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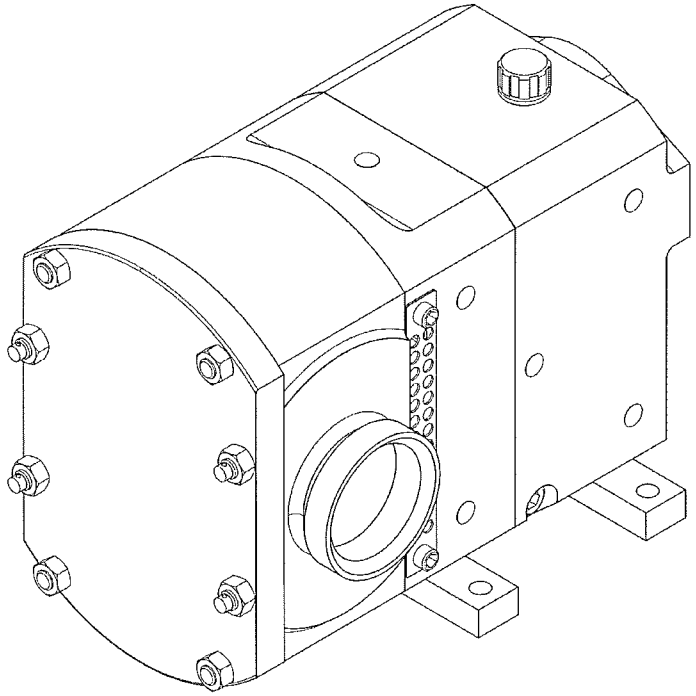
Installation, Operation and Maintenance Manual

Rotary Lobe Pump STP20/106/10



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Operation Manual

1.0 General

1.1 Pump limits of application or use

This pump has been designed for pumping a range of viscosities from water to semi-solid, suitable for both homogeneous liquids and liquids with non abrasive particles/ solids in suspension.

Speeds to 1000rpm and temperatures to100°C can be accomodated on this pump. These conditions cannot always be accomodated simultaneously.

The STP20/106/10 has been designed to operate at a maximum continuous discharge pressure of 10 Bar. However the STP20/ 106/10 is capable of withstanding discharge pressures up to a maximum of 11Bar intermittently. At pressures above 10 Bar there is the possibility of leakage from the primary seal, if this occurs and the seal continues to leak at pressures below 10 Bar it is an indication that the primary seal may have been permanently damaged and should therefore be replaced at the earliest opportunity. Continous operation at pressures above 10 Bar will result in premature failure of the pump.

If the user has not specified the pumping application or needs to change it, it is important to confirm that the materials of construction and product seals are compatible with the pumping application and that adequate NPSH is available.

For specific guidelines contact your supplier quoting pump serial number, system and duty details. (e.g. media, pressure(s), flowrate, pumping temperatures etc).

1.2 Duty conditions

The pump should only be used for the duty for which it has been specified. The operating pressure, speed and temperature limits have been selected at the time of order and MUST NOT be exceeded.
These details are stated on the original documentation and if not available may be obtained from your supplier quoting pump serial number.

1.3 Noise levels

Under certain operating conditions pumps and/or drives and/or the systems within which they are installed can produce sound pressure levels in excess of 80dBA. When necessary personal protection against noise should be taken to safeguard the hearing of persons who are likely to be in close proximity to the equipment. Please consult **Alfa Laval Ltd** for further information if necessary.

1.4 Utility requirements

Electrical supply:-
This pump may be supplied bareshaft or coupled to an electric motor.
Hydraulic supply:-
This pump may be coupled to a hydraulic motor.
Temperature control:-
Temperature control jackets will require appropriate hot or cold media supply i.e. oil/ water/steam.

1.5 External cleaning

Use cleaning fluids below PH 8. Cleaning fluids above PH 8 may cause some paint discolouration. Impact damage to the paint finish from abuse will result in the protective coating being lost leading to possible corrosion of the pump gearbox surfaces.

1.6 Safety precautions

All warnings in this manual are summarised on this page.

Pay special attention to the instructions below so that severe personal injury or damage to the pump can be avoided.

Personnel performing installation, operation and maintenance of the pump must have the relevant experience required.

Warning Signs


General safety instructions are preceded by this symbol.


Electrical safety instructions are preceded by this symbol.


Take great care when using caustic agents.

Installation


Always observe the technical data.


The pump **must** be electrically connected by authorised personnel. (See the motor instructions supplied with the drive unit).


Never start in the wrong direction of rotation with liquid in the pump.


Never put your hands or fingers inside the port connections

Operation


Always observe the technical data.


Never touch the pump or the pipelines when pumping hot liquids or when sterilising.


Never stand on the pump or pipelines.


Never run the pump with the suction side and/or the pressure side blocked.


Always handle toxic and acidic liquids with great care.


Never put your hands or fingers inside the pump or port connections.

Maintenance


Always observe the technical data.


Always secure the pump during maintenance and transportation.


Always disconnect the pump from the drive unit and power supply when servicing the pump.


The pump must **never** be hot when servicing it.


The pump and pipelines must **never** be pressurised when servicing the pump.


Never put your hands or fingers inside the port connections.

Study this manual carefully

1.7 Health and safety information

Potential safety hazards

The following section gives information on handling, storage and disposal of parts and materials used in the pumps which may be considered hazardous to health.

Please pass this information on to your Safety Officer, he may need it to comply with Health and Safety, and COSHH regulations.

General first aid

If potentially hazardous substances are accidentally inhaled, or skin or eyes contaminated, then the following basic precautions should be taken

Inhalation - Move to fresh air

Skin - Wash with soap and water

Eyes - Flush with water, seek medical attention

In all cases, if symptoms persist, seek medical attention.

Material	Use	Major hazard
SILICONE SEALANT	GEARBOX SEAL RETAINERS, GENERAL SEALANT.	RELEASES VAPOUR AT ROOM TEMPERATURE.
ANTI-SEIZE COMPOUNDS	BEARINGS	APPLIED FROM AEROSOL. RELEASES VAPOUR. DISPOSE OF CONTAINER AS IF PRESSURISED.
OIL AND GREASE	OIL - GENERAL LUBRICATION GREASE - PRODUCT SEALS, TIMING GEARS, GENERAL LUBRICATION.	SKIN AND EYE IRRITANT.
PLASTIC COMPOUNDS (PTFE, POLYPROPLYENE, PVC)	PTFE - 'O' RINGS, LIP SEALS	RELEASES FUMES WHEN HEATED.
ELASTOMERIC COMPOUNDS (EP, VITON, NITRILES, PTFE)	'O' RINGS, LIP SEALS	RELEASES FUMES WHEN HEATED.
PAINT	EXTERNAL PUMP SURFACES.	RELEASES DUST AND FUMES IF MACHINED. TREAT AS A FIRE HAZARD.

2.0 Unpacking, handling and storage

To avoid any problems, on receipt of your pump always use the following procedure:-

2.1 Documents

1. Check the delivery note against the goods received.

2.2 Unpacking

Care must be taken when unpacking the pump, and the following stages must be completed:-

1. Inspect the packing for any possible signs of damage in transit.

2. Carefully remove the packing.

3. Inspect the pump for any visible signs of damage.

4. Remove packing from the pump port connections.

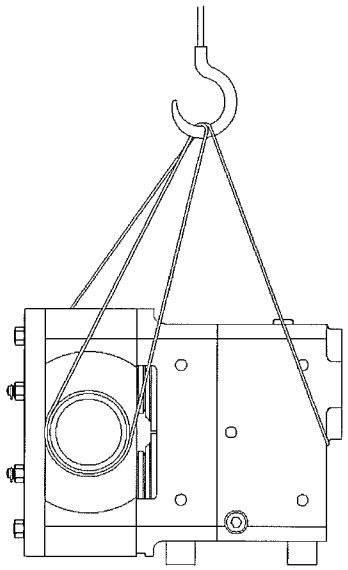
5. Ensure that any additional equipment such as seal flushing pipework is not damaged.

2.3 Handling

Refer to the pump weights guide, prior to using any lifting gear. Use the correct lifting slings for the pump weight.

An M10 x 15 tapping has been provided suitable for the fitting of an eyebolt to enable the pump to be lifted either with or without the hydraulic drive fitted. Alternatively slings should be wrapped around the ports and the hydraulic drive flange.

Note : To stop the slings slipping always cross the slings at the lifting hooks.



Bareshaft pump

2.4 Pump storage

After receipt and inspection if the pump is not to be installed immediately the pump should be repacked and placed in suitable storage. The following points should be noted:-

1. Plastic or gasket type port covers should be left in place.

2. Pumps received wrapped with corrosion inhibiting treatment material should be re-wrapped.

3. A clean, dry storage location, free from vibration should be selected. When a moist dusty atmosphere must be used for storage, further protect the pump or unit with a moisture repellent cover until it is to be installed.

4. Rotate pump by hand, weekly, to prevent bearing damage.

5. All associated ancillary equipment should be treated similarly.

2.5 Transportation

Never lift or elevate in any way other than described in this manual.
Always drain the pump head and accessories of any liquid.
Always ensure that no leakage of lubricants can occur.
Always transport the pump in it's upright position.
Always ensure that the unit is securely fixed during transportation.
Always use original packaging or similar during transportation.

2.6 Recycling Information

Unpacking

- Packing material consists of wood, plastics, cardboard boxes and in some cases metal straps.
- Wood and cardboard boxes can be reused, recycled or used for energy recovery.
- Plastics should be recycled or burnt at a licensed waste incineration plant.
- Metal straps should be sent for material recycling.

Maintenance

- During maintenance oil and wearing parts in the machine are replaced.
- All metal parts should be sent for material recycling.
- Worn out or defective electronic parts should be sent to a licensed handler for material recycling.
- Oil and all non metal wear parts must be taken care of in agreement with local regulations.

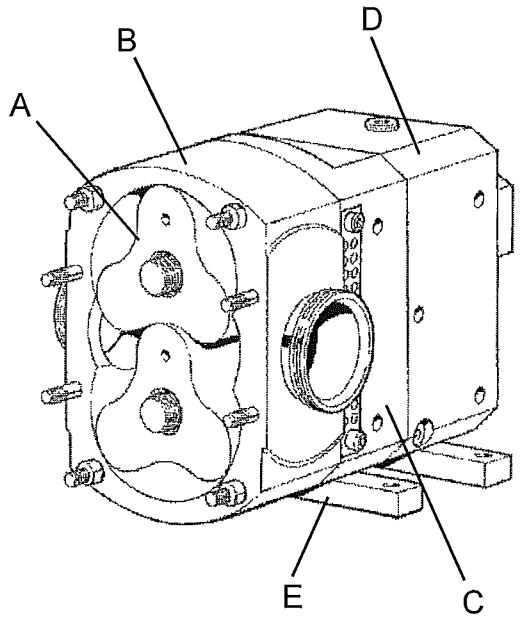
Scrapping

- At end of use, the equipment shall be recycled according to relevant local regulations. Beside the equipment itself, any hazardous residues from the process liquid must be considered and dealt with in a proper manner. When in doubt, or in the absence of local regulations, please contact Alfa Laval.

3.0 Description of pump or pump unit

3.1 General pump description

The pump supplied is a positive displacement pump, which may be supplied bare shaft (see below) or with a drive unit . The drawing below indicates various parts of the pump.



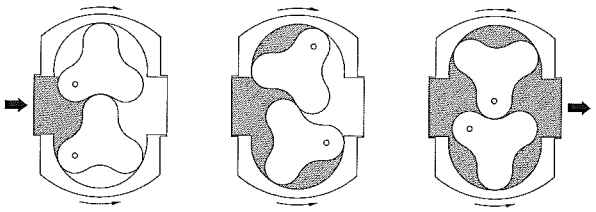
Bareshaft pump

Item	Description
A	Rotors
B	Rotorcase
C	Bearing Housing
D	Gear Housing
E	Feet

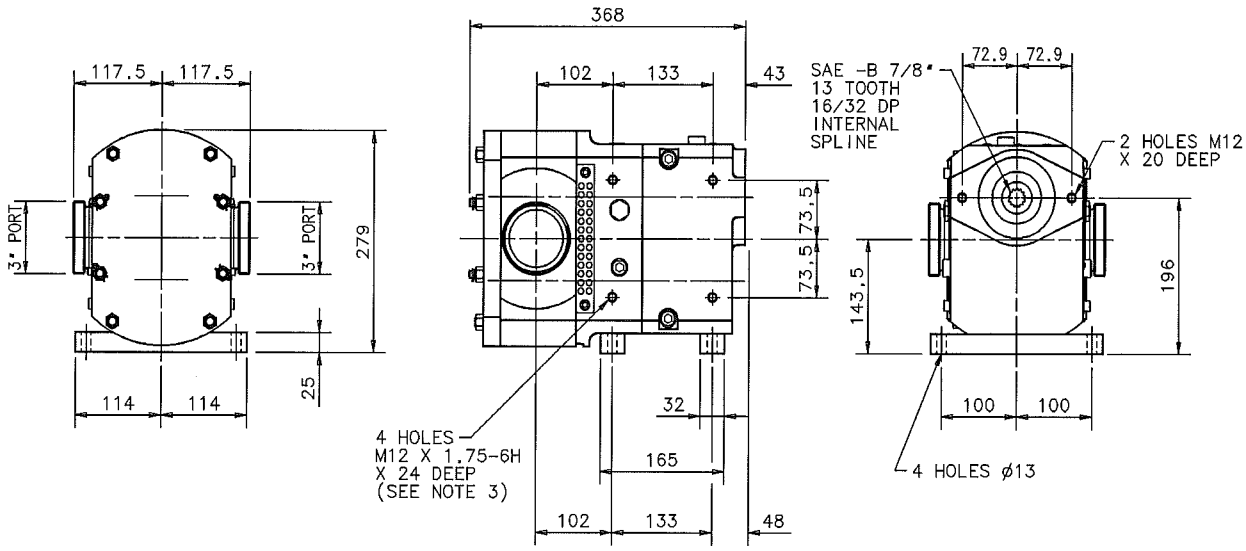
3.2 Principle of operation

The pumps are of the positive displacement rotary type with trilobe rotors. The direction of flow is reversed by changing the direction of rotation of the pump's drive shaft. The pumping principle is as follows.

The volume at the inlet increases when the rotors rotate and the product is drawn into the pump. It is then transported in the space between the lobes and the periphery of the rotorcase to the discharge side, where volume between the rotors is reduced and the product is discharged.



3.3 Pump dimensions - horizontally ported pump



The above dimensions are for guidance only and should not be used for installation purposes. Certified dimensions are available upon request.

3.4 Pump weight

Pump weight (dry)with plain cover 63.00 kg
Pump weight (dry) with relief valve 66.50 kg

The above weights are for guidance only and will vary depending upon the specification of the pump.

3.5 Pump displacement

Pump displacement per revolution is 1.06 litres

3.6 Pump information chart

Pump	Max flowrate (m^3/h)	Max pressure (bar)	Max speed (rev/min)	Max Pressure at max CIP Temp of 130°C (bar)
STP20/106/10	63.6	10	1000	3

3.7 Pressure relief valve

A integral relief valve is available. It can be used regardless of the direction of rotation. A manual override is also available.

When fitted, the 4 mm diameter drain hole should always be facing vertically downward regardless of pump mounting.

The relief valve is designed to partially protect the pump from damage caused by over-pressurisation. The relief valve is preset at 10 bar.

Over pressurisation can occur if :-

1. A valve is closed against the pump discharge.
2. The product viscosity in the system is significantly increased.
3. The pump speed is increased.

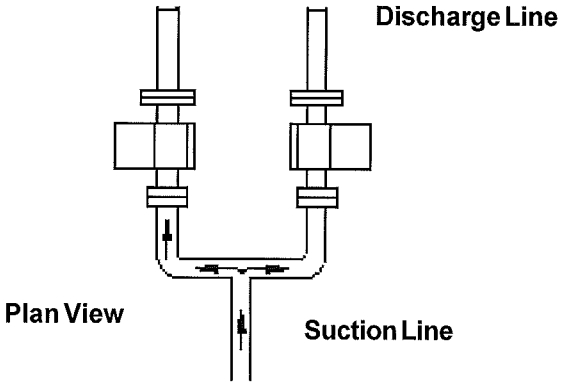
4.0 System design and installation

4.1 System design advice

When designing the pumping system :-

Do - Confirm with the supplier the Net Positive Suction Head (NPSH) requirements for the system, as this is crucial for ensuring the smooth operation of the pump and preventing cavitation.

Do - Avoid suction lifts and manifold/ common suction lines for two pumps running in parallel, as this may cause vibration or cavitation.



Do - Protect the pump against blockage from hard solid objects e.g. nuts, bolts etc. Also protect the pump from accidental operation against a closed valve by the use of relief valve, pressure switch, etc..

Do - Fit suction and discharge pressure monitor points as close to the pump ports as possible for diagnostic purposes.

Do - Install a non-return valve to prevent turbining when high pressures are applied to the pump whilst it is not in use.

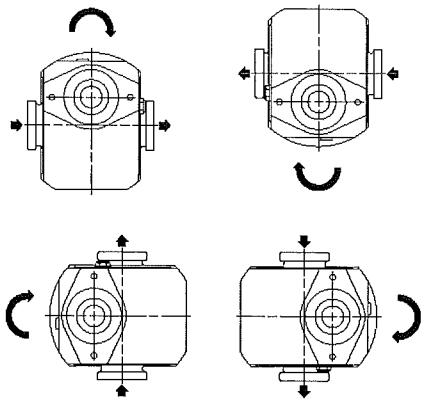
Do - Install valves if two pumps are to be used on manifold/common discharge lines.

Do - Make the necessary piping arrangements if steam is required for heating /cooling tanks.

Do not- Subject the pump to rapid temperature changes during C.I.P. (Cleaning in Place) procedures. **Pump seizure can result from thermal shock.** A suitable by-pass is recommended.

4.2 Direction of rotation

The direction of flow is dictated by the direction of rotation of the drive shaft. Reversing the direction of rotation will reverse the flow direction.



4.3 Pipework

All pipework **must** be supported. The pump **must not** be allowed to support any of the pipework weight.

Remember - Pipework supports must also support the weight of the product being pumped.

Always :-

Have - Suitably sized short straight suction lines to reduce friction losses in the pipework thereby improving the NPSH available.

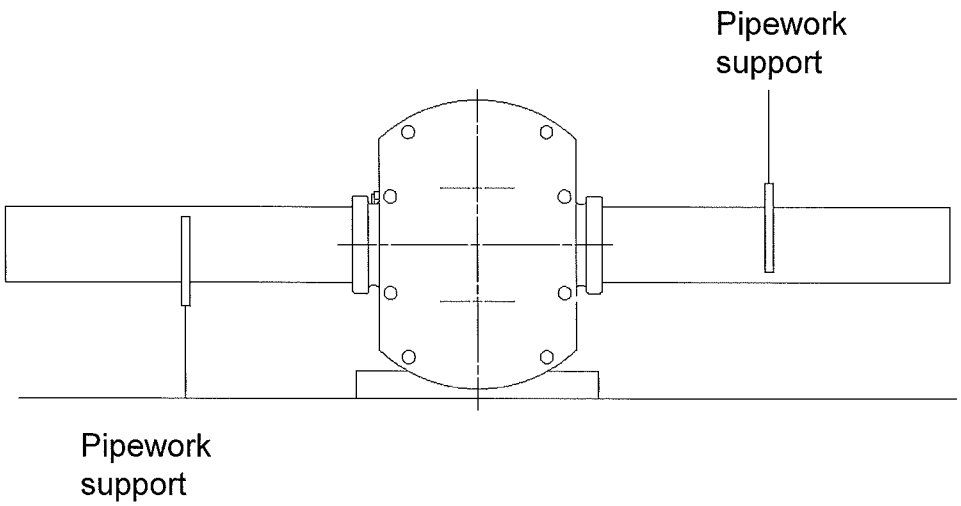
Avoid - Bends, tees and any restraints close to either suction or discharge side of pump. Use long radius bends wherever possible.

Provide - Valves on each side of the pump to isolate the pump when necessary.

Keep - Pipework horizontal where applicable to reduce air locks. Include eccentric reducers on suction lines if required.

Check - Coupling alignment during installation.

Use - Flexible connections between tank pipework and suction port where conditions allow.



4.4 Port Orientation

The pump can be mounted in either horizontal or vertical port orientation by changing the pump mounting feet and its position. Pump should not be side mounted when fitted with vertically ported feet.

5.0 Commissioning

When taking delivery of a new or refurbished pump unit it is essential to check that the gearbox is filled with the correct quantity of oil to the centre of the sight glass, with one of the recommended grades of lubricant in the table below. Failure to have the correct grade and level of oil in the gearbox prior to installation and start-up, could result in serious damage to the internal components.

The oil filler cap does not require to have vent/breather hole. Using this type of solid filler cap prevents the ingress of dirt and cleaning solutions that would contaminate the lubricant and reduce or destroy its effectiveness . If this cap is lost at any time it is important that a replacement of the same type is fitted immediately.

5.1 Lubricating the pump

The gearbox should be filled to the mid point of the sight level glass. This requires approximately 1.5 litres of oil for a Horizontally ported pumps and 0.9 litres for Vertically ported pumps.

5.2 Recommended lubricants

Make	Grade
	-20°C +130°C
BP Energol	GR-XP150
Castrol Alpha	SP150
Mobil Gear	629
Shell Omala	150
Texaco Meropa	150
Esso Spartan	150

If none of the above manufacturers grades are obtainable a suitable alternative high grade 80-90 gear lubricant may be used

5.3 Changing the oil :-

The pump will **not** be supplied oil filled.

First change - After 150 hours of operation or after 1 month, whichever comes first.

Subsequent changes - Every 3000 hours of operation or annually, whichever comes first.

Only use the recommended oil types.

5.4 Oil capacity

Pump model	Porting	Litres
STP20/106/10	Horizontal	1.5
STP20/106/10	Vertical	0.9

6.0 Start up, shut down and Cleaning in Place

6.1 Pump Start Up Check List

		Yes	No
1.	Has the pipework system been flushed through to purge welding slag and/or any other hard solids?	☐	☐
2.	Have all obstructions been removed from the pipework or pump?	☐	☐
3.	Are the pump connections and pipework joints tight and leak-free?	☐	☐
4.	Is there lubrication in the pump and drive unit?	☐	☐
5.	Are the pipework valves open?	☐	☐
6.	Are all safety guards in place?	☐	☐
7.	Start then stop the pump to check that the product is flowing in the correct direction?	☐	☐
8.	Are the pump speed/pressure and temperature settings below the pump maximum limitations?	☐	☐

When all answers are 'yes', the pump may be used.

If there are any pumping problems refer to the fault finding chart

6.2 Pump shut down procedure

1. Turn the pump off.

2. Isolate the pump/drive from all power and control supplies.

3. Close the pipework valves to isolate the pump.

4. Ensure all auxiliary services such as heating/cooling tanks supply etc. are isolated.

5. If the pump is to be dismantled, refer to section 8 of this manual.

6.3 Cleaning In Place (CIP)

The pump can be manually cleaned or cleaned in place(CIP). The following is an example of a typical CIP procedure. Specific requirements for each application should be dictated by the carrier/shipper.

- Determine last product handled by the pump
- Remove the dust caps and/or fittings from the pump, rinse any residue from them with hot water.
- Connect hot water hose to the pump inlet or connect pump inlet to the tank trailer outlet valve during the tank's hot water cleaning cycle.
- When not fitted connect a ball or gate valve (to restrict liquid flow) to the pump discharge outlet.
- If driven hydraulically, ensure that the hydraulic proportional control valve is in the neutral position.
- If driven hydraulically or electric/ hydraulically, start system and run at normal operating speed. Open the ball or gate valve on the pump cleaning system so the hot water or cleaning solution from the tank flows into the pump. (hot water should be 80°C to 90°C) If hydraulically driven, select forward on the proportional control valve and slowly increase (by pushing the handle) to full pump speed. When driven electrically start the system and slowly increase the speed with the handwheel on the belt variator.
- Using the ball or gate valve, (to restrict liquid flow) increase the pump pressure to approximately 4-5 bar while it is operating. A pressure gauge at the discharge outlet will be required. This will ensure that the cleaning solution is cleaning the pump under high pressure conditions.
- Run the pump for 15 minutes under this pressure.

Relief Valve Pumps Only
WARNING: Do not complete this next step if your pump does not have a relief valve !!

- Close the ball or gate valve (to restrict liquid flow) until the pump relief valve actuates. Open the valve and close it again. Open valve once again - this should have now cleaned any residue from behind the relief valve diaphragm and any other close tolerance areas inside the pump.
- Shut down pump system in reverse order of above.
- Clean all external fittings from the fittings box with hot water and return.
- Remove all hose and fittings from the pump, bag ends and seal the ports.

IMPORTANT
Do not subject the pump to rapid temperature changes as pump seizure can result from thermal shock.

7.0 Maintenance and inspection

7.1 Maintenance schedule

It is advisable to install pressure gauges on both sides of pump as close as possible to the ports so that any problems within the pump/ pipework will be highlighted.

Your weekly schedule should include:

- Checking the **oil level** in the gearcase
- Checking the **product seals** for leakage and replace as necessary. The pump has been designed to operate at a maximum continuous discharge pressure of 10 bar. However, it is capable of withstanding discharge pressures up to a maximum of 11 bar intermittently. At pressures above 10 bar there is the possibility of leakage from the primary seal, if this occurs and the seal continues to leak at pressures below 10 bar, it is an indication that the primary seal may be permanently damaged and should therefore be replaced at the earliest opportunity.
- Checking the **oil seals** for leakage and replace as necessary at the earliest opportunity.
- Check **pumping pressures.** In certain operational circumstances the pump will pose a thermal hazard and as such should not be touched during operation. After shutdown the pump unit should be allowed time to cool.

7.2 Recommended spare parts

The following table details the recommended spare parts that should be retained within your maintenance schedule. (Refer to the Exploded drawings and parts list in section 17 of this manual).

Part description

Description	Quantity
'O' ring, product seal	2
or	
Lip seal, product seal	2
or	
Mechanical seal	2
'O' ring, seal housing	2
'O' ring, sleeve/shaft	2
'O' ring, sleeve/rotor	2
'O' ring, rotor nuts	2
'O' ring, front cover	1
Oil seal drive end	1
Oil seal gland end	2

Refer to spare parts manual for item numbers.

7.3 Maintenance tools

The following lists the maintenance tools required when working on the pump.

Dismantling the pump head

You will need:

Spanners
Socket set
Plastic block
Soft mallet
Cleaning hose
Rotor removal tool (supplied with pump)
6" Prybar (i.e. Snap-On Pt. 650)

Dismantling the gearbox

You will need - A fully equipped work shop in addition to the above.

7.4 Service Instructions for 3A Standard 02-10

Rotor nut O-ring Seal Replacement Interval

It is recommended that the rotor nut O ring seal is replaced every 12 months to maintain a bacteria tight seal.

Rotor Nut Seal Inspection

Periodaically inspect the rotor nut O-ring seal for any discoloration, nicks, or cracks. If any of the defects above are noticed, the O-ring seal must be replaced. Inspection and replacement refer to the seal replacement procedure below.

Seal Replacement Procedure

1. Remove rotorcase cover.
2. Undo rotor nuts and ensure components are dry before servicing.
3. With a penlight, inspect rotor nut blind tapped hole for contamination. If soiled, refer to cleaning procedure below.
4. Remove and discard rotor nut O-ring seal.
5. Fit new rotor nut O-ring seal.
6. Fit rotor nut and use a torque wrench to tighten to 150 Nm.
7. Fit the rotorcase cover.

Cleaning Procedure for Soiled Rotor Nut Tapped Hole

1. Remove rotor nut from the shaft.
2. Submerge and soak nut for 5 minutes in COP tank with 2% caustic wash.
3. Scrub the hole with internal thread vigorously by plunging a clean sanitary bristle pipe brush in and out of the hole for 2 minutes while submerged.
4. Soak nut in acid sanitizer for 5 minutes, and then scrub the hole again with the pipe brush for 2 minutes.
5. Rinse well with clean water and blow-dry tapped hole with clean air.
6. Swab test the inside of the tapped hole to determine cleanliness.
7. Should the swab test fail, repeat steps 2 thru 6 above until swab test is passed.

Should swab testing continue to fail, or time is of the essence, install a new rotor nut.

8.0 Disassembly

8.1 Before dismantling the pump

Before starting to dismantle the pump
Always:-

Purge -

the pump and system if any noxious/hazardous products have been pumped.

Isolate -

pump/drive unit from all power and control supplies.

Close -

pipework valves to isolate the pump

Disconnect -

the pump from the drive unit.

Secure -

The pump must be securely held during maintenance to maintain stability.

Read this section before continuing to dismantle the pump

To aid re-assembly, note which components came off which shaft. Good engineering practise suggests that components removed from a shaft should be assembled on the same shaft.

If removing the front cover for any reason check that rotorcase retaining nuts are tight before replacing.

8.2 Removing the front cover

1. Remove the 'R' clips (2) and carefully loosen the front cover retaining nuts (3) as there may still be residual pressure in the system.

2. Remove the front cover nuts and take off the cover (6). If stuck, loosen by tapping with soft mallet at overlap at sides. **Do not lever off.**

3. Flush out the pump head before continuing.

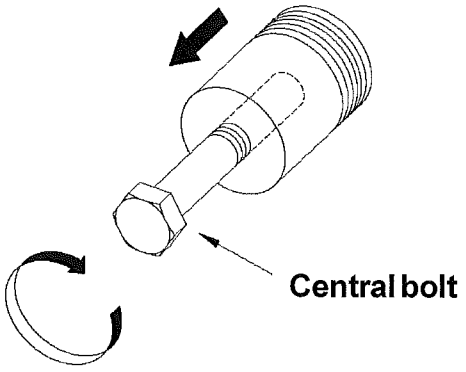
4. Remove the 'O' ring (7) from the front cover.

8.3 Removing the rotors

1. Insert a plastic block between the two rotors (13) to stop them turning.

2. Using a spanner remove the rotor nuts (9). These nuts have right hand threads.

3. The rotors can be removed from the shafts (28,29) by hand or by using the extractor tool supplied with the pump to aid disassembly. Unscrew the central bolt until flush on the inside, screw the tool two full turns into the rotor. Whilst preventing the tool from turning screw in the central bolt. The rotor is jacked off the shaft for hand removal.



8.4 Product seal removal

1. 'O' ring- Refer to section 10

2. Lip Seal - Refer to section 11

3. Mechanical Seal - Refer to section 12

8.5 Removing the rotorcase

1. Remove the rotorcase retaining nuts. (5).

2. Gently tap the rotorcase (11) on each side with a soft mallet to release it from the bearing housing. (18)

3. The rotorcase will be supported on the studs (4) during removal.

4. The rotorcase and seal housing (66) can be removed as an assembly.

8.6 Removing the shaft sleeves and shims

1. Remove the wire shaft sleeve retaining clip (64) from the shaft taking care not to damage the shaft spline or sleeve abutment face.

2. Pull the shaft sleeve (42) off the shaft.

3. The setting ring (35) and shims (25) can be removed from the shaft. Take care not to lose or mix any shims and check no shims are left inside the sleeve.

8.7 Draining the pump of lubricant

1. Remove the drain plug (51) from the gear housing (14). The lubricant may now be drained into a suitable container.

8.8 Removing the front seal retainer

1. Remove the seal retainers (36) by levering with a screwdriver/lever.

2. Once the seal retainers are removed the oil seals (37) can be removed using a screwdriver/lever. It is essential to renew the oil seals upon reassembly.

8.9 Removing the gear housing

1. Remove the socket head cap screws (15).

2. Tap the foot of the bearing housing assembly (18) gently to release the gear housing (14) from the bearing housing.

3. Slide the gear housing (14) from the shafts. Remove the circlips (86) from the bearing bore. Heat the gear housing to 70°C and remove the bearing rear outer races (39). Allow to cool and press out the oil seal (41). It is essential to renew the oil seal upon re-assembly.

4. Remove the gasket (17).

8.10 Removing the timing gears

1. Pull the rear inner bearing races (39) off the shafts. A puller or extractor may be required to do this.

2. Disengage the tabs of the lock washers (52) fitted to the timing gear nuts (38) and with a plastic block between the gears to stop them turning remove the locking nuts with a 'sharp tap' on a 'C' spanner.

3. Remove the timing gears (23,24), keys (46) and any shims (30) from the shafts. Note position of shims(top/bottom).

8.11 Shaft and bearing removal

1. Replace the rotors back on the shafts. Disengage the tabs of the lock washers (32) fitted to the bearing nuts (31) and with the rotors locked by using a rag or similar to stop them turning remove the locking nuts with a 'sharp tap' on a 'C' spanner. Remove the rotors from the shafts.

2. Disassemble shafts (28,29) from bearing housing (18).

3. Remove each bearing set (33) (inner cones and outer cups) and **maintain in sets** if they are to be re-used.

To assist assembly note the positions on the shaft from which the bearings were removed. Good engineering practice suggests that if bearings are removed from the shafts for any reason they should be replaced with new bearings.

9.0 Assembly

Assemble components to the shaft from which they were removed.

9.1 Fitting shafts into the bearing housing

1. Locate the outer cups (33) into the bearing housing (18). This operation is made easier if the bearing housing is heated to 70°C. Press fit against the shoulders after cooling.

2. Position the drive shaft (29) vertically in the vice using soft jaws and apply antiseize compound to the bearing diameters.

3. Heat the front bearing inner cones to 110°C. **Do not use any form of live flame when heating as this will damage bearings.**

4. Assemble the front bearing inner cone (33) onto the shaft (29) ensuring a positive fit against the shaft shoulder.

5. Locate the drive shaft assembly in the bearing housing (18) in the bore marked with an 'X' in the drainage slot.

6. Locate the second heated bearing on the drive shaft and retain with the tab washer (52) and bearing nut (38) (hand tight).

7. Repeat the operation for the auxiliary shaft (28).

8. **Allow bearings to cool to handling temperature.**
   Note: Failure to do so will result in incorrectly set bearings.

9. Secure the drive shaft (29) and tighten the bearing lock nut (31), release the shaft, lightly tap each end of the shaft with a soft mallet and rotate.

   Check the torque required to turn the shaft in the bearings. The bearings are correctly adjusted when the torque to turn each shaft is 1.90 to 2.26 Nm for new bearings.

   If a torque wrench is not available tighten until shaft is firm without spinning. Repeat the above for the auxiliary shaft (28).

10. Lock the bearing retaining nuts (31) with the tab washers (32). If no tab lines up with any slot gradually tighten (never loosen) until engagement is possible.

11. Apply oil to the bearings.

9.2 Fitting the front seal retainers

1. Lightly lubricate the outside diameter of the oil seals (37) then press the oil seals into the front seal retainers (36).

2. Clean the rear face of the retainers and the mating faces on the bearing housing (18). Apply silicone sealant to the retainers and press into place.

9.3 Fitting timing gears and setting rotor timing

1. Locate the timing shims (30) on each shaft from which they were removed.

2. Locate gear keys (46) into shafts (28,29).

3. Slide each timing gear (23,24) onto the shafts, realign marks if gears were previously marked in pairs.

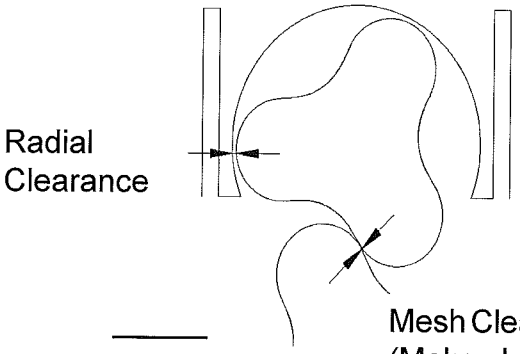
4. Locate tab of locking washer (52) in keyway of each gear.

5. Fit the timing gear lock nuts (38) and with a plastic block in the gears to stop them turning tighten with a 'sharp tap' on a 'C' spanner.

9.4 Adjusting the rotor timing

1. Slide rotors (13) onto the shafts (28,29), but do not tighten the retaining nuts (9).

2. Turn the shaft so that the rotors are in the position shown below.

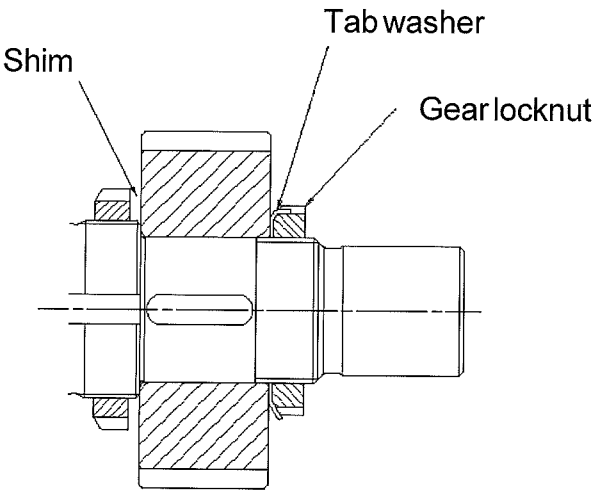


3. With the rotors loose on the shafts, using feeler gauges measure between the point indicated (mesh) whilst squeezing the lobes together. Turn the shaft as required to measure all six positions.

4. If the measurement points are unequal, note the difference and which side of the rotor has the larger clearance.

5. Correct the difference by adding or removing shims (30) between the gear face and shaft shoulder as indicated in the diagram. Fully tighten the gear retaining nuts and check the clearances are within the specification limits. If correct, lock the gear lock nuts (38) with the tab washer (52).

6. Remove the rotors.



9.5 Fitting the gear housing

1. Clean the gear housing (14) and heat to a temperature of 70°C. Re-assemble the bearing outers (39) into the housing. Allow to cool to handling temperature. Fit new circlips (86), then with light lubrication to the outside diameter of the oil seal (41) press into the housing.

2. Ensuring that the faces of the bearing housing and gear housing are clean, fit new gasket (17) to bearing housing.

3. Carefully slide the gear housing over the shaft ensuring the oil seal is not cut or damaged. Tighten the socket head cap screws (15) to a torque figure of 45Nm.

9.6 Setting the rotor clearances

Incorrect setting of the rotor clearances will damage the pump.

1. Fit the rotorcase (11) and retain with four nuts (5) tightened to 40Nm.

2. Fit the setting ring (35) with chamfer towards the shaft shoulder and 0.5mm of shims onto the shaft. At this point, do not fit 'O' rings (45). Slide shaft sleeve onto the shaft ensuring that the drivepin locates in any position other than the missing spline.

3. Fit the rotors (13) and torque the retaining nuts (9) to 150Nm.

4. Using a micrometer and feeler gauges measure the front and back clearances respectively.

5. Adjust the shims (25) if necessary to ensure the front and back clearances are within the specified limits.

6. Check the radial clearances are within specification limits.

7. If all clearances are correct, remove rotors, shaft sleeves and rotorcase taking care not to disturb the shims.

8. Lightly grease the seal sleeve 'O' rings (45) and fit to the sleeve.

9. Fit the sleeves onto the shafts ensuring that the drive pins locate in any other position than the missing spline.

10. Fit the seal sleeve retaining clips (64) onto the shafts.

11. Fit the rotorcase (11) and retain with four nuts (5) tightened to 40Nm.

9.7 Fitting the seal

O'ring - Refer to section **10**

Lip Seal - Refer to section **11**

Mechanical Seal - Refer to section **12**

9.8 Fitting the rotors

1. Align the rotor with the missing spline of the shaft.

2. Lubricate the rotor nut sealing 'O' (10) ring and fit to the nut groove.

3. Use a plastic block between the rotors to stop them turning while tightening the rotor nuts (9) to 150 Nm.

4. To check that the rotors are correctly synchronised turn the pump by hand, and check the meshing clearances with feeler gauges through all six points.

9.9 Fitting the front cover

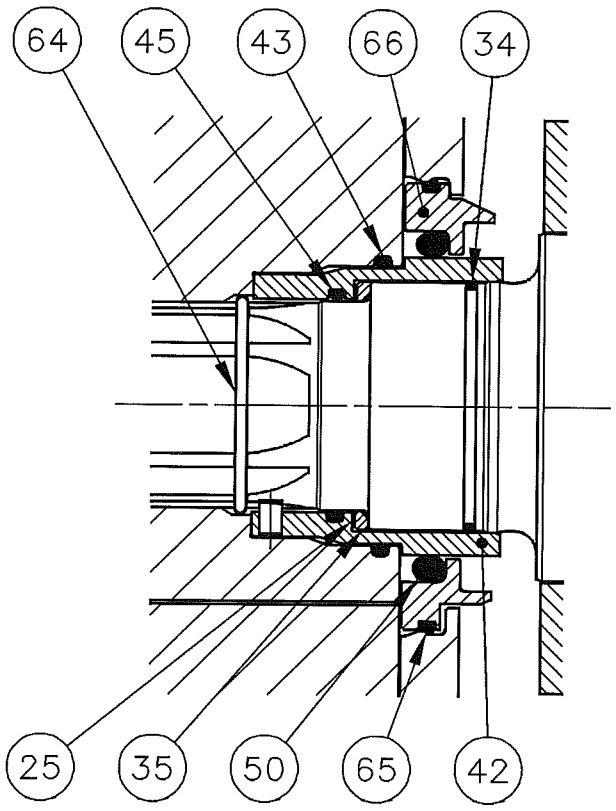
1. Fit the front cover 'O' ring (7).

2. Fit the cover (6) onto the rotorcase studs (4) and tighten the front cover nuts to the recommended torque - 40 Nm. Fit 'R' clips (2).

3. The pump can now be mounted with its drive unit.

4. **Prior to start up the pump must be filled with oil.**
   Read the start-up check list before proceeding to start the pump, see section 6.1

10 Replacing 'O'Ring Seal



ITEM	DESCRIPTION
25	Shim Pack
34	'O' Ring Shaft
35	Setting Ring
42	Shaft Sleeve
43	'O'Ring Sleeve/Rotor
45	'O'Ring Shaft/Sleeve
50	'O'Ring Product
65	'O'Ring Seal Housing/Rotorcase
66	Seal Housing

10.1 Product 'O'ring seal replacement

1. The product 'O'ring (50) can be removed from the front of the pump with a screwdriver or similar tool once the rotor retention nut (9) and rotor (13) are removed. Take care not to damage the sleeve surface.

10.2 'O'ring seal fitting

1. Press a new product 'O'ring fully into the seal housing (66), replace the rotors and rotor retention nuts. To aid seal fitting water may be used to lubricate the 'O'ring.

10.3 To remove the seal housing

1. Remove the gland guards (21).

2. Thoroughly clean the inside and outside of the seal area on the rotorcase and the bores of the rotor.

3. Remove the product 'O'ring (50)(see previous section).

4. Use a suitably sized screwdriver or lever to lever between the seal housing (66) and shaft sleeve (42). This will ease the seal housing out of the rotorcase. Ensure care is taken not to damage the sleeve sealing surface.

10.4 Seal housing fitting

This can be done with the rotorcase on or off the pump.

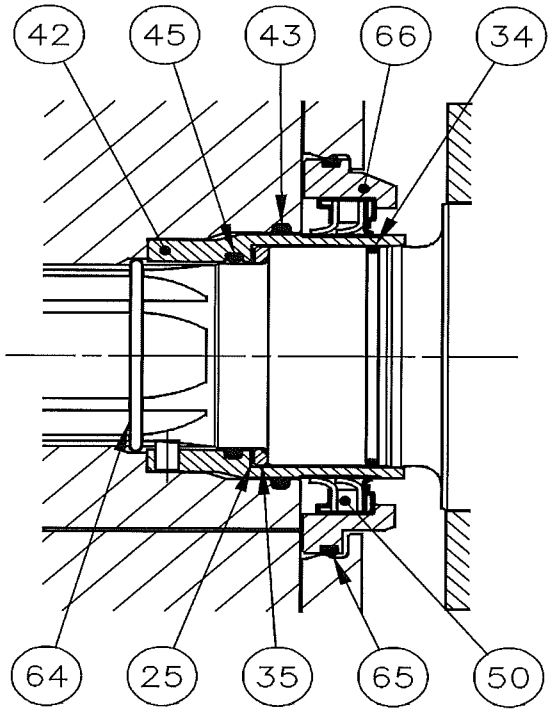
1. Ensure the seal housings and seal recesses are clean.

2. Position the seal housing (66) loosely in the rotorcase with the flat, inside the rotor case, aligned. Once correctly aligned push the seal housing into the rotorcase. Check the seal housing is below the back face of the rotorcase.

3. Lightly lubricate the 'O'rings with water or a suitable grease.

NOTE: To assist fitting the seal housing the rotor and rotor retaining nut can be used to press the seal housing.

11 Replacing Lip Seal



11.1 Lip seal removal

The product lip seal (81) and seal housing (66) should be removed as an assembly.

1. Remove the gland guards (21).
2. Thoroughly clean the inside and outside of the seal area.
3. Use a suitably sized screwdriver/lever to lever between the seal housing (66) and shaft sleeve (42).This will ease the seal housing out of the rotorcase. Ensure care is taken not to damage the sleeve sealing surface.
4. Press the lip seal out of the seal housing.

NOTE: The lip seal assembly (lip seal and housing, pre-pressed) is available as spare part.

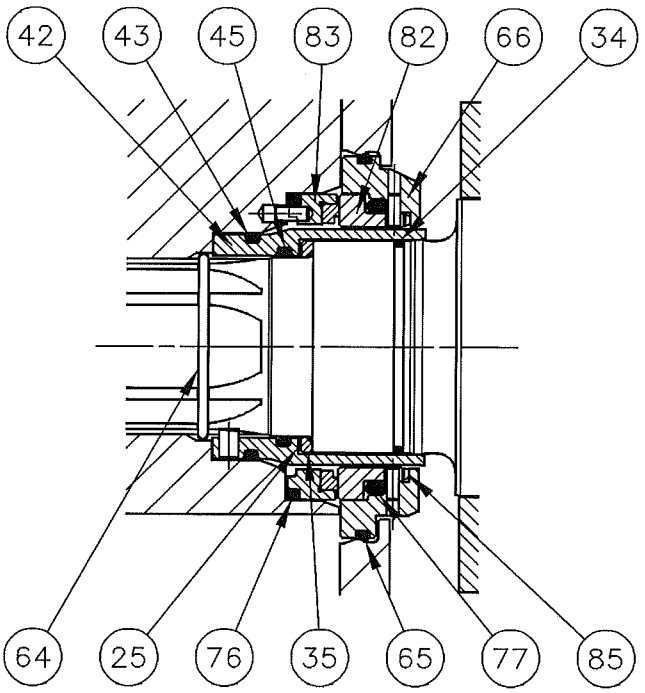
ITEM	DESCRIPTION
25	Shim Pack
34	'O' ring Shaft
35	Setting Ring
42	Shaft Sleeve
43	'O'Ring Sleeve/Rotor
45	'O'Ring Shaft/Sleeve
65	'O'Ring Seal Housing/Rotorcase
66	Seal Housing
81	Lip Seal

11.2 Lip seal fitting

1. Ensure the seal housings and seal recesses are clean.
2. Press the lip seal (81) in to the housing (66).
3. Pack the lip seals with **NON SILICON** grease (food quality if required).
4. Position the seal housing loosely in the rotorcase with the drive flat inside the rotor case aligned. Once correctly aligned push the seal housing into the rotorcase. Check the seal housing is below the back face of therotorcase.
5. Lightly lubricate the 'O'rings with water or a suitable grease.

NOTE: To assist fitting the seal housing the rotor and rotor retaining nut can be used to press the seal housing.

12 Replacing Mechanical Seal



ITEM	DESCRIPTION
42	Shaft Sleeve
43	'O'Ring Sleeve/Rotor
45	'O'Ring Shaft/Sleeve
64	Clip Shaft Sleeve Retention
65	'O'Ring Seal Housing/Rotorcase
66	Seal Housing
76	'O' Ring Mech Seal/Rotor
77	'O'Ring Mech Seal/Housing
82	Seal Face Static
83	Seal Face Rotary
85	Wave Spring

12.1 Single mechanical seal

The seal comprises of a rotary face with associated 'O' ring which is located in the rotor with two pins providing the drive. A wave spring provides a closing force through the static face. Two pins provide anti-rotation fixing for one static face with associated static 'O' ring.

12.2 Single mechanical seal removal

1. Remove the gland guards (21).

2 Thoroughly clean the inside and outside of the seal area on the rotorcase and the bores of the rotor. The static element of the seal and the seal housing (66) should be removed as an assembly.

3. Use a suitably sized screwdriver to lever between the seal housing and shaft sleeve (42). This will ease the seal assembly out of the rotorcase.

4. With the static seal assembly on a suitable work bench use a screwdriver or lever in the wave spring recess to prise the static seal face (82) out of the seal housing. The wave spring (85) can be pressed over the drive pins and removed.

5. Use a screwdriver/lever to prise the rotary seal (83) face out of the rotor.

12.3 Single mechanical seal fitting

1. Ensure the seal housings and seal recesses are clean.

2. Lightly lubricate the 'O'rings and springs with a silicon grease (Food quality if required).

3. Position the wave springs (85) into the seal housing (66).

4. Fit the static face (82) with associated 'O' ring to the seal housing recess. Ensure location pins engage correctly.

5. Press the rotating faces (83) in to the rotor bores ensuring the drive pins locate correctly.

6. Position the seal housing loosely in the rotorcase with the flat inside the rotor case aligned. Once correctly aligned push the seal housing into the rotorcase. Check the seal housing is below the back face of the rotorcase.

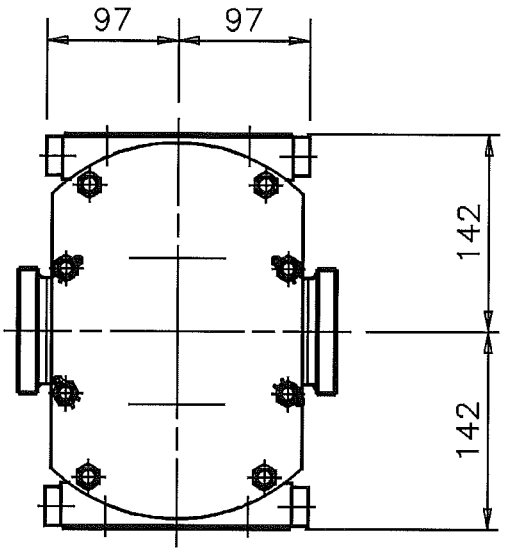
NOTE: To assist fitting the seal housing the rotor and rotor retaining nut can be used to press the seal housing.

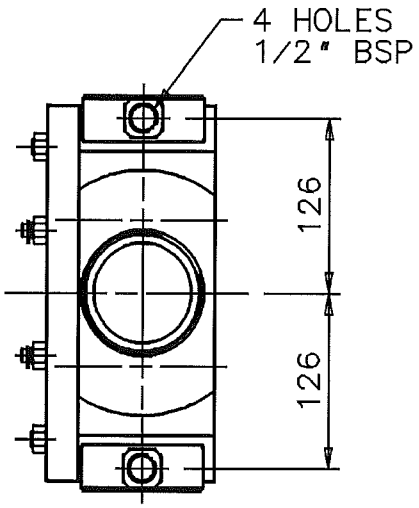
7. Wipe all lapped seal face surfaces until clean.

8. Follow the rotor assembly procedure in section 9.8

13 Pump heating tank

13.1 Heating tank dimensions





Care should be taken when piping up and connecting to heating tanks.

Heating tank removal

1. Relieve all pressure from the heating tank system.
2. Clean heating tank area.
3. Disconnect the pipework.
4. Remove the M8 cap screws and heating tanks.

Heating tanks supplied with new pumps are hydrostatically tested. A certificate can be provided on request.

Prior to operation a hydrostatic test of the heating system is recommended.

Hydrostatic test pressure (water) :- 6 bar
Maximum working pressure :- 3.7 bar

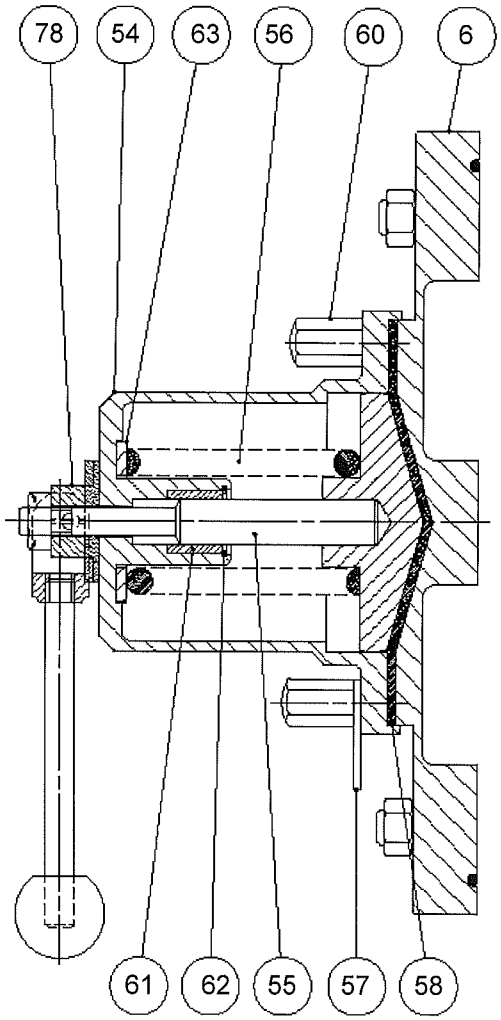
Heating tanks should be in operation approximately 15 minutes prior to pump start-up and remain in operation for 15 minutes after pump shutdown.

13.2 Heating tank fitting

1. Ensure all mating faces are clean and free of product.
2. Secure using the M8 cap screws and lock washers. Tighten to a torque of 45Nm.
3. Connect pipework.
4. Check system for leaks prior to use.

NOTE: If the pump was not originally fitted with heating tanks, the rotorcase will require drilling and tapping. Refer to **Alfa Laval Ltd.**

14 Relief Valve



ITEM	DESCRIPTION
6	Front Cover
54	Valve Housing
56	Spring
55	Valve Head Stem
57	Anchor Plate
58	Diaphragm
60	Nut
61	Bush
62	Circlip
63	Spacer Valve Preloading
78	Lever Lift Assembly

The relief valve is factory set to operate at 10 bar to partially protect the pump from over pressurisation. The relief pressure can not be field adjusted.

14.1 Disassembly - Relief valve

Take extreme care when removing the valve housing as the spring has been compressed.

1. If the pump is still in the system, ensure there is no pressure in the pump head.
2. Clean the outside of the pump and valve casing.
3. Remove the manual override lever (78) if fitted.
4. Remove the nuts (60) and housing (54). Loosen the nuts equally in order to move the housing away from the rotorcase squarely.
5. Remove the valve spring (56), spacer valvehead assembly and diaphragm (58).

14.2 Assembly - Relief valve

1. Ensure mating faces are clean and free of product.
2. Fit the diaghragm with PTFE face towards relief valve front cover.
3. Place the spring (56) on the valve head (55).
4. Fit the valve head/spring assembly into the valve housing (54).
5. Mount the housing assembly to the front cover and retain with nuts. Tighten nuts evenly to a torque of 20Nm.

No discharge	Under capacity	Irregular discharge	Prime lost after starting	Pump stalls after starting	Pump overheats	Motor overheats	Excessive power absorbed	Noise & vibration	Pumping element wear	Excessive primary seal wear	Product loss through primary seal	Seizure	Causes		Remedies
•													Incorrect direction of rotation	1	Reverse drive
•													Pump un-primed	2	Expel gas from supply line & pumping chamber, introduce liquid
•	•	•	•					•					Insufficient NPSH available	3	Increase supply line diameter, increase suction head. Simplify supply line configuration & reduce length. Reduce speed. Decrease product temp., check effect of increased viscosity on available & permitted power inputs
•	•	•	•					•					Air entering supply line	4	Remake pipework joints, check primary seal
	•	•	•					•					Gas in supply line	5	Expel gas from supply line & pumping chamber, introduce liquid
•	•	•	•					•					Insufficient head above vessel outl	6	Raise product level. Lower outlet position
	•	•						•					Inlet valve strainer blocked	7	Service fittings
	•		•	•	•	•	•	•					Product viscosity above rated capa	8	Decrease pump speed. Increase product temperature
	•												Product viscosity below rated capa	9	Increase pump speed. Decrease product temperature
					•			•	•			•	Product temp. above rated temp.	10	Cool the pumping chamber
				•		•	•						Product temp. below rated temp.	11	Heat the pumping chamber
								•	•	•	•	•	Unexpected solids in product	12	Clean system. Fit strainer to inlet line
	•	•	•	•	•	•	•	•	•			•	Delivery pressure above rated capa	13	Check for obstruction. Service system to prevent problem recurring. Simplify
						•	•	•					Pump speed above rated figure	14	Decrease pump speed
	•												Pump speed below rated figure	15	Increase pump speed
	•				•	•	•	•	•			•	Rotorcase strained by pipework	16	Check alignment of pipes. Fit flexible pipes or expansion fittings. Check pipework support.
								•					Flexible coupling misaligned	17	Check alignment & adjust mounts accordingly
					•	•	•	•	•			•	Insecure pump drive mounts	18	Fit lock washers to loose fasteners & retighten
				•	•	•	•	•	•			•	Shaft bearing wear or failure	19	Refer to pump manual for replacement parts
					•	•	•	•				•	Worn or un-synchronized timing ge	20	Refer to pump manual for replacement parts
				•	•	•	•	•	•			•	Gear case oil quantity incorrect	21	Refer to pump manual for instructions
•	•												Contact of pumping parts	22	Check rated & actual duty pressures
	•							•					Relief valve leakage	23	Check pressure setting & adjust if required. Examine & clean seating surfaces, replace worn parts
	•							•					Relief valve chatter	24	Check for wear on sealing surfaces, replace if necessary

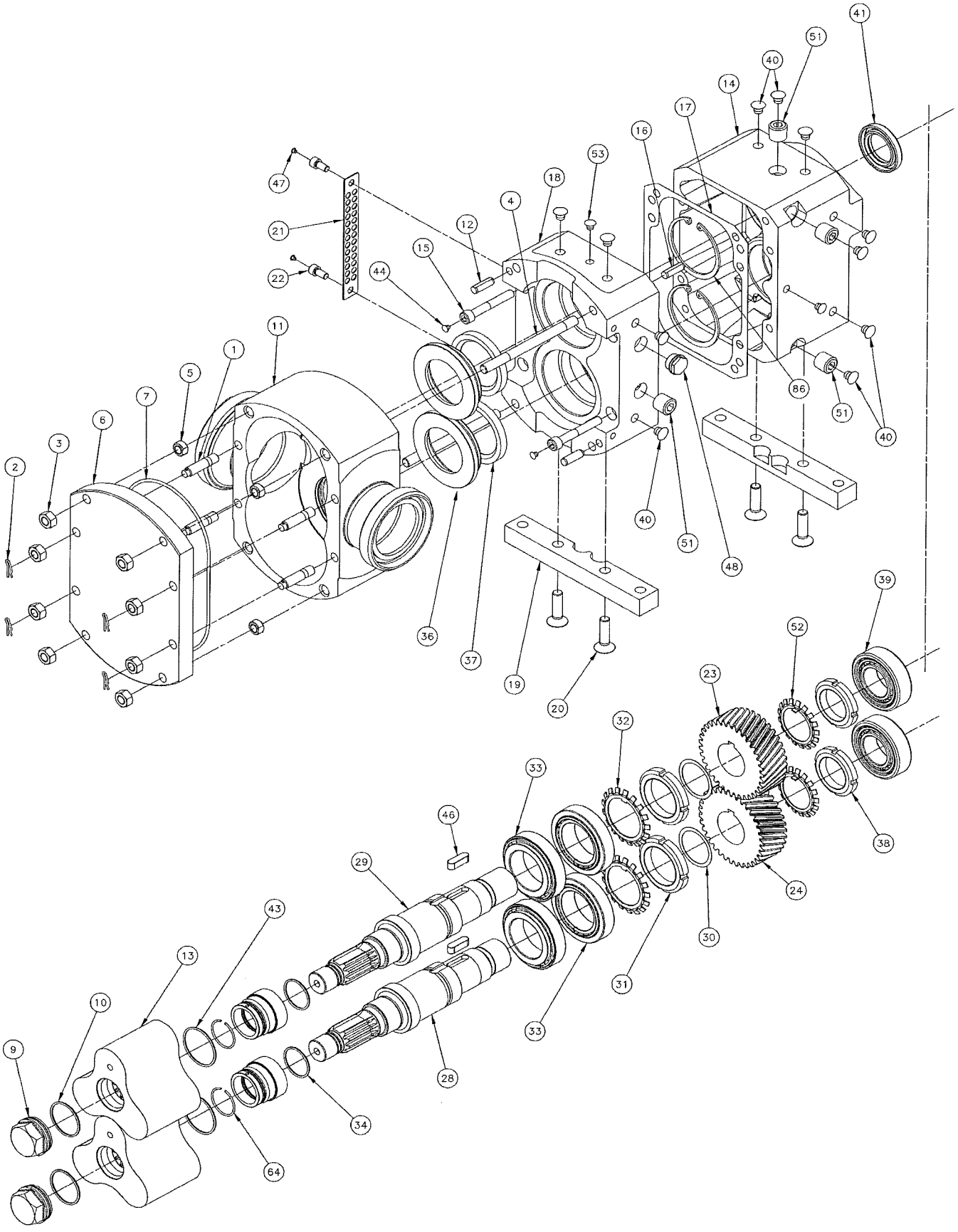
16 Torque settings/spanner sizes

Recommended torque settings in Nm

Description	Pump	Tool Sizes
	STP20/106/10	
Front cover nut	40	19mm
Rotorcase retainer	40	16mm
Rotor nut	150	41mm
Bearing housing screw	45	8mm Allen
Relief valve nut	20	14mm
Foot screw	100	8mm Allen
Gland guard screw	20	6mm Allen
Sight glass	2	22 mm

17 Exploded view drawing and parts list

Item	Description	Qty
1	Stud, rotorcase cover	4
2	Clip, rotorcase cover stud	4
3	Nut, rotorcase cover stud	8
4	Stud, rotorcase cover	4
5	Nut, rotorcase retention	4
6	Cover, plain rotorcase	1
7	'O' Ring, cover	1
9	Nut, rotor retention	2
10	'O' Ring, rotor sealing nut end	2
11	Rotorcase	1
12	Dowel, rotorcase	2
13	Rotors	2
14	Housing, gear	1
15	Screw, gear housing	4
16	Dowel, gear housing	2
17	Gasket, bearing/gear housing	1
18	Housing, bearing	1
19	Foot, horizontal port	2
20	Screw, horizontal port foot	4
21	Guard, gland	2
22	Screw, gland guard	4
23	Timing gear - LH	1
24	Timing gear - RH	1
28	Shaft, auxiliary	1
29	Shaft, drive	1
30	Shim, timing gear	1 set
31	Nut, bearing	2
32	Tab washer, bearing nut	2
33	Bearing, front	4
34	'O' ring, shaft	2
36	Retainer, seal	2
37	Lip seal, gland end	2
38	Nut, timing gear	2
39	Bearing, rear	2
40	Blanking plug	14
41	Lip seal, drive end	1
43	'O' ring, rotor	2
44	Plug, gear housing screw	4
46	Key, timing gear	2
47	Plug, gland guard screw	4
48	Sight Glass	2
51	Plug, filler and drain	6
52	Tab Washer, timing gear	2
53	Blanking plug	3
64	Clip, shaft sleeve retainer	2
86	Circlip	2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