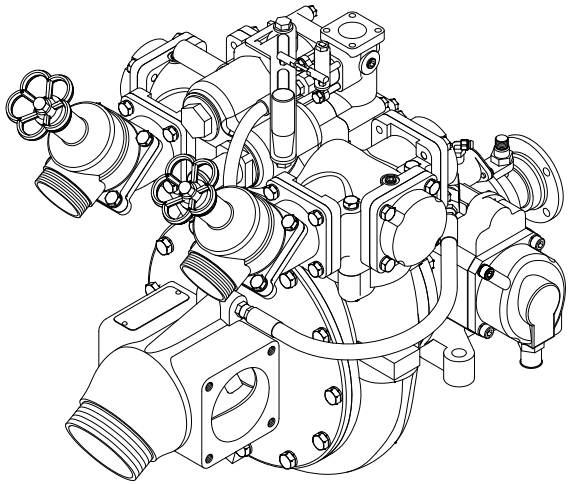
HL Series Centrifugal Fire Pumps
Overhaul Instructions



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Read through the safety information and overhaul instructions carefully before repairing your Waterous HL Series Fire Pump.

NOTE: Instructions subject to change without notice

Table of Contents

Waterous Company, 125 Hardman Avenue South, South St. Paul, Minnesota 55075 USA (651) 450-5000

www.waterousco.com

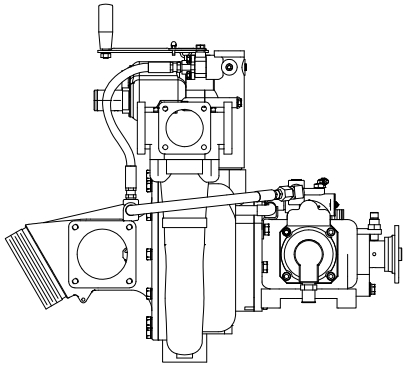
Introduction

This instruction provides the necessary steps to overhaul HL Series Fire Pumps. Note that the instructions are divided into Disassembly and Reassembly sections, see Pages 7 and 8 for indexes.

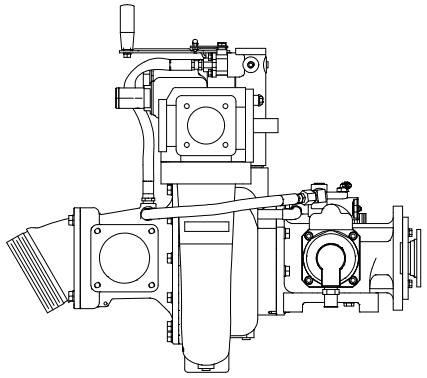
HL200K, HL300K and HL400K Gear Drive Models Only:

This instruction covers the removal of the K Series Transmission from the pump only. For transmission overhaul instructions, see separate instructions F-1031, Section 4309. Follow the instructions for Heavy Duty K Transmissions.

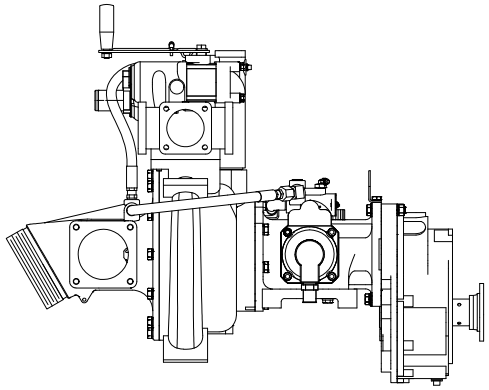
Available Pump Models



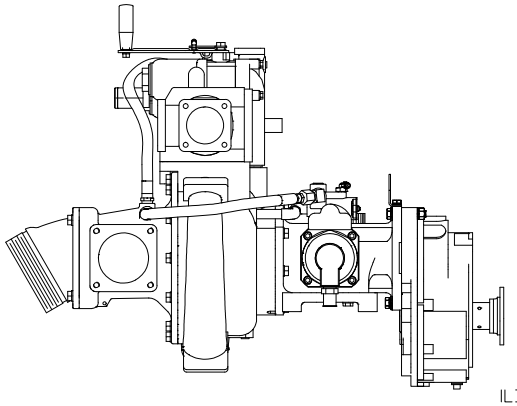
HL200D/300D



HL400D



HL200K/300K



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HL400K

Safety Information

Read through the safety information carefully prior to working on your Waterous Fire Pump.

⚠ WARNING

Death or serious personal injury might occur if proper operating procedures are not followed. The pump operator, as well as individuals connecting supply or discharge hoses to the apparatus must be familiar with these pump operating instructions as well as other operating instructions and manuals for the apparatus, water hydraulics and component limitation.

⚠ WARNING

Pressure Hazard. May result in personal injury.

Prior to connection or removal of hoses, caps or other closures with pump intake or pump discharge connections, relieve pressure by opening drains or bleeder valves. Bleeder valves should also be used while filling a hose connected to an intake with water.

⚠ WARNING

Scalding Water Hazard. May result in serious burns.

When operating the pump, be sure to open at least one discharge valve slightly to prevent the pump from overheating. If the pump runs for a few minutes completely closed, it may heat the water enough to scald someone when the valve is opened. Overheating can damage the packing, seals and other pump parts. If the apparatus builder has installed a by pass system or other provision designed to prevent overheating, opening a discharge valve may be unnecessary.

⚠ WARNING

Rotating Parts Hazard or Unexpected Truck Movement. May result in serious personal injury or death.

Stop the engine, set the parking brake and chock the wheels prior to working on the pump.

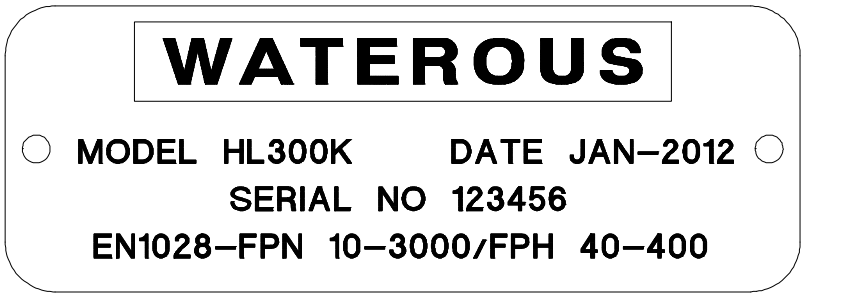
Ordering Repair Parts

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

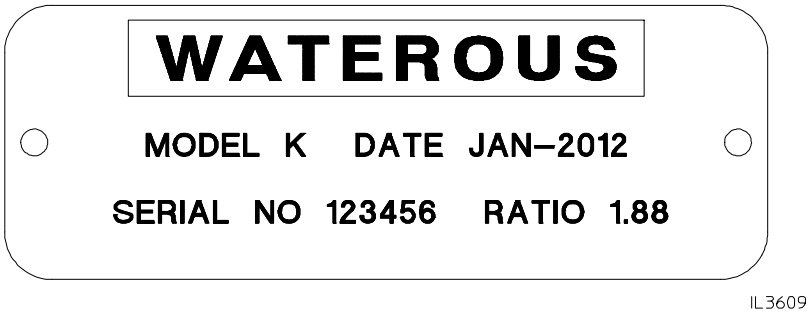
Refer to the Service Parts Lists furnished with your pump for identification of individual components.

Component	Pump Model					
	HL200 Series		HL300 Series		HL400 Series	
	HL200D	HL200K	HL300D	HL300K	HL400D	HL400K
Pump	SPL83161	SPL83161	SPL83161	SPL83161	SPL83155	SPL83155
Auxiliary Intake and Discharge Fittings	SPL83156	SPL83156	SPL83156	SPL83156	SPL83156	SPL83156
Optional RTP Foam System	SPL83157	SPL83157	SPL83157	SPL83157	SPL83157	SPL83157
Optional Control Panel	SPL83158	SPL83158	SPL83158	SPL83158	SPL83158	SPL83158
K Series Transmission	-	SPL83160	-	SPL83160	-	SPL83160

Refer to the diagrams below for Pump Model and Serial Number locations:



Serial Plate Located on Pump Intake Fitting (All Models)



Serial Plate Located on Pump Transmission (Models HL200K, HL300K and HL400K only)

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

Component	Repair Kit	Includes:
Piston primer	K 974	All internal components to overhaul one primer
Mechanical Seal	K 1036	All components for replacing mechanical seal
O-rings	K 1040	O-rings usually replaced during overhaul
Shims	52880	High Pressure Impeller Shims
PIV	K 1260	All internal components to overhaul one PIV

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. A suitable hoist and slings.
4. Torque capability up to 325 lb-ft (440 N•m)

While no special tools and equipment are required, a few special items are illustrated or described so the mechanic can make them. 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 and 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 O-ring seals. If scratches are not severe, and are not under 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.

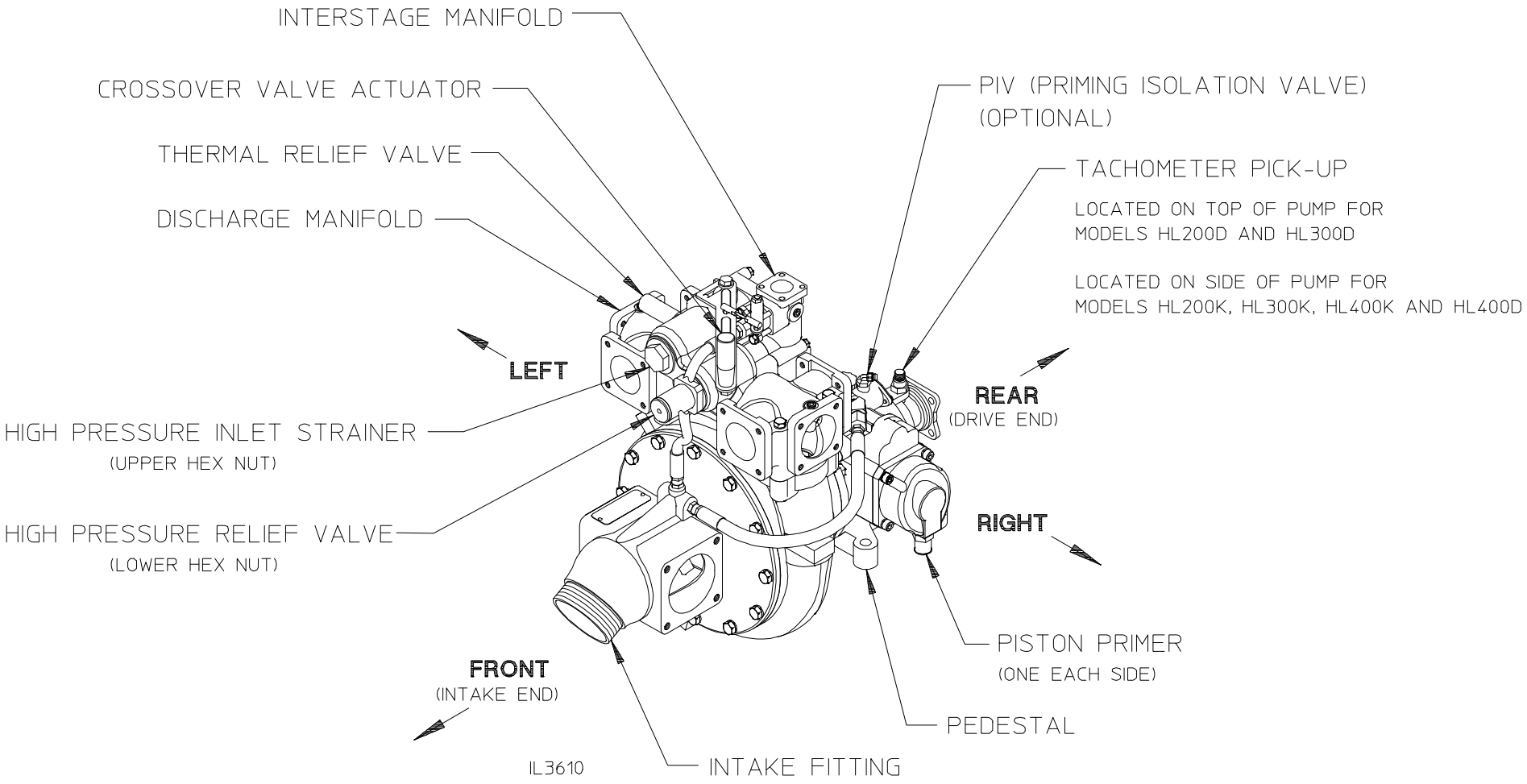
End Yoke and Companion Flange Nuts

Do not reuse self-locking nuts. Apply lubrication oil to the shaft threads before removing.

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.

Pump Components



Direct Drive Model HL300D Shown

NOTE: For clarity, diagram does not show fittings installed on the pump intake and discharge openings. Location of some components vary slightly based on pump model and input rotation.

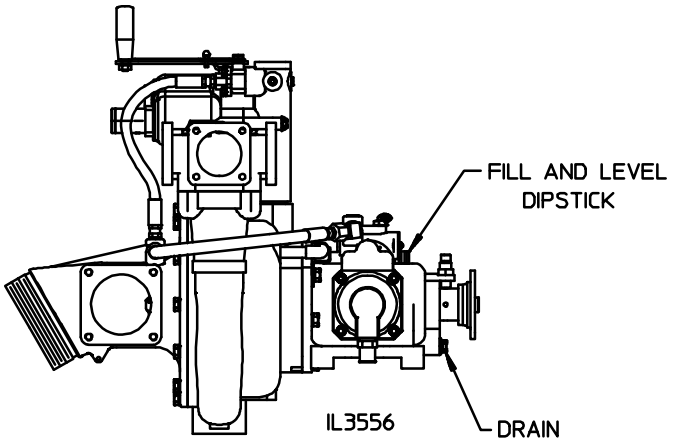
Disassembly Index

NOTE: For clarity, diagrams do not show fittings installed on the pump intake and discharge openings.

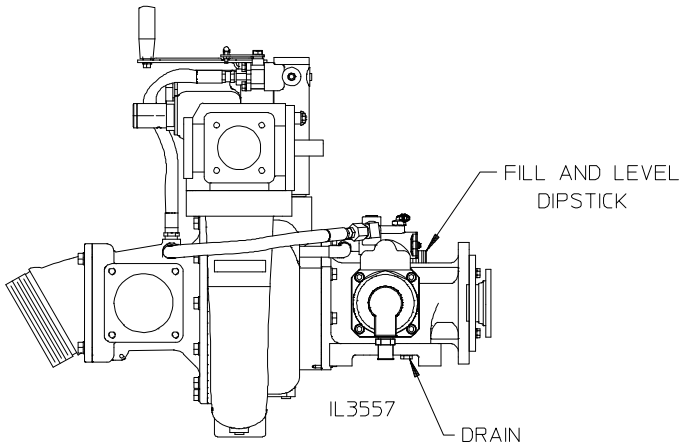
Reassembly Index

Drain Lubricants from Pump

Models HL200D, HL300D and HL400D
1. Drain lubricant from Pedestal (Primer Housing).

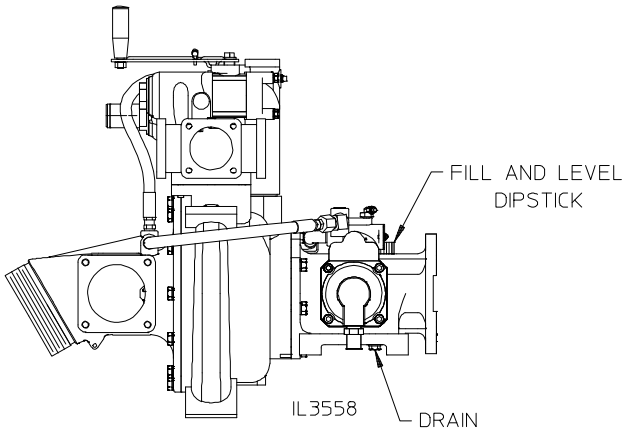


Models HL200D and HL300D

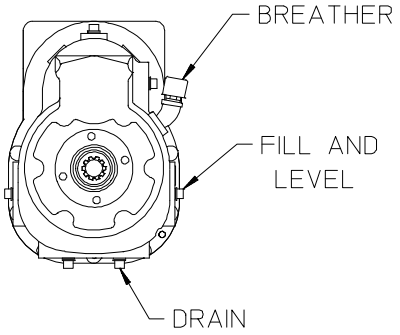


Model HL400D

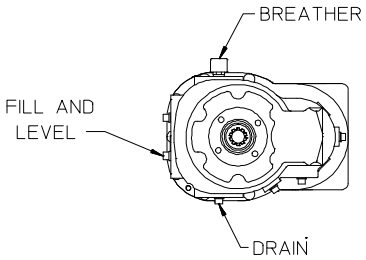
Models HL200K, HL300K and HL400K
Drain lubricant from Pedestal (Primer Housing) and K Series Transmission



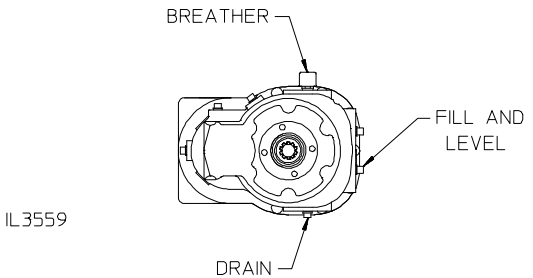
Pedestal (Primer Housing)



Transmission Mounted Vertically



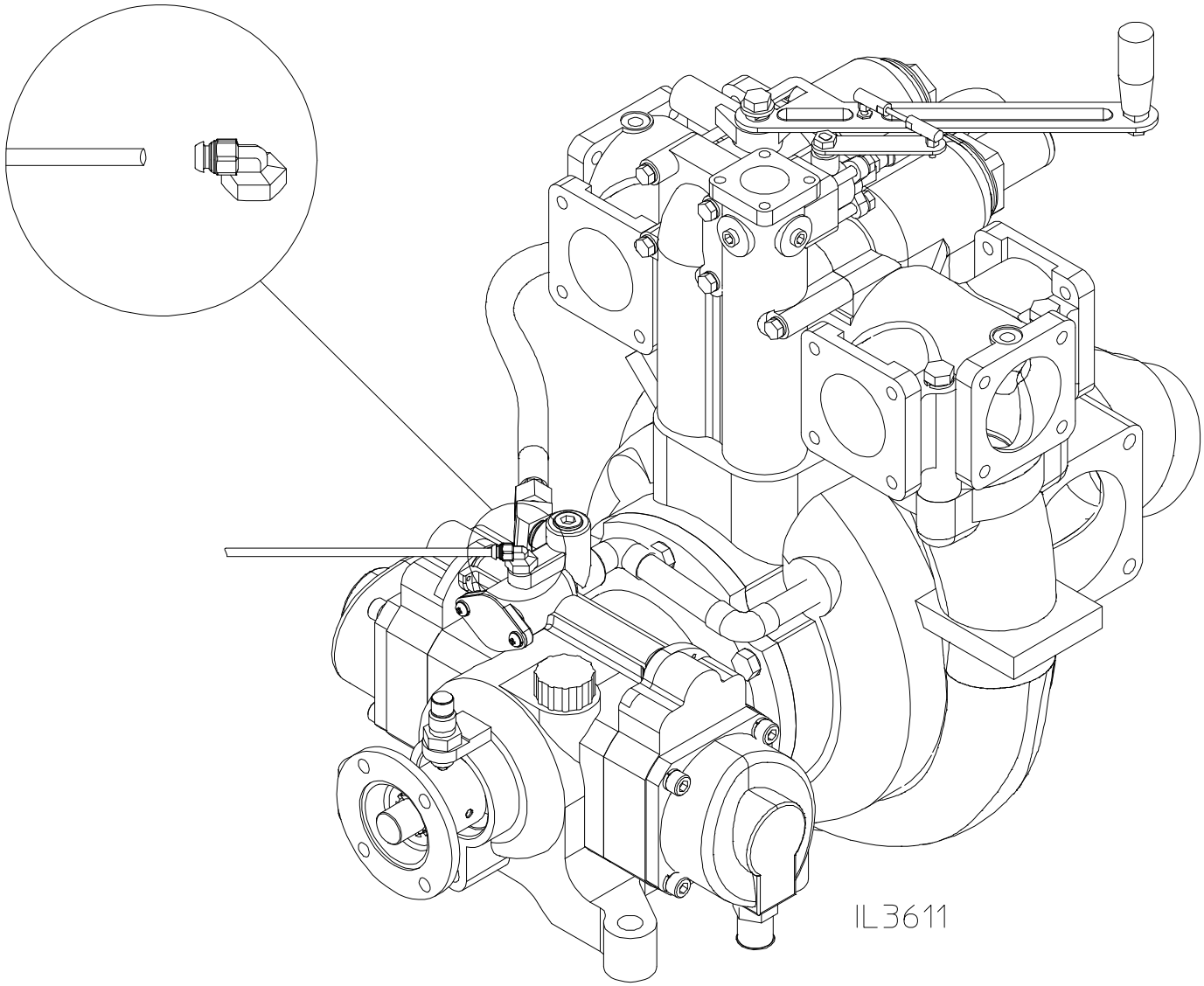
Transmission Mounted to the Left



Transmission Mounted to the Right

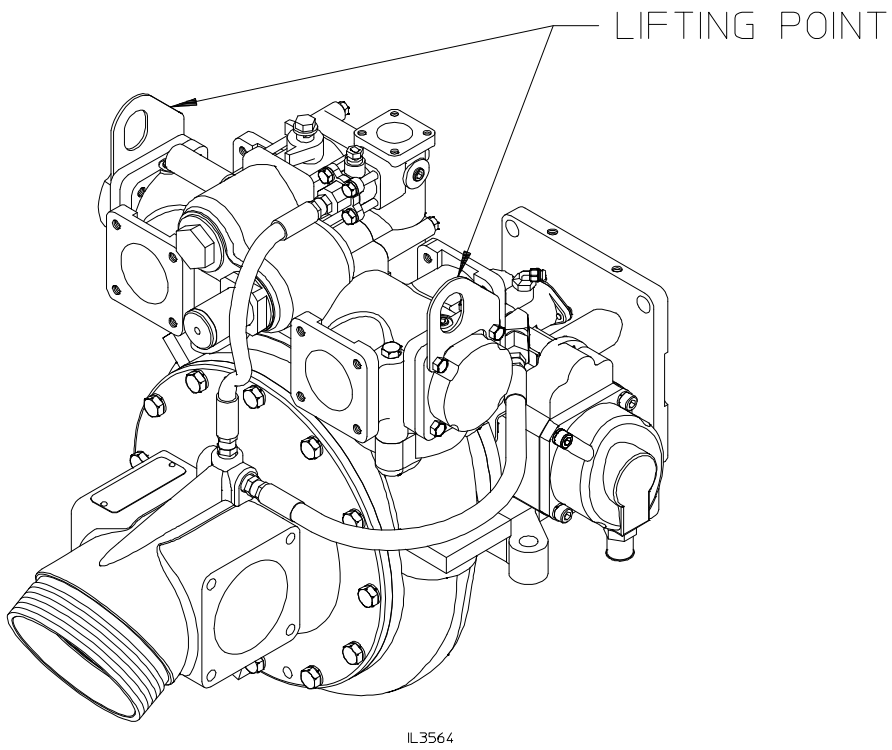
Disconnect PIV (Priming Isolation Valve) Air Line

1. Required only if your pump is equipped with optional PIV feature.
2. Connection made with push-on fitting.
3. Push in fitting retaining ring and hold. Firmly grasp air line and pull out of fitting.

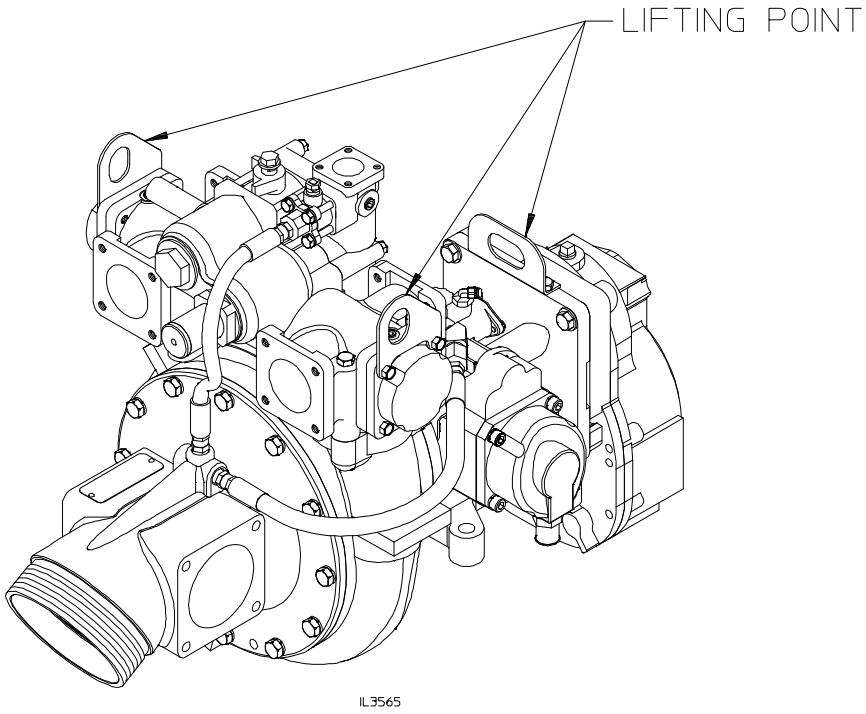


Remove Pump

1. Disconnect driveline, intake piping, discharge piping, pump and primer drain lines, tachometer cable and any accessory equipment connections.
2. Remove four bolts attaching the pump to the vehicle frame.
3. Lift the pump out of the vehicle using the lifting points on the pump.



Models HL200D, HL300D and HL400D

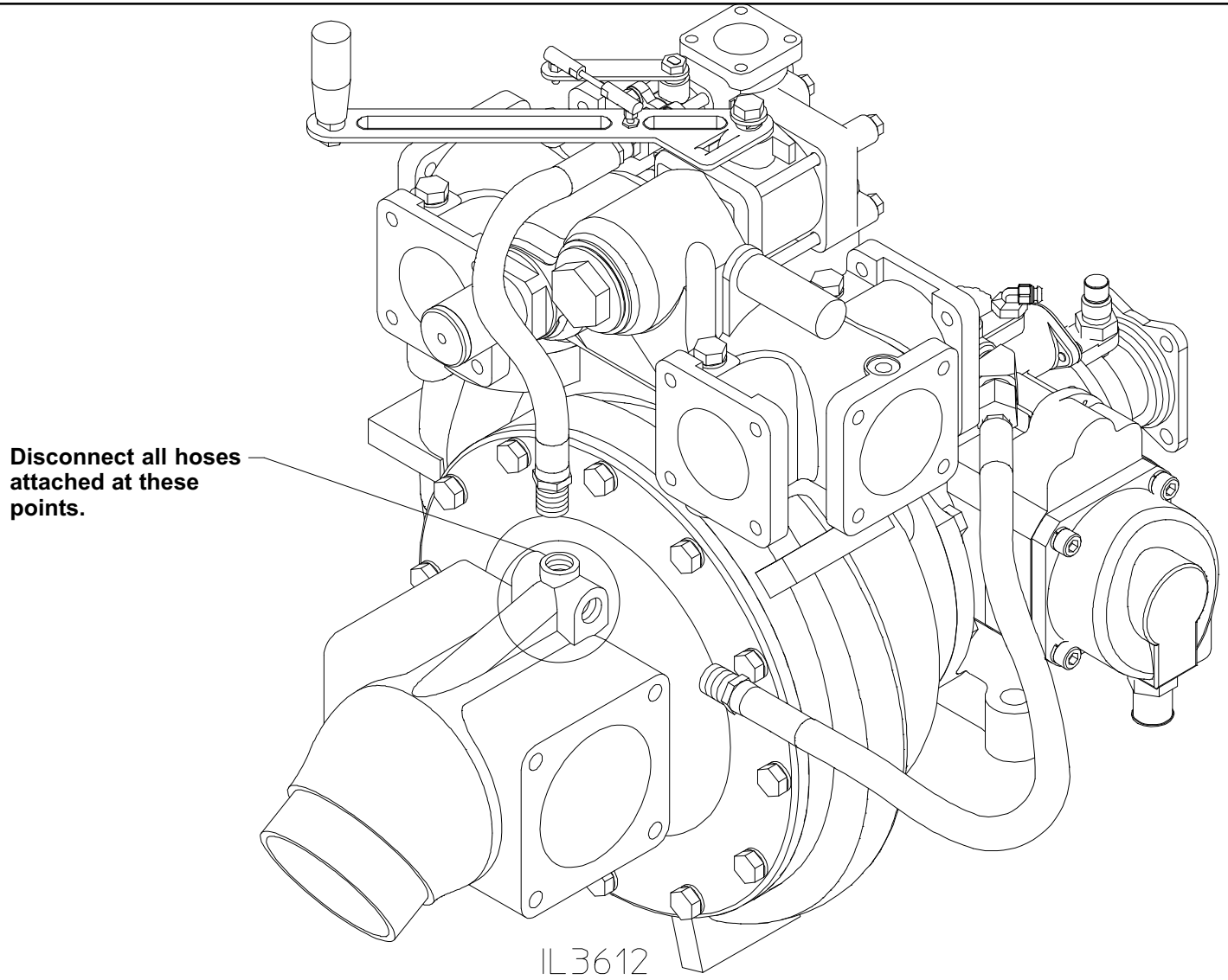


Models HL200K, HL300K and HL400K

Disconnect Hoses

1. Disconnect all hoses attached to the intake fitting.

NOTE: If the hose connection at the intake fitting is not a swivel connection, disconnect hose at other end.

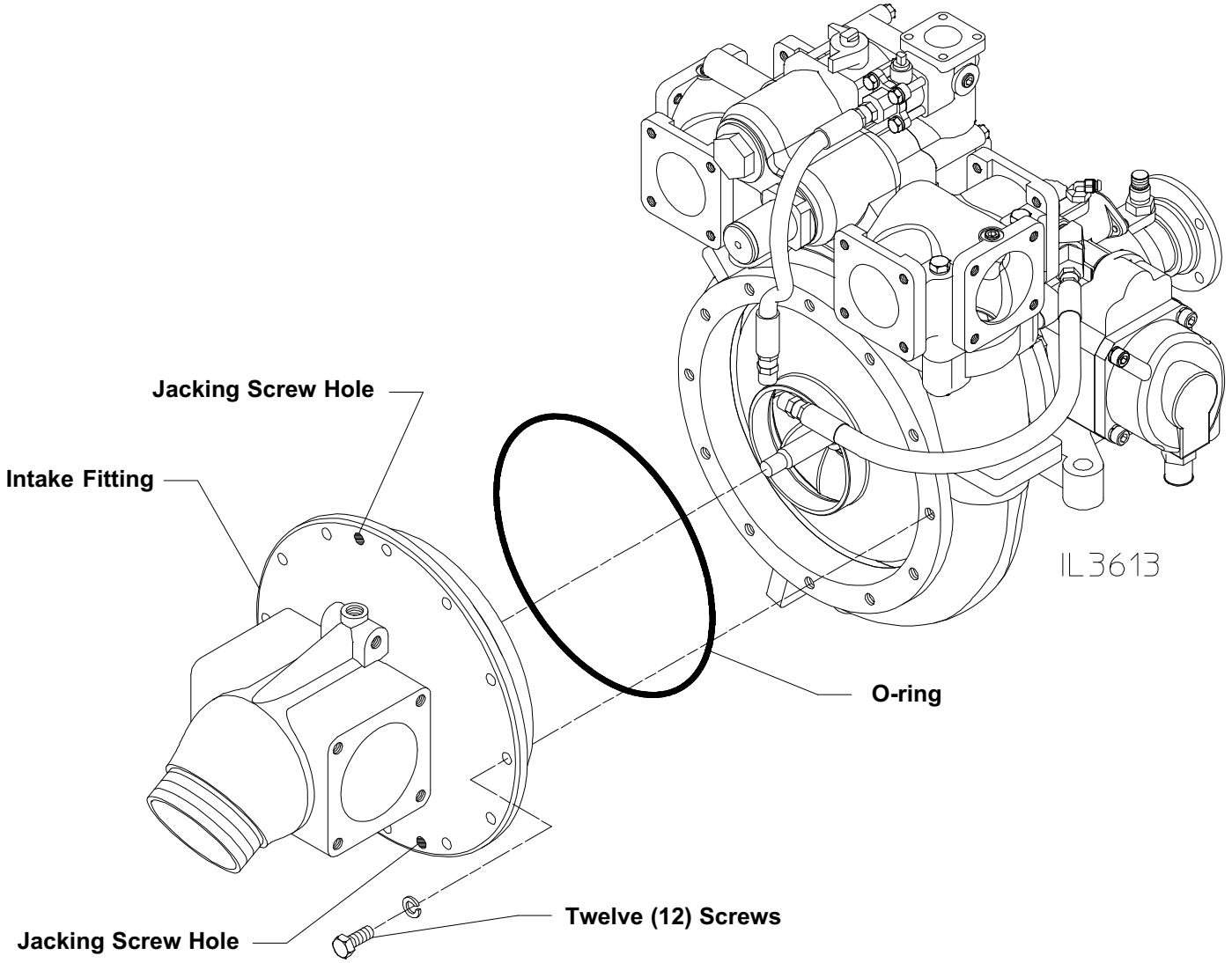


Remove Intake Fitting

HL200 and HL300 Series Models

1. Remove the twelve (12) screws attaching the intake fitting to the pump body.
2. Place two (2) of the screws in the jacking screw holes. Alternate tightening the two (2) jacking screws to separate the fitting from the pump body.

NOTE: Impeller wear ring and shaft bushing will remain in the intake fitting. See Page 30 for instruction on inspecting and replacing these items.

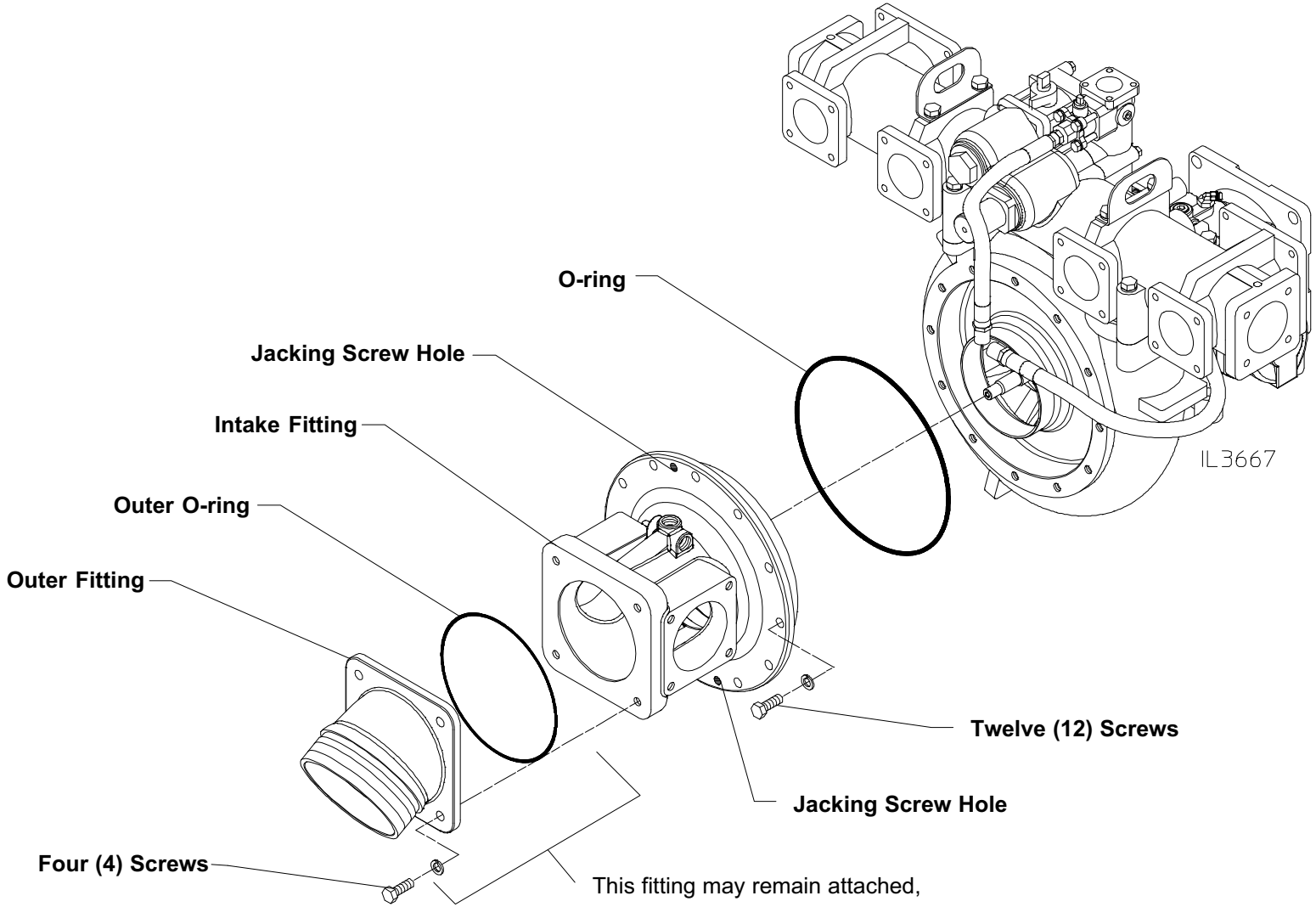


Remove Intake Fitting

HL400 Series Models

1. Remove the twelve (12) screws attaching the intake fitting to the pump body.
2. Place two (2) of the screws in the jacking screw holes. Alternate tightening the two (2) jacking screws to separate the fitting from the pump body.
3. The outer fitting may remain attached to the inner fitting if repairs to the joint O-ring are not required.

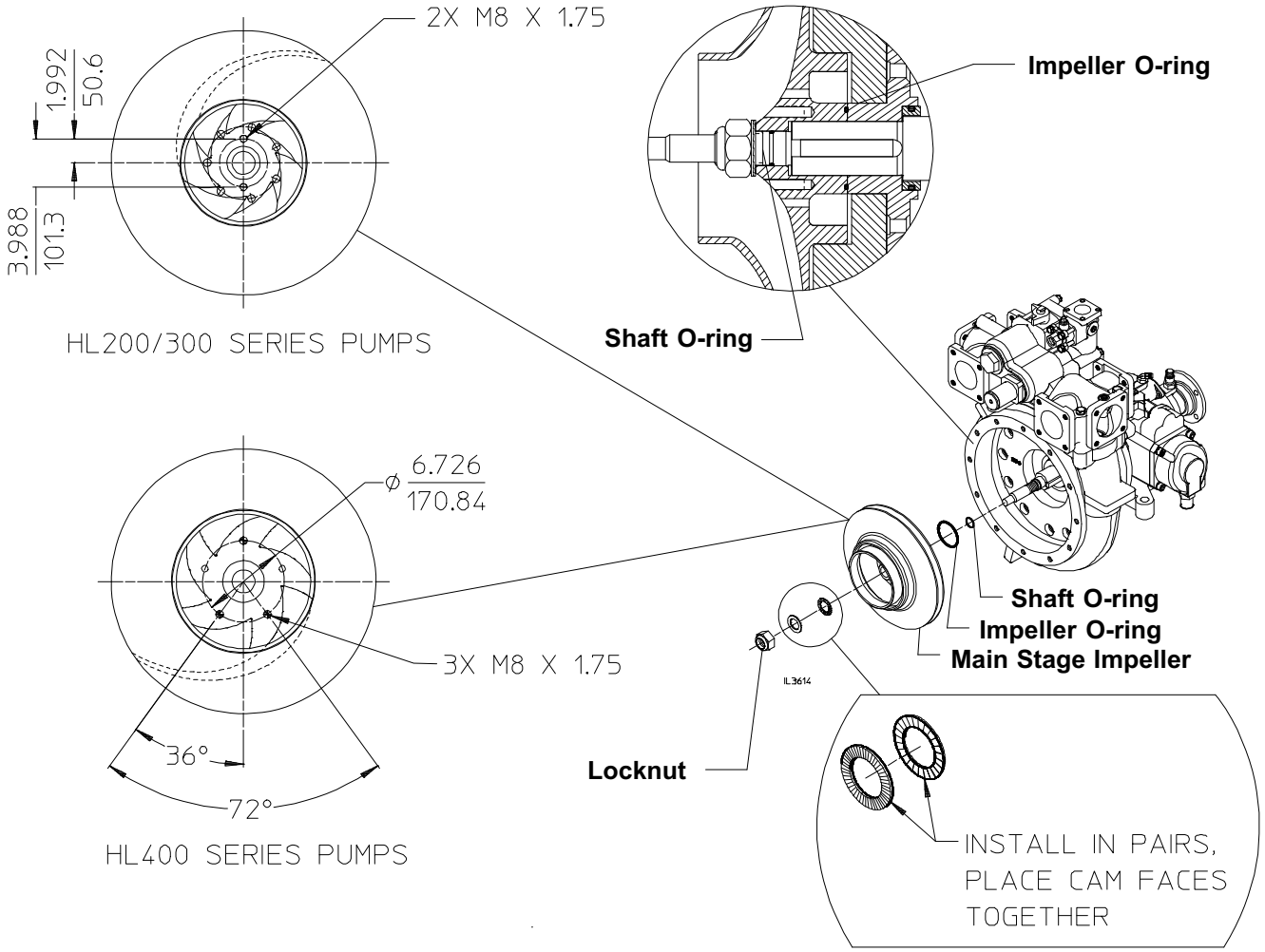
NOTE: Impeller wear ring and shaft bushing will remain in the intake fitting. See Page 30 for instruction on inspecting and replacing these items.



Disassembly - Remove Impellers

Main Stage Impellers

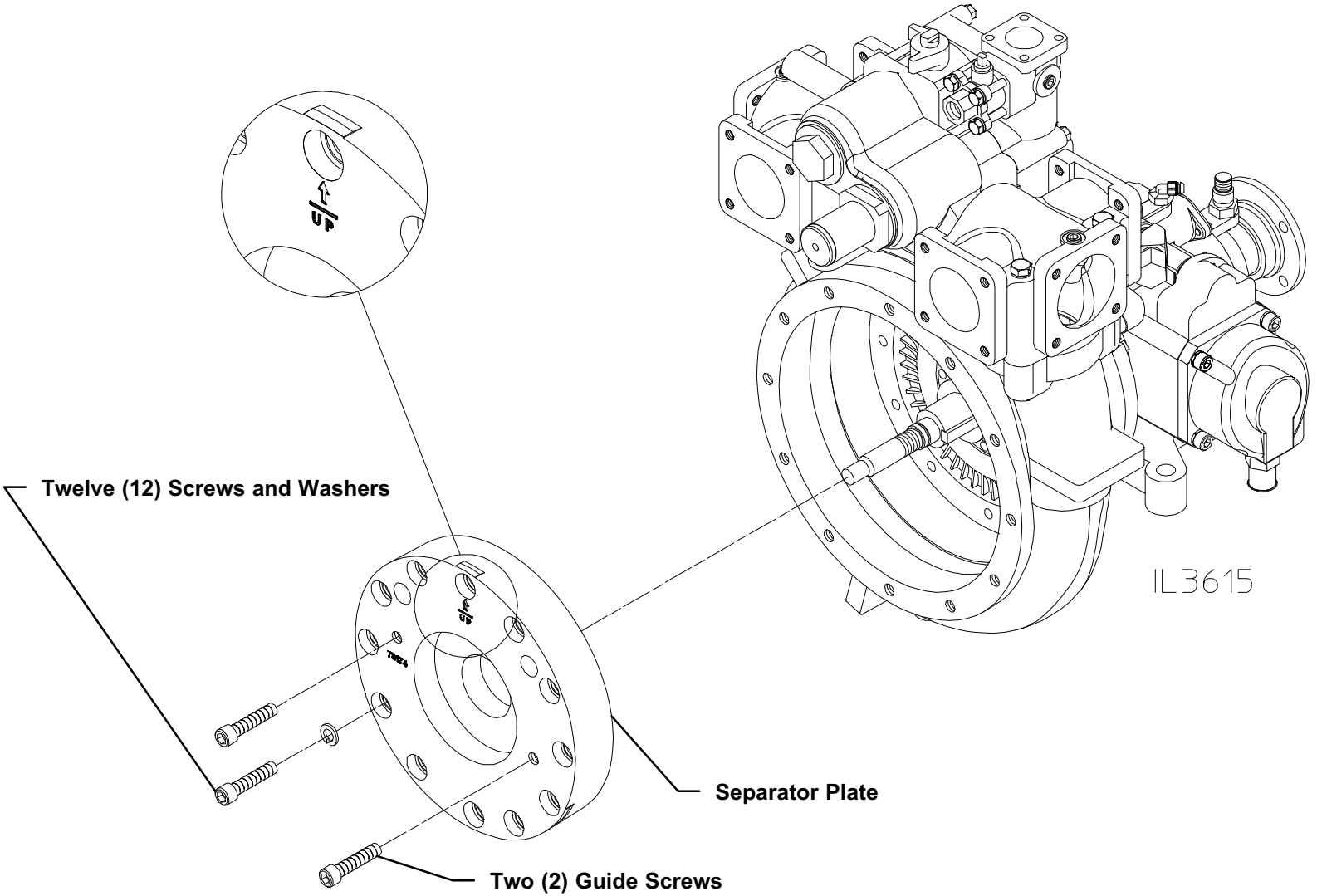
1. Restrain the companion flange on drive end of pump to prevent movement.
2. Remove locknut and washer from end of shaft.
3. Remove impeller from shaft. The M8-1.75 tapped holes in the impeller may be used to pull the impeller off the shaft.
4. Remove the O-ring in the groove on the back side of the impeller.
5. Remove the O-ring from the groove in the shaft.



High Pressure Stage Impeller

Remove Separator Plate

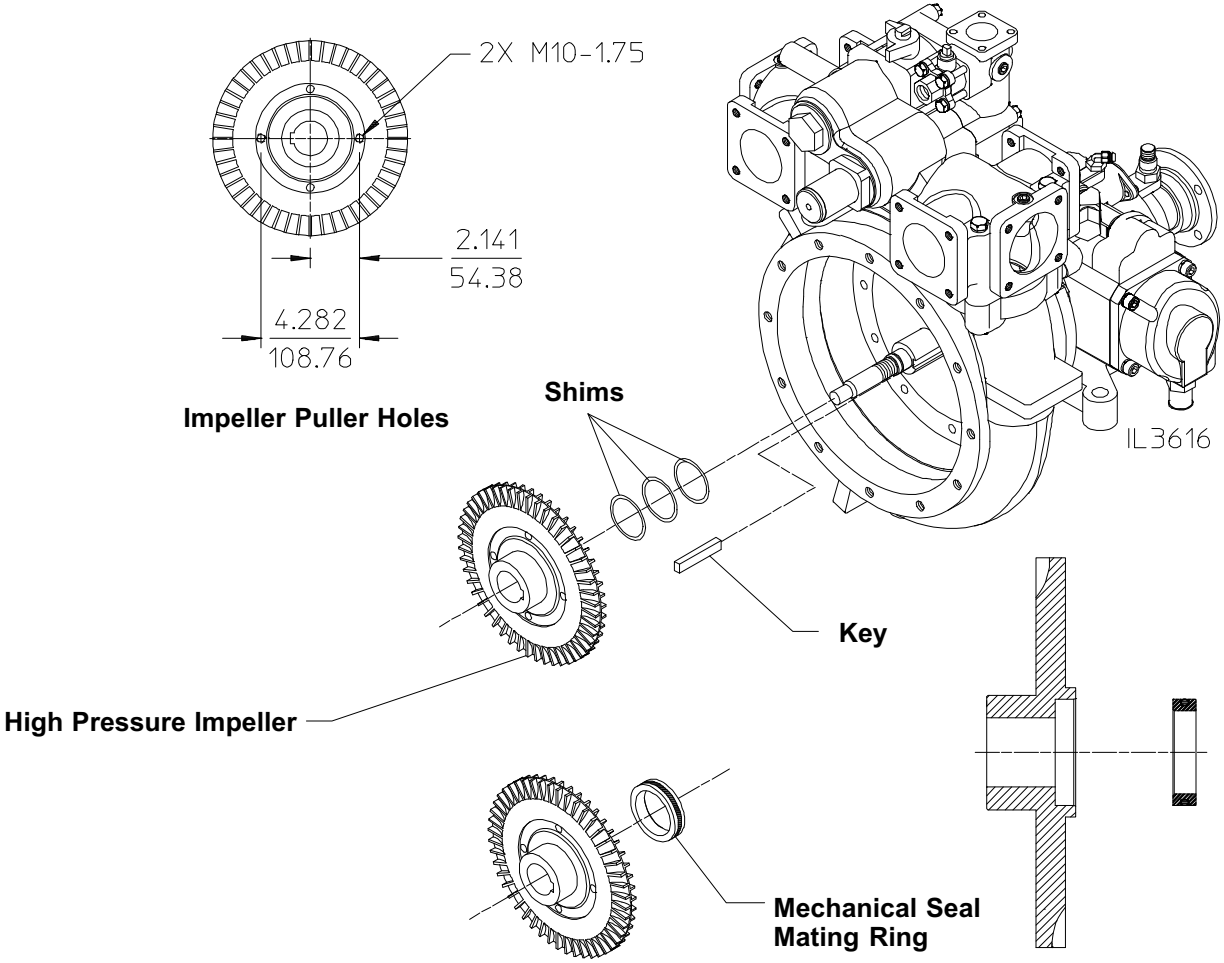
1. Remove the twelve (12) socket head screws and washers which attach the separator plate to the pump body.
2. Long M12 bolts may be installed in the two M12-1.75 tapped holes and used as handles to guide the separator plate out of the pump.



Remove High Pressure Impeller

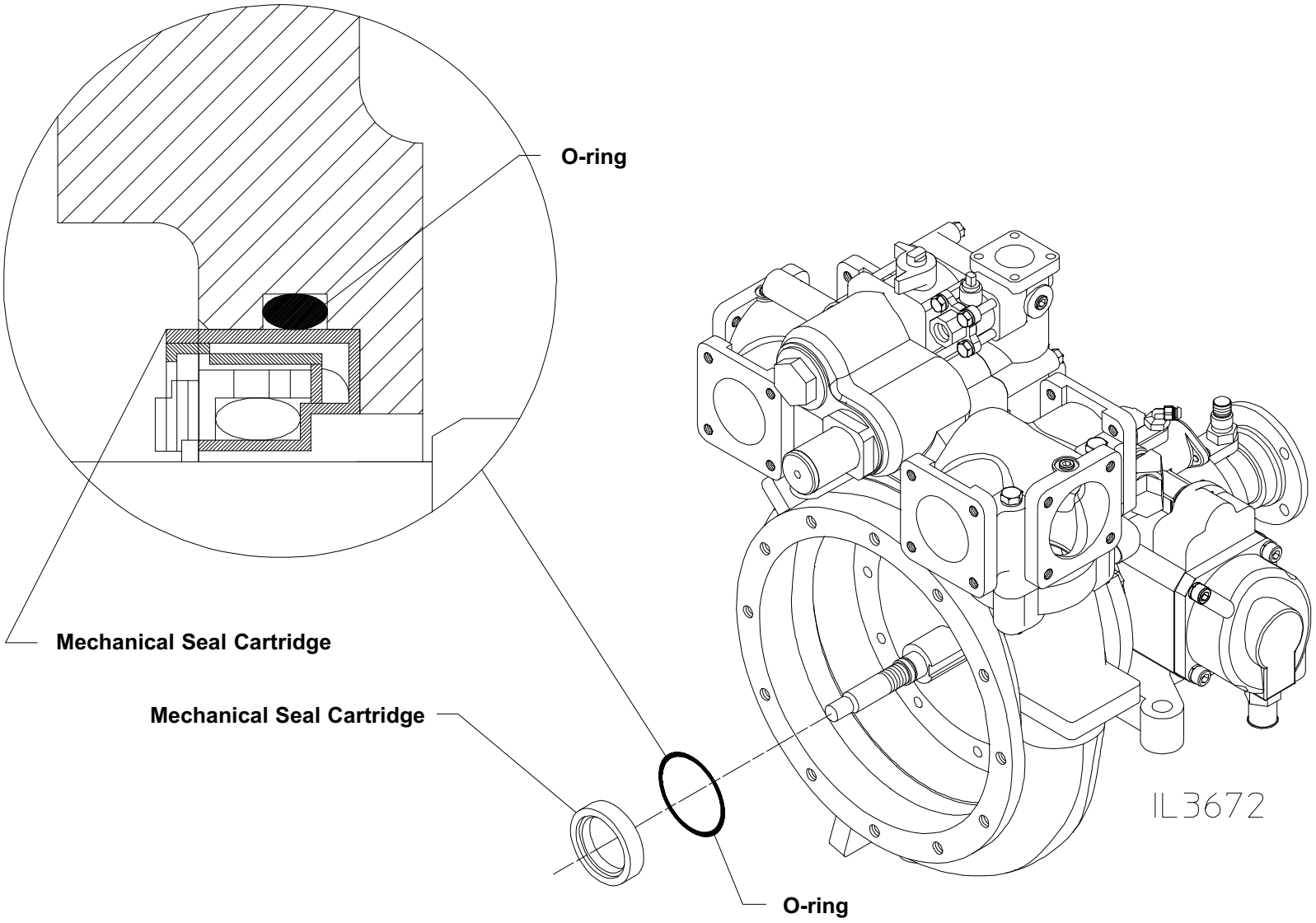
1. Remove impeller from shaft. The two (2) M10-1.5 tapped holes in the impeller may be used to pull the impeller off the shaft.
2. Remove the mechanical seal mating ring from the bore on the back side of the impeller and discard.
3. Remove the key from the shaft.
4. Remove the shims from behind the impeller.

If the shims are damaged, discard as new shims must be installed
If the impeller shaft, pump body, separator plate or high pressure impeller are being replaced, discard as new shims must be installed.
If only the mechanical seal is being replaced, save the shims for re-use.



Remove Mechanical Seal

1. Grip the lip of the mechanical seal cartridge and pull out of pump.
2. Remove the O-ring from the groove in the pump body seal bore.

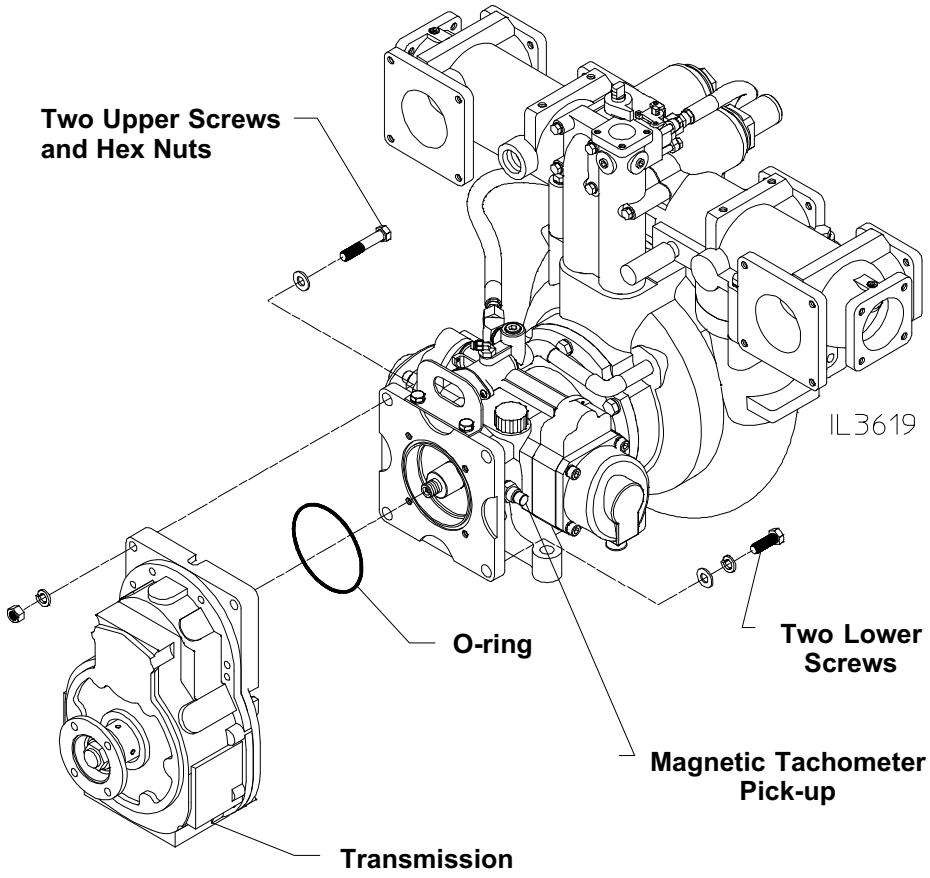


HL200K, HL300K and HL400K Gear Drive Models

Remove Transmission:

1. Remove the four (4) bolts attaching transmission to pump.
2. Slide the transmission back until clear of shaft spline.
3. Remove the O-ring from the groove in pump pedestal.
4. If shaft will be removed from pump pedestal, remove magnetic tachometer pick-up from pump pedestal.

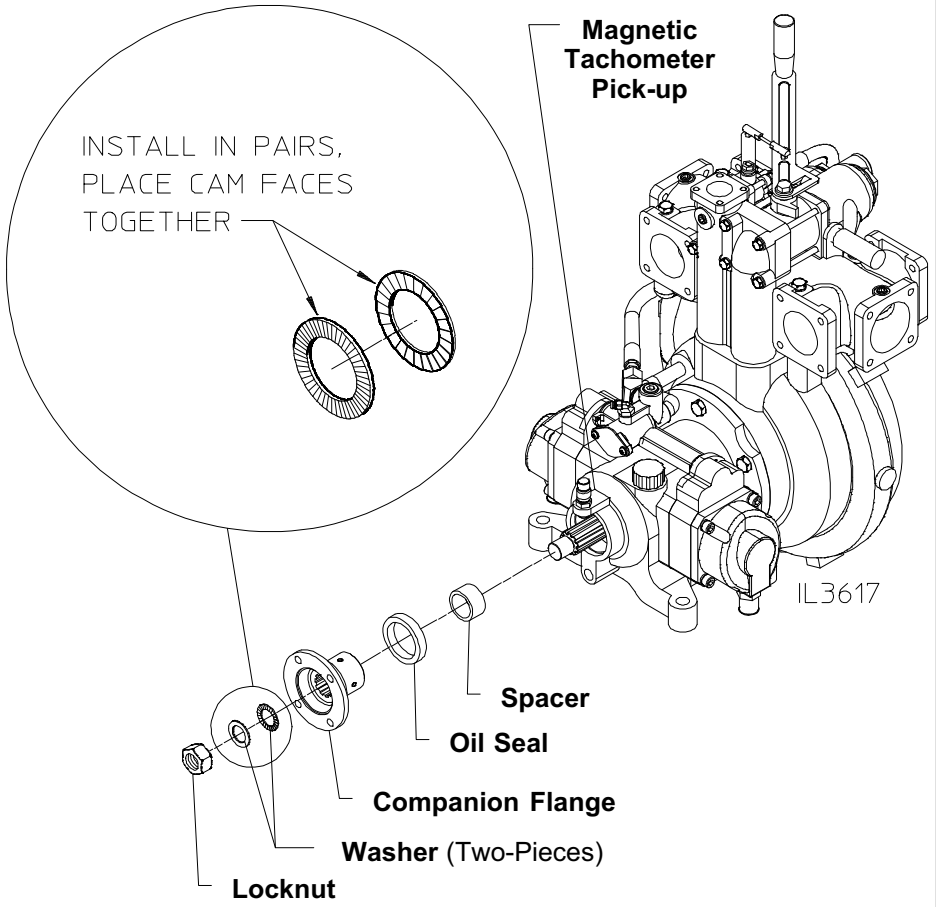
NOTE: For overhaul of transmission, see separate overhaul instruction F-1031, Section 4309.



HL200D and HL300D Direct Drive Models

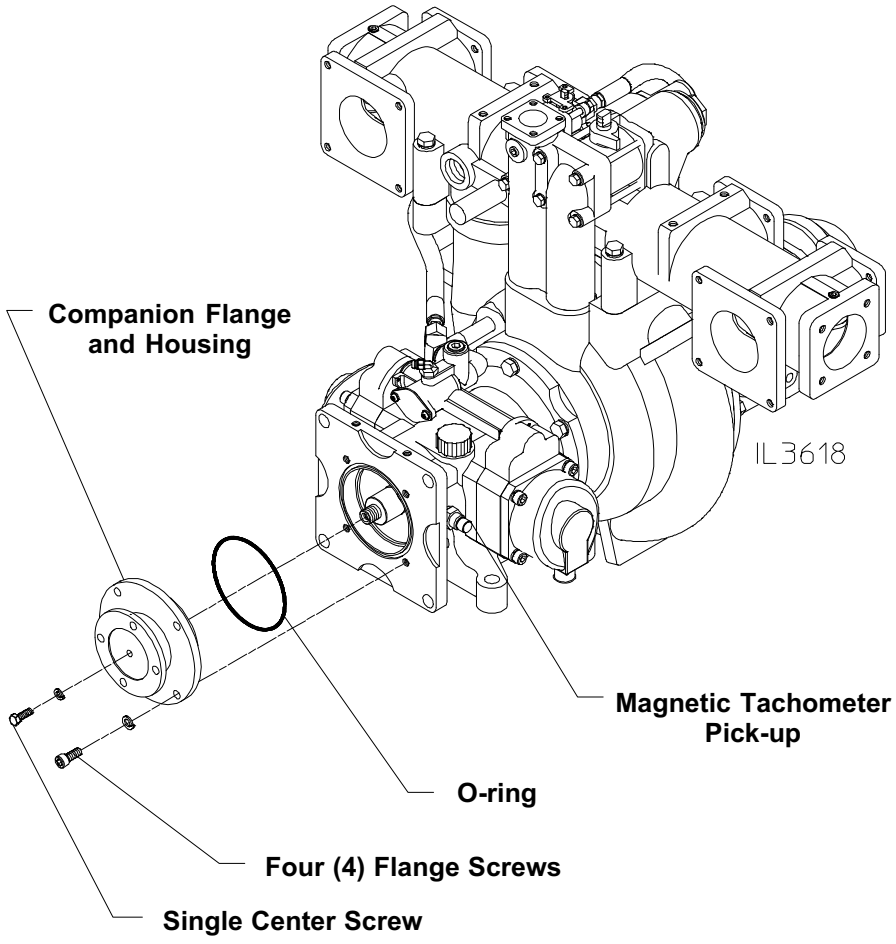
Remove Companion Flange:

1. Restrain the companion flange to prevent movement.
2. Remove the locknut and washer from shaft.
3. Slide companion flange back until clear of shaft spline.
4. Remove oil seal from pump pedestal.
5. Remove spacer from shaft.
6. If shaft will be removed from pump pedestal, remove magnetic tachometer pick-up from pump pedestal.



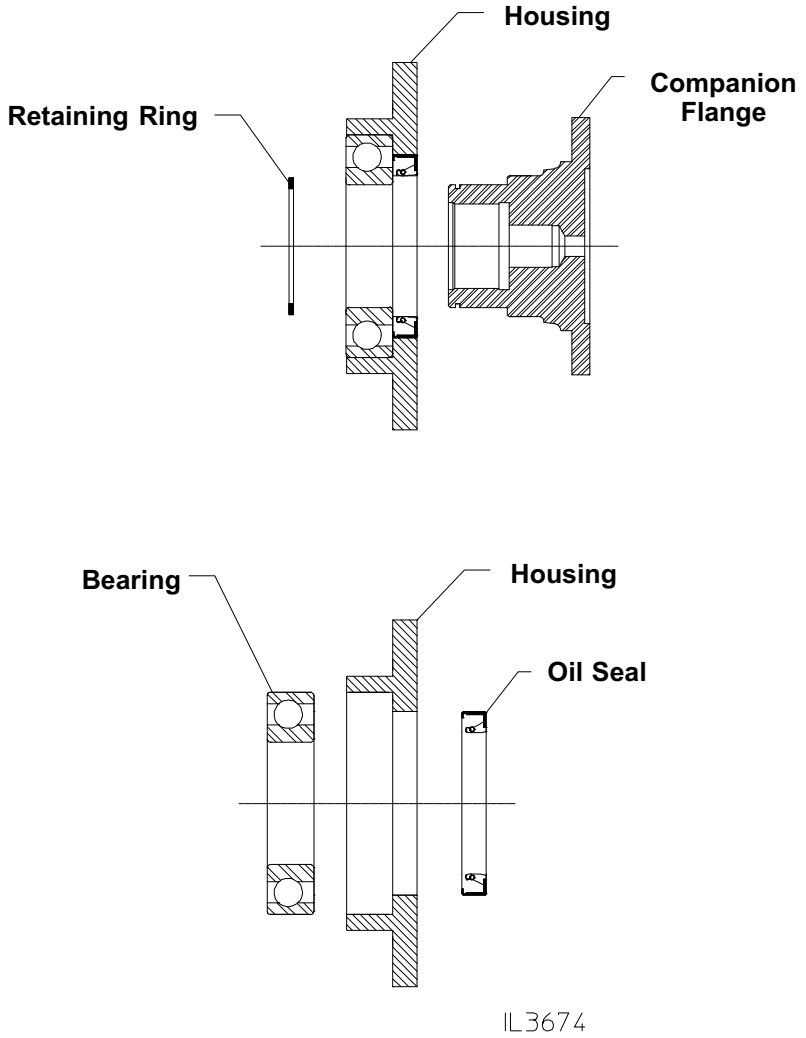
Remove Companion Flange from Pump:

1. Remove hex head screw attaching companion flange to shaft.
2. Remove the four (4) socket head screws attaching bearing housing to pump pedestal.
3. Slide companion flange/bearing housing back until clear of shaft and pump pedestal.
4. Remove O-ring from groove in pump pedestal.
5. If shaft will be removed from pump pedestal, remove magnetic tachometer pick-up from pump pedestal.



Disassemble Companion Flange:

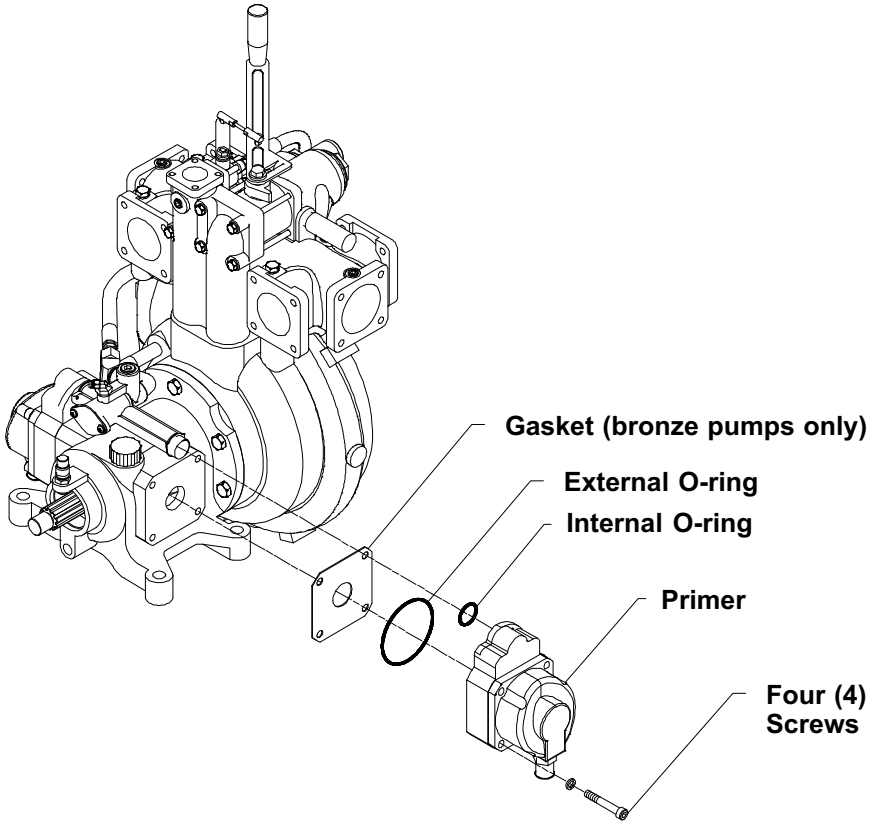
1. Remove retaining ring from companion flange.
2. Press companion flange out of bearing.
3. Remove bearing from bearing housing.
4. Remove oil seal from bearing housing.



Disassembly - Remove Primers

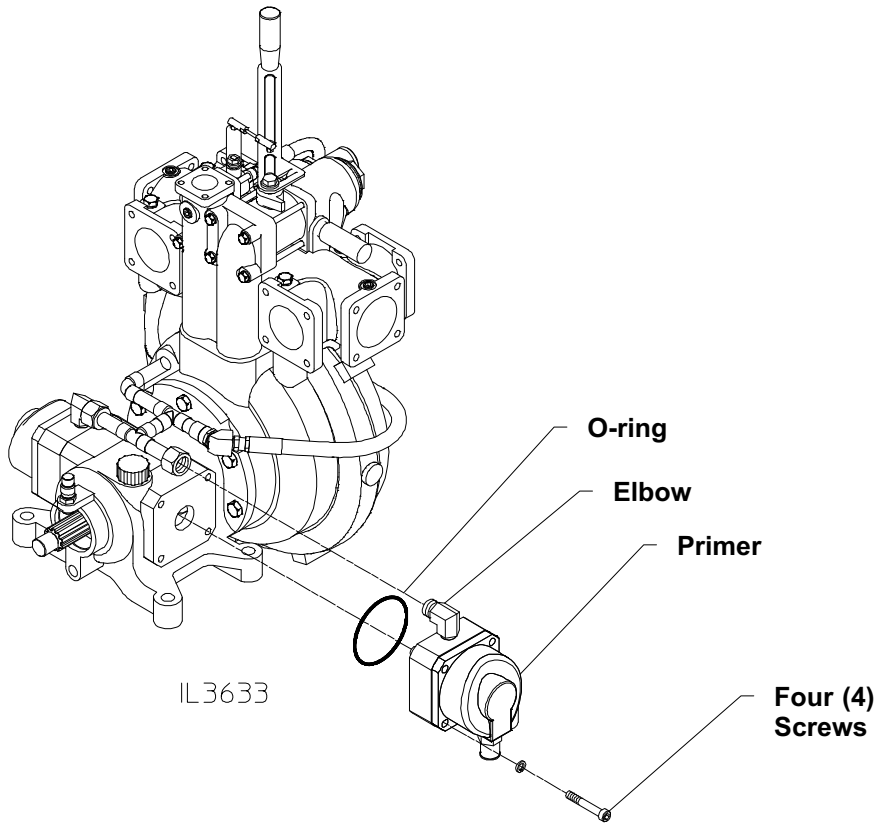
Pumps with PIV (Priming Isolation Valve)

1. Remove the four (4) socket head screws attaching primer to pump pedestal.
2. Slide the primer back until clear of pump pedestal.
3. Remove the O-ring from external groove in primer (Note that bronze pumps use an O-ring and gasket).
4. Remove O-ring from internal groove in primer.
5. Repeat Process for primer on opposite side of pump.
6. If the pedestal will be removed from the pump or the PIV overhauled, remove the PIV from the pump (see next page for instructions.)



Pumps without PIV (Priming Isolation Valve)

1. Remove the four (4) socket head screws attaching primer to pump pedestal.
2. Loosen the hex nut on top of the primer until it is disengaged from the elbow.
3. Slide the primer back until clear of pump pedestal.
4. Remove the O-ring from external groove in primer.
5. Repeat Process for primer on opposite side of pump.
6. If the pedestal will be removed from the pump or the PIV overhauled, remove the PIV from the pump (see next page for instructions.

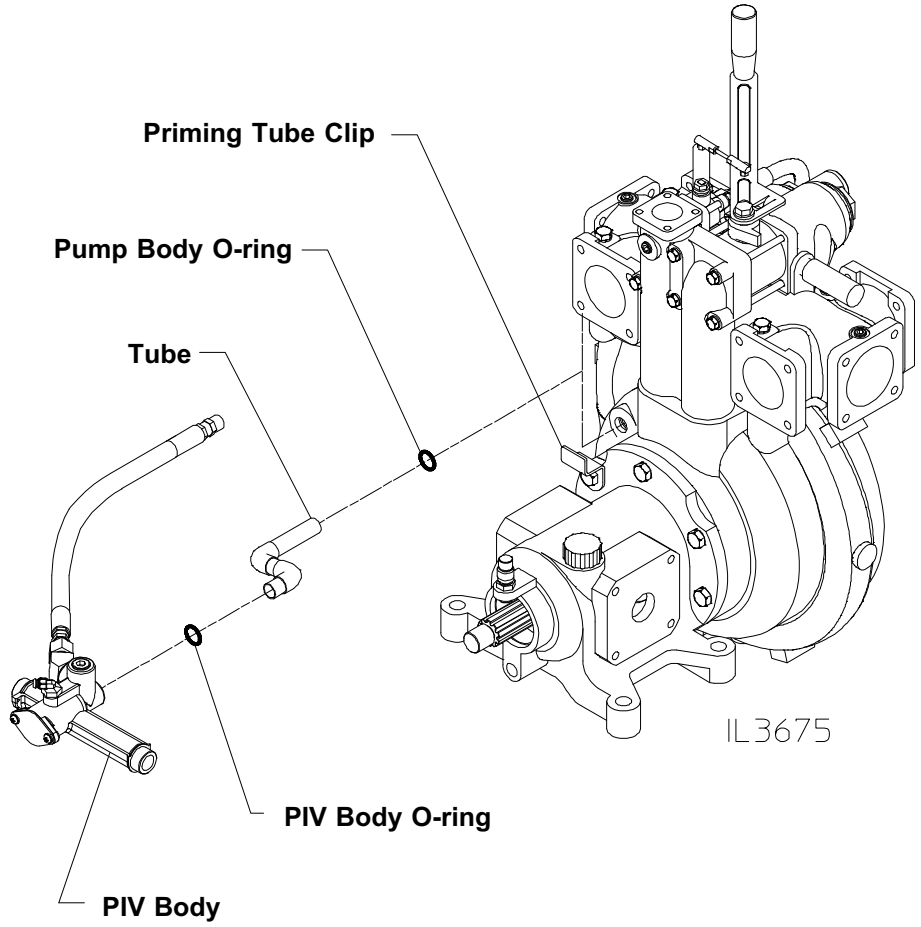


Piston Primer Disassembly

Order Piston Primer Repair Kit K 974 and follow instructions included with the kit.

Remove PIV (Priming Isolation Valve)

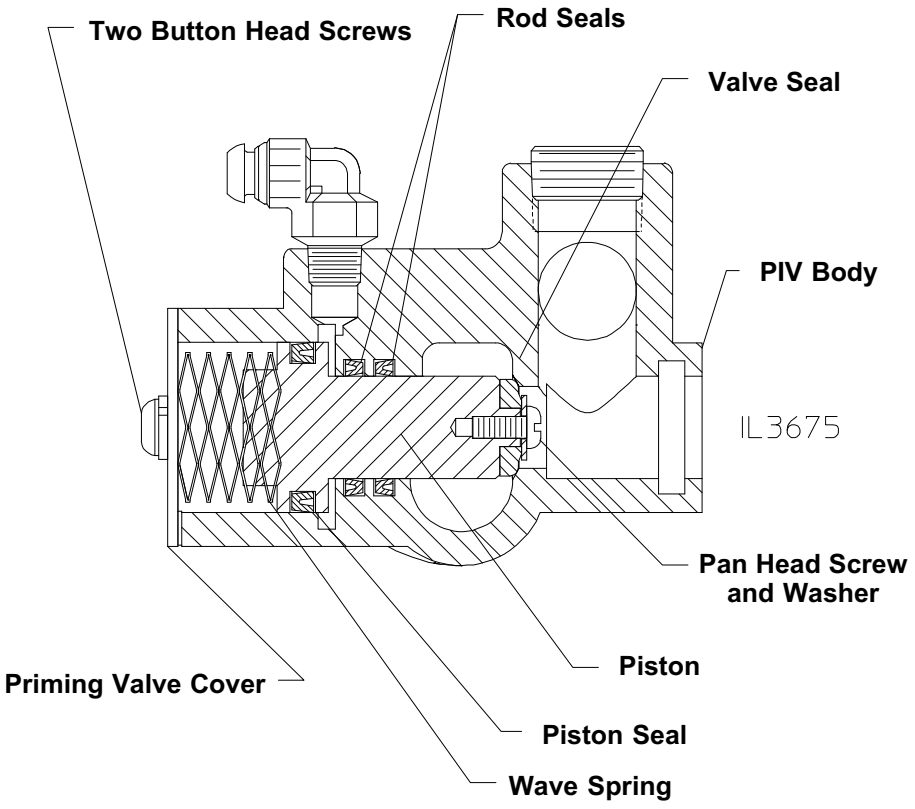
1. Lift PIV up to disengage body from priming tube clip.
2. Pull PIV body away from the pump to disengage tube from hole in pump body.
3. Remove the priming tube from the PIV body.
4. Remove the O-rings from the internal grooves in the pump body and PIV body.



Disassembly PIV (Priming Isolation Valve)

(Required only if PIV requires overhaul).

1. Remove the two button head screws and washers from the priming valve cover.
2. Remove the priming valve cover.
3. Remove the wave spring from the internal bore in the valve body.
4. Remove the piston from the valve. Push out of valve from end opposite of priming valve cover.
5. Remove the piston seal from the groove in the piston.
6. Remove the pan head screw and washer from end of piston and remove the valve seal.
7. Remove the two rod seals from the internal grooves in the valve body.



PIV Disassembly

Order PIV Overhaul Kit K 1260 and follow instructions included with the kit.

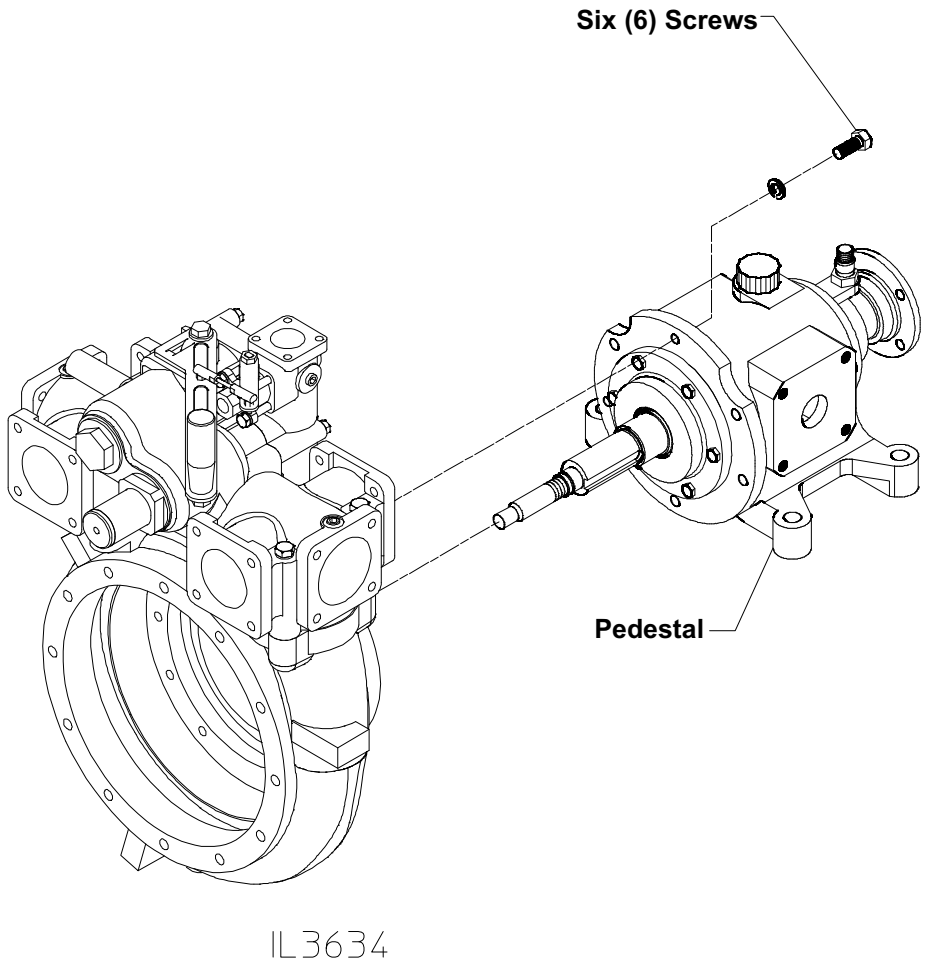
Disassembly - Separate Pump from Pedestal

Remove Pedestal from Pump Body

1. Remove the six (6) hex head screws attaching pedestal to pump body.

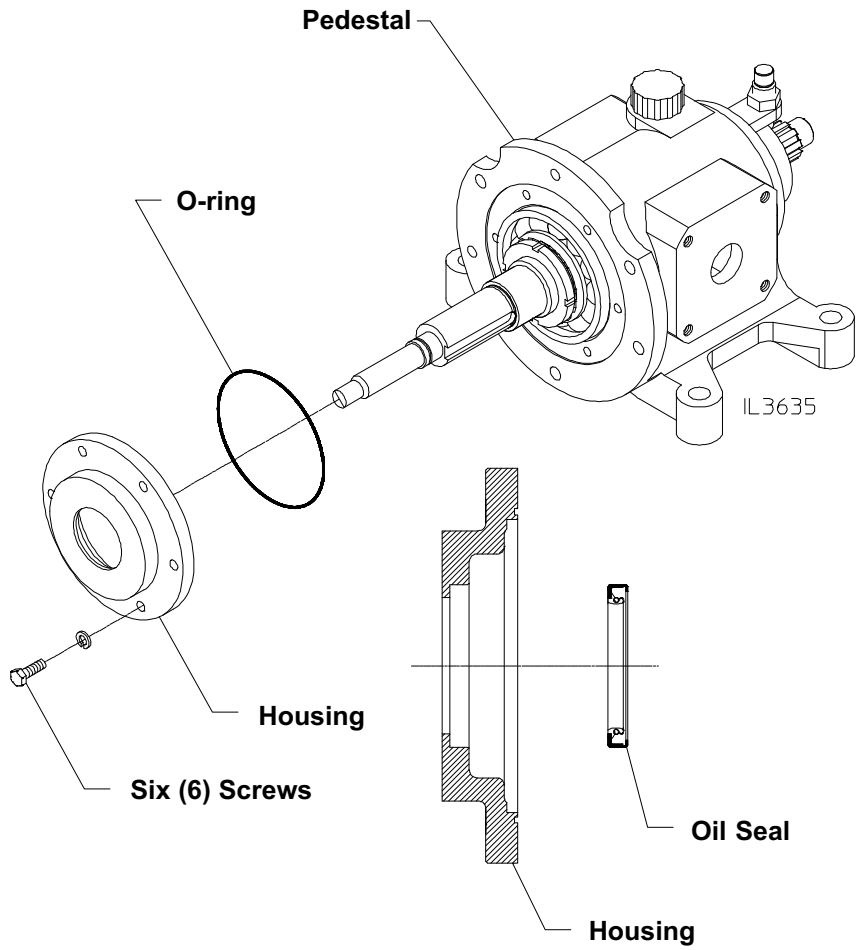
Note that if the pump has an optional PIV, one screw retains the priming tube clip.

2. Slide pedestal back until impeller shaft is clear of pump body.



Remove Pedestal Oil Seal

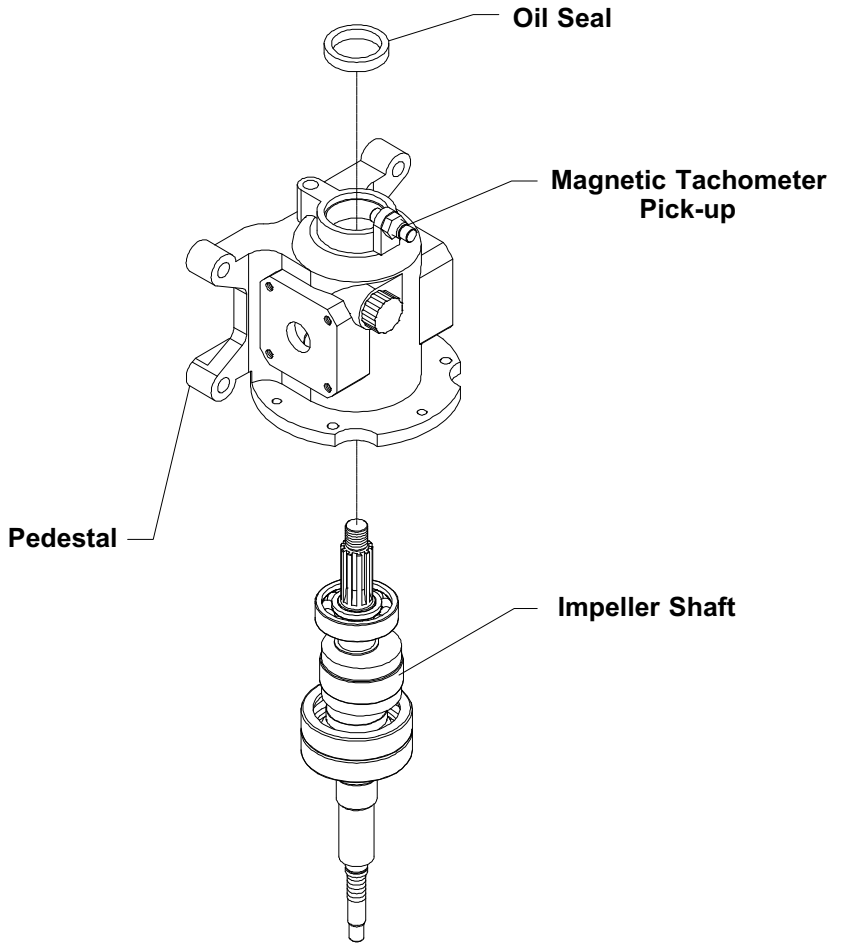
1. Remove the six (6) hex head screws attaching oil seal housing to pedestal.
2. Lift the oil seal housing off of the pedestal.
3. Remove the O-ring from the oil seal housing.
4. Remove the oil seal from the housing.



Disassembly - Remove Impeller Shaft

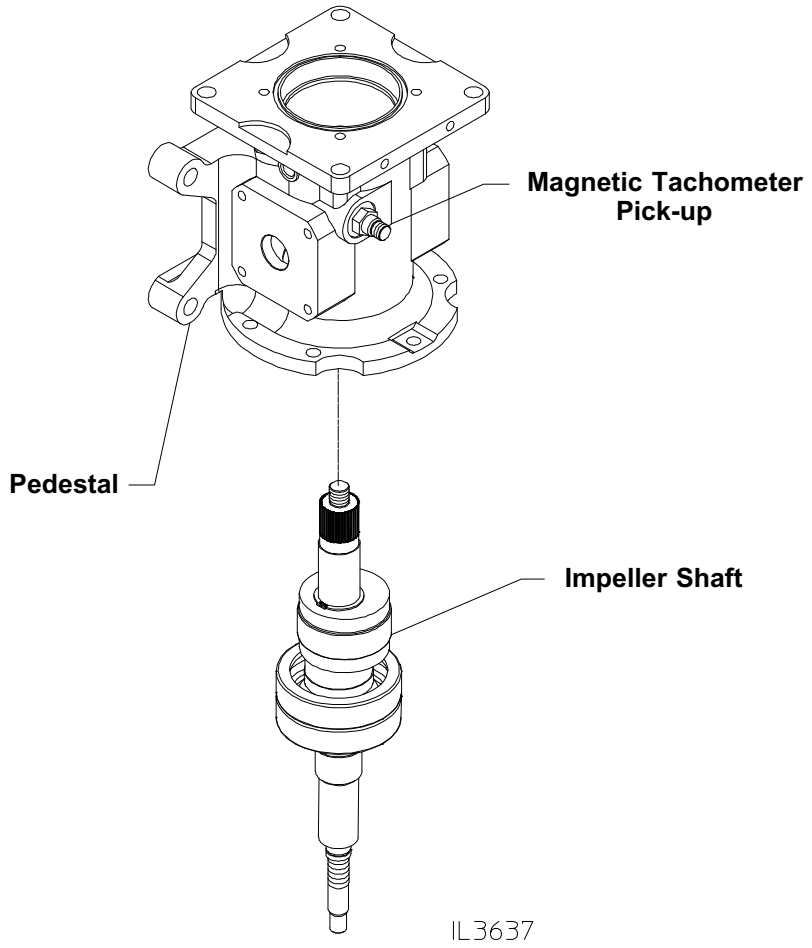
HL200D and HL300D Direct Drive Models

1. Remove the magnetic tachometer pick-up from pump pedestal.
2. Stand pedestal on pump flange end.
3. Press impeller shaft out of pedestal by applying force or lightly tapping on drive end of shaft.
4. Remove oil seal from drive end of pedestal.



HL400D Direct Drive, HL200K, HL300K, HL400K Gear Drive

1. Remove the magnetic tachometer pick-up from pump pedestal.
2. Stand pedestal on pump flange end.
3. Press impeller shaft out of pedestal by applying force or lightly tapping on drive end of shaft.



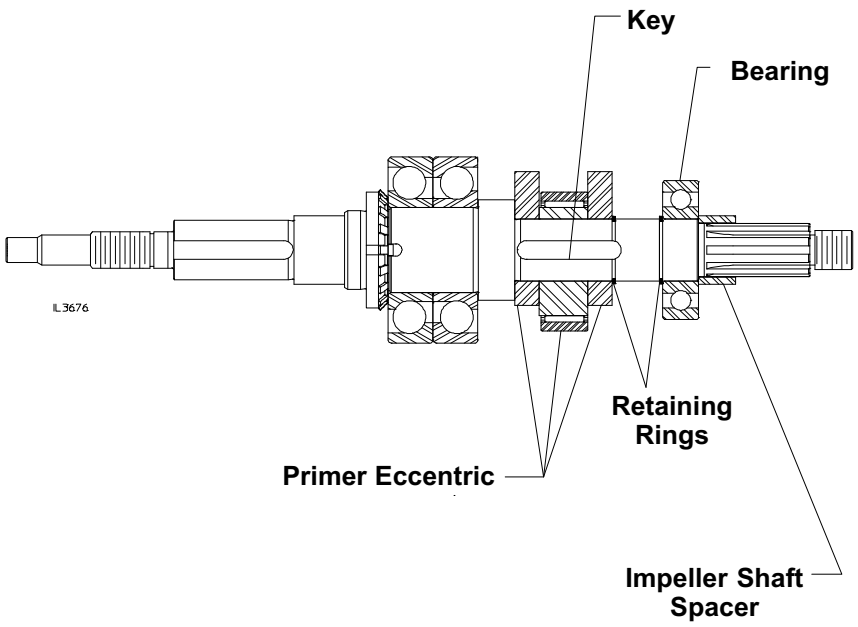
IL3637

HL200D and HL300D Direct Drive Models

1. Remove impeller shaft spacer.
2. Remove the two (2) retaining rings.
3. Press outboard bearing off of shaft.
4. Slide the primer eccentric off of shaft.

NOTE: The primer eccentric consists of two (2) separate pieces (inner and outer races) which are held in place by the counter weights. Keep counterweights and eccentric together as a unit during removal and storage.

5. Remove shaft key.

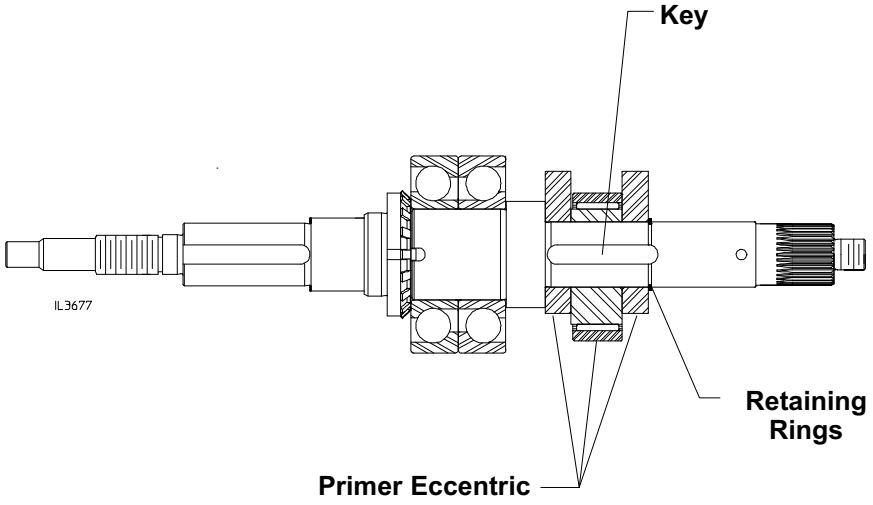


HL400D Direct Drive, HL200K, HL300K, HL400K Gear Drive

1. Remove the retaining ring.
2. Slide the primer eccentric off of shaft.

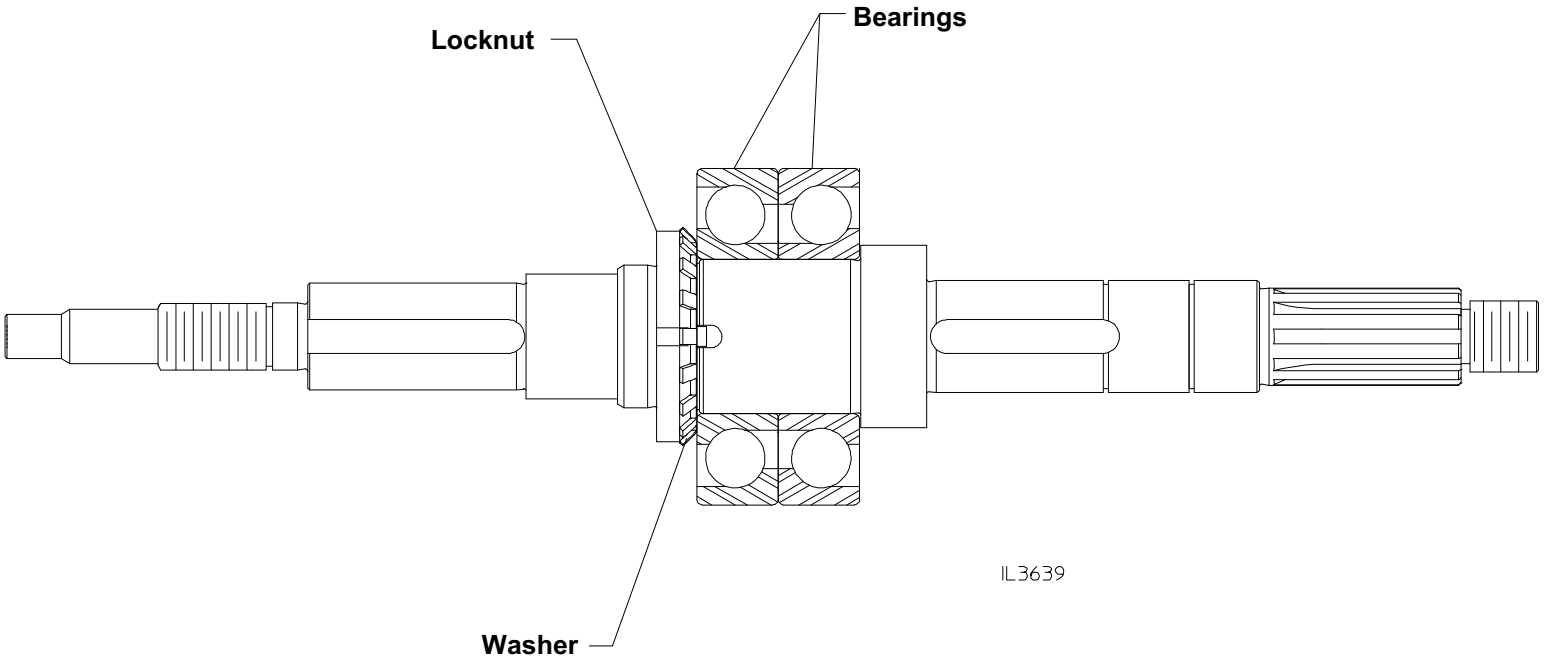
NOTE: The primer eccentric consists of two (2) separate pieces (inner and outer races) which are held in place by the counter weights. Keep counterweights and eccentric together as a unit during removal and storage.

3. Remove shaft key.



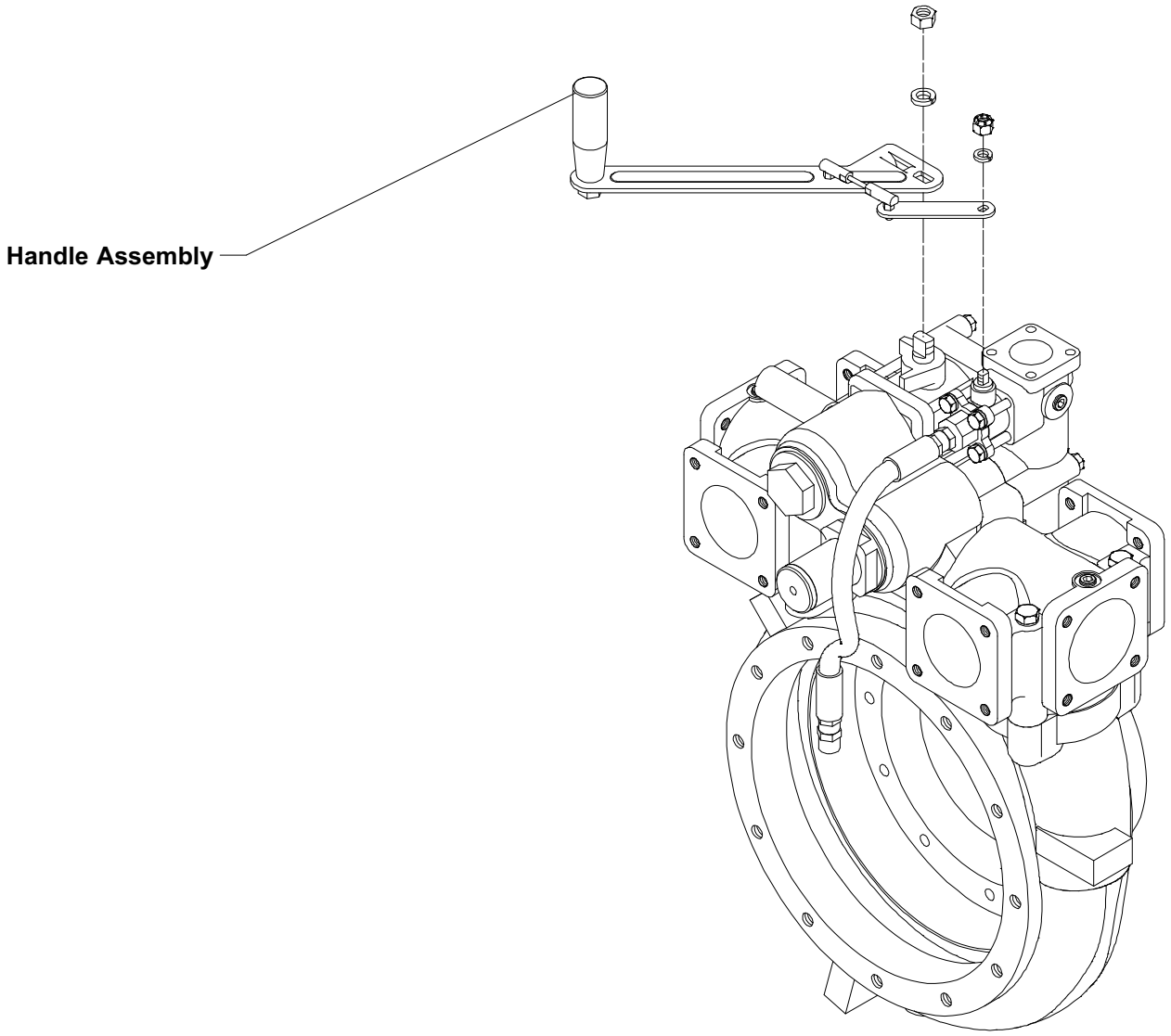
Remove Inboard Bearings

1. Restrain the drive end of the impeller shaft to prevent movement during locknut removal (On HL200D and HL300D models, the companion flange may be temporarily installed and used to restrain the shaft.)
2. Disengage washer tabs from locknut slots.
3. Remove locknut.
4. Remove washer.
5. Press bearings off shaft.



Remove Crossover Valve Actuator

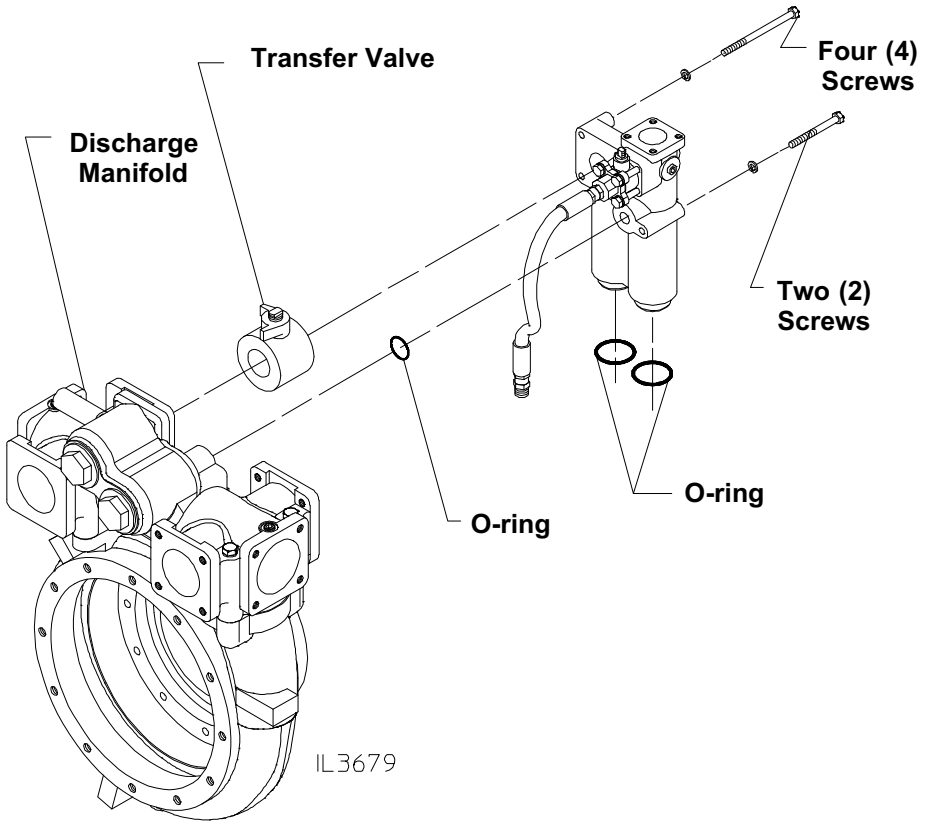
1. Remove the hex nuts attaching the handle assembly to transfer valve and return ball valve.
2. Remove the handles. Note that the linkage rod connecting the handles may be left attached.



Remove Interstage Manifold

Remove Interstage Manifold from Pump:

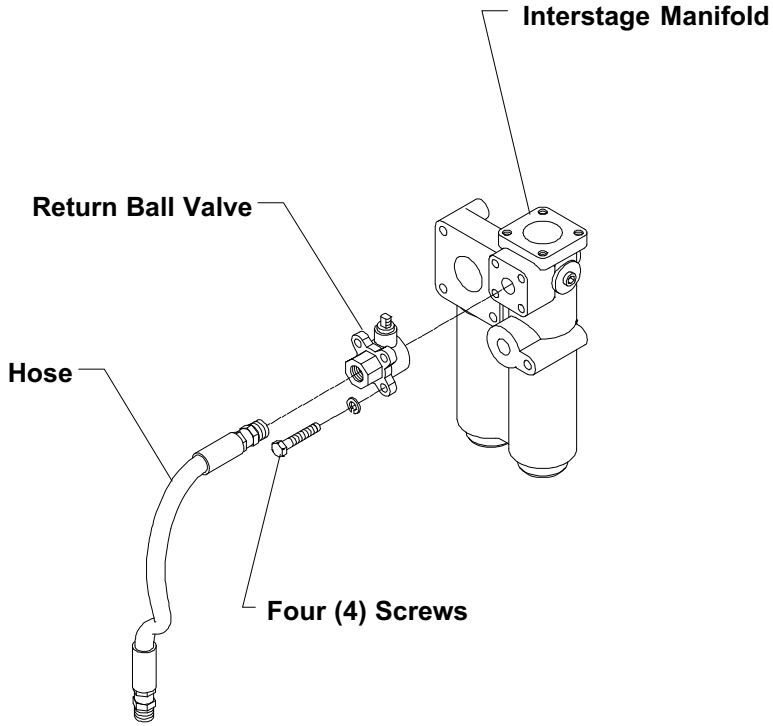
1. Note that if the discharge manifold is also being removed, the interstage manifold and discharge manifold may be removed as one unit (see next page). The interstage manifold may then be removed from the discharge manifold.
2. Remove the four (4) hex head screws from the transfer valve flange and two (2) hex head screws from the return ball valve flange.
3. Note that the transfer valve is trapped between the manifolds by the screws and will be loose.
4. Lift the interstage manifold off the pump while holding the transfer valve.



Remove Return Ball Valve from Interstage Manifold

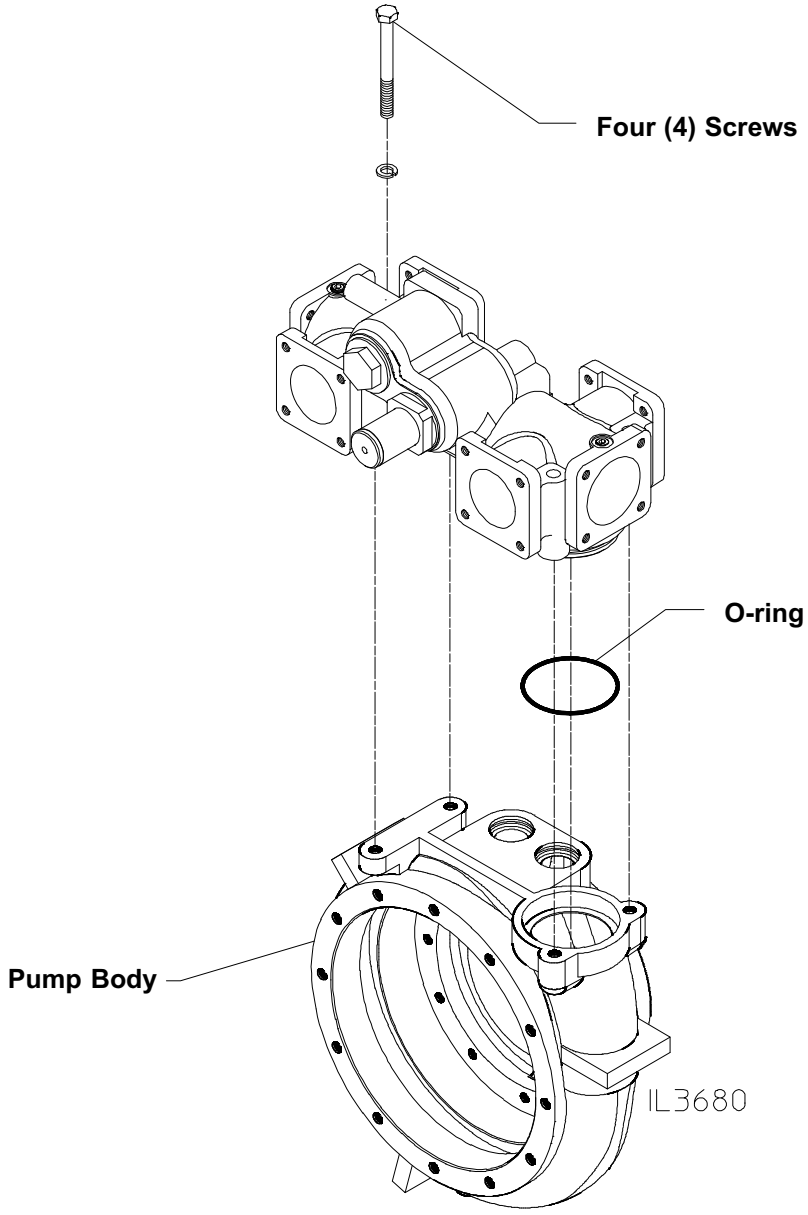
Remove Return Ball Valve from Interstage Manifold:

1. Disconnect the hose from the valve.
2. Remove the four (4) hex head screws from the valve flange.
3. Pull the valve away from the interstage manifold.



Remove Discharge Manifold

1. Remove the four (4) hex head screws which attach the manifold to the pump body.
2. Lift the manifold off the pump body.



Reassembly – Inspection and Repair

Mechanical Seal

Always install a new mechanical seal during reassembly. Follow seal installation instructions carefully.

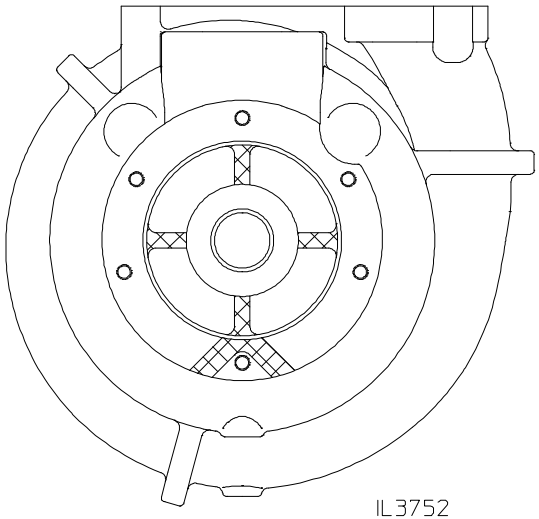
Impeller Shaft

Examine shaft for severe scratches, grooves and corrosion paying special attention to oil seal and mechanical seal shaft journals. If present, replace shaft. Minor scratches in non-critical areas will not affect pump performance. Also check for cracks, pitting, twisted splines and damaged keyways and replace the shaft if found.

Volute Body and Intake Fitting

Examine for cracks, corrosion or other damage. Replace defective parts.

Clean out the mechanical seal weep passageways in the pump volute as shown below.



Areas to be check and cleaned.

Impellers and Wear Rings

Check the wear rings and impeller hubs for deep grooves and scratches.

Wear rings are located as follows:

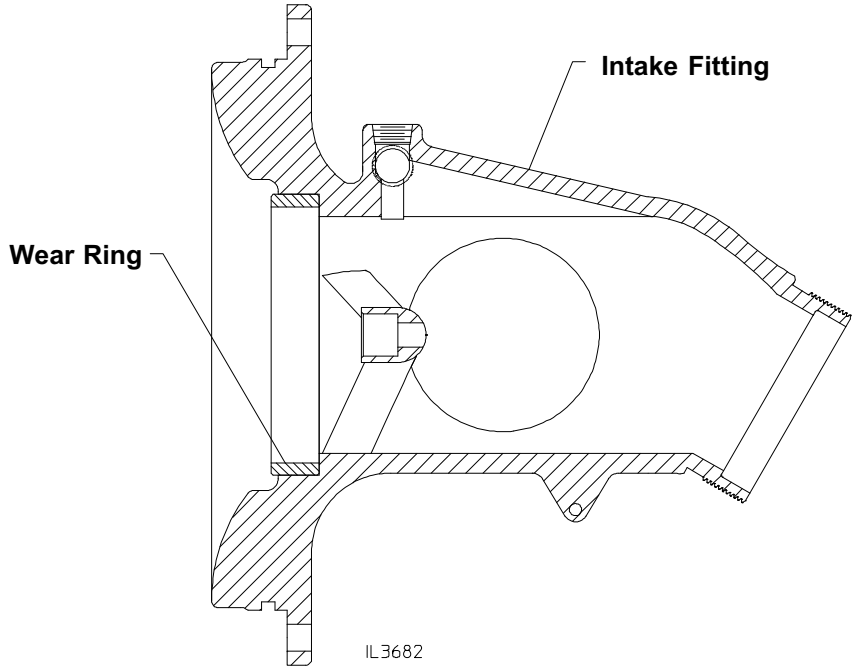
Main Stage Impeller: Separate wear ring installed in pump intake fitting.

High Pressure Impeller: Inside diameter of separator plate acts as wear ring.

Carefully measure the outside diameter of the impeller and the inside diameter of the wear ring/separator plate.

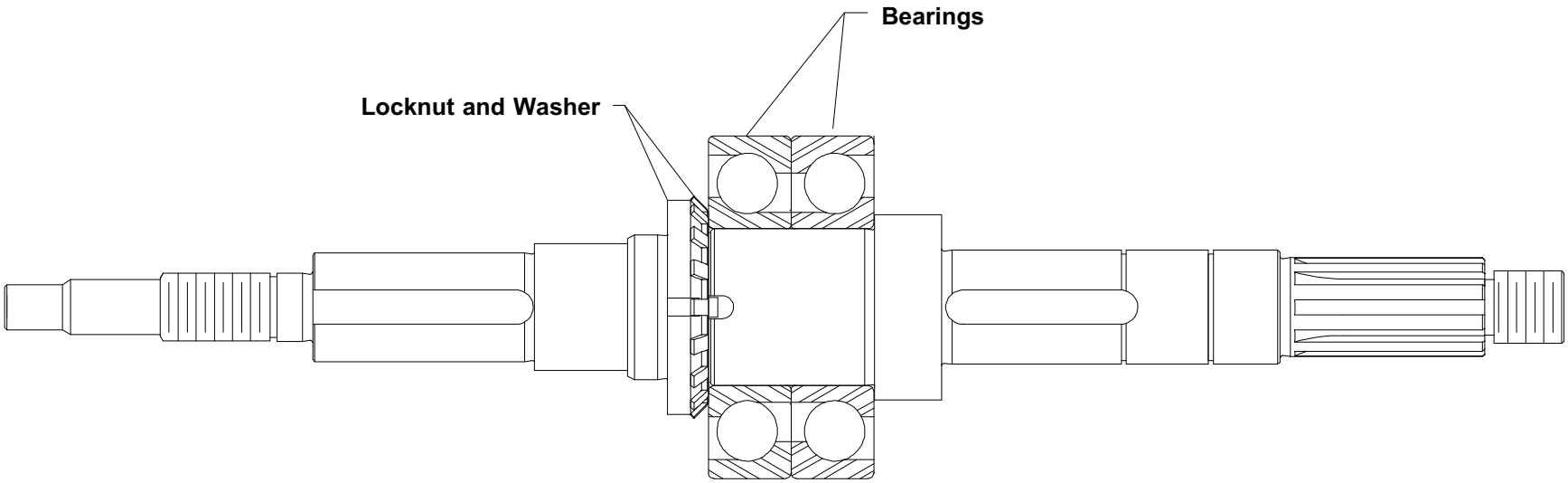
If the difference between these measurements exceeds .020 in. / .51 mm or if the components are scratched or grooved, replace the impeller and wear ring separator plate.

NOTE: The wear ring may be removed from the pump intake fitting by cutting the ring in two places and then prying the pieces out of the intake fitting. Install new wear ring by pressing it into the bore in the intake fitting.



Install Inboard Bearings

1. Align bearings back to back with inner races aligned as shown (ball cages back to back).
2. Press bearings on shaft.
3. Install the locknut washer.
4. Restrain the drive end of the impeller shaft to prevent movement during locknut installation (On HL200D and HL300D models, the companion flange may be temporarily installed and used to restrain the shaft).
5. Install the locknut. Torque to 120 lb-ft (163 N•m).
6. Install the locknut washer.
7. Bend washer tabs into slots of locknut.



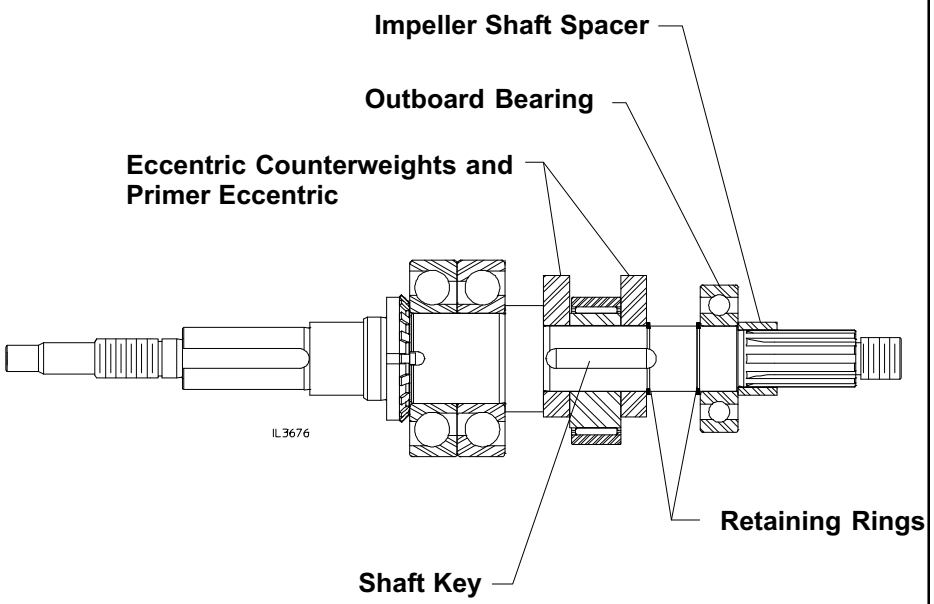
Install Primer Eccentric

HL200D and HL300D Direct Drive Models

1. Install the shaft key.
2. Slide the eccentric counter weights and primer eccentric onto the shaft.

NOTE: The primer eccentric consists of two (2) separate pieces (inner and outer races) which are held in place by the counterweights. Keep the counterweights and eccentric together as a unit during installation.

3. Install the two (2) retaining rings.
4. Install the impeller shaft spacer.
5. Press the outboard bearing on the shaft.

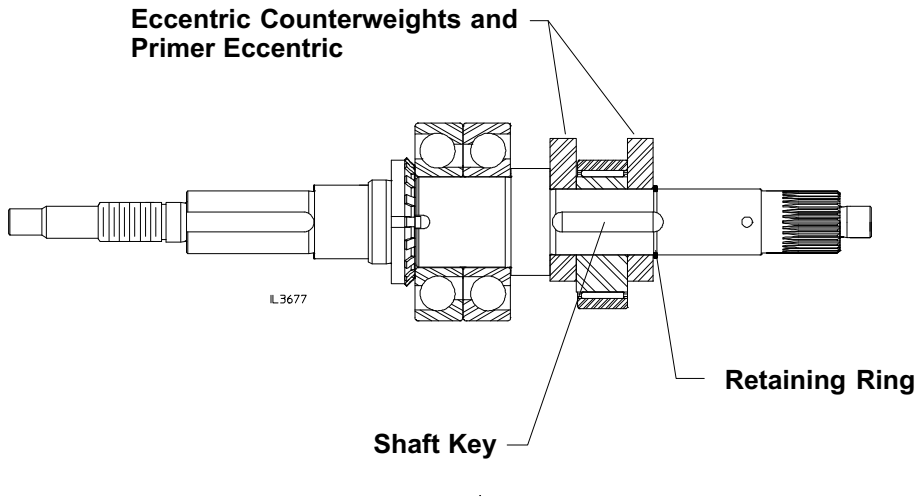


HL400D Direct Drive Models
HL200K, HL300K, HL400K Gear Drive Models

1. Install the shaft key.
2. Slide the eccentric counter weights and primer eccentric onto the shaft.

NOTE: The primer eccentric consists of two (2) separate pieces (inner and outer races) which are held in place by the counterweights. Keep the counterweights and eccentric together as a unit during installation.

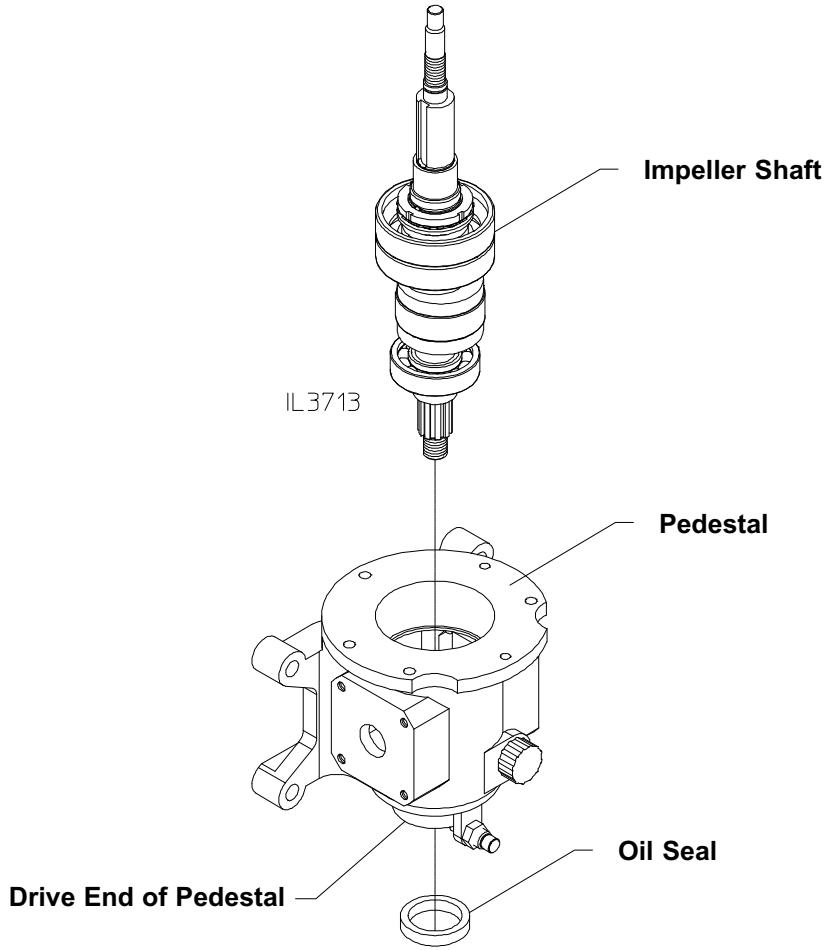
3. Install the retaining rings.



Install Impeller Shaft in Pedestal

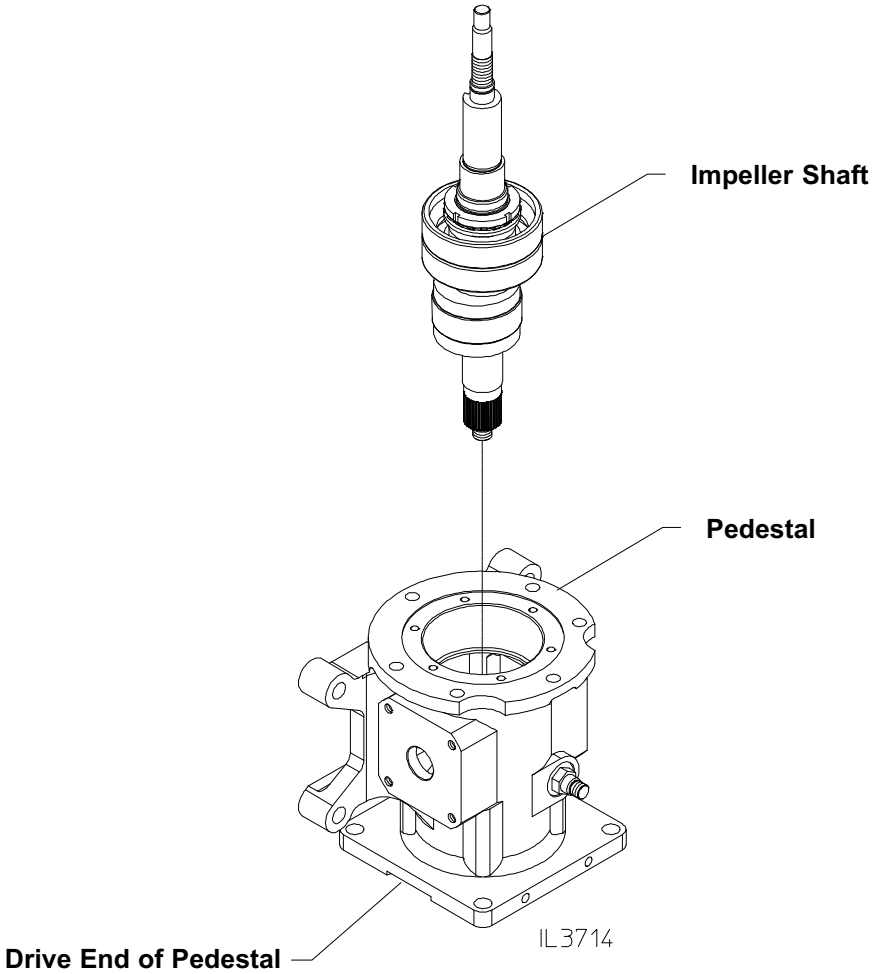
HL200D and HL300D Direct Drive Models

1. Stand pedestal on drive end flange.
2. Press impeller shaft into pedestal by applying force or lightly tapping on pump end of shaft.
3. Install the oil seal in the drive end of the pedestal.



HL400D Direct Drive Models
HL200K, HL300K, HL400K Gear Drive Models

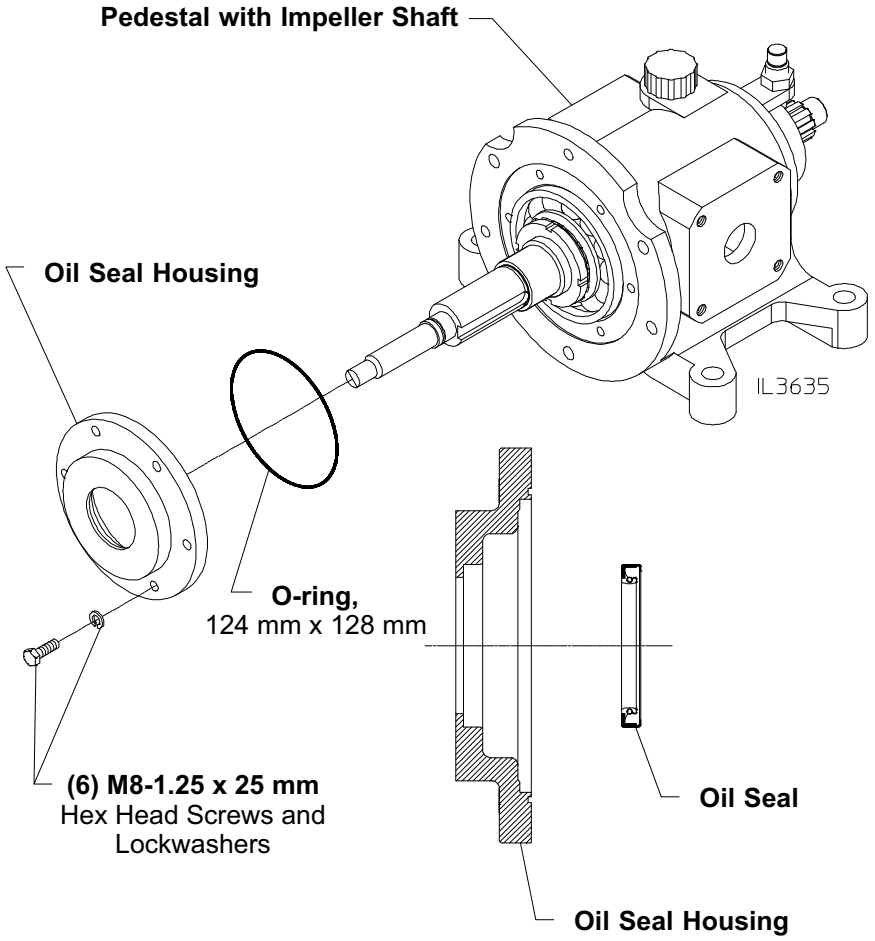
1. Stand the pedestal on drive end flange.
2. Press the impeller shaft into pedestal by applying force or lightly tapping on pump end of shaft.



Install Pedestal on Pump Body

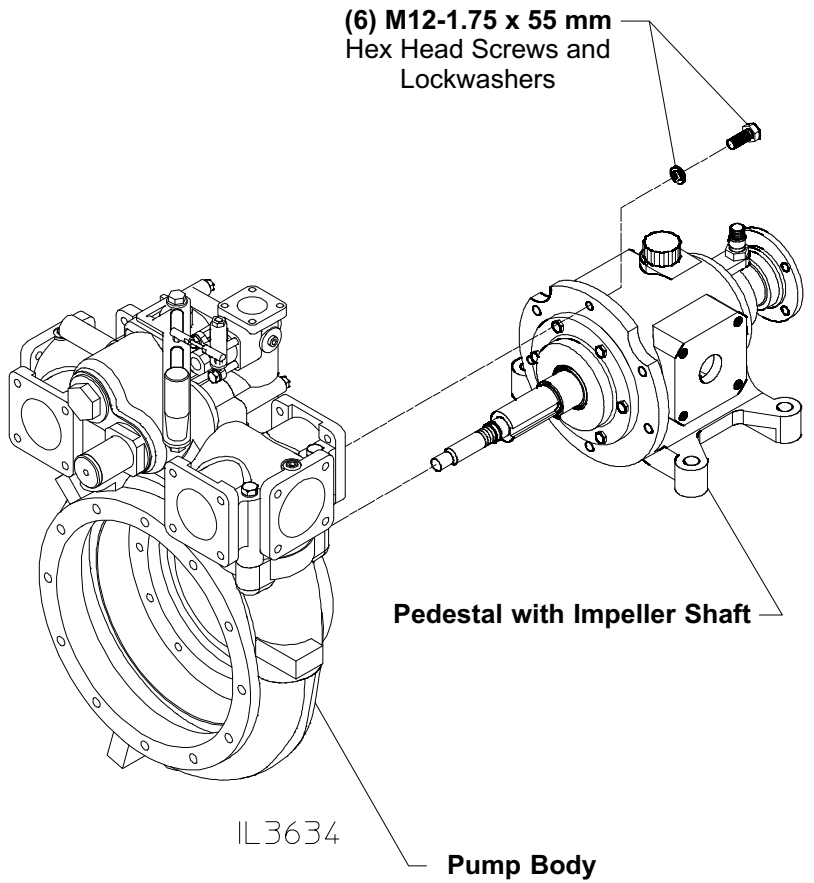
Install Pedestal Oil Seal

1. Install the oil seal in the oil seal housing.
2. Install the O-ring on oil seal housing.
3. Install the oil seal housing over the impeller shaft and outside diameter of the bearing.
4. Install the six (6) hex head screws and lock washers. Torque to 25 lb-ft. (34 N•m)



Install Pump Body on Pedestal

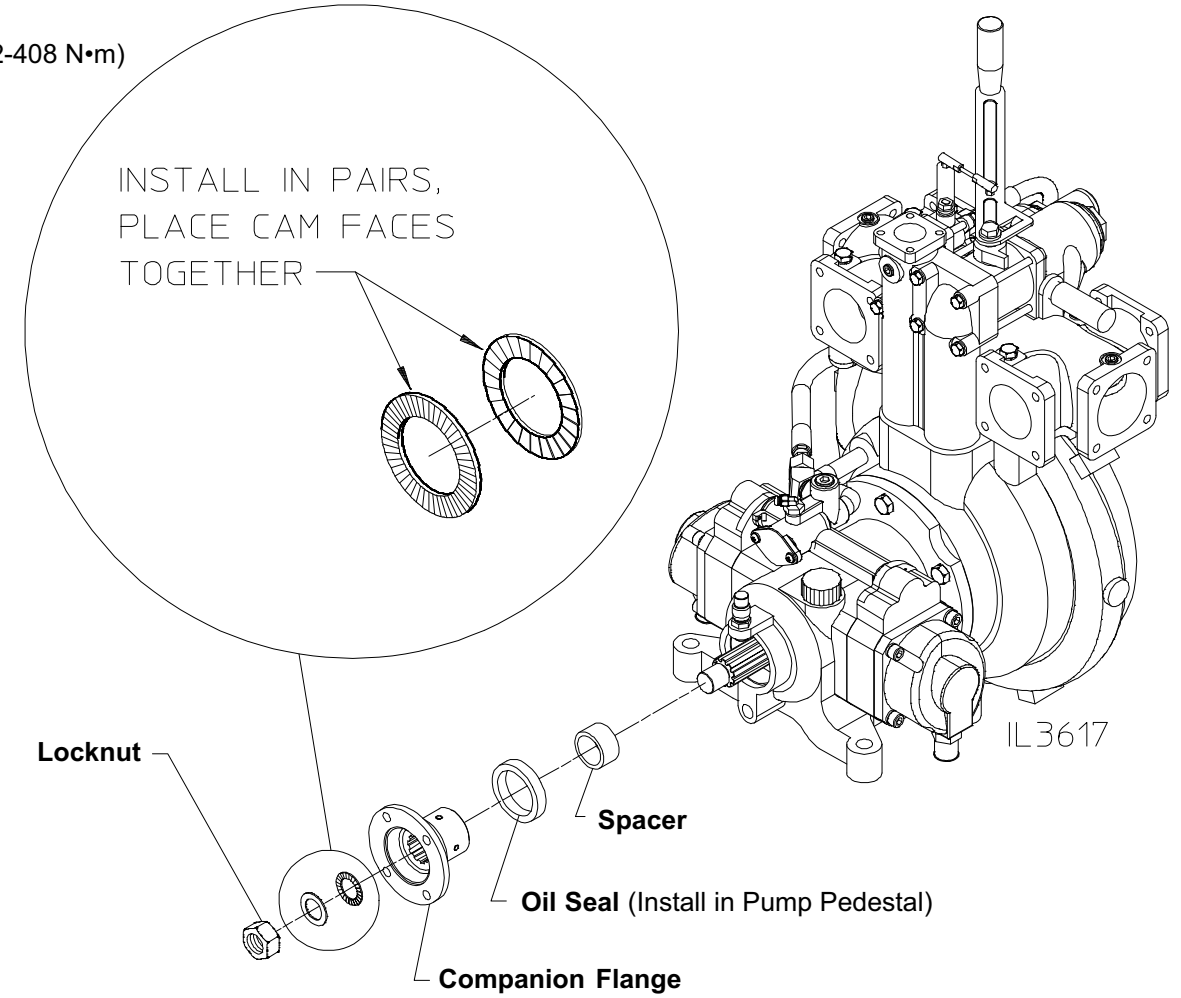
1. Install the pump body over the impeller shaft and outside diameter of the oil seal housing.
2. With pedestal and pump body in vertical position, install the six (6) hex head screws and lockwashers finger tight.
3. Mount an indicator dial to shaft and sweep pump body bore. Bore to be within .003 in. (.075 mm). Adjust if needed.
4. Torque the six (6) hex head screws to 40 lb-ft (54 N•m). Note that if the pump has an optional PIV, one screw retains the priming tube clip.
5. Recheck indicator.



HL200D and HL300D Direct Drive Models

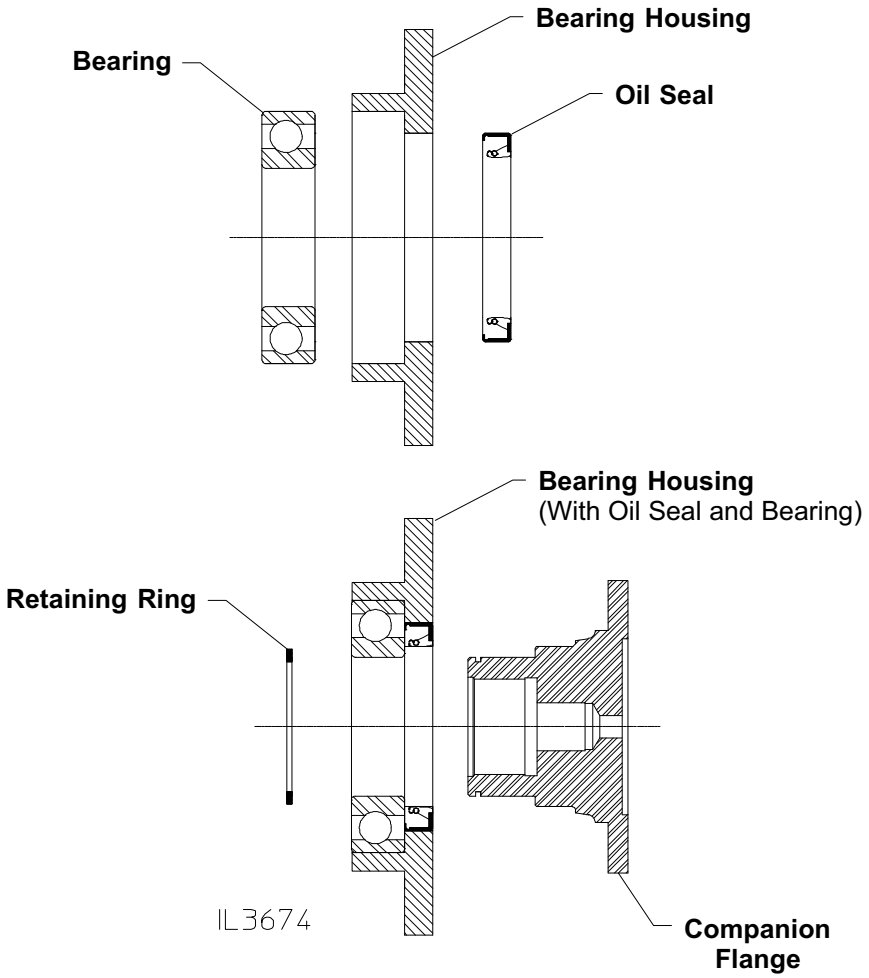
Install Companion Flange:

1. Install spacer on shaft.
2. Install oil seal in pump pedestal.
3. Slide companion flange onto shaft spline and into pedestal/oil seal.
4. Restrain the companion flange to prevent movement.
5. Install washer and locknut. Torque to 200-300 lb-ft . (272-408 N•m)
6. Install magnetic tachometer pick-up in pump pedestal.
   See page 37 for installation.



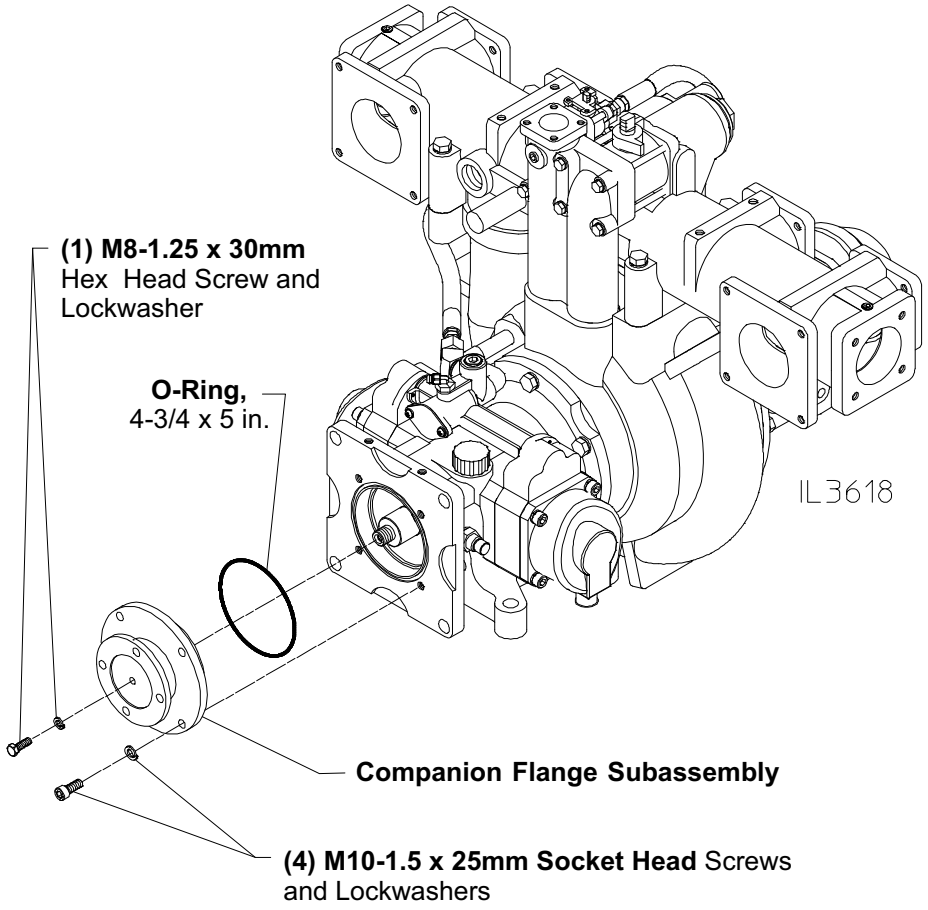
Assemble Companion Flange:

1. Install the oil seal in bearing housing.
2. Install bearing in bearing housing.
3. Lay the bearing housing on bearing side.
4. Press companion flange through bearing from the oil seal side.
5. install retaining ring in companion flange.
6. Tap bearing back into bearing housing to ensure bearing is seated in bore.



Install Companion Flange on Pump:

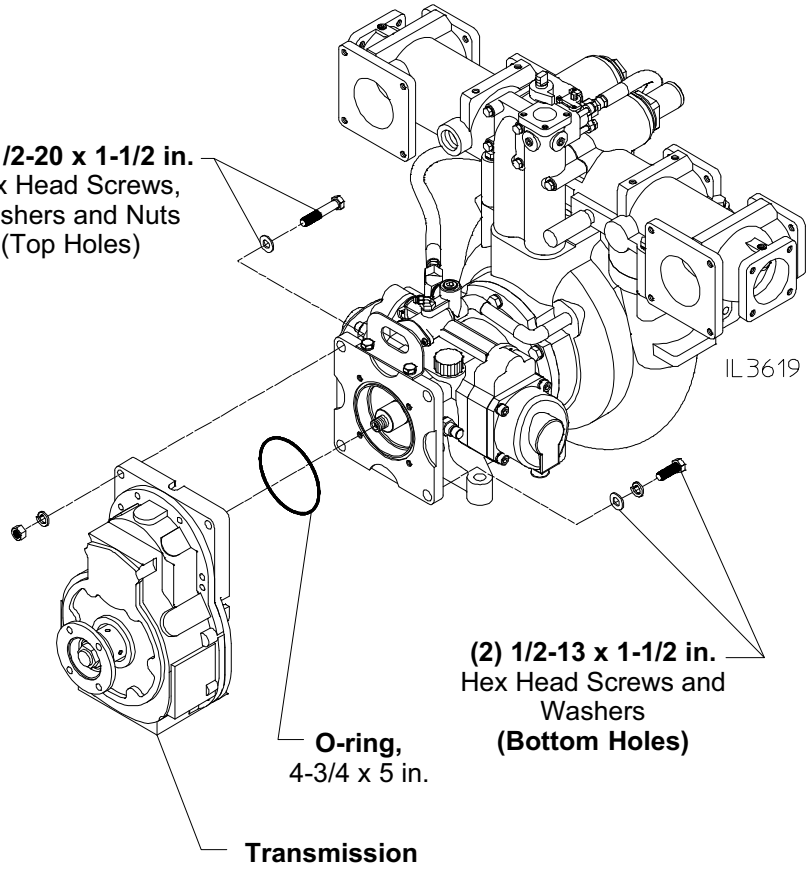
1. Install O-ring in groove on pump pedestal.
2. Slide companion flange/bearing housing back over shaft spline and into bearing housing.
3. Install the companion flange hex head screw and washer. Torque to 19 lb-ft. (27 N•m).
4. Install the four (4) socket head screws and washers attaching bearing housing to pump pedestal. Torque to 38 lb-ft (53 N•m).
5. Install magnetic tachometer pick-up in pump pedestal. See Page 37 for installation.



Install Transmission

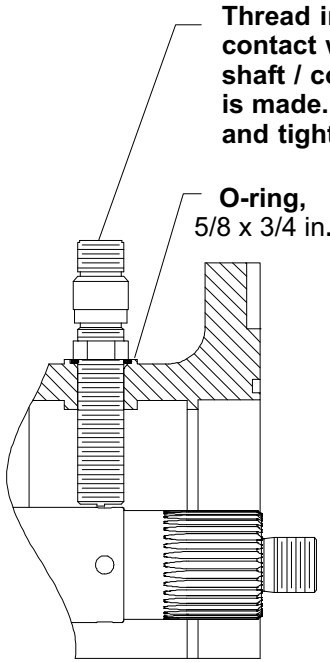
HL200K, HL300K and HL400K Gear Drive Models

1. Install O-ring in the groove on pump pedestal.
2. Slide the transmission onto shaft spline.
3. Install the four (4) bolts attaching transmission to pump. Torque to 50 lb-ft (68 N•m).

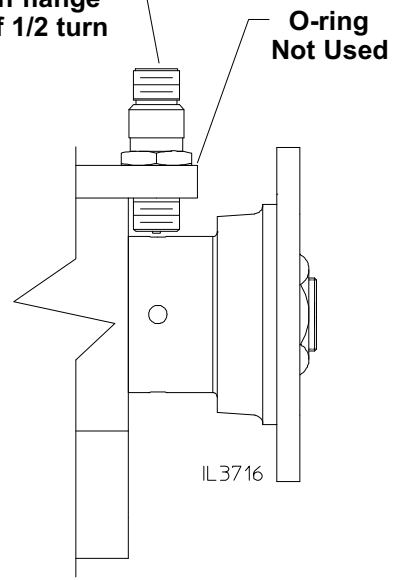


Install Magnetic Tachometer Pick–up

1. Install O-ring in groove on pedestal (HL200K, HL300K, HL400D and HL400K models only. O-ring is not used on HL200D and HL300D models).
2. Thread pick-up completely into pedestal (finger tight).
3. Back out 1/2 turn.
4. Slowly turn shaft to ensure pick-up is not contacting moving parts.
5. Repeat process until shaft turns freely.
6. Tighten locknut.



Models HL200K, HL300K, HL400D

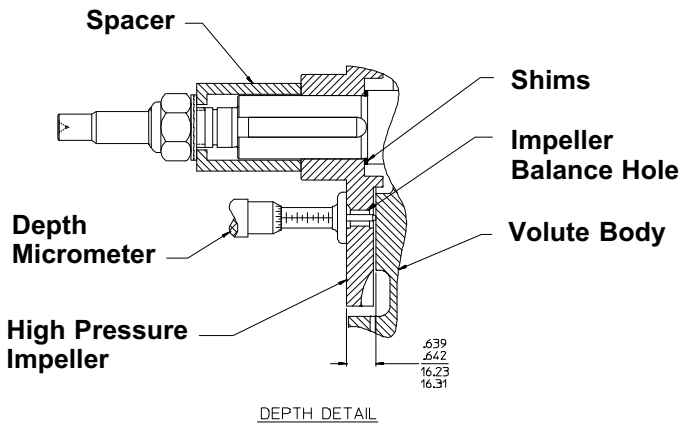


Models HL200D, HL300D

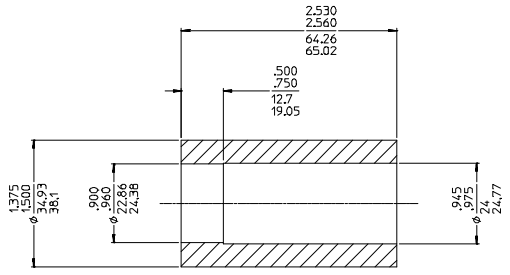
Reassembly - Shim High Pressure Impeller

Determine Amount of Shims Required

1. Using shim pack Waterous part no. 52880, install two (2) .010 in. (.254 mm) thick shims on the impeller shaft. Note that the shim pack includes two (2) .002 in. (.050 mm), one (1) .005 in. (.127 mm) and three (3) .010 in. (.254 mm) shims.
2. Install impeller key and high pressure impeller.
3. Install a temporary spacer on the shaft. See Spacer Detail for fabrication details.
4. Install the impeller washer and locknut.
5. Restrain the companion flange on the drive end of the pump from moving and torque locknut to 140-150 lb-ft (190-203 N•m).
6. Check the gap measurement between the high pressure and volute body with a depth gauge. Insert the gauge through one of the holes in the impeller. See Depth Detail below.
7. The gauge must read between .639 and .642 (16.23 and 16.31 mm). This dimension sets the clearance at .009 to .012 in. (.23 to .31mm).
8. If the measurement does not meet the required gauge reading, add or remove shims until the required clearance is achieved.
9. Remove the impeller and temporary spacer leaving the correct shims on the impeller shaft.



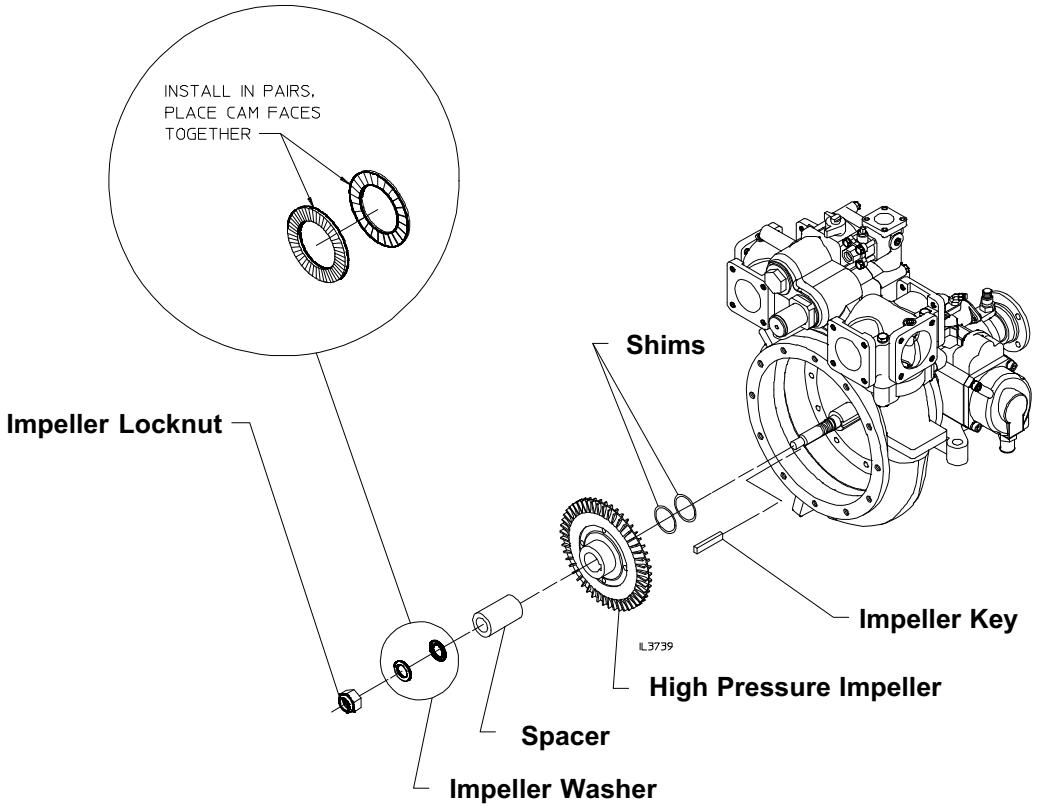
DEPTH DETAIL



SPACER DETAIL
MATERIAL: STEEL OR ALUMINUM BAR STOCK

ALL DIMENSIONS SHOWN AS INCH/MILLIMETER

(INCH / MILLIMETER)

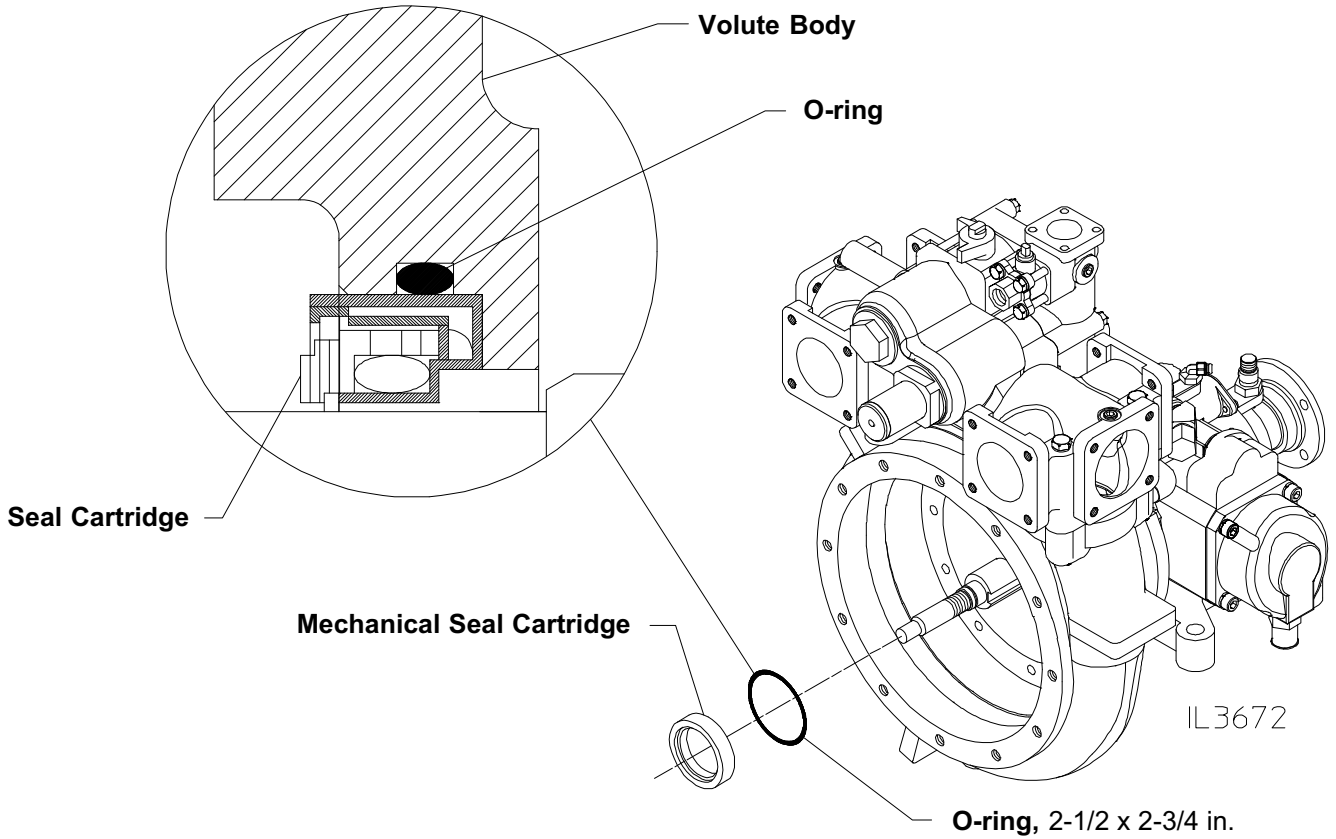


Install Mechanical Seal

NOTICE

The mechanical seal stationary ring and cartridge carbon ring are made of brittle material. The material can easily be cracked or chipped. Extra care must be taken when handling.

1. Install O-ring in the bore groove in the volute body.
2. Apply a light coating of lubricant to the outside of the mechanical seal cartridge and O-ring in the volute body bore.
3. Install the mechanical seal cartridge in the volute body bore with the raised carbon ring side facing out. Gently tap the outside metal ring of the cartridge until seated.
4. Wipe the exposed face of the seal cartridge with a clean lint free cloth or tissue paper to remove any seal lubricant.

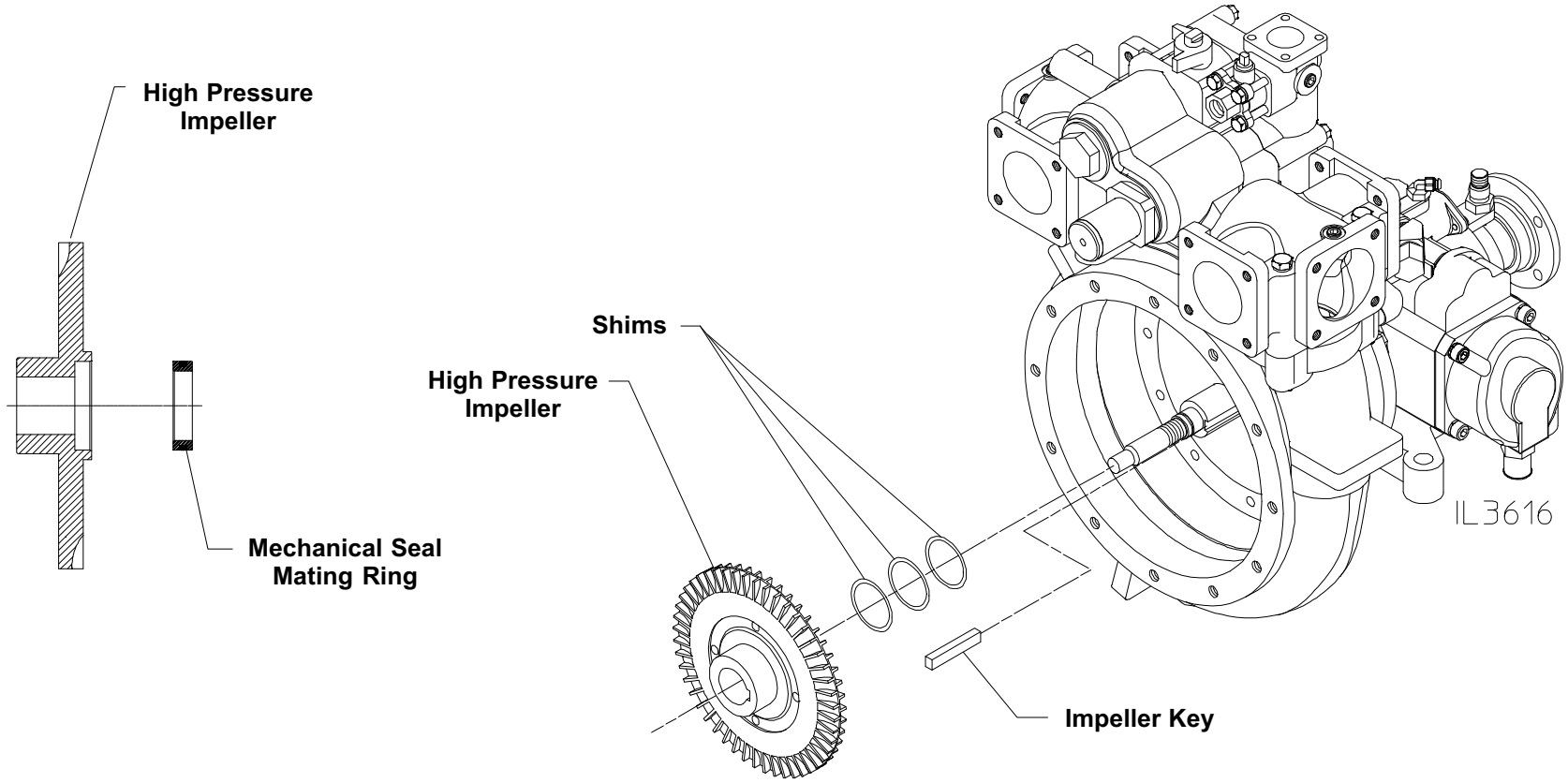


Install High Pressure Stage Impeller

NOTICE

The mechanical seal stationary ring and cartridge carbon ring are made of brittle material. The material can easily be cracked or chipped. Extra care must be taken when handling.

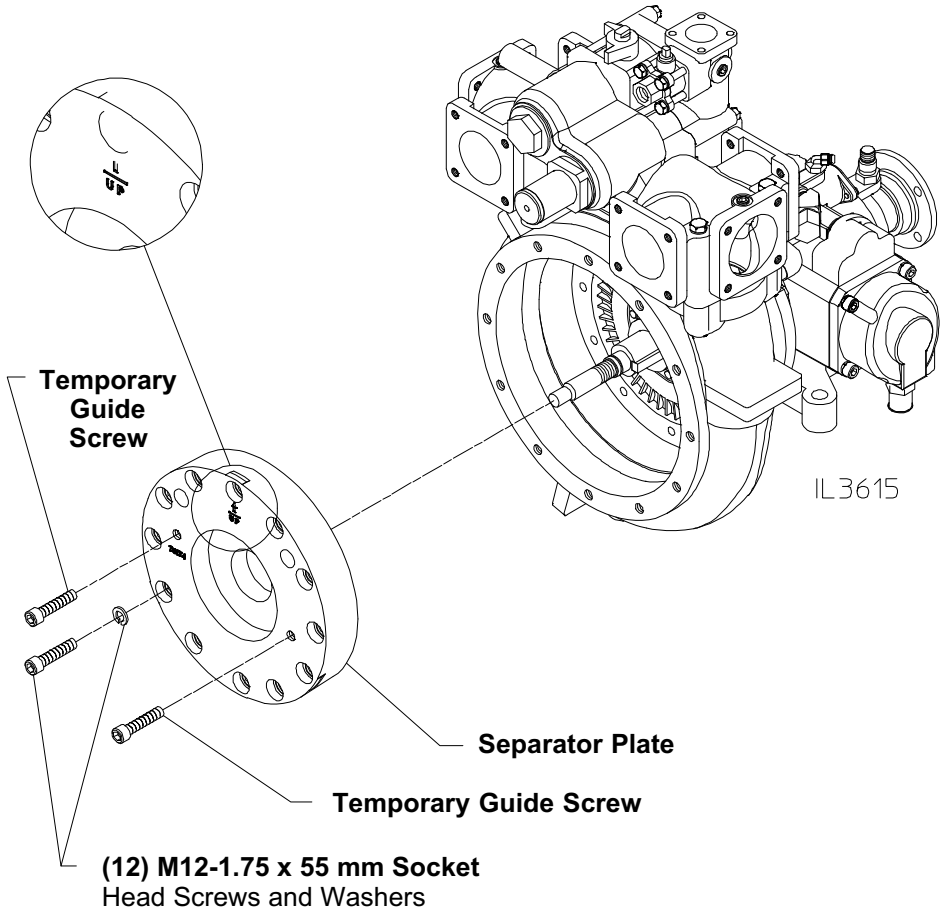
1. Apply a light coating of lubricant to the O-ring on the mechanical seal mating ring.
2. Install the mechanical seal mating ring in the high pressure impeller bore with the polished side facing out. If it cannot be seated by hand, lightly tap into place with a piece of wood, being careful not to scratch or mar the polished face.
3. Wipe the exposed face of the seal mating ring with a clean lint free cloth or tissue paper to remove any seal lubricant.
4. Install impeller key, shims and high pressure impeller.



Install Separator Plate

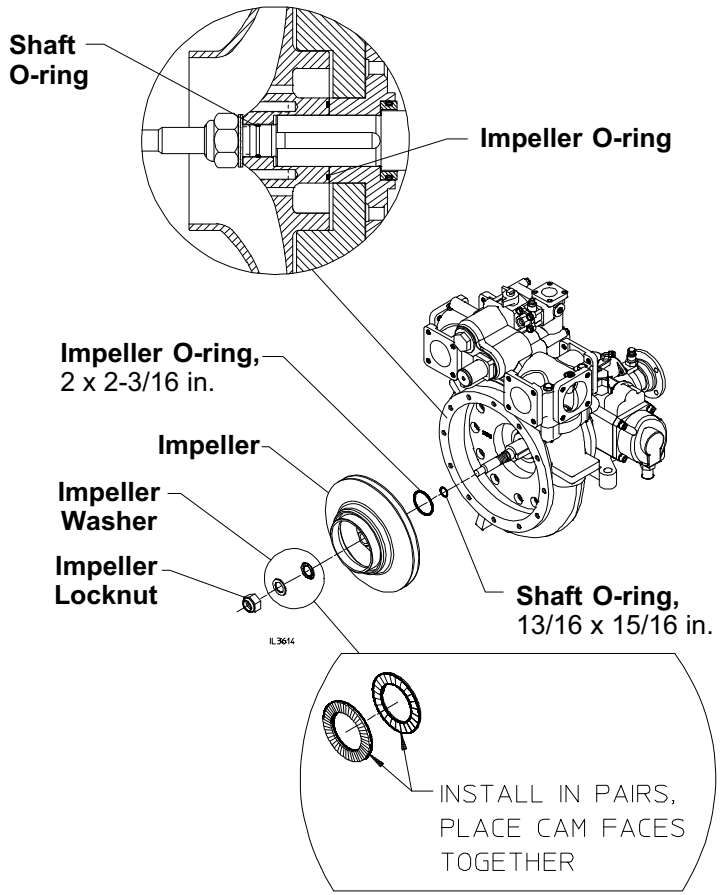
NOTE: Long M12 bolts may be installed in the two (2) M12-1.75 tapped holes and used as handles to guide the separator plate into the pump.

1. Locate the marking indicating the up position of the separator plate.
2. Install separator plate over the impeller shaft and hub of the high pressure impeller. The up marking must be facing out and point in the direction of the pump discharge.
3. Install the twelve (12) socket head screws and washers using Blue Loctite. Torque to 40-45 lb-ft (54-61 N•m).



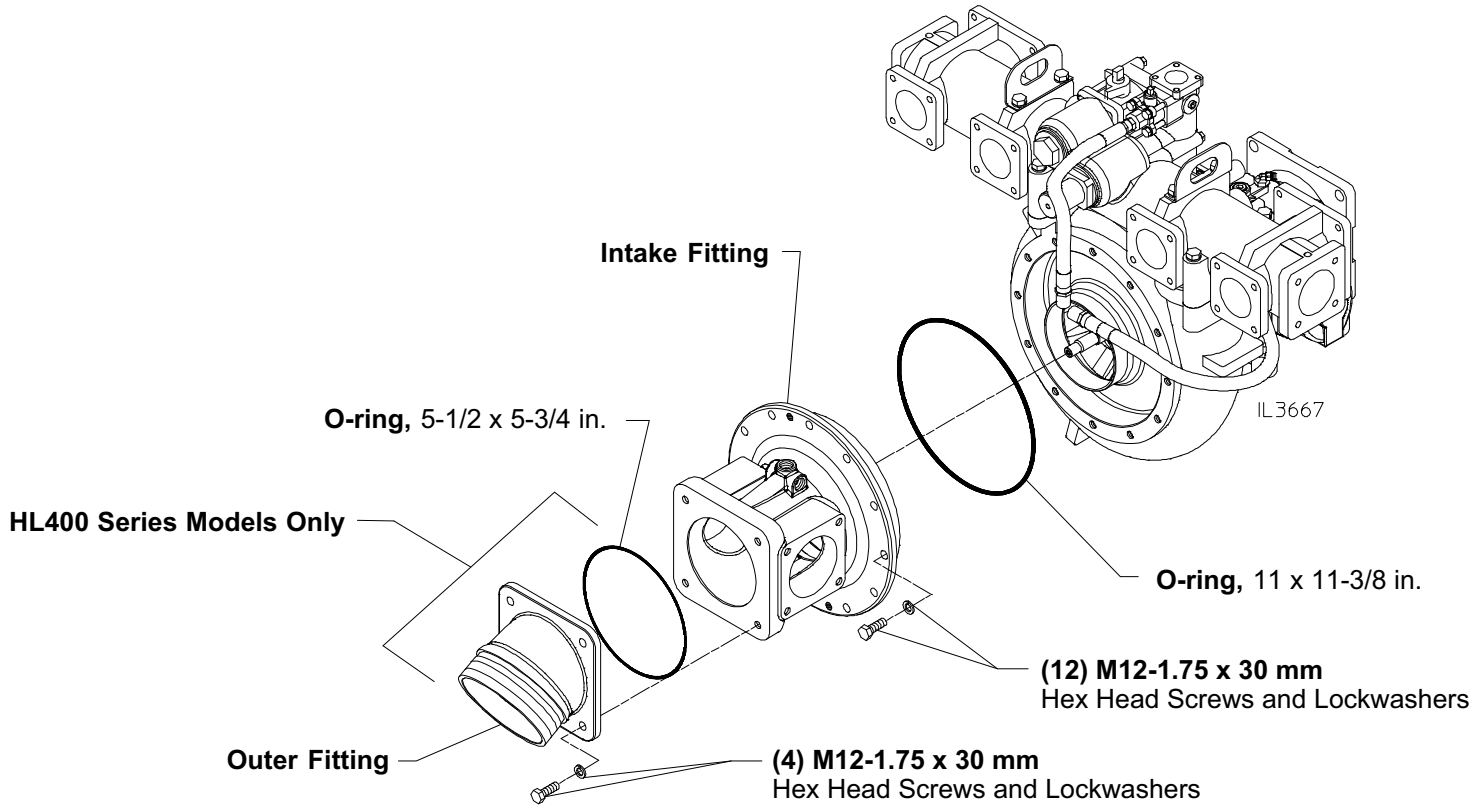
Install Main Stage Impeller

1. Install the small O-ring on the impeller shaft and the larger O-ring in the back side of the impeller.
2. Install the impeller on the shaft, engaging the key.
3. Install the impeller washer. The washer faces must be orientated so the cam faces engage. See Washer Detail.
4. Install the impeller locknut.
5. Restrain the companion flange on the drive end of the pump from moving and torque locknut to 140-150 lb-ft 9190-203 N•m).



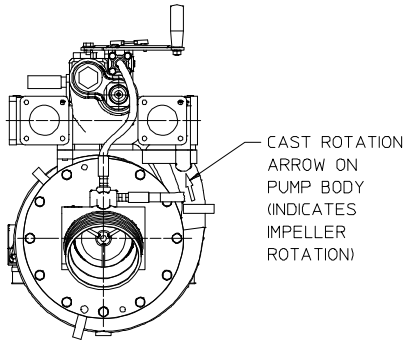
Install Intake Fitting

1. Install the O-ring in the groove on the intake fitting.
2. Carefully install the intake adapter over the impeller shaft. The end of the impeller shaft must nest into the internal bearing in the intake adapter.
3. Temporarily install two (2) hex head screws without washers on opposite side of the intake fitting.
4. Tighten the two (2) screws to bring the intake flange in contact with the volute body flange.
5. Rotate the impeller shaft. There should be no contact between the impeller and wear ring in the intake adapter.
   a. If there is no contact, install the twelve (12) screws and lockwashers and tighten evenly from side to side. Torque to 67 lb-ft (91 N•m).
   b. If there is contact, correct before proceeding. Check the following causes of the contact:
      1. Raised burr or nick on either the impeller hub or wear ring.
      2. Wear ring was cocked when installed in intake adapter and is deformed sufficiently to contact the impeller.
   c. Once the contact issue is resolved, install the twelve (12) screws and lockwashers an tighten evenly from side to side. Torque to 67 lb-ft (91 N•m).
6. HL400 Series Models Only: If the outer fitting was removed, install the fitting with the O-ring. Torque the four (4) screws to 67 lb-ft (91 N•m).

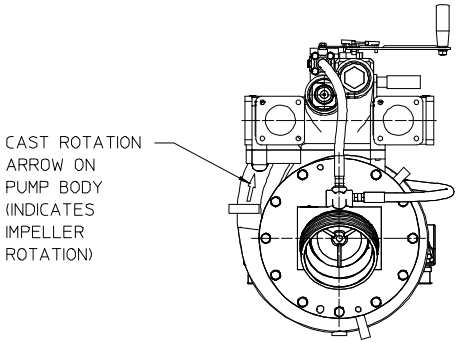


Determining Impeller Rotation

1. The assembly of the discharge components varies slightly based on Pump Model and input rotation.
2. The input rotation of the drive end of the pump determines the direction the pump impeller rotates.
3. If you are unsure of the impeller rotation of your pump, the cast rotation arrow on the pump body can be used to determine which rotation configuration you have. The pump model can be obtained from the serial plate attached to the pump intake fitting. Compare your pump to the diagrams below.

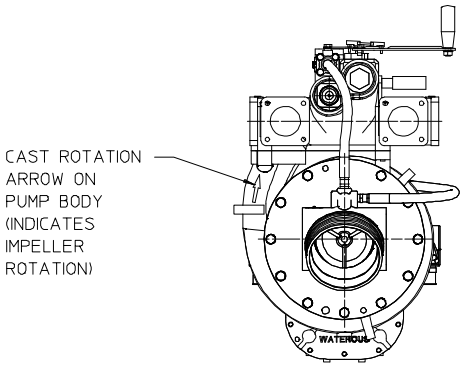


CLOCKWISE (CW) INPUT ROTATION
COUNTER-CLOCKWISE (CCW) IMPELLER ROTATION

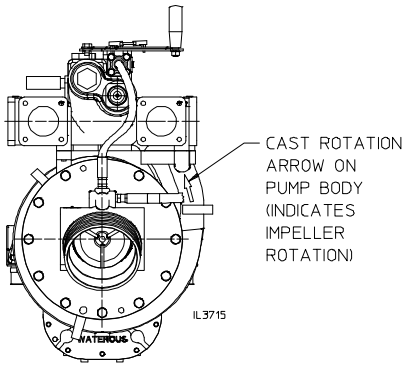


COUNTER-CLOCKWISE (CCW) INPUT ROTATION
CLOCKWISE (CW) IMPELLER ROTATION

MODELS HL200D, HL300D AND HL400D



CLOCKWISE (CW) INPUT ROTATION
CLOCKWISE (CW) IMPELLER ROTATION

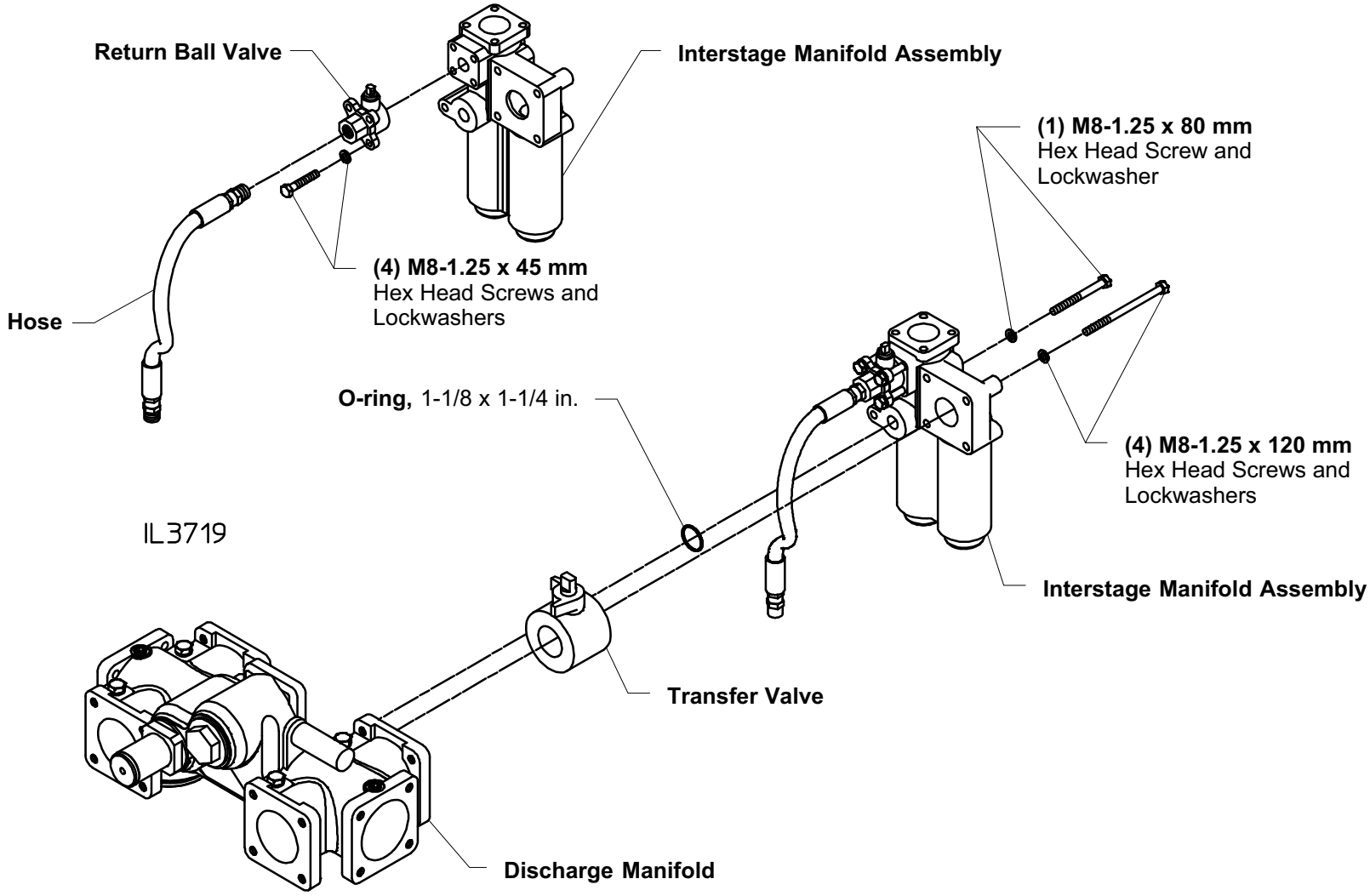


COUNTER-CLOCKWISE (CCW) INPUT ROTATION
COUNTER-CLOCKWISE (CCW) IMPELLER ROTATION

MODELS HL200K, HL300K AND HL400K

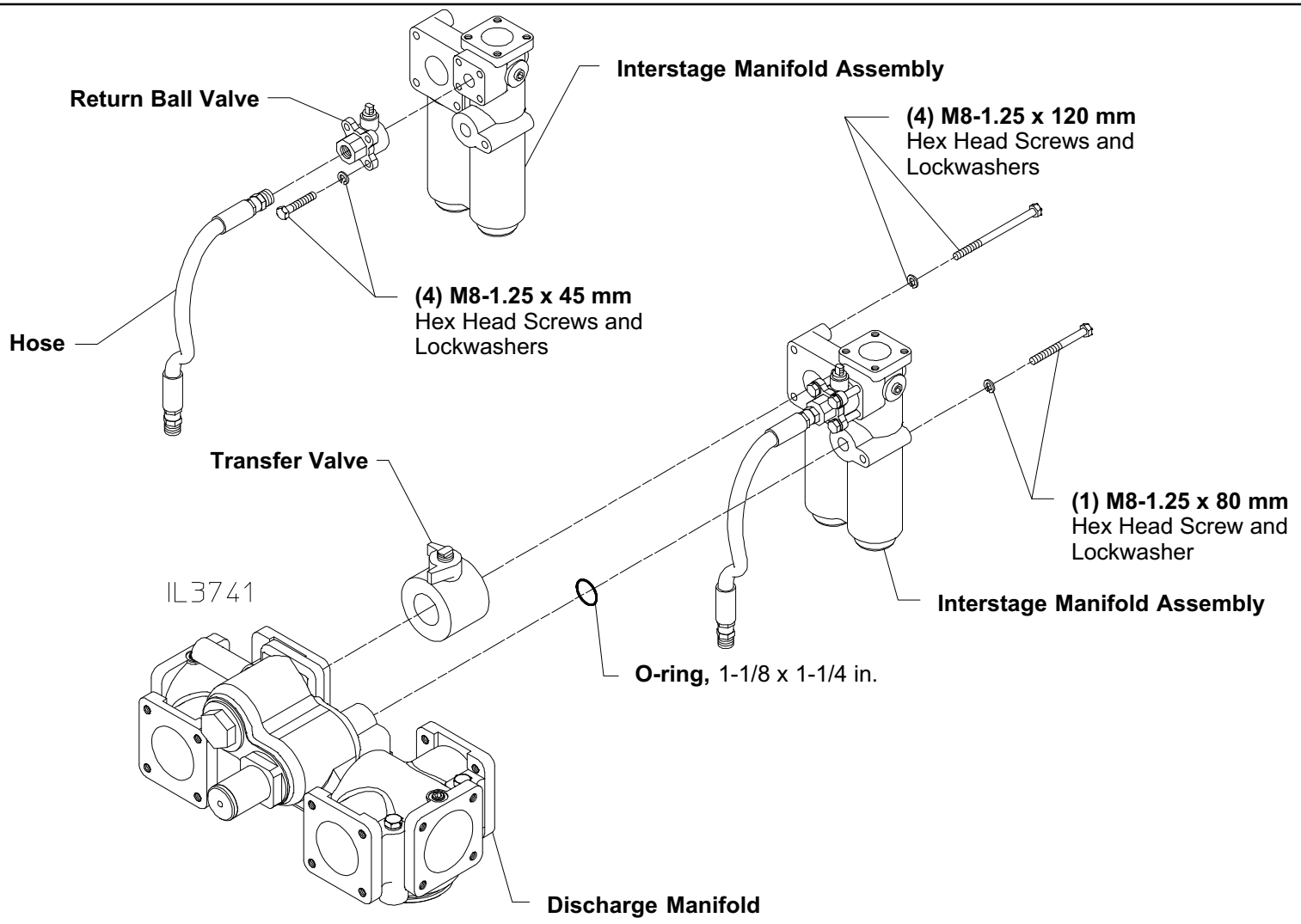
Install Interstage Manifold *(CW Impeller Rotation)*

1. Install the return ball valve on the interstage manifold with four (4) hex head screws and lockwashers. Torque to 13 lb-ft (18 N•m).
2. Connect the hose to the return ball valve.
3. Install O-ring in groove of discharge manifold.
4. While holding the transfer valve in position, install the interstage manifold on the discharge manifold. Install the four (4) hex head screws and lockwash-ers. Torque to 13 lb-ft (18 N•m). Note that the transfer valve is trapped between the interstage and discharge manifolds by the screws and must be orient-ated as shown in the diagram.



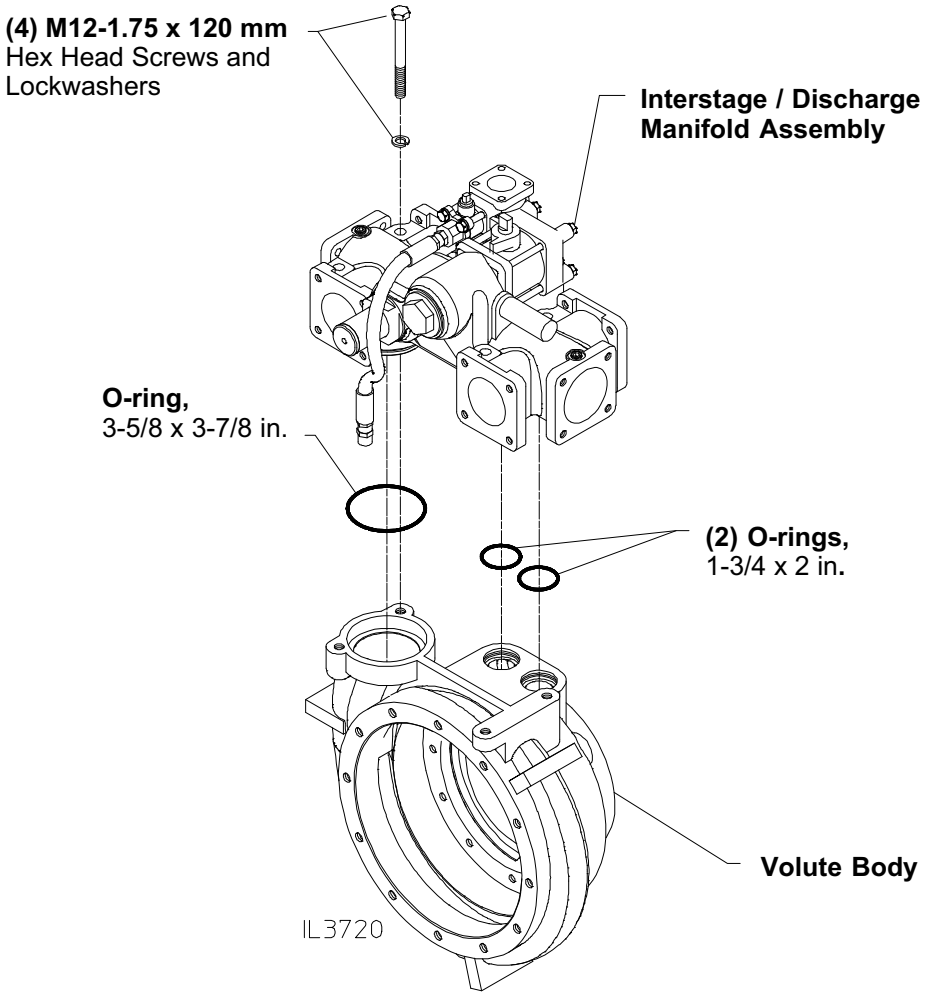
Install Interstage Manifold *(CCW Impeller Rotation)*

1. Install the return ball valve on the interstage manifold with four (4) hex head screws and lockwashers. Torque to 13 lb-ft (18 N•m).
2. Connect the hose to the return ball valve.
3. Install O-ring in groove of discharge manifold.
4. While holding the transfer valve in position, install the interstage manifold on the discharge manifold. Install the four (4) hex head screws and lockwashers. Torque to 13 lb-ft (18 N•m). Note that the transfer valve is trapped between the interstage and discharge manifolds by the screws and must be orient-ated as shown in the diagram.

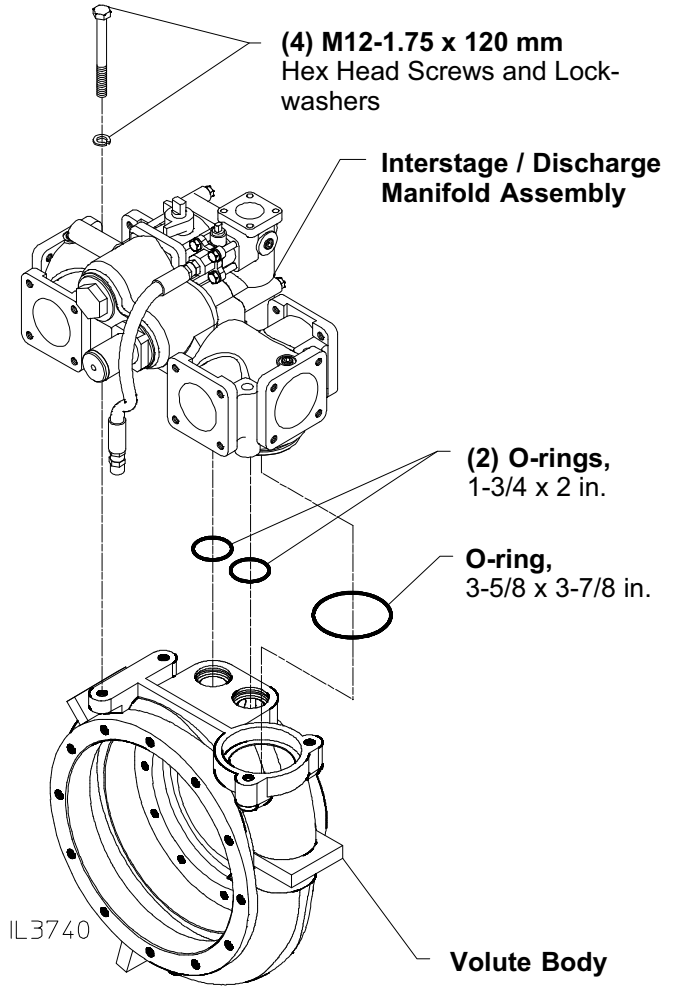


Install Discharge Manifold *(Either Rotation)*

1. Install the two (2) O-rings in the volute body bores.
2. Install the single O-ring in the groove on the manifold pilot diameter.
3. Install the discharge manifold on the pump body aligning the manifolds with the volute body bores.
4. Install the four (4) hex head screws and lockwashers. Torque to 25 lb-ft (34 N•m).



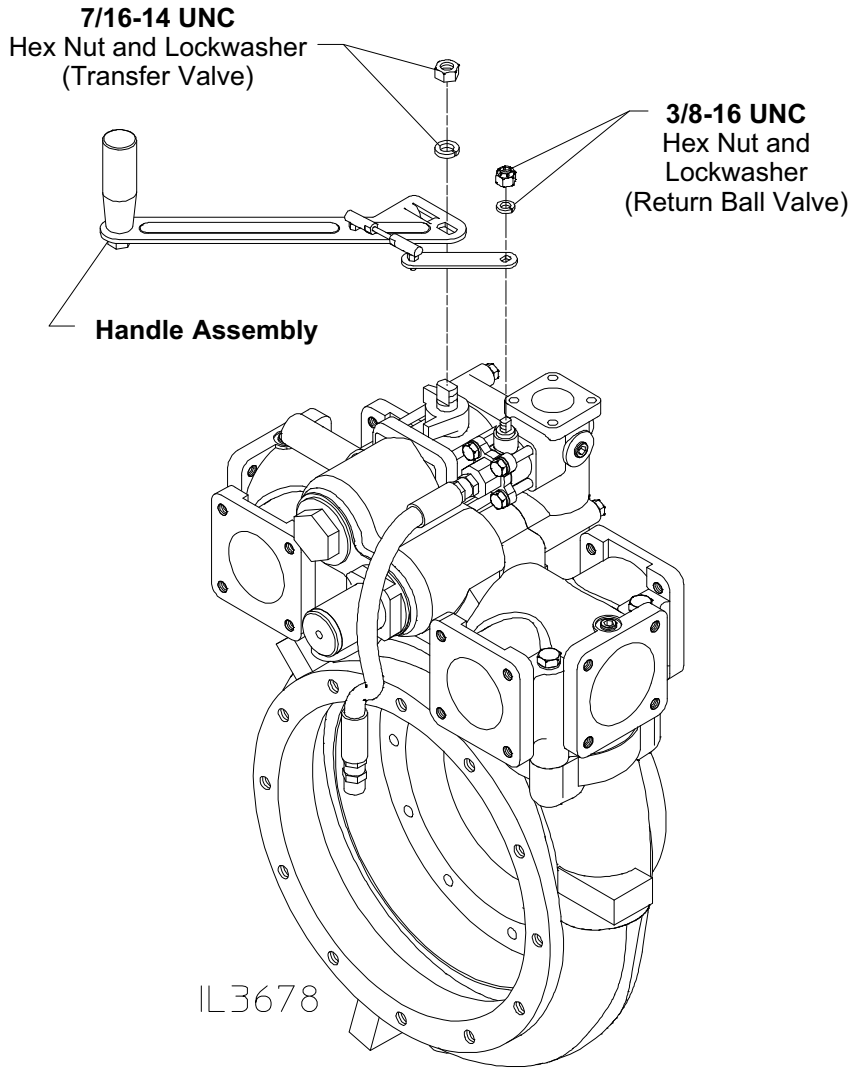
CW Impeller Rotation
(Reference Page 43)

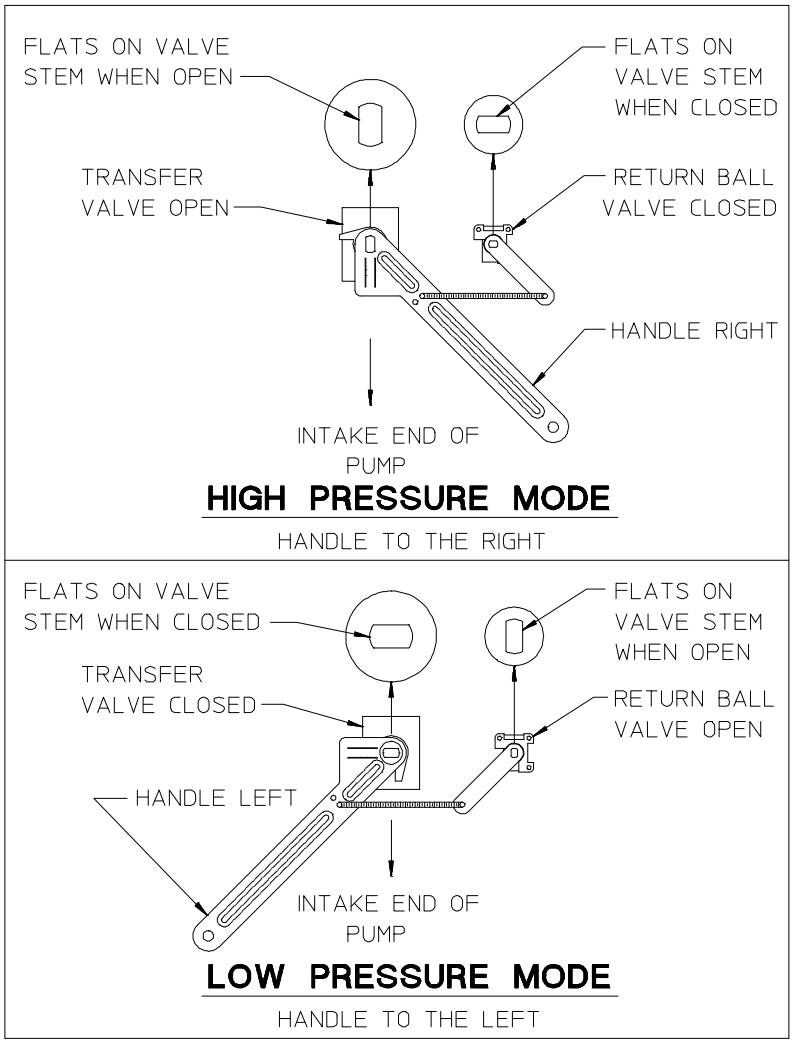


CCW Impeller Rotation
(Reference Page 43)

Install Crossover Valve Actuator *(CCW Impeller Rotation)*

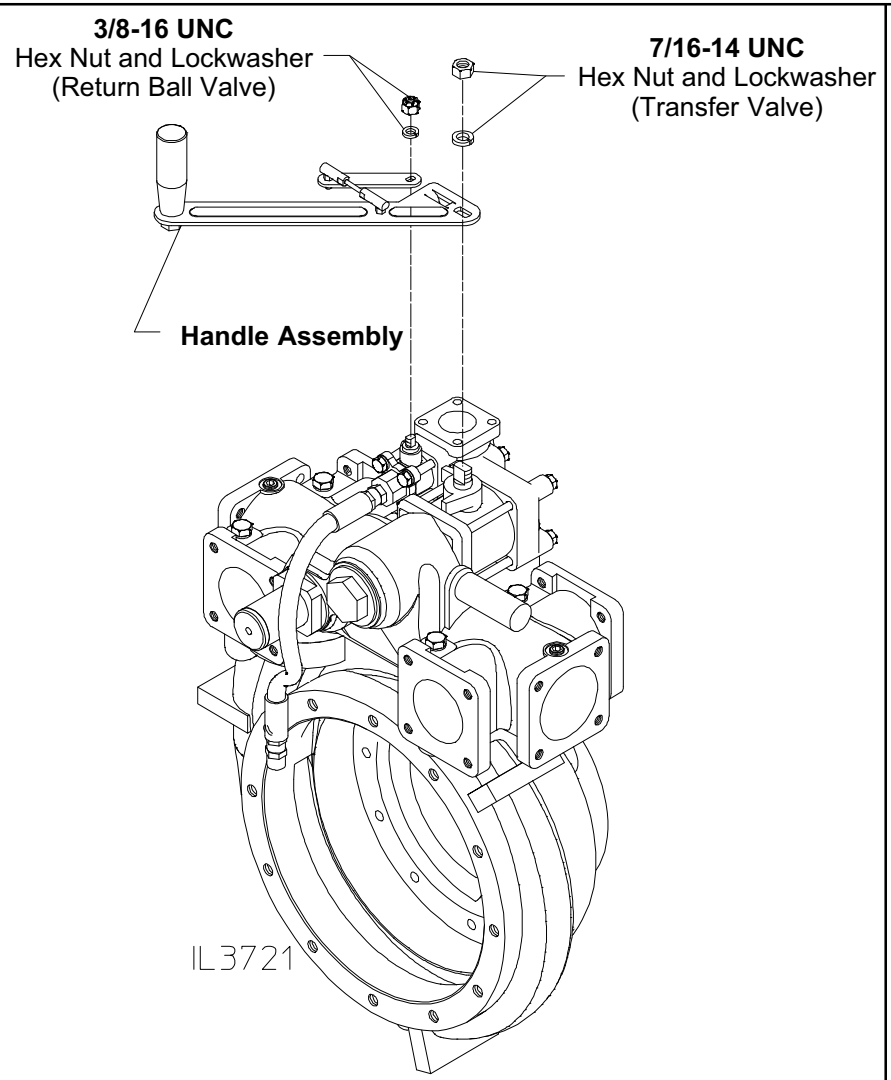
1. Position transfer valve and return ball valve stems in the positions shown.
2. Install handles on transfer valve and return ball valve with the hex nuts and lockwashers.
3. If the linkage rod was removed, reconnect to handles. Adjust handle travel by decreasing or increasing the thread engagement in handles so that both valves fully open and close.

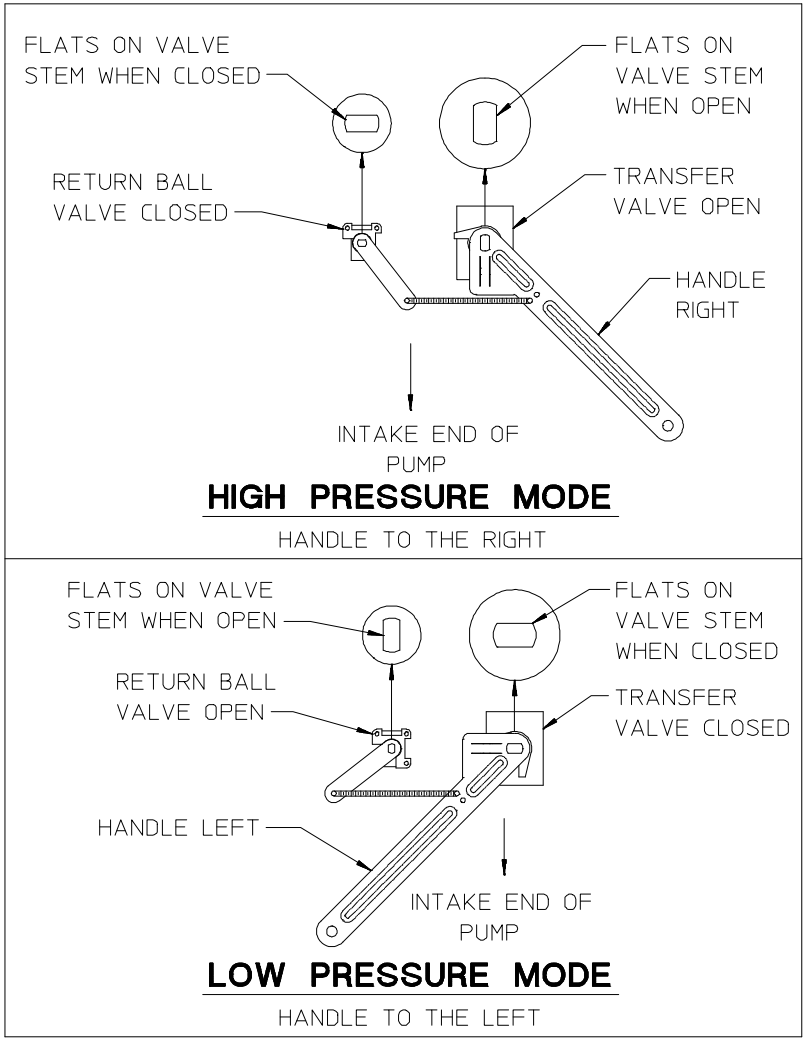




Install Crossover Valve Actuator *(CW Impeller Rotation)*

1. Position transfer valve and return ball valve stems in the positions shown.
2. Install handles on transfer valve and return ball valve with the hex nuts and lockwashers.
3. If the linkage rod was removed, reconnect to handles. Adjust handle travel by decreasing or increasing the thread engagement in handles so that both valves fully open and close.



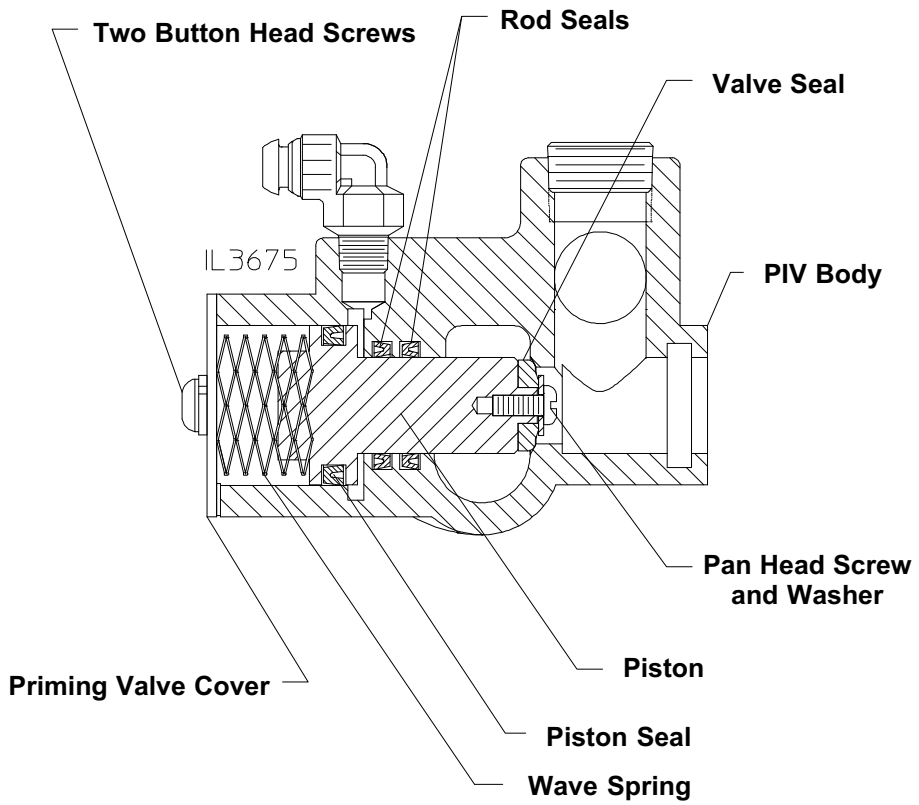


Reassembly - Install PIV (Priming Isolation Valve)

Assemble PIV (Priming Isolation Valve)

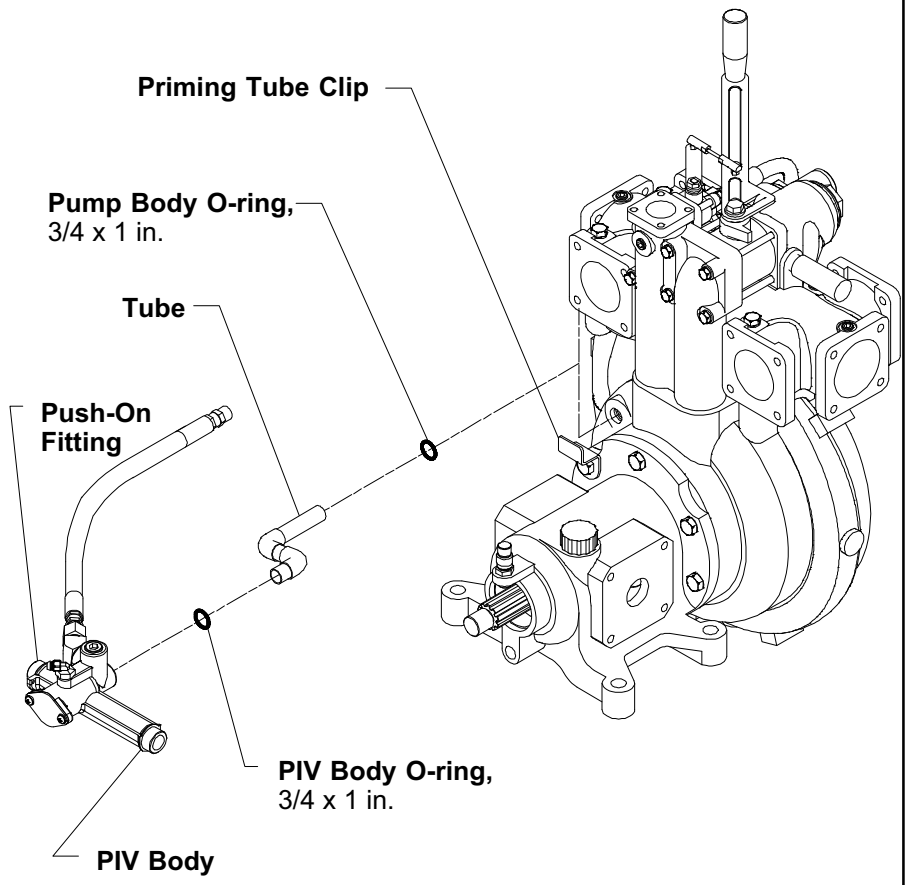
(Required only if PIV requires overhaul)

1. Install the piston seal in the groove in the piston.
2. Install the valve seal on the piston with the pan head screw and washer.
3. Install the two (2) rod seals and O-ring in internal grooves in the valve body.
4. Install the piston in the valve body.
5. Install the wave spring from the internal bore in the valve body.
6. Install the priming valve cover with the two button head screws and washers.



Install PIV (Priming Isolation Valve)

1. Install O-rings in the internal grooves in the pump body and PIV body.
2. Install priming tube in the PIV body.
3. Install PIV body/tube assembly in pump body while engaging the PIV body on the priming tube clip.
4. Connect air line to push-on fitting retaining ring in and hold while pushing the air line in.



Reassembly - Install Primers

Pumps with PIV (Priming Isolation Valve)

Aluminum Pumps:

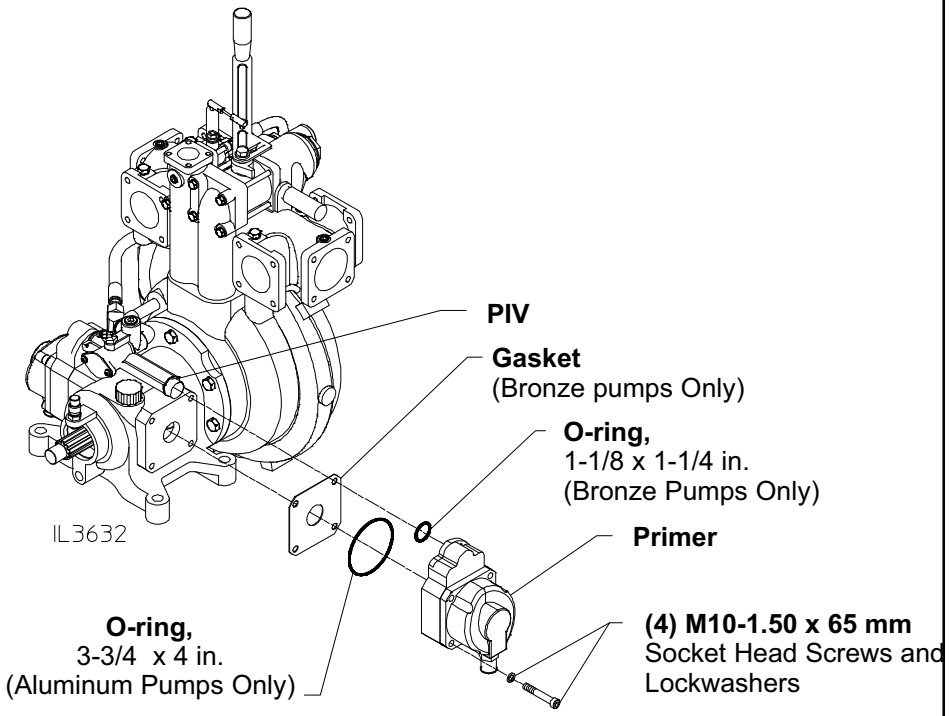
1. Install large O-ring in external groove in primer.

Bronze Pumps:

1. Install small O-ring over end of PIV.
2. Install gaskets.

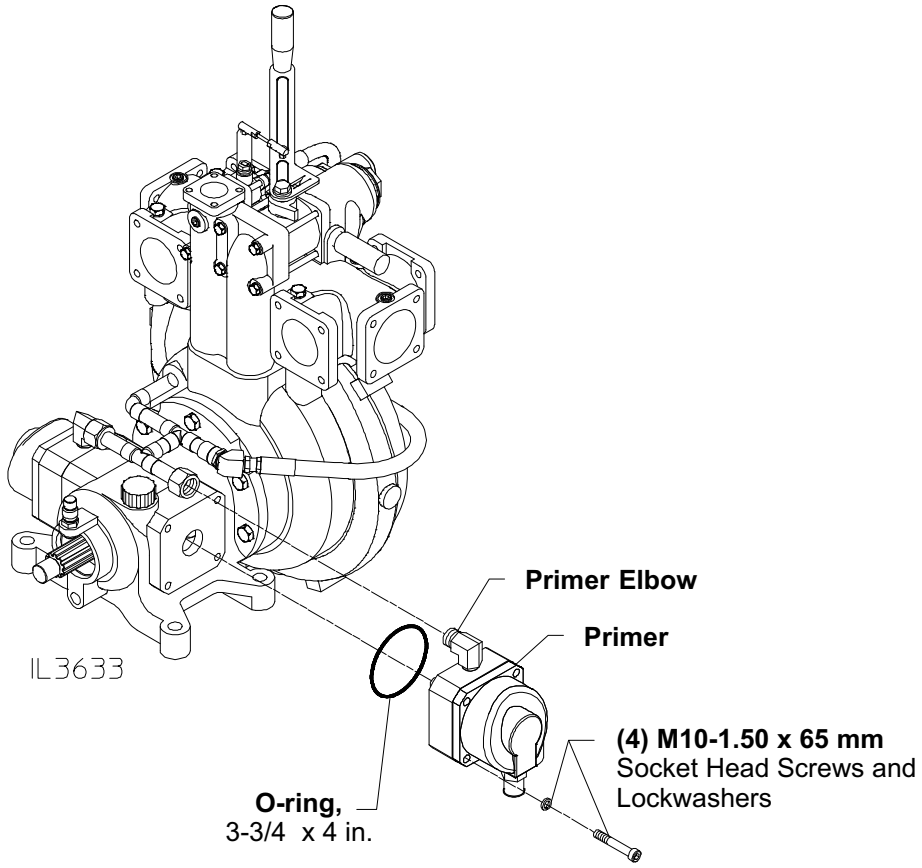
All Pumps:

1. Install primer on pump flange and over the end of the PIV. Note that the left side primer has a small pin which aligns with a hole on the PIV flange.
2. Install the four (4) socket head screws and washers. Torque to 18 lb-ft (25 N•m).
3. Repeat process for primer on opposite side of pump.



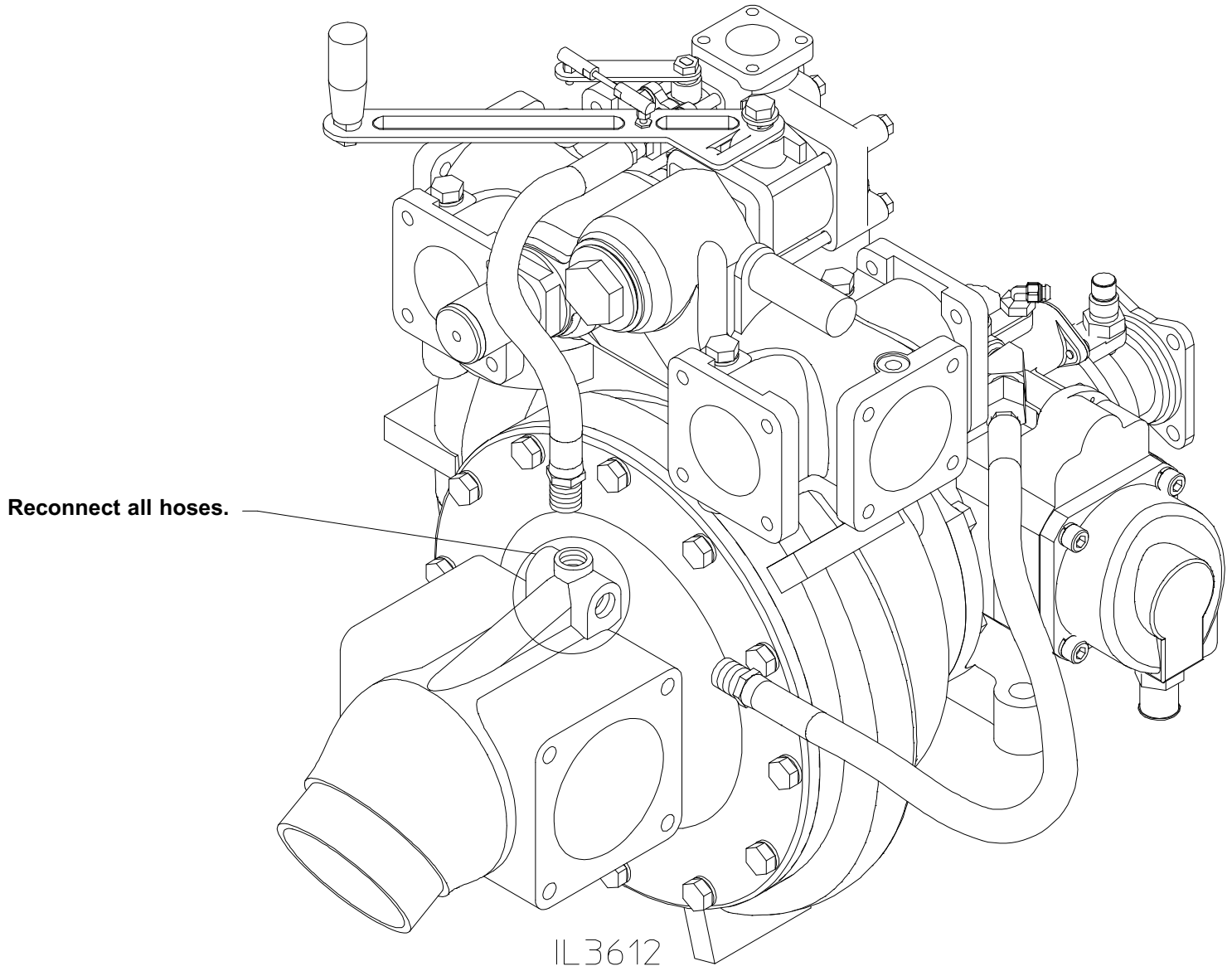
Pumps without PIV (Priming Isolation Valve)

1. Install O-ring in external groove in primer.
2. Install primer on pump flange while engaging the primer elbow with the tube.
3. Install the four (4) socket head screws and washers. Torque to 18 lb-ft (25 N•m).
4. Connect the compression elbow on the top of the primer.
5. Repeat process for primer on opposite side of pump.

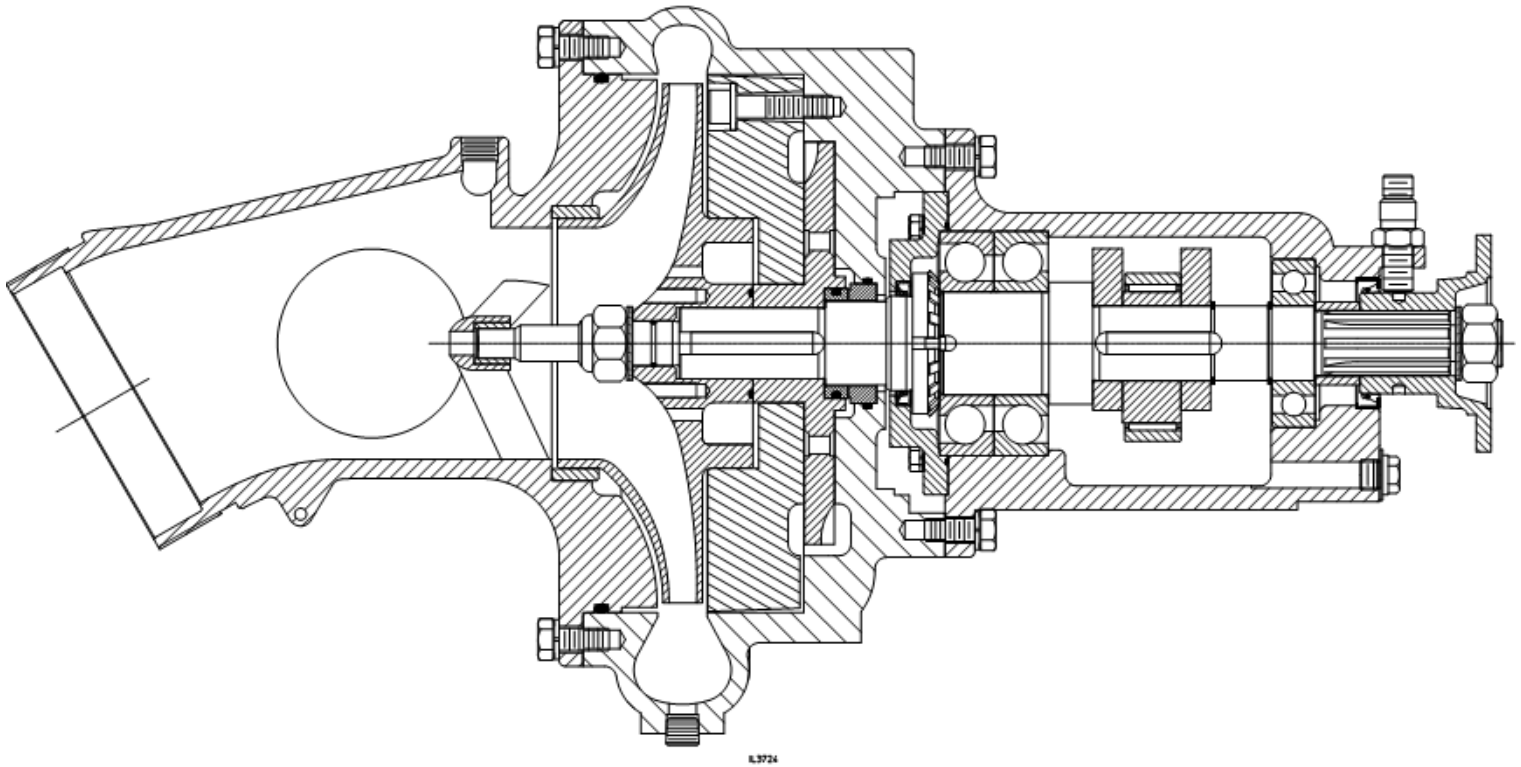


Install Hoses on Intake Fitting

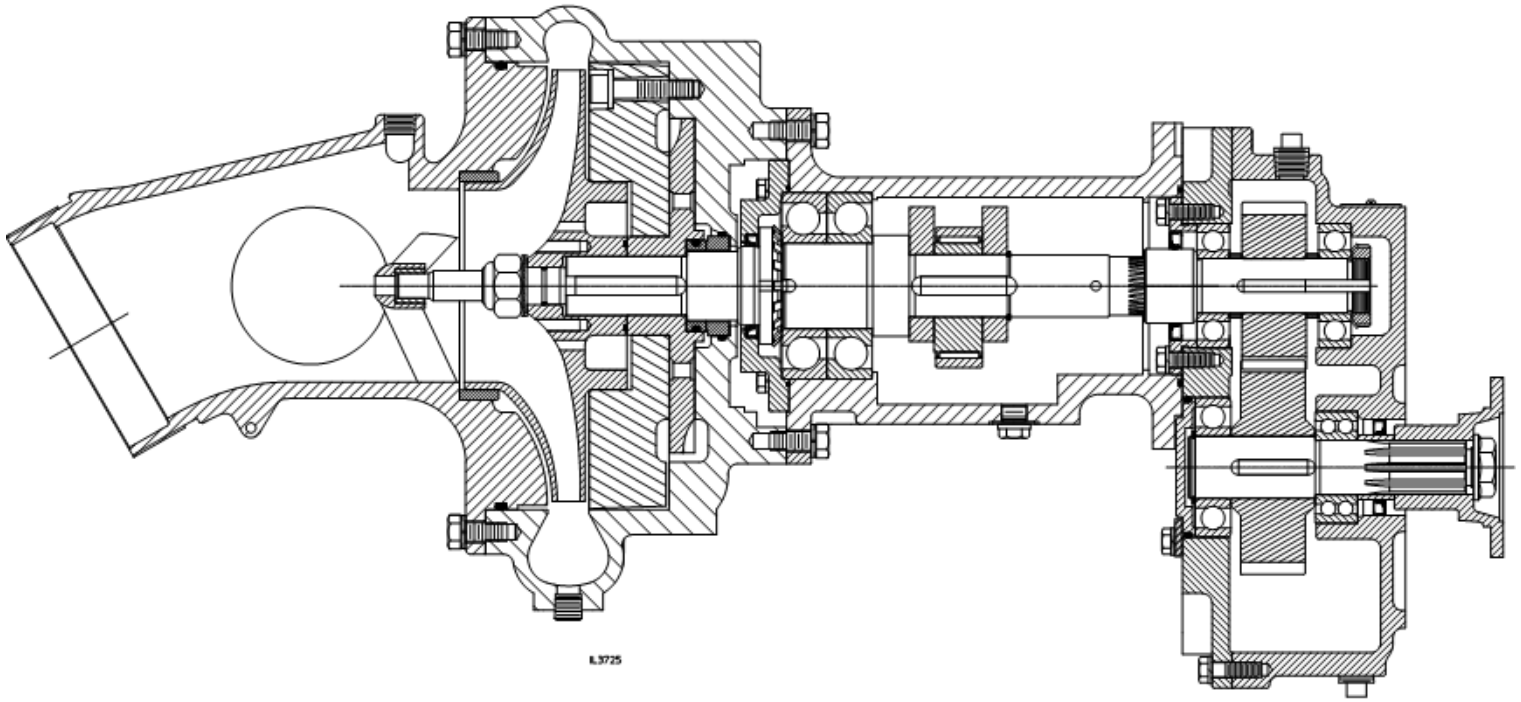
1. Connect all hoses in their original location on the intake fitting.



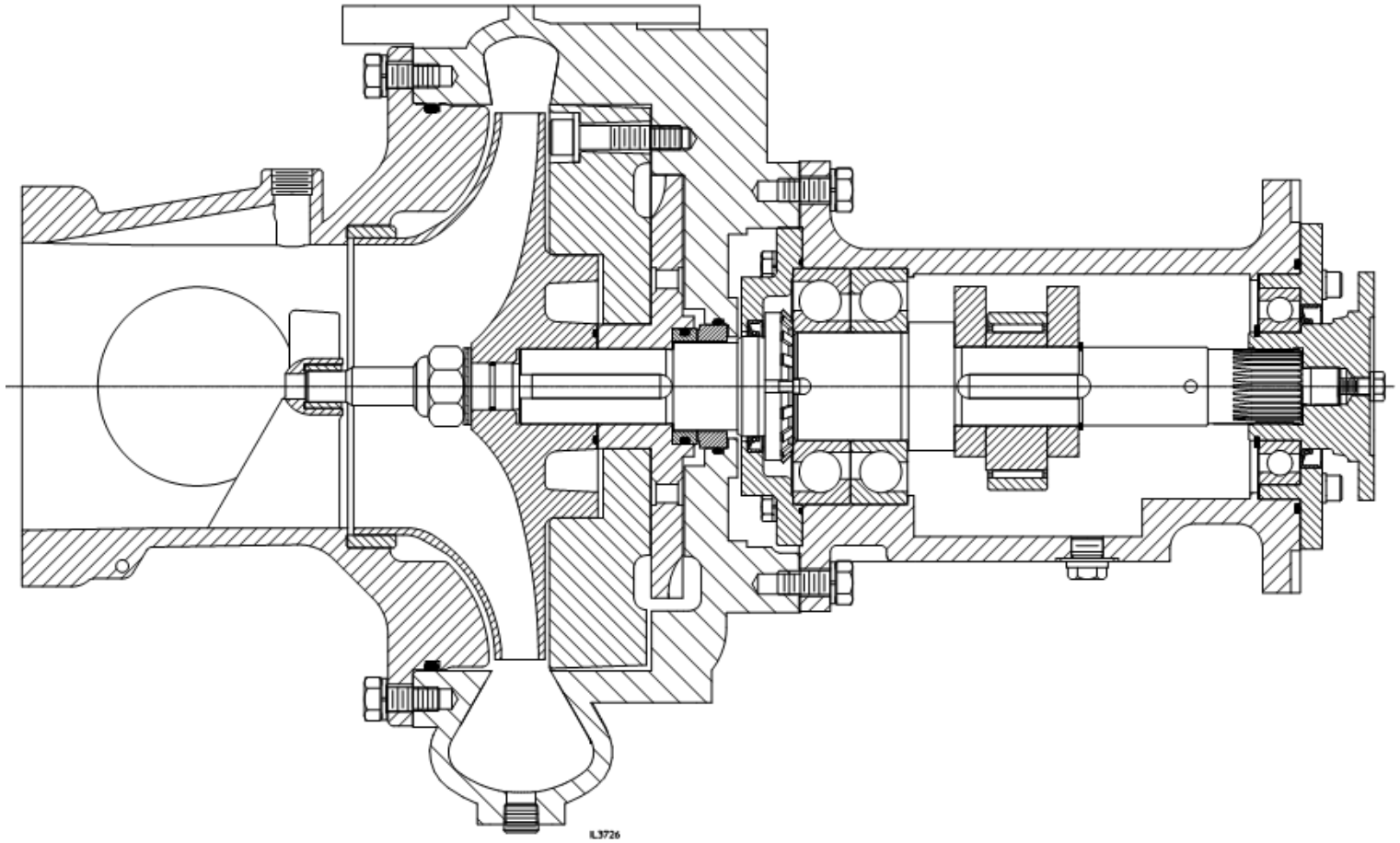
HL200D and HL300D Direct Drive Models



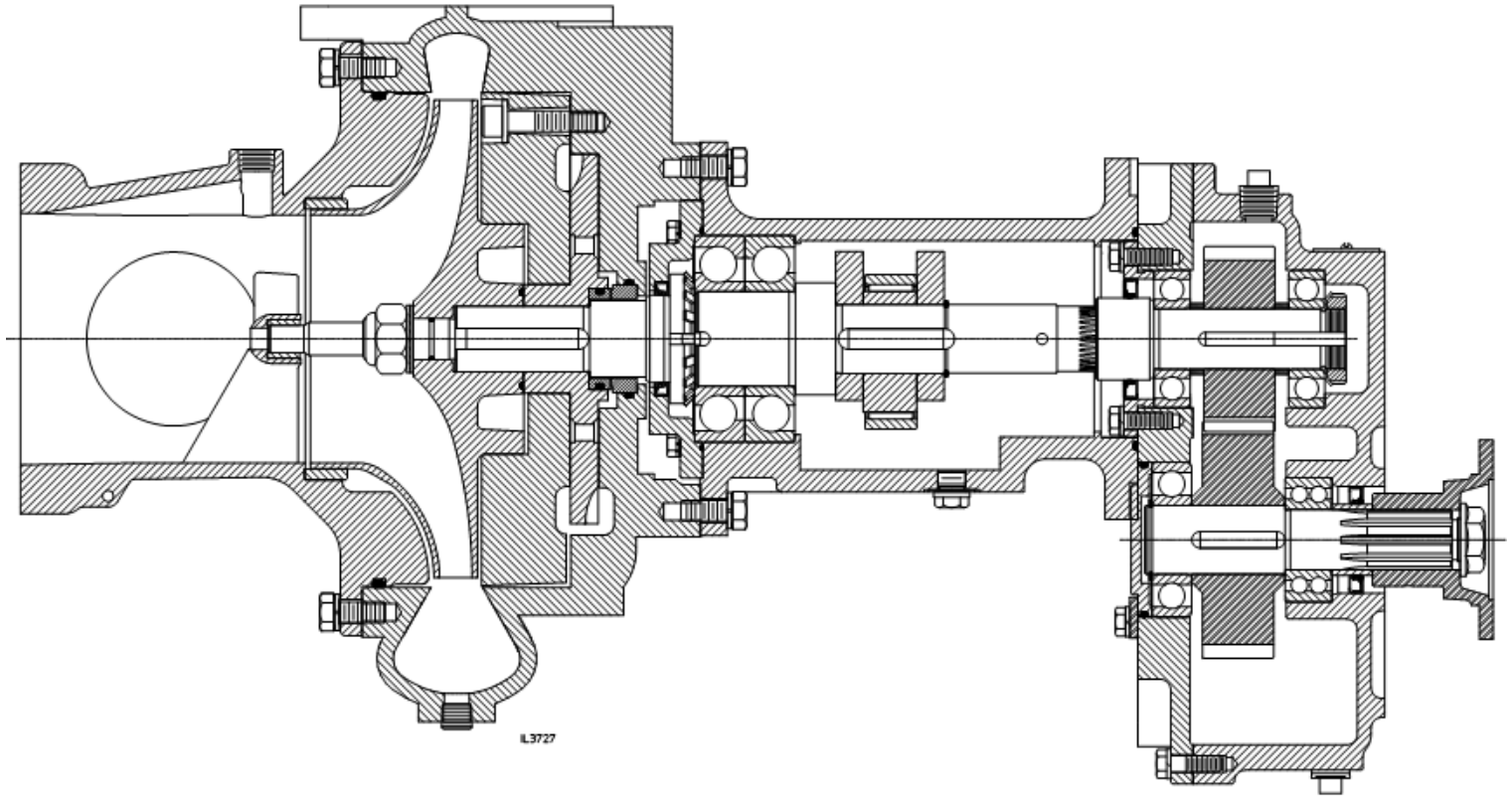
HL200K and HL300K Gear Drive Models



HL400D Direct Drive Model



HL400K Gear Drive Model



Final Assembly Steps

1. Install pump in vehicle.
2. Connect Intake and discharge piping.
3. Connect propeller or drive shaft to the pump
4. Connect the drain lines, air lines, electrical wiring and similar equipment to the pump and accessories.
5. Check and verify all fasteners and connections are secure.

Lubrication

Before operating the pump, add lubricants specified below (See Page 9 for fill locations).

NOTICE

1. Capacities shown are approximate. Quantities listed are based on ratio and/or mounting orientation.
2. Always fill to the marking on dipstick (pedestal) or bottom of plug labeled “Oil Level” (K Transmission).
3. K Transmission breather may be removed and the hole used as the lubricant fill.
4. Synthetic oil substitutes are acceptable.

Models HL200D, HL300D and HL400D

Lubrication required for Pedestal (Priming Housing) Only.

Location	Lubricant	Capacity
Pedestal (Primer Housing)	SAE 10W-30 Motor Oil	.95 Liter (1 Quart)

Models HL200K, HL300K and HL400K

Lubrication required for Pedestal (Priming Housing) and K Series Transmission.

Location	Lubricant	Capacity
Pedestal (Primer Housing)	SAE 10W-30 Motor Oil	.95 Liter (1 Quart)
K Series Transmission	SAE 80W-90 Gear Oil	.95 Liter (1 Quart)

NOTICE

Failure to properly lubricate the pump may result in serious damage.

Hydrostatic and Operational

Before a pump can be returned to service, it is advisable to give the pump a hydrostatic and operational tests 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.
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.