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ViscoTwin 70 G7

Operation & Maintenance Manual

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1. ABOUT VISCOTWIN SCREW PUMPS

1.1 Safety Notes

This manual contains instructions which should be heeded to ensure personal safety and prevent damage to property. These instructions are highlighted by a warning triangle and a color to indicate the degree of the hazard. The following warnings should be observed throughout the life cycle of the pump:

ROTATING PARTS
Indicates rotating parts that can cause injury. Only perform work on or near these parts when it is locked to prevent rotation. It is advised to have a protective barrier surrounding the rotating part to prevent injury or property damage during operation.

HIGH VOLTAGE
Indicates high voltage and risk of shock or severe burns. No work should be performed around high voltage parts unless they have been disconnected from the main power supply. Any work on high voltage parts must only be performed by an electrician licensed in the state where operations and maintenance is being performed.

CRUSHING PARTS
Indicates moving parts that can crush and cut. Perform work with awareness of how parts move and where these crushing parts can be encountered.

SUSPENDED LOAD
Indicates a suspended or overhung load, where parts can fall, slip, or tip over if not properly secured. Do no work on any part that is suspended and avoid being directly under or near a suspended load. Do not stand between a stationary object and a suspended load.

LIFTING OBJECTS
Indicates heavy objects that can cause muscle strain or back injury. Lifting aids and proper lifting techniques should be used to prevent injury.

LEAKAGES
Indicates that leaks are possible. Leaked fluid can cause slip-and-fall hazards and should be cleaned up and disposed of immediately.

HOT SURFACE
Indicates a surface is hot to the touch and can cause burn injury. Do not maintain or touch a hot surface until the pump is turned off and allowed to cool. If immediate repair is necessary, it is advised to wear protective gloves while handling a hot part.

CAUTION
When operating the **ViscoTwin 70 G7**, it is essential to wear appropriate protective equipment.

Commissioning and operating the **ViscoTwin 70 G7** may only be performed by qualified personnel. Qualified personnel in terms of the safety instructions in this operating and safety manual are persons who have completely read this manual.

Furthermore, maintenance can only be performed by qualified maintenance technicians. Qualified maintenance technicians in terms of the maintenance instructions in this operating and safety manual are persons who have read Chapter 4 “Maintenance” and have been trained by **Processtec** in the use and maintenance of this pump. In lieu of in-person training by **Processtec** personnel, a qualified maintenance technician may also review the online maintenance movies available at http://processtec.com. **WARNING: ANY MAINTENANCE LEVEL 2 PERFORMED ON THIS PUMP BY UNTRAINED PERSONNEL WITHOUT THE EXPRESS WRITTEN CONSENT OF PROCESSTEC WILL RELEASE PROCESSTEC OF ANY LIABILITY AND VOID ANY WARRANTY CLAIMS ON THE PUMP..**

In addition to this operating manual, general on-site regulations as well as city, state, and federal regulations applicable to accident prevention must be made available and followed.

The **ViscoTwin 70 G7** may only be used in the applications as specified in Chapter 3 "Operation" on page 29, and only in connection with the spare parts recommended by **Processtec, Inc**.

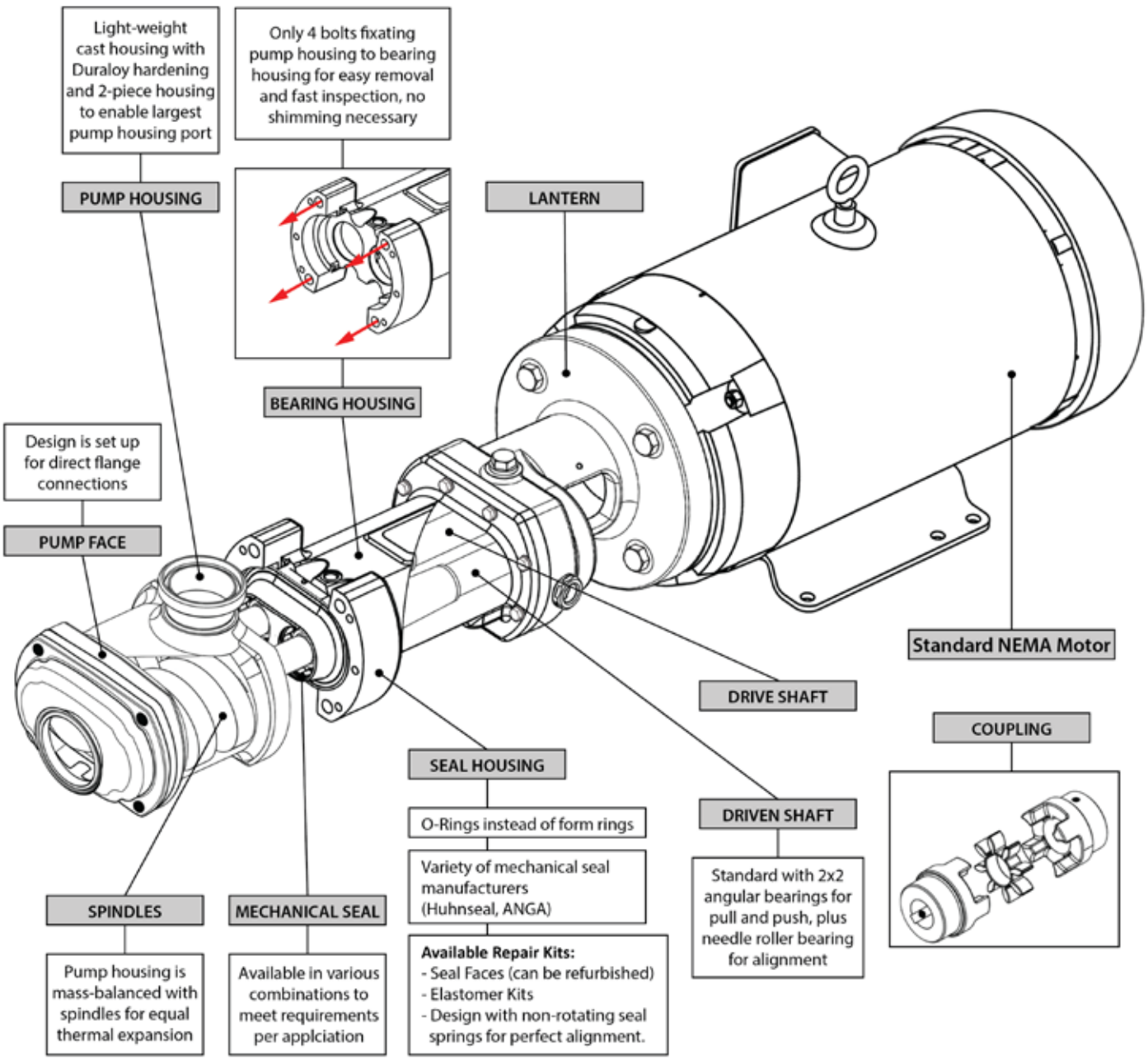
1.2 Working Principle

Screw pumps are rotary positive displacement pumps for conveying low to high viscosity media. The **ViscoTwin 70 G7** is a positive displacement pump characterized by a double screw, or spindle, design. The pump utilizes very close tolerances to create a series of "sealed" chambers between spindle windings. This allows the pump to more efficiently transport highly viscous product with minimal slippage and precision flowrate control as well as gentle handling of solid particulates already mixed into the product. The precision craftsmanship of the **ViscoTwin 70 G7** means it can generate a very high pressure differential, even with a low inlet pressure.

The pump is also highly customizable, with several sizes and inlet/outlet variations to suit the needs of the product and the space available. Additionally, the pump is maintenance friendly and fully CIP-able, to ensure ease of use.

ViscoTwin 70 G7 pumps used in the food and beverage industry are designed to meet the most stringent sanitary design criteria (3A, EHEDG), and are built with corrosion-resistant materials in accordance with recommendations from US Food and Drug Administration (FDA) and other international food safety governing bodies. Pumps are delivered with a motor, lantern, and framing as standard for easy installation.

1.3 General Overview



1.4 Options

1.4.1 Options for 3A or EHEDG

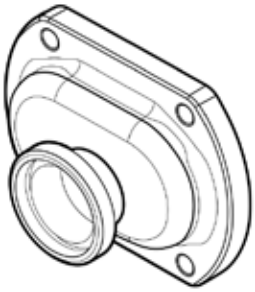
All **ViscoTwin** pump models including all associated options as listed throughout this Section 1.4 are designed according 3A and EHEDG guidelines. General design and detail design considerations like radii, O-ring grooves, surface treatment, material, and elastomer selection fulfill both norms.

Only pumps for the US dairy industry require the 3A symbol attached to it. The only difference is a slight improvement on the spindle polish. In case the spindles are hardened with the kolsterization process, the spindels show a matte surface, because the spindle polishing took place before the kolsterization process.

All **ViscoTwin** Pump Housings are hardened with a DURALOY treatment. The inside surface of the pump housing is always matte.

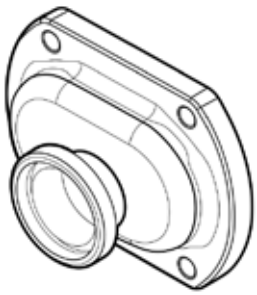
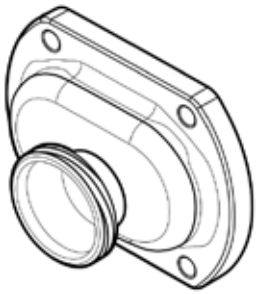
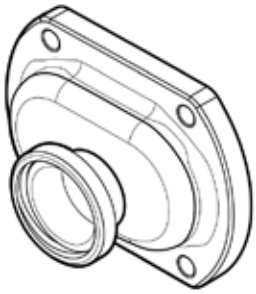
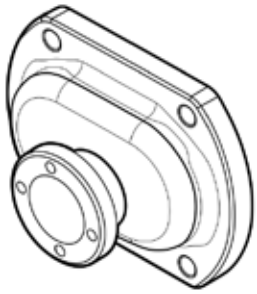
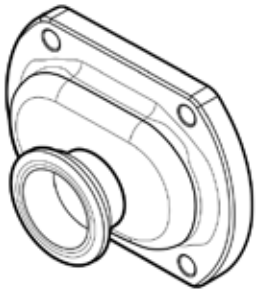
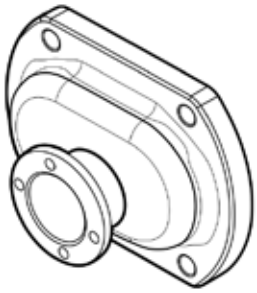
The general build of all **ViscoTwin** pumps also fulfills OSHA and CE guidelines.

1.4.2 Pump Face Options



The ViscoTwin 70 G7 has one style of pump face that is included by default. It can be modified to accomodate a variety of Port Sizes and Process connections. See the tables below for a complete list of options available.

PORT SIZE OPTIONS			
OD1.5"	OD2.0"	OD2.5"	OD3"

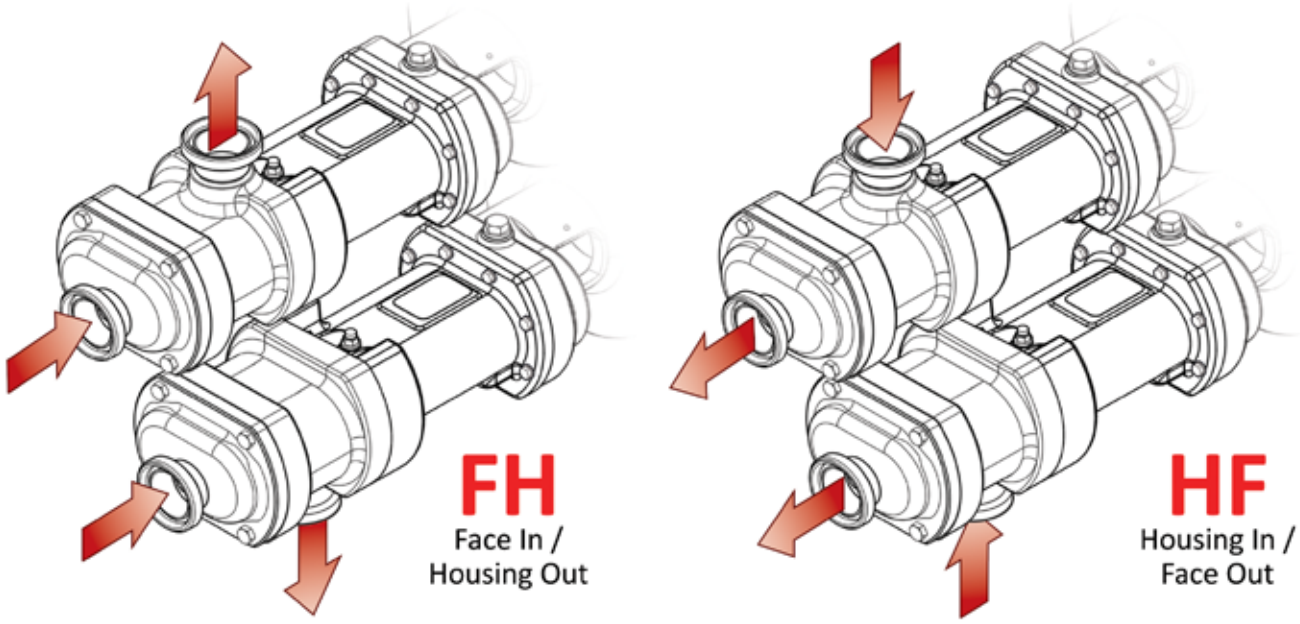
PROCESS CONNECTION OPTIONS			
 **Tri Clamp** (Standard)	 **DIN 11851**	 **DIN 11864-1** (Screwed Union)	 **DIN 11864-2** (Flange Union)
 **DIN 11864-3** (Clamp Union, Feral Collar Side)	 **Varivent Flange**	 **Butt Weld**	 **Short Pipe**

NOTE: Processtec supplies the Non O-ring / Collar side; the mated O-ring Groove side & clamps are not included with the ViscoTwin Pump.

1.4.3 Pump Housing Options

Flow Direction

The ViscoTwin 70 G7 has two general flow directions: Face in -> Housing out (FH) and Housing in -> Face out (HF)



It is preferred to drag the product along the bottom of the housing which requires the shafts to spin "outwards".

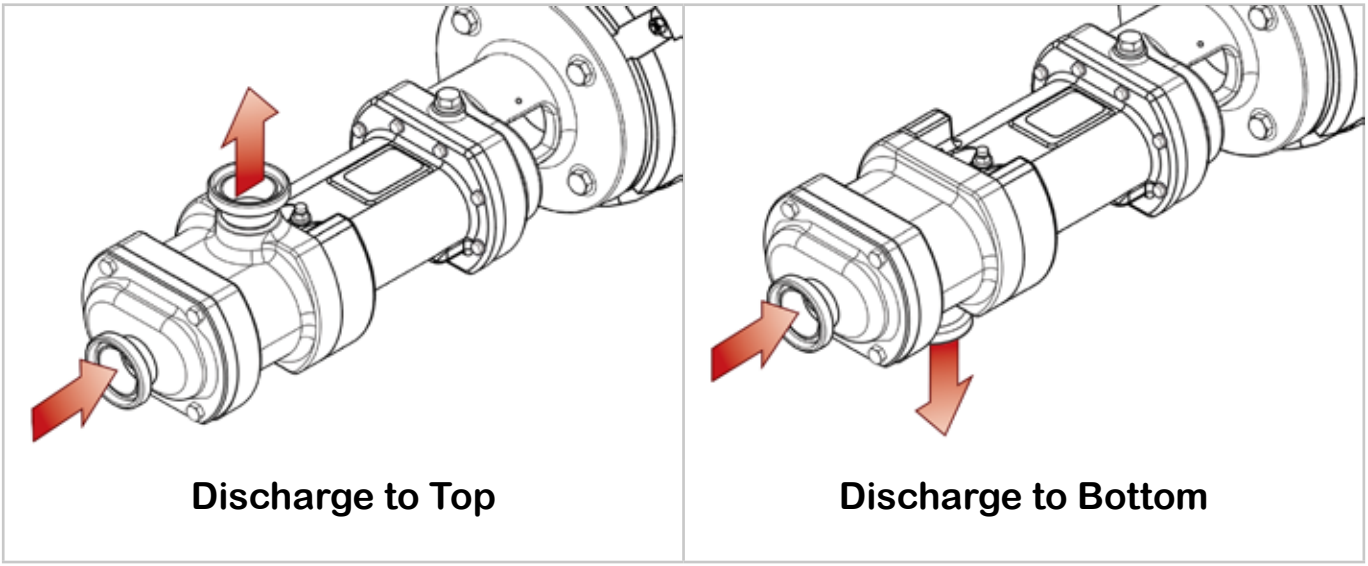
Spindle arrangement for shafts turning "Outwards":
Housing arrangement "FH" -> Spindle arrangement "V"
Housing arrangement "HF" -> Spindle arrangement "A"
Outwards turning shafts require the PIN arrangement "3"

Spindle arrangement for shafts turning "Inwards":
Housing arrangement "FH" -> Spindle arrangement "A"
Housing arrangement "HF" -> Spindle arrangement "V"
Inwards turning shafts require the PIN arrangement "1"

The most common arrangement for ViscoTwin pumps is arrangement FHO3V (see page 119).

Port Direction

The ViscoTwin 70 G7 also has two general port directions: Discharge to Top, and Discharge to Bottom.



1.4.4 Elastomer Options

Elastomer Selection Table

	MAX. TEMP	MAX. FAT	TEMP / STRESS
EPDM	140° C	10%	28 bar
FKM	120° C	100%	28 bar

1.4.5 Spindle Options

Three different spindle pitches are available for each ViscoTwin pump size. Each individual spindle pitch itself has the following options:

- Standard EHEDG polish
- Standard 3A polish
- Hardened EHEDG polish
- Hardened 3A polish
- Hardened tapered EHEDG polish
- Hardened tapered 3A polish

Smaller spindle pitches are used to create high discharge pressures, especially with product at viscosities below 2000 cps, at the cost of limiting the flow rate. Larger spindle pitches can be used for high viscous product at medium discharge pressure, and/or high flowrates of low viscous media like CIP at lower differential pressures.

For product with specific particulate sizes, the spindle pitch will determine the minimum pump size. For example, if the particulate requires a cross section of 1", then the pump would need to be a Model 104.53 or Model 130.65.

22mm

29mm

43mm

Volume per Revolution

SIZE	SCREW PITCH	VOLUME PER REVOLUTION		PARTICULATE SIZE	
		METRIC	US STANDARD	METRIC	US STANDARD
ViscoTwin 70 G7	**22 mm**	0.071 Liter	0.019 Gal	11 mm	7/16"
	29 mm	0.094 Liter	0.025 Gal	15 mm	9/16"
	43 mm	0.140 Liter	0.037 Gal	22 mm	14/16"

Max Pump Head RPM: 4000 rpm.

1.4.6 Mechanical Seal Options

Different mechanical sealing surfaces and elastomers are available for the **ViscoTwin 70 G7** pumps. Material and design are selected based on application.

For a long service life, please follow the operating conditions the mechanical seals are designed for. **Processtec** has mechanical seals for various requirements available.

Design Options

Mechanical seals for the **ViscoTwin** are categorized as follows:

- Single Acting Mechanical Seals (SAMS)
- Double Acting Mechanical Seals (DAMS)

Available sealing surfaces in the product area:

- Silicon Carbide (SIC)
- Tungsten Carbide (TC)
- Tungsten Carbide Knife Edge (TC-KE)

Available Elastomers in the product area:

- FKM (standard)
- EPDM for high temperature without fat content

The mechanical seals are designed to withstand a product area pressure of up to 400 psi.

1.4.7 Bearing Housing Options

Housing Options:

There are two housing options available for the **ViscoTwin** Bearing Housing and Gear Housing. Both have distinct advantages.

Stainless Steel

The **Stainless Steel** bearing housing is our standard option. The **Stainless Steel** bearing housing will not show external wear even after many years in operation, and fulfills the highest sanitary standards.

Oil sample testing kits can be ordered by contacting info@processtec.com.

Powder Coated

The **Powder Coated** bearing housing is an economic solution made from cast iron. The powder coating is resilient to external weathering, however some wear can show over time.

Bearing Options

The ViscoTwin pump bearing housing is designed to address various forces impacting the pump shafts, which are dependent on flow direction and discharge pressure.

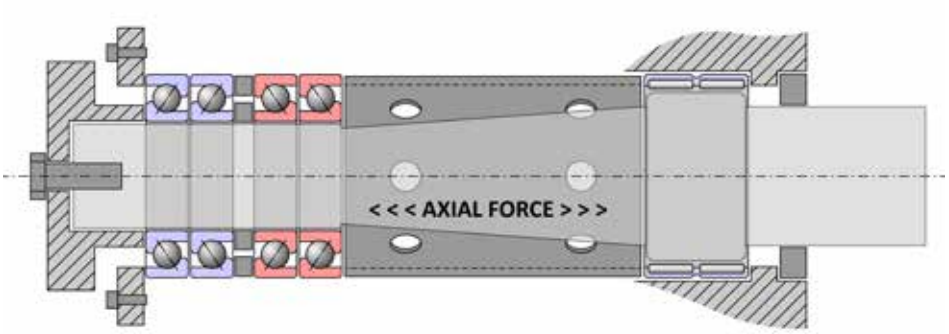
Each shaft is supported by 4 angular ball bearings and one set needle bearing. The needle bearings support the shaft against radial forces in the front. The 4 angular ball bearings support the shaft against axial and radial forces in the back.

The axial forces limit the bearing's lifespan based on P = F / A, where:

P = differential pressure
F = Axial Force on the Shaft
A = Spindle Surface

For more details, please consult Section 6.4 "Maximizing Bearing Lifespan" on page 132.

ViscoTwin bearing housings are configured based on pressure rating and flow direction as follows:

2:2 Standard (Up to 300 psi)	

1.4.8 Motor Options

For ViscoTwin pump motors are optimized to deliver max torque in the 300 - 1200 rpm range at the lowest performance requirement to save cost & complexity. Above 1200 rpms, the ViscoTwin pump motor can be used to boost CIP & water, as low viscous media doesn't require high torque. In order to use the motor at higher rpm's, the VFD must be set to allow spin over 60 Hz. Most modern motors from reputable manufacturers can handle the 4000 rpm's, as the shaft & bearings from 4-pole + motors are typically the same as their 2-pole counterparts.

Sample with 7.5kW (10hp) Motor

DESCRIPTION	SPEED @ 50 Hz	TORQUE @ 50Hz	SPEED @ 60 Hz	Torque @ 60Hz
2-Pole Motor	2900 rpm	25 Nm / 18 lb-ft	3500 rpm	20 Nm / 15 lb-ft
4-Pole Motor	1450 rpm	49 Nm / 36 lb-ft	1750 rpm	41 Nm / 30 lb-ft
6-Pole Motor	965 rpm	74 Nm / 55 lb-ft	1166 rpm	61 Nm / 45 lb-ft
8-Pole Motor	725 rpm	99 Nm / 73 lb-ft	875 rpm	82 Nm / 60 lb-ft

Gearmotors

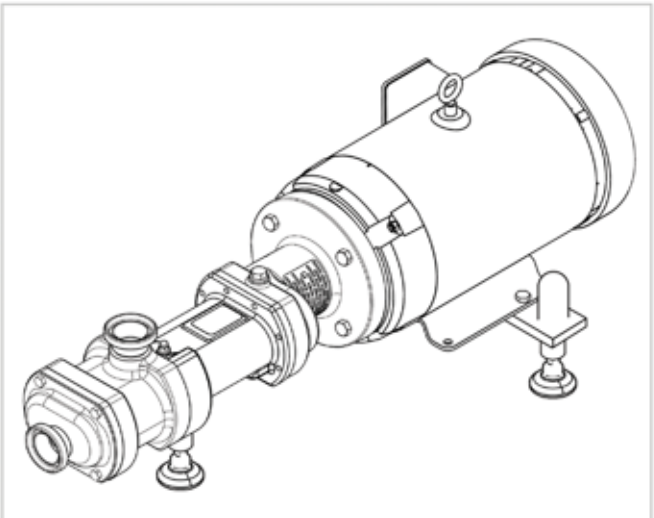
Gearmotors are selected when higher torque is needed at lower power & CIP boosting isn't required.

The general limit on gearboxes for overspeeding is 1.5x to 2x to nominal speed.

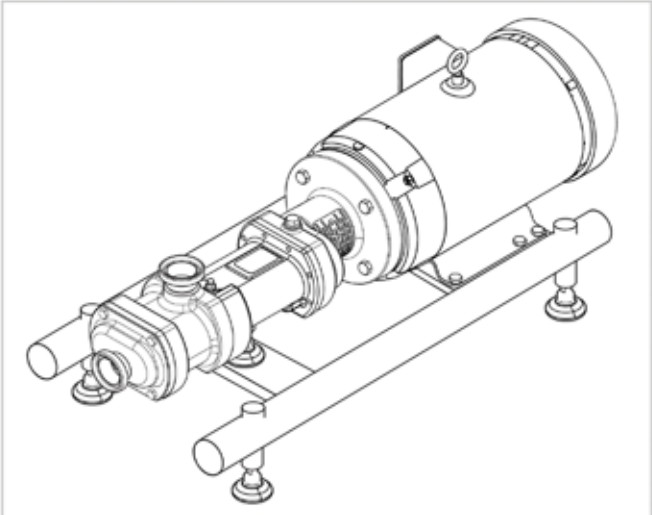
The generic rule of thumb is:
Metric: (Kw x 9549) = RPM x Torque in Nm
Imperial: (HP x 5252) = RPM x Torque in lb-ft.

The torque value of an electric motor is approximately flat between 30 Hz to 60 Hz. Above 60 Hz, the formulas above apply. Below 30 Hz, the loss in torque is very minimal.

1.4.9 Frame Options



Frame #1 Frameless (w/Three Legs)



Frame #3 Heavy Duty Frame

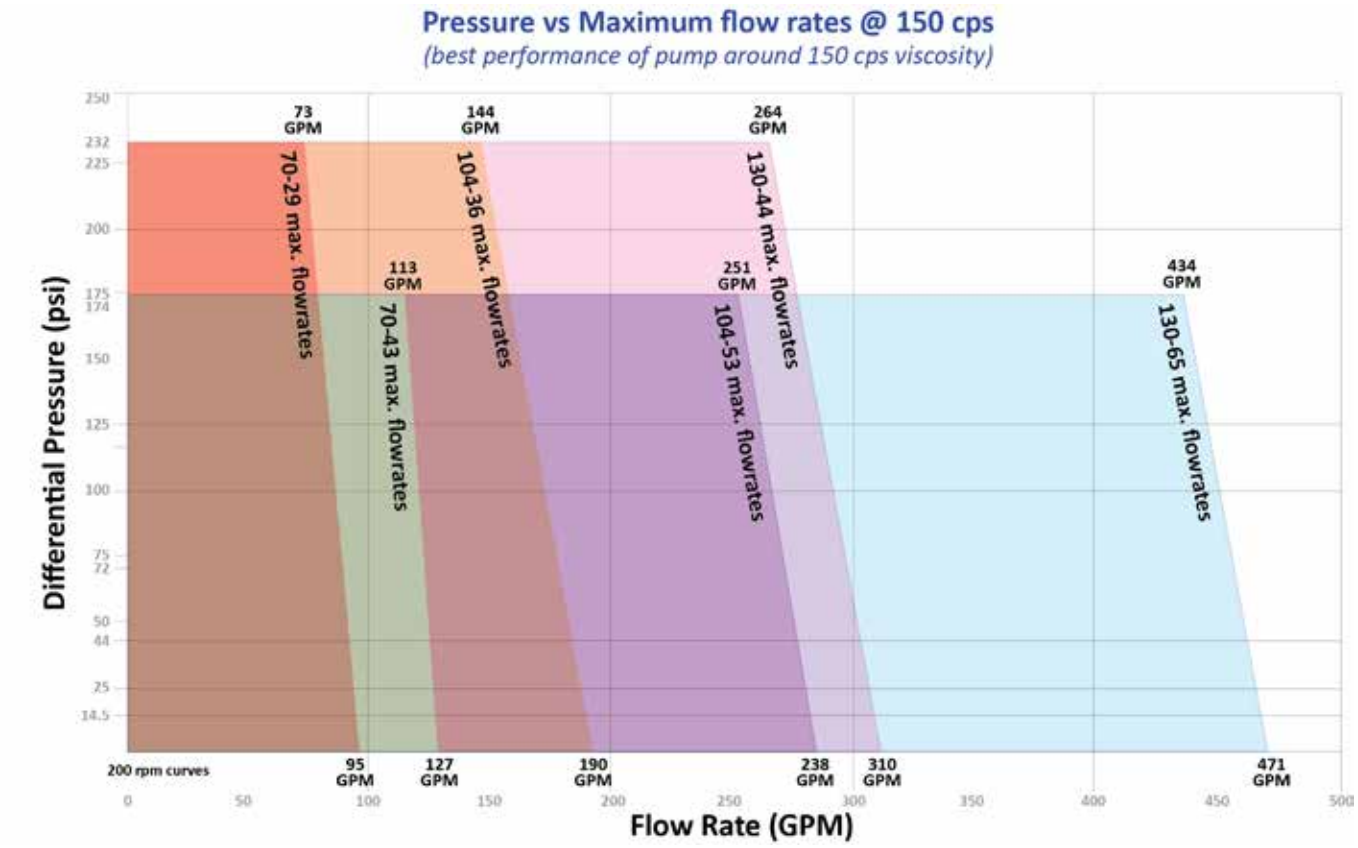
1.5 Performance Tables

The ViscoTwin pump sizing is dependant on the following factors:

- Viscosity of the pumped media
- Required Flowrate
- Required differential pressure (NPSH Optimized discharge pressure)

In the food industry it is very common to have several different set points for various products with various viscosities. Also, the pump is often used for self propelling CIP and needs to speed up in order to meet the desired CIP flowrate of 1.8 m/sec (5 ft/sec) for appropriate line cleaning.

1.5.1 Sizing Chart



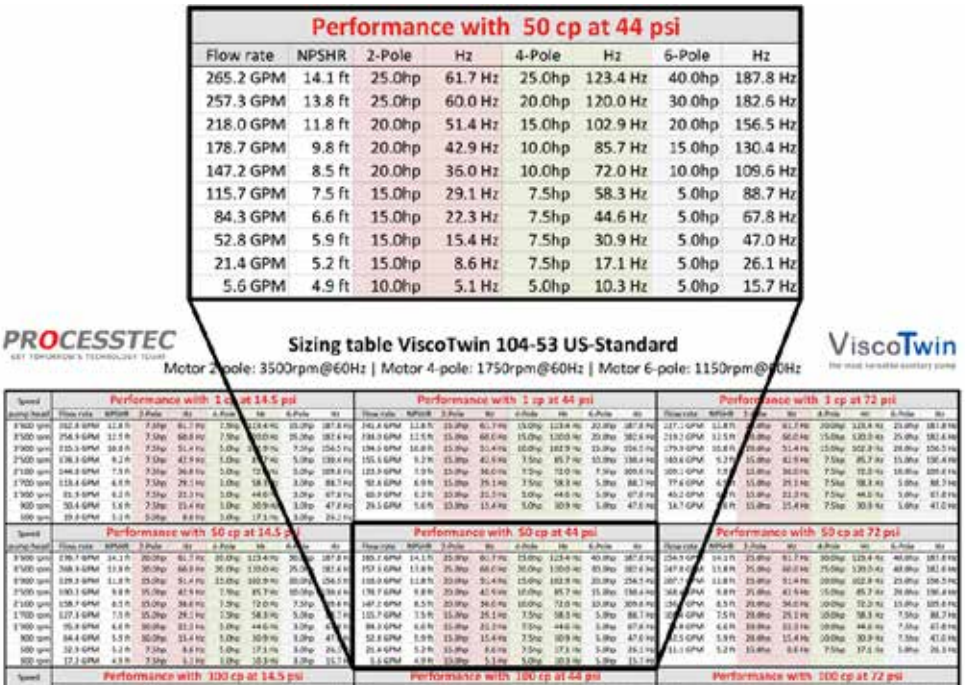
The pump sizing is best accomplished with a proprietary sizing software. For the engineer without access to a sizing program, we created some sizing tables that are ready for download.

The Sizing Tables can be viewed and/or downloaded from the **Processtec** website:

https://processtec.com/sizing-us-standard.html

To use the Sizing Charts, follow these steps:

STEP 1) Find the field that comes closest to the viscocity and pressure range
STEP 2) Find the closest Flow Rate in GPM
STEP 3) Determine the RPM on the Pump Shaft
STEP 4) Specify the Motor



Performance with 50 cp at 44 psi

Flow rate	NPSHR	2-Pole	Hz	4-Pole	Hz	6-Pole	Hz
265.2 GPM	14.1 ft	25.0hp	61.7 Hz	25.0hp	123.4 Hz	40.0hp	187.8 Hz
257.3 GPM	13.8 ft	25.0hp	60.0 Hz	20.0hp	120.0 Hz	30.0hp	182.6 Hz
218.0 GPM	11.8 ft	20.0hp	51.4 Hz	15.0hp	102.9 Hz	20.0hp	156.5 Hz
178.7 GPM	9.8 ft	20.0hp	42.9 Hz	10.0hp	85.7 Hz	15.0hp	130.4 Hz
147.2 GPM	8.5 ft	20.0hp	36.0 Hz	10.0hp	72.0 Hz	10.0hp	109.6 Hz
115.7 GPM	7.5 ft	15.0hp	29.1 Hz	7.5hp	58.3 Hz	5.0hp	88.7 Hz
84.3 GPM	6.6 ft	15.0hp	22.3 Hz	7.5hp	44.6 Hz	5.0hp	67.8 Hz
52.8 GPM	5.9 ft	15.0hp	15.4 Hz	7.5hp	30.9 Hz	5.0hp	47.0 Hz
21.4 GPM	5.2 ft	15.0hp	8.6 Hz	7.5hp	17.1 Hz	5.0hp	26.1 Hz
5.6 GPM	4.9 ft	10.0hp	5.1 Hz	5.0hp	10.3 Hz	5.0hp	15.7 Hz

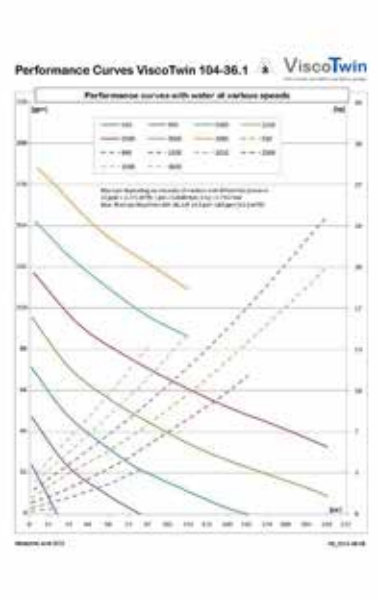
PROCESSTEC
Sizing table ViscoTwin 104-53 US-Standard
Motor 2-pole: 3500rpm@60Hz | Motor 4-pole: 1750rpm@60Hz | Motor 6-pole: 1150rpm@60Hz
ViscoTwin

Sizing Tables:

ViscoTwin G7 70-29	ViscoTwin G7 104-36	ViscoTwin G7 130-44
ViscoTwin G7 70-43	ViscoTwin G7 104-53	ViscoTwin G7 130-65

1.5.2 Water Curves

These Water Curve Performance Charts show CIP & waterflush and also products with Viscocity 1.



Water Curve Performance Charts in **US STANDARD** can be viewed and/or downloaded from the **Processtec** website here:
https://processtec.com/water-curves-us-standard.html

Water Curve Performance Charts in **METRIC** can be viewed and/or downloaded from the **Processtec** website here:
https://processtec.com/sizing-us-standard.html

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2. INSTALLATION

2.1 Unpacking

Check the contents and all wrapping when unpacking the pump. Inspect the pump carefully for any damage that may have occurred during shipping. Immediately report any damage to the carrier. Keep the protective caps over the pump inlet and outlet in place until the pump is installed.

2.2 Inspection / Technical Documentation

Inspect the pump for visible shipping damages on pump head, lantern with coupling, motor, and frame. Locate the technical documentation that is shipped with the pump including:

0. Equipment Recieving Protocol
00. Pump Shipping Documents Template

1. Configuration Key
2. Equipment Commissioning Protocol

3.1 3.1 Pump Housing Photo
3.2 3.2 Spindle Photo
3.3 3.3 Bearing Housing Photo

4. Spindle and Pin Configuration
5. ViscoTwin Manual (70 G7)
6. Spare Parts Catalog (70 G7)
7. Customer Recommended Tools Catalog

Use these documents to ensure the pump is shipped as ordered & store these documents for future reference. All pumps are labeled with a sticker showing a QR code, the pump model, a serial number, and a Component ID identifying the building plan of the pump at **Processtec**.

2.3 Hoisting and Transportation

The instructions below outline the proper methods for hoisting and transportation of ViscoTwin Pumps. The photos may show a slightly different version of the pump than your version, but the methods shown are the same.

LIFTING WITH A PALETTE JACK OR FORKLIFT FORKS

A Palette Jack can be used to lift the ViscoTwin Assembly, if it is already on a flat surface. Slide the forks of the palette jack underneath the lift points, taking care to make sure that the Assembly Footing Tabs are being supported sufficiently.

Forklift forks can also be used to lift the ViscoTwin Assembly by sliding underneath the footing on the Motor and Bearing Housings. Make sure that the ViscoTwin Assembly is completely supported and that both forks are contacting the ViscoTwin Assembly before lifting.

WRAPPING A LIFTING STRAP AROUND THE LANTERN

The ViscoTwin Assembly, when bolted together properly, is strong enough to be hoisted via a strap around the Safety Lantern.

Using the properly-rated lifting strap, wrap it underneath the lantern.

Move one end of the looped strap through the other end, and then cinch down the strap around the Safety Lantern.

LIFTING HOOK INSTALLATION

The Lifting Hook can be attached to the Pump Housing, and is designed to lift the ViscoTwin Pump Head while maintaining a center of balance.

Be sure that the clamps are firmly in place on the Pump Housing before proceeding.

STRAP PLACEMENT FOR HOISTING THE MOTOR

Forklift forks can also be used to lift the ViscoTwin Motor, in conjunction with properly placed hoisting straps.

Make sure that the ViscoTwin Motor is completely supported and that both forks are making good contact before lifting.

PUMP ASSEMBLY HOISTED IN MID-AIR

When the ViscoTwin Assembly is hoisted in midair via the lifting strap, the position of the strap on the lantern will determine whether the assembly stays level or not.

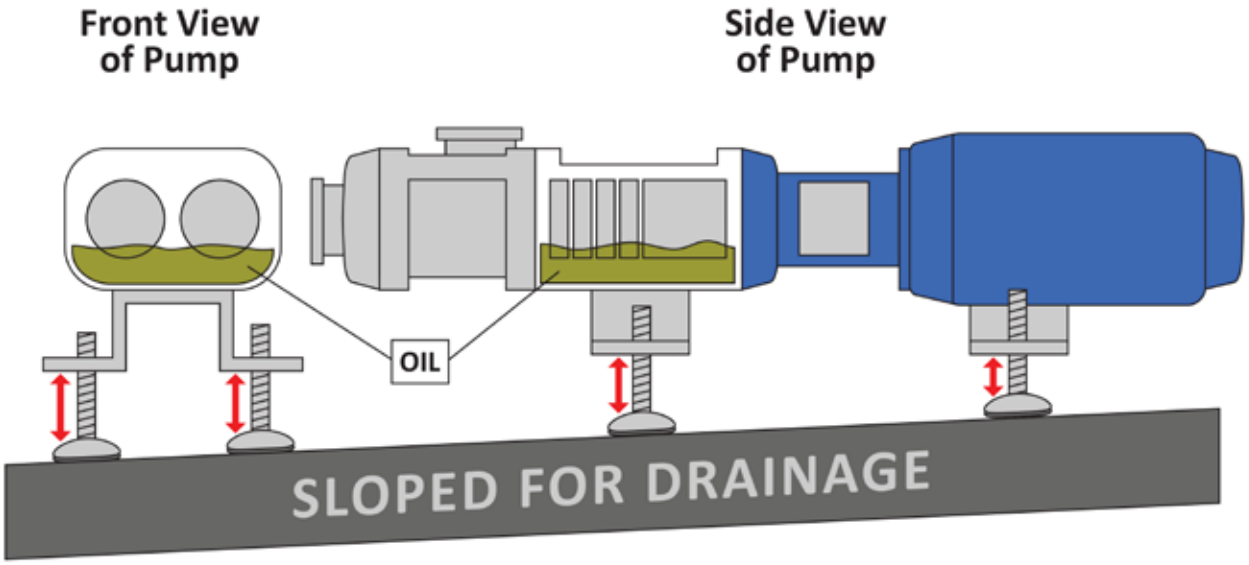
You can lift the entire assembly a few inches to see if the position of the lifting strap is centered on the assembly, supporting it evenly, then lower it back down to re-adjust the position of the lifting strap on the Safety Lantern.

A proper position on the Safety Lantern will allow you to hoist the assembly in a level position.

2.4 Installation

The following points need to be considered while installing the pump in the system:

1. All pump frames are delivered with height adjustable feet to accommodate sloped floors for drainage. The pump should be level so the pump operates even with a low oil level and still reach all bearings. To level the pump, adjust the height-adjustable feet individually (see red arrows) until the pump is level.



2. No excess forces should be exerted on the pump from piping systems, platforms etc.
3. Ensure good access to the oil sight glass at the gear housing for regular inspection from operators and maintenance personnel.
4. Ensure good access to the bolts (Pos. 1016) to easily remove the Pump Housing with a extended torque wrench for sanitary inspection.
5. Ensure that the whole pump can be easily accessed for preventive pump maintenance at the Pump Housing and the Gear Housing for oil change. If this can not be arranged, ensure that the pump can be easily removed from the operating location with a palette jack, forklift or rollers, into a location that allows accessing all parts of the pump.
6. Connect the Seal Water if the pump is equipped with a double seal that requires seal water. It is recommended that the seal water automatically starts and stops with the pump to save water.
7. Ensure that the electric wiring can easily be disconnected for maintenance and is not a safety hazard or dirt trap.

2.5 Piping Before and After the Pump

Sizing the correct upstream and downstream piping including valves and fittings is very involved and depends on the experience of the application engineer. **Processtec** developed a sizing program that accounts for kV values of common sanitary valves and pipe fittings at various sizes and port arrangements. The program requires the input of a valid apparent viscosity value. Please consult **Processtec** engineering if you need support to verify your piping arrangement.

2.5.1 Upstream Piping

The upstream piping of the pump requires the utmost attention. The NPSH available from the system (NPSHa) needs to be higher (higher absolute pressure) than the NPSH required (NPSHr) by the pump (lower absolute pressure).

The NPSHa must be less than the NPSHr or cavitation occurs. The pumped media creates vaporized bubble that immediately collapse & damage both the product & the pump.

The ViscoTwin has excellent suction capabilities and will maintain it throughout its life cycle if operated per design. Since ViscoTwin pumps can be used with very viscous media, any flow restrictions preventing the product from arriving at the pump suction nozzle at the desired flowrate must be removed. If the pump is sped up faster than the product can enter the pump, the pump cavitates, and will damage the pumped media, and the pump itself.

Typical installation errors that create cavitation:

- Product has a higher apparent viscosity than anticipated. Typically, colder product results in a higher apparent viscosity.
- The upstream pipe is undersized in diameter as well as the associated valves, fittings, elbows, and tees.
- Too many restricting devices in the suction line like valves, tees, elbows, or other pipe restrictions.
- The suction pipe is too long.
- Particulates in the product are caught in valves, restricting the flow

2.5.2 Downstream Piping

The max discharge pressure on standard ViscoTwin models depends on the pump configuration and the pumped media. Pump configurations with the largest possible spindle pitch max out between 12 bar and 14 bar. Pumps equipped with the smaller spindle pitches (consult the options table) have a max discharge pressure of 16 bar (232 psi). The max temperature with standard elastomers is 130° C (266° F).

If the desired discharge pressure can not be met with the ViscoTwin 70 G7 due to spindle pitch restriction, **Processtec** recommends using the ViscoTwin 104 G7 with a smaller spindle pitch.

2.5.3 Piping Before and After the Pump

The ViscoTwin pump operates like a hybrid pump between a centrifugal pump and an absolute positive displacement pump, primarily due to slip between the left and right hand spindles and between the spindles and the pump housing. Due to this fact bypasses are generally not needed, allowing for a deadzone-free piping arrangement. ViscoTwin pumps can be installed in series without a bypass if proper engineering principles are applied.

In case the pump is cleaned with an external CIP supply pump for a higher flowrate than the ViscoTwin is designed for, the pushing CIP solution will propel the ViscoTwin pump at a relatively low flow restriction, making a bypass obsolete. The pump will start to spin, even if it is not started. No damage will occur if correct engineering principles are applied.

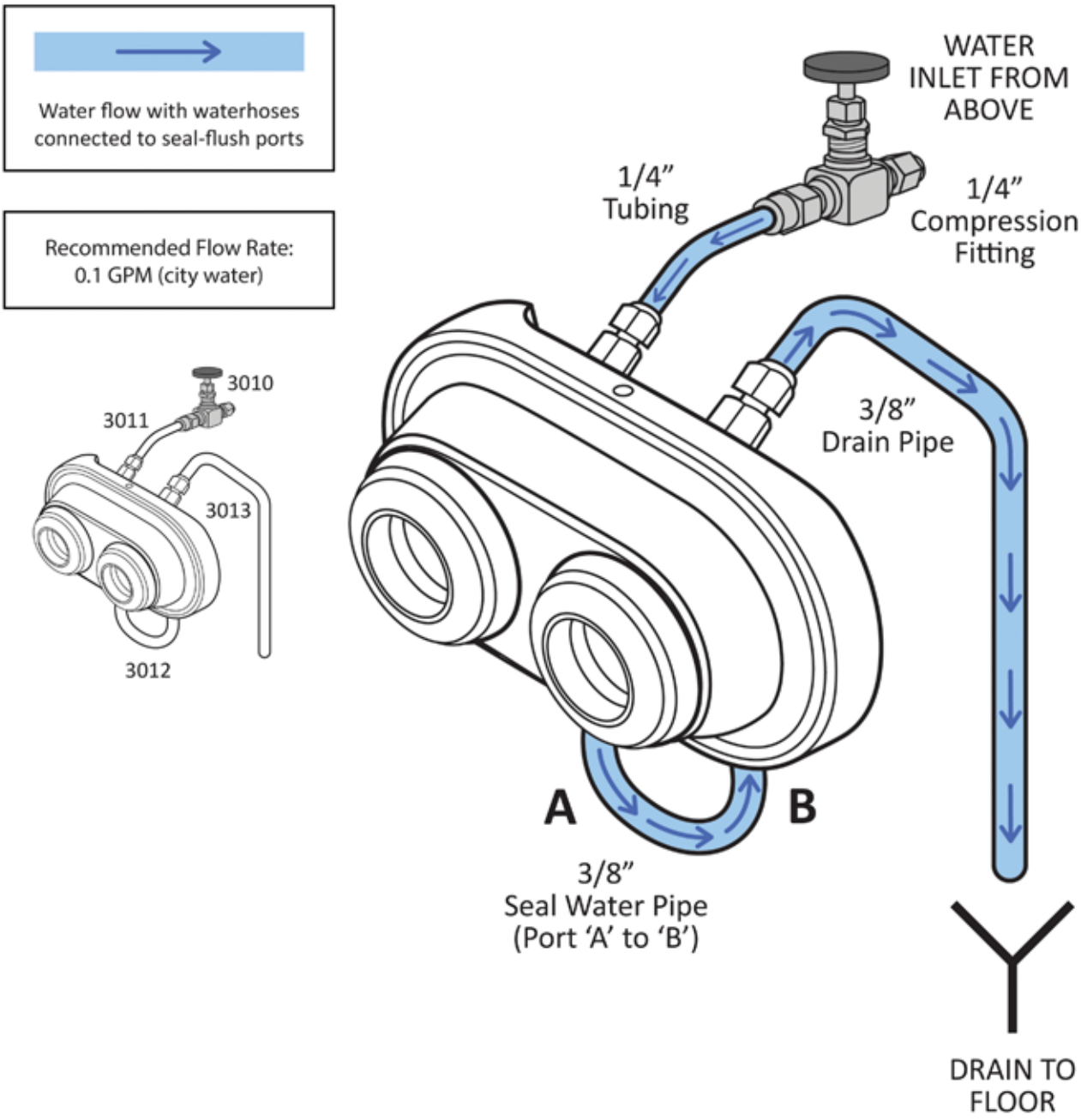
2.6 Mechanical Seal Connection

To maximize the service life of the mechanical seals and ensure a cool and clean area behind the inboard sealing surface, **ViscoTwin** pumps are pre-piped for pass through seal water with a manual needle valve to restrict the flow at the inlet. The inlet piping is connected with a 1/4” compression fitting. The bypass piping and discharge piping is piped in 3/8” round tubing, avoiding corners for easy passage of eventual residues or debris. The recommended flowrate is 0.1 GPM. **Processtec** offers options to safe water usage with:

- A pneumatic or magnetic valve to start the seal water only if necessary
- A small flowmeter (1/4”) to confirm the flow of seal water
- A quench tank installation (see Section 6.3 "Quench Design for Recirculating Fluids in Mechanical Seals" on page 131)

2.7 Pre-Installation of Seal Water for Dual Acting Mechanical Seal

When using city water (from the tap), it is advisable to run an in-line filter, to prevent any possible debris or sediment from entering the pump.



NOTE: Your pumps Mechanical Seal may look slightly different, but the fittings used for flushing are the same.

2.8 Electrical Installation

Processtec on default selects 3-phase AC motors that meet country specific installation requirements. For the US and Canada we select NEMA frame motors. For Mexico, Europe and Australia we select IEC motors that meet country spec.

Other motor standards are available upon request. It is up to the client to follow the country specific guidelines for electrical installations.

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3. OPERATION

3.1 Pump Startup

Before starting up the ViscoTwin 70 G7 pump after the installation, or after system changes upstream occur, it is important that no debris or foreign material can enter the pump head. Because of the tight clearance between the spindles and the pump housing, any debris entering the pump housing can cause severe damage to pump housing and spindles. After any system modification upstream occur, the piping needs to be severely flushed. Before the pipe flushing begins, the pump suction line needs to be disconnected from the pump face or pump housing, and directed to the floor so no debris can be flushed into the pump housing.

3.2 Soft Starting the Pump

It is recommended to gradually ramp up the pump speed, as opposed to performing a hard start. Twin Screw pumps are mostly used in heavy duty applications with viscous media, often with particulates, and changing viscosity based on product properties and fluctuating temperatures. Most food products have non-Newtonian fluid behavior and are shear thinning.

When starting up slow, the viscous product is forced into motion. Friction along the pipe walls is imparted onto the product. The imparted friction on the shear thinning product lowers the apparent viscosity momentarily. The lower apparent viscosity results in a lower overall pressure drop in the system. This is especially helpful in the suction line of the pump. Lower apparent viscosity increases the NPSH available (NPSHa).

The soft start allows the pump to ramp up speed over a period of 15 to 30 seconds in a controlled manner while reading the motor amps from the VFD into the PLC. The shear thinning effect is sensed with the decreasing amps indicated by the VFD.

3.3 Avoiding Pump Cavitation

When the pump cavitates due to a flowrate that is too high for the suction line size and the product viscosity, the flowrate needs to be lowered. The NPSH Optimized Pump Face from **Processtec** has a built in pressure gauge port to install a vacuum sensor to indicate the NPSH directly at the pump head. With the feedback signal from the vacuum gauge, the pump can be safely operated at min NPSH required, resulting in its max speed for the given setup without damaging the product and pump.

3.4 Pumping Sensitive Products

Sensitive product like macaroni & cheese sauce or cooked potato pieces can easily be pumped without creating damage to it if the pump housing and the spindles are correctly sized. However, if the pump suction is too strong, sensitive product contents like macaroni can be stretched and break apart. In this case, the flowrate must be lowered as a momentary solution. For a long term solution, the pump suction system must be modified by increasing the suction line size and removing flow restrictions like valves, Tee's etc. The NPSH at the pump face should read between 2 and 4 feet, depending on product.

Note that -14.5 psi (- 1 bar) is absolute vacuum on this planet. If the suction line is undersized, hence the NPSH is too low or almost zero, no pumping system exists to provide the desired performance.

3.5 Material Selection for Sealing Surfaces

ViscoTwin pumps are often operated with viscous and sticky media in a stop and go application. The pump re-start can stress the seal faces at the engagement pins and break brittle seal face materials such as Silicon Carbide. In this case, a sustainable solution would be to use Tungsten Carbide knife edge seal faces.

3.6 Pumping Product with Large Particulates

When the application requires pumping product with large particulates, the pump housing needs to be configured accordingly:

- **Considering Spindle Size** - Large enough spindle pitches: A spindle pitch 65 means that the cross section between the flanks is 32.5mm = 1-1/4 inches.

- **Considering Port Size** - Large enough port size: The most critical opening is in the seal area towards the pump housing. Bigger is better.

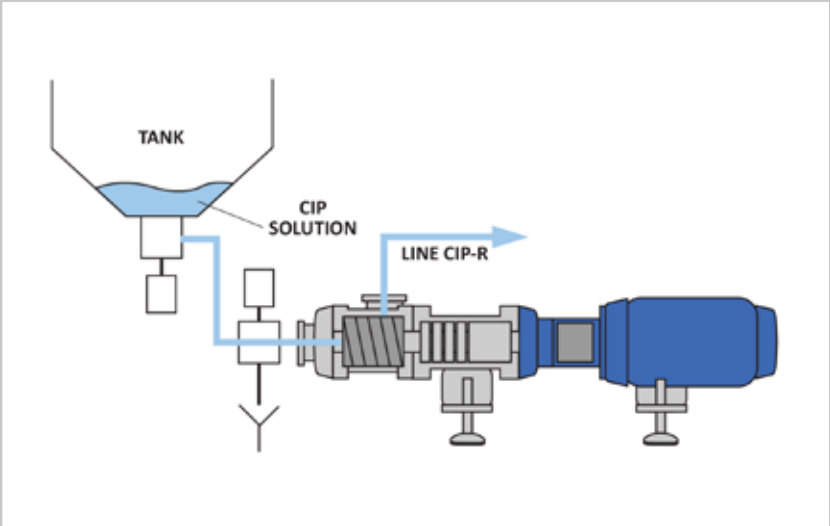
- **The Ideal RPM Range** - Slow enough spindle speed: between 300 and 800 rpm.

3.7 CIP / COP Solution

CIP stands for Clean In Place, which is the process in which a pump is cleaned in its current location. It is standard for most pumps in the Industry. The ViscoTwin can be CIP'd in a variety of different setups:

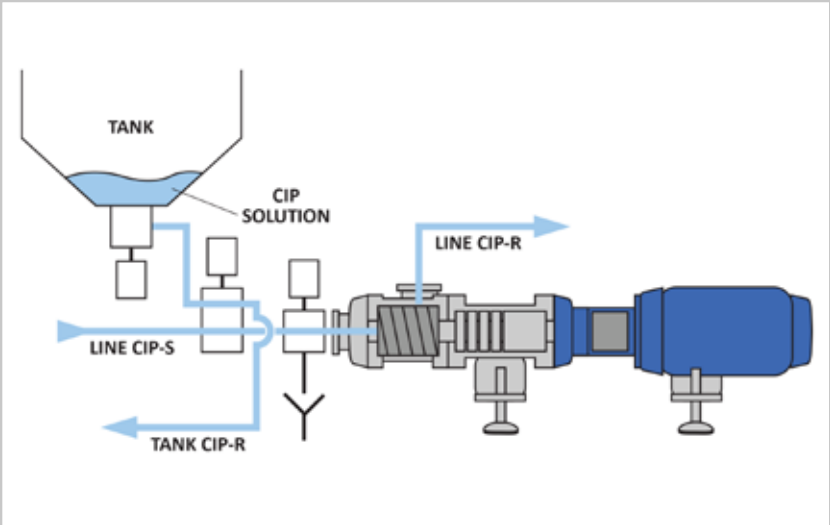
Self-Propelled Cleaning

The pump is used as a CIP return pump. This is mostly the case when a pump is installed as a tank discharge pump.



Inline Cleaning

The pump does not need to propel the CIP solution and is part of the cleaned pipe line. A dedicated CIP pump upstream is propelling the CIP solution. In this case there is no need for a bypass around the pump housing to achieve a high flow rate in the upstream and downstream pipe.



ViscoTwin pumps operating with watery solution are like a hybrid between a centrifugal and positive displacement pump.

ViscoTwin pumps have sufficient slip for CIP solution to be pushed through the pump head without creating large pressure drops. The spindles will start spinning by themselves if not operated during in-line cleaning. To protect the outboard seal faces from overheating, the seal water supply should be activated during CIP.

3.8 Visual Inspection

We recommend daily observation of the pump as described in Subsection 4.2.1 "Maintenance Level 1 (ML-1)" on page 39.

3.9 Available Elastomer Options

If excessive wear and tear on elastomers in the Pump Housing is observed, **Processtec** offers various elastomer options to address demanding applications based on temperature, oil/fat content, and permeable stress. We offer EPDM and FKM.

For more information, check out the Elastomer Options Chart in Subection 1.4.4 "Elastomer Options" on page 8.

3.10 Leakage

Leakage is the primary concern for mechanical sealing. Mechanical Seal Leakage depends on many factors, most of which are listed in the table below. Leakage is generally significantly higher during initial startup when the elastomers are dry and need to be broken-in to allow proper sealing. Afterwards, the elastomers should seal completely during normal operations.

Possible Causes of Mechanical Seal Failures or Leakage

FAILURES OR LEAKAGE	POSSIBLE CAUSES
Dry-Running	Thermal shock from lack of seal water
Mechanical Shock	Stator installed at the wrong angle
Wear on the sliding surfaces	Deposits on the sliding surfaces
Corrosion on the sliding surfaces or springs	Dirt, oil, or grease on the sliding surfaces
Axial misalignment	Improper installation
Extreme vibrations	Excess loads from pipe connections
Caked-on product on the product-side of the seal (DAMS)	Damaged/destroyed atmospheric-side of the seal (DAMS)
The seal faces will glue together	Long storage time and the screws have not been hand-turned as instructed

Slow leaks are a primary concern as the small amount of liquid tends to evaporate into the atmosphere. This is unacceptable with toxic or environmentally harmful liquids. The standard for such cases is a Double Acting Mechanical Seal with a quench medium to flush out and contain dangerous product media in a separate, closed system.

Due to legal regulations, leaks must be constantly monitored to protect the environment. For maintenance or cleaning cycles, it is recommended to monitor flushing loss using either a visual flow measurement or a back-pressure sensor. **Processtec** advises regularly inspecting and/or replacing the visible O-rings on the mechanical seal cartridge during maintenance and inspection intervals or repairs.

3.11 Scratches in the Pump Housing

If the spindles or the pump housing show scratches, this indicates that the spindles touch each other or touch the pump housing. The following should be investigated first:

A) Pump configuration with PIN position:

Each ViscoTwin Pump Housing is configured based on flow direction and kind of pumped product. The standard configuration is **FHO3V**:

F: Face In
H: Housing Out
O: Spindles turning outwards
3: Pin Position 3
V: Spindle Arrangement “V”

For more information, please see Section 5.5 "Pump Housing Configurations" on page 117.

B) The spindles are not correctly gapped. The clearances between the spindles show that the flights on one side touch each other. Please consult Subsection 4.5.8 "Proper Gapping of Pump" on page 84.

C) The spindles touch the housing at the pump face end when A) and B) are verified and correct. The clearance between spindle tip and housing is too small for the viscosity of the pumped product and the associated rpm. This issue can be addressed with tapered spindles.

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4. MAINTENANCE

4.1 Maintenance Preparation

4.1.1 General Movie: HOW THE PUMP WORKS

QR Code
Please use any cell phone or tablet with a QR reader application to start the movie.

This movie can be found at
https://processtec.com/videos/ViscoTwin-Mechanics-2.mp4

4.1.2 Introduction to Web Page

In the ViscoTwin Overview section on the main **Processtec** webpage (http://processtec.com/viscotwin-overview.html), you will find a variety of content that is helpful for pump maintenance, including links to various Maintenance Movies, General Documents and Manuals, and other useful information. Use the QR Code to the right to access this section on the **Processtec** web page.

On that Overview page, you will find the Downloads section (http://processtec.egnyte.com/fl/kdahMFELvV#folder-link/Products/ViscoTwin/ViscoTwin%20G7), which contains a directory of folders containing the following technical information:

- Explosion Drawings G7
- Manuals G7 (70, 104, 130)
- Pin Configurations G7
- Spare Parts Catalog G7
- Tool List G7
- Torque Tables G7

4.1.3 Risk Assessment for Pump Maintenance

1) Risk of Pump Falling
There are certain precautions which must be taken when working around ViscoTwin pumps. Failure to adhere to the proper guidelines for transporting or lifting of the pump can result in personal injury, or damage to the pump itself.

When moving or lifting the pump, please keep the following in mind:

- Pumps and related parts are heavy, and must be moved using the proper steps as outlined in Section 2.3 "Hoisting & Transportation" on page 20.
- When moving the pump, you must observe the center of gravity and also the maximum weight of the load.
- Only use suitable slings with sufficient load-bearing capacity.
- Only use proper hoisting attachment points to lift the motor.
- Never stand underneath the motor while it is being lifted or suspended.
- Never stand between the suspended load and a stationary object (such as a wall or floor)
- Keep the surrounding area clear from obstructions, and free from people

2) Metal Splinters due to Sharp Spindle Flights
This mostly occurs because the spindles touched while in operation. Reasons for touching spindles are failure to correctly install the spindles on the shaft or foreign material entered the pump and scratched the spindles and the pump housing.

3) Pinched Fingers / Cut Fingers
Pinched fingers occur when the pump is manually moved while the pump housing is removed. Carrying the pump on the spindles is risky because the spindles can turn towards each other.

4.1.4 Safety Measures

1) LOTO - Follow factory instructions for LOTO (Lock Out / Tag Out).

2) Wear Gloves - To prevent burns and cuts.

3) Hands-On Training - Qualified Maintenance Technicians performing **ML-2** tasks need to have hands-on training. They need to become familiar with the pump, the required tools, the supporting documents and charts.

4.2 Explaining Maintenance Levels

4.2.1 Maintenance Level 1 (ML-1)

ML-1 is the daily observation of the pump by the operator, which includes the following steps:

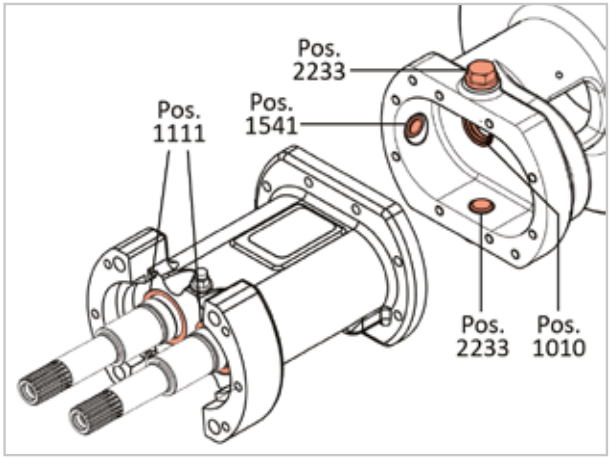
STEP 1) Checking for Product Leaks

A) Product leaks can occur around the pump housing due to a leaking pipe connection, or a worn and brittle O-ring in the pump housing.

B) In case the seal water is cloudy, the mechanical seal has a leak and needs to be inspected by a maintenance technician.

STEP 2) Check for Oil Leaks at the following positions:

A) Both Shaft Seal Rings in front of the Bearing Housing (Pos. 1111).
B) The Shaft Seal Ring in the back of the Gear Housing (Pos. 1010).
C) The Oil Level Sight Gauge at the Gear Housing (Pos. 1541).
D) Both Oil Plugs at the Gear Housing (Pos. 2233).



In case the operator notices oil leaks on the floor, a maintenance technician needs to inspect the pump.

STEP 3) Check for Strange Noises

In case unusual noises occur, the pump needs to be stopped. A maintenance technician needs to inspect the pump for:

A) Foreign material in the pump housing
B) Damaged mechanical seals
C) Damaged or mis-aligned motor coupling
D) Damage at the motor, failing motor bearings

4.2.2 Maintenance Level 2 (ML-2)

ML-2 is recommended to only be performed by qualified maintenance tehcnicians as defined in Section 1.1 "Safety Notes" on page 1.

STEP 1) Sanitary Inspection

In order to inspect the product contact area, the pump housing needs to be removed by unthreading the four (4) bolts in Pos. 1016. The spindles, the mechanical seals, the seal housing and the pump housing with pump face can be inspected from every angle.

STEP 2) Oil Inspection/Sampling and/or Oil Change

A) The first oil change is required after 250 hours. This is known as the break-in period.

B) It is recommended to sample the oil every 3 months after the first oil change and exchange it accordingly with the recommended oil. Based on the humidity of the environment, the oil can degrade more or less quickly depending on amount of starts and stops the pump is exposed to. Repeated start/stopping heats and cools the bearing housing, which sucks in outside air and mositure into the gear housing.

STEP 3) Exchange Mechanical Seal

Please follow the steps outlined in Subsection 4.4.2 "Complete Pump Disassembly" on page 46.

STEP 4) Gapping the Pump

In case the spindles touch each other after a pump cleanup because foreign material entered the pump housing, the pump needs to be gapped. Please follow Subsection 4.5.8 "Proper Gapping of Pump" on page 84.

4.2.3 Maintenance Level 3 (ML-3)

ML-3 is recommended to only be performed by a specialized shop that handles bearing exchange and pump testing like **Processtec**.

STEP 1) Timing

In very rare cases the pump needs to be timed. Timing is necessary when the gearwheel space is too small for gapping. The gearwheel needs to be moved by one tooth. Timing is always necessary after a bearing exchange.

STEP 2) Bearing Fatigue

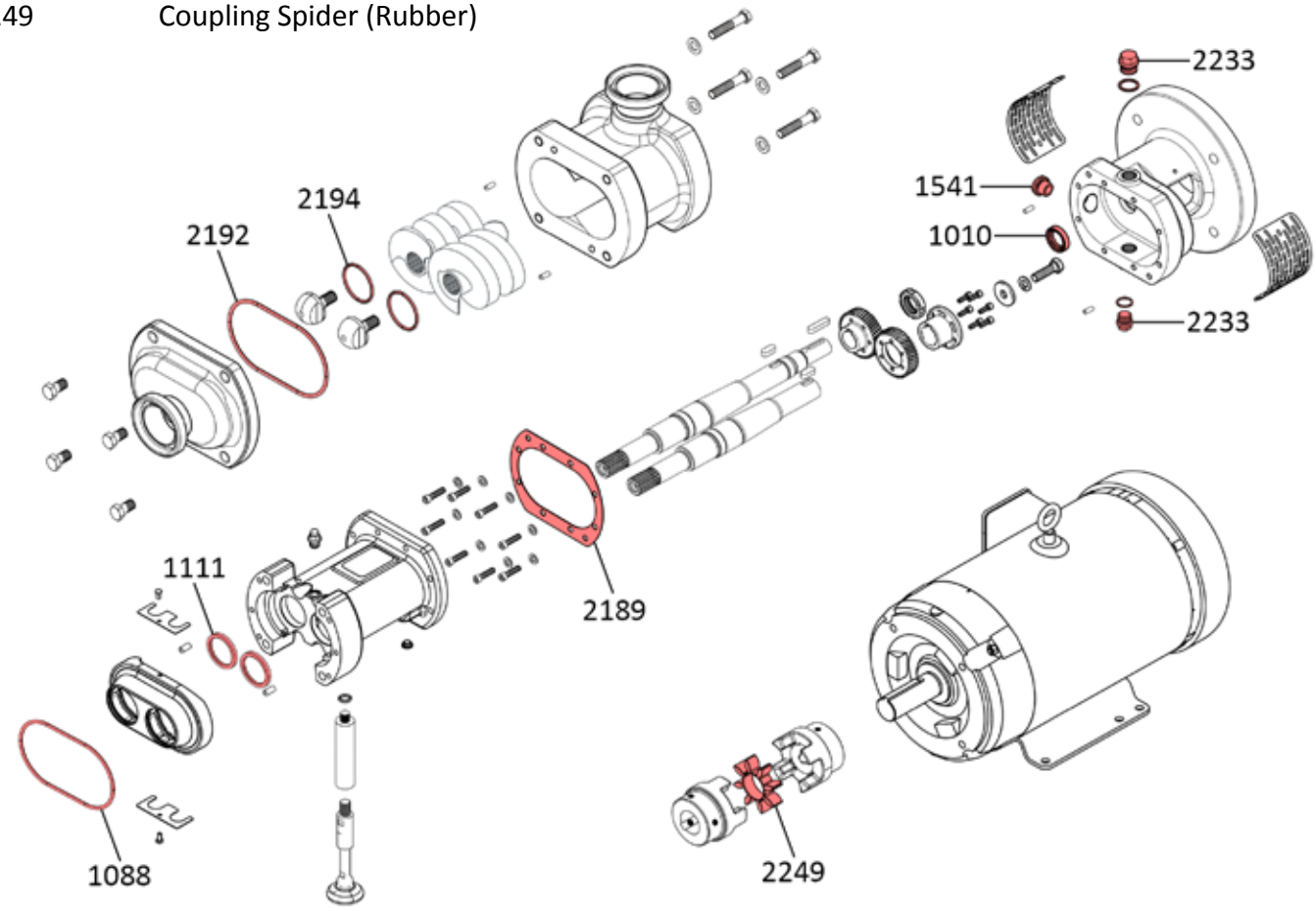
Exchange all bearings with the correct tools only by a specialized shop. For more information on Bearing Fatigue, please see Section 6.4 "Maximizing Bearing Lifespan" on page 132.

4.3 Material at hand, Required Parts & Tools

4.3.1 Recommended Spare Parts

The recommended spare parts at hand are shown in the explosion drawing in the following positions:

Pos. #	Description
2192	Pump Face O-Ring
2194	Spindle Screw O-Ring
1088	Seal Housing O-Ring
1111	Shaft Sealing Ring (Bearing Housing)
2189	Gasket (Gear Housing)
1010	Shaft Sealing Ring (Gear Housing)
1541	Oil Level Sight Gauge
2233	Screw Plug
2249	Coupling Spider (Rubber)



NOTE: *See Section 5.2 "Spare Parts" on page 100 for complete Spare Parts Listings.*

4.3.2 Recommended Tools

The recommended tools at hand are Tools for 70 ML-2 use only. (Please see Section 5.1 "Tools" on page 93 for more information)

4.3.3 Recommended Oils, Grease

The quality of the bearing oil greatly influences the service life of the pump, especially pumps operating in humid environments with many starts and stops. Please study Section 6.4 "Maximizing Bearing Lifespan" on page 132.

It is important to notice that not all oils can be mixed. Synthetic oils based on Polyglycol have water absorbing properties that greatly increase service life, but cannot be mixed with oils based on Polyalphaolifin.

Processtec recommends Klubersynth UH1-6 150 for ViscoTwin pumps. It's a foodgrade oil with water absorbing properties. Its viscosity covers a large temperature range. The max temperature is 140° C.

The ViscoTwin 70 G7 requires 0.6 liter gear oil.

In cold locations like receiving bays, **Processtec** recommends the selection of the lower end viscocity, normally indicated with numbers 68 or 100. For warmer processing environments, we recommend a more viscous oil indicated with numbers 150.

For more information on Oils, please see to Section 5.6 "Oils, Grease & Lubrication Recommended" on page 125.

4.4 Maintenance Instructions for ML-2

4.4.1 Removing the Pump Housing

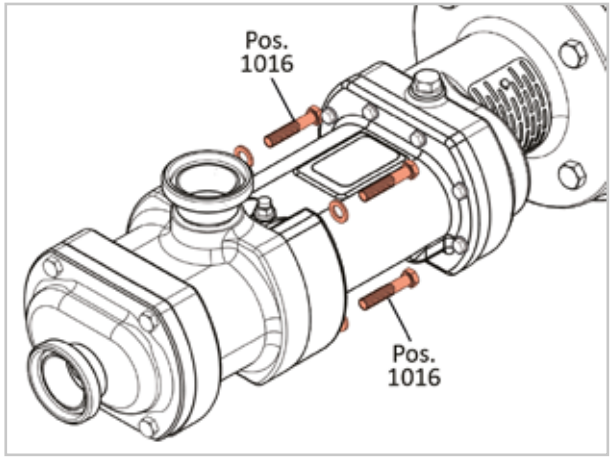
Removing the Pump Housing can be done for the following reasons:

A) Sanitary Inspection
B) First action in case the pump does not pump product.

Required Tools:

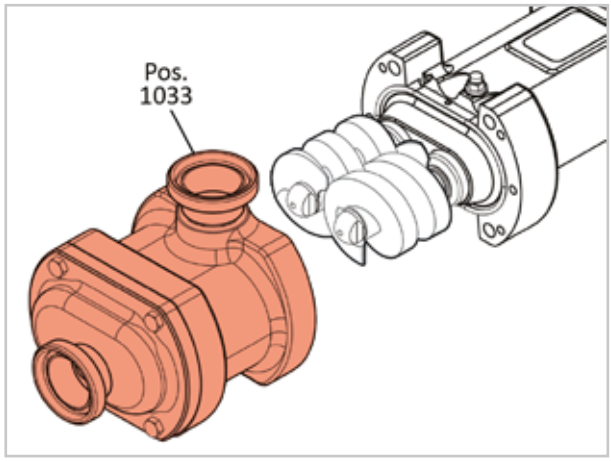
- 19mm Hex Nut Socket (for Pos. 1016)
- Torque Wrench - Large (1/2" Drive, Capable of Torque up to 70 Nm)

STEP 1)
Remove the FOUR (4) Hex Screws (Pos. 1016).



STEP 2)
Remove the whole Pump Housing (Pos. 1033) towards the front.

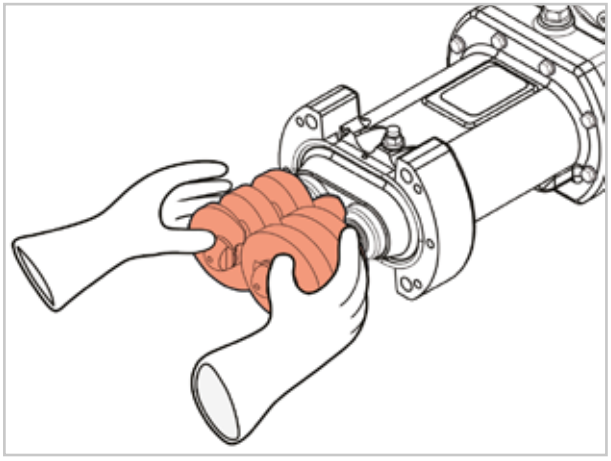
STEP 3)
Inspect the product contact surfaces for cleanliness



STEP 4)
Inspect the product contact surfaces for scratches and bruises.

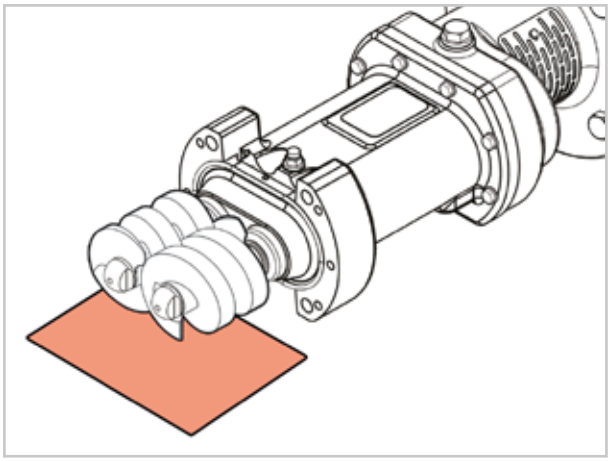
STEP 5)
Inspect the elastomers for wear and tear, and correct installation.

STEP 6)
Turn the Spindles with your hands (use gloves) and inspect that the spindles turn freely and do not touch.



STEP 7)
Push the spindles axially to inspect that the shafts are tight, indicating that the bearings are in good condition.

STEP 8)
Hold a white sheet of paper underneath the spindles and verify that the spindles do not touch.



STEP 9)
In case of touching or tight gaps, the pump needs to be gapped. This can become necessary if foreign material entered the pump, blocked one of the shafts, and the gearwheel slipped. For more information, please see Subsection 4.5.8 "Proper Gapping of the Pump" on page 84.

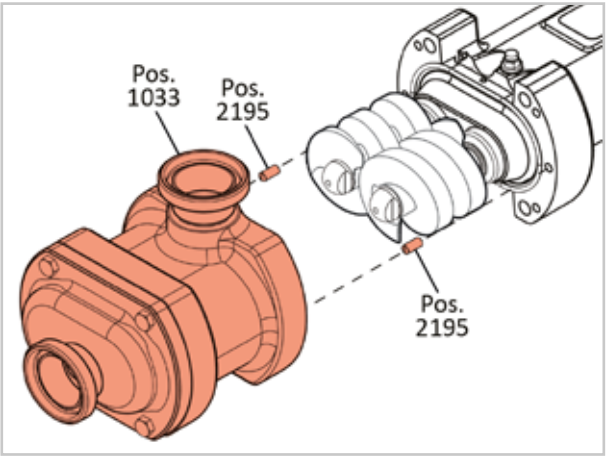
4.4.2 Re-assembly of the Pump Housing

Re-assembly of the Pump Housing is accomplished with the following steps.

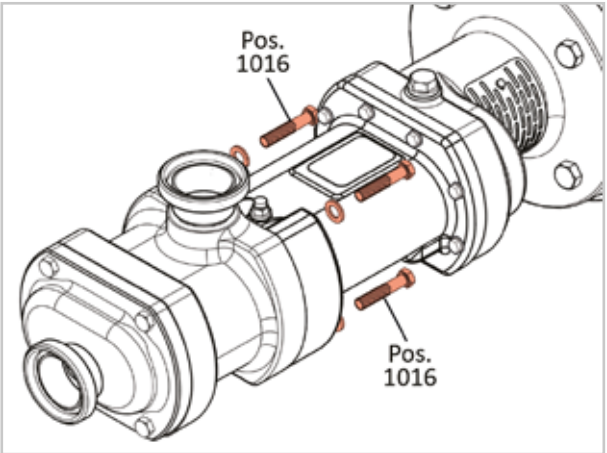
Required Tools:

- 19mm Hex Nut Socket (for Pos. 1016)
- Torque Wrench - Large (1/2" Drive, Capable of Torque up to 70 Nm)

STEP 1)
Slide the Pump Housing (Pos. 1033) back into position. Check that the TWO (2) Pump Housing Alignment Pins (Pos. 2195) are still in place. If you removed the pins, please re-install it as required by your Pump Housing Pin Configuration (Pos 1, 2 or 3).



STEP 2)
Re-install the FOUR (4) Hex Screws (Pos. 1016) and torque each of them to 70 Nm.



4.4.3 Complete Pump Disassembly (DAMS Huhnseal)

Removing the Pump Housing can be done for any one of the following reasons:

A) Exchange of the Mechanical seals
B) Exchange of all elastomers in the product contact surface area.
C) Exchange of the spindles because of wear or reconfiguring the pump
D) General Pump Inspection

Required Tools:

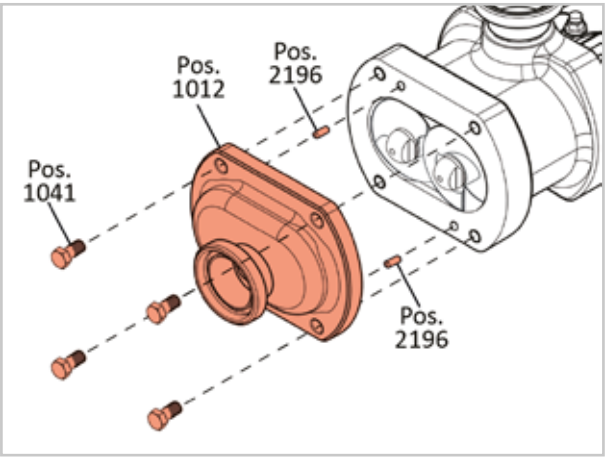
- 8mm Hex Nut Socket (for Pos. 2284)
- 19mm Hex Nut Socket (for Pos. 1016 & 1041)
- 27mm Spindle Screw (for Pos. 2180)
- Torque Wrench - Small (1/4" Drive, Capable of Torque ranging from 8 to 15 Nm)
- Torque Wrench - Large (1/2" Drive, Capable of Torque up to 150 Nm)

Action steps for complete pump disassembly:

STEP 1) Removing the Pump Face
STEP 2) Removing the Pump Housing
STEP 3) Blocking the Shaft in the Lantern Area
STEP 4) Removing the Spindles
STEP 5) Removing the Seal Housing
STEP 6) Inspecting the Pump Parts

STEP 1)
REMOVING THE PUMP FACE

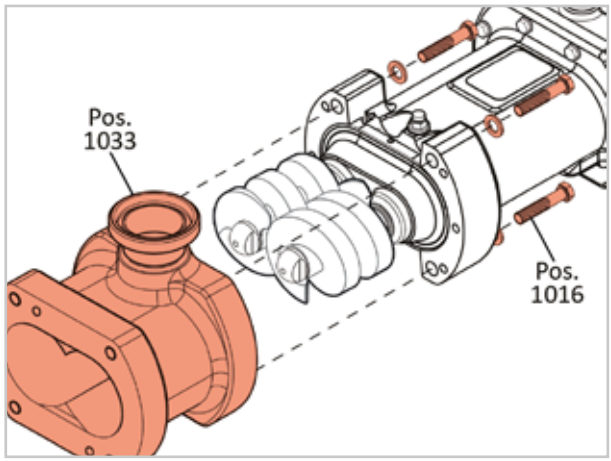
A. Remove the Pump Face (Pos. 1012) by unthreading the FOUR (4) Hex Head Bolts (Pos. 1041). If the pump face is still held in place by the Pump Face Alignment Pins (Pos. 2196), you may need a mallet to remove it.



STEP 2)
REMOVING THE PUMP HOUSING

A. Remove the FOUR (4) Hex Screws (Pos. 1016).

B. Remove the whole Pump Housing (Pos. 1033) outwards, away from the Gear Housing, and off of the spindles. Lift slightly before pulling away, so as to not scratch the spindles.



STEP 3)
BLOCKING THE SHAFT IN THE LANTERN AREA

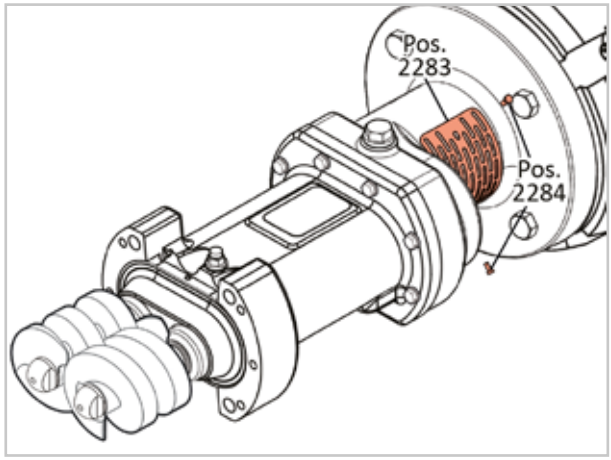
Blocking the Shaft in the Lantern area prevents the spindles from turning during maintenance and inspection.

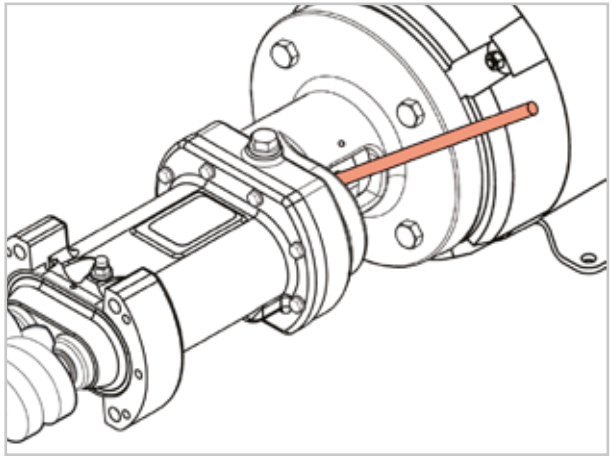
A. Remove both Cap Nuts (Pos. 2284) from the Lantern Safety Guard using an 8mm socket.

B. Remove the Lantern Safety Guard (Pos. 2283).

C. Insert Locking Rod into Shaft Coupler hole and using your other hand, turn the spindles until the Rod is resting against the lantern.

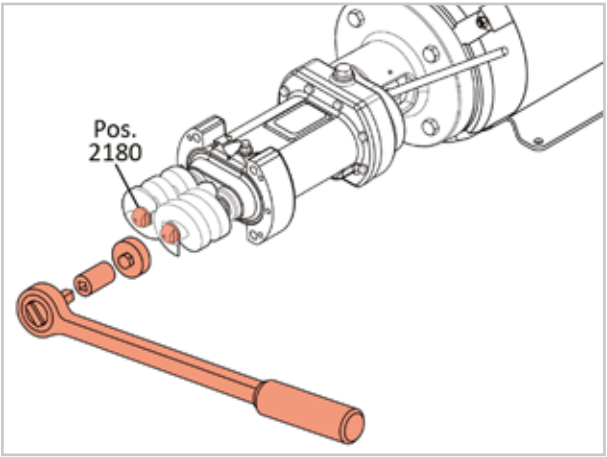
D. In case the Locking Rod is not available, loosen the coupling halves, and use a Flat Tire Lever to block the rotation by wedging it between the teeth on the coupler.





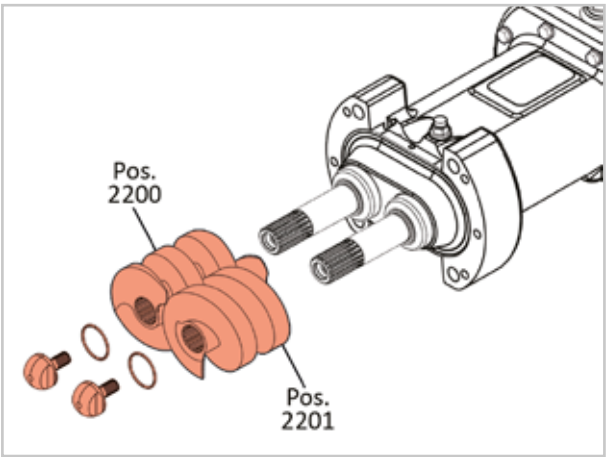
STEP 4)
REMOVING THE SPINDLES

A. Once the Locking Rod is in place, use the Aluminum Spindle Bolt Socket on a torque wrench to loosen both Spindle Screws (Pos. 2180) on the Drive and Driven Shafts, alternating back and forth until both screws can be removed by hand.



B. Before removing the Spindles, take a picture from the top view that clearly shows your Spindle Configuration ("A" or "V").

C. Gently slide both spindles off of the shafts, and set off to the side, preferably in the same arrangement they were in when removed. Be sure to orient them in such a way that it is clear to you which spindle was removed from which shaft.

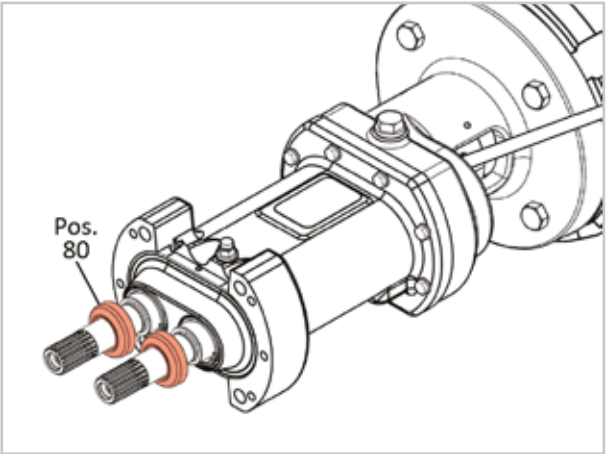


D. In the event that the spindles get stuck, simply use a Rubber Mallet to knock them loose. Hit one side, then the other, alternating until driven loose.

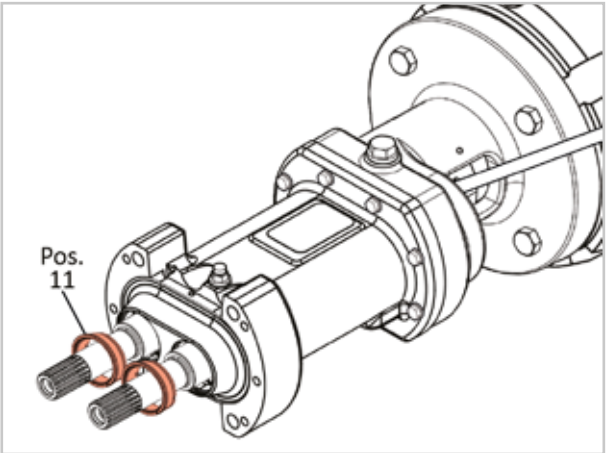
E. **WARNING! DO NOT USE A METAL HAMMER. DOING SO WILL CAUSE DAMAGE!**

STEP 5)
REMOVING THE SEAL HOUSING

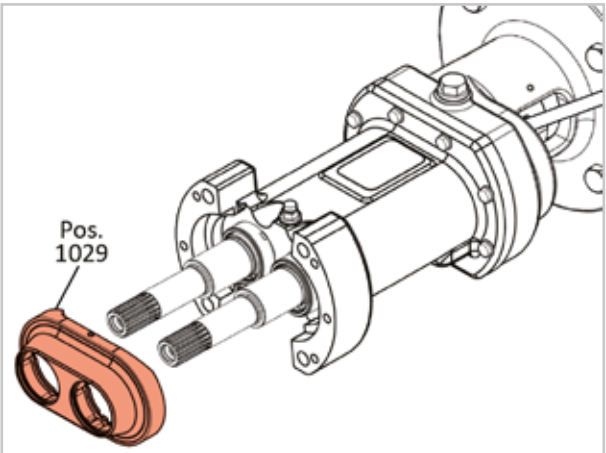
A. Remove the "Mushroom" Rotor Seal Faces (Pos. 80) from each of the shafts using your hands. When setting parts aside, take care to keep track of right and left sides, so that each individual part can be replaced onto the same side that it was removed from (**NOTE:** You must never place the seal face surfaces facing down - they must be kept pristine, as even a tiny scratch can compromise the seal).



B. Remove both Stator Seal Faces (Pos. 11) from the shafts, and place to the side. Keep the seal face pairs oriented in left and right positions, so that you can replace them onto the same side from which they were removed.



C. Grip the Seal Housing (Pos. 1029) and slide off and away from the shafts.



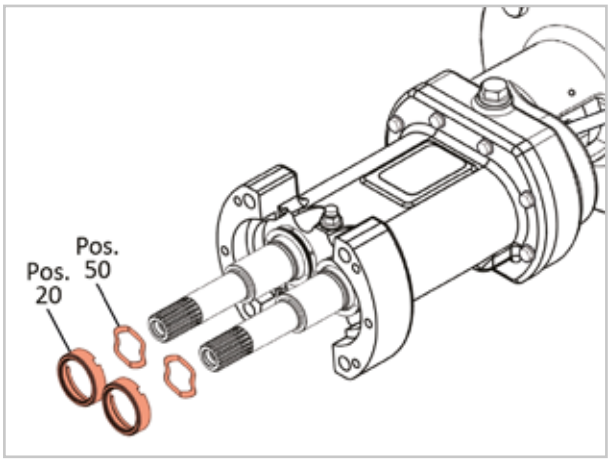
STEP 5)
REMOVING THE SEAL HOUSING (continued)

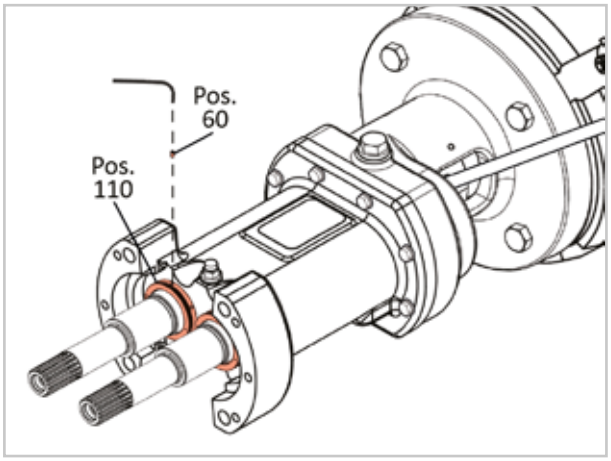
D. Remove both Rotator Seal Faces (Pos. 20) and Springs (Pos. 50).

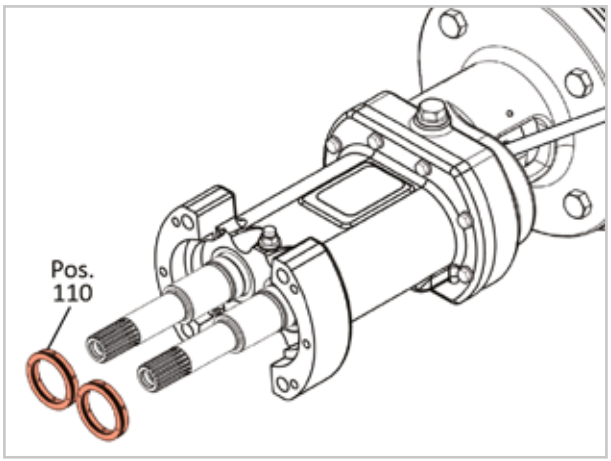
E. Loosen all SIX (6) Set Screws (Pos. 60) on each of the Stop Rings (Pos. 110) using a 2mm Hex Allen Wrench.

F. Slide each of the Stop Rings (Pos. 110) off of the shafts, and set aside.

G. Inspect the condition of the elastomers and seal faces, and based on your findings, you would either replace parts or re-assemble. Also clean and clear any residue left over on any of the parts, including bolt threads.







STEP 6)
INSPECTING THE PUMP PARTS

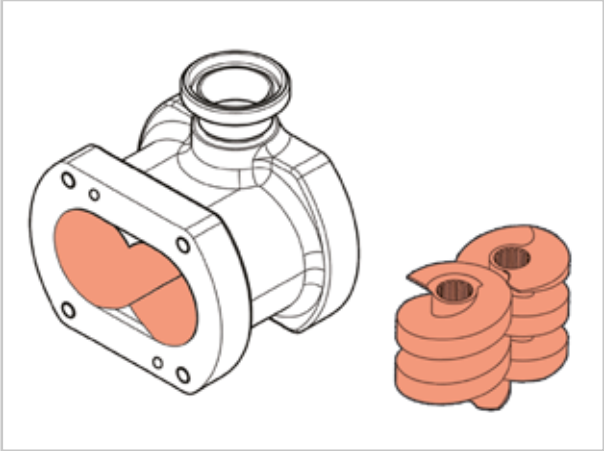
A. The Pump Housing should be smooth on the inside and not show any rough spots.

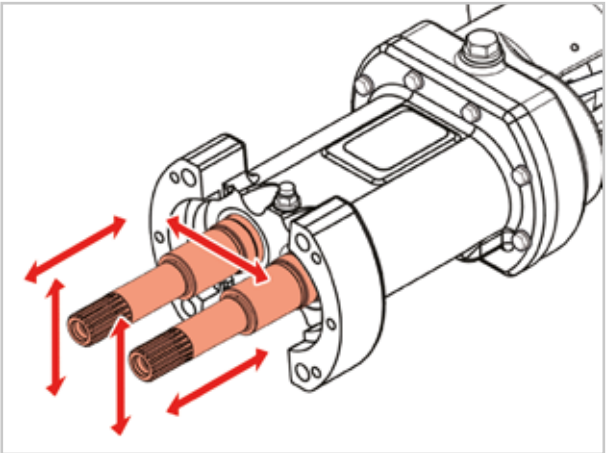
B. Both spindles should show smooth surfaces, and not be worn from touching or showing any splintered corners.

C. Both pump shafts need to sit tight without any play or wiggle room in the axial and radial directions. If any, there could be very minimal play from the gear wheels. Grip both shafts and wiggle up & down, forward & backwards, and also side to side, to check for excessive wear.

D. If even small movements are detected, it will require a complete bearing replacement before further operation.

E. Inspect both mechanical seals for visible wear and tear. In case the seals are worn, please send it to **Processtec** for refurbishing.





4.4.4 Complete Pump Re-assembly (DAMS Huhnseal)

To re-assemble the pump, follow each of the steps outlined in this subsection.

NOTE: Steps 1 through 6 in this subsection are applicable to **ViscoTwin** Pumps with *HUHNSEAL* Double Acting Mechanical Seals. For versions using *ANGA* Double Acting Mechanical Seals, please see Section 7.2 "Disassembly and Reassembly of the ANGA DAMS" on page 147. Once those steps are completed, continue these Complete Pump Assembly steps, starting with step 7,"Installing Both Spindles" on page 60.

Required Tools:

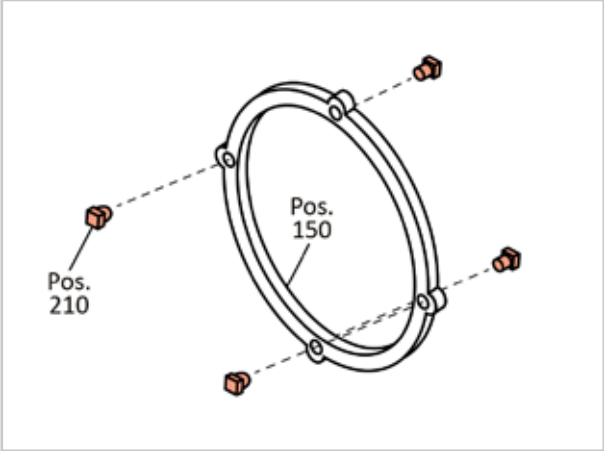
- 8mm Hex Nut Socket (for Pos. 2284)
- 19mm Hex Nut Socket (for Pos. 1016 & 1041)
- 27mm Spindle Screw (for Pos. 2180)
- Torque Wrench (Small) (1/4" Drive, Capable of Torque ranging from 8 to 15 Nm)
- Torque Wrench (Large) (1/2" Drive, Capable of Torque up to 100 Nm)

Action steps for Complete Pump Assembly (DAMS Huhnseal):

STEP 1) INSERT REAR STOP RINGS
STEP 2) INSTALL TEFLON RINGS AND O-RINGS
STEP 3) INSTALL STATOR SEAL FACES
STEP 4) REPEAT PREVIOUS THREE STEPS ON OTHER SIDE OF HOUSING
STEP 5) REINSTALL STOP RINGS AND SEAL FACES
STEP 6) REINSTALL SEAL HOUSING
STEP 7) INSTALLING BOTH SPINDLES
STEP 8) FIXATING THE SPINDLES
STEP 9) VERIFY THAT THE SPINDLES SPIN FREELY
STEP 10) REMOVAL OF THE LOCKING ROD
STEP 11) REINSTALL THE LANTERN SAFETY GUARD
STEP 12) CHECK GAPPING OF SPINDLES
STEP 13) INSTALL PUMP HOUSING
STEP 14) INSTALLING PUMP FACE TO PUMP HOUSING

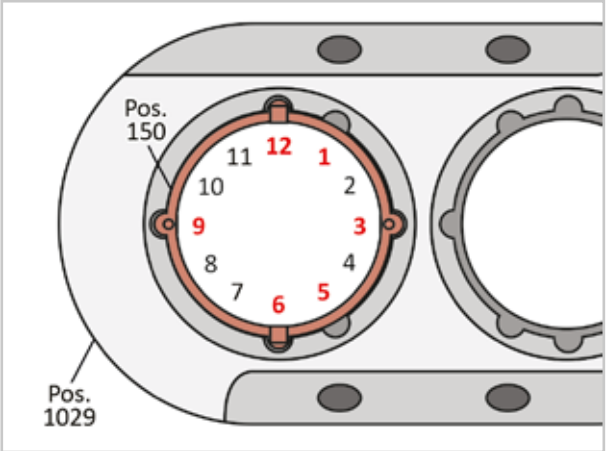
STEP 1)
INSERT REAR STOP RINGS

A. Using food-grade grease, coat each of the eight (8) Stop Ring Pins (Pos. 210) and press each of them into the TWO (2) Stop Rings (Pos. 150). Press the 12 and 6 O'clock pins in from one side of the Stop Ring, and then press the 3 and 9 O'clock pins in from the other side.



B. Insert one of the assembled Stop Rings (Pos. 150) into the Driven Shaft side of the Seal Housing (Pos. 1029), taking care to align it to the existing notches (at 12, 3, 6 & 9 O'clock), leaving the Water-flush notches (at 1 & 5 O'clock) clear.

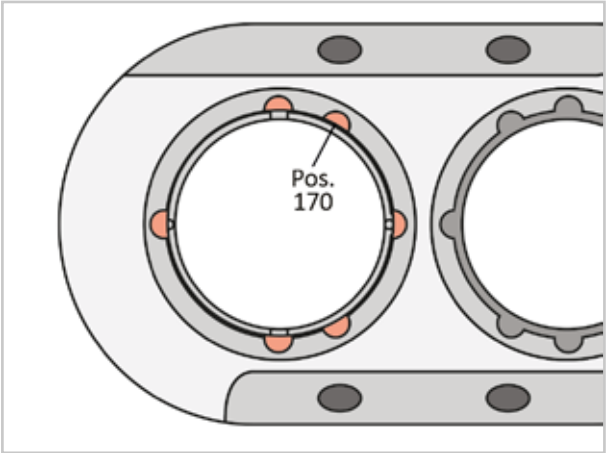
(NOTE: The Seal Housing view to the right is as seen from Atmospheric side of Pump.)

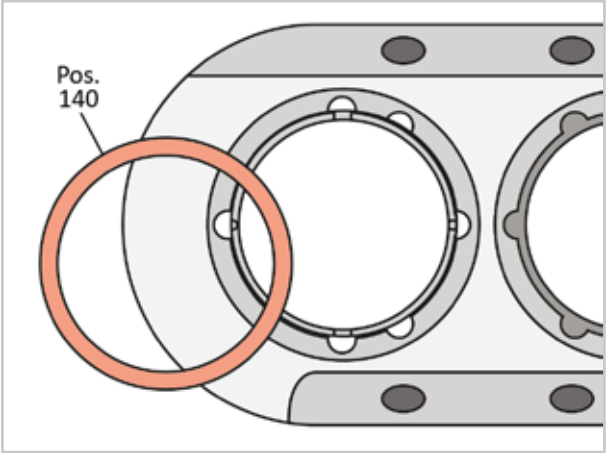


STEP 2)
INSTALL TEFLON RINGS AND O-RINGS

A. Install one Teflon Ring (Pos. 170) into the outer most O-ring groove of the Atmospheric side of the Seal Housing.

B. Now install an O-ring (Pos. 140) into the same groove, placing the O-ring underneath the Teflon ring (closer to the center of the Seal Housing).



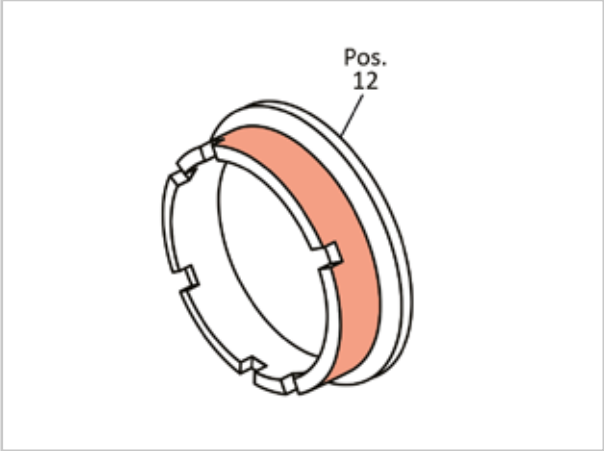


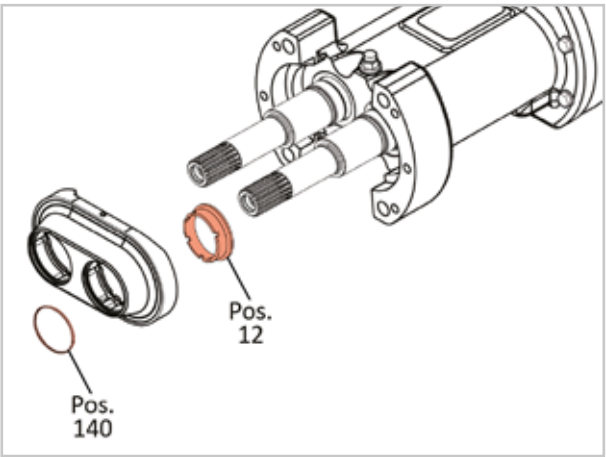
STEP 3)
INSTALL STATOR SEAL FACES

A. Lightly coat the smaller diameter "neck" of the Stator Seal Face (Pos. 12) with a small amount of food-grade grease.

B. Install the Stator Seal Face (Pos. 12) into the Atmospheric side of the Seal Housing, making sure that the notches line up with the Stop Ring Pins, so that it can be fully seated.

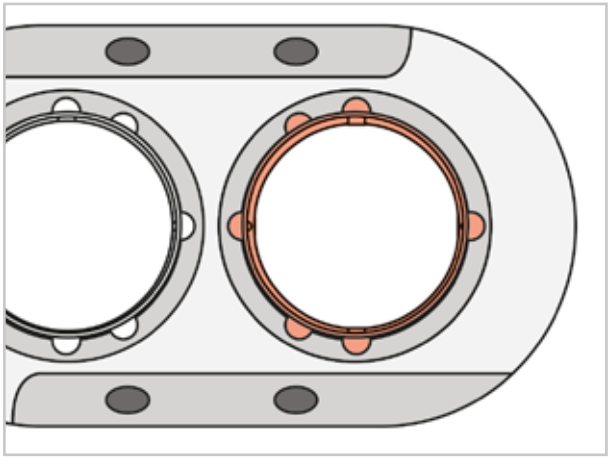
C. Lightly coat another O-ring (Pos. 140) with a food-safe grease, and from the Product Side of the Seal Housing, press into the O-ring groove on the Driven Shaft side.

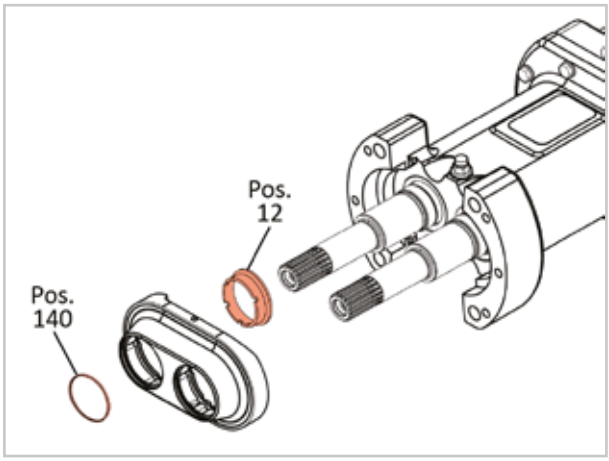




STEP 4)
REPEAT PREVIOUS THREE STEPS ON THE DRIVE SHAFT SIDE OF THE SEAL HOUSING

A. Repeat the previous three steps, installing all of the pieces onto the Drive Shaft side of the Seal Housing. Make certain the parts that were set aside in matched pairs are placed back onto the same side of the Seal Housing from which they were removed.





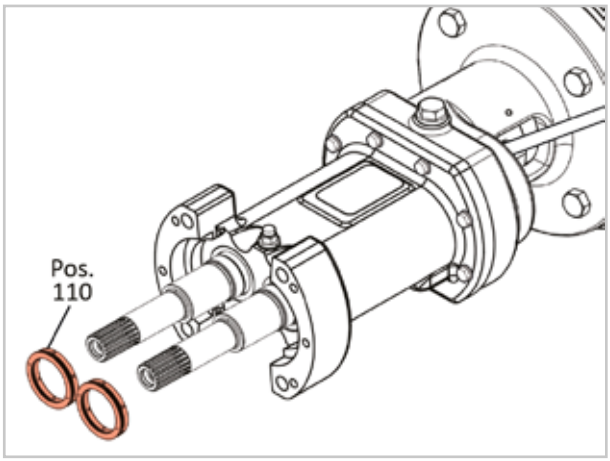
STEP 5)
REINSTALL STOP RINGS AND SEAL FACES

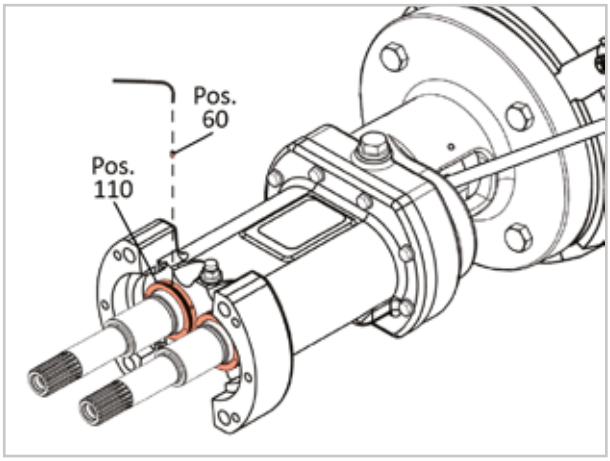
A. Reinstall the Stop Rings (Pos. 110) onto the shafts.

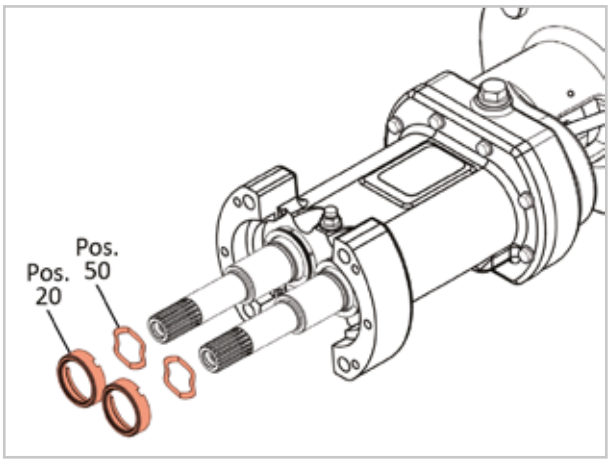
B. Tighten all six (6) Set Screws (Pos. 60) on each of the TWO (2) Stop Rings using a 2mm Hex Allen Wrench.

C. Reinstall both Springs (Pos. 50) and both Rotator Seal Faces (Pos. 20) onto the shafts.

D. Gently clean both Rotator Seal Faces (Pos. 20) with a lint-free cloth and rubbing alcohol. Since the Rotator Seal Face is not locked in position, it would be advisable to hold it in place with one finger, while using your other hand to wipe the surface of the seal face.







STEP 6)
REINSTALL SEAL HOUSING

A. Clean the seal faces on the Atmospheric side of the Seal Housing with a lint-free cloth and rubbing alcohol.

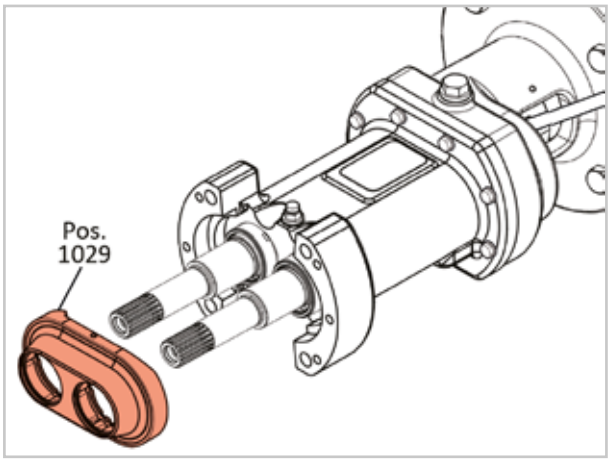
B. Reinstall the Seal Housing onto the Shafts. While pushing the Seal Housing all the way to to the back, make certain that the notches on the Rotator Seal Face (Pos. 20) line up with the "ear tabs" on the Stop Rings (Pos. 110). Enlist help if necessary.

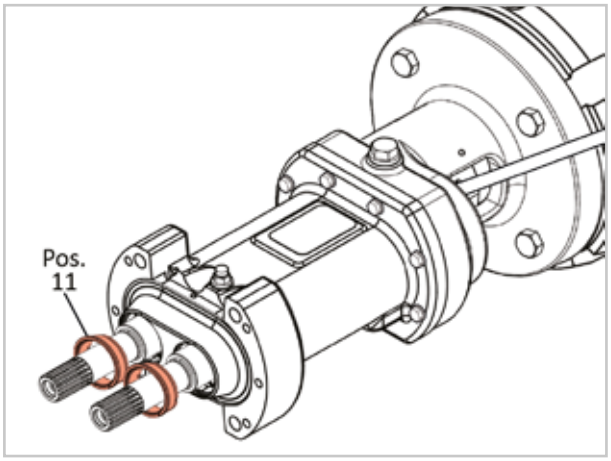
C. Reinstall the Stator Seal Faces (Pos. 11) onto the shafts, taking care not to mix up left and right sides. The notches on the seal faces must correspond to the pins on the Stop Rings (Pos. 150). The water-flush notches will remain open.

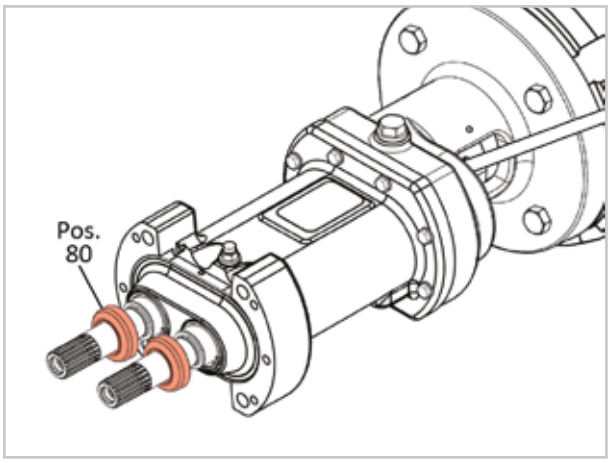
D. Clean the Stator Seal Faces with a lint-free cloth and rubbing alcohol.

E. Clean the assembled "Mushroom" Rotor Seal Faces (Pos. 80) with a lint-free cloth and rubbing alcohol (Pos. 80 in this case includes #'s 130, 90, 220 and 40).

F. Lightly grease the shafts with a food-safe grease to allow the assembled "Mushroom" Rotor Seal Faces to slide on easily, and then install them both onto the shafts and slide them all the way back.

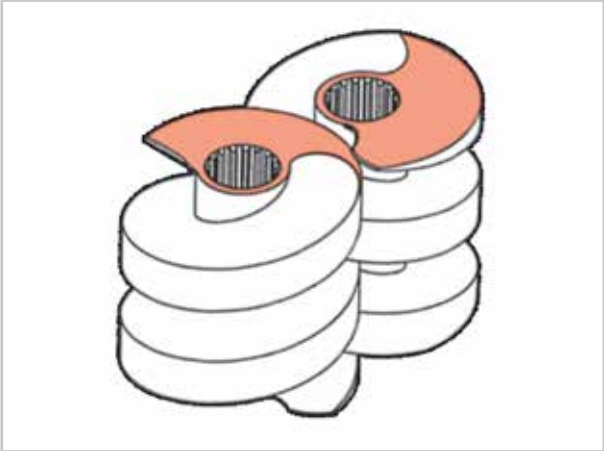




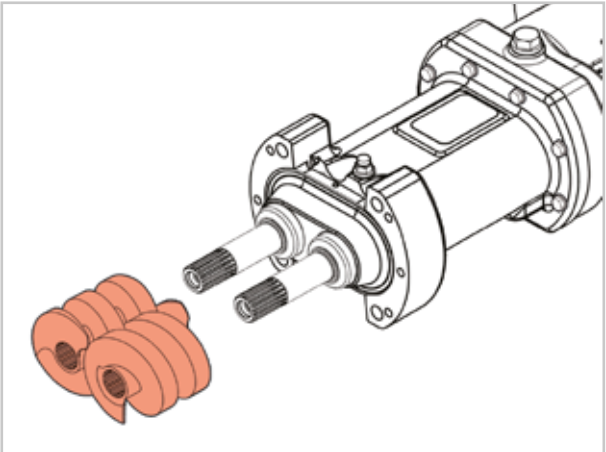


STEP 7)
INSTALLING BOTH SPINDLESt

A. Determine whether you have Spindle Configuration "A" or "V", based on your Pump Housing Configuration (Please refer to Section 5.5 "Pump Housing Configurations" on page 117 for more detailed information on identifying "A" or "V" Spindle Configurations).

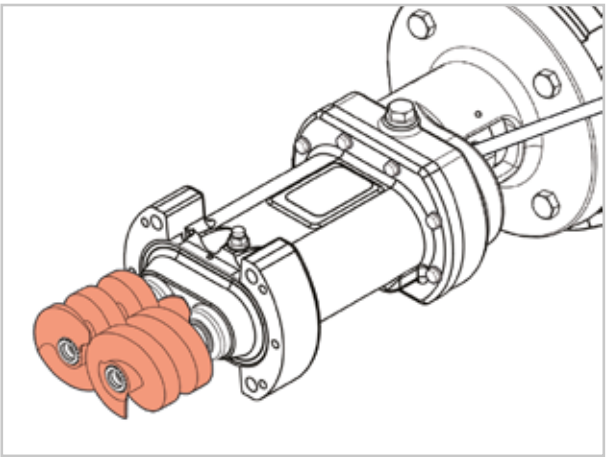


C. Place both spindles (Pos. 2200 & 2201) on a clean dry surface, with the spline sides facing downwards, and align them into either "A" or "V" configurations.



D. Rotate both spindles until they are aligned from the top view as shown to the right, where the colored/highlighted flat top surfaces of the spindles sit totally flush with each other.

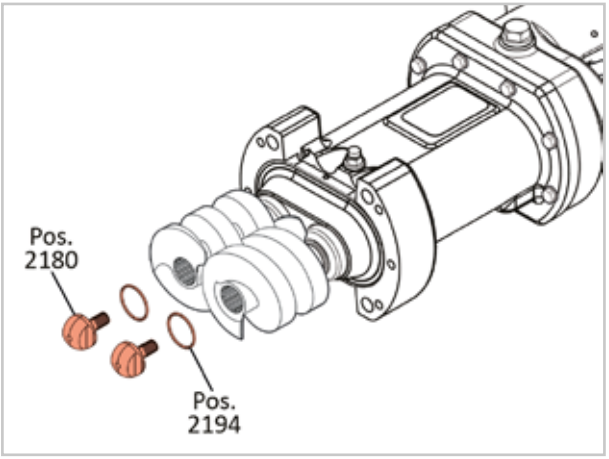
E. Pick up both Spindles, taking care to keep them aligned with each other in the current position, and place them onto the shafts, rotating them very slightly inwards and outwards, until they slide onto the Drive Shaft and Driven Shaft splines. Before proceeding to the next step, be sure to check that the Spindles are still aligned properly. If both Spindle surfaces are still flush with each other, then you have achieved proper alignment.



F. Press the Spindles towards the Product Side of the Bearing Housing (Pos. 1001) until they are flush up against the "Mushroom" Rotor Seal Faces. Readjust "Ear-Tabs" if needed.

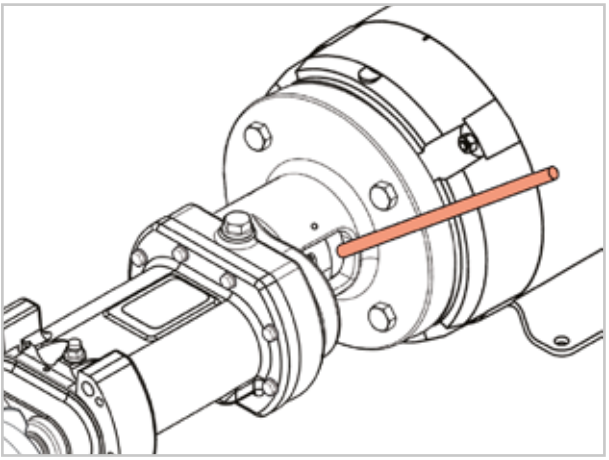
STEP 8)
FIXATING THE SPINDLES

To fixate the spindles, use the Spindle Screws (Pos. 2180) with O-rings (Pos. 2194). Add a small amount of Blue Loctite™ (one drop) to a small portion of the Spindle Screw threads to secure it. Torque both Spindle Screws to 100 Nm.



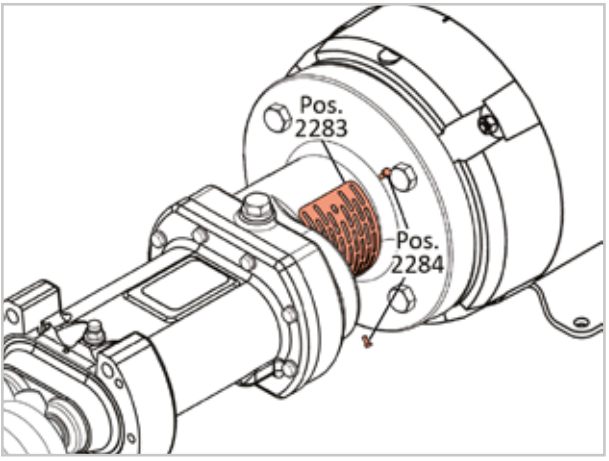
STEP 9)
REMOVAL OF THE LOCKING ROD

Remove the Locking Rod in the lantern area (If the Flat Tire Lever was used, re-assemble the coupler after removal).



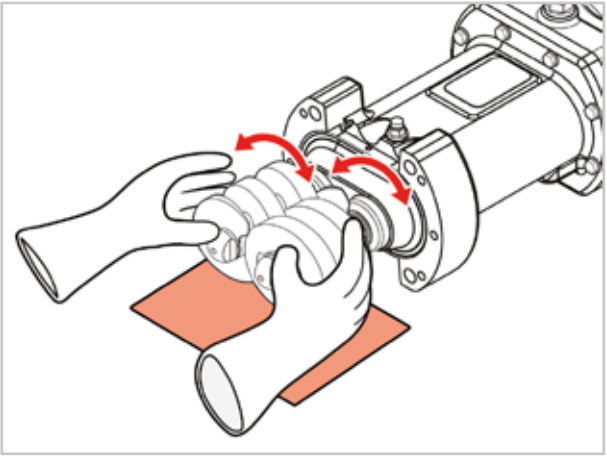
STEP 10)
REINSTALL THE LANTERN SAFETY GUARD

Re-install the Lantern Safety Guard (Pos. 2283) with the Cap Nuts (Pos. 2284).



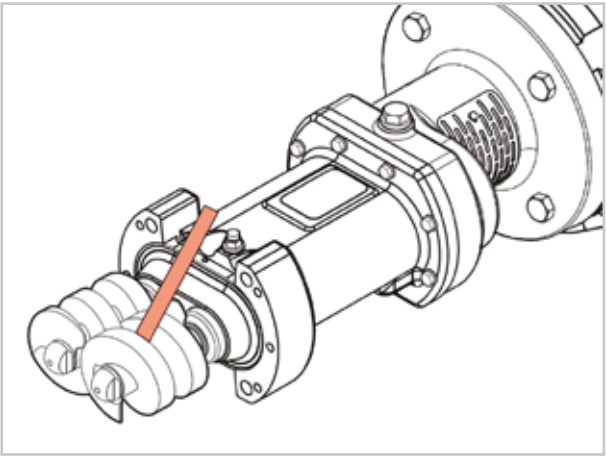
STEP 11)
VERIFY THAT THE SPINDLES SPIN FREELY

Verify while turning both spindles by hand that they are spinning freely. Then hold a white paper underneath the spindles and visually check that there is an even gap between the spindle flights. The spindles are not allowed to touch.



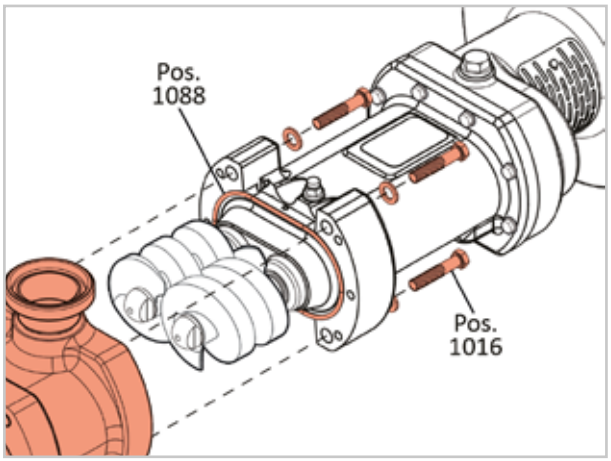
STEP 12)
CHECK GAPPING OF SPINDLES

In case the spindles touch each other, the shafts need to be gapped (See Subsection 4.5.8 "Proper Gapping of Pump" on page 84). In case that the tolerances between the flights are not equal but do not touch, gapping is not absolutely necessary.



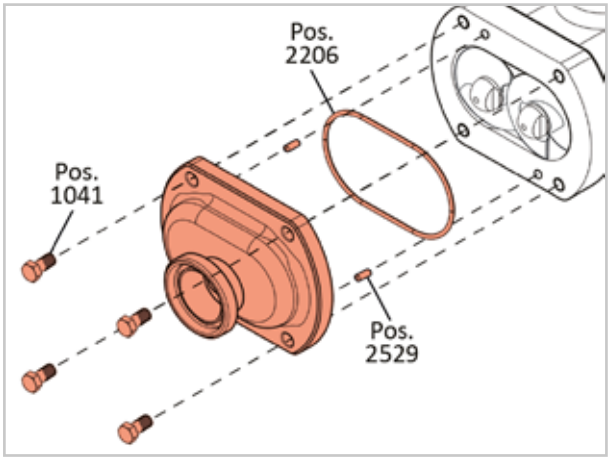
STEP 13)
INSTALL PUMP HOUSING

Verify that the O-ring (Pos. 1088) is correctly seated. Verify that both Alignment Pins for Seal Housing (Pos. 2536) are installed based on Pump Configurations (see separate instructions). Then install the pump housing. Torque all FOUR (4) hex screws (Pos. 1016) to 70 Nm, in a star pattern.



STEP 14)
INSTALLING PUMP FACE TO PUMP HOUSING

Install the Pump Face to the Pump Housing, taking care that the port on the Pump Face is towards the bottom. Verify that both Alignment Pins (Pos. 2529) are in position and the O-ring (Pos. 2206) is correctly in place. Tighten the FOUR (4) hex screws (Pos. 1041) to 70 Nm.



4.4.5 Complete Pump Disassembly (SAMS Huhnseal)

To disassemble ViscoTwin pumps with Huhnseal Single Acting Mechanical Seals, follow each of the steps outlined in this subsection.

Required Tools:

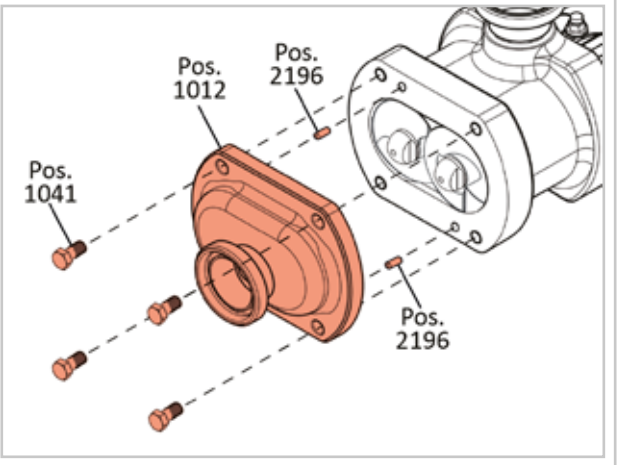
- 19mm Hex Nut Socket (for Pos. 1012 & 1033)
- 27mm Spindle Screw (for Pos. 2180)
- Torque Wrench (Large) (1/2" Drive, Capable of Torque up to 100 Nm)
- Circlip Pliers (for Pos. 200)

Action steps for complete pump disassembly:

STEP 1) Removing the Pump Face
STEP 2) Removing the Pump Housing
STEP 3) Blocking the Shaft in the Lantern Area
STEP 4) Removing the Spindles
STEP 5) Removing the Seal Housing
STEP 6) Inspecting the Pump Parts

STEP 1)
REMOVING THE PUMP FACE

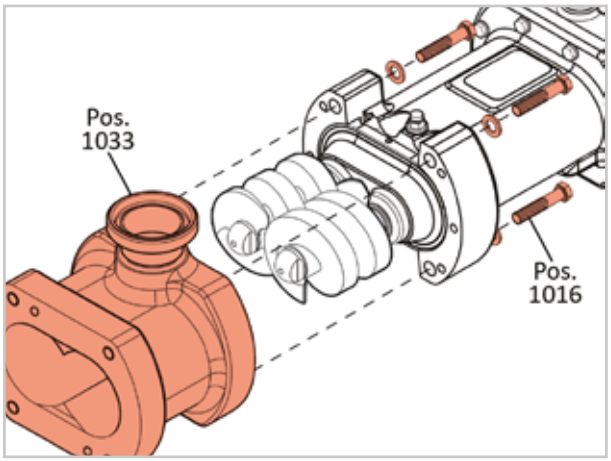
A. Remove the Pump Face (Pos. 1012) by unthreading the FOUR (4) Hex Head Bolts (Pos. 1041). If the pump face is still held in place by the Pump Face Alignment Pins (Pos. 2196), you may need a mallet to remove it.



STEP 2)
REMOVING THE PUMP HOUSING

A. Remove the FOUR (4) Hex Screws (Pos. 1016).

B. Remove the whole Pump Housing (Pos. 1033) outwards, away from the Gear Housing, and off of the spindles. Lift slightly before pulling away, so as to not scratch the spindles.



STEP 3)
BLOCKING THE SHAFT IN THE LANTERN AREA

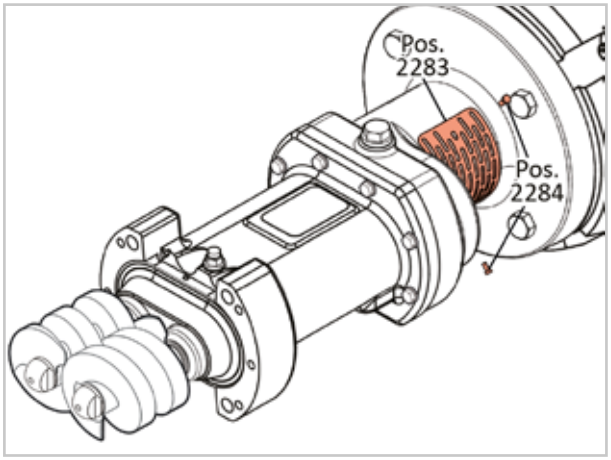
Blocking the Shaft in the Lantern area prevents the spindles from turning during maintenance and inspection.

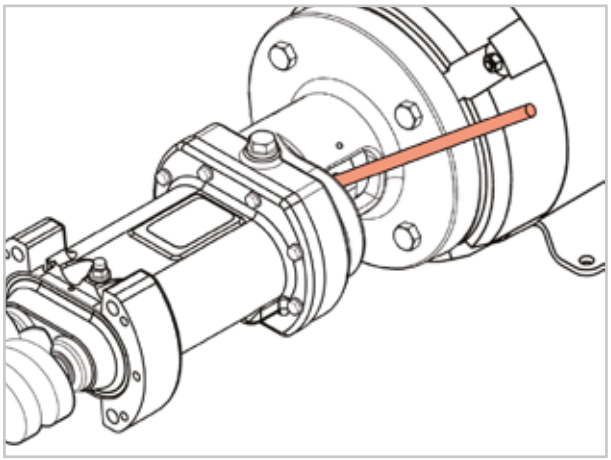
A. Remove both Cap Nuts (Pos. 2284) from the Lantern Safety Guard using an 8mm socket.

B. Remove the Lantern Safety Guard (Pos. 2283).

C. Insert Locking Rod into Shaft Coupler hole and using your other hand, turn the spindles until the Rod is resting against the lantern.

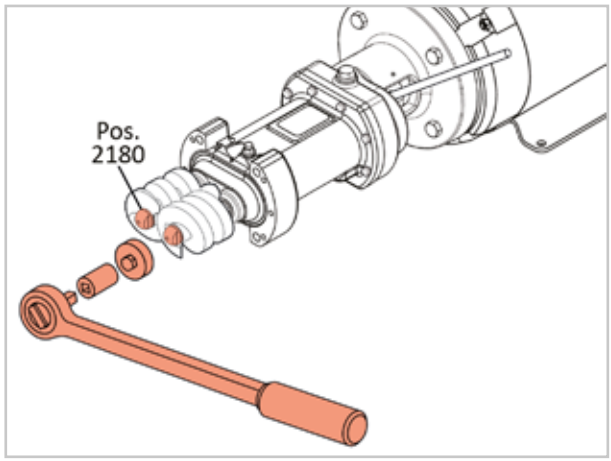
D. In case the Locking Rod is not available, loosen the coupling halves, and use a Flat Tire Lever to block the rotation by wedging it between the teeth on the coupler.





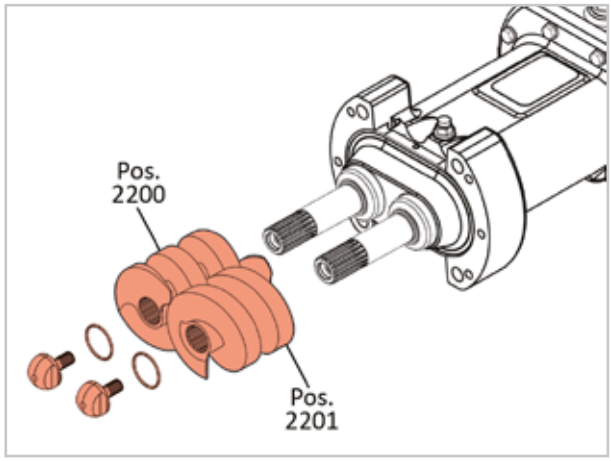
STEP 4)
REMOVING THE SPINDLES

A. Once the Locking Rod is in place, use the Aluminum Spindle Bolt Socket on a torque wrench to loosen both Spindle Screws (Pos. 2180) on the Drive and Driven Shafts, alternating back and forth until both screws can be removed by hand.



B. Before removing the Spindles, take a picture from the top view that clearly shows your Spindle Configuration ("A" or "V").

C. Gently slide both spindles off of the shafts, and set off to the side, preferably in the same arrangement they were in when removed. Be sure to orient them in such a way that it is clear to you which spindle was removed from which shaft.

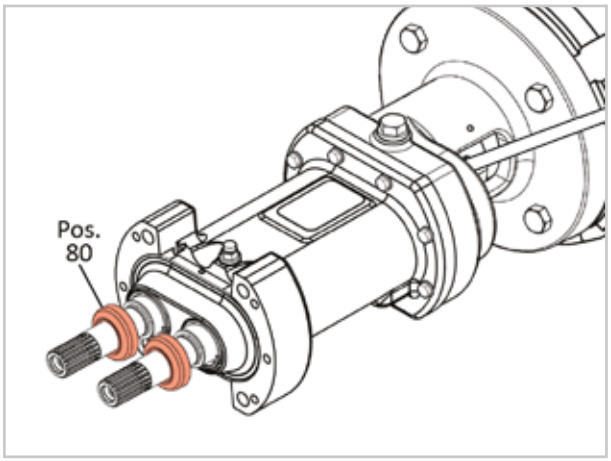


D. In the event that the spindles get stuck, simply use a Rubber Mallet to knock them loose. Hit one side, then the other, alternating until driven loose.

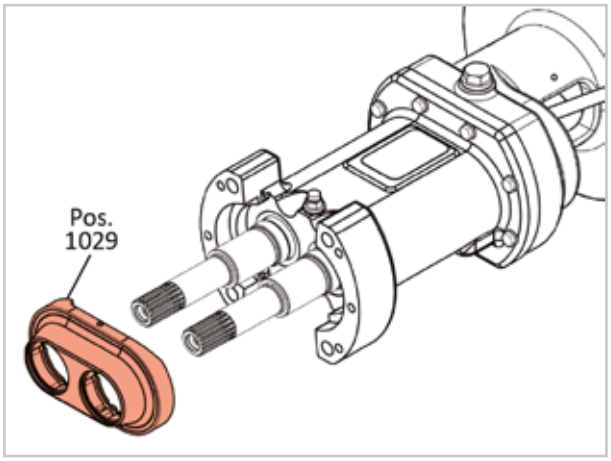
E. **WARNING! DO NOT USE A METAL HAMMER. DOING SO WILL CAUSE DAMAGE!**

STEP 5)
REMOVING THE SEAL HOUSING

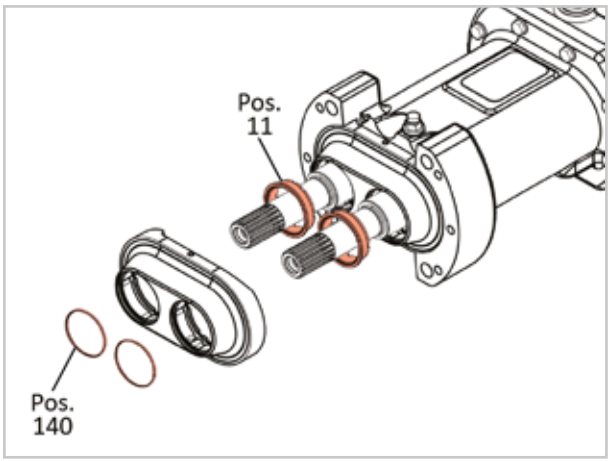
A. Remove the "Mushroom" Rotor Seal Faces (Pos. 80, which also includes Pos. 40, 210, 90, 130 and 220) from each of the shafts using your hands, twisting quickly while pulling to seperate the seal faces. When setting parts aside, take care to keep track of right and left sides, so that each individual part can be replaced onto the same side that it was removed from. **NOTE:** You must never place the seal face surfaces facing down - they must be kept pristine, as even a tiny scratch can compromise the seal.



B. Remove the Seal Housing (Pos. 1029) from the shafts along with the remaining seals.

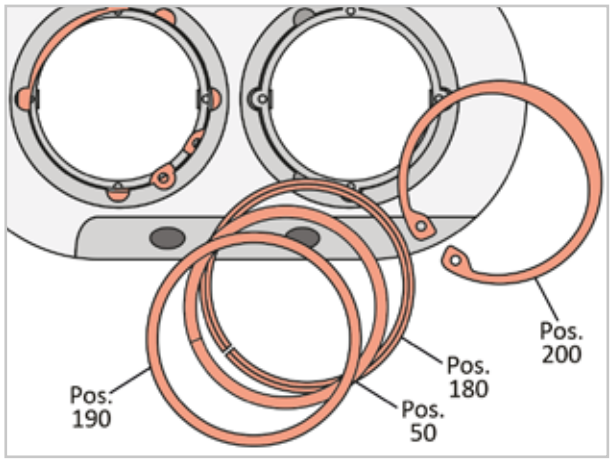


C. Remove the inboard stators (Pos. 11) from the Seal Housing and place to the side. Keep the seal face pairs oriented in left and right positions, so that you can replace them onto the same side from which they were removed. Remove O-rings (Pos. 140) located in the front section of the Seal Housing.



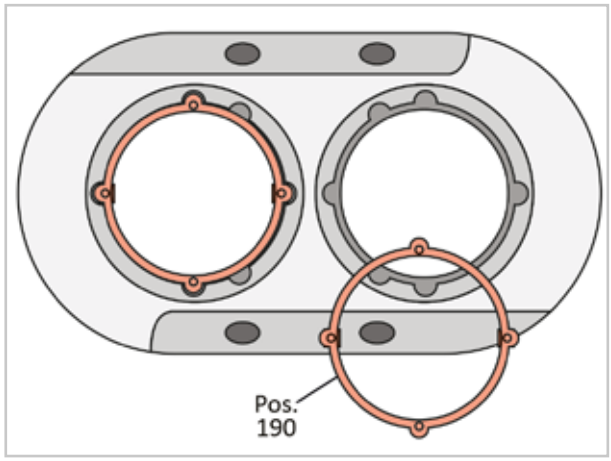
STEP 5)
REMOVING THE SEAL HOUSING (continued)

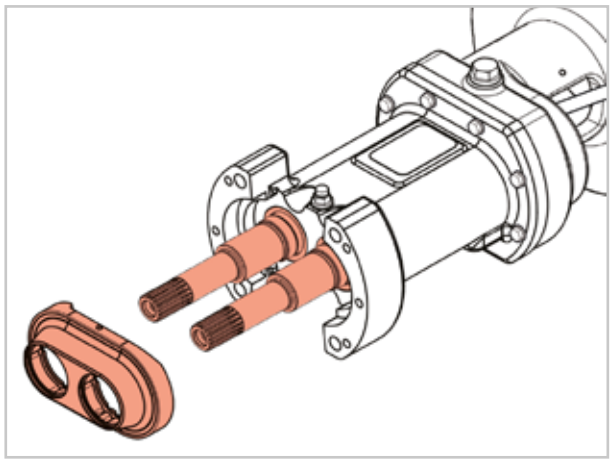
D. Using circlip pliers, grasp and remove the retaining rings (Pos. 200) on the Atmospheric side of the Seal Housing. In addition, remove spacers (Pos. 190), wave rings (Pos. 50) as well as the backup rings (Pos. 180).



E. Finally, remove the TWO (2) drive discs (Pos. 150) along with all FOUR (4) drive pins (Pos. 210) from the Seal Housing.

F. Clean the Seal Housing as well as the shafts and seal seats thoroughly, and then carefully inspect all of the removed parts. Replace any damaged parts as well as all O-rings and shaft sealing rings.





STEP 6)
INSPECTING THE PUMP PARTS

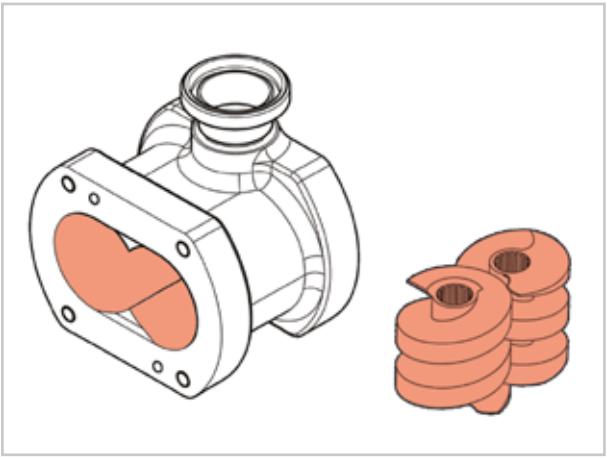
A. The Pump Housing should be smooth on the inside and not show any rough spots.

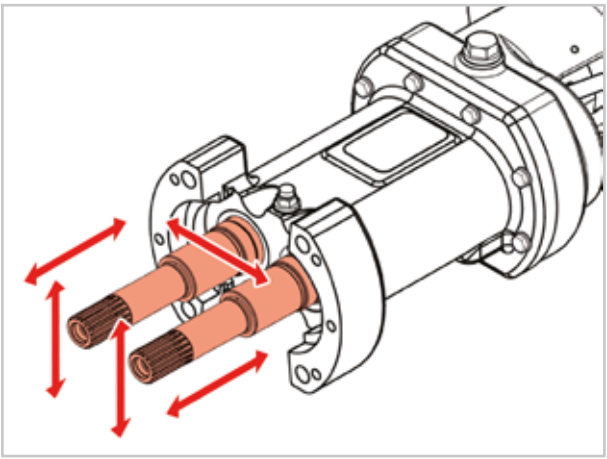
B. Both spindles should show smooth surfaces, and not be worn from touching or showing any splintered corners.

C. Both pump shafts need to sit tight without any play or wiggle room in the axial and radial directions. If any, there could be very minimal play from the gear wheels. Grip both shafts and wiggle up & down, forward & backwards, and also side to side, to check for excessive wear.

D. If even small movements are detected, it will require a complete bearing replacement before further operation.

E. Inspect both mechanical seals for visible wear and tear. In case the seals are worn, please send it to **Processtec** for refurbishing.





4.4.6 Complete Pump Re-assembly (SAMS Huhnseal)

To re-assemble **ViscoTwin** pumps using *HUHNSEAL* Single Acting Mechanical Seals, follow each of the steps outlined in this subsection.

NOTE: Steps 1 through 6 in this subsection are applicable to **ViscoTwin** Pumps with *HUHNSEAL* Single Acting Mechanical Seals. For versions using *ANGA* Single Acting Mechanical Seals, please see Section 7.3 "Disassembly and Reassembly of the ANGA SAMS" on page 157. Once those steps are completed, continue these Complete Pump Assembly steps, starting with step 6,"Installing Both Spindles" on page 76.

Required Tools:

- 8mm Hex Nut Socket (for Pos. 2284)
- 19mm Hex Nut Socket (for Pos. 1016 & 1041)
- 27mm Spindle Screw (for Pos. 2180)
- Torque Wrench (Small) (1/4" Drive, Capable of Torque ranging from 8 to 15 Nm)
- Torque Wrench (Large) (1/2" Drive, Capable of Torque up to 100 Nm)

Action steps for Complete Pump Assembly (DAMS Huhnseal):

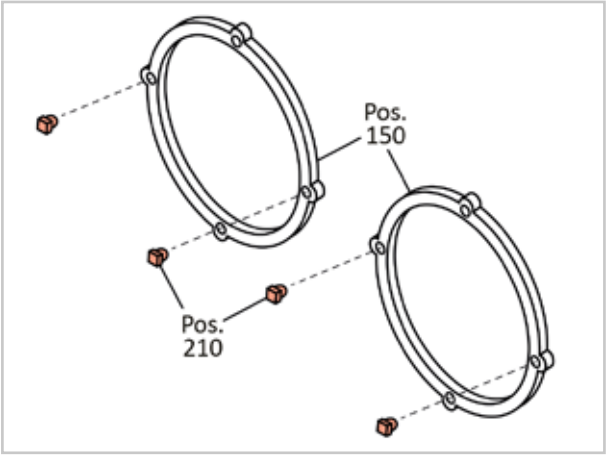
STEP 1) INSERT BOTH STOP RINGS
STEP 2) INSTALL BACKUP RINGS, WAVE RINGS AND SPACERS
STEP 3) INSTALL RETAINING RINGS AND O-RINGS
STEP 4) REINSTALL SEAL HOUSING AND INBOARD STATORS
STEP 5) REINSTALL INBOARD ROTORS AND SEAL FACES
STEP 6) INSTALLING BOTH SPINDLES
STEP 7) FIXATING THE SPINDLES
STEP 8) REMOVAL OF THE LOCKING ROD
STEP 9) REINSTALL THE LANTERN SAFETY GUARD
STEP 10) VERIFY THAT THE SPINDLES SPIN FREELY
STEP 11) CHECK GAPPING OF SPINDLES
STEP 12) INSTALL PUMP HOUSING
STEP 13) INSTALLING PUMP FACE TO PUMP HOUSING

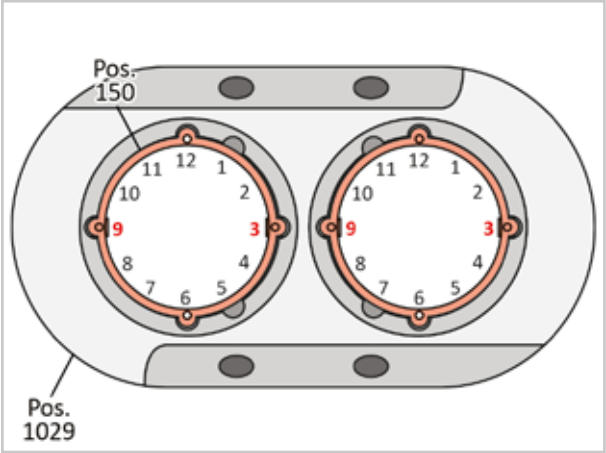
STEP 1)
INSERT BOTH STOP RINGS

A. Using food-grade grease, coat each of the FOUR (4) Stop Ring Pins (Pos. 210) and press each of them into the TWO (2) Stop Rings (Pos. 150) at the 3 and 9 O'clock positions.

B. Insert both of the assembled Stop Rings (Pos. 150) into the atmospheric side of the Seal Housing (Pos. 1029), taking care to align the Stop Ring Pins into the existing notches at 9 & 3 O'clock. Make certain that the side with the Stop Ring Pins is facing towards the product side of the seal housing.

(NOTE: The Seal Housing view to the right is as seen from Atmospheric side of Pump.)



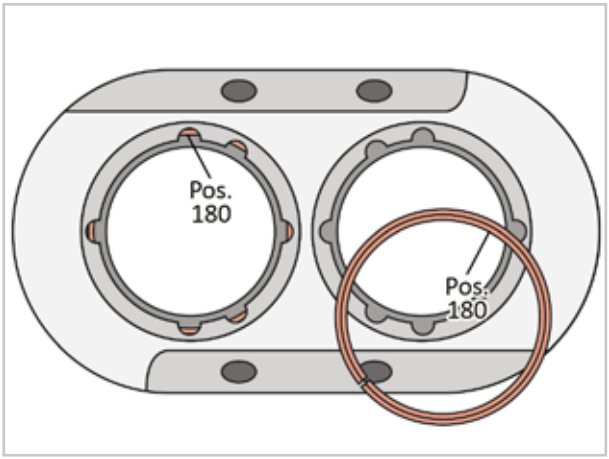


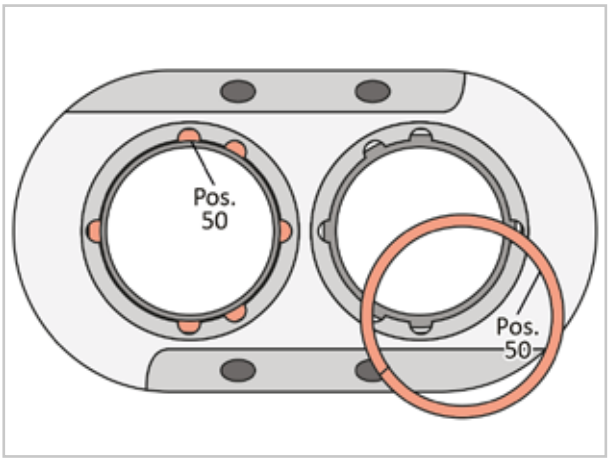
STEP 2)
INSTALL BACKUP RINGS, WAVE RINGS AND SPACERS.

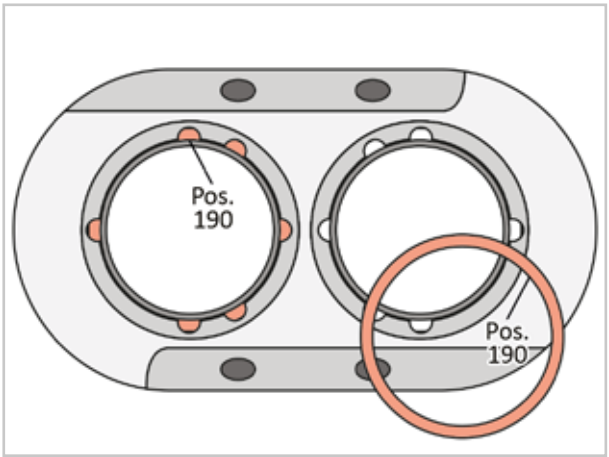
A. Install both backup rings (Pos. 180) into the outer most O-ring grooves of the Atmospheric side of the Seal Housing.

B. Install both wave rings (Pos. 50) up against the backup rings from the Atmospheric side of the Seal Housing.

C. Insert both spacers (Pos. 190) on top of the the wave rings (the final order from the center out should be 180, 50, 190).



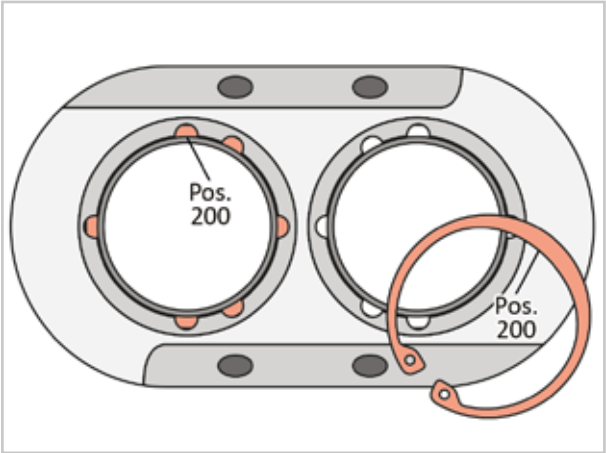


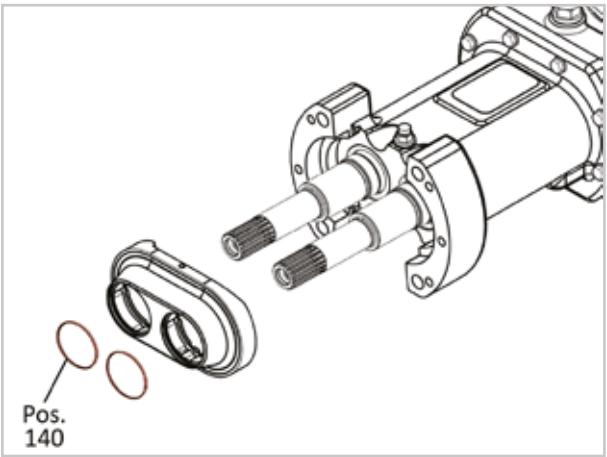


STEP 3)
INSTALL RETAINING RINGS AND O-RINGS

A. Insert both retaining rings (Pos. 200) using circlip pliers.

B. Lightly coat both O-rings (Pos. 140) with a food-safe grease, and from the Product side of the Seal Housing, press them into each of the front O-ring grooves of the Seal Housing.

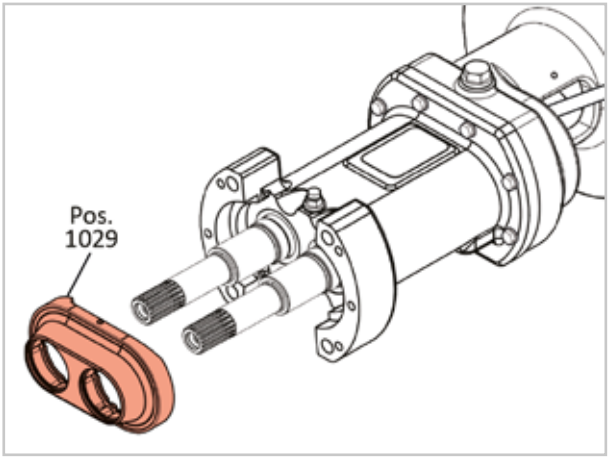


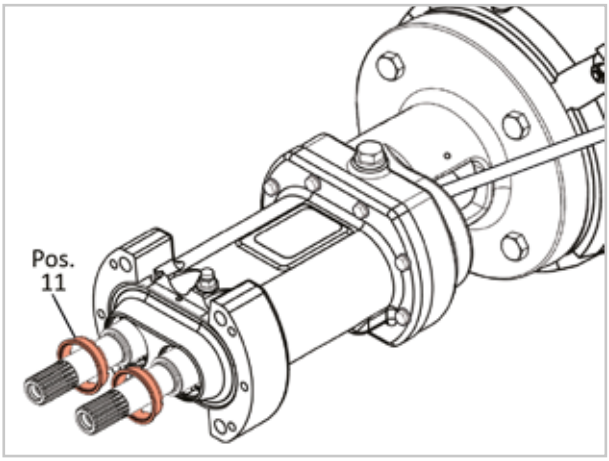


STEP 4)
REINSTALL SEAL HOUSING AND INBOARD STATORS

A. Carefully slide the Seal Housing onto the shafts.

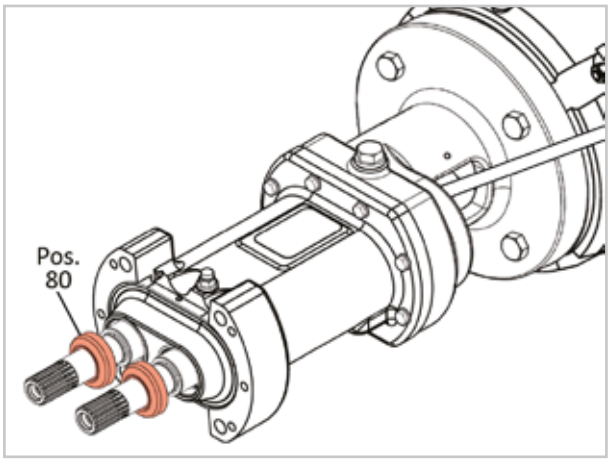
B. Lightly coat the smaller diameter "neck" of the Inboard Stators (Pos. 11) with a small amount of food-grade grease. Carefully slide both Inboard Stators (Pos. 11) into the product side of the Seal Housing via the shafts. The 3 and 9 O'clock grooves of both stators must align with the four drive pins (Pos. 210) on both drive discs (Pos. 150).



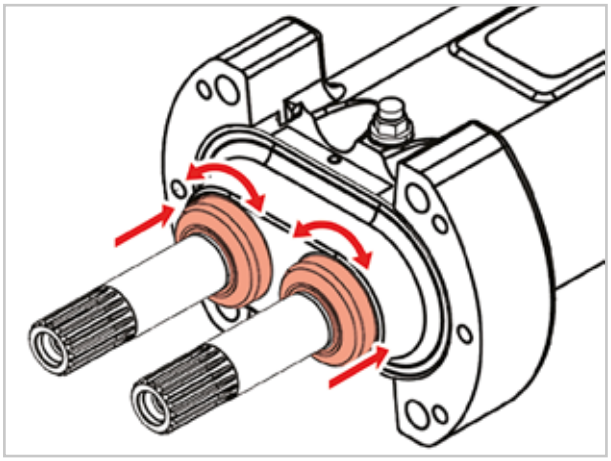


STEP 5)
REINSTALL INBOARD ROTORS AND SEAL FACES

A. Clean the assembled "Mushroom" Rotor Seal Faces (Pos. 80, including 130, 90, 220 and 40) with a lint-free cloth and rubbing alcohol. Lightly grease the shafts with a food-safe grease to allow the assembled "Mushroom" Rotor Seal Faces to slide on easily, and then install them both onto the shafts and slide them all the way back.

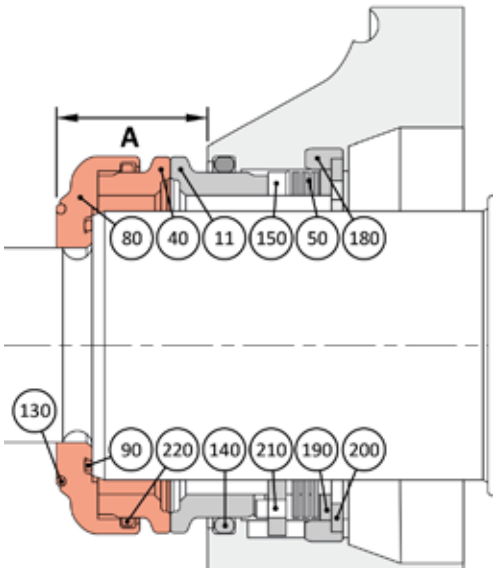


B. Check the free room of motion of the sealing by pushing the inboard rotor holder (Pos. 80) and spinning it bi-directionally.



During spinning, a small amount of play should be noticeable, coming from the gap between the drive pins (Pos. 210) and the grooves that are positioned in the seal faces (Pos. 40).

During pushing, the pressure from the installed wave rings (Pos. 50) should be even and consistent. Therefore, dimension A in the drawing showing the sealing cross section shall be as specified. You can confirm this distance with the use of a depth gauge.

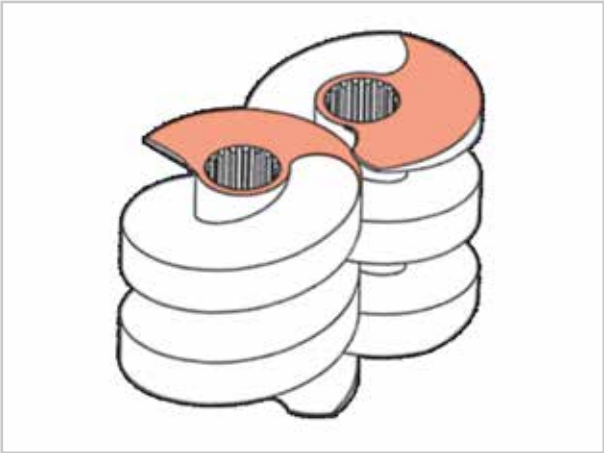


A = 33.3 ±0.3 mm (ViscoTwin 130)
A = 25.2 ±0.3 mm (ViscoTwin 104)
A = ___ ±0.3 mm (ViscoTwin 70)

NOTE: Check to be sure that the O-rings (pos. 130) are properly seated, and be sure that it remains fully seated as you complete the following steps.

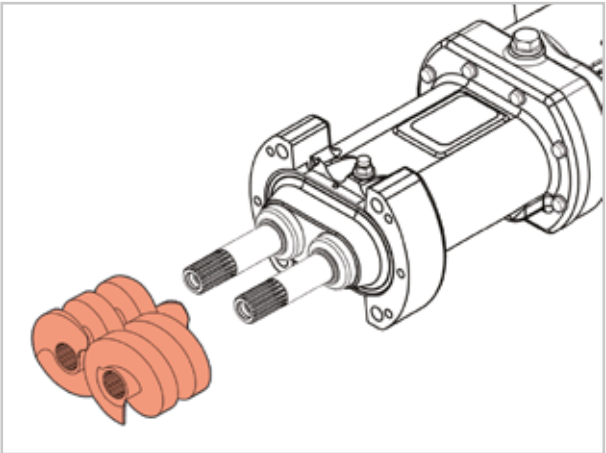
STEP 6)
INSTALLING BOTH SPINDLES

A. Determine whether you have Spindle Configuration "A" or "V", based on your Pump Housing Configuration (Please refer to Section 5.5 "Pump Housing Configurations" on page 117 for more detailed information on identifying "A" or "V" Spindle Configurations).

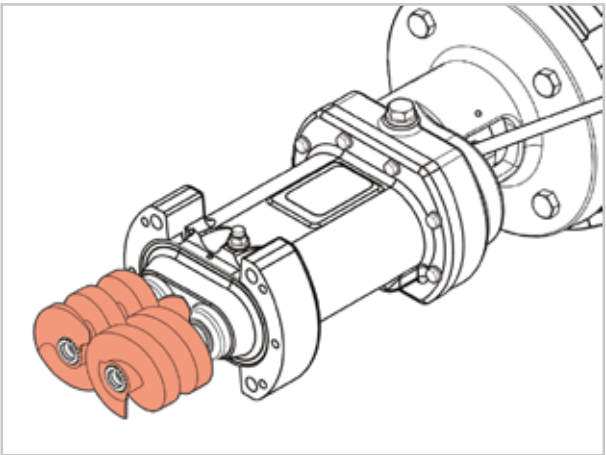


Place both spindles (Pos. 2200 & 2201) on a clean dry surface, with the spline sides facing downwards, and align them into either "A" or "V" configurations.

Rotate both spindles until they are aligned from the top view as shown to the right, where the colored/highlighted flat top surfaces of the spindles sit totally flush with each other.



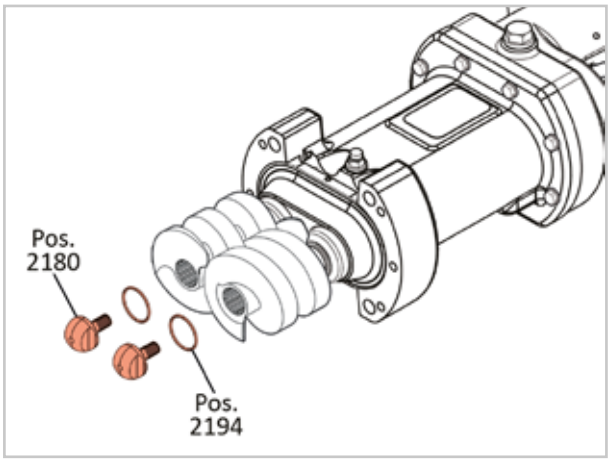
B. Pick up both Spindles, taking care to keep them aligned with each other in the current position, and place them onto the shafts, rotating them very slightly inwards and outwards, until they slide onto the Drive Shaft and Driven Shaft splines. Before proceeding to the next step, be sure to check that the Spindles are still aligned properly. If both Spindle surfaces are still flush with each other, then you have achieved proper alignment.



C. Press the Spindles towards the Product Side of the Bearing Housing (Pos. 1001) until they are flush up against the "Mushroom" Rotor Seal Faces. Make sure that the O-rings (Pos. 130) are still seated properly.

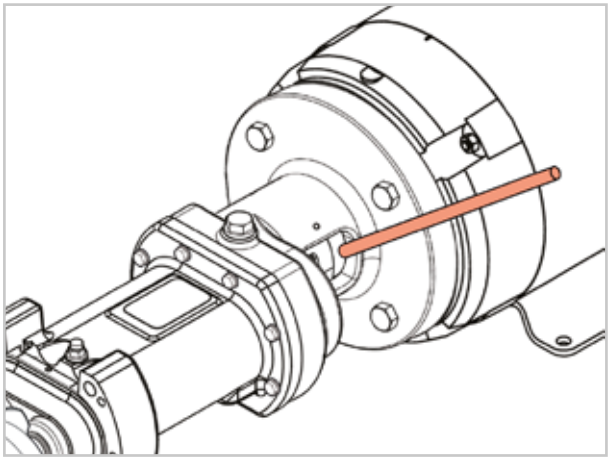
STEP 7)
FIXATING THE SPINDLES

To fixate the spindles, use the Spindle Screws (Pos. 2180) with O-rings (Pos. 2194). Add a small amount of Blue Loctite™ (one drop) to a small portion of the Spindle Screw threads to secure it. Torque both Spindle Screws to 100 Nm.



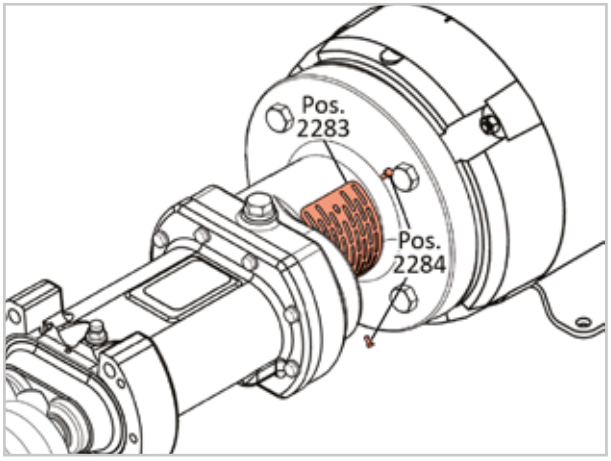
STEP 8)
REMOVAL OF THE LOCKING ROD

Remove the Locking Rod in the lantern area (If the Flat Tire Lever was used, re-assemble the coupler after removal).



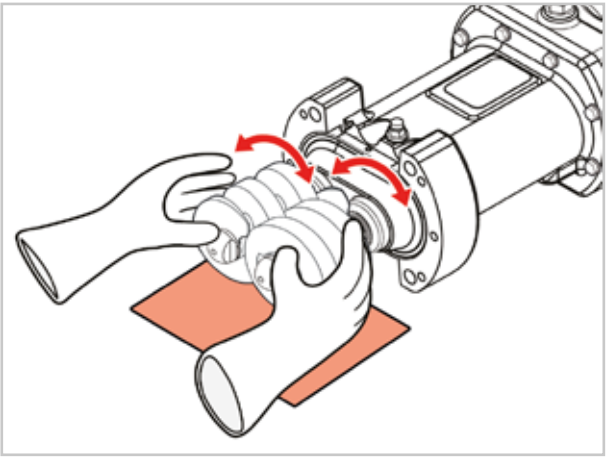
STEP 9)
REINSTALL THE LANTERN SAFETY GUARD

Re-install the Lantern Safety Guard (Pos. 2283) with the Cap Nuts (Pos. 2284).



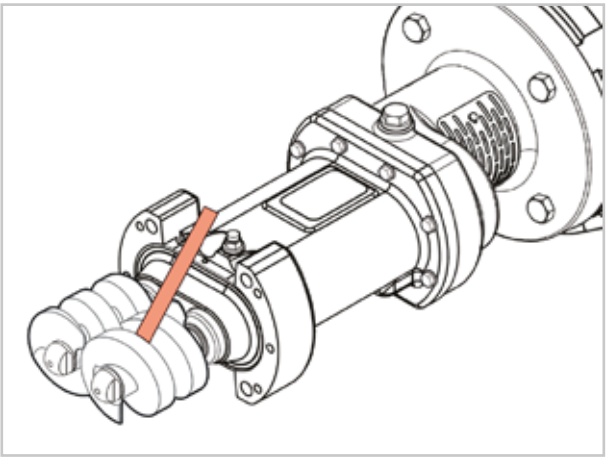
STEP 10)
VERIFY THAT THE SPINDLES SPIN FREELY

Verify while turning both spindles by hand that they are spinning freely. Then hold a white paper underneath the spindles and visually check that there is an even gap between the spindle flights. The spindles are not allowed to touch.



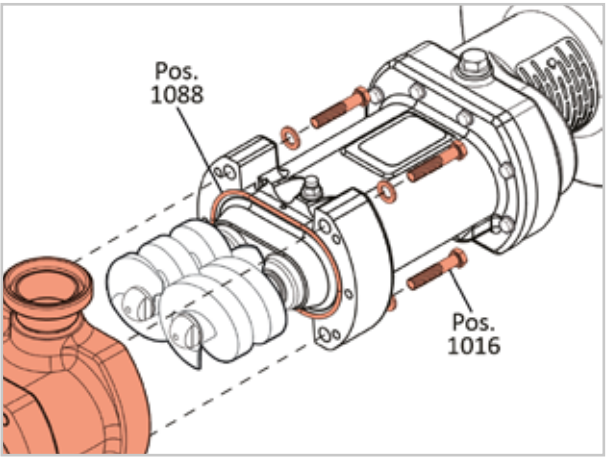
STEP 11)
CHECK GAPPING OF SPINDLES

In case the spindles touch each other, the shafts need to be gapped (See Subsection 4.5.8 "Proper Gapping of Pump" on page 84). In case that the tolerances between the flights are not equal but do not touch, gapping is not absolutely necessary.



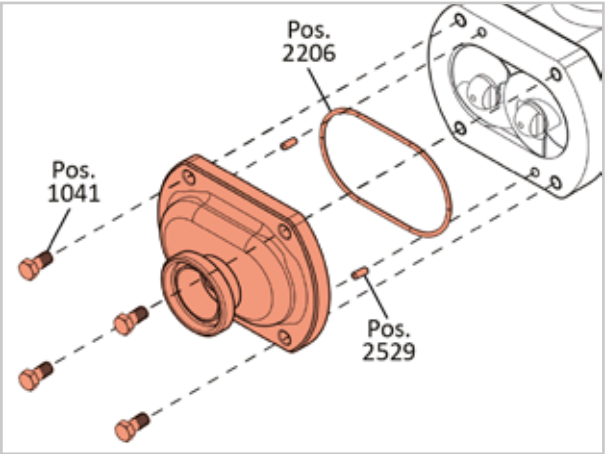
STEP 12)
INSTALL PUMP HOUSING

Verify that the O-ring (Pos. 1088) is correctly seated. Verify that both Alignment Pins for Seal Housing (Pos. 2536) are installed based on Pump Configurations (see separate instructions). Then install the pump housing. Torque all FOUR (4) hex screws (Pos. 1016) to 70 Nm, in a star pattern.



STEP 13)
INSTALLING PUMP FACE TO PUMP HOUSING

Install the Pump Face to the Pump Housing, taking care that the port on the Pump Face is towards the bottom. Verify that both Alignment Pins (Pos. 2529) are in position and the O-ring (Pos. 2206) is correctly in place. Tighten the FOUR (4) hex screws (Pos. 1041) to 70 Nm.



4.5 Preventative Maintenance Program

4.5.1 First Oil Change

A) The First Oil Change is required after 250 hours of operation, or 3 months (whichever comes first). This is known as the Break-In period.

4.5.2 Oil Change Intervals

A) After the first Oil Change is completed, sample & test the oil every 3 months for condensed water and debris.
B) Based on the results of the oil test, change if necessary. For more information about oils and oil testing, please see Section 5.6 "Oils, Grease & Lubrication Recommended" on page 125 and Section 5.7 "Oil Testing Kit" on page 127.
C) As a rule of thumb, the oil should last for 2000 to 3000 operating hours, or approximately 6 months.

4.5.3 Checking Levels on Motor Gearbox Oil

If the pump is motorized with a gearmotor, the gearbox needs gear oil as well. Please follow the instructions in the Motor Manual.

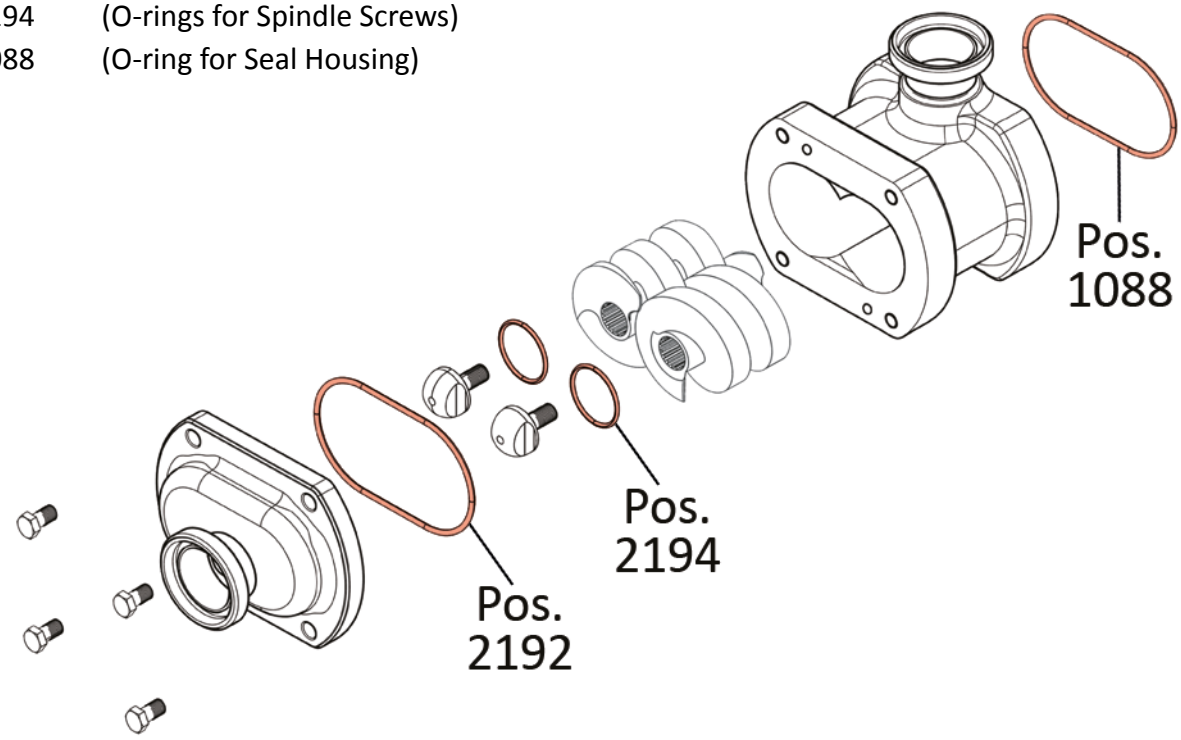
4.5.4 Greasing Motor Bearings

A) Motor Bearings must be properly greased according to the Motor Manufacturer's recommendations, which is typically every 3 months. Failure to do so could result in the motor not operating at peak performance, and can possibly lead to permanent motor damage or improper motor function.

4.5.5 Check Condition of O-rings

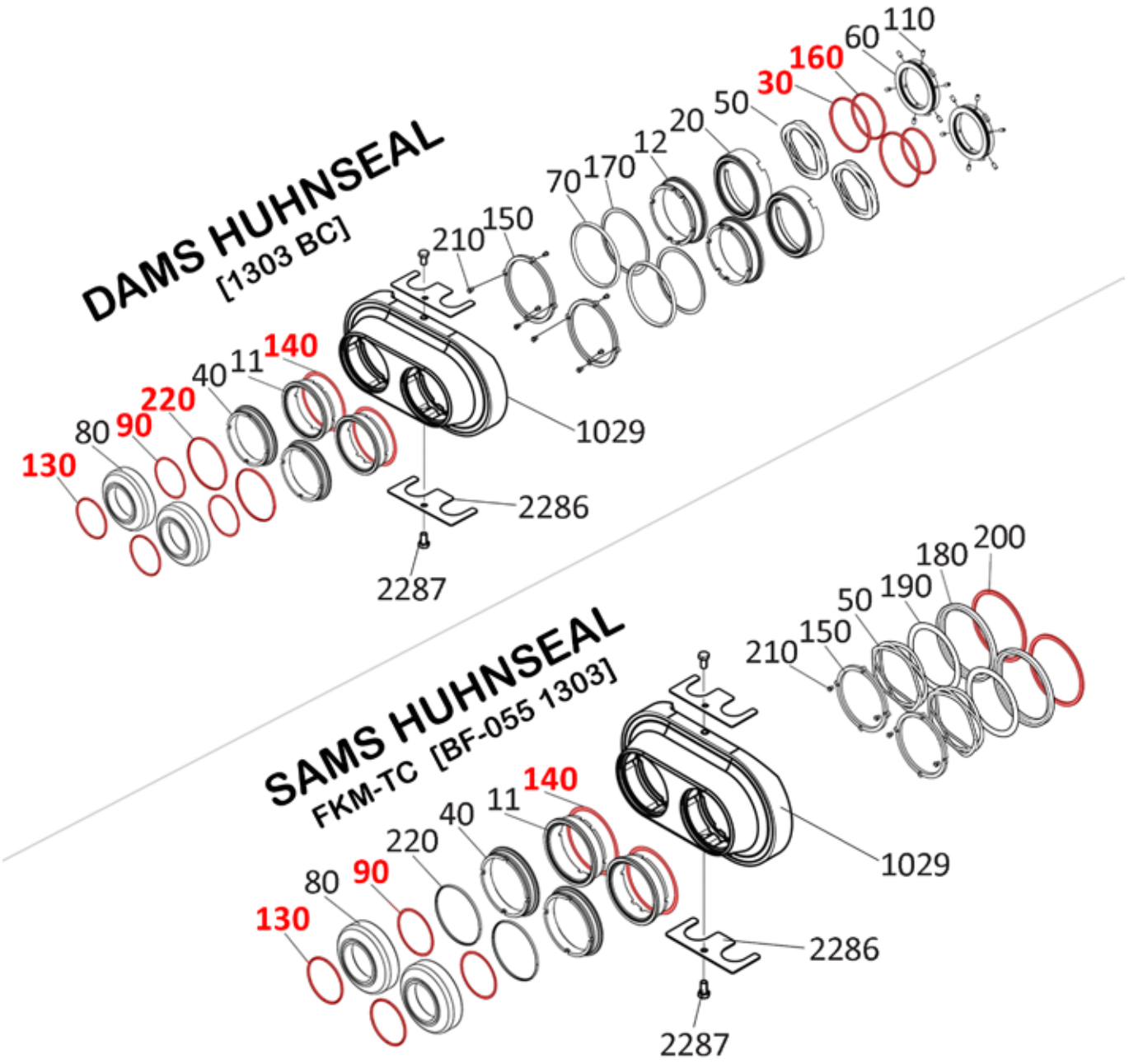
There are THREE (3) O-rings that need to be inspected to be sure they are free from damage in order for the ViscoTwin pumps to work correctly. The O-rings can be found at the following Position Numbers:

Pos. 2192 (O-rings for Pump Face)
Pos. 2194 (O-rings for Spindle Screws)
Pos. 1088 (O-ring for Seal Housing)



4.5.6 Check the Seals & Seal Housing O-rings (HUHNSEAL)

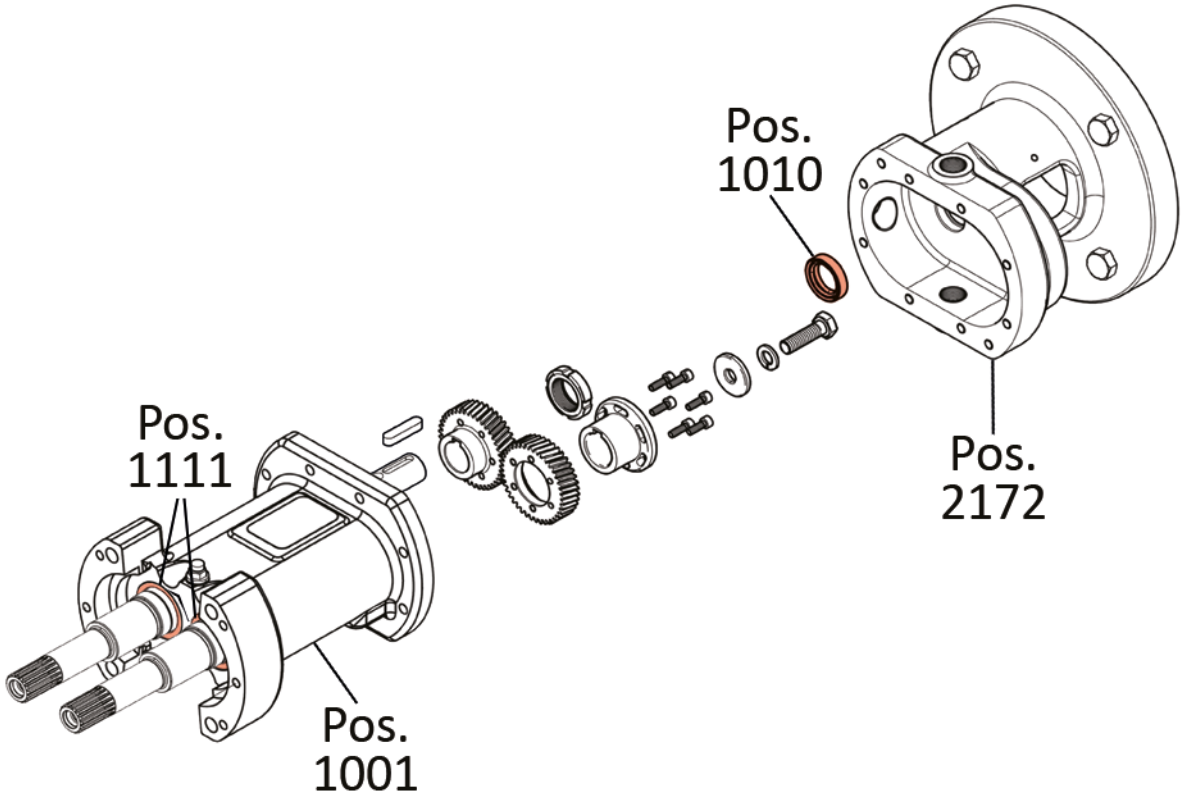
Inspect the Seals & Seal Housing O-rings on the Seal Housing:



NOTE: To see which Seals and Seal Housing O-rings need to be insepected on pumps running DAMS ANGA or SAMS ANGA, please see Section 7.3 "Check the Seals & Seal Housing O-rings (ANGA)" on page 159.

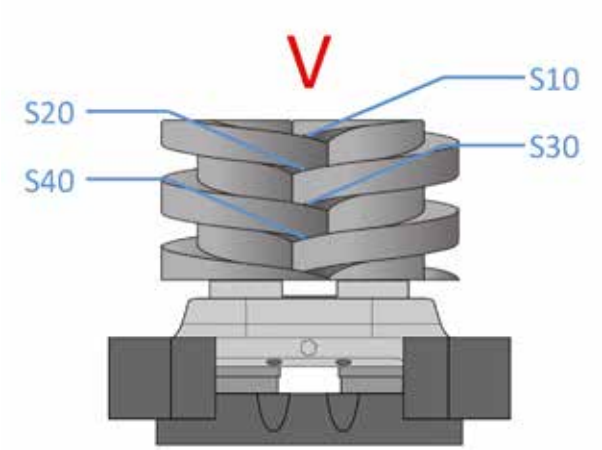
4.5.7 Check Oil Shaft Sealing Rings

Check the condition of the Oil Shaft Sealing Rings (Pos. 1111 & 1010) on the Bearing Housing (Pos. 1001) and also on the Gear Housing (Pos. 2172).



4.5.8 Proper Gapping of Pump

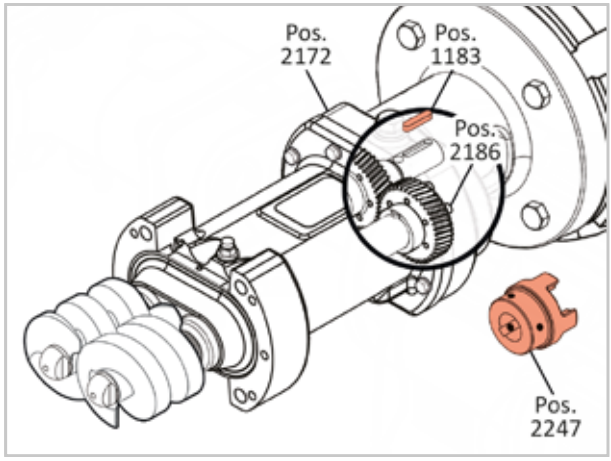
In case foreign material entered the pump housing and blocked the spindles, the gear synchronization lock ring (Pos. 2515) might have slipped. The "S" clearances between the spindles shifted to the extent that the spindles touch and block each other. In this case the pump needs to be gapped.



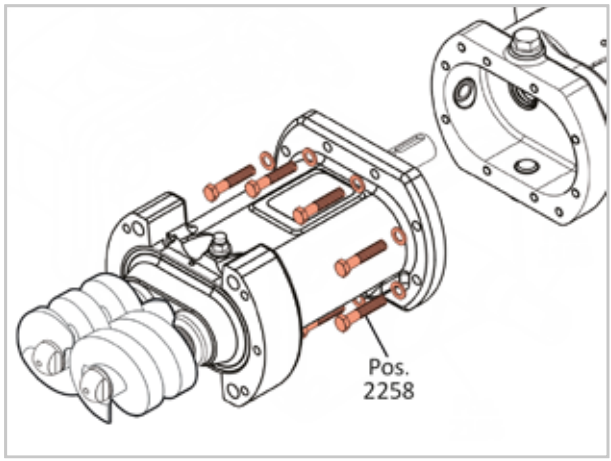
Gapping means that the "S" clearances between the spindle flights need to be evenly distributed while turning the driven shaft into the "middle position". Successful gapping results in the "S" clearances measuring all the same (S10, S20, S30, S40).

STEP 1)
The Gear Housing/Lantern (Pos. 2172) needs to be completely removed in order to gain access to the Socket Head Cap Screws (Pos. 2186) on the Gear Synchronization Lock Ring (Pos. 2176).

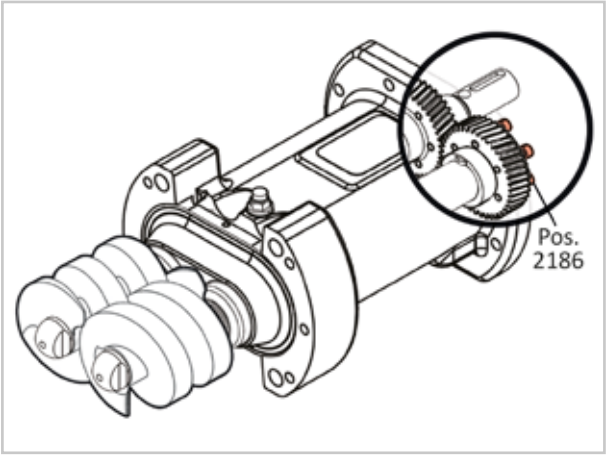
A. Using the Gear Housing lantern window to gain access, remove the Pump Coupling Hub (Pos. 2247). Then remove the Key (Pos. 1183) on the Drive Shaft using Ear Clamp Pliers.



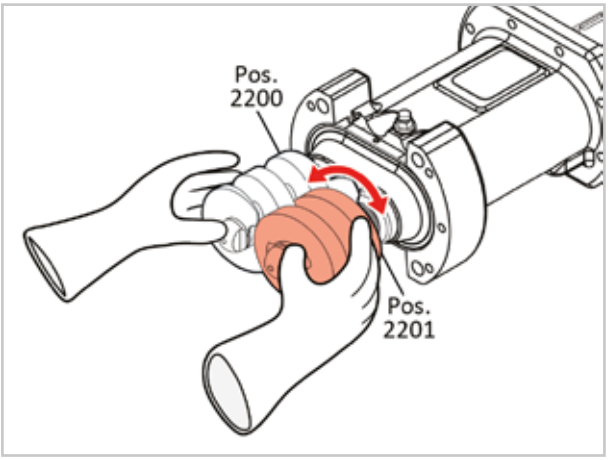
B. Now you can Drain the Oil. Once drained, loosen the EIGHT (8) Hex Socket Bolts (Pos. 2258) on the Gear Housing. Once these have been removed, carefully separate the Bearing Housing from the Gear Housing.



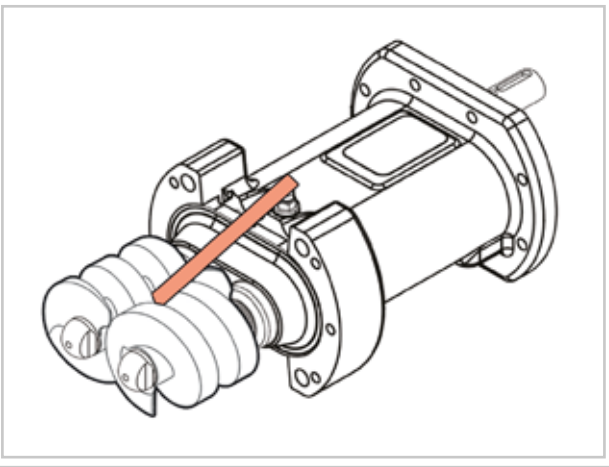
STEP 2)
Loosen all SIX (6) of the Gear Wheel Hex Socket Screws (Pos. 2186) but do not remove.



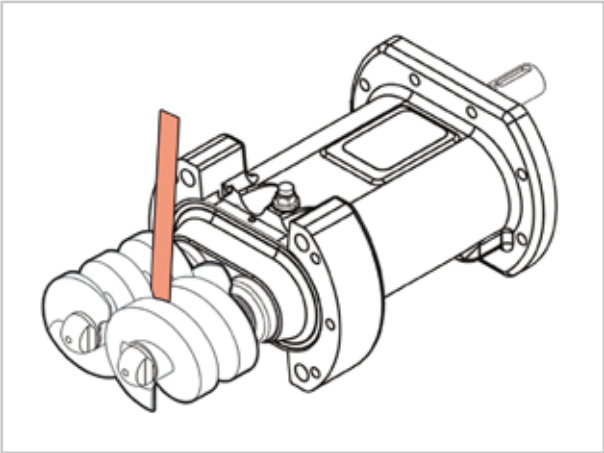
STEP 3)
Fixate the Drive Shaft (Pos. 1000) by holding the Drive Shaft Spindle (Pos. 2200) in your left hand, and rotating the Driven Shaft Spindle (Pos. 2201) with your right hand, until both spindles touch eachother at position S20 and S40.



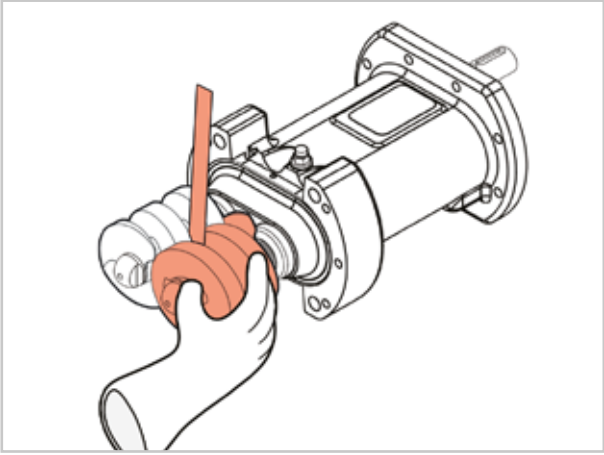
STEP 4)
Measure the gap position S30 with a feeler gauge. Divide that clearance in 2. (For example, if the clearance at S30 was 0.30mm, you will end up with .15mm). This is known as the "half-gap" dimension.



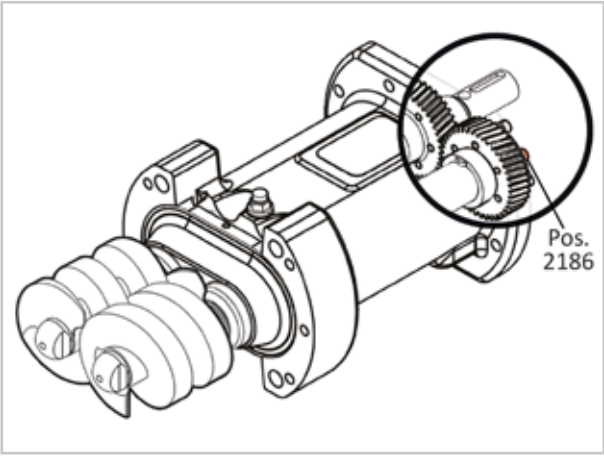
STEP 5)
Select a feeler gauge that is sized to this "half-gap" dimension, and insert it at S30, for use as a shim.



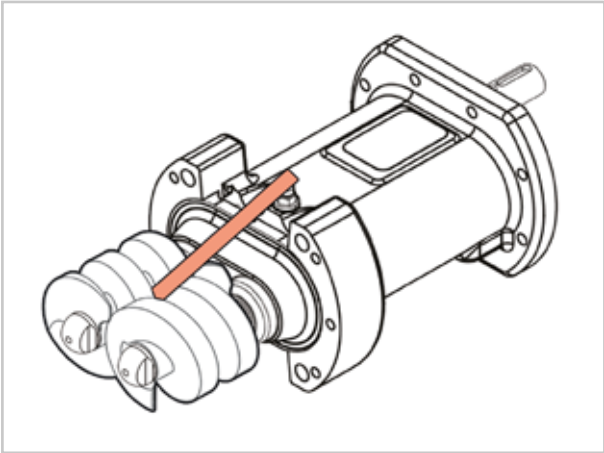
STEP 6)
Turn the Driven Shaft Spindle (Pos. 2201) until it closes onto the "half-gap" shim at S30. If done correctly, this will now give you the exact same gap at S20.



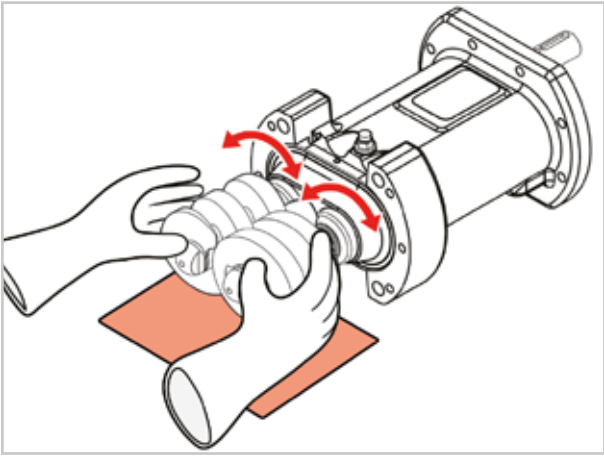
STEP 7)
Hand tighten just ONE (1) of the Socket Head Cap Screws (Pos. 2186). The shaft should be blocked and both spindles turn synchronized.



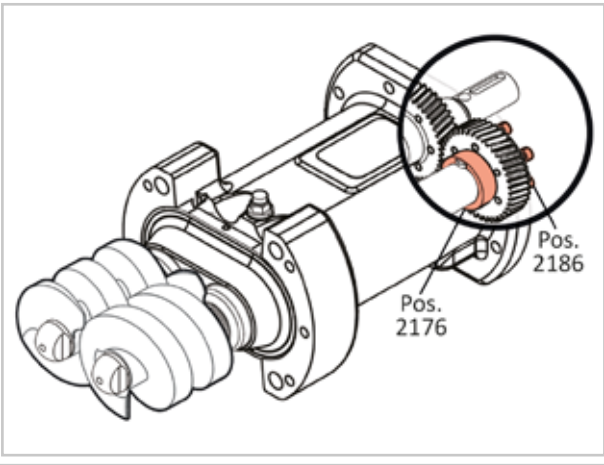
STEP 8)
Verify that S20 and S30 are now the same (or at least within .05mm). S10 will natively match with S30 and S20 will natively match with S40. Depending on the shape of the spindles used, a close value is good enough. The spindles are not allowed to touch anywhere, however. If that were to be the case, the spindles are severely damaged and probably need to be replaced.



STEP 9)
While hand turning the Spindles, verify that the shafts turn freely. Also verify, by holding a white sheet of paper underneath the spindles and then shining a flashlight upwards, that the gaps are clear from galls as well.

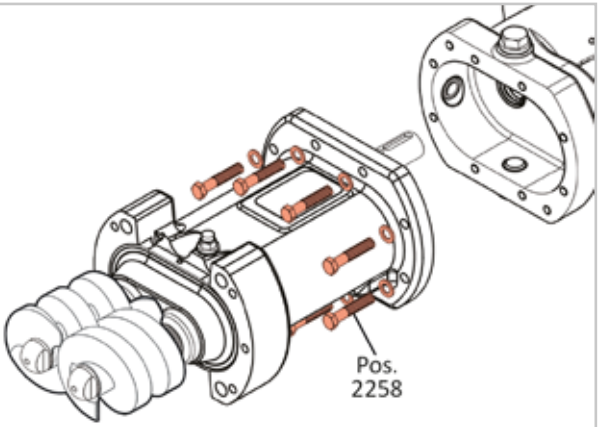


STEP 10)
Fixate the Gear Synchronization Lock Ring (Pos. 2176) while tightening (in a star pattern) the SIX (6) Gear Wheel Hex Socket Screws (Pos. 2186) to the recommended torque value in the torque chart (8 Nm / 5.9 lb-ft).



STEP 11)
Reassemble the pump by mating the Bearing Housing to the Gear Housing / Lantern, and hand tighten the EIGHT (8) Hex Socket Bolts (Pos. 2258) until snug. Then, moving in a star pattern, torque each bolt to 20 Nm / 14.8 lb-ft.

Finally, you must now refill the oil in the Gear Housing.

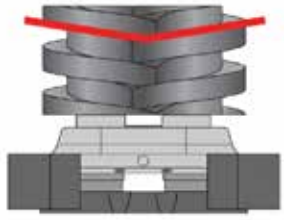


4.5.9 Changing Product Flow Direction

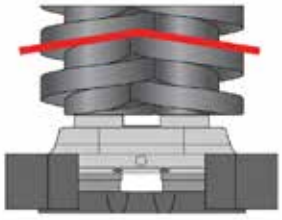
To change Product Flow Direction from any configuration, you will need to do ONLY ONE of the two following options:

OPTION 1

Change Spindle Arrangement from "V to A" or "A to V"



SPINDLE ARRANGEMENT: V

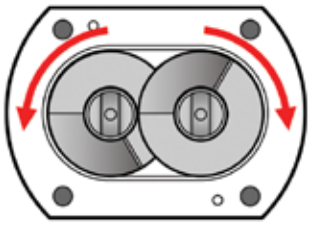


SPINDLE ARRANGEMENT: A

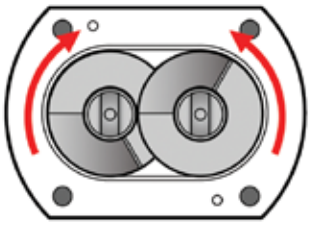
OR

OPTION 2

Step 1) Change Rotation from "O to I" or "I to O"

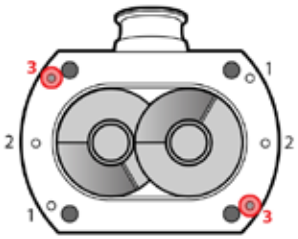


OUTWARDS
requires clearance on the top

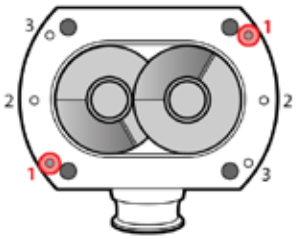


INWARDS
requires clearance on bottom

Step 2) Switch the Pin Arrangement from "3 to 1" or "1 to 3"



PIN CONFIGURATION: 3

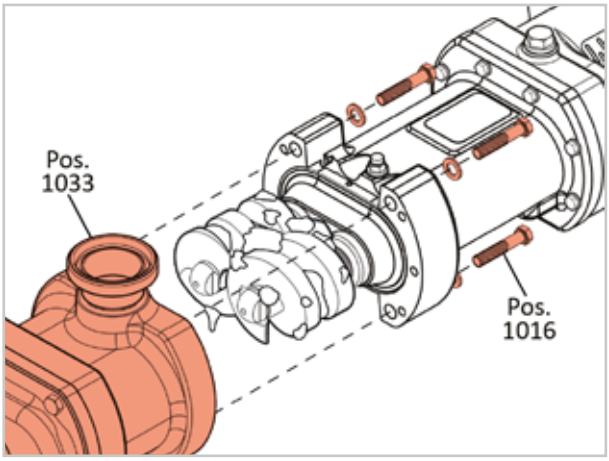


PIN CONFIGURATION: 1

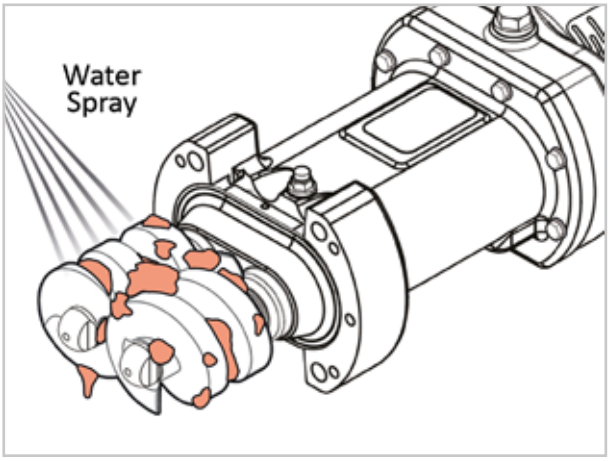
4.6 Failures

4.6.1 Foreign Material enters Pump Housing

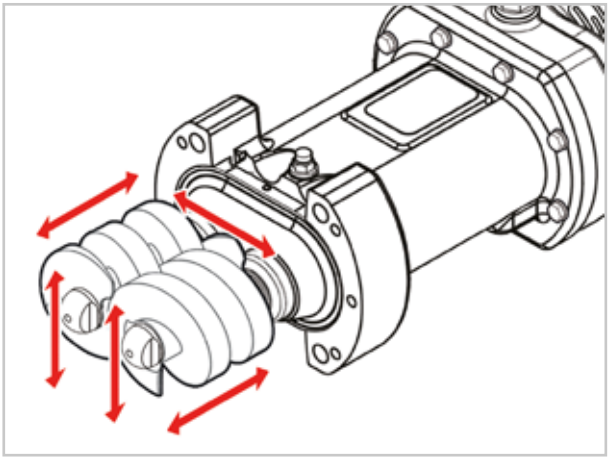
STEP 1)
Remove Pump Housing.



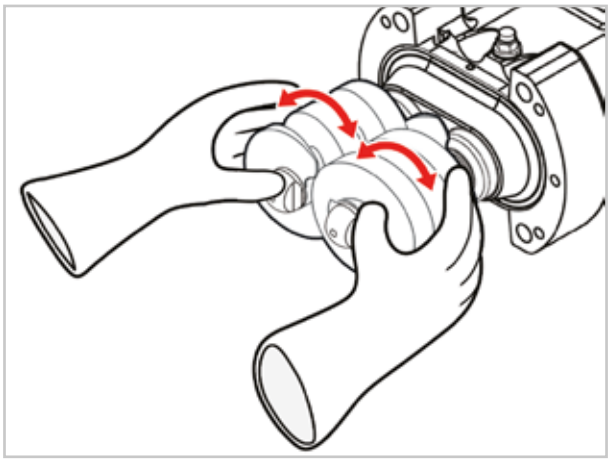
STEP 2)
Clean Area.



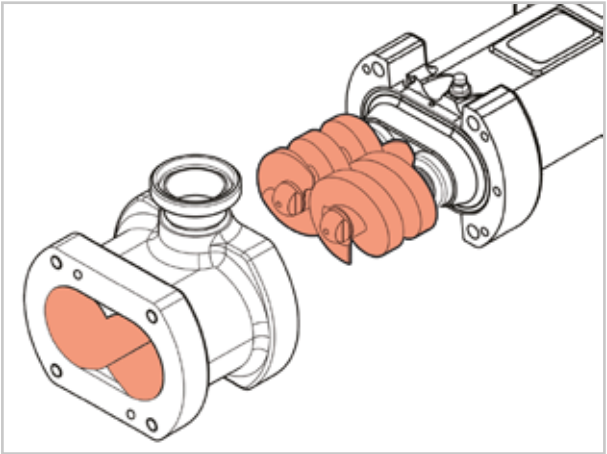
STEP 3)
Inspect shaft for axial & radial movement by hand.



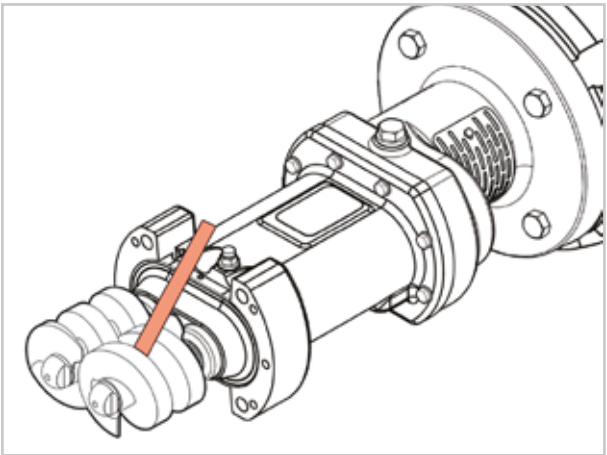
STEP 4)
Inspect if spindles turn by hand. Visually inspect the condition of the spindles.



STEP 5)
Inspect the spindles and housing condition for debris, scars, and crevices. If necessary, gap or time the spindles.



STEP 6)
Gapping and/or timing can be necessary if spindles need to be replaced.



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5. TOOL-BOX

5.1 Tools

Below are all of the Tools that are available from **Processtec** for use on the ViscoTwin pumps:

5.1.1 ViscoTwin Tools

Spindle Screw Socket with Hex_VT70_G7, NG				for Pos. 2180
PART NUMBER	**CUSTOMER REFERENCE #**	**MATERIAL**	**TOOL NUMBER**	
12566		Aluminum	T-36	
NOTES: *To loosen and tighten Spindle Bolts*				

Mounting Cone for Shaft Sealing Ring Gear Housing_VT70_G7				for Pos. 1010
PART NUMBER	**CUSTOMER REFERENCE #**	**MATERIAL**	**TOOL NUMBER**	
12586		Stainless Steel	T-46	
NOTES:				

Press Fitting Mandrel_VT70_G7				for Pos. 1010
PART NUMBER	**CUSTOMER REFERENCE #**	**MATERIAL**	**TOOL NUMBER**	
18775		Stainless Steel	T-55	
NOTES:				

Mounting Cone Bearing Housing_VT70_G7				for Pos. 1111
PART NUMBER	**CUSTOMER REFERENCE #**	**MATERIAL**	**TOOL NUMBER**	
12568		Stainless Steel	T-16	
NOTES:				

5.1.2 General Tools

Torque Wrench Large				- -
PART NUMBER	**CUSTOMER REFERENCE #**	**MATERIAL**	**SIZE**	
21852		- -	1/2"	
NOTES: *For 1/2" drive, 30-340 Nm,* *for high torque application*				

Torque Wrench Medium				- -
PART NUMBER	**CUSTOMER REFERENCE #**	**MATERIAL**	**SIZE**	
21851		- -	3/8"	
NOTES: *For 3/8" drive, 10-135 Nm,* *for medium torque application*				

Torque Wrench Small				- -
PART NUMBER	**CUSTOMER REFERENCE #**	**MATERIAL**	**SIZE**	
21873		- -	1/4"	
NOTES: *For 1/4" drive, 2.5-25 Nm,* *for small torque application*				

Hex Nut				for Pos. per Torque Table
PART NUMBER	**CUSTOMER REFERENCE #**	**MATERIAL**	**SIZE**	
21853		- -	10 mm	
21854		- -	13 mm	
21915		- -	16 mm	
21910		- -	18 mm	
21855		- -	19 mm	
21911		- -	22 mm	
21856		- -	24 mm	
21857		- -	27 mm	
21858		- -	30 mm	
21912		- -	32 mm	
NOTES: *Operate on positions per chart*				

Hex Socket Bits_VT70				for Pos. see Notes
PART NUMBER	CUSTOMER REFERENCE #	MATERIAL	SIZE	
21830		CVS	2.5 mm	
21832		CVS	4 mm	
21834		CVS	5 mm	
21836		CVS	6 mm	
21838		CVS	8 mm	
NOTES: *Operate on positions per chart* *For Pos. 1008, 2247, 2248, 2258*				

Pliers				for Pos. 1183
PART NUMBER	CUSTOMER REFERENCE #	MATERIAL	SIZE	
21844		- -	- -	
NOTES:				

Hex Socket Screw Drivers				for Pos. 2287 & 2259
PART NUMBER	**CUSTOMER REFERENCE #**	**MATERIAL**	**SIZE**	
21913		- -	7 mm	
21914		- -	10 mm	
NOTES:				

Feeler Gauge Metric				- -
PART NUMBER	**CUSTOMER REFERENCE #**	**MATERIAL**	**SIZE**	
21847		303	- -	
NOTES: *Long blades to verify gaps in Spindles, Housing*				

Set of Small Hooks for Removal of O-Rings				- -
PART NUMBER	**CUSTOMER REFERENCE #**	**MATERIAL**	**TOOL NUMBER**	
21848		Stainless Steel	- -	
NOTES: *Operate on positions per chart, used for removal of O-rings*				

Hex Socket Extension				- -
PART NUMBER	**CUSTOMER REFERENCE #**	**MATERIAL**	**TOOL NUMBER**	
21874		- -	9"	
NOTES: *For 1/2" drive*				

Wrench for Operating Hex Nuts				- -
PART NUMBER	**CUSTOMER REFERENCE #**	**MATERIAL**	**SIZE**	
21849		- -	3/8"	
21850		- -	1/2"	
NOTES:				

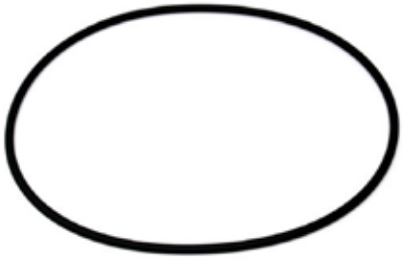
Flat Tire Lever				for Pos. 4000
PART NUMBER	**CUSTOMER REFERENCE #**	**MATERIAL**	**SIZE**	
21846		- -	24"	
NOTES: *Blocking of the Coupling on G7 Pumps* *to loosen or tighten Spindles*				

5.2 Spare Parts

Below is a list of the Spare Parts that are available from **Processtec** for use on the ViscoTwin pumps:

5.2.1 Spare Parts for Pump Housing

Spindle Screw_VT70_G7, NG				Pos. 2180
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
18559		316L	- -	
NOTES:				

O-Ring for Pump Face_VT70_G7, NG				Pos. 2192
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
12508		FKM	DIN3771-122,5x4,0	
12514		EPDM	DIN3771-122,5x4,0	
NOTES:				

O-Ring for Spindle Screw_VT70_G7, NG				Pos. 2194
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
12500		FKM	DIN3771-38x3,0	
12501		EPDM	DIN3771-38x3,0	
NOTES:				

Dowel Pin for Pump Housing_VT70, VT104, VT130_G7, NG				Pos. 2195
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
12616		316	DIN7-8h8x16	
NOTES:				

Spindle Left Handed_G7, NG				Pos. 2200
PART #	**SPECIFIC MODEL NAME**	**MATERIAL**	**SPECIFICATION**	
22143	Spindle (Left Handed) VT70.22SEH	316	22mm Standard, EH	
- -	Spindle (Left Handed) VT70.22S3A	316	22mm Standard, 3A	
22144	Spindle (Left Handed) VT70.22HEH	316	22mm Hardened, EH	
- -	Spindle (Left Handed) VT70.22H3A	316	22mm Hardened, 3A	
12628	Spindle (Left Handed) VT70.29SEH	316	29mm Standard, EH	
17561	Spindle (Left Handed) VT70.29S3A	316	29mm Standard, 3A	
12644	Spindle (Left Handed) VT70.29HEH	316	29mm Hardened, EH	
11223	Spindle (Left Handed) VT70.29H3A	316	29mm Hardened, 3A	
12630	Spindle (Left Handed) VT70.43SEH	316	43mm Standard, EH	
16548	Spindle (Left Handed) VT70.43S3A	316	43mm Standard, 3A	
12645	Spindle (Left Handed) VT70.43HEH	316	43mm Hardened, EH	
11224	Spindle (Left Handed) VT70.43H3A	316	43mm Hardened, 3A	
NOTES: *Rotation Direction* 				

Spindle Right Handed_G7, NG

Pos. 2201

PART #	SPECIFIC MODEL NAME	MATERIAL	SPECIFICATION
22141	Spindle (Right Handed) VT70.22SEH	316	22mm Standard, EH
- -	Spindle (Right Handed) VT70.22S3A	316	22mm Standard, 3A
22142	Spindle (Right Handed) VT70.22HEH	316	22mm Hardened, EH
- -	Spindle (Right Handed) VT70.22H3A	316	22mm Hardened, 3A
12629	Spindle (Right Handed) VT70.29SEH	316	29mm Standard, EH
- -	Spindle (Right Handed) VT70.29S3A	316	29mm Standard, 3A
12647	Spindle (Right Handed) VT70.29HEH	316	29mm Hardened, EH
11226	Spindle (Right Handed) VT70.29H3A	316	29mm Hardened, 3A
12631	Spindle (Right Handed) VT70.43SEH	316	43mm Standard, EH
16549	Spindle (Right Handed) VT70.43S3A	316	43mm Standard, 3A
12646	Spindle (Right Handed) VT70.43HEH	316	43mm Hardened, EH
19978	Spindle (Right Handed) VT70.43H3A	316	43mm Hardened, 3A

NOTES:
Rotation Direction

5.2.2 Spare Parts for Seal Housing

O-Ring Seal Housing_VT70_G7, NG				Pos. 1088
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
12499		FKM	DIN3771-120x4,0	
12502		EPDM	DIN3771-120x4,0	
NOTES:				

Elsatomer Kit SAMS_VT70_G7				Pos. 2261 BF
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
15955		FKM	ANGA, SD: 36mm	
19174		EPDM	ANGA, SD: 36mm	
NOTES:				

Elastomer Kit SAMS_VT70_G7				Pos. 2261 BF
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
6985		FKM	HUHNSEAL, SD: 36mm	
8300		EPDM	HUHNSEAL, SD: 36mm	
NOTES:				

Elastomer Kit DAMS_VT70_G7				Pos. 2261 BC
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
17715		FKM	ANGA, SD: 36mm	
16552		EPDM	ANGA, SD: 36mm	
NOTES:				

Elastomer Kit DAMS_VT70_G7				Pos. 2261 BC
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
8318		FKM	HUHNSEAL, SD: 36mm	
8319		EPDM	HUHNSEAL, SD: 36mm	
NOTES:				

Mechanical Seal SAMS_VT70_G7				Pos. 1303 BF
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
18710	S3	SIC/SIC FKM	ANGA, SD: 36mm	
19170	S3	SIC/SIC EPDM	ANGA, SD: 36mm	
17562	S4	TuC/TuCKE FKM	ANGA, SD: 36mm	
19074	S4	TuC/TuCKE EPDM	ANGA, SD: 36mm	
NOTES:				

Mechanical Seal SAMS_VT70_G7				Pos. 1303 BF
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
11457	S1	SIC/SIC FKM	HUHNSEAL, SD: 36mm	
19364	S1	SIC/SIC EPDM	HUHNSEAL, SD: 36mm	
12748	S2	TuC/TuCKE FKM	HUHNSEAL, SD: 36mm	
19365	S2	TuC/TuCKE EPDM	HUHNSEAL, SD: 36mm	
NOTES:				

Mechanical Seal DAMS_VT70_G7				Pos. 1303 BC
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
16952	D3	SIC/SIC FKM	ANGA, SD: 36mm	
16546	D3	SIC/SIC EPDM	ANGA, SD: 36mm	
17583	D4	TuC/TuCKE FKM	ANGA, SD: 36mm	
19423	D4	TuC/TuCKE EPDM	ANGA, SD: 36mm	
NOTES:				

Mechanical Seal DAMS_VT70_G7				Pos. 1303 BC
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
11441	S1	SIC/SIC FKM	HUHNSEAL, SD: 36mm	
19286	S1	SIC/SIC EPDM	HUHNSEAL, SD: 36mm	
11894	S2	TuC/TuCKE FKM	HUHNSEAL, SD: 36mm	
11165	S2	TuC/TuCKE EPDM	HUHNSEAL, SD: 36mm	
NOTES:				

5.2.3 Spare Parts for Bearing Housing

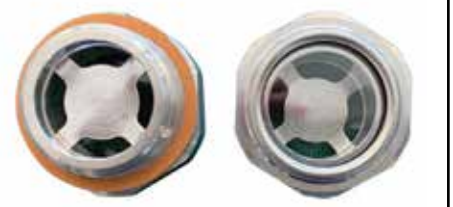
Shaft Sealing Ring Bearing Housing_VT70_G7				Pos. 1111
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
12527		FKM	DIN3760-AS 40x52x8	
NOTES:				

Key for Coupling_VT70_G7				Pos. 1183
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
12617		304	DIN6885-AS 6x6x25	
NOTES:				

Flat Gasket Gear Housing_VT70_G7				Pos. 2198
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
12493			1 mm	
NOTES:				

5.2.4 Spare Parts for Gear Housing

Shaft Sealing Ring Gear Housing_VT70_G7				Pos. 1010
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
16545		FKM	DIN3760-AS-22x40x7,	
NOTES:				

Oil Level Sight Gauge_VT70_VT104, VT130_G7				Pos. 1541
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
6986		Aluminum, Glass	G 3/4"	
NOTES:				

Magnetic Screw Plug_VT70, VT104, VT130_G7				Pos. 2233
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
18756		Aluminum	G 1/2"	
NOTES:				

Gear Oil Bearing Housing VT				
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
21871		- -	5 L	
NOTES:				

5.2.5 Spare Parts for Drive Train

Coupling Hub Pump_VT70_G7				Pos. 2247
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
19509		Aluminum	AL090, BS: 20mm	
6738		Aluminum	AL0100, BS: 20mm	
8299		Aluminum	AL0110, BS: 20mm	
NOTES:				

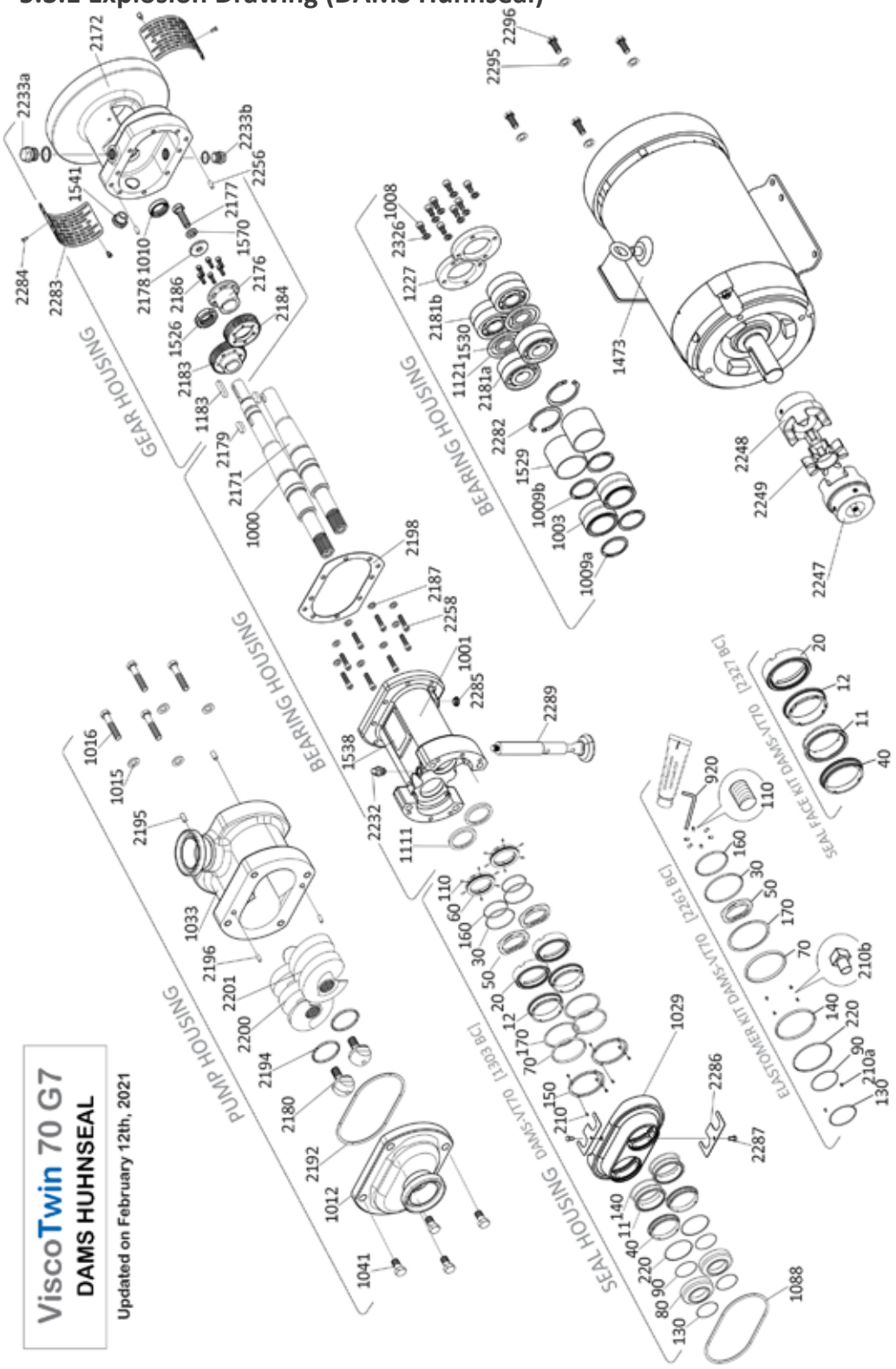
Coupling Hub Motor_VT70_G7				Pos. 2248
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
- -		Aluminum	Variable	
NOTES: *Please consult configuration key or contact* **Processtec**.				

Coupling Spider_VT70_G7				Pos. 2249
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
19067		Elastomer NBR	LOVEJOY, Model L090 Solid Type	
6751		Elastomer NBR	LOVEJOY, Model L100 Solid Type	
6752		Elastomer NBR	LOVEJOY, Model L110 Solid Type	
NOTES:				

W22 Severer Duty Motor				Pos. 3003
PART #	**CUSTOMER REFERENCE #**	**MATERIAL**	**SPECIFICATION**	
		CI	Variable	
NOTES: *WEG Severe Duty 25 HP* *Size might change due to application requirements.*				

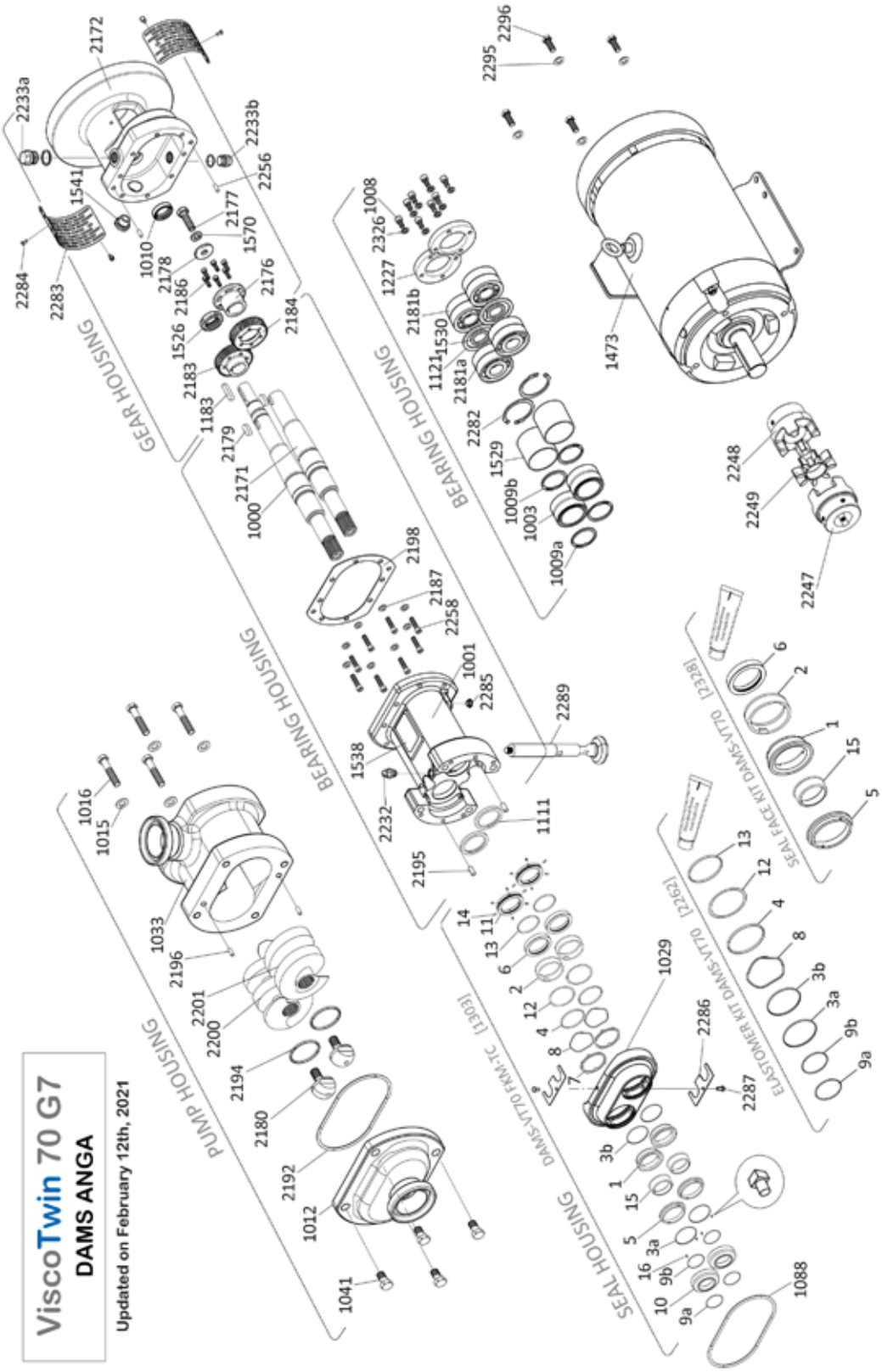
5.3 Explosion Drawings

5.3.1 Explosion Drawing (DAMS Huhnseal)



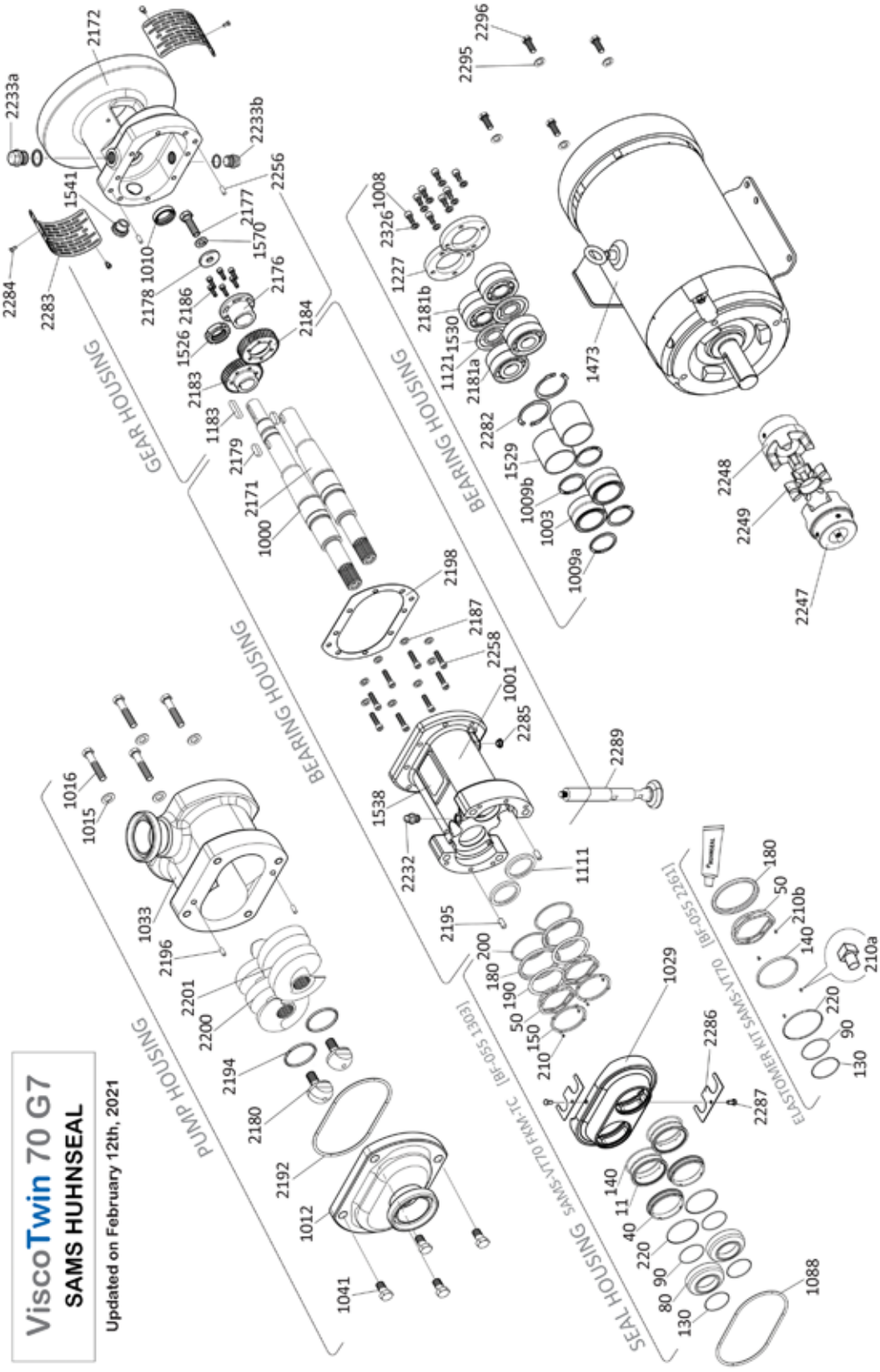
DAMS HUHNSEAL
(11" x 17")

5.3.2 Explosion Drawing (DAMS Anga)



DAMS ANGA
(11" x 17")

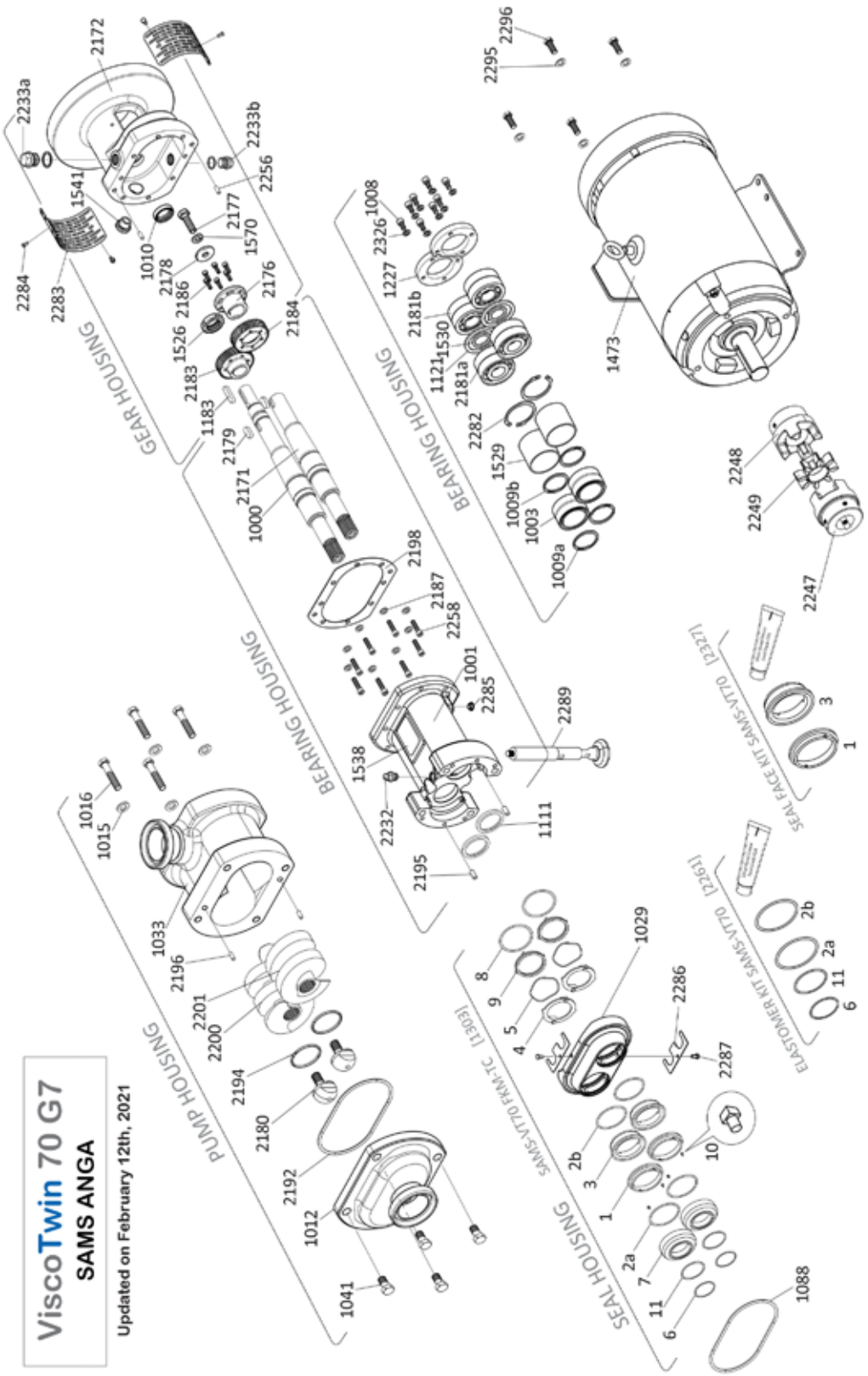
5.3.3 Explosion Drawing (SAMS Huhnseal)



ViscoTwin 70 G7
SAMS HUHNSEAL
Updated on February 12th, 2021

SAMS HUHSNEAL
(11" x 17")

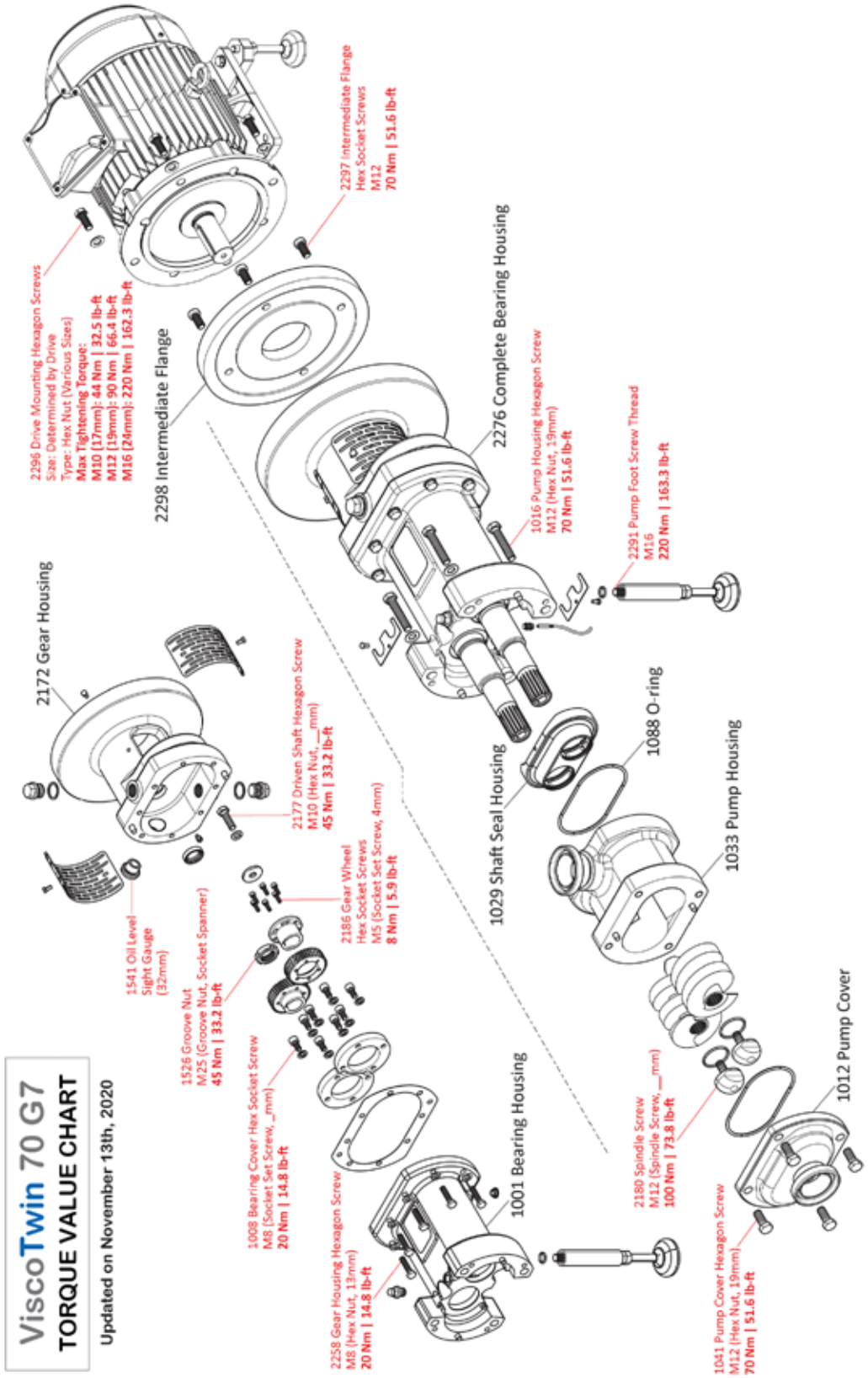
5.3.4 Explosion Drawing (SAMS Anga)



ViscoTwin 70 G7
SAMS ANGA
Updated on February 12th, 2021

SAMS ANGA
(11" x 17")

5.4 Torque Chart



TORQUE CHART
(11" x 17")

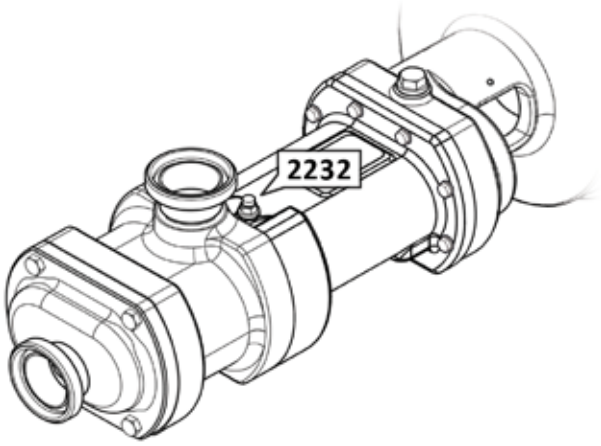
5.5 Pump Housing Configurations

Each ViscoTwin 70 G7 Pump Housing can be set up for a variety of configuration options to suit particular application.

Each Configuration has been uniquely identified with a series of letters and numbers that call out the specific flow direction, shaft rotation, pin positions and spindle arrangements to get the desired output.

For example, a FHO3V configuration means that the Flow Direction is Face In/Housing Out (FH), Shaft Rotation is Outward (O). Pin Position is Configuration 3 (3) with Spindle Arrangement V (V).

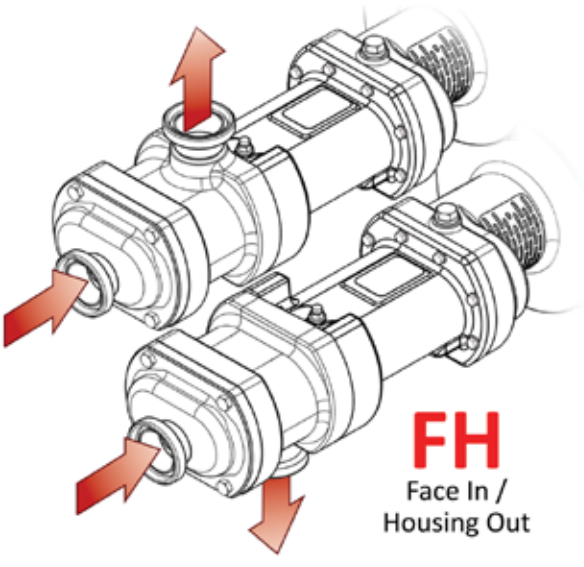
There are SIX possible configurations, and each one is listed in the chart below, as well on the following pages. The default configuration is FHO3V.



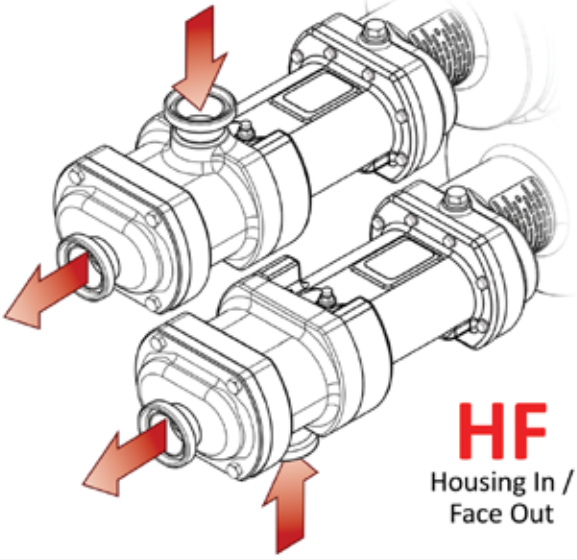
The TOP of the pump is always determined by the location of the VENT Plug (Pos. 2232) on the Bearing Housing, regardless of the Pump Housing orientation and the final position of the Pump.

CONFIGURATION NAME	FLOW DIRECTION	SPINDLE ROTATION	PIN POSITION	SPINDLE ARRANGE-MENT	COMMENTS
FHO3V	Face In / Housing Out	Outwards	3	V	Product dragged along the bottom
FHI1A	Face In / Housing Out	Inwards	1	A	Product dragged along the top
HFI1V	Housing In / Face Out	Inwards	1	V	Product dragged along the top
HFO3A	Housing In / Face Out	Outwards	3	A	Product dragged along the bottom
BDB2V	Bi-Directional	Bi-Directional	2	V	Limited Viscosity Tapered Spindles Preferred
BDB2A	Bi-Directional	Bi-Directional	2	A	Limited Viscosity Tapered Spindles Preferred

Flow Direction (figure 1)

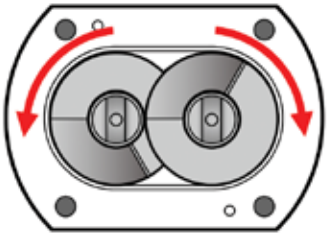


FH
Face In /
Housing Out

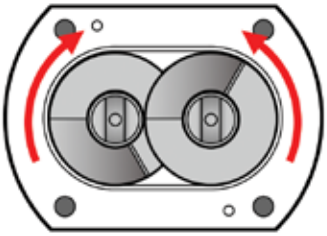


HF
Housing In /
Face Out

Shaft Rotation (figure 2)

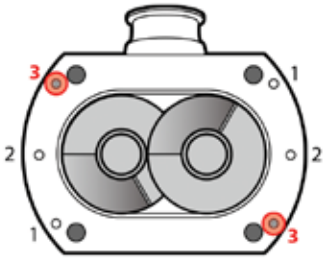


O
Outwards

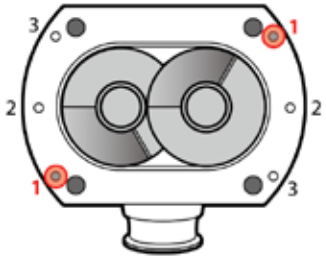


I
Inwards

Pin Configuration (figure 3)

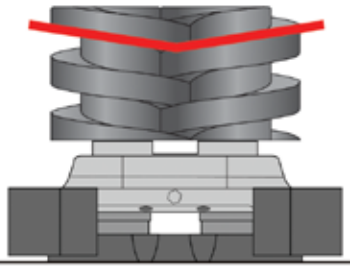


3
Both pins in
Position 3

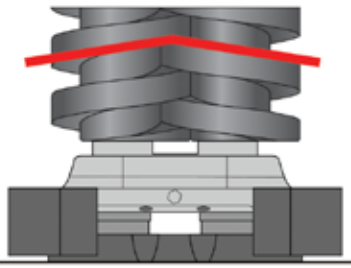


1
Both pins in
Position 1

Spindle Arrangement (figure 4)



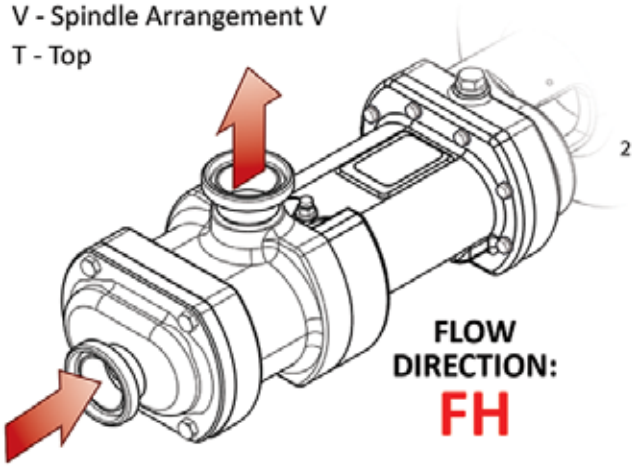
V
Spindle
Arrangement



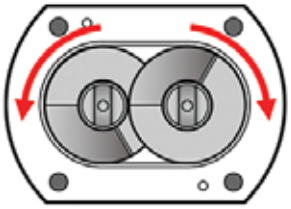
A
Spindle
Arrangement

FHO3V (T)

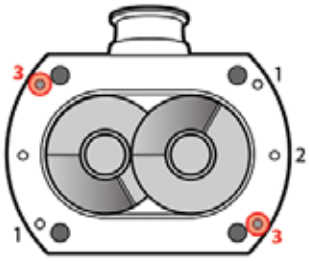
FH - Face In / Housing Out
O - Outwards
3 - Pin Position 3
V - Spindle Arrangement V
T - Top



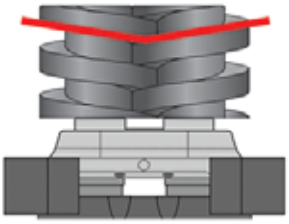
FLOW DIRECTION:
FH



SHAFT ROTATION:
OUTWARDS
requires clearance on the top



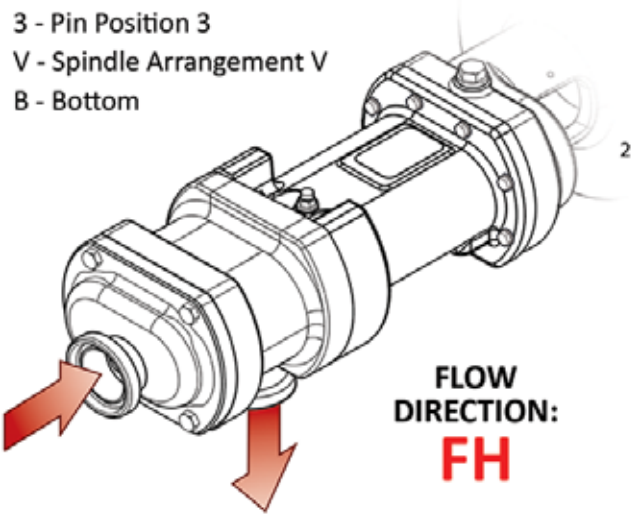
PIN CONFIGURATION:
3
delivers clearance on the top



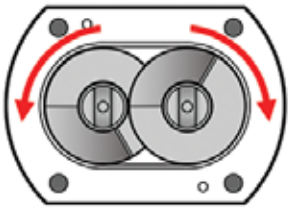
SPINDLE ARRANGEMENT:
V

FHO3V (B)

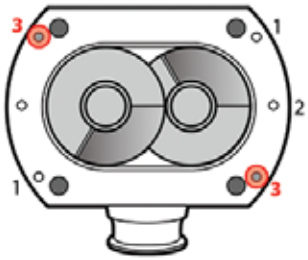
FH - Face In / Housing Out
O - Outwards
3 - Pin Position 3
V - Spindle Arrangement V
B - Bottom



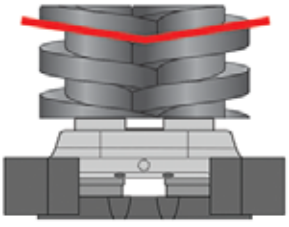
FLOW DIRECTION:
FH



SHAFT ROTATION:
OUTWARDS
requires clearance on the top



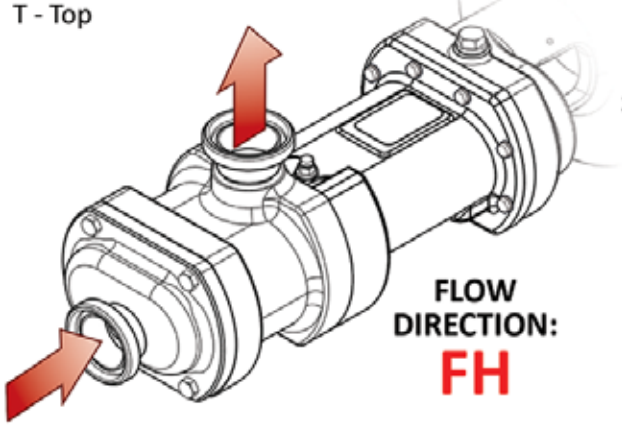
PIN CONFIGURATION:
3
delivers clearance on the top



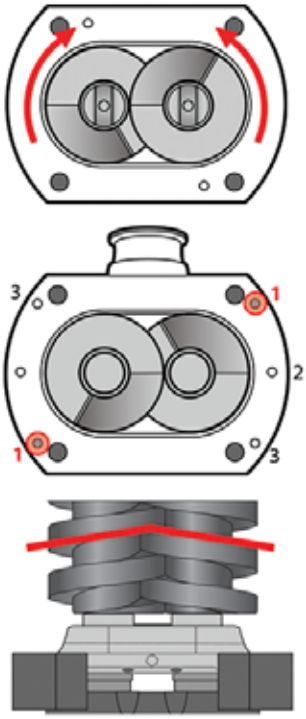
SPINDLE ARRANGEMENT:
V

FHI1A (T)

FH - Face In / Housing Out
I - Inwards
1 - Pin Position 1
A - Spindle Arrangement A
T - Top



FLOW DIRECTION:
FH



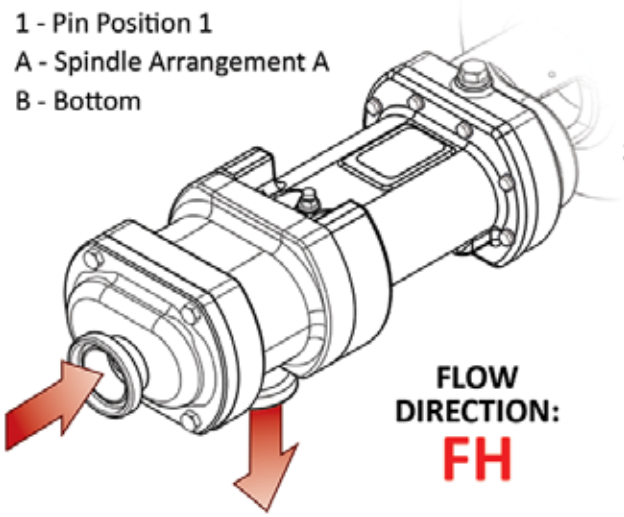
SHAFT ROTATION:
INWARDS
requires clearance on bottom

PIN CONFIGURATION:
1
delivers clearance on bottom

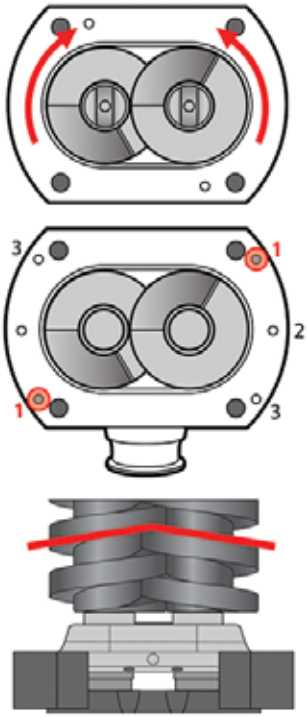
SPINDLE ARRANGEMENT:
A

FHI1A (B)

FH - Face In / Housing Out
I - Inwards
1 - Pin Position 1
A - Spindle Arrangement A
B - Bottom



FLOW DIRECTION:
FH



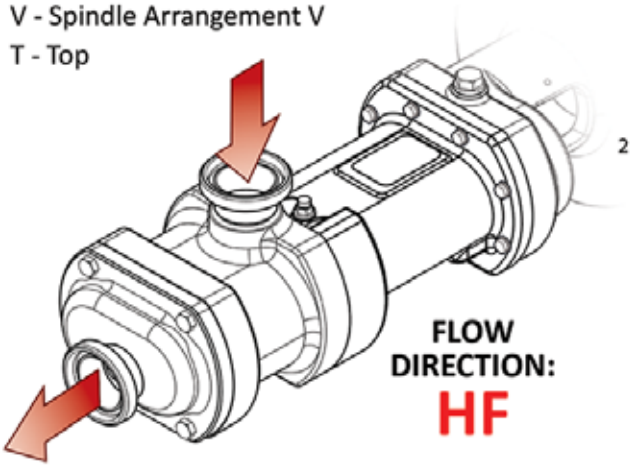
SHAFT ROTATION:
INWARDS
requires clearance on bottom

PIN CONFIGURATION:
1
delivers clearance on bottom

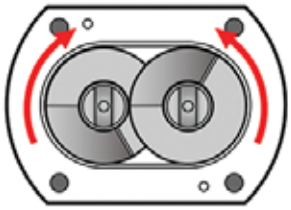
SPINDLE ARRANGEMENT:
A

HFI1V (T)

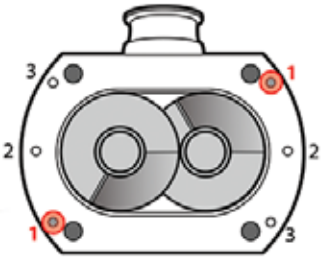
HF - Housing In / Face Out
I - Inwards
1 - Pin Position 1
V - Spindle Arrangement V
T - Top



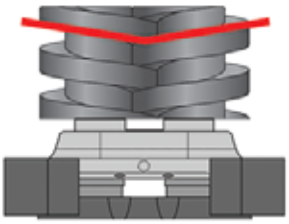
FLOW DIRECTION:
HF



SHAFT ROTATION:
INWARDS
requires clearance on bottom



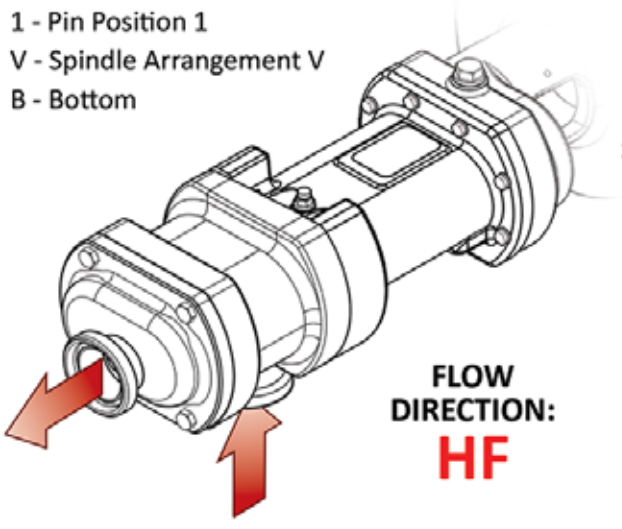
PIN CONFIGURATION:
1
delivers clearance on bottom



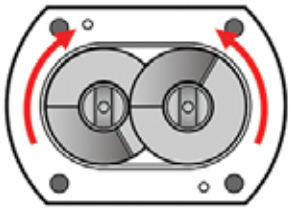
SPINDLE ARRANGEMENT:
V

HFI1V (B)

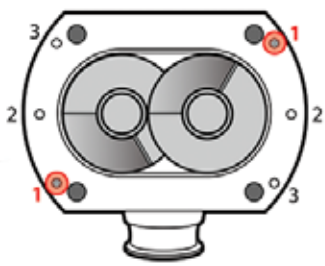
HF - Housing In / Face Out
I - Inwards
1 - Pin Position 1
V - Spindle Arrangement V
B - Bottom



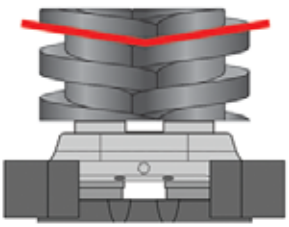
FLOW DIRECTION:
HF



SHAFT ROTATION:
INWARDS
requires clearance on bottom



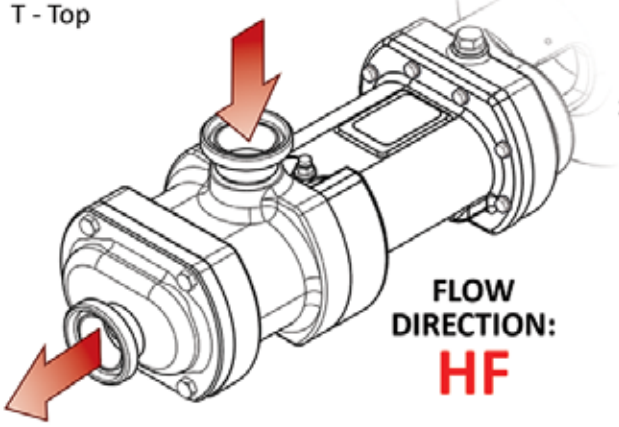
PIN CONFIGURATION:
1
delivers clearance on bottom



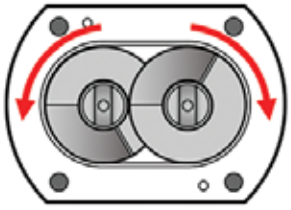
SPINDLE ARRANGEMENT:
V

HFO3A (T)

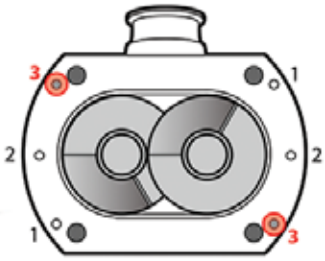
HF - Housing In / Face Out
O - Outwards
3 - Pin Position 3
A - Spindle Arrangement A
T - Top



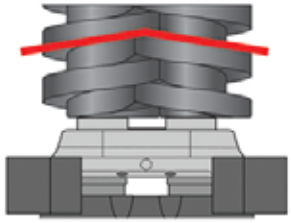
FLOW DIRECTION:
HF



SHAFT ROTATION:
OUTWARDS
requires clearance on the top



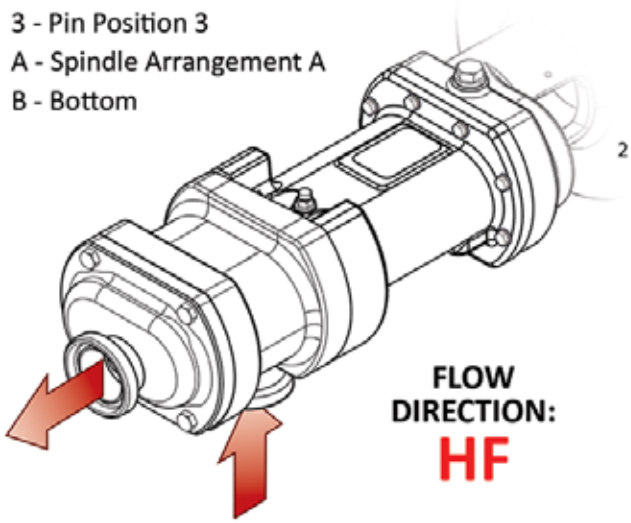
PIN CONFIGURATION:
3
delivers clearance on the top



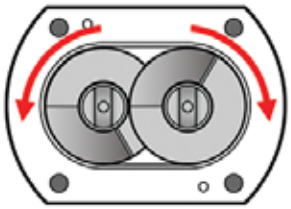
SPINDLE ARRANGEMENT:
A

HFO3A (B)

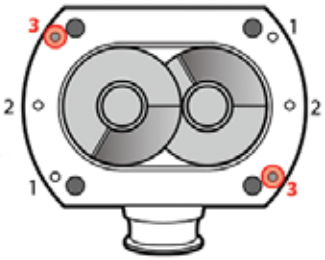
HF - Housing In / Face Out
O - Outwards
3 - Pin Position 3
A - Spindle Arrangement A
B - Bottom



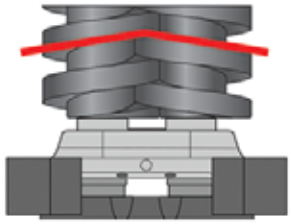
FLOW DIRECTION:
HF



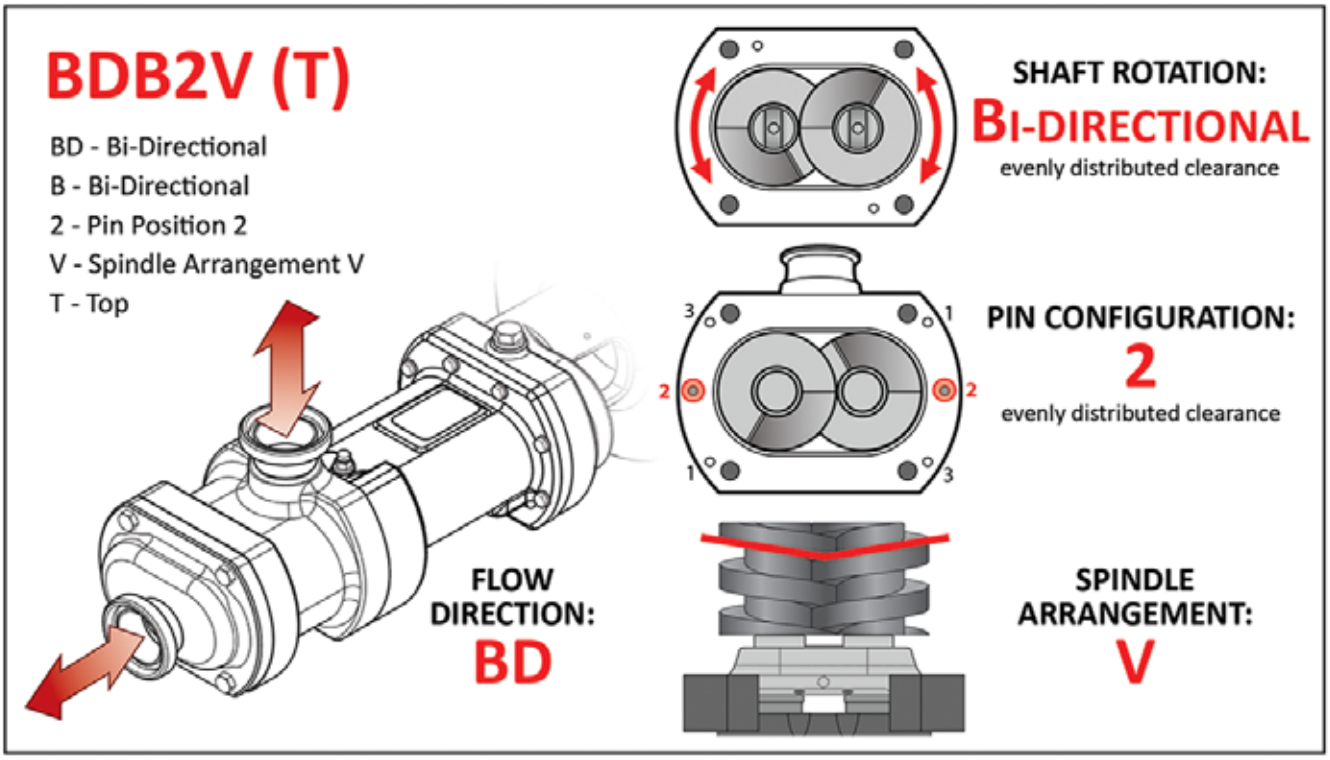
SHAFT ROTATION:
OUTWARDS
requires clearance on the top

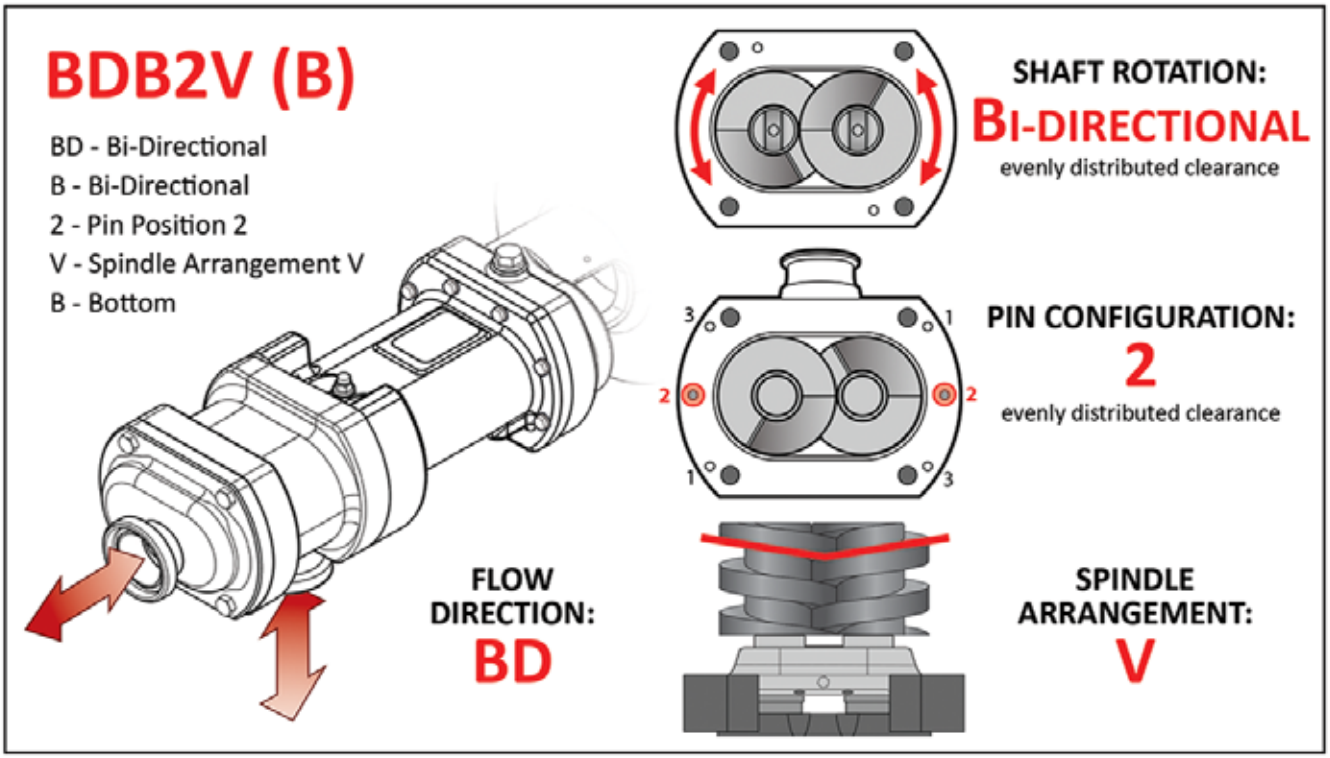


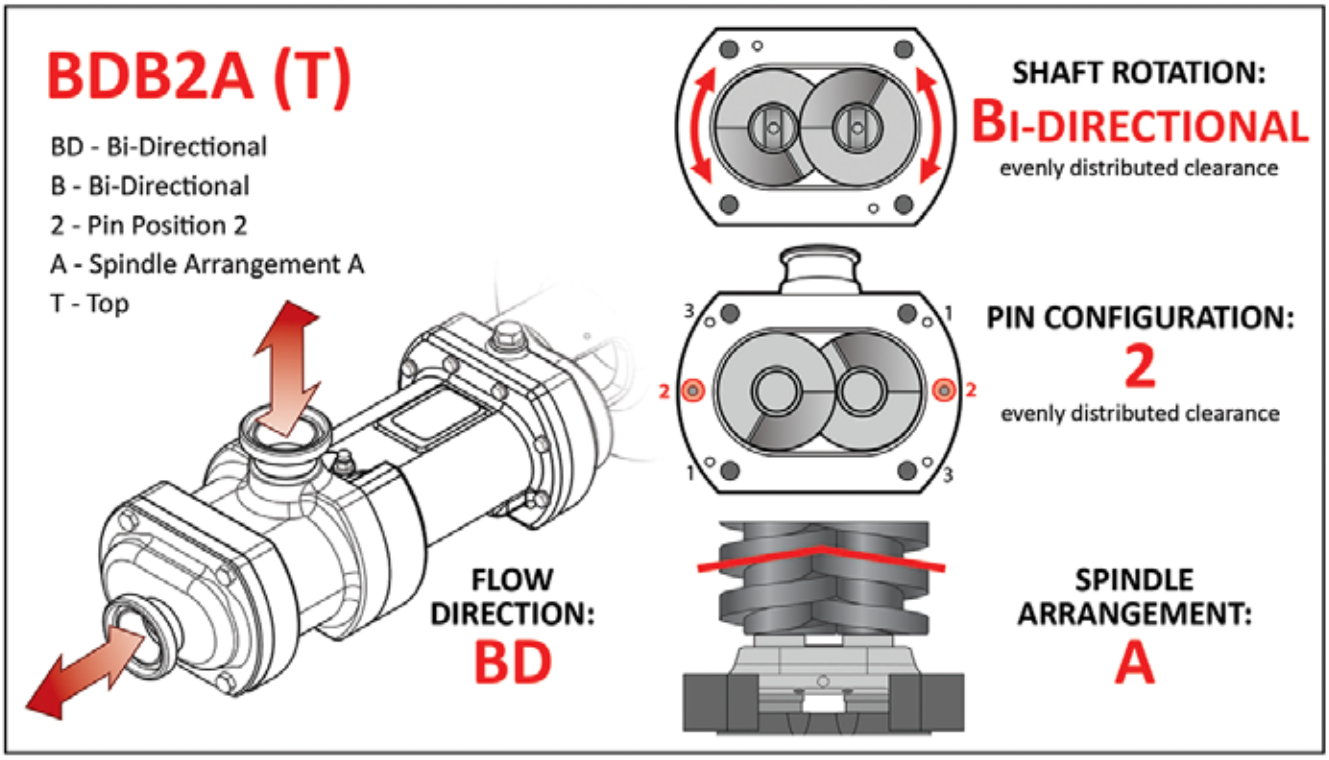
PIN CONFIGURATION:
3
delivers clearance on the top

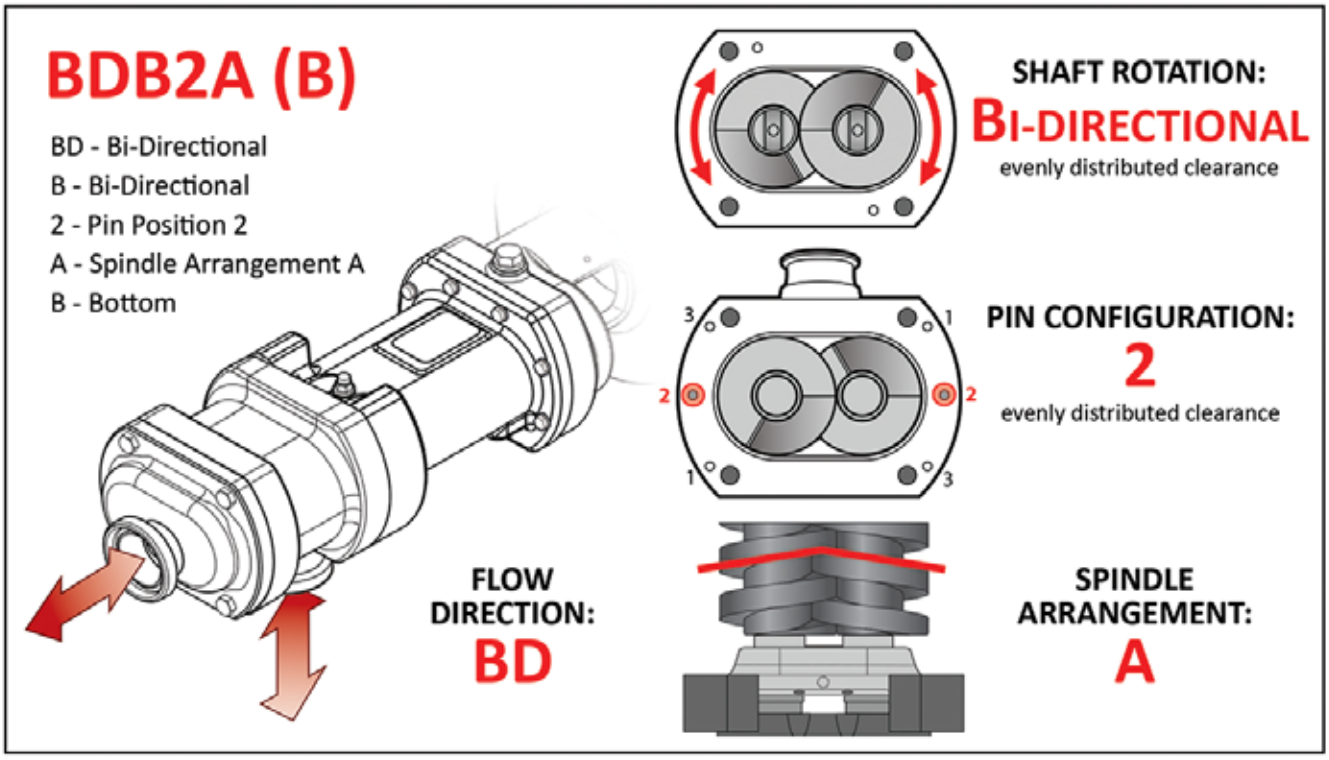


SPINDLE ARRANGEMENT:
A


BDB2V (T)
BD - Bi-Directional
B - Bi-Directional
2 - Pin Position 2
V - Spindle Arrangement V
T - Top
FLOW DIRECTION:
BD
SHAFT ROTATION:
BI-DIRECTIONAL
evenly distributed clearance
PIN CONFIGURATION:
2
evenly distributed clearance
SPINDLE ARRANGEMENT:
V


BDB2V (B)
BD - Bi-Directional
B - Bi-Directional
2 - Pin Position 2
V - Spindle Arrangement V
B - Bottom
FLOW DIRECTION:
BD
SHAFT ROTATION:
BI-DIRECTIONAL
evenly distributed clearance
PIN CONFIGURATION:
2
evenly distributed clearance
SPINDLE ARRANGEMENT:
V


BDB2A (T)
BD - Bi-Directional
B - Bi-Directional
2 - Pin Position 2
A - Spindle Arrangement A
T - Top
SHAFT ROTATION:
BI-DIRECTIONAL
evenly distributed clearance
PIN CONFIGURATION:
2
evenly distributed clearance
FLOW DIRECTION:
BD
SPINDLE ARRANGEMENT:
A


BDB2A (B)
BD - Bi-Directional
B - Bi-Directional
2 - Pin Position 2
A - Spindle Arrangement A
B - Bottom
SHAFT ROTATION:
BI-DIRECTIONAL
evenly distributed clearance
PIN CONFIGURATION:
2
evenly distributed clearance
FLOW DIRECTION:
BD
SPINDLE ARRANGEMENT:
A

5.6 Oils, Grease & Lubrication Recommended

Lubricating Bearings and Gear Wheels

There are a few options for gear wheel lubrication in the Pump / Bearing Housing of the ViscoTwin 70 G7:

Polyglycol based (can absorb up to 3% water)

- Klubersynth

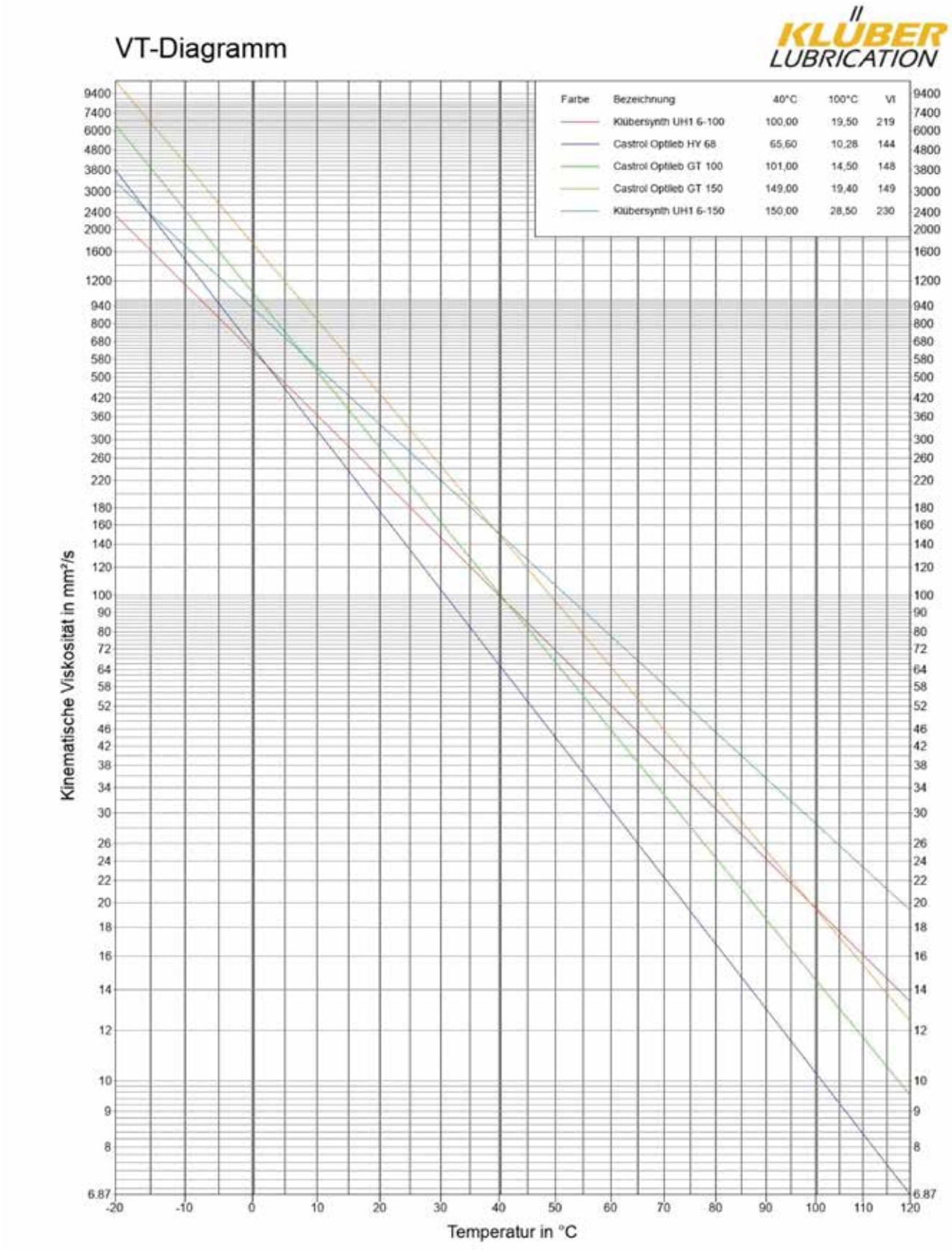
Polyalphaolefin based (cannot absorb water)

- Jax-68
- Castrol Optileb
- Lubriplate SFGO Ultra 220

As a general rule, thinner oil is more frequently used in colder areas, and thicker oil is use in warmer areas. A higher number next to the oil indicates a thicker oil, while a lower number indicates a thinner oil.

150 = thicker
68 = thinner

Jax-68 is used very commonly in the United States of America, where **Processtec** is located.


VT-Diagramm
KLÜBER LUBRICATION
Farbe
Bezeichnung
40°C
100°C
VI
Klübersynth UH1 6-100
100,00
19,50
219
Castrol Optileb HY 68
65,60
10,28
144
Castrol Optileb GT 100
101,00
14,50
148
Castrol Optileb GT 150
149,00
19,40
149
Klübersynth UH1 6-150
150,00
28,50
230
Kinematische Viskosität in mm²/s
Temperatur in °C

5.7 Oil Testing Kit (with Form)

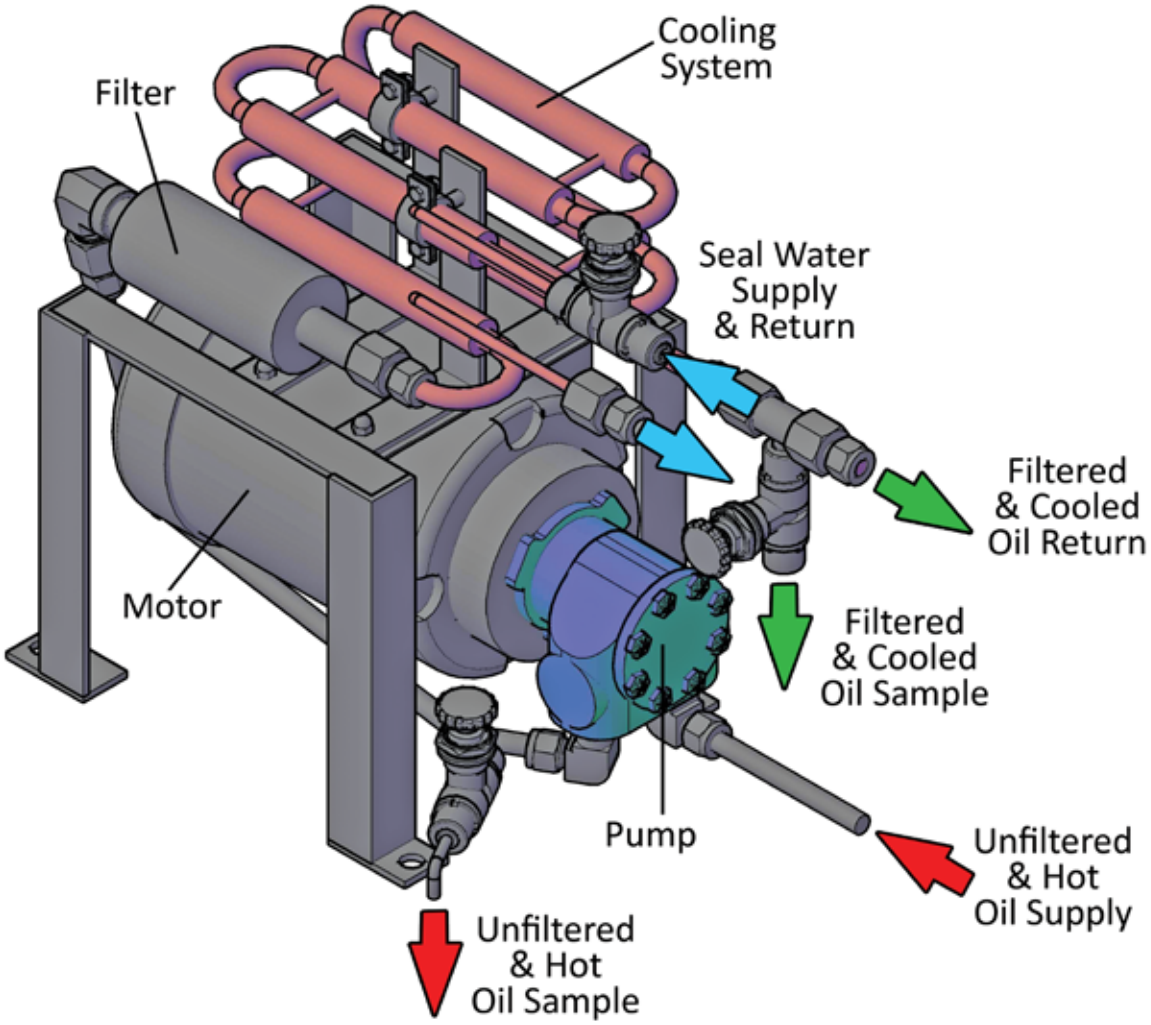
Please talk with your oil supplier about an Oil Testing Kit so that you can check and maintain the integrity of the pump oil.

6. GEEK'S CORNER

6.1 Oil Cooler with Oil Filter

In case very hot product is pumped, the heat can sometimes penetrate through the shaft to the needle bearings, and shaft seals (Pos. 2322). It is strongly recommended to install an oil cooler to maintain the oil temperature at the needle bearings at max 212° F (100° C).

Processtec's customized oil cooling system for **ViscoTwin** pumps is shown below.

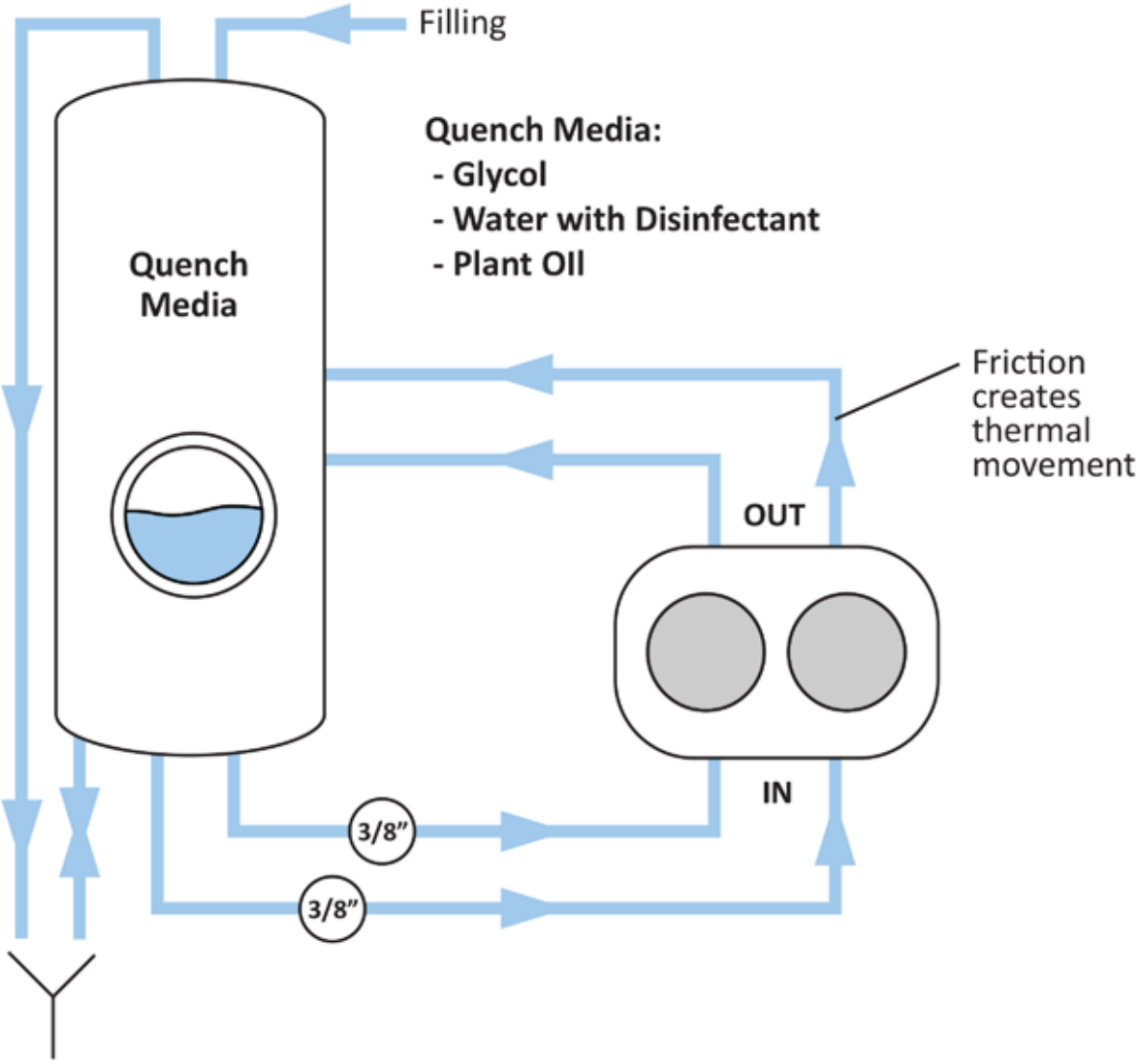


6.2 Vibration Sensor with Oil Temperature Sensors

Processtec, along with GEPA Engineering, is testing a customized solution to accurately sense the harmonics of ViscoTwin pumps. This will allow the pump's bearing to be monitored continuously.

Especially for high pressure applications where high axial forces dramatically limit the bearing lifespan, vibration monitoring will prevent unexpected downtime with planable preventative maintenance, making ViscoTwin high pressure pump setups a highly sustainable solution.

6.3 Quench Design for Recirculating Fluids in Mechanical Seals



6.4 Maximizing Bearing Lifespan

6.4.1 The Importance of Bearing Lifespan

Bearings are a key element to sustained pump operation. Throughout the lifespan of any pump, the bearings experience the majority of operation based wear and tear and are often the first point of failure. Without regular bearing maintenance, mechanical failure becomes inevitable. This leads to complications and consequences to further pump operation as well as significant losses in production from maintenance downtime. Bearing lifespan is an important tool in maximizing lifespan across the system as well as avoiding costly repairs.

Bearing Types Across ViscoTwin Pump Line

PUMP	BALL BEARING (SKF)	NEEDLE BEARING (FAG / KOYO)	APPLICABLE AREA (TOP OF SPINDLE)	APPLICABLE AREA (FRONT OF SPINDLE)
VT-70	7305 BECBY	NKJ 40/30	0.0037 m^2	0.0050 m^2
VT-104	7207 BECBY	NA 6910	0.0060 m^2	0.0079 m^2
VT-130	7209 BECBY	NA 6912	0.0113 m^2	0.0133 m^2

Table 1: ViscoTwin Pump Bearing Configuration

The **Processtec** line of ViscoTwin G7 pumps are equipped with two different types of bearings in varying configurations, each with their own specifications. All bearings used in ViscoTwin pumps are produced by SKF high-performance bearings with the exception of the needle bearing used in the Model VT-70, produced by KOYO.

6.4.2 Measured Impact of Each Variable

Introduction

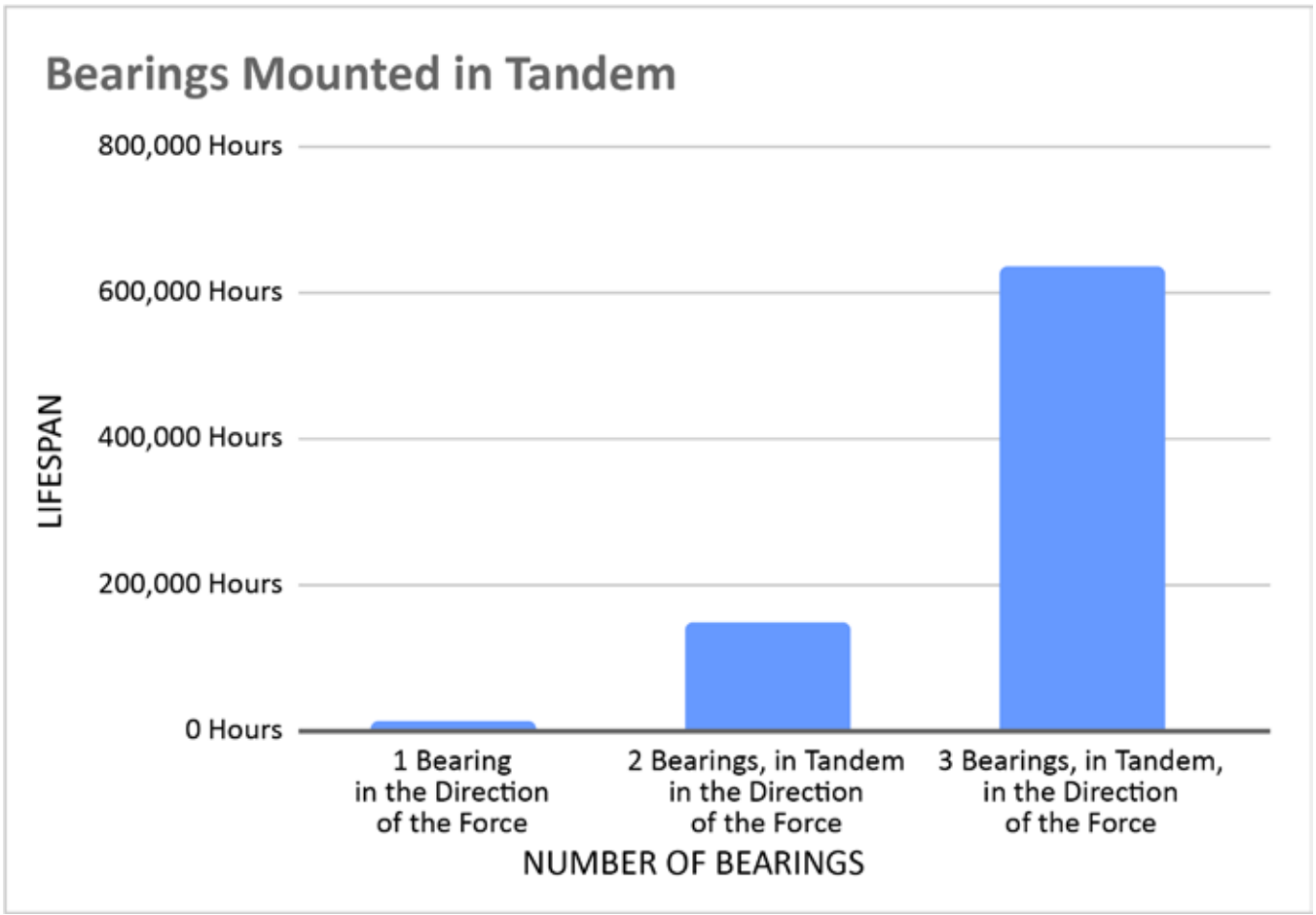
The following analysis was performed on a standard 7207 BECBY bearing in a test by SKF high-performance bearings. The constants for the models are as follows:

Pump: VT-104
Direction: Front in / Top Out
Exit Pressure: 25 bar
Supply Pressure: 2 bar
Radial Load: 3 kN
Total Axial Load: 14 kN
r/min: 1500
Number of bearings in Tandem: 2 sets of 2 bearings in tandem
Axial Load per Bearing: 7 kN
Operating Temperature: 80° C
Nc specifications: Slight-typical contamination
Lubrication Viscosity: 100 mm^2/s @ 40° C and 40 mm^2/s @ 100° C

6.4.3 Effective Variables in Bearing Lifespan

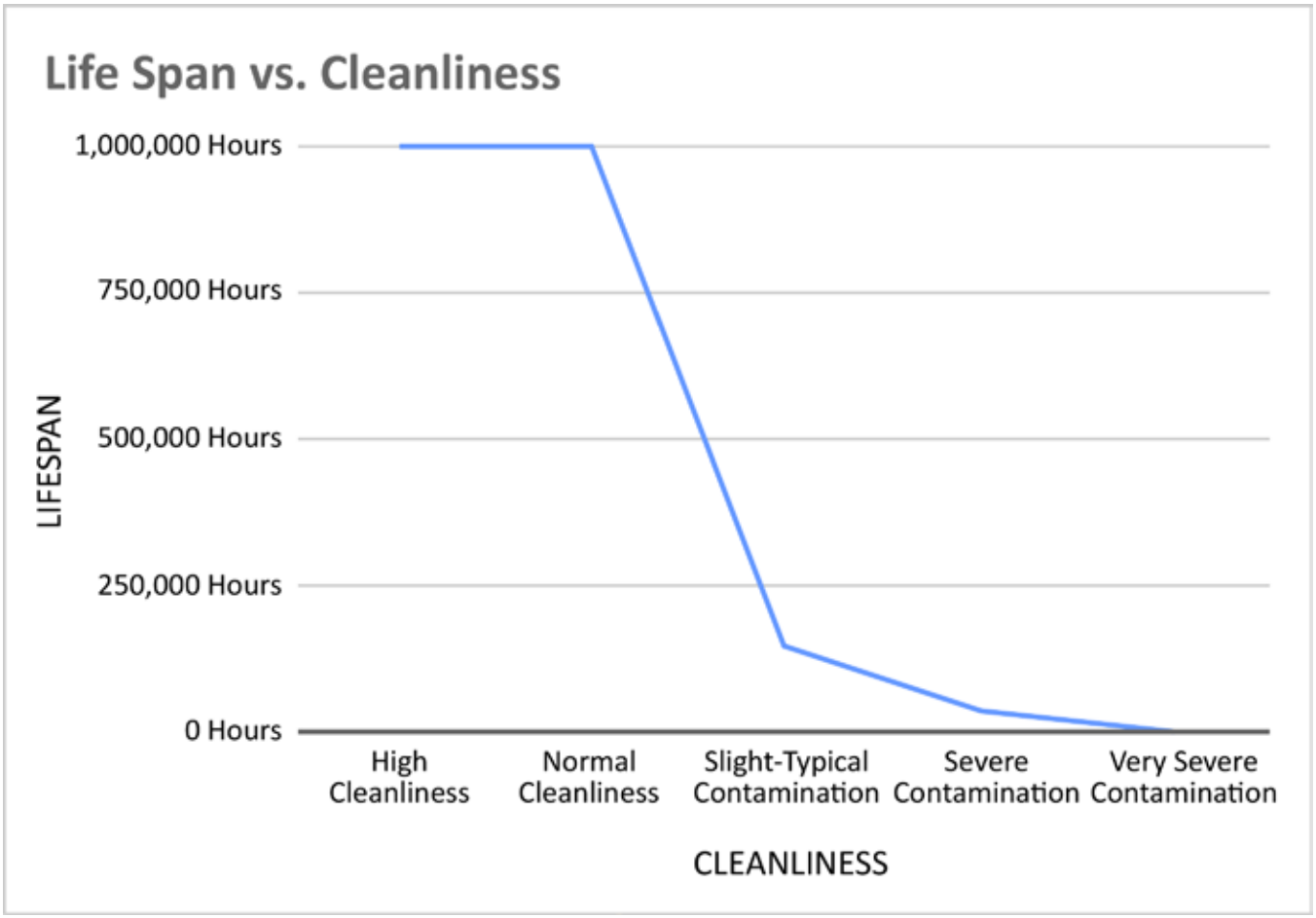
Mounting Arrangement

Processtec installs bearings in tandem to allow bearings to share the load evenly and reduce stress. This drastically extends the lifespan of bearings due to the force reduction by a factor of 'n', where 'n' is the number of bearings mounted in tandem with the force exerted on the bearing in both radial and axial dimensions.



Oil Cleanliness

During pump operation, friction tears particles from the exterior of the balls and rollers. These particles then accumulate in the oil, exponentially increasing the wear on the bearings as well as increasing the bearing operating temperature due to friction. For these reasons, it is vital to check the bearing oil regularly for the particulates and replace the oil as necessary. All **ViscoTwin** pumps come standard with two magnetic plugs to help collect and trap particulates, keeping the oil cleaner for longer.

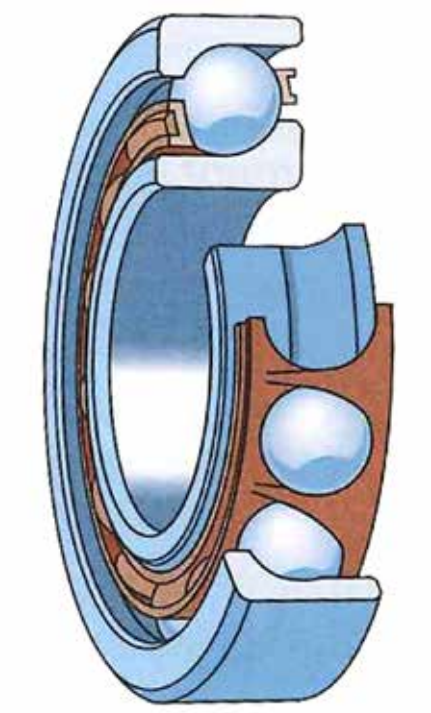


Bearing Quality

If a bearing fails to meet industry standards, it will be unable to distribute force on the rollers/balls evenly. Failing to meet these standards will not only create metal particles in the oil and increase operating temperature, it could also imbalance the pump shaft. It is essential that the pumps only use high-quality bearings with tight tolerances.

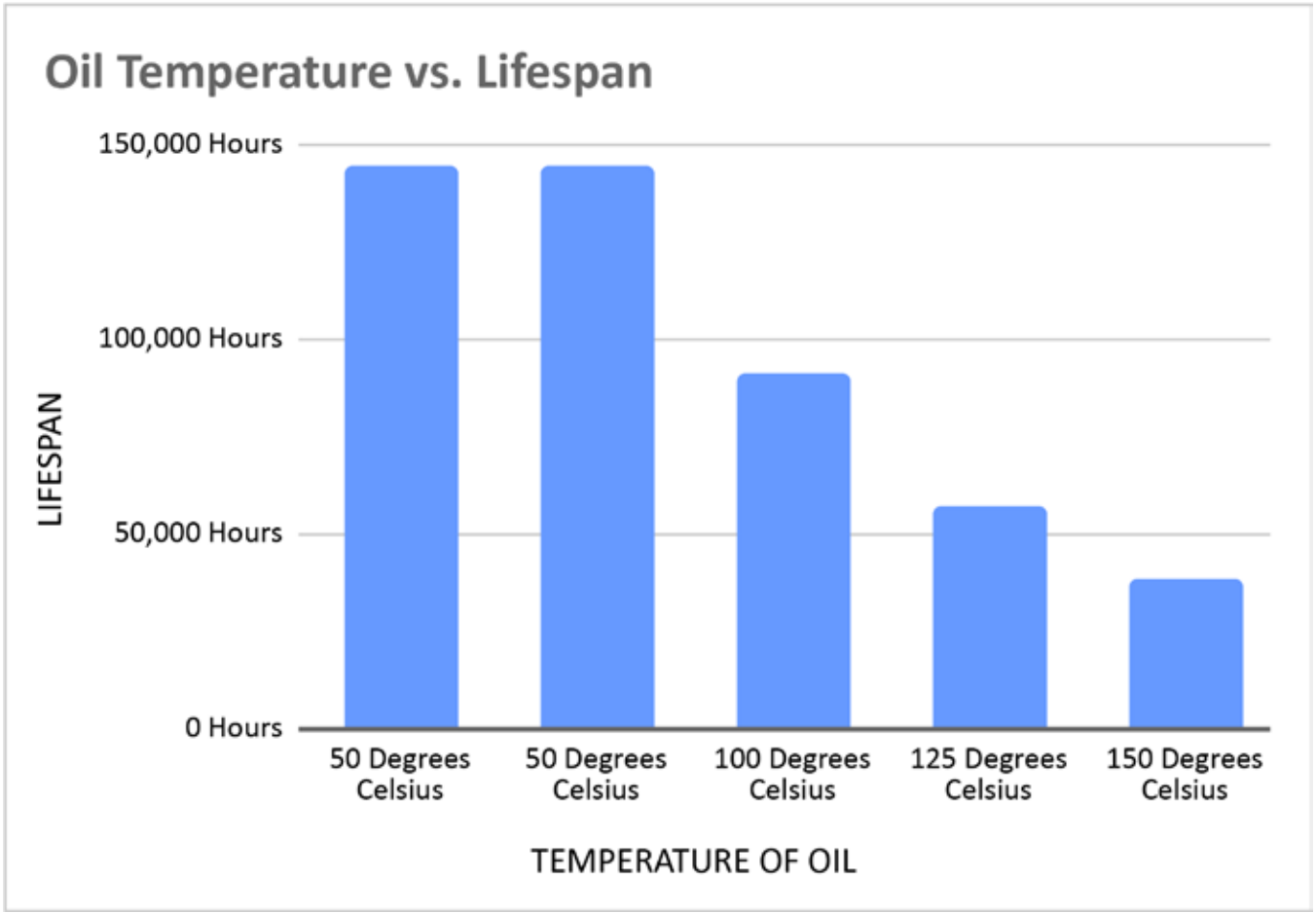
To ensure your bearing is functioning correctly, check the following things:

- All roller balls are present in the ball bearing.
- When rotated, all rollerballs make contact with both surfaces and roll and don't slip.
- Make sure there is very little play when holding the exterior ring and applying force to the side with the larger interior ring.
- Look for perfectly round roller balls. Any discoloration and dents can be a sign of a bad bearing.



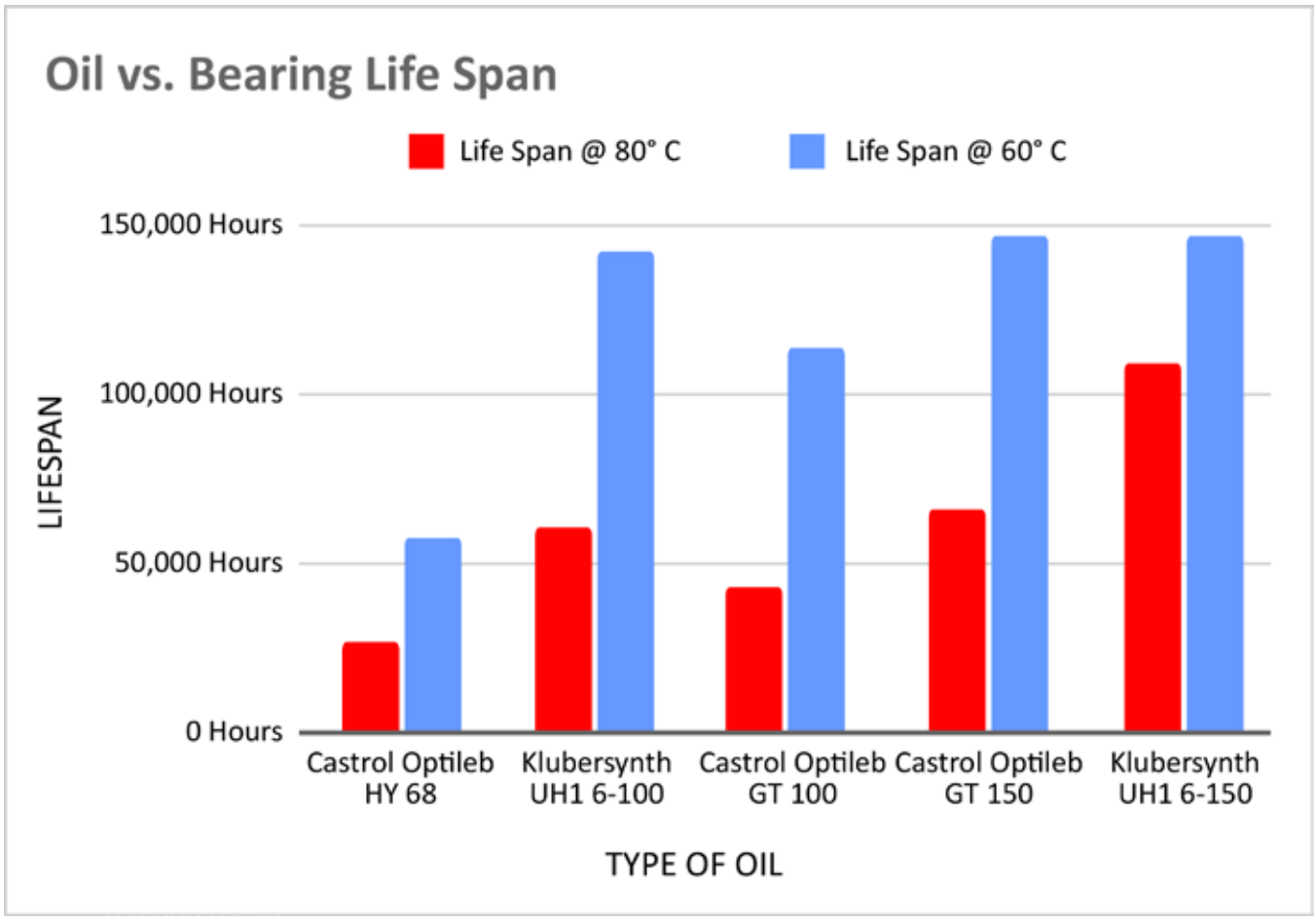
Oil Operating Temperature

As the bearings change temperature, they both expand and experience thermal shock, both of which serve to increase bearing wear and tear. With the rise in operating temperature, the oil also begins to thin, providing less lubrication for the bearings.



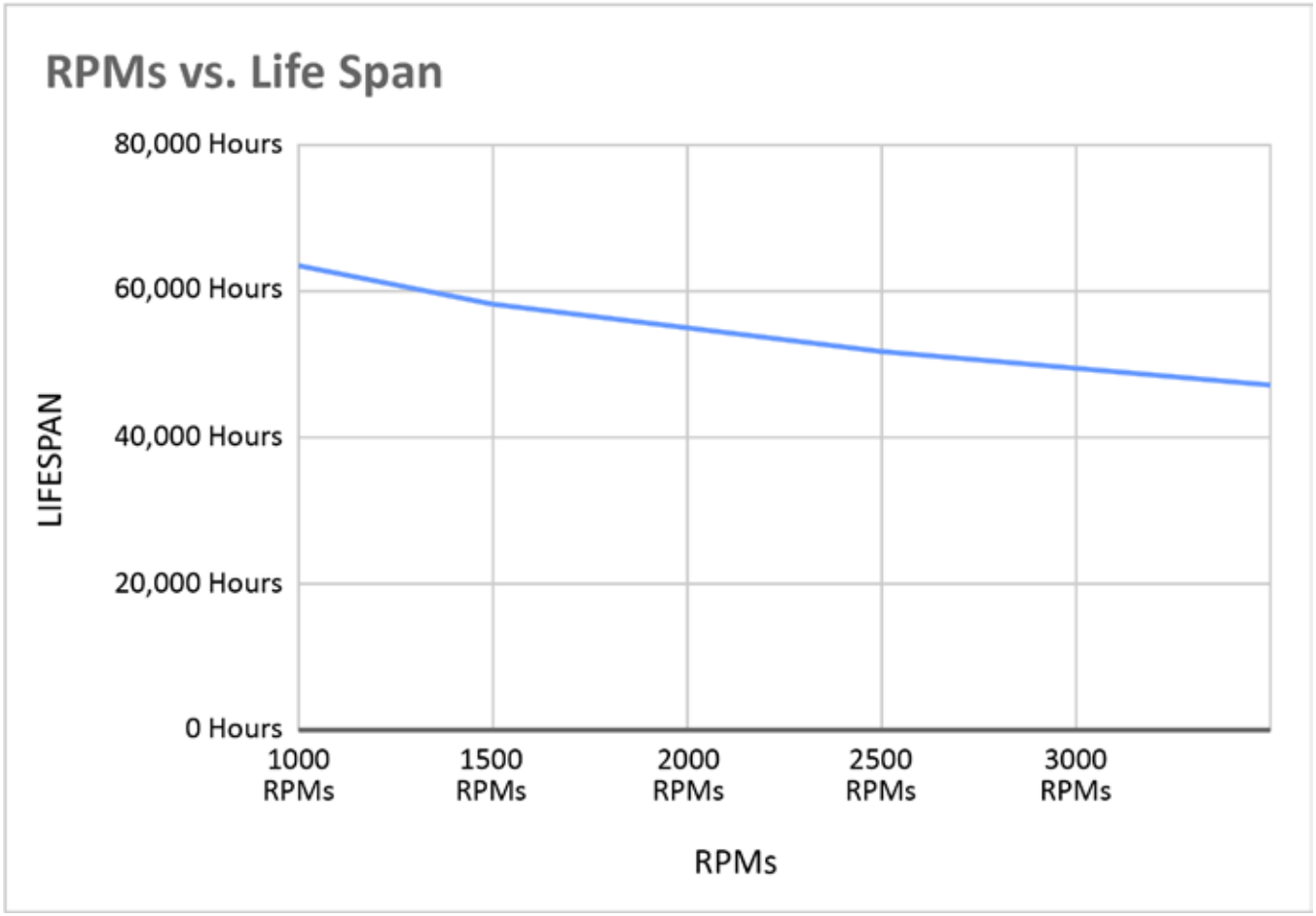
Oil Thickness

High viscosity oils are more effective at lubricating bearings. They reduce friction between the balls and the outer casing, thus reducing both heat generation and damage caused by parts contacting.



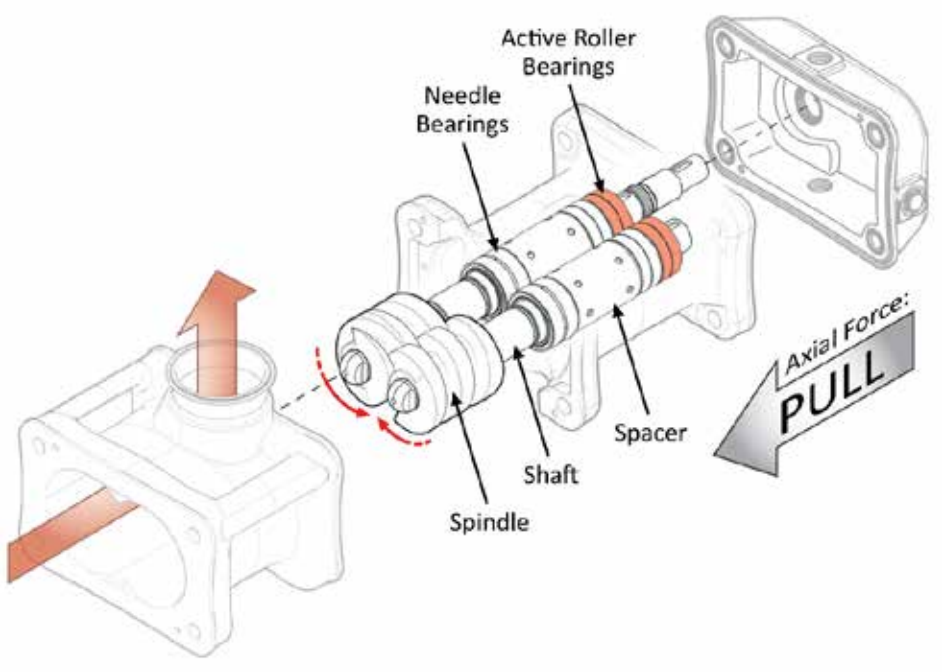
Rotation Per Minute

Increasing the RPM's forces each bearing to travel farther and faster over time, increasing the heat produced and damage each bearing will accumulate versus the same bearings being used at lower RPM's over the same time. Furthermore, the RPM's limits the effectiveness of more viscous oils due to the increased resistance from moving through thick oil, outweighing the benefits of more viscous oil.

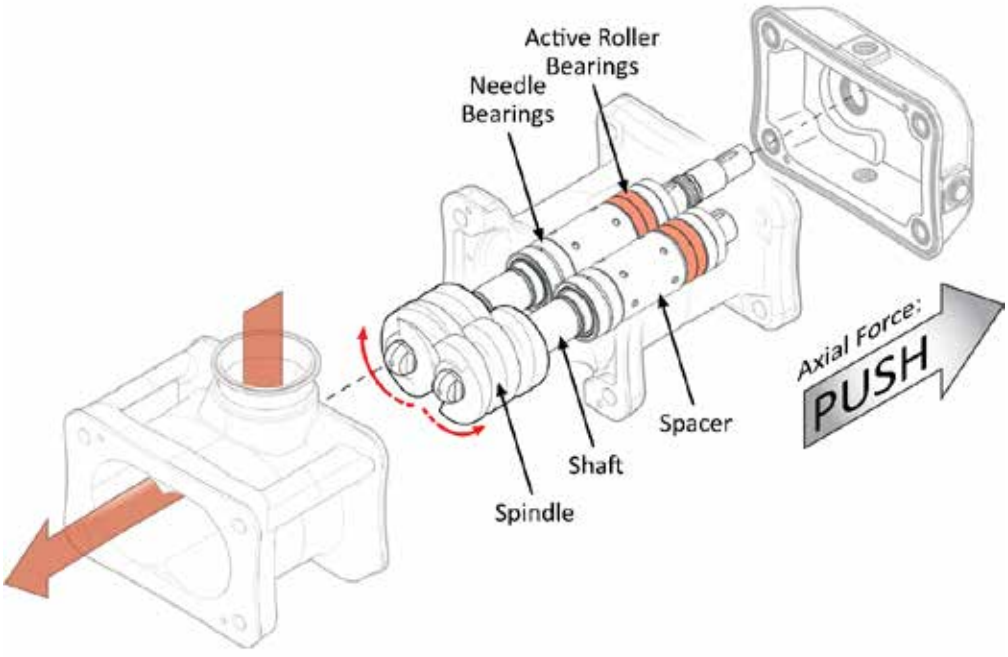


Reference Page

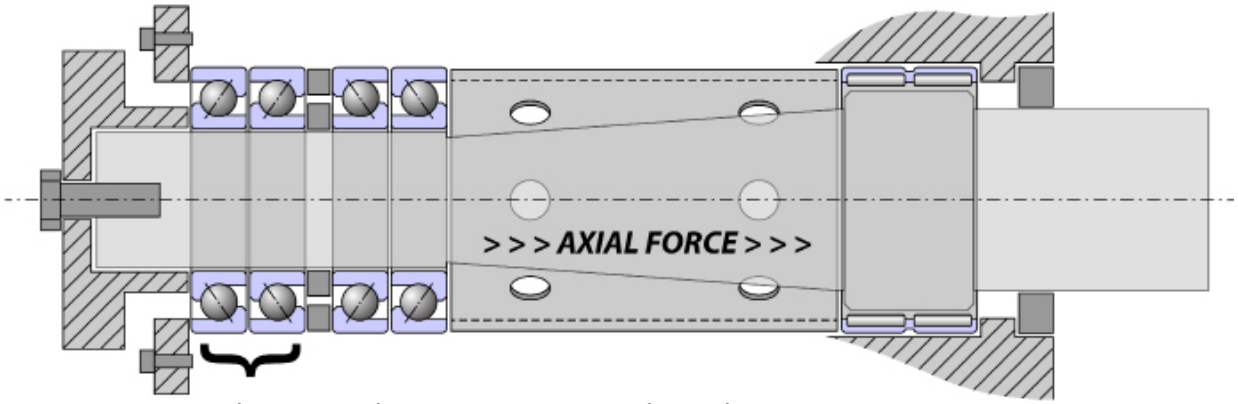
Pump Diagram (Front-In, Top-Out)



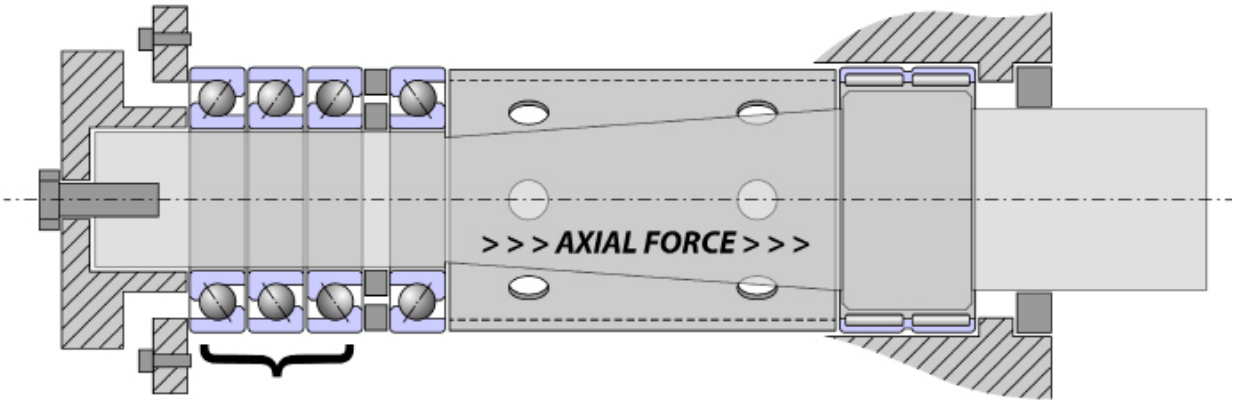
Pump Diagram (Top-In, Front-Out)



Bearing Arrangement



These two bearings are in tandem alignment where they share the Axial Force.



These three bearings are in tandem alignment when they share the Axial Force three ways.

Axial Load Calculation Method

Axial load is the force acting parallel to the axis of rotation along the shaft. The axial load can be found by using the following equation:

$$F_a = (P_o * A_o) - (P_i * A_i)$$

Where *Po* is pressure out of the pump, *Pi* is the pressure into the pump. *Ao* is the area of the spindle facing the direction the product exists. *Ai* is the surface area of the part of the spindle facing where the product enters the pump. *Fa* is the axial load.

Area Out	Area In	Pressure Out	Pressure In	Force Out	Force In	Axial Force	Per Bearing
A_o	A_i	P_o	P_i	$A_o * P_o$	$A_i * P_i$	$(A_o * P_o) - (A_i * P_i)$	$F_{a/n}$
0.0060 m²	0.0079 m²	2500.00 kn/m²	1000.00 kn/m²	15.11 kn	7.85 kn	7.26 kn	3.63 k n

Table 2: An example of ViscoTwin 104 Front In /Top Out with two bearings in tandem.

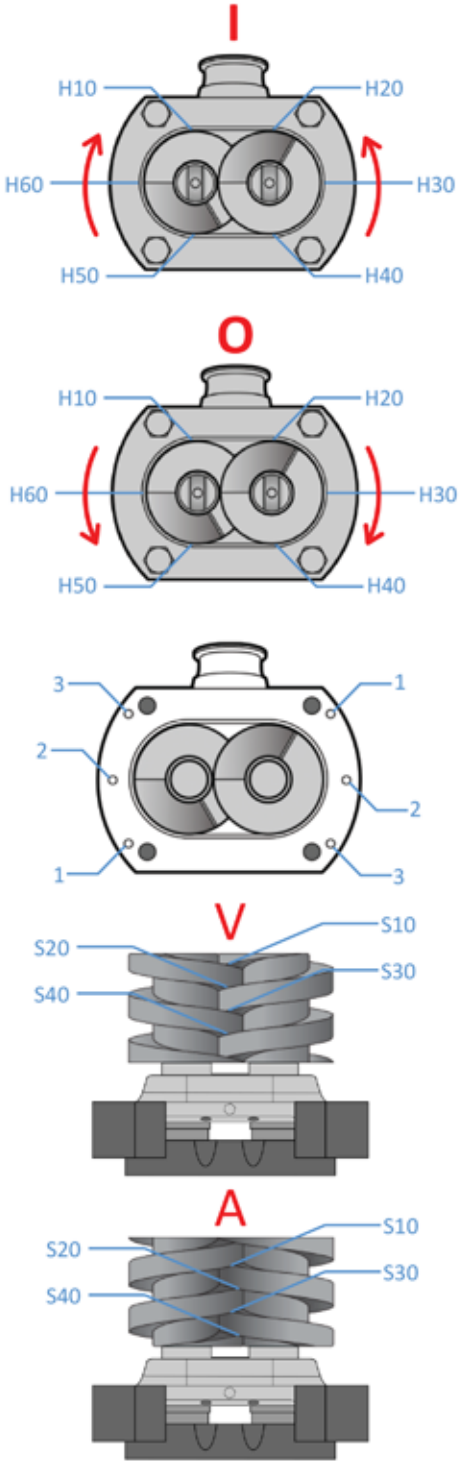
6.5 Equipment Commissioning Protocol

Equipment Commission Protocol

PROCESSTEC
GET TOMORROW'S TECHNOLOGY TODAY

Date Commissioned: _____ Job # _____

Serial #	Model #



ROTATION DIRECTION

O (RIGHT)	I (LEFT)

FRONT CLEARANCES

H10	mm
H20	mm
H30	mm
H40	mm
H50	mm
H60	mm

GEARBOX OIL

Kluber #

PIN ARRANGEMENT

Position #

HARDENED SPINDLES

Yes	No

SPINDLE ARRANGEMENT

'V'	'A'

SPINDLE CLEARANCES

S10	mm
S20	mm
S30	mm
S40	mm
(1 inch = 1mm / 25.4)	
Comments:	

PICTURES TAKEN

YES	NO

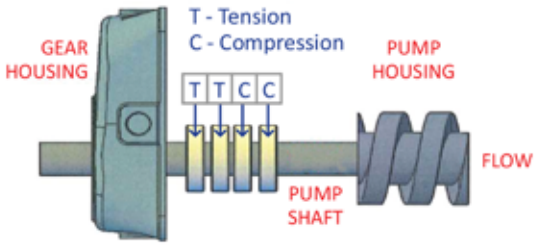
LABELS ATTACHED

YES	NO

SEAL MAKE & TYPE

ANGA	
HUHNSEAL	
Single Acting	
Double Acting	
SIC	
SIC/KE	
TC	
TC/KE	
FKM	
EPDM	
Perlast	
VT-70	

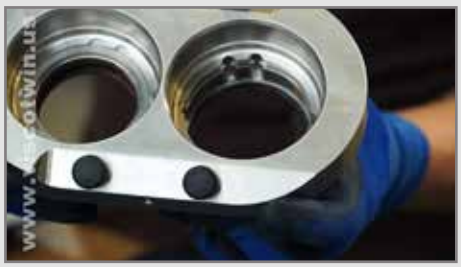
BEARING ARRANGEMENT

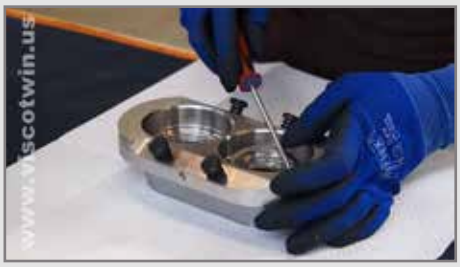


7. APPENDIX

7.1 Maintenance Movies

In the ViscoTwin section of the **Processtec** web page, you can find a listing of Maintenance Movies for the ViscoTwin 70 G7 series of pumps (https://processtec.com/viscotwin-70-g7-1.html). You can access all of the movies online by using the QR code to the right, or you can jump directly to a specific topic by using the corresponding QR codes in the following table.

QR CODE	MOVIE THUMBNAIL	DESCRIPTION
		ViscoTwin 70 G7 Complete disassembly with double acting mechanical seal. *Runtime 7:28 sec*
		ViscoTwin 70 G7 Disassembly of single acting mechanical seal housing. *Runtime 2:18 sec*
		ViscoTwin 70 G7 Disassembly of Single acting mechanical seal with clamping ring. *Runtime 2:57 sec*

		**ViscoTwin 70 G7** Reassembly of single acting mechanical seal with clamping ring. *Runtime 6:22 sec*
		**ViscoTwin 104 G7** Complete reassembly with single acting mechanical seal. *Runtime 18:02 sec*
		**ViscoTwin 70 G7** Manually cleaning, swab test, disassembly and reassembly. *Runtime 2:26 sec*
		**ViscoTwin 70 G7** Disassembly of single acting mechanical seal with spring washer. *Runtime 1:35 sec*
		**ViscoTwin 70 G7** Reassembly of double acting mechanical seal housing. *Runtime 6:22 sec*

		**ViscoTwin 70 G7** Reassembly of double acting mechanical seal showing all O-rings. *Runtime 2:00 sec*
		**ViscoTwin 70 G7** Complete reassembly with double acting mechanical seal. *Runtime 9:25 sec*
		**ViscoTwin 70 G7** Complete disassembly with double acting mechanical seal. *Runtime 4:17 sec*
		**ViscoTwin 70 G7** Timing. *Runtime 8:11 sec*
		**ViscoTwin 70 G7** Marriage with Motor. *Runtime 6:25 sec*

		**ViscoTwin 70 G7** Oil change. *Runtime 0:54 sec*
		**ViscoTwin 70 G7** Pins. *Runtime 0:41 sec*

7.2 Disassembly and Re-assembly of the DAMS ANGA

Disassembly of ANGA Double Acting Mechanical Seals:

1. Relieve the quench system or counter-pressure device, and drain the quench fluid.
2. Disassemble the Pump Face Cover (Pos. 1012).
3. Disassemble the Pump Housing (Pos. 1033) by removing the Hex Head Bolts (Pos. 1016).
4. Disassemble the Spindle Screw Bolts (Pos. 2180) and the Spindles (Pos. 2200 & 2201).
5. Carefully remove the assembled Mushroom Seal Face Assemblies (Pos. 9a, 10, 9b, 16, 3a, & 5) from the shafts and set aside with the Rotor Seal Faces facing up, in order to prevent any potential scratches or damages to the sealing surface areas.
6. Carefully remove the Insert Rings (Pos. 15) off of the shafts.
7. Carefully remove the Seal Housing (Pos. 1029) from the Drive and Driven shafts.
8. Loosen the Set Screws (Pos. 14) from the Stationary Seal Rings (Pos. 11) and remove the Stationary Set Rings, along with the O-rings (Pos. 13) and the Seal Ring Spacer (Pos. 6) from the shafts.
9. Remove the Guard Plates (Pos. 2286) from the Seal Housing (Pos. 1029) by loosening and removing the Hexhead Bolts (Pos. 2287).
10. Remove the Flushing Sockets (Pos. 1864) from the Seal Housing.
11. Remove both Atmospheric Seal Faces (Pos. 2) from the Atmospheric side of the Seal Housing.
12. Remove both Sinus Springs (Pos. 8) from the Atmospheric side of the Seal Housing.
13. Remove both O-rings (Pos. 4) from the outermost groove of the Atmospheric side of the Seal Housing.
14. Remove the Safety Rings (Pos. 12) from the outermost groove of the Atmospheric side of the Seal Housing.
15. Remove the Pressure Rings (Pos. 7) from the Atmospheric side of the Seal Housing.
16. Remove both Product Side Seal Faces (Pos. 1) from the Product Side of the Seal Housing.
17. Carefully remove both O-rings (Pos. 3b) from the Product Side of the Seal Housing.

ATTENTION!
Possible damage to property.

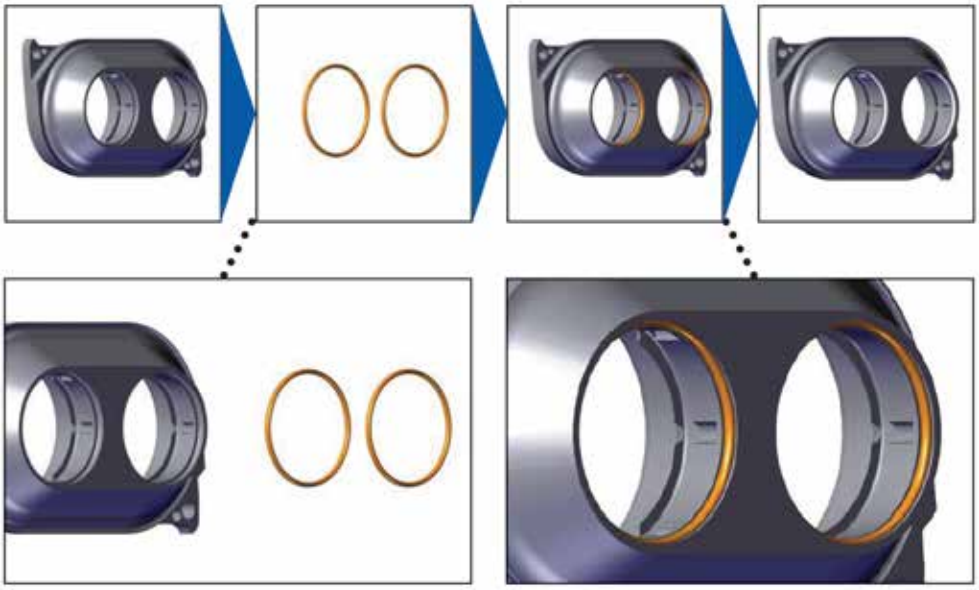
- **Equally clean the Seal Housing as well as the shafts and seal seats and carefully check the removed parts. Replace any damaged parts as well as all O-rings and shaft sealing rings**
- **During disassembly, be careful about the Drive Pins (Pos. 16). If they get lost use new ones. You can use food-safe grease to stick them in the holes of the Mushroom Seal Face Assemblies (Pos. 10).**

Re-assembly of ANGA Double Acting Mechanical Seals:

STEP 1)
PLACING O-RINGS

Tool / Components:
- Food Grade Grease
- Cleanser
- Cleaning Cloth
- O-rings 58x3 Pos. 3b (2x)

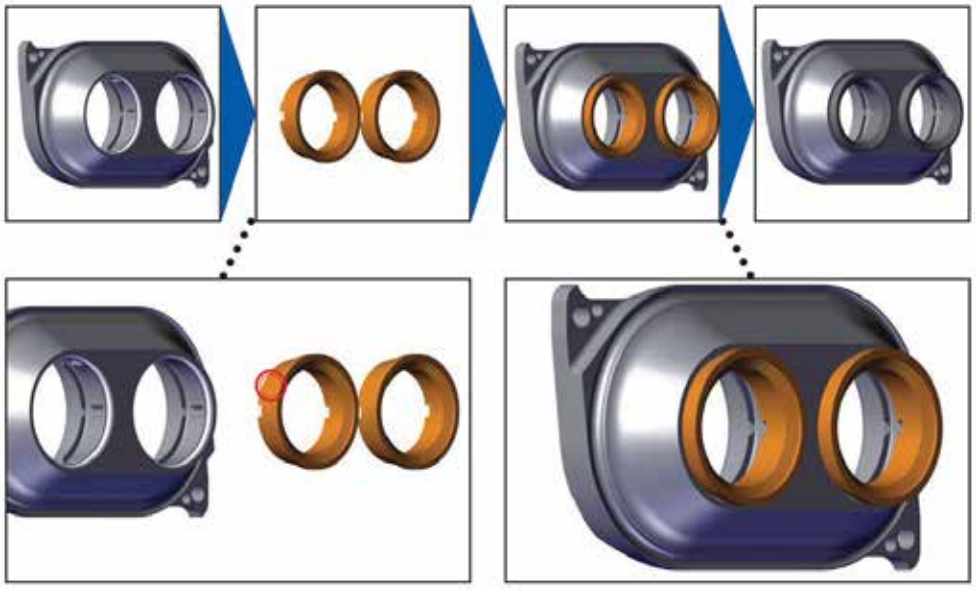
Steps:
1. Clean O-ring grooves
2. Put lubricant on O-rings (thin layer only)



STEP 2)
PLACING SEAL-FACES ON PRODUCT SIDE

Tool / Components:
- Lubricant
- Seal Face Pos. 1 (2x)

Steps:
1. Cover outer surface of seal faces with thin layer of lubricant.
2. Carefully place the seal faces straight into place. Grooves need to fit over cross.



CAUTION: *Front of seal face is delicate, do not use tools. Scratches will lead to leakage.*

STEP 3)
SET PRESSURE RINGS

Tool / Components:

- Pressure Ring Pos. 7 (2x)

Steps:

1. Place pressure ring into grooves.
2. Place into grooves in positions: 12-3-6-9
3. Keep flushing grooves clear!

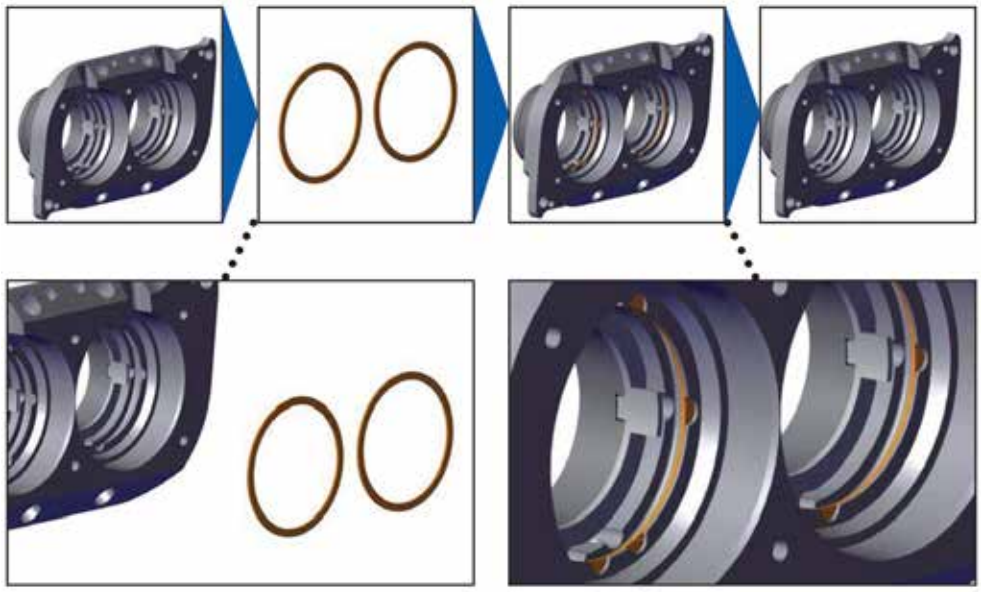
STEP 4)
PLACE PLASTIC SAFETY RINGS

Tool / Components:

- Safety Rings Pos. 12 (2x)

Steps:

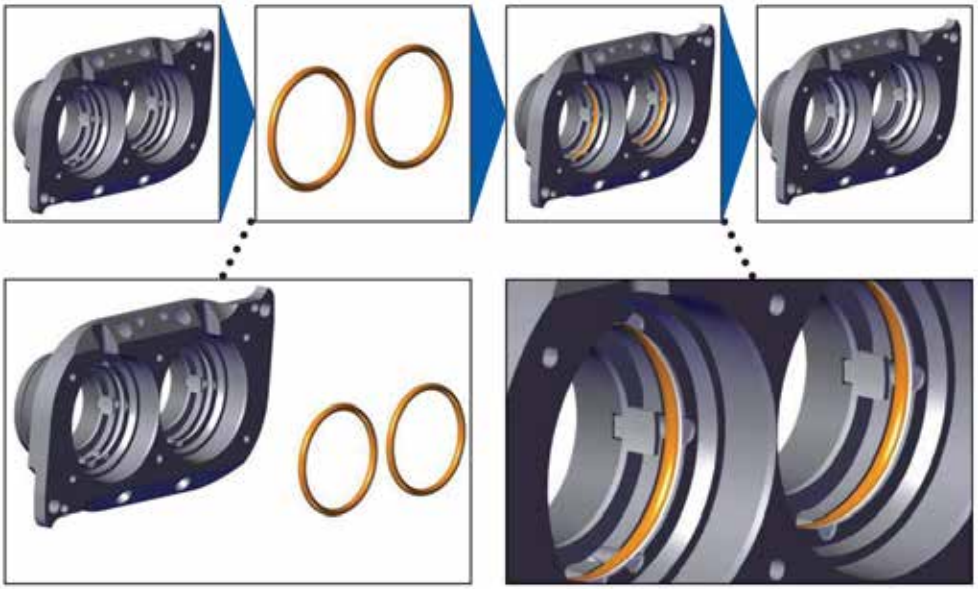
1. Clean grooves thoroughly.
2. Insert Safety rings and insure snug fit to rim.
3. DO NOT rip safety ring apart.



STEP 5)
PLACE O-RINGS 43x2

Tool / Components:
- O-rings Pos. 4 (2x)

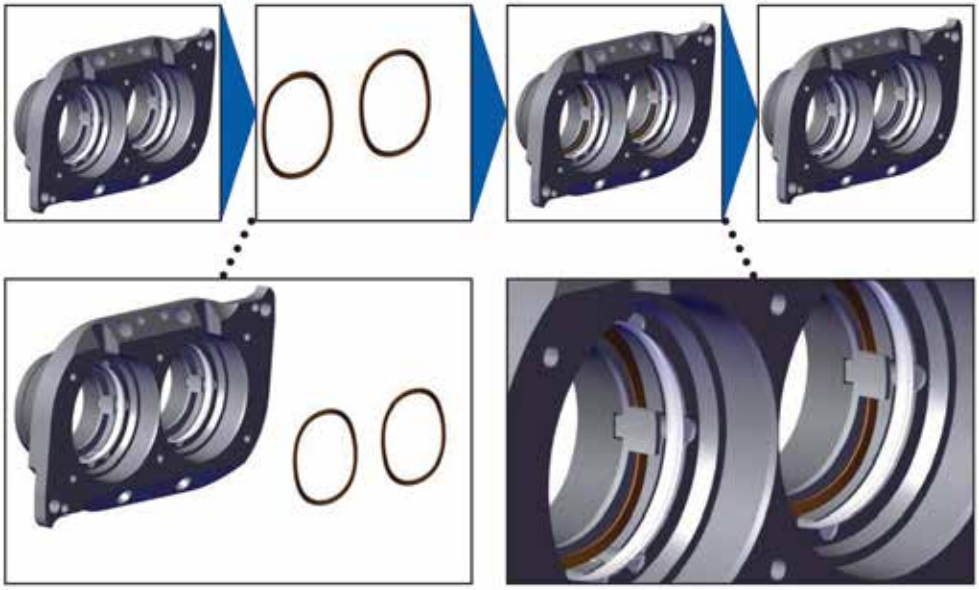
Steps:
1. Place O-ring behind safety ring.



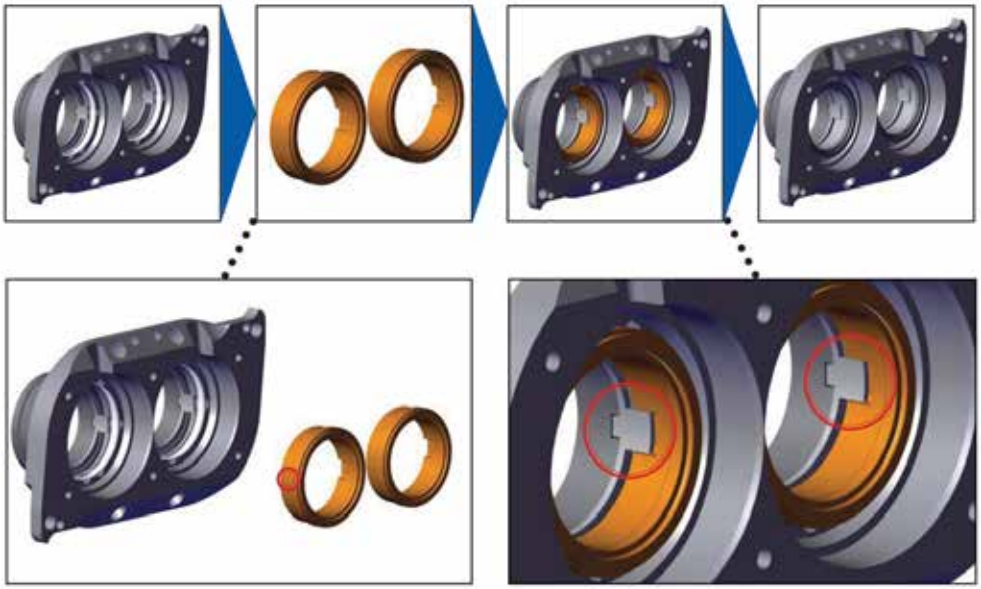
STEP 6)
INSERT SINUS-SPRING 43x2

Tool / Components:
- Sinus Spring Pos. 8 (2x)

Steps:
1. Place Sinus Spring at Pos. 8.



STEP 7)
PLACE SEAL FACE ATMOSPHERIC



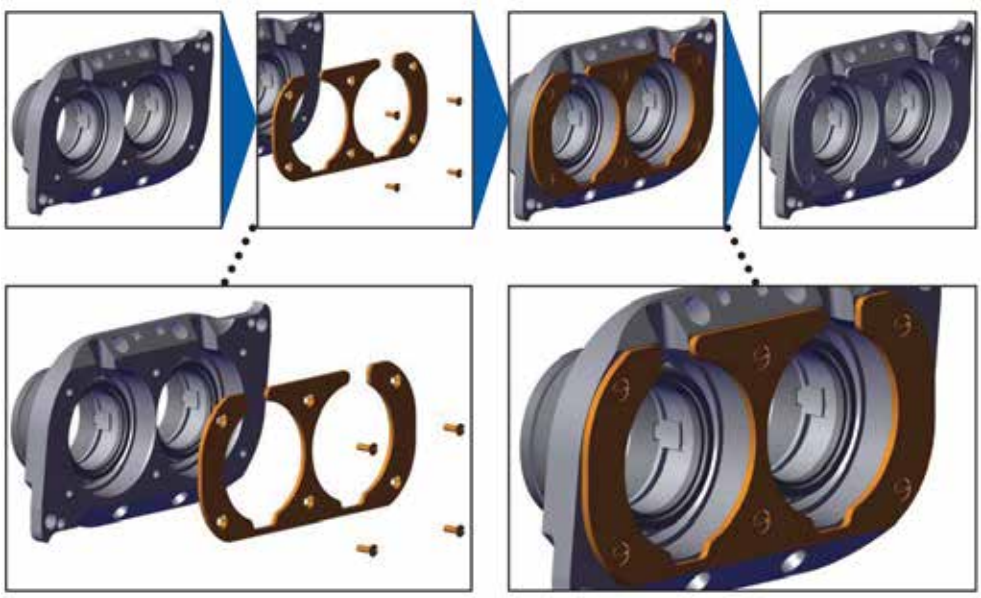
Tool / Components:

- Seal Faces Pos. 2 (2x)

Steps:

1. Put a thin layer of lubricant on the outside of the seal face.
2. Place seal face (Pos. 2) the way the groove of the seal face fits the cog of the pressure ring (Pos. 7) on both sides accurately.

STEP 8)
MOUNTING LOCK PLATE



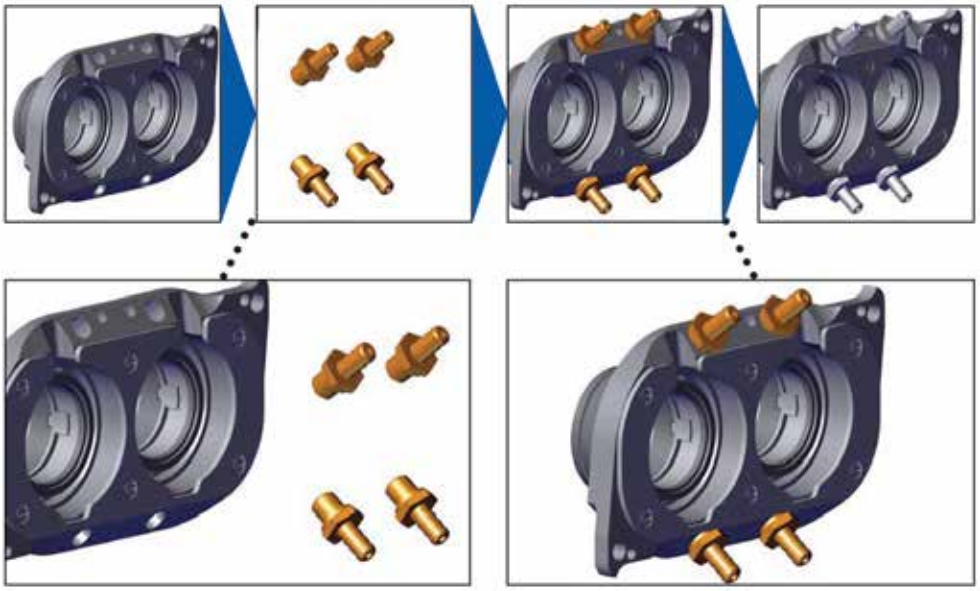
Tool / Components:

- Screwdriver
- Lubricant
- Cleanser / Cleaning Cloth
- Locking Plate 2324
- Countersunk Head Screws 2325

Steps:

1. Lubricate countersunk head screws.
2. Clean locking plate
3. Mount locking plate 2324 on sealing body 1029 with countersunk head screws.
4. Torque to 7.375 lb/ft (10 Nm).

STEP 9)
MOUNTING OF FLUSHING SOCKETS



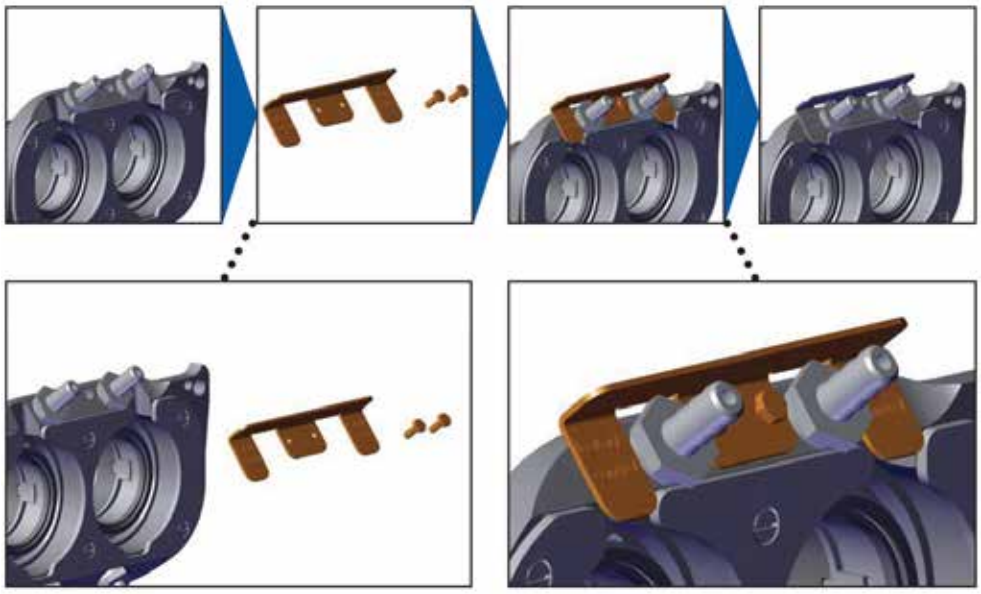
Tool / Components:

- Teflon band (for sealing)
- Wrench SW19
- For DAMS: Flushing Hose-sockets 1864 (4x)
- For SAMS: Lamellar plugs 1966 (4x)

Steps:

1. Wrap some Teflon band around the outer thread of the nipples (depending on the sealing type, a different connection might be applicable).
2. DAMS / SAMS
3. Torque to 14.75 lb/ft (20 Nm)

STEP 10)
MOUNTING OF GUARD PLATE



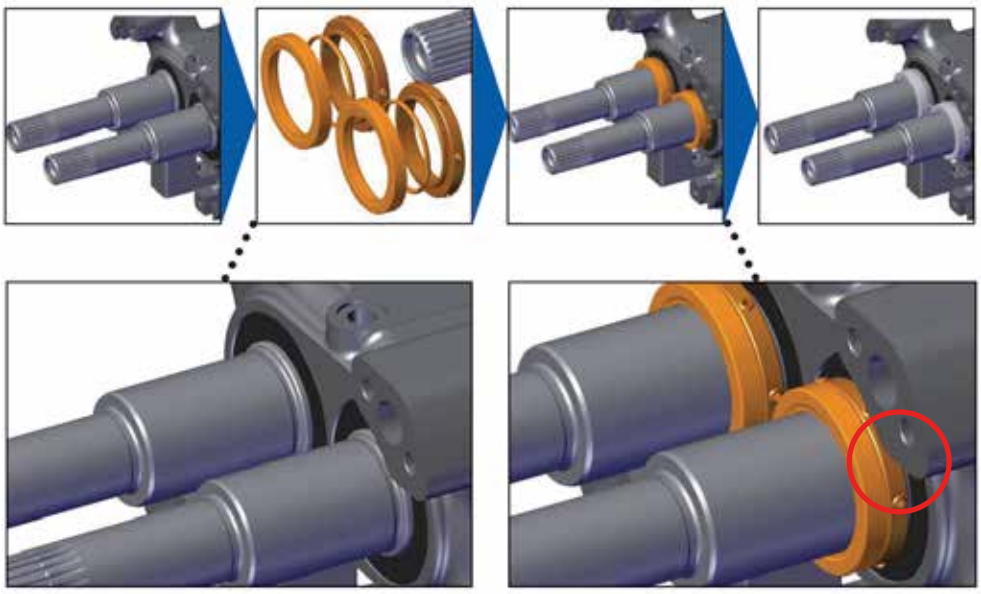
Tool / Components:

- Loctite, blue (Medium Hard)
- Wrench SW8
- Guard Plate 2286
- Hexhead bolt 2287 (2x)

Steps:

1. Drip a small amount of Blue Loctite on hexhead thread.
2. Torque to 7.375 lb/ft (10 Nm).

STEP 11)
MOUNTING OF STATIONARY SEAT RINGS



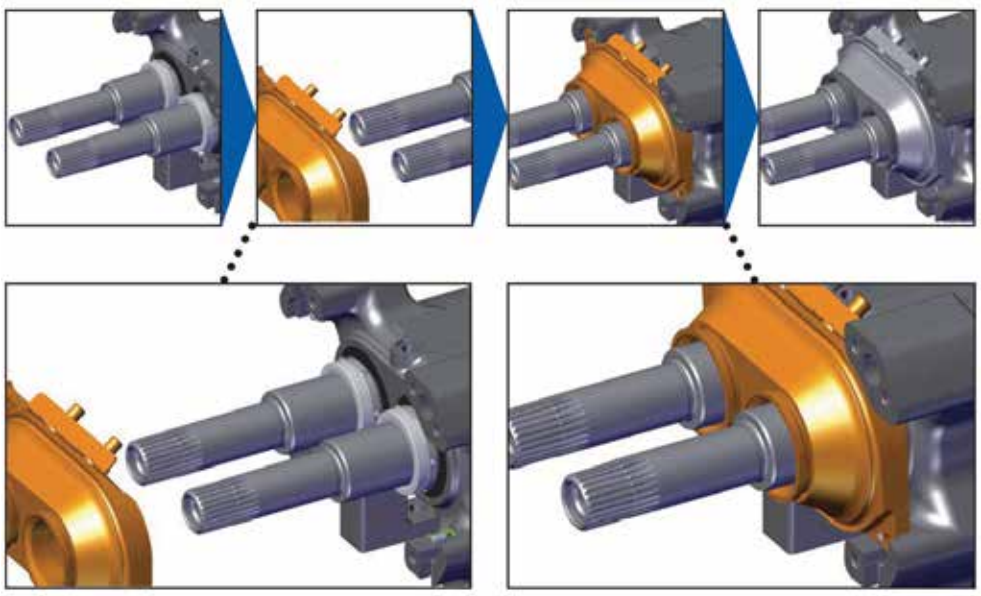
Tool / Components:

- Allen Key 2.5mm
- Blue Loctite (Medium Strength)
- Stationary Seat Rings (Pos. 6, 13, 14 & 11)

Steps:

1. Position stationary seal rings to suspension point.
2. Lubricate threads of set screws.
3. CAUTION: Tighten the set screws crosswise.
4. Torque to 3.68 lb/ft (5 Nm).

STEP 12)
SET SEALING BODY IN PLACE



Tool / Components:

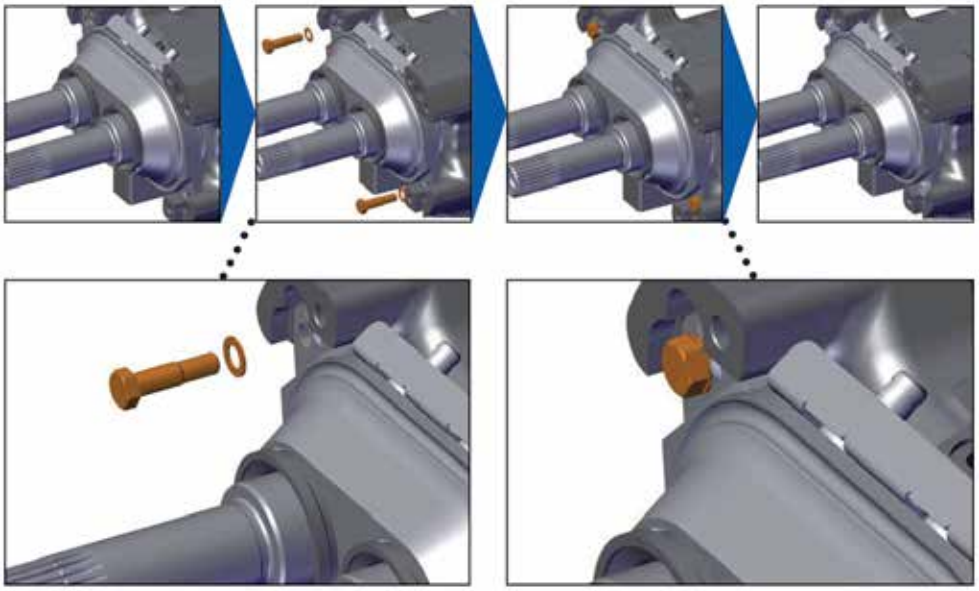
- Double Acting Mechanical Seals, pre-mounted
- Cleanser & Cleaning Cloth

Steps:

1. Degrease and clean seal face surfaces (Pos. 2 & 6).
2. Implement sealing body.

STEP 13)
TIGHTEN SEALING BODY ON BEARING HOUSING

NOTE: THIS STEP DOES NOT APPLY TO ViscoTwin 70 G7 pumps.



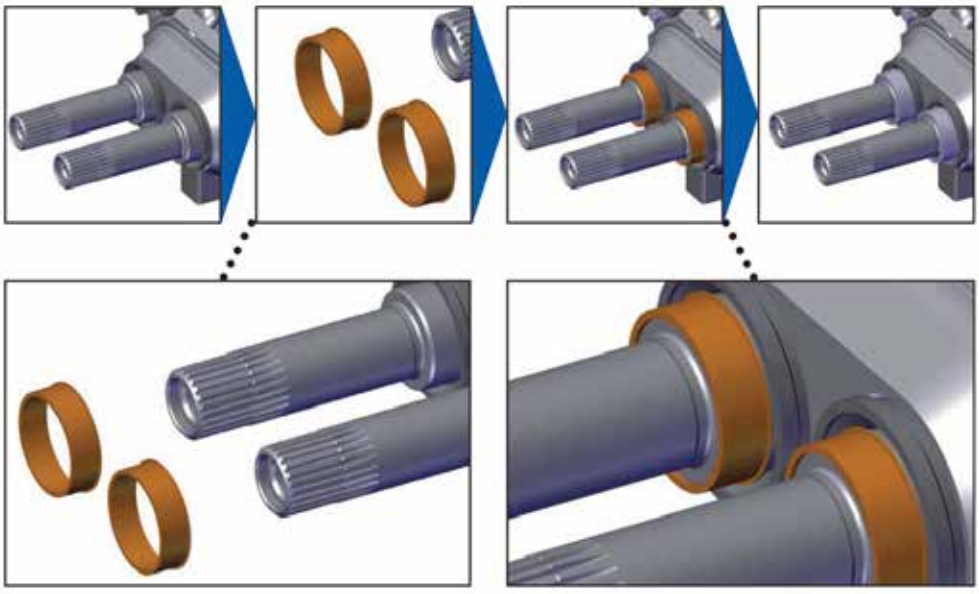
Tool / Components:

- Socket Wrench
- Socket SW13
- Dowel Screw 2259 (2x)
- Washer 2260 (2x)

Steps:

1. Screw in dowel screw and washer into the bearing housing 2276.
2. Torque to 59 lb/ft (80 Nm).

STEP 14)
POSITION INSERT RING



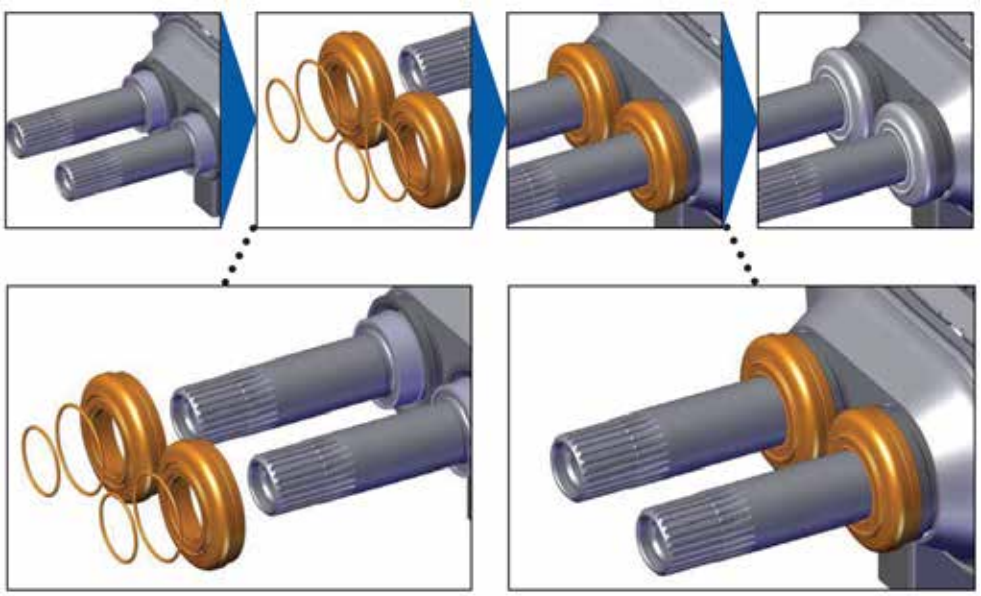
Tool / Components:

- Cleanser
- Cleaning Cloth
- Lubricant
- Insert Ring Pos. 15 (2x)

Steps:

1. Clean insert rings.
2. Clean drive shafts
3. Lubricate joining area.
4. Position insert rings.

STEP 15)
MOUNTING OF SEAL FACES ON PRODUCT SIDE



Tool / Components:

- Cleanser & Cleaning Cloth
- Lubricant
- O-ring Pos. 9a (2x)
- O-ring Pos. 9b (2x)
- O-ring Pos. 3a (2x)
- Sealing Housing Pos. 10 (2x)
- Rotating Seal Face Pos. 5 (2x)
- Pins Pos. 16 (4x)

Steps:

1. Lubricate O-rings (Pos. 9a & 9b).
2. Insert O-rings (Pos. 9a & 9b) into the Seal Face Housing (Pos. 10).
3. Position Seal Face Housing on drive shafts until snug fit.
4. Order of Mushroom Assembly Seal Faces once assembled: Pos. 9a, 9b, 10, 16, 3a, 5

CAUTION: *Degrease seal faces before positioning Rotating Seal Faces (Pos. 5). This step is important to prevent from breaking seal faces due to extended period of non-operating the pump.*

FINAL CHECKLIST

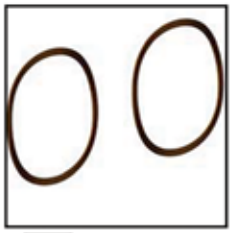

☐ Step 1


☐ Step 2


☐ Step 3


☐ Step 4


☐ Step 5

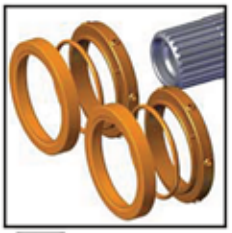

☐ Step 6

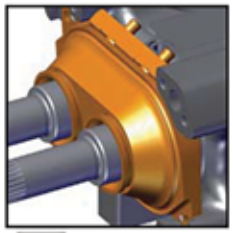

☐ Step 7

☐ Step 8

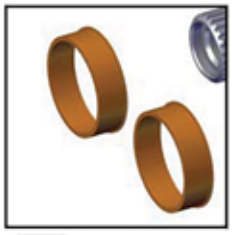

☐ Step 9

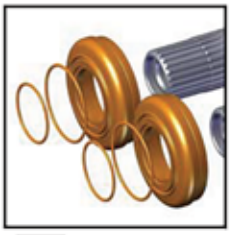

☐ Step 10


☐ Step 11


☐ Step 12

☐ Step 13


☐ Step 14


☐ Step 15

7.3 Disassembly and Re-assembly of the SAMS ANGA

Disassembly of ANGA Single Acting Mechanical Seals:

1. Relieve quench system or counter-pressure device, drain quench fluid.
2. Disassemble Pump Face (Pos. 1012).
3. Disassemble Pump Housing (Pos. 1033).
4. Disassemble Spindle Screw Bolts (Pos. 2180) and Spindles (twin screws) (Pos. 2200 & 2201).
5. Remove the Seal Housing "Mushroom" (Pos. 7), including O-rings (Pos. 6, 11, & 2a), Pins (Pos. 10), and Rotation Rings (Pos. 1). Set these assemblies aside with the the Rotation Rings (Pos. 1) sealing surfaces facing upwards, in order to avoid potential micro-scratches on the surfaces.
6. Remove both Stationary Rings (Pos. 3) and O-rings (Pos. 2b) from the Seal Housing (Pos. 1029).
7. Remove the Seal Housing (Pos. 1029) via the shafts.
8. Remove both Outer Thrust Rings (Pos. 8) from the Atmospheric side of the Seal Housing, followed by the Inner Thrust Rings (Pos. 9). You may need to rotate the Inner Thrust Rings 45° in order to be able to remove them from the Seal Housing.
9. Remove both Sine Springs (Pos. 5) from the Atmospheric side of the Seal Housing.
10. Finally, remove both Hold Rings (Pos. 4) from the Seal Housing.

ATTENTION!
Possible damage to property.

- **Equally clean the Seal Housing as well as the shafts and seal seats and carefully check the removed parts. Replace any damaged parts as well as all O-rings and shaft sealing rings**
- **During disassembly, be careful about the Seal Housing Pins (Pos. 10). If they get lost use new ones.**

Re-Assembly of ANGA Single Acting Mechanical Seals:

1. Place Hold Rings (Pos. 4) into the INNERMOST grooves from the Atmospheric side of the Seal Housing (Pos. 1029). Make sure that the square-shaped blocks on the backside of the Hold Rings are at the 3 O'clock and 9 O'clock positons, as these must align with the notches on the Stationary Rings in step 13.
2. Place both Sine Springs (Pos. 5) into the Atmospheric side of the Seal Housing. They fit neatly inside of the tabs on the Hold Rings.
3. Place Inner Thrust Rings (Pos. 9) into the Seal Housing grooves, and once seated, rotate them 45° to keep them in place inside the Seal Housing grooves.
4. Place Outer Thrust Rings (Pos. 8) into the Seal Housing grooves, up against the Inner Thrust Rings.
5. Mount the Flushing Sockets on top of the Seal Housing (Pos. 1029).
6. Mount Guard Plate (Pos. 2286) onto the Seal Housing using Hexaganol Screw and Washer (Pos. 2287).
7. Slide the Seal Housing (Pos. 1029) over the shafts, and seat it into place on the Bearing Housing. Take note of the two Alignment Pins.
8. Lubricate the Mushroom Assembly O-rings (Pos. 6 and Pos. 11) with a food-safe grease, and then insert them into the front face of the Seal Housing Mushroom Assemblies (Pos. 7).
9. Insert the Pins (Pos. 10) into the rear face of the Seal Housing Mushroom Assemblies. Use a small amount of food-safe grease to get them to stay in position.
10. Lightly lubricate the Mushroom Assembly O-ring (Pos. 2a) with a food-safe grease, and carefully insert it into the rear face of the Mushroom Assembly (Pos. 7).
11. Place the the Mushroom Assembly Insert Ring (Pos. 1) into the rear face of the Mushroom Assembly, and slide it in until it is fully seated inside of the Mushroom Assembly O-ring (Pos. 2a). Set these aside, with the surface of the Insert Ring facing up, to prevent micro-scratches or abrasions to the sealing surfaces.
12. Carefully insert both O-rings (Pos. 2b) into the Product side of the Seal Housing.
13. Lightly lubricate the outer neck surface of the Stationary Rings (Pos. 3), and carefully slide them over the shafts and into place on the Product Side of the Seal Housing, making sure the notches on the Stationary Rings line up with the pins on the Hold Rings from step 1.
14. After lubricating the shafts with a food-safe grease, carefully slide the full assembled Mushroom Assembly Seal Faces onto the shafts, and make sure they are properly seated (the entire assembly consists of Pos. 6, 11, 7, 10, 2a, & 1). Take extra precaution to not pinch or damage O-rings during installation.

7.4 Check the Seals & Seal Housing O-rings (ANGA)

Inspect the Seals & Seal Housing O-rings on the Seal Housing: