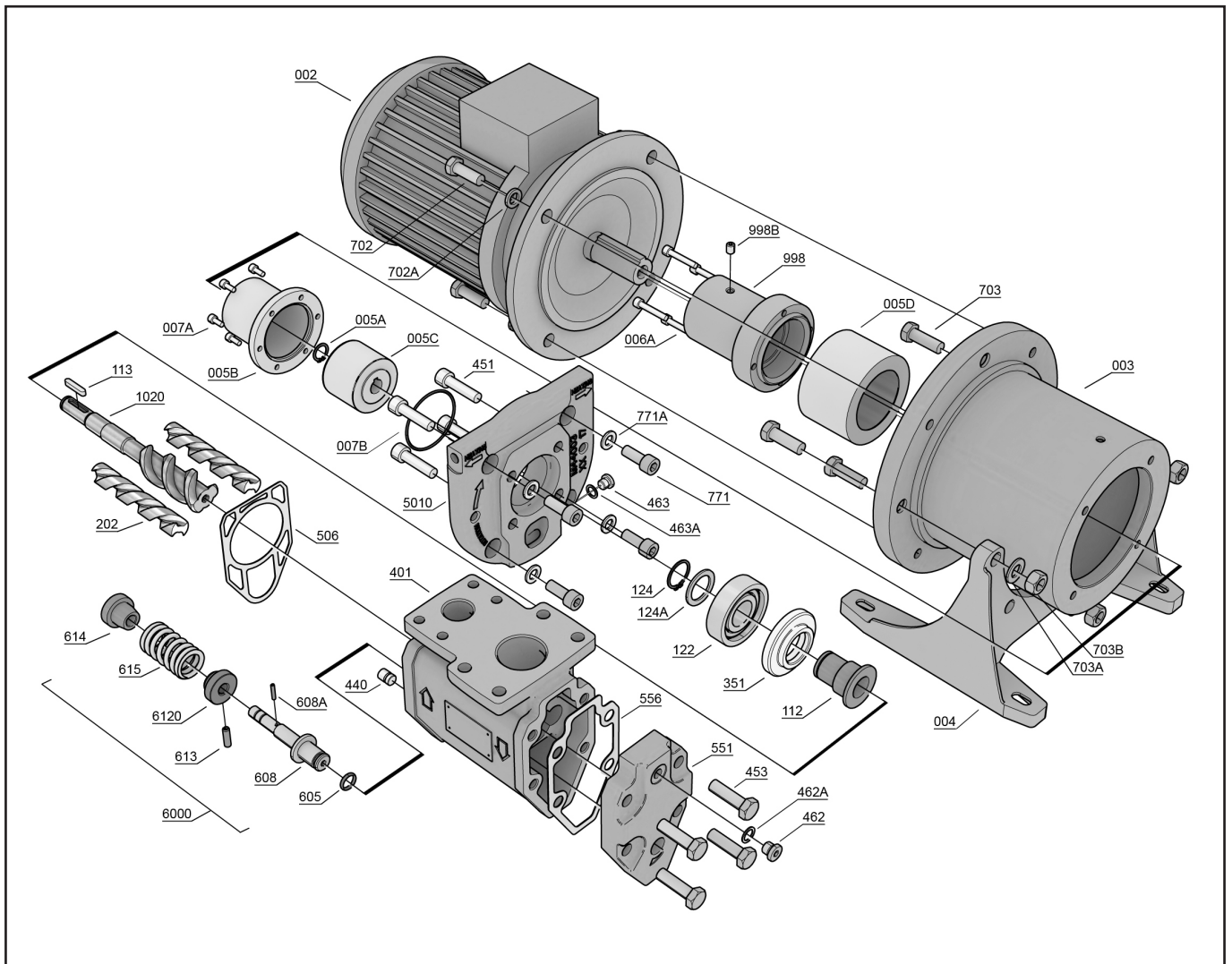




A Colfax Business Unit

# Opti Line ACE4 Screw pump

## Maintenance & Start up Instruction



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## Introduction

A screw pump from IMO is a quality product that is designed for a long problem free operation in tough environments. As all other mechanical products they do however requires a certain grade of maintenance and service in order to guarantee a faultless and economic favourable operation.

A recommendation is to go through the pump each 5 year in order to replace wear details such as ball bearings and certain gaskets and o-rings. A relatively small review of a screw pump from IMO means that the pump in most of the cases will be in a condition "as new" and therefore give the operator another long and problem free operation.

### Identification of safety instructions

Non compliance of safety instructions identified by the following symbol could affect safety for persons



Safety instructions where electrical safety is involved are identified by:



Safety instructions which shall be considered for reasons of safe operation of the pump or pump unit and/or protection of the pump or pump unit itself are marked by the sign:



## Service intervals

The intervals for inspection and replacement of wear parts vary greatly with the properties of the pumped liquid and can only be determined by experience. All internal parts of the ACE Optiline pump are lubricated by the pumped liquid. Pumping liquid which contain abrasive materials, or liquid that is corrosive, will significantly reduce service life and call for shorter service intervals. Wear in the pump will normally show as:

- Vibration
- Noise
- Loss of capacity
- Reduction in flow/pressure
- Loss of the magnetic power

We recommend planned inspections and/or overhaul at regular intervals, not exceeding 5 years. It is recommended to always have the spares included in joint spare part kit G057 together with the ball bearing 122 available for a planned inspection.

## Inspection of rotors

To reach the idler rotors in a quicker way than described in the dismantling section, loosen the rear cover (480) with the valve. Screw out the idler rotors backwards. Internal clearances in the pump, which are vital for its proper function, may have been affected by wear. Acceptable wear can be determined only by experience of the actual application. As a rule of thumb the following max clearance values may apply: Between rotor and bores: 0.2 mm, Between rotor flanks: 0.4 mm For light duties (low pressure, medium viscosity) even bigger clearances may be acceptable but for low viscosity/high pressure duties the limit will be lower. Also watch if there are major scratches on these parts.

## Inspection of the magnetic coupling

The magnetic coupling with all its components is considered to be maintenance free if operated and mounted according to our instructions.

The lifetime of the magnets is well within the lifetime of the pump and exchange of the magnets is only necessary if a major breakdown has occurred as a result of for example excessive amounts of dirt or particles in the pumped fluid.


## Common aspects with magnetic couplings

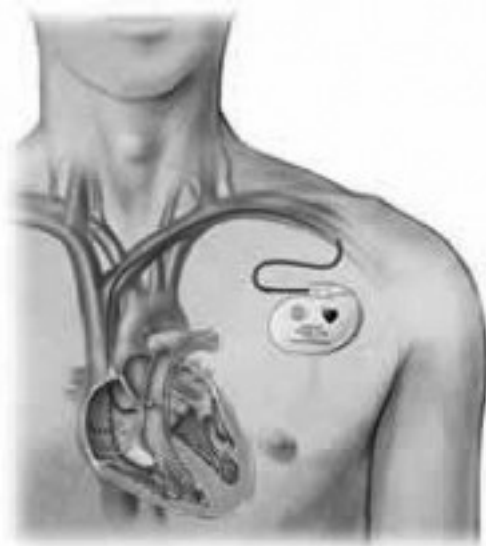
Permanent magnetic couplings generate a strong magnetic field. The installation must be carried out only by trained staff that has the understanding of how a magnetic coupling acts and all the safety precautions related to it. All installation instructions must be strictly followed. Modifications or changes to the magnetic coupling or its components are not to be allowed under any circumstances. IMO does NOT take any responsibilities for damages caused by improper use or damages related to this.

Magnetic data carriers such as bank cards, floppy disks etc may become unreadable and should always be kept separated from the magnetic field.

## DANGER

Installations and maintenance must always take place during complete shutdown in an un-pressurised condition. The drive unit must be secured against inadvertent switching on by means of blocking the electrical supply to the electric motor in order to avoid serious injuries due to rotating parts.

- 2  ATTENTION! In areas where permanent magnetic couplings are handled or stored with open access, persons with heart **PACEMAKERS** should keep a distance of 3 meters. For permanent magnetic couplings assembled within a pump a safety distance of 3 meter is sufficient.




## Precautions prior to starting maintenance on the pump

- 3  If the pumps operating temperature exceeds 60°C, let the pump cool off before any service, maintenance or dismantling work is commenced to avoid burn injury
- 4  All work carried out on the pump has to be performed in such a manner that risks for personal injury are observed!
- 5  When handling liquids that may harm skin, use gloves and/or protecting clothing!
- 6  When handling liquids which may involve fire hazard appropriate precautions to avoid danger are to be taken.
- 7  In case of failure for system with elevated pressure, fluid jets may cause injury and/or damage.
- 8  Oil leakage may make the floor slippery and cause personal injury.
- 9  Before any maintenance work, ensure that the driver is deenergized and the pump hydraulically isolated.
- 10  Connecting and disconnecting of electrical cables must be done only by personnel authorized to do such work.

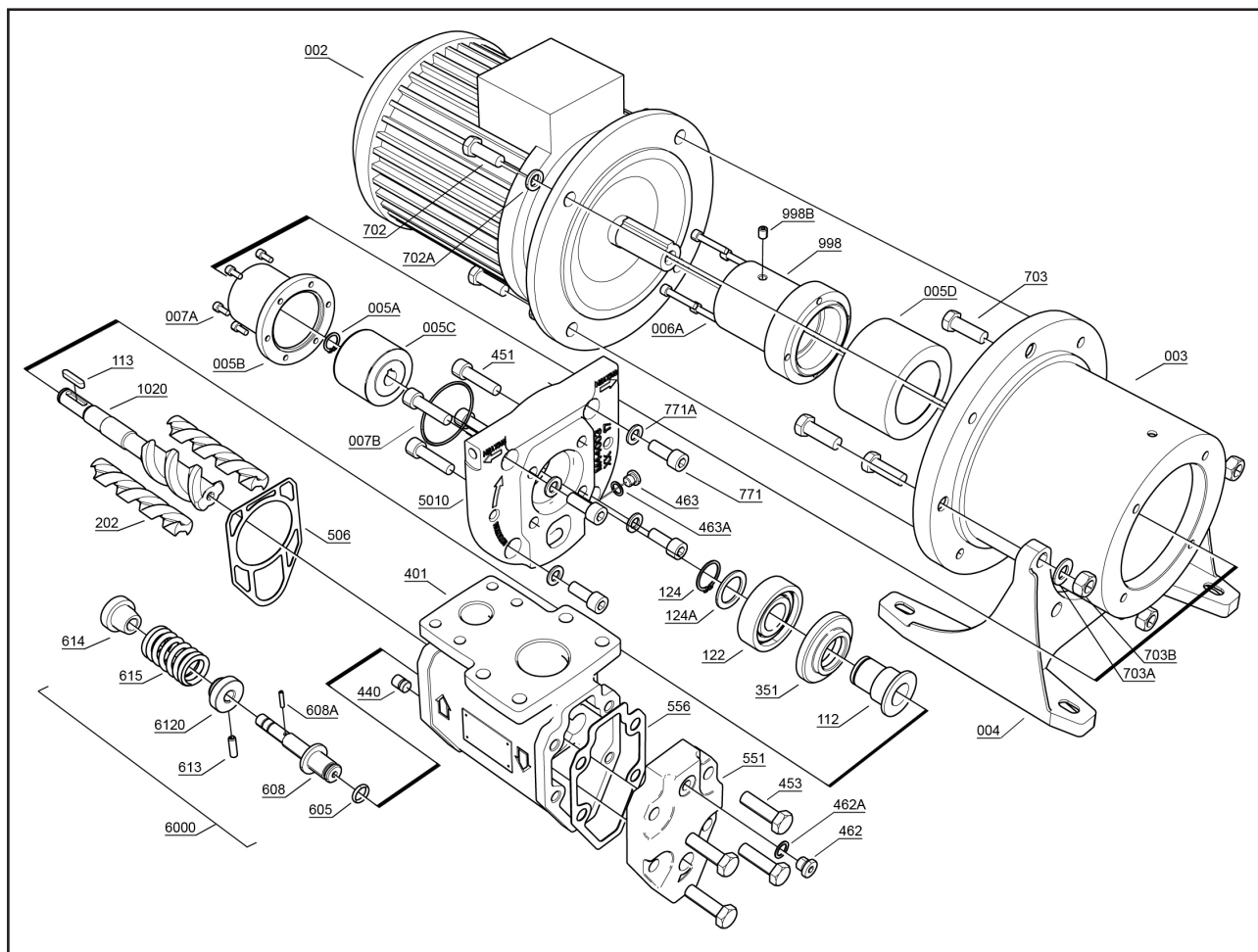
## List of components

Valid for all ACE Optiline Generation 4 pumps with sizes 025, 032, 038 and leads L, K, N & D  
With version codes, NJBP, NKBP, NLBP & NMBP

PosNo	Designation	Qty	G012	G054	G057	G070	G098	Notes	Explanations
002	Motor	1							
003	Connecting frame	1							G012: Rotorset
004	Angle bracket	1							G054: Major kit
005	Magnetic coupling complete	1					X		
005A	Retaining ring	1		X	X		X		G057: Joint kit
005B	Sealing can	1					X		G070: Compl valve
005C	Inner magnetic rotor	1					X		
005D	Outer magnetic rotor	1					X		G098: Compl magnetic coupling
006A	Screw	4							
007A	Screw	6							
007B	O-ring	1		X	X		X		
1020	Power rotor	1	X	X					
112	Balancing piston	1	X	X				2	
113	Shaft key	1	X	X					Notes:
122	Ball bearing	1	X	X					1) Gaskets for counter flanges
124	Retaining ring	1	X	X	X				
124A	Support ring	1	X	X	X				2) Not sold separately
202	Idler rotor	2	X	X					
351	Balancing bush	1	X	X					
401	Pump body	1							
418	Gasket	1		X	X			1	
423	Gasket	1		X	X			1	
451	Screw	4							
453	Screw	4							
462	Plug	1							
462A	Sealing washer	1		X	X				
463	Plug	1							
463A	Washer	1		X	X				
5010	Front cover	1							
502	Plug	2							
506	Gasket	1		X	X				
551	Rear cover	1							
556	Gasket	1		X	X				
6000	Compl. Valve	1				X			
(605)	O-ring	1		X	X	X			
(608)	Valve spindle	1				X		2	
(608A)	Tension pin	1				X		2	
6120	Set screw	1				X		2	
(613)	Tension pin	1				X		2	
(614)	Valve piston	1				X		2	
(615)	Valve spring	1				X		2	
701	Screw	4							
701A	Washer	4							
702	Screw	4							
702A	Washer	4							
703	Screw	3							
703A	Washer	3							
998	Drive hub	1							
998B	Screw	1							

1  Before commencing any work, read this instruction carefully! Failure to comply with these instructions may cause damage and personal injury!

For more information about the pumps identification code, technical data and performance we refer to the ACE Product description.



## Ordering Code

Item	Spare part sets	Part numbers for pump size		
		025	032	038
G012	Rotor set	D-lead		193362
	"	K-lead		193360
	"	L-lead	193356	193358
	"	N-lead	193357	193359
G054	Major kit	D-lead		193369
	"	K-lead		193367
	"	L-lead	193363	193365
	"	N-lead	193364	193366
G057	Joint kit		193374	193375
G070	Valve element		189873	189873
G098	Magnetic coupling	xKxx	193370	193370
	"	xLxx	193371	193371
	"	xMxx		193372
	"	xNxx		193373
122	Ball bearing		173765	173591

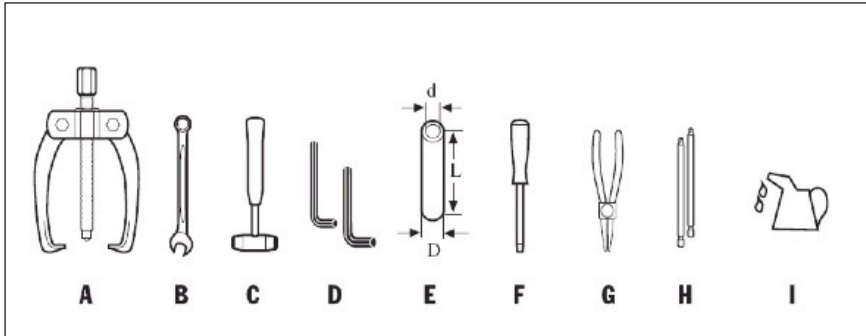
## Recommended Spare Parts Kits and tool kits

Every shutdown for service of a plant is costly. The time for repair should therefore be limited to a minimum which can be accomplished by keeping a spare pump. The changed pump can later be repaired at a suitable place and can then be used as a spare pump. For maintenance the following spare parts kits and tools are recommended:

Kit:	Content:	To be used for:
G057	Gaskets & o-rings	Dismantling of pump
G012	Rotor set	Repair after break down
122	Ball bearing	Repair after break down
193397	Toolkit	Dismantling & assembly

# Dismantling and reassembling the pump

## List of tools necessary for dismantling and reassembly

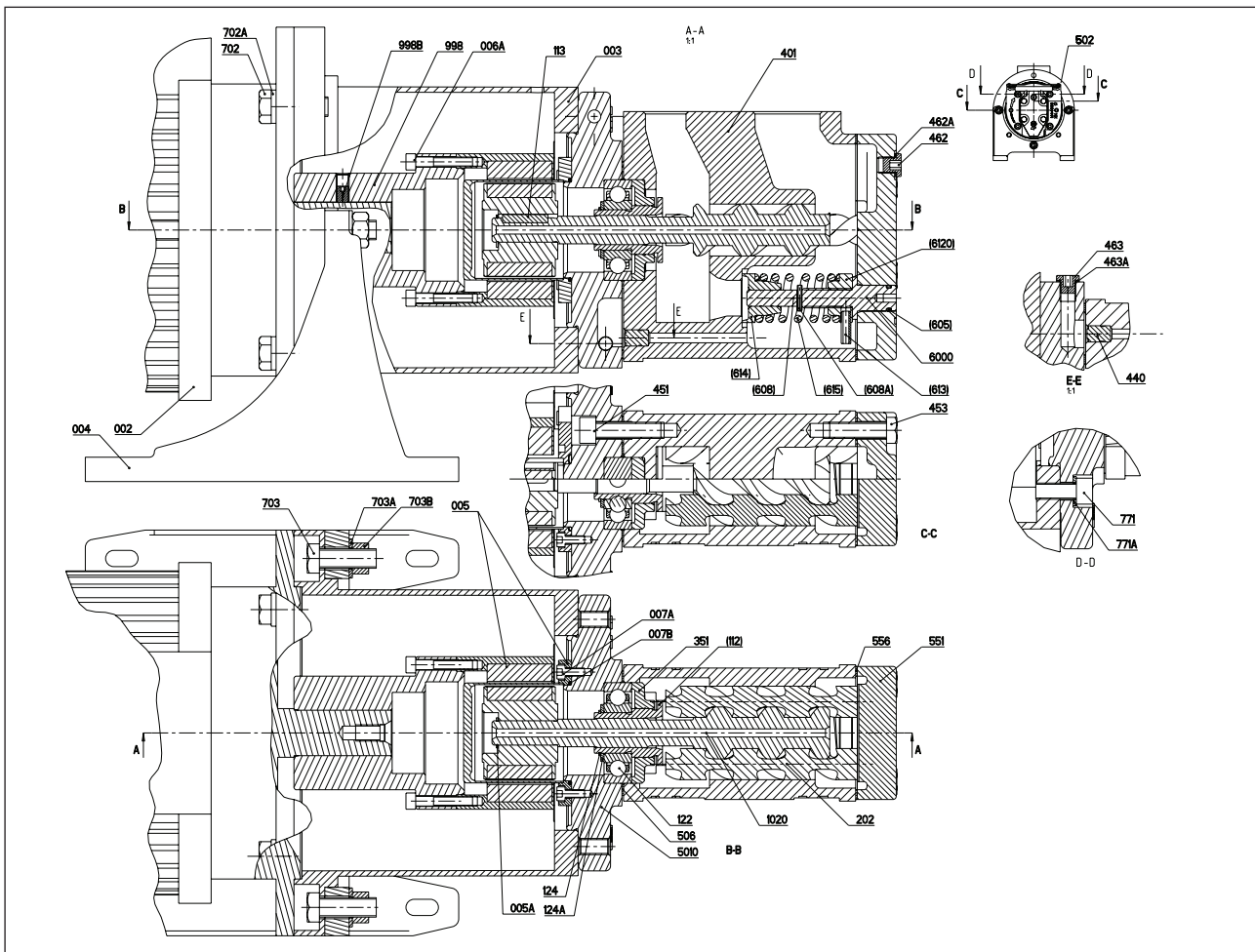


- A = Puller
- B = Spanner 16 mm
- C = Plastic mallet
- D = Allen keys (3 mm & 5 mm)
- E = Mounting Sleeve, D = 25,5 mm

- F = Screw driver
- G = Plier
- H = Guide Pins
- J = Oil can

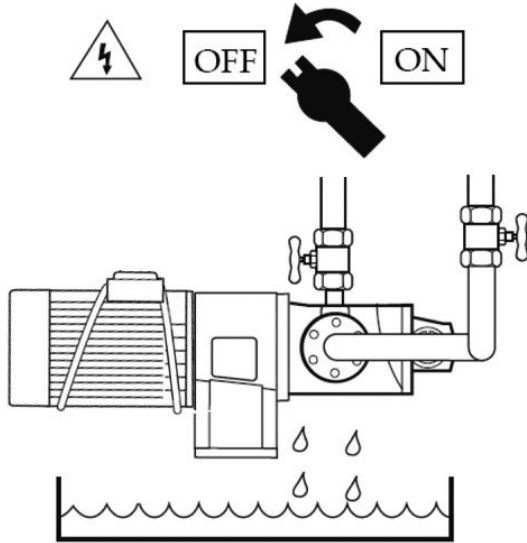
Tightening torque (Nm)	
Pos No	Torque
0006A	9
0007A	5
451	40
453	40
462	40
463	40
701	40
702 IEC	
80-90	25
100-132	40
703B IEC	
80-90	25
100-132	40
998B IEC	
80	9
90	20
100-132	40
	-
	Loctite 222

## Sectional View




# Dismantling

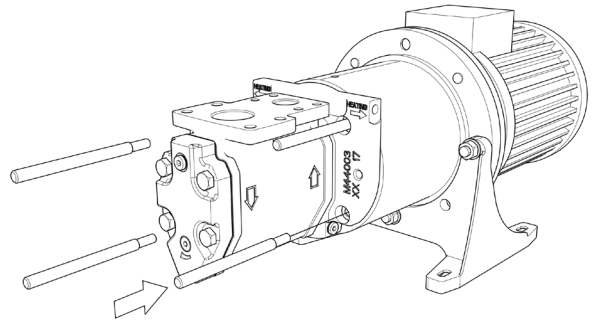
**A.**



- Turn the electricity OFF.
- Close the valves.

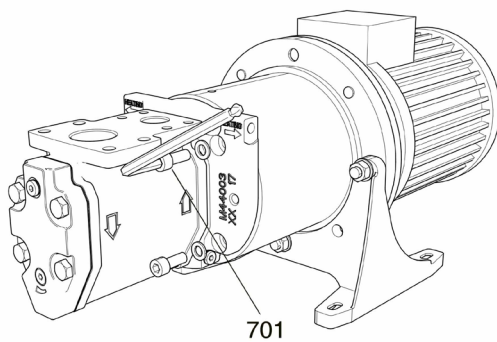
**11**  Use appropriate vessels to collect oil spillage when removing and opening the pump

**C.**



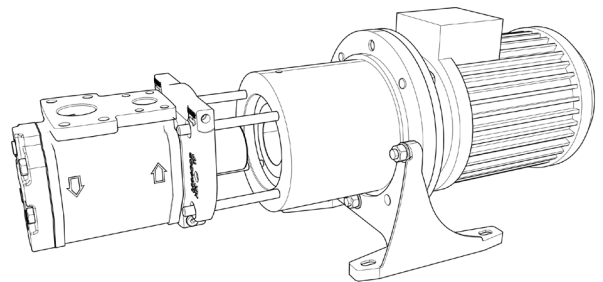
- Mount the guiding pins into the connecting frame.

**B.**



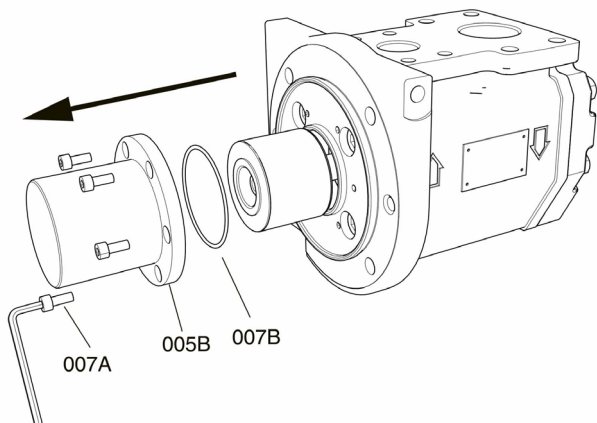
- Loosen the screws 701 with an allen key.

**D.**



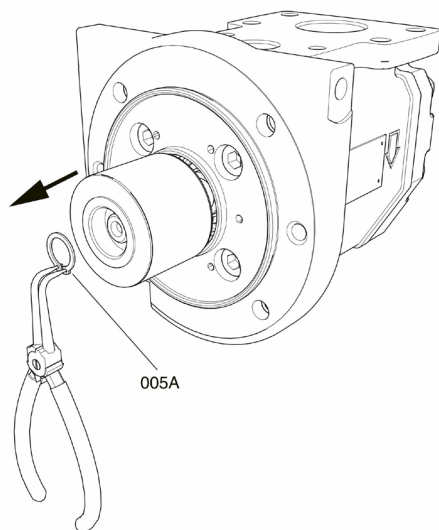
- Pull out the pump from the connecting frame together with the magnetic coupling. Beware of the magnetic force!

# E.



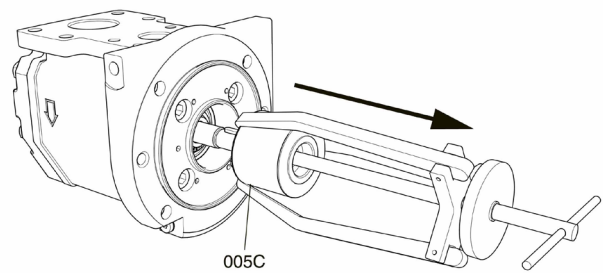
- Loosen the screws 007A with a allen key
- Pull out the sealing can 005B
- Remove the o-ring 007B

# F.



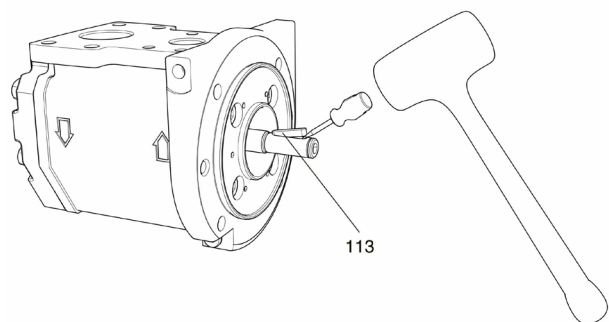
- Remove the circlip 005A with a suitable plier.

# G.



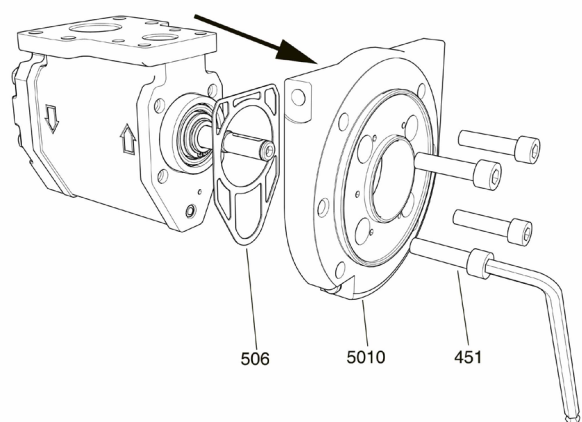
- Remove the inner magnetic rotor by means of a suitable puller.

# H.



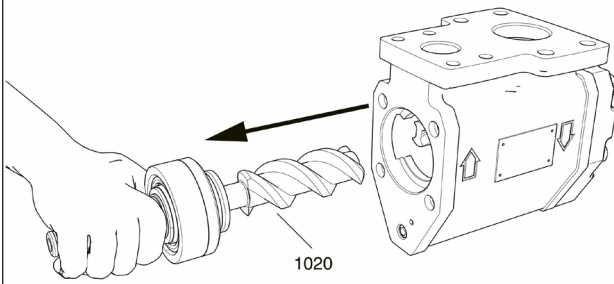
- Remove the key 113 with a suitable tool.

# I.

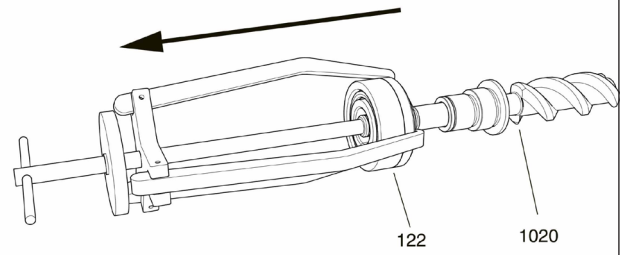


- Unscrew the bolts 451 with an allen key.
- Remove the front cover 5010 with its gasket 506.

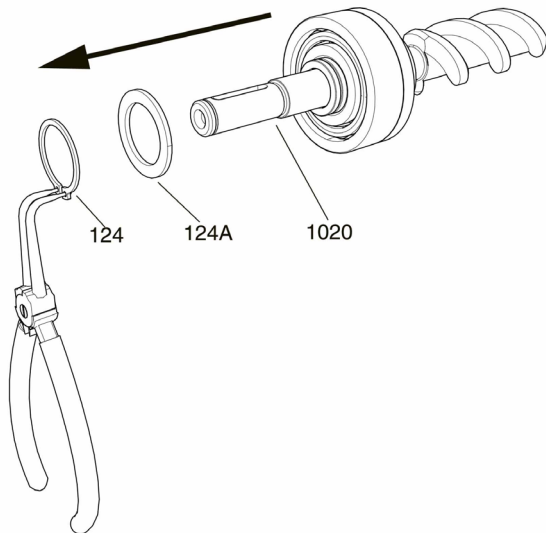


**J.**

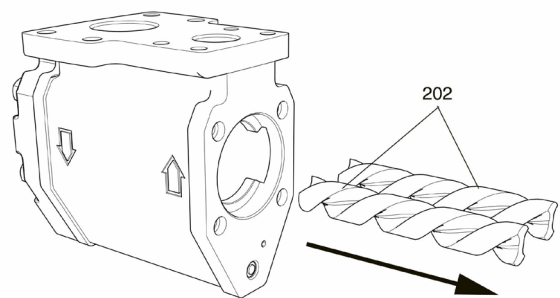
- Pull out the main rotor 1020 from the pump body with hand force.

**L.**

- Remove the ball bearing 122 from the main rotor 1020 with a suitable puller

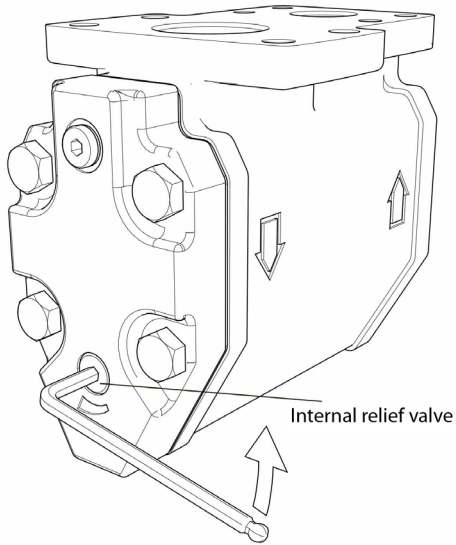
**K.**

- Remove the circlip 124 with a suitable plier from the main rotor 1020.
- Remove the support washer 124A from the main rotor 1020.

**M.**

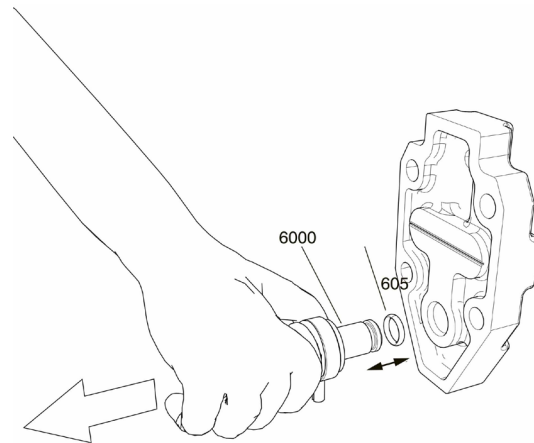
- Pull out the idlers 202 from the pump body.

**N.**



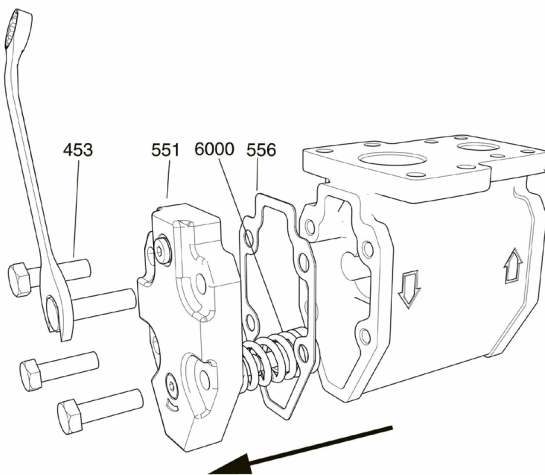
- Release the spring tension from the relief valve by unscrewing it counter clockwise.
- Count the number of turns so it easily can be set to the correct value again.

**P.**



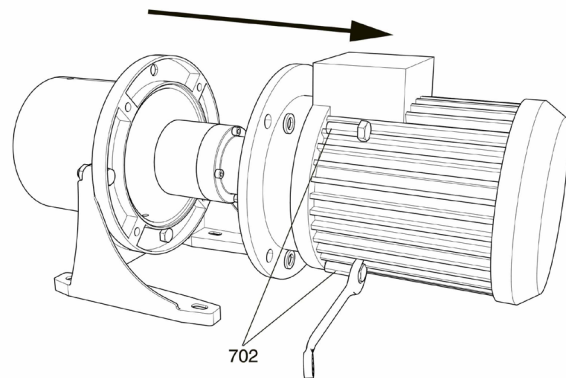
- Remove the valve 6000 with its o-ring 605.

**O.**



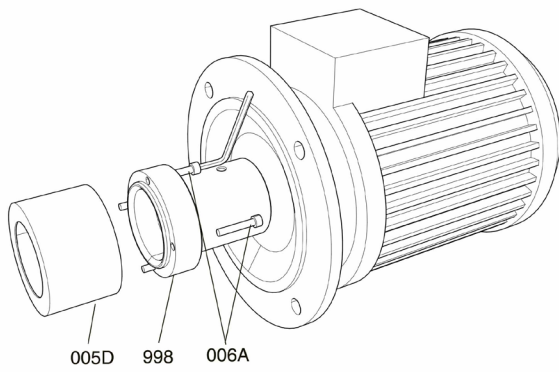
- Remove the bolts 453 and the back cover 551 with its gasket 556 together with the valve 6000.

**Q.**



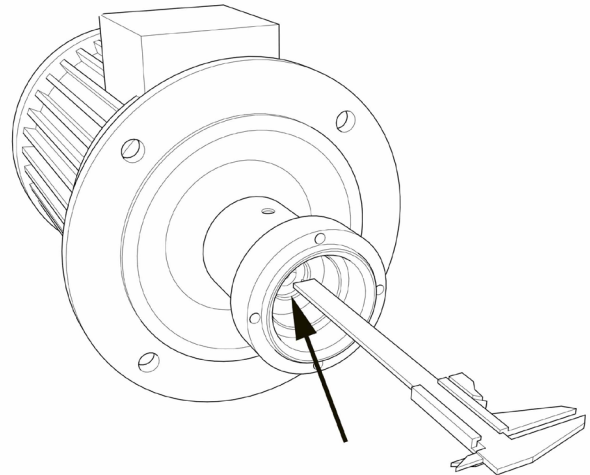
- Remove the bolts 702 and pull out the motor from the connecting frame.

**R.**



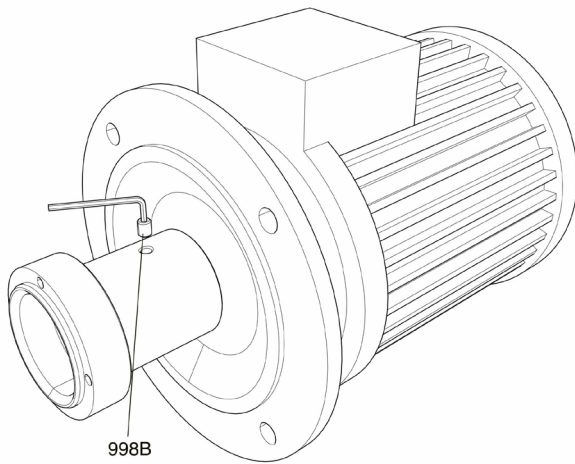
- Unscrew the bolts 006A and remove the magnet 005D from the drive hub 998.

**T.**



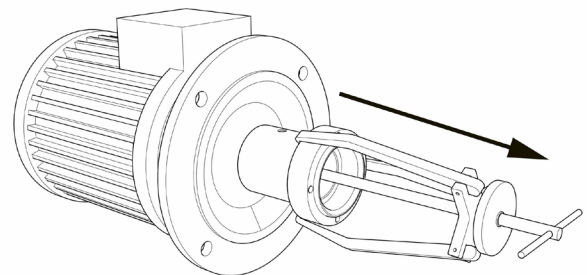
- Measure the distance between motor shaft end and the drive hub.

**S.**



- Release the screw 998B.

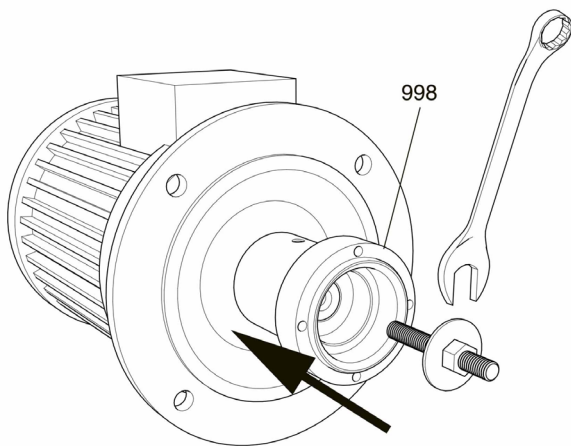
**U.**



- Remove the drive hub from the electrical motor with a puller.

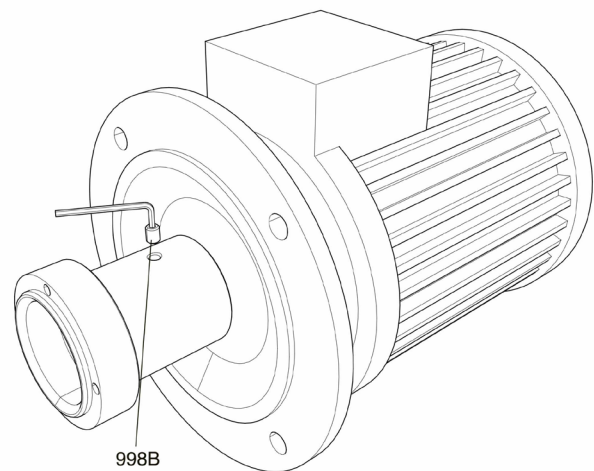
## Reassembly

**A.**



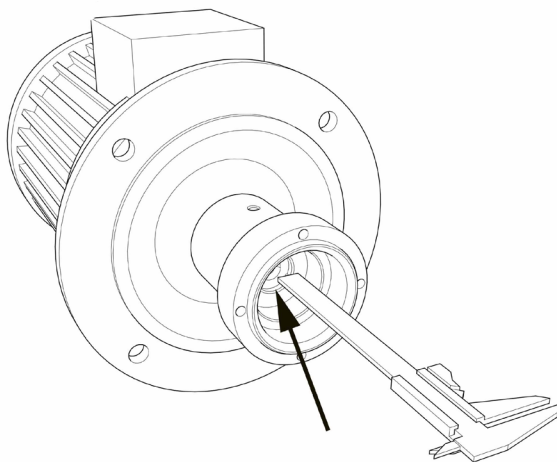
- Press the drive hub 998 on to the shaft by means of a suitable stud bolt with a washer and nut.

**C.**



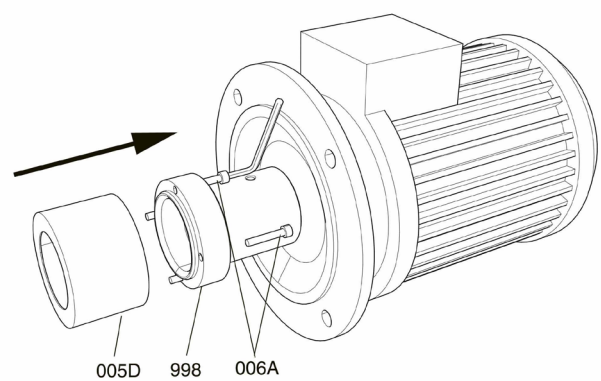
- Tight the screw 998B firmly.

**B.**



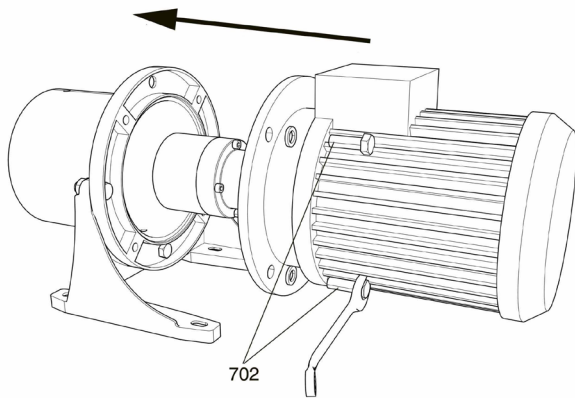
- Measure the distance so that it will be the same as before the dismount.

**D.**



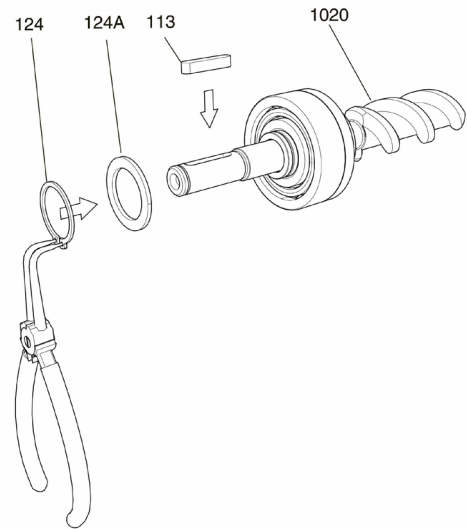
- Mount the magnet 005D onto the drive hub 998 by tightening the bolts 006A.

# E.



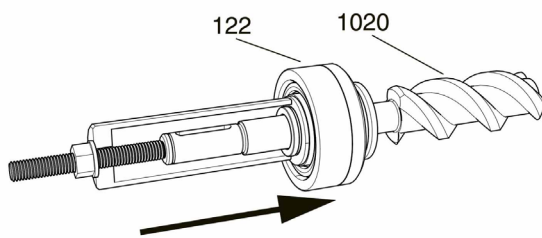
- Mount the electrical motor back into the connecting frame and tight the bolts 702.

# G.



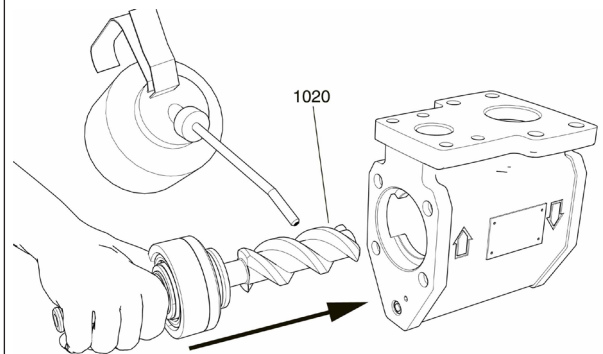
- Mount the washer 124A and the circlip 124 onto the main rotor 1020.
- Mount the key 113 in its groove.

# F.

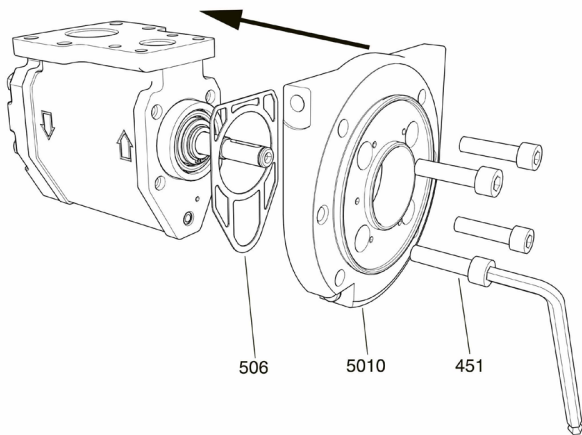


- Mount the ball bearing onto the rotor 1020 by either using a mounting tool as above or by heating up the ball bearing (max 110 deg).

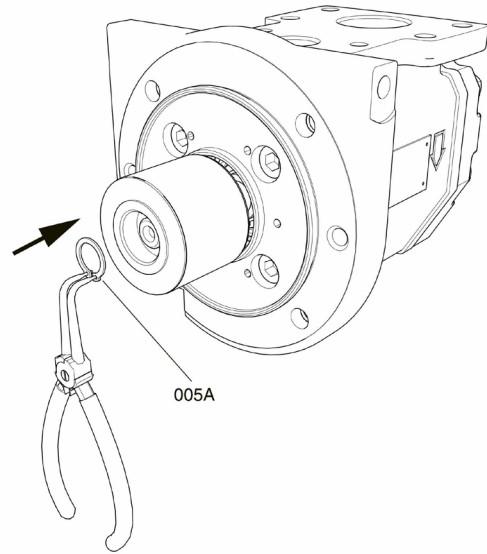
# H.



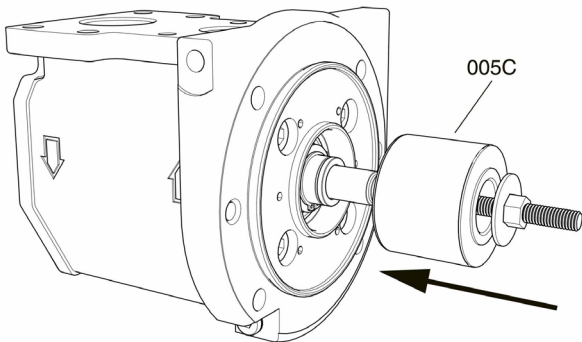
- Lubricate the drive shaft 1020 and mount it into the pump body.

**I.**

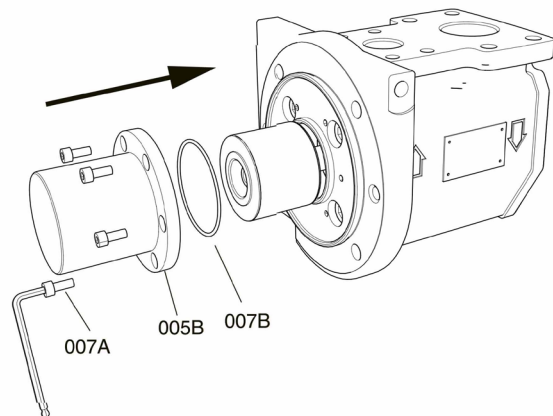
- Mount the frontcover 5010 and the gasket 506 and tight the bolts with the correct torque which can be found on page 8.

**K.**

- Mount the circlip 005A with a plier.

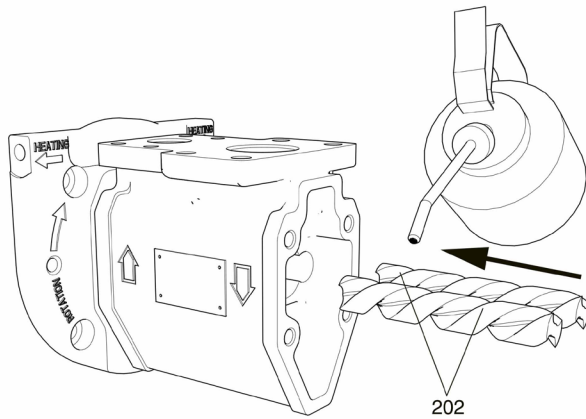
**J.**

- Mount the inner magnet 005C onto the shaft by using a stud bolt M6 with a suitable washer and nut, press the inner magnet into its final position by using hand force or a plastic mallet.

**L.**

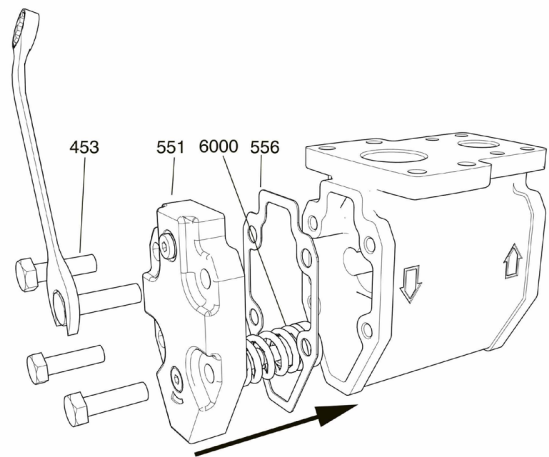
- Mount the o-ring 007B and the seal can 005B and tight the screws 007A with the correct torque as stated on page 8.

# M.



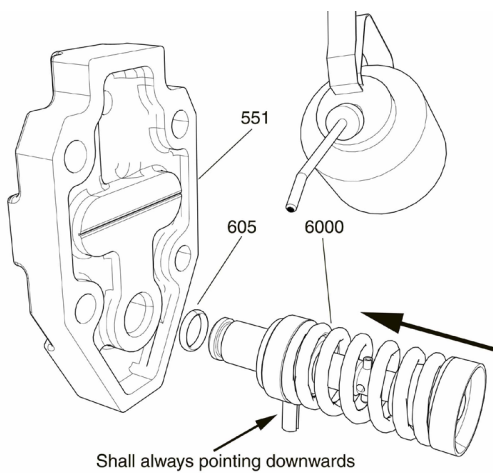
- Mount the idlers 202 into the pump body after thoroughly lubricating them.

# O.



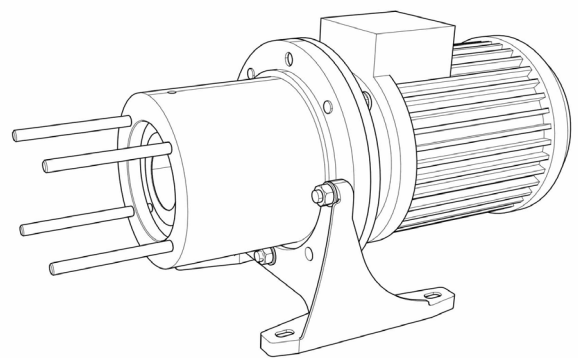
- Mount the back cover 551 together with the valve 6000 and gasket 556. Tight the bolts.
- Tight the bolts 453 with the correct torque that can be found on page 8.

# N.



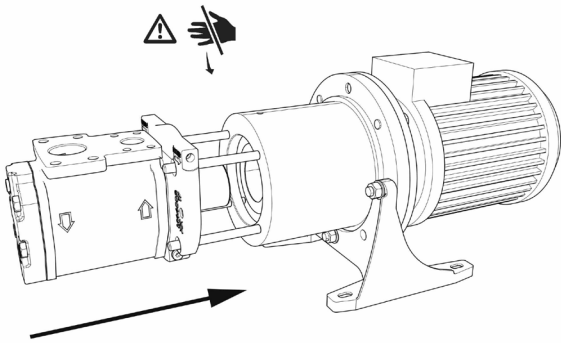
- Mount the valve 6000 with its o-ring 605 into the back cover 551, lubricate thoroughly.

# P.



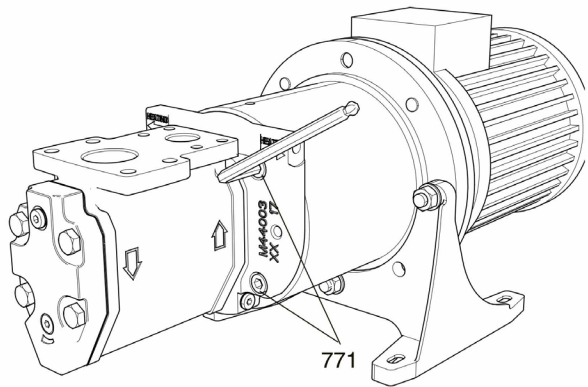
- Mount the guiding pins into the connecting frame.

**Q.**



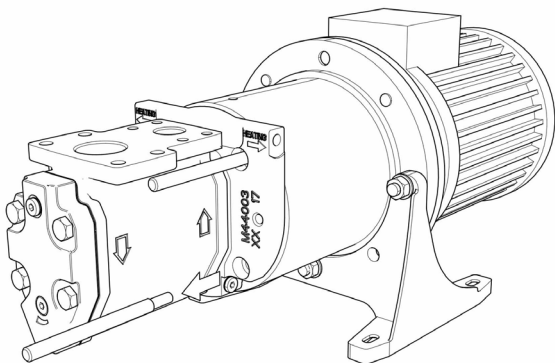
- Mount the pump into the connecting frame.

**S.**



- Mount the guiding pins into the connecting frame 003.

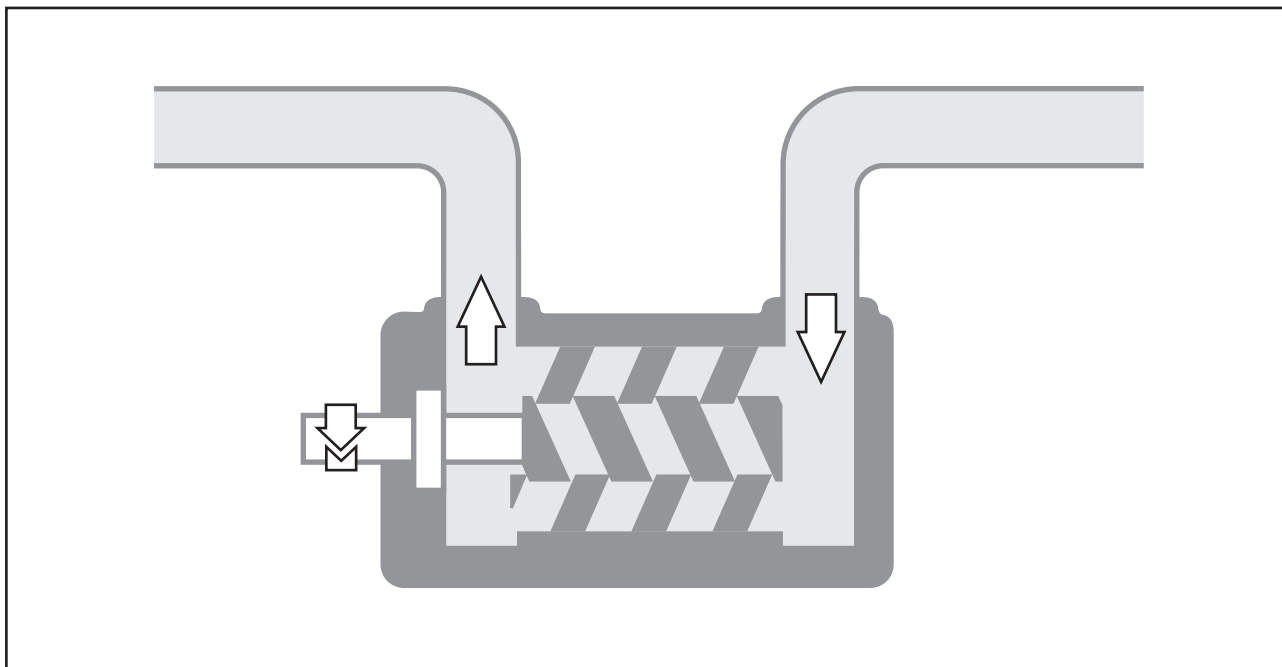
**R.**



- Remove the guiding pins from the pump.



# Installation and Start-up Instruction



Valid for ACE 025-038 Optiline Generation 4

**BEFORE COMMENCING ANY WORK,  
READ THIS INSTRUCTION CAREFULLY!**

## Identification of safety instructions

Non compliance of safety instructions identified by the following symbol could affect safety for persons



Safety instructions where electrical safety is involved are identified by:




Safety instructions which shall be considered for reasons of safe operation of the pump or pump unit and/or protection of the pump or pump unit itself are marked by the sign:



# Installation

Design limitations and technical data for each pump are found in the Product description. Installation of IMO AB low pressure pumps does not require special skills. However, these instructions presume that the work is carried out by experienced fitters!


**12**  Failure to comply with these instructions may cause damage and personal injury

## Transport and storage

Always protect the pump against ingress of water and other impurities. Store the pump in a clean, dry and warm environment. The pump is delivered with the internals oiled and with protective covers over the pipe connections and drain openings. These covers should remain in place for as long as possible during the mounting and installation procedure but must be removed before start up.

## Lifting of pump


Lifting of the complete pump unit with the lifting device attached to the motor, should be avoided as the motor's lifting provisions may not be able to carry the combined weight of the pump and motor.


**13**  All pumps should be lifted with straps securely attached to the pump or pump unit, so that the center of gravity is located between the straps in order to avoid tipping of the pump.

## Strainer

The pump has to be protected from foreign matters such as weld slag, pipe scale, etc., that could enter the pump via the suction line. If the cleanliness of the system cannot be guaranteed, a strainer must be installed in the inlet pipe near the pump. For practical reasons a suction strainer with 0.8-2.0 mm mesh openings is recommended.

The size of the strainer should be selected so that it is large enough to allow adequate pressure at the pump inlet. The pressure drop across the strainer should preferably not exceed 0.1 bar at max. flow rate and normal operating viscosity. A vacuum gauge between the strainer and the pump inlet is recommended to indicate when the strainer needs cleaning.

**14**  All work carried out on the pump has to be performed in such a manner that risks for personal injury are observed.

**15**  Lifting a complete pump unit, using slings or hooks attached to the pump or connecting frame may be dangerous since the centre of gravity of the pump unit may be higher than the points of attachment.

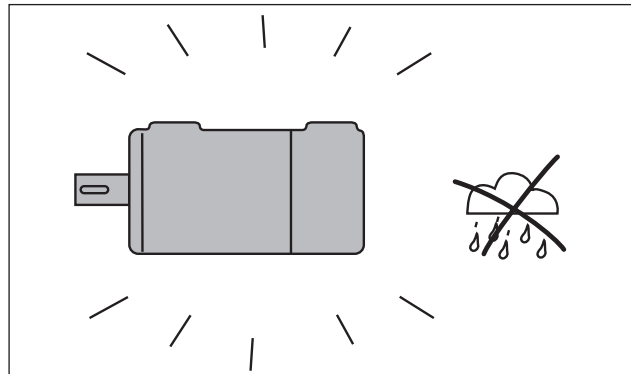


Fig 1. Keep dry and clean

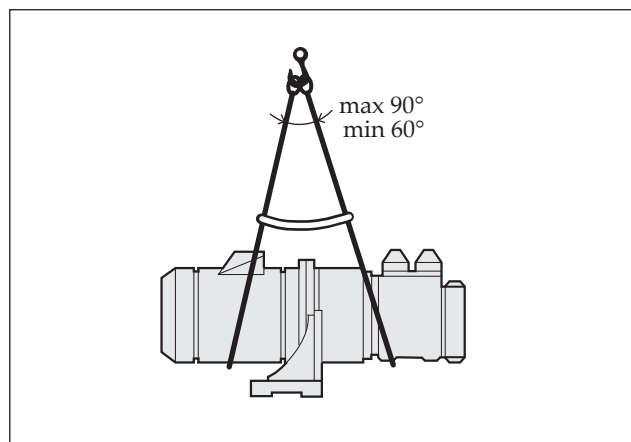


Fig 2. Lifting the pump

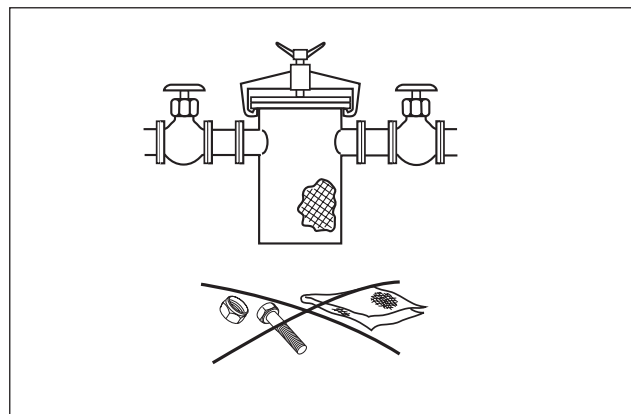


Fig 3 Strainer

## Pipe connections

The pipe work shall be installed and supported so that no pipe stresses are transferred to the pump body. The pipe forces and torque transferred to the pump shall be in accordance with ISO 14847. The pipe work should be tight in order to avoid leakage and infiltration of foreign particles and/or air. Shut off valves should be installed in both suction and discharge pipes, so that the pump can be hydraulically isolated.

## Suction line

The suction pipe should be designed so that the total pressure drop, measured at the pump inlet flange, does not exceed the suction capability of the pump. Make a proper calculation of the suction line including components such as valves, strainer, pipe bends etc. Generally, the pressure drop in the suction line should be as low as possible, which is achieved if the suction pipe is short, straight and has a suitable diameter. The velocity in the suction line should be kept in the range 0.5 - 1.2 m/s. For L.O. circulating systems, we recommend to keep it as low as possible. The suction line must be equipped with a port that allows filling the pump before start.

## Discharge line

The discharge line should be dimensioned to keep the velocity in the range 1 - 3 m/s.

## Deaeration

In installations with negative suction head, where the pump might be started against a pressurized system, a deaeration pipe with an orifice (2-3 mm is recommended) has to be installed. The deaeration pipe should be connected to the outlet pipe's highest point. This must also be installed when the pump is used as a stand-by pump.

## Liquid trap

In some mounting arrangements the pump may not retain the liquid at stand still. In such installations the suction pipe should be arranged so it forms a liquid trap together with the pump, keeping the pump half filled with liquid.

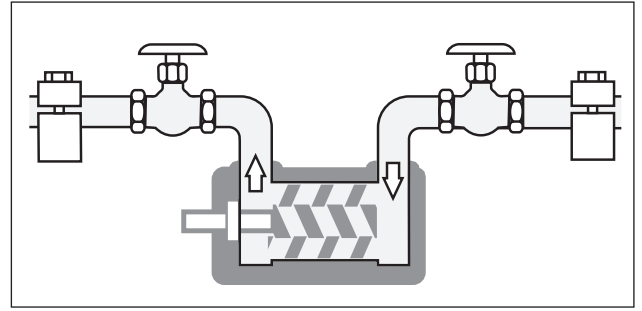


Fig. 4 Pipe connections

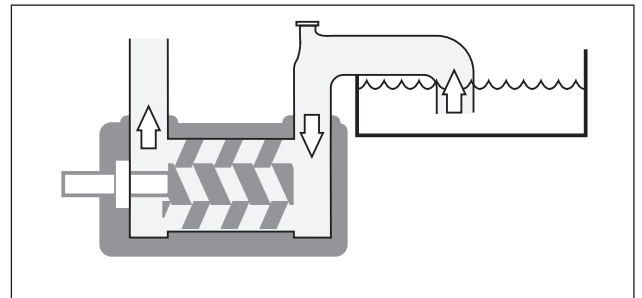


Fig. 5 Suction Line

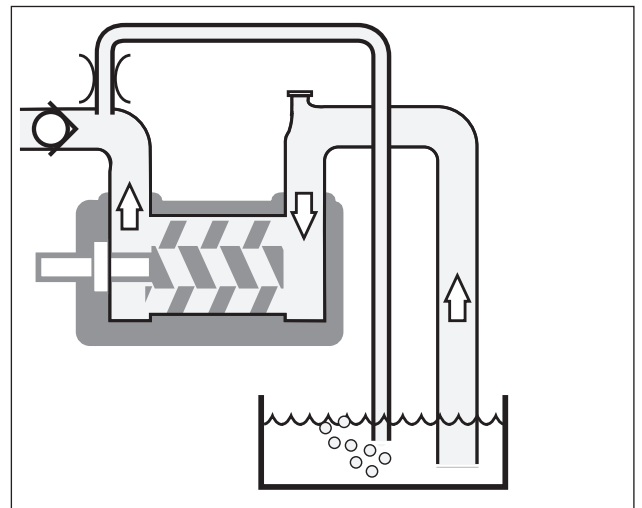




Fig. 6 Deaeration

16  When handling liquids that may harm skin use gloves and/or protective clothing

17  When handling liquids which may involve fire hazards appropriate precautions to avoid danger are to be taken.

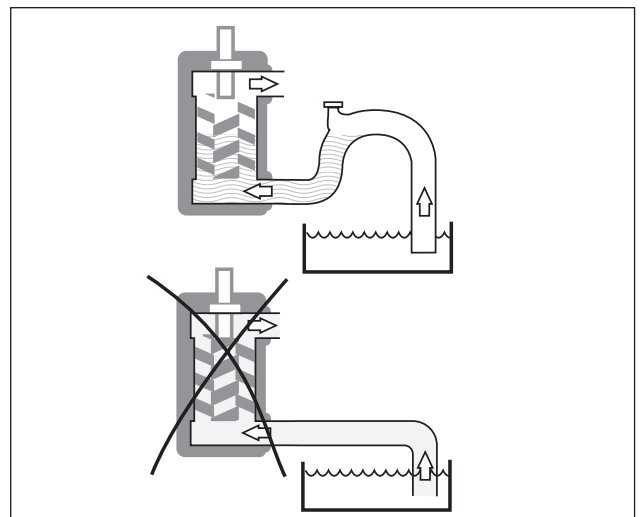


Fig. 7 Liquid trap

## Gauges

Gauges for monitoring the pump's working conditions are recommended. These gauges should be placed readable as close to the pumps in- and outlet flanges as possible. On the ACE Optiline standard pumps there are gauge connections for both in- and outlet.

## Pressure relief valve

All systems with screw pumps must be equipped with a pressure relief valve installed immediately adjacent to the pump. In the standard versions of IMO ACE Optiline pumps, this pressure relief valve is an integral part of the pump to protect the system against excess pressure. When liquid is circulated through the valve it heats up in proportion to the set pressure level and the percentage of by-passed liquid. 100% bypass can only be tolerated for less than about 3 minutes, 50 %by-pass generally for unlimited periods of time. If more than 50% recirculation is anticipated, a value specific to each application should be determined by closely monitoring the pump body temperature. If the pump is operating in line with a separate pressure control valve (see fig.9), the setting of the relief valve should be high enough so as not to interfere with the control valve. Likewise, if two pumps are operating in parallel, the setting should be such that interference between the two valves is avoided.

**Also remember that a total bypass by the pumps internal relief valve for longer periods will cut of the cooling flow to the pumps magnetic coupling and cause an overheating with destroyed magnets as a result quite fast.**

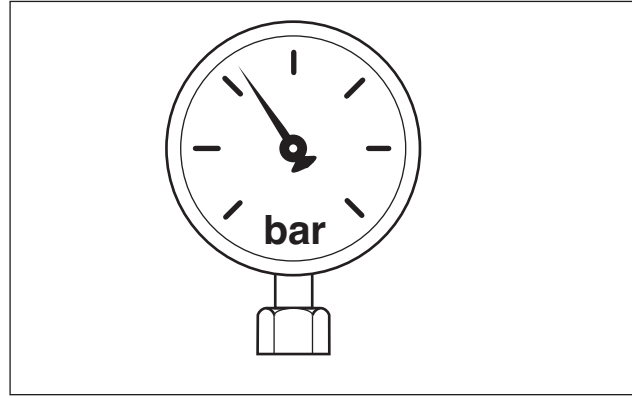


Fig. 8 Gauges

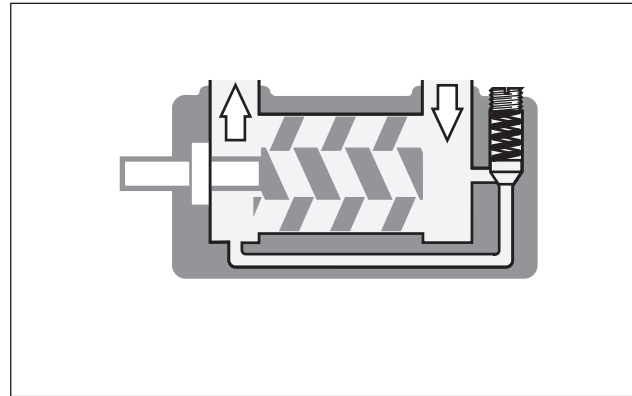


Fig. 9 Pressure Relief Valve

18



Oil leakage may make the floor slippery and cause personal injury.

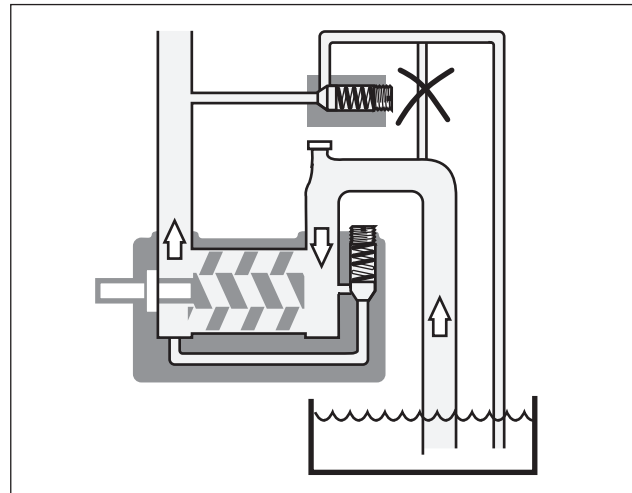


Fig. 10 External control with pressure relief valve


## Startup

### Pressure testing and flushing

The system must be flushed and pressure tested before connecting the pump. If corrosive liquid, such as water is used, the system must be thoroughly drained, dried and protected against corrosion after having been flushed.

### Before starting:

After installation and whenever it can be assumed that the pump has been emptied, the pump must be thoroughly filled with liquid. See fig 11.

**19**  Make sure the prime mover is locked out and can not be started accidentally.

### Direction of rotation

When the pump is ready to be started, switch the motor briefly on and off and check that the drive motor rotates in the correct direction as indicated by the rotation arrow. The arrow is placed on the side of the front cover 5010 as well as on riveted steel plates on the connecting frame 003.

### Differential pressure

Differential pressures below 1 bar is strictly forbidden as the magnetic coupling under these conditions may lose its cooling flow and cause an overheating of the magnetic coupling with a risk of a potential fire as a result.

We do strongly recommend magnetic coupled pumps to be equipped with a differential pressure monitoring device that stops the pump automatically if the differential pressure for some reason should drop to below 1bar.

### Air in the pumped fluid

It is forbidden to use the ACE Optiline pump with fluids that contains more than 0,2% of air due to the risk of ignition during an eventual overheating of the pump.

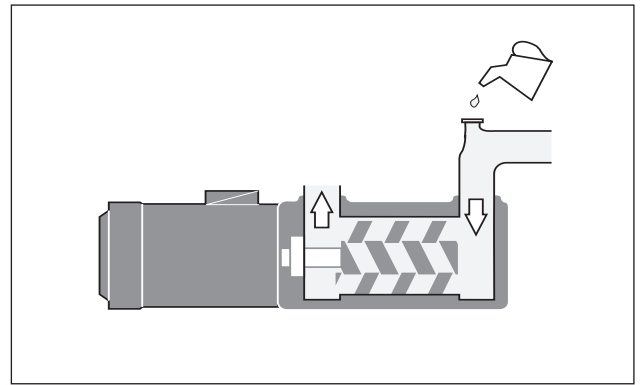



Fig. 11 Filling the pump

**20**  Don't mix up with arrow for inlet and outlet!

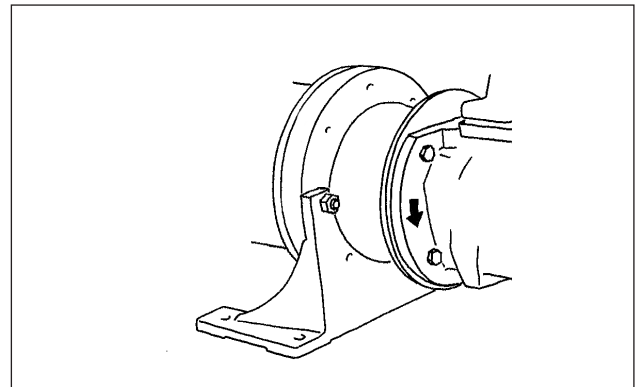


Fig. 12 Direction of rotation

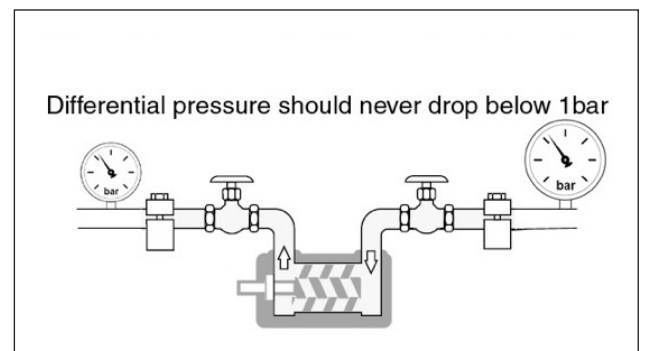



Fig. 13 Differential Pressure

## Trouble shooting

Problem	Cause	What to do
Wrong direction of rotation	- Electric cables to motor wrongly connected.	Reverse the terminal connection on electric motor.  <div style="border: 1px solid black; padding: 5px; display: inline-block;"> <span style="font-size: 1.2em;">⚠</span> Connecting and disconnecting of electric cables must be done only by personnel authorized to do such work.         </div>
The pump cannot be primed	<ul style="list-style-type: none"> <li>- Wrong direction of rotation.</li> <li>- Suction line is not open or pressure drop in the suction line is too high.</li> <li>- Major air leakage into the suction line.</li> <li>- The pump cannot evacuate the air through the discharge line due to excessive counter pressure.</li> </ul>	<p>See above.</p> <p>Check all components in suction line. The inlet condition should be checked with a vacuum gauge at the pump inlet. Check the suction line.</p> <p>See the chapter on Deaeration (see page 19).</p>
The magnetic coupling is slipping	<ul style="list-style-type: none"> <li>- A too high viscosity has caused the magnetic coupling to slip.</li> <li>- The pump is blocked inside the rotors by a foreign object.</li> </ul>	<p>Lower the viscosity to a maximum approved (the viscosity normally used in the pumped liquid) and restart the pump by switching it off and on.</p> <p>Remove the foreign object from the pump and control the bores and rotors for abnormalities/damages. Restart the pump by switching it off and on.</p>
No flow	<ul style="list-style-type: none"> <li>- The pump is not primed.</li> <li>- The pressure relief valve is set below the counter pressure.</li> </ul>	<p>See above.</p> <p>Readjust the pressure relief valve to a value above counter pressure.</p>
Flow too low	<ul style="list-style-type: none"> <li>- The magnetic coupling is slipping</li> <li>- The pressure relief valve is set too low (Discharge pressure also low).</li> <li>- Something is restricting the flow in the suction line. (This would usually cause noise).</li> <li>- The pumped liquid contains a significant amount of compressible gas, such as free air. (This would usually cause noise).</li> </ul>	<p>See above.</p> <p>Readjust the pressure relief valve</p> <p>Check all components in the suction line (strainers, valves etc).</p> <p>Go thru the system and determine if there are any leaks.</p>

Problem	Cause	What to do
<b>Pressure too low</b>	<ul style="list-style-type: none"> <li>- The pressure relief valve is set too low.</li> <li>- Counter pressure in the discharge line is too low due to a major leakage.</li> <li>- The valve piston is stuck in open position.</li> <li>- Something is restricting the flow in the suction line. (This would usually cause noise).</li> <li>- The pumped liquid contains a significant amount of compressible gas, such as free air. (This would usually cause noise).</li> <li>- A too small pump has been chosen.</li> </ul>	<p>Readjust the pressure relief valve.</p> <p>Check the components in the discharge line inclusive the recipients.</p> <p>Check the valve. See Maintenance and Service instruction for this pump.</p> <p>Check all components in the suction line (strainers, valves etc.).</p> <p>Contact your IMO AB representative.</p>
<b>Pressure too high</b>	<ul style="list-style-type: none"> <li>- The pressure relief valve is set too high.</li> <li>- The oil is too cold (or has higher viscosity than anticipated).</li> <li>- Counter pressure in the discharge line is too high.</li> </ul>	<p>Readjust the pressure relief valve.</p> <p>Reduce the pressure setting until operational temperature has been reached.</p> <p>Check the discharge line.</p>
<b>Drive motor difficult to start or tends to stop by tripping the motor overload relay</b>	<ul style="list-style-type: none"> <li>- Counter pressure too high.</li> <li>- Liquid too cold.</li> <li>- Motor is undersized for the prevailing conditions.</li> <li>- Electrical power supply faulty.</li> <li>- Motor overload relay set too low or is faulty.</li> <li>- Incorrect setting of Y/D starter.</li> </ul>	<p>See above: Pressure too high.</p> <p>Readjust the pressure relief valve to a lower value. Thus the power consumption for the pumping is relieved and overloading due to the high viscosity may be avoided. When the liquid has reached normal temperature and thus flows easily, the relief valve is reset to normal pressure.</p> <p>Check the motor.</p> <p>Check the motor and motor connection.</p> <p>Readjust or replace the relay.</p> <p>Readjust the setting of the starting sequence. The time before the motor overload relay is tripped should not exceed 10-15 seconds.</p>
<b>Noise and vibration</b> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;">  <p>22 Monitor the pump function and shut down if any sign of malfunction is noticed</p> </div>	<ul style="list-style-type: none"> <li>- The flow to the pump is insufficient.</li> <li>- Insufficient support of pipe work.</li> <li>- Air leakage into the suction line.</li> <li>- Faulty electrical supply.</li> </ul>	<p>See chapter: The flow is too low.</p> <p>Check for pipe vibrations in the pump connections. Check that the pipes are sufficiently clamped.</p> <p>Check the suction line for air leakage.</p> <p>Check all three phases of the supply.</p>



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