wright flow TECHNOLOGIES®

Installation, Operation and Maintenance Manual for the

Revolution®

Frame 6 & 7

wright flow TECHNOLOGIES®
A Unit of IDEX Corporation

Installation, Operation & Maintenance Manual
For The Revolution Range of Pumps

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1.0 Safety Information.

INCORRECT INSTALLATION, OPERATION, OR MAINTENANCE OF EQUIPMENT MAY CAUSE SEVERE PERSONAL INJURY OR DEATH AND/OR EQUIPMENT DAMAGE AND MAY INVALIDATE THE WARRANTY.

THIS INFORMATION MUST BE READ FULLY BEFORE BEGINNING INSTALLATION, OPERATION, OR MAINTENANCE AND MUST BE KEPT WITH THE PUMP. SUITABLY TRAINED OR QUALIFIED PERSONS MUST UNDERTAKE ALL INSTALLATION AND MAINTENANCE ONLY.

Danger - Failure to follow the listed precautionary measures may result in serious injury or death are identified by the following symbol:

Warning - Safety instructions which shall be considered for reasons of safe operation of the pump or pump unit and/or protection of the pump or pump unit itself are marked by the sign:

WARNING

DANGER

DO NOT OPERATE PUMP IF:

- The front cover is not installed correctly.
- Any guards are missing or incorrectly installed.
- The suction or discharge piping is not connected.

DO NOT place fingers, etc. into the pumping chamber or its connection ports or into any part of the gearbox if there is ANY possibility of the pump shafts being rotated. Severe injury will occur.

DO NOT exceed the pumps rated pressure, speed, and temperature, or change the system/duty parameters from those for which the pump was originally supplied, without confirming its suitability for the new duty. Running of the pump outside of its operation envelope can cause mechanical contact, excessive heat and can represent a serious risk to health and safety.

Installation and operation of the pump must always comply with health and safety regulations.

WARNING

A device must be incorporated into the pump, system, or drive to prevent the pump exceeding its stated duty pressure. It must be suitable for both directions of pump rotation where applicable. Do not allow pump to operate with a closed/blocked discharge unless a pressure relief device is incorporated. If an integral relief valve is incorporated into the pump, do not allow re-circulation through the relief valve for extended periods.

The mounting of the pump or pump unit should be solid and stable. Pump orientation must be considered in relation to drainage/cavity ventilation requirements. Once mounted, shaft drive elements must be checked for correct alignment. Rotate pump shaft by at least one full revolution to ensure smoothness of operation. Incorrect alignment will produce excessive loading and will create high temperatures and increased noise emissions. It may also be necessary to earth the pump head to avoid the build up of a potential charge difference that could cause a spark.

The installation must allow safe routine maintenance and inspection (to replenish lubricants, check for leakage, monitor pressures, etc) and provide adequate ventilation necessary to prevent overheating.

WARNING Fill all gearboxes with the recommended grades and quantities of lubricant (refer to section 3.5 and 6.3). Beware of over/under filling the gearbox as this could cause the pump to overheat and mechanical damage to occur.

WARNING Before operating the pump, be sure that it and all parts of the system to which it is connected are clean and free from debris and that all valves in the suction and discharge pipelines are fully opened. Ensure that all piping connecting to the pump is fully supported and correctly aligned with its relevant connections. Misalignment and/or excess loads will cause severe pump damage. This could result in unexpected mechanical contact in the pump head and has the potential to be an ignition source.

WARNING Be sure that pump rotation is correct for the desired direction of flow (refer to section 3.5).

WARNING Do not install the pump into a system where it will run dry (i.e. without a supply of pumped media) unless it is equipped with a flushed shaft seal arrangement complete with a fully operational flushing system. Mechanical seals require a thin fluid film to lubricate the seal faces. Dry running can cause excessive heat and seal failure.

WARNING Pressure gauges/sensors are recommended, next to the pump suction and discharge connections to monitor pressures.

Caution must be taken when lifting the pump. Suitable lifting devices should be used as appropriate. Lifting eyes installed on the pump must only be used to lift the pump, not pump with drive and/or base plate. If pump is base plate mounted, the base plate must be used for all lifting purposes. If slings are used for lifting, they must be safely and securely attached. For weights of bare shaft pumps refer to section 6.4.

DO NOT attempt any maintenance or disassembly of the pump or pump unit without first ensuring that:

- The pump is fully isolated from the power source (electric, hydraulic, pneumatic).

- The pumping chamber and any shaft seal support system are depressurised and purged.

- Any temperature control devices (jackets, heat-tracing, etc) are fully isolated, that they are depressurised and purged, and components are allowed to reach a safe handling temperature.

DO NOT loosen or undo the front cover, any connections to the pump, shaft seal housings, temperature control devices, or other components, until sure that such action will not allow the unsafe escape of any pressurised media.

Pumps and/or drives can produce sound power levels exceeding 85-dB (A) under certain operating conditions. When necessary, personal protection against noise must be taken.

Avoid any contact with hot parts of pumps and/or drives that may cause injury. Certain operating conditions, temperature control devices (jackets, heat-tracing, etc.), bad installation, or poor maintenance can all promote high temperatures on pumps and/or drives.

WARNING

When cleaning, either manually or by CIP method, the operator must ensure that a suitable procedure is used in accordance with the system requirements. During a CIP cleaning cycle, a pump differential pressure of between 2 and 3 bar (30 and 45 psi) is recommended to ensure suitable velocities are reached within the pump head. The exterior of the pump should be cleaned periodically.

Surface temperature of pump is also dependent on the temperature of pumped medium.

1.1 Risk assessment relating to the use of Wright Flow Technologies Revolution pumps and pump units in potentially explosive atmospheres.

Note:- For a feature to be suitable for an application, the feature must be fit for its designated purpose and also suitable for the environment where it is to be installed.

Source Of Hazards	Potential Hazards	Frequency Of Hazards	Recommended Measures
Unvented cavities	Build up of explosive gas	**Very Rare**	Ensure that pump is totally filled. Consider mounting ports vertically. **See Chapter 1.0**
Rotorcase / Rotors / Front Cover	Unintended mechanical contact	**Rare**	Ensure that operating pressures are not exceeded. Ensure that suffcient NPSH to prevent cavitation. **See Chapter 1.0/3.4.1** Service plan.
Pump external surfaces	Excess temperature. Electrostatic charging	**Rare**	User must ensure temperature limits. Do not overfill gearboxes with lubricant. Provide a ground contact for pump. **See Chapter 1.0/6.3 /** Service plan.
Cover 'O' ring	Pump liquid leakage. Build up of explosive gas.	**Very Rare**	Check selection of elastomers are suitable for application. Ensure cover retaining nuts are tight. Service plan.
Pump casing / cover	Pump liquid leakage. Build up of explosive gas.	**Very Rare**	Stainless steel, Corrosion resistant.
Shaft seals	Excess temperature. Unintended mechanical contact. Leakage. Build up of explosive gas.	**Rare**	Selection of seal system must be suitable for application. **See Chapter 5.0**. Service plan. Seals must never run dry.
Auxiliary system for shaft sealing	Pump liquid leakage. Build up of explosive gas.	**Rare**	Selection of auxiliary seal system must be suitable for application. Seals must never run dry.
Rotation direction test	Excess temperature	**Very Rare**	If flushed seals are installed ensure that flush is applied to seal assemblies. Only allow pump to run for minimum period - just a few seconds.
Closed valve condition	Excess Temperature. Excess Pressure. Mechanical contact.	**Rare**	Can cause excessive pressue, heat and mechanical contact. **See Chapter 1.0**
Shaft	Random induced current	**Very Rare**	Provide a ground contact for pump. **See Chapter 1.0.**
Mechanical shaft coupling (Torque Protection)	Temperature from friction Sparks from break up of shear pins. Electrostatic charging	**Rare**	Coupling selection must suit application. **See Chapter 1.0.**
Mechanical shaft coupling (standard)	Break up of spider. Unintended mechanical contact. Electrostatic charging	**Rare**	Coupling selection must suit application. Service plan. **See Chapter 1.0.**

2.0 Introduction.

2.1 General.

Revolution circumferential piston and rotary lobe pumps are manufactured by Wright Flow Technologies a unit of the IDEX Corporation.

2.2 Wright Flow Technologies Distributors.

Wright Flow Technologies distributes its products internationally via a network of authorised distributors. Throughout this manual where reference is made to Wright Flow Technologies, service and assistance will also be provided by any Wright Flow Technologies authorised distributor for Revolution.

2.3 Receipts and Storage.

Upon receipt of the pump, immediately examine it for any signs of visible damage. If any damage is noted, contact Wright Flow Technologies or your Wright Flow Technologies distributor and clearly mark upon the carriers' paperwork that the goods have been received in a damaged condition, with a brief description of damage.

If the pump is not required for immediate installation then it should be stored in a clean, dry environment. It is recommended that storage temperature should be between –10° and 40°C (14°F and 105°F).

2.4 Cleaning.

The Revolution pump series is suitable for both manual cleaning and CIP (Cleaning In Place), refer to section 3.4.2.

It is recommended that the exterior of the pump be cleaned periodically with a non-aggressive, non-abrasive cleaning solution.

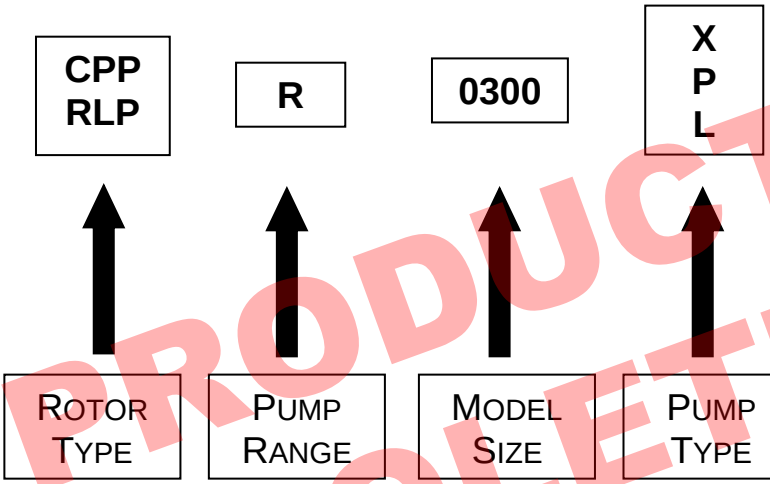
2.5 Pump Model Designation.

The designations of pump models in the Revolution range are as follows:

Fig 1 Designations

Size 2	Size 3	Size 4	Size 5	SIZE 6		SIZE 7	
R0150X	R0200X	R0450X	R1800X	R3200P		R4200P	
R0160L	R0300X	R0600P	R2200X	R3230P	ASEPTIC	R4230P	ASEPTIC
R0180P	R0400X	R0800X	R2600P	R3800P		R5200P	
		R1300X		R3830P	ASEPTIC	R5230P	ASEPTIC
				R3900P			
				R3930P	ASEPTIC		

For the maximum operating pressures, temperatures and speeds refer to section 3.3, Fig 6.



CPP = Circumferential Piston Pump
RLP = Rotary lobe Pump
R = Revolution
X = Setup for CPP and RLP
P = Setup for CPP
L = Setup for RLP

2.5.1 Pump Model and Serial Number.

Should you require any information regarding your Revolution pump contact Wright Flow Technologies or your Wright Flow Technologies distributor, providing the pump model and serial number as stated on the pump nameplate, see Fig 2, which is fixed to the pump gearbox.

Should this be damaged or missing, the pump serial number is also stamped on opposite corners of the rotorcase, (see Fig 3).

Fig 2 Nameplate

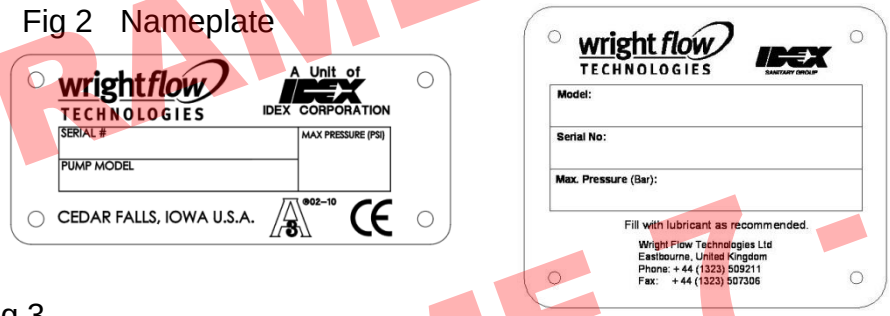
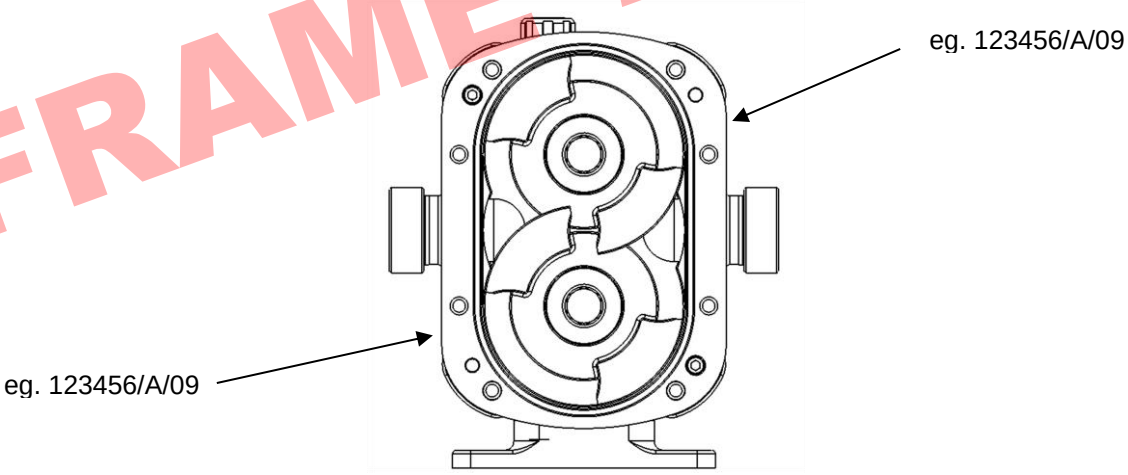
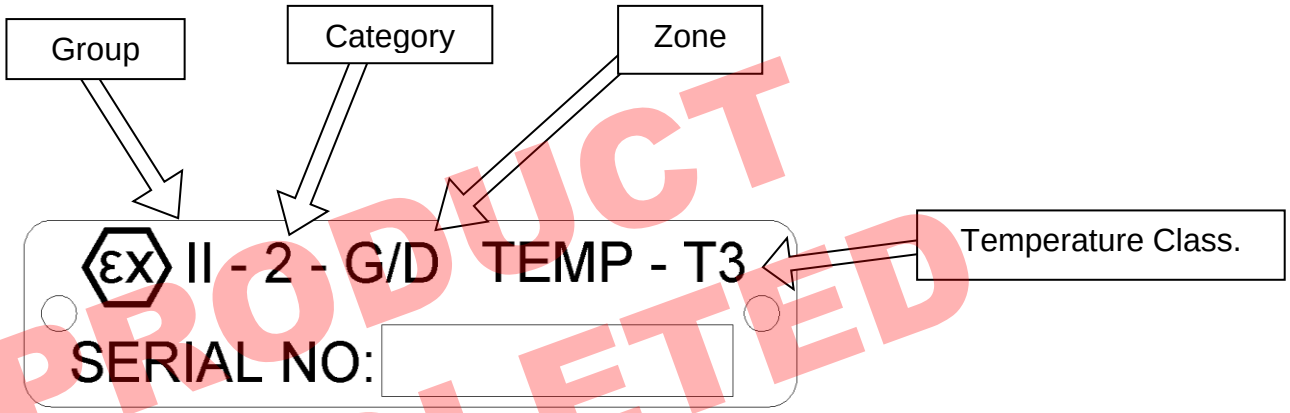


Fig 3



2.5.2 ATEX Identification Plate.

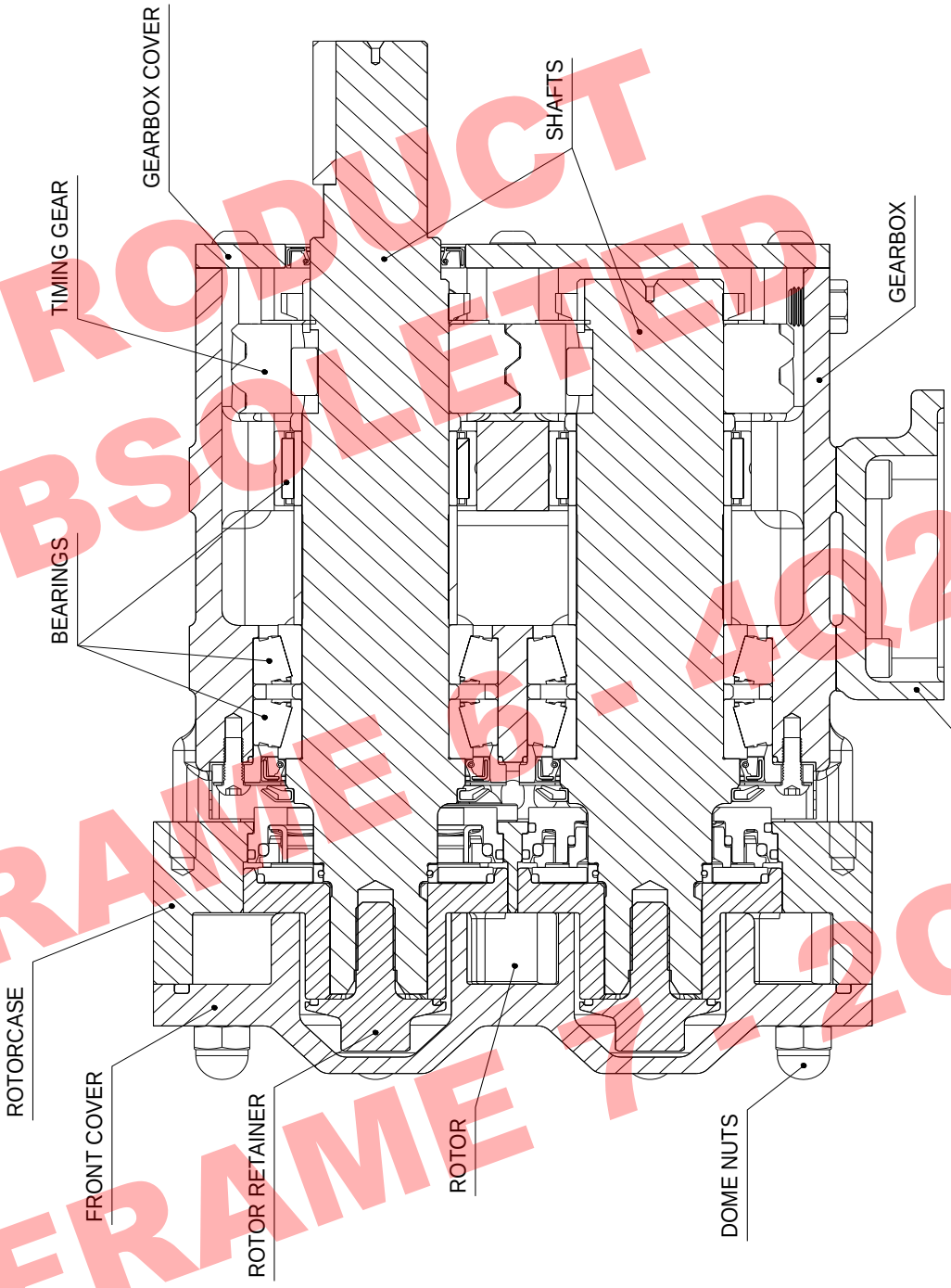


2.5.3 Equipment Groups & Categories.

Equipment-groups (Annex I of the EC-Directive 94/9/EC)							
Group I (mines, mine gas and dust)		Group II (other explosive atmospheres gas/dust)					
Category M		Category 1		Category 2		Category 3	
1	2	G (gas) (Zone 0)	D (dust) (Zone 20)	G (gas) (Zone 1)	D (dust) (Zone 21)	G (gas) (Zone 2)	D (dust) (Zone 22)
for equipment providing a very high level of protection when endangered by an explosive atmosphere	for equipment providing a high level of protection when likely to be endangered by an explosive atmosphere	for equipment providing a very high level of protection when used in areas where an explosive atmosphere is very likely to occur		for equipment providing a high level of protection when used in areas where an explosive atmosphere is likely to occur		for equipment providing a normal level of protection when used in areas where an explosive atmosphere is less likely to occur	

Standard Pump Component Terms

Fig 4



3.0 General.

3.1 Revolution Pumping Principal.

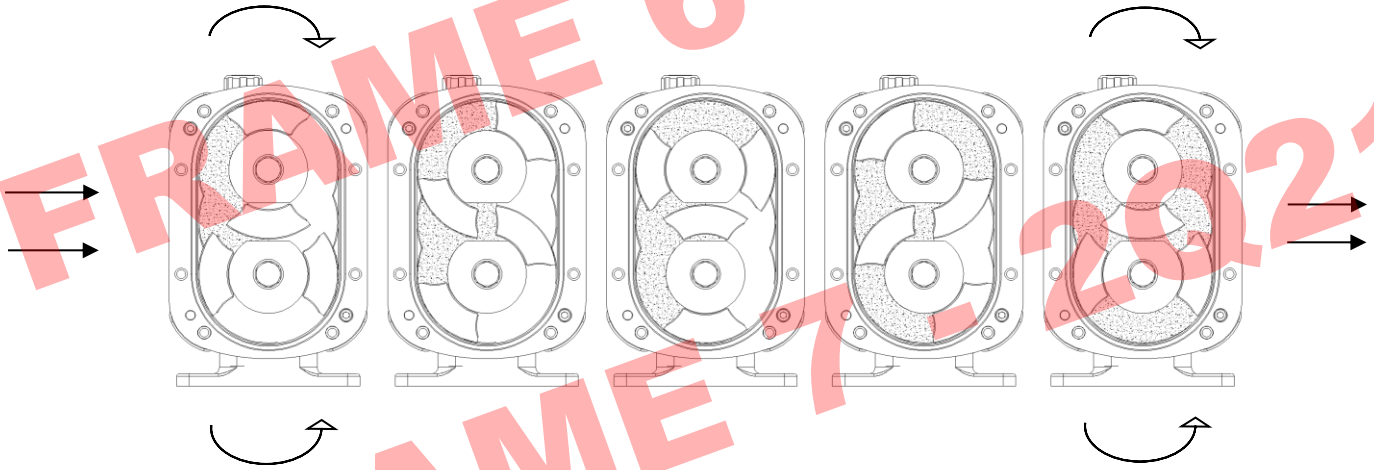
The pumping action is generated by the contra-rotation of two pumping elements (rotors) within a chamber (rotorcase) - see Fig 5. The rotors are located on shafts, which in turn are mounted within an external gearbox and supported by the bearings; the timing gears are also located on the shafts. The timing gears transfer the energy from the drive shaft to the driven shaft, synchronising the rotors such that they rotate without contact with each other.

As the rotors pass the suction port, see Fig 5, the cavity generated increases creating a pressure decrease, which induces the pumped medium to flow into the rotorcase.

The pumped medium is carried around the rotorcase by the rotors to the discharge side of the pump, here the cavity decreases and the pumped medium is discharged from the rotorcase.

For pump component terms see Fig 4.

Fig 5



3.2 Revolution Pump Head Modularity.

The Revolution pump has been designed with a universal pump head – This means that on some models by changing the rotors and front cover and a few ancillary items you change between a rotary lobe pump (RLP) and a Circumferential Piston Pump CPP.

Note when changing between RLP and CPP Timing and clearances must be checked

3.3 Revolution Range Operating Parameters.

The maximum pressure and speed operating parameters are given in Fig 6. In practice these may be limited due to the nature of the product to be pumped and/or design of the system in which the pump is to be installed. Consult Wright Flow Technologies or your Wright Flow Technologies distributor for assistance.

The operating temperature limit of the pump is determined by the rotor clearance.

For the circumferential piston pumps (CPP):

- Size 6 and 7 - four rotor clearance bands:
  (a) STANDARD CLEARANCES FOR 93°C / 200°F
  (b) FRONT FACE CLEARANCE 105°C / 220°F
  (c) HOT CLEARANCES FOR 150°C / 300°F
  (d) CHOCOLATE CLEARANCE
  (e) CLEARANCES FOR 93°C / 200°F (STAINLESS)
  (f) FRONT FACE CLEARANCE 105°C / 225°F (STAINLESS)
  (g) HOT CLEARANCES FOR 150°C / 300°F (STAINLESS)
  (h) CHOCOLATE CLEARANCE (STAINLESS)

The pump should not be subjected to sudden temperature changes to avoid the risk of damage from sudden expansion/contraction of components. Care should be taken when selecting pumps for handling liquids containing abrasive particles as these may cause wear of pump head components.

Revolution Series	Operating Temperature Limit °C (°F)			
	Standard	FF	Hot	Chocolate
Circumferential Piston	93°C (200°F)	105°C (221°F)	150°C (302°F)	Refer to WFT

N/A = Not Available

Gearbox Size	Pump Type	Model	Port Size (inch)	Displacement (l/rev)	Displacement (USG/rev)	Max Pressure (Bar)	Max Pressure (PSI)	Max RPM	Max Flow (m^3/hr)	Max Flow (GPM)
Frame 2	CPP	R0150X	1.5	0.055	0.014	21	305	800	2.6	11.6
	RLP	R0150X	1.5	0.061	0.016	15	218	1000	3.6	16
	RLP	R0160L	1.5	0.081	0.021	10	145	1000	4.9	21.4
	CPP	R0180P	1.5	0.11	0.029	14	203	800	5.3	23.2
	RLP	R0180L	1.5	0.11	0.029	7	102	1000	6.6	29.1
Frame 3	CPP	R0200X	1.5	0.16	0.04	21	305	800	8	34
	RLP	R0200X	1.5	0.18	0.05	14	203	1000	11	47
	CPP	R0300X	1.5	0.23	0.06	17	247	800	11	48
	RLP	R0300X	1.5	0.25	0.07	9	131	1000	15	66
	CPP	R0400X	2	0.29	0.08	14	203	800	14	62
	RLP	R0400X	2	0.33	0.09	7	102	1000	20	86
Frame 4	CPP	R0450X	2	0.4	0.1	31	450	600	15	67
	RLP	R0450X	2	0.5	0.1	15	218	800	22	95
	CPP	R0600P	2.5	0.6	0.2	21	305	600	21	92
	CPP	R0800X	3	0.8	0.2	17	247	600	28	122
	RLP	R0800X	2.5	0.8	0.2	9	131	800	39	173
	CPP	R1300X	3	1	0.3	14	203	600	36	159
	RLP	R1300X	3	1.1	0.3	7	102	800	51	226
Frame 5	CPP	R1800X	3	1.5	0.4	31	450	600	53	231
	CPP	R1830X	3	1.5	0.4	31	450	600	53	231
	RLP	R1800X	3	1.6	0.4	15	218	600	56	246
	CPP	R2200X	4	2	0.5	21	305	600	71	313
	CPP	R2230X	4	2	0.5	21	305	600	71	313
	RLP	R2200X	4	2.1	0.6	8	116	600	76	333
	CPP	R2600P	4	2.5	0.7	14	203	600	91	399
	CPP	R2630P	4	2.5	0.7	14	203	600	91	399
Frame 6	CPP	R3200P	6	3.1	0.8	21	305	600	112	494
	CPP	R3230P	6	3.1	0.8	21	305	600	112	494
	CPP	R3800P	6	3.8	1	14	203	600	138	606
	CPP	R3830P	6	3.8	1	14	203	600	138	606
	CPP	R3900P	6	4.8	1.27	8	116	500	173	761
	CPP	R3930P	6	4.8	1.27	8	116	500	173	761
Frame 7	CPP	R4200P	6	6.2	1.6	28	400	400	148	652
	CPP	R4230P	6	6.2	1.6	28	400	400	148	652
	CPP	R5200P	8	9	2.4	14	200	350	190	836
	CPP	R5230P	8	9	2.4	14	200	350	190	836

Fig 6

For weights see section 6.4

3.4 System Design.

3.4.1 System Design and Installation.

When incorporating any pump into a system it is considered good practice to minimize piping runs and the number of pipe fittings (tees, unions, bends etc.) and restrictions. Particular care should be taken in designing the suction line, which should be as short and straight as possible with a minimum of pipe fittings to minimise restricting product flow to the pump. The following should be considered at the design stage of any system.

Be sure ample room is provided around the pump to allow for:

- Access to the pump and drive for routine inspection and maintenance, i.e. to remove pump front cover and rotors.
- Ventilation of the drive to prevent overheating.

The exterior of the pump unit may exceed 68°C (154°F),
Appropriate measures must be taken to warn or protect operators.

WARNING

The pump must not be used to support piping. All piping to and from the pump unit must be independently supported. Failure to observe this may distort the pump head components or assembly and cause serious consequential damage to the pump.

Valves should be provided adjacent to the pump suction and discharge connections to allow the pump to be isolated from the system for routine inspection and maintenance.

Circumferential piston and rotary lobe pumps are of the positive displacement type and therefore an overload protection device must be provided. This can take the form of:

- An in-line pressure relief system, i.e. external to the pump.
- Incorporation of a torque-limiting device in the drive system.

WARNING

It is recommended that all piping and associated equipment from the tank to the discharge point is thoroughly cleaned before installation of the pump to avoid the possibility of debris entering the pump and causing damage.

WARNING

Pressure gauges should be installed adjacent to the pump suction and discharge connections such that system pressures can be monitored. These gauges will provide a clear indication of changes in operating conditions and where a relief valve is incorporated in the system, will be necessary for setting and checking the functioning of the valve.

WARNING

It is imperative that the suction condition at the pump inlet meets the Net Positive Suction Head required (NPSHr) by the pump. Failure to observe this could cause cavitation, resulting in noisy operation, reduction in flow rate and mechanical damage to the pump and associated equipment.

WARNING

The Net Positive Suction Head available (NPSHa) from the system must always exceed the Net Positive Suction Head required (NPSHr) by the pump.

Observing the following general guidelines should ensure the best possible suction condition is created.

- Suction piping is at least the same diameter as the pump connections.
- The length of suction piping is kept to the absolute minimum.
- The minimum number of bends, tees and pipe work restrictions are used.
- Calculations to determine system NPSHa are carried out for the worst condition, see below.

Should advice on pump or system NPSH characteristics be required contact the factory or their authorised distributor.

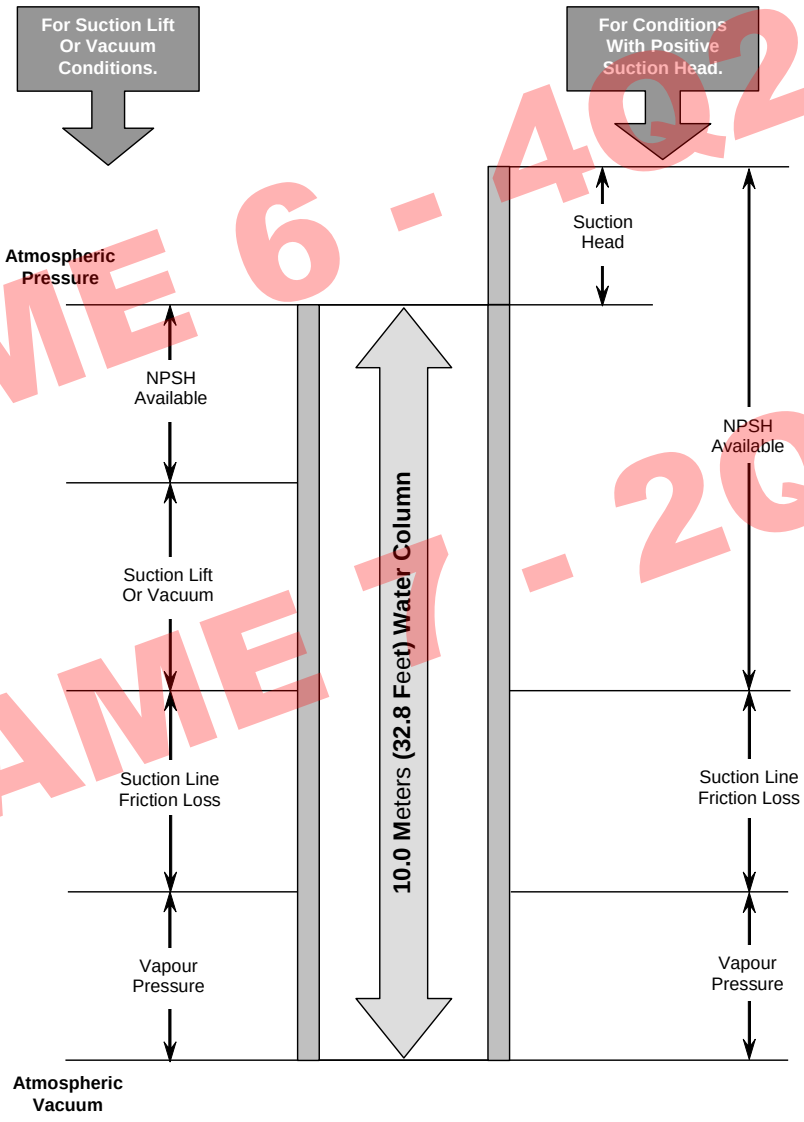


Fig 7

When installing a pump complete with base plate, motor and drive, the following guidelines must be observed:

a) The preferred drive arrangement for any circumferential piston or rotary lobe pump is in-line direct coupled. If an alternative is required please contact Wright Flow Technologies or your Wright Flow Technologies distributor.

b) Flexible couplings must always be incorporated and correctly aligned within the limits recommended by the coupling manufacturer. To check coupling alignment rotate the shaft by at least one full revolution and ensure that the shaft rotates smoothly.

Couplings of a non-flexible design must never be used.

c) Couplings must always be enclosed in a suitable guard to prevent contact with rotating parts, which could result in personal injury. Guards should be of suitable material, (see d) and of sufficiently rigid design to prevent contact with rotating parts under normal operating conditions.

d) When the pump is installed in a flammable or explosive environment, or is used for handling flammable or explosive materials, special consideration must be given. Not only to the safety aspects of the drive unit enclosure but also to the materials used for both the coupling and the guard to eliminate the risk of explosion.

e) Base plates must be secured to a flat level surface such that distortion and misalignment are avoided. Once base plates are fastened in position the drive alignment must be re-checked, (see b).

f) When using electric motor drives, ensure that the electrical supply is compatible with the drive and controls and that the method of wiring is correct for the type of starting required by the motor i.e. Direct On Line, or other similar method. Ensure all components are correctly grounded.

3.4.2 Installations with CIP Systems.

The Revolution pump range is designed to be effectively cleaned by the CIP procedures recommended for in place cleaning of process plants. It is recommended that a differential pressure of 2 to 3 Bar (30 to 45 psi) be developed across the pump head during cleaning in order to develop the necessary fluid velocities required for thorough cleaning.

To assist in maximizing the effectiveness of cleaning within the pump head, it is recommended that during the cleaning cycle a flow rate equivalent to a velocity of 1.5 metres per second in a pipe of equal diameter to the rotor case connections is achieved. In a pump with a 2.5 inch port, this means 300 litres per minute (for the R800).

We also recommend rotating the pump during the CIP cycle to help the flow enter all cavities.

3.5 Start Up Procedure.

WARNING

- Check that all piping and associated equipment are clean and free from debris and that all pipe connections are secure and leak free.

WARNING

- For pumps fitted with flushed product seals check all auxiliary services are in place and connected and provide sufficient flow and pressure for flushing purposes.

WARNING

- Ensure lubrication is provided for both pump and drive. The Revolution can be shipped with different lubrications see section 6.3 for capacities and grades.

WARNING

- If an external relief valve is incorporated in the system, check that it is set correctly. For start up purposes, it is considered good practice to set the relief valve lower than the system design pressure. On completion of start up, the relief valve should be reset to the required setting for the application. The required setting should never exceed the lower of either the pumps maximum pressure rating or the system design pressure.

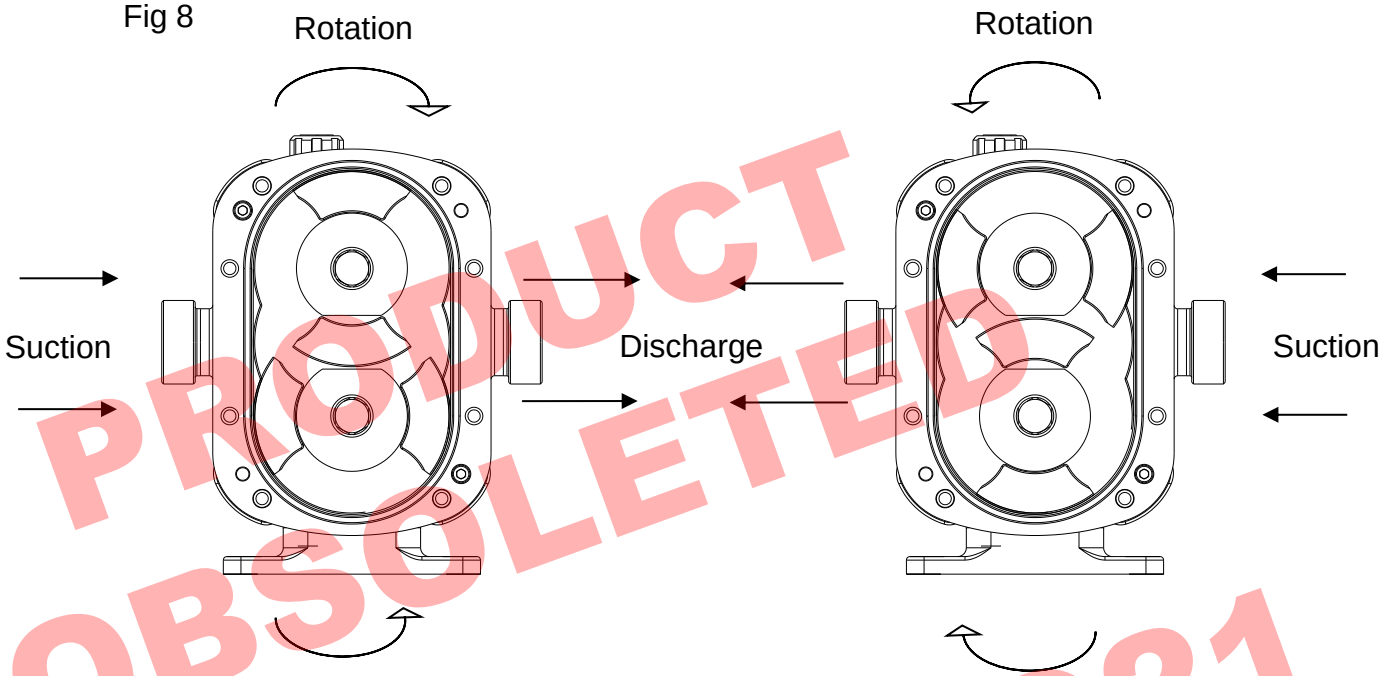
WARNING

- Be sure both suction and discharge valves are fully opened and that pipe work is free from all obstructions. The Revolution is a positive displacement type pump and should therefore never be operated against a closed valve as this would result in pressure overload, resulting in damage to the pump and possibly the system.

WARNING

- Make sure that the drive shaft rotation is correct for the direction of flow required. See Fig 8.

Fig 8



WARNING

- Be sure product is available in the suction vessel before starting the pump. This is very important for pumps fitted with un-flushed product seals, as these sealing arrangements must never be allowed to run dry.

- Before beginning operation, it is considered good practice to momentarily start/stop the pump to check the direction of rotation and ensure that the pump is free of obstructions. Once this has been carried out, begin operation keeping a visual check on suction and discharge pressure gauges and monitor the pump temperature and absorbed power where possible.

3.6 Shutdown Procedure.

When shutting the pump down, stop pump, close both the suction and discharge valves and ensure that the necessary safety precautions are taken:

- The prime mover power source has been isolated.

- If installed, pneumatically operated integral relief valve has been depressurised.

- Flushed product seal auxiliary services have been isolated and depressurised.

- Pump head and piping have been drained and purged.

- Before undertaking any work on the pump refer to sections 4, 5, and 6.

3.7 Routine Maintenance.

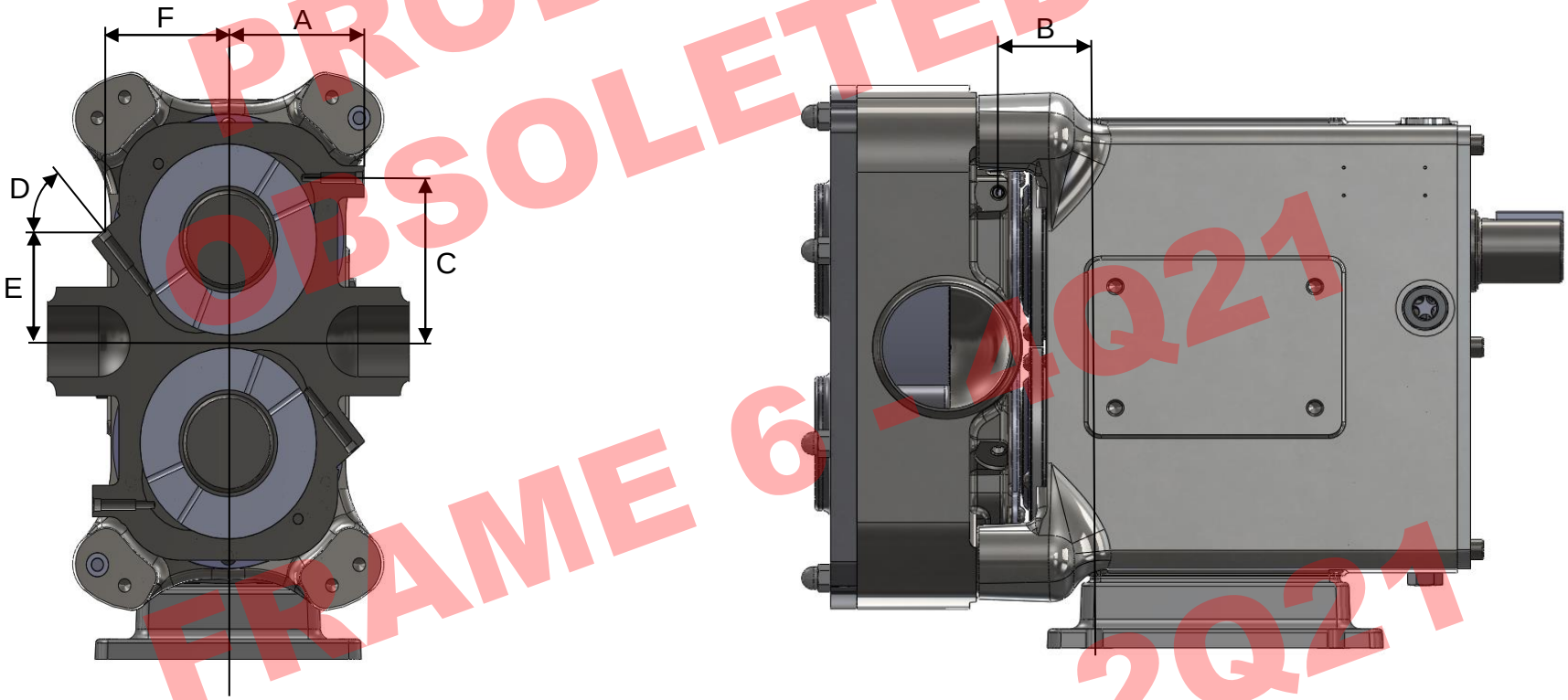
WARNING

- Check oil levels regularly.
- Change the oil every 12 months or 3000 operating hours, whichever is the sooner.
- For lubricant capacities and grades refer to section 6.3.

3.8 Double Seal Flushing Locations

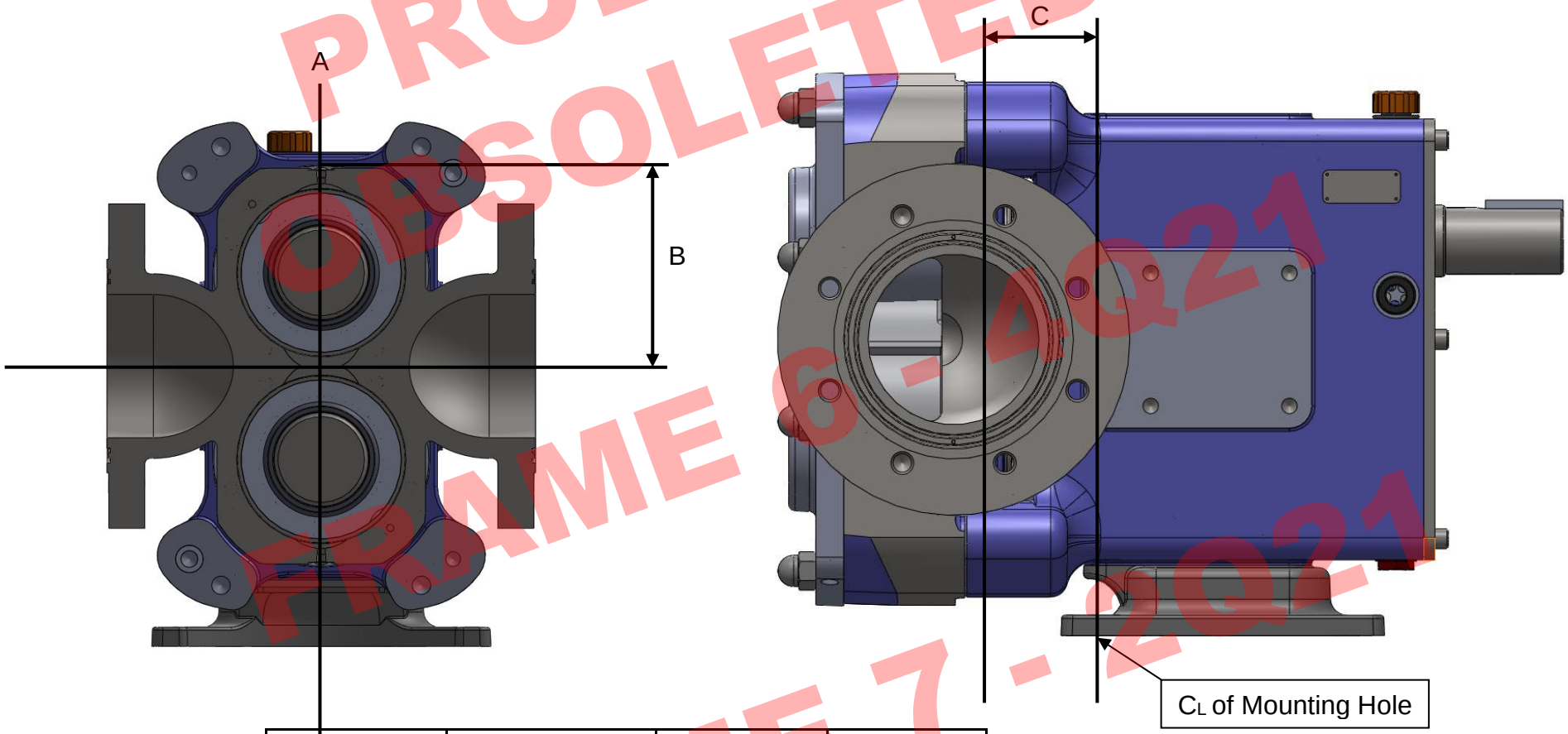
- Flush fluid should always fill seal chamber from the bottom port and exit out the upper most port. In and out are dependent on orientation of pump.

3.8.1 Flushing Positions Size 7



	A		B		C		D	E		F		Connection
	MM	Inch	MM	Inch	MM	Inch	Degrees	MM	Inch	MM	Inch	
Size 7	170	6.69	513	20.20	174.2	6.86	50	136.89	5.39	160	6.3	1/4” BSP

3.8.2 Flushing Positions Size 6

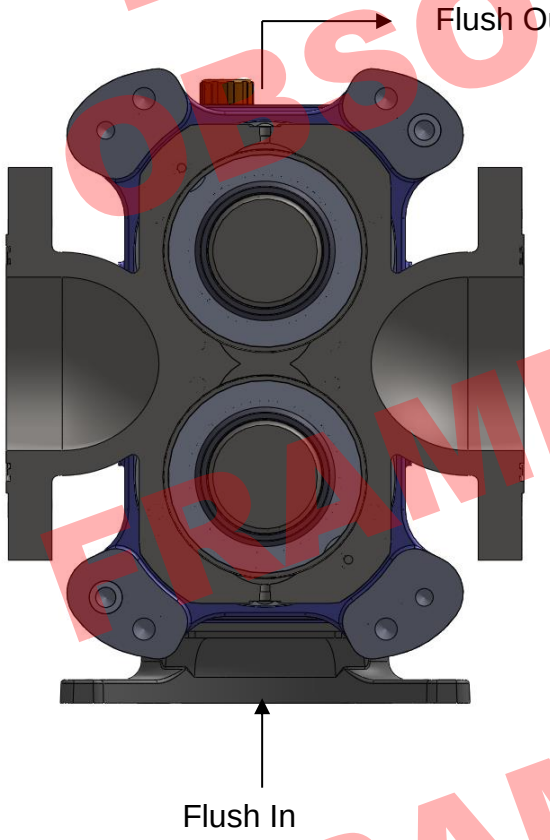


	A		B		C		Connection
	MM	Inch	MM	Inch	MM	Inch	
Size 6	C_L	C_L	188.76	7.43	101.3	3.99	1/8" BSP

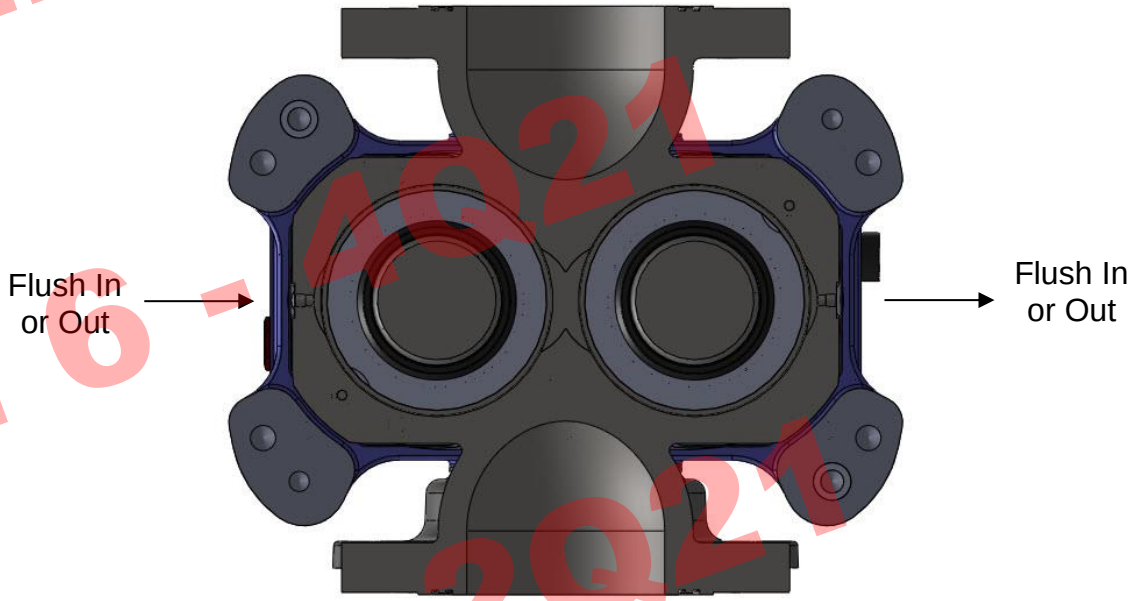
3.8.3 Recommended Flush Circulation

3.8.3.1 Frame 6

Horizontal Port Straight Flush



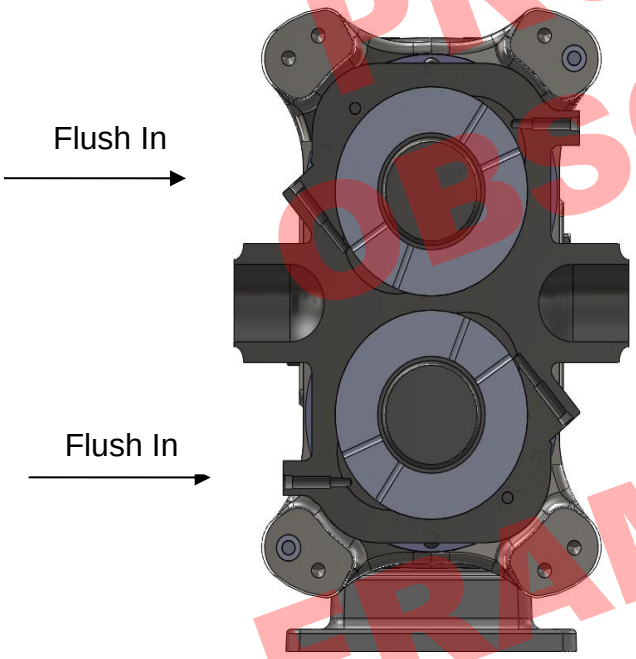
Horizontal Circular Flush



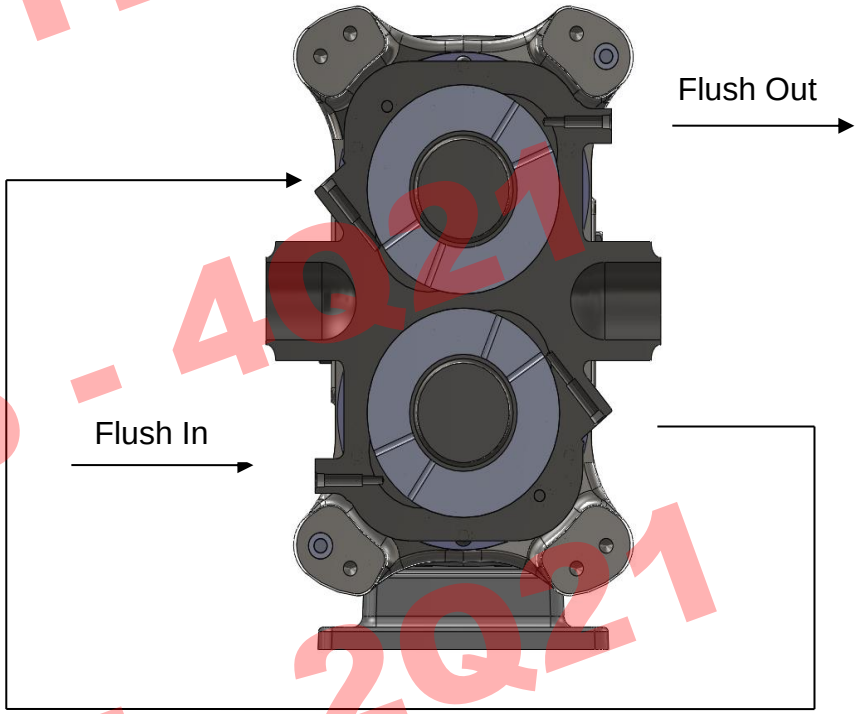
Note: The liquid supply connections to flushed seals are made using the threaded ports on the sides of the rotorcase. The pipe work should be arranged to provide an independent flush to each seal.

3.8.3.2 Frame 7

Horizontal Port Straight Flush



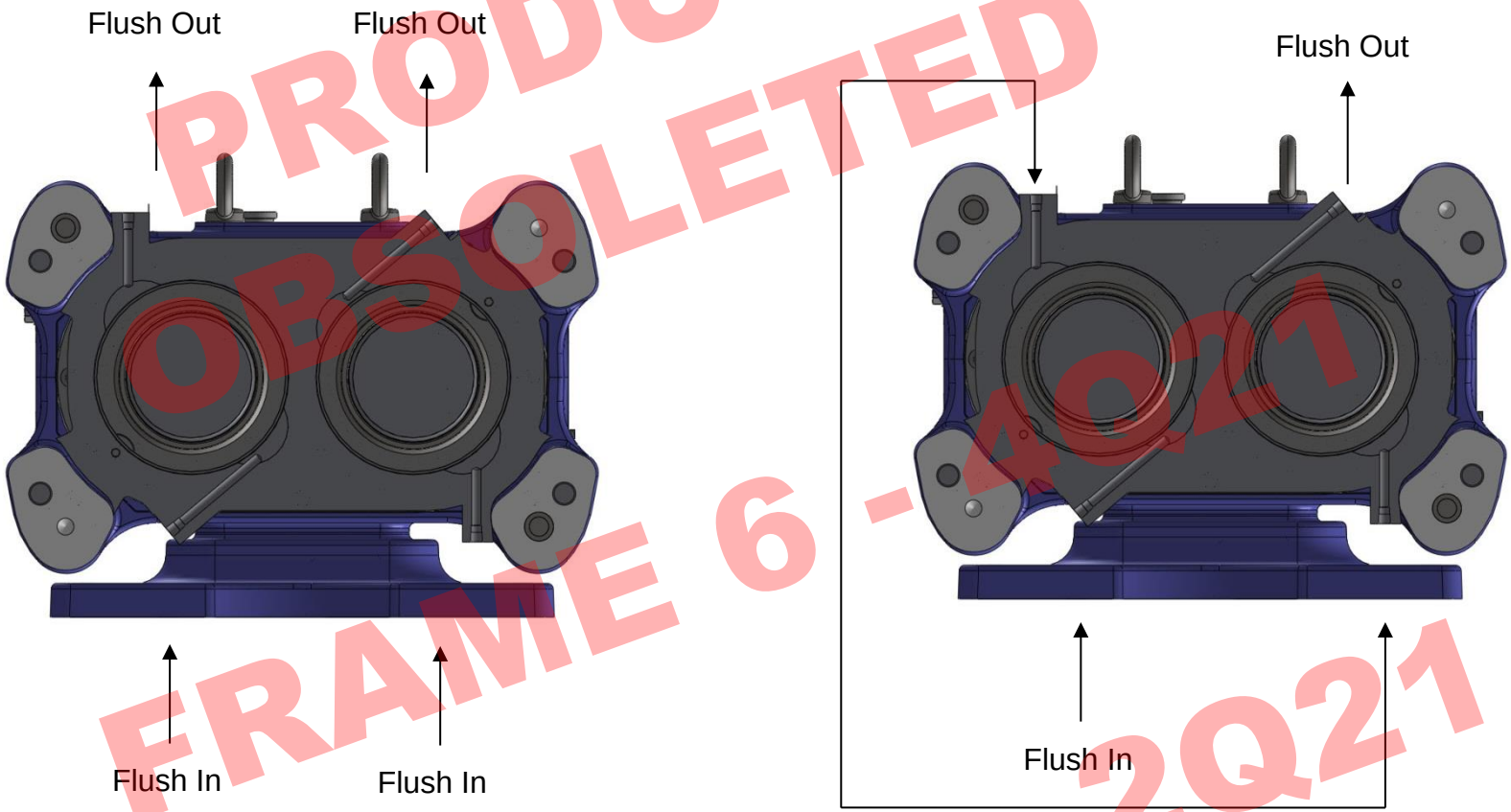
Horizontal Circular Flush



Note: The liquid supply connections to flushed seals are made using the threaded ports on the sides of the rotorcase. The pipe work should be arranged to provide an independent flush to each seal.

Vertical Straight Flush

Vertical Circular Flush



Note: The liquid supply connections to flushed seals are made using the threaded ports on the sides of the rotorcase. The pipe work should be arranged to provide an independent flush to each seal.

4.0 Revolution Disassembly and Assembly.

Before starting any work on the pump the recommended Shutdown Procedure should be followed, refer to section 3.6.

While disassembling or assembling the pump it is essential to ensure that the pump and/or components are secured to provide adequate stability.

Large pump components or sub-assemblies should be installed using suitable devices. Use threaded holes for the attachment of lifting eyes where appropriate for servicing pump. Threaded holes fixed with lifting eyes on pump are not suitable for lifting pump skids. Pump skids consist of one or all of the following components metal skid, electric motor, reduction drives, coupling, shaft guard, or any other component that is not part of the principal pump. Pump skids must be lifted by other means suitable to their weight and application. When lifting a skid consult a certified or otherwise qualified person with expertise on the subject of slings and riggings.

During disassembly or before assembly, all components should be inspected for fit, wear and damage. If worn or damaged the components should be replaced.

The position of all parts should be identified as they are removed to ensure they are reinstalled in the same position.

Lip seals and o-rings are incorporated within the gearbox assembly to contain the lubricant for the bearings and timing gears. Regular inspection and correct maintenance of these items will ensure that the lubrication is sustained and the pump maximum working life is achieved. To ensure this, it is extremely important that care is taken when removing and replacing new o-rings and lip seals. When removing and replacing lip seals ensure that the location bore for the outside diameter and the seat for the back of the lip seal is not damaged as this may create a leak path for the lubricant.

When removing lip seals or o-rings care should be taken to avoid cutting or tearing the sealing faces as they pass over keyways, splines, threads or other potentially sharp or abrasive edges. All lip seals and o-rings should be carefully examined and if damaged in any way, be replaced.

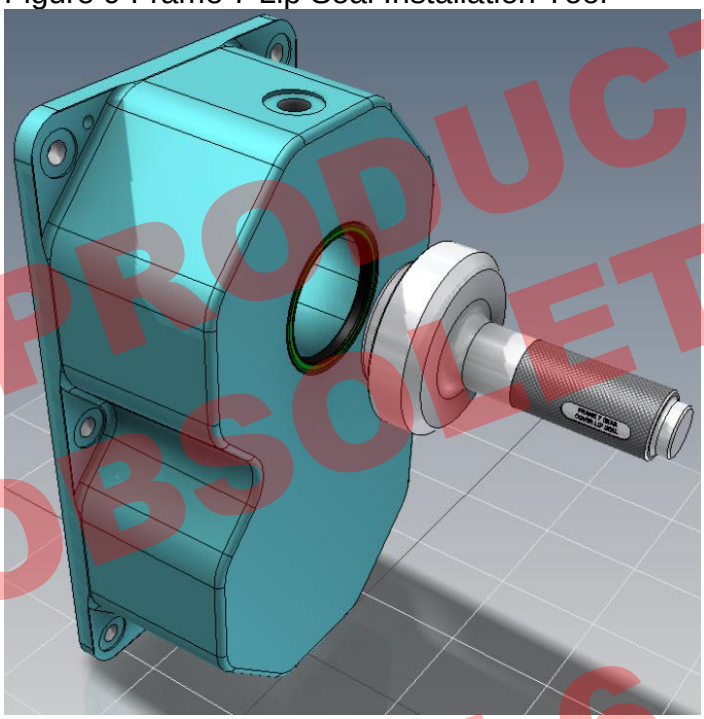
All o-rings and sealing lips of lip seals should be lightly lubricated with an appropriate lubricant (suitable for application) before installing.

When installing lip seals do not allow the rear face to come into contact with bearings or other rotating parts.

Prior to beginning assembly, ensure all parts are clean and free from burrs or damage. Where a vice is to be used then this should be installed with protective jaws to avoid damage to components. Do not hammer or apply undue force to install or position components. Special lip seal installation

tool part number RA79-7500-01 is available from the factory to assist in lip seal installation of Frame 7 gearbox cover.

Figure 9 Frame 7 Lip Seal Installation Tool



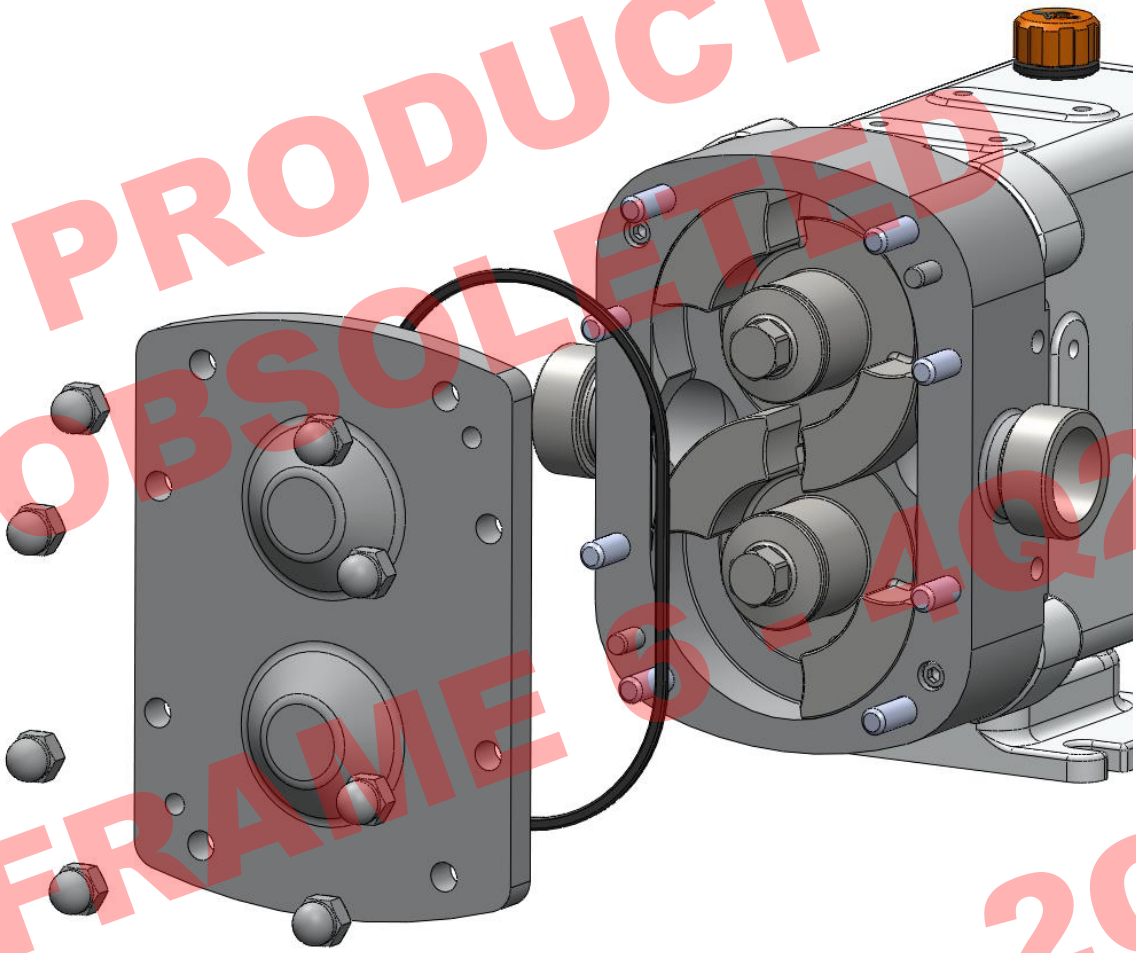
WARNING

All fasteners are required to be tightened to the required torque setting during assembly, refer to section 6.2.

4.1 Disassembly.

4.1.1 Front Cover and Rotor Removal.

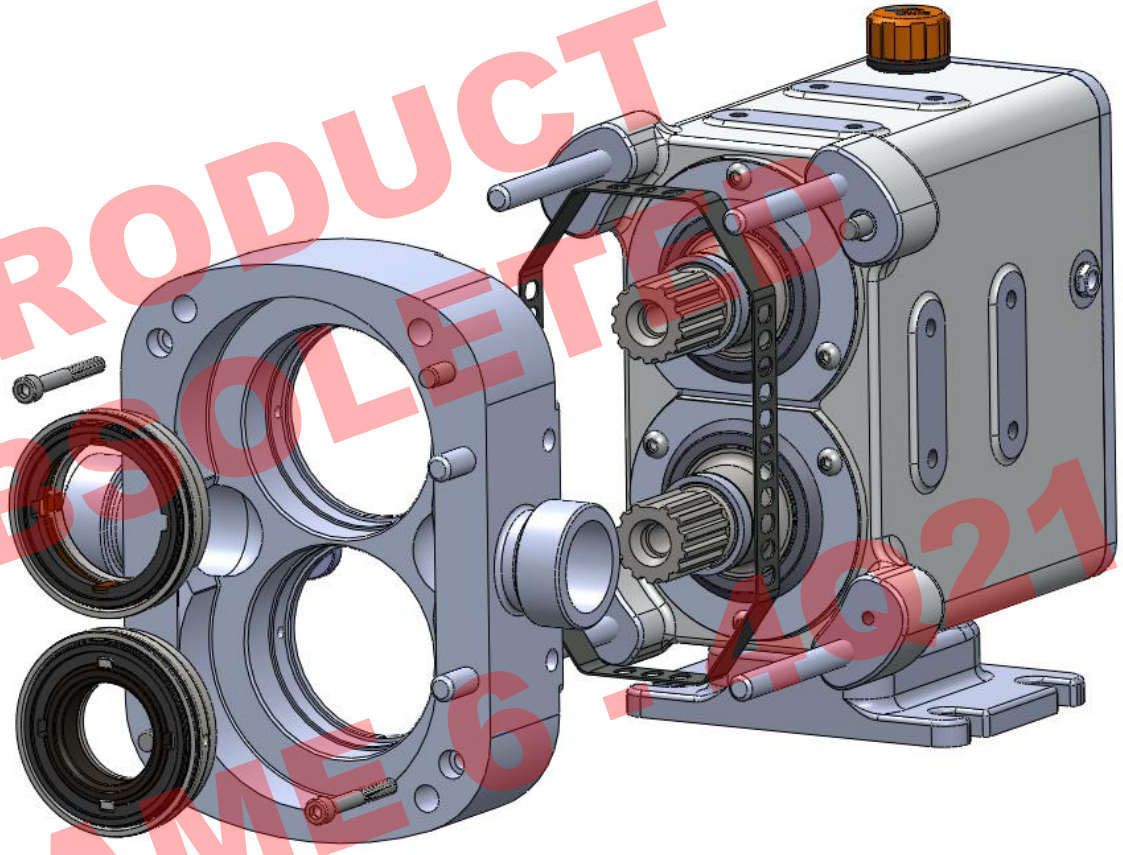
Fig 15.1



- Remove the front cover dome nuts.
- Remove the front cover and the front cover o-ring.
- Remove the rotors by unscrewing the rotor retaining bolts and o-rings, remove 3 bolts and rotor retainer plates and o-rings, taking care not to damage the product seal components.

4.1.2 Rotorcase Removal

Fig 16



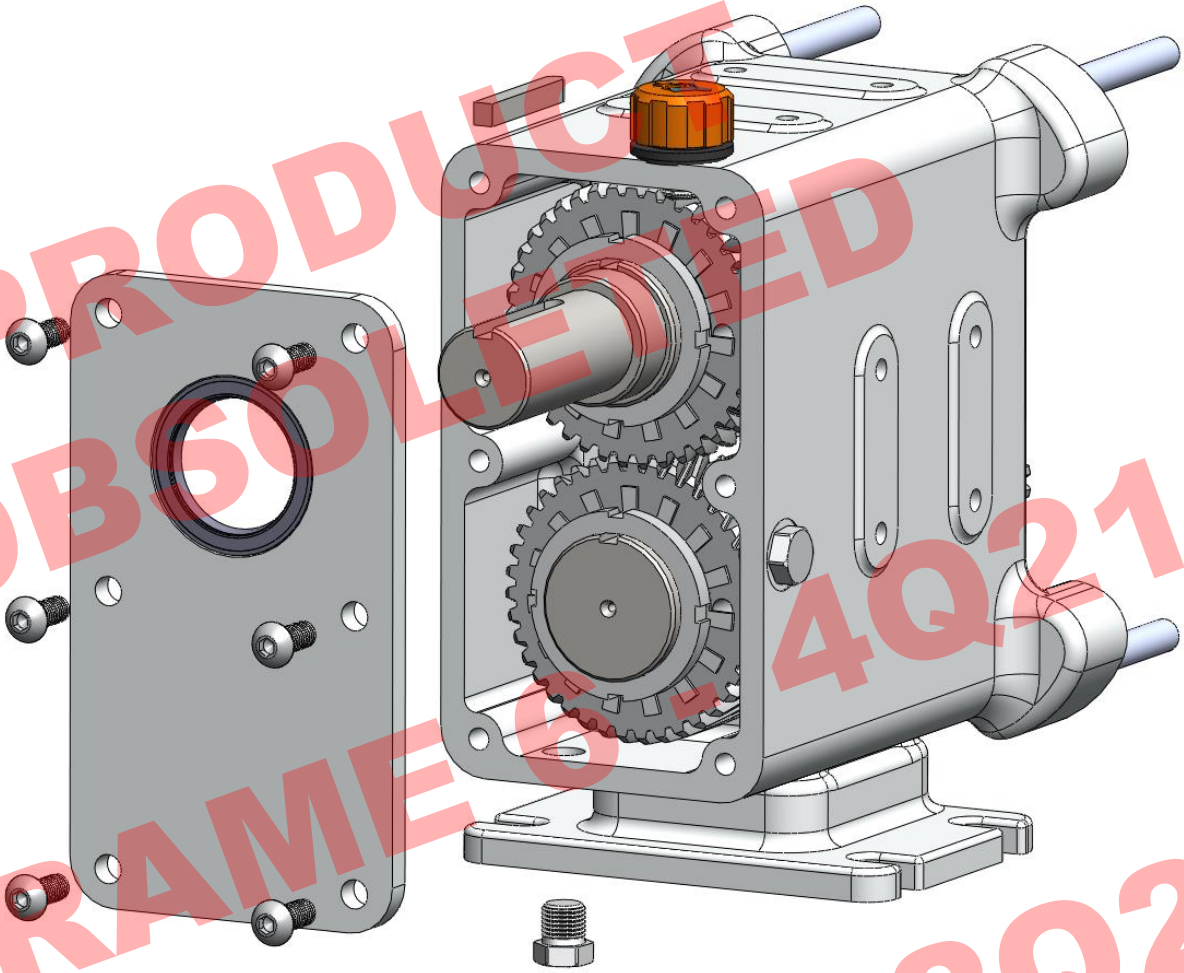
- Remove the 2 Seal Housings making sure that the static face is not damaged.

- Remove the 2 rotorcase retaining screws and then remove the rotorcase.

- Remove the guard.

4.1.3 Gearbox Disassembly.

Fig 17



- Make sure the gearbox lubricant has drained by removing the drain plug.
- Remove the drive key.
- Remove the hexagon head bolts and remove the gearbox cover.

4.1.4 Gear removal.

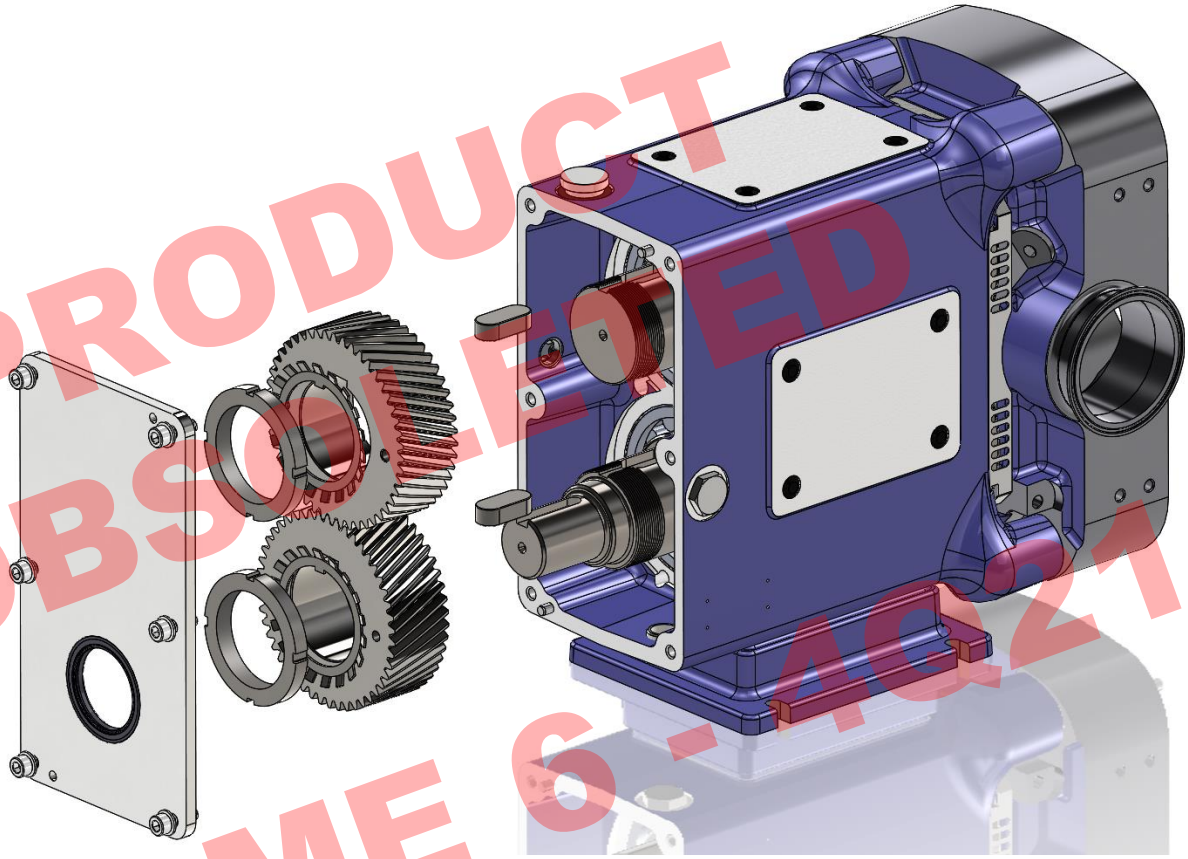


Fig 18

- Remove the lock nuts and tab washers.
- Remove the gears, the 2 threaded holes within the gears can be used to aid gear removal with a puller tool.

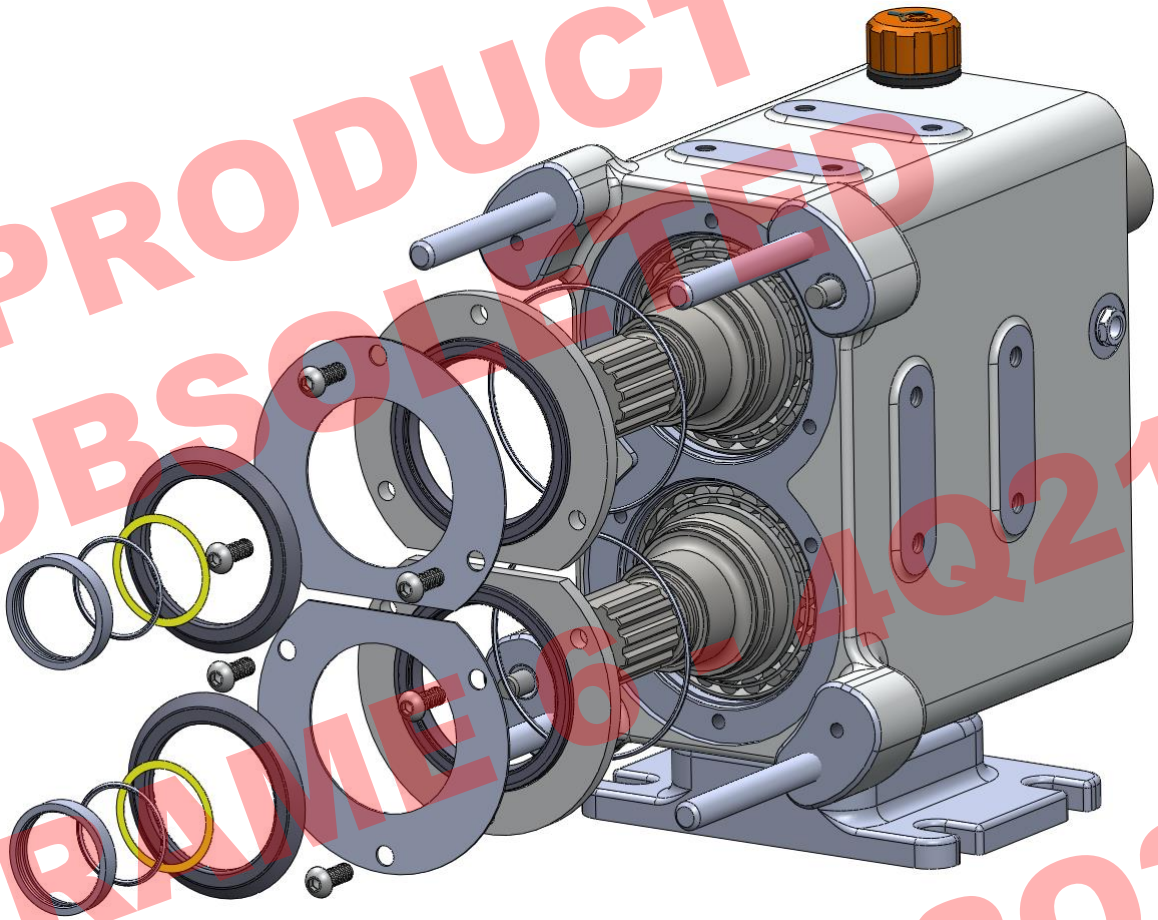
The 2 threaded holes are to be used only in conjunction with gear pullers – any other use will damage components.

- Remove the gear keys and then remove the gear spacer.

Keep the locknut, tab washer, gear, key, shims and gear spacer in the sets that they were removed and identify them drive and lay.

4.1.5 Front Spacers and Lip-seals.

Fig 19



- Remove the front spacer ring, o-ring and shims.

  Keep these in the sets that they were removed and identify them drive and lay.

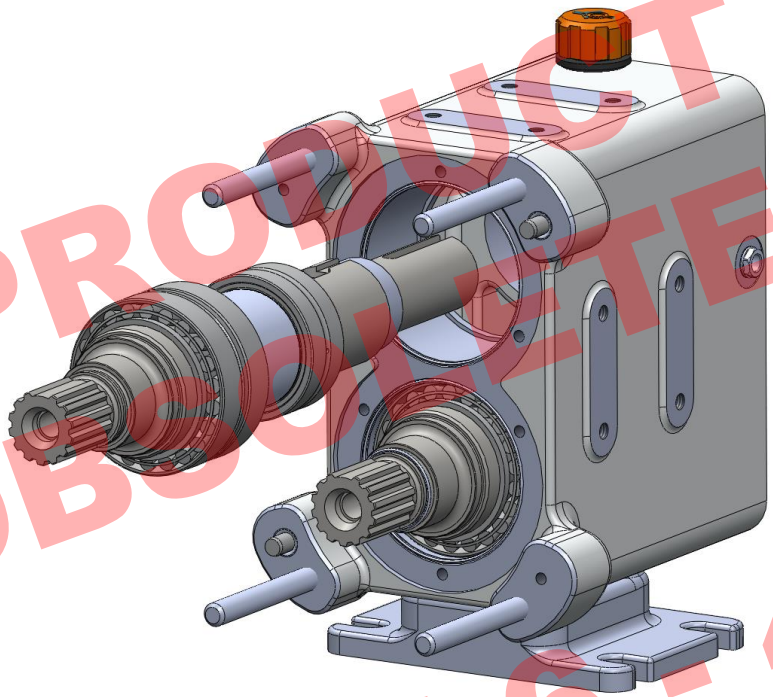
- Remove the screws holding the lip seal carriers.

- Remove the optional gamma seal, counter face gamma seal, bearing retainer plate and the o-ring.

At this point the shafts are not held in place so take care when moving the gearbox.

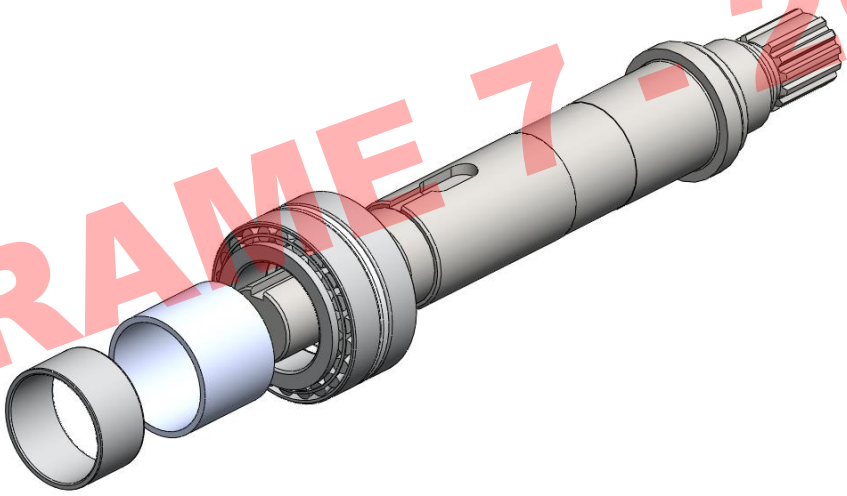
4.1.6 Shaft and Bearing Removal.

Fig 20



- Using a light press remove the shafts.

Fig 21

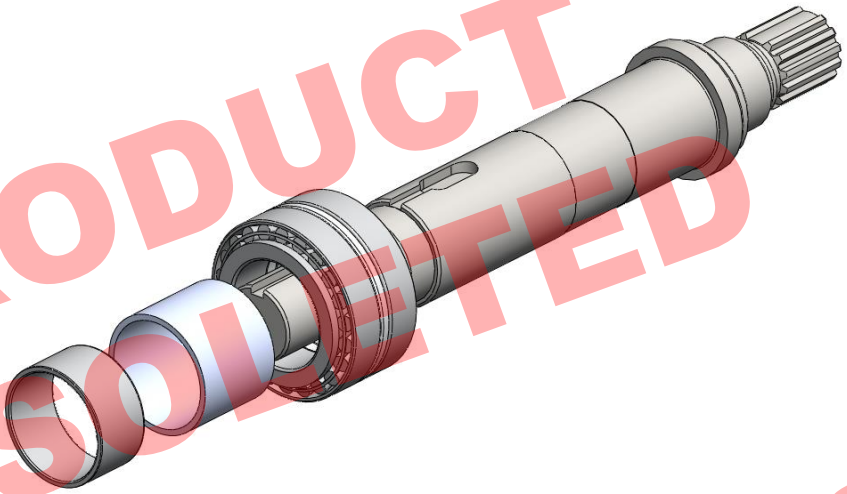


- Remove the bearings and spacer using a press

4.2 Assembly.

4.2.1 Shaft Assembly.

Fig 22



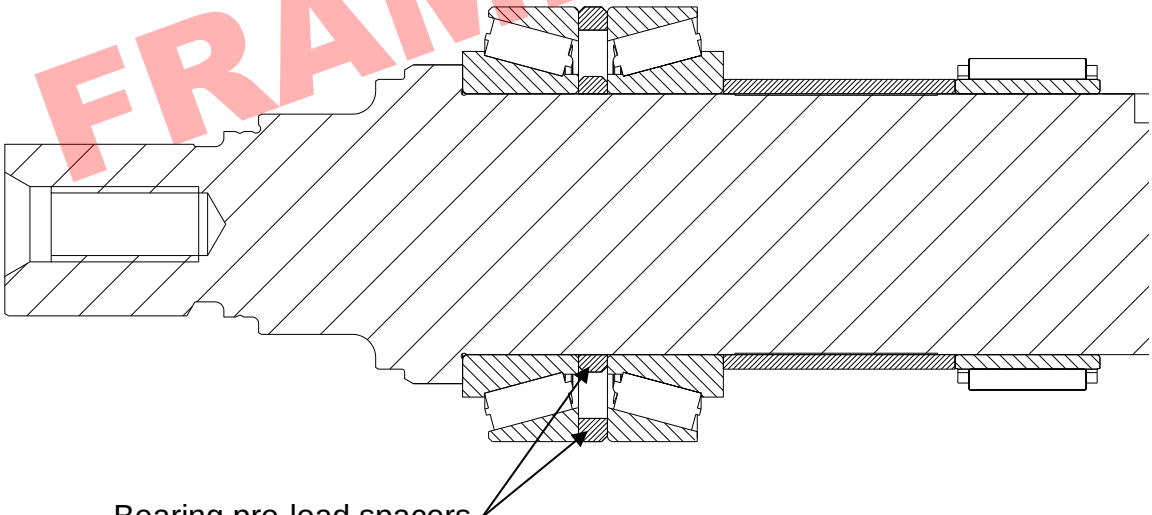
WARNING

- The tapered roller bearings have matched pre-load spacers; these set the rolling torque and must be kept with the matching bearings.

The preferred method of installing bearing cones is that they are heated to approximately 125°C (250°F) prior to installation. During this operation protective gloves should be used. Once bearing cones are installed in the correct position they should be allowed to cool before proceeding with assembly. After bearings cool they need to be pressed to assure they are fully seated. Press to 15 tons make sure necessary procedures are used to prevent component damage. During assembly press taper bearings onto shaft then press roller bearing onto shaft.

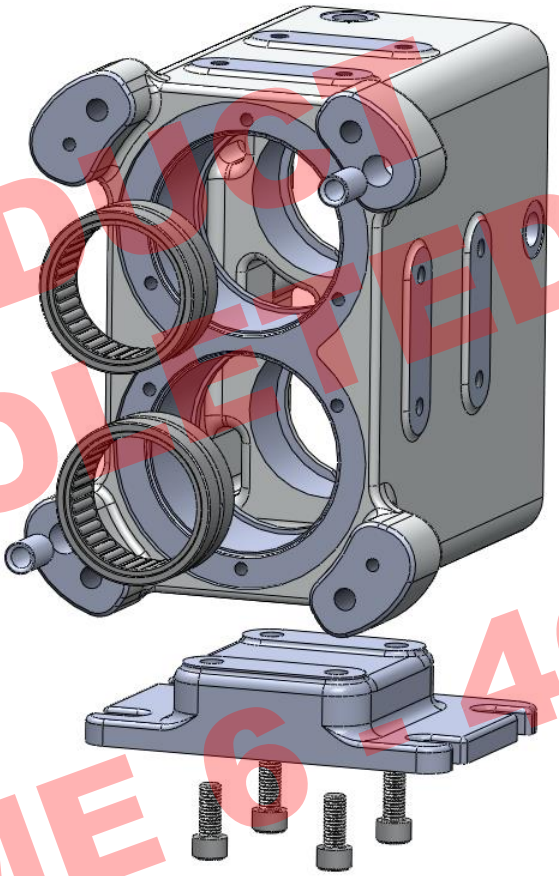
Under no circumstances should bearing cones or cups be hammered into position.

Fig 23



4.2.2 Gearbox.

Fig 24



- Install the foot and secure with the screws.

  The foot screws need to be retained using a thread locking compound adhesive, Loctite 270 or similar.

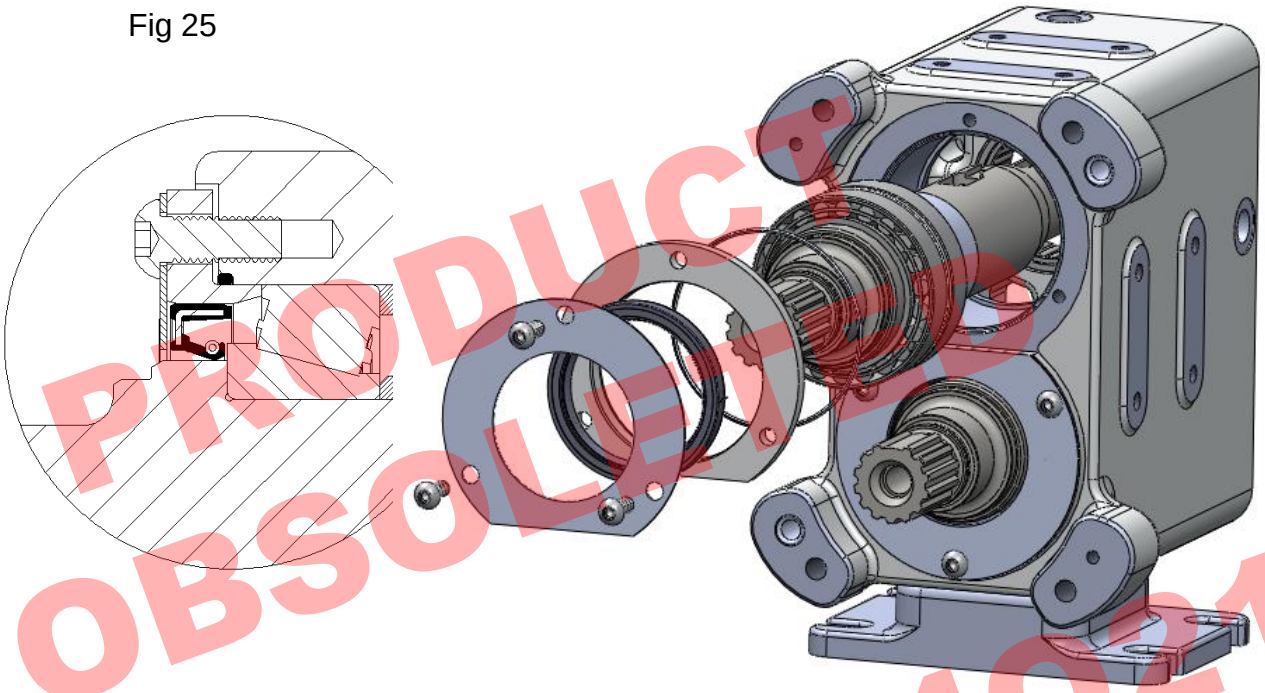
- Press in the rear outer shells of the needle roller bearings.

- Press in the dowel bushes.

  The dowel bushes need to be retained using a retaining compound adhesive, Loctite 638 or similar.

4.2.3 Shaft Installation.

Fig 25



- Install the shaft assemblies.
  - Light oil applied to the bearing bore will aid in assembly
  - Set gear box over bench with hole to allow shaft to drop through, or another holding fixture which allows shaft to drop through the gear box. Drop shaft assembly into gear box with aid of a hoist. Tap shaft into place with rubber mallet by hitting top of shaft. If needed, lightly press against the outer bearing race with an appropriate tool to fully seat the bearing and shaft assembly.

WARNING

Bench or holding apparatus must be of sufficient strength to hold weight of pump while tapping shaft into place.

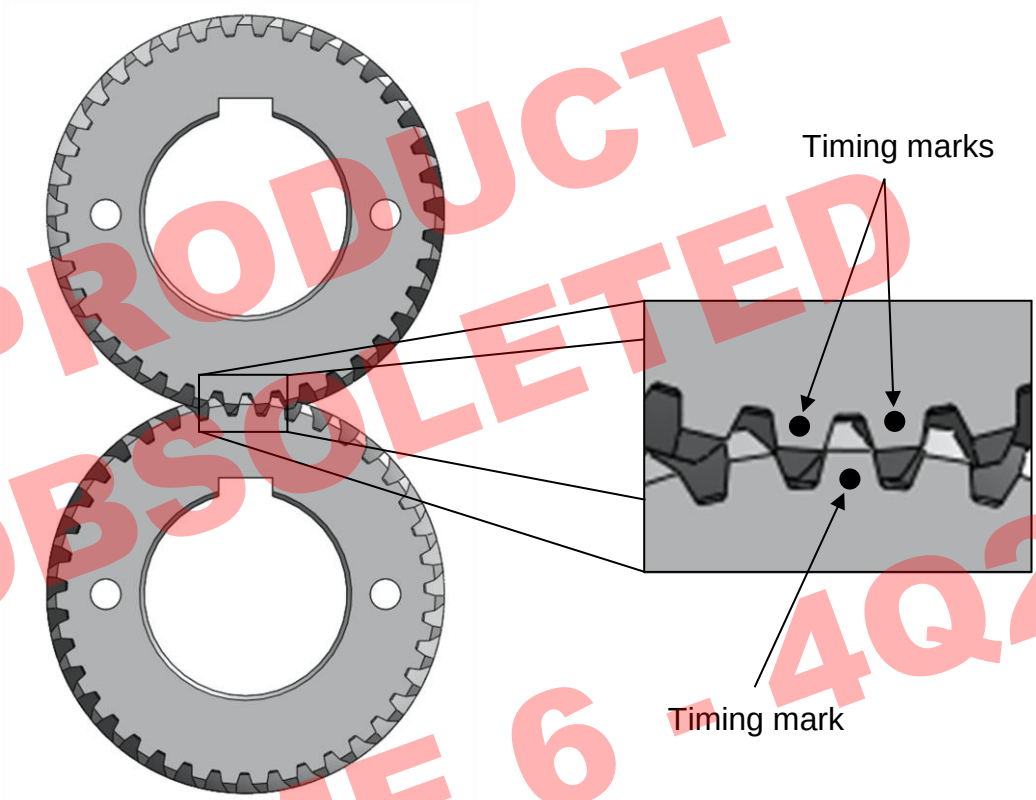
When installing the shafts make sure they are installed square to the gearbox and that none of the rollers on the needle roller bearing get obstructed.

- Install the lip-seals into the bearing retainer plate use special tools.
  - See section 4.0
- Install the o-ring, bearing retainer plate and optional counter face gamma seal.
- Install the screws and torque them up.

  See section 6.2 for torque settings.

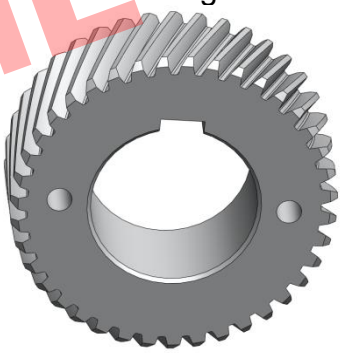
4.2.4 Timing Marks and Drive Gear Identification.

Fig 26



- Before installing the gears into the gearbox, identify the location of the timing marks and make sure they are lined up per above during installation. The gear with one mark should correspond with the drive shaft.

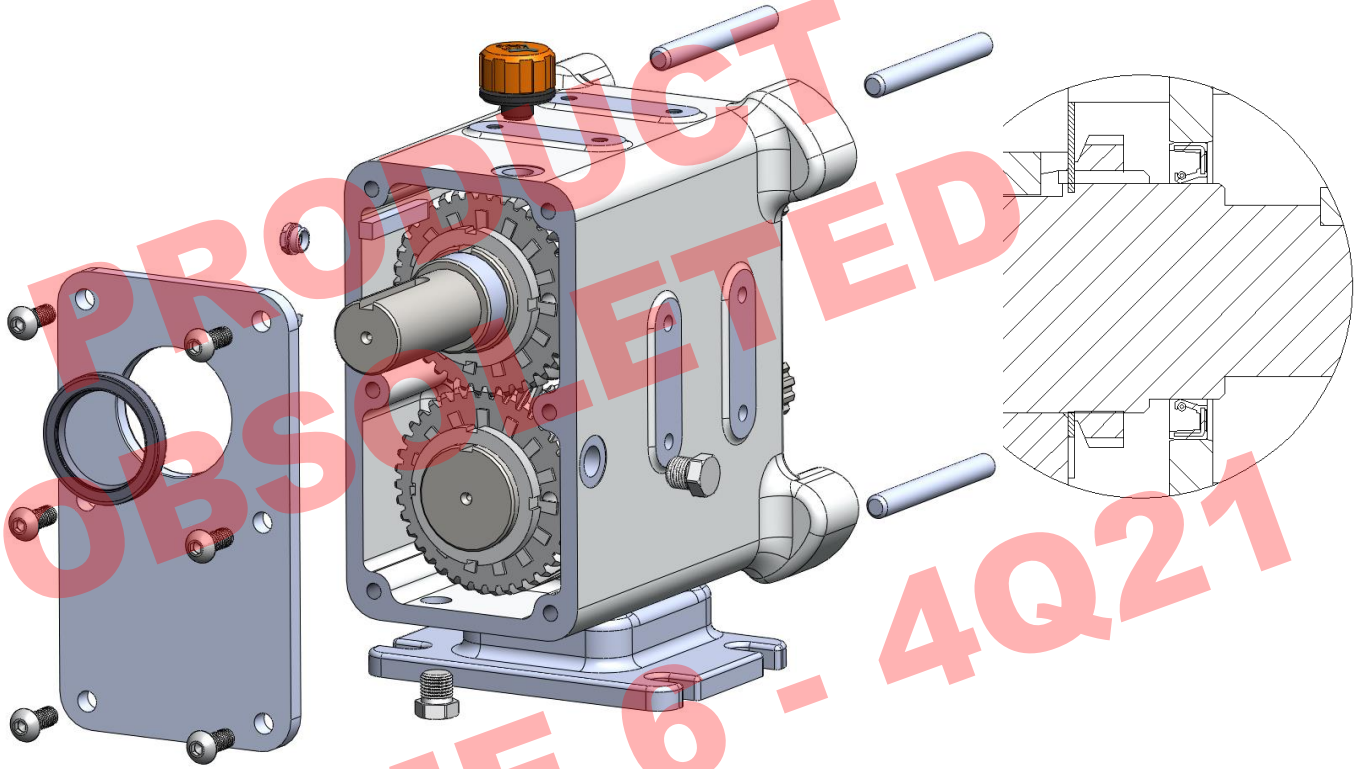
- The drive gear must be installed onto the drive shaft. The drive gear can be identified by looking at the direction of the helix angle, if the helix angle is slanting to the right then it's the drive gear see below.



- When installing the gears note the gear spacer and the keys must be installed first – otherwise the gear will foul on the gearbox and the timing will move.

4.2.5 Gearbox / Rotorcase Assembly.

Fig 33



- Once the correct timing is achieved lock the tab washers onto the gears.
- Install the oil filler plug, oil sight glass and the oil drain plugs, if the pump is to be oil filled. If the pump is grease filled use the drain plugs.
- Install the lip seal into the gearbox plate.
- Seal the gearbox plate using flange sealant, dow corning 732 or similar and secure using the screws. See section 6.2 for torque settings.
- Install the drive key.
- Install the rotorcase studs.

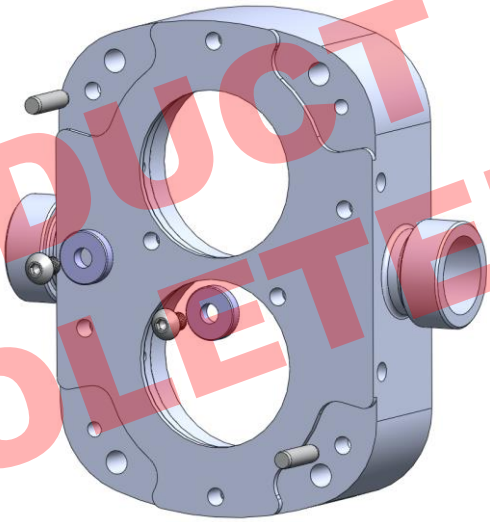
  The rotorcase studs need to be retained using a thread locking compound adhesive, Loctite 270 or similar.

- Install the anti-rotation washers and secure them with the button head screws, see section 6.2 for torque settings.

- Install the dowels.

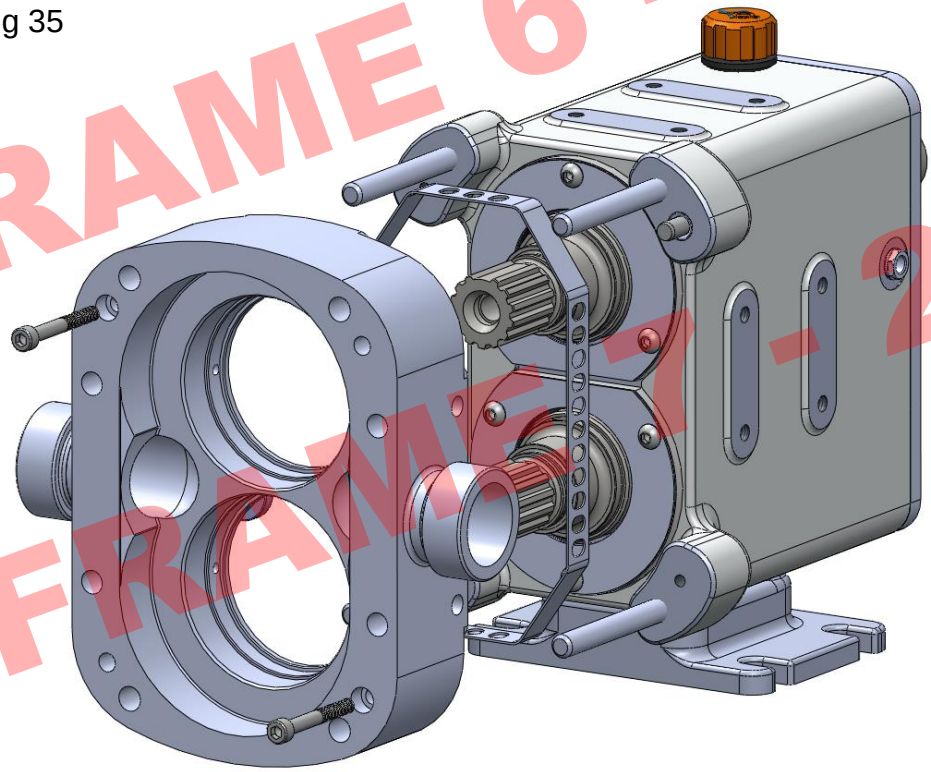
  The dowel bushes need to be retained using a retaining compound adhesive, Loctite 638 or similar.

Fig 34



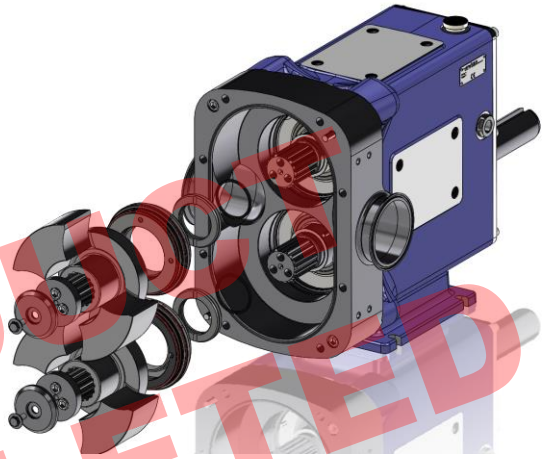
- Install the guard and rotorcase and secure using the retaining screws

Fig 35



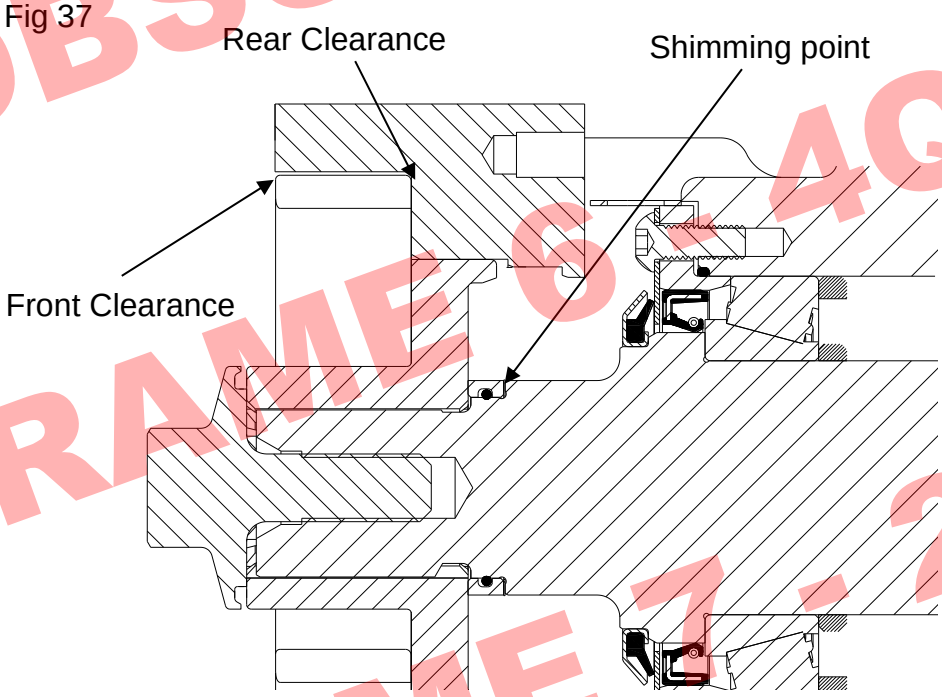
4.2.6 Front Clearance.

Fig 36



- Install the shims, front setting ring, rotor, rotor retainer and tighten them up, see section 6.2 for torque settings.

Fig 37



- Measure the front clearance and rear clearance and use the clearance chart section 6.1 to see how much shim you need to add / remove from the shimming point.

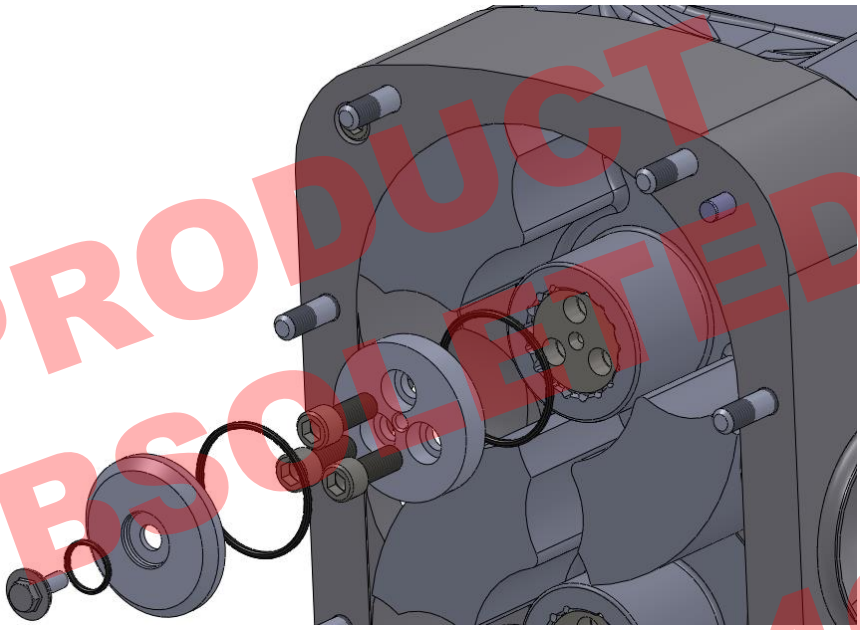
- After the front clearances have been set install the o-ring into the setting ring.

When checking the front and rear clearances secure the rotorcase in place using washers and nuts on the studs protruding from the gearbox.

After the front clearance has been set check the radial clearances
See section 8.1 for clearance settings.

4.2.7 Final assembly Size 6 & 7.

Fig 38



- Install pump seals before final assembly see section 5
- Install the rotor retainer o-ring, rotor retainer and the 3 Socket head cap screws - set the torque. See section 6.2
- Install the rotor retainer cap o-ring and the rotor retainer cap. Install the rotor retainer o-ring and retainer – set the torque See section 6.2.

  The rotorcase studs need to be retained using a thread locking compound adhesive, Loctite 270 or similar.

- Install the front cover o-ring, front cover and secure with the dome nuts.

5.0 Seal Section.

5.1 Single Seal.

Fig 39.1 Frame 6 Single Seal Cross Section

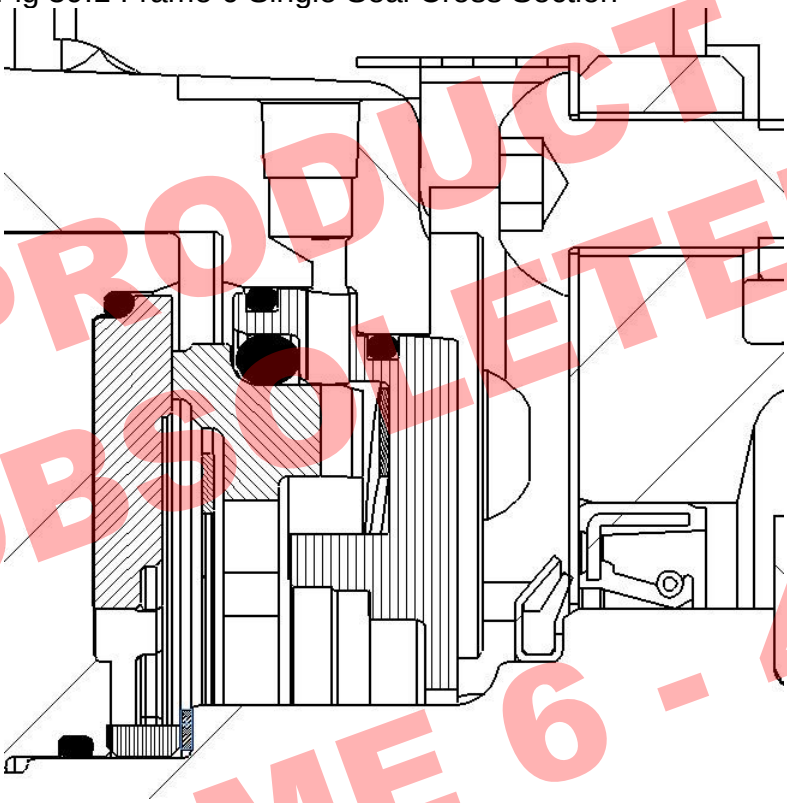


Fig 39.2 Frame 7 Single Seal Cross Section

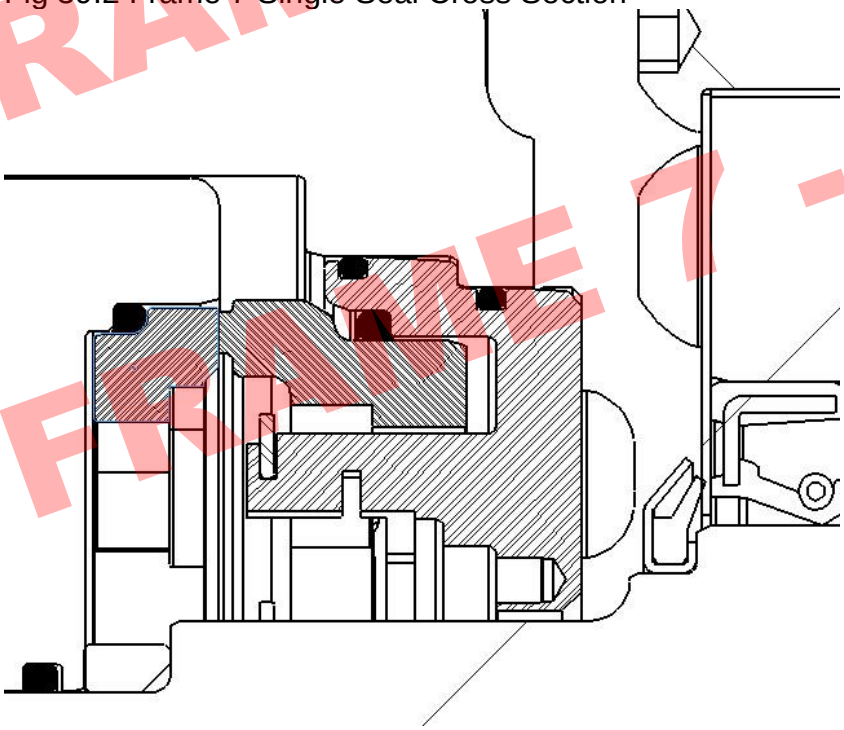
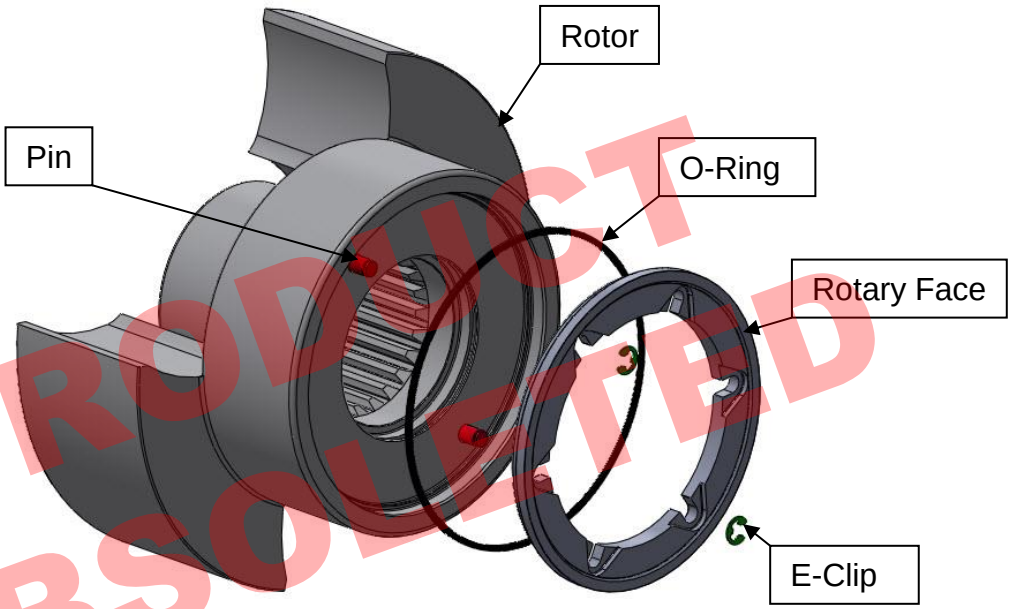
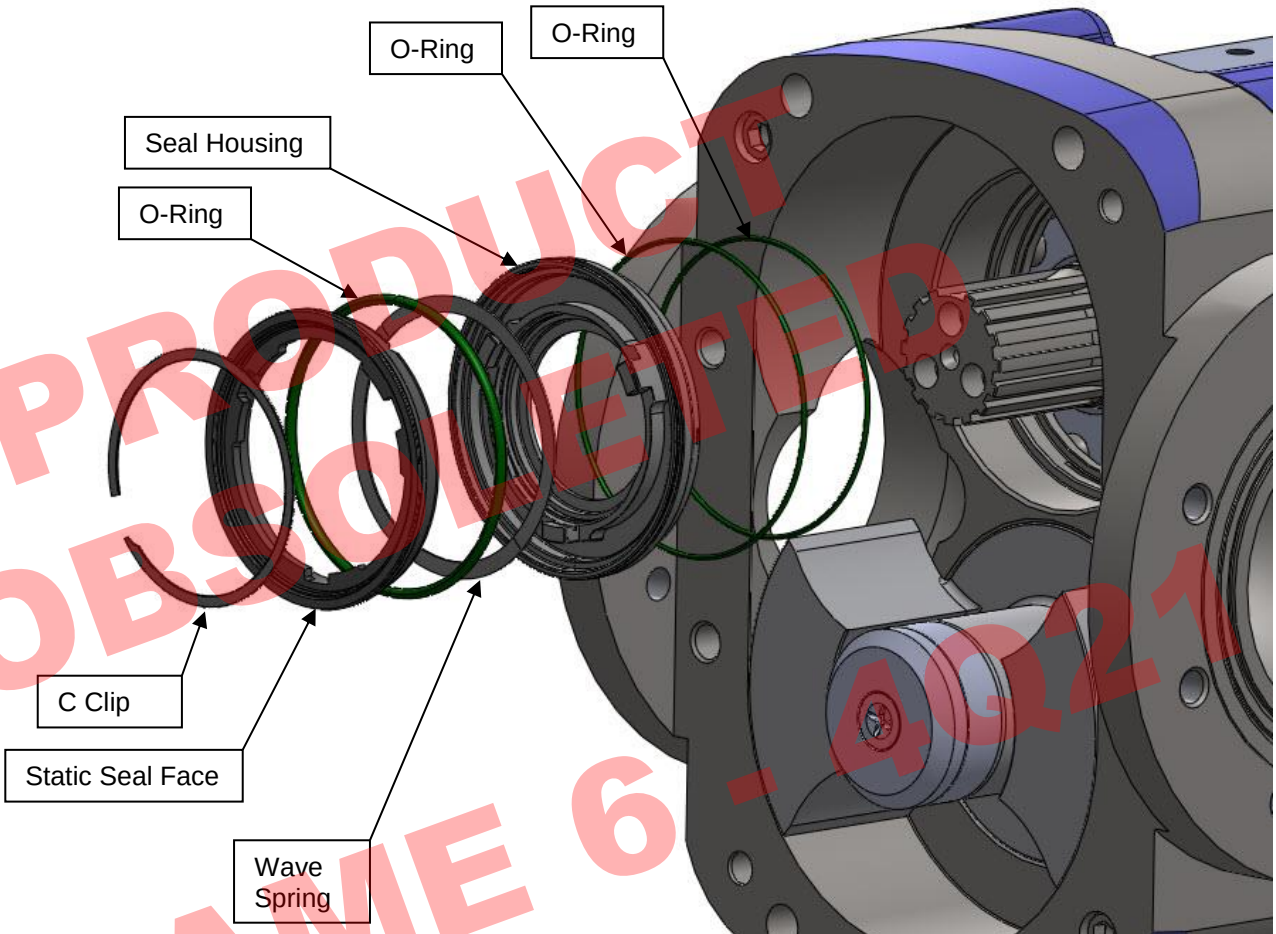


Fig 40.1 Frame 6 & 7 Rotary Seal Face



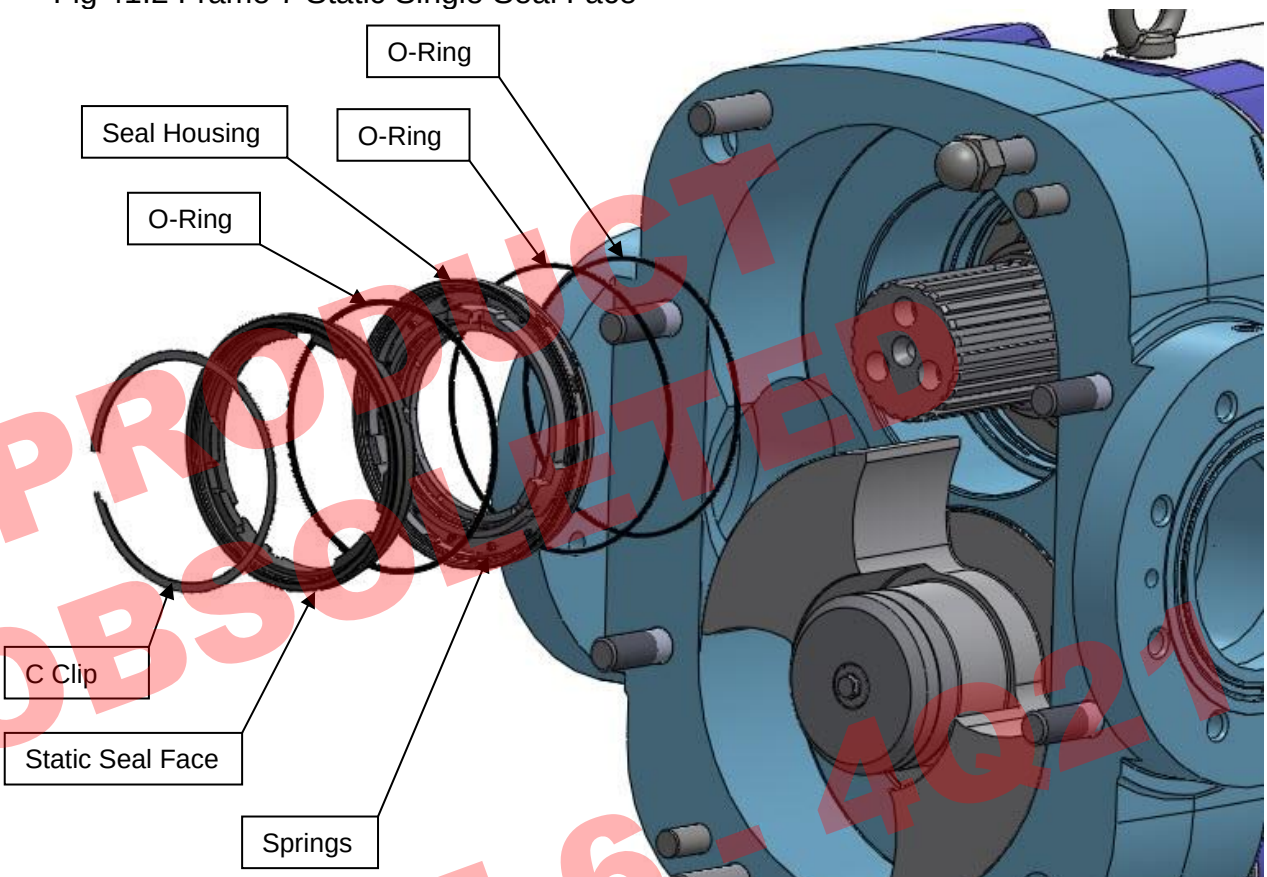
- Install pins into rotor 8mm of the Frame 6 pin should stand out and 12.5 mm of the Frame 7 pin should stand out
- Install the o-ring into the rotor.
- Install the rotary face into the rotor making sure the pins line up with seal face slots. Install clips onto pins.

Fig 41.1 Frame 6 Static Single Seal Face



- Frame 6
  - Install two o-rings onto the seal housing.
  - Install the seal housing into the rotorcase.
  - Install o-ring over seal face
  - Install wave spring into housing
  - Install static seal face
  - Install C Clip
  - Alternatively put seal together on bench and install as unit

Fig 41.2 Frame 7 Static Single Seal Face



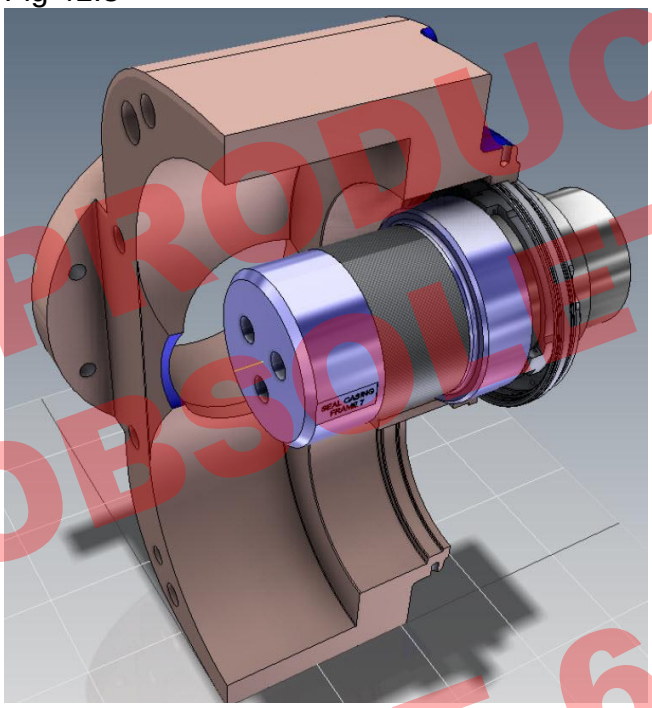
When installing the seal housing into the rotorcase the anti-rotation cut out must line up with anti-rotation washer on the rear of the rotorcase.

- Frame 7
  - Install two o-rings onto the seal housing.
  - Install the seal housing into the rotorcase.
  - Install o-ring over primary seal face
  - Install static seal face
  - Install C Clip
  - Alternatively put seal together on bench and install as an assembly
- Frame 6 and 7 Special Seal Installation Tool
  - Although not necessary but advised use seal installation tool part number RA69-4000-01 for Frame 6 and RA79-4000-01 for Frame 7 available from factory to assist in installation.
    - Align seal housing to anti rotation washer retainer washer
    - Slightly push seal into rotorcase to engage housing into anti rotation washer
    - Install seal installation tool over shaft and careful bottom out on seal face

WARNING Do not damage or chip seal face, if seal face chips replace seal

- Install rotor retainer bolts through seal installation tool
- Tighten bolts to draw seal tight into rotorcase

Fig 41.3



5.2 Double Seal – Flushed.

Fig 42.1 Frame 6 Double Seal Cross Section

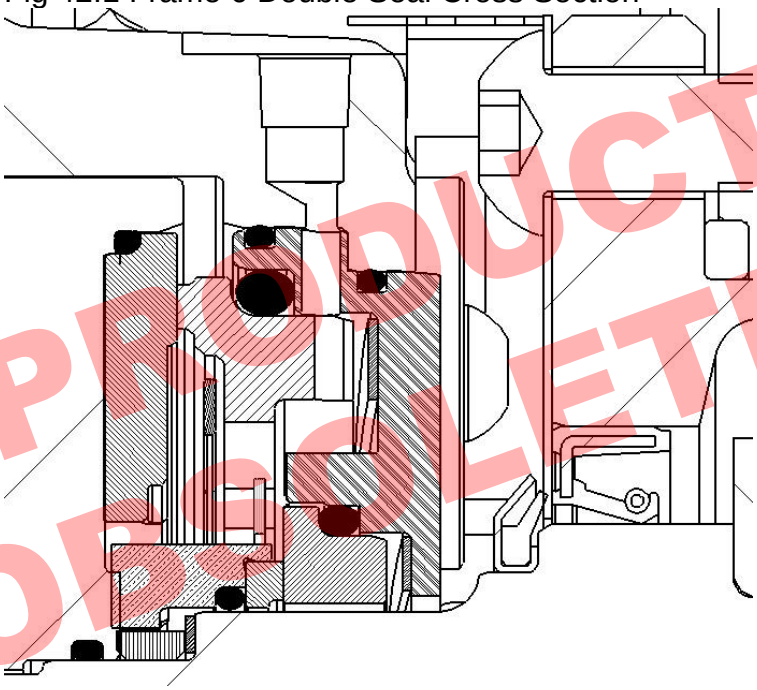


Fig 42.2 Frame 7 Double Seal Cross Section

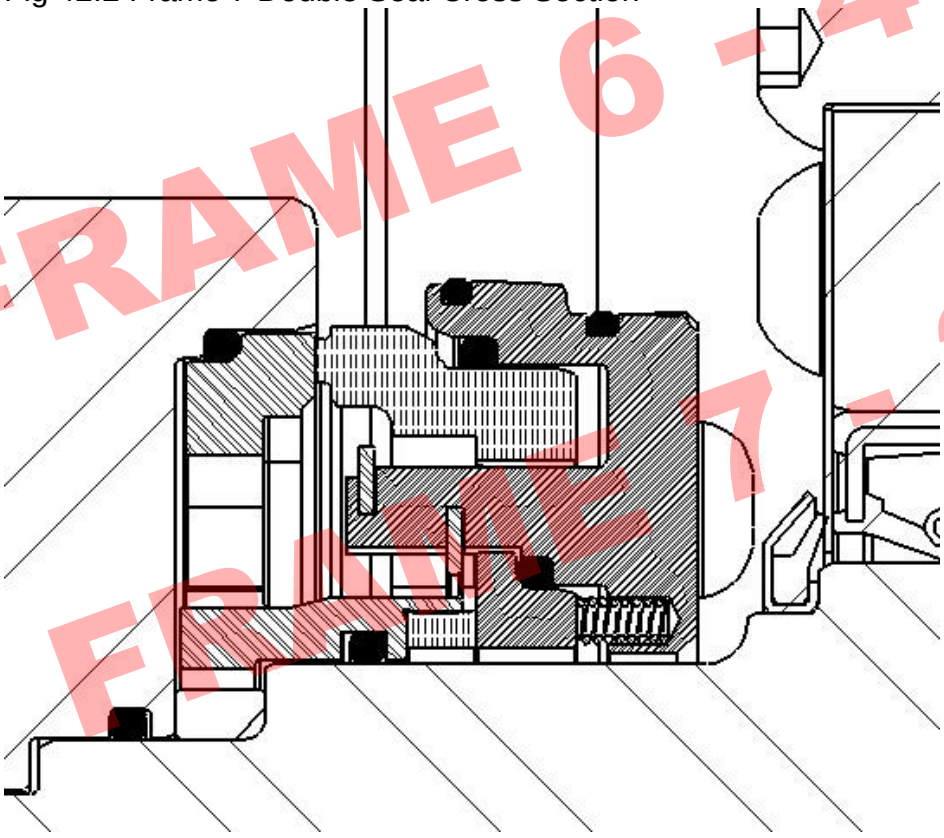
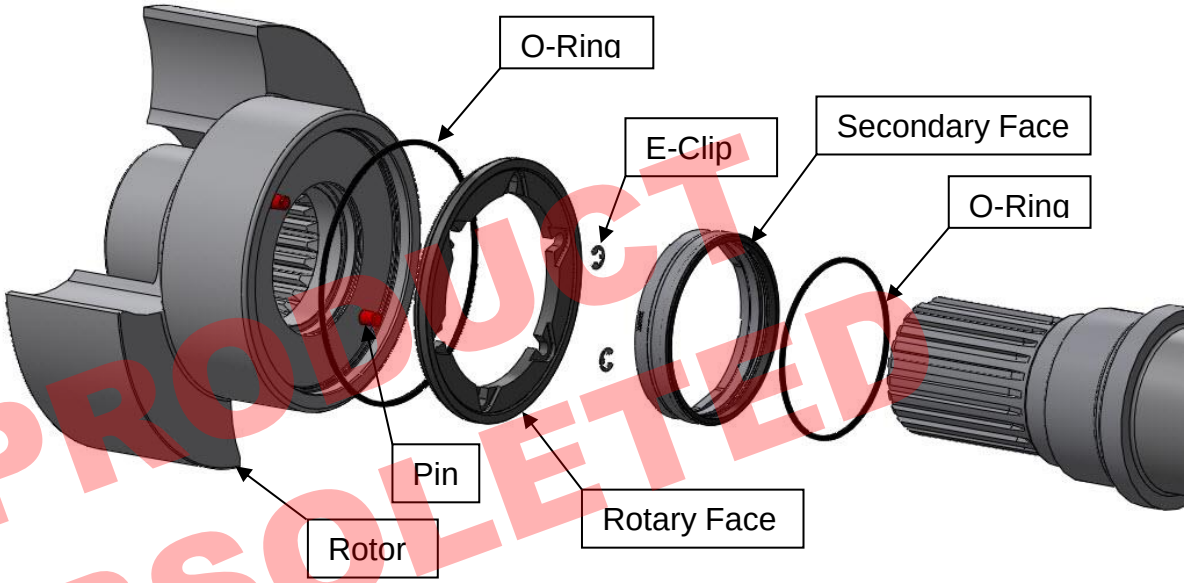
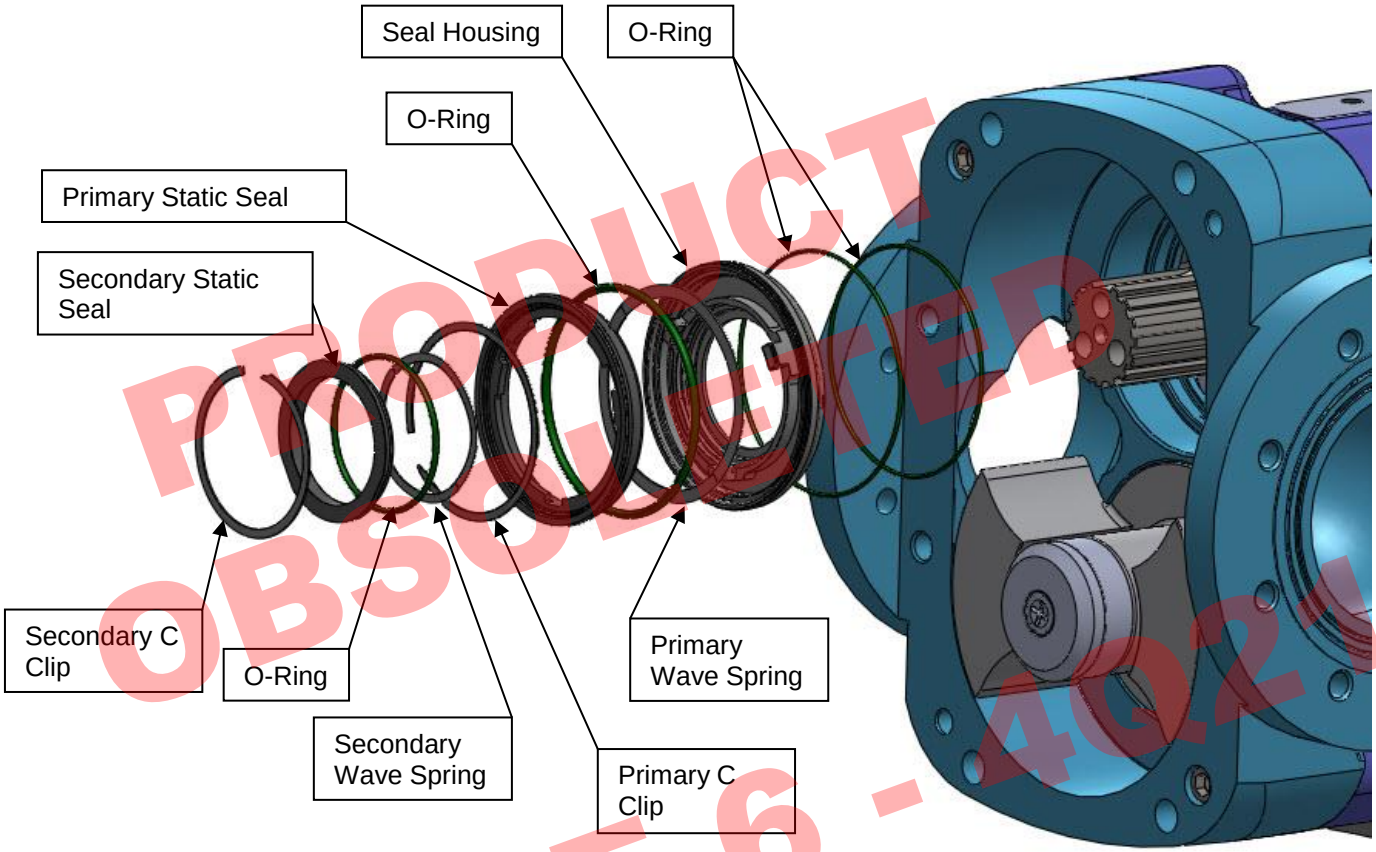


Fig 43.1 Frame 6 & 7 Rotary Seal Face



- Install pins into rotor 8mm of the Frame 6 pin should stand out and 12.5 mm of the Frame 7 pin should stand out
- Install the o-ring into the rotor.
- Install the rotary face into the rotor making sure the pins line up with seal face slots.
- Install clips onto pins.
- Install oring into secondary face
- Install secondary face over shaft

Fig 44.1 Frame 6 Static Double Seal

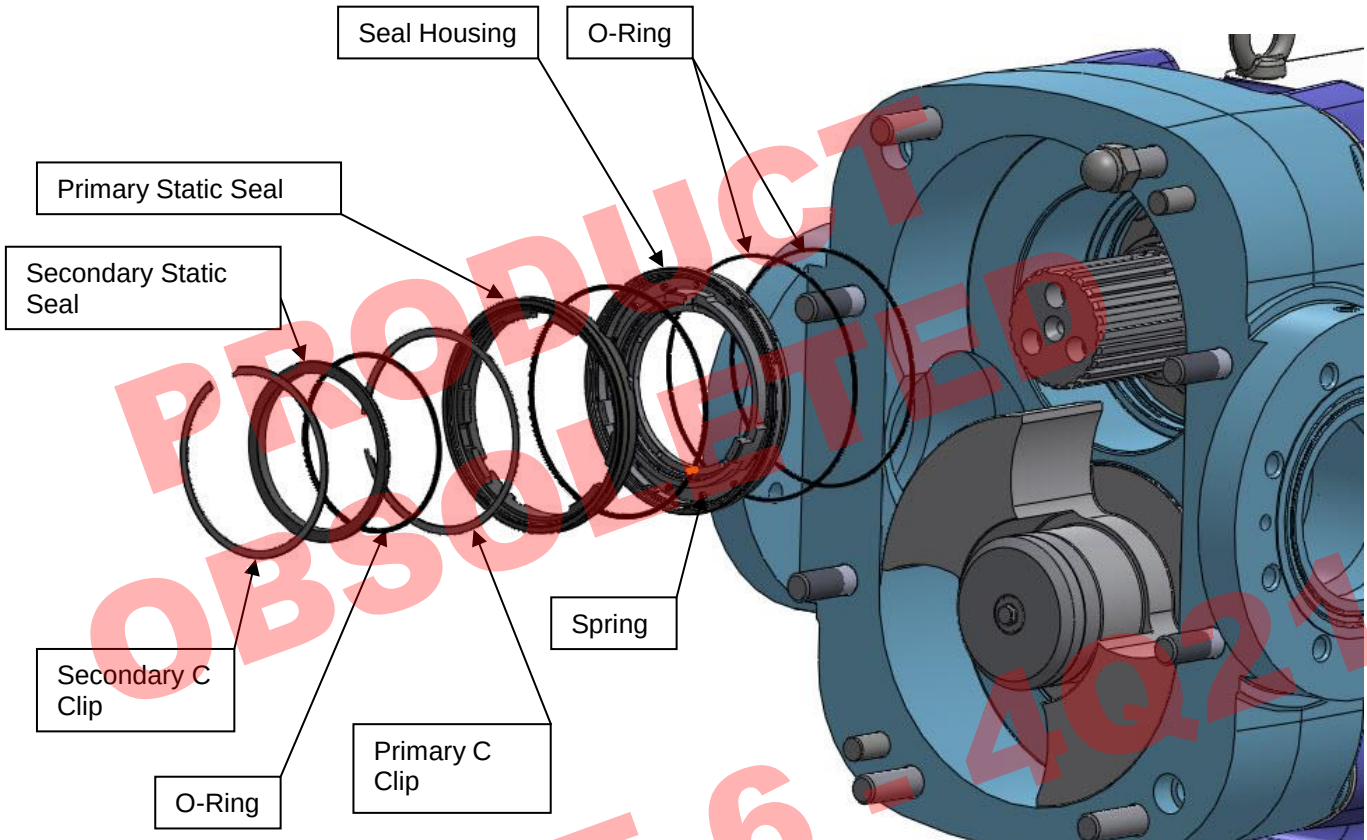


- Frame 6
  - Install the 2 seal housing o-rings into the seal housing.
  - Install the seal housing into the rotorcase.

When installing the seal housing into the rotorcase the anti-rotation cut out must line up with anti-rotation washer on the rear of the rotorcase.

  - Install secondary wave spring
  - Install oring over secondary seal face
  - Install secondary seal into housing using C clip
  - Install primary wave spring
  - Install o-ring over primary seal face
  - Install primary seal into housing using C clip

Fig 44.2 Frame 7 Static Double Seal



- Frame 7
  - Install the 2 seal housing o-rings into the seal housing.
  - Install the seal housing into the rotorcase.

When installing the seal housing into the rotorcase the anti-rotation cut out must line up with anti-rotation washer on the rear of the rotorcase.

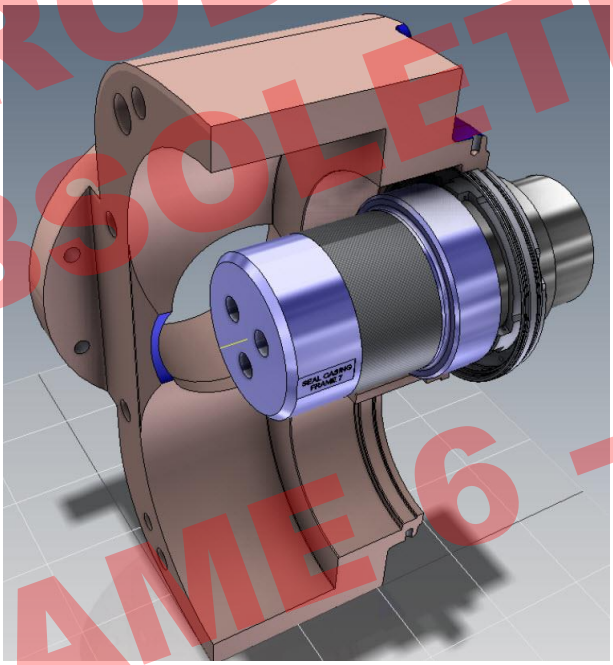
  - Install oring over secondary seal face
  - Install secondary seal into housing using C clip
  - Install o-ring over primary seal face
  - Install primary seal into housing using C clip
- Frame 6 and 7 Special Seal Installation Tool
  - Although not necessary but advised use seal installation tool part number RA69-4000-01 for Frame 6 and RA79-4000-01 for Frame 7 available from factory to assist in installation.

- Align seal housing to anti rotation washer retainer washer
- Slightly push seal into rotorcase to engage housing into anti rotation washer
- Install seal installation tool over shaft and careful bottom out on seal face

WARNING Do not damage or chip seal face, if seal face chips replace seal

- Install rotor retainer bolts through seal installation tool
- Tighten bolts to draw seal tight into rotorcase

Fig 44.3



5.3 Flushed Product Seals Auxiliary Services.

i) Terminology “Flush"

To provide a liquid barrier that is induced to flow through the seal area by an external means

ii) Flush Media

WARNING The media used for flushing a seal area must be fully compatible with the pumped media, and the relevant materials of construction of the pump. Special consideration must be given to the temperature limitations of the media to ensure that no hazards are created, e.g. risk of fire or explosion.

5.4 Double Mechanical Seal.

This seal arrangement requires a supply of media to be circulated between the inboard and outboard mechanical seals.

$$Q = \frac{(0.6 \times p + 0.25) \times n \times d^3 \times T}{c_p \times \rho \times 2.5 \times 10^9}$$

Q = Flow rate	[l/hr]
p = Applied buffer / barrier pressure	[bar]
n = Shaft speed	[rpm]
d = Shaft diameter	[mm]
T = Temperature of processed media	[°C]
ρ = Specific gravity of buffer / barrier fluid	[kg/dm^3]
c_p = Specific heat capacity for buffer / barrier fluid	[kJ/(kg x K)]

Typical values for some common barrier fluids:

Media	Density [kg/dm^3]	Specific Heat [kJ/(kg x K)
Water	1.0	4.2
Olive Oil	0.9	1.6
Mineral Oil	0.9	1.7
Acetone	0.8	2.2

The sealant system should be in operation 15 minutes before the product pump is switched on, and 15 minutes after the product pump is switched off

The flow rate of the barrier fluid should be calculated to achieve the required amount of heat removal per formula above. As a guide 2 to 3 litres/min for Carbon v. St.St., Carbon v. SIC. 3 to 4 litres/min. for SiC v. SiC & TC v. SiC.

The barrier fluid should be clean and stable

Do not operate seal in product temperatures in excess of 248° F without consulting Wright Flow applications engineering

WARNING

The flush media must be supplied at a minimum flow rate of 0.5 Litres/ Minute per seal, this can be worked out by the following equation where “Q” is the flow rate.

5.5 Seal Pressure/Speed/Temperature Limits

Pressure and speed are two of the most important factors for frictional heat generation in a mechanical seal and the seal face material properties set limits to these parameters. Depending upon processed product properties, the mechanical seal design and the seal face materials tribological, physical and thermal properties the below specified limits can differ.

Seal face combinations:

Size 6:		
Single seal:	**Max pressure (at speed)**	**Max speed (at pressure)**
Carbon v. Silicon Carbide	21 bar/305 psi (600 rpm)	600 rpm (21 bar/305 psi)
Silicon Carbide v. Silicon Carbide	21 bar/305 psi (600 rpm)	600 rpm (21 bar/305 psi)
Double outboard seal:	**Max pressure (at speed)**	**Max speed (at pressure)**
Carbon v. Silicon Carbide	1 bar/14.5 psi (600 rpm)	600 rpm (1 bar/14.5 psi)
Size 7:		
Single seal:	**Max pressure (at speed)**	**Max speed (at pressure)**
Carbon v. Silicon Carbide	28 bar/406 psi (400 rpm)	400 rpm (28 bar/406 psi)
Silicon Carbide v. Silicon Carbide	26 bar/377 psi (345 rpm)	400 rpm (21 bar/305 psi)
Double outboard seal:	**Max pressure (at speed)**	**Max speed (at pressure)**
Carbon v. Silicon Carbide	1 bar/14.5 psi (400 rpm)	400 rpm (1 bar/14.5 psi)

DIRECTION OF ROTATION
The Revolution-series mechanical seals are independent of the direction of rotation.

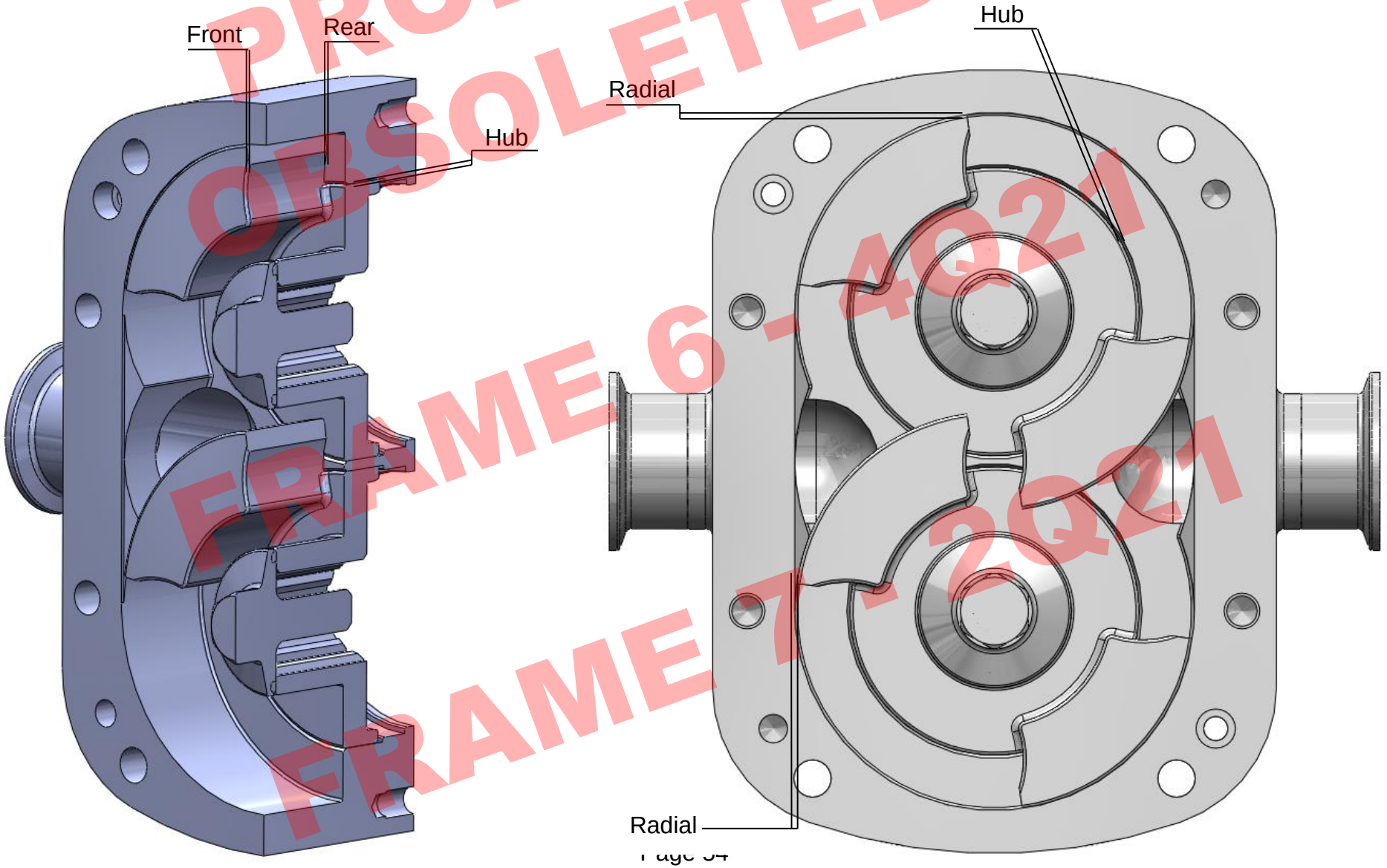
TEMPERATURE LIMITS
Following temperature limits apply to the different seal faces commonly used within mechanical seals:
Seal face max operating temperature, dependent on liquid being processed
Solid Resin-impregnated Carbon 200°C
Inserted Carbon 150°C
Solid Silicon Carbide 250°C

VISCOSITY LIMITS
Following viscosity limits apply to the different seal faces commonly used within mechanical seals:
Seal face Viscosity [cP]
Solid Carbon Up to 5000
Silicon Carbide Up to 150000
For viscosities above 150000 cP double seals should be considered.

WARNING **Note: For flush piping locations see 3.8.3**

6.0 Specifications.

6.1 Clearance Chart.



Revolution CPP - 808 ALLOY

Metric (mm)

	Model	Rotor Class	Temp Max (°C)	Front		Rear		Radial		Hub	
				Min	Max	Min	Max	Min	Max	Min	Max
SIZE 6	R3200P	STANDARD	93	0.19	0.28	0.13	0.23	0.16	0.22	0.09	0.14
		FF	105	0.34	0.43	0.13	0.23	0.16	0.22	0.09	0.14
		HOT	150	0.34	0.43	0.13	0.23	0.26	0.31	0.19	0.24
		HOT CHOC	REFER TO FACTORY	0.39	0.48	0.26	0.36	0.26	0.31	0.19	0.24
	R03800P	STANDARD	93	0.19	0.28	0.13	0.23	0.16	0.22	0.09	0.14
		FF	105	0.34	0.43	0.13	0.23	0.16	0.22	0.09	0.14
		HOT	150	0.34	0.43	0.13	0.23	0.26	0.31	0.19	0.24
		HOT CHOC	REFER TO FACTORY	0.39	0.48	0.26	0.36	0.26	0.31	0.19	0.24
	R03900P	STANDARD	93	0.19	0.28	0.13	0.23	0.16	0.22	0.09	0.14
		FF	105	0.34	0.43	0.13	0.23	0.16	0.22	0.09	0.14
		HOT	150	0.34	0.43	0.13	0.23	0.26	0.31	0.19	0.24
		HOT CHOC	REFER TO FACTORY	0.39	0.48	0.26	0.36	0.26	0.31	0.19	0.24
SIZE 7	R4200P	STANDARD	93	0.25	0.43	0.20	0.25	0.36	0.43	0.25	0.30
		FF	105	0.38	0.56	0.20	0.25	0.36	0.43	0.25	0.30
		HOT	150	0.38	0.56	0.20	0.25	0.51	0.58	0.38	0.43
		HOT CHOC	REFER TO FACTORY	0.51	0.76	0.38	0.46	0.64	0.76	0.51	0.58
	R5200P	STANDARD	93	0.25	0.43	0.20	0.25	0.36	0.43	0.25	0.30
		FF	105	0.38	0.56	0.20	0.25	0.16	0.43	0.25	0.30
		HOT	150	0.38	0.56	0.20	0.25	0.51	0.58	0.38	0.43
		HOT CHOC	REFER TO FACTORY	0.51	0.76	0.38	0.46	0.64	0.76	0.51	0.58

Imperial (inch)

Model	Rotor Class	Temp Max (°C)	Front		Rear		Radial		Hub	
			Min	Max	Min	Max	Min	Max	Min	Max
R3200P	STANDARD	93	0.007	0.011	0.005	0.009	0.006	0.009	0.004	0.006
	FF	105	0.013	0.017	0.005	0.009	0.006	0.009	0.004	0.006
	HOT	150	0.013	0.017	0.005	0.009	0.010	0.012	0.007	0.009
	HOT CHOC	REFER TO FACTORY	0.015	0.019	0.010	0.014	0.010	0.012	0.007	0.009
R03800P	STANDARD	93	0.007	0.011	0.005	0.009	0.006	0.009	0.004	0.006
	FF	105	0.013	0.017	0.005	0.009	0.006	0.009	0.004	0.006
	HOT	150	0.013	0.017	0.005	0.009	0.010	0.012	0.007	0.009
	HOT CHOC	REFER TO FACTORY	0.015	0.019	0.010	0.014	0.010	0.012	0.007	0.009
R03900P	STANDARD	93	0.007	0.011	0.005	0.009	0.006	0.009	0.004	0.006
	FF	105	0.013	0.017	0.005	0.009	0.006	0.009	0.004	0.006
	HOT	150	0.013	0.017	0.005	0.009	0.010	0.012	0.007	0.009
	HOT CHOC	REFER TO FACTORY	0.015	0.019	0.010	0.014	0.010	0.012	0.007	0.009
R4200P	STANDARD	93	0.010	0.017	0.008	0.010	0.014	0.017	0.010	0.012
	FF	105	0.015	0.022	0.008	0.010	0.014	0.017	0.010	0.012
	HOT	150	0.015	0.022	0.008	0.010	0.020	0.023	0.015	0.017
	HOT CHOC	REFER TO FACTORY	0.020	0.030	0.015	0.018	0.025	0.030	0.020	0.023
R5200P	STANDARD	93	0.010	0.017	0.008	0.010	0.014	0.017	0.010	0.012
	FF	105	0.015	0.022	0.008	0.010	0.006	0.017	0.010	0.012
	HOT	150	0.015	0.022	0.008	0.010	0.020	0.023	0.015	0.017
	HOT CHOC	REFER TO FACTORY	0.020	0.030	0.015	0.018	0.025	0.030	0.020	0.023

6.2 Fasteners & Torque Settings.

Description	Position		Size 6	Size 7
Dome Nut	Front Cover / Rotorcase	Qty / Pump	8	8
		Size - mm	M20	M24
		Torque - Nm	150	320
		Torque – ft-lb	110	236
Rotor Retainer	Rotor / Shaft	Qty / Pump	2	2
		Size - mm	M10	M12
		Torque - Nm	27	40
		Torque – ft-lb	20	30
Socket Cap Head Screw	Lobe Retainer Bolts	Qty / Pump	6	6
		Size - mm	M16	M20
		Torque - Nm	190	185
		Torque – ft-lb	120	136
Stud	Front Cover / Rotorcase	Qty / Pump	4	4
		Size - mm	M20	M24
		Torque - Nm	160	320
		Torque – ft-lb	120	236
Button Head Cap Screw	Anti-Rotation Washer / Rotorcase	Qty / Pump	2	2
		Size - mm	M8	M10
		Torque - Nm	25	25
		Torque – ft-lb	18	18
Stud	Gearbox Housing / Front Cover	Qty / Pump	4	4
		Size - mm	M20	M24
		Torque - Nm	160	320
		Torque – ft-lb	120	236
Socket Cap Head Screw	Rotorcase / Bearing Housing	Qty / Pump	5	2
		Size - mm	M16	M20
		Torque - Nm	190	185
		Torque – ft-lb	140	136
Drive Shaft / Driven Shaft	Bearing Housing / Gearbox Housing	Rolling Torque Nm	3 – 10.5	15-Sep
		Rolling Torque ft-lb	2.2 – 7.75	6.6 – 11.1

Table continued on next page

Fasteners & Torque Settings, continued

Description	Position		Size 6	Size 7
Button Cap Head Screw	Bearing Retainer	Qty / Pump	10	10
		Size - mm	M12	M12
		Torque - Nm	80	40
		Torque – ft-lb	59	30
Locknut	Timing Gear / Shaft	Qty / Pump	2	2
		Size - mm	M85 x 2	M105 x 2
		Torque - Nm	140 - 180	260 - 280
		Torque – ft-lb	160	200
Locknut	Inner Bearing/Shaft	Qty / Pump		4
		Size - mm	N/A	M120 x 2
		Torque - Nm		330 - 350
		Torque – ft-lb		250
Socket Cap Head Screw	Feet	Qty / Pump	4	4
		Size - mm	M16	M20
		Torque - Nm	190	185
		Torque – ft-lb	140	136
Socket Cap Head Screw	Rear Cover / Gearbox	Qty / Pump	6	6
		Size - mm	M12	M16
		Torque - Nm	80	95
		Torque – ft-lb	60	70
Hammer Drive Screw	Nameplate	Qty / Pump	4	4

6.3 Lubricants.

The Revolution has 2 lubrication options available gear oil and grease, the following lubricants are recommended for use with Revolution

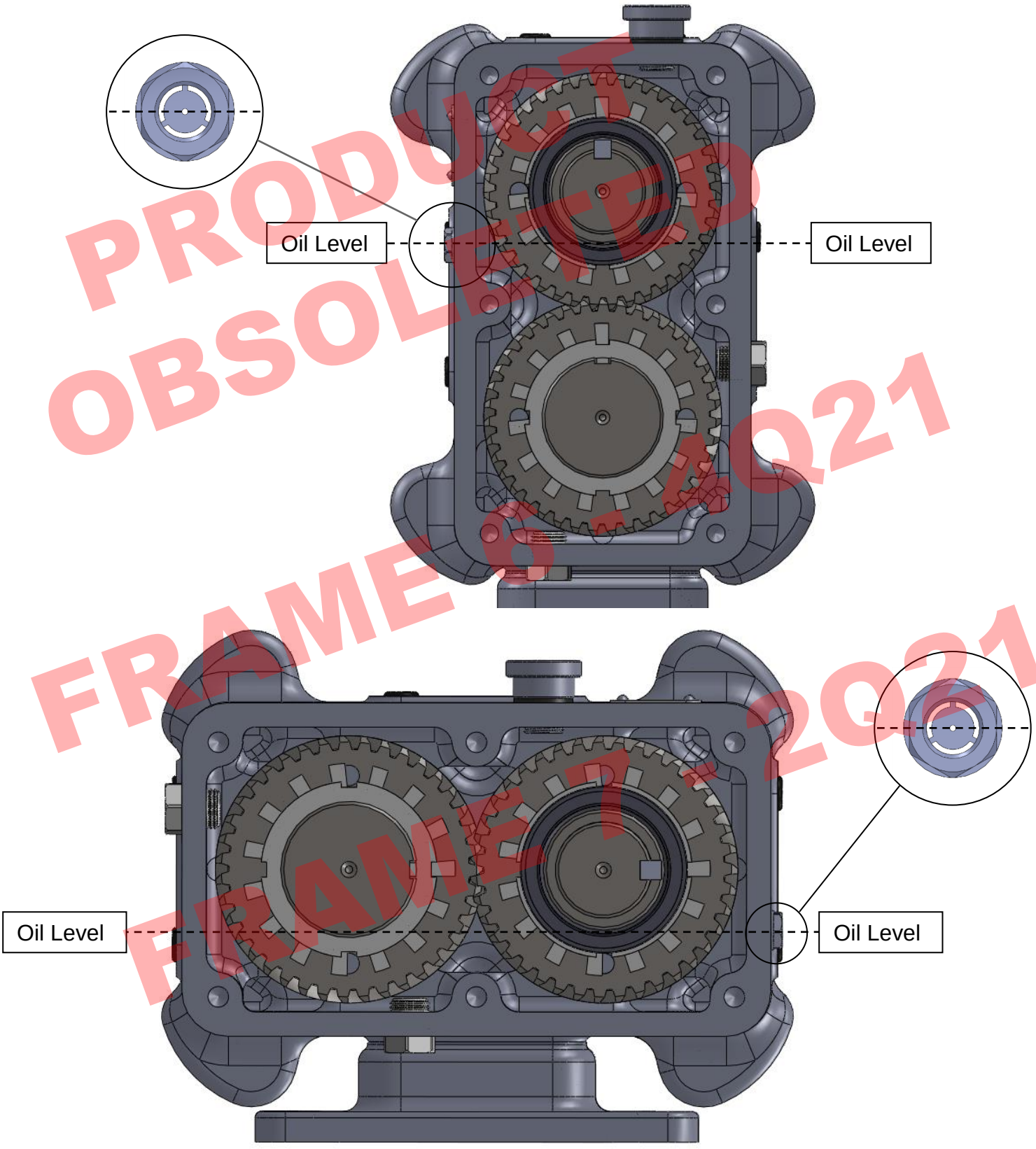
	Oil	
	Food Grade	Non-Food Grade
Governing Standard	Conforming to: NSF USDA-H1 FDA 21 CFR 178.3570 AGMA Grade 5 / ISO 220 / SAE 90 With synthetic base stock	Conforming to: AGMA Grade 5 / ISO 220 / SAE 90 With synthetic base stock
Brand	Petro-Canada Purity FG Synthetic EP 220	Petro-Canada Enduratex XL EP 220
	or equivalent, conforming to Governing Standard	or equivalent, conforming to Governing Standard

Grease	
Governing Standard	Conforming to: NLGI-00 Containing EP additives
Brand	Petro-Canada Precision XL EP00
	or equivalent, conforming to Governing Standard

Approximate grease capacities for the Revolution:

Size 6 – 7.50 Litres (1.98 Gallons)
Size 7 – 18.93 Litres (5.00 Gallons)

**** Note: For oil always add to the middle of the sight glass.**



6.4 Material Specifications and Pump Weights.

	Size 6,7
Rotorcase	316 C12F St.Steel
Front Cover	316 C12F St.Steel
Rotors	316 C12F St.Steel Or Alloy 808
Rotor Retainers	316L St.Steel
Shafts	17-4 PH St. Steel
Setting Ring	316 St.Steel
Gearbox	Cast Iron 250 / 304 St.Steel
Gearbox Cover	Cast Iron 250 / 304 St.Steel
Foot	Cast Iron 250 / 304 St.Steel

Pump Weights	Lbs.
R3200X	790
R3800X	
R3900X	940
R4200X	
R5200X	2200

6.5 Pump Lifting.

WARNING

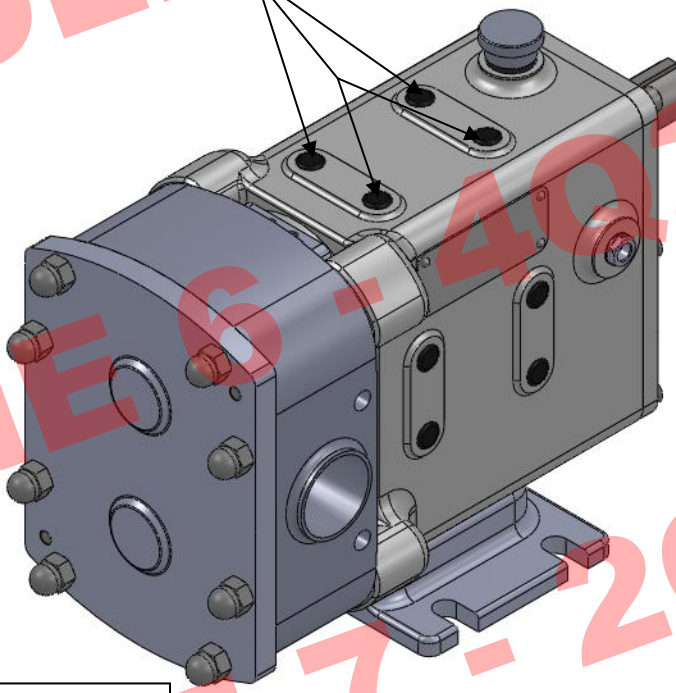
The Revolution pump has been designed with 4 Metric threaded locations on each side of the gearbox for lifting the pump.

Note
1) These lifting point have been designed to carry the weight of the pump only, if the pump has been installed / mounted these lifting point cannot be used.

2) On lifting two certified lifting eyes must be used in conjunction with a correctly rated lifting sling

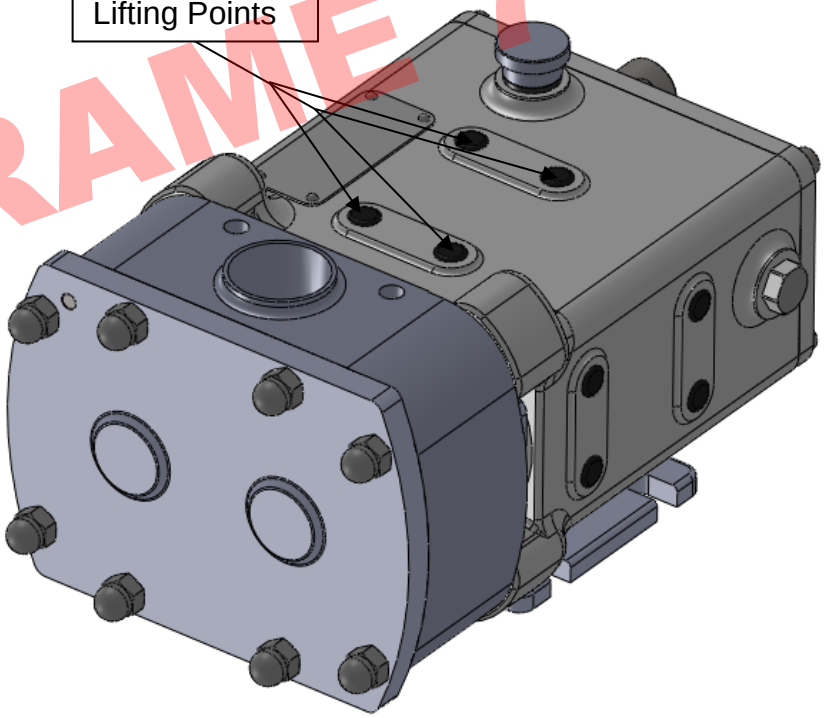
Lifting Points

Horizontal Port



Lifting Points

Vertical Ports

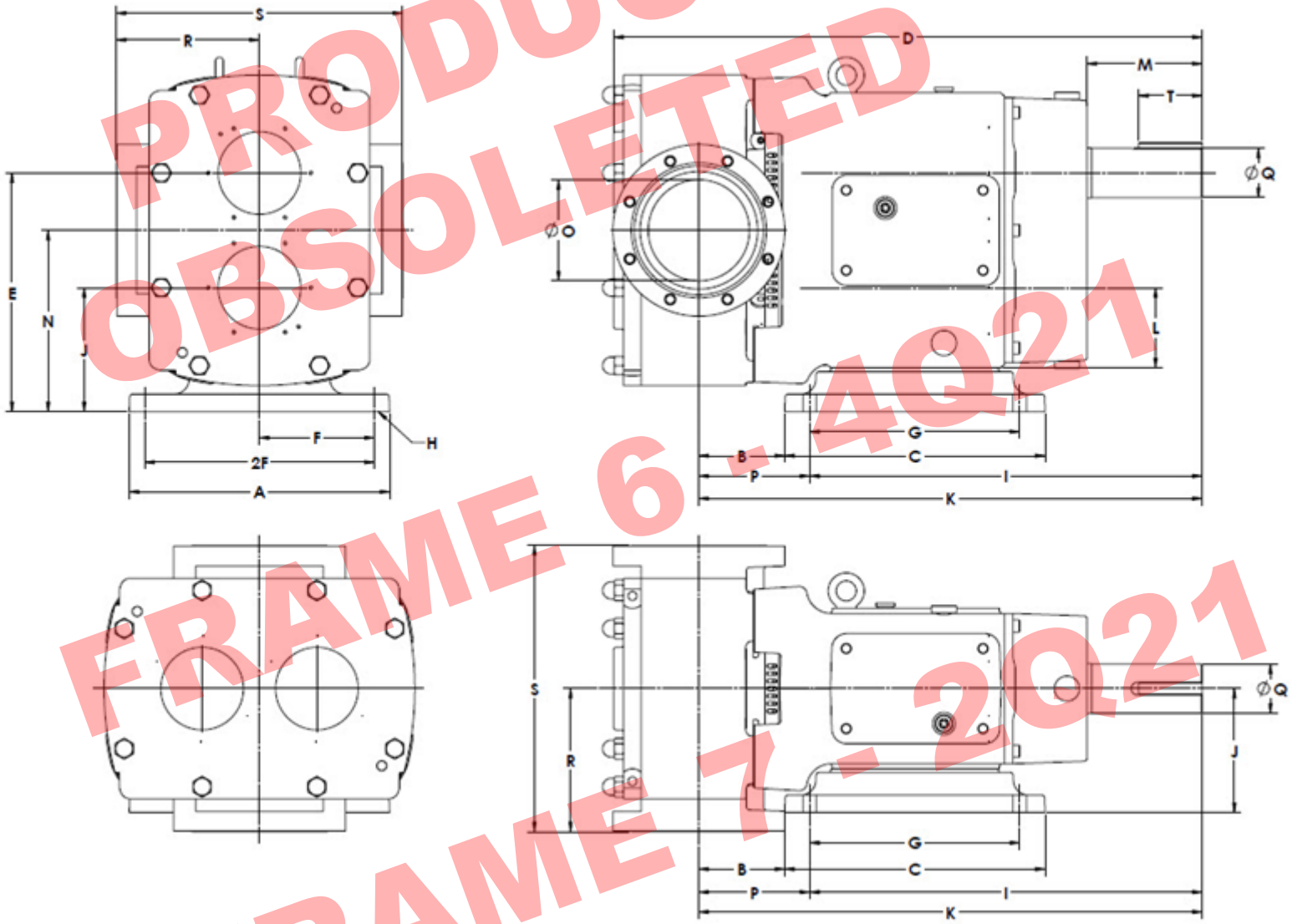


6.6 Foundation Dimensions

	Pump Type	Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Size 6	CPP	R3200X	320	97.5	290	696.5	353	133	203	17 x 27	420	175	549	115	115.5	264	154	129	60.3	203	406	5/8" x 70
	CPP	R3800X	320	121	290	722.6	353	133	203	17 x 27	420	175	565	115	115.5	264	154	153	60.3	203	406	5/8" x 70
	CPP	R3900P	320	151	290	725.5	353	133	203	17 x 27	420	175	602.5	115	115.5	264	154	182.5	60.3	203	406	5/8" x 70
Size 7	CPP	4200X	520	162	520	1129	476.5	229	419	27 x 31	783	247.5	995	160	230	362	154	212	98.4	285.8	571.5	1” x 127
	CPP	5200X	520	171	520	1174	476.5	229	419	27 x 31	783	247.5	1004	160	230	362	203	221	98.4	285.8	571.5	1” x 127

See dimensional drawing on following page

Note: Dimensions given are for guidance only and should not be used for installation purposes. Certified dimensions will be supplied upon request.



6.7 Trouble Shooting.

NO FLOW	IRREGULAR FLOW	UNDER CAPACITY	PUMP OVERHEATS	MOTOR OVERHEATS	EXCESSIVE ROTOR WEAR	EXCESSIVE SEAL WEAR	NOISE/VIBRATION	SEIZURE	PUMP STALLS ON START UP	CAUSES	ACTION
X										INCORRECT DIRECTION OF ROTATION	REVERSE MOTOR
X										PUMP NOT PRIMED	EXPEL GAS FROM SUCTION LINE/PUMP CHAMBER & PRIME
X	X	X					X			INSUFFICIENT NPSH AVAILABLE	INCREASE LINE DIA. & STATIC SUCTION HEAD. SIMPLIFY SUCTION LINE & REDUCE LENGTH. REDUCE PUMP SPEED AND PRODUCT TEMPERATURE.
	X	X					X			PRODUCT VAPOURIZING IN SUCTION LINE	
	X	X					X			AIR ENTERING SUCTION LINE	REMAKE PIPING JOINT
X	X	X					X			GAS IN SUCTION LINE	EXPEL GAS FROM SUCTION LINE/PUMP CHAMBER
	X	X					X			INSUFFICIENT STATIC SUCTION HEAD	RAISE PRODUCT LEVEL TO INCREASE STATIC SUCTION HEAD
			X	X			X		X	PRODUCT VISCOSITY TOO HIGH	DECREASE PUMP SPEED/INCREASE PRODUCT TEMPERATURE
		X								PRODUCT VISCOSITY TOO LOW	INCREASE PUMP SPEED/DECREASE PRODUCT TEMPERATURE
		X	X		X		X		X	PRODUCT TEMPERATURE TOO HIGH	COOL PRODUCT/PUMPING CHAMBER
				X					X	PRODUCT TEMPERATURE TOO LOW	HEAT PRODUCT/PUMPING CHAMBER
					X	X	X	X		UNEXPECTED SOLIDS IN PRODUCT	CLEAN THE SYSTEM/FIT STRAINER ON SUCTION SIDE OF PUMP
		X	X	X	X		X	X	X	DISCHARGE PRESSURE TOO HIGH	CHECK FOR BLOCKAGES/SIMPLIFY DISCHARGE LINE
			X	X	X		X	X		ROTORCASE STRAINED BY PIPING	CHECK PIPE ALIGNMENT /SUPPORT PIPING
				X			X			PUMP SPEED TOO HIGH	DECREASE PUMP SPEED
		X								PUMP SPEED TOO LOW	INCREASE PUMP SPEED
			X	X	X	X	X	X		SEAL FLUSH INADEQUATE	INCREASE SEAL FLUSH TO REQUIRED PRESSURE/FLOW
			X	X	X	X	X	X	X	BEARING/TIMING GEAR WEAR	REPLACE WORN COMPONENTS

6.8 Typical Noise Emission Data.

Model	Speed (rpm)	Sound Level Range (dB's)
Size 6	200	74 to 83
	400	75 to 84
	600	76 to 85
Size 7	250	86.5 to 89
	300	85.5 to 91.4
	325	88.1 to 92

*Reference Only
**Values taken during testing at random viscosities and pressures

Note: values given can vary greatly depending on application and ambient noise. Valures shown above should only be used as approximations.

6.9 Tool List.

Listed below are tools required for the maintenance for the Revolution.

TYPE	SIZE OR RANGE	Size 6	Size 7
Combination Spanner	15 mm		•
Combination Spanner	27 mm	•	
Combination Spanner	36 mm		•
Hexagon (Allen) Key	5 mm	•	
Hexagon (Allen) Key	8 mm	•	•
Hexagon (Allen) Key	10 mm	•	•
Hexagon (Allen) Key	14 mm	•	•
Hexagon (Allen) Key	17 mm		•
Hexagon (Allen) Key (Socket Driven)	5 mm	•	
Hexagon (Allen) Key (Socket Driven)	8 mm	•	•
Hexagon (Allen) Key (Socket Driven)	10mm	•	•
Hexagon (Allen) Key (Socket Driven)	14 mm		•
Hexagon (Allen) Key (Socket Driven)	17 mm		•
Torque Wrench	Adjustable to Min. 39 NM (28.76 ft-lb.)	•	
Torque Wrench	Adjustable to Min. 107 NM (78.91 ft-lb.)	•	
Torque Wrench	Adjustable to Min. 190 NM (140 ft-lb.)	•	•
Torque Wrench	Adjustable to Min. 330 NM (243 ft-lb.)	•	•
Depth Micrometer	0 - 25 mm (0 - 1")	•	•
Feeler Gauge Set		•	•
Micrometer	0 – 25 mm (0 – 1”)	•	•
Rolling Torque Meter	0 - 15 Nm (0 – 11.1 ft-lb.)	•	•
Rotor Retainer Socket	Supplied with Pump	•	
Rotor Retainer Socket	15 mm		•

TYPE	SIZE OR RANGE	Size 6	Size 7
C – Spanner	To Suit Locknut Ø110.0 mm (4.331")	•	
C – Spanner	To Suit Locknut Ø120.0 mm (4.724")		•
C – Spanner	To Suit Locknut Ø140.0 mm (5.512")		•

Soft Faced Mallet		•	•
Screwdriver	Flat Blade, Medium	•	•
Circlip Pliers	Internal	•	•
Pin Punch	Small	•	•
Steel Hammer	Small	•	•

7.0 Service History.

Pump Model: Pump Serial No:

Date	Comments

7.1 Notes

The information contained in this document is correct at time of print, but may be subject to change without prior notice.

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