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Weatherford®

PDM SYSTEM INFORMATION FOR PART 01780456
Manual, operation and maintenance WDD340

Operations and Maintenance Manual

Model WDD340 Pump

Manual Part Number 01780456

April 2015

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Chapter 1: Introduction

This manual has been designed to provide instruction and guidance for the use of the Weatherford WDD340 Pump. All personnel tasked with the operations and maintenance of this equipment should carefully study all sections pertaining to tasks they will be performing using this equipment, to ensure this system continues to operate at peak efficiency.

1.1 Product Details

The Weatherford WDD340 is a single acting triplex pump rated for 340 horsepower in intermittent duty service. It is offered in a wide variety of material and design options, allowing it to be utilized in a wide variety of applications. As a result, some components may vary from unit to unit. Check the spec sheet included with this manual to determine the exact configuration of your particular pump.

1.1.1 Specifications

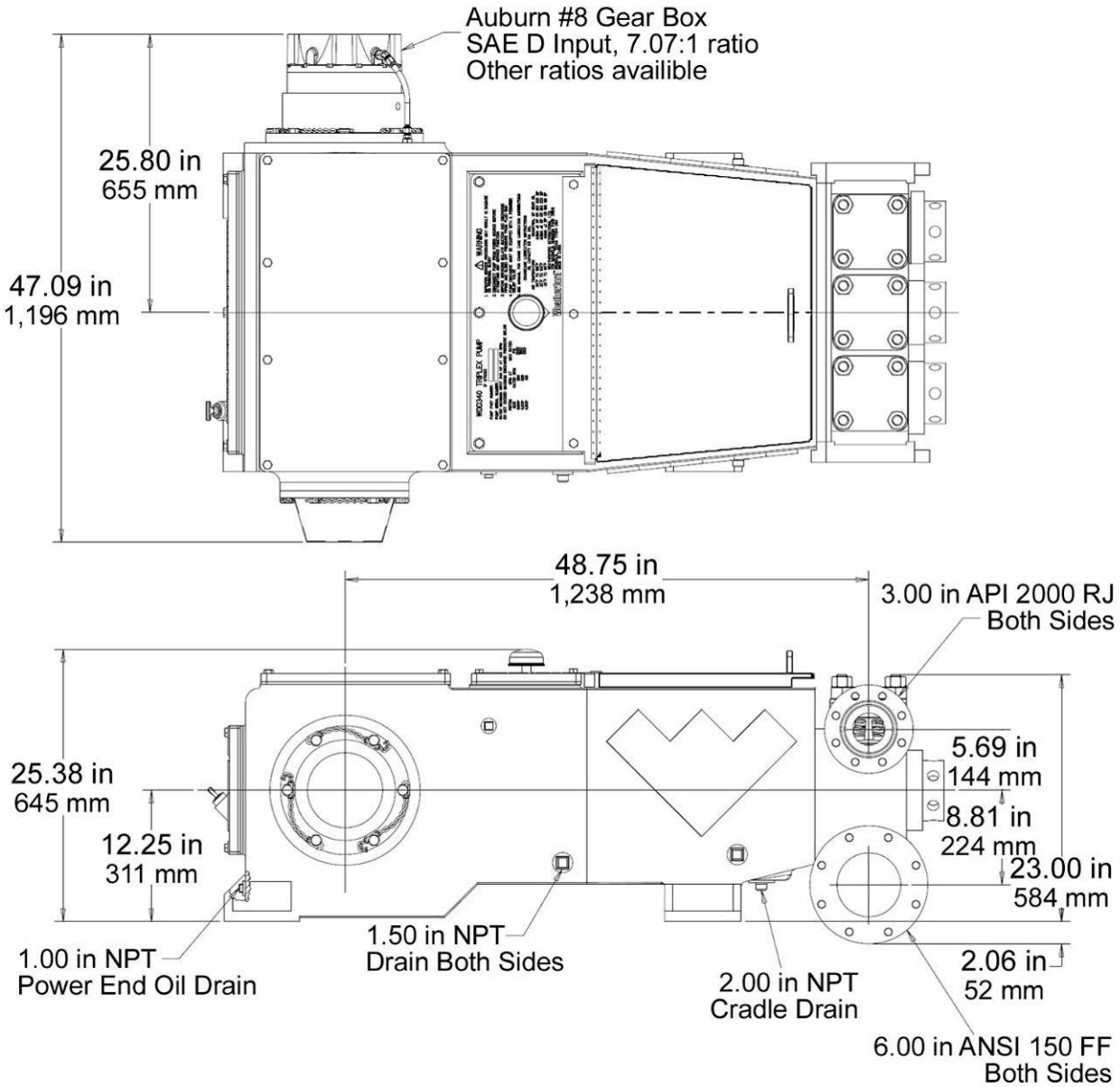
General Information	
Pump Type	Triplex
Pump Weight	4,500 lbs.
Bolt on Gear Reducer Weight	1,100 lbs
Planetary Gear Reducer Weight	80 lbs
Oil Capacity Pump	6.5 gal
Oil Capacity Bolt on Gear Reducer	3.5 - 6.5 gal*
Oil Capacity Planetary Gear Reducer	Integral with pump
Max Fluid Temperature	180° F
Mechanical Efficiency	90%

Operational Statistics	
Maximum Rated Power	340 HP
Maximum Discharge	2,000 psi
Maximum Rated Speed	350 RPM
Minimum Rated Speed	25 RPM
Stroke Length	5.00 IN

***Varies by Ratio**

Piston Size (in/mm)	Displacement (gal/rev)	Rated Pressure (psi/Mpa)	Rated Capacity GPM (BPD) 25 RPM	100 RPM	200 RPM	250 RPM	300 RPM	350 RPM
3.000 *76*	0.4590	2,000 *13.8*	11.5 *393*	45.9 *1,574*	91.8 *3,147*	114.7 *3,934*	137.7 *4,721*	160.6 *5,508*
3.500 *89*	0.6247	2,000 *13.8*	15.6 *535*	62.5 *2,142*	124.9 *4,284*	156.2 *5,355*	187.4 *6,426*	218.7 *7,497*
4.000 *102*	0.8160	1,650 *11.4*	20.4 *699*	81.6 *2,798*	163.2 *5,595*	204.0 *6,994*	244.8 *8,393*	285.6 *9,792*
4.500 *114*	1.0327	1,300 *9.0*	25.8 *885*	103.3 *3,541*	206.5 *7,082*	258.2 *8,852*	309.8 *10,623*	361.5 *12,393*

1.1.2 General Dimensions



1.2 Scope

This manual is intended to provide instruction and guidance on standard and frequently used procedures and processes regarding the WDD340 Pump. These include the setup and installation of the system, basic operations, storage, routine maintenance and basic troubleshooting, as well as a parts list for the various configurations of this system.

The information contained in this document has been expanded to include not only the core systems and functions of the WDD340 pump, but also some optional features that may be incorporated into the system. This information is included to ensure that the guidance provided remains applicable in most expected operating conditions and situations. As a result, some of the features described may not be present on a specific unit, and adjustments should be made accordingly.

This document was designed for use by pump operators, service personnel and other personnel familiar with the equipment and its expected use. As such, this document will not go very deeply into theory and basic processes, but will focus primarily on equipment-specific issues and procedures. Individuals without proper training or experience should always have a veteran hand supervising their use of this or any other powerful and potentially hazardous equipment.

This manual has been designed with the system's expected uses in mind. For help with events, situations and uses not typical to this system, or for advanced troubleshooting issues, please contact your local Weatherford representative.

1.3 Manual Organization

This manual has been laid out in accordance with the expected need of its users. It is divided into four sections, each of which is intended to cover one aspect of the equipment's use and functions.

Chapter 2: Storage and Installation covers the non-operational aspects of using and maintaining the system, from basic storage to installing the system on location.

Chapter 3: Operations covers the basic operating procedures, from the standard startup sequence to the general operations procedures and troubleshooting tips.

Chapter 4: Maintenance covers all aspects of the regular preventative maintenance that will help to ensure that the system operates at peak efficiency for as long as possible, including the tools used, operational guidelines and basic replacement procedures.

Chapter 5: Assembly and Disassembly covers the assembly and disassembly of the pump and its components, including advanced repair and replacement procedures.

Chapter 6: Glossary provides a list of standard terms and definitions regarding Quintiplex pumps in general and the WDD340 pump in particular.

Chapter 7: Parts Lists provides a comprehensive inventory of all the standard components used in the WDD340 pump.

1.4 Safety Summary

Every year, the Unites States Occupational Safety and Health Administration (OSHA) receives reports of millions of worker related injuries and deaths associated with the use of mechanical and industrial equipment. Many of these incidents occur due to either carelessness on the part of the operator or as a result of the operator not understanding the equipment and processes he or she was using. In many cases, such incidents could have been prevented through the use of basic, commonly-accepted safety procedures.

When working with industrial equipment, or indeed at any time you are working, it is important to employ all appropriate safety measures. These exist not only to protect the operator of the equipment, but also co-workers, supervisors, contract personnel and anyone else who happens to be in the area where the work is being performed. Always use good, sound mechanical practices when working with equipment, and follow the safety guidelines below.

At the same time, it is important to remember that no set of procedures is perfect. While these guidelines should help to significantly reduce the chance of an incident, they are no match for an aware and reasoning human mind. Always use your best judgment, and if something seems unsafe or dangerous, do not do it.

1.4.1 Safety Symbols and Terms

Throughout this document, you will regularly see a number of information boxes labeled with safety-specific terms. These are the standard terms and conventions that will help to ensure the safety and health of those working with or near this equipment. It is important to make sure that the operator and others know what each one means.

WARNING	WARNING safety notes MUST be followed carefully. Failure to do so may result in catastrophic equipment failure, serious injury and/or death.
CAUTION	CAUTION safety notes are very important and should be followed carefully. Failure to do so may result in equipment damage and/or personal injury.
NOTE	NOTE safety notes are used to notify personnel of information that is important, but not hazard related.

1.4.2 General Safety

The following are general safety practices which should always be used when working.

Qualified Personnel Only

Personnel without a thorough understanding of all processes and procedures required to operate and maintain equipment can unintentionally create hazards for themselves and others. Only individuals with proper training should ever operate or perform maintenance on industrial equipment in a workplace environment. This includes not only the appropriate procedures for the equipment being used, but also requires an understanding of all attached systems, equipment in the area, and general safety and hazard recognition training.

Equipment Ratings and Guidelines

Never use any equipment or machines for any purpose for which they are not specifically designed for without first receiving approval from the manufacturer. When using equipment and machinery, always follow all manufacturer instructions and guidelines, and never exceed the listed ratings and capacities

Safety Systems and Countermeasures

All equipment should have guards and other safety systems to protect personnel from exposed mechanical systems and dangers. It is the responsibility of every employee on site to ensure that all safety systems and countermeasures are in place, secure and effective.

Lock Out Tag Out

Before performing repairs or maintenance on any industrial equipment, you should always follow standard “Lock Out-Tag Out” procedures. This includes not only shutting down the equipment, but also isolating it from any potential power sources (electric, hydraulic, mechanical etc…). In addition, be sure to lock controls and tag the equipment as under maintenance to ensure that it is not accidentally reconnected or activated by a third party. Never activate systems tagged out of service.

Environmental Hazards

Never attempt to perform work in an environment in which your senses are significantly impaired, that is, if you cannot adequately visualize the area you are working in, the work you are performing, or you cannot be adequately alerted to potential dangers and hazards.

Appropriate Dress

It is the responsibility of employees to ensure that their clothing, hair and accessories do not pose a potential safety hazard when on the job. In industrial environments, this includes, but is not limited to, wearing all appropriate clothing and PPE, keeping hair short or restrained, avoiding loose clothing or jewelry like skirts or ties. Consult with the site supervisor or safety coordinator to ensure you meet all safety requirements.

Exercise Good Judgment

Especially when working in an industrial environment, it is important to remain alert and aware to avoid causing or entering potentially hazardous situations. Always be alert for potentially unsafe activities and situations, and do not attempt to work or operate equipment when sick, taking certain medications or in any other circumstances in which your senses or your judgment is in any way impaired.

1.4.3 Common Hazards

The following are major risks and hazards that may occur in an industrial environment. Each of the following is a WARNING level hazard, meaning personnel should obey all regulations or risk serious injury or even death.

Securing Equipment

Unsecured equipment can shift and move during operation, not only causing damage to the components but serious injury or death to personnel. All truck, trailer or skid mounted equipment should be secured with blocks and/or moorings prior to use, which should be inspected for damage before equipment is activated.

Hoisting and Lifting Equipment

Equipment that swings or falls while being hoisted can crush body parts caught between the equipment and other objects, causing serious injury and death. Always use lifting equipment rated a minimum of one and half times (1.5x) the load to be lifted, and check to ensure that all parts of the load are secure before lifting. Any time a piece of equipment is being hoisted or lifted; all personnel should clear all locations in which the equipment could swing, fall or any combination of the two.

Drive Systems

Drive systems can catch on body parts and loose clothing, dragging personnel into the system and inflicting serious injury or death. When working with drive systems, keep all guards in place and in good condition, and keep hands and clothing clear of the drive system cavity at any time when the drive is in motion.

Hydraulic and Pneumatic Systems

Hydraulic and Pneumatic systems operate by means of high-pressure fluids that can cause serious injury or death if vented improperly. Avoid striking or puncturing any hydraulic or pneumatic components or connections. When performing any work on these systems, even tightening a leaking joint, fitting or connection, slowly drain to zero pressure before commencing work, and disconnect and tag systems as “Out of Service.”

Electrical Systems

Most electrical systems contain high voltage current which can cause serious injury and death when improperly grounded. Avoid striking or puncturing any electrical components or connections, and ensure that the power is turned off, the system is disconnected and that it is tagged out of service before commencing work.

Lubrication and Filtration Systems

Failure to properly maintain lubrication and filtration systems can result in various types of catastrophic system failures which themselves can cause serious injury and death. Institute a complete lubrication program at regular intervals, and inspect all systems before operation.

1.4.4 Pump Specific Safety

The following are guidelines and practices which should be used when working with the WDD340 pump.

Disengage / Vent Pressure

As per standard Lock Out/Tag Out procedures, be sure to completely shut down the pump and vent all pressure from the pump and piping before performing any work on the equipment, and tag all equipment being worked on as “Out of Service.” Failure to do so may result in electrical shocks, crushing injuries or the sudden release of hot fluids at high pressure.

Pressure Relief

Never operate the pump without a pressure relief valve, rupture disk or other type of over-pressure safety device installed. All such equipment must be properly sized and fitted before they are used, and operators must ensure that there are no valves of any type between the pump and the safety device.

Fluid, Lubricant and Solvent Use

Only use fluids, lubricants or solvents approved for the equipment. Always exercise extreme care when using solvents to clean or degrease equipment. Many solvents are flammable or toxic, and some solvents may damage or deteriorate system components. Both of these conditions can lead to system failures and injury, so be sure to use only approved solvents, read all safety precautions before using and follow all appropriate procedures. Never mix fluids, lubricants or solvents.

Fluid, Lubricant and Solvent Disposal

Follow all normal health and environmental guidelines when disposing of fluids, lubricants or solvents. In the event of a spill, follow the appropriate steps and procedures to ensure the spill is cleaned up with minimal risk to fellow employees or the local environment.

Return Connector

The hydraulic tank return connector must be connected before the system is operated. Failure to do so can cause reservoir drain, fluid starvation and equipment damage.

Polished Areas

Never grip polished areas with tongs or other gripping devices, as it can result in equipment failure and potential injury.

Shields and Covers

When pumping hot fluids, it is important to always use shields and covers to protect service personnel from any accidental exposure.

Guards

Likewise, guards should always be used on belt drives, couplings and shafts to prevent personnel or objects from becoming entangled in rotating or reciprocating parts. Failure to do so can result in severe injury.

Battery Connections

Ensure the battery connections are made up to the positive (+) terminal only. Failure to do so can result in equipment damage and potential injury.

Zerk Fittings

Do not leave Zerk fittings installed on this high-pressure equipment, as the extreme pressures handed by these systems can cause the Zerk check ball to blow out.

Teflon Tape

Always start the wrap two (2) or more threads from the opening to prevent Teflon contamination of the hydraulic system.

Do Not Modify

Never modify the pump to perform beyond the rated specifications or use substitute parts or components without first consulting and receiving written consent from Weatherford. Failure to do so may put too much stress on certain components, which can result in catastrophic equipment failure, serious injury and/or death.

Chapter 2: Storage and Installation

This section shall provide a basic guide for all non-operational aspects of utilizing the WDD340 pump. It includes general guidelines and procedures for installing the pump, as well as a general guide to storing the equipment, including recommendations for dealing with severe environments.

2.1 Installation

The proper installation of the WDD340 pump is essential to ensuring optimal performance and a long service life, as well as significantly reducing required maintenance. This can require some precise values, and so it is important to plan ahead before the pump is brought to location and the rig-up is made. It is difficult, expensive and time consuming to correct errors in piping, pulsation dampener mounting and tie downs after they have been fabricated and welded in place.

The following outline is intended to provide a guide to choosing a location and installing the pump, and so all aspects should be considered and planned out before installation begins.

2.1.1 Location and Orientation

In order to improve performance and minimize maintenance issues, the pump skid should be located in a clean, dry, well-ventilated and well-illuminated area. The pump should be mounted horizontally on a flat, level surface in order to ensure proper operation and lubrication, and that the mounting surface is at least strong enough to withstand the forces and vibrations generated during pump operations.

The pump should be secured using the four (4) bolt holes provided in the mounting base. If mounted on a frame, ensure that it is level before mounting the pump. Locate the pump as close to the suction source as possible to minimize NPSH concerns.

CAUTION	Always make sure pumps are mounted on a level surface and are locked down evenly. Failure to do so can place unnecessary strain on both the frame and the pump, which can result in equipment damage and potential injury to personnel.

2.1.2 The Prime Mover

Before locking the pump into position, check that the prime mover has been aligned properly in relation to the pump.

Once mounted, confirm that the pump rotation is set to drive the top of the crankshaft towards the fluid end, as this will go a long way towards establishing proper splash lubrication and crosshead loading. Then verify that no damage has occurred to the components and systems, including all safety devices and guards.

CAUTION Never operate the pump without proper guards in place.

V-Belt and Chain Drives

For V-Belt and chain-driven units, check the alignment of the sheaves after the unit is installed but before the belt or chain is tensioned. It is critical that the grooves are aligned on both sheaves, and that the faces of the sheaves are square, as this will assure the user that the driver shaft and pump shaft of parallel.

To check sheave alignment, simply pull a string or wire across the centerline of the sheaves from one end to the other, and adjust one of the sheaves in and out until the string contacts each sheave face on two locations.

Belts or chains should be tensioned as recommended by the supplier. Do not exceed the recommended tension rating under any circumstances. Once tensioned, perform a final alignment check and ensure all mounted bolts are secure.

Direct-Coupled Installations

For direct coupled installations, ensure that the coupling is secure, then install all cages and guards and secure into position. Do not operate pump with loose cages or guards.

Auburn Gear

In place of standard motor connections, some WDD340 pumps come equipped with an Auburn Gear planetary gear drive. In such cases, the gear reducer should be connected directly to a hydraulic motor, and all guards and cages should be installed as normal.

2.1.3 Suction System

Single acting reciprocating pumps perform best when supplied with an appropriate level of fluid. Inadequate fluid supplies may lead to cavitations, which is one of the primary causes of premature pump failure. When setting up the pump, it is very important to ensure that there is sufficient fluid running through the pump at all times.

The fluid supply tank should be large enough to allow dissolved air and other gases to escape from the fluid, and allow suspended solids to settle out before entering the pump. For this reason, a system employing dams and settling chambers is desirable.

For a full discussion of suction system losses, consult the *Standards of the Hydraulic Institute*, 14th Edition.

Piping

The suction piping may connect to any of the flanges on the suction manifold, but should be one pipe size larger than the piping on the pump, and designed to promote low velocity supply (1-3ft/sec). The length of the suction piping should be minimized as much as possible to enhance pump efficiency, and utilize 45° long radius elbows to help reduce frictional pressure drops at the inlet. The suction piping should be supported to prevent unnecessary loads on the pump suction.

Line Valves

Only full open valves should be used on the suction piping to prevent any reduction or interruption of flow and thereby ensure the efficient operation of the pump. Drain valves should be installed at the lowest point in the piping, while vents should be located at the highest point available. Do not under any circumstances use any valve that has the potential to choke the flow of fluid through the line.

Pressure Relief Valve

A pressure relief valve should be included, especially if a charging pump is used, to prevent damage to either pump in the event of a high pressure surge occurring in the line. The valve should be located between the suction inlet and the charging pump's discharge outlet, and be mounted on the top of the line near the suction stabilizer so that it is elevated above the mud in the tank. The outlet line should gradually slope down to the tank level, and should be supported to prevent any dips or low spots where mud could collect, harden and potentially block flow.

The relief valve should be set to 15% greater than the normal operating pressure (35 psi for normal operations, but this value may vary depending on the specifics of the job).

WARNING	The pressure relief valve outlet must not connect back to the pump suction line. This can cause uncontrollable pressure surges, which can result in equipment damage and significant injury to personnel.

Suction Stabilizer

A suction pulsation dampener should be utilized, as it will significantly extend the pump's expendable life. This system should be mounted as close to the inlet as possible, before any valves or turns are placed in the suction piping. Only charge the pulsation dampener using a hand operated air pump.

WARNING	The use of a high pressure source or nitrogen bottle to charge the suction piping pulsation dampener can result in catastrophic equipment failure and serious injury to personnel.

WARNING	Do not use air to fill bladder, especially when pumping flammable fluids, as it may combust and cause catastrophic equipment failure and serious injury to personnel.

For full operating instructions and guidelines for this equipment, see the documentation provided by the pulsation dampener manufacturer.

Charging Pump

The WDD340 pump is designed to function using only its natural suction in most cases, but may occasionally require the assistance of a charging pump. Piping can be set up to allow the operator to switch between these configurations, but in such cases, the piping should be arranged so that the pulsation dampener remains in the line in all cases.

Charge pumps should be centrifugal pumps sized to 150% of the main pump volume to allow for the varying flow demands of the triplex pump. The charging pump should be set to ensure the suction manifold pressure remains between 20 and 30 PSI to ensure maximum volumetric efficiency and expendable parts life.

The charging pump may be driven using V-Belts or chains mounted to the WDD340 drive system (if applicable), but this is not recommended as it makes mounting the pump and inlet system piping difficult and may not provide sufficient RPMs during low speed operations. For this reason, it is recommended that a booster pump be used, powered by an electric motor.

For full operating instructions and guidelines for this equipment, see the documentation provided by the charging pump manufacturer.

Gauges and Meters

It is recommended that a pressure gauge be installed at the pump suction, and a low-suction pressure alarm and thermometer be mounted in the suction piping. However, do not install any metering device that causes a flow restriction on the suction piping. For full operating instructions and guidelines for this equipment, see the documentation provided by the manufacturer.

2.1.4 Discharge Piping

The discharge piping is subject to damage from the pulsations from the pump as well as loads imposed by thermal expansion of the pipe. Addressing these issues will normally result in superior pump performance.

Piping

All discharge piping should be at minimum the same size as the outlet on the pump. Gradual turns should be used to prevent unnecessary frictional pressure buildup, and no immediate turns next to the pump discharge should be used. 45° long radius elbows should be used to minimize flow frictional pressure concerns.

Furthermore, discharge piping should be supported, but allowed to move along the axis of the pipe. This ensures that any thermal expansion will not unnecessarily load the fluid end connections.

Line Valves

Only full open valves should be used on the suction line to prevent any reduction or interruption of flow and thereby ensure the efficient operation of the pump. Do not under any circumstances use any valve that has the potential to choke the flow of fluid through the line.

Pressure Relief Valve

A pressure relief valve should be installed on the opposite side of the pump discharge manifold from the strainer cross, and incorporate a high pressure relief line and a by-pass line. The valve should be a full-opening manual reset type valve, and set to a pressure no greater than 15% of the working pressure of the piston that is being used. Ensure that the relief valve is elevated above the fluid in the tank, and that the outlet line slopes gradually down to the tank level, and does not have any dips or low spots where fluid or contaminants could collect, harden and potentially block flow. The line should be the same size as the valve discharge opening, and lead back to the supply tank, but not the pump suction.

WARNING	The Relief Valve must not be connected to the discharge cross, as the systems can interfere with one another, resulting in potentially life-threatening situations.

WARNING	Do not put any type of shut-off valve between the pressure relief valve and the discharge manifold, in order to protect the system against damage resulting from accidental or incorrect start-up

WARNING	The Relief Valve outlet must not be connected to the pump suction line. This can cause uncontrollable pressure surges in the suction line, which can result in equipment damage and significant injury to personnel.

For full operating instructions and guidelines for this equipment, see the documentation provided by the pressure relief valve manufacturer.

Bypass Line

It is highly recommended that a bypass line be utilized. It will help to ease the start up torque requirements on the primary driver, allow a low discharge of pressure to help pump priming and allow the lubrication to be established prior to the load being applied.

Discharge Dampener

A discharge pulsation dampener should always be utilized, as it will prevent harmonic vibration from damaging the discharge piping and significantly extend the pump's operational life. This system should be mounted as close to the fluid end discharge as possible, before any valves or turns are placed in the suction piping. For full details on this equipment and operating instructions, see the manufacturer's documentation on this equipment.

For full operating instructions and guidelines for this equipment, see the documentation provided by the pulsation dampener manufacturer.

WARNING	Always use a regulator in the line when charging the discharge pulsation dampener. An uncontrolled increase of pressure can result in catastrophic equipment failure and serious injury to personnel.

WARNING	Do not use air to fill bladder, especially when pumping flammable fluids, as it may combust and cause catastrophic equipment failure and serious injury to personnel.

Gauges and Meters

A pressure gauge should be installed on the pump discharge, and a high-low pressure alarm system should be utilized to address problem conditions that could lead to pump failure. For full operating instructions and guidelines for this equipment, see the documentation provided by the manufacturer.

2.1.5 Auxiliary or Ancillary Systems

Any Auxiliary or Ancillary systems, such as lubrication sprayer systems, liner wash systems and gib cranes, should be installed in accordance with the manufacturer's guidelines. If those come into conflict with the regulations here, default to the manufacturer's specifications, unless those come into direct conflict with the safety and operational guidelines outlined here. When in doubt, contact a Weatherford professional or manufacturer agent for information regarding the systems used.

2.1.6 Installation Checklist

Pump Checklist

- □ Ensure the location for installation is clean, dry, well-ventilated and well-illuminated, and as close to the suction source as possible.
- □ Check that the pump is level and is properly secured using the bolt holes in the base.
- □ Ensure the pump rotation is set to drive the top of the crankshaft towards the fluid end.
- □ Ensure that the prime mover drives are properly aligned and configured (see 2.1.2: The Prime Mover, on page 13)
- □ Ensure all guards on the drives are in place and secure.

Suction Checklist

- □ Check that any charge pumps used are the proper size and are configured correctly.
- □ Check that the suction stabilizer is properly sized and installed correctly.
- □ Ensure that the piping is as short as possible and properly supported.
- □ Ensure that vents and drain valves are installed at the proper locations and clear for use.
- □ Ensure a pressure gauge is installed at the suction inlet, preferably with a thermometer and a low-pressure alarm.
- □ Install suction stabilizer as close to the suction inlet as possible, in line with the charging pump discharge if used.
- □ Check that the suction piping is properly sized and that there are no components that may choke or disrupt flow (tight elbows, partial valves, metering devices, etc…)

Discharge Checklist

- □ Ensure the discharge piping is properly sized and supported.
- □ Ensure the pressure gauge is installed at the pump discharge, preferably with a high-low pressure alarm.
- □ Install a discharge dampener as close to discharge outlet as possible.
- □ Ensure the pressure relief valve is installed and set to the appropriate pressure.
- □ Ensure the line from the pressure relief valve directs back to a supply tank and not the pump suction.
- □ Ensure the bypass line is properly installed and functioning.
- □ Check that the discharge piping is properly sized and that there are no components that may choke or disrupt flow (tight elbows, partial valves, metering devices, etc…)

2.2 Storage

While the WDD340 pump is a sturdy piece of equipment, it is very vulnerable to damage at certain times, especially when inactive. Over time, environmental forces can wear down even the strongest materials, and cause subtle but significant damage to vital components and systems. In addition, unlike equipment that is in use, stored units generally do not receive regular maintenance, and even small problems can become significant if not caught.

By storing the pump in accordance with the following guidelines, users may protect it from environmental wear and tear and ensure it continues to operate efficiently when it is again put into use.

2.2.1 Basic Storage Guidelines

In general, pumps should always be stored in a dry, temperature controlled environment, especially indoors. This will minimize environmental effects and help to prevent equipment degradation. Never store pumps directly on the floor or ground, but rather on a raised shelf or pallet several inches off the ground level.

New Pumps

Pumps come from the factory without any crankcase oil and are prepared for short term storage without any preparation. If users expect to store the unit for longer than this or in a severe environment, they should use the procedures as indicated below.

Precautions for Freezing Weather

Freezing weather can cause problems for equipment when pumping water-based fluids, or when water used to flush prior to storage is not properly dried. In environments with freezing or near-freezing temperatures, it is vital to ensure that a pump is dry prior to storage, and to thoroughly inspect the pump prior to use.

2.2.2 Short Term Storage

No extreme measures are required for short term storage of this equipment, which is defined as a period of six (6) months or less. In such cases, the fluid end of the pump should be drained, disassembled, cleaned and dried before they are put away. This is especially important in cases when the pump has been used in corrosive fluid applications, in which case the fluid end of the pump should be flushed with clean water or another non-corrosive cleanser and then blow dried with compressed air to ensure that the majority of the flushing fluid residue has been removed.

Severe Environment Precautions

In severe environments, take the following additional steps. The oil in the power end (crankcase) should be drained and the fill cap removed, and then refilled with 8 quarts of internal rust inhibitor vapor emitting oil. Replace the fill cap before storing.

In addition, pour 1 quart of internal rust inhibitor into both the suction and discharge ports of the fluid end, then install pipe plugs in any opening. Coat all exposed, unpainted metal surfaces with preservative oil, and cover the entire pump with a weather resistant coating, such as plastic or a canvas tarp.

2.2.3 Long Term Storage

As with short term storage, the fluid end should be drained, flushed and dried before storing. In addition, 1 quart of internal rust inhibitor should be poured into the suction and discharge ports of the fluid end, and then pipe plugs should be installed in any openings.

In addition, all oil should be drained from the power end, and all drive components should be sprayed with a rust preservative that is soluble in lubricating oil. This will require removing the rear cover, and the driveshaft should be rotated several times during the application to ensure even coverage. Once the rear cover is replaced, 2 quarts of rust inhibitor oil should be added to the crankcase, and all exposed metallic surfaces should be sprayed with a rust preventative coating, particularly the exposed portion of the driveshaft. Then cover the entire pump with a plastic or canvas tarp.

Upkeep for Long Term Storage

Units in long term storage should be inspected every two (2) months. During the inspection, the crankshaft should be rotated by hand at least 4 turns. Drain and replace the rust inhibitor in the crankcase every six (6) months.

2.2.4 Returning to Service

Pumps that have been stored for less than six (6) months should be able to be put right back into service with minimal complications. For units that have been in storage for six (6) months or more, drain any fluids in the crankcase and fluid end, refill the crank case with the specified quantity of oil, and inspect pump to ensure it is suitable for service.

CAUTION	Any pump that has been in storage, either after field use or as shipped from the manufacturer, should receive a thorough inspection to ensure that all parts and components are properly in place and that it has not been damaged in any way. Failure to do so can result in equipment failures which can damage the pump and injure nearby personnel.

Chapter 3: Operations

This section covers all standard procedures used to operate the WDD340 Pump. It includes all basic operational guidelines and recommendations, as well as pump startup and shutdown procedures.

3.1 Starting Procedure

The following startup procedure will help to ensure that the pump operates at maximum efficiency and will reduce the potential for damage during start-up.

3.1.1 Pre-Start Checklist

General Systems Checklist

The following items should be checked prior to starting up the pump.

- □ Check the installation to ensure that the pump is securely mounted horizontally and that no obvious damage to the pump has occurred.
- □ Verify that the prime mover is properly aligned.
- □ Check that the belts have the correct tension applied.
- □ Ensure that all guards and other safety devices are attached as required and functioning properly.

Fluid End Checklist

The following items should be checked prior to attaching discharge or suction piping.

- □ Remove any debris, and note any excessive rust on the system.
- □ Ensure stuffing boxes are tightened to the appropriate torque.
- □ Ensure piping is attached and proper stud/bolt tension has been applied.

Power End Checklist

The following items should be checked prior to startup.

- □ Check for any debris or signs of rust, remove if possible.
- □ Ensure the crank case is filled with the recommended type and volume of oil.
- □ Check the rotation to ensure the prime mover has been connected properly. The correct rotation is when the connecting rods come over the top of the crankshaft and are driving towards the fluid end.
- □ Ensure the breather cap and covers are in place prior to starting the pump.

3.1.2 Start Up Procedure

The following is the recommended start up procedure for the WDD340 pump.

1) Ensure that all guards and safety devices are in place.
2) If an external lubricating pump is used, engage it for 5 minutes prior to starting the prime mover.
3) Remove the access covers on the power end and fill reservoirs with oil to ensure lubrication will be in place when the pump starts. If starting a new pump or if the pump has recently been in storage, pour oil into the pinion bearing oil trough and crosshead oil reservoir as well to ensure immediate lubrication. Then replace the access covers.
4) Fill the liner wash system with coolant as necessitated by the pumping situation, in accordance with the manufacturer's guidelines.
5) Check the temperature of the lubricant in the crankcase and verify that the viscosity meets the minimum listed in the tables below.
   - If oil temperature is too low, use an external heat source to reduce viscosity.
   - If oil temperature is too high, provide a cooling loop to lower temperature.

CAUTION Do not operate the pump if the oil temperature is out of range.

6) Rotate the pump by hand to verify that there are no restrictions on its movement.
7) Open the bypass valve.
8) Open the valve at the suction tank
9) Apply power slowly (jog), verifying that proper rotation is established.
10) Open the discharge piping fully, increasing the power and closing the bypass line. Then check the following.
    - For external lubrication, ensure a constant supply of oil.
    - Check that the lubrication in the stuffing boxes is adequate.
    - Check the suction pressure and temperature.
    - Check the discharge pressure and temperature.
    - Check that the charge pressure of the discharge dampener is stable.
    - Check for leaks of any kind and remediate.
11) If all observed levels are within range, then release for operation.

3.2 General Operations

The following are some general guidelines for operating the WDD340 pump.

Intermittent Operations Use

The WDD340 pump is designed for intermittent operations, and is not rated for continuous service. The pump should not be run for more than 8 hours in any given 24 hour period. Doing so can place undue stress on the pump systems, which can result in operational malfunctions and potentially cause lasting damage to the components.

Pump Speed

The pump should be brought up to full operational speed gradually. This allows the flow velocity of the fluid in the suction piping to match the requirements of the pump without causing cavitations in the line.

Suction Pressure

The optimal suction pressure for the WDD340 is between 20 and 30 PSI, but any value between 15 and 40 PSI are considered acceptable. These pressures should be measured at the pump inlet during operations.

Natural Suction Operation

The maximum pump speed when operating with a “natural suction” (suction unassisted by systems such as a charging pump) is limited only by the pump’s ability to fill completely during the suction stroke. This limiting speed will be different for every installation, depending on suction piping, the available head, and the weight, pressure, viscosity and aeration of the fluid being pumped.

Experienced operators should be able to determine the limiting speed by slowly bring the pump up to speed and listening closely to its operation. As the limiting speed is approached, the pump will begin to pound, indicating cavitations in the line and incomplete filling of the chamber. This is the point at which a charging pump should be utilized, and should remain in use until operating conditions change and a natural suction can again be used.

Suction Stabilizer Charge and Adjustment

The suction piping pulsation dampeners should only be charged with a hand operated air pump. For full instructions in the safe operation of the low pressure suction piping pulsation dampener, see the documentation provided by the manufacturer of that equipment.

WARNING	The use of a high pressure source or nitrogen bottle to charge the suction piping pulsation dampener can result in catastrophic equipment failure and serious injury to personnel.

WARNING	Always use a regulator in the line when charging the discharge pulsation dampener. An uncontrolled increase of pressure can result in catastrophic equipment failure and serious injury to personnel.

WARNING	Do not use air to fill bladder, especially when pumping flammable fluids, as it may combust and cause catastrophic equipment failure and serious injury to personnel.

3.3 Basic Troubleshooting

The following section provides a basic guide to dealing with potential problems which may occur while using the WDD340 pump. This section is intended only as a basic problem solving tool, to help users ascertain the nature of the problem and allow for basic repairs should something go wrong. If problems do not match those outlined, or persist after all recommended solution options have been exhausted, do not attempt further work, but contact a Weatherford professional to examine the system and make a recommendation.

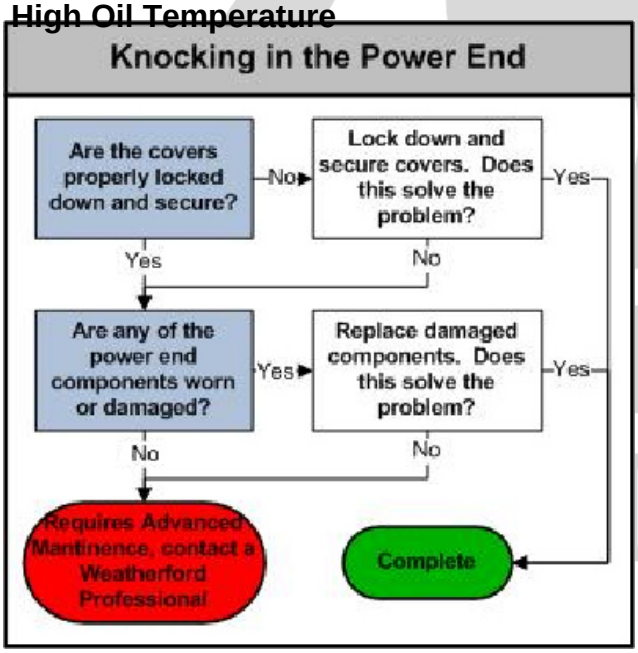
3.3.1 Power End Conditions

The following are some issues which can arise with the power end of the WDD340.

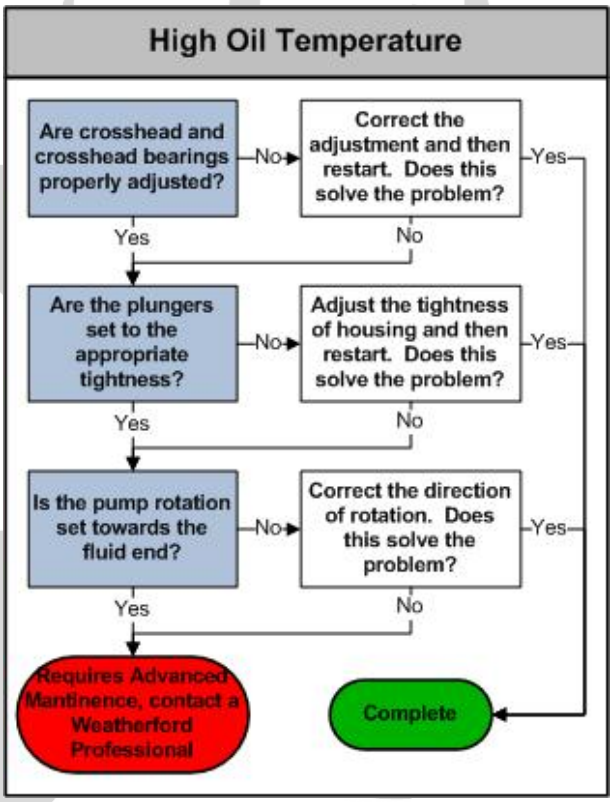
Knocking in the Power End

A knocking sound coming from the power end is usually caused by loose or worn components. Most often, it is simply a result of loosened or unsecured covers on the power end. Double check these, and make sure they are fit snugly and firmly locked into position.

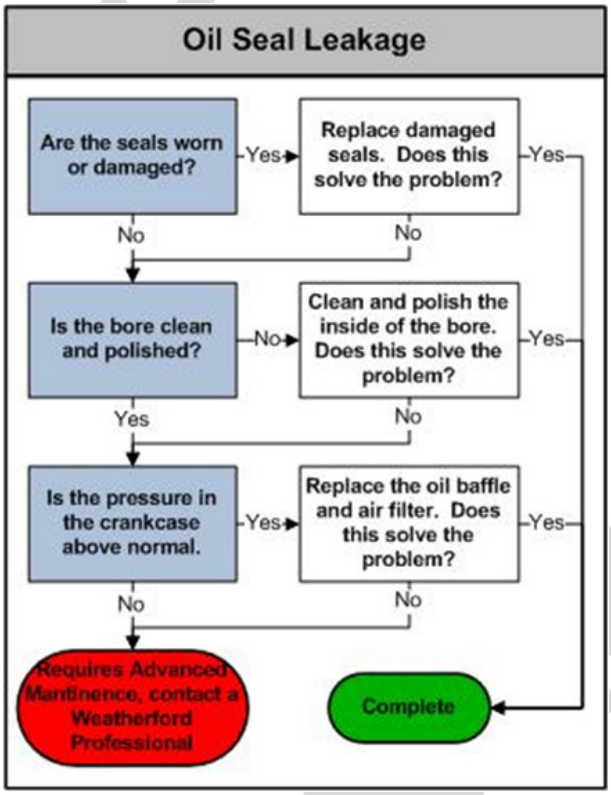
If they are secure, then likely the problem is worn or damaged components. Check the crossheads, crosshead pins, crank pin bearing, main bearing and crankshaft itself for signs of significant wear. In most cases, worn components will have to be replaced.



High Oil Temperature



The most common causes of high oil temperature are components improperly set into place. Check the crosshead and crosshead bearing adjustments, as well as the tightness of the plungers, and correct as necessary. If this does not work, double-check the pump rotation against the installation instructions (see 2.1.2: The Prime Mover, page 13) to ensure that it is rotating in the correct direction.



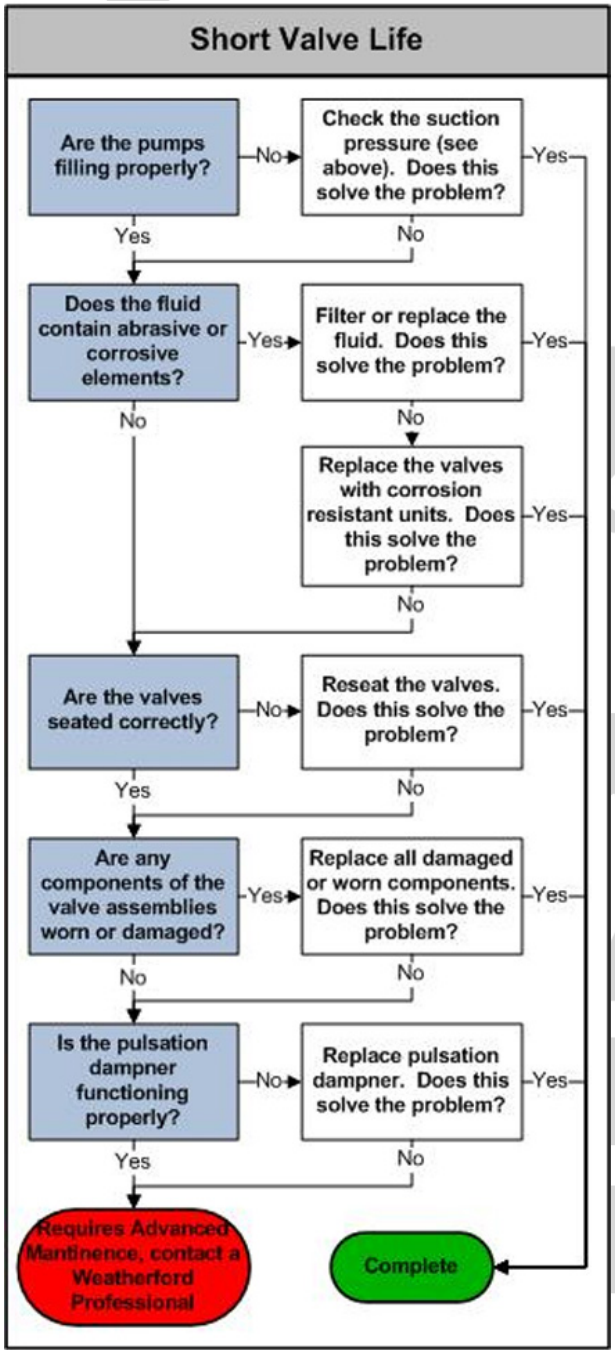
Oil Seal Leakage

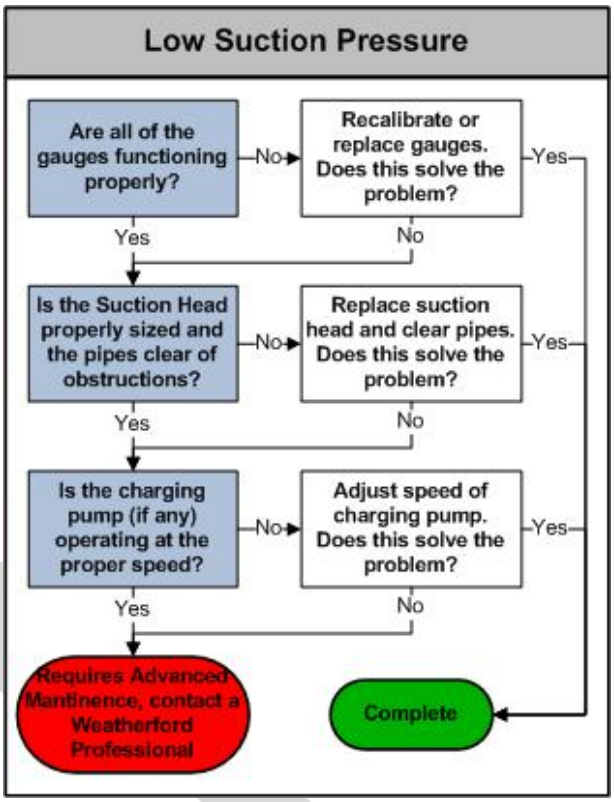
Most often, the oil seal leakage results from the seal not completely covering the bore. First, remove the seal and check it for damage, replacing if necessary. Then clean and polish the bore, and reinsert the seal, making sure that it is properly seated.

If this does not work, double check the pressure in the crankcase. If it is too high, replace the air breather and oil baffle.

3.3.2 Fluid End Conditions

The following are some issues that may arise regarding the Fluid End of the WDD340 pump, along with their most common causes and solutions.





Low Suction Pressure

Ensure that the pressure gauge is functioning properly and correctly calibrated. Low suction pressure is most often caused by insufficient flow. Check that the suction head is sufficiently sized for the suction desired and that there are no restrictions in the suction piping. If using a charging pump, also verify that it is operating at proper speed.

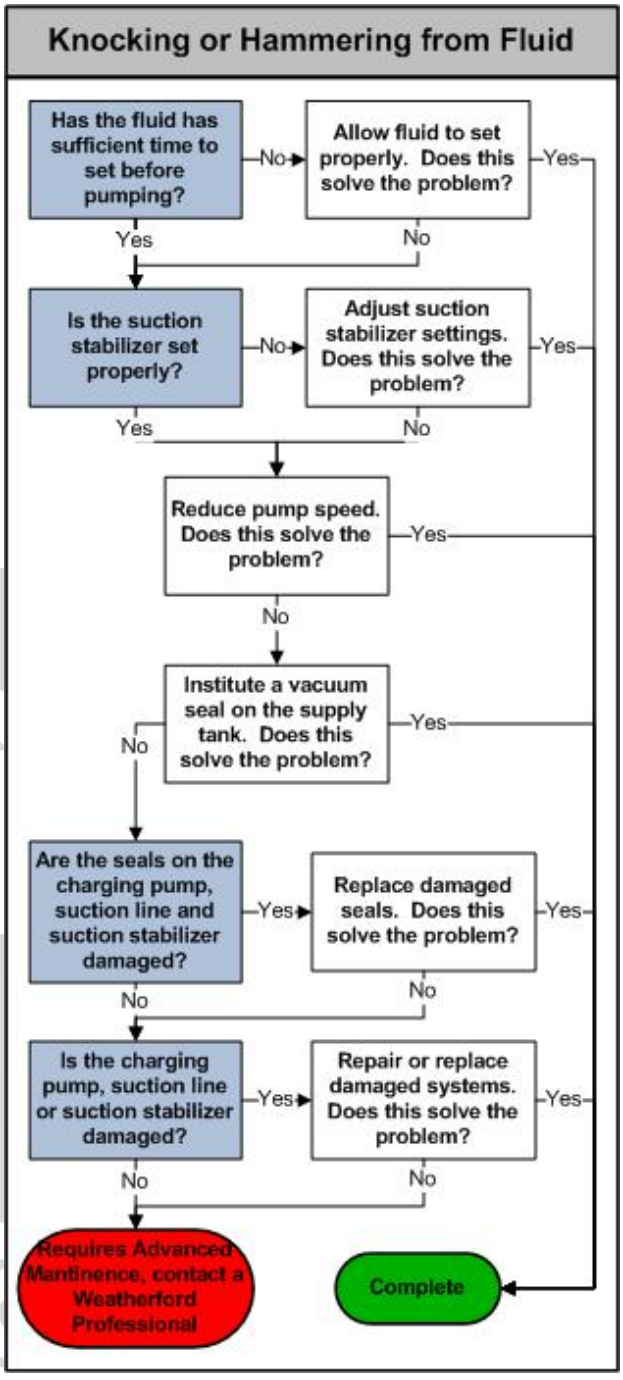
Short Valve Life

Check the suction pressure to make sure the pump is filling properly. If the pressure is normal, check the fluid for abrasive or corrosive elements. If present, filter or treat the fluid, or replace the valves with corrosion resistant materials. If this does not help, remove the valves and make sure they are seating correctly and that the components are not for damaged. Do the same for the pulsation dampener, and replace parts and systems as needed.

Knocking from Fluid End

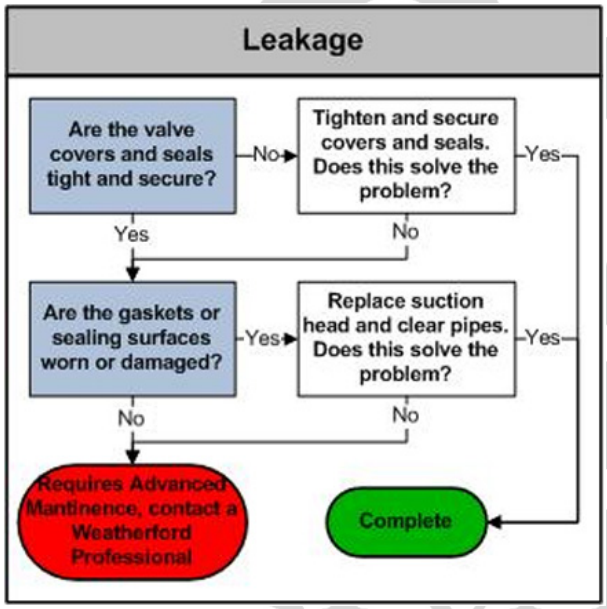
Most often, this is caused by air or gas in the fluid. This can be caused by pumping the fluid before it has set properly, so ensure that the fluid has enough time to set. If this is ruled out, check the suction stabilizer, and adjust as needed. If this does not work, then try reducing the pump's speed or imposing a vacuum on the supply tank.

If the fluid itself is not aerated, check the suction piping, suction stabilizer and charging pump for insufficient seals or damage that would allow air to enter the system. Repair or replace as necessary.



Leakage

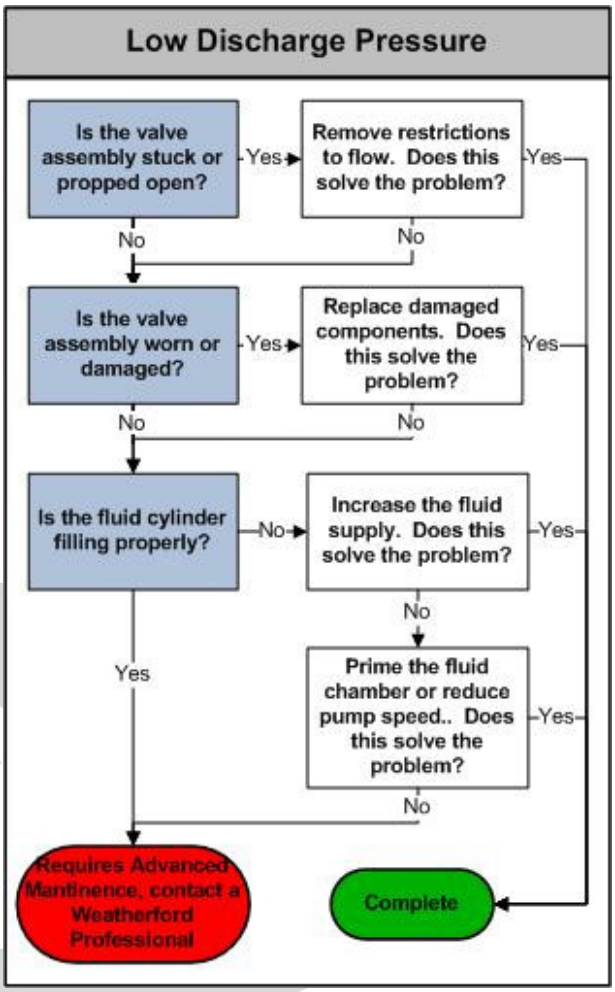
Leakage is a result of incorrect seals and defects in the sealing surfaces. Check to make sure the valve cover and stuffing box retainers are not loose, and tighten as necessary. Then check the gaskets and sealing surfaces for wear or damage, and replace as necessary.

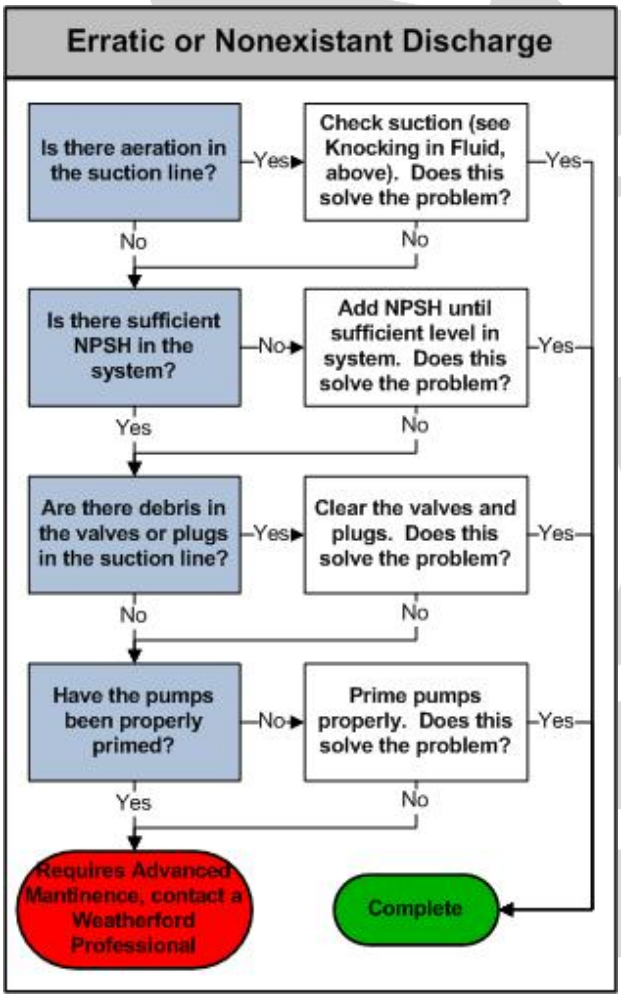


Low Discharge Pressure

Low suction pressure is most often caused by a stuck, worn or damaged valve assembly. Make sure the valve is not propped open, and remove any restrictions to the flow. If the valve assembly itself is damaged, it will need to be replaced.

If this does not work, check to make sure it is filling properly. If not, increase the fluid supply, either by opening up the piping or increasing the speed of any charging pumps used. If this does not work, try priming the fluid chambers or decreasing the pump speed.





Erratic or Nonexistent Discharge

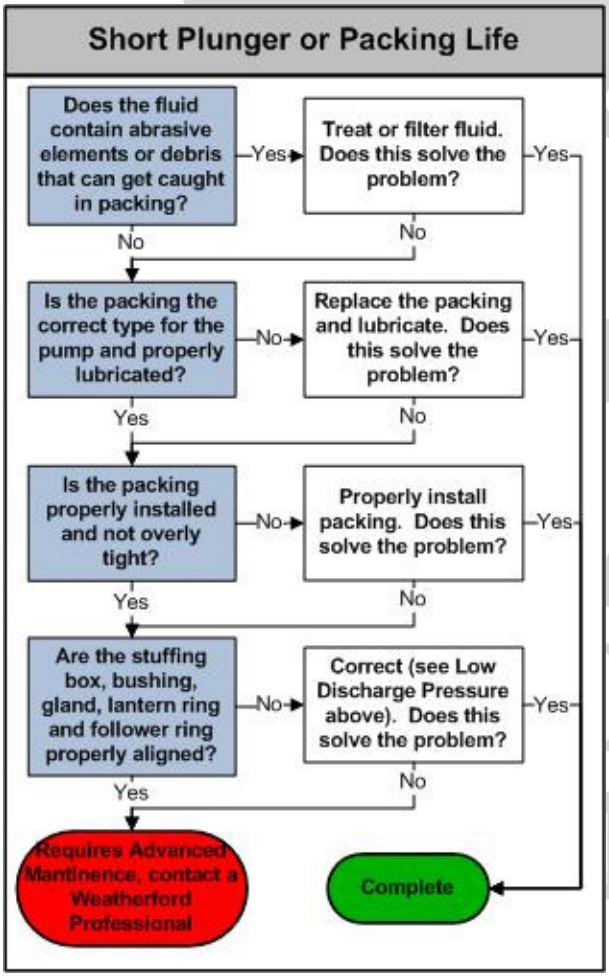
First, check the suction for aeration, as per Knocking from Fluid above. If this does not help, check that there is sufficient NPSH in the system, and rectify if needed. Then check for debris in the valves or plugs in the suction piping, and remove if found. Finally, make sure the pumps are primed properly.

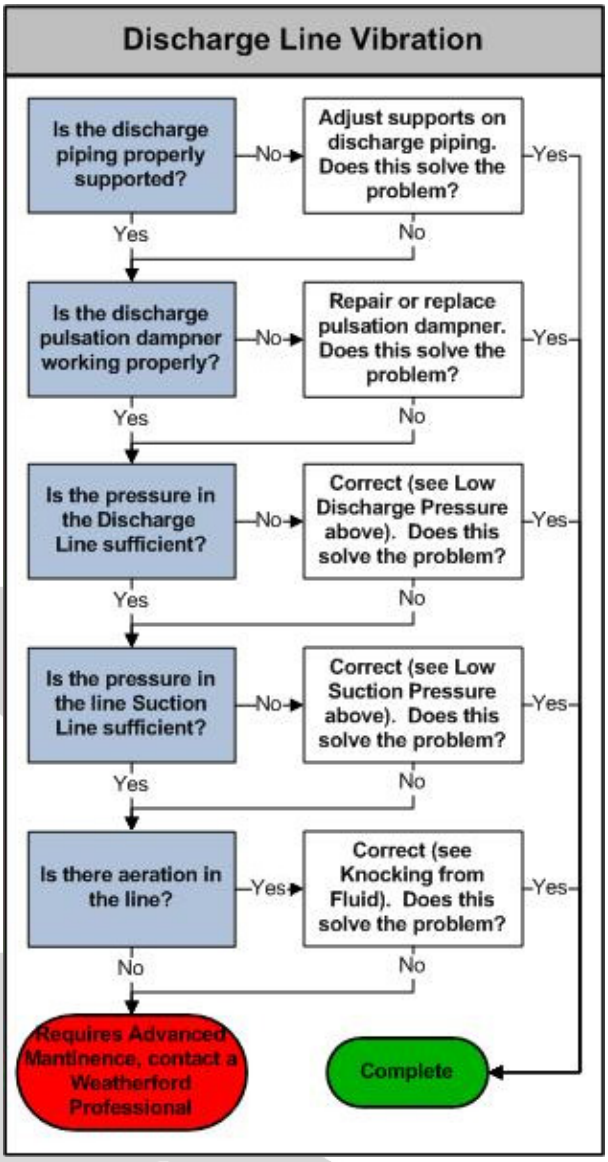
Short Plunger/Packing Life

Check the fluid for abrasive or corrosive elements, and filter or treat as needed. If debris appears in the packing, then adjust the fluid mix or using different packing.

In addition, make sure that the packing is the specified type for this machine, and is appropriately lubricated with rock drill oil. Double check that the packing is not over-tightened, as this will significantly reduce its operational life. If the fluid is clean, replacing the plungers with ceramic units will help if the fluid being pumped is clean.

If none of the above conditions apply, check the alignment of the stuffing box, bushing, gland, lantern ring and follower ring, and replace as needed.





Discharge piping Vibration

First, make sure that the discharge piping is properly supported, and that the discharge pulsation dampener is working normally. If so, then the cause is most likely the cause is either low discharge pressure or aeration of the line (see Knocking from Fluid and Low Discharge Pressure above), or low suction pressure (see Low Suction Pressure under 3.3.2: Fluid End Conditions).

Chapter 4: Maintenance

4.1 Tools and Equipment

4.1.1 Tools and Equipment Used

The following list includes all of the standard tools and equipment used to perform basic maintenance on the WDD340 pump. All are included in the basic maintenance kit.

- □ One (1) pipe wrench
- □ One (1) torque wrench
- □ One (1) valve puller assembly
- □ One (1) hook magnetic retriever tool
- □ One (1) seat driver
- □ One (1) dampener charging kit
- □ Lifting lug tool kit (see page 102)

4.2 General Maintenance Guidelines

Regular maintenance of the WDD340 pump will help to ensure not only a long operational life, but will also enhance the efficiency and operational stability of the pump. The guidelines provided below offer general instructions for maintaining the systems and equipment, as well as a maintenance schedule that will help to ensure optimal performance and lifespan.

All procedures outlined for the WDD340 pump should be followed in accordance with their scheduled timelines. Any third-party equipment and systems should be maintained in accordance with the manufacturer's guidelines.

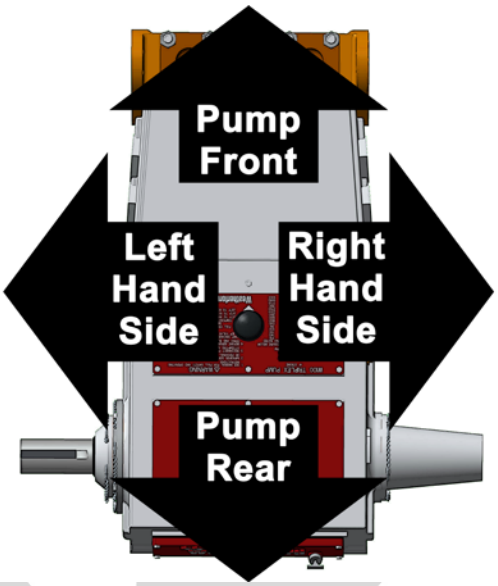
Gaskets and Seals

The gaskets and seals on the WDD340 pump require precise measurements and positioning to be effective, which is most effectively achieved during initial installation. The stresses of operations will cause small but significant deformations in these components, which should not affect them so long as they remain in place, but makes it very difficult to successfully remove and reinstall these components without a significant drop in operational efficiency. Therefore, Weatherford recommends that all valves and seals disturbed or removed during maintenance procedures be replaced with new units regardless of their apparent condition.

4.2.1 Pump Orientation Definitions

It is standard practice regarding hydraulic pumps to describe them as if viewed on a level surface, looking from behind the power end and towards the fluid end. Therefore, the “front” of the pump is the fluid cylinder, the “back” of the pump is the power end rear cover, and the “left” and “right” sides are defined as if viewed from this angle (see image).

As such, whenever this manual refers to the “front,” “back,” “left hand side” or “right hand side,” it is referencing the pump as if viewed from this orientation. See the *Standards of the Hydraulic Institute*, 14th Edition for more details.



4.2.2 Lubrication

Regular lubrication of the components is essential for pump longevity. By maintaining a regular lubrication schedule and using the correct lubrication for the type of service, the life of a pump can be extended dramatically.

Oil should always pour freely at the operating temperature, and should be free of contaminants. If the oil is contaminated, it should be replaced immediately. Replace oil as often as necessary to maintain proper viscosity and keep the oil free of sludge. Check oil level periodically (see 4.2.6: Daily Maintenance Checklist on page 34) and if the pump is idle for an extended period of time, rotate occasionally to avoid corrosion.

Crankcase Lubricants

During operation, significant loads will be placed on the crankshaft, connecting rods and crossheads, and so a heavy duty industrial gear lubricant rated for extreme pressure should be used. Consult the Lubrication Chart on page 32 for recommended lubrication by air temperature. At minimum, ‘an AGMA specification 250.04 oil that has passed a 60 lb load arm test’ should be used.

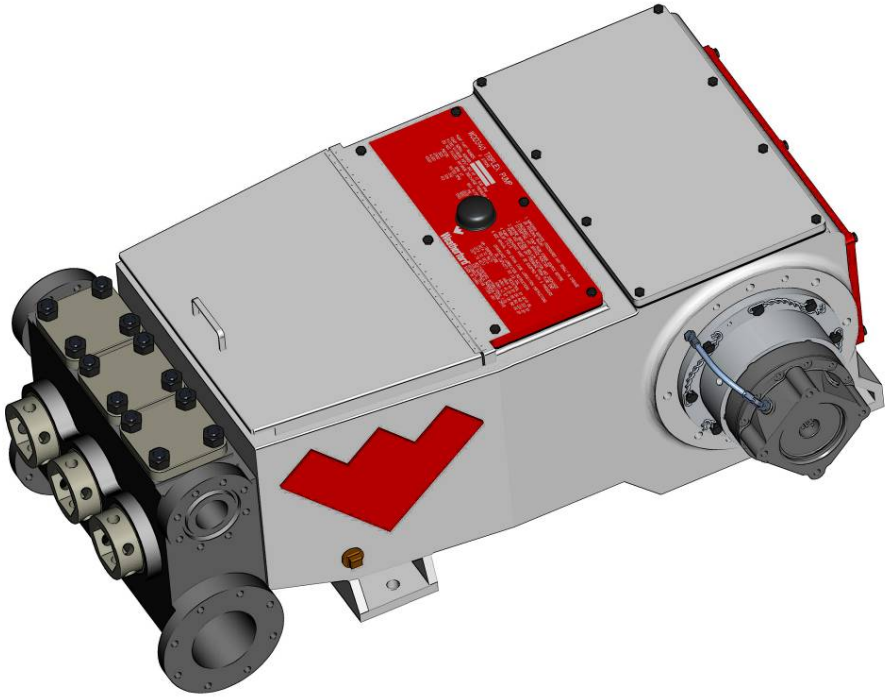
Piston Lubrication

The lubrication for the pistons is normally supplied by a drip inside the liner, as this is the most effective means of lubricating the piston cup. Use rock drill oil as indicated on the table below, and replace as indicated. Monitor the operation of the mechanical pump to ensure proper functioning.

Temperature Maintenance

The oil temperature should be continuously monitored during operations, and it is recommended that a low-level alarm system is employed to warn of extreme temperature fluctuations. In extreme conditions, a heat exchanger may be needed to keep the crankcase temperature below 180°F (82°C).

4.2.3 Lubrication Chart



Oil Quantity
Approximately 6.5 U.S. Gallons (24.6L)

Oil Type

Air Temperature (°F)			Air Temperature (°C)			Industrial EP Gear Oil
50°	to	176°	10°	to	80°	AGMA EP 460
30°	to	155°	-1°	to	68°	AGMA EP 320
-4°	to	125°	-20°	to	52°	AGMA EP 220

Oil Cleanliness
ISO 4406 Code 16/64 (NAS 1638 Class 8)

Oil Change Period
The pump should have its first oil change after 400 hours of operation.
Subsequent oil changes should occur every six months or 2,000 running hours, whichever comes first.

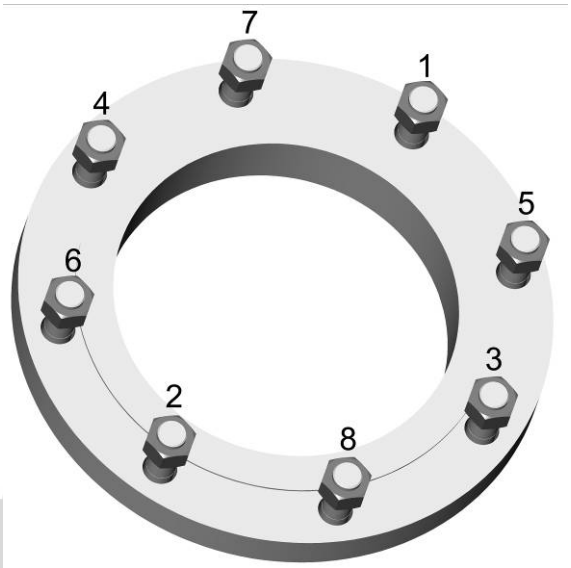
Oil Change Procedure
1. Shut down and lock out the pump as per standard procedure. The drain plug should be removed and the pump gear lube oil drained immediately after shutdown is complete.
2. Remove the pump gear inspection opening cover plate
3. Visually inspect the gearing status, and report any damage, defects or other potential problems.
4. Reinstall drain plug and ensure it is secure.
5. Refill the crankcase with the correct oil type (see above) through the cover plate opening.
   NOTE Oil may require pre-filtering to obtain an acceptable cleanliness level.
6. Replace the cover plate and gasket.

4.2.4 Fastener Torque Specifications

When tightening multiple bolts on flanges, it is considered the best practice to tighten opposite bolts first, to ensure a tight, flat seal. The diagram below provides a recommended order in which to tighten the bolts to best ensure a tight seal.

In addition, it is generally best to first tighten each bolt as far as possible by hand. Once all bolts are so tightened, tighten each bolt to one-half normal torque, and then finish by tightening each to full tightness.

CAUTION Failure to use proper torque values can cause fasteners to come loose over time, which can result in stress fatigue and major equipment damage.



4.2.5 Biannual Inspection

It is recommended that, in addition to the procedures and processes outlined below, the WDD340 pump receive a complete inspection about once every two years. This inspection should cover all components and systems, checking for wear and tear and ensuring that the pump is still in good operating condition. All damaged, defective or otherwise nonfunctional components should be repaired if possible or replaced.

4.2.6 Daily Maintenance Checklist

- □ Check the oil level and quality in the power end, lubricator and chain case. Ensure that the oil temperature is within range and check for contaminants. If oil is contaminated, remove and carefully clean the power end and screen before adding new oil.
- □ If a charging pump is used, check to ensure it is properly lubricated.
- □ Check the piston cup and adjust as needed.
- □ Check the lubrication on the pistons.
- □ Drain any piston leakage.
- □ Check the pressure in the suction system, ensuring it is within range. If not, consult Low Suction Pressure on page 26.
- □ Check that the suction stabilizer has the correct fluid level and pressure.
- □ Check the pressure in the discharge system, ensuring it is within range. If not, consult Low Discharge Pressure on page 28.
- □ Check that the pulsation dampener on the discharge system is set to the correct pressure.
- □ Check the entire pump for oil or fluid leaks, including the oil seals in the power frame. If leaks are detected, consult Oil Seal Leakage (page 25).
- □ Check to ensure the pump is clean and ready for work.
- □ Check to ensure the work area around the pump is clean and free from hazards.

4.2.7 Weekly Maintenance Checklist

- □ Flush the fluid in the cradle drain lines.
- □ Check the valves and seats for wear, and replace any cut or worn inserts.
- □ Check the bushing in the valve stem guide and replace if visibly worn.
- □ Check over the piston crosshead coupling for loose or damaged components, and correct as necessary.
- □ Clean the screens and settling chamber in the fluid reservoir.
- □ Check that there are no cracks, kinks, wrinkles or blockages in fluid hoses and lines.
- □ Check over all guards, shields and other safety systems, ensuring that they are properly locked into position and in working order.
- □ Check the condition of the Prime Mover, belts, chains or direct drive system in accordance with manufacturer's instructions.

4.2.8 Monthly Maintenance Checklist

- □ Check over all tools used to work on the pump, ensuring that they are in good working order and readily available.
- □ Check all of the bolting on the fluid and power ends of the pump, and make sure it is tight and secure.
- □ Check that the pressure relief valve is set to the correct pressure and operational.
- □ Check the pistons and cups for wear and tear, and replace as needed.
- □ Check the extension rod rods for wear and tear, and repair or replace as needed.
- □ Clean out the crankcase breather, replace as needed.
- □ Check the valves, seats and springs for wear and tear and to ensure they are in good working order. Replace as needed.

4.2.9 Semiannual Maintenance Checklist

- □ Check that all crossheads and crosshead pins have proper clearance and that they are in good working order.
- □ Check that the main bearing has proper clearance and that it is in good working order.
- □ Check that the crank pin bearing has proper clearance and that it is in good working order.
- □ Clean the foundation and/or the hold down bolts, and ensure the pump is properly oriented and secure against the surface.
- □ Check the bolting on the suction flange to ensure it is secure.
- □ Check the bolting on the discharge flange to ensure it is secure.
- □ Check the pump sheave or coupling for wear and tear. Replace as needed.
- □ Change the oil and the filter in the crankcase breather.
- □ Change the flushing media.

4.3 Routine Maintenance Procedures

4.3.1 Venting Pressure in the Fluid End

Before any maintenance is performed on the stuffing boxes, pistons or valves, all pressure should be vented from the system. To do so, close the shut-off valves in both the suction and discharge lines and then open the by-pass line. Allow all pressure to vent completely before performing maintenance on fluid end components.

CAUTION	Even while at rest, the fluid end of the system is under significant pressure, which if accidentally or inappropriately released can cause significant equipment damage and injury to nearby personnel. All pressure must be vented from the system before any maintenance on the fluid end is performed.

4.3.2 Pre-Installation Procedure

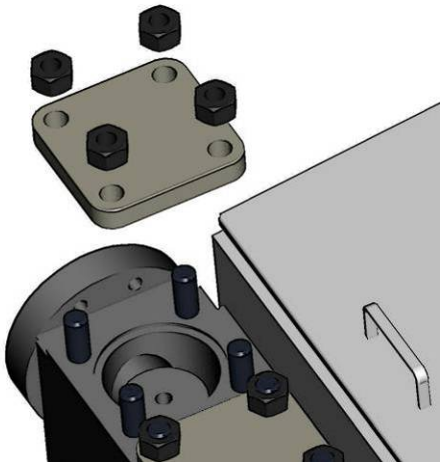
Before installing any parts or components into the system, all parts should be gathered and checked to ensure they are ready for use before installation begins. This includes checking that all mountings, sealing faces and bores are clean and free of burrs, nicks and raised metal.

4.4 Components Disassembly

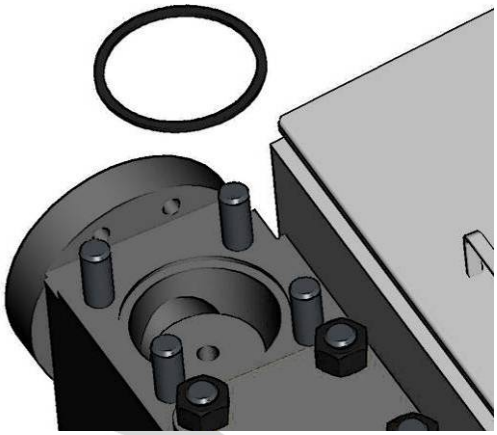
4.4.1 Removing the Valves

The following is standard procedure for removing the valves on the WDD340 pump.

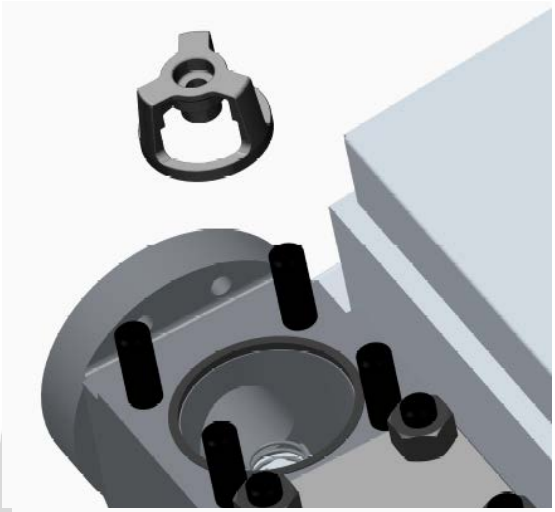
1 Remove the nuts from the cover screws and the valve covers.



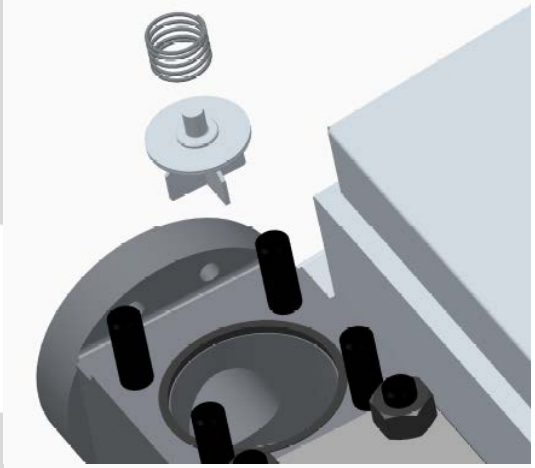
2 Remove the valve seal from the counter bore. Inspect the valve seal for cuts or extrusions, and replace if necessary.



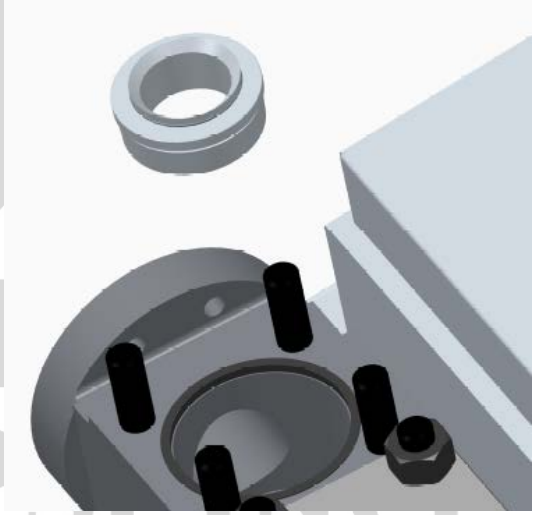
3 Use the retainer tool to unlock the spring retainer from the discharge valve assembly, and lift out of the bore.



4 Lift the spring and valve free of the bore.

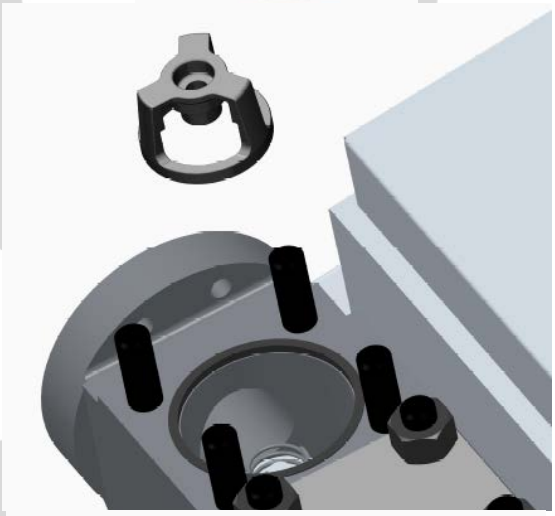


5 Remove the valve seat by placing the puller head through the seat opening and engage the lugs to the underside of the seat. Pull the seat free, bumping loose if necessary, and extract from the bore.

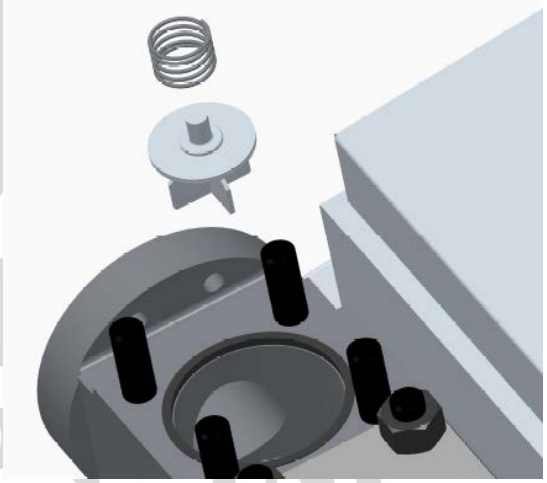


6 Reassemble all of the discharge valve components outside of the fluid cylinder in order to keep the component parts together.

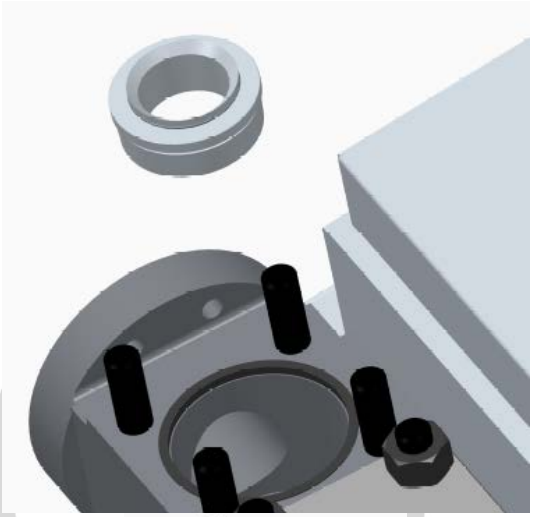
7 Use the retainer tool to unlock the spring retainer from the suction valve assembly, and lift out of the bore.



8 Lift the springs and valve free of the bore.

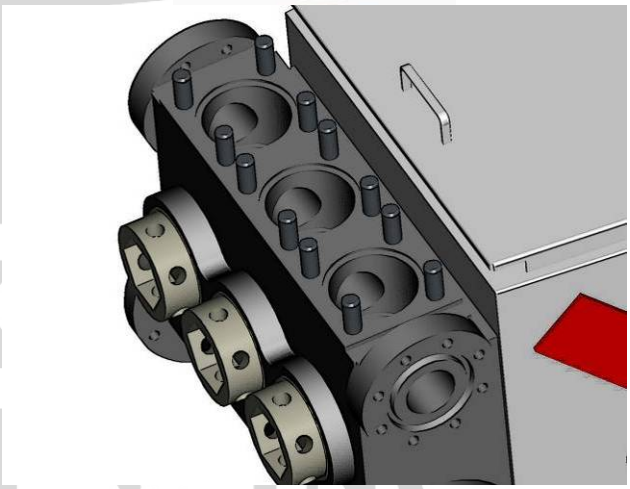


9 Remove the valve seat by placing the puller head through the seat opening and engage the lugs to the underside of the seat. Pull the seat free, bumping loose if necessary, and extract from the bore.



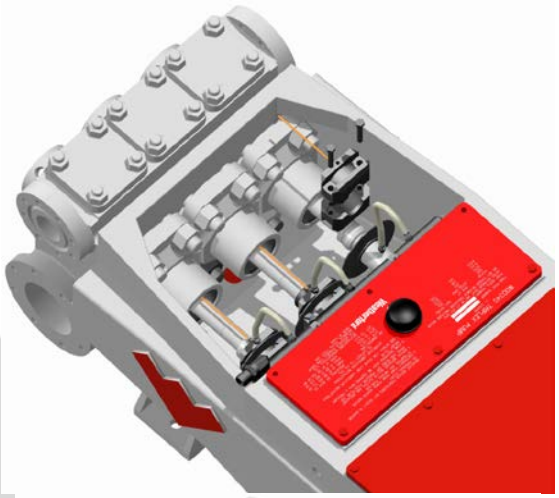
10 Reassemble all of the suction valve components outside of the fluid cylinder in order to keep the component parts together.

11 Check the cylinder tapers and sealing counter bore for nicks, scratches, cuts or washed out areas with a flashlight. The fluid cylinder should be reworked if these areas are too deep for the seals to work effectively.



4.4.2 Removing the Piston and Liner

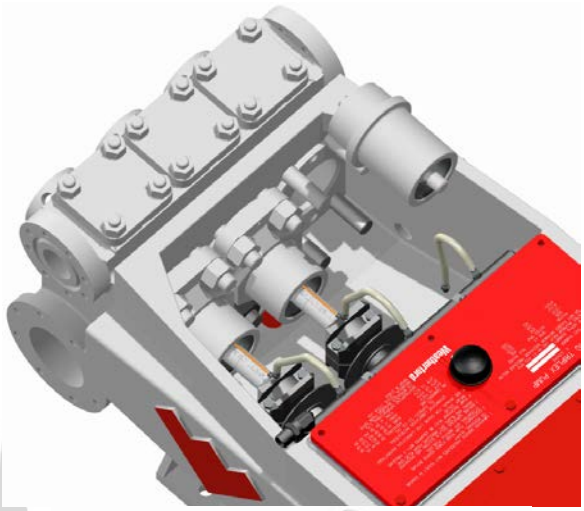
1 Rotate the pump until the intermediate rod is at the end of its suction stroke (fully retracted towards the power end). Disconnect the liner wash system from the clamp. Then remove the clamp affixing the piston rod to the intermediate rod.



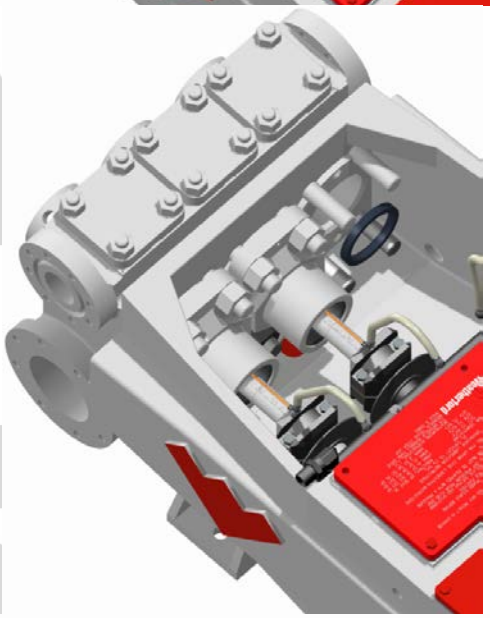
2 Remove the sub-rod.

3 Remove the four (4) liner retainer nuts and the liner retainer.

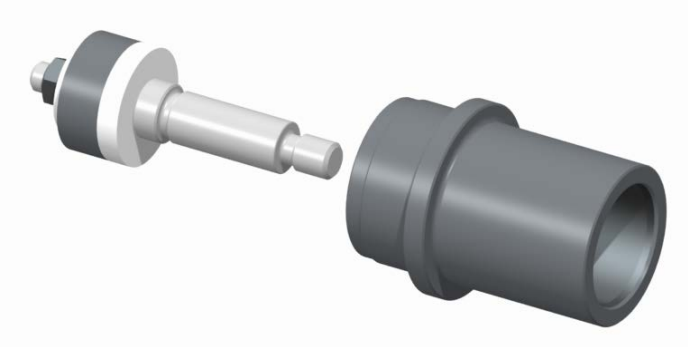
4 Remove the liner with piston assembly and piston rod.



5 Remove the seal and discard. Note the seal should be disposed of properly and not reused.



6 Remove the piston rod and piston assembly from the liner.

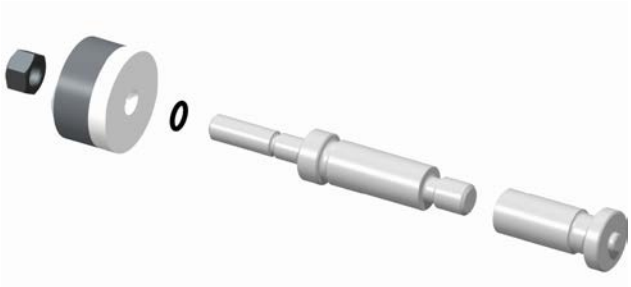


4.4.3 Piston Disassembly & Parts Replacement

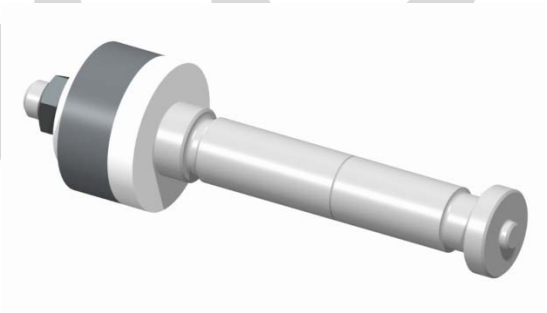
The following procedure is intended to be used to disassemble and replace the component parts for the pistons on the WDD340 pump.

1 The piston hub seal is located in the piston counter bore. To access, simply remove the piston rod nut and slide the piston hub off of the piston rod.

NOTE Always replace seals which have been loosened or manipulated during maintenance procedures.



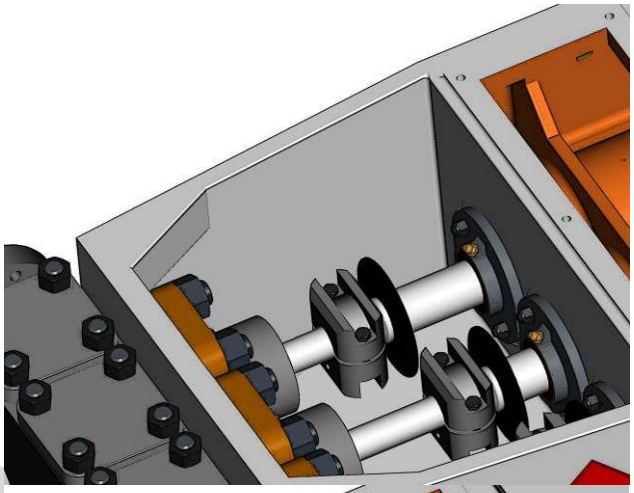
2 Replace the hub, ensuring that the seal remains properly aligned with the groove in the piston hub. Lock into position using the piston rod nut, and torque to 800 ft. lbs. torque (on a 1" piston rod nut).



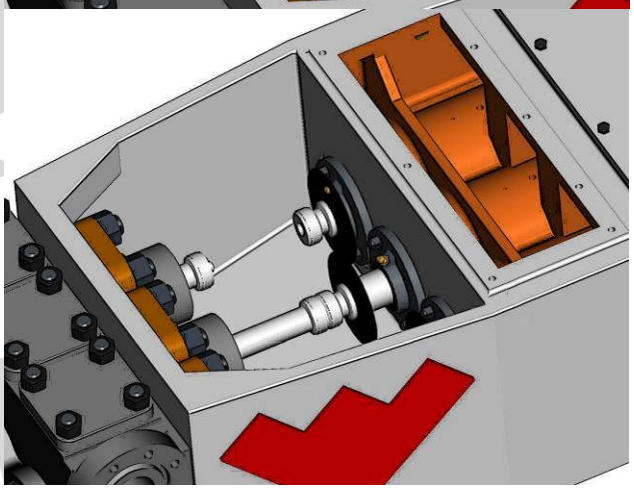
4.4.4 Removing the Intermediate Rods

The following is procedure for removing the intermediate rods from the WDD340 pump.

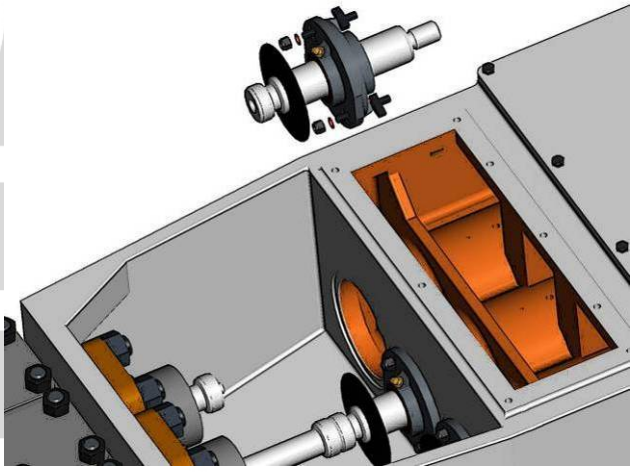
1 Rotate the crankshaft until the intermediate rod is at the end of the suction stroke (fully retracted towards the power end).



2 Loosen the intermediate rod from the crosshead ½ turn. A backup wrench should be used for this application.



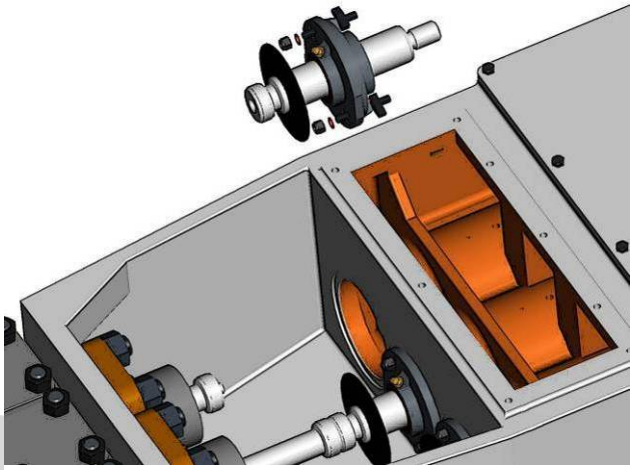
3 Rotate the crankshaft until the intermediate rod is fully retracted towards the power end. Loosen the two (2) wiper box nuts so that the J-hooks disengage, and then remove the wiper box and intermediate rod as a single assembly.



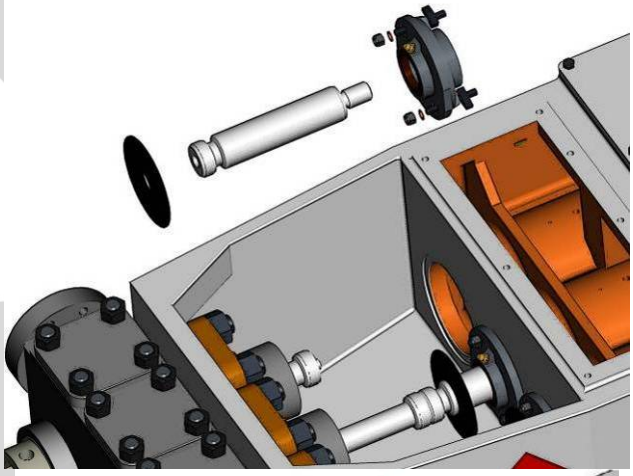
4.4.5 Disassembling the Intermediate Rods and Wiper Boxes

The following is standard procedure for disassembling the intermediate rods and wiper boxes on the WDD340 pump.

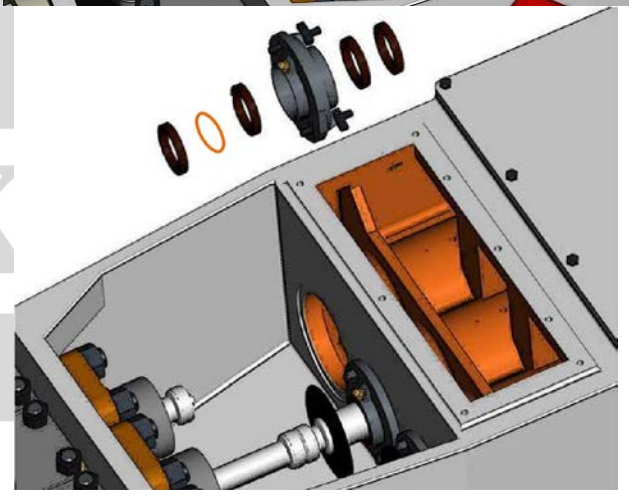
1 Remove the intermediate rod assembly as indicated in (page 44).



2 Remove the baffle and the intermediate rod from the wiper box.



3 Remove the two seals and lantern ring from the front and two (2) wiper seals from the back of the wiper box. Be sure to note the direction the seals are facing.



4.5 Components Assembly

4.5.1 Piston Cup Replacement

The standard pistons for the WDD340 pumps have separate piston cups, which may be removed for replacement, use the following procedure to replace the cups.

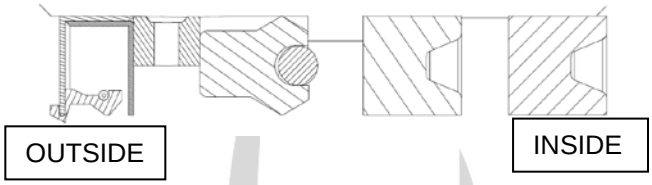
1 To remove, simply remove the snap ring from the front of the hub and slide the piston cup free.

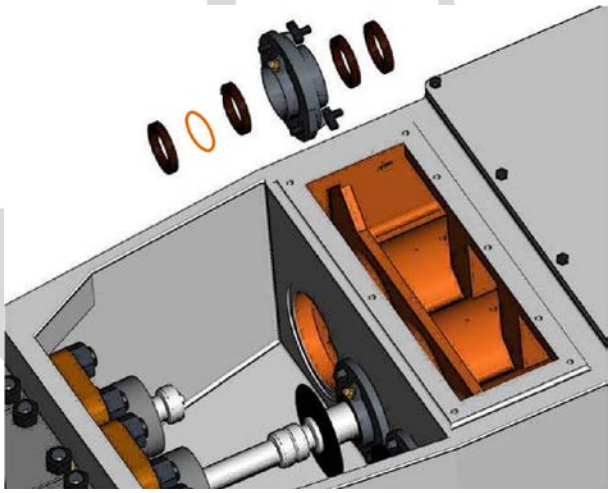
2 To reinstall, simply slide the new cup and plate onto the hub and secure in place with a snap ring. (see page 97 for the replacement kit)

4.5.2 Replacing the Intermediate Rods and Wiper Boxes

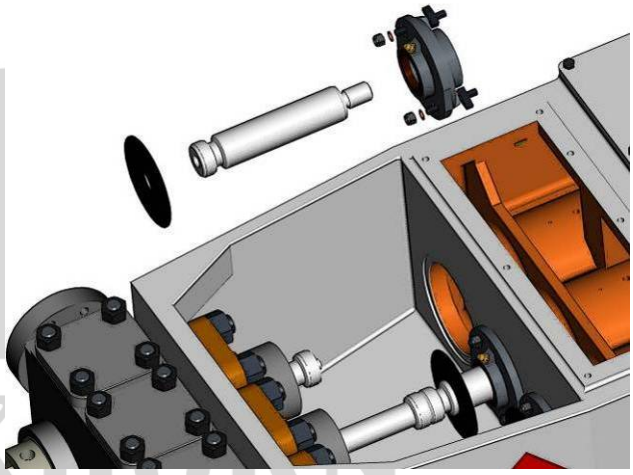
The following is standard procedure for replacing the wiper boxes and intermediate rods. Be sure to clean the seal bore in the wiper box before beginning reinstallation.

1 Install seals and lantern rings as shown.

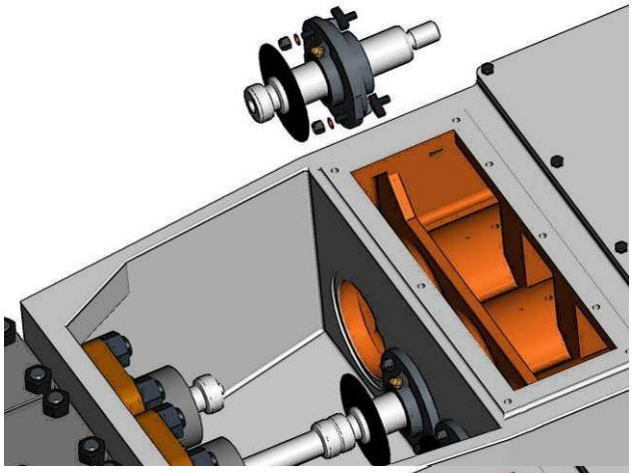




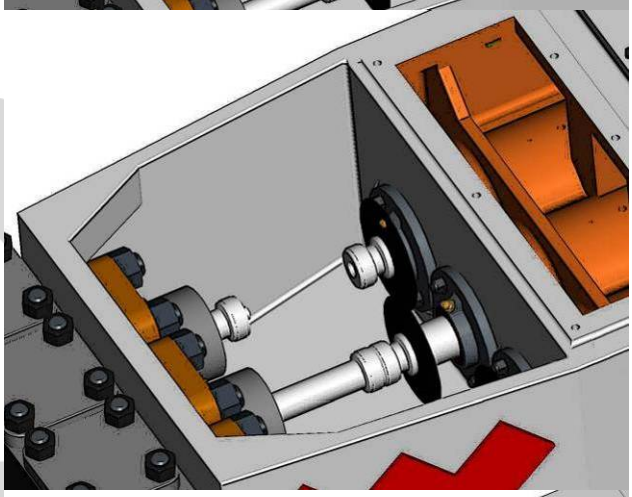
2 Slide the wiper box onto the intermediate rod.



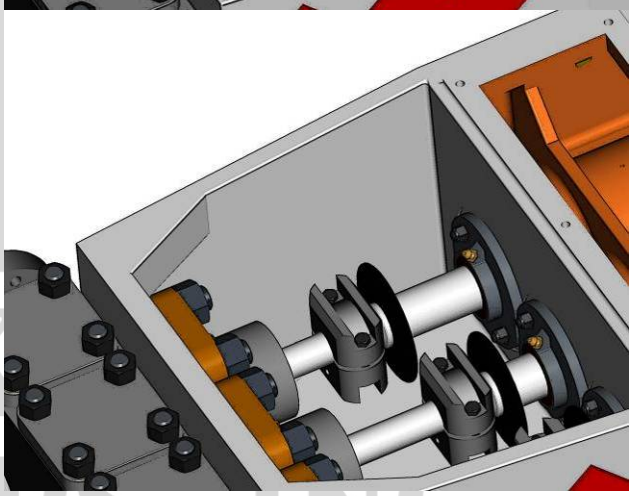
3 Rotate the crankshaft until the crosshead is at the end of the suction stroke (fully retracted towards the power end). Coat all threads with anti-seize, then lower the intermediate rod and wiper box assembly into the cradle. Check that the wiper box seal is in place and then screw the intermediate rod into the crosshead.



4 Rotate the crankshaft until the intermediate rod is at the end of its discharge stroke (fully extended towards the fluid end). Slide the wiper box into place and rotate the wiper box nuts until the J-hooks are engaged, and then tighten.



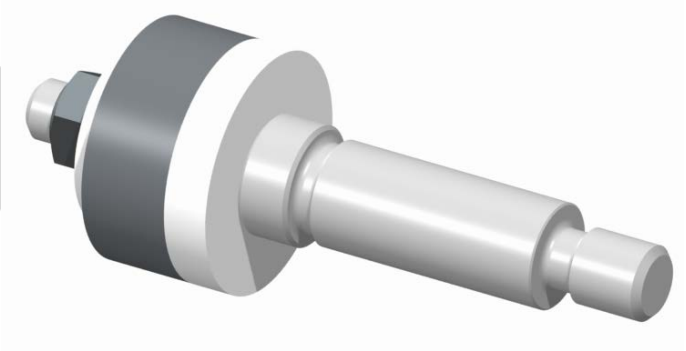
5 Tighten the intermediate rod into the crosshead; use a pipe wrench with a 3 foot cheater pipe. Fill the wiper box with grease until it begins to leak out of the bottom vent hole.



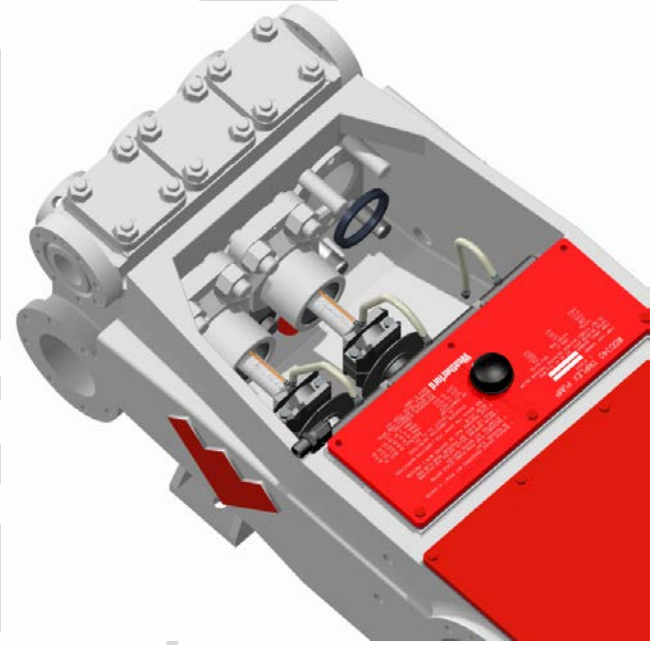
4.5.3 Installing the Liner and Piston

1 Check that all parts are clean and free of nicks and burrs.

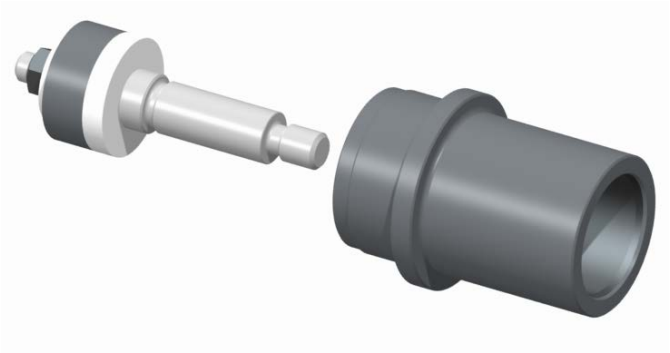
2 Assemble the piston as per the instructions provided in Piston disassembly and parts replacement.



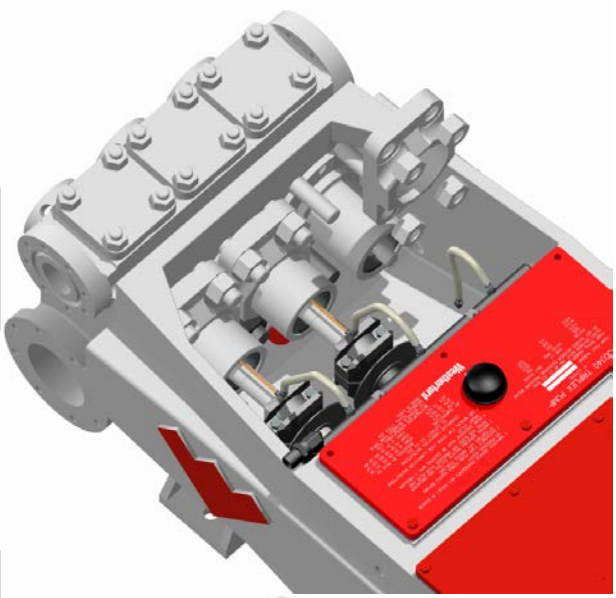
3 Clean the face of the fluid cylinder and liner. Install a new seal in the bore.



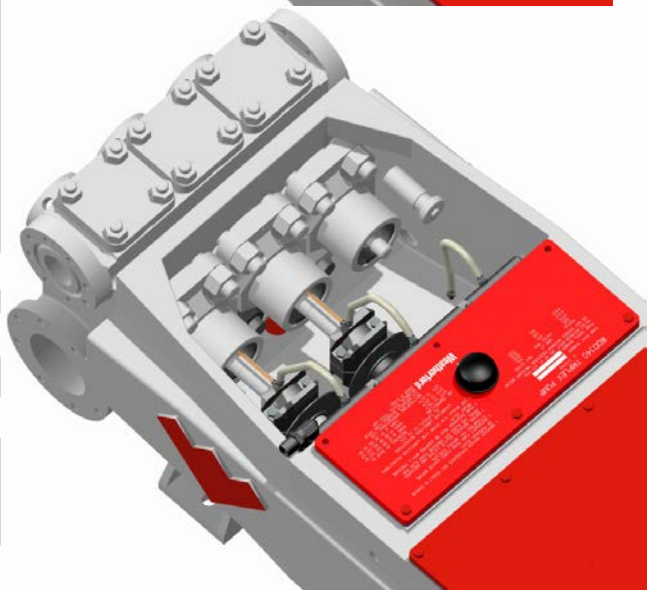
4 Drive the piston into the liner with a driving tool, exercise caution to ensure the piston rod is not damaged. Place liner into pump frame.



5 Install the liner retainer. Tighten the liner retainer nuts to 640 ft lbs of torque.



6 Assemble sub-rod to piston rod.



7 Rotate the pump until the intermediate rod mates back up with the sub rod. Ensure that the numbers stenciled on each side of the piston rod clamps match and install around the piston rod and crosshead extension end flanges respectively, ensuring that the liner wash connection holes remain at the top center.

8 Unite the clamp halves and torque the bolts into place at 150 ft lbs. Reconnect the liner wash hose.

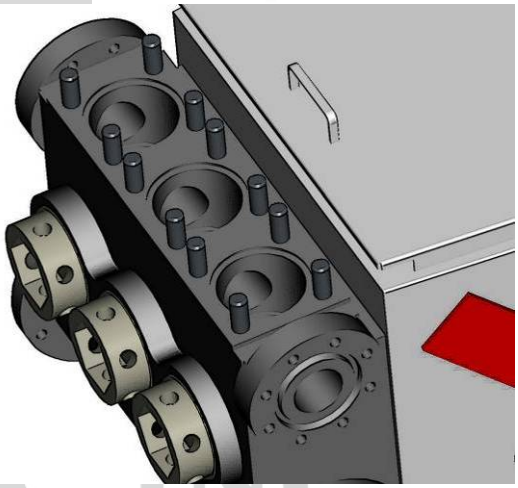
4.5.4 Installing the Valves

The following is standard procedure for installing the valves on the WDD340 pump.

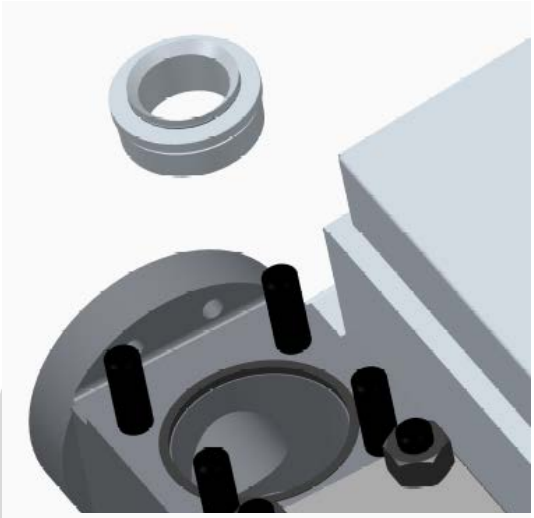
1 Thoroughly clean and inspect all parts, checking for corrosion and other damage. Repair or replace as required.

2 Assemble the suction valve assemblies on top of the pump. Make certain the seat is shouldered up to the cage and the spring is correctly positioned atop the valve.

3 Make certain that the cylinder tapers are clean and dry. Note that this may require solvent cleaning and drying of the bores

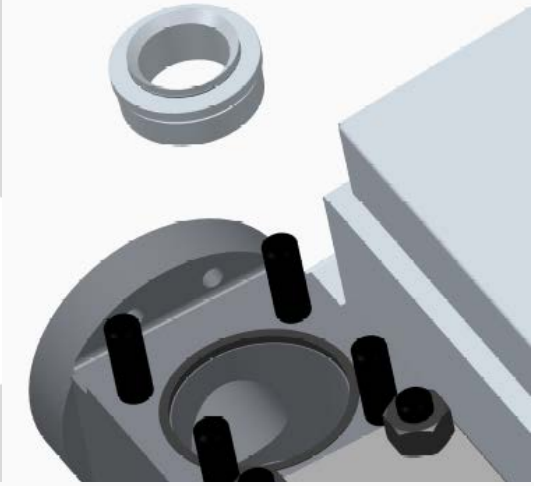


4 Insert the suction valve seat into the bore.

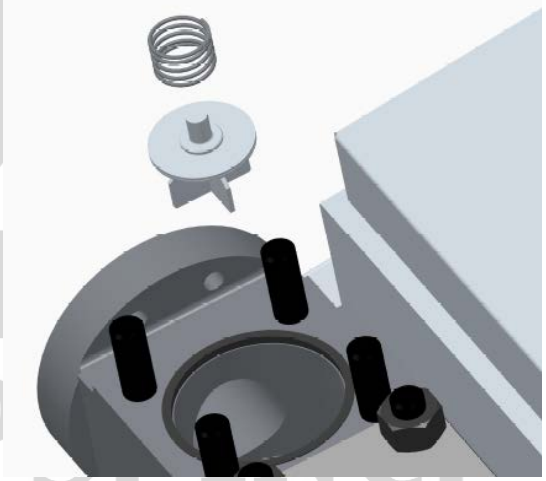


5 With a bar and driver, tap the seat into place with two or three strokes.

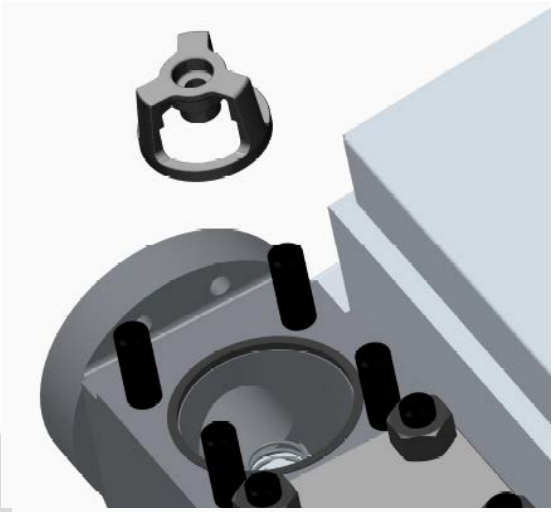
NOTE: The valve seat does not have to be completely seated, as start-up pressure will drive the seat into place.



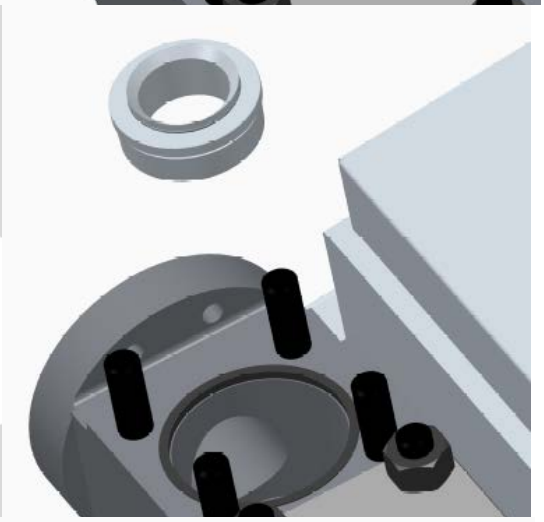
6 Place the suction valve with the spring in position on top of the seat.



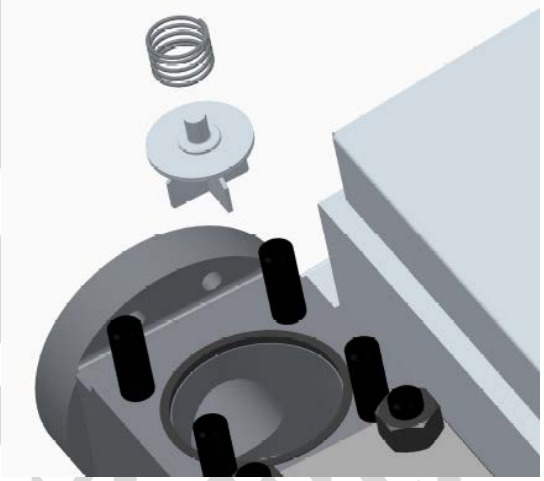
7 Insert the valve retainer into the bore, and thread into place tighten with the retainer tool.



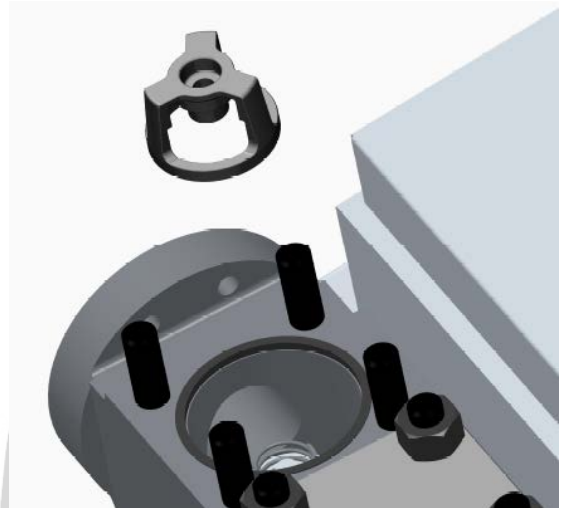
8 Insert the discharge valve seat into the bore and secure as per step 5 above.



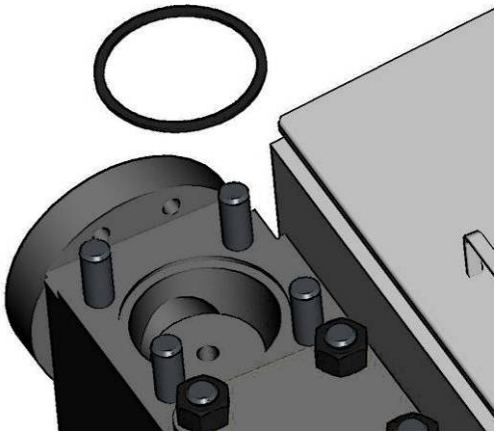
9 Place the suction valve with the spring in position on top of the seat.



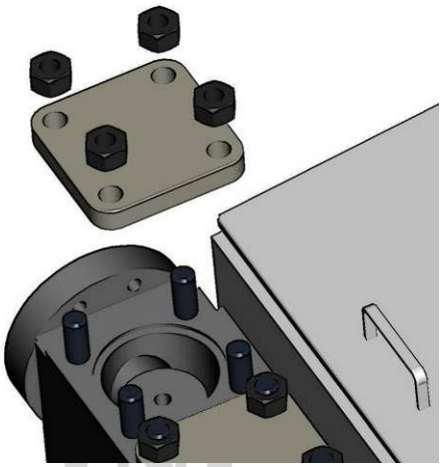
10 Insert the valve retainer into the bore and thread into place tighten with the retainer tool.



11 Install a new seal in the counter bore of the fluid end.



12 Install the valve cover and cover nuts, and torque to 620 ft. lbs.



Chapter 5: Assembly/Disassembly

5.1 Disassembly Procedures

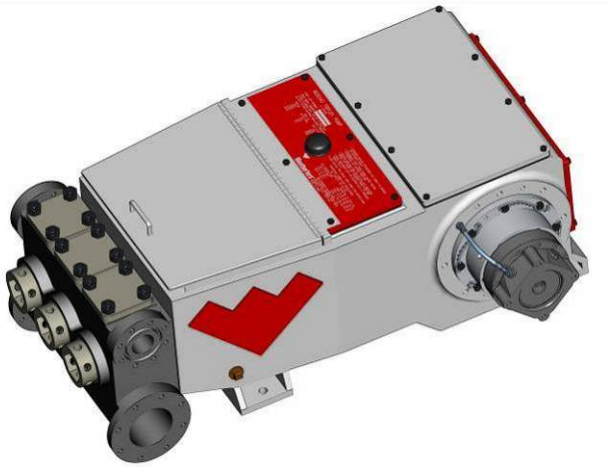
These procedures outline the basic disassembly procedures for the fluid end of the WDD340 pump. They cover the safest, most effective methods of accomplishing the tasks, and should be followed unless there is a compelling reason otherwise.

CAUTION Even while at rest, the fluid end of the system is under significant pressure, which if accidentally or inappropriately released can cause significant equipment damage and injury to nearby personnel. All pressure must be vented from the system before any maintenance on the fluid end is performed.

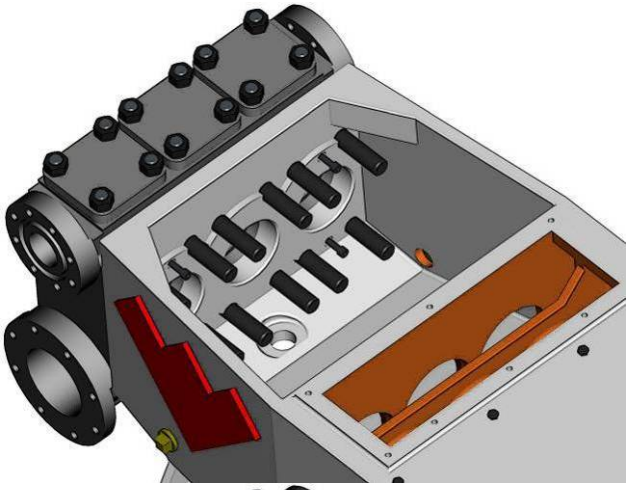
5.1.1 Removing the Fluid cylinder

NOTE While the cylinders can be removed without disturbing the pistons and liners, it is highly recommended that the liners be fully removed in order to better gain access to all fasteners.

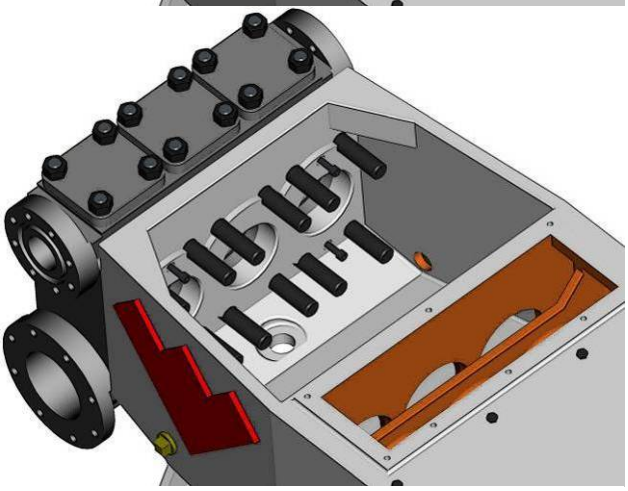
1 Disconnect all piping connected to the fluid cylinder and drain.



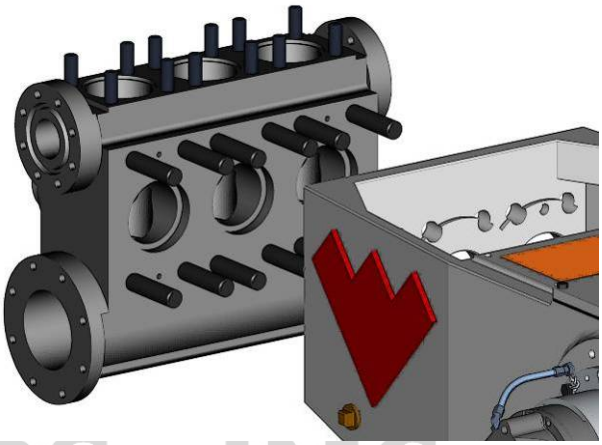
2 Remove the pistons and liners as per sections 4.4.2 (on pages 41).



3 Remove the four (4) fluid cylinder socket head cap screws.



4 Remove the fluid cylinder.



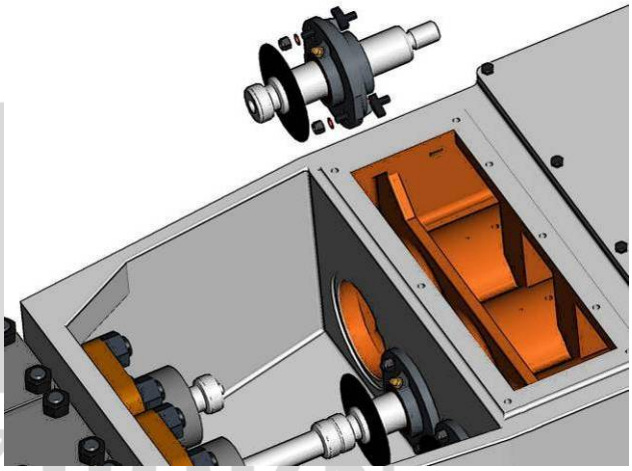
5.1.2 Removing the Connecting Rod

The following is the procedure for removing connecting rods from the WDD340 pump.

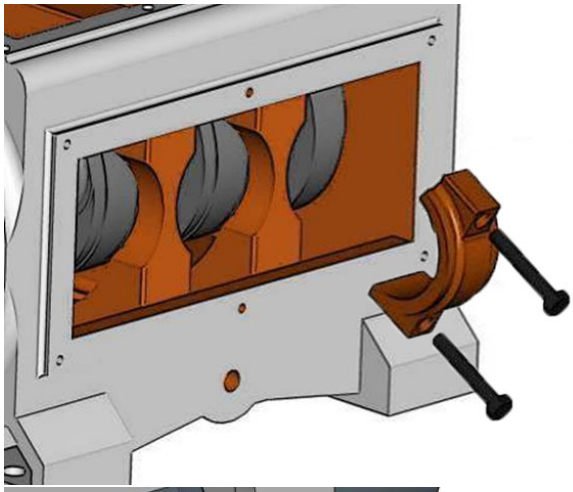
CAUTION The crossheads, connecting rods, and connecting rod bearings are all parts of a carefully machined set designed to ensure maximum operational efficiency. When removed from the pump, all components should be marked and kept together to avoid any confusion, and the fits should be rechecked when reinstalled.

1 Drain the oil from the pump and remove the back cover from the power frame.

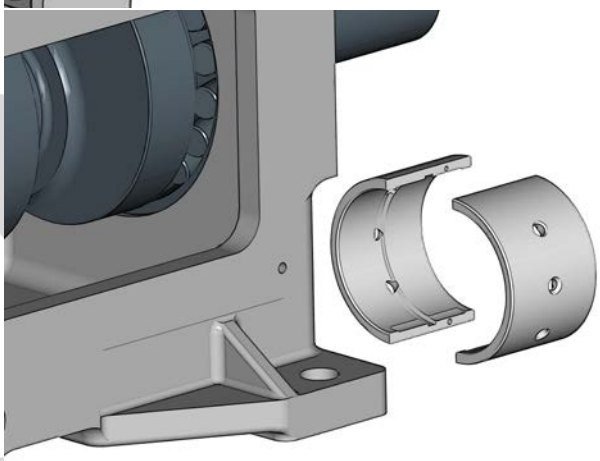
2 Remove the intermediate rods and wiper boxes as per 4.4.4 and 4.4.5 (page 44-45).



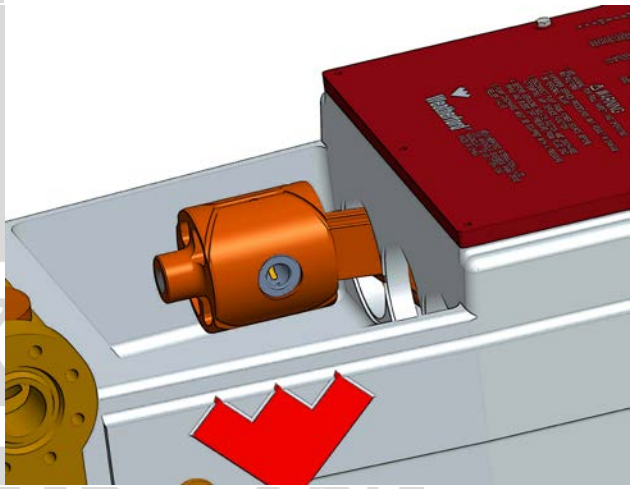
3 Cut the tie wire from the nuts holding the connecting rod cap in place. Remove the nuts and remove the cap, noting which connecting rod and bore it was attached to, as they are a matched set.



4 Slide the connecting rod and crosshead assembly forward in the bore, and remove the insert bearings, being sure to note which connecting rod and bore the bearings are attached to, as they are a matched set.

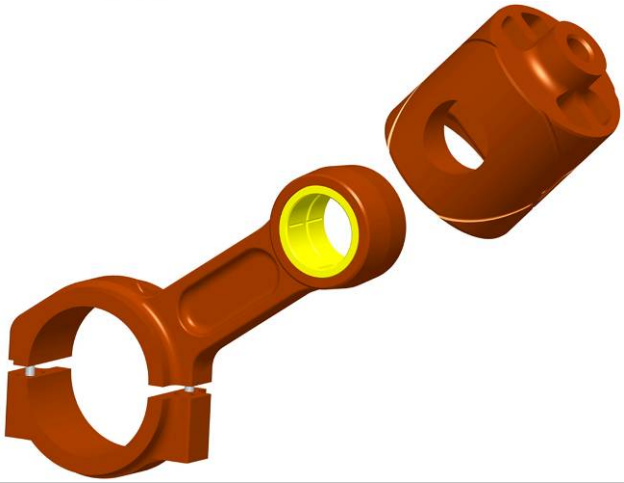


5 Remove the connecting rod and crosshead assembly through the cradle of the pump.

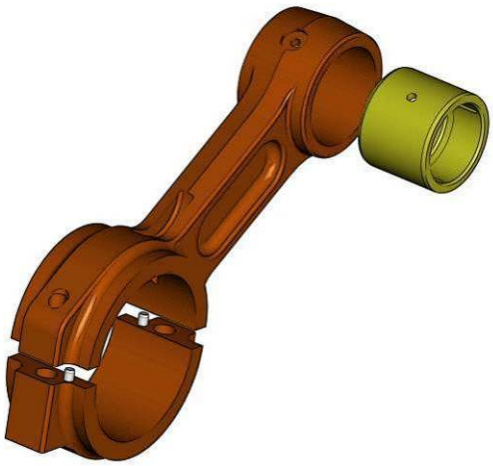


6 Back off the set screw and press the wrist pin out of the crosshead assembly.

7 Remove the crosshead from the connecting rod.



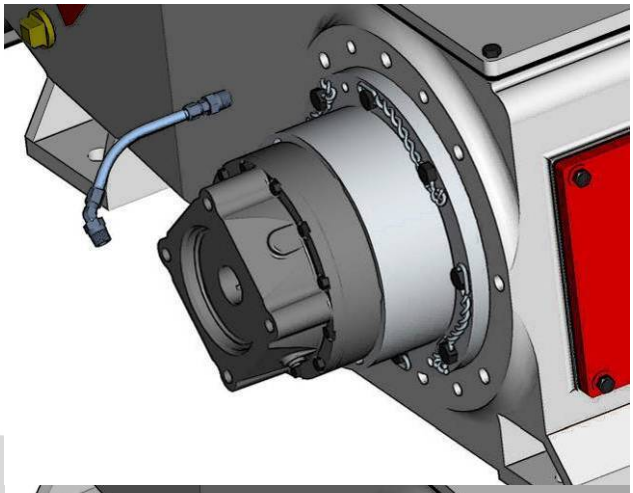
8 Press the bushing from the connecting rod.



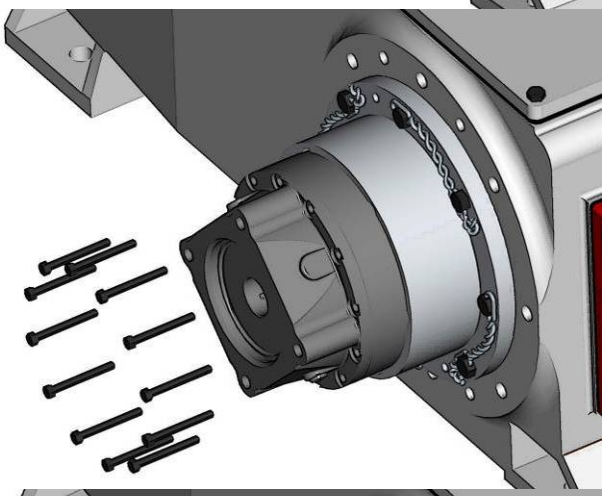
5.1.3 Removing and Disassembling the Auburn Gear

Some WDD340 pumps use an Auburn Gear to allow the pump to be run using a hydraulic motor. If so equipped, use the following procedure to disassemble the Auburn Gear.

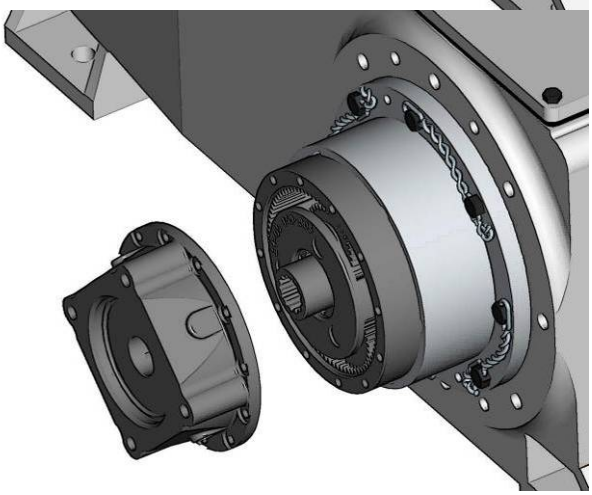
1 Drain the Auburn Gear assembly of fluids and remove the lubrication hose. Also remove any liquid sealant affixing the planetary gear assembly to the adapter.



2 Unbolt the Auburn Gear Cover from the ring gear.

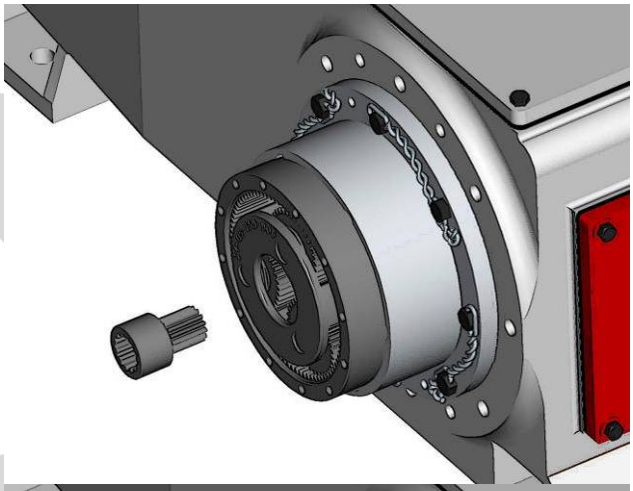


3 Slide the Auburn Gear cover free of the frame, exercising care to avoid knocking loose the sun gear or planetary gear carrier.

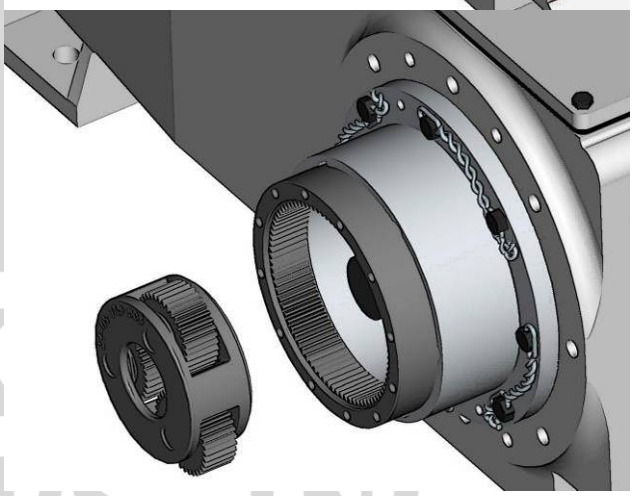


4 Remove the thrust washer from the Auburn Gear cover.

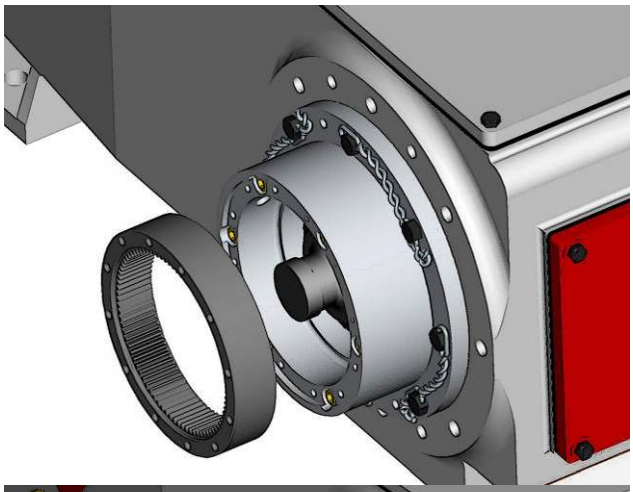
5 Slide the sun gear free of the planetary gear carrier.



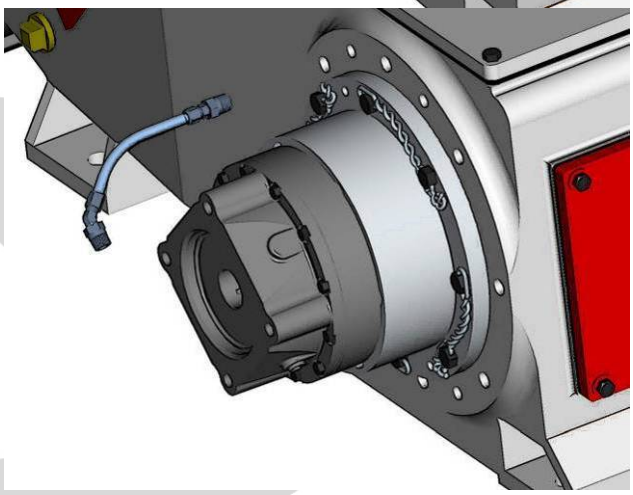
6 Side the planetary gear carrier free of the ring gear.



7 Remove the bolts affixing the ring gear to the adapter, and slide free of the frame.



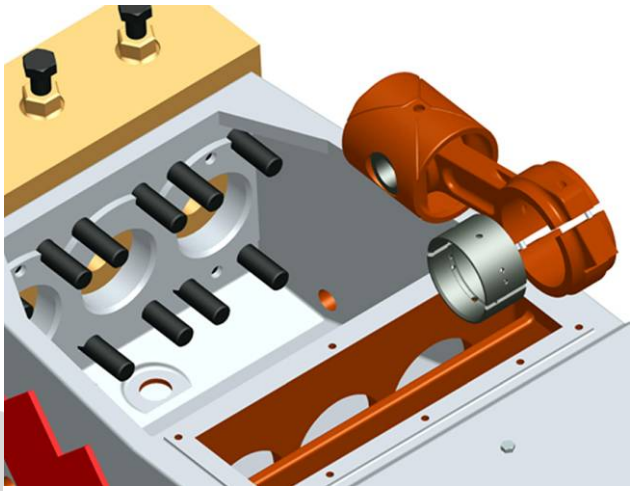
8 Unbolt the Auburn Gear adapter from the pump frame, and remove the adapter and gasket.



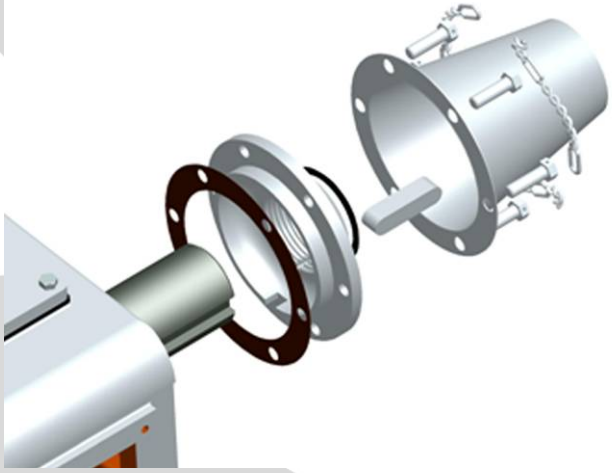
5.1.4 Removing the Crankshaft Assembly

The following is standard procedure for removing the crankshaft and bearings from the WDD340 pump.

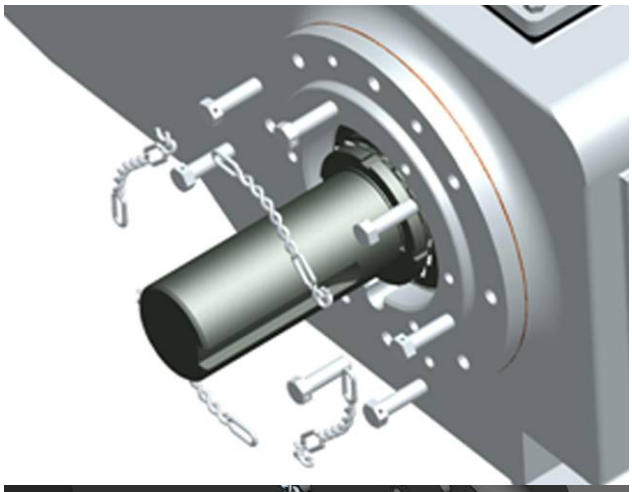
1 Remove the connecting rods and crossheads as per 5.1.2: Removing the Connecting Rod (page 58).



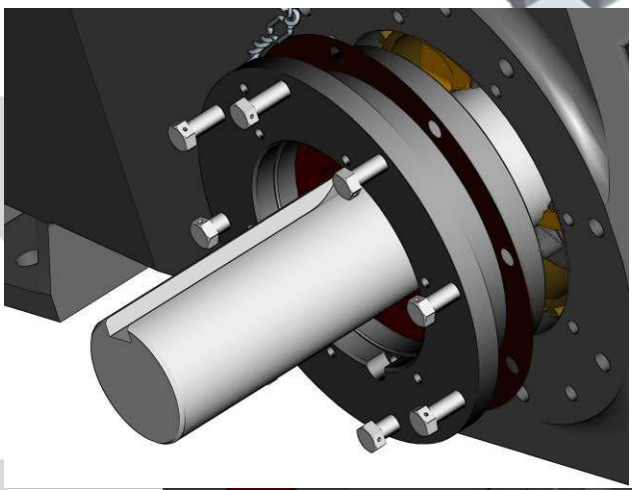
2 Remove the right side crankshaft extension cover and crankshaft bearing retainer.



3 Remove the left side crankshaft bearing retainer.

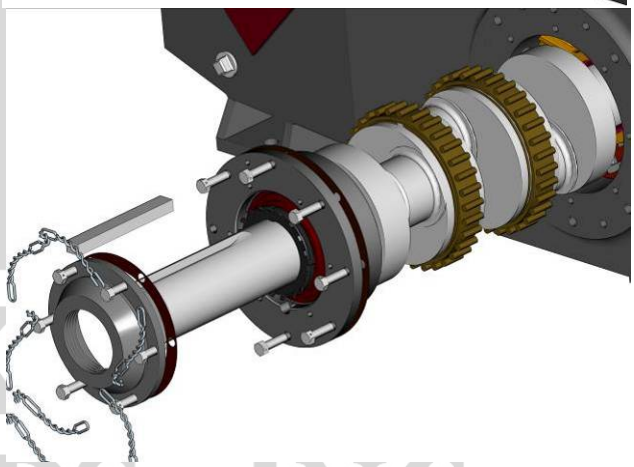


4 Remove the cap screws affixing the main crankshaft bearing cage to the power frame.

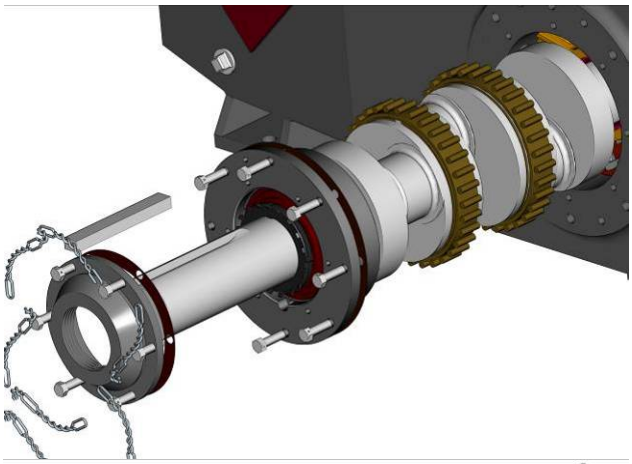


5 The crankshaft can only be removed from the left-hand side of the power frame.

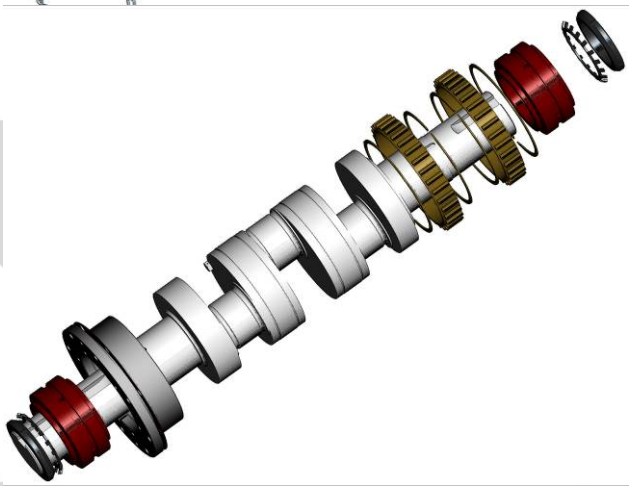
CAUTION Use extreme care when sliding out the crankshaft assembly to avoid potential injury or damage to the components. Puller holes are provided in the bearing cage for this purpose.



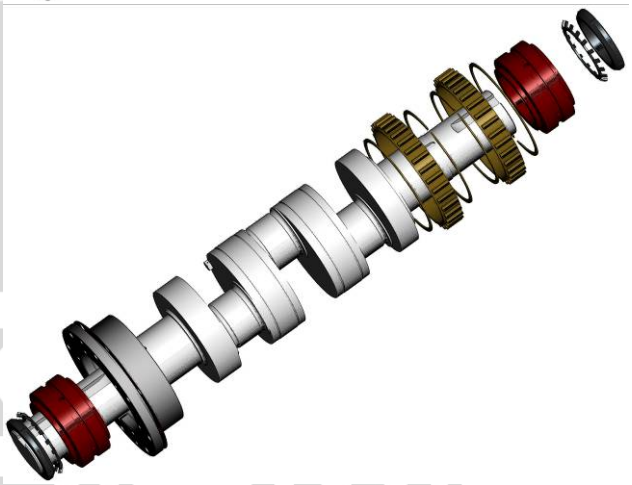
6 Do not remove the main bearings unless they are to be replaced, as removal necessitates the use of special tools or cutting the bearing apart with a torch.



7 To remove the center bearings, remove the right side snap ring and the bearing, then remove the remaining snap rings and the second bearing. Make sure the crankshaft is well supported and stable during this process.



8 To remove the main bearings, remove the two (2) bearing lock nuts and the washers, and then remove the main bearings from the crankshaft.



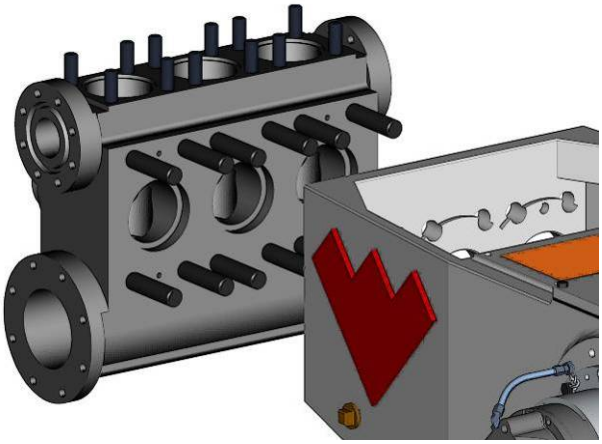
5.2 Assembly Procedures

These procedures outline the basic assembly and replacement procedures for the components in the power end of the WDD340 pump. As with the Disassembly Procedures, they should be followed unless there is a compelling reason not to.

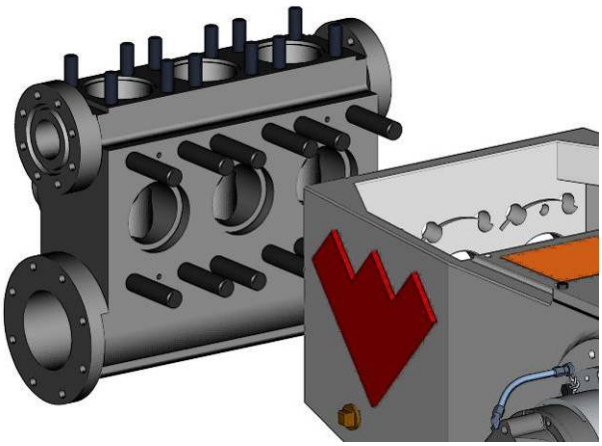
5.2.1 Replacing the Fluid cylinder

The following is standard procedure for replacing the fluid cylinder on the WDD340 pump.

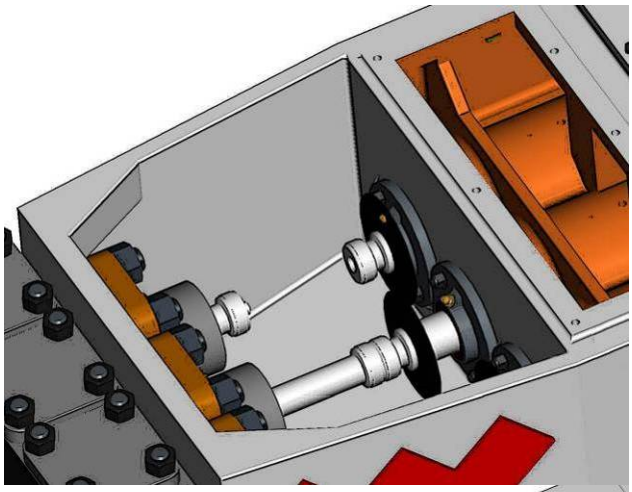
1 Clean all of the sealing faces of the Fluid cylinder and power frame.



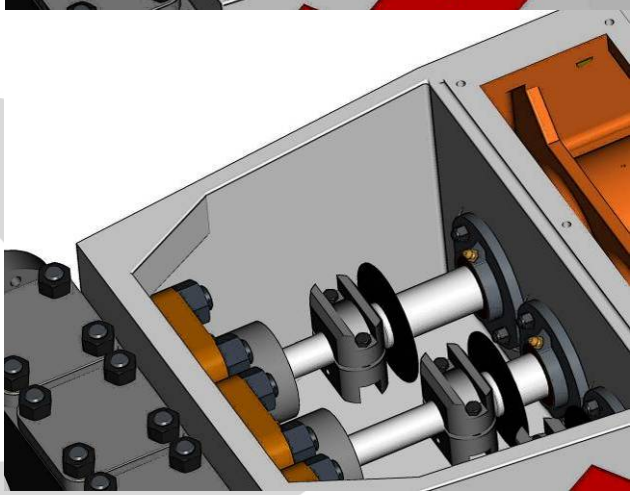
2 Install the Fluid cylinder, making sure that the stuffing box seals are in place if they have been removed. Install and tighten the socket head cap screws to hold the Fluid cylinder in place.



3 Install the pistons and liners as per the instructions in section 4.5: Components Assembly, page 46.



4 Reconnect all piping to the fluid cylinder.

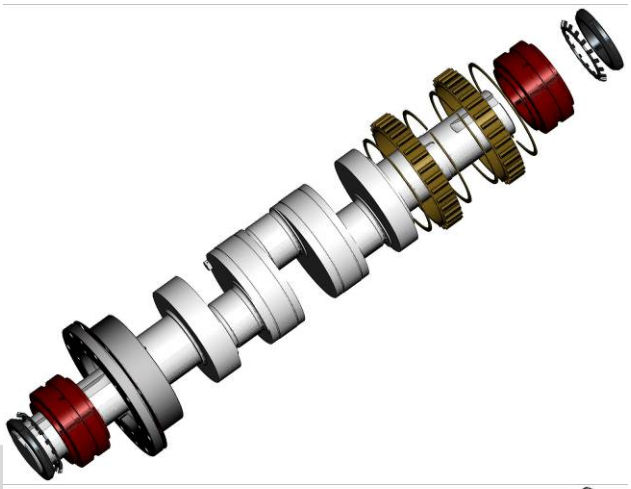


5.2.2 Replacing the Crankshaft Assembly

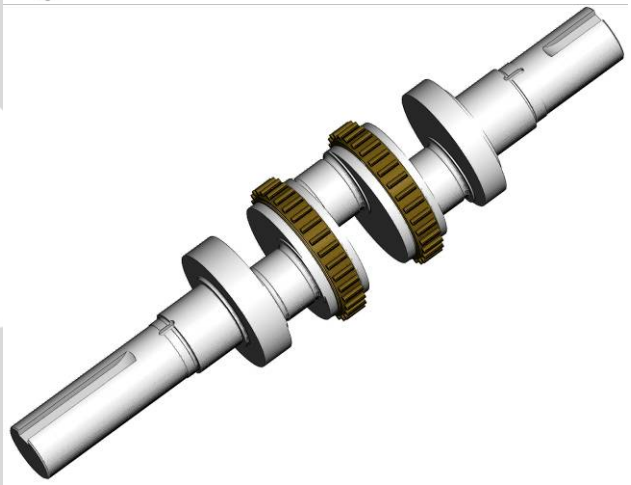
The following is standard procedure for replacing the crankshaft in the WDD340 pump.

1 Before beginning installation, check to ensure that the crankshaft is clean and free of burrs. Then unpack the main crankshaft bearing and mark to ensure they are not interchanged as they are a matched set.

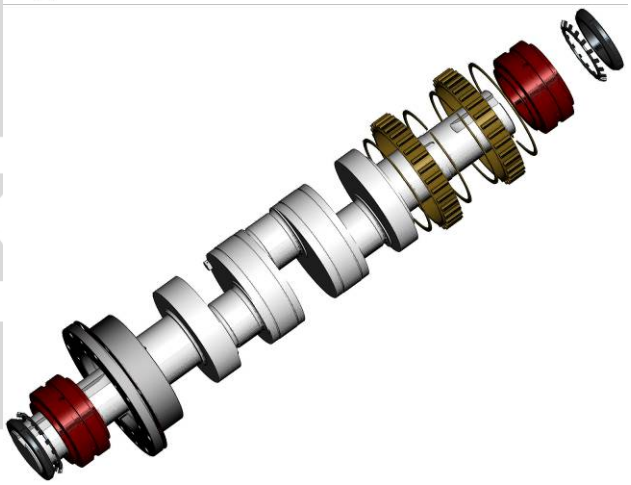
NOTE For best results, stand the crankshaft vertically during this process, taking appropriate measures to prevent it from slipping or falling.



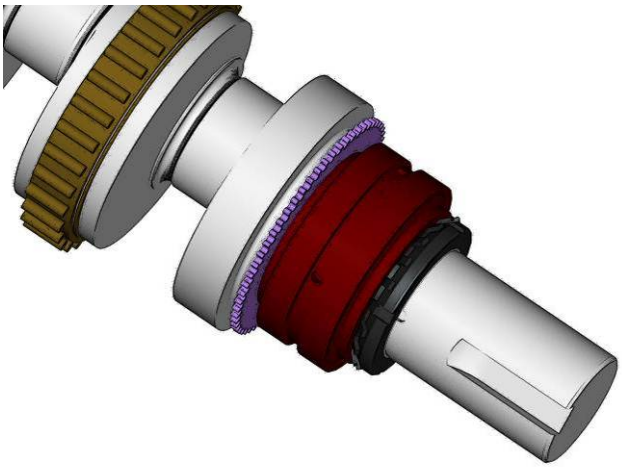
2 Install the lower side center bearing snap ring followed by the inner half of the cylindrical roller bearing and the upper side snap ring. Repeat for the other center bearing.



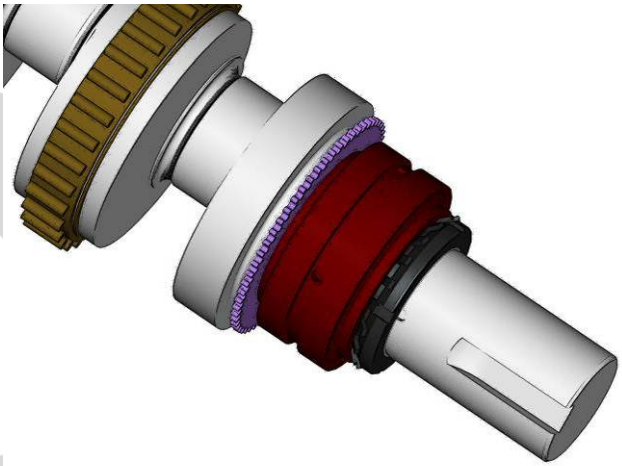
3 Heat each of the main crankshaft bearing components in an electric oven or oil bath to 300°F (149°C). Confirm the temperature of the components before beginning installation.



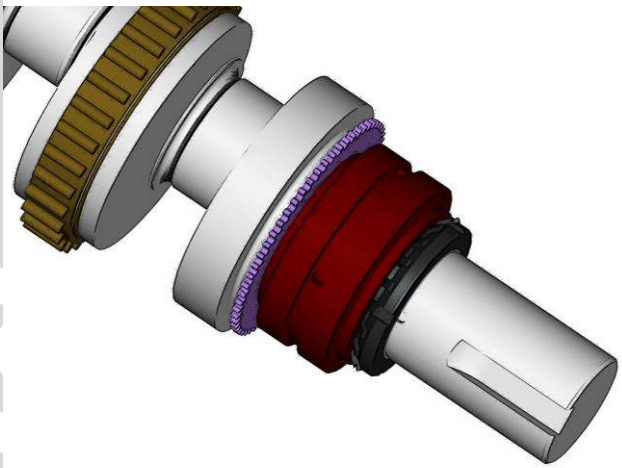
4 Install the chain sprocket on the right hand crankshaft extension with the beveled side towards the center of the crankshaft.



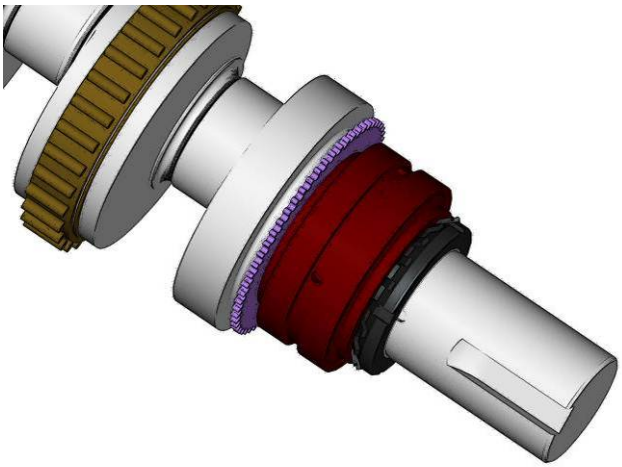
5 Install the inboard cone assembly on the right hand crankshaft extension so that the thick edge of the taper is set against the corner of the sprocket.



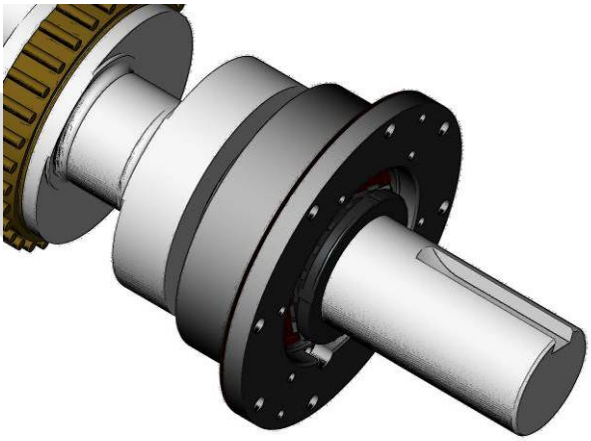
6 Assemble the outer race on the right hand crankshaft extension. The race should be shouldered against the inboard cone assembly



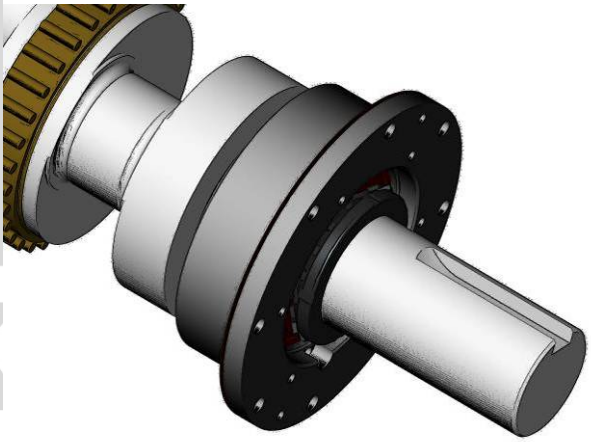
7 Assemble the main crankshaft bearing spacer on the right hand crankshaft extension so that it is shouldered against the inboard cone assembly.



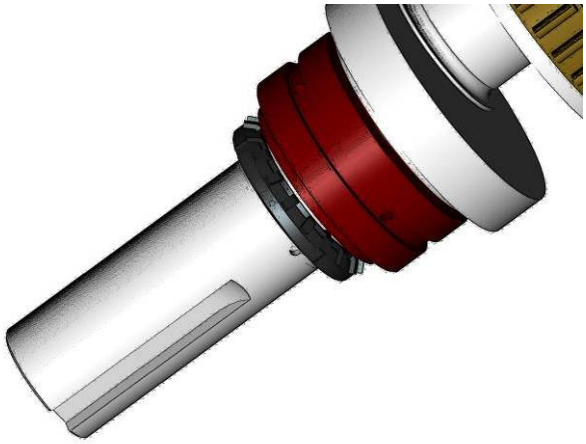
8 Assemble the outboard cone assembly on the right hand crankshaft extension.



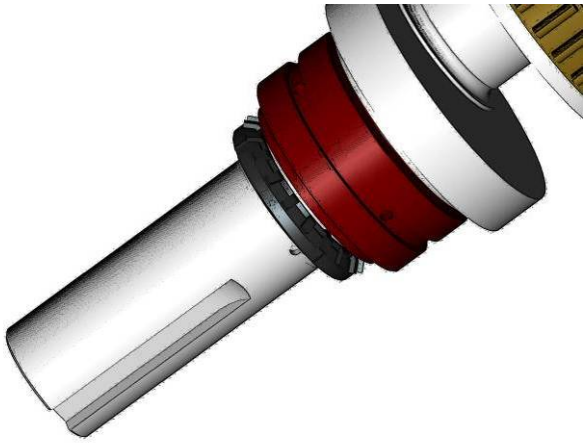
9 Install the bearing lock washer and nut hand tight to secure the bearing in place. It should be tightened fully once the crankshaft is slid into the power frame.



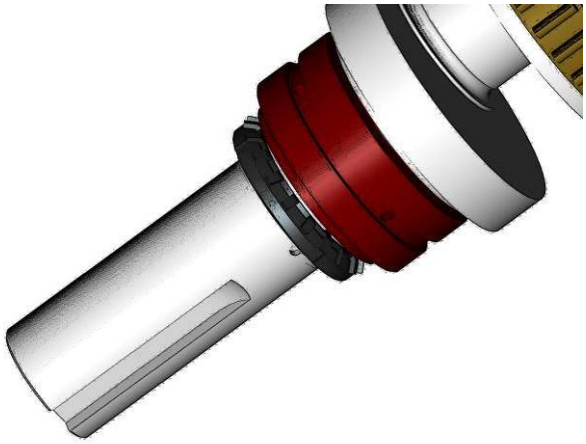
10 Drive the outer race into the bottom shoulder of the main crankshaft bearing housing.



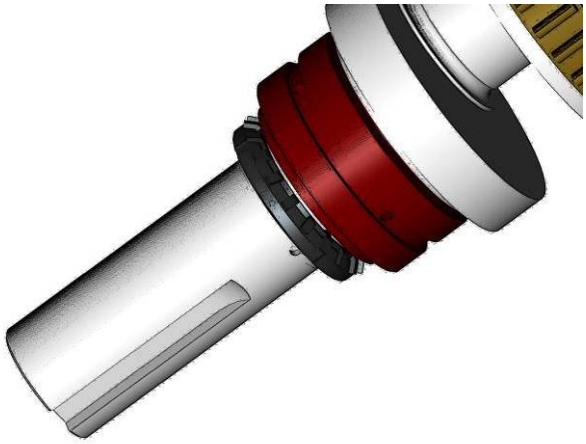
11 Install the inboard cone assembly on the left hand crankshaft extension so that the thick edge of the taper is set against the shoulder of the crankshaft.



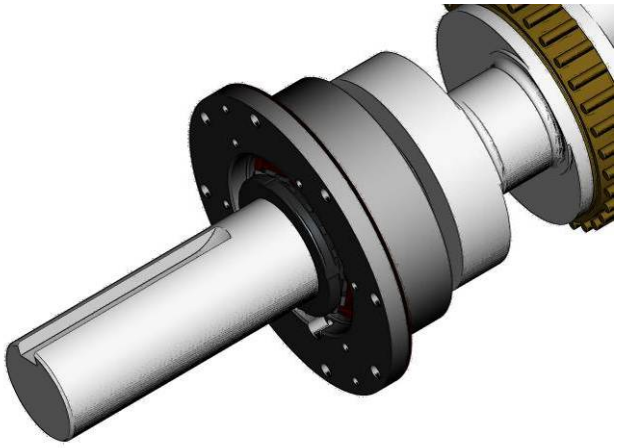
12 Install the main crankshaft bearing housing against the inboard cone assembly on the left hand crankshaft extension.



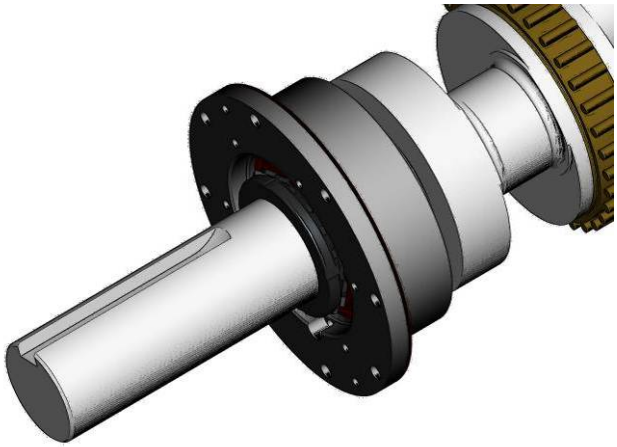
13 Assemble the main crankshaft bearing spacer on the left hand crankshaft extension so that it is shouldered against the inboard cone assembly.



14 Install the outboard cone assembly with the thin edge of the taper against the bearing spacer.

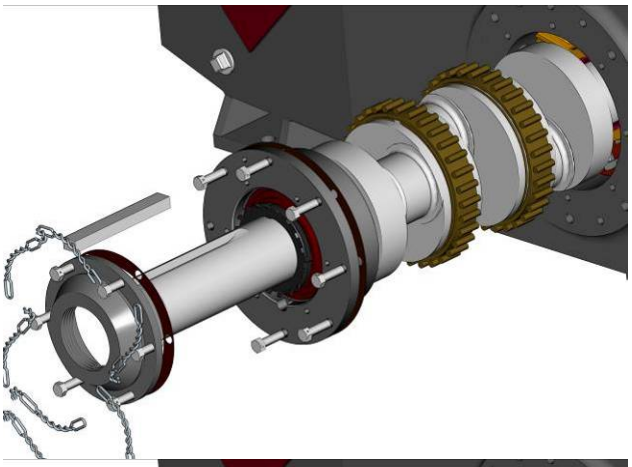


15 Install the bearing lock washer and nut hand tight to secure the bearing in place.

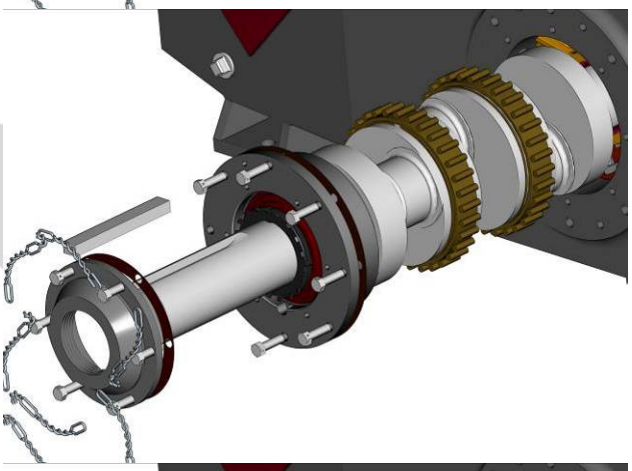


16 Install the crankshaft assembly in the power frame, utilizing the correct gasket and being sure to mark the “Top” of the assembly. The assembly should be oriented to the “left” (if facing the frame from the power side towards the fluid end). Torque the fasteners to 143 ft. lbs.

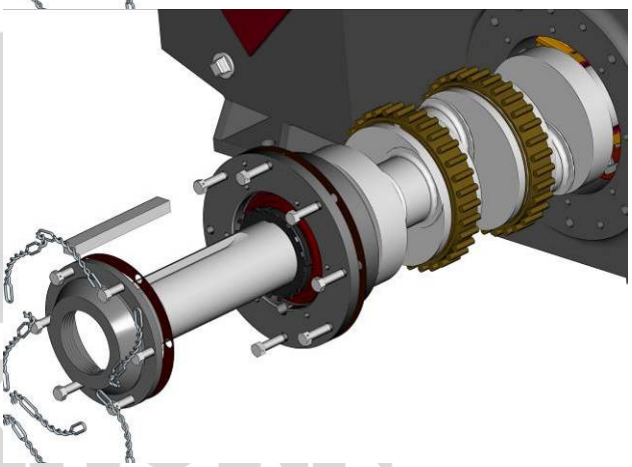
NOTE: Exercise care when passing the assembly through the power frame.



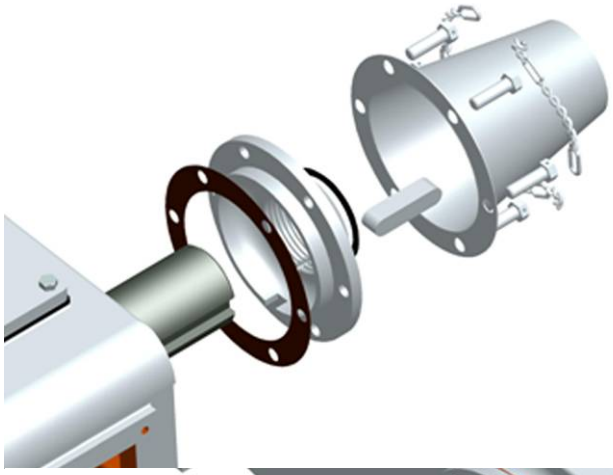
17 Tighten the bearing lock nuts and align one tooth of the lock washer with the notch on the lock nut.



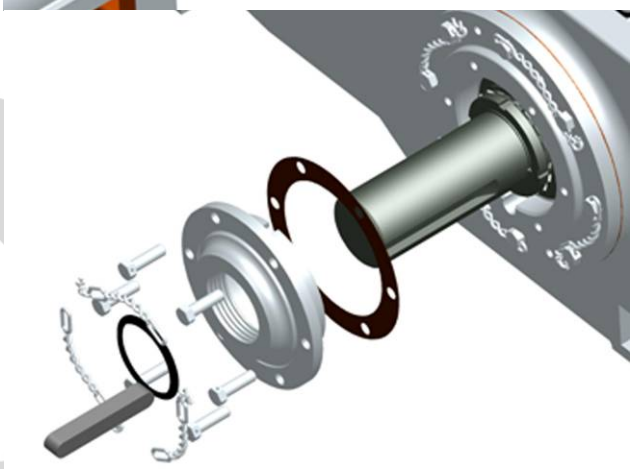
18 Bend one tooth from the lock washer into the notch on the locknut.



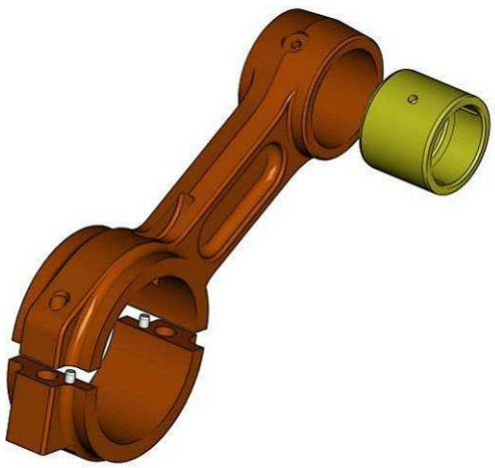
19 Install the crankshaft extension cover, dirt excluder and crankshaft bearing retainer on the right hand shaft extension side. Make certain the “top” mark is facing upwards and the clearance of the labyrinth seal (there should be no metal to metal contact between the shaft and the retainer). Torque the fasteners to 143 ft. lbs.



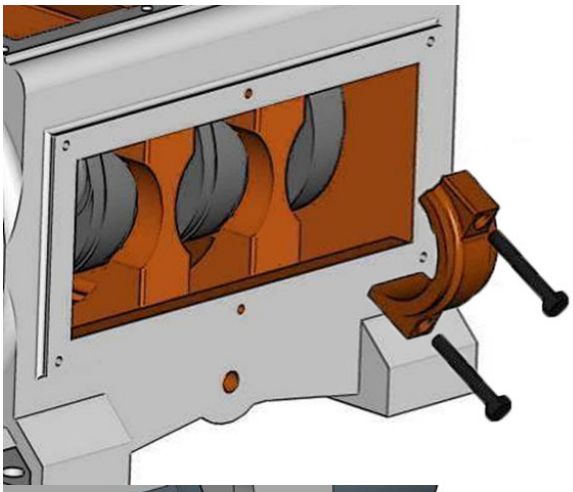
20 Install the crankshaft bearing retainer on the left hand shaft extension side. Make certain the “top” mark is facing upwards and the clearance of the labyrinth seal (there should be no metal to metal contact between the shaft and the retainer). Torque the fasteners to 143 ft. lbs.



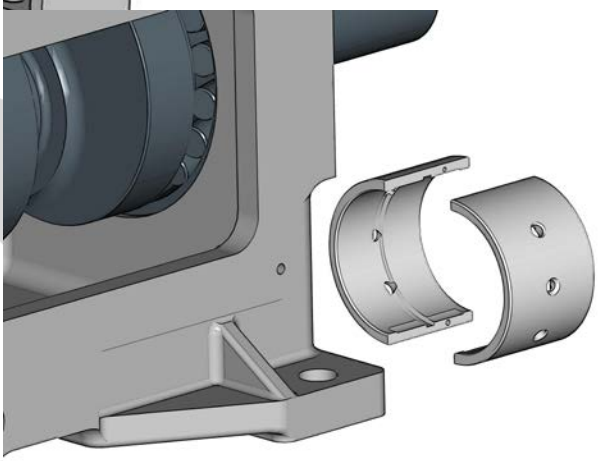
21 Reassemble each connecting rod and crankpin insert bearing combination separate from the crankshaft, ensuring that the marks conform on all sides.



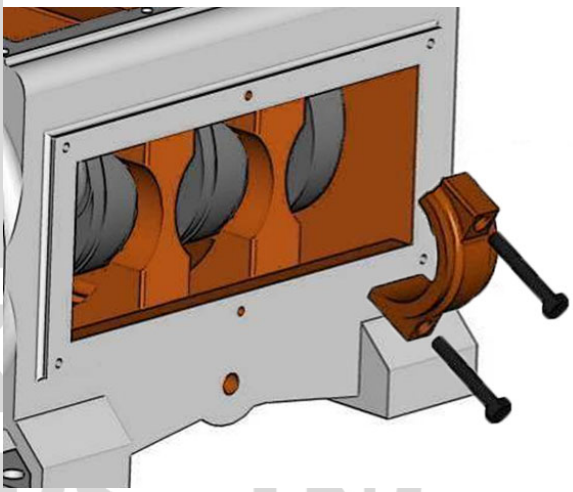
22 Check the crankpin insert bearings for pin engagement and fit over the cap half of the connecting rods. Make sure to match the marks on either side.



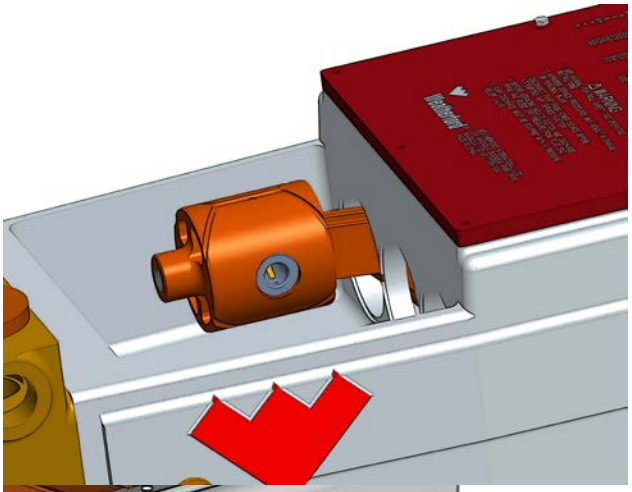
23 Install both crankpin insert bearing halves onto the crankshaft with the dowel pins. Rotate the crankshaft as needed to install.



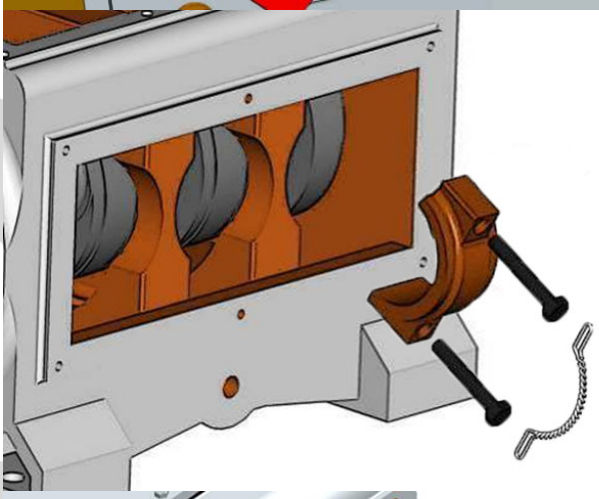
24 Once in place, connect the cap half of the connecting rod over the crankpin insert bearing halves. Make sure the dowel pin is seated properly and the lubrication hole in the bearing matches the oil hole in the connecting rod.



25 Slide the connecting rod back over the crankshaft, exercising care so the aluminum insert is not damaged. Match the numbers on the cap and rod.



26 Install the two cap screws into the connecting rod cap and tighten to the proper torque, then lock-wire the cap screws securely.

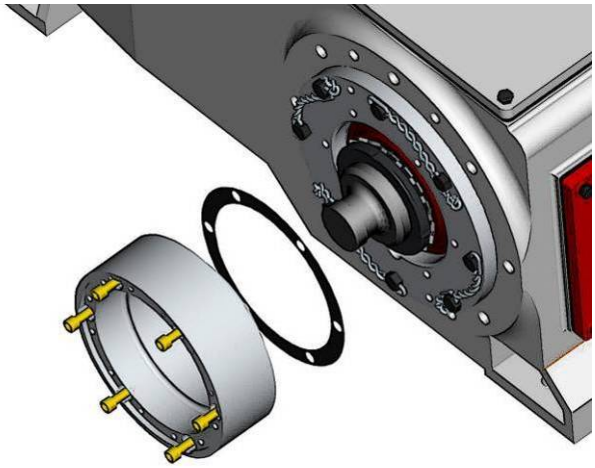


22 Replace the rear cover of the power end and lock-wire the crankshaft bearing housing and retainers. Then fill the pump with the proper type and quantity of oil (see 4.2.1, page 31).

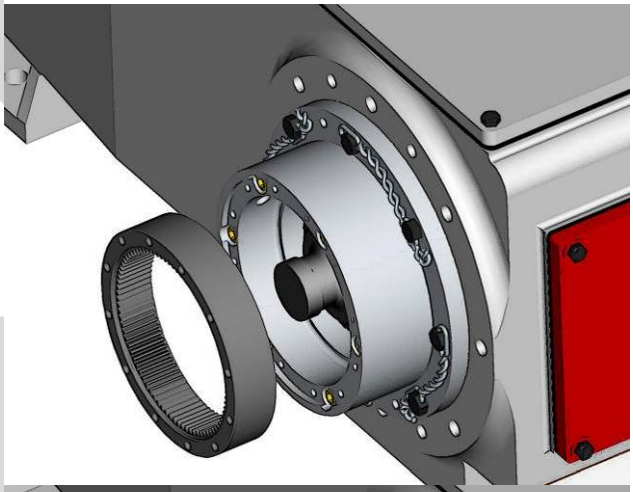
5.2.3 Installing the Auburn Gear

Some WDD340 pumps utilize an Auburn Gear to allow the pump to be run using a hydraulic motor. If so equipped, use the following procedure to install the Auburn Gear.

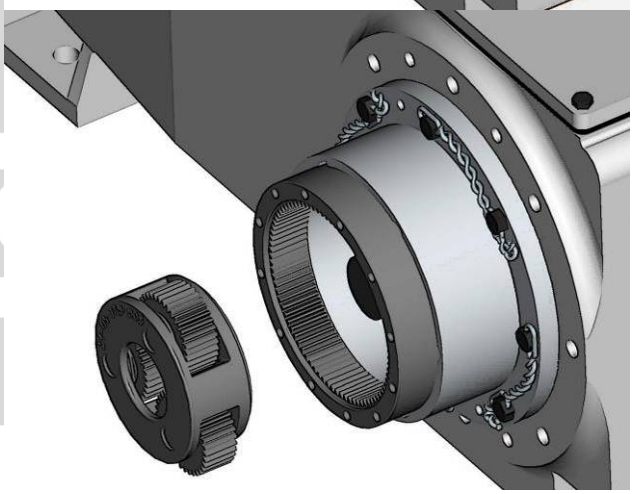
1 Position the Auburn Gear adapter and gasket on the frame, and bolt into position. Torque the fasteners to 143 ft. lbs.



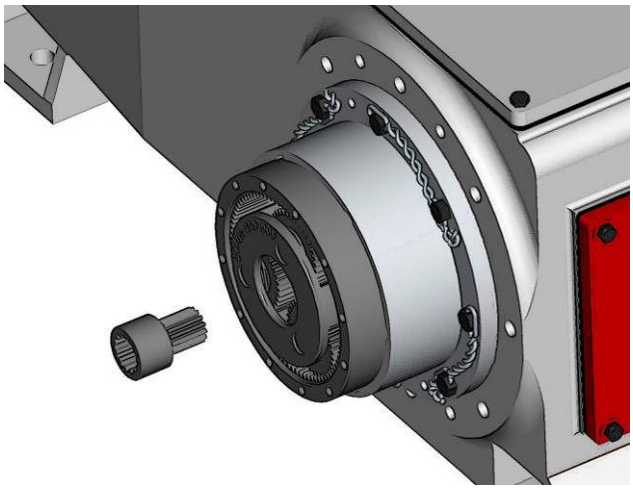
2 Apply sealant to both sides of the ring gear and slide into position, and then bolt the ring gear to the Auburn Gear adapter.



3 Slide the planetary gear carrier into position in the ring gear.

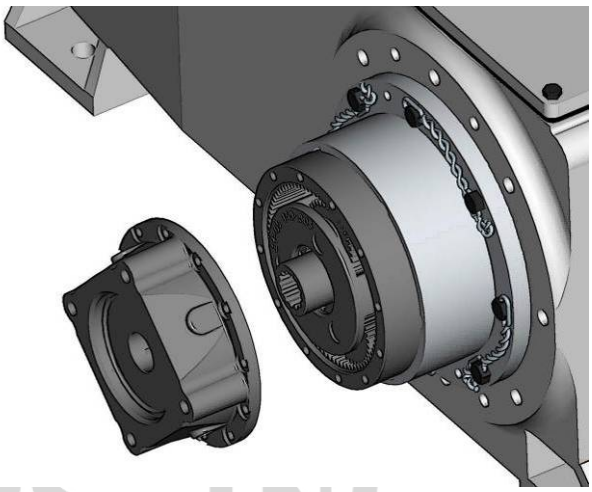


4 Slide the sun gear into the center of the planetary gear carrier.

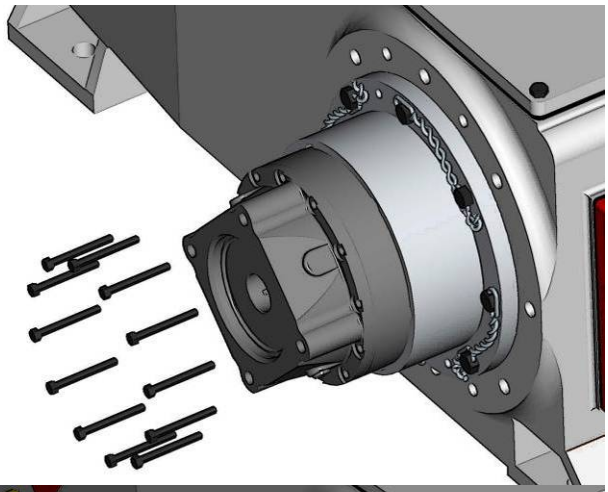


5 Install the thrust washer onto the Auburn Gear cover, using a dab of grease to secure it into place.

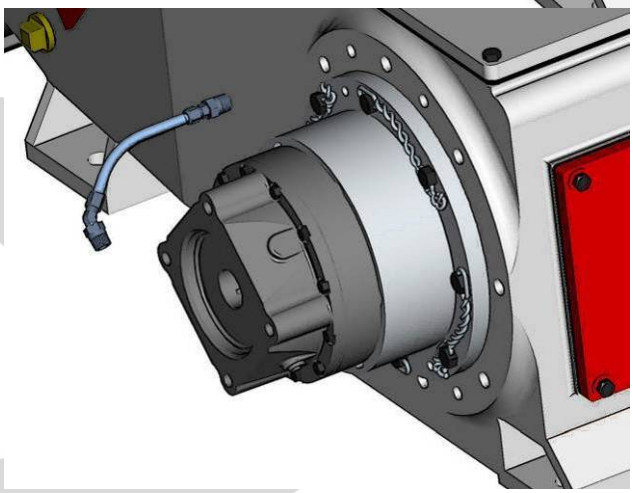
6 Slide the cover into position on the ring gear, exercising care not to disrupt the seating of the planetary and sun gears. When properly installed, the thrust washer should have between 0.050” and 0.180” of clearance.



7 Bolt the Auburn Gear cover into place, and apply liquid sealant along the seal between the cover and the ring gear. Torque the fasteners to 30 ft. lbs.



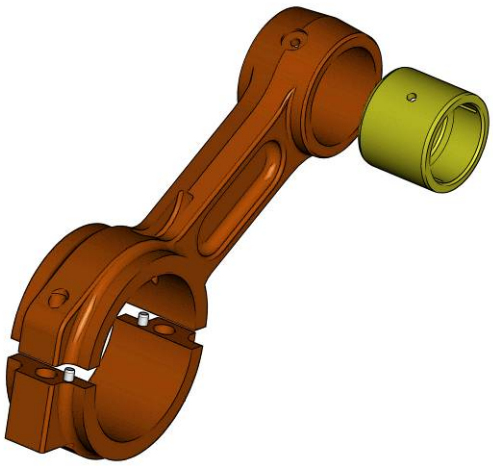
8 Attach the lubrication hose to the Auburn Gear cover and the pump frame and secure.



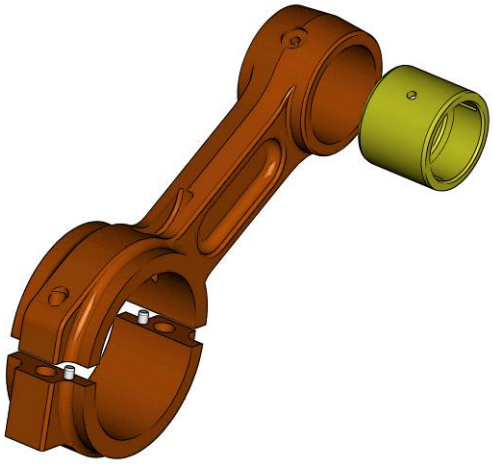
5.2.4 Replacing the Connecting Rod

The following is standard procedure for replacing the connecting rod in the WDD340 pump.

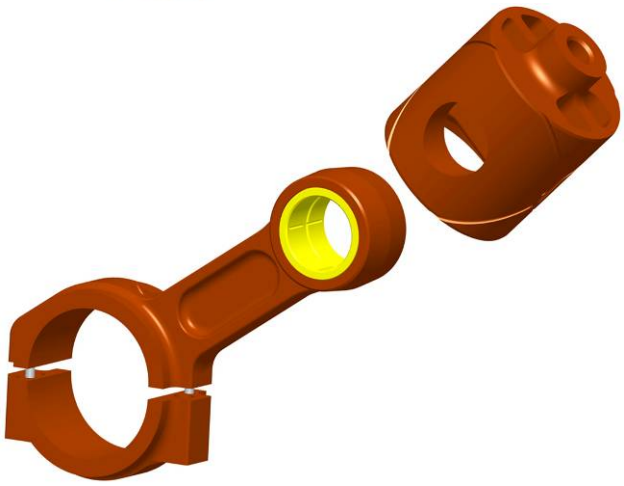
1 Press the crosshead pin bushing into the connecting rod.



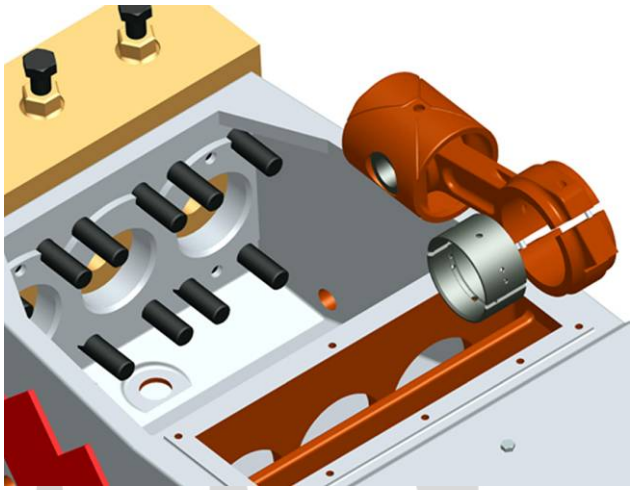
2 Ream the bushing to size. If necessary, scrape to remove high spots, and affix into position using the pin.



3 Install the wrist pin bearing by pressing it into the crosshead in the correct orientation. Note that crossheads are marked top bottom, and it is vital to ensure they are installed correctly.



4 Replace the connecting rod assembly as per steps 1-4 of 5.2.2: Replacing the Crankshaft Assembly (page 69).



Chapter 6: Glossary

AGMA: The American Gear Manufacturers Association.

Auburn Gear: A planetary gear reducer assembly designed to allow the pump to be run using a hydraulic motor.

Baffle: See Baffle Plate.

Baffle Plate: A rubber or thin metal disc which deflects leakage away from the wiper box

Bearing: A device that supports, guides, and reduces the friction of motion between fixed and moving machine parts.

Bearing Housing: The outer shell of a bearing, designed to protect, support and contain the other elements.

Bearing, Connecting Rod: See Bearing, Crankpin.

Bearing, Crankpin: A bearing which transmits the oscillating reciprocating load transmitted by the connecting rod to the crankshaft. Also known as the connecting rod bearing.

Bearing, Main: The bearing which supports the crankshaft and absorbs the liquid and inertia loads that are developed by the pistons as they displace the fluid. Also known as the main crankshaft bearing.

Bearing, Main Crankshaft: See Bearing, Main.

Bearing, Wrist Pin: See Bushing, Wrist Pin.

Breather: A vent which allows for pressure equalization between the inside and the outside of the pump.

Bushing, Throat: A bushing located on the fluid cylinder side of the stuffing box and used to hold the packing in place.

Bushing, Wrist Pin: The bearing which attaches the connecting rods to the crossheads and allows the circular motion of the crankshaft to be transformed into an oscillating force on the crossheads. Sometimes known as the Wrist Pin Bearing.

Bypass Line: A length of piping leading off the main line used to vent excess pressure from the pump.

Bypass Valve: See Valve, Bypass

Cavitation: The sudden formation and collapse of low pressure bubbles in fluid.

Chain Drive: See Drive, Chain.

Charging Pump: See Pump, Charging.

Connecting Rod: A rod which articulates the motion of the crankshaft to the crosshead. Power is transmitted through the combination of compression and tension.

Connecting Rod Insert Bearing: See Bearing, Crankpin.

Cooling Loop: A device designed to reduce fluid temperatures by pumping a coolant through a loop of hose or piping to absorb heat from the fluid, and then through a second loop to disperse the heat into the environment.

Cradle: The portion of the pump which connects the fluid end to the power frame. Also known as the Frame Extension.

Crankcase: See Power Frame

Crankpin Bearing: See Bearing, Crankpin.

Crankshaft: The stepped shaft which transmits power and motion to the connecting rods through eccentric rotation. Main bearings and connecting rods are fitted to this component.

Crankshaft Bearing Housing: The housing which secures the main bearing in place.

Crankshaft Extension Cover: A metal guard designed to shield the extended end of the crankshaft.

Crosshead: A system which creates linear reciprocating motion derived from the crankshaft's rotary motion through the connecting rod. The reciprocating motion of the crosshead is applied to the piston via the extension rod.

Crosshead Extension: See Extension Rod.

Dampener Charging Kit: A tool used to adjust the pressure in the pulsation dampeners.

Degassing Equipment: Systems designed to remove aeration from the fluid.

Direct Coupled Drive: See Drive, Direct Coupled.

Dirt Excluder: An elastomeric guard designed to keep dirt out of the pump.

Discharge Dampener: The pulsation dampener mounted in the discharge piping.

Discharge Line: See Discharge Piping.

Discharge Manifold: See Manifold, Discharge

Discharge Piping: The piping which carries fluid out from the discharge manifold. Also known as the Discharge Line.

Discharge Pulsation Dampener: See Discharge Dampener.

Discharge Valve: A valve assembly located in the fluid cylinder, designed to channel fluid from the cylinder to the discharge manifold and to prevent return flow.

Drain Valve: See Valve, Drain.

Drive System: A system which provides power transmission and speed reduction from the prime mover to the pump power end. Usually includes a manual pump rotating device.

Drive, Chain: A drive system consisting of a multiple strand roller chain running on sprockets.

Drive, Direct Coupled: A drive system in which the prime mover is directly connected to the power end of the pump.

Drive, V-Belt: A drive system consisting of a set of V-Belts running on sheaves.

Eccentric Bearing: A bearing set so that its center is offset from a rotating axle, used to convert rotary motion into linear reciprocating motion via the connecting rods and crossheads.

Electric Drive Motor: DC traction type motors or AC variable frequency motors.

Extension Rod: The rod which connects the crosshead to the piston or plunger. Also known as the plunger or crosshead extension.

External Lube Oil Pump: See Pump, External Lubricating.

External Lubricating Pump: See Pump, External Lubricating.

Flange, Discharge Companion: The main flange extending from the Discharge Manifold, used to attach the Discharge Piping and Cross.

Flange, Suction Companion: The main flange extending from the Suction Manifold, used to attach the Suction Piping.

Fluid: Any non-solid material. In this document, unless otherwise specified the term fluid will refer to the material being moved by the pump.

Fluid Cylinder: A chamber in which the motion of the pistons is imparted to the fluid, which may consist of separate suction and discharge modules. Also known as the Liquid Cylinder.

Fluid End: The portion of the pump which handles the fluid being moved. Includes the fluid cylinder, valves and other systems. Also known as the Liquid End.

Follower Bushing: A ring located in the stuffing box between the packing and the spring, used to hold the packing in place.

Frame Extension: See Cradle.

Gear, Auburn: See Auburn Gear.

Gear End: See Power End.

Gear, Planetary: See Planetary Gear.

Gland Nut: A threaded nut located at the atmospheric side of the stuffing box, used to compress the packing.

Guard: A portion of the pump designed to protect users by preventing access to potentially hazardous areas or blocking debris.

Heat Exchanger: A device designed to transfer heat from one medium to another.

Hydrogen Sulfide: A colorless gas with a rotten egg smell that often forms in crude oil, natural gas and hot springs. The gas is explosive and corrosive to machine parts, and exposure can be extremely hazardous to humans and animals in even small doses.

Internal Lubricating Pump: See Pump, Internal Lubricating.

Jib Crane: A light duty crane mounted atop the pump for handling heavy equipment when servicing the pump. Also known as the Service Crane.

Knocking: An arrhythmic pounding in the fluid end, usually the result of aeration of the fluid.

Lantern Ring: A ring located in the stuffing box to provide an access point to inject lubricants as required.

Liner Spray System: See Liner Wash System.

Liner Wash System: A lubrication system consisting of a number of valves which spray lubricants onto the pistons and extension rods. Also known as the Liner Sprayer System.

Liner Wash Pump: See Pump, Liner Wash.

Liner Wash Tank: Storage tank for the liner wash fluid, including a settling section and a reservoir section.

Liquid Cylinder: See Fluid Cylinder.

Liquid End: See Fluid End.

Lubricant: A fluid designed to reduce friction.

Main Bearing: See Bearing, Main.

Main Crankshaft Bearing: See Bearing, Main.

Manifold: A chamber which accepts and directs the flow of fluid.

Manifold, Discharge: A manifold which accepts fluid from the individual discharge valves and directs it to the discharge valve assemblies.

Manifold, Suction: A manifold which accepts fluid from the suction ports and distributes it to the suction valve assemblies.

Packing: The material used to provide a seal around the plunger.

Packing Ring: See Packing.

pH: The measure of the acidity or basicity of a solution.

Planetary Gear: A gear reducer utilizing a carrier assembly containing multiple gears rotating around a central or “sun” gear.

Plunger: A smooth rod which is attached to the extension rod and is capable of exerting pressure upon the fluid within the fluid cylinder. Sealing rings for the plunger are stationary, with the plunger sliding through a cavity within the rings (see Stuffing Box).

Plunger Extension: See Extension Rod.

Power Crosshead: See Crosshead.

Power End: The portion of the pump in which the rotating motion of the crankshaft is converted into reciprocating motion through the connecting rods and crossheads. Also known as Gear End.

Power Frame: The portion of the power end that contains the crankshaft, connecting rods, crossheads and bearings used to transmit power and motion to the fluid end.

Pressure Relief Valve: See Valve, Pressure Relief.

Prime Mover: The device which provides power to the drive system.

Pulsation Dampener: A liquid or gas charged, chambered device that minimizes periodic increases and decreases in the pressure of a fluid.

Pump, Charging: A pump that provides pressurized fluid flow to the suction of the main pump.

Pump, External Lubricating: An electrically powered pump located outside of the power frame which provides lubrication pressure to the pump crankcase.

Pump, Internal Lubricating: A crankshaft-powered pump located inside of the crankcase which provides it with lubrication pressure.

Pump, Liner Wash: An electric centrifugal pump circulating liner wash and cooling fluid from the liner wash tank to the liner spray nozzles.

Pump, Triplex: A reciprocating pump utilizing three plungers or pistons working in three separate cylinders, designed so that its power strokes are evenly distributed over the course of a crankshaft revolution.

Race: A groove in a machine through which a moving part slides or rolls.

Retainer: A device which affixes one component to another, usually mounting a component onto a frame.

Seal: A device designed to prevent fluids from leaving a specific location.

Seat Driver: A driving tool used to move the seat into position in the cylinder, consisting primarily of a long, heavy rod with a seat adapter at the end.

Seat Puller: A system used to remove the valve seat from the cylinder. The system comes in many configurations, but most commonly consists of a valve seat adapter attached to a pulling rod, which itself is mounted on a heavy duty frame and driven by a manual hydraulic pump. The when the pump is used, the pulling rod exerts vertical pressure on the seat, eventually wrenching it free from the fluid cylinder.

Service Crane: See Jib Crane.

Shield: A type of guard designed to protect against flying debris or components.

Snap Ring: An oblong metal ring which can be deformed and put into place, at which point it will snap back to its unstressed position in a groove or retainer.

Stop: A device that obstructs movement.

Stuffing Box: The cylindrical cavity through which the piston rod reciprocates and in which liquid leakage is controlled by means of packing. A follower bushing and throat bushing contain the packing within the stuffing box.

Stuffing Box Gland: See Gland Nut.

Suction Depulser: See Suction, Stabilizer.

Suction Line: The piping which carries fluid into the suction manifold. Also known as Suction Piping.

Suction Manifold: See Manifold, Suction.

Suction Piping: See Suction Line

Suction Stabilizer: A low-pressure pulsation dampener mounted in the suction piping.

Suction Valve: A valve assembly located in the fluid cylinder, designed to channel fluid from the suction manifold to the fluid cylinder and prevent return flow.

Sump: A reservoir of oil, usually located in the crankcase.

Teflon Tape: A film cut to specified widths for use in sealing pipe threads.

Thread Compound: A paste for pipe joint threads that holds the pipes in place and prevents corrosion.

Throat Bushing: See Bushing, Throat.

Tie Wire: A fine wire that is twisted around a bracket to keep the fastener from loosening.

Torque: A measure of twisting force usually indicated in terms of foot-pounds.

Triplex Pump: See Pump, Triplex.

Valve: A structure which regulates the flow of fluid through a system by opening and closing under set conditions.

Valve Assembly: A configuration of parts including, but not limited to, the valve itself, a seat, spring, and spring retainer, all in normal operating positions relative to each other.

Valve Cage: A device designed to guide and control the movement of the valve.

Valve Cover: The cover which holds the valve in place in the fluid cylinder.

Valve Cover Seal: The seal around the valve cover.

Valve Puller Assembly: See Seat Puller

Valve Retainer: See Valve Cage.

Valve Seat: A surface against which a valve may rest in order to seal the aperture.

Valve Seat Puller: See Seat Puller.

Valve, Bypass: A specialized pressure relief valve hooked to the bypass line.

Valve, Discharge: The valve assembly through which fluid exits the pump into the discharge manifold.

Valve, Line: A valve designed to control flow through the piping.

Valve, Pressure Relief: A valve designed vent excess pressure from the system by opening at a set pressure value.

Valve, Shut-Off: A valve designed to completely stop the flow of fluid.

Valve, Suction: The valve assembly through which fluid enters the pump from the suction manifold.

V-Belt: A belt designed with a "V" shape to mate with a tracking groove in the sheave in order to enhance traction and prevent the belt from unintentionally slipping off.

V-Belt Drive: See Drive, V-Belt.

Vent: A system in the piping designed to remove aeration from the fluid.

Wiper Box: A cylindrical cavity through which the extension rod reciprocates and in which liquid leakage is controlled by means of wipers.

Wrist Pin: The component which connects the connecting rod to the crosshead.

Wrist Pin Bearing: See Bushing, Wrist Pin.

Wrist Pin Bushing: See Bushing, Wrist Pin.

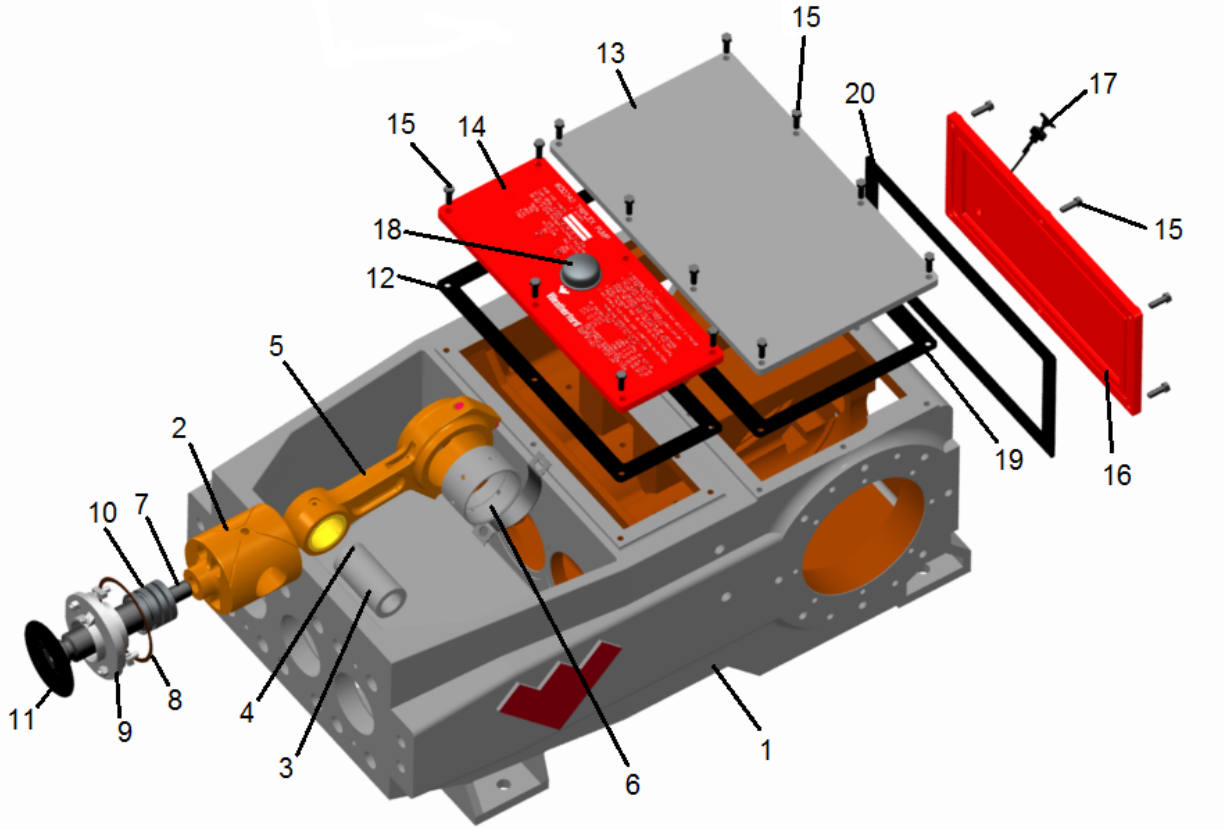
Zerk Fitting: A lubrication fitting in mechanical systems used to allow grease to be added with a grease gun.

Chapter 7: Parts Lists

The following sheets contain the master parts lists for the WDD340 pump. These lists are designed to be comprehensive to every pump made, and so may include parts and systems that are not included on the particular unit this manual came with. For a specific list of exactly which parts and components are on a particular unit, consult the specifications sheet that came with the pump.

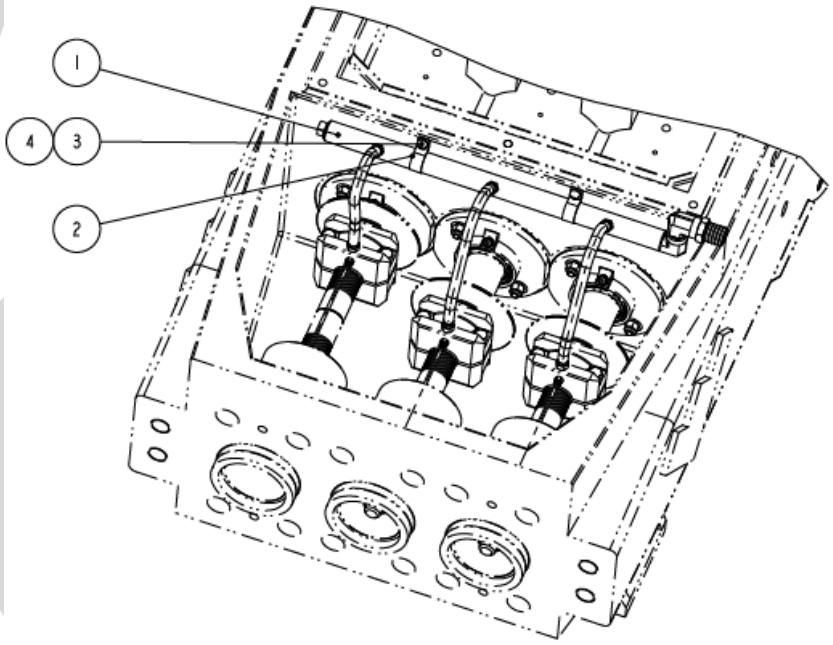
7.1 Power End

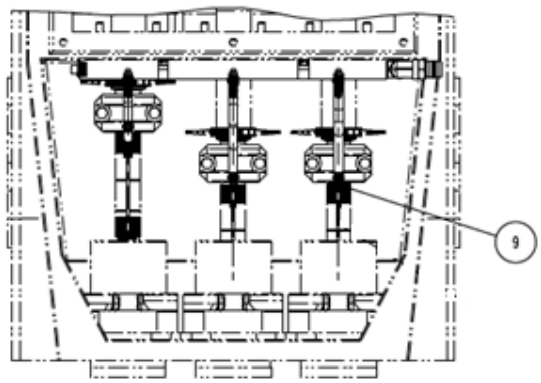
7.1.1 Common Power End Parts

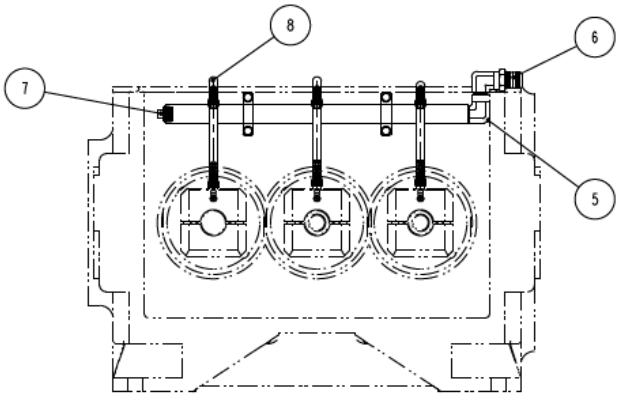


Item	Part Number	Description	Qty	Item	Part Number	Description	Qty
1	1285715	Frame, Power	1	13	1285745	Plate, Power End Top	1
2	1285711	Crosshead	3	14	1411470	Plate, Crosshead Cover	1
3	1285737	Wrist Pin	3	15	1284565	Screw, HHC	20
4	1284577	Set Screw	3	16	1734682	Plate, Power End Cover	1
5	1296207	Assembly Connecting Rod	3	17	1285730	Dipstick	1
6	1285702	Bearing, Crankpin	6	18	1284536	Cap, Breather	1
7	1310180	Intermediate Rod	3	19	1285726	Gasket, Top Cover	1
8	1285721	Seal, Wiper Box	3	20	1285728	Gasket, Back Cover	1
9	1375414	Assembly Wiper Box	3	NS	2192452	Assembly, Cradle Cover	1
10	1285762	Wiper	6	NS	1376658	Assembly Piston Clamp	3
	1961634	Spacer	3	NS	1284405	Pin	3
	1944958	Seal, Polypak	3	NS	1284597	Plug, Pipe 1” MNPT	8
	446609	Oil, seal	3	NS	1284601	Plug, Pipe 1.5” MNPT	1
11	1285676	Baffle	3	NS	2325716	Assembly, cradle cover bumper	1
12	1285729	Gasket, Crosshead Cover	1	NS	1249544	Tie Wire	-

7.1.2 Assembly Liner Wash

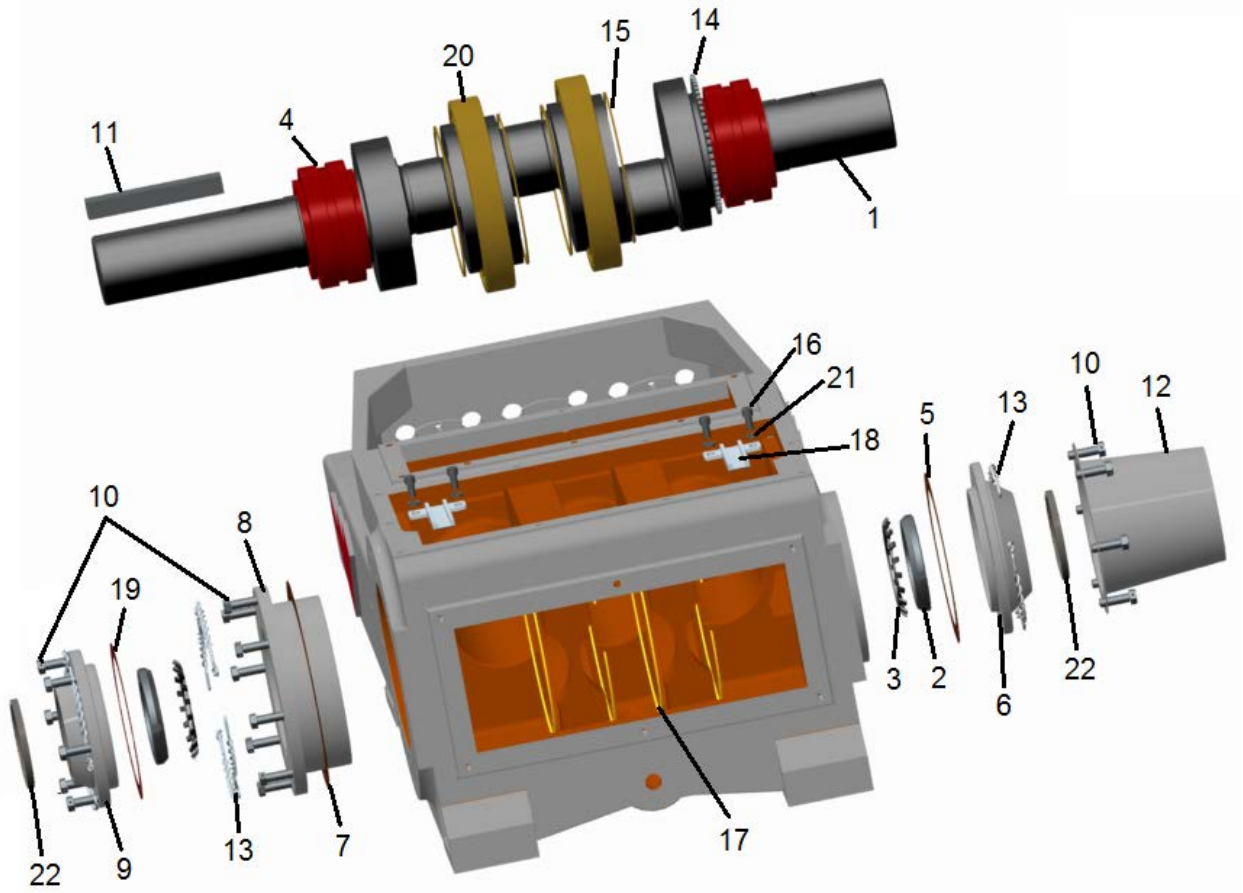






Item	Part Number	Description	Qty.
	1960261	Assembly, liner wash	
1	2286818	Manifold, liner wash	1
2	2291096	Clamp, pipe two holes 1-5/16 OD steel	2
3	2016705	Washer, split lock 0.680 OD x 0.375 ID x 0.090 THK steel	4
4	217635	Bolt, hex 0.375-16 UNC X 0.750 GR5	4
5	1889447	Elbow, 90 DEG 0.750 MNPT x 0.750 FNPT 150 psi iron BLK	2
6	2291070	Adapter, BARB hose 0.750 MNPT x 1.000 hose ID 150 psi	1
7	1012663	Plug, pipe .750 NPT SQ head	1
8	2290200	Hose, liner wash 0.375ID x 0.625OD w/ 9/16-18 JIC fittings	3
9	2379873	Nipple, pipe 0.125 NPT x 8.000 LG black steel	3

7.1.3 Straight Shaft Assembly - Left Hand Drive

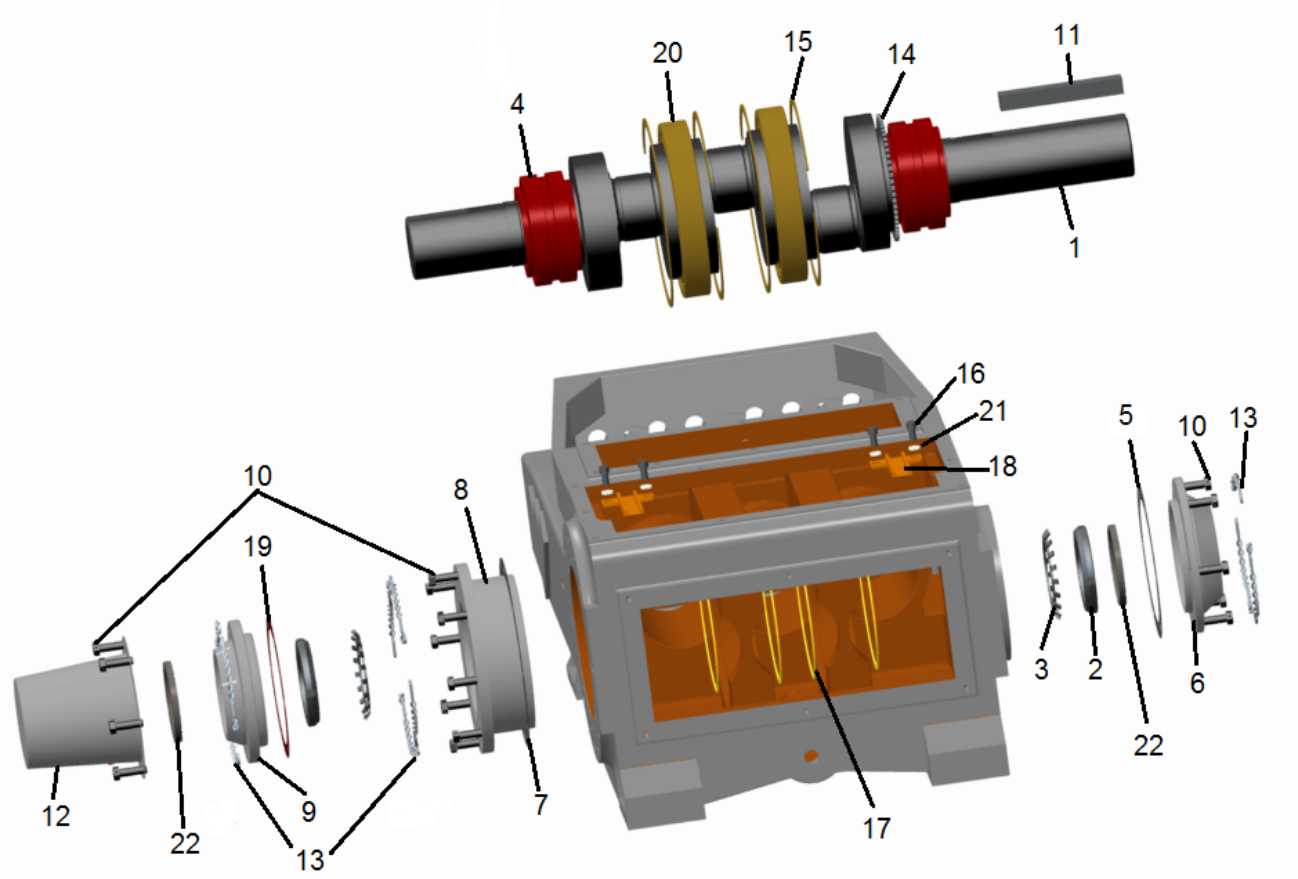


Item	Part Number	Description	Qty.
	2175532	Assembly, Power End LH	
1	1285710	Crankshaft LH Drive	1
2	1285735	Lock Nut	2
3	1285760	Washer, Bearing	2
4	1285700	Bearing, Tapered Roller	2
5	1285718	Gasket, Bearing Retainer	1
6	2192381	Retainer, Bearing RH	1
7	1285723	Gasket, Bearing Housing	1
8	1285705	Carrier, Bearing	1
9	2192438	Retainer, Bearing LH	1
10	1284589	Screw, HHC	20
11	1285732	Key	1

Item	Part Number	Description	Qty.
12	1371259	Guard	1
13	1249544	Tie Wire	-
14	1285757	Sprocket, Crankshaft	1
15	1285754	Ring, Snap, Crank	4
16	1284592	Screw, HHC	4
17	1285755	Ring, Frame Snap	4
18	1285759	Trough	2
19	1315561	Gasket, Bearing Retainer	1
20	1285698	Bearing, Center Roller	2
21	1414040	Washer, Spring Lock	4
22	2193057	Seal, Crankshaft	2

*Items on this page plus Common Power End Parts on page 87 make up Assembly 2175532.

7.1.4 Straight Shaft Assembly - Right Hand Drive

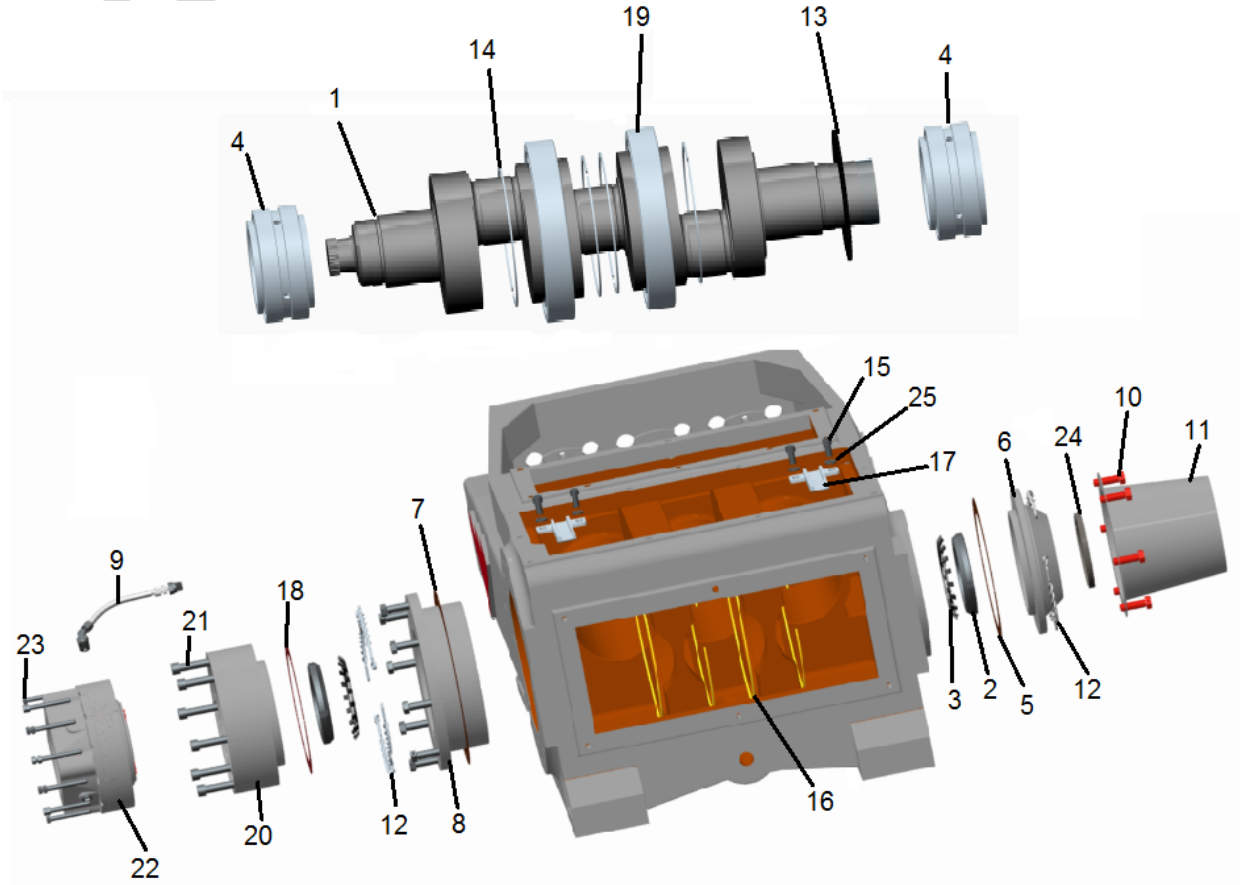


Item	Part Number	Description	Qty
	2214816	Assembly, Power End RH	
1	1971103	Crankshaft, RH Drive	1
2	1285735	Lock Nut	2
3	1285760	Washer, Bearing	2
4	1285700	Bearing, Tapered Roller	2
5	1285718	Gasket, Bearing Retainer	1
6	2192381	Retainer, Bearing RH	1
7	1285723	Gasket, Bearing Housing	1
8	1285705	Carrier, Bearing	1
9	2192438	Retainer, Bearing LH	1
10	1284589	Screw, HHC	20
11	1285732	Key	1

Item	Part Number	Description	Qty.
12	1979274	Guard	1
13	1249544	Tie Wire	-
14	1285757	Sprocket, Crankshaft	1
15	1285754	Ring, Snap, Crank	4
16	1284592	Screw, HHC	4
17	1285755	Ring, Frame Snap	4
18	1285759	Trough	2
19	1315561	Gasket, Bearing Retainer	1
20	1285698	Bearing, Center Roller	2
21	1414040	Washer, Spring Lock	4
22	2193057	Seal, Crankshaft	2

*Items on this page plus Common Power End Parts on page 87 make up Assembly 2214816.

7.1.5 Planetary Gear Assembly – Left Hand Drive

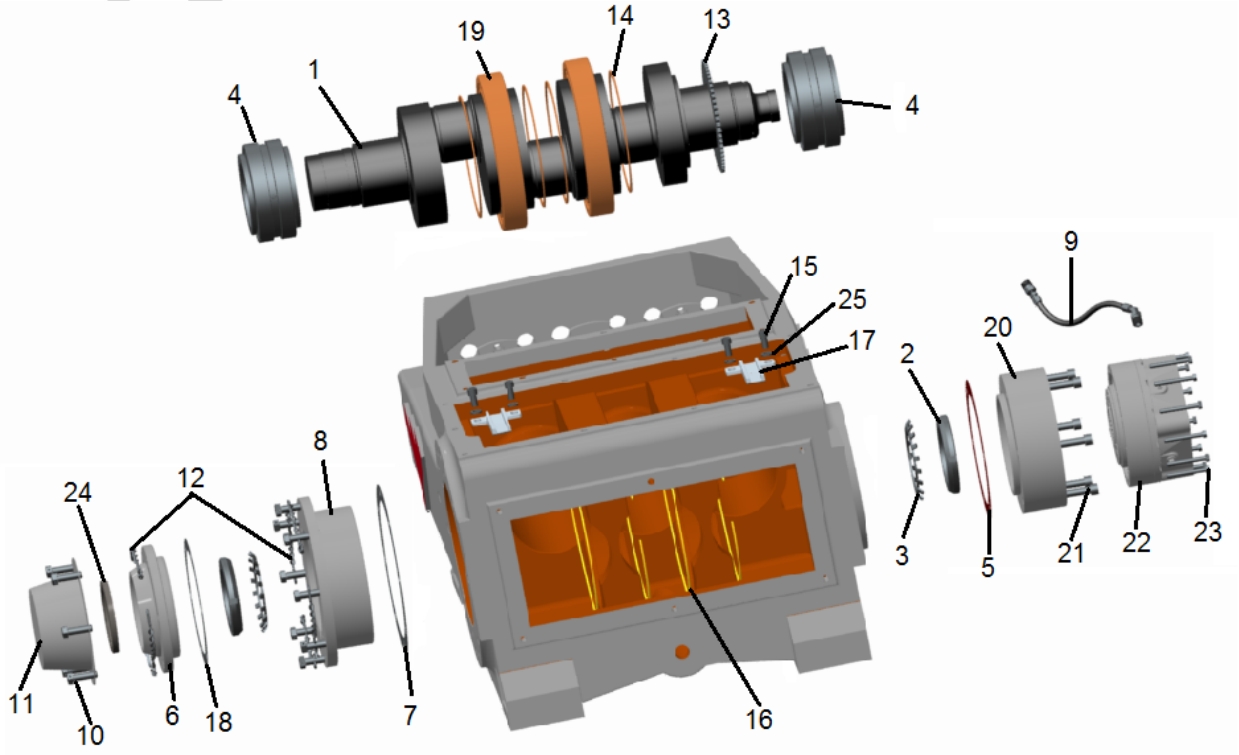


Item	Part Number	Description	Qty
	1740261	Assembly Power End AG8 LH	
1	1390867	Crankshaft, LH Drive	1
2	1285735	Lock Nut	2
3	1285760	Washer, Bearing	2
4	1285700	Bearing, Tapered Roller	2
5	1285718	Gasket, Bearing Retainer	1
6	2192438	Retainer, Bearing RH	1
7	1285723	Gasket, Bearing Housing	1
8	1798795	Carrier Main Bearing	1
9	1788252	Lubrication Hose, Assy.	1
10	1284589	Screw, HHC	14
11	2193091	Guard	1
12	1249544	Tie Wire	-

Item	Part Number	Description	Qty
13	1285757	Sprocket, Crankshaft	1
14	1285754	Ring, Snap, Bearing	4
15	1284592	Screw, HHC	4
16	1285755	Ring, Frame Snap	4
17	1285759	Trough	2
18	1798268	Gasket, Bearing Retainer	1
19	1285698	Bearing, Center Roller	2
20	1390868	Adapter, Auburn Gear LH	1
21	1788251	Screw, SHC	6
22	1391342	Auburn Gear Assy. 7.07	1
23	0181435	Screw, HHC	12
24	2193057	Seal, Crankshaft	1
25	1414040	Washer, Spring Lock	4

*Items on this page plus Common Power End Parts on page 87 make up Assembly 1740261.

7.1.6 Planetary Gear Assembly – Right Hand Drive

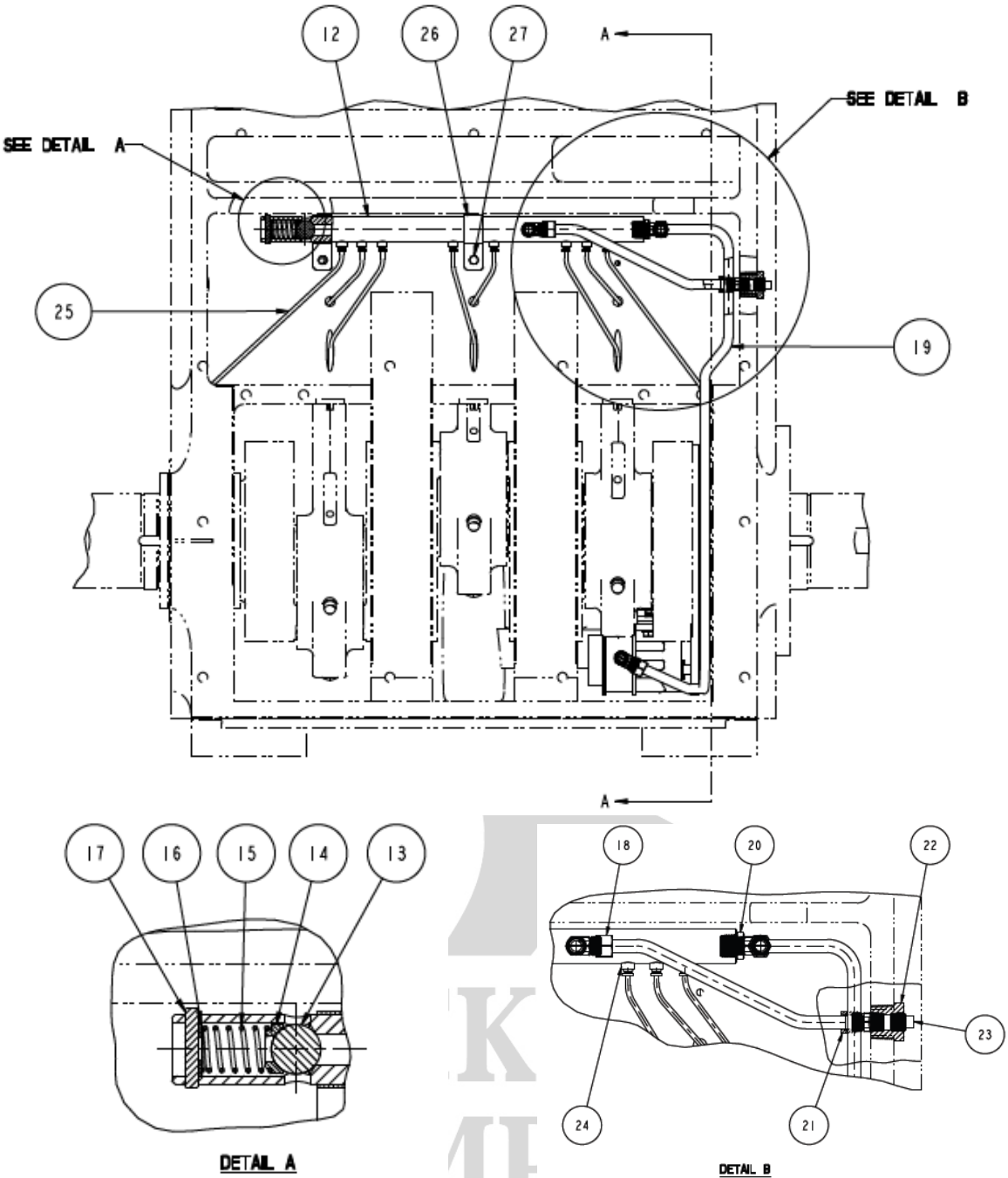


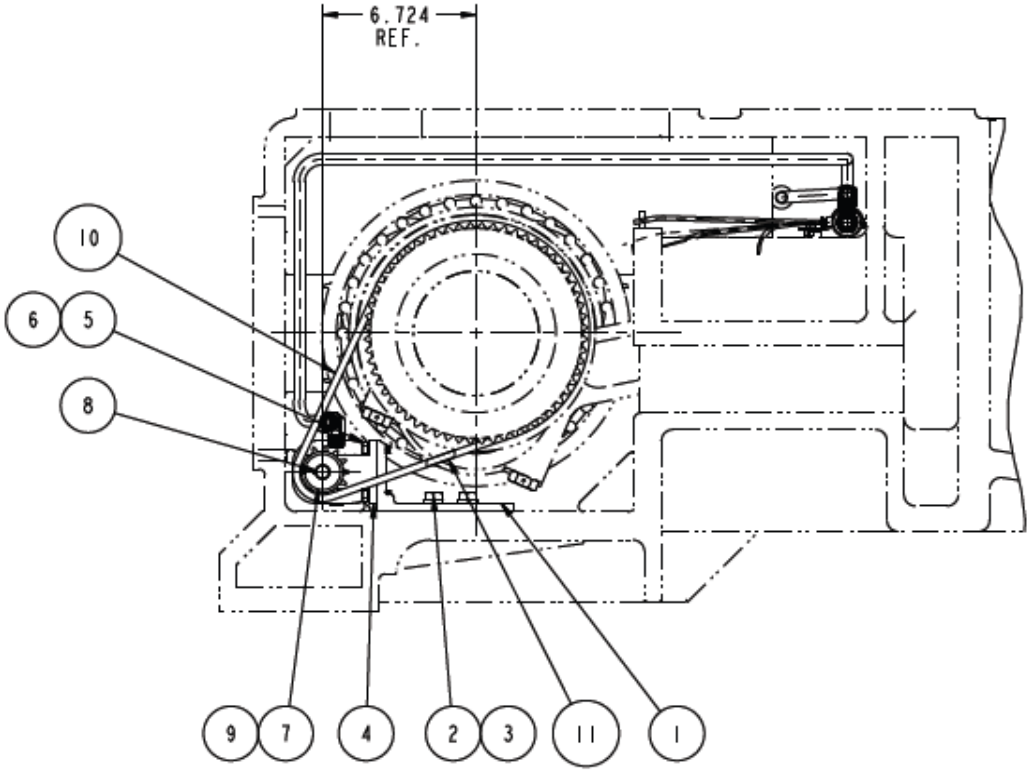
Item	Part Number	Description	Qty
	1760194	Assembly Power End AG8 RH	
1	1724669	Crankshaft, RH Drive	1
2	1285735	Lock Nut	2
3	1285760	Washer, Bearing	2
4	1285700	Bearing, Tapered Roller	2
5	1285718	Gasket, Bearing Retainer	1
6	2192381	Retainer, Bearing LH	1
7	1285723	Gasket, Bearing Housing	1
8	1285705	Carrier Main Bearing	1
9	1788253	Lubrication Hose, Assy.	1
10	1284589	Screw, HHC	14
11	2197670	Guard	1
12	1249544	Tie Wire	-

Item	Part Number	Description	Qty
13	1285757	Sprocket, Crankshaft	1
14	1285754	Ring, Snap, Bearing	4
15	1284592	Screw, HHC	4
16	1285755	Ring, Frame Snap	4
17	1285759	Trough	2
18	1315561	Gasket, Bearing Retainer	1
19	1285698	Bearing, Center Roller	2
20	1724661	Adapter, Auburn Gear LH	1
21	1788251	Screw, SHC	6
22	1391342	Auburn Gear Assy. 7.07	1
23	0181435	Screw, HHC	12
24	2193057	Seal, Crankshaft	1
25	1414040	Washer, Spring Lock	4

*Items on this page plus Common Power End Parts on page 87 make up Assembly 1760194.

7.1.7 Power End Lubrication Assembly

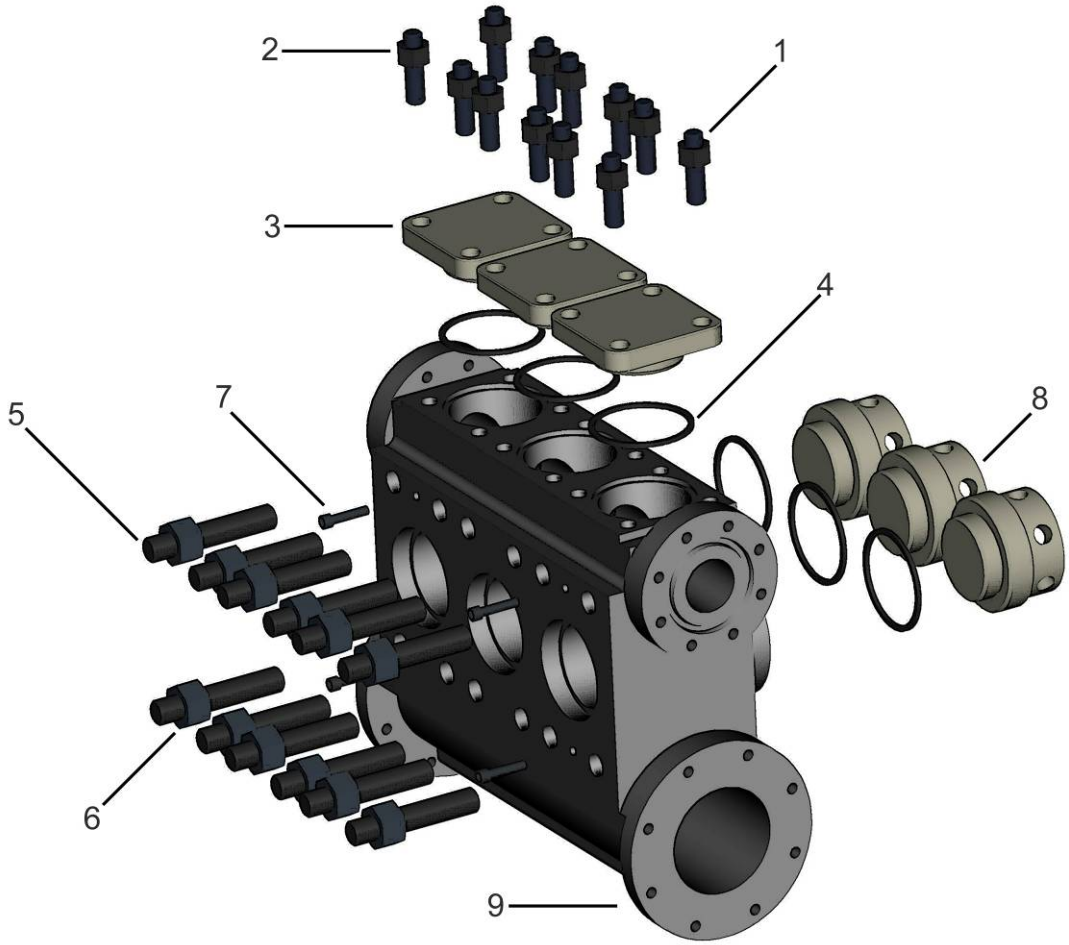




Item	Part Number	Description	Qty	Item	Part Number	Description	Qty
	1881747	Assembly, power end lubrication		14	203058	Retainer, ball valve	1
1	1414055	Support, lube pump bracket	1	15	190982	Spring, ball valve power end lube	1
2	213685	Bolt, hex 0.50-13UNC X 1.25	2	16	1257145	Washer, flat 0.375 CS USS Zn	1
3	1257137	Washer, split lock 0.500 CS	2	17	1414057	Pin, cotter 0.250 OD x 1.500 LG	1
4	1414042	Pump, B+S #1s	1	18	2267350	Elbow, comp 0.375 MNPT	3
5	195938	Bolt, hex 0.375-16 UNC X 1.00	4	19	2292242	Tubing, copper .50 OD .436 ID	48
6	2016705	Washer, split lock 0.680 OD	4	20	2095219	Bushing, reducing 0.500 MNPT	1
7	1414050	Sprocket, 13 teeth RC-40	1	21	2267362	Fitting, .375 MNPT x .500	1
8	1414056	Key, 0.125 x 0.125 x 0.625 CS	1	22	1414044	Adapter, gage lubrication	1
9	777386	Set screw, 0.190-24 x 0.375	1	23	1008255	Plug, pipe .375 NPT 150 PSI	1
10	1414045	Chain, RC-40 76 pitches steel	1	24	1414048	Fitting, .188 TBE x .125 MNPT	8
11	1818758	Link, connecting RC-40 0.500	1	25	2292240	Tubing, copper .188 OD .124 ID	60
12	1414043	Pipe, manifold power end lube	1	26	2292229	Clamp, one hole 1.000 steel	2
13	1414052	Ball, valve 0.938 DIA	1	27	1921313	Screw, cap 0.25-20 x .50 CS	2

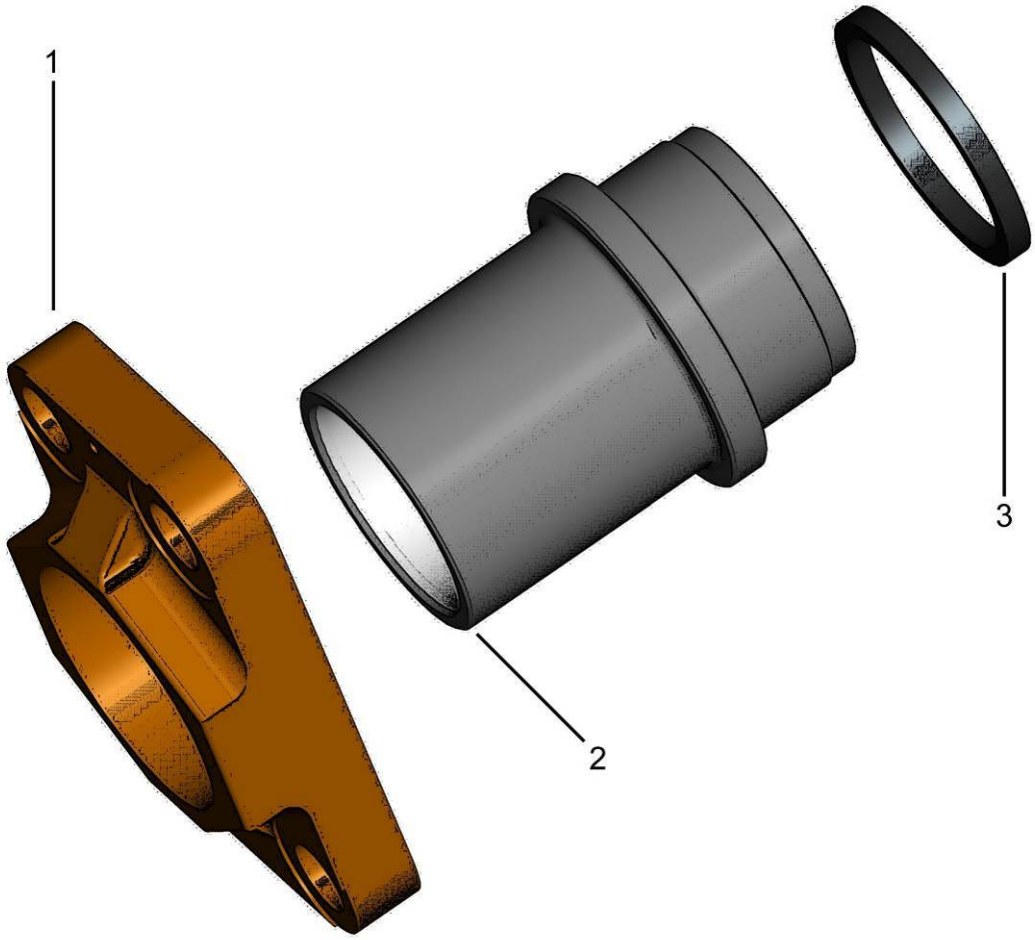
7.2 Fluid End

7.2.1 Fluid End Assembly



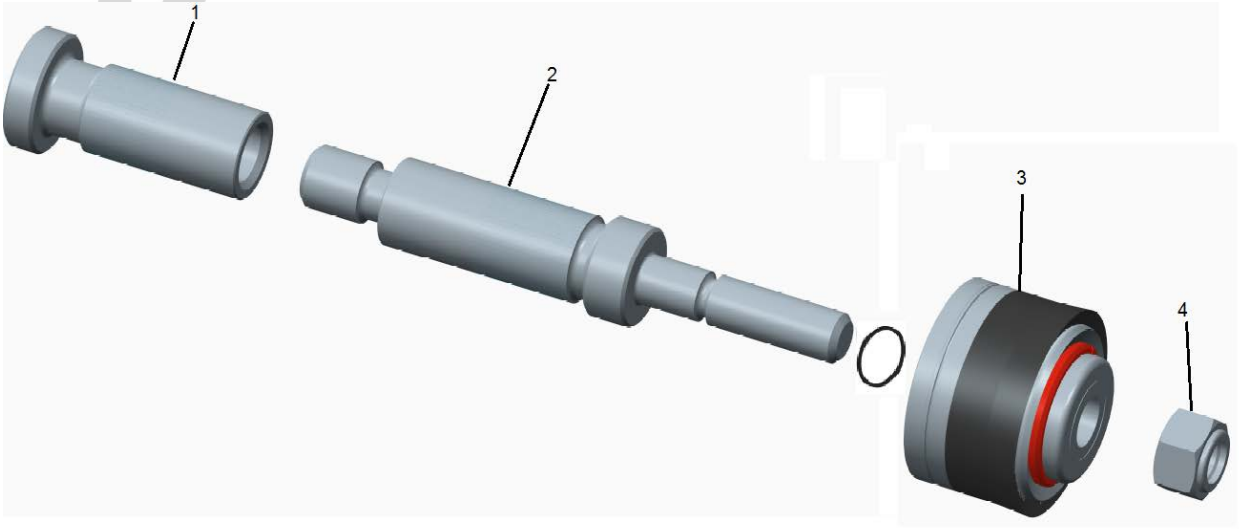
Item	Description	DI	Qty.
	Fluid End Assembly	1870161	1
1	Stud	1870531	12
2	Nut	1284562	12
3	Cylinder Top Cover	1372067	3
4	Seal, Cover	1285394	6
5	Stud	1284609	12
6	Nut	1284555	12
7	Cap Screw	1284547	4
8	Front Cover	1390828	3
9	Fluid Cylinder	1385168	1

7.2.2 Liner Assembly



Item	Part Number	Description
1	1285417	Liner Retainer
2	1315942	Liner, 3.000” diameter
	1788208	Liner, 3.500” diameter
	1788209	Liner, 4.000” diameter
	1788210	Liner, 4.500” diameter
3	1783082	Liner Seal

7.2.3 Piston Assembly



Item	Part Number	Description
1	1818145	Piston Sub Rod
2	1818144	Piston Rod
3	2386855	Assembly, piston 3.00 B-Series NBR 1.000 bore
	2388035	Assembly, piston 3.50 B-Series NBR 1.000 bore
	2388033	Assembly, piston 4.00 B-Series NBR 1.000 bore
	2365101	Assembly, piston 4.50 B-Series NBR 1.000 bore
4	1725728	Nut, 1” Lock

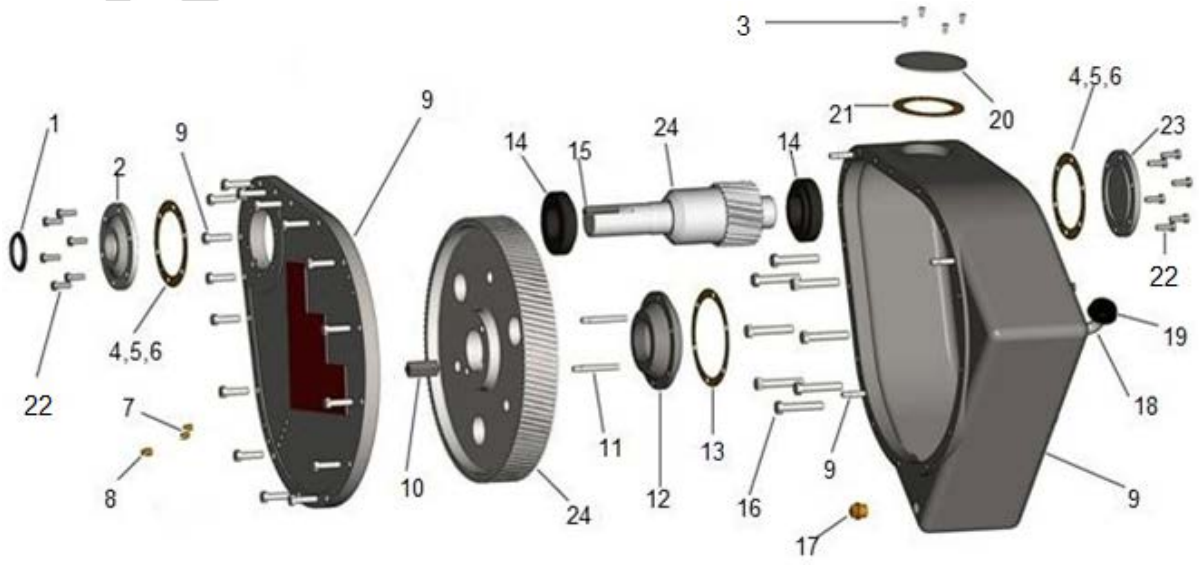
Part Number	Description
2386863	Kit, piston 3.00 B-Series NBR 1.000 bore
2386859	Kit, piston 3.50 B-Series NBR 1.000 bore
2386857	Kit, piston 4.00 B-Series NBR 1.000 bore
2388110	Kit, piston 4.50 B-Series NBR 1.000 bore

Kit includes 1) piston rubber, 1) plate and 1) o-ring.

7.3 Valve Assemblies

Part Number	Description	Qty.
1412301	Assembly, Valve Suction Tapered AR W165-W300L AM	1
1412314	Assembly, Valve Discharge Tapered AR W165-W300L AM	1

7.4 Gear Reducer Assembly



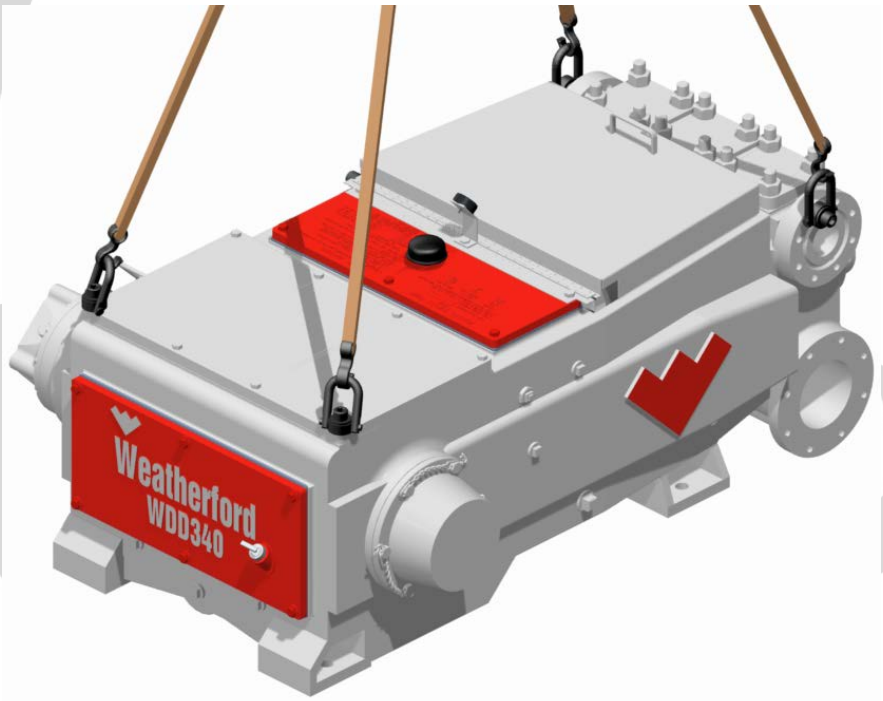
Item	Part Number	Description	Qty.
1	1378402	Excluder, Dirt	1
2	1378398	Retainer, HS Bearing	1
3	217635	Bolt, HH .375-16 x .75" LG	4
4	1720739	Shim, HS Bearing 0.020 GR	2
5	1720738	Shim, HS Bearing 0.007 GR	6
6	1720737	Shim, HS Bearing 0.005 GR	6
7	107618	Plug, Square HD .375"	3
8	448734	Plug, Square HD .500"	1
10	1379634	Key, Gear 1.25 x 1.25 x 3.5”	1
11	1378401	Pin, Taper #10 x 4.5"	2
12	1378405	Retainer, Main Bearing	1

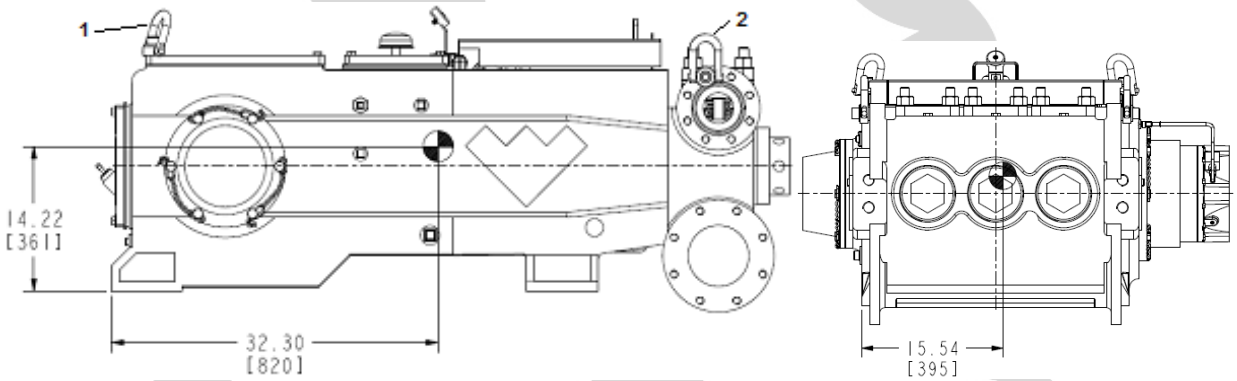
Item	Part Number	Description	Qty.
13	1315561	Gasket, Retainer Cage	1
14	1720736	Bearing, HS Shaft	2
15	1379631	Key, Pinion .875" x .875" x 4"	1
16	2271740	Bolt, hex .875-9 x 4.5”	8
17	764906	Plug, 1.25" magnetic	1
18	1001976	Elbow, Standard 1" x 90	1
19	1284536	Cap, Breather 1" MNPT CS	1
20	1378404	Cover, Inspection	1
21	1378408	Gasket, Inspection Cover	1
22	1236072	Screw, Cap Hex .625-11 x 1.25"	12
23	1378403	Cap, HS Pinion Bearing	1
NS	1223645	Nut, .625-18UNF	2

Variations by Gear Reduction Ratio

Item	Description	Gear Reducer Ratio								Qty
		2.27	2.89	3.25	3.36	3.69	4.38	4.84	5.56	
9	Housing, Gear Reducer	1378414						1882398	2316233	1
24	Gear, Set	2232766	2013074	2013076	2016080	2013088	2013092	2013094	2315786	1
	Complete Assembly	1884814	1884820	1884822	1884826	1884828	1378415	1882400	2326076	

7.5 Lifting of Pump





Item	Part Number	Description	Qty
	2432536	Kit, tool lifting lug WDD340	
1	1209515	Ring, hoist swivel 0.500-13 x 2.500 2500 LB load alloy steel	2
2	2432533	Ring, hoist swivel 0.750-10 x 1.563 5000 LB load alloy steel	2