no.	Part	Pos. no.	Part
180	Pump bracket	914.3	Socket screw
526	Pump bracket foot	914.6	Socket screw
894	Hexagon nut	914.7	Socket screw

7 Spare parts

Model 3SVI



Pos. no.	Part	Pos. no.	Part
180	Pump bracket	914.6	Socket screw
663	Pedestal	914.9	Socket screw
914.3	Socket screw		

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Please visit www.alfalaval.com to access the information directly.