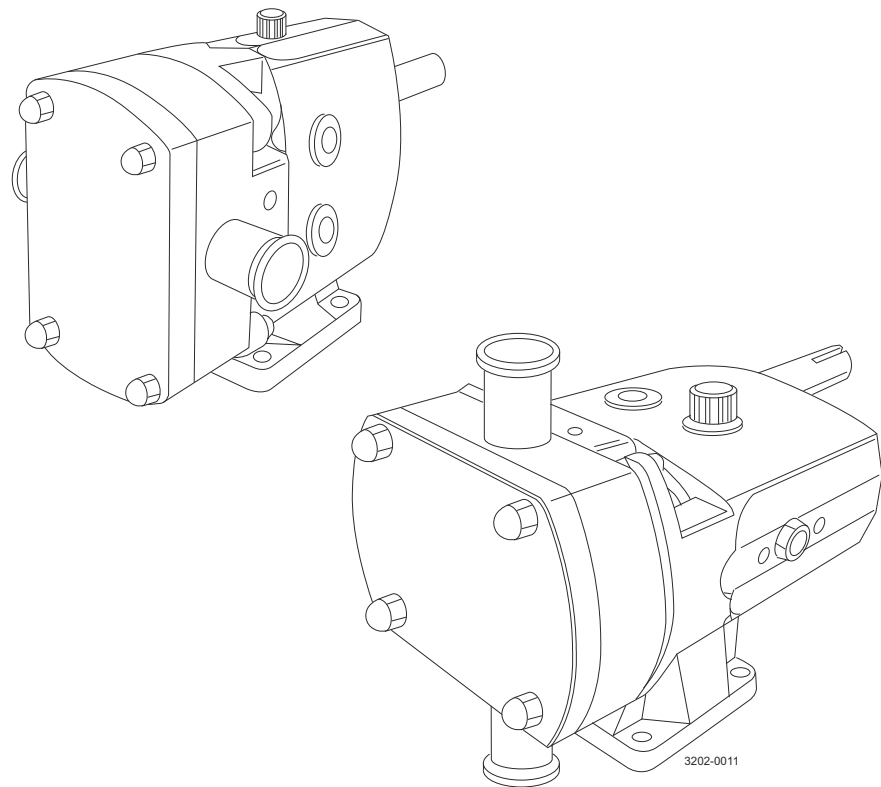


# Alfa Laval SX

Rotary lobe pumps

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Lit. Code

200007900-4-EN-GB

Instruction Manual

**Published by**  
Alfa Laval Kolding A/S  
Albuen 31  
DK-6000 Kolding, Denmark  
+45 79 32 22 00

**The original instructions are in English**

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# 1 Declarations of Conformity

## 1.1 EU Declaration of Conformity

The designated company

Alfa Laval Kolding A/S, Albuen 31, DK-6000 Kolding, Denmark, +45 79 32 22 00

Company name, address and phone number

Hereby declare that

Pump

Designation

SX1, SX2, SX3, SX4, SX5, SX6, SX7

Type

Serial number from E10.000 to E1.000.000

Serial number from AAX000000001 to AAX999999999

is in conformity with the following directives with amendments:

- Machinery Directive 2006/42/EC
- RoHS Directive 2011/65/EU and amendments

The person authorised to compile the technical file is the signer of this document.

Vice President BU Hygienic Fluid Handling

Head of Product Management

Title

Mikkel Nordkvist

Name

Kolding, Denmark

Place

2024-06-01

Date (YYYY-MM-DD)



Signature

DoC Revison\_ 01\_062024 / This Declaration of Conformity replaces Declaration of Conformity dated 2022-10-01



## 1.2 UK Declaration of Conformity

The designated company

Alfa Laval Kolding A/S, Albuen 31, DK-6000 Kolding, Denmark, +45 79 32 22 00

Company name, address and phone number

Hereby declare that

Pump

Designation

SX1, SX2, SX3, SX4, SX5, SX6, SX7

Type

Serial number from E10.000 to E1.000.000

Serial number from AAX000000001 to AAX999999999

is in conformity with the following directives with amendments:

- The Supply of Machinery (Safety) Regulations 2008
- The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

Signed on behalf of: Alfa Laval Kolding A/S.

Vice President BU Hygienic Fluid Handling

Head of Product Management

Title

Mikkel Nordkvist

Name

Kolding, Denmark

Place

2024-06-01

Date (YYYY-MM-DD)



Signature

DoC Revison\_ 02\_062024



## 2 Safety

### Read this first



This Instruction Manual is designed for operators and service engineers working with the supplied Alfa Laval product.

Operators must read and understand the **Safety, Installation and Operating** instructions of the supplied Alfa Laval product before carrying out any work or before you put the supplied Alfa Laval product into service!

Not following the instructions can result in serious accidents.

This documentation describes the authorized way to use the supplied Alfa Laval product. Alfa Laval will take no responsibility for injury or damage if the equipment is used in any other way.

This Instruction Manual is designed to provide the user with the information to perform tasks safely for all phases in the lifetime of the supplied Alfa Laval product.

The operator shall always read the chapter **Safety** first. Hereafter the operator can skip to the relevant section for the task to be carried out or for the information needed.

**Always** read the chapter **Technical Data** thoroughly.

This is the complete Instruction Manual for the supplied Alfa Laval product.

#### NOTE

The illustrations and specifications in this Instruction Manual were effective at the date of printing. However, as continuous improvements are our policy, we reserve the right to alter or modify the Instruction Manual without prior notice or any obligation.






The English version of the Instruction Manual is the original manual. Alfa Laval cannot be held responsible for incorrect translations. In case of doubt, the English version applies.





## 2.1 Safety Signs

### Mandatory Action Signs

	General mandatory action sign.
	Refer to instruction manual.
	Use eye protection - safety glasses.
	Use protective hand wear - safety gloves.
	Wear protective equipment - safety helmet.
	Use ear protection in noisy environments - noise protector.
	Wear protective equipment - safety shoes.

### Warning Signs


	General warning.
	Corrosive substance.
	Hot surface and burning danger.
	Cutting danger.
	Heavy object lifting.

	Transportation with forklift truck or other industrial vehicles if heavy.
	Electricity.
	Sharp element.
	Crushing of hands.






## 2.2 Safety precautions

All warnings in the manual are summarised on this page. Pay special attention to the instructions below so that severe personal injury and/or damage to the Supplied Alfa Laval Product is avoided.





### General

	<p>To prevent unexpected start and contact with electrical live and moving parts.</p> <p><b>Always</b> disconnect the power supply safely:</p> <ul style="list-style-type: none"> <li>• The power supply disconnecting device must be disconnected (in off position) and locked.</li> <li>• In case the pump is capable of being plugged into an electrical supply, removal of the plug is sufficient, provided that the operator can check from any of the points to which he has access that the plug remains removed.</li> </ul> <p><b>Always</b> refer to the motor Instruction Manual for installation and maintenance of the motor.</p> <p><b>Never</b> touch the rotors through the inlet/outlet during start/stop as this can cause serious injury.</p>
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### Transportation and Lifting

    	<p><b>General:</b></p> <p><b>Never</b> lift or elevate in any way other than described in this manual.</p> <p><b>Always</b> use the original packaging or similar during transportation.</p> <p><b>Always</b> use suitable transport device ie. forklift or pallet lifter.</p> <p><b>Always</b> ensure that personnel must have experience with lifting operations.</p> <p><b>Always</b> ensure that no leakage of lubricants can occur.</p> <p><b>Always</b> drain the pump head and accessories of any liquid.</p> <p><b>Always</b> ensure that compressed air is released.</p> <p><b>Always</b> transport the pump in its upright position.</p> <p><b>Always</b> use predesigned lifting points if defined. Ensure that the lifting equipment is suitable for the supplied Alfa Laval product.</p> <p><b>Always</b> ensure that the unit is securely fixed during transportation.</p> <p><b>Always</b> ensure the lifting point to be in line with center of gravity. Adjust lifting point if necessary.</p> <p><b>Always</b> use appropriate lifting equipment for heavy parts when relevant. Use lifting logs when available.</p> <p><b>Always</b> keep an eye on the load and stay clear during the lifting operation.</p>
---	--


## Installation

	<p>If the local safety regulations prescribe that the installation has to be inspected and approved by responsible authorities before the pump is put into service, consult with such authorities before installing the equipment and have the projected installation approved by them.</p>
	<p><b>Always</b> ensure all pipe lines (product, air, and water) are depressurized and emptied before installation, inspection, assembling and disassembling.</p>
	<p><b>Always</b> check direction is as required for the system design during installation.</p>
	<p><b>Never</b> start the pump with the front cover removed.</p>


## Operation

	<p><b>Never</b> touch the pump or the pipelines when pumping hot liquids or when sterilising.</p>
	<p><b>Never</b> run the pump with both the suction side and the pressure side blocked.</p>
	<p><b>Never</b> run the pump when partially installed or not completely assembled.</p>
	<p><b>Necessary</b> precautions must be taken if leakage occurs as this can lead to hazardous situations.</p>
	<p><b>Always</b> handle lye and acid with great care.</p>
	<p><b>Never</b> use the pump for products not mentioned in the Alfa Laval pump selection program.</p>
	<p><b>Always</b> follow the instructions in the safety data sheets from the suppliers of cleaning agents, detergents, oils etc.</p>
	<p>The Alfa Laval pump selection program can be acquired from your local Alfa Laval sales company.</p>


## Maintenance

	<p>In order to optimise the operation of the supplied Alfa Laval product and to minimize the down time due repair activities, the maintenance should consist of:</p> <ul style="list-style-type: none"> <li>• Inspection and maintenance of the supplied Alfa Laval product: strictly follow the technical documentation</li> <li>• <b>Preventive maintenance:</b> visual inspection of the supplied Alfa Laval product followed by necessary adjustments and planned periodic replacement of wear and tear parts</li> <li>• <b>Repairs:</b> unscheduled break-down of a component, often causing the system to stop. Damaged components shall be replaced or repaired</li> <li>• <b>Stock of Alfa Laval genuine spare parts:</b> Alfa Laval recommend keeping a stock of genuine spare parts facilitating preventive maintenance and reducing down time in case of unplanned break-downs</li> </ul> <p><b>Never</b> service the pump when it is hot.  <b>Never</b> service the pump if pressurised.  <b>Always</b> use Alfa Laval genuine spare parts.</p> <p><b>Always</b> lubricate according to the motor/geared motor manufacturers recommended procedures, schedule and recommend lubricants.</p> <p><b>Always</b> ensure any vent plugs, if fitted, are clean and free from blockage.</p>
---	--



## Storage




	<p><b>Alfa Laval recommend:</b></p> <ul style="list-style-type: none"> <li>• Store the supplied Alfa Laval product as supplied in original packaging</li> <li>• Port opening(s) should be protected against any ingress</li> <li>• Bare steel (not stainless) should be lightly oiled/greased</li> <li>• Store in a clean, dry place without direct sunlight or UV light</li> <li>• Temperature range -5 °C to 40 °C (23 °F - 104 °F)</li> <li>• Relative humidity less than 60%</li> <li>• No exposure to corrosive substances (including contained air)</li> </ul>
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## Noise


	<p>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 80dB[A]. When necessary, protection against noise should be taken.</p>
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## Hazards

 	<p><b>Burn Hazard</b></p> <ul style="list-style-type: none"> <li>Lubrication oil, machine parts and various machine surfaces can be hot and cause burns. Wear protective gloves</li> </ul>
--	--

  	<p><b>Corrosive Hazard</b></p> <ul style="list-style-type: none"> <li><b>Always</b> handle cleaning liquids, lye and acid with great care and in accordance with separate instructions for those fluids</li> <li>When using chemical cleaning agents and lubricants, make sure you follow the general rules and suppliers recommendation regarding ventilation, personnel protection etc.</li> </ul>
---	--

## Safety check

	<p>A visual inspection of any protective device (shield, guard, cover or other) on the supplied Alfa Laval product shall be carried out at least every 12 months. If the protective device is lost or damaged, especially when this leads to deterioration of safety performance, it shall be replaced. The fixing of the protective device should only be replaced with fixings of the same or an equivalent type.</p> <p><b>Inspection acceptance criteria:</b></p> <ul style="list-style-type: none"> <li>It should not be possible to reach moving parts originally protected by a protective device</li> <li>The protective device must be securely mounted</li> <li>Ensure that screws for the protective device are securely tightened</li> </ul> <p><b>Procedure in case of non-acceptance:</b></p> <ul style="list-style-type: none"> <li>Fix and/or replace the protective device</li> </ul>
---	--

## 2.3 Warning Signs in Text

Pay attention to the safety instructions in this Instruction Manual.

Below are definitions of the four grades of warning signs used in the text where there is a risk for injury to personnel or damage to the supplied Alfa Laval product.

 **DANGER**

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING**

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION**

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate damage to the supplied Alfa Laval product.

 **NOTE**

Indicates important information to simplify or clarify procedures.

## 2.4 Requirements of Personnel

### Operators

The operators shall read and understand this Instruction Manual.

### Maintenance personnel

The maintenance personnel shall read and understand this Instruction Manual. The maintenance personnel or technicians shall be skilled within the field required to carry out the maintenance work safely.

### Trainees

Trainees can perform tasks under the supervision of an experienced employee.

### People in general


The public shall not have access to the supplied Alfa Laval product.

In some cases, specially skilled personnel may need to be hired (i.e. electricians, welders). In some cases the personnel has to be certified according to local regulations with experience of similar types of work.

## 2.5 Recycling Information

### Unpacking

Packing material may consist of wood, plastics, cardboard boxes and in some cases metal straps.

	<ul style="list-style-type: none"> <li>• Wood and cardboard boxes can be reused, recycled or used for energy recovery</li> <li>• Plastics should be recycled or burnt at a licensed waste incineration plant</li> <li>• Metal straps should be sent for material recycling</li> </ul>
---	---

### Maintenance

During maintenance, oil (if used) and wear parts in the supplied Alfa Laval product should be replaced.

- Oil and all non-metal wear parts must be disposed of in accordance with local regulations
- Rubber and plastics should be burnt at a licensed waste incineration plant. If not available they should be disposed of in accordance with local regulations
- Bearings and other metal parts should be sent to a licensed handler for material recycling
- Seal rings and friction linings should be disposed of to a licensed land fill site. Check your local regulations
- All metal parts should be sent for material recycling
- Worn out or defected electronic parts should be sent to a licensed handler for material recycling

### Scrapping

At end of use, the equipment must be recycled in accordance with the relevant local regulations. Besides 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 your local Alfa Laval sales company.

### How to contact Alfa Laval

Contact details for all countries are continually updated on our website.

Please visit [www.alfalaval.com](http://www.alfalaval.com) to access the information directly.

## 3 Introduction

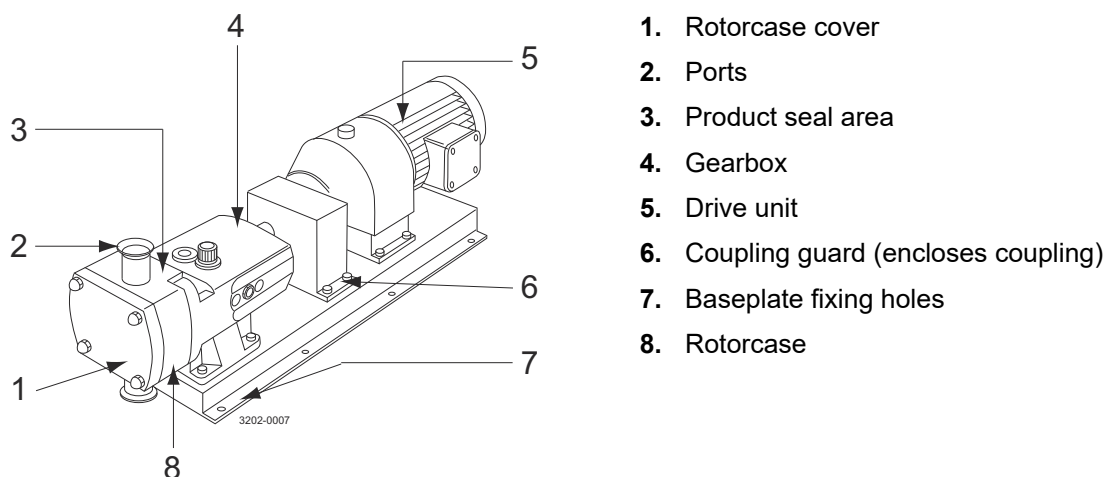
The Alfa Laval SX Rotary Lobe Pump is designed with optimized pump head geometry and multi-lobe rotors to ensure low-shear operation with minimum pulsation. This makes the SX the best choice for maintaining the integrity of delicate products.

The pump is designed according to the most stringent hygienic design standards and with verified, effective Cleaning-in-Place (CIP) and Sterilization-in-Place (SIP).

### 3.1 General Information

The SX 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 SX range has a universal gearbox design which 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.



1. Rotorcase cover
2. Ports
3. Product seal area
4. Gearbox
5. Drive unit
6. Coupling guard (encloses coupling)
7. Baseplate fixing holes
8. Rotorcase

### 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.

### External Cleaning

Use cleaning fluids above or below PH 8 may cause some surface discolouration.

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## 4 Installation

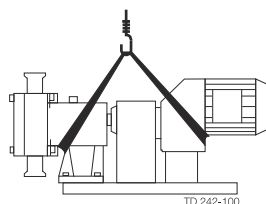
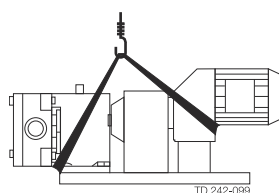
### 4.1 Unpacking, Handling and Storage

#### NOTE

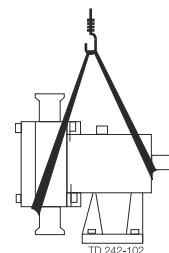
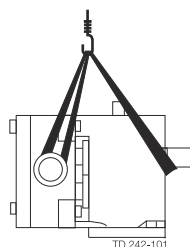
Refer to the pump weights guide (See *Weight* on page 52) before selecting and using any lifting gear.

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



#### 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.
- Be careful not to discard any manuals that may be enclosed with the packaging.
- Report any damage to the carrier.

**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 wrapping 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.

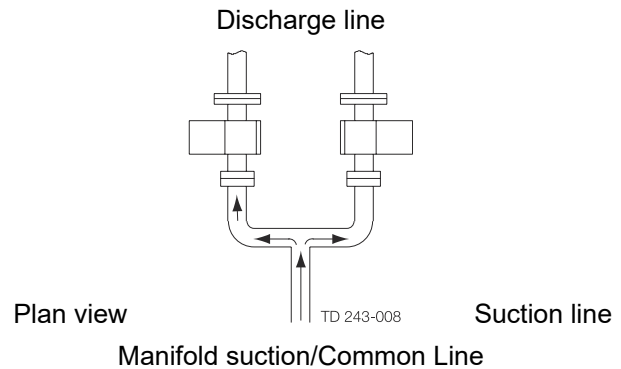
## 4.2 System Design and Installation

### NOTE

To ensure optimum operation it is important that any pump unit is installed correctly. When designing a pumping system the following should be taken into consideration.

### 4.2.1 System Design

- Confirm the Net Positive Suction Head (NPSH) available from the system exceeds the NPSH required by the pump, as this is crucial for ensuring the 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 welding slag etc. Also protect the pump from accidental operation against a closed valve by using relief valves, pressure switches or current limiting devices
- Fit suction and discharge 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 a media is required for heating/ cooling jackets and saddles
- Allow at least 1 m for pump access/maintenance all around the pump
- Do not subject rotary lobe pumps to rapid temperature changes, as pump seizure can result from thermal shock



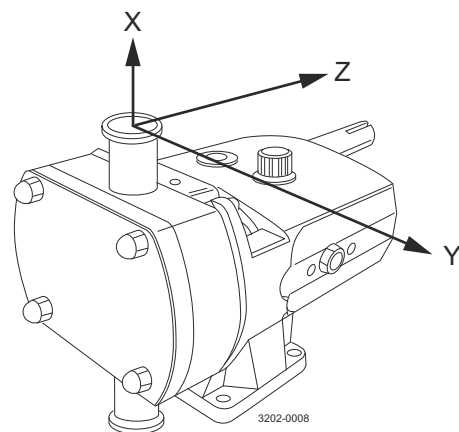
### 4.2.2 Pipework

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

#### Remember:

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

- 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 long radius bends wherever possible
- Provide isolating valves on each side of the pump when necessary
- Keep pipework horizontal where applicable to reduce air locks. Include eccentric reducers on suction lines

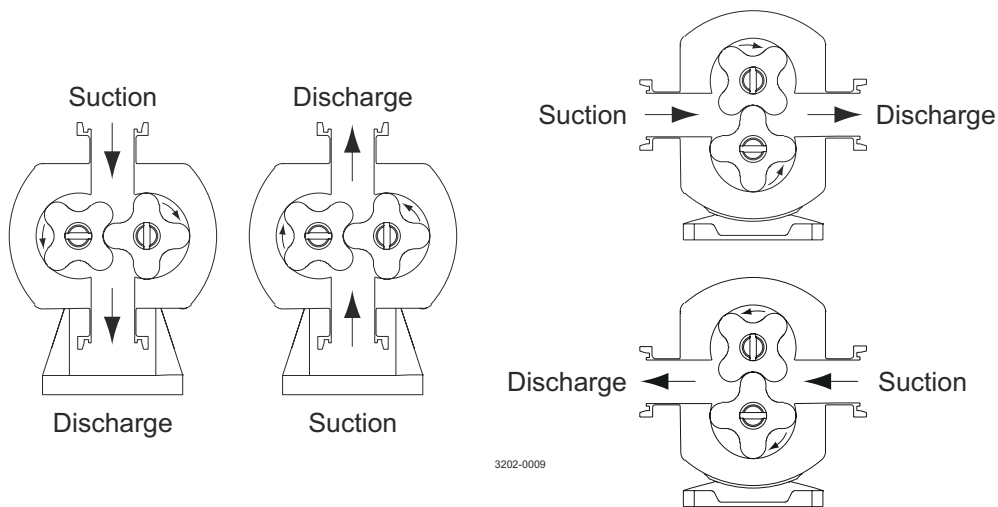


### 4.2.3 Maximum Forces and Moments

Pump Model	Units	Forces				Moments			
		FZ	FY	FX	EF	MZ	MY	MX	EM
SX1	N	80	60	70	120	30	30	30	50
	lbf	18	13	16	27	22	22	22	37
SX2	N	125	100	110	190	60	70	75	115
	lbf	28	22	25	43	44	52	55	85
SX3/4	N	165	135	150	260	100	115	140	205
	lbf	37	30	34	58	74	85	103	151
SX5/6	N	300	250	250	460	125	145	175	260
	lbf	67	56	56	103	92	107	129	192
SX7	N	380	320	320	590	165	190	230	340
	lbf	85	72	72	133	122	140	170	251

### 4.2.4 Direction of flow

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.



### 4.2.5 Pump Lubrication

The pump will be supplied pre-filled with food grade (NSF-1) synthetic (PAO based) oil as standard.

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

The oil should be changed every 3000 hrs of operation or every 2 years, whichever comes first.

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](#) on page 51 for oil approximate quantities required.**

#### Recommended Oils

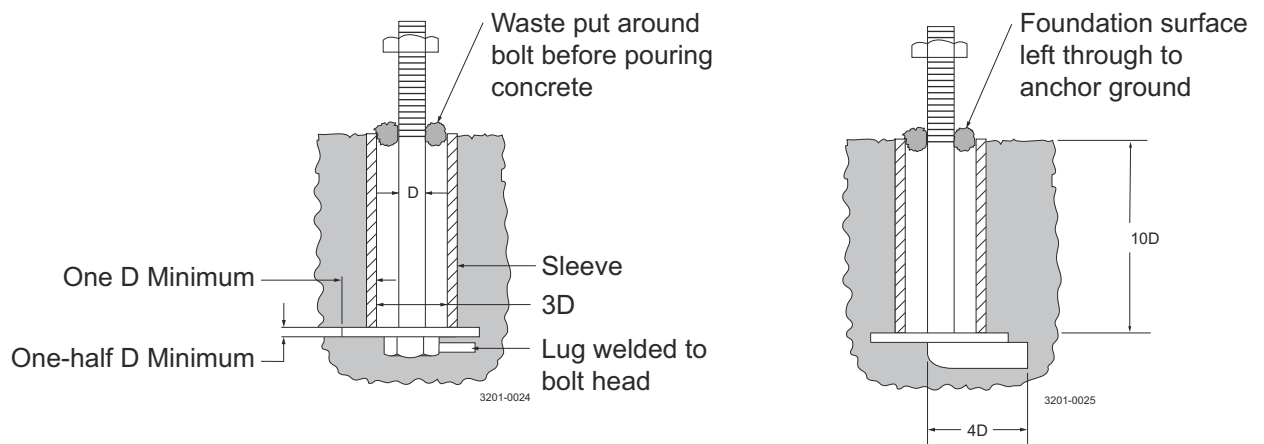
Food Grade Oil (NSF H-1)
-20 °C to +150 °C (-4 °F to 302 °F)
Mobil SHC Cibus 150
Bel-Ray No-Tox HD 150 #62686
Castrol Optileb GT 150
Klüber Klüberoil 4 UH1-150 N
Fusch Cassida GL / GLE 150
Mobil Glygole 150 (US/CAN)

Above oil recommendations may use different base oil technologies (mineral or PAG) which are incompatible with the existing PAO based oil. Care should be taken to follow the oil manufactures recommendation on flushing if changing the oil type.

For ATEX applications refer to ATEX addendum manual.

## 4.2.6 Baseplate Foundations

Pumps when supplied with a drive unit are normally mounted on a baseplate. Our standard baseplates have pre-drilled fixing holes to accept base retaining bolts. To provide a permanent rigid support for securing the pump unit, a foundation is required which will also absorb vibration, strain or shock on the pumping unit. Methods of anchoring the baseplate to the foundation are varied, they can be studs embedded in the concrete either at the pouring stage as shown below, or by use of epoxy type grouts. Alternatively mechanical fixings can be used.



The drawing above shows two typical methods for foundation bolt retaining. The sleeve allows for “slight” lateral movement of the bolts after the foundation is poured. Rag or waste paper can be used to prevent the concrete from entering the sleeve while the foundation is poured. A minimum of 14 days is normally required to allow the curing of the concrete prior to pump unit installation.

### Ball Foot Baseplate with Adjustable Feet

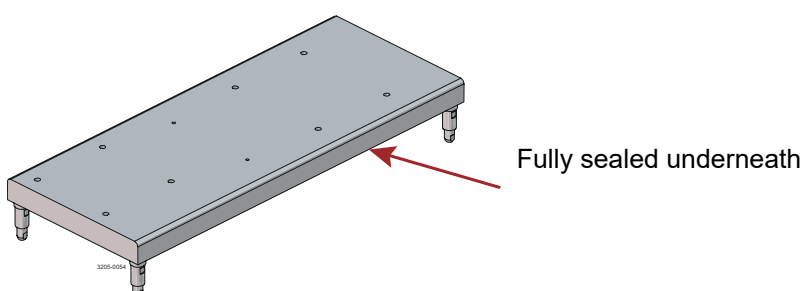
The pump can be supplied with an optional ball foot baseplate with height adjustable feet.

When used:

- **Ensure** the floor is level and is able to support the weight of the complete unit
- **Ensure** the unit is supported by all feet equally

### 3A Approved Ball Foot Baseplate with Adjustable Feet

For 3A approved mounted pumps a 3A approved ball foot baseplate is required which has additional sealant applied to the underside.



### 4.2.7 Coupling Alignment

Before the pump unit is installed it is important to ensure that the mounting surface is flat to avoid distortion of the baseplate, which may cause pump/motor shaft misalignment and pump/motor unit damage.

Once the baseplate has been secured, the pump shaft to motor shaft coupling alignment should be checked and adjusted as necessary. This is achieved by checking the maximum angular and parallel misalignment for the couplings as stated below.

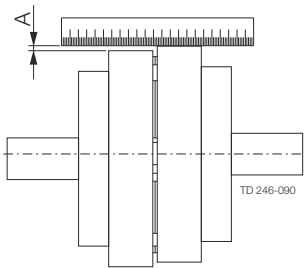
Shaft alignment that is outside the stated tolerances can be corrected by applying shims under the motor or pump foot, or, by moving the pump or drive sideways on the baseplate.

All bolts that have been loosened should be re-tightened to the stated torque figure.

**The following dimensions and tolerances apply to standard supply couplings only.**

#### Parallel misalignment

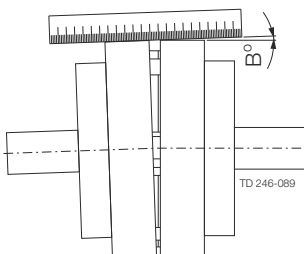
Measure 4 positions at 90° around coupling



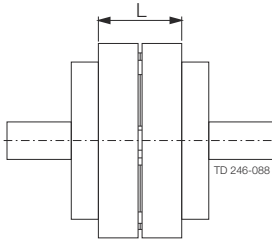
Coupling size	Dimension A Maximum
70	0.3 mm
90	0.3 mm
110	0.3 mm
130	0.4 mm
150	0.4 mm
180	0.4 mm
230	0.5 mm
280	0.5 mm

#### Angular misalignment

Measure 4 positions at 90° around coupling



Coupling size	Dimension B Maximum
70	1°
90	1°
110	1°
130	1°
150	1°
180	1°
230	1°
280	1°

**Assembled length**

Coupling size	Dimension L $\pm$ 1.0 mm
70	25
90	30.5
110	45
130	53
150	60
180	73
230	85.5
280	105.5

**Recommended bolt torques**

Thread Diameter	M6	M8	M10	M12	M16	M20	M24
Torque (Nm)	6	15	30	50	120	250	200

## 4.3 Flushing seal arrangement and pre-start up checks

### NOTE

This page is not applicable for ATEX applications.  
For ATEX application see ATEX addendum.

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

#### It is important that:

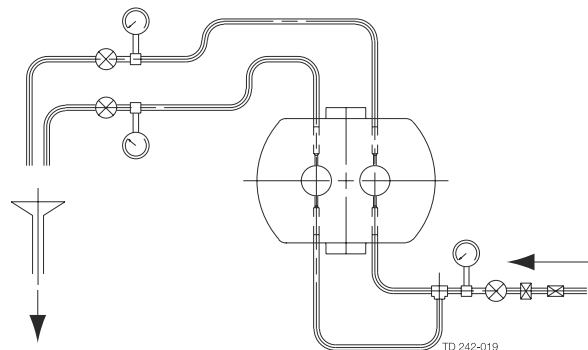
- The flush is correctly connected (see below)
- A compatible flushing fluid is used and supplied at the correct pressure and flow rate (see [Step 5](#))
- The flush is turned on at the same time/ prior to starting the pump, and turned off at the same time/after stopping the pump

- 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

- 3 Flushing arrangements in principle.



---

#### 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 both single and flushed mechanical seal arrangements the temperature of flush media should never allowed to exceed the maximum temperature of the pumped media. For advice on selecting a suitable flushing fluid please contact pump supplier.

---

#### 5 Flushing pressure and flow rate

Single flushed 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.

**Minimum flow rate required per shaft seal is 30 l/hr**

---

#### 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
  - Check that inlet and outlet valves are open
-

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## 5 Maintenance

### 5.1 Cleaning In Place (CIP)



**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 agent.

**Always** store/discharge cleaning agents in accordance with current rules/directives.



A suitable by-pass is recommended.

The pump has been designed for Clean in Place (CIP) operation with both 3A and EHEDG certification. However, due to variations in pumped products, system design, cleanliness requirements and chemicals used we recommend that users develop suitable CIP processes during commissioning on normal operating conditions and products and verify these meet the required levels of cleanliness ensuring a minimum flow velocity of 1.5 m/s (4.92 ft/s).

To ensure optimum drainability of the rotorcase we recommend the pump is specified with vertical porting (top/bottom).

#### Thermal Shock

Where metallic components are subjected to sudden changes in temperature the differing rates of contraction / expansion experienced, especially where there are very small clearances, can allow contact between the rotating and static parts potentially causing surface damage and pump seizure.

To minimise the risk of thermal shock occurring it is recommended that, if during process steps, the pumped media and/or seal flush media have a differential temperature of more than 50 °C (90 °F), the pump should be stationary and allowed to stabilise for a minimum of 15 minutes before operating.

## 5.2 Maintenance schedule

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
- 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.

Any loss or damage to any guards or covers, especially if this leads to a deterioration of safety performance, shall be replaced immediately. The fixings of any guards or covers should only be replaced with fixings of the same type and specification.

### 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

### 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:

Periodically inspect the rotor retainer cup seal for any discolouration, nicks, or cracks. If any of the defects above are noticed, the rotor retainer cup seal must be replaced. Inspection and replacement refer to the seal replacement procedure below.

### Seal Replacement Procedure

1. Remove rotor case cover (see [Dismantling, Step1](#))
2. Undo rotor retainer and ensure components are dry before servicing

3. With a penlight, inspect rotor retainer blind tapped hole for contamination. If soiled, refer to cleaning procedure below
4. Remove and discard rotor retainer cup seal
5. Fit new rotor retainer cup seal
6. Fit rotor retainer and use a torque wrench to tighten to correct torque value (see [Tool Requirements](#) on page 53)
7. Fit the rotor case cover

#### **Cleaning Procedure for Soiled Rotor Nut Tapped Hole**

1. Remove rotor retainer 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 two minutes while submerged
4. Soak rotor retainer in acid sanitizer for 5 minutes, and then scrub the hole again with the pipe brush for two minutes
5. Rinse well with clean water and blow-dry blind 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 through 6 above until swab test is passed

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

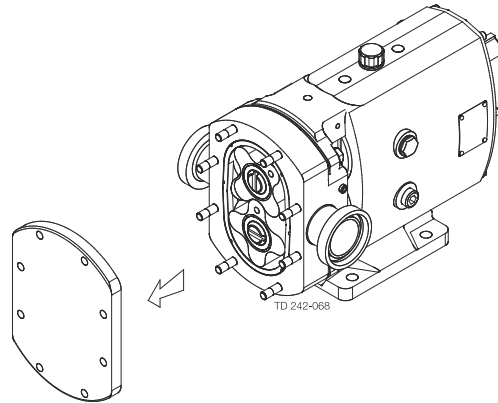
## 5.3 Dismantling

### NOTE

Before disassembling the pump refer to safety precautions. See *Parts Lists and Exploded Views* on page 59.

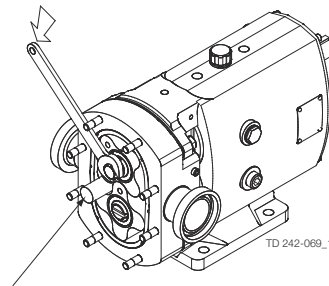
#### 1 Removing rotorcase cover.

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



#### 2 Removing rotors

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

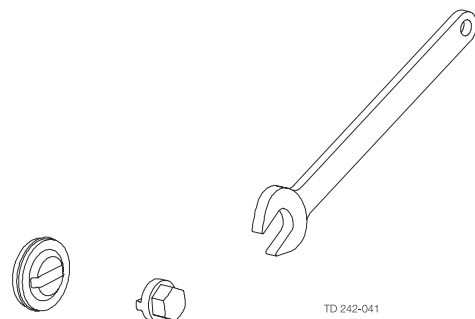


Plastic or wooden block

- #### 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.

Pump series 6 and 7 rotors are retained by torque locking assemblies, TLA's (19) and can be removed by:

- loosen each TLA screw in several stages in a diametrically opposite sequence.
- use bolts to screw into two of the TLA holes (fitted with washers) and extract the TLA's.



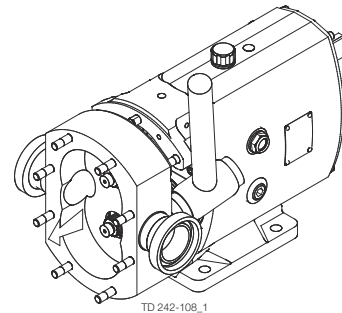
Rotor retainer removal tool

#### 4 Removing static seal components

Please see *Primary Seals Removal and Fitting* on page 44.

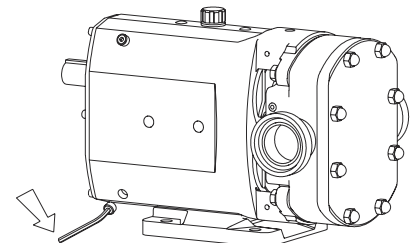
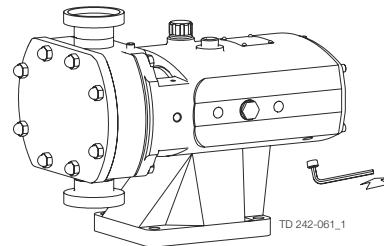
#### 5 Removing rotorcase

- a) For flushed mechanical seal arrangements, remove the seal housing retaining nuts and ease the seal housing from the rotorcase.
- b) Remove the rotorcase retaining nuts (4) and washers (4A).
- c) Tap both sides of the rotorcase (9) with a soft mallet.
- d) The rotorcase must not be allowed to drop onto the shafts (24 and 25) during the removal process.



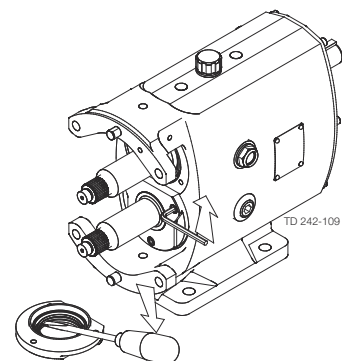
#### 6 Draining pump lubrication.

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



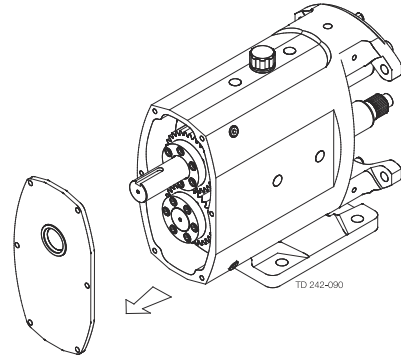
#### 7 Removing seal retainers.

- a) Remove screws (15).
- b) Then remove seal retainers (14) - as a liquid sealant has been used a lever may be required to remove retainers.
- c) 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.



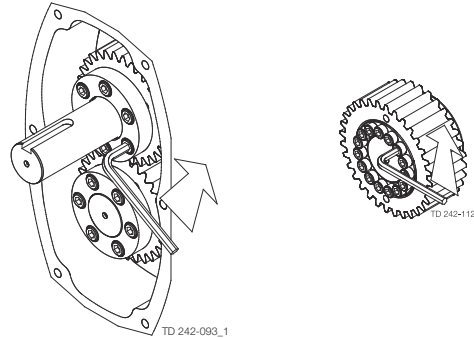
**8** Removing Gearcase Cover.

- a) Remove screws (6).
- b) 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.



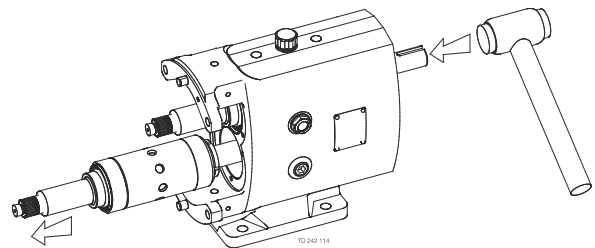
**9** Removing timing gears.

- a) Release clamp plate screws (40) on pump series 1, 2 and 3. For pump series 4, 5, 6 and 7 remove the torque locking assembly screw in several stages.
- b) Remove gears (36) using the tapped extraction holes provided, or remove shaft assembly as shown in step 10 below.



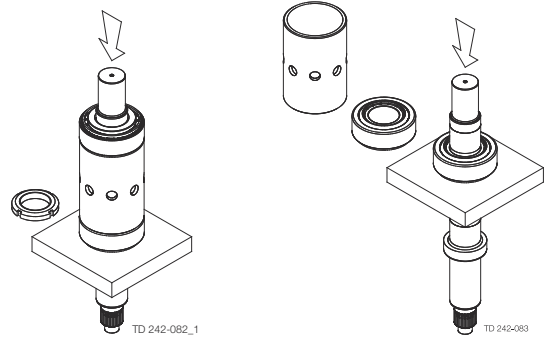
**10** Shaft assembly removal.

- a) Using a soft mallet gently tap the rear end of each shaft (24 and 25), to remove through the front of the gearcase (1).
- b) Support each shaft during removal from the gearcase.
- c) Remove the shaft abutment spacer (27):-  
For vertically ported pumps this is placed in the right hand bearing bore when viewed on the front face of the gearcase.-  
For horizontally ported pumps the shaft abutment spacer is placed in the top bearing bore.



**11** Bearing removal.

- a) Hold the shafts (24 and 25) in a vice using soft jaws to protect the areas where the seals will be located.
- b) 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.
- c) 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).
- d) 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.



## 5.4 Assembly

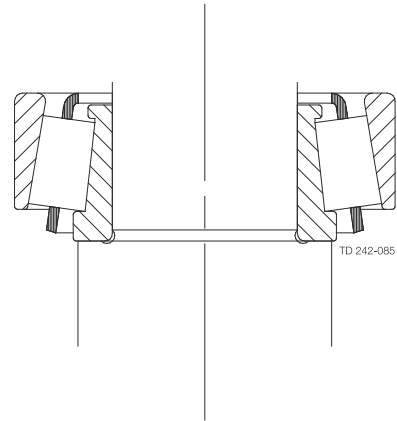
### 5.4.1 Fitting Bearings to Shafts

Take care not to damage shaft surfaces, in particular where the seals will be located. Ensure all fastenings are tightened to torque settings as shown in *Technical Data* on page 51).

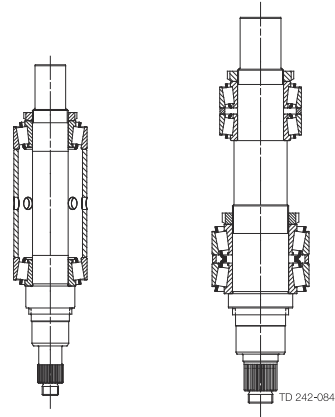
On series 1, 2 and 3 pumps, bearings do not require heating. For series 4, 5, 6 and 7 pumps, heat the bearing inner cones to 110 °C (230 °F).

**Do not use any form of live flame when heating, as this will damage bearings.**

- 1 Position shaft (24 and 25) vertically in a vice using soft jaws and apply anti-seize compound to the bearing diameters.
- 2 Place the inner cone on the shaft ensuring a positive fit against the shaft shoulder.



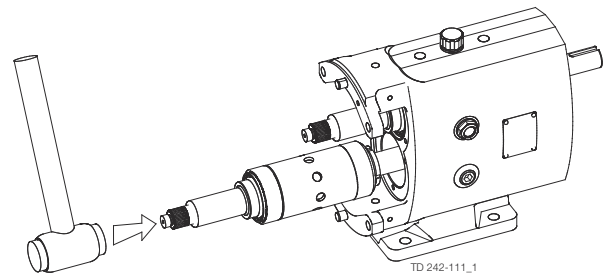
- 3 Locate outer cup, bearing spacer (32) and rear bearing cup.



- 4 Allow bearings to cool (series 4, 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.

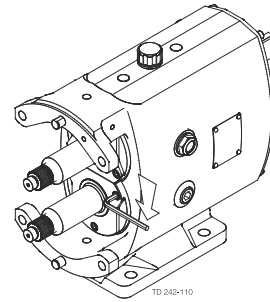
#### 5.4.2 Fitting Shaft Assemblies

- 1 Replace the shaft abutment spacer (27):
  - For vertically ported pumps this is placed in the right hand bearing bore when viewed on the front face of the gearcase
  - For horizontally ported pumps the shaft abutment spacer is placed in the top bearing bore
- 2 Identify drive and auxiliary shaft positions according to gearcase cover (5) orientation.
- 3
  - a) Using a soft faced mallet tap the shafts (24 and 25) into the gearcase (1).
  - b) 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 [Checking Rotor Abutment Alignment](#) on page 38.



### 5.4.3 Fitting Seal Retainers

- 1 Clean the rear face of the seal retainers (14), fit in position and tighten.
- 2
  - a) Check rotor alignment is correct by referring to [Checking Rotor Abutment Alignment](#) on page 38.
  - b) When rotor alignment is correct remove seal retainers and press new lip seals (16) into seal retainers.
  - c) 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.
- 3 Replace and tighten the screws (15).

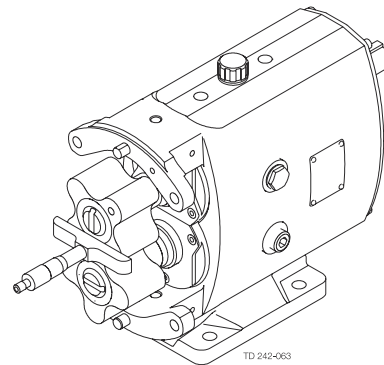


### 5.4.4 Checking Rotor Abutment Alignment

#### NOTE

Incorrect setting of rotor alignment will damage the pump.

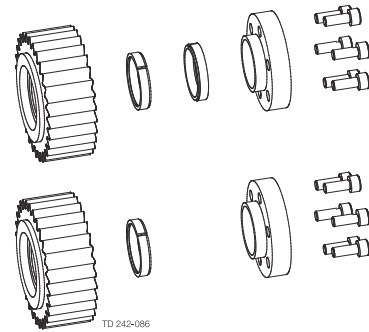
- 1 Fit rotors onto shafts (24 and 25) and tighten rotor retainers (22).
- 2
  - a) Using a depth micrometer ensure axial alignment is within tolerance of 0.012 mm (0.0005 in).
  - b) If the alignment is incorrect, the shaft abutment spacer (27) must be replaced/machined.



### 5.4.5 Fitting Timing Gears

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

- 2 a) Before fitting the torque locking devices (38) lubricate them with gear oil. Series 1, 2 and 3 have two sets of elements.  
b) Series 4, 5, 6 and 7 pumps have torque locking assemblies.

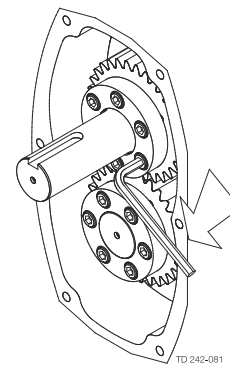


3 Fit timing gear clamp plates (39) - series 1, 2 and 3 only.

Fit torque locking assemblies (37) - series 4, 5, 6 and 7 only.

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](#) on page 40.



## 5.4.6 Adjusting Rotor Timing

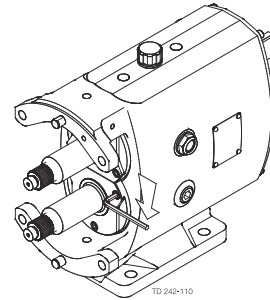
### NOTE

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.

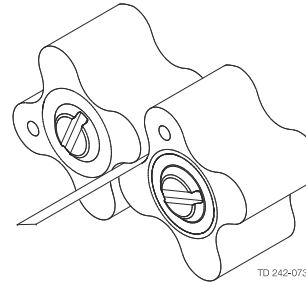
To allow timing adjustment ensure that one shaft is able to rotate within the torque locking assembly/element. The other torque locking assembly/element should be tightened to the recommended torque.

- 1 Locate one rotor (17) on to the drive shaft (24) with the dimple at the top. Turn the rotor through  $45^\circ$ . Fit the second rotor on to the auxiliary shaft (25) with its dimple at the top as shown.

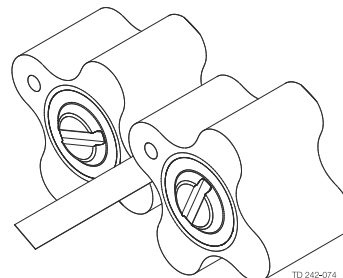
Dimples



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



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

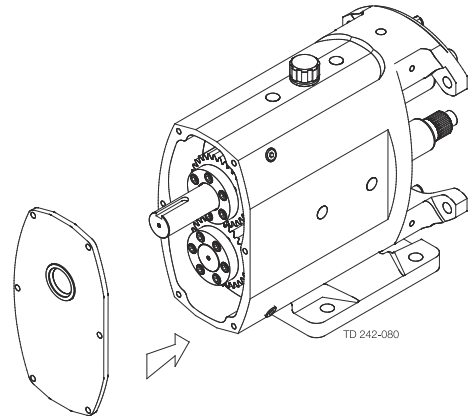


- 4 If the measurement points are unequal tap the rotor which is on the free turning shaft until equal measurement through 8 points is achieved.

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

### 5.4.7 Fitting Gearcase Cover

- 1 Clean the gearcase cover bore and remove all gasket material from the face. Press a new lip seal (7) into the cover (5).
- 2 Apply liquid gasket to the face of the cover where it mates with the gearcase.
- 3 Smear oil on the inner lip of the lip seal and carefully slide the cover over the shaft ensuring the lip seal is centred and not cut or damaged. Tighten the screws (6).



### 5.4.8 Fitting and Shimming Rotorcase

#### NOTE

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. Plastic 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. For ATEX applications stainless steel shims are fitted. Shims can be stacked unequally providing the clearances are achieved.**

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

### 5.4.9 Fitting Primary Seals

- 1 Refer to section 4.5 for seal fitting instructions.

### 5.4.10 Fitting Rotors

#### NOTE

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

- 1 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 auxiliary shaft (25) with its dimple at the top as shown.

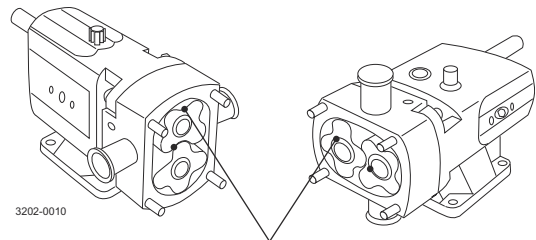
For series 6 and 7 pumps the rotors are retained by torque locking assemblies, TLA's.

Slide the TLA assembly onto the shaft. Locate the clamp plate tool and tighten to the recommended torque figure.

Tighten the TLA screws to the recommended torque figure.

Unscrew the clamp plate tool and remove.

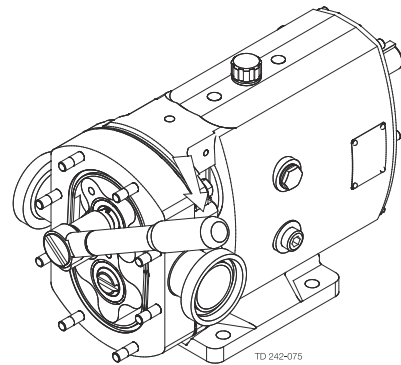
Replace the rotor cap and tighten to the recommended torque figure.



Dimpled master lobes

- 2 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](#) on page 51.

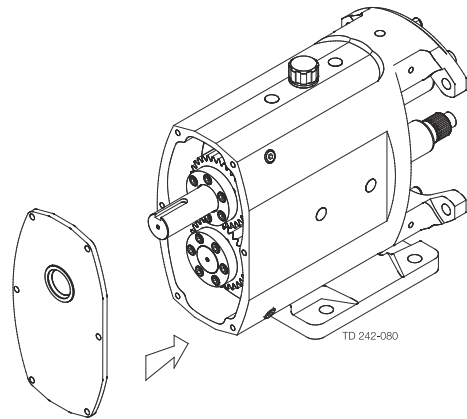
Check cup seal is fully seated and below the surface of the rotor - if necessary apply finger pressure to the seal to ensure it is correctly positioned.



- 3 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 been attained.

### 5.4.11 Fitting Rotorcase Cover

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



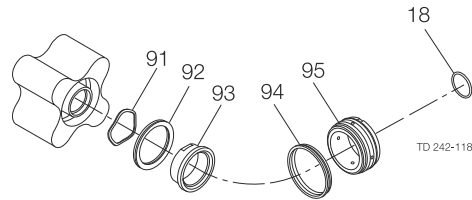
## 5.5 Primary Seals Removal and Fitting

### 5.5.1 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.

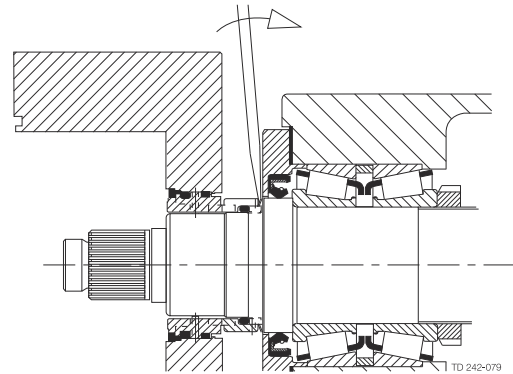
The R00 mechanical seal is completely front loading without need of removing rotorcase for access or replacement. The seal setting distance is pre-set.

Item	Description
91	Wave spring
92	Squad ring
93	Rotary seal ring
94	Cup seal
95	Stationary seal ring
18	Rotor sealing O-ring



### Seal removal

1. Remove rotorcase cover, rotors and rotor sealing O-ring (18).
2. Extract the rotary seal ring (93), squad ring (92) and wave spring (91) from the rear of the rotors.
3. Gently ease the stationary seal ring (95) and cup seal (94) from the rotorcase using a suitable lever on the rear of the seal as illustrated.



### Seal fitting

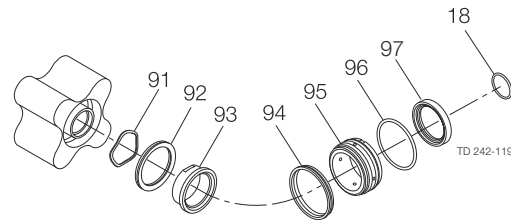
1. Lightly lubricate cup seal (94) and fit to stationary seal ring (95).
2. Carefully aligning the slots in the stationary seal ring with the anti rotation dogs in the rotorcase, gently press the stationary seal ring assembly into the rotorcase bore until the stop is reached.
3. Fit wave spring (91) into the rear bore of the rotor.
4. Lightly lubricate squad ring (92) with appropriate grease and fit to rotary seal ring (93).
5. For SX1-5 align the two flats on the rotary seal ring with the drive flats in the rotor and gently push the rotary seal ring assembly into the rear bore of the rotor.  
For SX6-7 align the two slots on the rotary seal ring with the drive pins in the rotor and gently push the rotary seal ring assembly into the rear bore of the rotor.
6. Wipe clean the sealing faces with solvent

7. Lightly lubricate rotor sealing O-ring (18) and slide onto shaft up to the shoulder.
8. Refit the rotors and rotorcase cover.

### 5.5.2 R00 Single flushed/quench mechanical seal

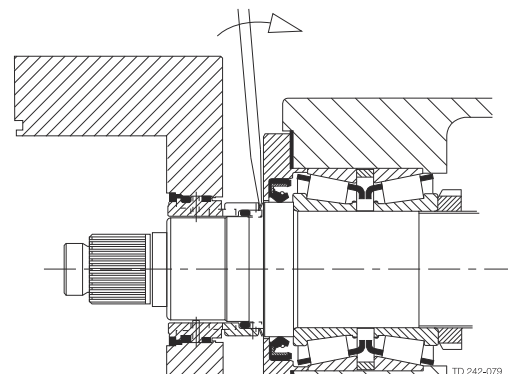
The R00 mechanical seal is completely front loading without need of removing rotorcase for access or replacement. The seal setting distance is pre-set.

Item	Description
91	Wave spring
92	Squad ring
93	Rotary seal ring
94	Cup seal
95	Stationary seal ring
96	Stationary seal ring O-ring
97	Lip seal
18	Rotor sealing O-ring



### Seal removal

1. Isolate the flush media.
2. Remove rotorcase cover, rotors and rotor sealing O-ring (18).
3. Extract the rotary seal ring (93), wave spring (91) and squad ring (92) from the rear of the rotor.
4. Gently ease the lip seal (97), O-ring (96), stationary seal ring (95) and cup seal (94) from the rotorcase using a suitable lever on the rear of the seal as illustrated.



### Seal fitting

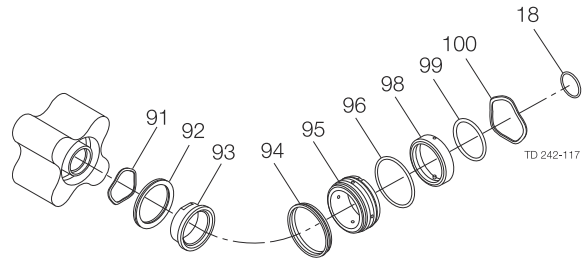
1. Lightly lubricate cup seals (94) with appropriate grease and fit to stationary seal rings (95).
2. Fit cup seal and O-ring (96) to stationary seal assembly.
3. Fit lip seal (97) into stationary seal assembly.
4. Carefully aligning the slots of the stationary seal ring with the anti rotation dogs in the rotorcase, gently press the stationary seal ring assembly into the rotorcase bore until the stop is reached.
5. Fit wave spring (91) into the rear bore of the rotor.
6. Lightly lubricate squad rings (92) with appropriate grease and fit to rotary seal rings (93).

7. For SX1-5 align the two flats on the rotary seal ring with the drive flats in the rotor and gently push the rotary seal ring assembly into the rear bore of the rotor.  
For SX6-7 align the two slots on the rotary seal ring with the drive pins in the rotor and gently push the rotary seal ring assembly into the rear bore of the rotor.
8. Wipe clean the sealing faces with solvent.
9. Lightly lubricate rotor sealing O-ring (18) and slide onto shaft up to shoulder.
10. Refit the rotors and rotorcase cover.

### 5.5.3 R00 Double flushed mechanical seal

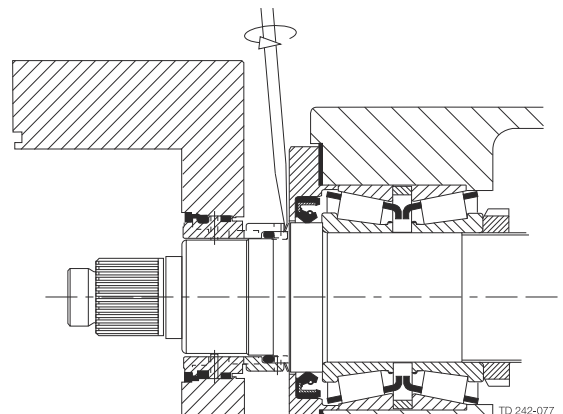
The R00 mechanical seal is completely front loading without need of removing rotorcase for access or replacement. The seal setting distance is pre-set.

Item	Description
91	Wave spring
92	Squad ring
93	Rotary seal ring (inboard)
94	Cup seal
95	Stationary seal ring
96	Stationary seal ring O-ring
98	Rotary seal ring (outboard)
99	Rotary seal ring O-ring
100	Wave spring
18	Rotor sealing O-ring



### Seal removal

1. Isolate the flush Media.
2. Remove rotorcase cover, rotors and rotor sealing O-ring (18)
3. Extract the rotary seal ring (93), wave spring (91) and squad ring (92) from the rear of the rotor.
4. Gently ease all other seal components from the rotorcase using a suitable lever on the rear of the seal as illustrated.



### Seal fitting

1. Lightly lubricate cup seals (94) and stationary seal O-rings (96) with appropriate grease.
2. Fit cup seal (94) and O-ring (96) to stationary seal ring (95).

3. Lubricate and fit rotary seal ring O-ring (99) into outboard rotary seal ring (98).
4. Slide wave spring (100) along shaft through the rotorcase bore until located on the shaft shoulder.
5. Wipe clean the sealing faces with solvent.
6. Carefully aligning the slots in the stationary seal rings with the anti rotation dogs in the rotorcase, gently press the stationary seal ring assembly into the rotorcase bore until the stop is reached.
7. Fit wave spring (91) into the rear bore of the rotor.
8. Lightly lubricate squad rings (92) with appropriate grease and fit to rotary seal rings (93).
9. For SX1-5 align the two flats on the rotary seal ring with the drive flats in the rotor and gently push the rotary seal ring assembly into the rear bore of the rotor.  
For SX6-7 align the two slots on the rotary seal ring with the drive pins in the rotor and gently push the rotary seal ring assembly into the rear bore of the rotor.
10. Lightly lubricate rotor sealing O-ring (18) and slide onto shaft up to the shoulder.
11. Refit the rotors and rotorcase cover.

 **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.

## 5.6 Troubleshooting

Problem														Probable Causes	Solutions		
No flow	Under capacity	Irregular discharge	Low discharge pressure	Pump will not prime	Prime lost after starting	Pump stall when starting	Pump overheats	Motor overheats	Excessive power absorbed	Noise and Vibration	Pump element wear	Syphoning	Seizure			Mechanical seal leakage	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.

Problem														Probable Causes	Solutions		
No flow	Under capacity	Irregular discharge	Low discharge pressure	Pump will not prime	Prime lost after starting	Pump stall when starting	Pump overheats	Motor overheats	Excessive power absorbed	Noise and Vibration	Pump element wear	Syphoning	Seizure			Mechanical seal leakage	Mechanical seal leakage
										√	√			√	√	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.
							√	√	√					√		Gland over-tightened	Slacken and re-adjust gland packing.
	√	√			√					√					√	Gland under-tightened	Adjust gland packing.
														√	√	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.

Problem														Probable Causes	Solutions		
No flow	Under capacity	Irregular discharge	Low discharge pressure	Pump will not prime	Prime lost after starting	Pump stall when starting	Pump overheats	Motor overheats	Excessive power absorbed	Noise and Vibration	Pump element wear	Syphoning	Seizure			Mechanical seal leakage	Mechanical seal leakage
√	√	√														Worn pumping element.	Fit new components.
√	√									√						Rotorcase cover relief valve leakage.	Check pressure setting and re-adjust if necessary. Examine and clean seating surfaces. Replace worn parts.
√										√						Rotorcase cover relief valve - chatter.	Check for wear on sealing surfaces, guides etc. Replace if necessary.
√	√															Rotorcase cover relief valve incorrectly set.	Re-adjust spring compression - valve should lift approx. 10% above duty pressure.
√				√												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. Fit flushed packed gland.
									√	√						Faulty motor.	Check and replace motor bearings.
√																Pumping element missing	Fit pumping element.

## 6 Technical Data

### NOTE

Technical data must be observed during installation, operation and maintenance.  
All personnel should be informed about the technical data.

### 6.1 Technical Data

#### Standard specification

Product wetted steel parts:	W. 1.4404 (316L)
Inside surface finish:	Mech Ra ≤ 0.8 (Mech Ra ≤ 32)
Gearbox:	Stainless steel (Cast iron)
Base plate:	Stainless steel
Coupling guard:	Stainless steel
Rotor:	Four-lobe
Product wetted elastomers:	EPDM
Other elastomers:	FPM
Shaft seal:	Single mechanical (R00), Single Flush (R00), Double Mechanical (R00)
Rotary seal face:	Carbon, Silicon Carbide
Stationary seal face:	Stainless steel, Silicon Carbide

#### Shaft seals

Single, single flush and double mechanical available. All options are fully front loading and interchangeable.

Max flush pressure, single flush:	0.5 bar (7.25 PSI)
Max flush pressure, double mechanical:	1 bar over product pressure
Water consumption, flushed or double mechanical:	0.5 l/min (0.13 gallon/min)
Flush connections:	BSPT or NPT

#### Temperature

Max process and CIP temperature:	150 °C (302 °F )
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#### Motor

Gear motor, 4 poles, to IEC metric standard, 50/60 Hz, suitable for frequency conversion, IP55, insulation class F.

#### Warranty

Extended 3-years warranty on SX pumps. The warranty covers all non wear parts on the condition that genuine Alfa Laval Spare Parts are used.

## 6.2 Oil Capacities

Pump model	Port orientation		Port orientation	
	Vertical litres	Horizontal litres	Vertical US pints	Horizontal US pints
SX1	0.30	0.40	0.60	0.80
SX2	0.60	0.70	1.20	1.40
SX3	1.10	1.50	2.20	3.10
SX4	1.50	2.00	3.20	4.20
SX5	3.00	4.00	6.30	8.40
SX6	4.50	7.00	9.50	14.80
SX7	9.00	12.00	19.00	25.40

## 6.3 Weight

### NOTE

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

Pump model	Bare Shaft Pump kg (lb)		Pump with drive unit kg (lb)	
	Port Orientation Horizontal	Port Orientation Vertical	Horizontal	Vertical
SX1/005	15 (33)	16 (35)	46 (101)	49 (108)
SX1/007	16 (35)	17 (37)	55 (121)	58 (128)
SX2/013	32 (71)	33 (73)	80 (176)	81 (179)
SX2/018	33 (73)	34 (75)	85 (187)	86 (190)
SX3/027	57 (126)	59 (130)	147 (324)	150 (331)
SX3/035	59 (130)	61 (134)	152 (335)	155 (342)
SX4/046	107 (236)	110 (243)	271 (597)	274 (604)
SX4/063	113 (249)	116 (256)	277 (611)	280 (617)
SX5/082	155 (342)	155 (342)	295 (650)	295 (650)
SX5/115	165 (364)	165 (364)	310 (683)	310 (683)
SX6/140	278 (613)	278 (613)	545 (1202)	545 (1202)
SX6/190	290 (639)	290 (639)	570 (1257)	570 (1257)
SX7/250	336(741)	344 (759)	652(1438)	660 (1455)
SX7/380	358(789)	366(807)	677(1493)	685 (1510)

## 6.4 Tool Requirements

Description	Tool required	Pump Model						
		SX1	SX2	SX3	SX4	SX5	SX6	SX7
Rotorcase cover nut (13)	Socket Size (mm)	13	17	17	17	17	19	19
	Torque Setting (Nm)	20	39	39	39	39	105	105
	Torque Setting (lbft)	14.8	28.8	28.8	28.8	28.8	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)	-	-	-	-	-	8	8
	Torque Setting (lbft)	-	-	-	-	-	5.9	5.9
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)	10	10	10	25	25	25	40
	Torque Setting (lbft)	7.4	7.4	7.4	18.4	18.4	18.4	29.5
Gearcase cover screw (6)	Key Size (mm)	5	5	5	6	6	6	6
	Torque Setting (Nm)	10	10	10	25	25	25	25
	Torque Setting (lbft)	7.4	7.4	7.4	18.4	18.4	18.4	18.4
TLA/Clamp plate screw (40)	Key Size (mm)	5	5	5	6	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 (inch)	¼	¼	¼	¼	⅜	⅜	⅜
Foot bolt (58)	Key Size (mm)	5	6	6	8	10	10	24
	Torque Setting (Nm)	15	30	30	60	50	50	120
	Torque Setting (lbft)	11.1	22.1	22.1	44.3	37	37	89
Sight glass (46)	Socket size (mm)	22	22	22	22	22	22	22
	Torque Setting (Nm)	2	2	2	2	2	2	2
	Torque Setting (lbft)	0.9	0.9	0.9	0.9	0.9	0.9	0.9

## 6.5 Pump Data Table

Model	Displacement			Suction & Discharge Connection Size				Differential Pressure Max Speed		Maximum Capacity at rev/min	Maximum Capacity at max. rpm m <sup>3</sup> /hr
	litres/ rev 100 rev	Imp gal/ 100 rev	US gal/ diameter	Nominal Bore (International Std) (Standard)		Connection Size		bar	PSI		
				mm	inch	mm	inch				
SX1/005	0.050	1.1	1.3	22	0.87	25	1.0	12	174	1200	3.60
SX1/007	0.070	1.5	1.8	35	1.38	40	1.5	7	101	1200	5.04
SX2/013	0.128	2.8	3.4	35	1.38	40	1.5	15	217	1000	7.68
SX2/018	0.181	4.0	4.8	47	1.85	50	2.0	7	101	1000	10.86
SX3/027	0.266	5.9	7.0	47	1.85	50	2.0	15	217	1000	15.96
SX3/035	0.350	7.7	9.2	62	2.44	65	2.5	7	101	1000	21.00
SX4/046	0.460	10.1	12.2	47	1.85	50	2.0	15	217	1000	27.60
SX4/063	0.630	13.9	16.6	62	2.44	65	2.5	10	145	1000	37.80
SX5/082	0.820	18.0	21.7	62	2.44	65	2.5	15	217	600	29.52
SX5/115	1.150	25.3	30.4	73	2.87	80	3.0	10	145	600	41.40
SX6/140	1.400	30.8	37.0	73	2.87	80	3.0	15	217	500	42.00
SX6/190	1.900	41.8	50.2	96	3.78	100	4.0	10	145	500	57.00
SX7/250	2.500	55.0	66.0	96	3.78	100	4.0	15	217	500	75.00
SX7/380	3.800	83.6	100.4	140	5.51	150	6.0	10	145	500	114.00

### Maximum pump differential pressure may be limited based on the connection type used as below:

- DIN11851 – 40 bar / 580 PSI (25-40 mm), 25 bar / 362 PSI (50-100 mm), 16 bar / 232 PSI (150 mm)
- ISO (IDF) – 16 bar / 232 PSI (1"-2"), 10 bar / 145 PSI (2.5"-4"), providing provision for support ring is to be made
- SMS – 10 bar / 145 PSI (all sizes)
- RJT – 10 bar / 145 PSI (all sizes)
- Tri-clamp (BS4825) – Pressure rating is dictated by the clamp band used (Refer to clamp band supplier)
- DIN11864-1 – 40 bar / 580 PSI (25-40 mm), 25 bar / 362 PSI (50-100 mm)
- DIN11864-2 – 25 bar / 362 PSI (25-40 mm), 16 bar / 232 PSI (50-100 mm)
- For size 150 mm on SX7/380 pumps, only DIN11851, SRJT or Tri-clamp connections are available.

### For units covered under EHEDG certification only the following process connection type and gasket (supplied by others) combinations are EHEDG approved:

- DIN11851 with ASEPTO-STAR k-flex or SKS EHEDG gasket system
- Triclamp (BS4825 part 3) with Combifit T-Ring Gasket
- DIN11864-1
- DIN11864-2

### NOTE



**ATEX applications: Differential pressure, Max. speed and Max. capacity are not applicable for ATEX applications.**

## 6.6 Pumphead Clearance Information



Pump Model	Pressure bar	Rotor Length	Front Clearance Min.	Back Clearance Min.	Rotor Diameter Min.	Radial Clearance Min.	Mesh Clearance Min.
SX1/005	6	28.88 - 28.91	0.11	0.05	57.85	0.16	0.06
	12	28.80 - 28.83	0.16	0.08	57.75	0.21	0.15
SX1/007	7	41.74 - 41.77	0.19	0.11	57.65	0.23	0.21
SX2/013	5	38.30 - 38.33	0.10	0.05	80.34	0.10	0.09
	15	38.18 - 38.21	0.16	0.11	80.06	0.24	0.17
SX2/018	7	54.08 - 54.11	0.14	0.09	80.16	0.16	0.17
SX3/027	5	52.36 - 52.39	0.11	0.10	95.50	0.13	0.24
	15	52.22 - 52.25	0.21	0.14	95.14	0.28	0.24
SX3/035	7	68.81 - 68.84	0.19	0.11	95.20	0.28	0.24
SX4/046	5	51.96 - 51.99	0.08	0.05	124.91	0.11	0.22
	15	51.89 - 51.92	0.13	0.07	124.75	0.19	0.22
SX4/063	5	71.18 - 71.21	0.09	0.05	124.81	0.16	0.20
	10	71.06 - 71.09	0.16	0.10	124.73	0.20	0.20
SX5/082	15	67.25 - 67.30	0.20	0.15	150.04	0.23	0.25
SX5/115	10	94.55 - 94.60	0.20	0.15	150.04	0.23	0.25
SX6/140	15	79.55 - 79.60	0.20	0.15	177.22	0.24	0.38
SX6/190	10	107.82 - 107.87	0.25	0.15	177.22	0.24	0.38
SX7/250	15	104.64 - 104.69	0.33	0.28	205.78	0.56	0.50
SX7/380	10	158.89 - 158.94	0.38	0.30	205.78	0.56	0.50

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## 7 Spare Parts

For every delivered Alfa Laval Product, a spare part list is available.

This spare part list contains a range of the most common wear parts for the machinery. If any component not mentioned is required, please contact your local Alfa Laval representative for availability.

You can find our spare part catalogue at <https://hygienicfluidhandling-catalogue.alfalaval.com>.

**Always** use Alfa Laval genuine spare parts. The warranty of Alfa Laval products is dependent on use of Alfa Laval genuine spare parts.

### 7.1 Ordering Spare Parts

When ordering spare parts, please always state:

1. Serial number (if available)
2. Item number/spare part number (if available)
3. Capacity or other relevant identification

### 7.2 Alfa Laval Service

Alfa Laval is represented in all larger countries of the world.

Do not hesitate to contact your local Alfa Laval representative, with any questions or requirement of spare parts for Alfa Laval equipment.

## 7.3 Warranty - Definition



The rules of Intended use are absolute. Use of the supplied Alfa Laval product is allowed only when in compliance with the technical data supplied with the Intended use.

Differing utilisation, other than agreed with Alfa Laval Kolding A/S, exclude any liability and warranty.

No modification or alteration of the supplied Alfa Laval product is allowed, unless explicit permission is granted by Alfa Laval Kolding A/S.



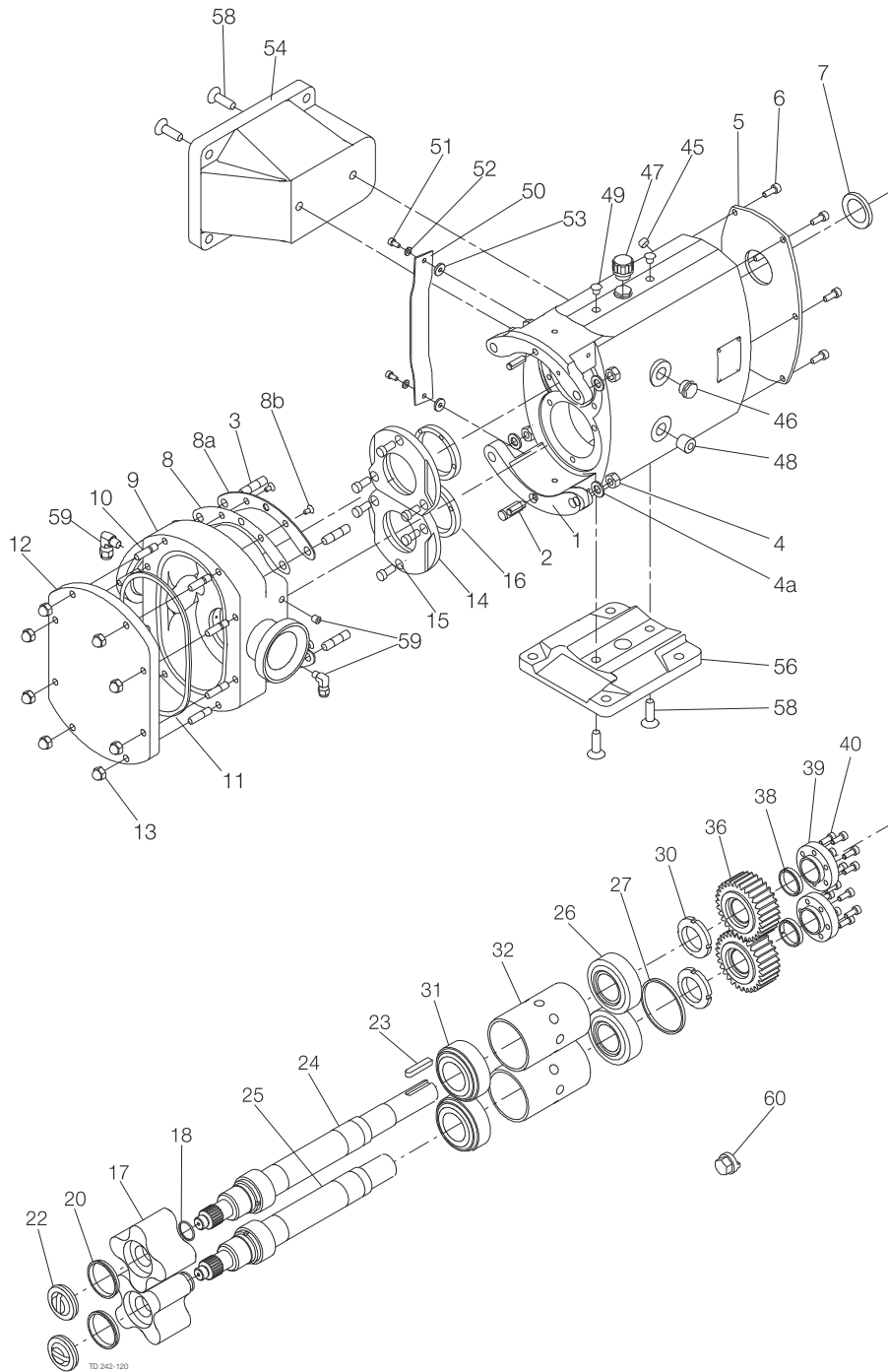
### Liability and warranty are excluded:

- If advice and instruction of operating instructions are ignored
- For incorrect operation or for insufficient maintenance of the supplied Alfa Laval product
- For any kind of change of function of the supplied Alfa Laval product without prior written agreement by Alfa Laval Kolding A/S
- If supplied Alfa Laval product is modified by non-authorized persons
- If using the supplied Alfa Laval product without attention of appropriate safety regulations, (see [Safety](#) on page 7)
- If protection equipment is not used and vessel process / ancillary equipment is not brought to a standstill
- If the supplied Alfa Laval product and ancillary parts are not properly maintained (to be executed in intervals and including fitting of prescribed replacement parts)

When exchanging parts, only original replacement parts, released from the manufacturer, must be used.

# 8 Parts Lists and Exploded Views

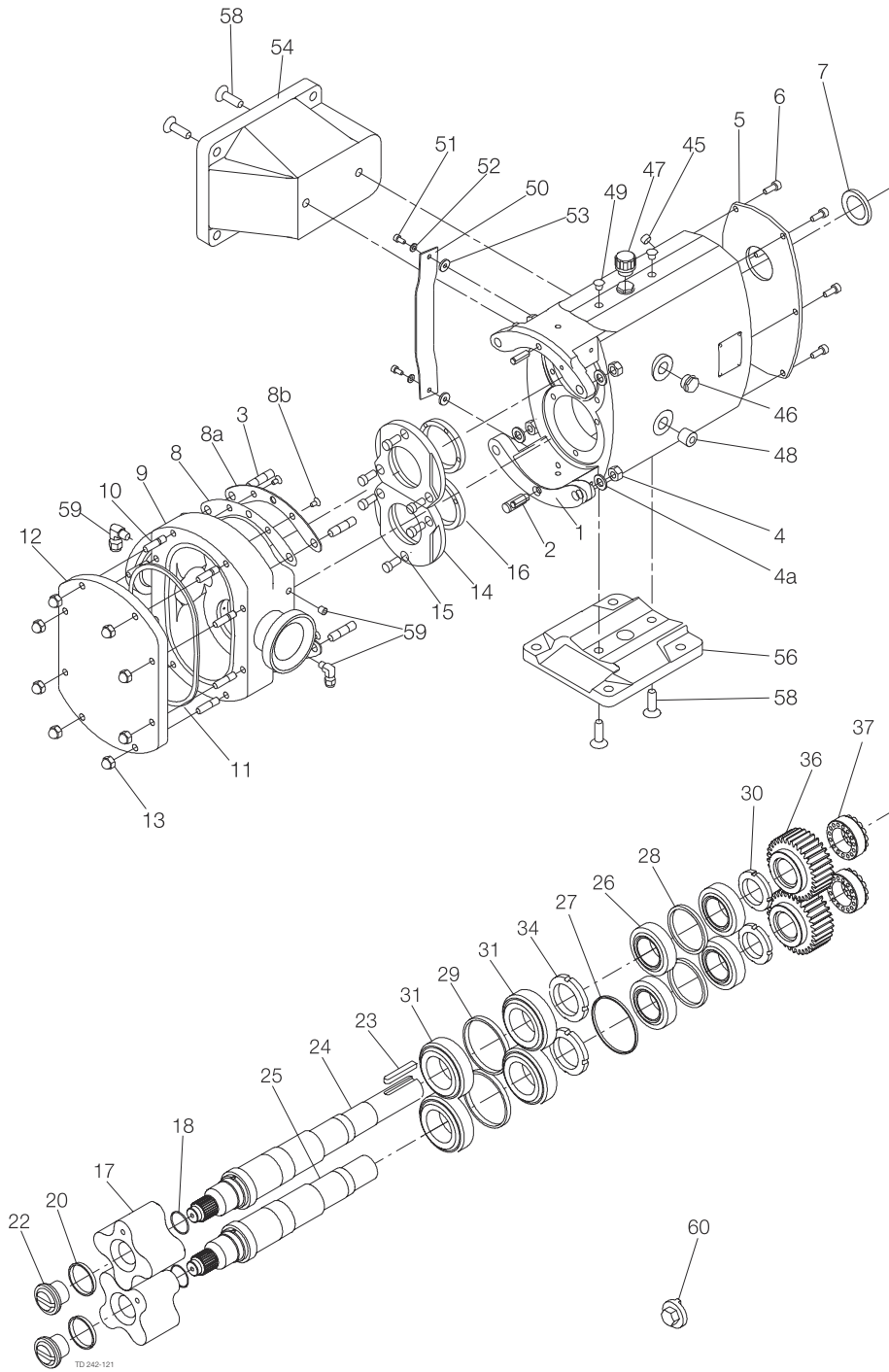
## 8.1 SX1-3 Pump Range



Pos.	Qty.	Denomination
1	1	Gearcase
2	2	Dowel
3	4	Stud, rotorcase retention
4	4	Nut, rotorcase retention
4a	4	Washer, rotorcase retention
5	1	Cover, gearcase
6	6	Screw, gearcase cover
7	1	Lip seal, drive end
8	2	Shim
8a	2	Shim retainer
8b	4	Screw, shim retainer
9	1	Rotorcase
10	4/8	Stud, rotorcase/cover retention (Qty 4 for SX1/2 - Qty 8 for SX3)
11	1	Compression joint
12	1	Cover, rotorcase
13	4/8	Dome nut, rotorcase cover (Qty 4 for SX1/2 - Qty 8 for SX3)
14	2	Retainer, seal
15	6	Screw, seal retainer
16	2	Lip seal, gland end
17	2	Rotors
18	2	O-Ring, rotor sealing shaft end
19	2	Torque locking assembly, rotor
20	2	Cup seal, rotor retainer
22	2	Rotor retainer

Pos.	Qty.	Denomination
23	1	Key
24	1	Shaft, drive
25	1	Shaft, auxiliary
26	2	Bearing, rear
27	1	Spacer, shaft abutment
30	2	Nut, bearing front
31	2	Bearing, front
34	2	Nut, bearing front
36	2	Timing gear
38	2	Torque locking element
39	2	Clamp plate
40	12	Screw, clamp plate
45	2	Drainplug
46	1	Sight glass
47	1	Filler plug
48	2	Plug
49	4	Blanking plug
50	2	Gland guard
51	4	Screw, gland guard
52	4	Washer, gland guard screw
53	4	Washer, gland guard screw
54	4	Foot, vertical port
56	1	Foot, horizontal port
58	2	Bolt, Foot
50	1	Rotor removal tool

## 8.2 SX4 Pump Range

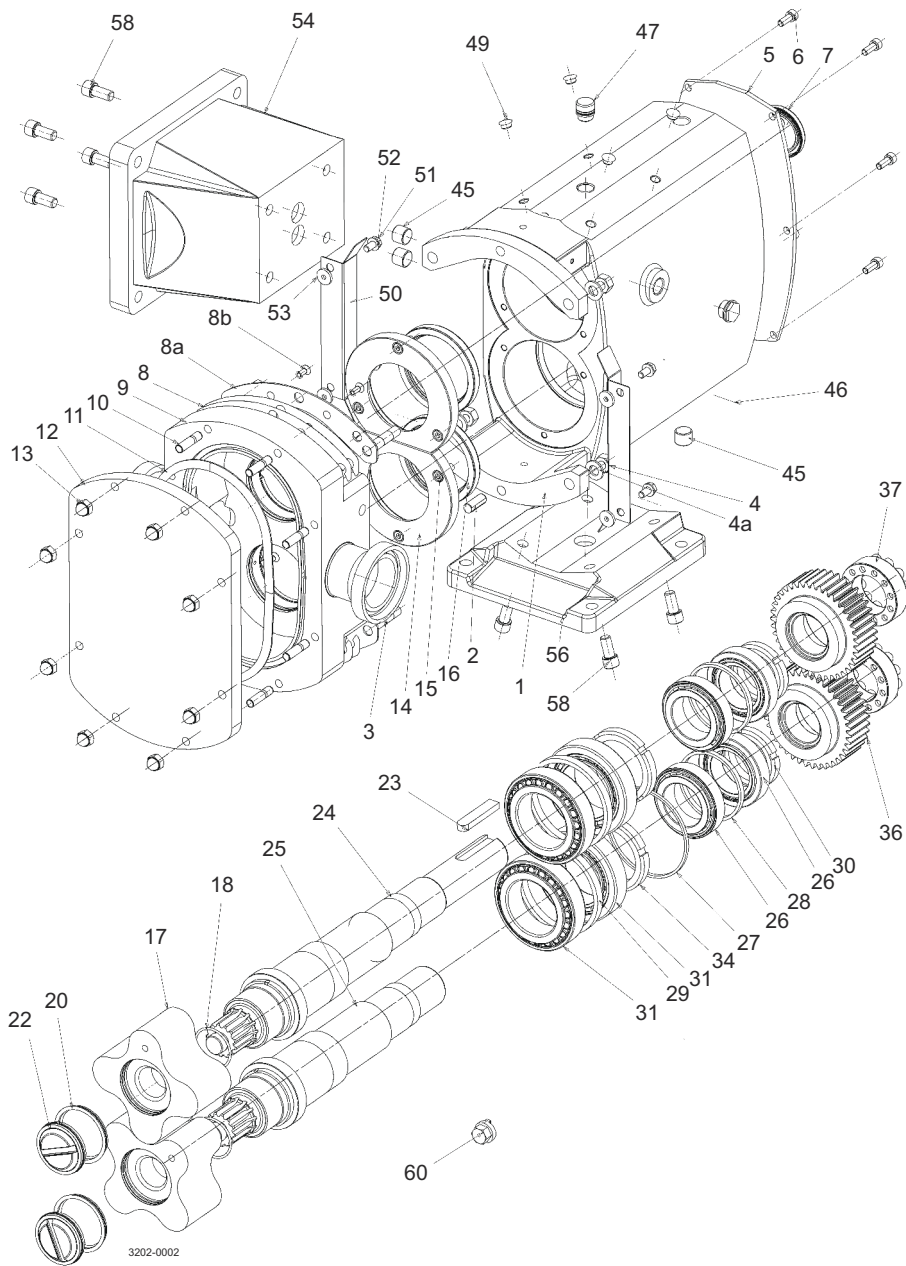


TD 242-121

Pos.	Qty.	Denomination
1	1	Gearcase
2	2	Dowel
3	4	Stud, rotorcase retention
4	4	Nut, rotorcase retention
4a	4	Washer, rotorcase retention
5	1	Cover, gearcase
6	6	Screw, gearcase cover
7	1	Lip seal, drive end
8	2	Shim
8a	2	Shim retainer
8b	4	Screw, shim retainer
9	1	Rotorcase
10	8	Stud, rotorcase/cover retention
11	1	Compression joint
12	1	Cover, rotorcase
13	8	Dome nut, rotorcase cover
14	2	Retainer, seal
15	6	Screw, seal retainer
16	2	Lip seal, gland end
17	2	Rotors
18	2	O-Ring, rotor sealing shaft end
19	2	Torque locking assembly, rotor
20	2	Cup seal, rotor retainer
22	2	Rotor retainer
23	1	Key

Pos.	Qty.	Denomination
24	1	Shaft, drive
25	1	Shaft, auxiliary
26	4	Bearing, rear
27	1	Spacer, shaft abutment
28	2	Spacer, bearing drive end
29	2	Spacer, bearing gland end
30	2	Nut, bearing
31	4	Bearing, front
34	2	Nut, bearing front
36	2	Timing gear
37	2	Torque locking assembly
45	2	Drainplug
46	1	Sight glass
47	1	Filler plug
48	2	Plug
49	4	Blanking plug
50	2	Gland guard
51	4	Screw, gland guard
52	4	Washer, gland guard screw
53	4	Washer, gland guard screw
54	1	Foot, vertical port
56	1	Foot, horizontal port
58	2	Bolt, Foot
60	1	Rotor removal tool

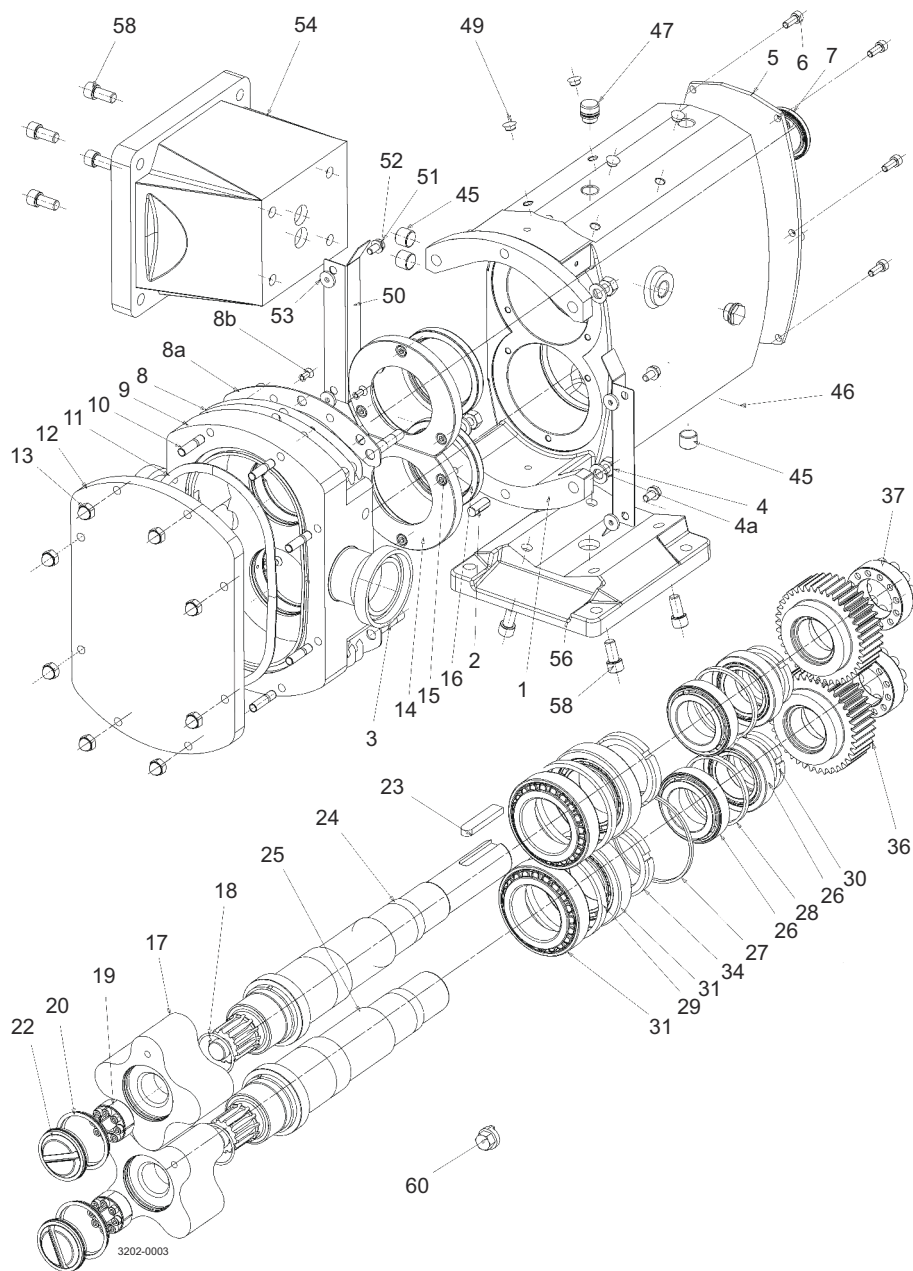
### 8.3 SX5 Pump Range



Pos.	Qty.	Denomination
1	1	Gearcase
2	2	Dowel
3	4	Stud, rotorcase retention
4	4	Nut, rotorcase retention
4a	4	Washer, rotorcase retention
5	1	Cover, gearcase
6	6	Screw, gearcase cover
7	1	Lip seal, drive end
8	2	Shim
8a	2	Shim retainer
8b	4	Screw, shim retainer
9	1	Rotorcase
10	6	Stud, rotorcase/cover retention
11	1	Compression joint
12	1	Cover, rotorcase
13	8	Dome nut, rotorcase cover
14	2	Retainer, seal
15	6	Screw, seal retainer
16	2	Lip seal, gland end
17	2	Rotors
18	2	O-ring, rotor sealing shaft end
20	2	Cup seal, rotor retainer
22	2	Rotor retainer
23	1	Key

Pos.	Qty.	Denomination
24	1	Shaft, drive
25	1	Shaft, auxiliary
26	4	Bearing, rear
27	1	Spacer, shaft abutment
28	2	Spacer, bearing drive end
29	2	Spacer, bearing gland end
30	2	Nut, bearing front
31	4	Bearing, front
34	2	Nut, bearing front
36	2	Timing gear
37	2	Torque locking assembly
45	7	Drain Plug
46	1	Sight glass
47	1	Filler plug
49	8	Blanking plug
50	2	Gland guard
51	4	Screw, gland guard
52	4	Washer, gland guard screw
53	4	Washer, gland guard screw
54	1	Foot, vertical port
56	1	Foot, horizontal port
58	4	Bolt, foot
60	1	Rotor removal tool

### 8.4 SX6-7 Pump Range



Pos.	Qty.	Denomination
1	1	Gearcase
2	2	Dowel
3	4	Stud, rotorcase retention
4	4	Nut, rotorcase retention
4a	4	Washer, rotorcase retention
5	1	Cover, gearcase
6	6	Screw, gearcase cover
7	1	Lip seal, drive end
8	2	Shim
8a	2	Shim Retainer
8b	4	Screw, shim retainer
9	1	Rotorcase
10	8	Stud, rotorcase/cover retention
11	1	Compression joint
12	1	Cover, rotorcase
13	8	Dome nut, rotorcase cover
14	2	Retainer, seal
15	6	Screw, seal retainer
16	2	Lip seal, gland end
17	2	Rotors
18	2	O-ring, rotor sealing shaft end
19	2	Torque locking assembly, rotor
20	2	Cup seal, rotor retainer
22	2	Rotor retainer

Pos.	Qty.	Denomination
23	1	Key
24	1	Shaft, drive
25	1	Shaft, auxiliary
26	4	Bearing, rear
27	1	Spacer, shaft abutment
28	2	Spacer, bearing drive end
29	2	Spacer, bearing gland end
30	2	Nut, bearing front
31	4	Bearing, front
34	2	Nut, bearing front
36	2	Timing gear
37	2	Torque locking assembly
45	7	Drain plug
46	1	Sight glass
47	1	Filler plug
49	8	Blanking plug
50	2	Gland guard
51	4	Screw, gland guard
52	4	Washer, gland guard screw
53	4	Washer, gland guard screw
54	1	Foot, vertical port
56	1	Foot, horizontal port
58	4	Bolt, foot
60	1	Rotor removal tool