

CL Series Fire Pumps (One-Piece Head / Volute Design)

Overhaul Instructions

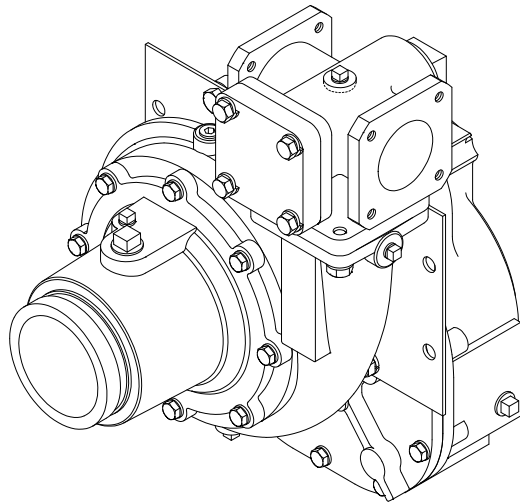
Form No.	Section	Issue Date	Rev. Date
F-1031	4216	04/24/98	06/26/08

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Fire Pumps – Since 1886



Introduction

This instruction contains the information needed to overhaul and repair Waterous CL series centrifugal fire pumps. Since several types of transmissions are available for these pumps, they are covered in different in-

structions. Operation and Maintenance instructions for CL pumps are covered in F-1031, Section 2104.1.

General Overhaul Information

Tools and Equipment

The following tools and equipment may be 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 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.

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 Body Gaskets

To provide added sealing for gaskets between bodies and intake adapters, coat both sides of these gaskets with a suitable sealant. Be sure all traces of previous gaskets and sealant are removed before installing new gaskets.

Disassembly

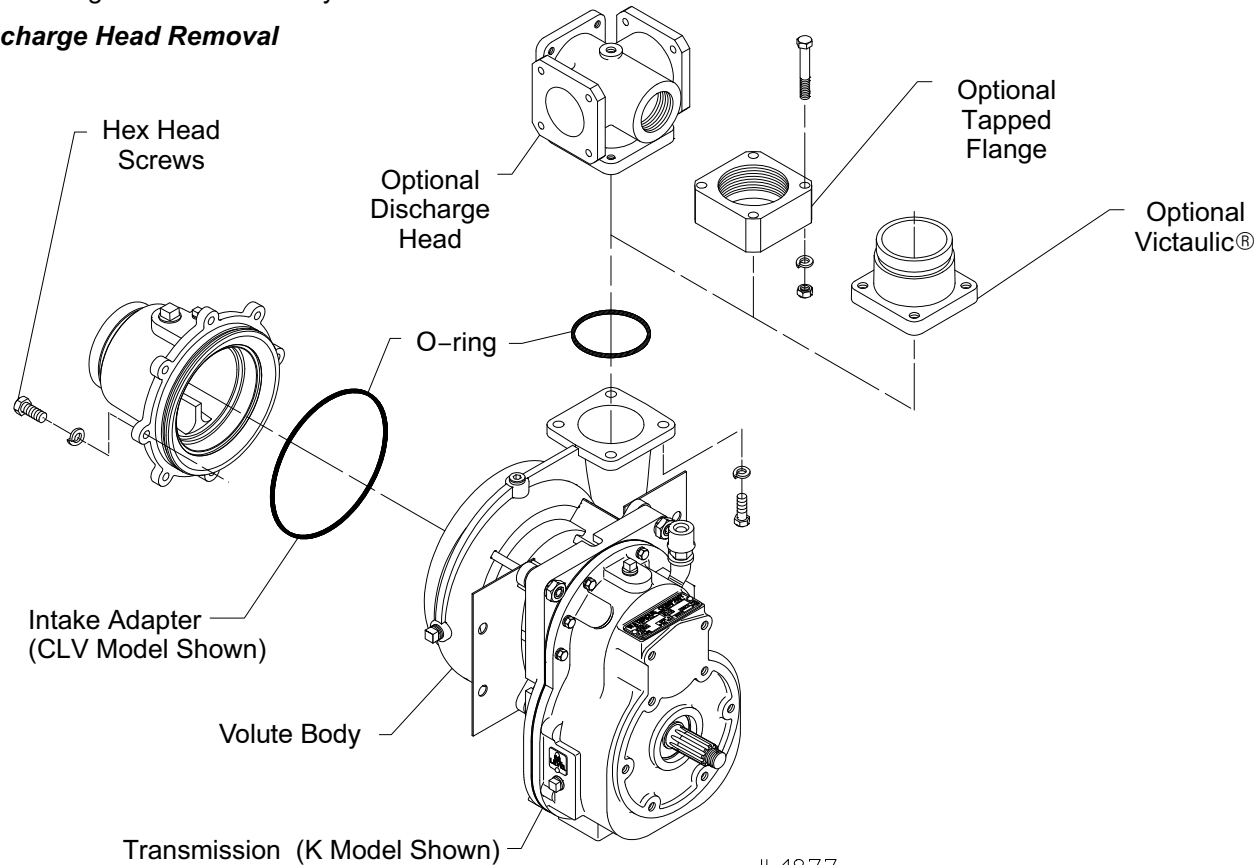
Before beginning the disassembly of the CL pump, perform the following:

1. Disconnect all cooling and drain lines, electrical wiring and similar connections to the pump and transmission.
2. Drain lubricant from transmission.
3. Disconnect the propeller or drive shaft(s) from the transmission.

Removing the Intake Adapter and Discharge Head

1. Remove the hex head screws and lock washers attaching the intake adapter to the volute body.
2. Remove the hex head screws and lock washers attaching the discharge head, Victaulic® or tapped flange to the volute body.
3. Separate the intake adapter from the body.
4. Discard the O-rings.

Figure 1. Intake Adapter and Discharge Head Removal



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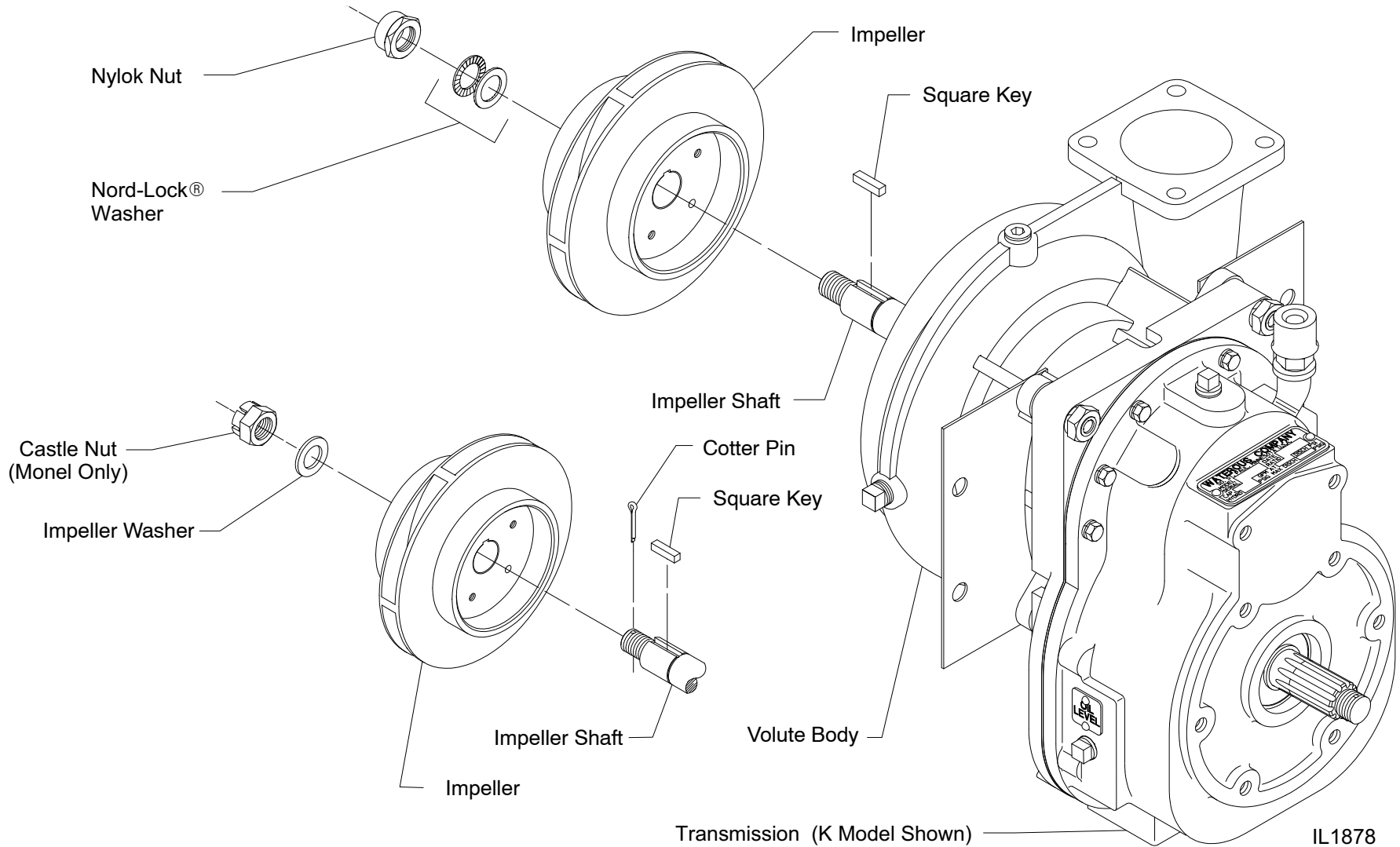
Removing the Impeller

1. Remove the Nylok nut and impeller washer or Nord-Lock® washer from the impeller shaft.

NOTE: Units equipped with a Monel impeller shaft use a cotter pin and castle nut instead of the Nylok nut.

Figure 2. Impeller Removal

2. Remove the impeller using a puller. NOTE that 5/16-18 UNC threaded puller holes are provided in the impeller. Remove the square key from the keyway.



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Removing the Mechanical Seal

1. Remove the retaining ring from the impeller shaft.
2. **(Pumps built prior to 2/4/05 only)** Remove spring sleeve and spring from the mechanical seal.
3. 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, follow the instructions on the next page to remove the volute body from the transfer case. Removal of the volute body will force the mechanical seal off the impeller shaft. The stationary ring will remain in the volute body and must be removed later.

Figure 3. Mechanical Seal Removal

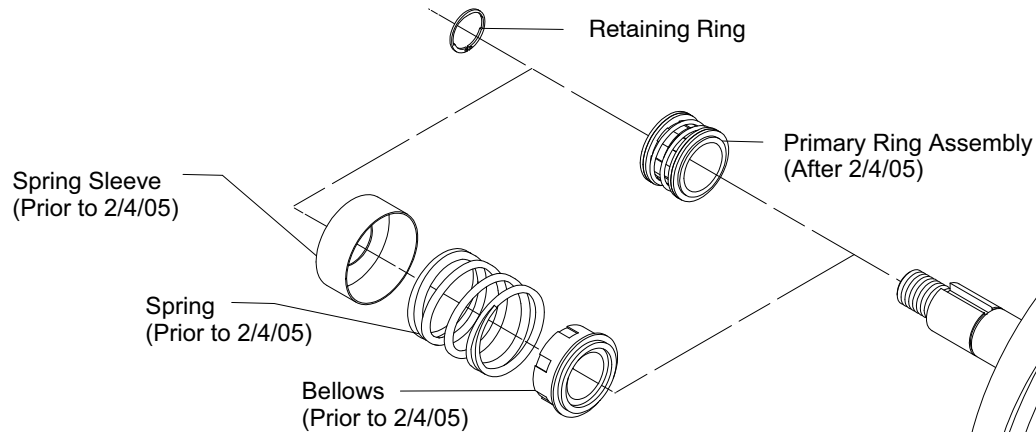
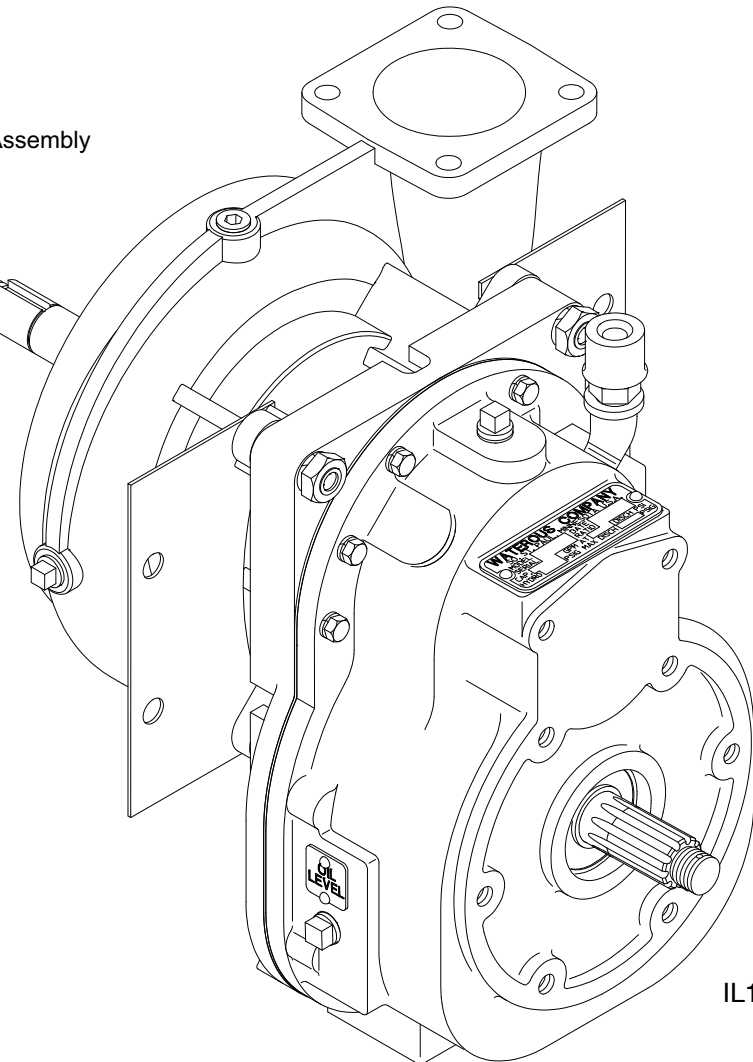
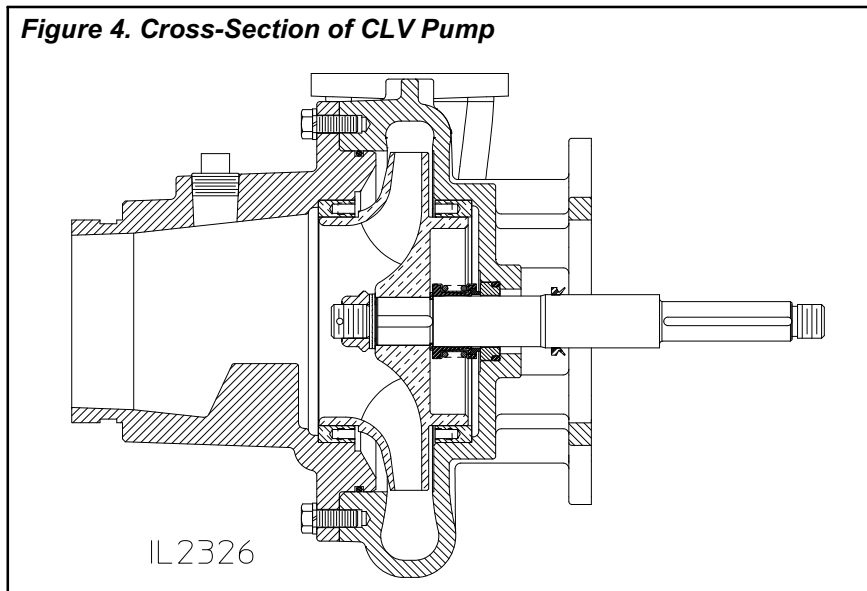


Figure 4. Cross-Section of CLV Pump



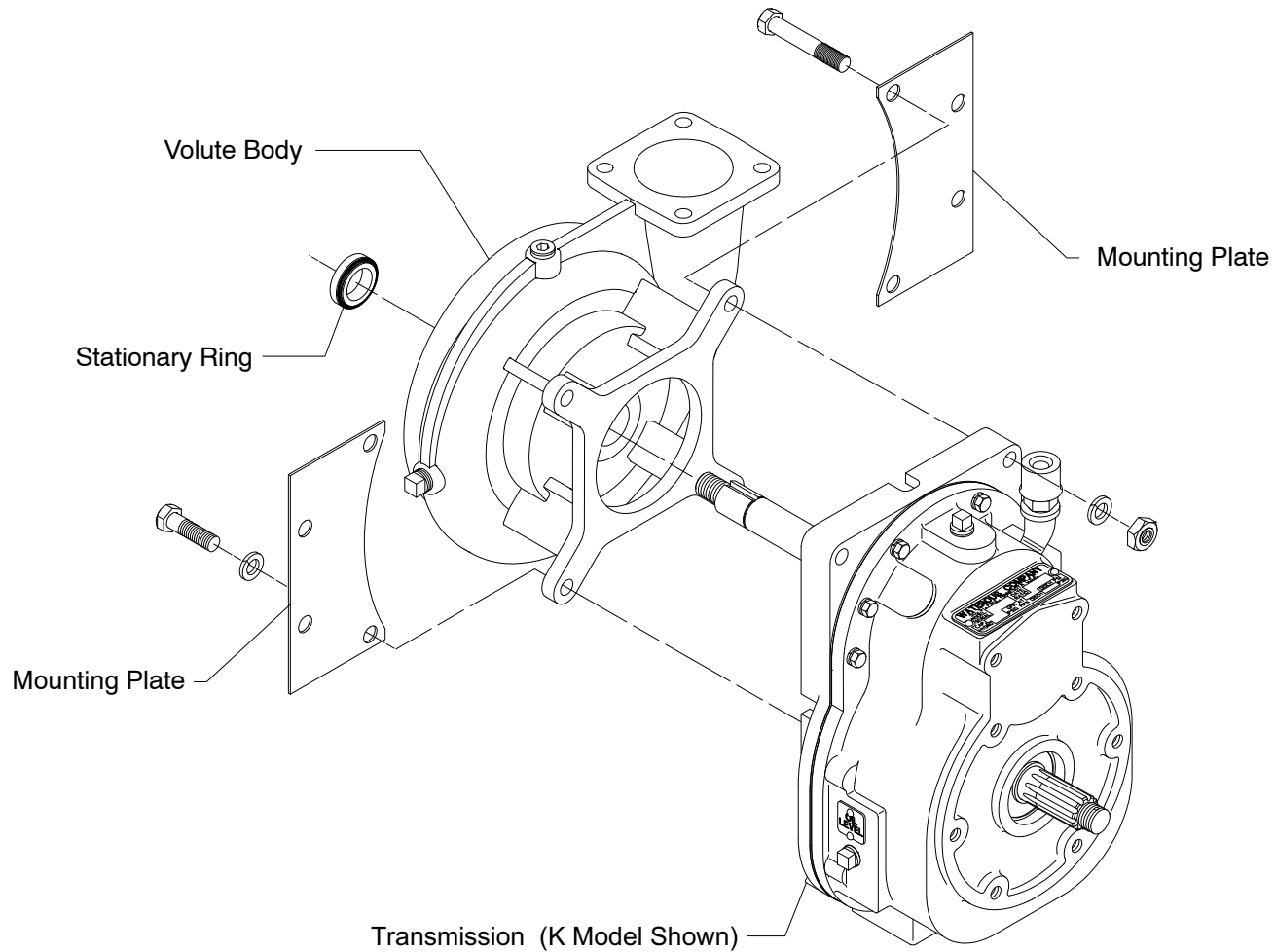
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Removing the Volute Body

1. Remove the hex head screws that attach the volute body and mounting plates to the transmission.
2. Slide the volute body off the impeller shaft.
3. Remove the mechanical seal stationary ring from the body by lightly tapping on it from the transmission side.

NOTE: Removal of the impeller shaft from the transmission is not necessary unless the shaft is damaged. If impeller shaft removal is necessary, see the transmission overhaul instructions.

Figure 5. Removing the Volute Body



Inspection and Repair

Impeller

Check wear rings and impeller hubs for deep grooves or scratches. Spiral grooves or grooves parallel to the impeller shaft increase leakage. Inspect for excessive wear ring clearance. Carefully measure the outside diameter of the impeller hubs and the inside diameter of the wear rings installed in the volute body and intake adapter. Diametric clearances in excess of .027 inches may warrant wear ring replacement. Original factory clearance is .019 to .023 diametrically.

If inspection shows that the wear ring clearances are excessive or the impeller hubs are scored or grooved, turn the impeller hubs on a lathe to an acceptable dimension. Table 1 shows the original hub dimensions for each impeller and the rework dimensions for each degree of undersize.

Keep the hub diameters within 0.015 in. TIR of the impeller shaft bore. If the impeller hubs do not clean up at first undersize dimension, turn the hub down to the next degree of undersize. Replace the impeller if the hubs do not clean up at the last undersize dimension.

Table 1. Impeller and Wear Ring Repair Dimensions

Impeller No.	Original Hub Dia.	Original Wear Ring No.	Reworked Hub Dia.	New Wear Ring No.
70980 (clockwise) 70981 (counterclockwise)	4.623/4.621	5753	4.598/4.596 4.573/4.571 4.548/4.546	50832-25 50832-50 50832-75

Impeller Shaft

Examine shaft for signs of severe scratches, grooves or corrosion, especially under the mechanical seal. If scratches are not severe, and are not under the seal, 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.

Installing Undersize Wear Rings

Replacement wear rings are available as follows:

- 0.025 in. undersize
- 0.050 in. undersize
- 0.075 in. undersize

NOTE: Wear rings may be removed by criss-crossing two pry bars under opposite sides of the wear ring. Pry up the wear ring by applying equal pressure to both pry bars. Wear ring 5753 is equipped with two 1/4-20 UNC tapped holes to allow attachment of a suitable puller.

Before pressing new wear rings in place, remove all corrosion from body and adapter counterbores and apply a generous amount of Lubriplate or similar lubricant to the outer ring surfaces. With a suitable arbor, carefully press the rings into the counterbores. Make sure the rings are seated firmly against the counterbore shoulders.

Volute Body and Intake Adapter

Examine these 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.

Reassembly

Reassembly of the CL pump is essentially the same as the disassembly procedure, except it is reversed. Note that if undersize wear rings are re-

quired, they should be installed during reassembly. Also, if a new impeller is needed, install new standard size wear rings for the impeller.

Reassembling the Volute Body

1. Apply a light coating of seal lubricant to the O-ring on the stationary 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.

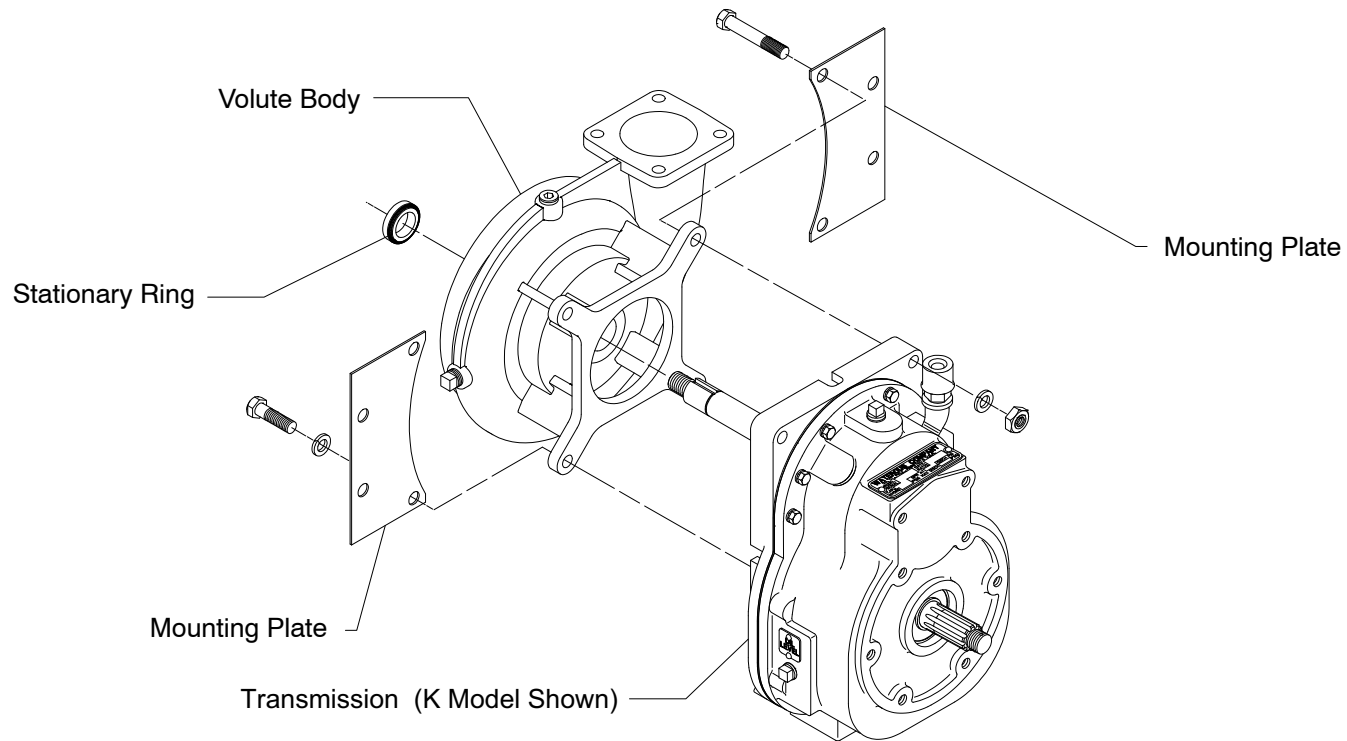
2. Slip the ring over the end of the impeller shaft, with the finish lapped face of the ring facing up (the opposite side of a new ring has a mark on it). Slide it along the shaft and push it into and seat it in the bore in

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.

NOTE: Care should be taken not to damage stationary ring finished (lapped) surface.

3. Slide the volute body onto the impeller shaft.
4. Attach the volute body and mounting plates to the transmission using hex head screws.

Figure 6. Reassembling the Volute Body



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Installing the Mechanical Seal

CAUTION

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.

1. Wipe the face of the previously installed stationary ring of the mechanical seal with a clean lint-free cloth and denatured alcohol.

Figure 7. Mechanical Seal Installation

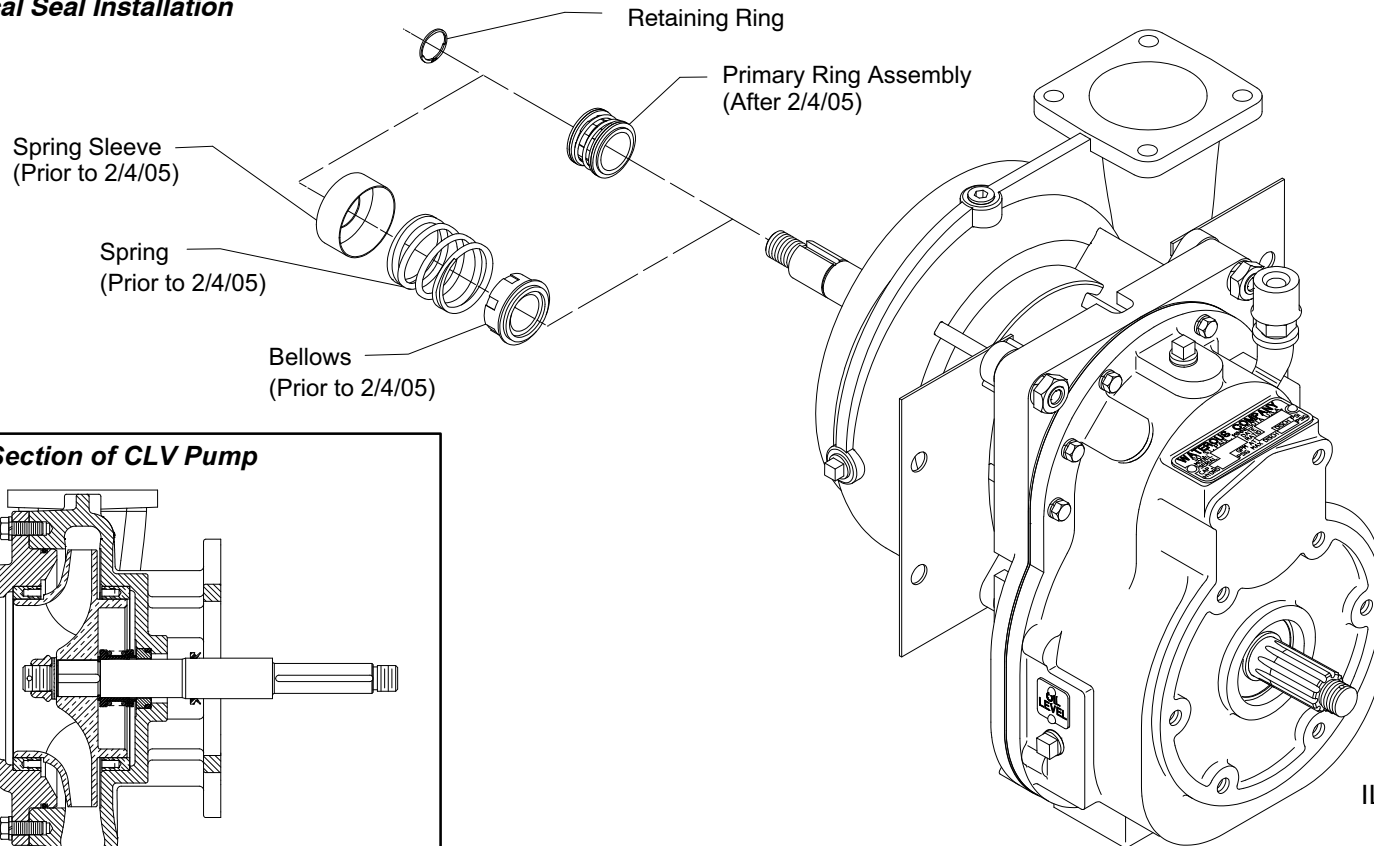
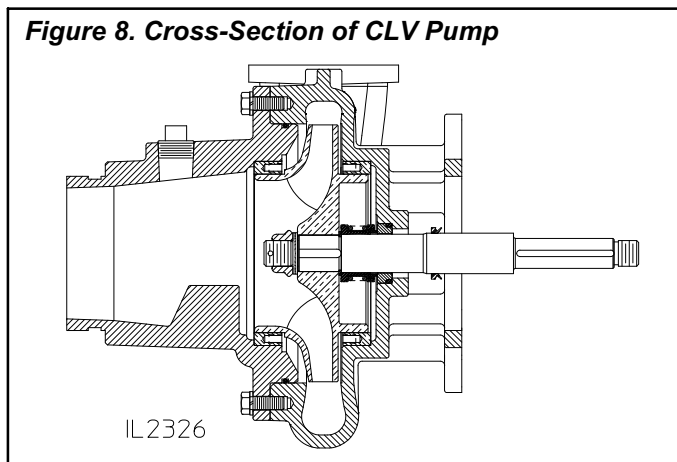


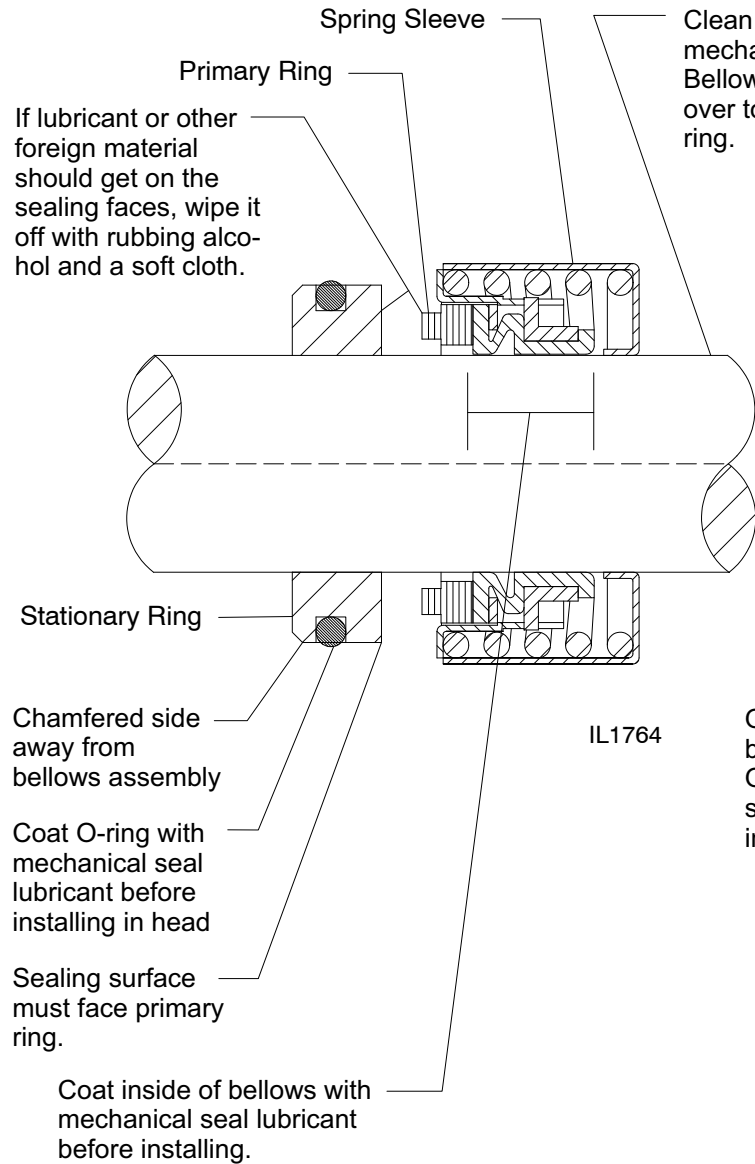
Figure 8. Cross-Section of CLV Pump



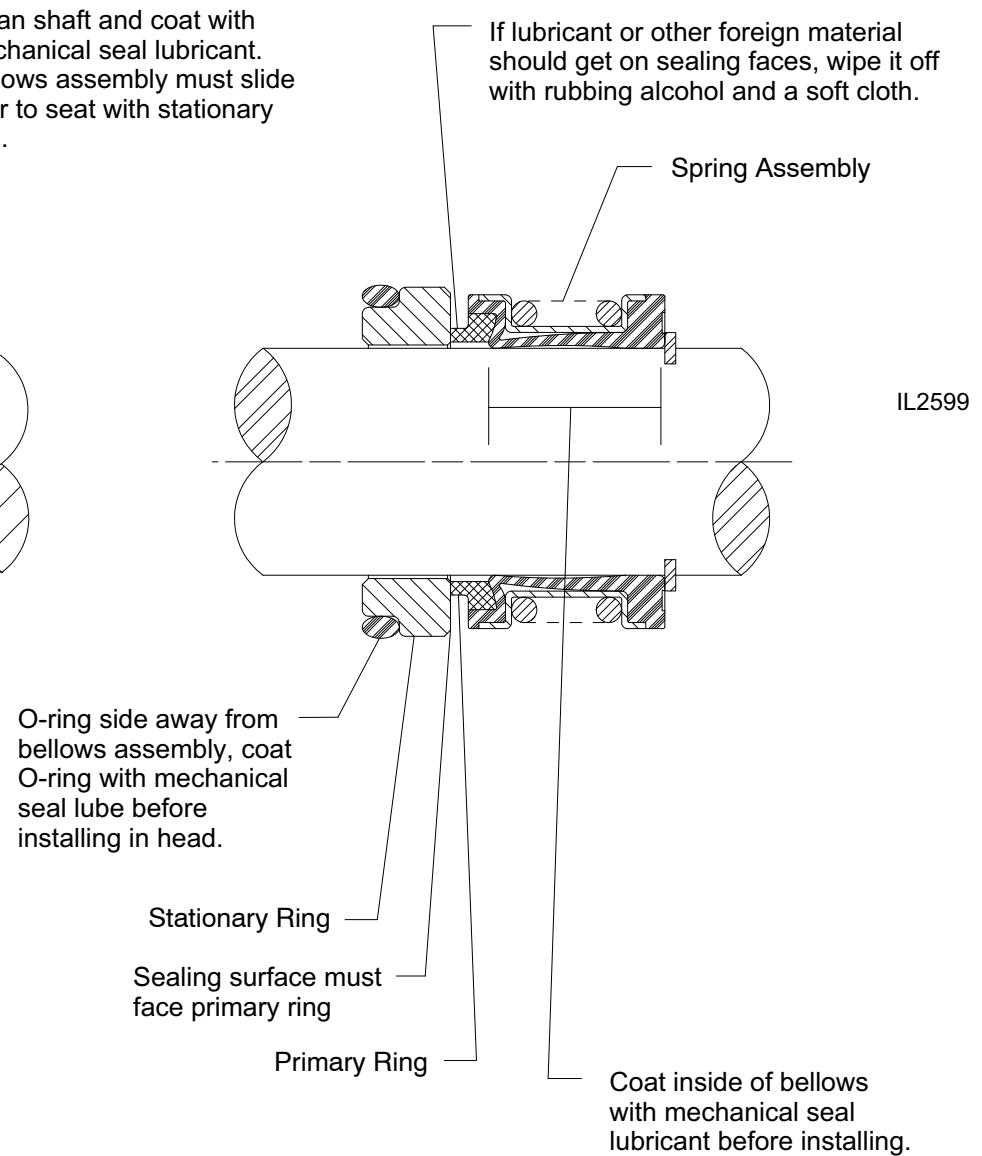
2. Wipe a few drops of seal lubricant on the inside of the bellows of the mechanical seal and wipe the face of the carbon ring with a lint-free cloth and denatured alcohol. Coat impeller shaft with mechanical seal lubricant (see Figure 9) and slide the seal onto the shaft until the carbon ring contacts the stationary ring.
3. **(Pumps built prior to 2/4/05 only)** Slide the spring and spring sleeve over the end of the impeller shaft so the small end of the spring fits over the shell of the bellows assembly.
4. Install the retaining ring.

Figure 9. Mechanical Seal Lubrication Application

(Pumps Built Prior to 2/4/05)



(Pumps Built After 2/4/05)



Installing the Impeller

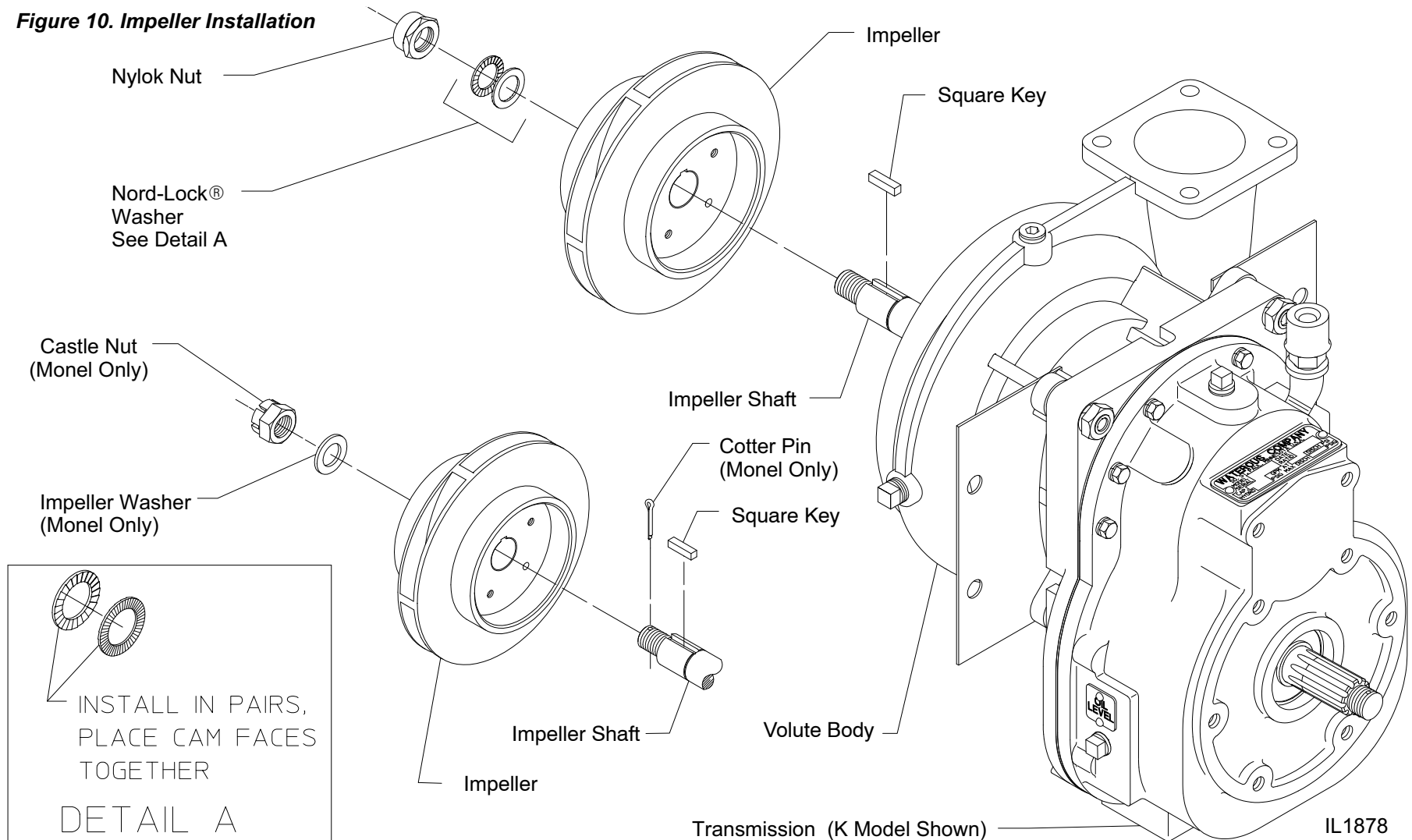
1. Slide the impeller onto the impeller shaft.

NOTE: Units equipped with a Monel impeller shaft use a cotter pin and castle nut instead of the Nylok nut.

2. Secure the impeller with a Nord-Lock® washer and Nylok nut or an impeller washer, castle nut and cotter pin (Monel only).

NOTE: Apply Loctite® 242 to shaft and nut threads. Tighten impeller nut until seated against impeller. Do not torque over 75 ft.-lbs (102 N.m).

Figure 10. Impeller Installation



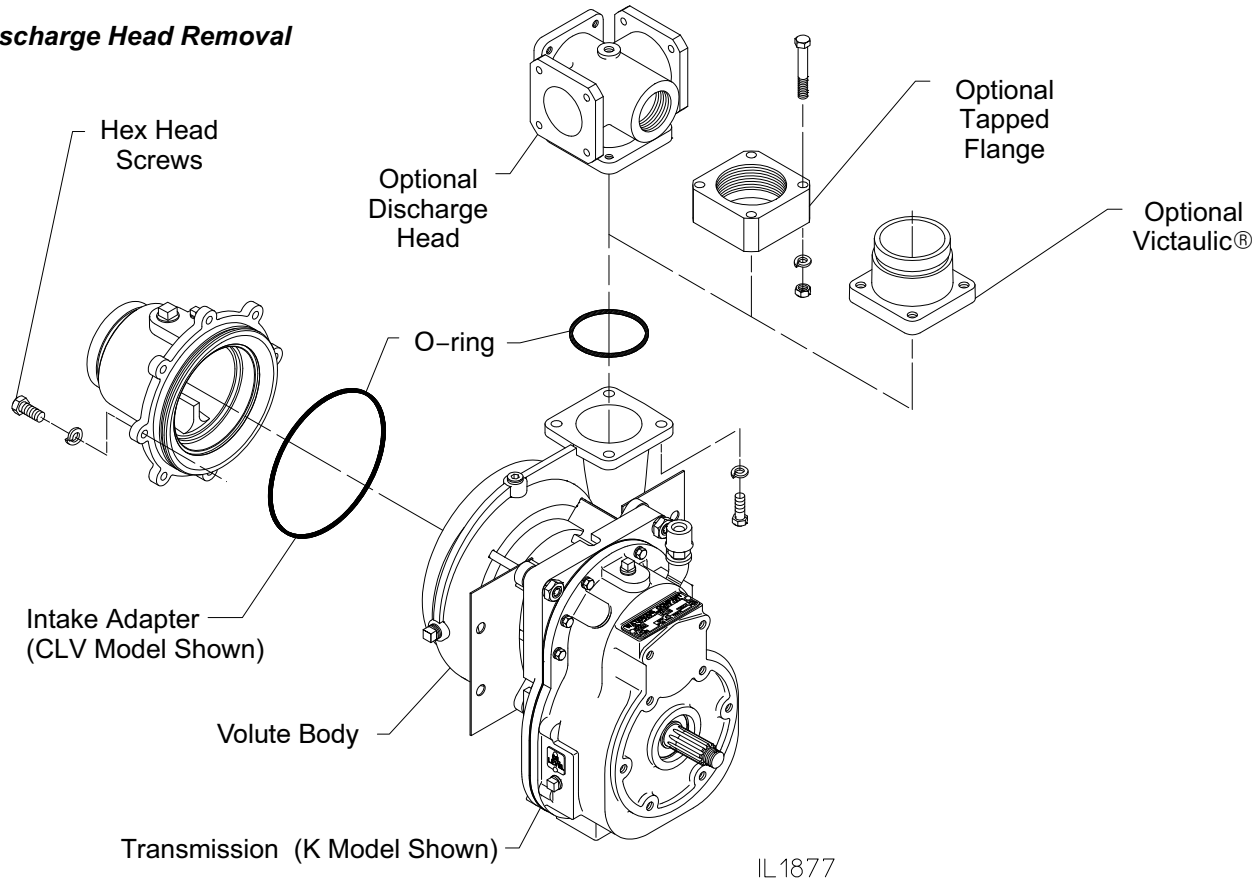
INSTALL IN PAIRS,
PLACE CAM FACES
TOGETHER

DETAIL A

Installing the Intake Adapter and Discharge Head

1. Install new O-rings.
2. Secure the intake adapter to the volute body with hex head screws and lock washers.
3. Secure discharge head, Victaulic® or tapped flange with hex head screws and lock washers.

Figure 11. Intake Adapter and Discharge Head Removal



Final Assembly

To complete final assembly, perform the following:

1. Connect the propeller or drive shaft(s) to the transmission.
2. Connect the cooling and drain lines, electrical wiring and similar equipment to the pump and accessories.
3. Fill the pump transmission with lubricant as directed in the transmission operation and maintenance instructions.

Testing

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

Hydrostatic Testing

1. Connect the pump to a hydrant or other pressurized water supply.
2. Close all drain lines and open the discharge and priming valves.
3. Open hydrant until the water runs out through the discharge valves and discharge pipe in priming pump (if used).
4. Close all valves. Be sure to evacuate all air from the pump.
5. Check for leaks with a portable light. If leaks are discovered, tighten connections or attaching parts as necessary. Repeat until all leaks are eliminated.

NOTE: The mechanical seal may leak under hydrostatic pressure; however, it should stop leaking after the seal faces are run in during operational testing.

6. Shut hydrant valve after all leaks are eliminated.
7. Drain pump completely and disconnect intake hose.

Operational Testing

1. Operate the pump at its maximum intended service pressure.
2. Check for leaks with a portable light. If leaks are discovered, stop the pump and tighten connections or tighten attaching parts as necessary. Repeat until all leaks are eliminated.
3. Check for unusual noises, oil leaks, overheated bearings, etc. while the pump is running. If anything unusual is discovered, stop the pump immediately and determine the cause of the problem.
4. Perform service test (refer to NFPA 1911).

