INSTRUCTIONS 1009-B00 e

Section	1009
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SSP-X Serie Pumps

INSTALLATION

OPERATION

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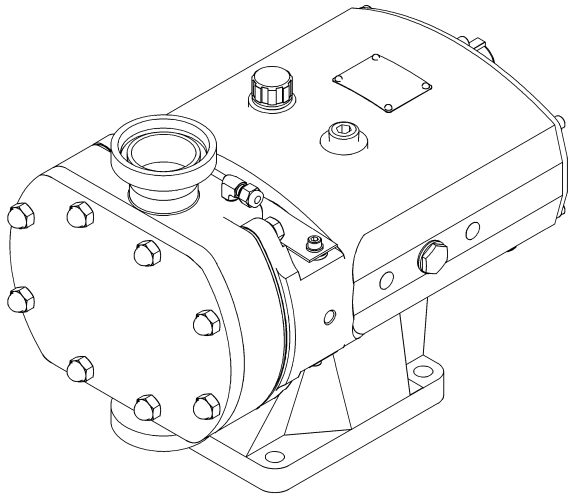
SSP Pumps

Series SSP-X

Stainless Steel Positive Displacement Rotary Lobe Pumps

Operating Manual



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

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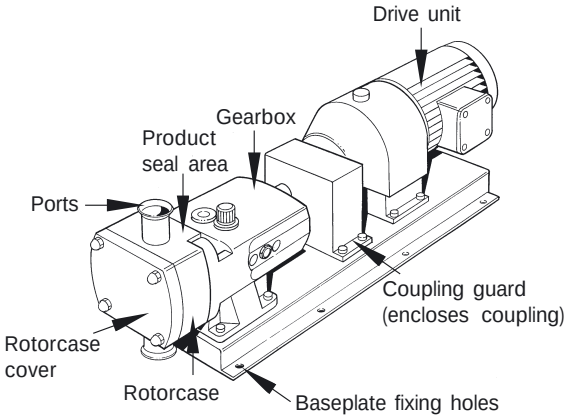
The SSP-X pump is a positive displacement rotary lobe pump ; it may be supplied with or without a drive unit (see drawing). The drawing shown indicates various parts of the pump unit.

The Series SSP-X range has a universal gearbox design in models SSP-X1 - 4. This enables the flexibility of mounting pumps with the inlet and outlet ports in either a vertical or horizontal plane. The port orientation, vertical or horizontal, may be changed by moving one of two available bolt-on feet on the gearbox. Port orientation should be specified when ordering, but the alternative foot design allows pumps that are already installed being changed should the need arise.

Models SSP-X5, 6 and 7 pumps only have the inlet and outlet ports in the vertical plane by using dedicated gearbox castings.



Pump 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 order documentation and if not available may be obtained from your supplier quoting pump model and serial number.

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 85dB[A]. When necessary, protection against noise should be taken.

Unsafe practices and other important information are emphasized in this manual.
Warnings are emphasized by means of special signs.

Always read the manual before using the pump !

WARNING !
Indicates that special procedures must be followed to avoid severe personal injury.

CAUTION !
Indicates that special procedures must be followed to avoid damage to the pump.

NOTE !
Indicates important information to simplify or clarify practices.

General warning :

Dangerous electrical voltage :

Caustic agents :

All warnings in the manual are summarised on this page.
Pay special attention to the instructions below so that severe personal injury or damage to the pump are avoided.

Installation

- **Always** observe the technical data (see chapter 5).
- **Never** start in the wrong direction of rotation with liquid in the pump.
- **Never** put your hands or fingers inside the port connections or anywhere close to rotating shafts.

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

Operation

- **Always** observe the technical data (see chapter 5).
- **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 both the suction side and the pressure side blocked.
- **Never** put your hands or fingers inside the port connections or anywhere close to rotating shafts.

Only handle toxic and acidic liquids in accordance with their manufacturers instructions and recommendations.

Maintenance

- **Always** observe the technical data (see chapter 5).
- The pump must **never** be serviced when hot.
- The pump and the pipelines must **never** be pressurised when the pump is being serviced.
- **Never** put your hands or fingers inside the port connections or anywhere close to rotating shafts.

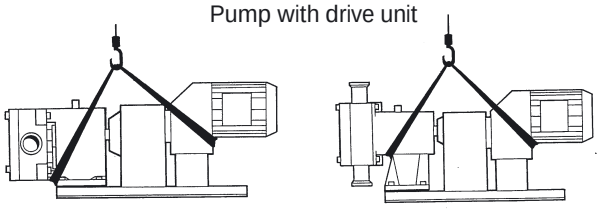
Always disconnect the power supply when the pump is being serviced.

Step 1

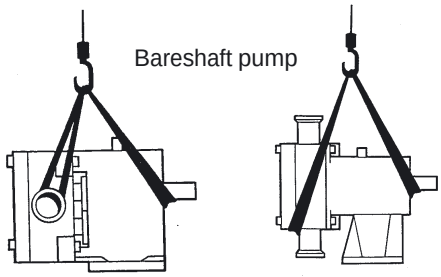
Refer to the pump weights guide (chapter 5) before selecting and using any lifting gear. The drawing show how the pump should be lifted.

Ensure that lifting equipment is correctly rated and used within these limits.

Pump with drive unit



Bareshaft pump



Step 2

On receipt always :

- Check the delivery note against the goods received.
- If motorised, check that the drive instructions are available.
- Inspect the packing for signs of damage in transit.
- Carefully remove the packing away from the pump.
- Inspect the pump for any visible signs of damage.
- Clean away the packing from the pump port connections.
- Report any damage to the carrier.

Step 3

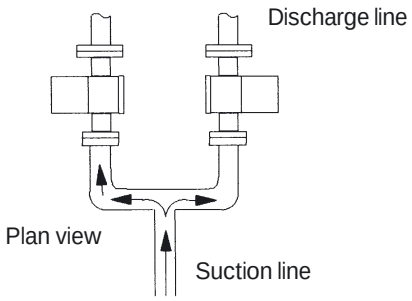
After receipt and inspection, if the pump is not to be installed immediately, the pump should be repacked and placed in suitable storage. The following points should be noted :

- Plastic or gasket type port covers should be left in place.
- Pumps received wrapped with corrosion inhibiting treatment material should have wrappiong replaced.
- A clean, dry storage location free from vibration should be selected. If a moist or dusty atmosphere is used for storage, further protect the pump or unit with a suitable cover.
- Rotate the pump/pump unit by hand weekly, to prevent bearing damage.
- All associated ancillary equipment should be treated similarly.

Step 1

When designing the pumping system :

- Confirm the Net Positive Suction Head requirements of the pump (NPSHr) are met, as this is crucial for wnsuring smooth operation of the pump and preventing cavitation.
- Avoid suction lifts and manifold/common suction lines for two pumps running in parallel, as this may cause vibration or cavitation.
- 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 using either relief valves, pressure switch or current limiting device.



Step 2

Before the pump is installed it is advisable to consider the following :

Always

- ensure that the mounting surface is flat to avoid distortion of the baseplate, as this will cause pump/motor shaft misalignment and pump/motor unit damage.

Check

- pump shaft to motor shaft alignment is within manufacturers limits once the base plate has been secured.

Always allow at least 1 m for pump access/maintenance all around the pump.

- Fit suction and discharge pressure monitor points for diagnostic purposes.
- Fit valves if two pumps are to be used on manifold/common discharge lines.
- Make the necessary piping arrangements if flushing is required for the seal or if media is required for heating/cooling jackets.
- Do not subject the pump to rapid temperature changes. Pump seizure can result from thermal shock.

Step 3

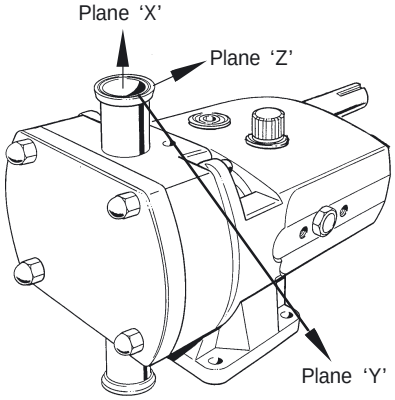
All pipework must be supported. The pump must not be allowed to support any of the pipework weight beyond the limits set in the following table.

Remember :

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

Always :

- Design short straight suction lines to reduce friction losses in the pipework thereby improving the NPSH available from the system.
- Avoid bends, tees and any restrictions close to either suction or discharge side of pump. Use ling radius bends wherever possible.
- Provide isolating 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.



Step 3 - continued

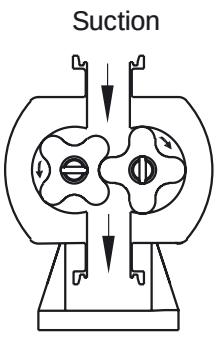
Table of Maximum Forces and Moments

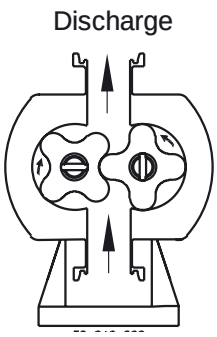
Pump Model			Forces				Moments			
			FZ	FY	FX	EF	MZ	MY	MX	EM
SSP-X1	Forces	N	80	60	70	120				
		lbf	*18*	*13*	*16*	*27*				
	Moments	Nm					30	30	30	50
		lbft					*22*	*22*	*22*	*37*
SSP-X2	Forces	N	125	100	110	190				
		lbf	*28*	*22*	*25*	*43*				
	Moments	Nm					60	70	75	115
		lbft					*44*	*52*	*55*	*85*
SSP- X3/4	Forces	N	165	135	150	260				
		lbf	*37*	*30*	*34*	*58*				
	Moments	Nm					100	115	140	205
		lbft					*74*	*85*	*103*	*151*
SSP-X5/6	Forces	N	300	250	250	460				
		lbf	*67*	*56*	*56*	*103*				
	Moments	Nm					125	145	175	260
		lbft					*92*	*107*	*129*	*192*
SSP-X7	Forces	N	380	320	320	590				
		lbf	*85*	*72*	*72*	*133*				
	Moments	Nm					165	190	230	340
		lbft					*122*	*140*	*170*	*251*

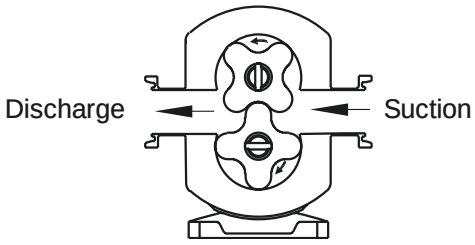
Step 4

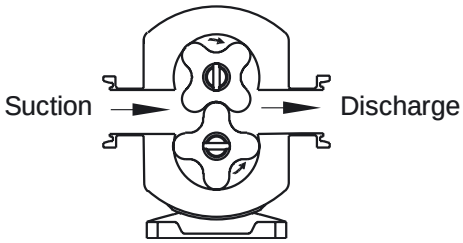
The direction of flow is dictated by the direction of rotation of the drive shaft. Reversing the direction of rotation will reverse the flow direction.

For oil quantities required, please see technical data (chapter 5).









Step 5
The pump will be supplied pre-filled with oil.
Check the oil level.

Oil changing : Oil level must be checked with the pump static.

First change : After 150 hours of operation, thereafter every 3000 hours of operation.

Oil filling : Fill with oil through the filler plug to the level indicated in the sight glass.

NOTE !
On horizontally ported pumps the sight glass must be fitted to the upper hole on the side of the gearcase.
Refer to technical data (chapter 5) for oil quantities required.

Pump Operating Temperature	
-20°C to +130°C (-4°F to +266°F	+130°C to 200°C (+266°F to 392°F)
BP Energol GR - XP150	BP GRS15
Castrol Alpha SP150	Castrol Alpha SN150
Mobil Gear 629	Mobil Glycoyle 30
Shell Omala 150	Shell Tivela WA
Texaco Meropa 150	Texaco Synlube SAE90
Esso Spartan EP150	Esso IL1947

Step 1

A flushed seal arrangement is fitted in order to cool or clean the seal area.

It is important that :

- The flush is correctly connected (see below).
- A compatible flushing fluid is used and supplied at the correct pressure and flow rate.
- The flush is turned on at the same time/prior to starting the pump, and turned off at the same time/after stopping the pump.

Step 2

Connecting the flush

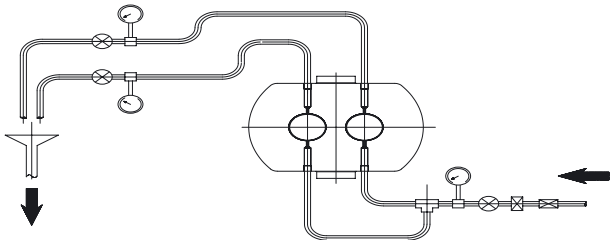
The following equipment is strongly recommended when using a flushing system :

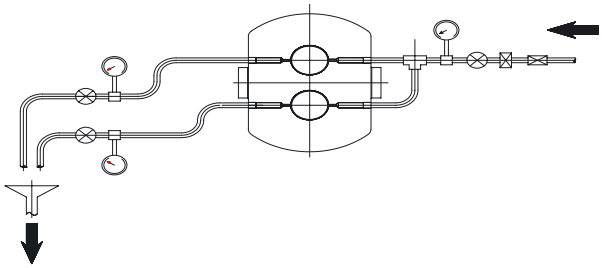
- Control valve and pressure gauge, to enable the correct flushing pressure to be obtained and monitored.
- Isolation valve and check valve, so that the flush can be turned off, and to stop any unwanted substances flowing in the wrong direction.
- A method of visibly indicating flushing fluid flow.

Step 3

Flusing pipework

This suggested arrangement is for single mechanical seals. If the pump is fitted with double mechanical seals or packed glands the pressure gauges and control valves should be fitted on the outlet side of the system.





Step 4

Flushing fluid

The choice of flushing fluid is dependent upon the fluid being pumped and duty conditions i.e. pressure and temperature. Usually water is used for cooling or flushing water soluble products. For advice on selecting a suitable flushing fluid please contact pump supplier.

Step 5

Flusing pressure and flow rate

Single mechanical seal 0.5 bar *(7 psi)* maximum. Any further increase in pressure will result in lip seal failure.
Double mechanical seal/flushed packed gland 1.0 bar *(14 psi)* higher pressure than the discharge of the pump. If the discharge pressure fluctuates set the pressure to suit maximum condition.

The flushing flow rate must be adequate to ensure that the temperature limitation of the seals is not exceeded. Contact your pump supplier for further information on the recommended flow.

Step 6

Pre-start up checks

- Check the pipework system has been purged to remove debris.
- Check all obstructions have been removed from pipework and pump.
- Check pump connections and pipework joints are tight.
- Check lubrication levels are correct.
- Check seal flushing is connected if applicable.
- Check all safety guards are in place.

The pump can be manually cleaned or cleaned in place (CIP). The following is an example of a typical CIP procedure. However specific advice for each application should be sought from the pump supplier.

Typical CIP procedure

1. Flush through the system with cold water or bore water (6°) *(43°F)*.
2. Run hot caustic soda (70-80°C) *(158-176°F)* at 2.5% dilution through the system for 20-30 minutes.
3. Final flush through with cold water again.

Warnings

- **Never** touch the pump or the pipelines as they will be extremely **hot** !
- **Do not** subject the pump to rapid temperature changes during CIP procedures, as pump seizure can result from thermal shock. A suitable by-pass is recommended.
- **Always** rinse well with clean water after using a cleaning agent.

- **Always** use rubber gloves and protective goggles when handling caustic agents.
- **Always** store/discharge cleaning agents in accordance with current rules/directives.

It is advisable to install pressure gauges on both sides of the pump so that any problems within the pump/pipework can be monitored.

Maintenance schedule

Your weekly schedule should include :

- Checking the oil level in the gearcase with the pump stationary.
- Checking the seals for leakage and replacing as necessary.
- Checking the oil seals for leakage.
- 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.

Oil should be changed every 3000 hours of operation or a period of 2 years, whichever is the soonest.

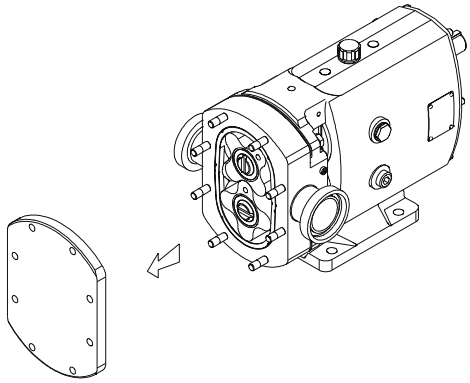
Recommended Spare Parts

The table shows recommended spare parts that should be retained within your maintenance schedule.

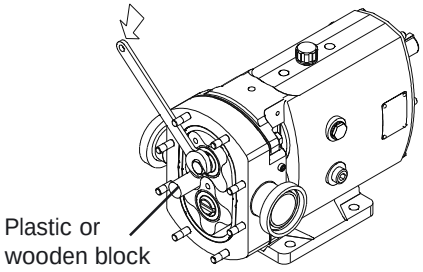
Part description	Quantity
Lip seal drive end	1
Compression joint rotorcase cover	1
Lip seal gland end	2
Cup seal, rotor retainers	2
Primary seals	2

Step 1
Before disassembling the pump refer to safety precautions. See exploded view drawings (chapter 6).

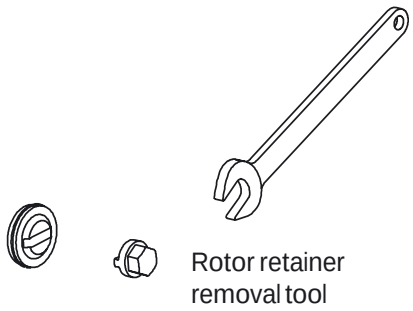
Removing rotorcase cover.
Remove rotorcase cover nuts (13) and cover (12).



Step 2
Removing rotors
Insert a plastic/wooden block between the two rotors (17) to stop them turning.



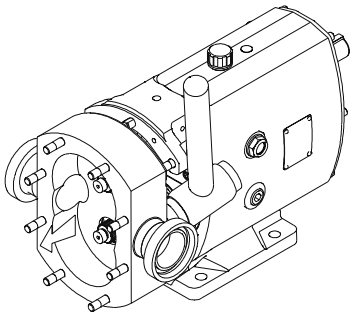
Step 3
Remove rotor retainer (22) and rotors. A rotor retainer removal tool (supplied with all new pumps) is used for this purpose by sliding the tool into the rotor retainer slot and turning in an anti-clockwise direction.



Step 4
Removing static seal components
Please see section 4.5 for seal removal.

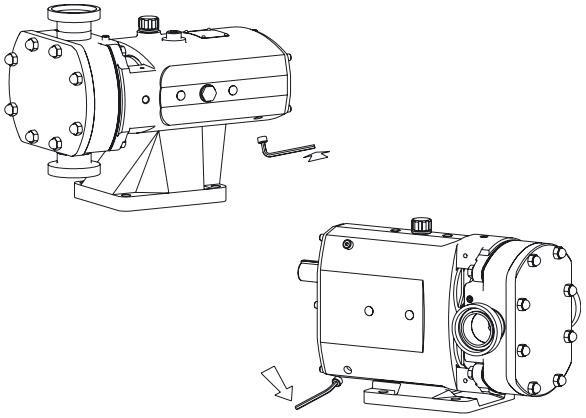
Step 5
Removing rotorcase

1. For flushed mechanical seal arrangements, remove the seal housing retaining nuts and ease the seal housing from the rotorcase.
2. Remove the rotorcase retaining nuts (4) and washers (4A).
3. Tap both sides of the rotorcase (9) with a soft mallet.
4. The rotorcase must not be allowed to drop onto the shafts (24 and 25) during the removal process.
5. Shims (8) should not be removed unless rotor clearances require resetting.



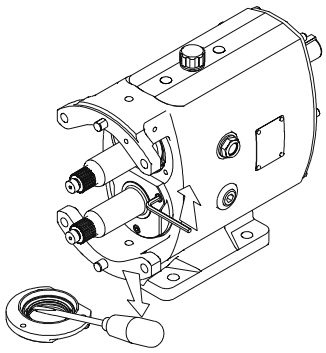
Step 6
Draining pump lubrication

1. Place a tray under the gearcase to collect the waste lubricating oil.
2. Remove the lower drain plug (45) at the side of the gearcase (1).



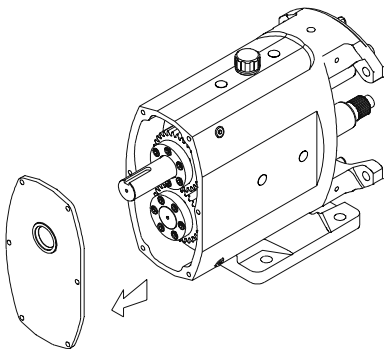
Step 7
Removing seal retainers

1. Remove screws (15).
2. Then remove seal retainers (14) - as a liquid sealant has been used a lever may be required to remove retainers.
3. The lip seals (16) can be removed using a screwdriver/ lever once the seal retainers are removed. It is essential to renew the lip seals and it is recommended that new gaskets or sealant be used prior to reassembly.



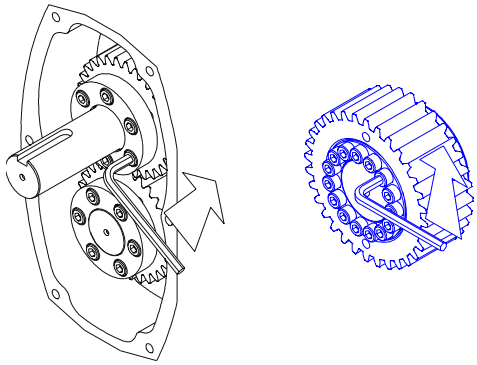
Step 8
Removing Gearcase Cover

1. Remove screws (6).
2. Remove gearcase cover (5) after breaking the gasket seal then press out the lip seal (7). It is essential to renew the lip seal prior to reassembly.



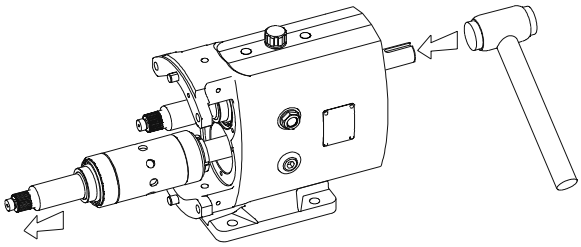
Step 9
Removing timing gears

1. Release clamp plate screws (40) on pump models SSP-X1, 2 and 3. Release the torque locking assembly screws in several stages on pump models SSP-X4, 5, 6 and 7.
2. Remove gears (36) using the tapped extraction holes provided, or remove shaft assembly as shown in step 10 below.



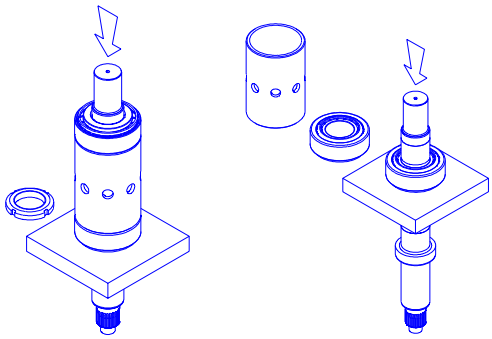
Step 10
Shaft assembly removal

1. Using a soft mallet gently tap the rear end of each shaft (24 and 25), to remove through the front of the gearcase (1).
2. Support each shaft during removal from the gearcase.
3. Remove the shaft abutment spacer (27) from:
   - On models SSP-X1, 2, 3 and 4, the bearing bore opposite the rotorcase mounting face with the additional machining mark.
   - On models SSP-X5, 6 and 7 pumps, the right hand bearing bore when viewed from the front of the pump.



Step 11
Bearing removal

1. Hold the shafts (24 and 25) in a vice using soft jaws to protect the areas where the seals will be located.
2. Remove the bearing nuts (30) with a ‘sharp tap’ on a ‘C’ spanner. The nuts may be tight all the way off as they are fitted with thread locking adhesive.
3. Mount the shaft vertically in a press with a tool positively located against the bearing inner as shown and apply pressure to the top of the shaft so that the shaft moves through the bearings (26 and 31).
4. Remove each bearing set (inner and outer). Good engineering practice suggests that if bearings are removed from the shafts they should be renewed.
   Clean and examine all components for wear or damage. Renew where necessary.



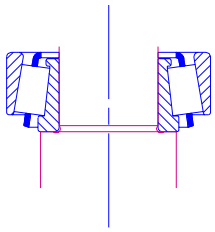
4.4.1 Fitting bearings to shafts

Take care not to damage shaft surfaces, in particular where the seals will be located.
Ensure all fasteings are tightened to torque settings as shown in Technical Data (chapter 5).

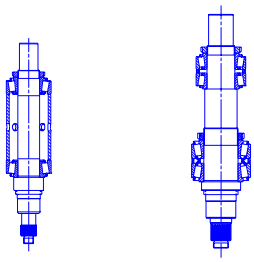
On models SSP-X1, 2 and 3 pumps, bearings do not require heating. For models SSP-X4, 5, 6 and 7 pumps, heat the bearing inner cones to 110°C *(230°F)*.
Do not use any form of live flame when heating, as this will damage bearings.

Step 1
Position shaft (24 and 25) vertically in a vice using soft jaws and apply anti-seize compound to the bearing diameters.

Step 2
Place the inner cone on the shaft ensuring a positive fit against the shaft shoulder.



Step 3
Locate outer cup, bearing spacer (32) and rear bearing cup.



Step 4
Allow bearings to cool (models SSP-X4, 5, 6 and 7 pumps only). Failure to do so will result in incorrectly set bearings.

1. Apply Permabond Grade 145 or equivalent locking compound to the bearing nut thread.
2. Tighten the bearing nut (30), whilst at the same time rotating the bearings (26 and 31) and spacer (32). The bearings are correctly adjusted when the spacer can only be moved with a light tap of a mallet.
3. Repeat the above for double bearing assemblies.
4. Apply oil to the bearings.

4.4.2 Fitting Shaft Assemblies

Step 1

Replace the shaft abutment spacer (27) in :

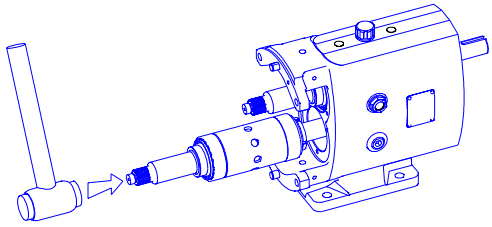
- On models SSP-X1, 2, 3 and 4 pumps, the bearing bore opposite the rotorcase mounting face with the additional machining mark.
- On models SSP-X5, 6 and 7 pumps, the right hand bearing bore when viewed from the front of the pump.

Step 2

Identify drive and auxillary shaft positions according to gearcase cover (5) orientation.

Step 3

1. Using a soft faced mallet tap the shafts (24 and 25) into the gearcase (1).
2. If the bearings have been replaced, a new abutment spacer will probably be needed. It is vital to ensure the rotor alignments is within the limits set in section 4.4.4.



4.4.3 Fitting seal retainers

Step 1

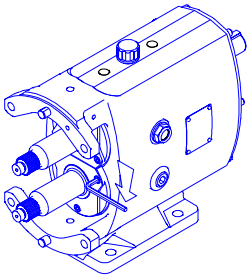
1. Clean the rear face of the seal retainers (14), fit in position and tighten.

Step 2

1. Check rotor alignment is correct by reffering to the rotor abutment alignment in section 4.4.4.
2. When rotor alignment is correct remove seal retainers and press new lip seals (16) into seal retainers.
3. Apply liquid sealant onto the front of the gearcase (1) and push the seal retainers into position. Make sure lip seals are not damaged when sliding them onto the shafts.

Step 3

Replace and tighten the screws (15).



4.4.4 Checking rotor abutment alignment

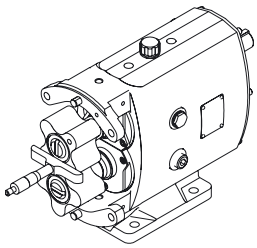
Step 1

Incorrect setting of rotor alignment will damage the pump.

Fit rotors onto shafts (24 and 25) and tighten rotor retainers (22).

Step 2

1. Using a depth micrometer ensure axial alignment is within tolerance of 0.012mm *(0.0005 in)*.
2. If the alignment is incorrect, the shaft abutment spacer (27) must be replaced/machined.



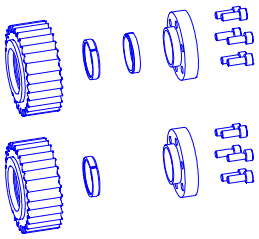
4.4.5 Fitting timing gears

Step 1

Slide timing gears (36) onto shafts (24 and 25), realigning timing marks.

Step 2

1. Before fitting the torque locking devices (38) lubricate them with gear oil. Models SSP-X1, 2 and 3 have two sets of elements.
2. Models SSP-X4, 5, 6 and 7 pumps have torque locking assemblies.



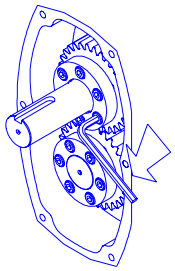
Step 3

Fit timing gear clamp plates (39) - models SSP-X1, 2 and 3 only.

Step 4

Timing adjustment is now required:

Tighten one clamp plate/torque locking assembly only, allowing rotation of the shaft in the other gear for timing adjustment. See Adjusting Rotor Timing section 4.4.6.



4.4.6 Adjusting rotor timing

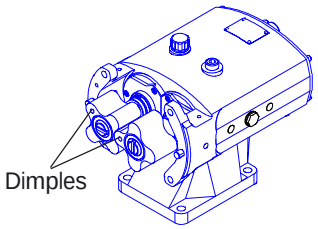
Step 1

If the rotor timing requires adjustment (and assuming the pump has not yet been re-built), it is important to establish the cause for the rotors mistiming before proceeding.

To allow timing adjustment ensure that one shaft is able to rotate within the torque locking assembly/element. The other torque locking assembly/element should be tightened to the recommended torque.

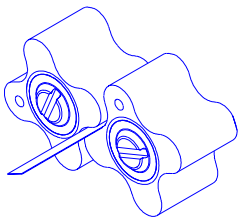
Step 2

Locate one rotor (17) on to the drive shaft (24) with the dimple at the top. Turn the rotor through 45°. Fit the second rotor on to the auxillary shaft (25) with its dimple at the top as shown.



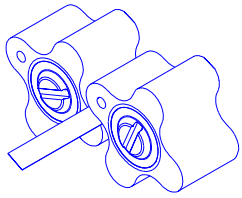
Step 3

Turn the shaft so that the rotors are in the new positions as shown.



Step 4

Using feeler gauges measure between the points indicated, turning the shaft as required.



Step 5

If the measurement points are unequal tap the rotor which is on the free turning shaft until equal measurement through 8 points is achieved.

Step 6

Tighten the torque locking assemblies or clamp plate screws. Confirm timing is still correct. Remove the rotors.

4.4.7 Fitting gearcase cover

Step 1

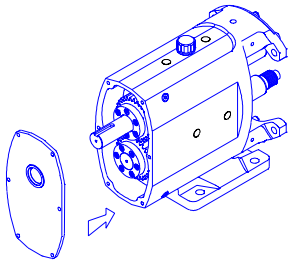
Clean the gearcase cover bore and remove all gasket material from the face. Press a new lip seal (7) into the cover (5).

Step 2

Apply liquid gasket to the face of the cover where it mates with the gearcase.

Step 3

Carefully slide the cover over the shaft ensuring the lip seal is centred and not cut or damaged. Tighten the screws (6).



4.4.8 Fitting and shimming rotorcase

The rotorcase may require re-shimming if new components have been fitted. Back clearances must be checked before operating the pump.

NOTE !

Your supplier can advise the correct clearances from the pump serial number. Should they need adjustment follow steps below. Any incorrect setting of clearances is likely to damage the pump in operation. Shims vary in colour for different thickness, and are grouped in equal packs at the top and bottom of the rotorcase held in place by shim retainers.

Step 1

1. Remove the shim retainers (8A) and fit one of the thinnest shims (8) to top and bottom position.
2. Replace shim retainers and screws (8B).
3. Fit the rotorcase (9) to the gearcase (1), tighten the rotorcase retaining nuts (4) and fit the rotors (17).

Step 2

The back clearances can now be measured using feeler gauges. The additional shimming required to bring the clearances within tolerance can be determined, fit additional shims and re-check the clearances.

4.4.9 Fitting primary seals

Step 1

Refer to section 4.5 for seal fitting instructions.

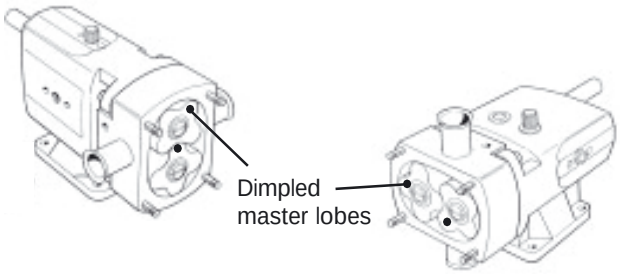
4.4.10 Fitting rotors

Step 1

If fitted, carefully slide the O rings (18) over the shaft spline until they fit tightly against the shaft shoulder.

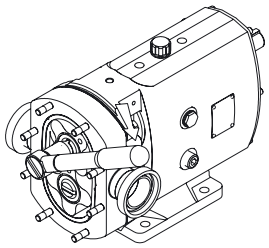
Step 2

Locate one rotor (17) on to the drive shaft (24) with the dimple at the top. Turn the rotor through 45°. Fit the second rotor on to the auxillary shaft (25) with its dimple at the dop as shown.



Step 3

Fit new rotor retainer cup seals (20) to rotor retainers (22). Use a wooden/plastic block between the rotors to stop them turning whilst tightening the rotor retainers to the recommended torque settings shown in Technical Data (chapter 5).

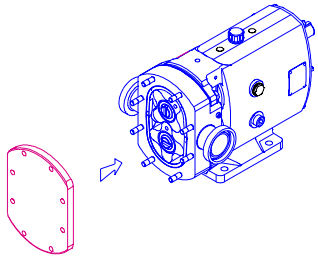


Step 4

To check rotors are correctly synchronised turn the drive shaft (24) by hand and check meshing clearances with feeler gauges to ensure that equal measurement through all eight points has beed attained.

4.4.11 Fitting rotorcase cover

1. Fit new rotorcase cover compression joint (11).
2. Fit rotorcase cover onto rotorcase (9) and tighten rotorcase cover nuts (13).
3. Refer to pump start up checks prior to operation.

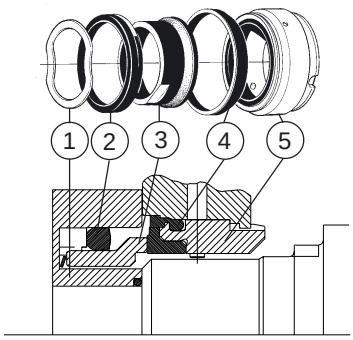


4.5.1 R00 Single mechanical seal

Mechanical seals are fragile. Take extreme care when handling. Clean components before fitting, checking there is no damage to sealing faces. New elastomeric parts should be fitted during assembly.

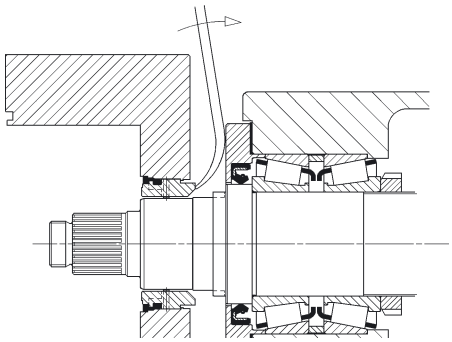
The R00 mechanical seal is completely front loading without need of removing rotorcase for access or replacement. The seal setting distance is pre-set.

Item	Description
1	Wave spring
2	Squad ring
3	Rotary seal ring
4	Cup seal
5	Stationary seal ring



Seal removal

1. Extract the rotary seal ring (3), wave spring (1) and squad ring (2) from the rear of the rotor.
2. Gently ease the staitonary seal ring (5) from the rotorcase using a suitable lever on the rear of the seal.



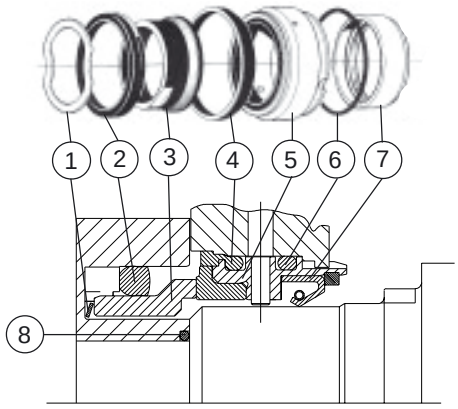
Seal fitting

1. Lightly lubricate cup seal (4) and fit to stationary seal ring (5).
2. Carefully aligning the slots in the stationary seal ring with the anti rotation dogs in the rotorcase, gently press the stationary seal ring assembly into the rotorcase bore until the stop is reached.
3. Fit wave spring (1) into the rear bore of the rotor.
4. Lightly lubricate squad ring (2) and fit to rotary seal ring (3).
5. Align the two flats on the rotary seal ring with the drive flats in the rotor and gently push the rotary sela ring assembly into the rear bore of the rotor.
6. Wipe clean the sealing faces with solvent and replace rotors as in section 4.4.10.

4.5.2 R00 Single flushed/quench mechanical seal

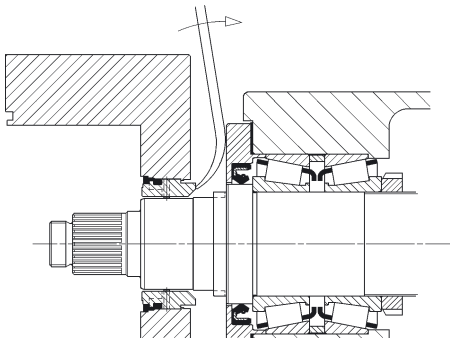
The R00 mechanical seal is completely front loading without need of removing rotorcase for access or replacement. The seal setting distance is pre-set.

Item	Description
1	Wave spring
2	Squad ring
3	Rotary seal ring
4	Cup seal
5	Stationary seal ring
6	Stationary seal ring o-ring
7	Lip seal
8	Spline sealing o-ring



Seal removal

1. Isolate the flush.
2. Extract the rotary seal ring (3), wave spring (1) and squad ring (2) from the rear of the rotor.
3. Gently ease the stationary seal ring (5) from the rotorcase using a suitable lever on the rear of the seal.



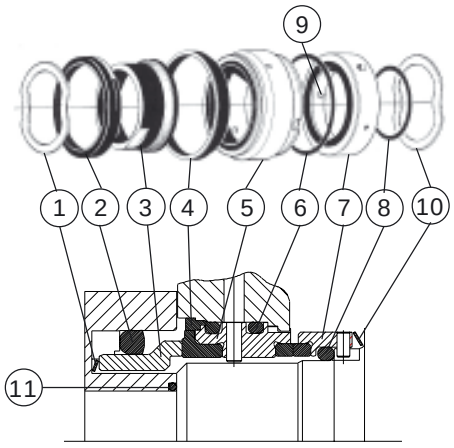
Seal fitting

1. Lightly lubricate cup seal (4) and stationary seal ring o-ring (6).
2. Fit cup seal and o-ring to stationary seal rings (5).
3. Fit lip seal (7) into stationary seal assembly.
4. Carefully aligning the slots of the stationary seal ring with the anti rotation dogs in the rotorcase, gently press the stationary seal ring assembly into the rotorcase bore until the stop is reached.
5. Fit wave spring (1) into the rear bore of the rotor.
6. Lightly lubricate squad ring (2) and fit to rotary seal ring (3).
7. Replace the spline sealing o-ring (8).
8. Align the two flats on the rotary seal ring with the drive flts in the rotor and gently push the rotary seal ring assembly into the rear bore of the rotor.
9. Wipe clean the sealing faces with solvent and replace rotors as 4.4.10.

4.5.3 R00 Double flushed mechanical seal

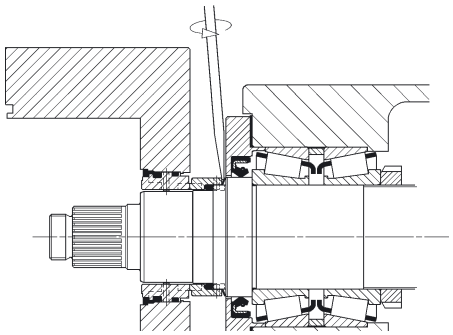
The R00 mechanical seal is completely front loading without need of removing rotorcase for access or replacement. The seal setting distance is pre-set.

Item	Description
1	Wave spring
2	Squad ring
3	Rotary seal ring (inboard)
4	Cup seal
5	Stationary seal ring
6	Stationary seal ring o-ring
7	Stationary seal ring o-ring (outboard)
8	Rotary seal ring o-ring
9	Drive pin
10	Wave spring
11	Spline sealing o-ring



Seal removal

1. Isolate the flush.
2. Extract the rotary seal ring (3), wave spring (1) and squad ring (2) from the rear of the rotor.
3. Gently ease the stationary seal ring (5) from the rotorcase using a suitable lever at the rear of the seal.



Seal fitting

1. Lightly lubricate cup seal (4) and stationary seal ring o-ring (6).
2. Fit cup seal and o-ring to stationary seal rin g (5) and then lubricate and fit rotary seal ring o-ring (8) into outboard rotary seal ring (7).
3. Slide wave spring (10) along shaft through the rotorcase bore until located on shaft shoulder. Wipe clean the sealing faces with solvent.
4. Fit outboard rotary seal assembly, ensuring the drive pins (9) engage with slots in the shaft.
5. Carefully aligning the slots of the stationary seal ring with the anti rotation dogs in the rotorcase, gently press the stationary seal ring assembly into the rotorcase bore until the stop is reached.
6. Fit wave spring (1) into the rear bore of the rotor and replace the spline sealing o-ring (11).
7. Lightly lubricate squad ring (2) and fit to rotary seal ring (3).

NOTE !

If the flushing pressure is in excess of 5 bar above the discharge pressure an o-ring is specified in place of the squad ring.

8. Align the two flats on the rotary sela ring with the drive flats in the rotor and gently push the rotary seal ring assembly into the rear bore of the rotor. Wipe clean the sealing faces with solvent and replace rotors as in section 4.4.10.

Problem															Probable Causes	Solutions
No flow	Under capacity	Irregular discharge	Low discharge pressure	Pump will not prime	Prime lost after starting	Pump stalls when starting	Pump overheats	Motor overheats	Excessive power absorbed	Noise and vibration	Pump element wear	Syphoning	Seizure	Mechanical seal leakage		
✓				✓											Incorrect direction of rotation.	Reverse motor.
✓															Pump not primed.	Expel gas from suction line and pumping chamber and introduce fluid.
✓	✓	✓	✓		✓					✓					Insufficient NPSH available.	Increase suction line diameter. Increase suction head. Simplify suction line configuration and reduce length. Reduce pump speed.
	✓	✓	✓		✓					✓					Fluid vaporising in suction line.	Increase suction line diameter. Increase suction head. Simplify suction line configuration and reduce length. Reduce pump speed.
✓	✓	✓		✓	✓					✓					Air entering suction line.	Remake pipework joints.
	✓	✓		✓	✓					✓					Strainer or filter blocked.	Service fittings.
	✓				✓	✓	✓	✓	✓	✓					Fluid viscosity above rated figure.	Increase fluid temperature. Decrease pump speed. Check seal face viscosity limitations.
✓	✓		✓												Fluid viscosity below rated figure.	Decrease fluid temperature. Increase pump speed.
							✓			✓	✓		✓	✓	Fluid temp. above rated figure.	Cool the pump casing. Reduce fluid temperature. Check seal face and elastomer temp. limitations.
						✓		✓	✓						Fluid temp. below rated figure.	Heat the pump casing. Increase fluid temperature.
										✓	✓		✓	✓	Unexpected solids in fluid.	Clean the system. Fit strainer to suction line. If solids cannot be eliminated, consider fitting double mechanical seals.
✓	✓	✓			✓	✓	✓	✓	✓	✓	✓		✓	✓	Discharge pressure above rated figure	Check for obstructions i.e. closed valve. Service system and change to prevent problem recurring. Simplify discharge line to decrease pressure.
														✓	Seal flushing inadequate.	Increase flush flow rate. Check that flush fluid flows freely into seal area.
	✓							✓	✓	✓					Pump speed above rated figure.	Decrease pump speed.
✓	✓														Pump speed below rated figure.	Increase pump speed.
	✓						✓	✓	✓	✓	✓		✓		Pump casing strained by pipework.	Check alignment of pipes. Fit flexible pipes or expansion fittings. Support pipework.
							✓			✓	✓		✓		Flexible coupling misaligned.	Check alignment and adjust mountings accordingly.
							✓	✓	✓	✓	✓		✓		Insecure pump driver mountings.	Fit lock washers to slack fasteners and re-tighten.
							✓	✓	✓	✓	✓		✓	✓	Shaft bearing wear or failure.	Refer to pump maker for advice and replacement parts.
							✓	✓	✓	✓	✓		✓		Insufficient gearcase lubrication.	Refer to pump maker's instructions.
✓	✓						✓	✓	✓	✓	✓		✓		Metal to metal contact of pumping element.	Check rated and duty pressures. Refer to pump maker.
✓	✓		✓												Worn pumping element.	Fit new components.
✓				✓											Suction lift too high.	Lower pump or raise liquid level.
														✓	Fluid pumped not compatible with materials used	Use optional materials.
												✓			No barrier in system to prevent flow passing.	Ensure discharge pipework higher than suction tank.
														✓	Pump allowed to run dry.	Ensure system operation prevents this. Fit single or double flushed mechanical seals.
									✓	✓					Faulty motor.	Check and replace motor bearings.
✓															Pumping element missing	Fit pumping element.

5.1.1 Oil capacities

Pump model	Port orientation		*Port orientation*	
	Vertical litres	Horizontal litres	*Vertical US pints*	*Horizontal US pints*
SSP-X1	0.30	0.40	*0.60*	*0.80*
SSP-X2	0.60	0.70	*1.20*	*1.40*
SSP-X3	1.10	1.50	*2.20*	*3.10*
SSP-X4	1.50	2.00	*3.20*	*4.20*
SSP-X5	5.00	-	*10.60*	-
SSP-X6	8.50	-	*18.00*	-
SSP-X7	12.50	-	*26.40*	-

5.1.2 Weights

Pump model	Bare Shaft Pump kg *(lb)* Port Orientation		Pump with drive unit kg *(lb)* Port Orientation	
	Horizontal	Vertical	Horizontal	Vertical
SSP-X1-0005	15 *(33)*	16 *(35)*	46 *(101)*	49 *(108)*
SSP-X1-0007	16 *(35)*	17 *(37)*	55 *(121)*	58 *(128)*
SSP-X2-0013	32 *(71)*	33 *(73)*	80 *(176)*	81 *(179)*
SSP-X2-0018	33 *(73)*	34 *(75)*	85 *(187)*	86 *(190)*
SSP-X3-0027	57 *(126)*	59 *(130)*	147 *(324)*	150 *(331)*
SSP-X3-0035	59 *(130)*	61 *(134)*	152 *(335)*	155 *(342)*
SSP-X4-0046	107 *(236)*	110 *(243)*	271 *(597)*	274 *(604)*
SSP-X4-0063	113 *(249)*	116 *(256)*	277 *(611)*	280 *(617)*
SSP-X5-0082	-	155 *(342)*	-	295 *(650)*
SSP-X5-0115	-	165 *(364)*	-	310 *(683)*
SSP-X6-0140	-	278 *(613)*	-	545 *(1202)*
SSP-X6-0190	-	290 *(639)*	-	570 *(1257)*
SSP-X7-0250	-	340 *(750)*	-	660 *(1455)*
SSP-X7-0380	-	362 *(798)*	-	685 *(1510)*

The above weights are for guidance purposes only and will vary dependent upon specification of pump, baseplate and drive unit.

5.1.3 Tool requirements

Description	Tool required	Pump Model						
		SSP-X1	SSP-X2	SSP-X3	SSP-X4	SSP-X5	SSP-X6	SSP-X7
Rotorcase cover nut (13)	Socket Size (mm)	13	17	17	17	17	19	19
	Torque Setting (Nm)	*20*	*40*	*40*	*40*	*40*	*105*	*105*
	Torque Setting (lbft)	*14.8*	*29.5*	*29.5*	*29.5*	*29.5*	*77.4*	*77.4*
Rotor retainer (22)	Socket Size (mm)	19	19	19	24	24	24	24
	Torque Setting (Nm)	*20*	*60*	*80*	*120*	*160*	*160*	*160*
	Torque Setting (lbft)	*14.8*	*44.3*	*59.0*	*88.5*	*118.0*	*118.0*	*118.0*
Rotor TLA (19)	Key Size (mm)	-	-	-	-	-	5	5
	Torque Setting (Nm)	-	-	-	-	-	*14*	*14*
	Torque Setting (lbft)	-	-	-	-	-	*10.3*	*10.3*
Rotorcase retaining nut (4)	Spanner Size (mm)	13	17	17	19	19	24	24
	Torque Setting (Nm)	*20*	*40*	*40*	*64*	*64*	*175*	*175*
	Torque Setting (lbft)	*14.8*	*29.5*	*29.5*	*47.2*	*47.2*	*129.1*	*129.1*
Seal retainer screw (15)	Key Size (mm)	5	5	5	6	6	6	8
	Torque Setting (Nm)	*8*	*8*	*8*	*20*	*20*	*20*	*38*
	Torque Setting (lbft)	*5.9*	*5.9*	*5.9*	*14.8*	*14.8*	*14.8*	*28.0*
Gearcase cover screw (6)	Key Size (mm)	5	5	5	6	6	6	6
	Torque Setting (Nm)	*8*	*8*	*8*	*20*	*20*	*20*	*20*
	Torque Setting (lbft)	*5.9*	*5.9*	*5.9*	*14.8*	*14.8*	*14.8*	*14.8*
TLA/Clamp plate screw (40)	Key Size (mm)	5	5	5	5	6	6	6
	Torque Setting (Nm)	*12*	*17*	*12*	*14*	*35*	*35*	*35*
	Torque Setting (lbft)	*8.9*	*12.5*	*8.9*	*10.3*	*25.8*	*25.8*	*25.8*
Drain plug (45)	Key *Size (in)*	*¼*	*¼*	*¼*	*¼*	*½*	*½*	*½*
Foot bolt (58)	Key Size (mm)	5	6	6	8	-	-	-
	Torque Setting (Nm)	*15*	*30*	*30*	*60*	-	-	-
	Torque Setting (lbft)	*11.1*	*22.1*	*22.1*	*44.3*	-	-	-

5.1.4 Technical specifications

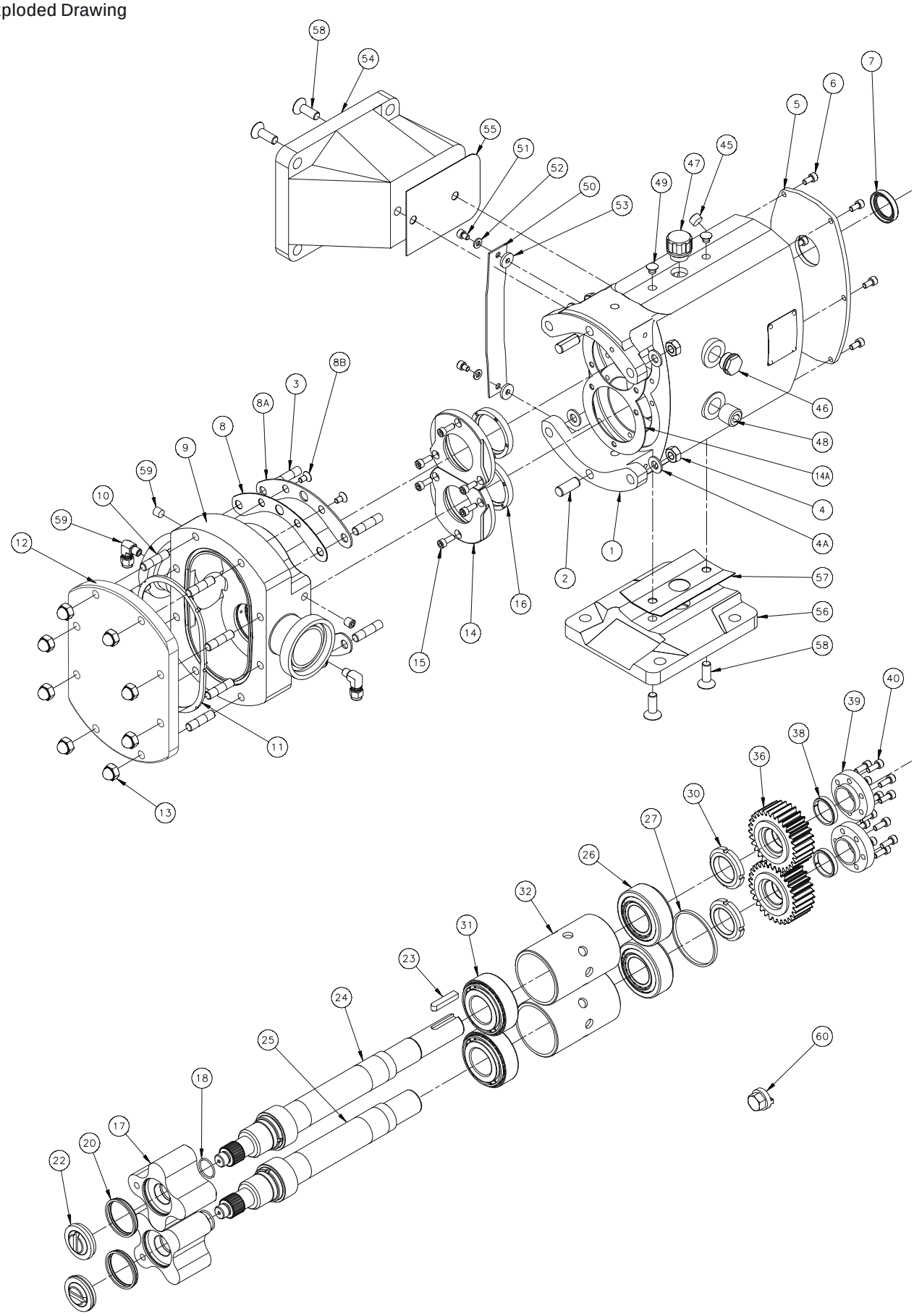
Model	Displacement			Suction & Discharge Connection Size				Differential Pressure		Maximum Speed	Maximum Capacity at Max Speed
	litres/rev	Imp gal/ 100 rev	US gal/ 100 rev	Nominal Bore Diameter (Standard)		Connection Size (International Std)					
				mm	inches	mm	inches	bar	psi	rev/min	m^3/h
SSP-X1/0005	0,050	1,1	1,3	22	0,87	25	1,0	12	174	1400	4
SSP-X1/0007	0,070	1,5	1,8	35	1,38	40	1,5	7	101	1400	6
SSP-X2/0013	0,128	2,8	3,4	35	1,38	40	1,5	15	217	1000	8
SSP-X2/0018	0,181	4,0	4,8	47	1,85	50	2,0	7	101	1000	11
SSP-X3/0027	0,266	5,9	7,0	47	1,85	50	2,0	15	217	1000	16
SSP-X3/0035	0,350	7,7	9,2	62	2,44	65	2,5	7	101	1000	21
SSP-X4/0046	0,460	10,1	12,2	47	1,85	50	2,0	15	217	1000	28
SSP-X4/0063	0,630	13,9	16,6	62	2,44	65	2,5	10	145	1000	38
SSP-X5/0082	0,820	18,0	21,7	62	2,44	65	2,5	15	217	600	30
SSP-X5/0115	1,150	25,3	30,4	73	2,87	80	3,0	10	145	600	41
SSP-X6/0140	1,400	30,8	37,0	73	2,87	80	3,0	15	217	500	42
SSP-X6/0190	1,900	41,8	50,2	96	3,78	100	4,0	10	145	500	57
SSP-X7/0250	2,500	55,0	66,0	96	3,78	100	4,0	15	217	500	75
SSP-X7/0380	3,800	83,6	100,4	140	5,51	150	6,0	10	145	500	114

Parts List

Pos.	Description
1	Gearcase - universal mounting
2	Dowel
3	Stud, rotorcase retention
4	Nut, rotorcase retention
4A	Washer, rotorcase retention
5	Cover, gearcase
6	Screw, gearcase cover
7	Lip seal, drive end
8	Shim
8A	Shim retainer
8B	Shim retainer screws
9	Rotorcase
10	Stud, rotorcase/cover retention (not SSP-X1/005)
11	Compression joint
12	Cover, rotorcase
13	Dome nut, rotorcase cover
14	Retainer, seal
15	Screw, seal retainer
16	Lip seal, gland end
17	Rotors
18	'O' Ring, rotor sealing shaft end (flushed seal only)
20	Cup seal, rotor retainer
22	Rotor retainer
23	Key
24	Shaft, drive
25	Shaft, auxiliary
26	Bearing, rear
27	Spacer, shaft abutment
30	Nut, bearing
31	Bearing, front
32	Spacer, bearing
36	Timing gear
38	Torque locking element
39	Clamp plate
40	Screw, clamp plate
45	Drain plug
46	Sight glass
46A	Washer, sight glass
47	Filler plug
48	Plug
49	Blanking plug
50	Gland guard
51	Screw, gland guard
52	Washer, gland guard (only SSP-X3)
53	Washer, gland guard
54	Foot, vertical port
55	Foot gasket, vertical port
56	Foot, horizontal port
57	Foot gasket, horizontal port
58	Bolt, Foot
59	Plug/elbow for seal flushing (if required)
60	Rotor removal tool

This page shows an exploded drawing of the SSP-X1 - 3. *The drawing includes all items of the pump.*

Exploded Drawing

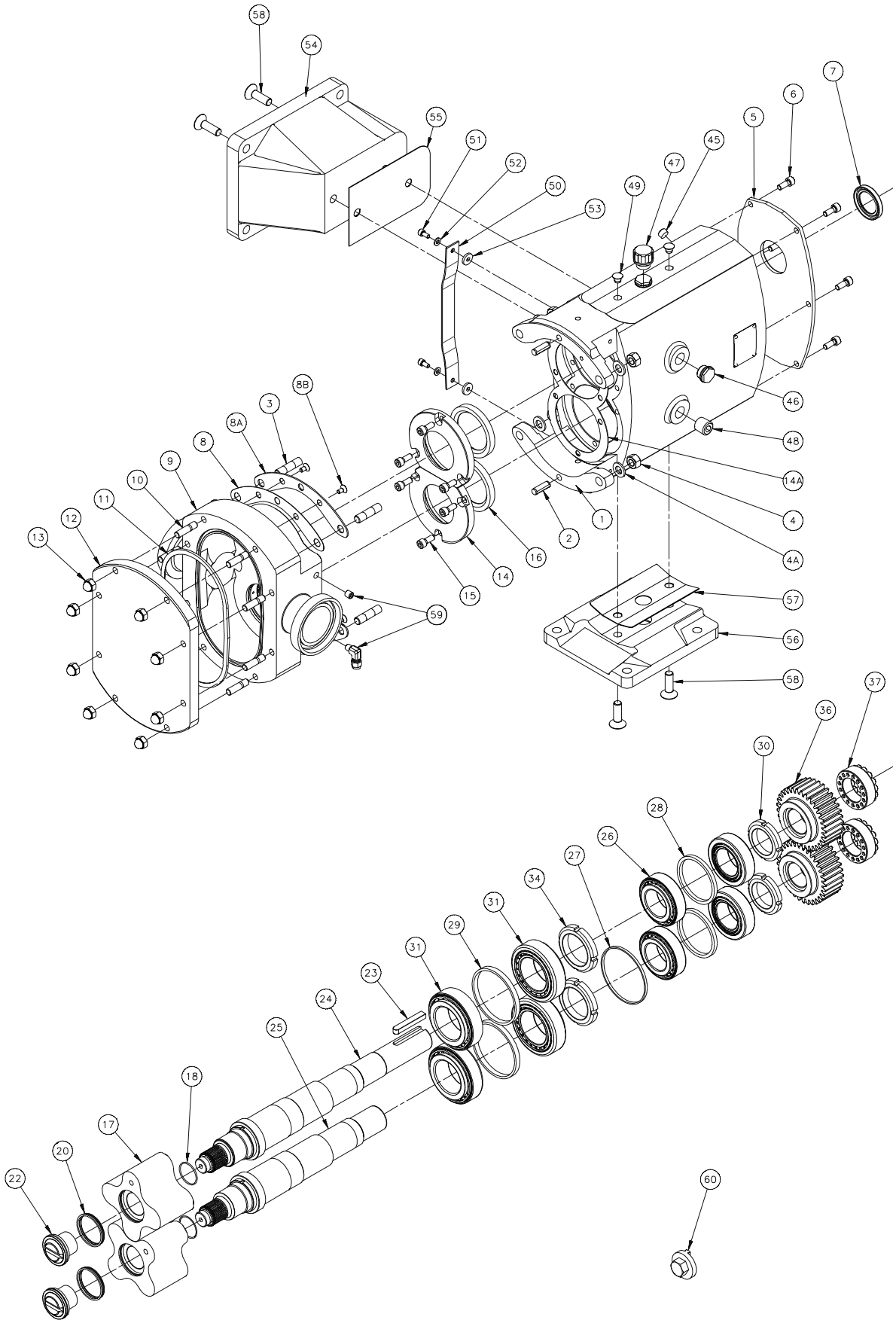


Parts List

Pos.	Description
1	Gearcase - universal mounting
2	Dowel
3	Stud, rotorcase retention
4	Nut, rotorcase retention
4A	Washer, rotorcase retention
5	Cover, gearcase
6	Screw, gearcase cover
7	Lip seal, drive end
8	Shim
8A	Shim retainer
8B	Shim retainer screws
9	Rotorcase
10	Stud, rotorcase/cover retention
11	Compression joint
12	Cover, rotorcase
13	Dome nut, rotorcase cover
14	Retainer, seal
15	Screw, seal retainer
16	Lip seal, gland end
17	Rotors
18	'O' Ring, rotor sealing shaft end (flushed seal only)
20	Cup seal, rotor retainer
22	Rotor retainer
23	Key
24	Shaft, drive
25	Shaft, auxiliary
26	Bearing, rear
27	Spacer, shaft abutment
28	Spacer, bearing drive end
29	Spacer, bearing gland end
30	Nut, bearing
31	Bearing, front
34	Nut, bearing front
36	Timing gear
37	Torque locking assembly
45	Drain plug
46	Sight glass
47	Filler plug
48	Plug
49	Blanking plug
50	Gland guard
51	Screw, gland guard
52	Washer, gland guard
53	Washer, gland guard
54	Foot, vertical port
55	Foot gasket, vertical port
56	Foot, horizontal port
57	Foot gasket, horizontal port
58	Bolt, Foot
59	Plug/elbow for seal flushing (if required)
60	Rotor removal tool

This page shows an exploded drawing of the SSP-X4. *The drawing includes all items of the pump.*

Exploded Drawing

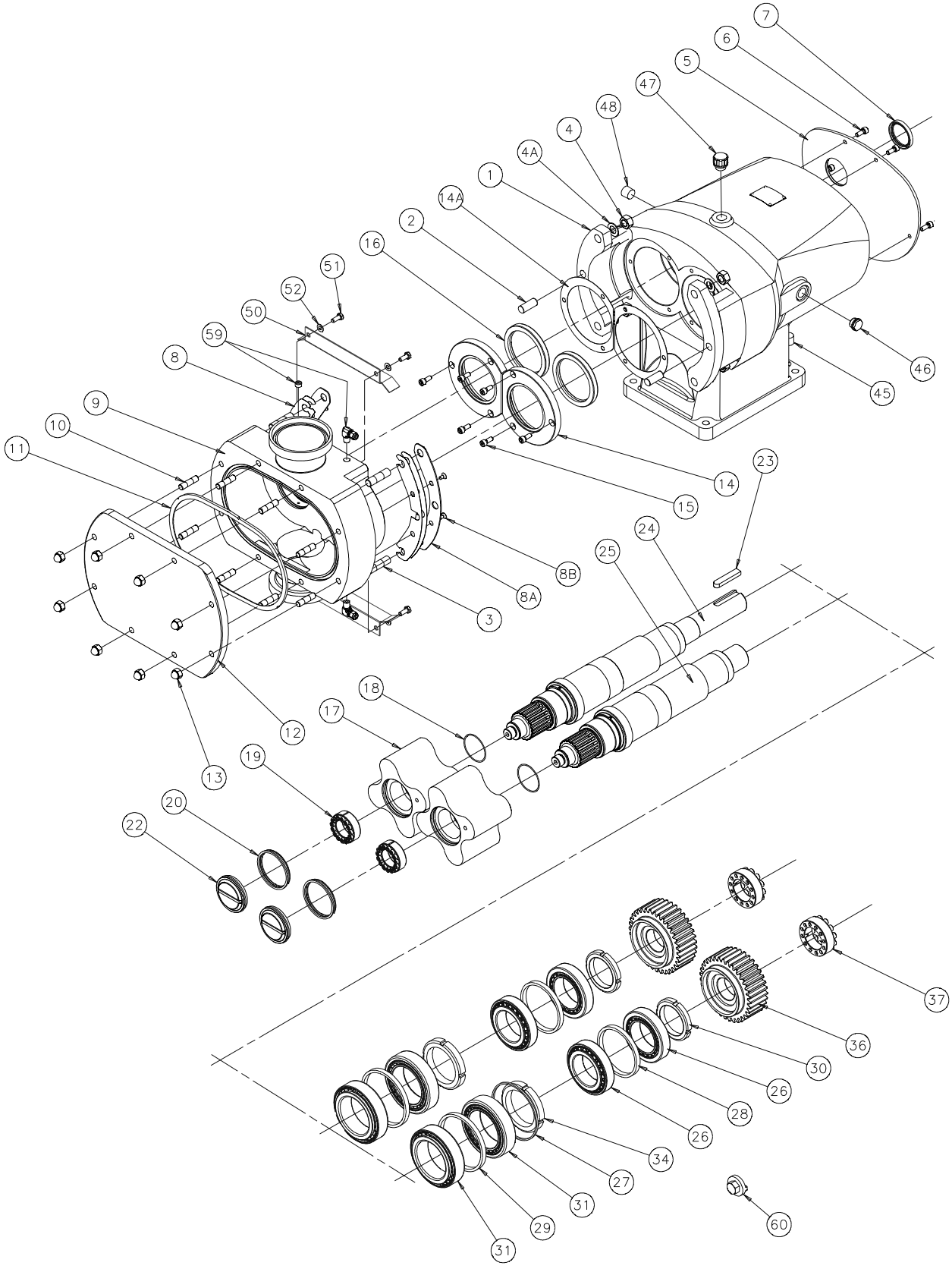


Parts List

Pos.	Description
1	Gearcase
2	Dowel
3	Stud, rotorcase retention
4	Nut, rotorcase retention
4A	Washer, rotorcase retention
5	Cover, gearcase
6	Screw, gearcase cover
7	Lip seal, drive end
8	Shim
8A	Shim retainer
8B	Shim retainer screws
9	Rotorcase
10	Stud, rotorcase/cover retention
11	Compression joint
12	Cover, rotorcase
13	Dome nut, rotorcase cover
14	Retainer, seal
15	Screw, seal retainer
16	Lip seal, gland end
17	Rotors
18	O-ring, rotor sealing shaft end (flushed seal only)
20	Cup seal, rotor retainer
22	Rotor retainer
23	Key
24	Shaft, drive
25	Shaft, auxiliary
26	Bearing, rear
27	Spacer, shaft abutment
28	Spacer, bearing drive end
29	Spacer, bearing gland end
30	Nut, bearing rear
31	Bearing, front
34	Nut, bearing front
36	Timing gear
37	Torque locking assembly
46	Sight glass
47	Filler plug
48	Drain plug
50	Gland guard
51	Screw, gland guard
52	Washer, gland guard
60	Rotor removal tool

This page shows an exploded drawing of the SSP-X5 - 7 - vertically ported.

The drawing includes all items of the pump.



PLEASE READ AND APPLY THE FOLLOWING ADDITIONAL INSTALLATION AND OPERATION INSTRUCTIONS IF THE PUMP IS INSTALLED IN AN ATEX AREA.

ATEX Directive 94/9/EC

The ATEX Directive 94/9/EC covers equipment and protective systems that will be used in areas endangered by potentially explosive atmospheres created by the presence of flammable gases, vapours and dusts. Rotary Lobe Pumps supplied with an ATEX symbol are classified for use in potentially explosive atmospheres under ATEX Directive 94/9/EC Group II, Categories 2 and 3.

Technical File Ref: SSP-Xex – 1/7 Document reference no. 9612-9602-01

Type of Equipment: Rotary Lobe Positive Displacement Pumps

Equipment Group: and Category: Group II category 2 G (zone 1) and D (zone 21)
Group II category 3 G (zone 2) and D (zone 22)
For Temperature class see table below

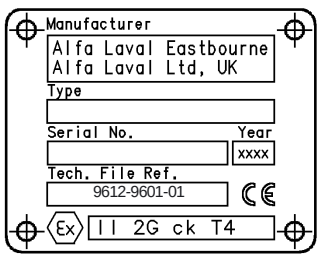
Ignition Protection used: EN13463-1: 2001 c k

Maximum Surface Temperature: The maximum surface temperature of the pump is dependent upon the temperature of the media processed by the pump. The table below relates the process fluid temperature to the maximum surface temperature on the pump and temperature class. It is important that the correct seal temperature class is applied as referred to in the seal suppliers supplement sheet.

Temperature Class	Maximum surface temperature	Maximum temperature of processed fluid
T1	450°C	N/A
T2	300°C	N/A
T3	200°C	150°C
T4	135°C	135°C
T5	100°C	100°C
T6	85°C	80°C

To ensure the pump supplied is compliant with this directive, the additional instructions must be followed:

a) Ensure the baseplate and pump has ground contact (earthing) and is not inclined more than 2 Degrees.
b) ATEX compliant seals must be installed in the pump and used as stated in the manufacturers instructions supplied.
c) An ATEX compliant external pressure relief valve must be used and set to protect the pump from over pressurisation by inadvertent closure of valves or blockages.
d) An ATEX certified motor must be installed and used as stated in the manufacturers instructions supplied.
e) An ATEX certified reduction gearbox must be installed and used as stated in the manufacturers instructions supplied.
f) An ATEX certified coupling must be installed and used as stated in the manufacturers instructions supplied
g) All pump head and seal cavities must be vented to purge air from the system prior to start-up.
h) Dependent upon product/duty and cleaning (CIP) conditions the pump's external surfaces may become hot – the temperature should not be allowed to exceed the stamped temperature class shown on the label



Typical nameplate

PLEASE READ AND APPLY THE FOLLOWING ADDITIONAL INSTALLATION AND OPERATION INSTRUCTIONS IF THE PUMP IS INSTALLED IN AN ATEX ZONE 1 OR ZONE 21 AREAS

ATEX Directive 94/9/EC

The ATEX Directive 94/9/EC covers equipment and protective systems that will be used in areas endangered by potentially explosive atmospheres created by the presence of flammable gases, vapours and dusts. Rotary Lobe Pumps supplied with an ATEX symbol are classified for use in potentially explosive atmospheres under ATEX Directive 94/9/EC Group II, Categories 2.

Technical File Ref: SSP-Xex – 1/7 Document reference no. 9612-9602-01

Type of Equipment: Rotary Lobe Positive Displacement Pumps

Equipment Group: and Category: Group II category 2 G (zone 1) and D (zone 21) For Temperature class see table below

Ignition Protection used: EN13463-1: 2001 c k

Maximum Surface Temperature: The maximum surface temperature of the pump is dependent upon the temperature of the media processed by the pump. The table below relates the process fluid temperature to the maximum surface temperature on the pump and temperature class. It is important that the correct seal temperature class is applied as referred to in the seal suppliers supplement sheet.

Temperature Class	Maximum surface temperature	Maximum temperature of processed fluid
T1	450°C	N/A
T2	300°C	N/A
T3	200°C	150°C
T4	135°C	135°C
T5	100°C	100°C
T6	85°C	80°C

To ensure the pump supplied is compliant with this directive, the additional instructions must be followed :

a) Apply all additional instructions listed in Appendix A.
b) Dependent upon product/duty and cleaning (CIP) conditions the pump's external surfaces may become hot – the temperature should not be allowed to exceed the stamped temperature class shown on the machines label. Daily checks must be made for any signs of overheating and/or paint discolouration.
c) The weekly maintenance checks listed in the Maintenance Schedule should be made on a daily basis, and a daily check on the lubrication for signs of contamination must be added.
d) Pump gearbox bearings must be renewed every 2 years or 9000 hours whichever is first.
e) Replace gearbox lip seals if disturbed i.e. cover removed.
f) A pressure gauge and control valve should be fitted to the seal flush outlet pipe work, and a minimum back pressure of 0.3 bar applied during operation.