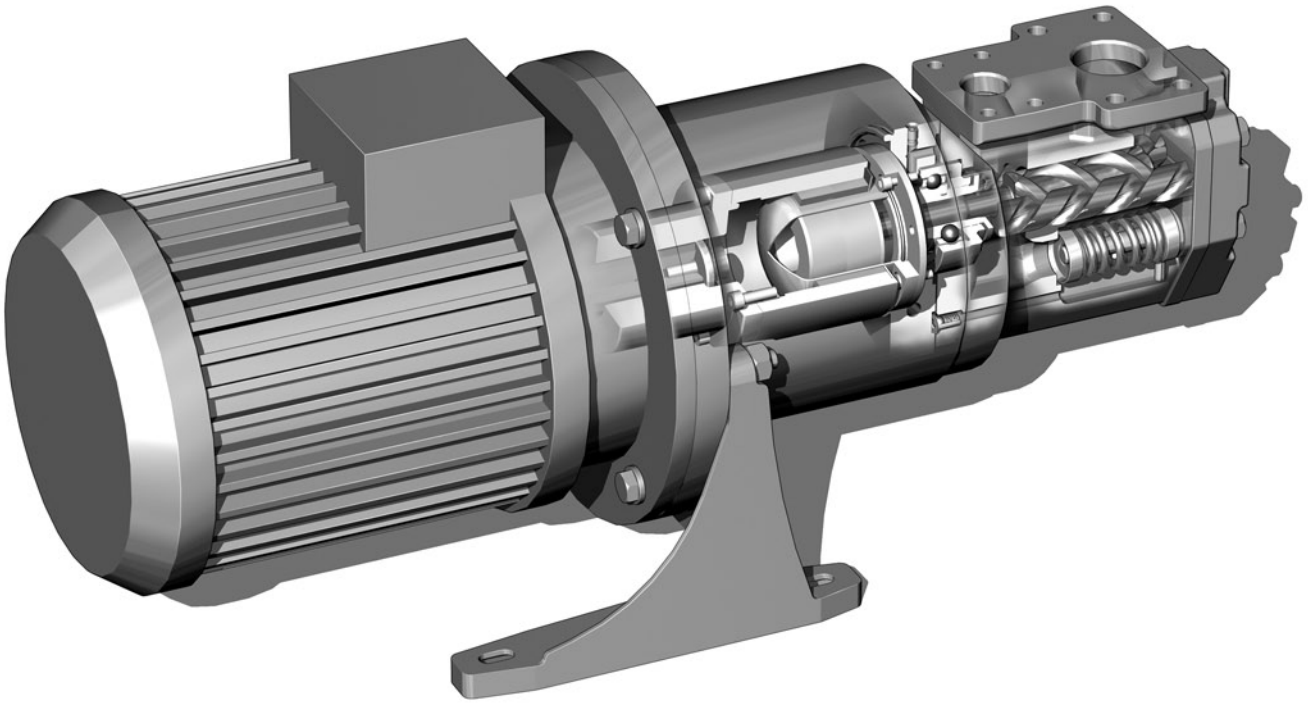
A Member of the
COLFAX PUMP GROUP

Opti Line ACE3

Screw pump

Installation & Service Instruction



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Contents

Indentification of safety instructions

Non complience of safety instructions identified by the this symbol could affect safety for persons.

Safety instructions where electrical safety is involved are identified in this way.

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 this sign.

Installation

BEFORE COMMENCING ANY WORK, READ THIS INSTRUCTION CAREFULLY!

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

1 Failure to comply with these instrutions may cause damage and personal injury!

2 The installation must always be designed to minimise damage, should an operational or functional failure occur. E.g. precautions should be considered to collect oil spillage due to a broken pipe or pump housing, to stop pump operation if overheating should occur or if the oil volume is below a minimum tank level

3 When fitting the shaft coupling, do not use a hammer or similar as this may damage the ball bearing and shaft seal.
Use some kind of press tool.

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

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

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.

6 All work carried out on the pump has to be performed in such a manner that risks for personal injury are minimized!

Lifting of pump

7 The pump 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.

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.

8 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 attachments.

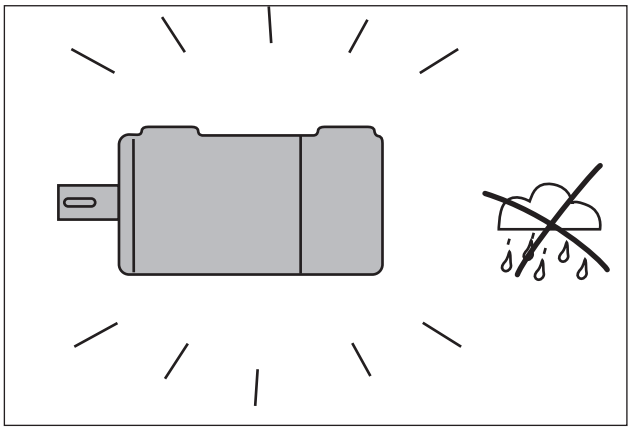

Fig 1 Clean and dry environment

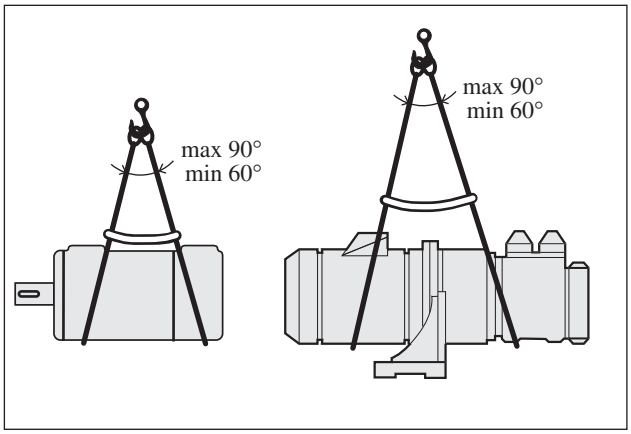

Fig 2 Lifting of pump

9 Measures shall be provided to avoid accidental contact with the outer magnetic rotor.

Pipe connections

The pipe work shall be installed and supported so that no pipe stresses are transfered to the pump body.
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.
These recommendations may imply piping dimesions, deviations from the actual port sizes, dependent on pump speed and other duty conditions. To facilitate priming at start-up, the suction line should have a minimum internal volume, not bigger than what can be displaced (oil filled) by the pump within 30 seconds.
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 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 an stand-by pump.

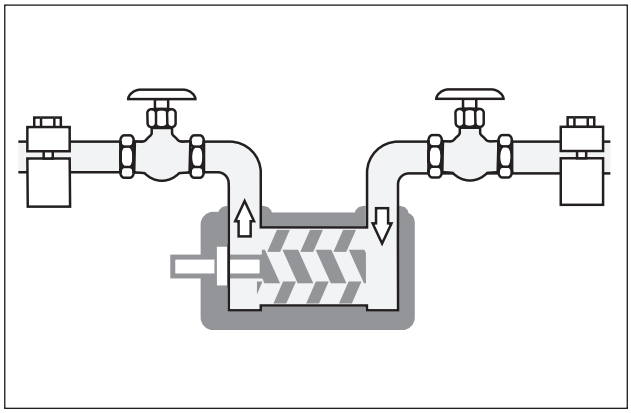

Fig. 3 Pipe connection

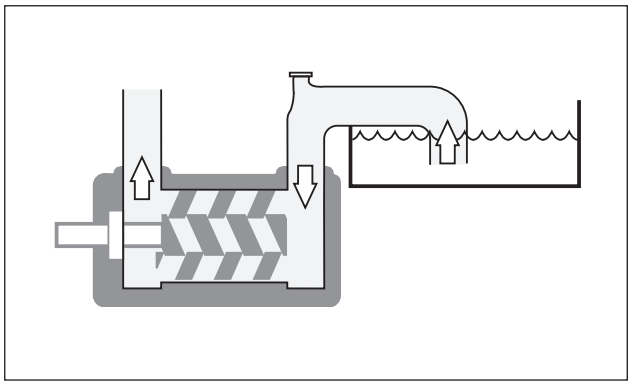

Fig. 4 Suction line

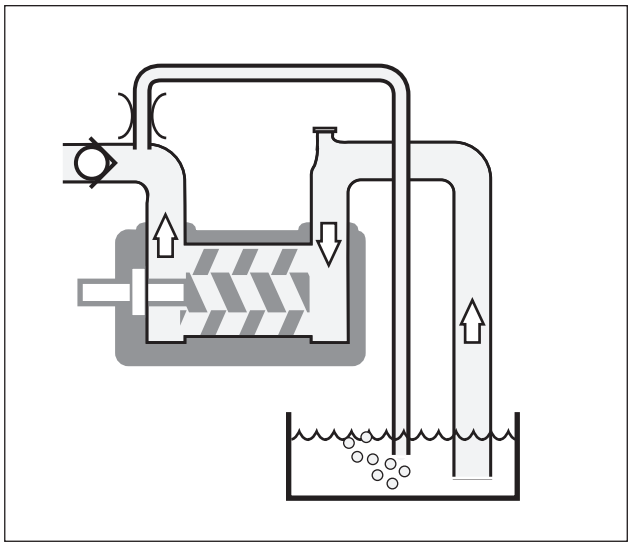

Fig. 5 Dearation

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Strainer

The pump has to be protected from foreign matter, 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 0.5 - 0.8 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.

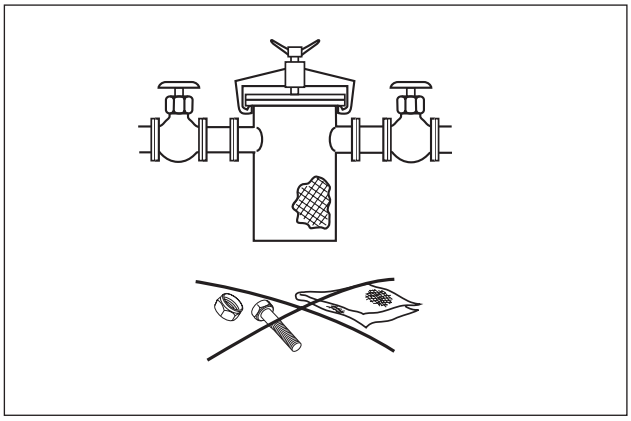

Fig. 6 Strainer

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. See fig. 7.

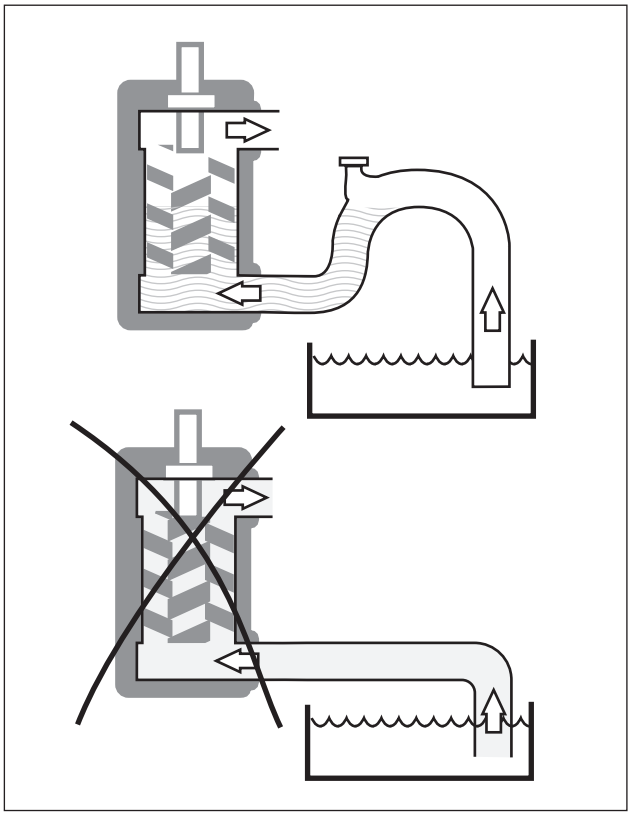

Fig. 7 Liquid trap

Gauges

Gauges for monitoring the pump's working conditions are recommended. These gauges should be placed readable as close to the pump's in- and outlet flanges as possible. On standard pumps, series ACE 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.
This pressure relief valve is an integral part of the Opti Line ACE 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% by-pass can only be tolerated for less than about 3 minutes, 80 % 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.

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.

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

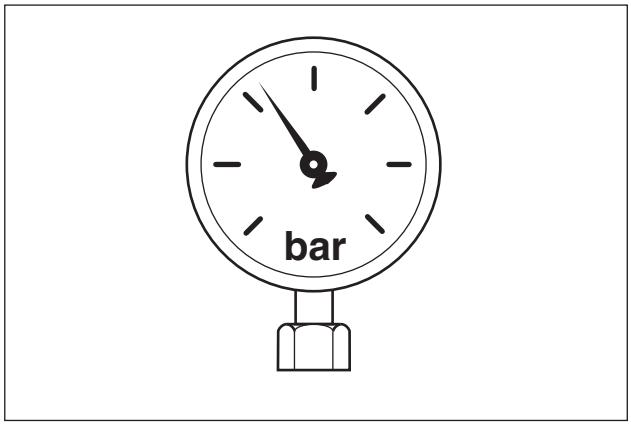

Fig. 8 Gauges

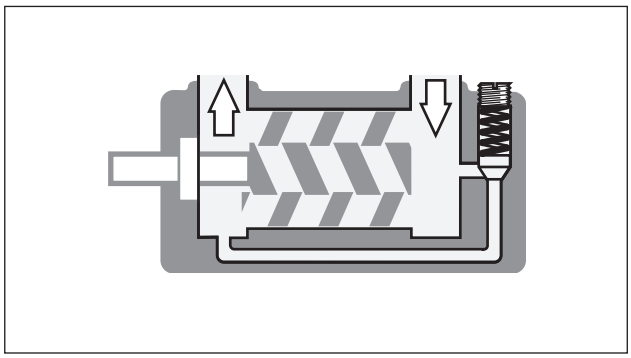

Fig. 9 Pressure relief valve

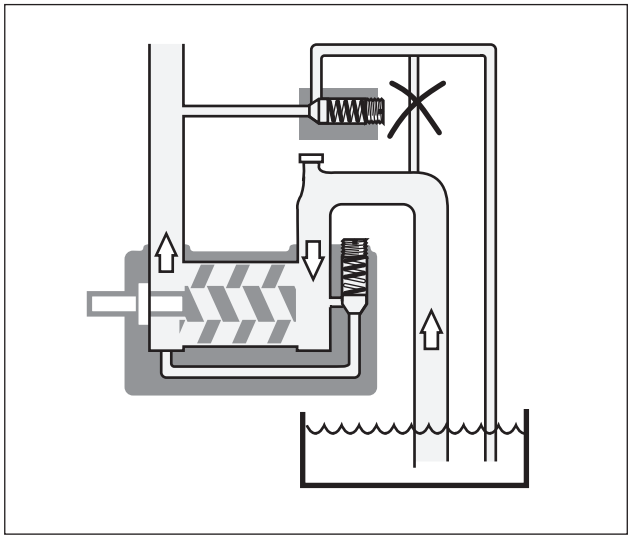

Fig. 10 External control with pressure relief valve

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Start-up

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.

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

Rotate the shaft by hand while filling the pump, to ensure that the rotor bores and magnetic couplings are filled. This is done by rotating the fan on the electric motor after removing the fan cover.

12 **Do not forget to fit the motor fan cover again before making start of motor possible.**

If the suction pipe cannot be completely filled, it is important to ensure that the trapped air is evacuated without any pressure build up. (See fig. 5 Deaeration).

13 **Starting a dry pump is likely to cause damage to the pump and it's bearing and magnetic coupling.**

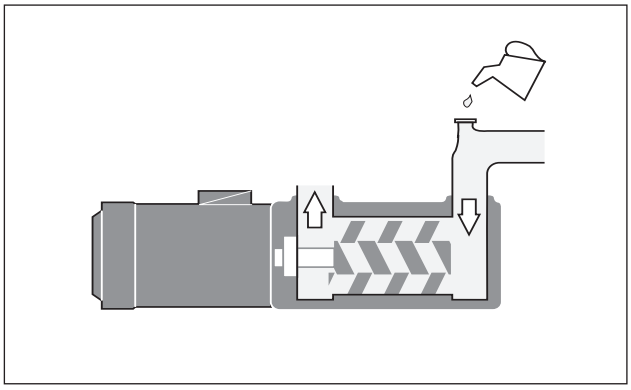

Fig. 11 Filling the pump

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 different spots depending on the pump series.

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

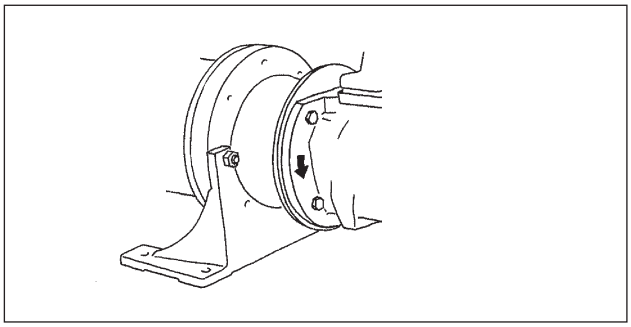

Fig. 13 Direction of rotation

Starting

Check that all valves necessary for the operation are fully opened in both discharge and suction lines.
The first time, the pump should be started with the adjusting spindle of the pressure relief valve tightened to half of the available turns (the valve setting is increased when the spindle is turned clockwise).

By monitoring the pressure gauge it can be determined when the suction line is primed and the pump begins to work. Should the pump not operate normally soon after start, stop the pump within half a minute. Start again after about 3-5 minutes and run for half a minute. This procedure may need to be repeated a couple of times if the suction line is long. Should the pump still not work, it must be assumed there is a problem in the system that needs to be remedied. Check the suction line calculation on page 4 and/or see "Trouble shooting", page 8.

Setting the pressure relief valve

The setting of the opening pressure is made as follows: Tighten the valve spindle by rotating clockwise to the maximum extent. The system pressure is regulated by throttling to required value. The pressure relief valve is eased until the pressure is just beginning to decrease by turning the spindle CCW. The valve is now preset for desired opening pressure. Open the throttling valve entirely.

15 **If operating temperature exceeds 60°C (149°F), appropriate measures to avoid skin contact shall be provided.**

16 **Use hearing protections whenever high noise can be expected from pump, motor and/or environment.**

Trouble shooting

Problem	Cause	What to do
Wrong direction of rotation	- Electric cables to motor wrongly connected.	Reverse the terminal connection on electric motor. 17  **Connecting and discon-necting of electric cables must be done only by personnel authorized to do such work.**
The pump cannot be primed	- Wrong direction of rotation.	See above.
	- Suction line is not open or pressure drop in the suction line is too high.	Check all components in suction line. The inlet condition should be checked with a vacuum gauge at the pump inlet. Check oil viscosity.
	- Major air leakage into the suction line.	Check the suction line.
	- The pump cannot evacuate the air through the discharge line due to excessive counter pressure.	See the chapter on Deaeration (page 4).
No flow	- The pump is not primed.	See above.
	- The pressure relief valve is set below the counter pressure or outlet is blocked.	Check outlet line. Readjust the pressure relief valve to a value above counter pressure.
Flow too low	- The pressure relief valve is set too low (Discharge pressure also low).	Readjust the pressure relief valve
	- Something is restricting the flow in the suction line. (This would usually cause noise).	Check all components in the suction line (strainers, valves etc.).
	- The pumped liquid contains a significant amount of compressible gas, such as free air. (This would usually cause noise).	See next page, Noise and Vibration (page 9).
Pressure too low	- The pressure relief valve is set too low.	Readjust the pressure relief valve.
	- Counter pressure in the discharge line is too low due to a major leakage.	Check the components in the discharge line inclusive the recipients.
	- The valve piston is stuck in open position.	Check the valve. See Installation & Service instruction for respective pump.
	- Something is restricting the flow in the suction line. (This would usually cause noise).	Check all components in the suction line (strainers, valves etc.).
	- The pumped liquid contains a significant amount of compressible gas, such as free air. (This would usually cause noise).	See next page, Noise and Vibration (page 9).
	- A too small pump has been chosen.	Contact your IMO AB representative.

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Disturbance	Cause	What to do
Pressure too high	- The pressure relief valve is set too high.	Readjust the pressure relief valve.
	- The oil is too cold (or has higher viscosity than anticipated).	Reduce the pressure setting until operational temperature has been reached.
	- Counter pressure in the discharge line is too high.	Check the discharge line.
Drive motor difficult to start or tends to stop by tripping the motor overload relay	- Counter pressure too high.	See above: Pressure too high.
	- Liquid too cold.	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.
	- Motor is undersized for the prevailing conditions.	Check the motor.
	- Electrical power supply faulty.	Check the motor and motor connection.
	- Motor overload relay set too low or is faulty.	Readjust or replace the relay.
	- Incorrect setting of Y/D starter.	Readjust the setting of the starting sequence. The time before the motor overload relay is tripped should not exceed 10-15 seconds.
Noise and vibration	- The flow to the pump is insufficient.	See previous page, Flow too low (page 8).
18 **Monitor the pump function and shut down if any sign of malfunction is noticed**	- Insufficient support of pipe work.	Check for pipe vibrations in the pump connections. Check that the pipes are sufficiently clamped.
	- Air leakage into the suction line.	Check the suction line for air leakage.
	- Free air in the liquid or gas cavitation.	Contact your IMO AB representative or IMO AB service department.
	- Faulty electrical supply.	Check all three phases of the supply.

Components

List of components

Valid for all pumps in sizes: ACE 025/032/038 Rotor diameter and Generation: L3/K3/N3
With version codes: { N { K { B { P The version code is composed of the letters in the 4 columns.
{ L *Example of pump designations std: ACE 025L3 NKBP*
{ M

Pos No	Denomination	Qty	Components included in spare parts set G012	G054	G057	G070	G098	Notes	Explanations:
002	Motor	1							G012: Rotor set
003	Connecting frame	1							
004	Angle bracket	1							G054: Major kit
005	Magnetic coupling	1					x		
005A	Retaining ring	1		x	x		x		G057: Joint kit
006A	Screw	1							
007A	Screw	1							G070: Complete valve element
007B	O-ring	1		x	x		x		
1020	Power rotor	1	x	x					G098: Compl magnetic coupling
105	Nozzle	1	x	x				3	
112	Balancing piston	1	x	x				3	
113	Key	1	x	x					
122	Ball bearing	1	x	x					
124	Retaining ring	1	x	x					
124A	Support washer	1	x	x					
202	Idler rotor	2	x	x					
351	Balancing bush	1	x	x					
401	Pump body	1							**Notes:**
418	Gasket	1		x	x			1	
423	Gasket	1		x	x			1	1) Gaskets for counter flanges
440	Return valve	1							
451	Screw	1							2) Sizes 025-032 only
453	Screw	1							
462	Plug	1							3) Not sold seperately
462A	Sealing washer	1		x	x				
463	Plug	1							
463A	Sealing washer	1		x	x				
5010	Front cover	1							
506	Gasket	1		x	x				
520	Cover	1						2	
520A	O-ring	1		x	x			2	
551	Rear cover	1							
556	Gasket	1		x	x				
605	O-ring	1		x	x	x			
608	Valve spindle	1				x		3	
608A	Tension pin	1				x		3	
6120	Set screw	1				x		3	
613	Pin	1				x		3	
614	Valve piston	1				x		3	
615	Valve spring	1				x		3	
701	Screw	2							
701A	Washer	2							
702	Screw	4							
702A	Washer	4							
703	Screw	3							
703A	Washer	3							
703B	Nut	3							
998	Drive hub	1							
998A	Washer	1							
998B	Screw	1							

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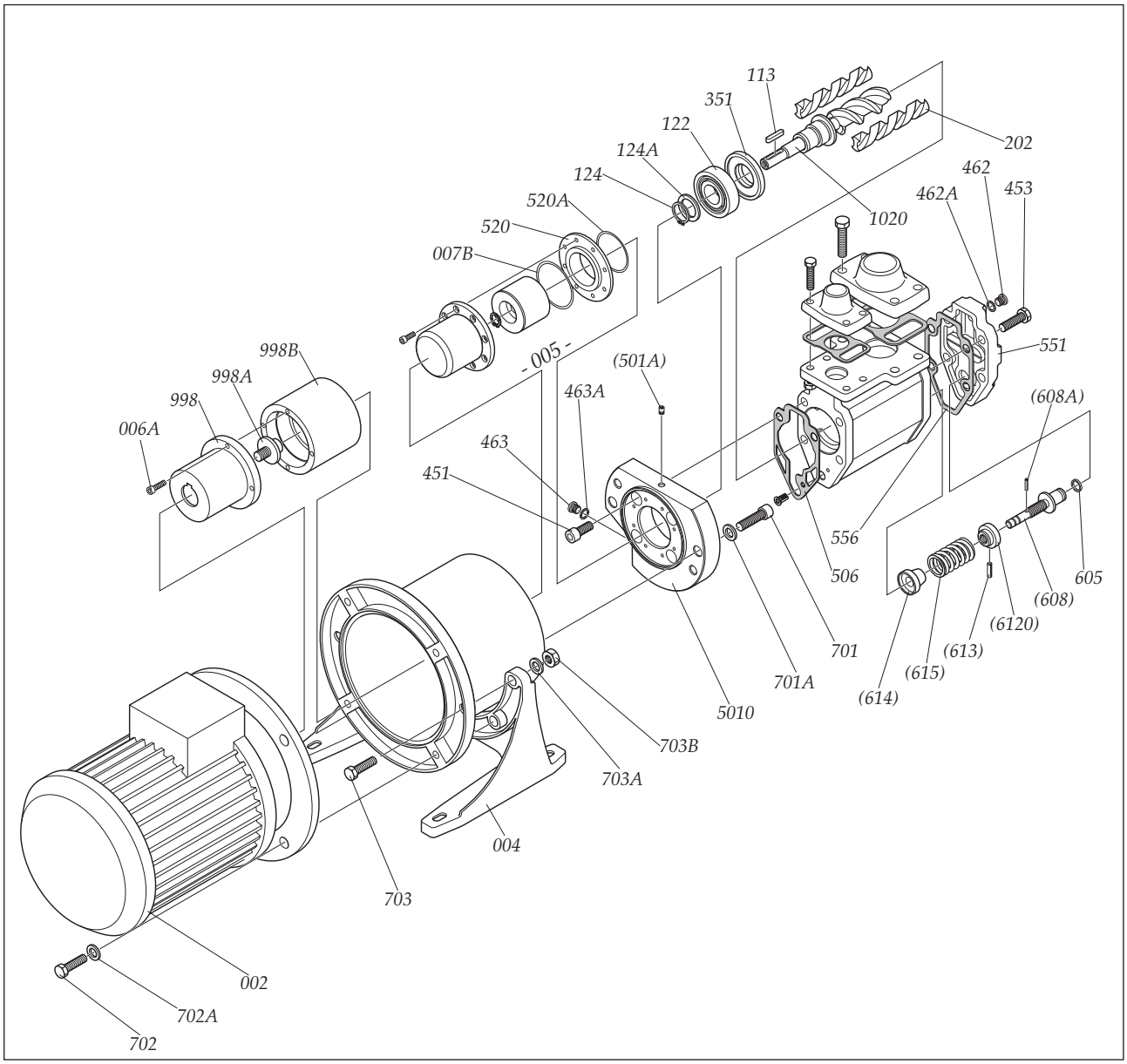
Exploded view



Ordering code

Item	Spare Parts sets	Part numbers for pump size 025	032	038
G012	Rotor set N-, K-lead	-	-	192246
	" L-lead	192242	192244	-
	Rotor set N-lead	192243	192245	192247
G054	Major kit K-lead	-	-	192252
	" L-lead	192248	192250	-
	" N-lead	192249	192251	192253
G057	Joint kit	192260	192261	192262
G070	Valve element	189873	189873	189873
G098	Magnetic coupling K	192254	192254	-
	" L	192255	192255	192258
	" M	-	192256	192259
122	Ball bearing	173765	173765	173591

Recommendation:
For maintenance the following spare part sets are recommended:

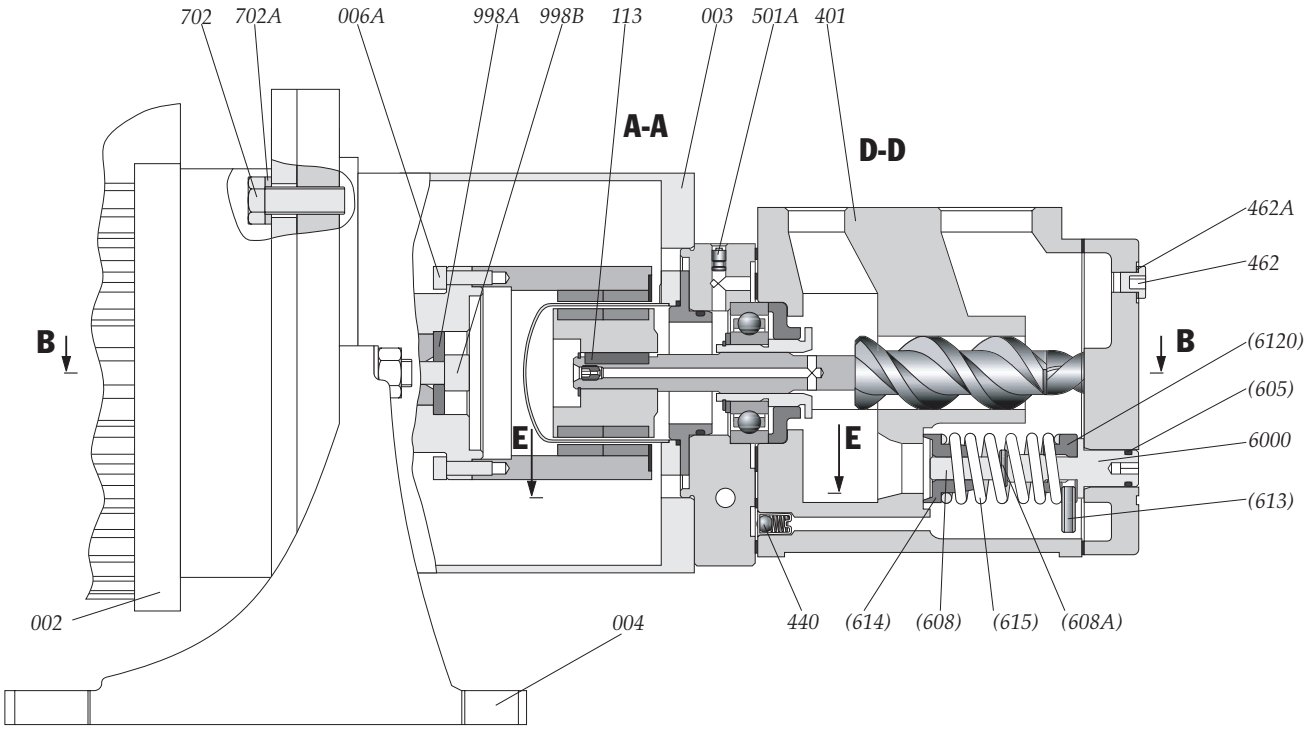
Set: *To be used:*

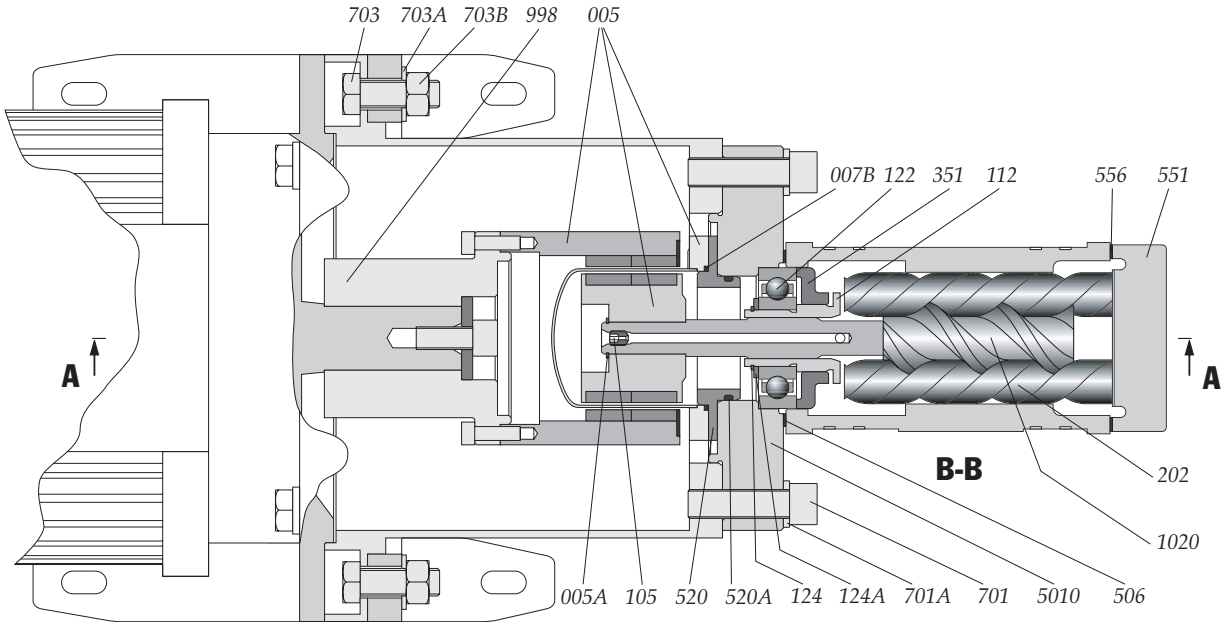
G054 Major kit
For repair after damage or greater wear.

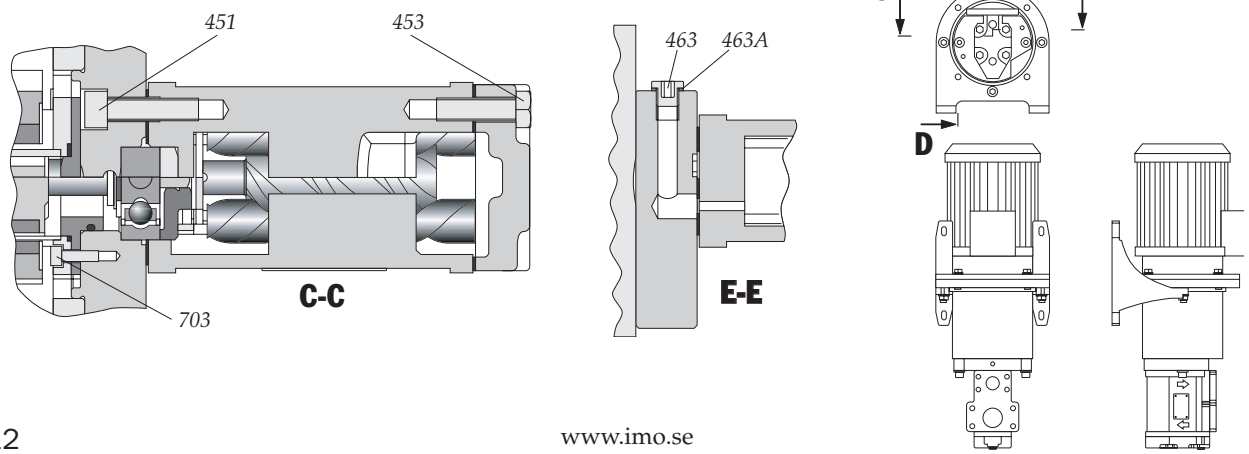
G057 Joint kit
For dismantling the pump.

Ordering example:
For IMO-pump ACE 032N3 NKBP, serial number 456789:
Ball bearing pos 122 p/n 173765
Valve element pos G070 p/n 189873

Sectional view







Service and maintence

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. Pumping liquid which contains abrasive materials, or liquid that is corrosive, will significantly reduce service life and call for shorter service intervals.
Wear will normally show as unnormal:

- Vibration
- Noise
- Loss of capacity
- Reduction in flow/pressure

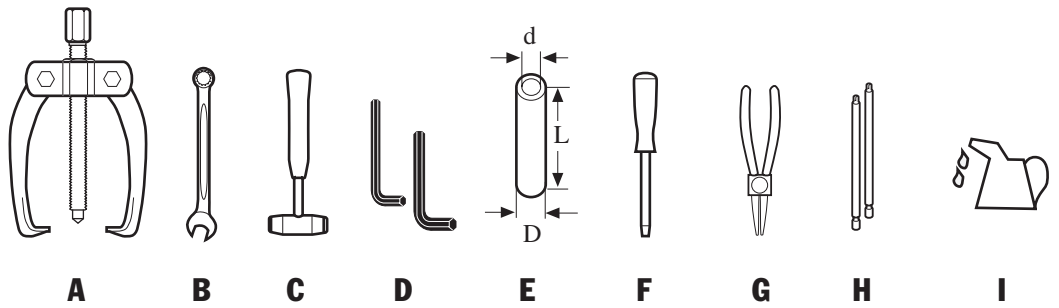
19 

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.

Inspection of rotors

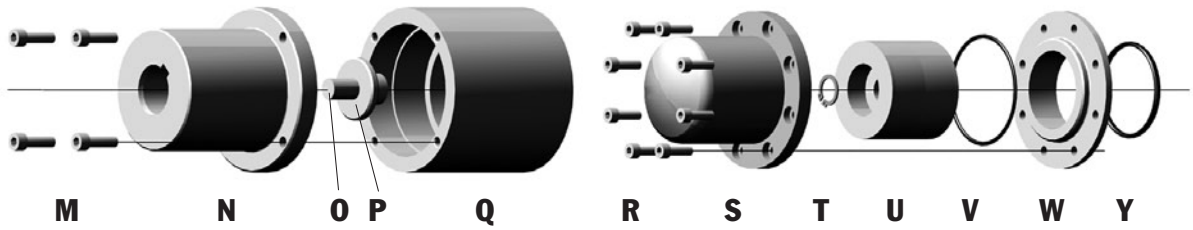
A quick inspection of the idler rotors can be made simply by removing the rear cover. Note that the driver must be deenergized and the pump hydraulically isolated before the rear cover is removed.
If a more thorough investigation is needed, proceed as under ”Dismantling/Reassembly”.

Useful tools



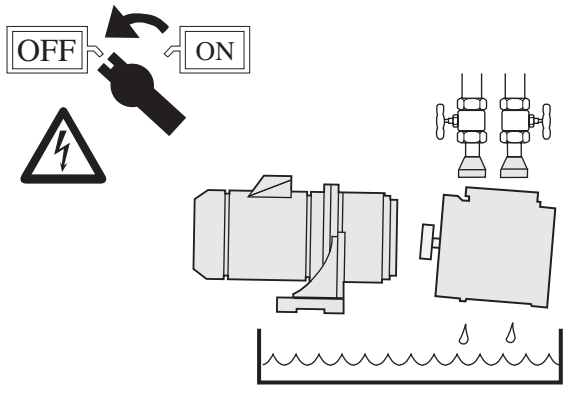
A = Puller
B = Screw spanner 16 mm
C = Plastic mallet
D = Allen keys (3 mm & 5 mm)
E = Mounting sleeve, D=25,5 mm
F = Screw driver
G = Plier
H = Guide pins
I = Oil can

Magnetic coupling

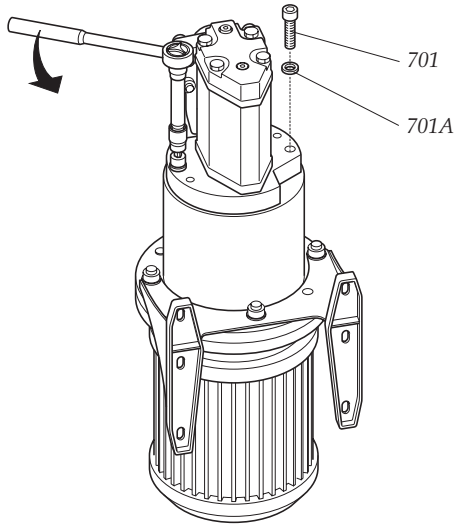


M = Screws (006A)
N = Drive hub (998)
O = Screw (998B)
P = Washer (998A)
Q = Outer magnetic rotor
R = Can screws
S = Sealing can
T = Retaining ring
U = Inner magnetic rotor
V = O-ring (007B)
W = Cover (520)
Y = O-ring (520A)

Dismantling



1. Turn the electricity OFF. Close the valves Remove the pump from the system



2. Remove connections screws 701 and washers 701A

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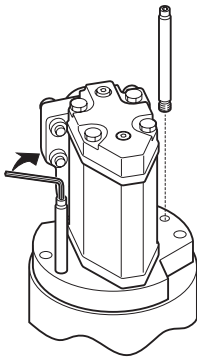
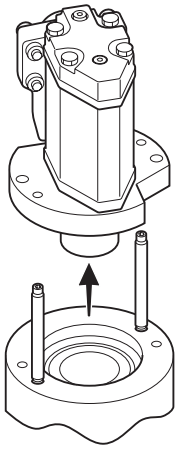
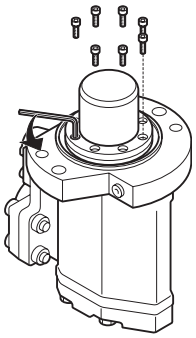


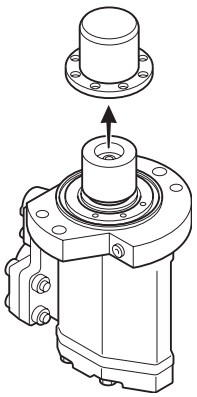
3. Mount guide pins (H)



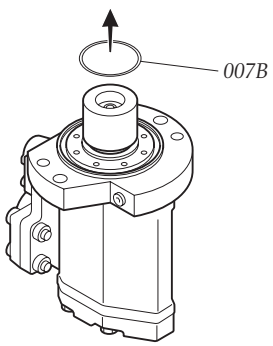
4. Dismount the pump. *Be careful with the magnetic force the first 5 cm*



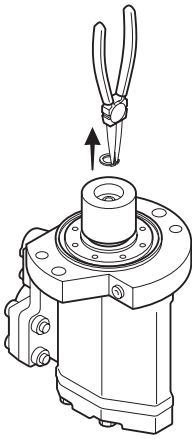
5. Dismount can screws (R) using the Allen key (non-magnetc)



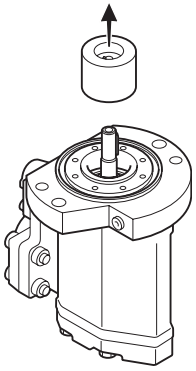
6. Remove the Sealing can (S)



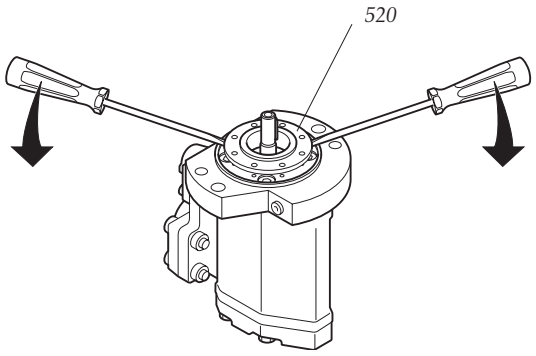
7. Remove the o-ring 007B



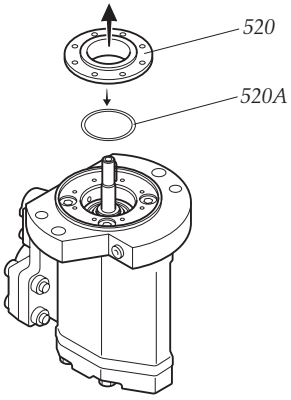
8. Remove the retaining ring (T)



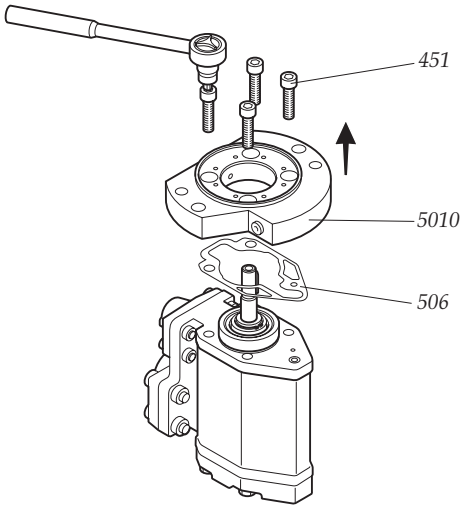
8. Remove the inner magnetic rotor (U)



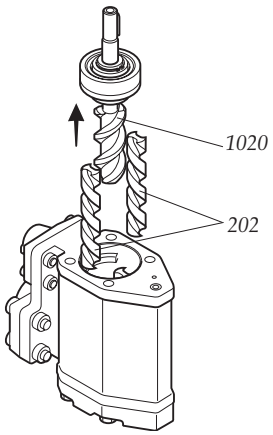
9. Lift cover 520. (*Not valid for size 038)*



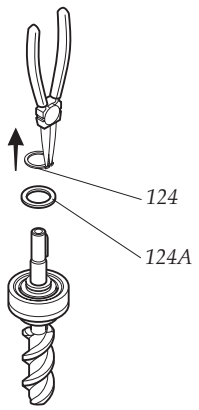
10. Remove cover 520 and o-ring 520A



11. Remove cover screws 451 and dismount front cover 5010 and gasket 506



12. Remove power rotor 1020 and idler rotors 202



13. Remove retaining ring 124 and support washer 124A

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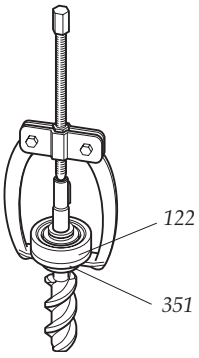
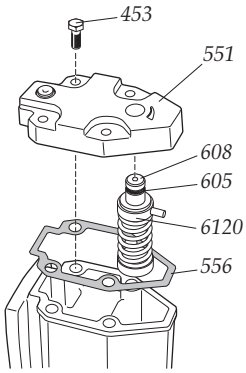
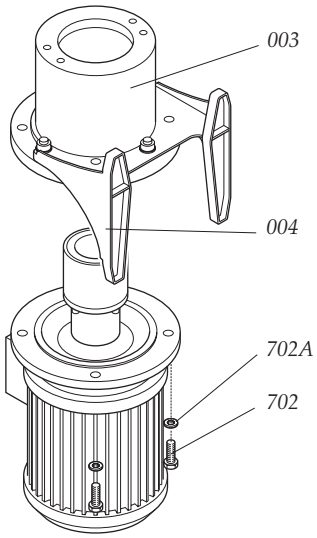


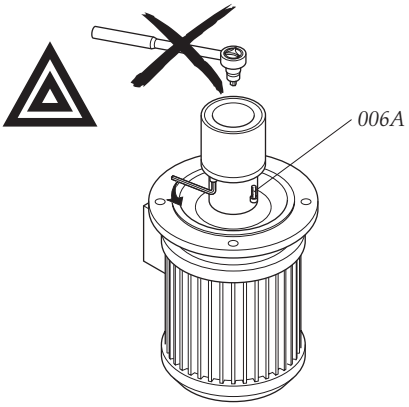
14. Dismount ball bearing 122 and balancing bush 351



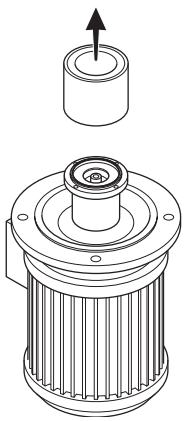
15. Release spring tension by turning valve spindle 608 CCW as much as possible. Loosen and remove screws 453. Separate the valve element from the rear cover 551. If necessary, replace the gasket 556 and the o-ring 605



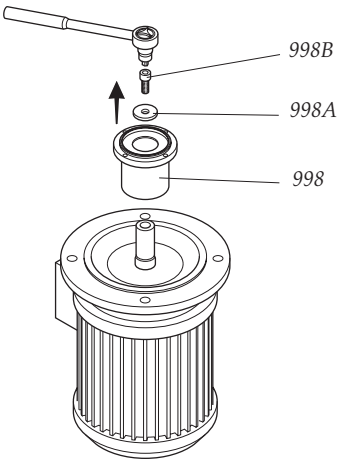
16. Remove screws 702 between connection frame 003 and motor 002. Dismount connecting frame together with angle bracket 004



17. Release screws 006A to dismount the outer magnetic rotor (Q). *Do not use spanner inside magnetic rotor!*

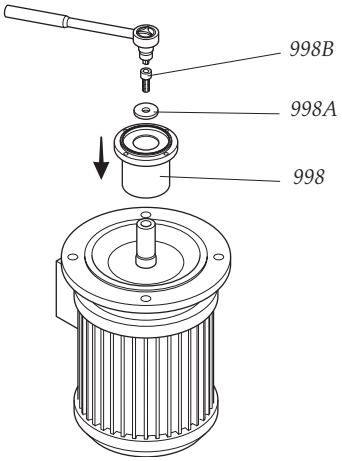


18. Remove the outer magnetic rotor (Q)

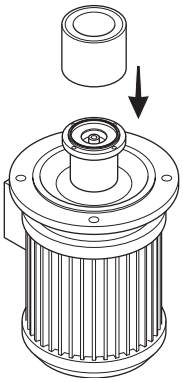


19. Dismount screw 998B and washer 998A and then remove the drive hub 998

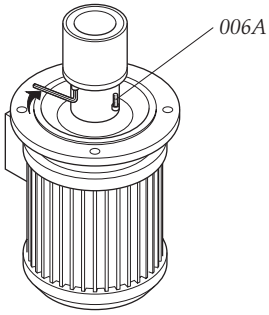
Reassembly



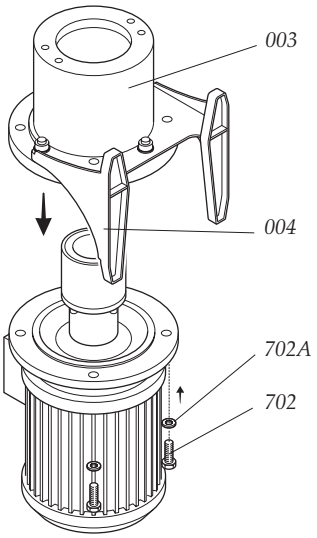
1. Attach the drive hub 998 using washer 998A and screw 998B



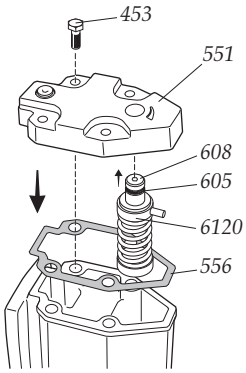
2. Place the outer magnetic rotor (Q) on the drive hub (N)



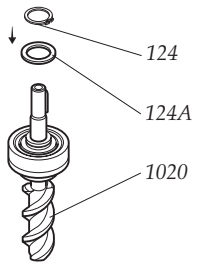
3. Attach the outer magnetic rotor (Q) using screws 006A and non-magnetic Allen key



4. Fit the connection frame 003 on top and fasten the washers 702A and screws 702



5. Fit the gasket 556 in place and fit the valve elements thin end (608) in place in the rear cover 551. Place the cover on top of the pump and tighten the screws 453



6. Place the washer 124A and retaining ring 124 on top of the bearing on power rotor 1020

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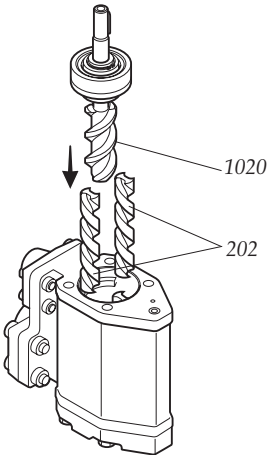
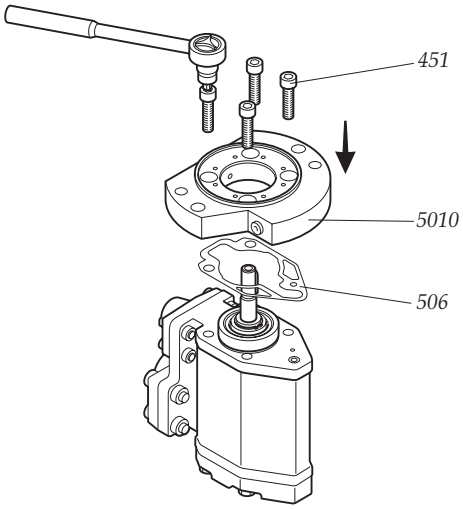
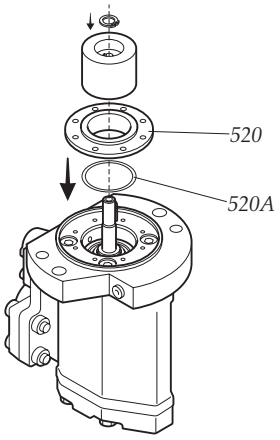


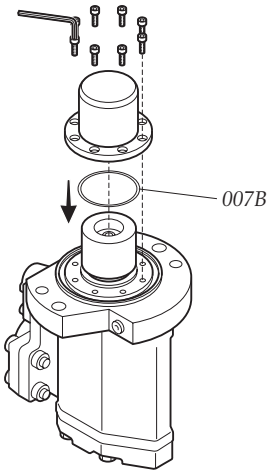
7. Reinsert the idler rotors 202 and the power rotor 1020 into the pump



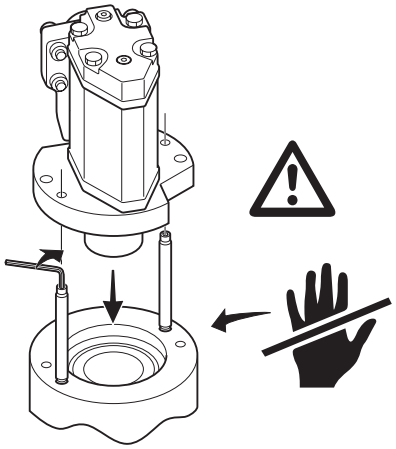
8. Place gasket 506 and front cover 5010 and tighten screws 451



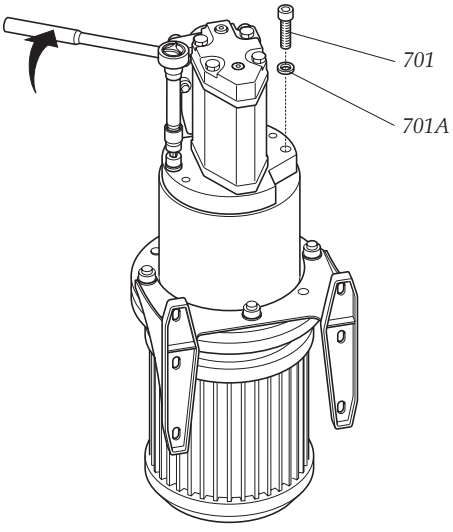
9. Place the o-ring 520A, cover 520, inner magnetic rotor (U) and the retaining ring (T) back in position



10. Place the o-ring 007B and then the sealing cup (S) and tighten all screws (R)



11. Fasten the guide pins (H) before sliding the pump back onto the connection frame 003.
Do not place any fingers between the pump and the connecting frame during assembly!



12. Fasten the pump using washers 701A and screws 701

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