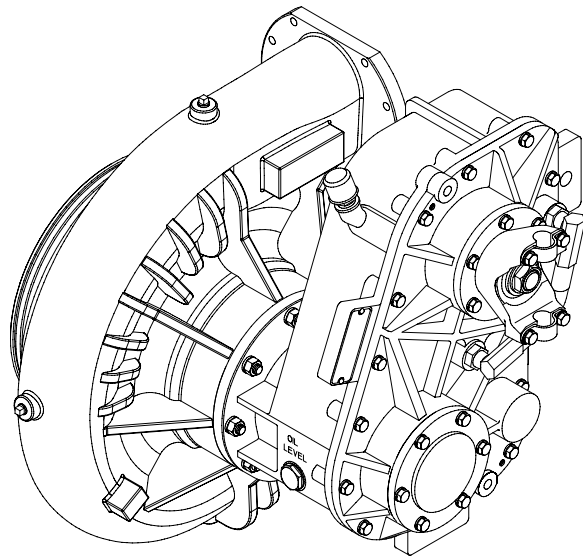


Model CRQA Fire Pump

Overhaul Instructions

Form No.	Section	Issue Date	Rev. Date
F-1031	4312	03/02/98	05/08/20



IL1872

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***No longer used, replaced by
F-1031-4214 and F-2876***



Introduction

This instruction provides the necessary steps to overhaul model CRQA fire pumps. Note that the instructions are divided into Disassembly and Reassembly sections.

Ordering Repair Parts

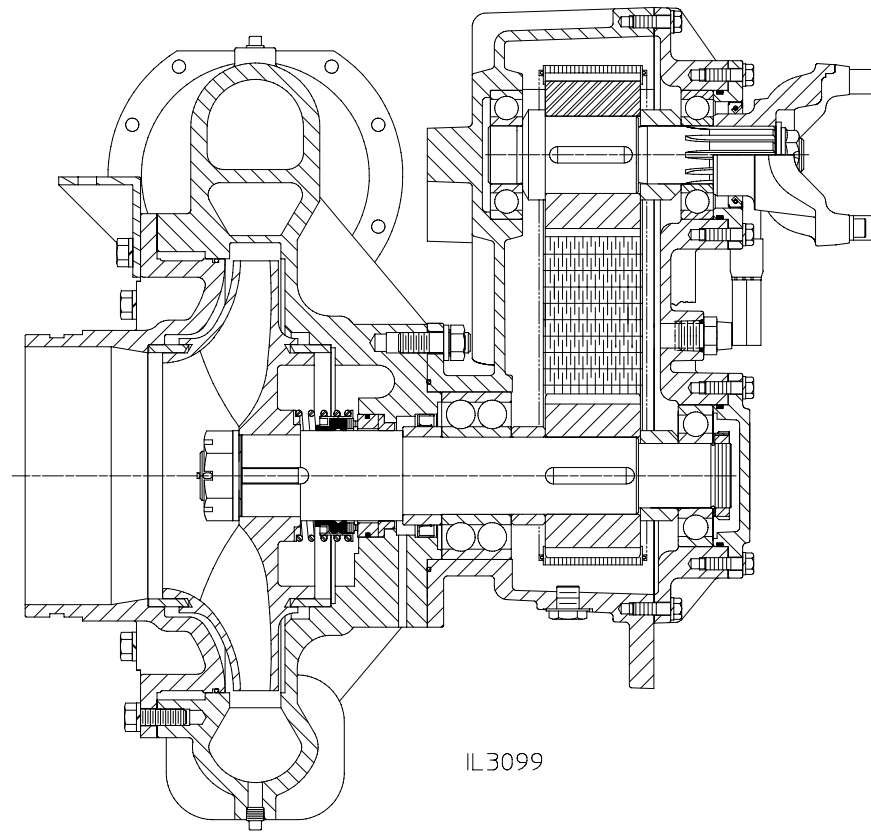
When ordering repair parts, furnish the reference number of the component (from Service Parts List) along with the Pump Model and serial number.

Refer to the Service Parts Lists furnished with your pump for identification of individual components.

The following repair kits are available for servicing the components identified:

Component	Repair Kit	Includes:
Mechanical Seal	K 716	One Mechanical Seal

Cross-Section View of CRQA



General Overhaul Information

Tools and Equipment

The following tools and equipment are needed to overhaul a pump:

1. Usual automotive mechanic's hand tools.
2. An arbor press for assembling or disassembling components.
3. An engine lathe for turning impeller hubs.
4. A suitable hoist and slings.
5. Torque capability up to 325 lb-ft.

While no special tools and equipment are required, a few special items are illustrated or described so the mechanic can make them or they are available from the apparatus manufacturer or the Waterous Company. These special items are not absolutely necessary, but they will make the mechanic's work much easier.

Preliminary Testing

Before disassembling a pump, test it thoroughly, if possible, and record the results. A comparison of this test with periodic tests recommended in form F-1031, Section 1000 can often reveal specific pump troubles. Excessive speed, for instance, indicates that impellers and/or wear rings are probably worn.

Cleaning

The continued satisfactory operation of a pump depends to a great extent upon the cleanliness of its internal parts. Sand, dirt or other abrasive material will wear bearings, gears and related parts. Before disassembling a pump for repairs, be sure to clean its exterior. Make sure the working space, benches and tools are clean. Use only clean, lint-free cloths to wipe off components. Before reassembling a pump or its components, be sure to clean them thoroughly.

Pump Bodies and Impellers

Flush out these components and related parts with clean water. Use a stiff brush to remove loose scale, caked sediment, etc. Be sure to remove all

traces of old gaskets. Examine pump bodies, covers, adapters and fittings for cracks, severe corrosion or other damage. Almost all damage to these parts results from improper use or maintenance, or from freezing. Replace defective parts.

Bearings, Gaskets, Seals and O-rings

Parts of this nature are frequently damaged during removal or disassembly. In addition, they sometimes deteriorate or lose their effectiveness because of age or misuse. Replacing these parts whenever overhauling a pump is a good policy.

Impeller Shafts

Examine shaft for severe scratches, grooves or corrosion - especially under packing or mechanical seals. If scratches are not severe, and are not under packing and seals, clean them with a fine-cut file. Grooves are usually permissible if they are not sharp or too deep. Even slight longitudinal scratches will cause leaks and should be removed.

Installing Ball Bearings

Most Waterous pumps are designed so that ball bearings fit tightly on their shafts and have relatively loose fits in the bearing housings. When mounting these bearings on shafts, always apply force to the inner races. When bearings have a tight fit in the housings, and a heavy force is necessary to install them, be sure to apply force only to the outer bearing races. For either type of fit, applying force to the wrong bearing race may damage the balls and race.

Transmission Case Gaskets

To provide added sealing for gaskets between transmission halves, coat both sides of these gaskets with a suitable sealant. A compound such as Permatex Super 300 is recommended for this application. Be sure all traces of previous gaskets and sealant are removed before installing new gaskets.

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Assemble Pump:

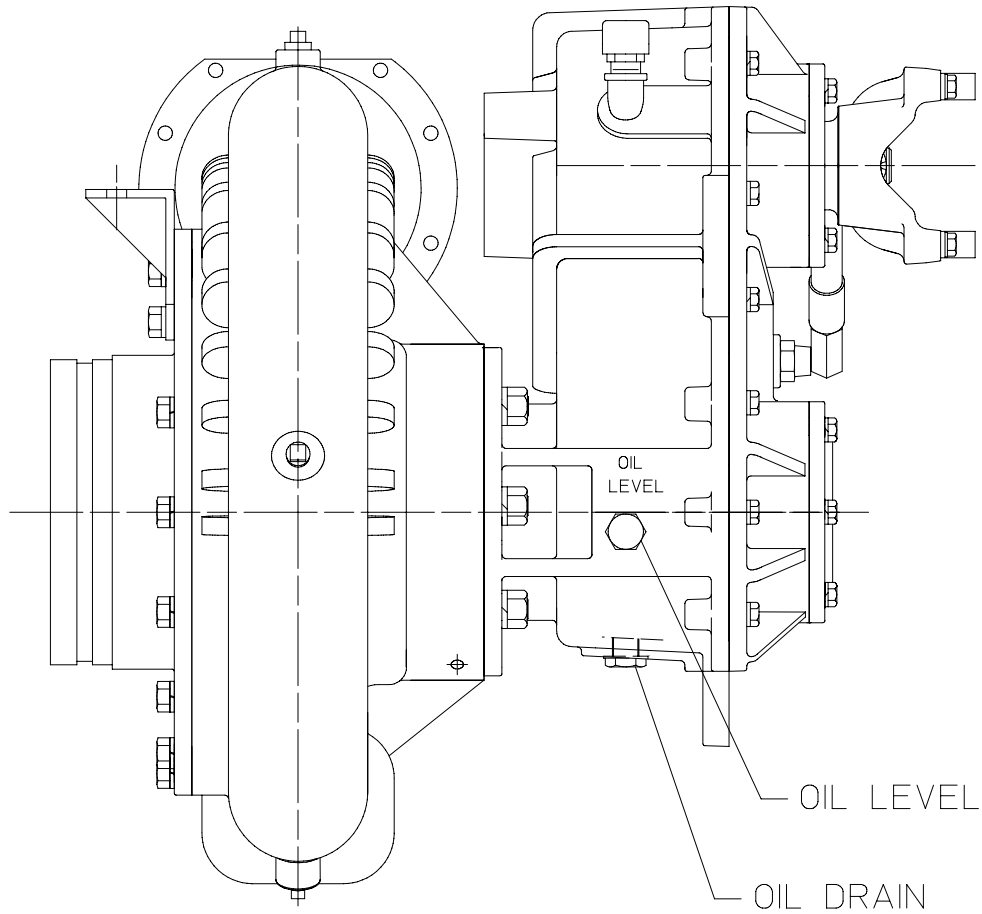
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Disassembly

Remove Pump From Vehicle



1. Drain fluid from transmission.
2. Disconnect propeller or drive shafts to pump transmission.
3. Disconnect pump intake and discharge piping.
4. Disconnect cooling and drain lines, electrical wiring and similar equipment from pump and accessories.

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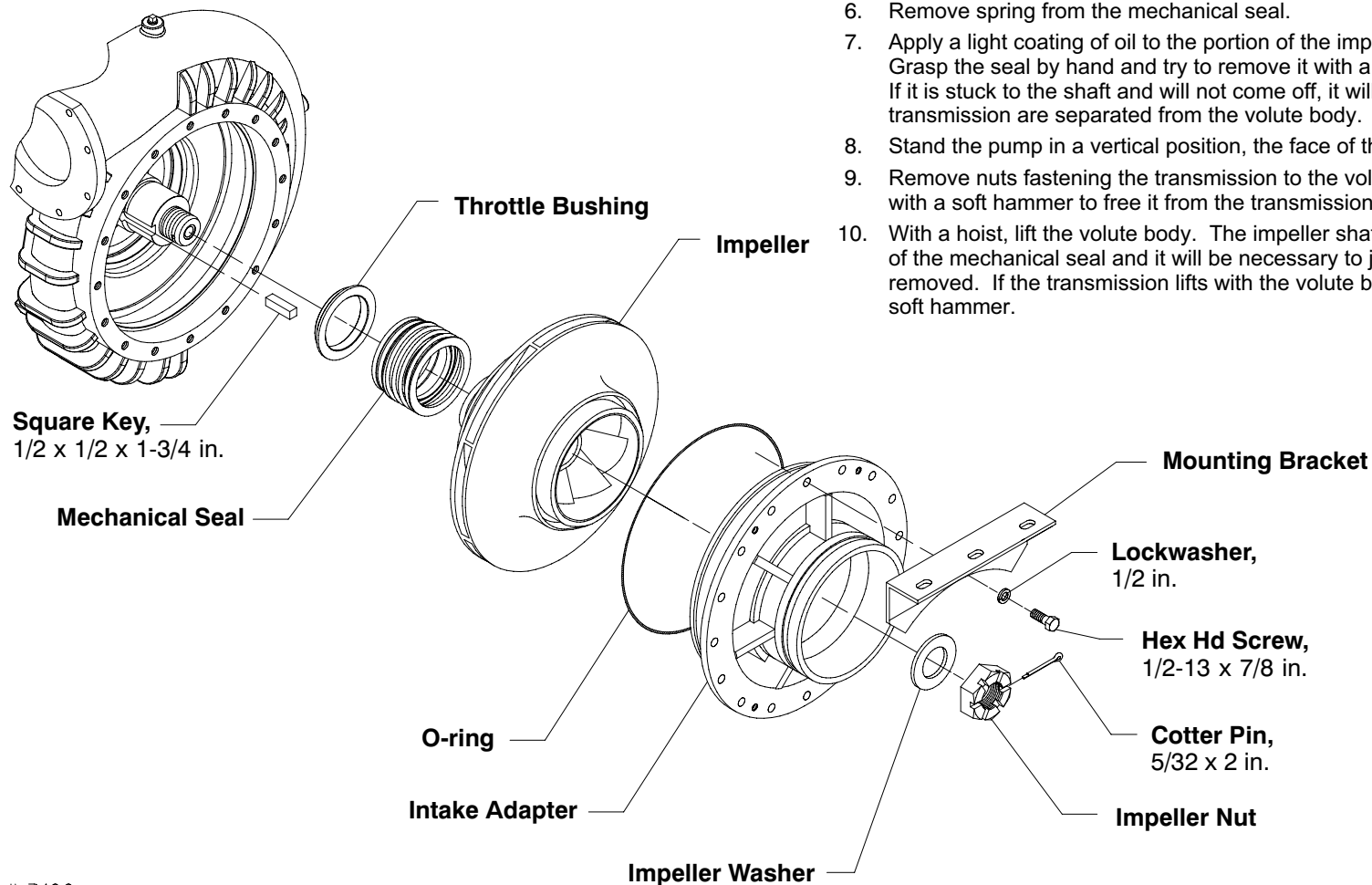
Disassembly

Intake Adapter, Impeller & Mechanical Seal Removal

Before disassembling the pump, mark the position of the intake adapter, volute body and the mounting bracket to each other.

Note: The wear rings in the volute body and intake adapters cannot be removed without ruining them. They should only be removed if new wear rings are required.

1. Remove the three (3) screws that attach the mounting bracket to the intake adapter and volute body.
2. Remove hex hd screws attaching the intake adapter to the volute body. Remove intake adapter from the volute body and remove the O-ring from the groove in the intake adapter.
3. Remove cotter pin, impeller nut and impeller washer.
4. Remove impeller from impeller shaft. Tapping the impeller lightly with a soft hammer may be necessary to free it from the impeller shaft so it can be removed. There are 3/8-16 UNC tapped holes in the impeller to allow use of a puller if necessary.
5. Remove square key from the impeller shaft.
6. Remove spring from the mechanical seal.
7. Apply a light coating of oil to the portion of the impeller shaft the mechanical seal is on. Grasp the seal by hand and try to remove it with a combined pulling and twisting motion. If it is stuck to the shaft and will not come off, it will come off when the impeller shaft and transmission are separated from the volute body.
8. Stand the pump in a vertical position, the face of the volute body up.
9. Remove nuts fastening the transmission to the volute body. Tap the volute body lightly with a soft hammer to free it from the transmission.
10. With a hoist, lift the volute body. The impeller shaft will probably adhere to the bellows of the mechanical seal and it will be necessary to jiggle the volute body as it is being removed. If the transmission lifts with the volute body, tap on the transmission with a soft hammer.

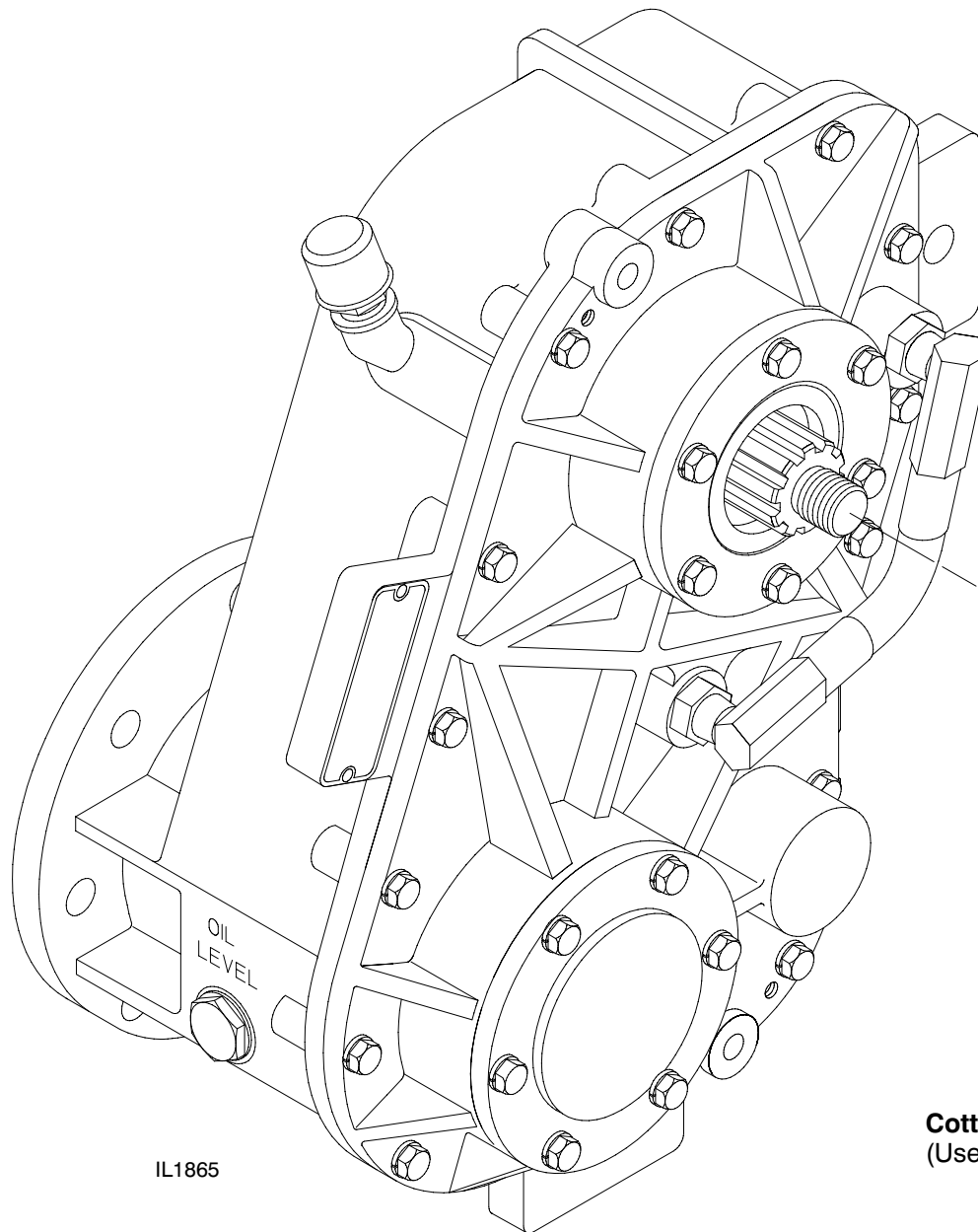


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Disassembly

Removal of End Yoke

1. Remove the cotter pin, shaft nut, or self-locking nut and washer from the drive shaft. Do not reuse self-locking nut. Apply lubricating oil to the threads before removing.
2. Slide the end yoke off the shaft.



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Self-Locking Nut
(Used After April 20, 1998)

Castle Nut
(Used Prior to April 20, 1998)

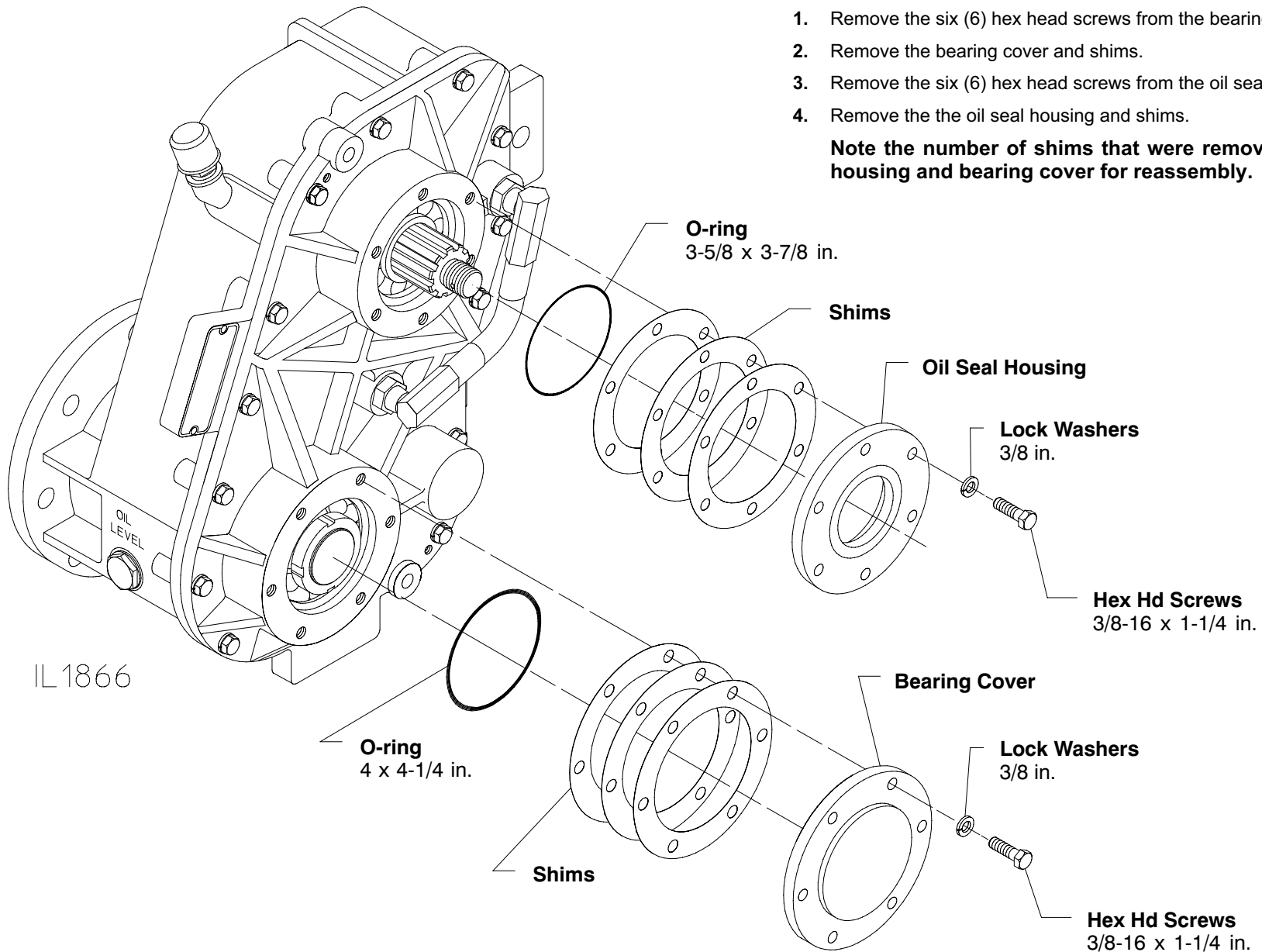
Cotter Pin
(Used Prior to April 20, 1998)

Disassembly

Removal of Bearing Cover and Oil Seal Housing

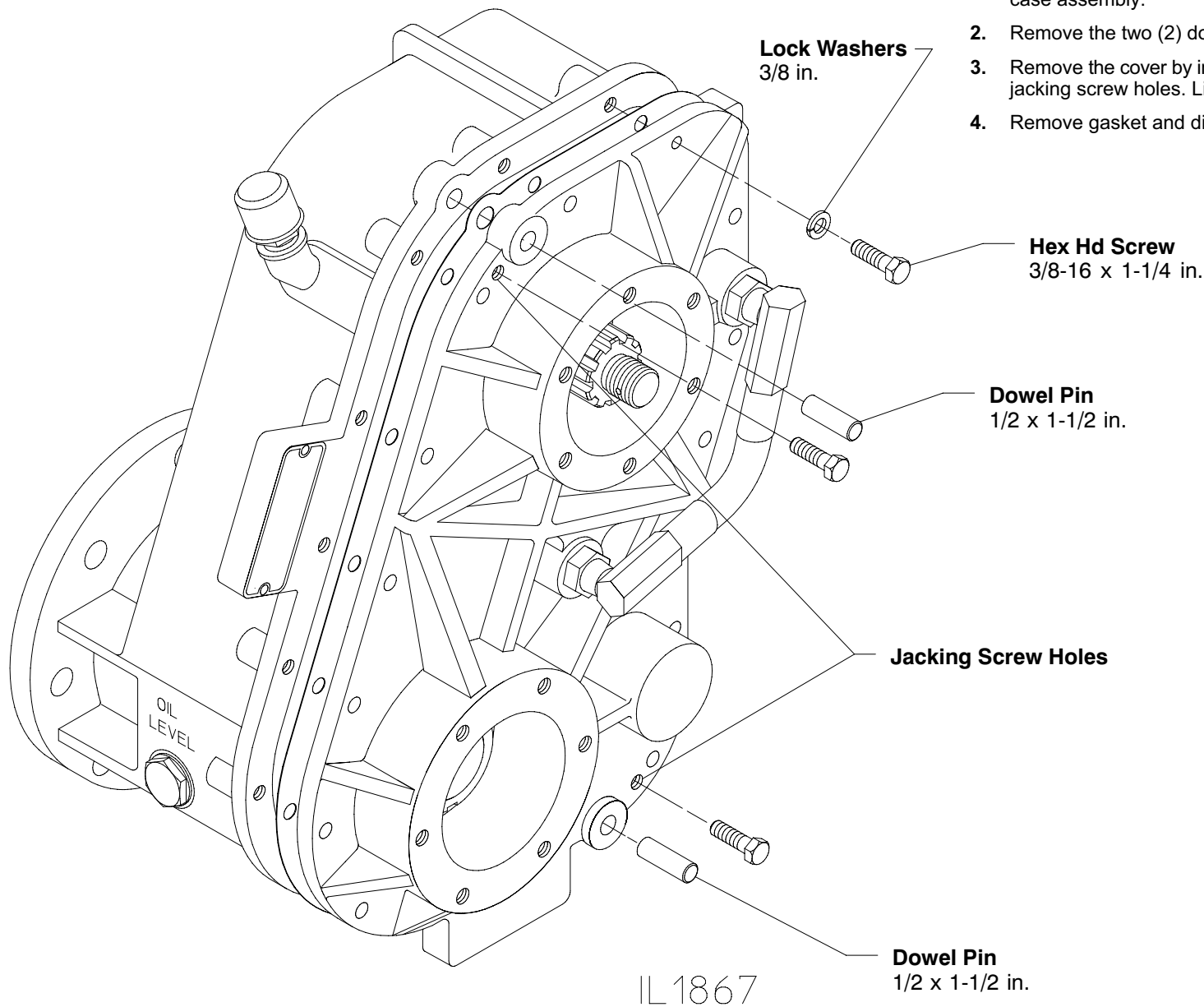
1. Remove the six (6) hex head screws from the bearing cover.
2. Remove the bearing cover and shims.
3. Remove the six (6) hex head screws from the oil seal housing.
4. Remove the the oil seal housing and shims.

Note the number of shims that were removed with the oil seal housing and bearing cover for reassembly.



Disassembly

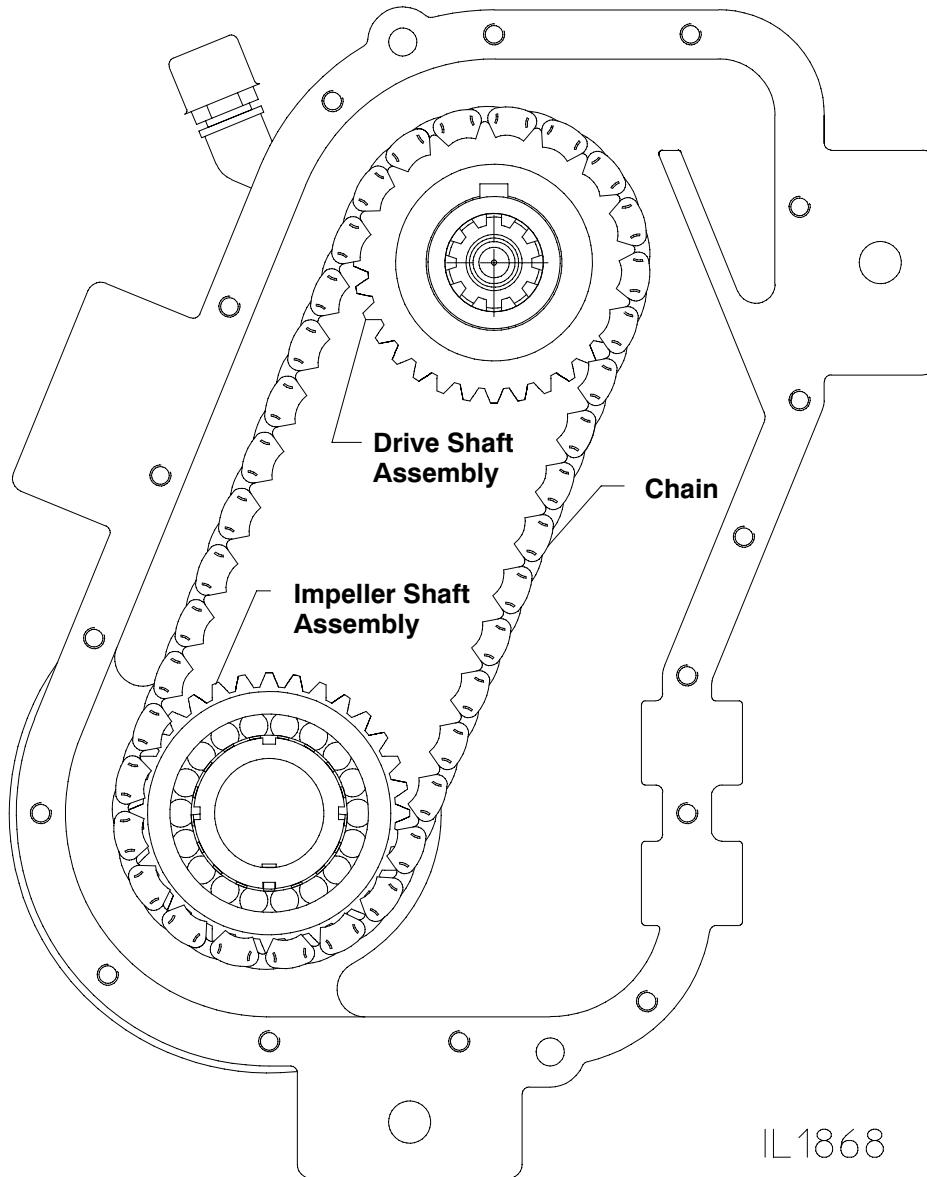
Removal of Case Assembly



1. Remove the fifteen (15) hex head screws from the cover of the case assembly.
2. Remove the two (2) dowel pins.
3. Remove the cover by inserting hex head screws in the two (2) jacking screw holes. Lift cover off evenly.
4. Remove gasket and discard.

Disassembly

Removal of Drive and Impeller Shafts



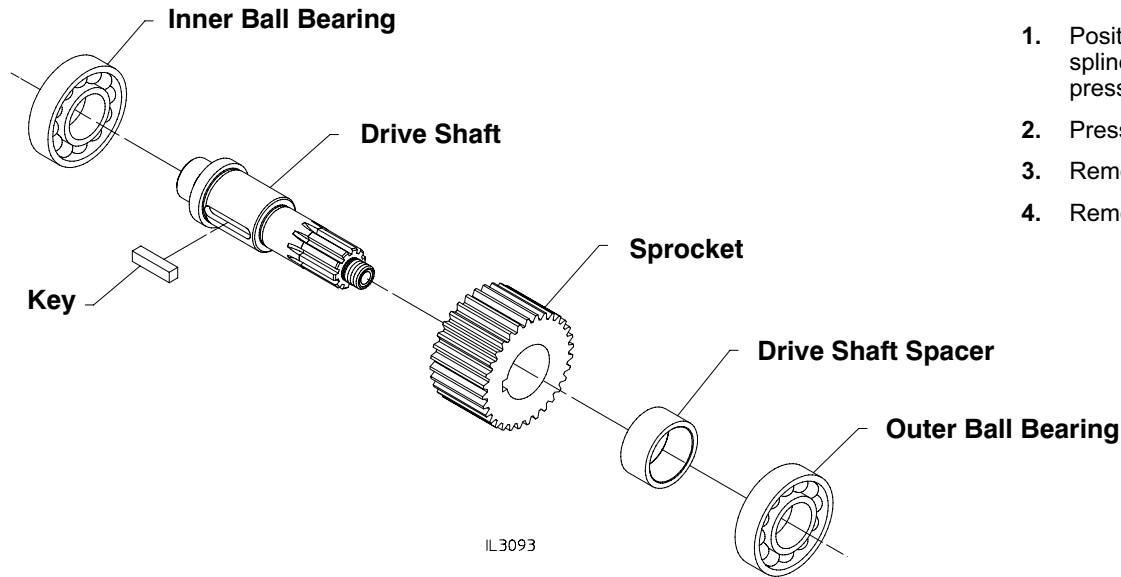
1. Lift the drive shaft assembly, impeller shaft assembly and chain up evenly until the drive shaft assembly clears the bore.
2. Remove the drive shaft assembly and chain.
3. Remove the impeller shaft assembly.

NOTE: Take care not to scratch the oil seal sleeve or mechanical seal journal on the impeller shaft.

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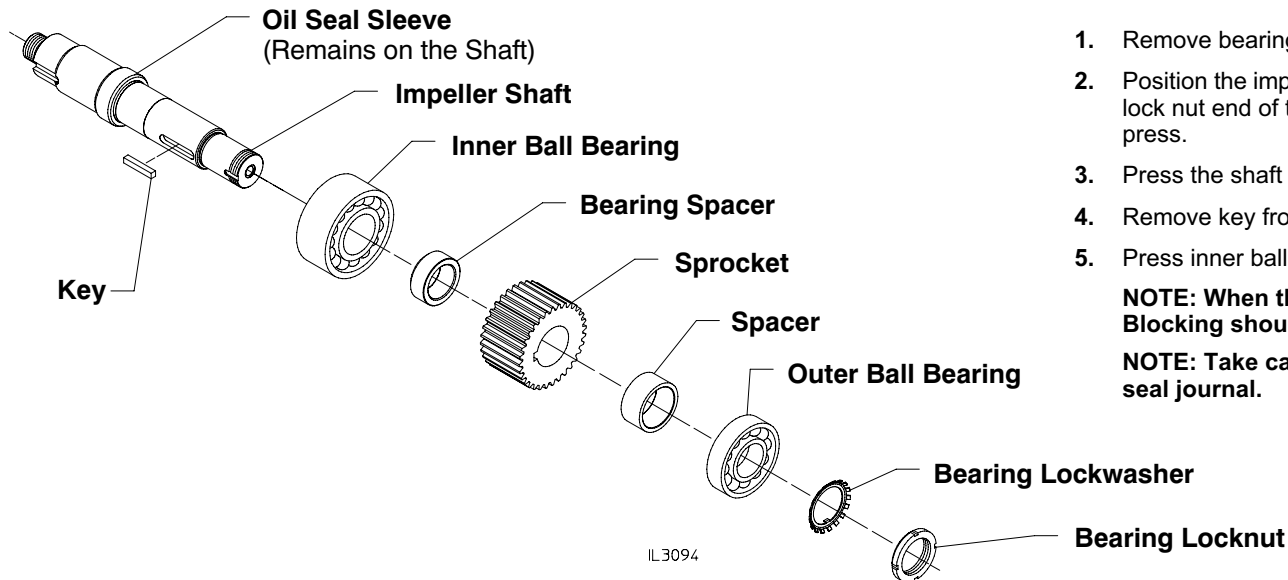
Disassembly

Disassembly Sprocket and Bearings - Drive Shaft



1. Position the drive shaft assembly in a vertical position in a press with the spline end of the shaft up and the sprocket supported by the table of the press.
2. Press the shaft out of the sprocket, drive shaft spacer and outer ball bearing.
3. Remove key from the drive shaft.
4. Remove the inner ball bearing from the drive shaft.

Disassembly Sprocket and Bearings - Impeller Shaft



1. Remove bearing lock nut and bearing lockwasher.
2. Position the impeller shaft assembly in a vertical position in a press with the lock nut end of the shaft up and the sprocket supported by the table of the press.
3. Press the shaft out of the bearing, sprocket and spacers.
4. Remove key from the impeller shaft. Remove bearing spacer.
5. Press inner ball bearing off the shaft.

NOTE: When the shaft is free of the inner ball bearing, it will fall free. Blocking should be provided under the shaft.

NOTE: Take care not to scratch the oil seal sleeve or mechanical seal journal.

Reassembly

Inspection and Repair

Impeller and Wear Rings

Check wear rings and impeller hubs for deep grooves or scratches. Spirol grooves or grooves parallel to the impeller shaft increase leakage. Inspect for excessive wear ring clearance. Diametric clearances in excess of .027 inches may warrant wear ring replacement. Original factory clearance is .019 to .023 diametrically. The diametric clearance should be determined by averaging the results of four measurements taken at 90 degree increments as follows:

Clean and remove small burrs or other protrusions from the wear ring inner diameters and the impeller hub O.D. and I.D. Position each wear ring on the impeller hub on which it was used. Hold the wear ring firmly against one side of the hub and measure total clearance on the opposite side, using a feeler gauge. Do not bottom the wear ring against the bottom of the groove in the impeller.

Impeller hub to wear ring clearance is restored by turning impeller hubs to sizes noted in table and by installing matching undersize wear rings. See table.

Impeller and Wear Ring Repair Dimensions

Original Hub Dia.	Original Wear Ring No.	Reworked Hub Dia.	New Wear Ring No.
7.501/7.499	72346	7.476/7.474 7.451/7.449	72346-25 72346-50

Ball Bearings

When cleaning bearings, bearing manufacturers recommend placing them in a basket and suspending the basket in a container of solvent, preferably overnight. Avoid rotating the bearings before solid particles are removed, to prevent damaging races and balls.

After cleaning, spin them immediately in light oil and check each one as described below:

1. Examine bearing for rusted or pitted balls, races or cages.
2. Check cage and races for cracks or other damage. Examine balls and races for brinelling, abrasion and serious discoloration. If in doubt about condition of bearing, replace it.
3. Rotate bearing slowly, and check for roughness or excessive internal looseness. If a rough spot is found, it may be dirt caked on a race. Try cleaning it again. If endplay is doubtful, compare it with a new bearing. If the bearings are not to be installed right away, wrap them in clean, oil proof paper.

Reassembly

Inspection and Repair (Continued)

Impeller Shaft

Examine shaft for signs of severe scratches, grooves or corrosion, especially under the oil seal or mechanical seals. If scratches are not severe, and are not under seals, they can be ignored. Check for cracks, pitting, twisted splines or damaged keyway.

Scratches in the area of the bellows of the mechanical seal can possibly be removed by spinning the shaft in a lathe and polishing with a fine emery cloth. The journal for the oil seal may be similarly cleaned, however, spiral type polishing may lead to oil leaks.

Installing Oil Seals

Before installing an oil seal in a housing, be sure that the seal, shaft and housing are clean.

Apply force to the outer edge of the seal and press in evenly.

Oil Seal Sleeve

Check for wear and scratches where the seal contacts the sleeve. The journal may be polished with a fine emery cloth, however; any polishing that leaves a spiral pattern may lead to an oil leak. If a groove has been worn in the sleeve, it can be reused by turning it end for end.

If questionable, replace the sleeve or fit with a thin replacement sleeve. This replacement sleeve allows use of the same size oil seal. This type of repair sleeve is available through most sources of oil seals.

Volute Body and Intake Adapter

Examine for cracks, severe corrosion or other damage. Almost all damage to these parts results from improper use or maintenance, or from freezing. Replace defective parts.

Clean out drainage hole in volute body, located between the seat for the throttle bushing and oil seal.

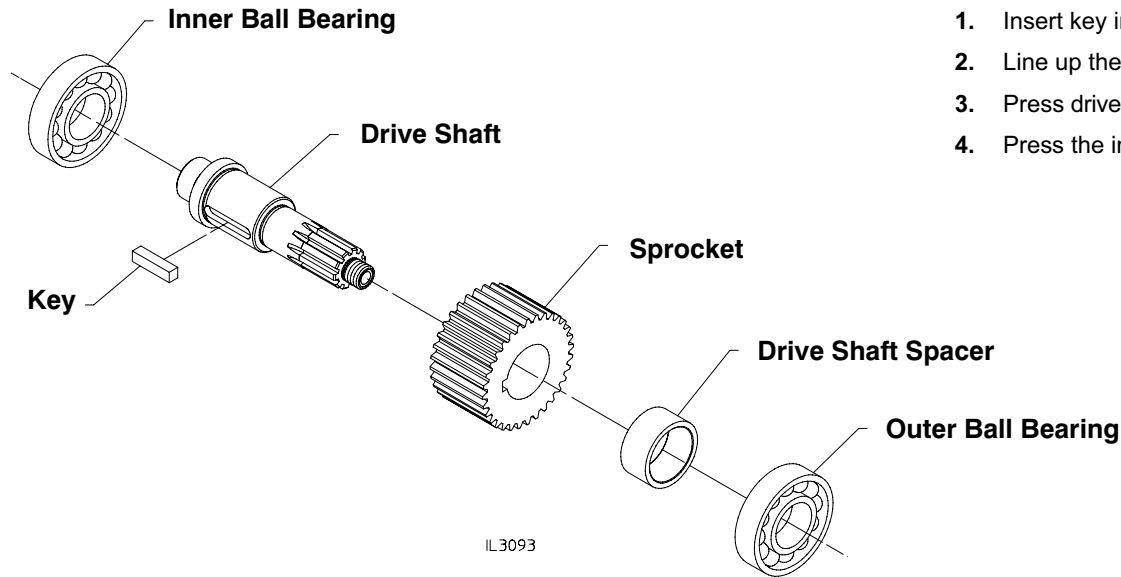
Throttle Bushing

Note: The bushing serves as a restriction to fluid leakage if the mechanical seal fails.

Examine the bore in the bushing for wear due to contact with the shaft. The size of the bore is 2.760/2.762.

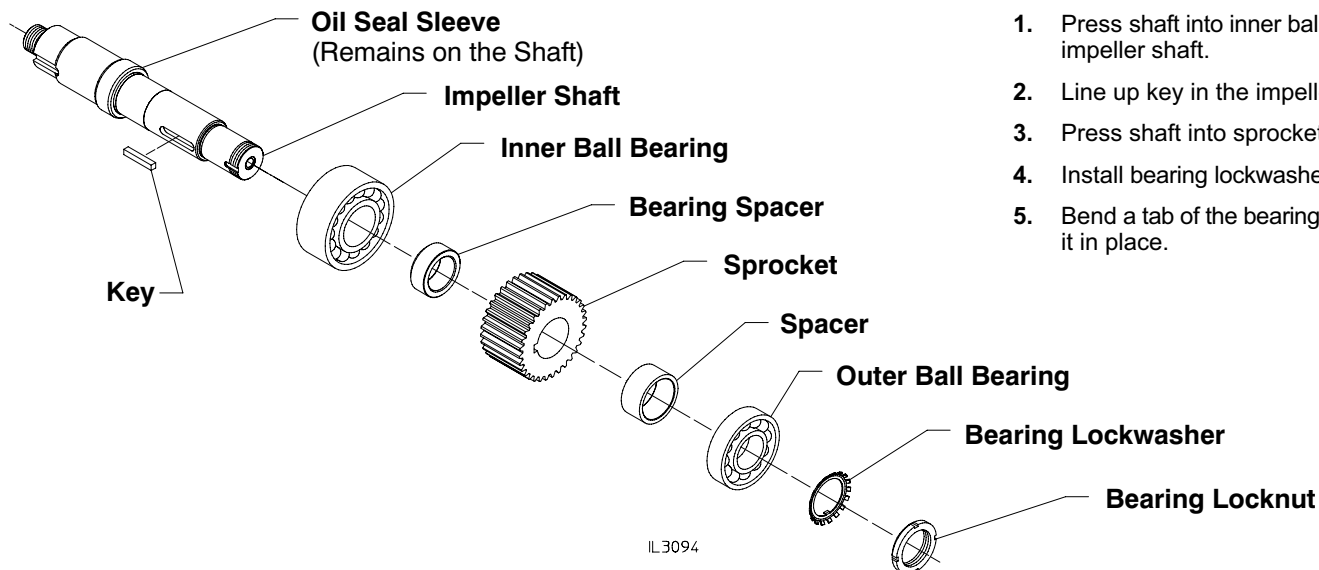
Reassembly

Reassembly Sprocket and Bearings - Drive Shaft



1. Insert key into keyway in the drive shaft.
2. Line up the keyway in the sprocket with the key in the drive shaft.
3. Press drive shaft into the sprocket, drive shaft spacer and outer ball bearing.
4. Press the inner ball bearing onto the drive shaft.

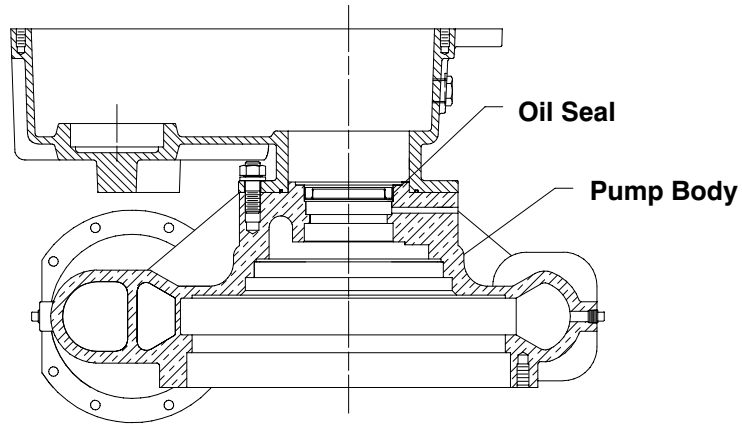
Reassembly Sprocket and Bearings - Impeller Shaft



1. Press shaft into inner ball bearing and spacer. Install key into the keyway in the impeller shaft.
2. Line up key in the impeller shaft with keyway in the sprocket.
3. Press shaft into sprocket, shaft spacer and outer ball bearing.
4. Install bearing lockwasher and bearing lock nut on shaft and secure. 1/4 TFFT.
5. Bend a tab of the bearing lockwasher into a slot in the bearing lock nut to secure it in place.

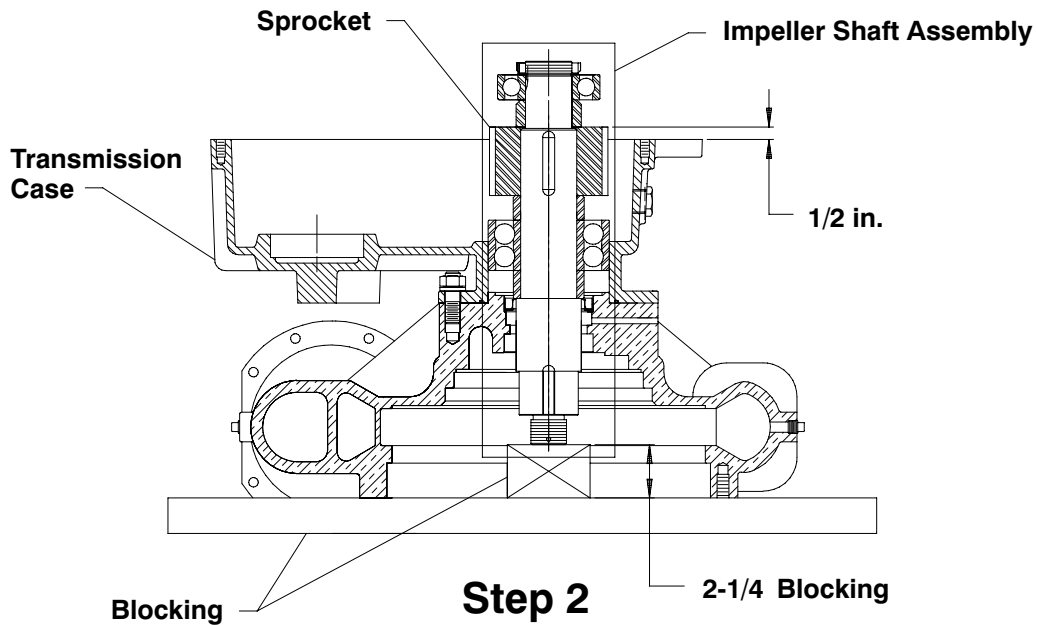
Reassembly

Installing Impeller Shaft Assembly

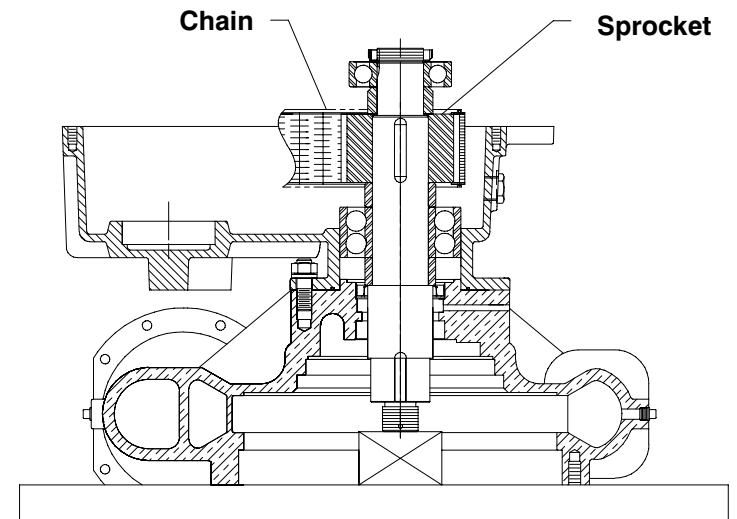


Step 1

1. Install oil seal in pump body. Make sure the lip of the seal is facing towards the transmission.
2. Add blocking as shown and lower impeller shaft assembly into the bore of the transmission until the top of the sprocket is approximately 1/2" higher than the top of the case (see side view - cutaway below). Note that care must be taken not to damage the oil seal in the pump body.
3. Place the chain around the impeller shaft sprocket as shown in the diagram below.



Step 2

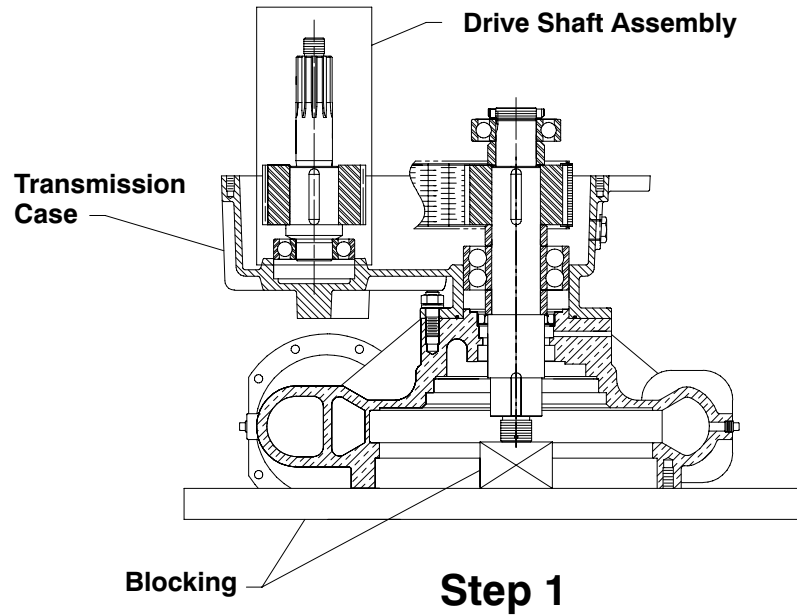


Step 3

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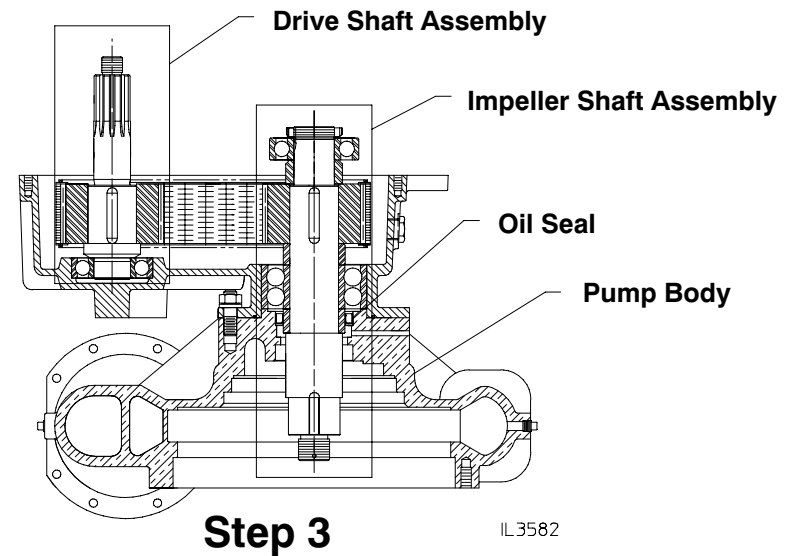
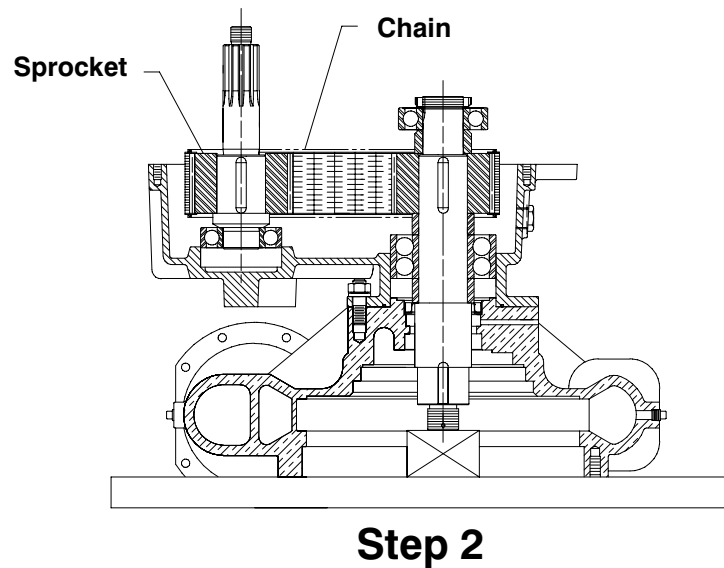
Reassembly

Installing Drive Shaft Assembly



1. Lower the drive shaft assembly into the transmission.
2. Wrap the chain around the sprocket.
3. Remove blocking and then lower both the drive shaft assembly and the impeller shaft assembly into their bores simultaneously (note that this may require two people to perform this task).

NOTE: Care must be taken not to damage the oil seal in the pump body.

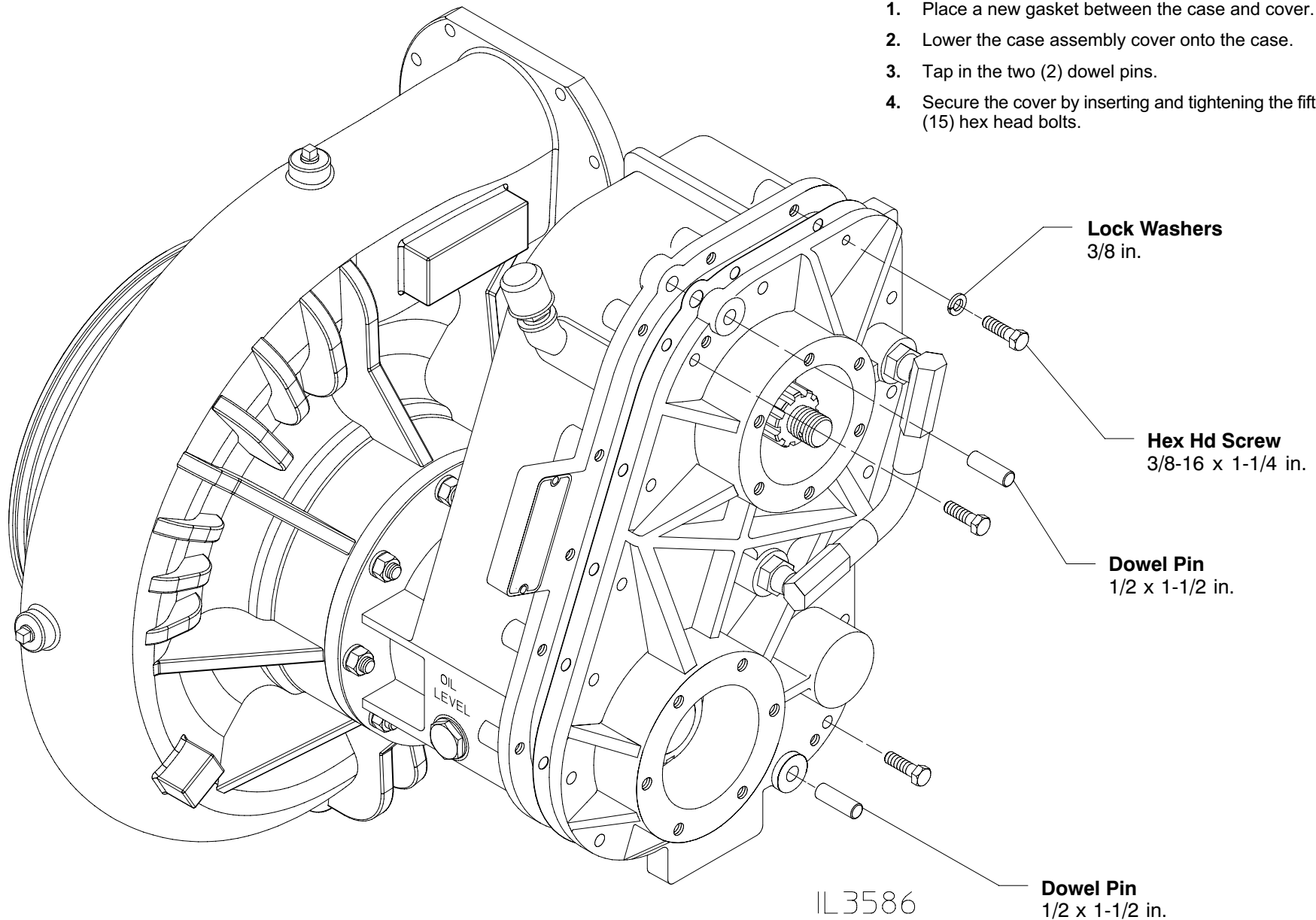


IL3582

Reassembly

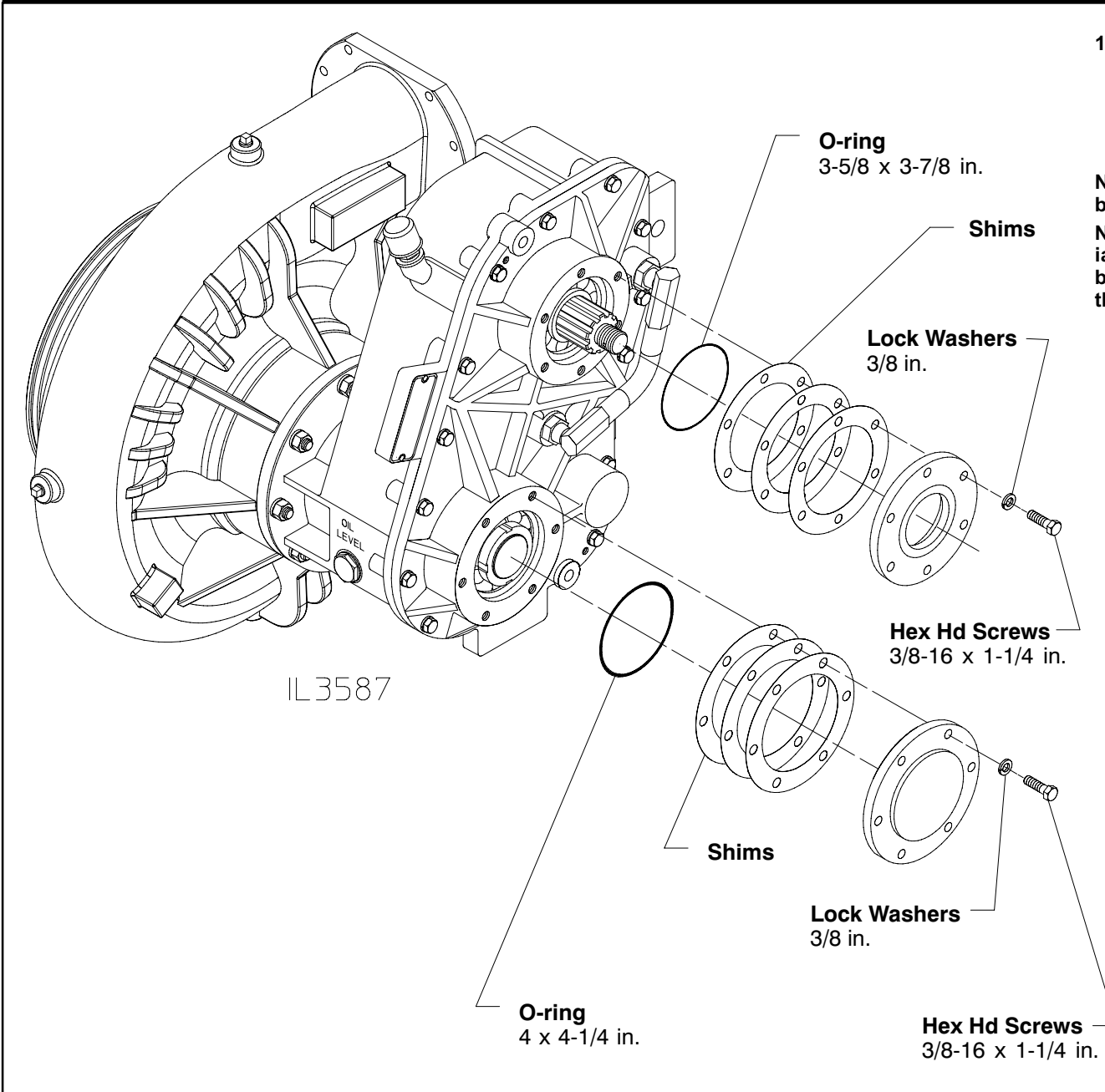
Install the Case Assembly Cover

1. Place a new gasket between the case and cover.
2. Lower the case assembly cover onto the case.
3. Tap in the two (2) dowel pins.
4. Secure the cover by inserting and tightening the fifteen (15) hex head bolts.



Reassembly

Installing Bearing Cover and Oil Seal Housing



1. Before installing oil seal in the seal housing, coat the seal outer diameter evenly with sealant (Loctite Ultra Blue RTV Silicon Sealant). Be sure that the seal, shaft and seal housing are clean. Always install a seal with the seal lip facing in. Apply force to the outer edge of the seal and press in evenly.

NOTE: The pump must be attached to the transmission before the impeller shaft can be shimmed.

NOTE: The shafts were factory shimmed to limit the axial float to 0.005 - 0.010. If any of the drive line parts have been changed, it may be necessary to change the total thickness of shims. Perform the following:

2. Hold the bearing cover or oil seal housing in position against the transmission case without an O-ring and measure the gap between the face of the cover/housing and transmission case with a feeler gage in several places. This gap thickness plus .005" is the minimum amount of shims to select.
3. Remove bearing cover or oil seal housing and install a new O-ring. Reinstall with shims between the face of the cover/housing and the transmission case. Install and tighten screws.
4. Check to assure that axial float exists either with an indicator or by feel. If in doubt, add an additional .005" shim. No harm will result from a small amount of additional axial float, but bearing life will be shortened if bearings are excessively pre-loaded.

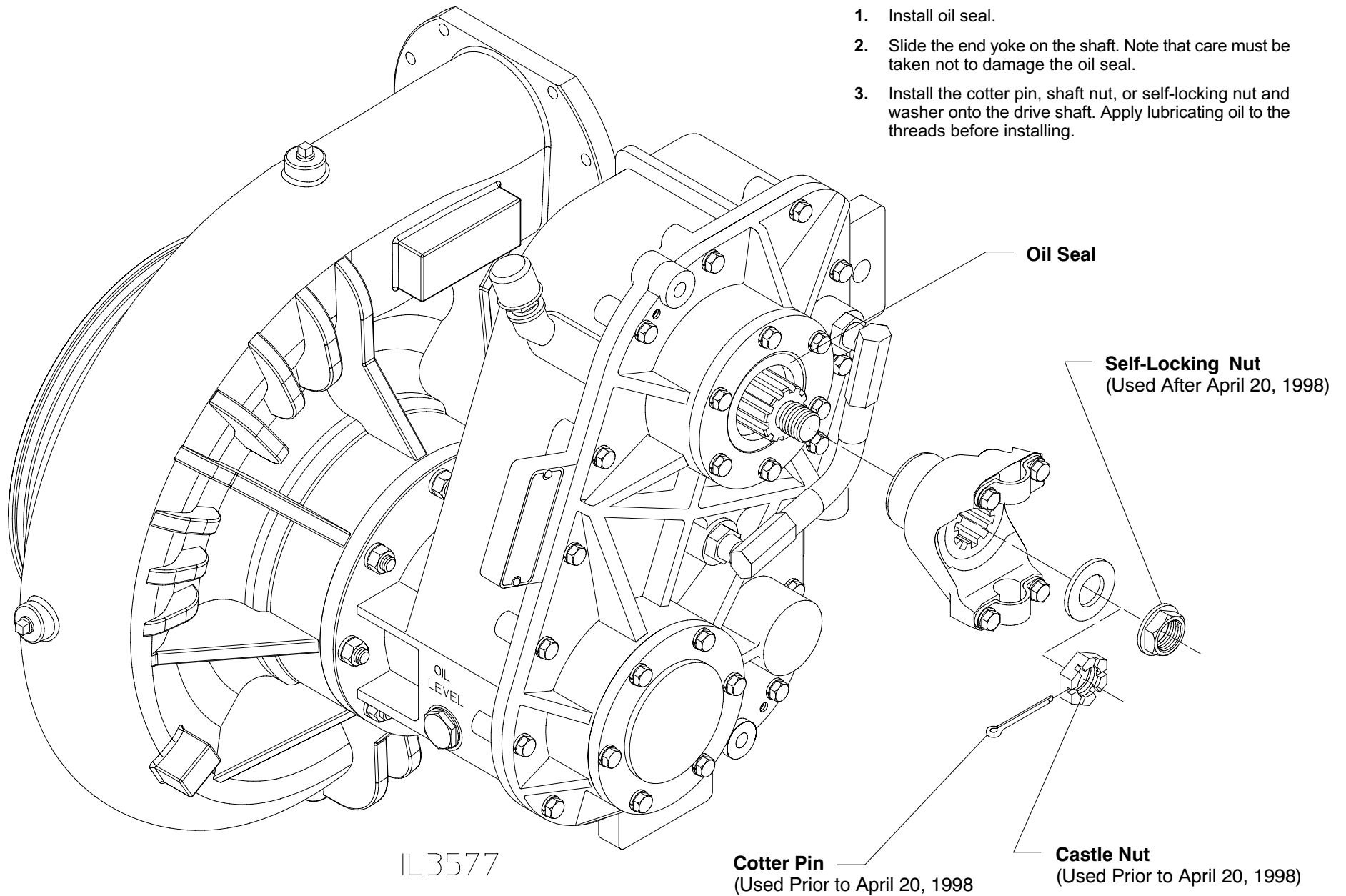
NOTE: The shims are color coded for thickness as follows:

Blue005"
Aluminum007"
Brown010"

Reassembly

Installing the End Yoke

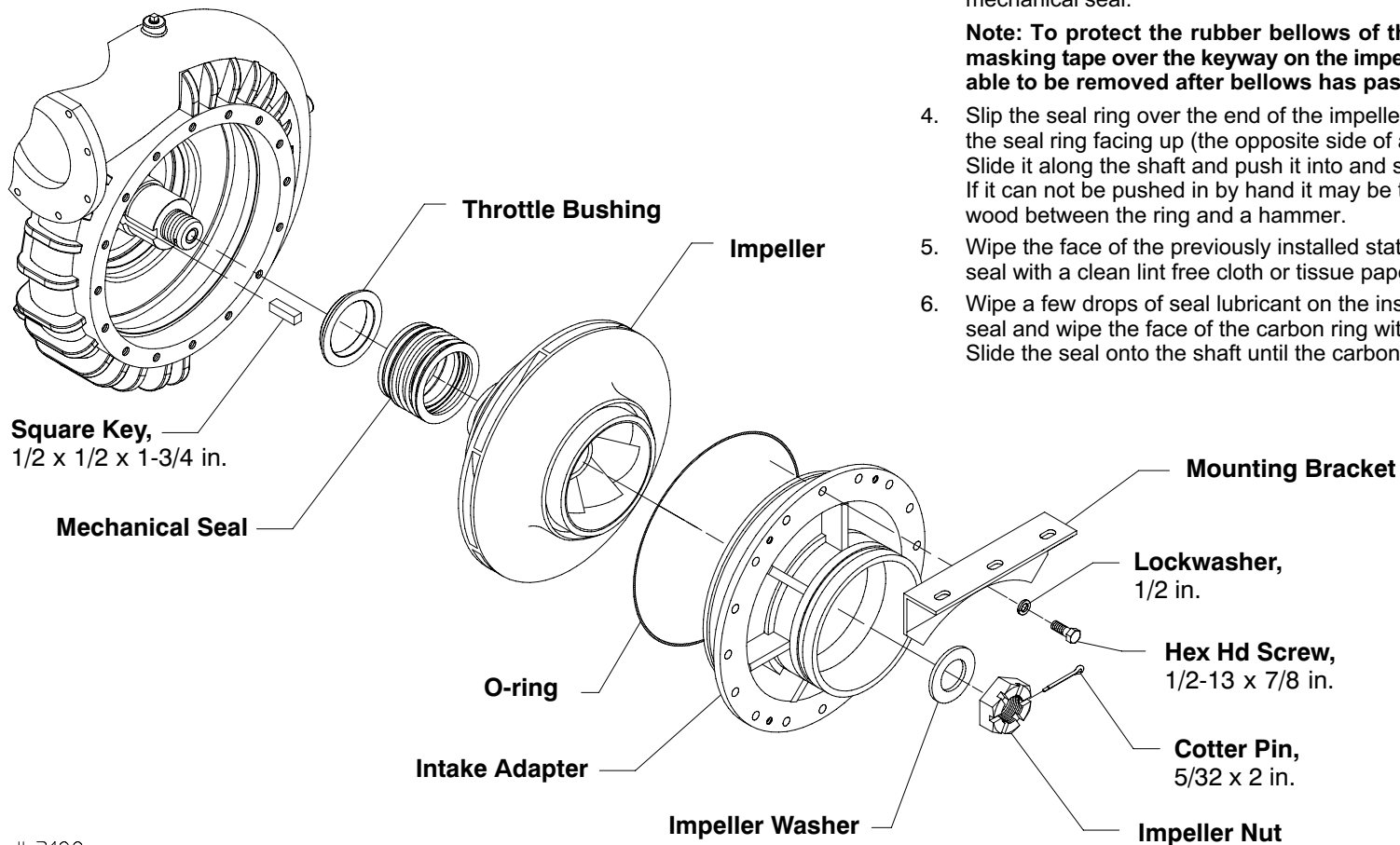
1. Install oil seal.
2. Slide the end yoke on the shaft. Note that care must be taken not to damage the oil seal.
3. Install the cotter pin, shaft nut, or self-locking nut and washer onto the drive shaft. Apply lubricating oil to the threads before installing.



Reassembly

Intake Adapter, Impeller & Mechanical Seal Installation

1. Temporarily install the impeller and rotate the impeller shaft. The impeller should rotate without contact with the wear ring in the volute body. Remove the impeller.
2. Slip the throttle bushing over the end of the impeller shaft and down onto the bore in the volute body. Tap into position until it seats against the shoulder in the body.



IL3100

NOTICE

The mechanical seal primary and stationary rings are made of brittle material. The material can be cracked or chipped. Extra care must be taken when handling these rings.

Note: If Waterous Mechanical Seal Lubricant part no. 52608 is not available, P80 rubber lubricant, straight dish soap or glycerin may be substituted.

3. Apply a light coating of seal lubricant to the O-ring in the stationary seal ring of the mechanical seal.
- Note: To protect the rubber bellows of the mechanical seal, place a piece of masking tape over the keyway on the impeller shaft, making sure that the tape is able to be removed after bellows has passed over the keyway.**
4. Slip the seal ring over the end of the impeller shaft, with the finish lapped face of the seal ring facing up (the opposite side of a new seal ring has a mark on it). Slide it along the shaft and push it into and seat it in the bore in the volute body. If it can not be pushed in by hand it may be tapped into place by use of a block of wood between the ring and a hammer.
 5. Wipe the face of the previously installed stationary seal ring of the mechanical seal with a clean lint free cloth or tissue paper.
 6. Wipe a few drops of seal lubricant on the inside of the bellows of the mechanical seal and wipe the face of the carbon ring with a lint free cloth or tissue paper. Slide the seal onto the shaft until the carbon ring contacts the stationary seal ring.

Reassembly

Intake Adapter, Impeller & Mechanical Seal Installation Continued

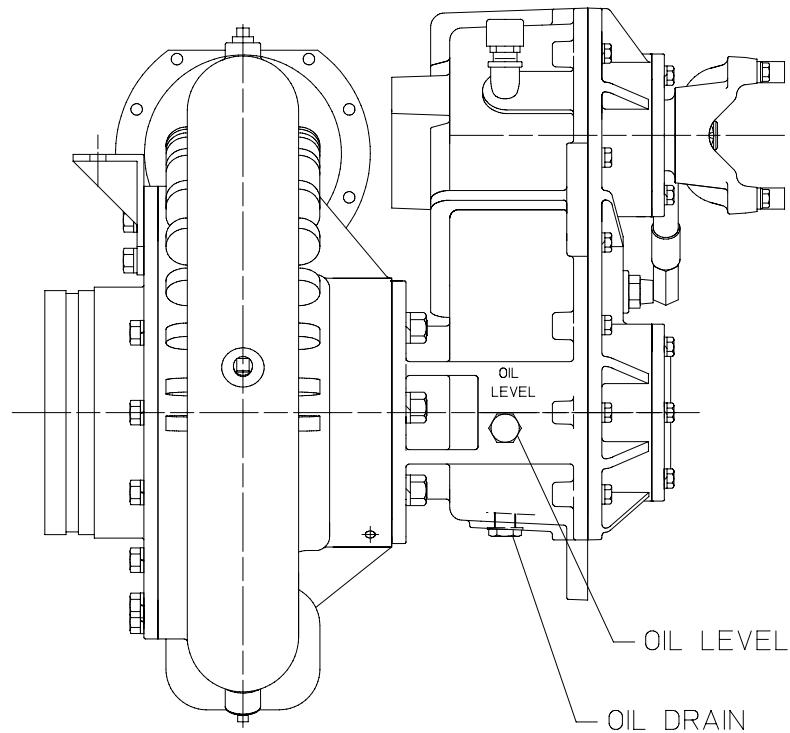
7. Install the spring over the seal assembly.
8. Install key in the impeller shaft and then install the impeller, washer and locknut and snug up the nut. Rotate the impeller to assure seating of the mechanical seal spring into the counterbore on the backside of the impeller. If the spring is not properly seated it will snap into place when the impeller is rotated.
9. Tighten locknut and line up slot in the nut with the hole in the shaft. Install and secure cotter pin.
10. Grease O-ring and install it in the groove in the intake adapter.
11. Position the intake adapter in its original position with the volute body. Line up holes and tap the adapter down into position. Position the mounting bracket in its original position with the intake adapter and the volute body. Install screws and lockwashers. Tighten until the surface of the adapter meets the surface of the volute body. Rotate the impeller shaft. Make sure the wear rings and the impeller are not rubbing against each other.
12. If the impeller turns freely, tighten screws evenly from side to side. Torque to 75 lb.ft.
13. If the impeller rubs against the wear rings, remove the adapter and determine the cause. The following can cause rubbing:
 - a) Raised burr or nick on either the hub of the impeller or on the wear ring.
 - b) Wear ring cocked when installed and is deformed sufficiently to rub on the impeller.
 - c) Impeller hub was not reworked to correct size for use with new undersize wear ring.
14. After correcting the problem of rubbing between the impeller and wear rings, reinstall the intake adapter.

Lubrication

Fill transmission to the bottom of the oil level plug hole with ATF. Capacity is approximately 1.50 quarts (1.42 liters).

NOTICE

Do not overfill.



IL3626

Final Assembly

1. Check all fasteners for tightness.
2. Install pump in vehicle.
3. Connect propeller or drive shafts to pump transmission.
4. Connect pump intake and discharge piping.
5. Connect cooling and drain lines, electrical wiring and similar equipment from pump and accessories.
6. Fill transmission with lubricant. See Lubrication.

Testing

Before a pump is returned to service, it is advisable to give it both hydrostatic and operational tests to check it for leaks and to make sure the pump operates properly.

Hydrostatic Testing

1. Connect pump to a hydrant or other pressurized water supply.
2. Close all drain lines and open discharge and priming valves.
3. Open hydrant until water runs out through discharge valves and discharge pipe in priming pump. Close all valves. Be sure to evacuate all air from pump.
4. Apply water pressure to pump for 15 minutes. Do not exceed 350 psi (24.2). With a portable light, check pump for leaks. If leaks are discovered, tighten connections or attaching parts as necessary.

Note: If a mechanical seal is used, it may leak under hydrostatic pressure. However, it should stop leaking after the seal faces are run-in during operation testing.

5. After all leaks are eliminated, shut hydrant valve, drain pump completely and disconnect intake hose.

Operational Testing

1. Operate pump at its maximum intended service pressure. Do not exceed 350 psi (24.2 bar) (450 psi, 31 bar with positive intake).
2. With a portable light, check pump for leaks. If leaks are discovered, stop pump and tighten connections or attaching parts as necessary. Repeat until all leaks are eliminated.
3. While pump is running, check for unusual noises, oil leaks, overheated bearings, etc. If anything unusual is discovered, stop pump immediately and determine the cause.