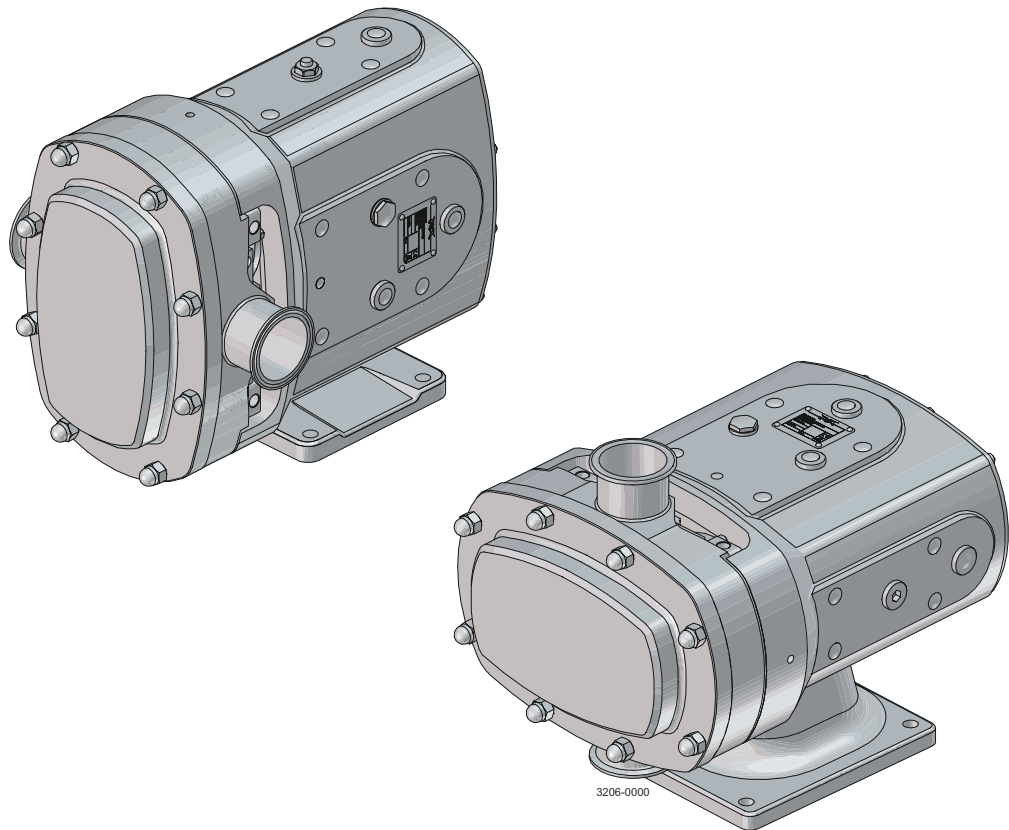


# Alfa Laval DuraCirc® Range

Circumferential Piston Pump

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Instruction Manual

**Published by**  
Alfa Laval Kolding A/S  
Albuen 31  
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**The original instructions are in English**

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# 1 Declarations of Conformity

## 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

DuraCirc 32;33;34;42;43;52;53;54;62;63;72;73;74

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.

Global Product Quality Manager

Title

Lars Kruse Andersen

Name

Kolding, Denmark

Place

2022-10-01

Date (YYYY-MM-DD)



Signature

This Declaration of Conformity replaces Declaration of Conformity dated 2021-03-31



**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

DuraCirc 32;33;34;42;43;52;53;54;62;63;72;73;74

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

Global Product Quality Manager

Title

Lars Kruse Andersen

Name

Kolding, Denmark

Place

2022-10-01

Date (YYYY-MM-DD)



Signature

DoC Revision\_02\_102022



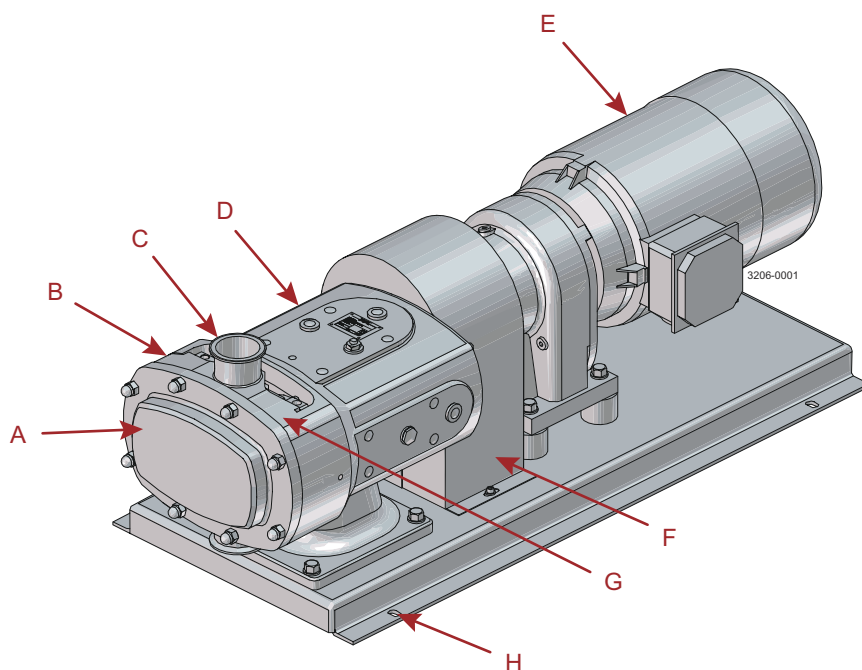
## 2 General information

### 2.1 General information

The DuraCirc pump supplied is a positive displacement circumferential piston pump, which may be supplied with or without a drive unit. The drawing shown indicates main components of the pump unit.

The DuraCirc 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.

#### Drawing shows only mounted unit



- A Rotorcase cover
- B Rotorcase
- C Ports
- D Gearbox
- E Drive unit
- F Coupling guard (encloses coupling)
- G Product seal area (inside rotorcase)
- H Baseplate fixing holes

#### 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 80dB[A]. It is recommended that the noise level is measured during commissioning, running on normal operating conditions and appropriate personal protective equipment used where necessary.

**Vibration Limits**

Bare shaft pump units have been tested and found to be within the limits published under ISO 10816-7 Category 2 under normal operation conditions. Actual vibration of mounted units can be affected by numerous external factors such as mounting method, foundation, alignment, speed and duty point. As such, we recommend the maximum operating limit of 8.5 mm/s RMS with a trip limit of 10.6 mm/s RMS as per ISO 10816-7 Cat. 2 is observed in any monitoring equipment if used.

---

## 3 Safety

### 3.1 Important information

**Always read the manual before using the pump!**

#### **WARNING**

Indicates that special procedures must be followed to avoid serious personal injury.

#### **CAUTION**

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

#### **NOTE**

Indicates important information to simplify or clarify procedures.

---

This instruction manual is designed to provide the user with the information to perform tasks safely for all phases in the life time of the product supplied.

The user shall always read the safety section first. Hereafter the user can skip to the relevant section for the task to be carried out or for the information needed.

This is the complete manual for the supplied product.

#### **Skills for personal:**

##### **Operators:**

The operators shall read and understand the instruction manual for the supplied product

##### **Maintenance personnel:**

The maintenance personnel shall read and understand the instruction manual.

The maintenance personnel or technicians shall be skilled within the field required to carry out the maintenance work.

##### **Trainees:**

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

##### **People in general:**

The public shall not have access to the supplied product.

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#### **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.

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## 3.2 Warning signs



General warning



Dangerous electrical voltage



Caustic agents



Hot Surfaces

### 3.3 Safety precautions

#### Installation:

**Always** read the technical data thoroughly. (See Section 6 Technical data)

**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 parts.



**Always** have the drive electrically connected by authorized personnel. (see the motor instructions supplied with the drive unit.)

**Alfa Laval recommends the supply disconnecting device shall be in accordance with EN60204-1.**



#### Operation:

**Always** read the technical data thoroughly. (See Section 6 Technical data)

**Never** stand on the pump or pipelines.

**Never** run the pump with either or both suction side and pressure side blocked.

**Never** put your hands or fingers inside the port connections or anywhere close to rotating parts.

**Never** run the pump unless fully assembled, i.e. pump head must not be removed from gearcase.

**Always** ensure any guards are securely in place and in good condition.



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

In certain operating conditions the external surface of the pump and/or ancillary equipment may exceed 80°C / 176° F. As such users should avoid touching the pump and/or ancillary equipment during operation taking precautions if it is unavoidable to do so.



**Always** handle toxic and acidic liquids in accordance with the manufacturer's instructions and recommendations.



#### Maintenance:

**Always** read the technical data thoroughly. (See Section 6 Technical data)

**Never** service the pump when it is hot.

**Always** ensure the pump and pipelines are de-pressurised when the pump is serviced.

**Never** put your hands or fingers inside the port connections or anywhere close to rotating parts.

**Always** ensure the power supply is disconnected (in an off position) and is locked out to prevent accidental operation.



Please refer to drive and coupling operating manuals supplied with the unit for maintenance instructions.

**Always** ensure pump and ancillary equipment has been allowed to cool before touching



**Transportation:**

Transportation of the pump or the pump unit:

**Never** lift or elevate in any way other than described in this manual

**Always** drain the pump head and accessories of any liquid

**Always** ensure that no leakage of lubricants can occur

**Always** transport the pump in its upright position

**Always** ensure that the unit is securely fixed during transportation

**Always** use original packaging or similar during transportation

**Always** use suitable transport device i.e. forklift truck or pallet lifter

---



## 4 Installation

### 4.1 Unpacking, handling and storage

**Always** ensure any personnel undertaking lifting operations have the suitable experience and training to do so safely.

**Ensure** any lifting equipment used is in good condition and has been suitably tested, using lifting lugs when applied.

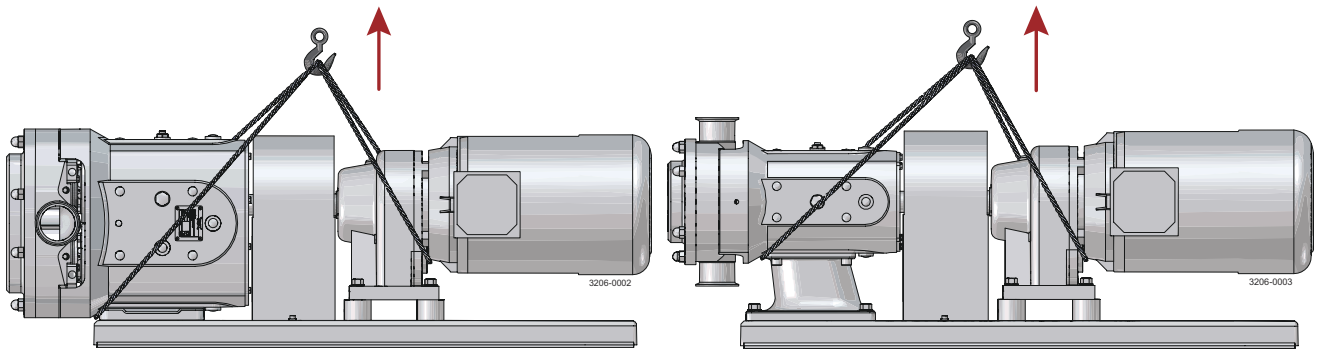
**Ensure** any lifting equipment used is rated for and used within the load limits. Refer to the pump weights guide.

**Always** ensure that the lifting points are in line with the centre of gravity and adjust lifting point if necessary.

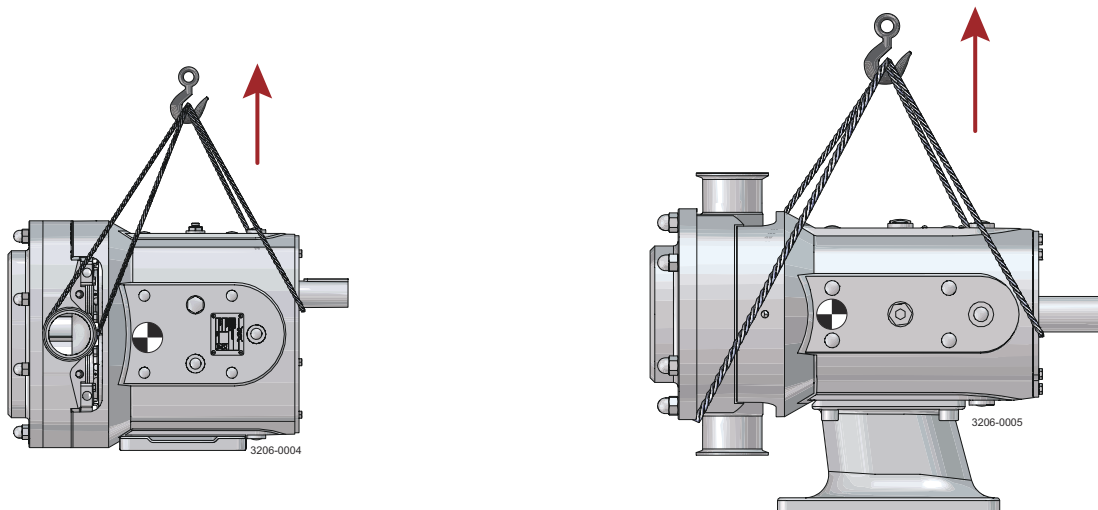
**Always** keep an eye on the load and stay clear during the lifting operation.

The diagrams below show examples of how the equipment should be lifted, however the user is to ensure this can be done safely with the equipment at hand:

Pump with drive unit



Bareshaft pump (typical location of centre of gravity shown)



On receipt always:

- Check the delivery note against the goods received.
- If motorised, check that the drive instructions are available.
- Be careful not to discard any manuals that may be enclosed with the packaging.
- 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 immediately to the carrier.

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

- Plastic or gasket type port covers should be left in place.
- A clean, dry storage location free from vibration and without direct sunlight or UV light should be selected.
- Temperature range of between -5 to +40°C
- Relative humidity <60%
- If a moist or dusty atmosphere is used for storage, further protect the pump or unit with a suitable cover.
- No exposure to corrosive substances, including those contained in the air.
- Rotate the pump/pump unit by hand weekly, to prevent bearing damage.
- All associated ancillary equipment should be treated similarly.

## 4.2 Recycling information

### Unpacking

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

### Maintenance

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

### End of life

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

## 4.3 System design, installation and operation

When designing, installing and operating pipework systems where pumps are used, especially where the pumped media is viscous, there are general recommendations and good engineering practices that should be employed to ensure long term, reliable pump and system operation.

### 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 and/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 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.
- Allow at least 1 m for pump access/maintenance all around the pump.

To reduce the risk of damage caused by sudden changes in temperature (thermal shock) ensure any temperature changes are done gradually and equipment temperature is allowed to stabilise before operation.

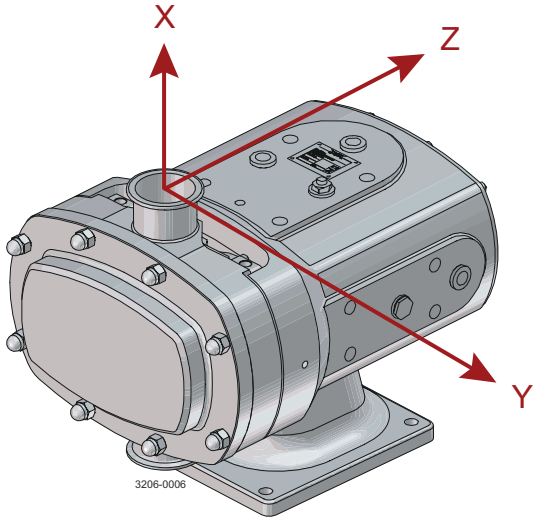
### Pipework:

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.

**Table of Maximum Forces and Moments**



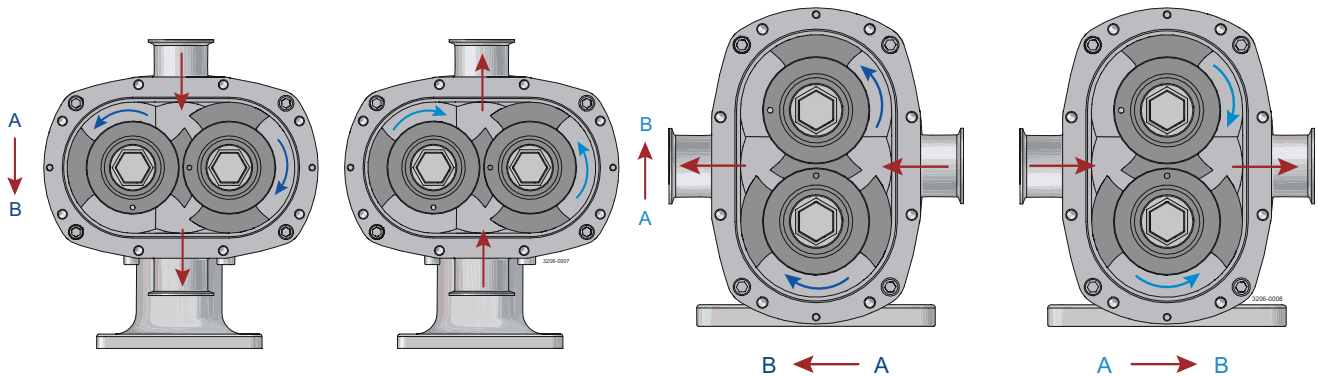
| Port  |      | Forces |               |           | Moments |               |           |
|-------|------|--------|---------------|-----------|---------|---------------|-----------|
| Size  |      | Units  | F (x, y or z) | F (total) | Units   | M (x, y or z) | M (total) |
| 25mm  | 1"   | N      | 190           | 270       | Nm      | 85            | 125       |
|       |      | lbf    | 43            | 61        | lbf.ft  | 63            | 92        |
| 40mm  | 1.5" | N      | 255           | 360       | Nm      | 115           | 170       |
|       |      | lbf    | 57            | 81        | lbf.ft  | 85            | 125       |
| 50mm  | 2"   | N      | 295           | 420       | Nm      | 145           | 210       |
|       |      | lbf    | 66            | 94        | lbf.ft  | 107           | 155       |
| 65mm  | 2.5" | N      | 360           | 510       | Nm      | 180           | 263       |
|       |      | lbf    | 81            | 115       | lbf.ft  | 133           | 194       |
| 80mm  | 3"   | N      | 425           | 600       | Nm      | 215           | 315       |
|       |      | lbf    | 96            | 135       | lbf.ft  | 159           | 232       |
| 100mm | 4"   | N      | 505           | 720       | Nm      | 260           | 385       |
|       |      | lbf    | 114           | 162       | lbf.ft  | 192           | 284       |
| 150mm | 5"   | N      | 720           | 1020      | Nm      | 385           | 365       |
|       |      | lbf    | 162           | 229       | lbf.ft  | 284           | 417       |

**NOTE**

At no time shall the values of  $F_x$ ,  $F_y$  and  $F_z$  or  $M_x$ ,  $M_y$  and  $M_z$  be the maximum values

**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.



A Suction  
B Discharge

A Suction  
B Discharge

**Pump Lubrication:**

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

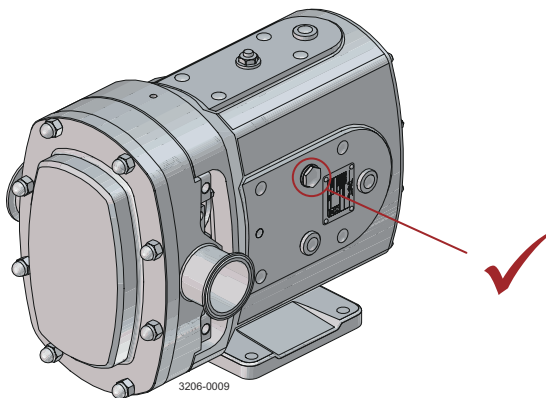
Oil level must be checked with the pump static using the oil sight glass fitted to the side of the gearbox.

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

Oil filling: Fill with oil through the filler plug to the mid level of 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 Section 6 Technical data for oil quantities required.



**Recommended Oils:**

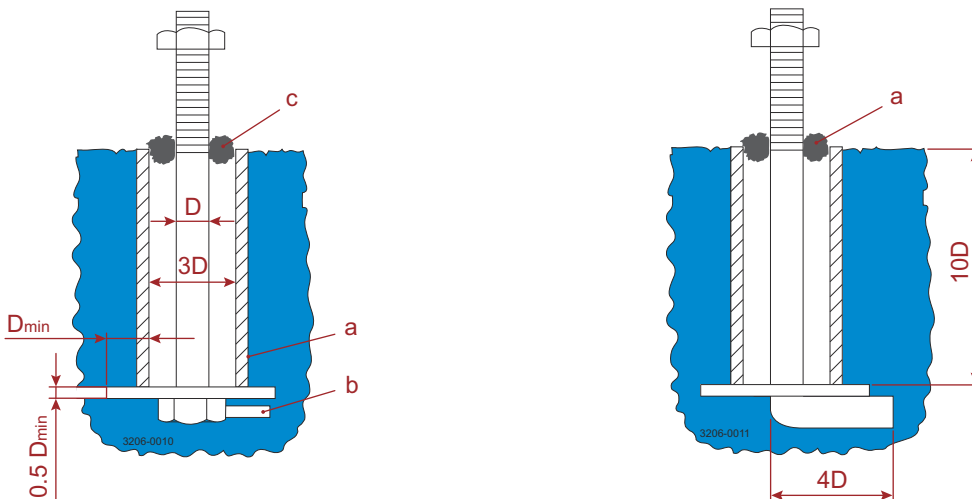
|   |
|---|
| <b>Food Grade Oil (NSF H-1)</b><br><b>-20°C to +150°C (-4°F to 302°F)</b> |
| Mobil SHC Cibus 150   |
| Bel-Ray No-Tox HD 150 #62686  |
| Castrol Optileb GT 150  |
| Klüber Klüberoil 4 UH1-150 N  |
| Fusch Cassida GL / GLE 150  |
| Mobil Glygole 150 (US/CAN)  |

All oils are poly-alpha-olefin based please check compatibility before mixing with other base oils.

**Baseplate Foundations**

Pumps when supplied with a drive unit are normally mounted on a baseplate. Alfa Laval standard positive displacement pump 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.

Ensure the floor is able to support the weight of the pump unit.



a Sleeve

b Lug welded to bolt head

c Waste put around bolt before pouring concrete

a Foundation surface left through to anchor ground

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 wastepaper 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.

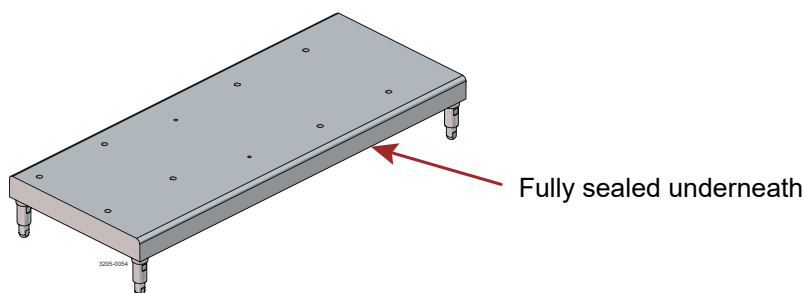
When used:

**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.



### 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 (Fenner HRC Type).

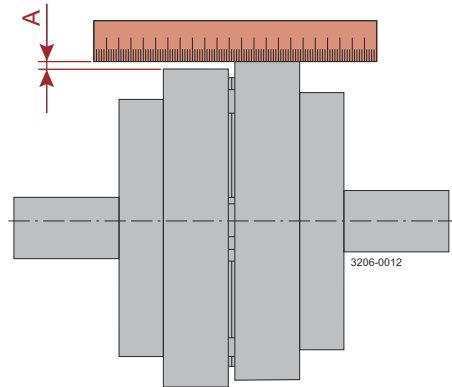
Recommended bolt torques for pump and motor mounting.

| Thread Diameter | M6  | M8   | M10  | M12  | M16  | M20   | M24   |
|-----------------|-----|------|------|------|------|-------|-------|
| Torque (Nm)     | 6   | 15   | 30   | 50   | 120  | 150   | 200   |
| Torque (ft lbf) | 4.4 | 11.0 | 22.1 | 36.8 | 88.5 | 110.6 | 147.5 |

### Parallel Misalignment

Measure 4 positions at 90° around coupling

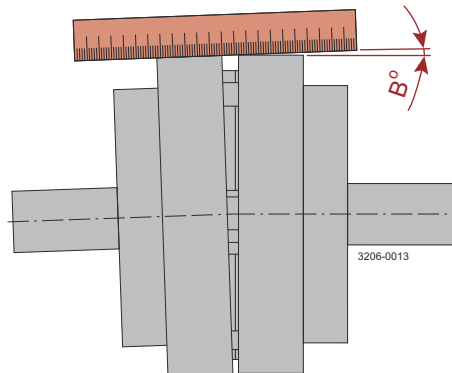
| Coupling size | Dimension A Maximum |
|---------------|---------------------|
| 70            | 0.3 mm              |
| 90            | 0.3 mm              |
| 110           | 0.3 mm              |
| 130           | 0.4 mm              |
| 150           | 0.4 mm              |
| 180           | 0.4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



### Angular Misalignment

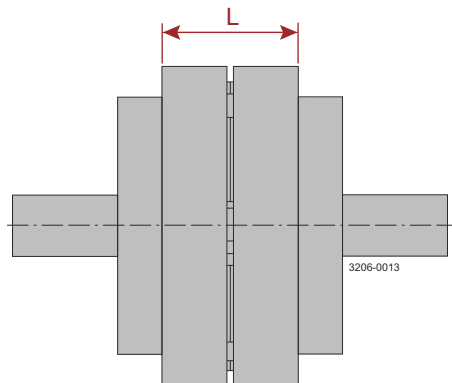
Measure 4 positions at 90° around coupling

| Coupling size | Dimension A Maximum |
|---------------|---------------------|
| 70            | 1°                  |
| 90            | 1°                  |
| 110           | 1°                  |
| 130           | 1°                  |
| 150           | 1°                  |
| 180           | 1°                  |
| 230           | 1°                  |
| 280           | 1°                  |



### Assembled length

| Coupling size | Dimension A Maximum |
|---------------|---------------------|
| 70            | 25                  |
| 90            | 30.5                |
| 110           | 45                  |
| 130           | 53                  |
| 150           | 60                  |
| 180           | 75                  |
| 230           | 85.5                |
| 280           | 105.5               |



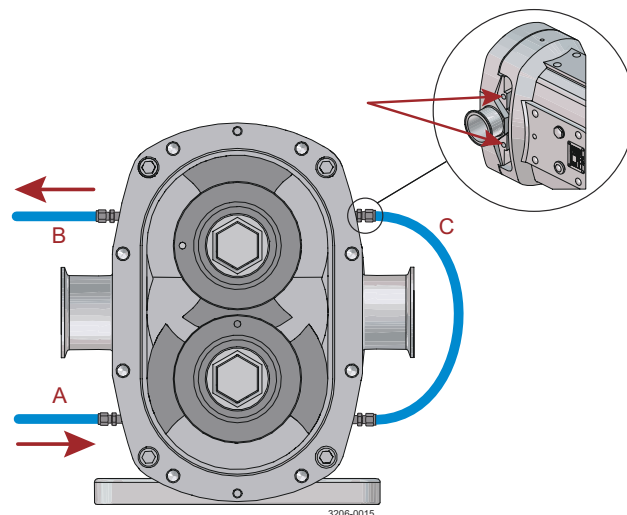


## 4.4 Flushing seal arrangement and pre-start up checks

1 A flushed seal arrangement may be fitted in order to cool, heat or clean the seal area (dependant on application). It is important that:

- The flush is correctly connected (see diagram).
- A compatible flushing fluid is used and supplied at the correct pressure and flow rate (see Flush Pressure and Flow Rates section below)
- 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.

A Flush inlet  
B Flush outlet  
C Link pipe



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.

Flush Connection Size (Femail)

| Model    | Size<br>BSP(G) / NPT w/Adapter |
|----------|--------------------------------|
| 32/33/34 | 1/8"                           |
| 42/43    | 1/8"                           |
| 52/53/54 | 1/4"                           |
| 62/63    | 1/4"                           |
| 72/73/74 | 1/4"                           |

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

**4 Flush Pressure & Flow Limits:**

Single Mechanical Flushed - 0.5 bar max

Double Seal (SiC/Carbon) - 1 bar above pump discharge upto 16 bar max

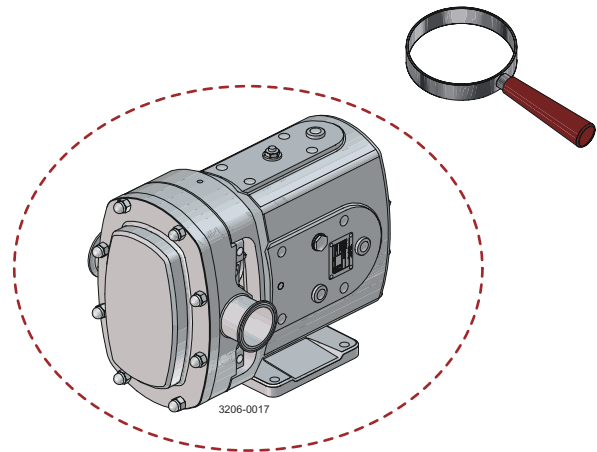
Double Seal (SiC/SiC) - 1 bar above pump discharge upto 20 bar max

O-Ring Seal Flushed - 0.5 bar max

Flush Media Flow (all seal types) - 30 l/h per seal minimum

**5 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.



## 5 Maintenance

### 5.1 Cleaning in place (CIP)

The DuraCirc pump range 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 1.5m/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 to ensure any temperature changes have a differential of less than 50°C (90°F) and that the pump is left stationary for a minimum of 15 minutes between sudden changes in process media temperatures before start up to allow for temperature of the components to stabilise.

---

### WARNINGS

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



A suitable by-pass is recommended.

**Always** handle cleaning agents with great care and follow instructions in the safety datasheets.



**Always** rinse well with clean water after using a cleaning agent.



**Always** use rubber gloves and protective goggles when handling caustic cleaning agents.



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



## Non-Galling Alloy (ASTM A-494) Compatibility

ASTM A-494 is the standard rotor material for DuraCirc pumps. This alloy was developed specifically for corrosion resistance and close operating clearance requirements of high performance rotary positive displacement pumps. ASTM A-494 is a nickel based, corrosion-resistant, non-galling or seizing material. The ASTM designation is A-494 Grade CY5SnBiM (UNS N26055), and the material is listed in the 3-A Sanitary Standards as acceptable for product contact surfaces.

The above properties make ASTM A-494 the ideal material for the DuraCirc pump range. This rotor material permits close operating clearances in the liquid end which provides improved pump efficiency and reduced shear damage as well as being non-galling in the event of contact with the body or cover during operation.

The corrosion resistance of ASTM A-494 is approximately equal to AISI 300 Series Stainless Steel. However, ASTM A-494 has limited resistance to certain aggressive chemicals that may be commonly used in contact with AISI 300 Series Stainless Steel.

Nitric Acid is commonly used to passivate new installation of stainless steel equipment however is not chemically compatible with the ASTM A-494 material used for the rotors. Therefore, when passivating with Nitric acid, special considerations should be made:

- If possible, the pump should be removed from the system during the passivation process and passivated separately by hand.
- If removal of the pump is not possible ensure the passivation media is circulated by a separate pump unit.
- Ensure the passivation media is used as per the manufacturers instructions (dilution, temperature and time) and not left in contact with the pump for extended periods of time.
- Ensure the pump is fully flushed after passivation with clean water to ensure no residue remains.

If you have any questions regarding other aggressive chemicals, please contact Alfa Laval for assistance.

## 5.2 Maintenance schedule

It is advisable to install pressure gauges on both sides of the pump the DuraCirc pump range.

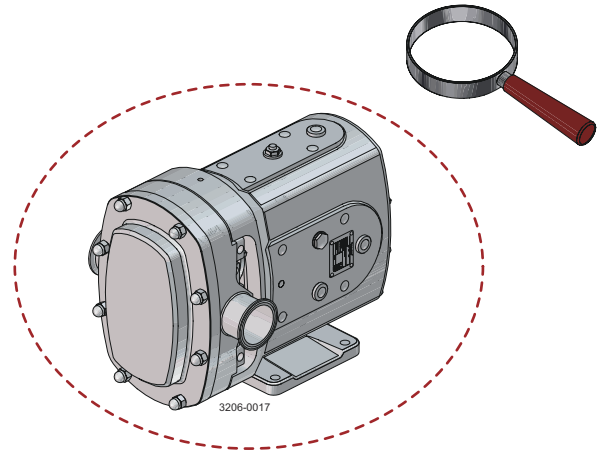
### Maintenance schedule

#### NOTE

Below checks to be carried out when the pump is not operational, and any electrical supply has been safely disconnected and locked so accidental operation cannot occur. In certain operational circumstances the pump will pose a thermal hazard and as such should not be touched until allowed to reach safe temperature before undertaking checks.

#### Periodic Checks:

- Check seals for leakage.
- Check the lip seals for leakage.
- Check pumping pressures are within expected duty.
- Check oil level in the gearcase with pump stationary.



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.

If any problems are observed further investigation should be carried out and problems rectified before re-starting.

#### Annual Checks (in addition to the above):

- Remove the rotors and check for signs of damage, condition of splines and for signs of stress cracking in the wing / hub radius.
- Check wet end clearances are within specifications.

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 |
|------------------------------|----------|
| Complete Service Kit         | 1        |
| • Full wet end elastomer kit |          |
| • Mechanical seal kit        |          |

### **Rotor Nut P-Ring Elastomer Replacement Interval**

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

### **Rotor Nut P-Ring Elastomer Inspection**

Periodically inspect the rotor nut elastomer seal for any discoloration, nicks, or cracks. If any of the defects above are noticed, the elastomer seal must be replaced following the procedure below for 3A compliance:

#### Cleaning Procedure for Soiled Rotor Nut Tapped Hole (3A)

1. Remove rotor nut from the shaft.
2. Submerge and soak nut for 5 minutes in COP tank with 2% caustic wash.
3. Scrub the hole with internal thread vigorously by plunging a clean sanitary bristle pipe brush in and out of the hole for two minutes while submerged.
4. Soak nut 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 thru 6 above until swab test is passed. Should swab testing continue to fail, or time is of the essence, install a new rotor nut.

## 5.3 Dismantling

Before dismantling the pump refer to safety precautions in Section 3.

Refer to the exploded diagram and parts list in Section 7.

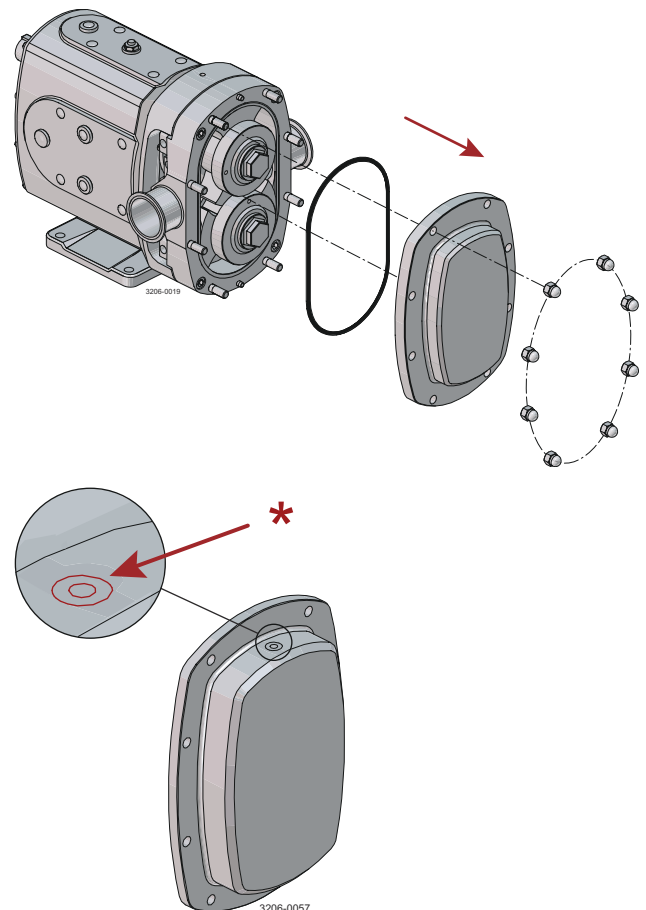
**NOTE:** It is recommended to mark the positions of the rotors and rotorcase (e.g. Top/Bottom or Left/Right) prior to removal to ensure parts are refitted in the same position.

### 1 Removing rotorcase cover

1. Remove rotorcase cover nuts (8) and cover (1).
2. Remove front cover P-ring (5).

#### **NOTE**

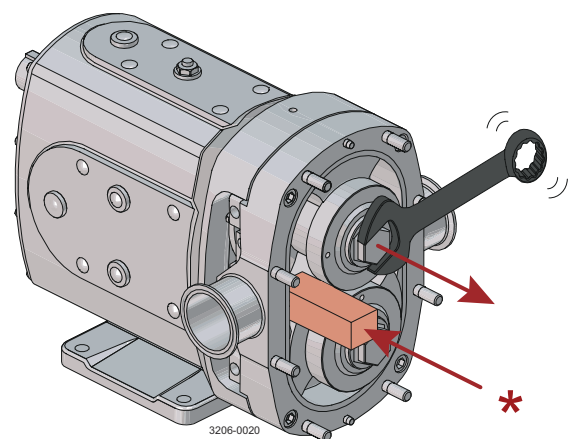
\*) Pump models 62 to 74 are supplied with a M6 tapped hole in the front cover for use with a lifting eye (not supplied) to aid lifting

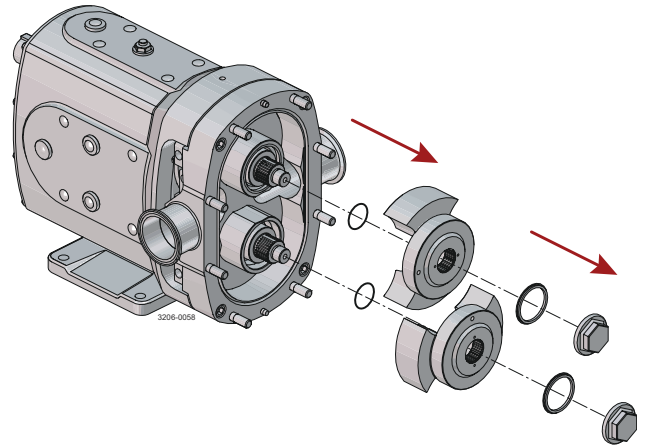


### 2 Removing rotors

1. Insert a plastic (nylon) block between the two rotors (3) to stop them turning.
2. Remove rotor retention nuts (4).
3. Remove rotors (3)
  - Orientate rotors to be perpendicular to each other (one rotor at 12/6 o'clock, one rotor at 3/9 o'clock) then remove the rotor with both wings exposed first.
4. Remove the rotor nut P-rings (6) and rotor shaft O-rings (7).

\* Plastic block

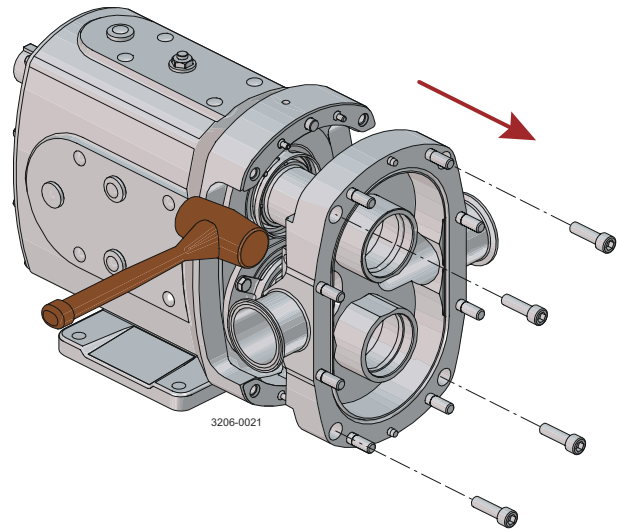




3

1. Remove rotorcase retaining screws (11).
2. Remove rotorcase (2) tapping both sides with a soft mallet if required.
3. If Double Mechanical seals are fitted remove from the shaft.

**Note:** Shim retainer (13) and Shims (12) should not be removed unless rotor clearances require resetting.

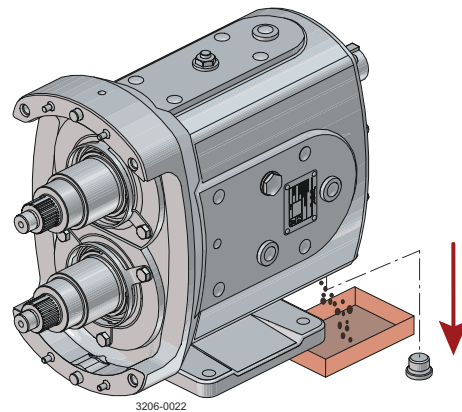


4

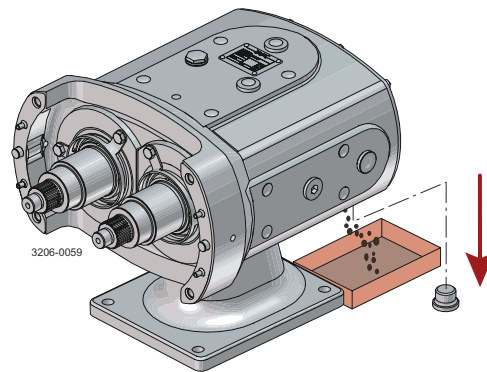
#### Draining pump lubrication

1. Place a tray under the gearcase to collect the waste lubricating oil.
2. Remove the lower drain plug (46) at the bottom of the gearcase (31).

**Note:** Used oil should be disposed of appropriately as per local regulations.

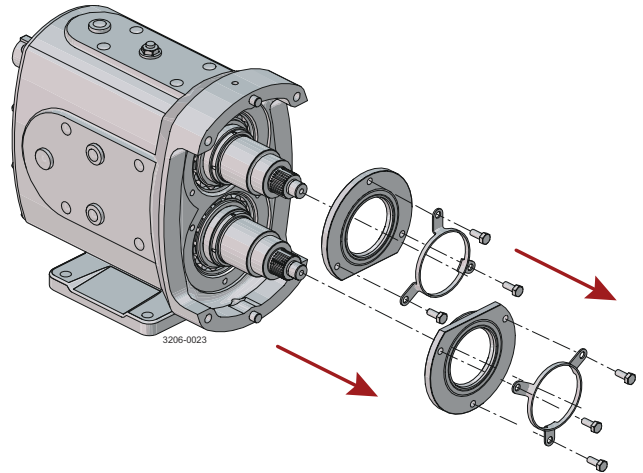






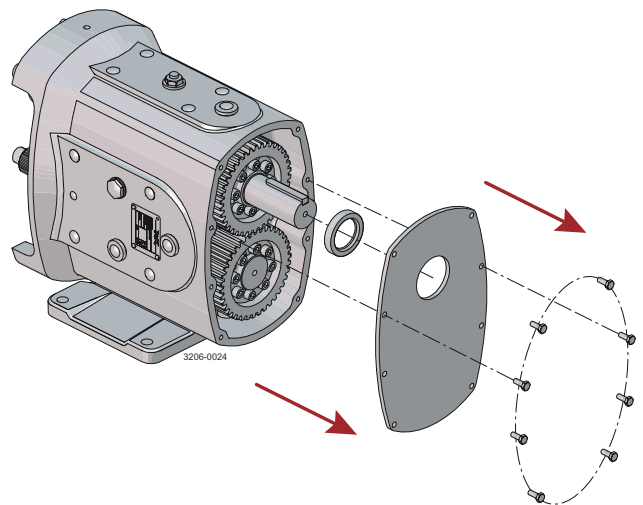
## 5 Removing gland guards seal retainers

1. Remove screws (40).
2. Then remove gland guards (22) and seal retainers (34).
3. Remove the lip seals (36) and seal retainer o-rings (37) from the seal retainers and dispose. It is essential to renew the lip seal and o-ring prior to reassembly.



## 6 Removing Gearcase Cover

1. Remove drive key (65) and then remove rear cover screws (42).
2. Tap the center of the cover to help break the gasket seal then remove the gearcase cover (35).
3. Remove the lip seal (38) from the cover and dispose. It is essential to renew the lip seal prior to reassembly.

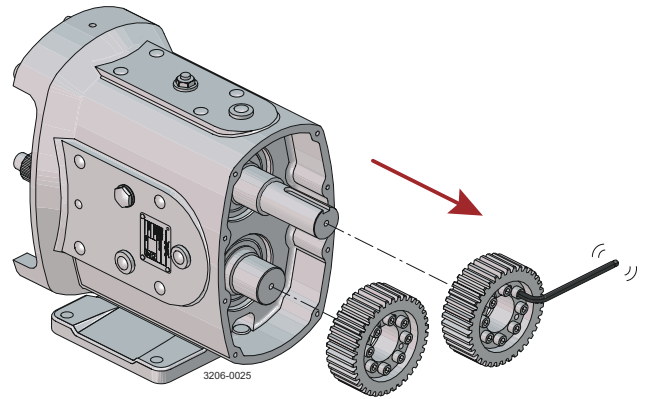


## 7 Removing timing gears

1. Lock the timing gear in position by placing a small soft rod between the gear teeth.
2. Loosen the torque lock assembly screws (39) but do not remove fully.
3. Remove gears (36) and torque lock assembly from the shafts (51 and 52)

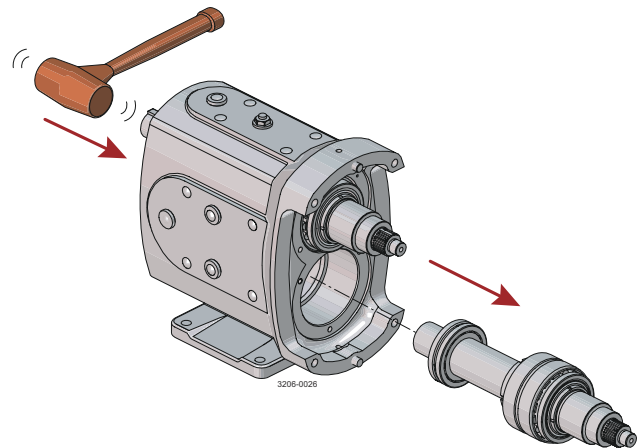
### NOTE

If the torque locking assembly is difficult to loosen from the shafts then three screws can be removed completely and inserted in the exposed threaded holes, tightening gradually in a radial pattern to remove.



## 8 Shaft assembly removal

1. Using a soft mallet gently tap the rear end of each shaft (51 and 52) and remove through the front of the gearcase (31).
2. Support each shaft during removal from the gearcase.
3. Remove the shaft shims (53) fitted in to the bore marked by a dimple when viewed from the front.
4. Pump size 32 to 43 only: Remove the rear circlip (60) and outer rear bearing (58) race from the rear bearing bores.



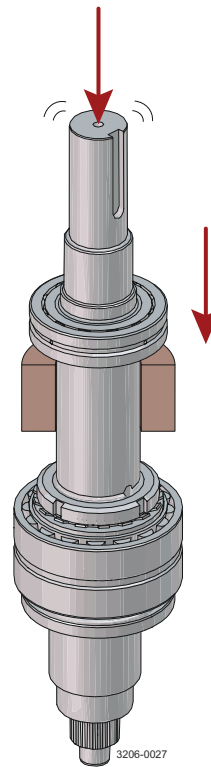
## 9 Bearing removal

### NOTE

Removal of the bearings requires the use of a press. Ensure any tooling used is adequately rated for the job and in good working condition, appropriate personal protection equipment (PPE) is worn and the user is competent at using the tools safely.

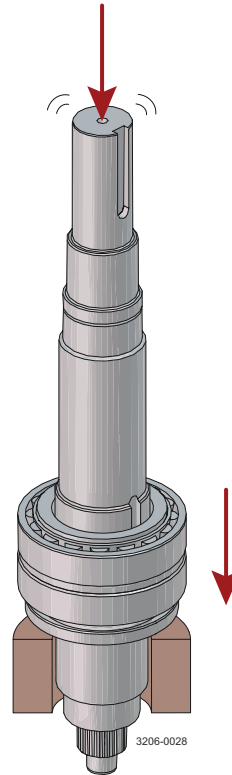
**10** Rear Bearing Removal

1. Remove the shaft circlip (59) from the shaft (51 and 52)
2. Mount the shafts vertically in a press with a tool positively located against the rear bearing inner race (58) as shown and apply pressure to the top of the shaft so that the shaft moves through the bearing. Ensure the shaft is supported and is not allowed to drop once bearing is removed.



**11** Front Bearing Removal

1. Remove the shafts from the press and hold in a vice using soft jaws to protect the areas where the lip seals will be located.
2. Bend the tab on the tabbed lock washer (56) up and remove the bearing nuts (57) using a 'C' spanner and tapping with a mallet.
3. Mount the shaft vertically in a press with a tool positively located against the front bearing inner race (54) as shown and apply pressure to the top of the shaft so that the shaft moves through the bearing and spacer pack.
4. Once the first bearing is free remove from the shaft together with the spacer (55) and the outer race of the second bearing (54).
5. Continue to apply pressure to the top of the shaft so that the inner race of the second bearing is free and remove. Good engineering practice suggests that if bearings are removed from the shafts for any reason they should be renewed.
6. Clean and examine all components for wear or damage. Renew where necessary.



## 5.4 Assembly

**NOTE:** Ensure all screws and nuts are torqued to the values stated in Section 6.

### 1 Fitting bearings to shafts

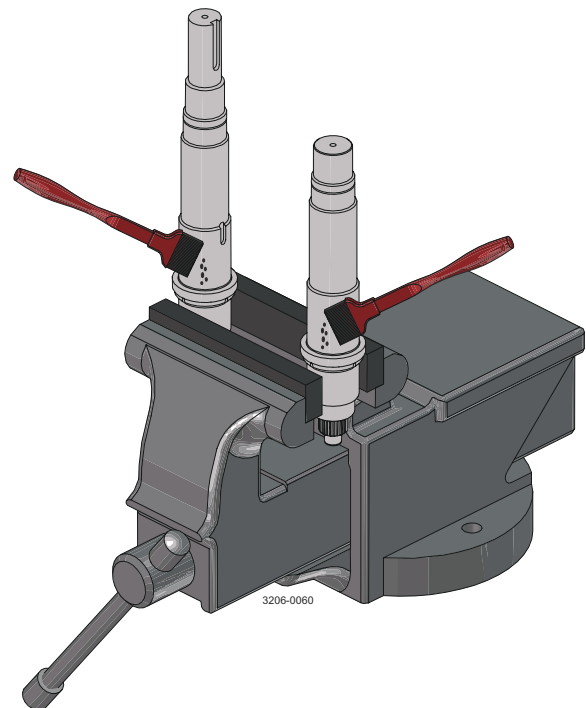
Take care not to damage shaft surfaces, in particular where the lip seals will be located.

On DuraCirc 32 to 43 models, bearings do not require heating. For DuraCirc 52 to 74 models, heat the bearing inner cones to 115°C (239°F).

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

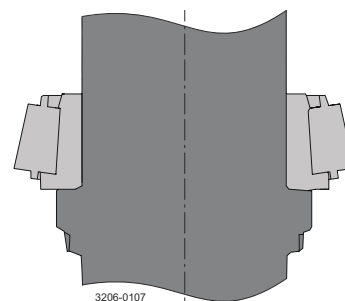
### 2 Front Bearings

Position shafts (51 and 52) vertically in a vice using soft jaws and apply anti-seize compound to the bearing diameters.

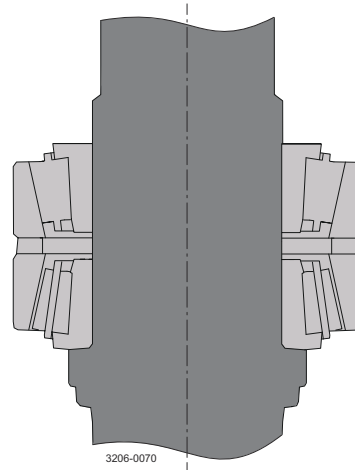


### 3 DuraCirc models 52 to 74 only: Heat the first inner bearing cone (54) using a bearing heater to 115°C / 239°F

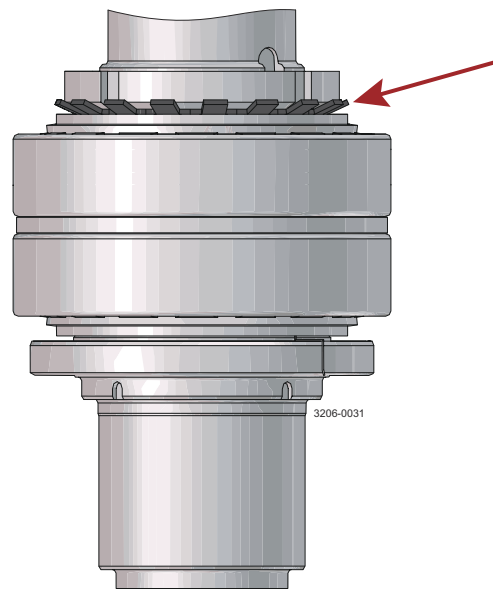
Place the inner cone of the bearing (54) on the shaft as shown ensuring a positive fit against the shaft shoulder using a press and appropriate tool if required.



- 4 Fit the first bearing outer cup, bearing spacer (55) and rear bearing outer cup on the shaft as shown. Fit the second inner bearing cone to the shaft as per Step 2 above.



- 5
1. DuraCirc models 52 to 74 only: Allow bearings to cool to ambient temperature. Failure to do so will result in incorrectly set bearings.
  2. Fit the tabbed lock washer (56) on the shaft with the tabs angled away from the bearing.
  3. Locate and tighten the bearing nut (57), whilst at the same time rotating the bearings (54) and spacer (55). The bearings are correctly adjusted when the spacer can only be moved with a light tap of a mallet.
  4. Once in place bend one of the tabs of the tabbed lock washer (56) in to the nearest cut out on the bearing nut (57). If no tab is aligned with the cut out on the bearing nut tighten the bearing nut slightly until aligned with a tab.



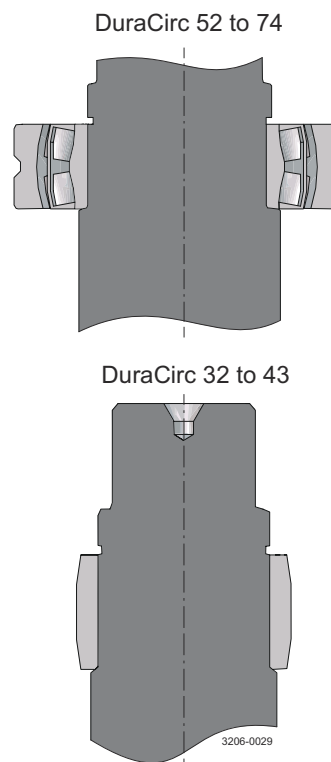
## 6 Rear Bearings

Position shaft (51 and 52) vertically in a vice using soft jaws and apply anti-seize compound to the bearing diameters.

7

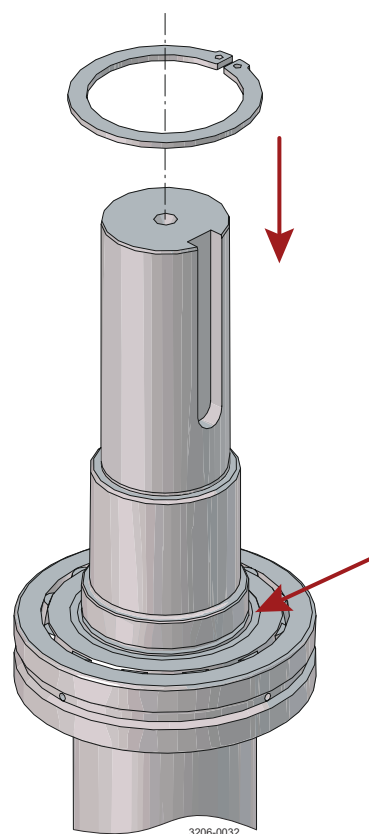
DuraCirc models 52 to 74 only: Heat the rear bearing (58) using a bearing heater to 115°C / 239°F

Place the bearing (58) (Inner race part only on the DuraCirc models 32 to 43) on the shaft as shown ensuring a positive fit against the shaft shoulder using a press and appropriate tool if required.



8

Fit the bearing shaft retaining circlip (59) in the groove on the shaft.



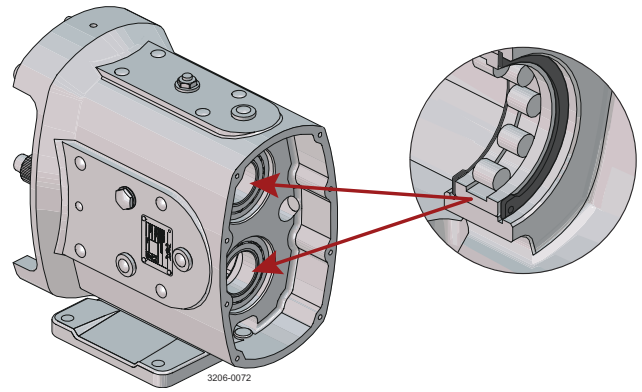
9

Apply small amount of recommended gearbox oil to the bearings.

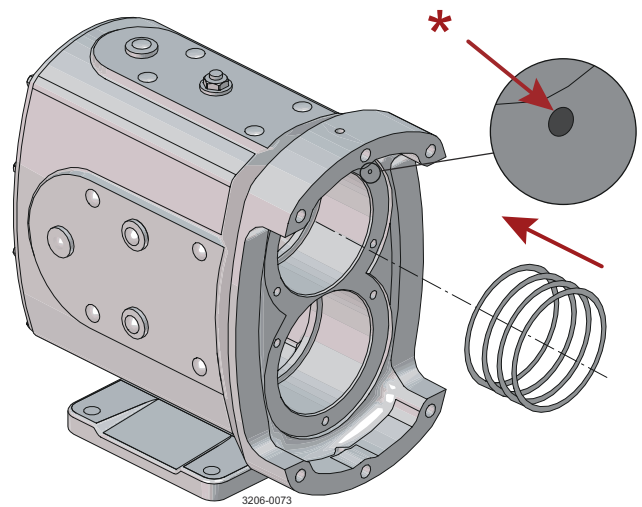
**10** Fitting Shaft Assemblies.

DuraCirc models 32 to 43 only:

1. Lightly oil the rear bearing bores of the gearcase (31) with gearbox oil.
2. Fit first bearing circlip (60) in the inner most groove in the rear bearing bore of the gearcase (31).
3. Locate the outer race of the rear bearing (58) in the rear bearing bore.
4. Fit second bearing circlip (60) in the outer most groove in the rear bearing bore.



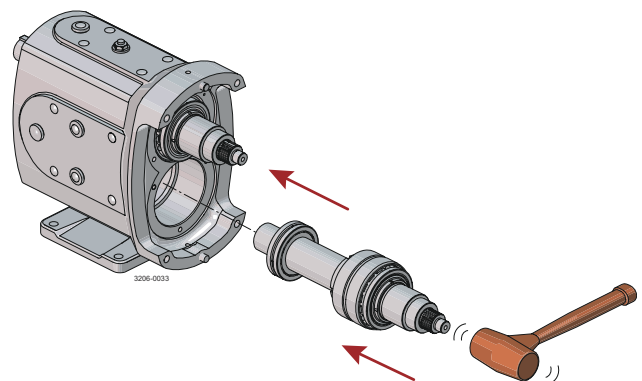
**11** Replace the shaft shims (53) in to the bore marked with a dimple (as viewed from the front of the gearcase).



**12** Identify the drive (51) and auxiliary (52) shaft positions according to the gearcase cover (5) orientation or original pump specification.

1. Lightly oil the bearing bores of the gearcase (31) with gearbox oil.
2. Using a soft faced mallet tap the shafts (51 and 52) into the gearcase (31).

NOTE: For Duracirc 52 to 74 pump models ensure the outer race of the rear bearing (58) is kept perpendicular to the rear bearing bore to avoid hold up on the bore. Only light tapping with a soft mallet should be used and only if required. If the shaft does not easily slide into the bore check bearing alignment and front bearing tension.



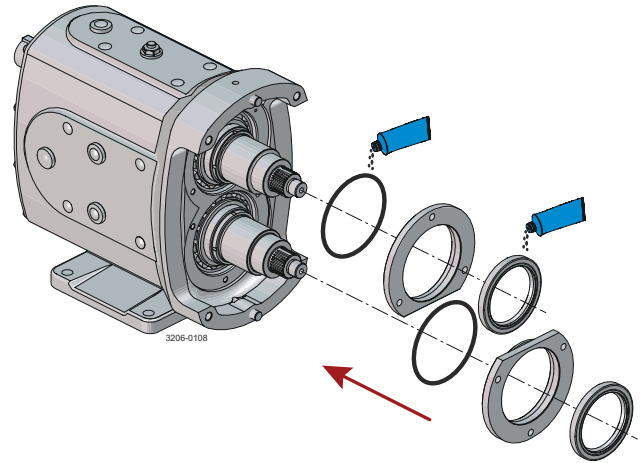


## 14 Fitting and retainers and gland guards

Clean the rear face of the seal retainers (14) and the front face of the gearcase (31), fit in position and tighten.

## 15

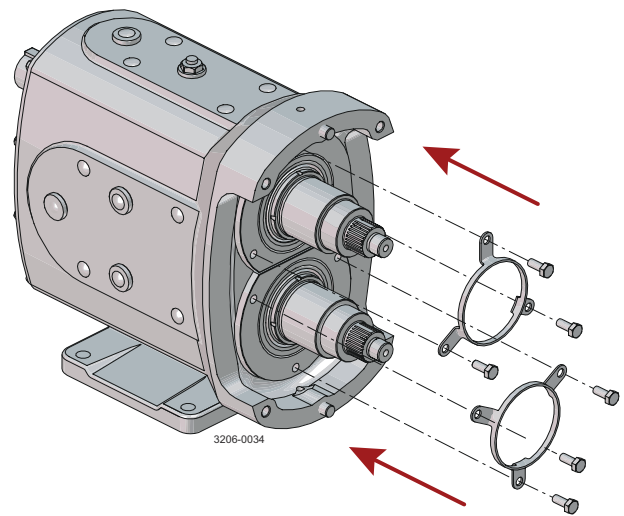
1. Check rotor alignment is correct by referring to the rotor abutment alignment in step 18 and adjust as required.
2. When rotor alignment is correct remove seal retainers and press new lip seals (36) until flush with front face.
3. Lubricate with a small amount of lubricant and fit a new O-ring (37) to the seal retainer
4. Apply a small amount of gearbox oil to the inner lip of the lip seal (36) and push the seal retainers into position. Make sure lip seals are not damaged when sliding them onto the shafts.



## 16

Position the gland guards (22) and tighten the screws (40).

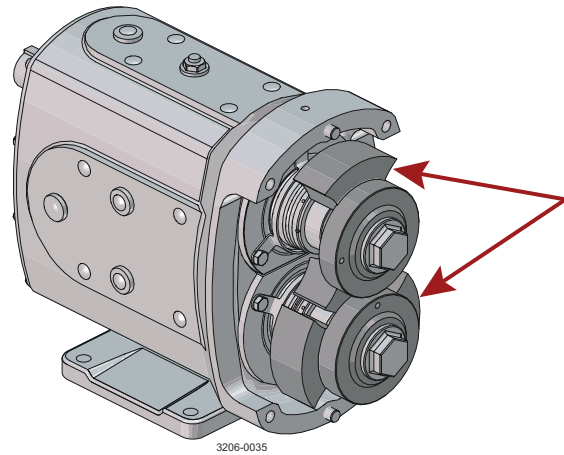
If the rotor abutment has been checked and is within specification move to Step 20.



### 17 Checking rotor abutment alignment.

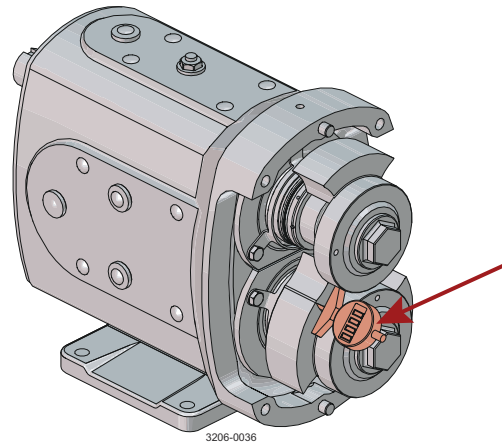
**Note:** Incorrect setting of rotor alignment will damage the pump.

1. Set the position of the missing spline in the shafts (51 and 52) to approximately 90deg to each other (e.g. 12 o'clock and 3 o'clock).
2. Fit the rotors (3) ensuring to align the missing spline in the rotors with the missing spline on the shafts.
3. Fit the rotor nut (4) and tighten fully locking the rotors against each other if required.



- ### 18
1. Rotate the rotors to allow measurement of the rotor wing face to face axial alignment.
  2. Using a depth micrometre ensure axial alignment is within a tolerance of 0.015mm (0.0006 in) across each wing, rotating the rotors as required.
  3. If the alignment is within tolerance move to step 15. If the alignment is incorrect, note the adjustment required and move to step 19 to adjust the abutment shims (37).

Note: If used rotors are being refitted it may be difficult to accurately measure face to face axial alignment due to rotor wear. In this case the rear rotor hub to rotor front wing clearance should be checked using a feeler gauge.



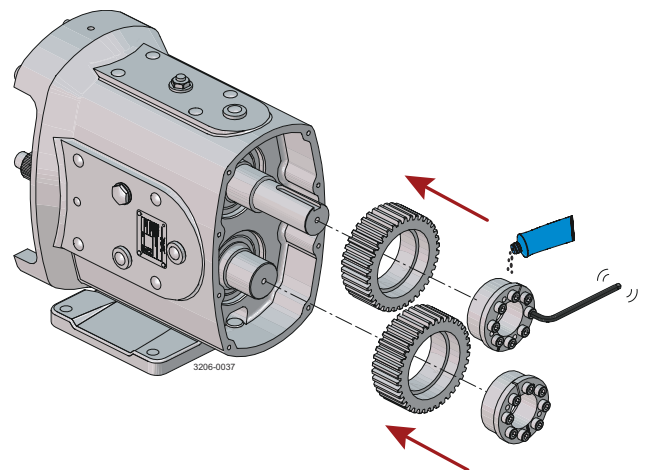
19

1. Remove the rotor nuts (4) and rotors (3).
2. Remove the seal retainer (34) only from the shaft position marked with the dimple on the gearcase (3).
3. Remove this shaft only (either 51 or 52) from the gearcase and remove the gearbox shims (53).
4. Measure the removed shims and adjust (add, swap or remove) shims by the required amount as noted during measurement above. Add shims to move the rotor position forward, remove shims to move the shaft backwards.
5. Refit the adjusted shim pack into the front bearing bore marked with the dimple of the gearcase.
6. Refit the shaft following the instructions in step 13.
7. Refit the seal retainer and tighten.
8. Repeat steps 17 and 18 above to verify rotor abutment is now within tolerance.
9. Return to step 15.

20

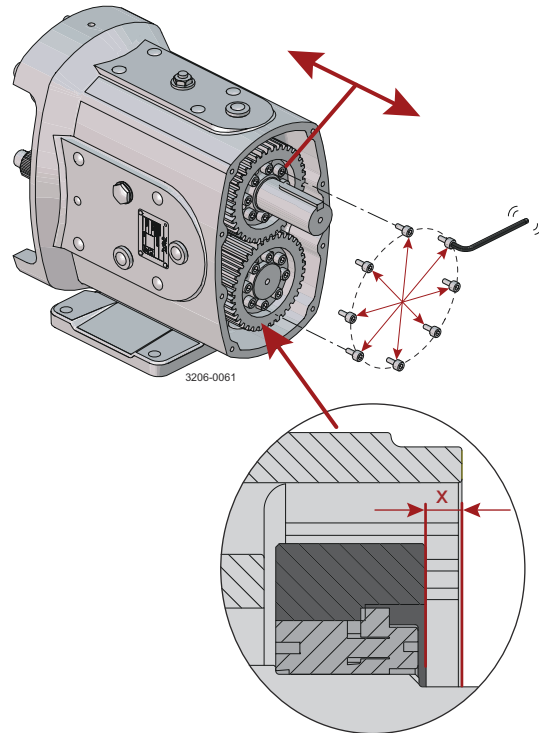
Fitting timing gears and torque locking assemblies (TLA).

1. If re-using torque locking assemblies (62) ensure the screws are fitted in the correct holes (i.e. not holes used for removal) and ensure the screws are fitted loosely.
2. Lightly lubricate the TLAs with the recommended gearbox oil.
3. Ensure the recess of the timing gear (61) and rear face of the TLAs are free from debris and fit the TLA to the timing gear.
4. Slide the timing gear and TLA on to the shafts (51 and 52) together.



21

1. Gradually tighten the TLA screws (62) in a circular pattern until hand tight and the shafts can be rotated. Ensure the TLA is pushed fully back on the shaft and that the timing gear is pulled forward during tightening to ensure correct placement.
2. Check that the face of the timing gear does not sit proud of the rear face of the gearcase by checking the dimension from the rear face of the timing gear to the rear face of the gearcase is as per the table below. If not, loosen the TLA slightly and repeat Step 21.
3. Timing adjustment is now required.



| Model    | Dimension X (mm) |
|----------|------------------|
| 32/33/34 | 1.5              |
| 42/43    | 4.0              |
| 52/53/54 | 6.0              |
| 62/63    | 9.5              |
| 72/73/74 | 6.0              |

22

Adjusting rotor timing

**NOTE**

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

23

Tighten one of the torque locking assemblies (62) fully as per the below list to the torque stated in Section 6

- Horizontally Ported: - Top Shaft
- Vertically Ported: - Right Shaft (as looking from the front of the pump)

24

1. Set the shafts (51 and 52) with the missing spline as per the diagram (shown with the rotorcase fitted for demonstration).\*)

\*) Missing Spline

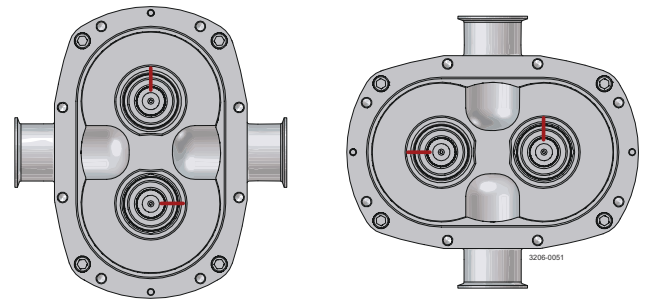
2. If rotors (3) are not fitted then fit on the shafts in the sequence shown in the diagram ensuring to align the missing spline in the rotor with the shafts. \*)

\*) Missing Spline

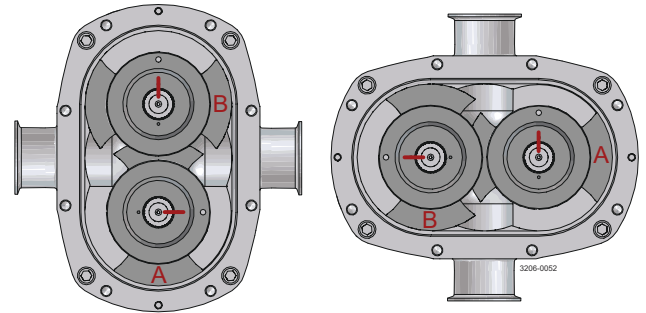
A = First

B = Second

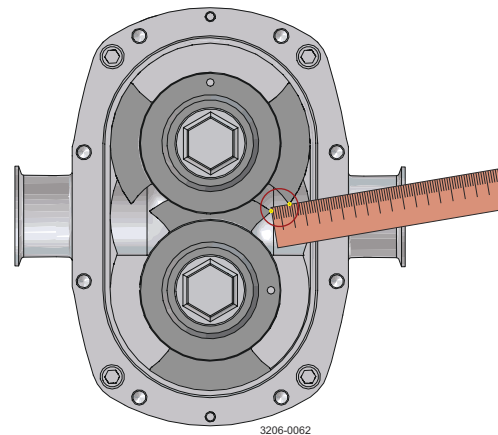
3. Fit the rotor nuts (4) and tighten to the torque value stated in Section 6, locking the rotors against each other to tighten if required.
4. Check to ensure shafts are still in the correct position above and adjust if required.
5. Measure the rotor wing tip to tip gap is equal on both sides. If not hold the top rotor or right rotor firmly and tap the other rotor with a soft mallet to adjust the timing.
6. Recheck the rotor wing tip to tip gap is equal on both sides. If not repeat the previous step.
7. When the gap is equal on both sides tighten the TLA (62) fully to the torque stated in section 6, ensuring the shaft and rotor assembly does not move.
8. Recheck the rotor wing tip to tip gap is equal, if not loosen the TLA and repeat above steps.
9. Rotate the rotors 90 degrees and check the gap is equal, repeat until all tips have been checked.
10. Remove the rotor nuts and rotors.



— (\*)



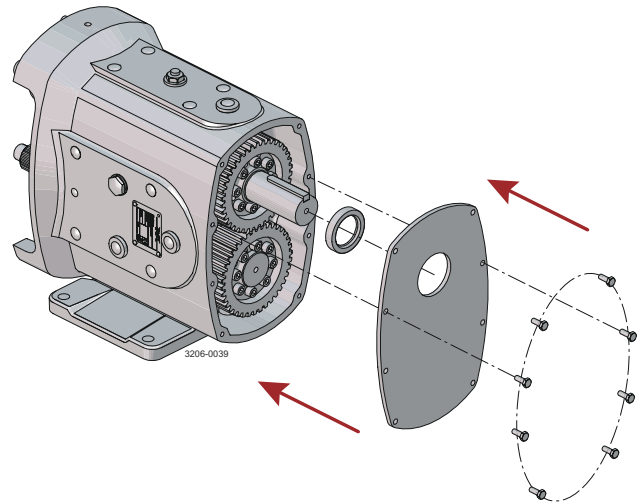
— (\*)



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## 25 Fitting gearcase cover

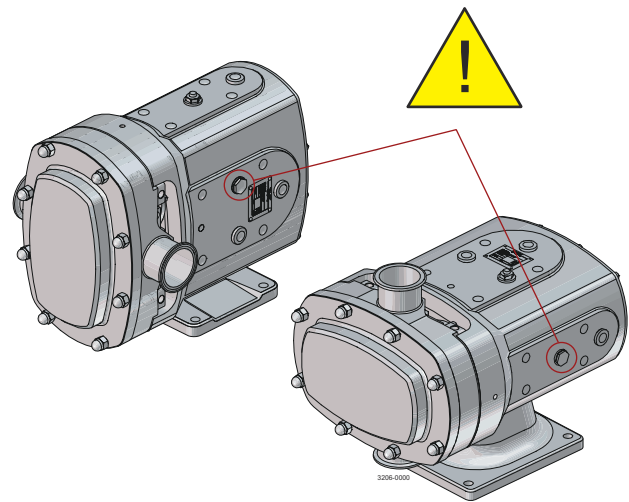
1. Remove all old gasket material from both mating faces and wipe clean with a solvent. Clean the bore of the gearcase cover (35) and press a new lip seal (38) into the cover until flush.
2. Apply liquid gasket (such as Teroson MS930 or similar) to the rear face of the gearbox, ensuring the sealant is applied to the inner side of the cover screw thread holes.
3. Apply a small amount of gearbox oil on the inner lip of the lip seal and carefully slide the cover over the shaft ensuring the lip seal is centered and not cut or damaged then secure with the gearbox cover screws (42).



### NOTE

It is recommended to allow the sealant time to set before filling with oil. Follow the recommendations of the sealant manufacture.

- ## 26
- Refit any blanking plugs (45) removed during the disassembly checking the O-rings are not damaged and replacing as required. Refit the oil sight glass (44) in the side of the gearcase (31) as shown. Refill with the recommended oil (as stated in Section 4). Quantity guidelines for each pump size and orientation as given in Section 6.1 however oil should be added to the gearbox until the sight glass is filled with oil. Check the pump for any signs of oil leakage and rectify as required.



## 27 Fitting and shimming of Rotorcase

Whenever the rotor case and rotors have been removed it is good engineering practice to check the clearances of the pump to ensure they are within specification shown in the clearance charts before putting back in to operation.

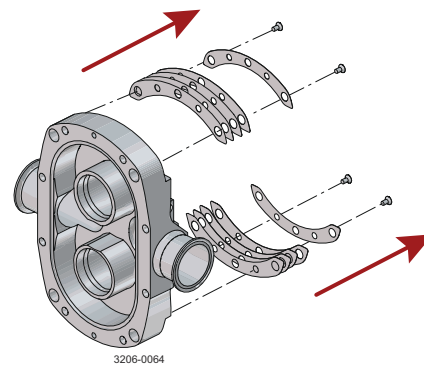
If the existing rotorcase and rotors are being refitted and no changes have been made to the rotor abutment setting (gearbox shims) then no changes to the rotorcase shims should be required. In this case please proceed to step 29.

If a new rotorcase and/or new rotors and/or changes to the rotor abutment setting (gearbox shims) has been made then reshimming of the rotorcase will be required. In this case please proceed to step 28.

**Note:** Your supplier can advise the correct clearances from the pump serial number. Any incorrect setting of clearances is likely to damage the pump in operation. Shims can be stacked unequally providing the clearances are achieved.

## 28

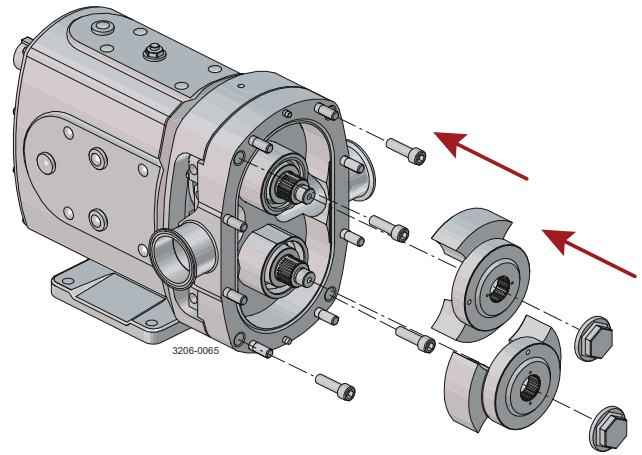
1. Remove the shim retainer screws (14), shim retainers (13) and shims (14) if fitted.
2. From the shim set select and measure out initial shims totalling as below:
  - DuraCirc models 32 to 43 :- 0.5mm
  - DuraCirc models 52 to 74 :- 0.6mm
3. Fit the shims, shim retainer and shim retainer screws and tighten to the correct setting. Ensure the shim retainer is fitted the correct way round with the counter sunk holes visible and check the screws do not sit proud of the shim retainer.





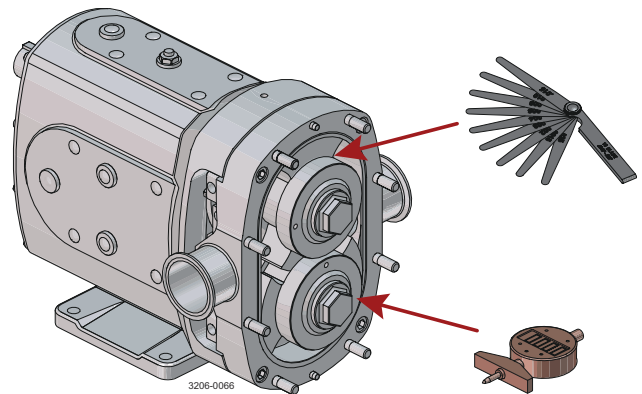
29

1. Ensure the shim retainers are correctly fitted to the rotorcase (3) and that the shim retainer screws (14) are not sitting proud of the shim retainers (13). If the shims have been removed during disassembly and not been kept in the matched sets please follow the instructions in step 30.
2. Refit the rotorcase to the gearcase (31) observing the correct orientation as marked during disassembly, refit the rotorcase screws (11) and tighten.
3. Refit the rotors (3) observing the correct position as marked during disassembly, refit rotor nuts (4) and tighten.



30

1. Using feeler gauges to check the back clearance (rear rotor face to rotorcase) and a depth micrometer to check the front clearance (front rotor face to rotorcase) record the values and check against the clearance charts for the appropriate pump model.
2. If the clearances are within the specification, then no further adjustment is required and can proceed to step 32.
3. If the clearances recorded are outside the specification, then adjustment to the rotorcase shims will be required.





31

1. Remove the rotor nuts, rotors and rotorcase and place face down on a suitable surface.
2. Remove the shim retainer screws (14), shim retainers (13) and shims (12) ensuring to make note of the position of each.
3. Measure the removed shims and adjust (add, swap, or remove) shims by the required amount as noted during measurement above. Add shims to move the rotorcase forward (decrease back clearance) or remove shims to move the rotorcase backwards (increase back clearance).
4. Fit the shims, shim retainer and shim retainer screws and tighten to the correct setting. Ensure the shim retainer is fitted the correct way round with the counter sunk holes visible and check the screws do not sit proud of the shim retainer.
5. Repeat step 30 above to recheck the clearances.

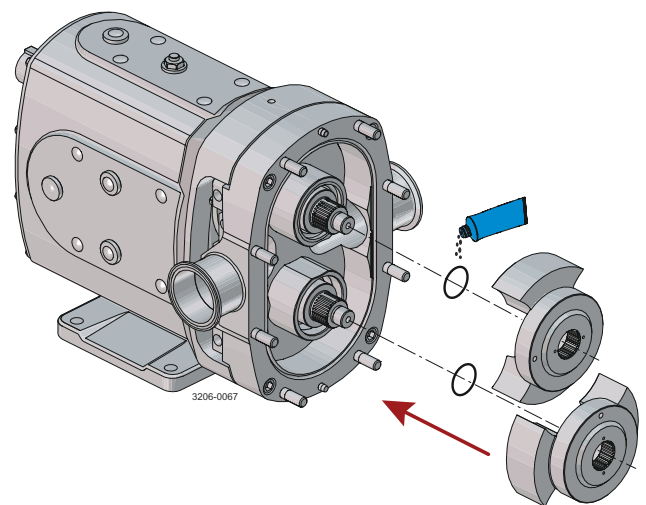
32

Once the clearances have been checked and are within specification remove the rotor nuts and rotors. Depending on the seal type fitted the rotorcase may need to be removed also. Please refer to Section 5.5 for seal fitting instructions.

33

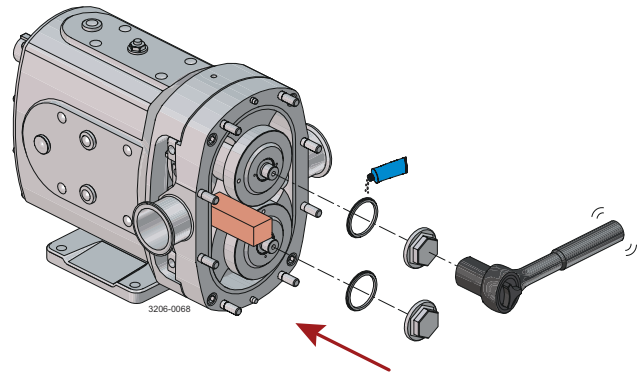
### Fitting rotors

1. Ensure the rotorcase is fitted and the rotorcase screws are tightened as per the specification in Section 6.1
2. Lubricate and fit new rotor o-rings (7) to the shaft (51 and 52).
3. Refit the rotors (3) ensuring to align the missing spline in the rotor with the shafts and observing the position marks made during disassembly if refitting existing components.



34

1. Lightly lubricate and fit new P-ring elastomer (6) into the groove on the rotor nuts (4) ensuring the correct orientation.
2. Fit rotor nuts and tighten to torque shown in Section 6.1. Use a plastic (nylon) block to stop the rotors from turning during tightening.



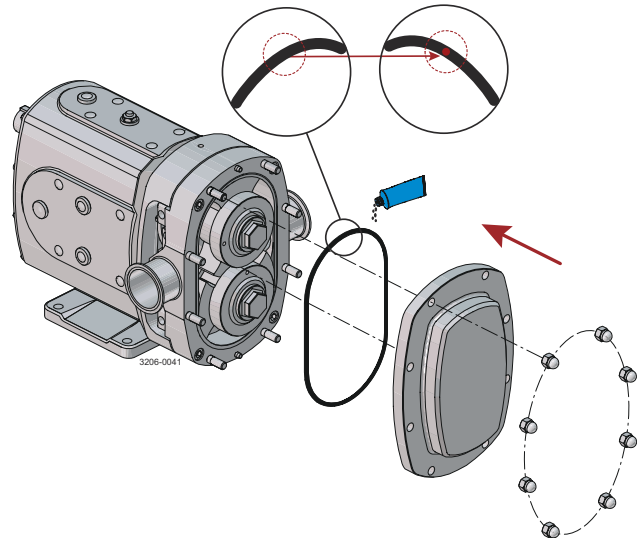
35

- To check rotors are correctly synchronised turn the drive shaft (51) by hand and check all clearances with a suitable gauge against recommended clearance figures as shown in separate addendum for Pump Head Clearances.

36

#### Fitting rotorcase cover

1. Lubricate and fit new P-ring elastomer (11) (Red ID Mark) to the rotorcase (2) ensuring the coloured mark is towards the rotor case and is fully seated in the groove.
2. Fit rotorcase cover (1) onto rotorcase (2) and tighten rotorcase cover nuts (8).
3. Refer to pump start up checks prior to operation.

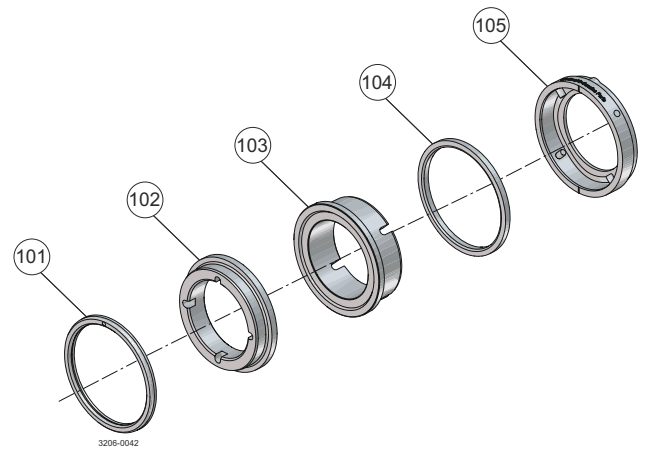


## 5.5 Primary seals removal and fitting

### 1 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.

| Item | Description                  |
|------|------------------------------|
| 101  | Square Ring (Yellow ID mark) |
| 102  | Rotary Seal Face             |
| 103  | Static Seal Face             |
| 104  | Squad Ring (White ID mark)   |
| 105  | Static Assembly              |



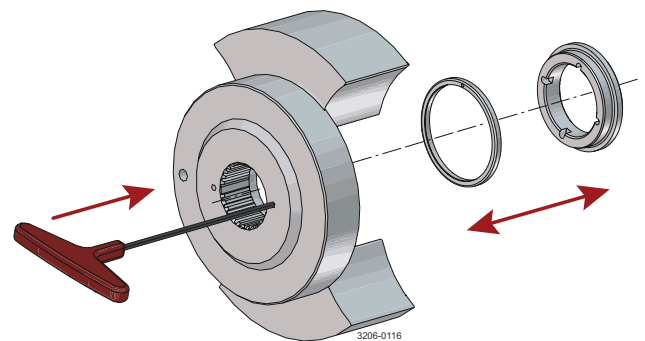
### Seal Removal

#### ! NOTE

It is recommended to mark the positions of the rotors and rotorcase (e.g. Top/Bottom or Left/Right) prior to removal to ensure the parts are refitted in the same positions.

### 2

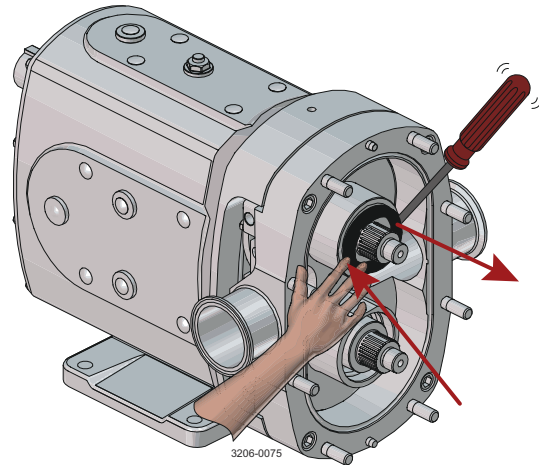
1. Remove rotorcase cover (1) and rotors (3).
2. Extract the rotary seal face (102) and square ring (101) from the rotor.
  - A small diameter tool can be passed through the holes in the front of the rotor to aid removal without damaging the rotor or seal.
3. Remove the static seal face (103) and squad ring (104) from the static assembly (105) using a small screwdriver if required.
4. Remove the static assembly from the rotorcase (2) if replacement is required.



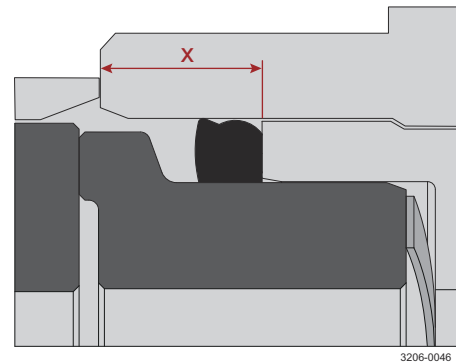
**Seal fitting**



Ensure all screws and nuts are torqued to the values stated in Section 6.

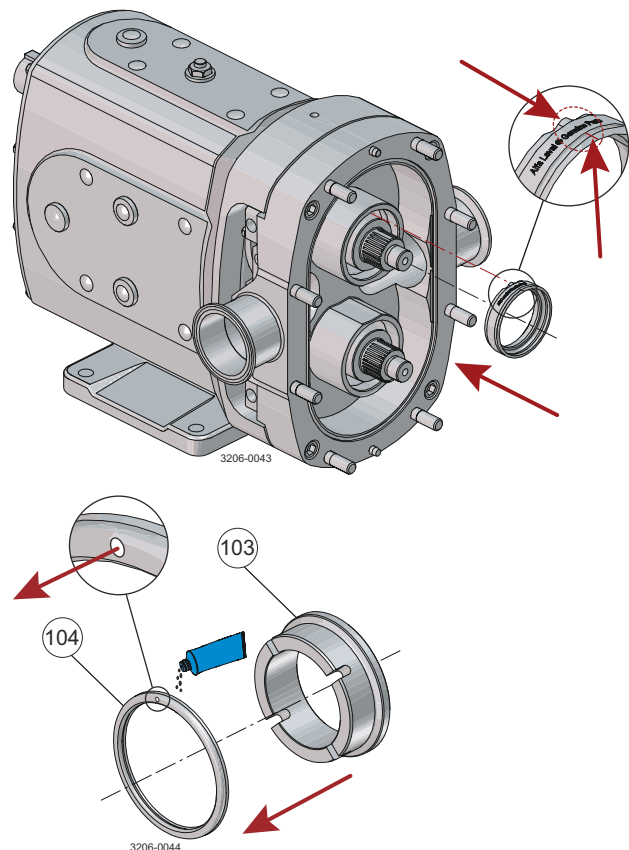


| Model    | Dimension X (mm) |
|----------|------------------|
| 32/33/34 | 5.5              |
| 42/43    | 8                |
| 52/53/54 | 6.5              |
| 62/63    | 9                |
| 72/73/74 | 9.5              |

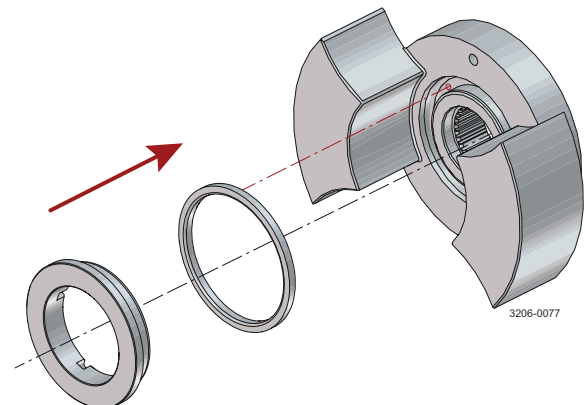
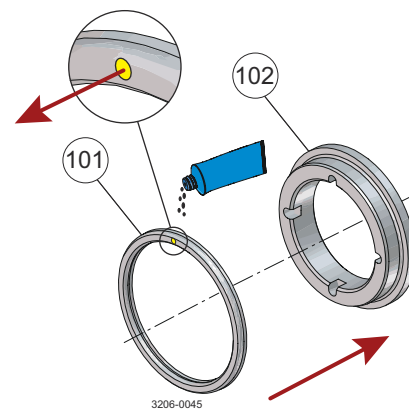
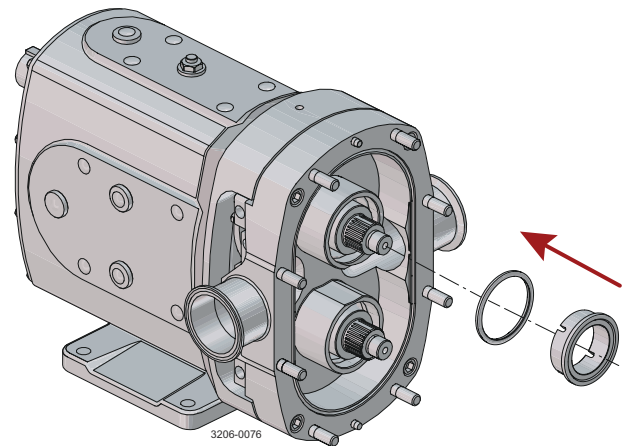


**3**

1. If the static assembly (105) was removed, align the line mark on front face of with the lugs in the bore of the rotorcase (2) and press back ensuring the drive ring is kept square to the bore until fully engaged.
2. Ensure the static assembly is fully seated by checking dimension shown below against the table. If not remove the static assembly, refit and check.
3. Lubricate the squad ring (104) and fit to the static seal face (103) ensuring the lip of the elastomer is towards the seal face (larger diameter) as shown in the diagram. Note: the coloured mark should be facing away from the static seal face.
4. Align the slots in the static seal face (103) with the pins in the static assembly (105) and press back gently until fully engaged.
5. Wipe clean the stationary seal faces with solvent.

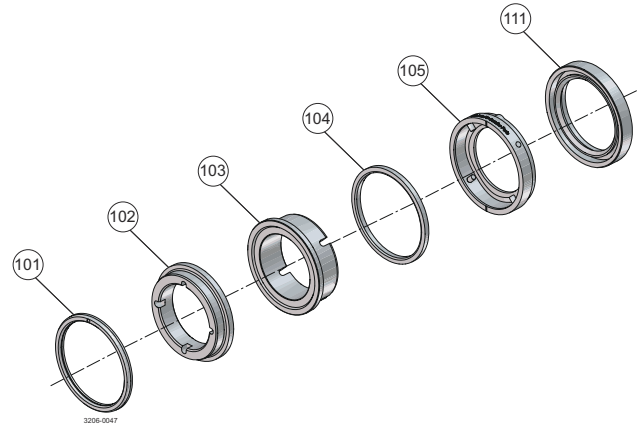


6. Lubricate the square ring elastomer (101) and fit to the rotary seal face (102) ensuring the rounded edge is fitted in to the radius of the seal face part as shown in the diagram. Note: the coloured dot should be facing away from the rotary seal face.
7. Align the cut out on the rotary seal face (102) with the pins in the bore of the rotor (3) and press back gently until fully seated.
8. Wipe clean the rotary seal faces with solvent.
9. Refit the rotors (3), rotor nuts (4) and rotorcase cover (1) as per the main assembly instructions in Section 5.4



#### 4 Single flushed mechanical seal

| Item | Description                  |
|------|------------------------------|
| 101  | Square Ring (Yellow ID Mark) |
| 102  | Rotary Seal Face             |
| 103  | Static Seal Face             |
| 104  | Squad Ring (White ID Mark)   |
| 105  | Static Assembly              |
| 111  | Lip Seal                     |



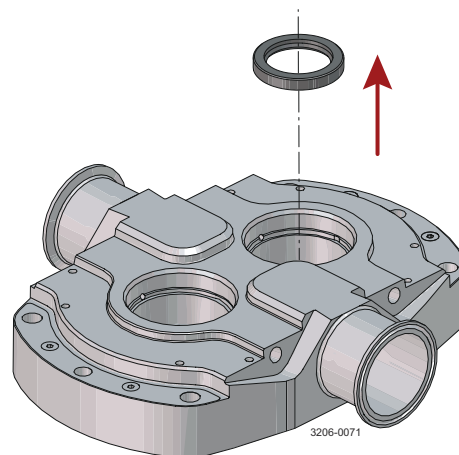
#### Seal removal

#### NOTE

It is recommended to mark the positions of the rotors and rotorcase (e.g. Top/Bottom or Left/Right) prior to removal of the parts are refitted in the same position. Ensure the flush system has been de-pressurized and is isolated before continuing.

#### 5 Single flushed mechanical seal

1. Follow instructions 1. to 4. as for the single seal disassembly.
2. Remove the flush pipework to the rotorcase (2) and then remove the rotorcase placing it face down on a suitable surface.
3. Remove the lip seal (111) from the rear seal bore of the rotorcase.

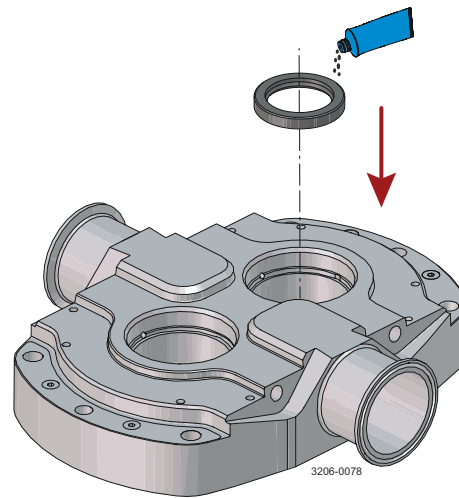


## 6 Seal fitting

### NOTE

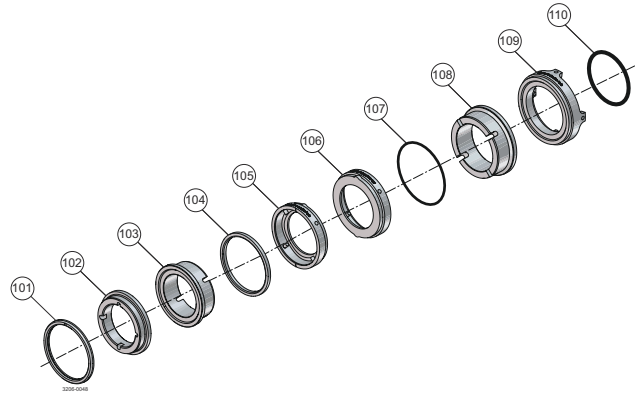
Ensure all screws and nuts are torqued to the values stated in Section 6.

1. Apply a small amount of suitable lubrication to the new lip seal (111) and press fit to the rear seal bore of the rotorcase (2) until flush with end of bore.
2. Refit the rotorcase ensuring the rotor case screws (11) are torqued to tightening the rotorscrews to the required torque setting as shown in Section 6.
3. Follow instructions 1. to 9. as for the single seal assembly.
4. Refit the flush pipework and refill, checking for any leaks and correct operation before restarting the pump.



## 7 Double flushed mechanical seal

| Item | Description                  |
|------|------------------------------|
| 101  | Square Ring (Yellow ID Mark) |
| 102  | Rotary Seal Face             |
| 103  | Static Seal Face             |
| 104  | Squad Ring (White ID Mark)   |
| 105  | Static Assembly              |
| 106  | Static Assembly (Outboard)   |
| 107  | Static O-ring (Outboard)     |
| 108  | Static Seal Face (Outboard)  |
| 109  | Rotary Assembly (Outboard)   |
| 110  | Rotary O-ring (Outboard)     |



### Seal removal

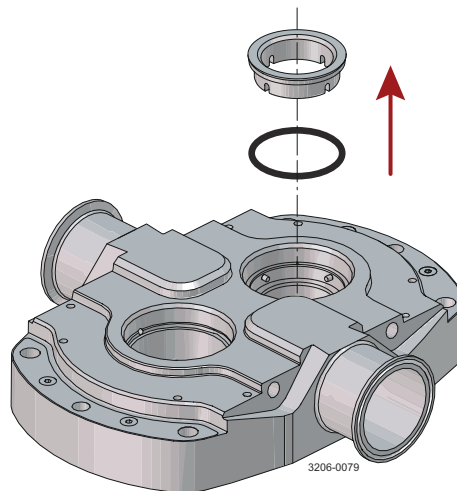


It is recommended to mark the positions of the rotors and rotorcase (e.g. Top/Bottom or Left/Right) prior to removal to the parts are refitted in the same position.

Ensure the flush system has been de-pressurised and is isolated before continuing.

## 8

1. Follow instructions 1. to 4. as for the single seal disassembly.
2. Remove the flush pipework to the rotorcase (2) and then remove the rotorcase placing it face down on a suitable surface.
3. Extract the outboard static seal face (108) and static O-ring (107) from the outboard static assembly (106).
4. Remove the outboard static seal assembly (106) from the rear of the rotorcase if replacement is required.
5. Remove the outboard rotary assembly (109) and rotary O-ring (110) from the shafts (51 and 52).

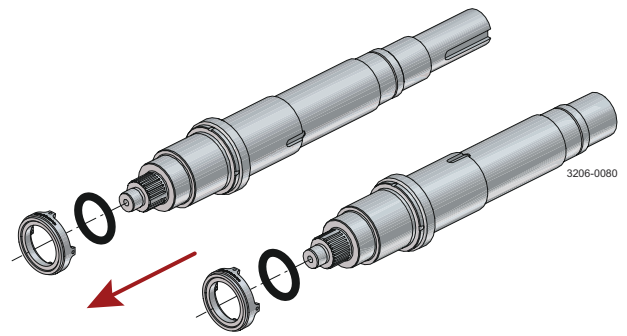




## Seal fitting

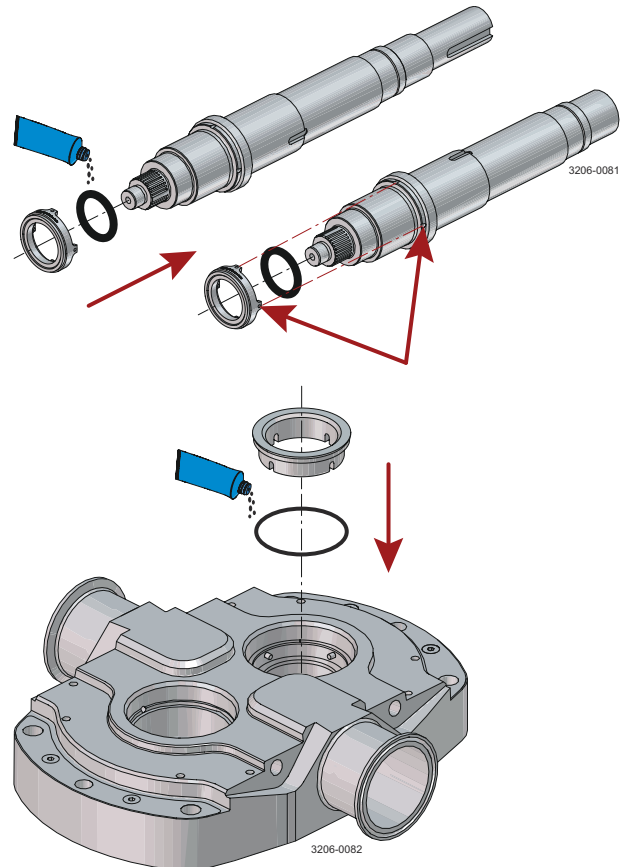
**NOTE**

Ensure all screws and nuts are torqued to the values stated in Section 6.



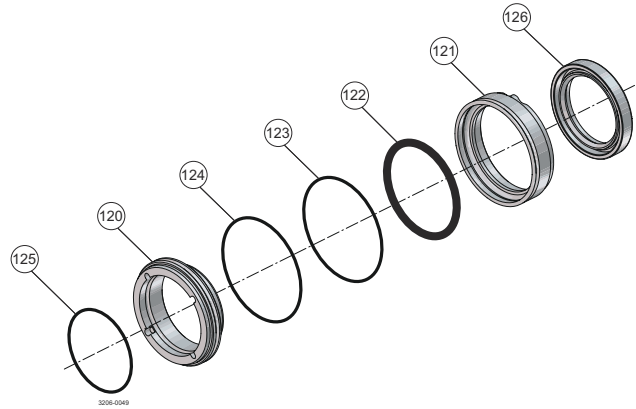
9

1. Lightly lubricate the outboard rotary O-ring (110) with a suitable lubricant and fit on to shaft (51 and 52).
2. Align the pins of the outboard rotary assembly (109) with the slots in the shaft and push back until fully engaged on shaft.
3. If the outboard static assembly (106) was removed, align the marks on the face of the outboard static assembly with the lugs in the rear seal bore of the rotorcase (2) and press back ensuring the static assembly is kept square to the bore until fully engaged.
4. Lubricate the outboard static O-ring (107) with appropriate grease and fit to the outboard static seal face (108).
5. Align the slots in the outboard static seal face with the pins in the outboard static assembly and press back gently until fully engaged.
6. Refit the rotorcase to the gearcase (31), ensuring the shafts do not contact the fitted seal components, refit the rotorcase screws and tighten.
7. Follow instructions 1. To 9. as for the single seal assembly.
8. Refit the flush pipework, refill and pressurise, checking for any leaks and correct operation before restarting the pump.



## 10 O-ring Seal (Single and Flush)

| Item | Description                   |
|------|-------------------------------|
| 120  | Sleeve                        |
| 121  | Static Assembly, O-ring seal  |
| 122  | O-Ring, Primary               |
| 123  | O-Ring, Static                |
| 124  | O-Ring, Sleeve Outer          |
| 125  | O-Ring, Sleeve Inner          |
| 126  | *Lipseal (flush version only) |



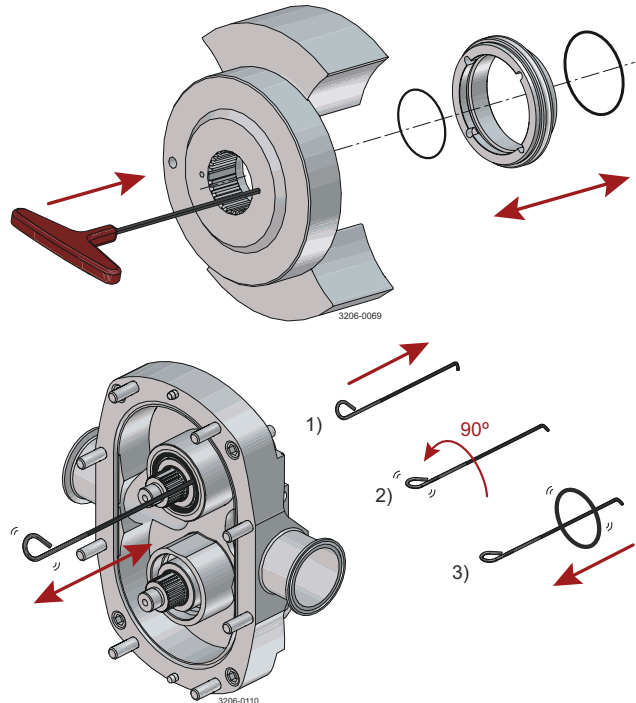
O-ring seal removal:

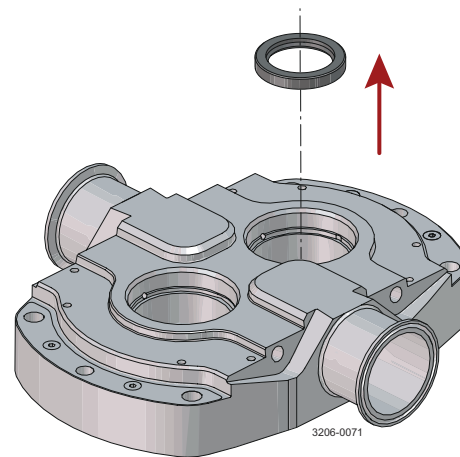
### NOTE

It is recommended to mark the positions of the rotors and rotorcase (e.g. Top/Bottom or Left/Right) prior to removal to the parts are refitted in the same position.

## 11

1. Remove rotorcase cover (1) and rotors (3).
2. Extract the sleeve (120) and from the rotor then remove the inner sleeve o-ring (124) and outer sleeve o-ring (125) from the sleeve. Check sleeve for grooves and deep scratches and replace as necessary. – A small diameter tool can be passed through the holes in the front of the rotor to aid removal if required.
3. Remove the primary o-ring (122) from the static assembly using the tool provided.
4. Remove the static assembly (121) from the rotorcase using the tool provided if replacement is required and then remove static o-ring (123).
5. Flushed seals only - Remove the flush pipework to the rotorcase (2) and then remove the rotorcase placing it face down on a suitable surface. Remove the lip seal (126) from the rear seal bore of the rotorcase.

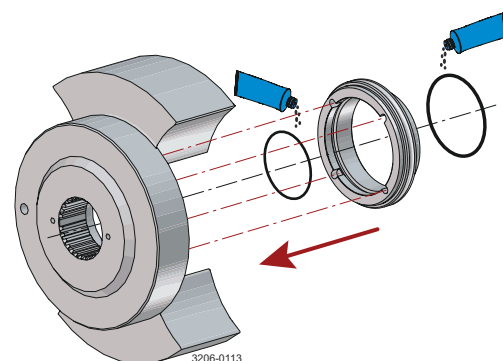
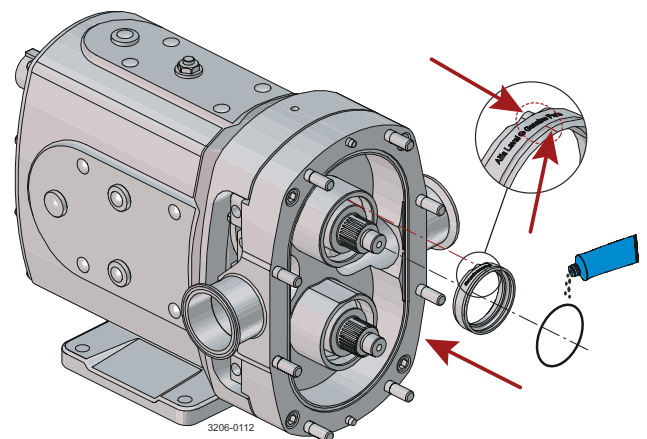
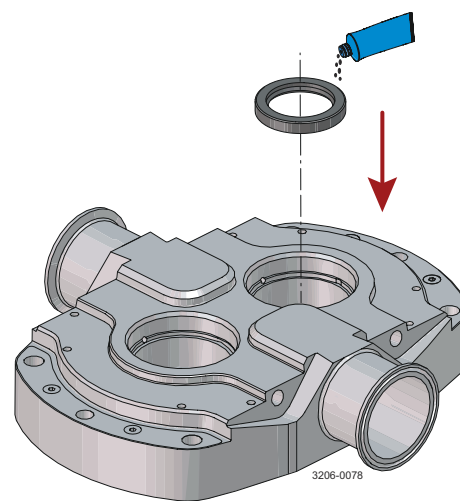




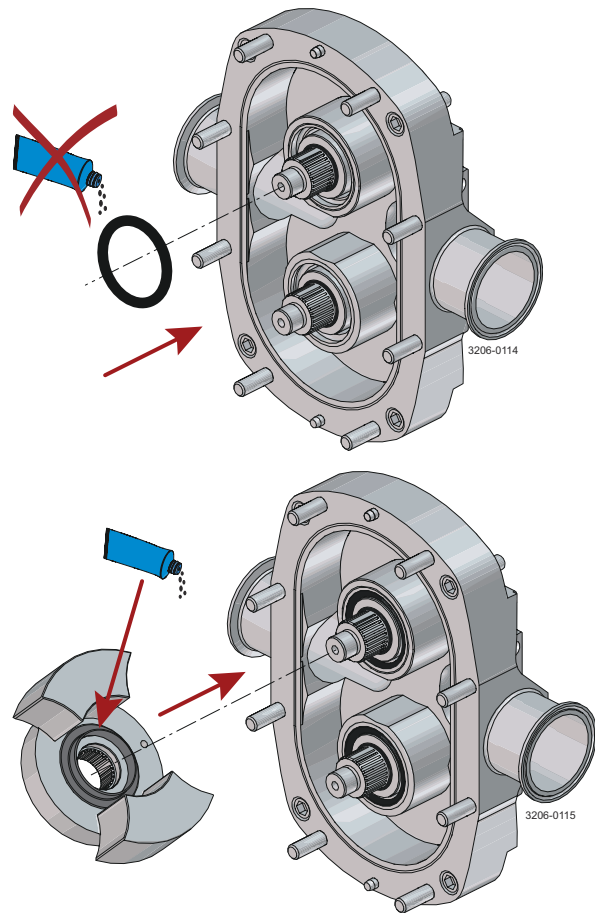
## 12 O-ring seal fitting:

**NOTE:** Ensure all screws and nuts are torqued to the values stated in Section 6.

1. Flushed seal only: Apply a small amount of suitable lubrication to the new lip seal (126) and press fit to the rear seal bore of the rotorcase (2) until flush with end of bore. Refit the rotorcase ensuring the rotor case screws (11) are tightened correctly.
2. If the static assembly was removed lightly lubricate the static o-ring (123) and fit to the static assembly (121). Align the mark on the front face of the static assembly with the lugs in the bore of the rotorcase (2) and push back ensuring the static assembly is kept square to the bore until fully engaged.
3. Lightly lubricate the outer sleeve O-ring (124) and inner sleeve O-ring (125) and fit to the sleeve (120).
4. Align the slots in the sleeve with the pins in the rotor (3) and push until fully seated.
5. **Without** lubricating, fit primary O-ring (122) in to the static assembly ensuring it is pushed firmly and evenly in to position.
6. Lightly lubricate the outside diameter of the sleeve.



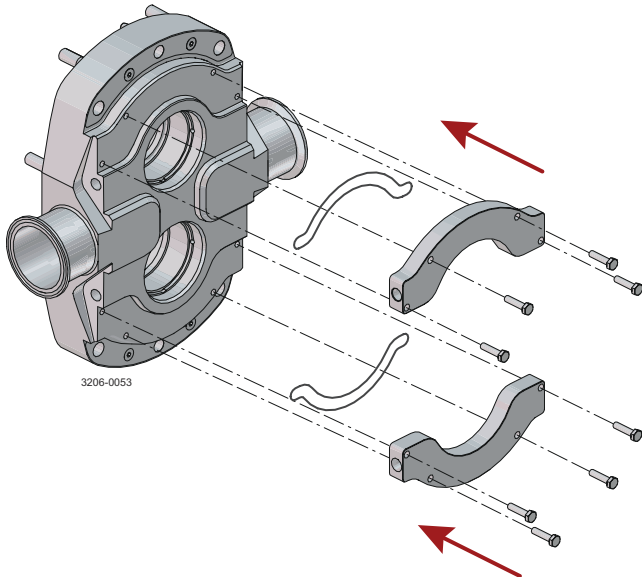
7. Refit the rotors (3), rotor nuts (4) and rotorcase cover (1) as per the main assembly instructions in Section 5.4
8. Flushed seals only - Refit the flush pipework and refill, checking for any leaks and correct operation before restarting the pump.



## 5.6 Heating/Cooling devices

The DuraCirc pumps have the option of being fitted with a heating/cooling jacket fitted on the rear of the rotorcase.

These are to be used for heating the pump head to maintain the pumped media viscosity and reduce risk of any crystallisation/solidification of the pumped product occurring. They may also be used for cooling purposes.



The maximum pressure and temperature of heating/cooling fluid is 3.5 bar (50 psi) and 150°C (302°F) respectively. Heating/cooling jackets should be in operation approximately 15 minutes prior to pump start up and remain in operation 15 minutes after pump shut down.

### Disassembly

**NOTE:** It is recommended to mark the positions of the rotors and rotorcase (e.g. Top/Bottom or Left/Right) prior to removal to the parts are refitted in the same position.

Ensure pump has been allowed to reach ambient temperature before continuing and that any heating / cooling media has been drained.

1. Remove rotorcase cover (1) and rotors (3).
2. Remove the jacket connection pipes.
3. Remove the rotorcase (2) and place face down on a suitable surface.
4. Remove the jacket screws (19) and the jackets (17) using a soft mallet to gently tap free if required.
5. Remove the o-ring (18) and replace.
6. Clean the jacket and the mating face of the rotor case of any debris or residue and ensure the port connections are not blocked.

## Reassembly

1. Wipe the mating surfaces of the rotorcase (2) and jacket (17) with a solvent and ensure the O-ring groove is clean and free of debris and damage (replace jacket if required).
2. Lightly lubricate new o-rings (18) and push firmly in the jacket O-ring groove.
3. Position the jacket on the rotorcase (2), fit screws (19) and tighten to the values given in the table below.
4. Refit the rotorcase (2), rotors (3), rotor nuts (4) and rotorcase cover (1) as per the main assembly instructions in Section 5.4
5. Refit jacket connection pipes, refill and check for leaks.

|   | <b>32/33/34</b> | <b>42/43</b>   | <b>52/53/54</b> | <b>62/63</b>     | <b>72/73/74</b>  |
|---|-----------------|----------------|-----------------|------------------|------------------|
| Screw Size / Torque                         | M5              | M5             | M6              | M8               | M8               |
| Torque Setting                              | 5 Nm<br>4 lbft  | 5 Nm<br>4 lbft | 10 Nm<br>7 lbft | 20 Nm<br>15 lbft | 20 Nm<br>15 lbft |
| Flush connection BSP(G)<br>NPT with Adaptor | 1/8"            | 1/8"           | 1/4"            | 1/4"             | 1/4"             |

All flush connections are Female

## 5.7 Troubleshooting

|                          |                             |                            |
|--------------------------|-----------------------------|----------------------------|
| 1 No flow                | 6 Prime lost after starting | 11 Noise and vibrations    |
| 2 Under capacity         | 7 Pump stalls when starting | 12 Pump element wear       |
| 3 Irregular discharge    | 8 Pump overheat             | 13 Syphoning               |
| 4 Low discharge pressure | 9 Motor overheats           | 14 Seizure                 |
| 5 Pump will not prime    | 10 Excessive power absorbed | 15 Mechanical seal leakage |
|                          |                             | 16 Mechanical seal leakage |

| Problem |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | Probable Causes | Solutions                          |   |
|---------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|-----------------|------------------------------------|---|
| 1       | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |                 |                                    |   |
| x       |   |   |   |   | x |   |   |   |    |    |    |    |    |    |    |                 | Incorrect direction of rotation    | Reverse motor   |
| x       |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |                 | Pump not primed                    | Expel gas from suction line and pumping chamber and introduce fluid   |
| x       | x |   |   | x |   | x |   |   |    |    |    |    |    |    |    |                 | Insufficient NPSH available        | Increase suction line diameter<br>Increase suction head<br>Simplify suction line configuration and reduce length<br>Reduce pump speed |
|         |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |                 | Fluid vaporising in suction line   | Increase suction line diameter<br>Increase suction head<br>Simplify suction line configuration and reduce length<br>Reduce pump speed |
| x       |   | x |   | x | x |   |   |   |    |    |    |    |    | x  |    |                 | Air entering suction line          | Remake pipework joints  |
|         | x |   |   |   | x |   |   |   |    |    |    |    |    |    |    |                 | Strainer or filter blocked         | Service fittings  |
|         | x |   |   |   |   | x | x | x |    |    | x  |    |    |    |    |                 | Fluid viscosity above rated figure | Increase fluid temperature<br>Decrease pump speed<br>Check seal face viscosity limitations  |
| x       |   |   | x |   |   |   |   |   |    |    |    |    |    |    |    |                 | Fluid viscosity below rated figure | Decrease fluid temperature<br>Increase pump speed   |
|         |   |   |   |   |   |   |   | x |    | x  |    |    |    | x  |    | x               | Fluid temp. above rated figure     | Cool the pump casing<br>Reduce fluid temperature<br>Check seal face and elastomer temp. limitations                                   |
|         |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |                 | Fluid temp. below rated figure     | Heat the pump casing<br>Increase fluid temperature  |
|         |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |                 | Unexpected solids in fluid         | Clean the system<br>Fit strainer to suction line<br>If solids cannot be eliminated consider fitting double mechanical seals           |

| Problem |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | Probable Causes | Solutions                                    |   |
|---------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|-----------------|--|---|
| 1       | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |                 |  |   |
| x       | x | x |   |   |   | x | x | x |    | x  |    |    |    | x  |    | x               | Discharge pressure above rated figure        | Checks for obstructions i.e. closed valve<br>Service system and change to prevent problem recurring<br>Simplify discharge line to decrease pressure |
|         |   |   |   |   |   |   |   |   |    |    |    |    |    |    | x  | x               | Seal flushing inadequate                     | Increase flush flow rate<br>Check that flush fluid flows freely into seal area  |
| x       |   |   |   |   |   |   |   | x | x  | x  |    |    |    |    |    |                 | Pump speed above rated figure                | Decrease pump speed   |
| x       |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |                 | Pump speed below figure                      | Increase pump speed   |
| x       |   |   |   |   |   |   |   | x | x  | x  |    |    |    |    |    |                 | Pump casing strained by pipework             | Check alignment of pipes<br>Fit flexible pipes or expansion fittings.<br>Support pipework   |
|         |   |   |   |   |   |   |   | x | x  | x  |    |    |    |    |    |                 | Flexible coupling misaligned                 | Check alignment and adjust mounting accordingly   |
|         |   |   |   |   |   |   |   | x | x  | x  |    |    |    |    |    |                 | Insecure pump driver mountings               | Fit lock washers to slack fasteners and retighten   |
|         |   |   |   |   |   |   |   | x | x  | x  |    |    |    |    |    |                 | Shaft bearing wear or failure                | Refer to pump maker for advice and replacement parts  |
|         |   |   |   |   |   |   |   | x | x  | x  |    |    |    |    |    |                 | Insufficient oil lubrication                 | Refer to pump maker's instructions  |
| x       | x |   |   |   |   |   |   |   | x  |    |    |    |    |    |    |                 | Metal to metal contact of pumping element    | Check rated and duty pressure.<br>Refer to pump maker   |
| x       |   |   | x |   |   |   |   |   |    |    |    |    |    |    |    |                 | Wam pumping element                          | Fit new components  |
| x       |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |                 | Suction lift too high                        | Lower pump or raise liquid level  |
|         |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |                 | No barrier in system to prevent flow passing | Ensure discharge pipework higher than suction tank  |
|         |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |                 | Pump allowed to run dry                      | Ensure system operation prevent this<br>Fit single or double flushed mechanical seals.<br>Fit flushed packed gland                                  |
|         |   |   |   |   |   |   |   |   | x  |    |    |    |    |    |    |                 | Faulty motor                                 | Check and replace motor bearings  |
| x       |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |                 | Pumping element missing                      | Fit pumping element   |



## 6 Technical data

### 6.1 Technical data

#### 6.1.1 Approximate oil capacities

| Pump model | Horizontal Ports |        | Vertical Ports |        |
|------------|------------------|--------|----------------|--------|
|            | litres           | us.gal | litres         | us.gal |
| 32/33/34   | 0.9              | 0.13   | 0.5            | 0.24   |
| 42/43      | 1.5              | 0.26   | 1              | 0.40   |
| 52/53/54   | 3.5              | 0.61   | 2.3            | 0.92   |
| 62/63      | 6.6              | 1.22   | 4.6            | 1.74   |
| 72/73/74   | 10.3             | 1.82   | 6.9            | 2.72   |

#### 6.1.2 Weights

| Pump model | Typical Bare Shaft Pump kg (lb)<br>Port Orientation |                | Typical Pump with Drive Unit kg (lb)<br>Port Orientation |                |
|------------|---|----------------|--|----------------|
|            | Horizontal ports                                    | Vertical ports | Horizontal ports   | Vertical ports |
| 32         | 32 (70)   | 33 (72)        | 73 (160)   | 74 (163)       |
| 33         | 33 (72)   | 34 (74)        | 81 (178)   | 82 (180)       |
| 34         | 36 (79)   | 37 (81)        | 88 (194)   | 89 (196)       |
| 42         | 60 (132)  | 63 (138)       | 151 (332)  | 154 (339)      |
| 43         | 63 (138)  | 66 (145)       | 157 (346)  | 160 (352)      |
| 52         | 110 (242)   | 113 (249)      | 274 (604)  | 277 (610)      |
| 53         | 114 (251)   | 117 (257)      | 294 (648)  | 297 (654)      |
| 54         | 122 (269)   | 125 (275)      | 330 (727)  | 333 (734)      |
| 62         | 203 (447)   | 208 (458)      | 444 (979)  | 449 (990)      |
| 63         | 210 (463)   | 214 (471)      | 447 (1051)   | 481 (1060)     |
| 72         | 327 (721)   | 334 (736)      | 607 (1338)   | 614 (1353)     |
| 73         | 345 (760)   | 352 (776)      | 661 (1457)   | 668 (1472)     |
| 74         | 366 (807)   | 373 (822)      | 685 (1510)   | 692 (1525)     |

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

## 6.1.3 Tool requirements

| Description                      | Tool Required         | Pump Model |       |          |       |          |
|----------------------------------|-----------------------|------------|-------|----------|-------|----------|
|                                  |                       | 32/33/34   | 42/43 | 52/53/54 | 62/63 | 72/73/74 |
| Nut, Rotorcase Cover (8)         | Socket Size (mm)      | 13         | 17    | 19       | 19    | 19       |
|                                  | Torque Setting (Nm)   | 20         | 40    | 65       | 65    | 65       |
|                                  | Torque Setting (lbft) | 15         | 29    | 48       | 48    | 48       |
| Nut, Rotor (4)                   | Socket Size (mm)      | 24         | 30    | 36       | 41    | 55       |
|                                  | Torque Setting (Nm)   | 60         | 120   | 220      | 300   | 360      |
|                                  | Torque Setting (lbft) | 44         | 88    | 162      | 221   | 265      |
| Screw, Rotor (11)                | Socket Size (mm)      | 13         | 17    | 19       | 19    | 24       |
|                                  | Torque Setting (Nm)   | 20         | 40    | 65       | 65    | 120      |
|                                  | Torque Setting (lbft) | 15         | 29    | 48       | 48    | 88       |
| Screw, Seal Retainer (40)        | Socket Size (mm)      | 10         | 10    | 13       | 13    | 13       |
|                                  | Torque Setting (Nm)   | 10         | 10    | 20       | 20    | 20       |
|                                  | Torque Setting (lbft) | 7          | 7     | 15       | 15    | 15       |
| Screw, Gearcase Cover (42)       | Socket Size (mm)      | 8          | 10    | 10       | 13    | 13       |
|                                  | Torque Setting (Nm)   | 5          | 10    | 10       | 20    | 20       |
|                                  | Torque Setting (lbft) | 4          | 7     | 7        | 15    | 15       |
| Screw, Torque Lock Assembly (62) | Socket Size (mm)      | 5          | 5     | 6        | 6     | 6        |
|                                  | Torque Setting (Nm)   | 17         | 17    | 41       | 41    | 41       |
|                                  | Torque Setting (lbft) | 13         | 13    | 30       | 30    | 30       |
| Plug, Drain (46)                 | Key Size (mm)         | 3/8"       | 3/8"  | 3/8"     | 3/8"  | 3/8"     |
|                                  | Torque Setting (Nm)   | 30         | 30    | 30       | 30    | 30       |
|                                  | Torque Setting (lbft) | 22         | 22    | 22       | 22    | 22       |
| Screw, Foot (41)                 | Key Size (mm)         | 6          | 8     | 10       | 10    | 14       |
|                                  | Torque Setting (Nm)   | 20         | 40    | 65       | 65    | 95       |
|                                  | Torque Setting (lbft) | 15         | 29    | 48       | 48    | 70       |
| Screw, Shim Retainer (14)        | Socket Size (mm)      | 8          | 10    | 10       | 10    | 10       |
|                                  | Torque Setting (Nm)   | 5          | 10    | 10       | 10    | 10       |
|                                  | Torque Setting (lbft) | 4          | 7     | 7        | 7     | 7        |
| Screw, Jacket (19)               | Socket Size (mm)      | 8          | 8     | 10       | 13    | 13       |
|                                  | Torque Setting (Nm)   | 5          | 5     | 10       | 20    | 20       |
|                                  | Torque Setting (lbft) | 4          | 4     | 7        | 15    | 15       |
| Plug, Vent (43)                  | Socket Size (mm)      | 22         | 22    | 22       | 22    | 22       |
|                                  | Torque Setting (Nm)   | 80         | 80    | 80       | 80    | 80       |
|                                  | Torque Setting (lbft) | 59         | 59    | 59       | 59    | 59       |
| Sight Glass (44)                 | Socket Size (mm)      | 22         | 22    | 22       | 22    | 22       |
|                                  | Torque Setting (Nm)   | 2          | 2     | 2        | 2     | 2        |
|                                  | Torque Setting (lbft) | 1          | 1     | 1        | 1     | 1        |

## 6.1.4 Pump Data Table

| Pump  | Displacement   |                      |                     | Port size |      | Max. Working Pressure |     | Max Speed |
|-------|----------------|----------------------|---------------------|-----------|------|-----------------------|-----|-----------|
| Model | litres/<br>rev | lmg gal /<br>100 rev | US gal /<br>100 rev | mm        | inch | bar                   | psi | rev /min  |
| 32    | 0.03           | 0.66                 | 0.79                | 25        | 1    | 25                    | 362 | 1000      |
| 33    | 0.05           | 1.10                 | 1.32                | 40        | 1.5  | 25                    | 362 | 1000      |
| 34    | 0.12           | 2.64                 | 3.17                | 50        | 2    | 16                    | 232 | 1000      |
| 42    | 0.23           | 5.06                 | 6.08                | 50        | 2    | 20                    | 290 | 750       |
| 43    | 0.29           | 6.38                 | 7.66                | 50        | 2    | 13                    | 188 | 750       |
| 52    | 0.37           | 8.14                 | 9.78                | 50        | 2    | 37                    | 536 | 750       |
| 53    | 0.58           | 12.8                 | 15.3                | 65        | 2.5  | 25                    | 362 | 750       |
| 54    | 0.96           | 21.1                 | 25.4                | 80        | 3    | 16                    | 232 | 750       |
| 62    | 1.44           | 31.7                 | 38.0                | 80        | 3    | 37                    | 537 | 600       |
| 63    | 1.98           | 43.6                 | 52.3                | 100       | 4    | 25                    | 362 | 600       |
| 72    | 1.92           | 42.2                 | 50.8                | 100       | 4    | 40                    | 580 | 600       |
| 73    | 2.86           | 62.7                 | 75.3                | 150       | 6    | 25                    | 362 | 600       |
| 74    | 4.14           | 91.5                 | 110                 | 150       | 6    | 16                    | 232 | 600       |

**Please Note:**

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

- DIN11851 – 40 bar (25-40mm), 25 bar (50-100mm), 16 bar (150mm)
- ISO (IDF) – 16 bar (25-50mm), 10 bar (65-100mm) providing provision for support ring is to be made
- SMS – 10 bar (all sizes)
- RJT – 10 bar (all sizes)
- Tri-clamp (BS4825) – Pressure rating is dictated by the clamp band used (Refer to clamp band supplier)
- DIN11864-1 – 40 bar (25-40mm), 25 bar (50-100mm)
- DIN11864-2 – 25 bar (25-40mm), 16 bar (50-100mm)

For size 150mm on DuraCirc 73 and 74 pumps, only DIN11851, SRJT or Tri-clamp connections are available.

## 6.1.5 Seal Operating Limits

| Seal Type                    | Maximum Speed   | Maximum Process Pressure |     |
|------------------------------|-----------------|--------------------------|-----|
|                              |                 | bar                      | psi |
| Mechanical Seal (Sic/Carbon) | Max. Pump Speed | 15                       | 218 |
| Mechanical Seal (Sic/Sic)    | Max. Pump Speed | Max. Pump Pressure       |     |
| O-ring Seal                  | 300             | 7                        | 102 |

Maximum Flush Pressures:

Mechanical Seal – Single Flush = 0.5 bar / 7 psi

Mechanical Seal – Double (Sic/Carbon) = 1 bar above pump discharge upto 16 bar / 232 psi

Mechanical Seal – Double (Sic/Sic) = 1 bar above pump discharge upto 20 bar / 290 psi

O-ring Seal – Flushed = 0.5 bar / 7 psi

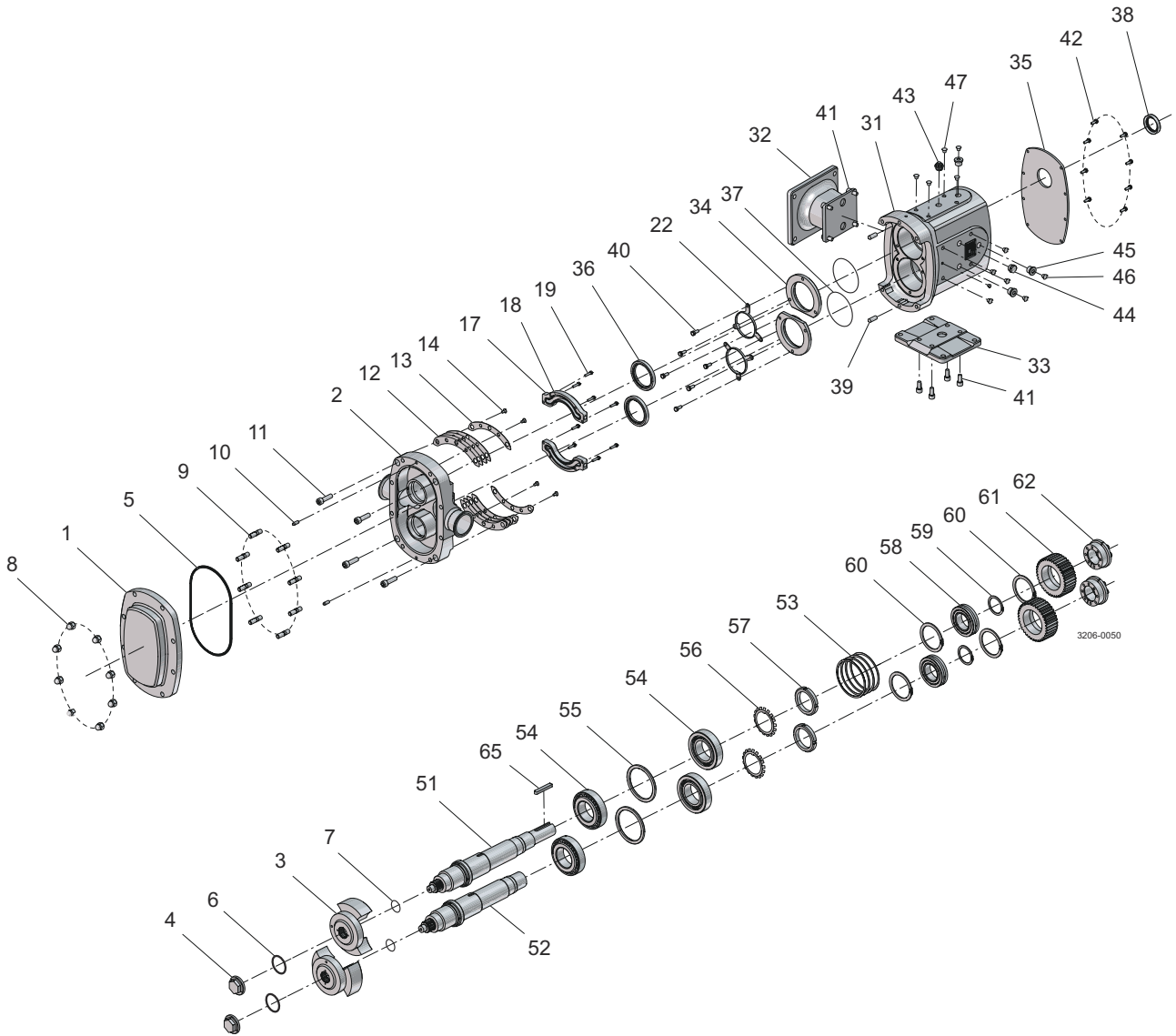
## 6.2 Pumphead Clearance information

For pump head clearances please see separate addendum sheet.



# 7 Parts list

## 7.1 DuraCirc Pump Range



| Pos. | Qty | Denomination           |
|------|-----|------------------------|
| 1    | 1   | Cover, Rotorcase       |
| 2    | 1   | Rotorcase              |
| 3    | 2   | Rotor                  |
| 4    | 2   | Nut, Rotor             |
| 5    | 1   | P-ring, Cover          |
| 6    | 2   | P-ring, Roter nut      |
| 7    | 2   | O-ring, Rotor shaft    |
| 8    | 8   | Nut, Dome              |
| 9    | 8   | Stud, Rotorcase        |
| 10   | 2   | Dowel, Rotorcase       |
| 11   | 4   | Screw, Rotorcase       |
| 12   | 2   | Shim, Rotorcase        |
| 13   | 2   | Retainer, Shim         |
| 14   | 4   | Screw, Shim retainer   |
| 17   | 2   | Heating jackets        |
| 18   | 2   | O-ring, Heating jacket |
| 19   | 8   | Screw, Heating jacket  |
| 22   | 2   | Guard, gland           |
| 31   | 1   | Gearcase               |
| 32   | 1   | Foot, Vertical port    |
| 33   | 1   | Foot, Horizontal port  |
| 34   | 2   | Retainer, Seal         |
| 35   | 1   | Cover, Gearcase        |
| 36   | 2   | Lip seal, Gland end    |
| 37   | 2   | O-ring, Seal retainer  |
| 38   | 1   | Lip seal, Drive end    |
| 39   | 2   | Dowel, Gearcase        |
| 40   | 2   | Screw, Seal rainer     |
| 41   | 1   | Screw, Foot            |
| 42   | 2   | Screw, Gearcase cover  |
| 43   | 6   | Plug, Breather         |



| Pos. | Qty | Denomination                               |
|------|-----|--|
| 44   | 4   | Sight glass                                |
| 45   | 8   | Plug, Gearcase                             |
| 46   | 1   | Plug, Blanking                             |
| 47   | 2   | Plug, Blanking                             |
| 51   | 1   | Shaft, Drive                               |
| 52   | 1   | Shaft, Auxillary                           |
| 53   | 1   | Shim, Gearbox                              |
| 54   | 4   | Bearing, Front                             |
| 55   | 2   | Spacer, Bearing                            |
| 56   | 2   | Washer, tab lock                           |
| 57   | 2   | Nut, Shaft                                 |
| 58   | 2   | Bearing, Rear                              |
| 59   | 2   | Circlip, Shaft                             |
| 60   | 4   | Circlip, Bearing *(DuraCirc 32 to 43 Only) |
| 61   | 2   | Timing Gear                                |
| 62   | 2   | Torque Locking Assembly (TLA)              |
| 65   | 1   | Key, Drive                                 |