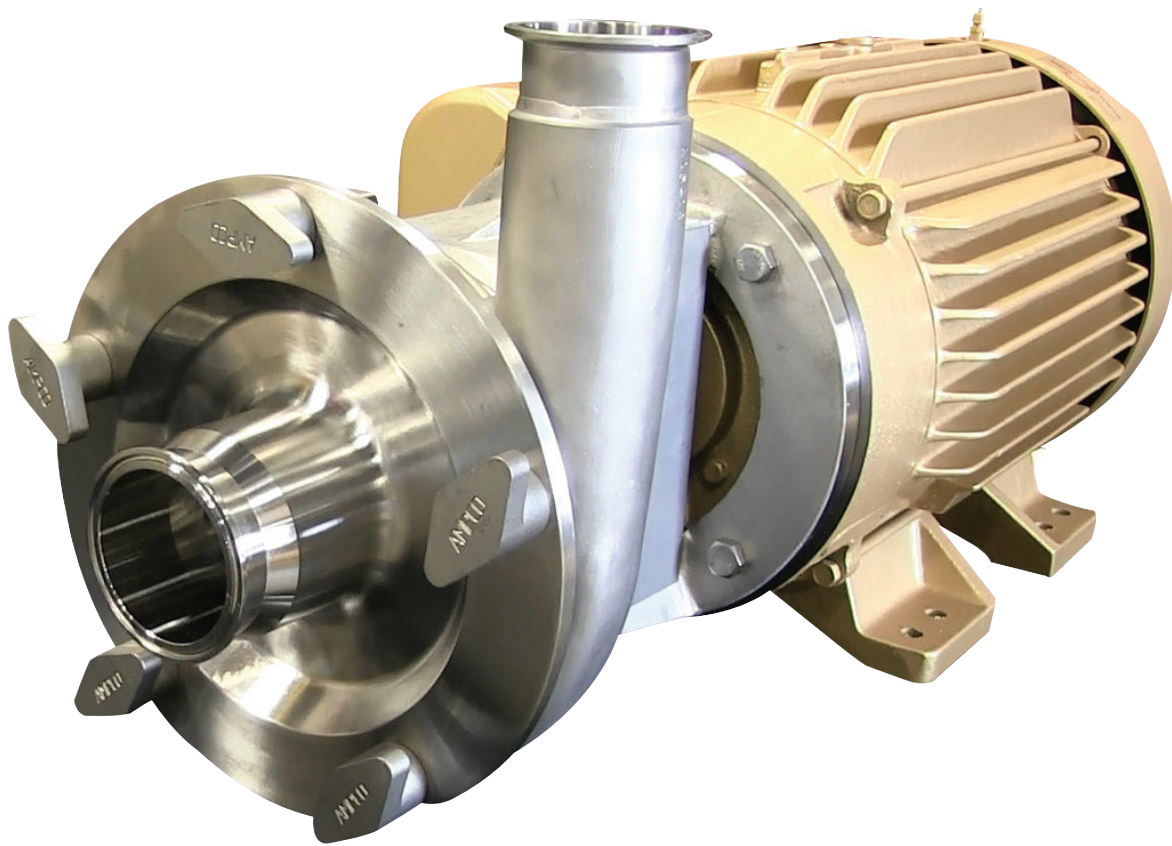




LF Series Manual



CENTRIFUGAL PUMPS
INSTALLATION AND MAINTENANCE MANUAL

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INTRODUCTION

To ensure the best results and service, please read and fully understand this manual prior to putting this pump into service. For any questions regarding operation, maintenance, or installation, please contact your local distributor or Ampco Pumps Company:

Ampco Pumps Company
2045 W. Mill Road
Glendale, WI 53209
Phone: (800) 737-8671 or (414) 643-1852
Fax: (414) 643-4452
Email: ampcoocs@ampcopumps.com

GENERAL INFORMATION

Each Ampco "LF" Series pump is fully assembled, lubricated, and tested at the factory and shipped ready for use. Standard maintenance practices are outlined in this manual. For more information, please refer to Maintenance. Following these guidelines will provide long-lasting, trouble-free service when the pump is incorporated in a properly designed system.

SHIPPING DAMAGE OR LOSS

Upon receiving equipment that is damaged or if your shipment is lost in transit, immediately file a claim with the carrier. At time of pick-up, the carrier signed the bill of lading, acknowledging that they have received the product from Ampco in good condition.

RECEIVING/SAFETY

PUMP RECEIVING

Ampco covers the pump inlet and discharge ports prior to shipping, ensuring that foreign matter does not enter the pump during shipment. If the protective covers are missing upon arrival, remove the pump cover and inspect to ensure it is free from contaminate before turning the shafts. Please make note of the pump serial number; this will assist in the process of ordering replacement parts and/or a warranty claim. For more information regarding shipment damage or warranty, please refer to Terms and Conditions.

SAFETY

IMPORTANT: Read and understand this manual BEFORE installation, operation or maintenance of the pump. Improper installation, operation, or maintenance may result in severe injury or death. Equipment damage caused by user neglect will invalidate the pump warranty.

There are safety symbols used throughout this manual identifying safety concerns.

WARNING: Hazards or unsafe practices that COULD result in severe personal injury or death, and how to avoid them.

CAUTION: Hazards or unsafe practices that COULD result in minor personal injury or damage to product or property.

INSTALLATION AND MAINTENANCE OF AMPCO CENTRIFUGAL PUMPS

INSTRUCTIONS

Your Ampco centrifugal pump is a rugged unit designed to provide years of low cost pumping service. There is a small amount of necessary care required to ensure you of this expected long service. It is recommended that you carefully review the installation and operating sections in this manual.

Every Ampco pump receives a careful running test at the factory to ensure that the head-capacity rating is met in accordance with the Hydraulic Institute Standards and to ensure mechanical soundness. Special instructions and advice for unusual conditions, such as corrosive, abrasive and other problems are too numerous to be included in the general book, but will be the subject of specific discussion on orders or inquires for special applications.

LOCATION

The immediate environment, in which the unit is located, while usually of prime importance to the pump, may determine the enclosures needed for the motor. Ampco can supply several different motor enclosures to meet specific requirements.

The LF Series pumps series are supplied with total enclosed motors as standard. They may be installed where dirt, moisture and mild corrosion are present or in outdoor locations. Wash-down duty motors, with epoxy paint or paint free stainless steel, are designed for applications where the motor is frequently subject to wash-down to maintain a bacteria-free operation environment. Specialty motors may be required for moist, corrosive or explosive environments. Motor drain plugs (if not equipped with automatic drains) must be removed periodically to drain accumulated condensation.

Pump units should be located where daily visual inspection is possible and no surrounding structure interferes with ventilating air over or through the motor.

Submerged suction is the most economical and convenient method of priming a pump when installed in such a position that the top of the casing is below the surface of the liquid to be pumped. The liquid will flow by gravity into the pump and displace the air (through the discharge if possible or a vent when available).



INSTALLATION

Begin with a suction line as direct and simple as possible. The suction line is usually the most sensitive part of the entire pumping system being totally dependent on outside forces to provide liquid flow into the center of the impeller.

Locate the pump as close to the supply of liquid as possible, with short and direct suction piping. Use wide radius elbows to help reduce friction loss. Air pockets due to high sections, concentric reducers, valve bonnets, etc. should be eliminated by installing a suction having a continual rise or at very least a straight horizontal run with an air eliminator near the pump suction entry. To prevent air pockets use eccentric pipe reducers that are mounted in a horizontal position across the top of the pipeline and valves that can be positioned in a place rather than the normal upright position as an air pocket may exist in the upright valve bonnet.

Above all, remember that until the liquid reaches the leading edges of the rotating impeller vane the pump cannot impart its energy to move the liquid.

If possible, try not to connect an elbow directly to the inlet of the pump. This may cause excessive turbulence and hinder pump performance.

STARTING

The pump must be primed before starting, as the mechanical seal depends on the liquid being pumped for lubrication and cooling. Even a short run to determine direction of rotation without first priming may seriously damage the seal.

The correct direction of rotation is counter-clockwise when viewed from the suction end of the pump. It is recommended to turn the pump by hand before starting the first time to ensure the unit is not binding.

MAINTENANCE

Since long-term breakdown cannot be tolerated in most services, maintenance procedures and a contingency plan must be established in advance to minimize any production loss caused by down time.

During building and start-up it is common to use outside personnel. Operating personnel should acquaint themselves with the pump, particularly its running performance. This will aid in establishing a standard for future reference. This manual and other information provided with the pump should be filed for future reference.

All possible performance data should be recorded once the system is functioning properly and stable. Suction and discharge pressure readings, flow rate, seal leakage rate, bearing temperature, noise and vibration levels all provide input to a pump's performance in the system. It is unlikely that all of this data can be measured, but any

information gathered can help alert the user of problems with the pump or system.

Operating personnel should know that any changes in the system or the liquid being pumped might have an effect on the pump's performance. It is advisable to also record the fluid temperature, specific gravity, viscosity, liquid concentration, percent of solid concentration, other additives and properties. A proper maintenance procedure should begin with a file for each pump. All known data relative to the pump, fluid handled and system should be included. Complete records of maintenance and repair costs along with a log of the unit's operating hours should be kept.

In addition, complete pump identification—size, type, operating speed, manufacturer, serial number, model number and material of construction should be noted.

MAINTENANCE PROCEDURES

Daily Check-possibly the most important inspection will be the daily observation.

1. Seal leakage rate
2. Pressure reading and flow indication
3. Change in operating sound
4. Change in bearing temperature
5. Check to make sure flow is going through the double seal flush lines

Semi-Annual Inspection-typically made at 6-month intervals with results noted in pump's maintenance file.

1. Check of mechanical seal assembly
2. Check of bearing lubrication

Annual Inspection-includes Semi-Annual inspection plus:

1. Removal of seal for inspection
2. Bearing Check
3. Check of axis/running clearance of impeller

CONTINGENCY PLAN

For inspection findings and breakdowns, a contingency plan should be developed. To begin with, an adequate supply of probably replacement parts should be kept on hand.

The minimum recommended spare parts are as follows:

1. Mechanical seal kit (complete with O-ring set)
2. Volute casing O-ring
3. Impeller Key

In addition Ampco recommends:

1. Impeller
2. Impeller Nut

Where service cannot be interrupted, a complete stand-by pump unit fully assembled (and in a by-pass line) is recommended.

DISMANTLE AND REPLACE PARTS AS FOLLOWS:

Before attempting any service on the pump or motor, disconnect or lock out electrical power to the pump motor. If the pump and motor are to be removed as a unit, note the wiring configuration. Use colored or numbered tape to mark the wire connections of the motor and power source, for reconnection.

These instructions are limited to fluid ends only. See other drawings and literature applicable to motors, pedestals, frames, shafts, bearings, etc., if additional repairs are required.

1. Disconnect pump from both suction and discharge piping. Remove the shaft cover guard at this time by taking off the cover guard bolt.
2. Remove cover by taking off casing nuts. A rubber mallet may be necessary to loosen the nuts.
3. Remove the impeller nut using a 15/16" socket and holding the stub shaft with a 3/8" rod in the predrilled hole. Ease the impeller off the shaft. Pinch bars between the impeller and cover may be required. Be careful not to mar the pump's surface finish. Remove the impeller key by compressing the seal.
4. Remove all mechanical seal components by simply pulling them off the shaft. In order to remove the seal components, if may be necessary to reach around to the back side of the pump casing and push the seal towards the narrow end of the stub shaft using your fingertips.
5. (For double seals only) Remove the external double seal components from the stub shaft.
6. Thoroughly clean the seal cavity and shaft and dry with a clean cloth.

The Mechanical seal is the only expendable pump part. It is suggested that the complete mechanical seal, both stationary and rotating members, be replaced whenever dripping or leakage occurs at the shaft, or whenever parts are removed to the point of separating the primary sealing surfaces.

The fluid end is now completely dismantled: Additional procedures are dictated by purpose for which unit was disassembled.

MECHANICAL SEAL REPLACEMENT AND REASSEMBLY

Please see the table on page 5 for proper identification of all seal components. The numbers in parenthesis refer to the diagram on page 5 for mechanical seal components.

1. (For double seals only) Place the O-ring (12) into the double rotating seal (11) and lubricate sufficiently. Install the wave spring (13) behind the 3mm shaft pins and then push the rotating seal (11) on to the shaft, making certain to engage the slots in the seal with the pins on the shaft.
2. Place the stationary seal O-ring (2) in the groove on the single stationary seal (1) and lubricate sufficiently. If necessary, repeat for double stationary seal O-ring (10).
3. Place the stationary seal O-ring (1) in the pump housing. The seal is keyed such that it must be installed with the protruding square flats aligned with the square pocket that is milled into the housing.
4. **Install the wave spring (6) on the inside surface of the seal driver (8) with the open slot of the spring facing inward.**

5. **Place the backup ring (5) on the inside edge of the seal driver. Lubricate the single rotating seal O-ring (4) and place it on the back-up ring.**
6. **Install the rotating seal (3) into the seal driver, making certain to engage the slots on the seal with the pins on the driver.**
7. Slide the inner seal driver O-ring (7) onto the shaft and lubricate sufficiently.
8. Slide the seal driver /rotating seal assembly from step (6) onto the shaft.
9. Place the outer seal driver O-ring (9) in the O-ring groove on the seal driver and lubricate sufficiently.
10. Place impeller key in the slot on the shaft.
11. Install the impeller nut gasket onto the impeller nut and lubricate sufficiently.
12. Slide the impeller onto the shaft, making certain to align the keyway with the key that was installed in step (10).
13. Thread the impeller nut/gasket assembly from step (11) to the shaft finger-tight. Place a 3/8" rod in the shaft hole and use a 15/16" socket with a torque wrench to tighten the nut to 40 ft-lbs. Rotate the impeller by hand to verify that it is spinning freely.
14. Install the cover O-ring and lubricate sufficiently.
15. Secure the cover to the casing using the wing nuts. Tighten the wing nuts hand-tight and then provide additional tightening by tapping the nuts gently with a soft faced hammer.
 One way to damage a new seal is to run it dry. Be sure the pump is in place and primed before operating.
16. Place the pump back into service and inspect for proper rotation and leaks.

PUMP SHAFT REPLACEMENT

If the pump stub shaft is being replaced, it is recommended that new shaft collar also be installed.

1. Begin with pump disassembly as directed previously.
2. (Cinch-type adapters only) if the water cascade option has been ordered, use a channel locks or pipe wrench to remove the water pipes. Use two 3/4" wrenches to loosen the adapter clamping bolt and nut. The gap can be widened if necessary by using a flat blade screwdriver. Once the cinch fit has been loosened, remove the pump casing.
 - 2a. (Flange-type adapters only) If the water cascade option has been ordered, use a channel locks or pipe wrench to remove the water pipes. Use a 3/4" socket to remove the housing bolts and washers, and then remove the pump casing.
3. Loosen the shaft collar with an Allen wrench (3/16", 1/4" or 3/8" see sizes in table on page 5) so that the stub shaft can be taken off the motor. A rubber mallet may be used to tap the stub shaft if it will not slide off. Be careful not to drop the shaft collar when the stub shaft comes off the motor.
 - 3a. If the stub shaft does not come off, the volute, impeller, impeller nut gasket and impeller nut may be assembled onto the shaft to help pull the stub shaft off (make sure that all the seal pieces are out of The volute). A cloth between the volute casing and impeller is necessary in this step. Pull on the Volute or gently tap it with a rubber mallet to create enough force to free the stub shaft from the motor.

4. Slide the new shaft collar onto the new stub shaft and slide the two together onto the motor shaft, keeping the motor keyway in line with the 3/8" hole on the stub shaft. If the collar has an identification groove in it, this will rest against the step in the stub shaft.
5. Line up the slot in the collar with the stub shaft slot. Do not tighten the shaft collar yet. Since the shaft was disassembled, the impeller clearance in the volute may have changed. The impeller must be repositioned for proper pump performance and to ensure that the impeller will not rub.
6. Slide the volute over the pump shaft and shoulder it against the adapter.
7. Using two 3/4" wrenches, tighten the adapter bolt to secure the volute, making sure the pump discharge is aligned for the piping. For pumps with frame sizes 280 or larger use a 3/4" wrench to tighten all bolts between the volute and the adapter.
8. Install the seal, impeller and impeller nut as described in steps 1-13 of the previous procedure.
9. The critical impeller gap is the gap between the volute and the nearest impeller blade to it. This will be measured using a feeler gauge. The blades may not all be at the same distance due to manufacturing and balance procedures. Please see the table on page 5 for the correct impeller gaps.
10. With a rubber mallet, gently tap the impeller not to drive the stub shaft towards the motor while the feeler gauge is between the impeller and volute. This will create the critical impeller gap.
11. When the impeller gap is correct, align the shaft collar slot with the slot in the stub shaft and the motor shaft keyway and tighten the shaft collar with an Allen wrench (3/16", 1/4 or 3/8", see sizes in table on page 5) to secure the shaft position.
12. Remove the feeler gauge and re-install the cover O-ring, cover and wing nuts.

MOTOR REPLACEMENT

Before attempting any service on the pump or motor disconnect or lock out electrical power to the pump motor. If the pup and motor are to be removed as a unit, note the wiring configuration. Use colored or numbered tape to mark the wire connections of the motor and power source for reconnection.

1. Begin disassembling the pump by removing the impeller and seal components as described in steps 1-6 of the prior dismantling procedure.
2. Remove the housing and shaft as described in steps (23) of the pup shaft replacement procedure.
3. Remove the adapter bolts and washers using a socket or box wrench and then separate the adapter from the motor.
4. Use a socket or box wrench to bolt the adapter to the new motor. Make certain to install the washers and bolts in the proper sequence.
5. Install the shaft, impeller, seal, housing and cover as described in steps 4-12 of the shaft replacement procedure.
6. Replace the shaft guards. If the water cascade option has been ordered, replace the water pipes.

LF V401 PUMP DISMANTLING AND SEAL REMOVAL

ATTENTION! Before attempting any service on any pump or motor. Disconnect or lockout electrical power to the pump motor. If the pump and motor are to be removed as a unit. Note the wiring and configuration. Use colored or numbered tape to mark the wire connections of the pump motor and power source, for reconnection.

TOOLS REQUIRED TO DISMANTLE PUMP AND REMOVE SEAL:

1¼" socket wrench

Torque wrench

¾" round bar

90° o-ring pick

7/16" wrench

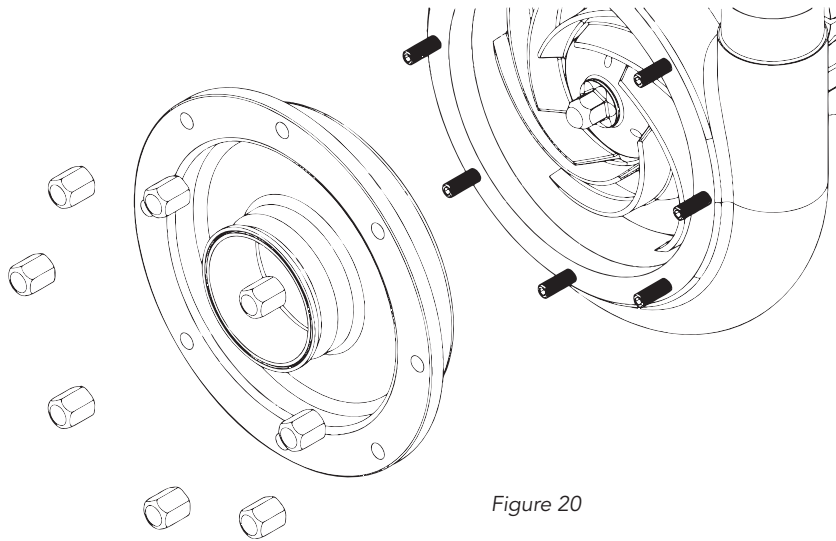


Figure 20

1. Disconnect electrical power to the pump motor and follow any lockout / tagout procedures in place at your facility.
2. Disconnect pump from the suction piping. Drain all fluids from the pump.
3. Loosen and remove cover wing nuts, cover, cover gasket and shaft guard. **See figure 20.**

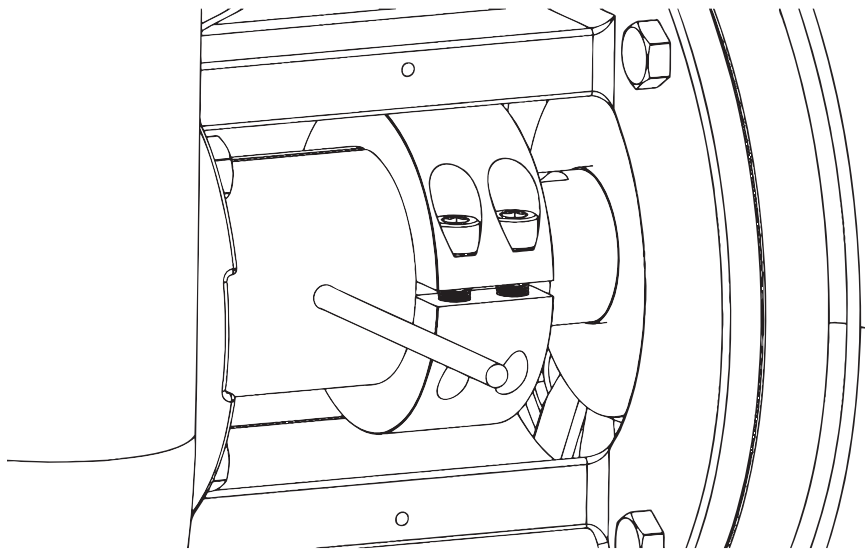


Figure 20

4. Insert a 3/8" bar in the hole in the stub shaft. **See figure 21.** Turn the impeller nut with a socket wrench counterclockwise to remove the impeller nut.

5. Remove the impeller nut gasket, impeller, and the impeller key. This process can be seen in **Figure 22**.

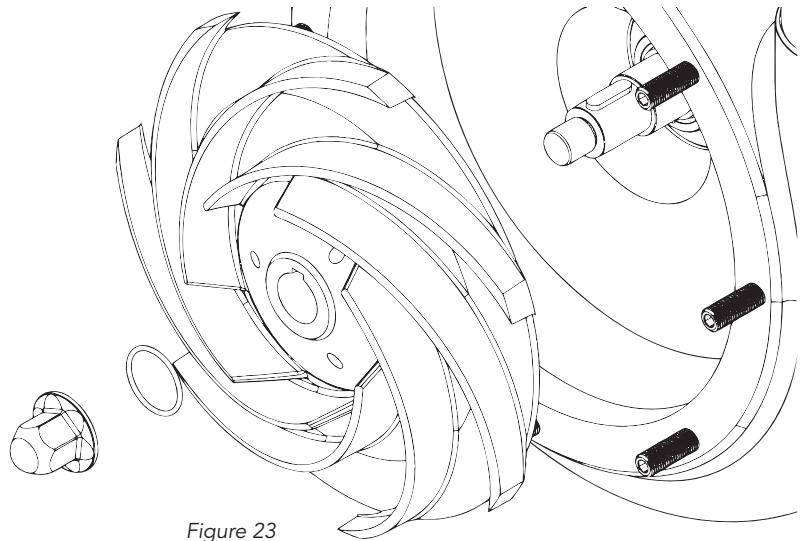


Figure 23

6. Pull out the seal driver if it did not already come out with the impeller and the single seal spring. Removal of the impeller key is not necessary, keep track of it if you do remove it.

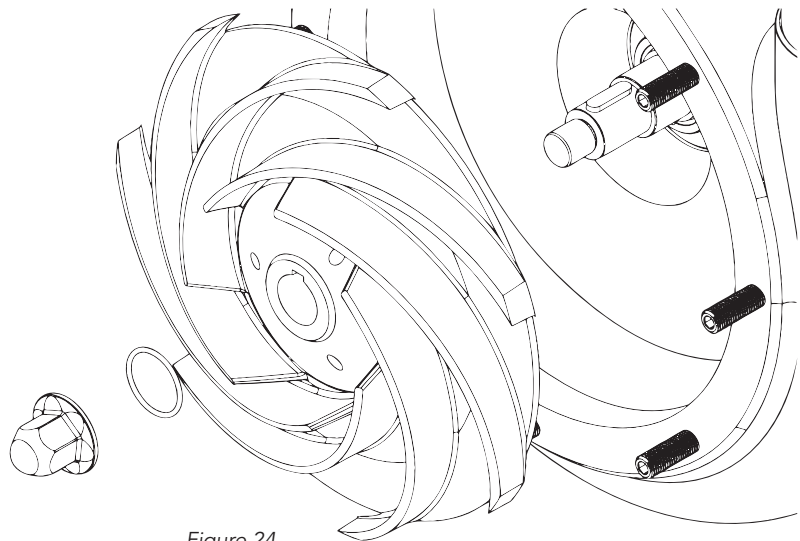


Figure 24

7. Pull out the rotating seal. You may have to use a pick to separate the rotating seal from the stationary seal while taking care not to scratch or damage the sealing surfaces, **figure 25**.

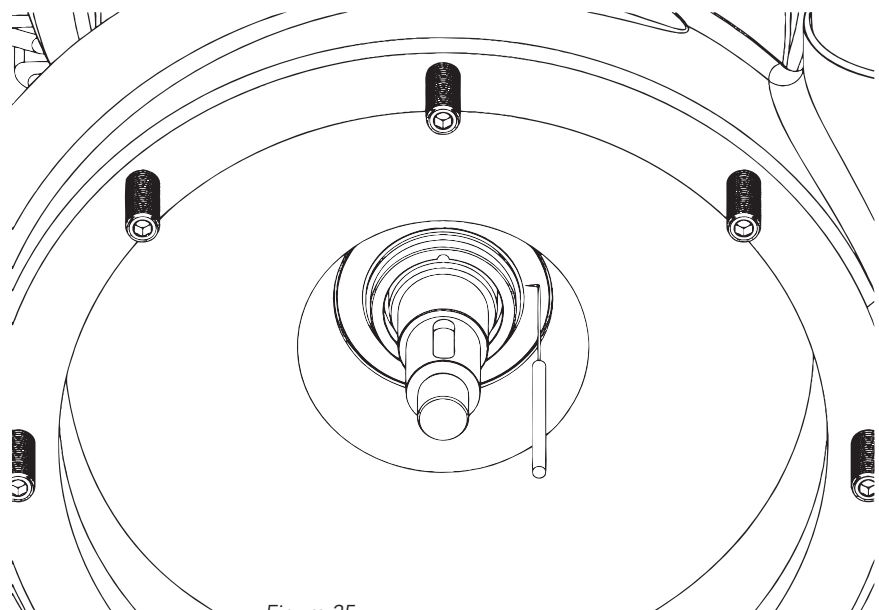


Figure 25

8. Push the stationary seal out from the back of the pump using an o-ring pick or your fingers or both again make sure to push outside of the rear seal face so the seal surfaces are not damaged. Pushing on opposite sides of the shaft with constant light pressure the best. See *figure 25*.

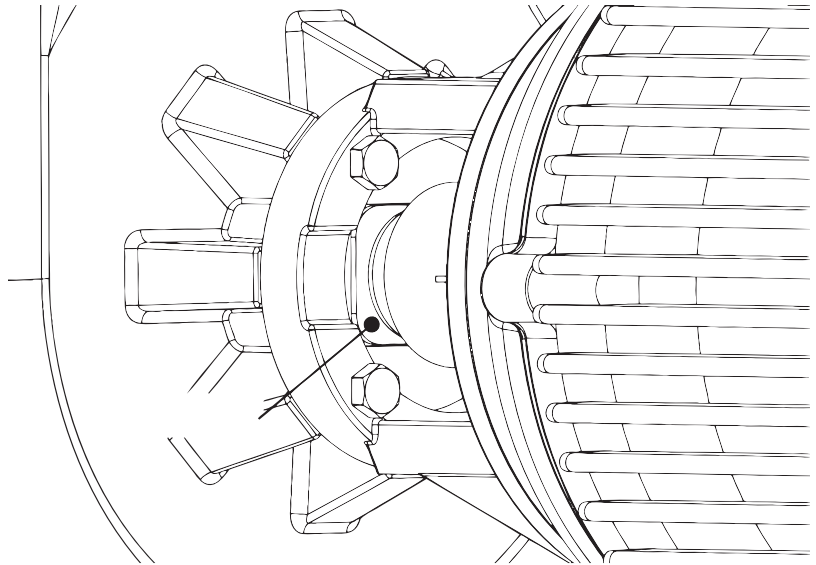


Figure 25

9. Remove the stationary seal once pushed out of its bore. The double seal may also come out with the stationary seal if the pump has this option. See *figure 26*.

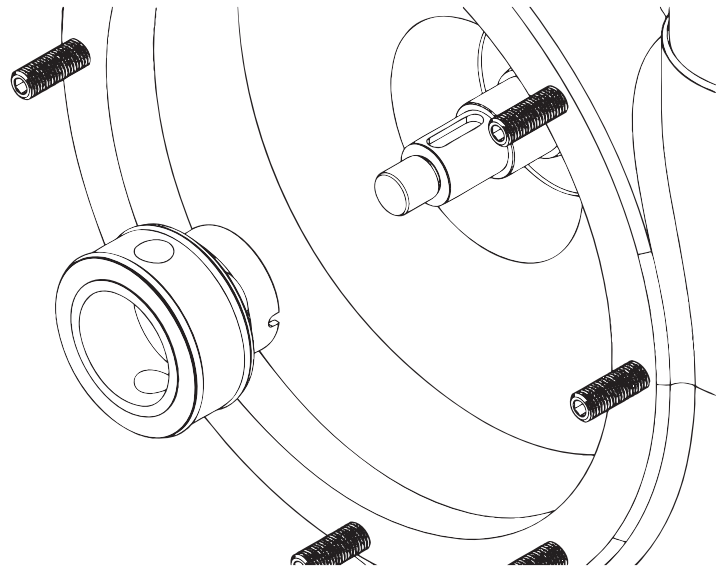


Figure 26

10. Remove the double rotating seal assembly which includes the double seal driver, double spring, double o-ring and the double seal. Check the condition of the casing, impeller, rotating seal, stationary seal and double seal assemblies. Clean and remove any foreign matter before reinstalling the seal and assembling the pump.

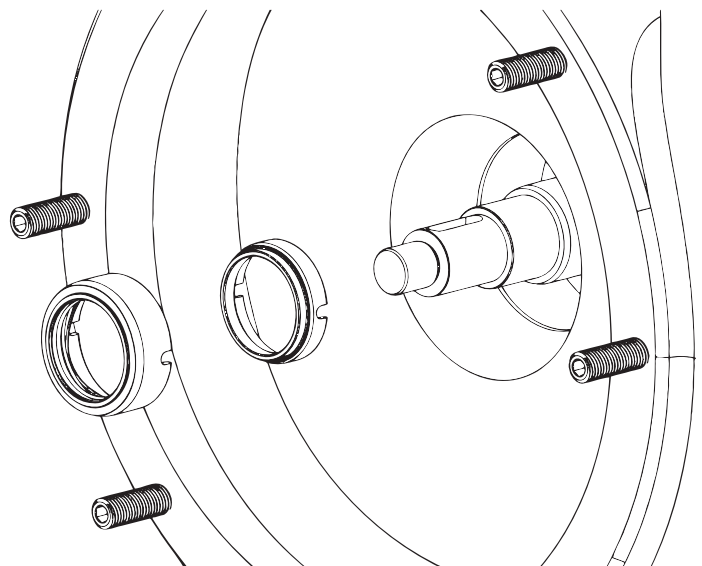


Figure 27

LF V401 PUMP ASSEMBLY AND SEAL INSTALLATION

When replacing the seal assembly lubricate all o-rings with food grade lubricant to ease assembly. Once the pump is fully assembled turn the stub shaft a few revolutions by hand making sure it turns relatively freely and nothing is rubbing inside the pump. Running the pump with foreign objects in the pump or having the impeller making contact with either the cover or the casing will result in serious damage if not completely destroying the pump. For assembling pumps with single seals, start at step number.

TOOLS REQUIRED TO DISMANTLE PUMP AND SEAL INSTALLATION:

1¼" socket wrench

7/16" wrench

3/8" round bar

Torque wrench

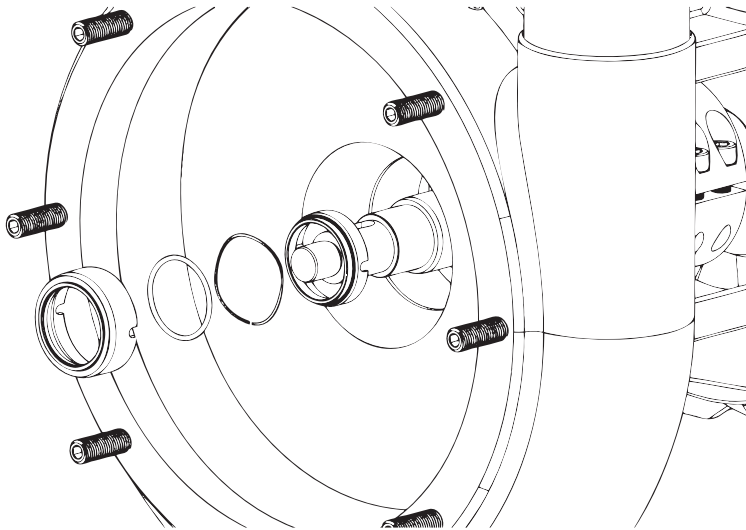


Figure 28

1. Slide the rotating double driver onto the stub shaft, the rotating double spring, the rotating double o-ring and then the rotating double seal in this order one component at a time. **Figure 28.**

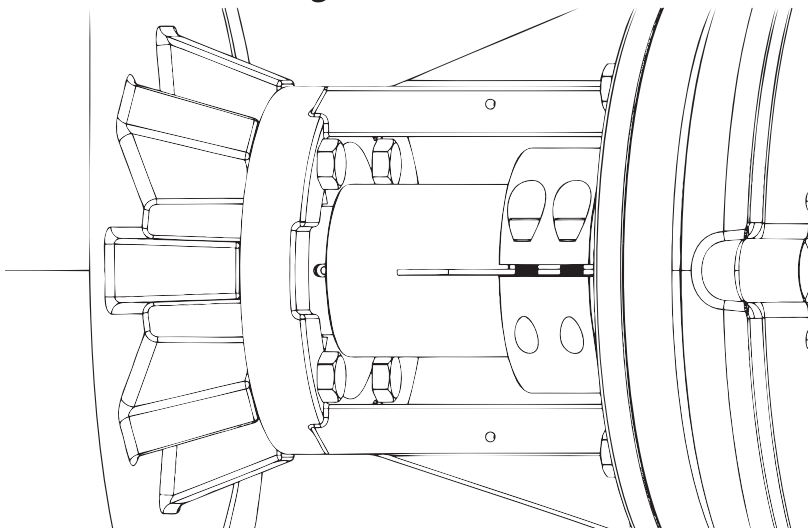


Figure 29

2. Slots in the double seal driver and rotating double seal fit over the driving pins on the stub shaft. See **figure 29.**

3. The o-rings on the stationary seal must be lubricated well or it will be very difficult to push the stationary seal into the its' bore. Line up the flats on the stationary seal with the rectangular hole in the hub of the casing. See *figure 30*.

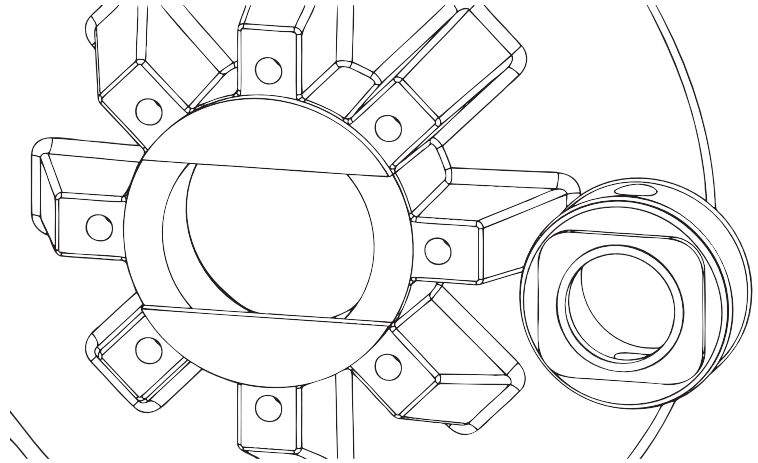


Figure 30

4. *Install the stationary seal pushing the stationary seal into the casing bore.*

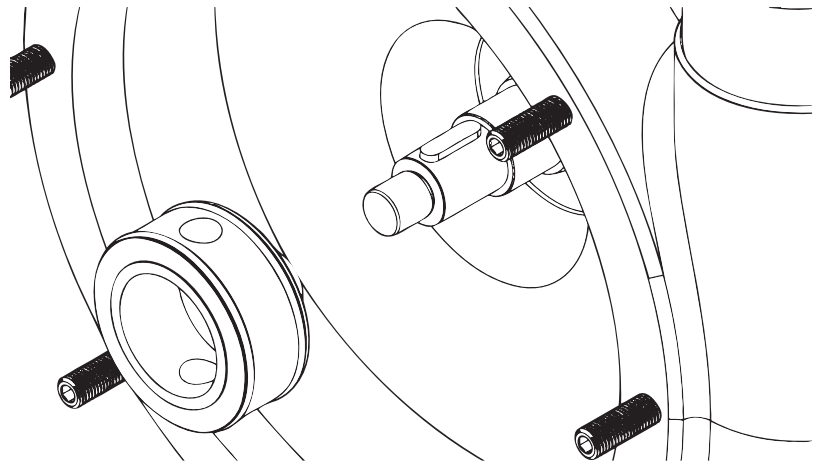


Figure 31

5. *Make sure the stationary seal seats against the back face of the bore.*

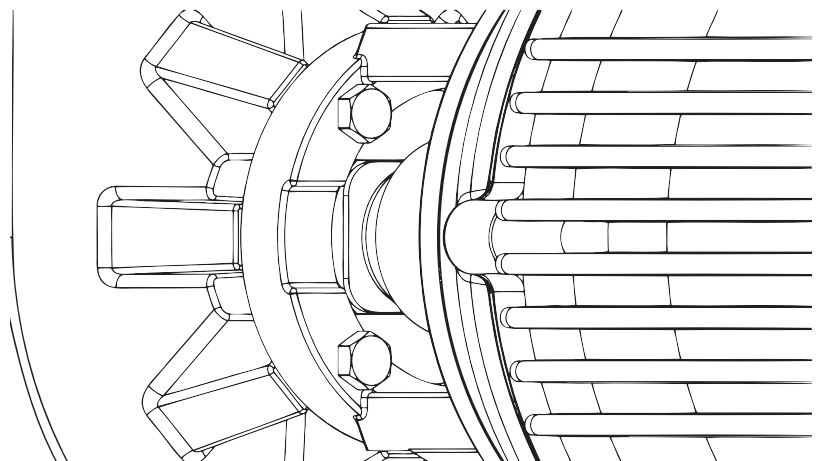


Figure 32

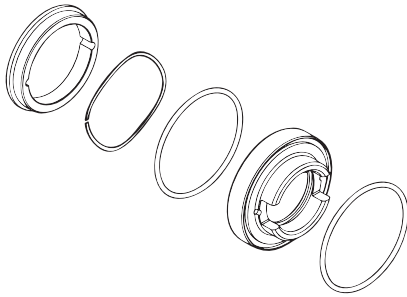


Figure 33

6. Assemble single seal and driver assembly. Insert the seal driver o-ring and the single seal o-ring into the seal driver. Insert the single seal spring into the seal driver. Then press the rotating single seal into the seal driver while noting that the notches in the rotating single seal line up with the seal driver pins. **Figure 33.**

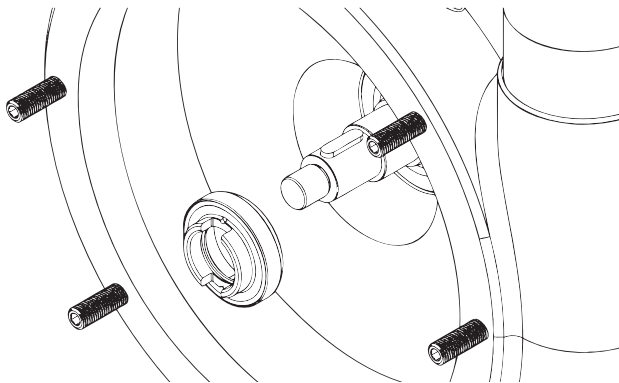


Figure 34

7. Install the single seal and driver assembly. Slide single seal assembly over the stub shaft and against the stationary seal.

8. Install impeller and impeller key, if it is not already in the stub shaft. **Figure 35.** Note driving pins in impeller hub will go into the large slots in the front of the single seal driver. Replace the impeller nut gasket and impeller nut and torque to the correct value.

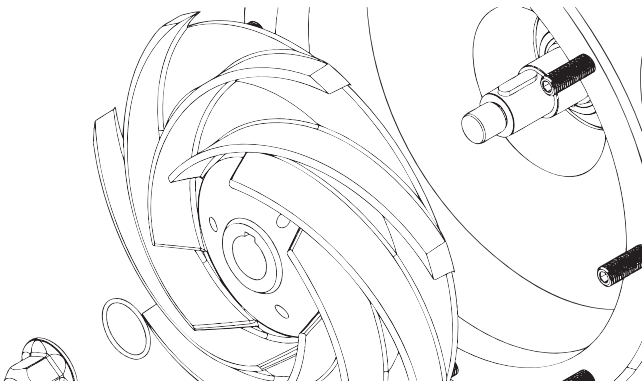


Figure 35

9. Replace the cover and check that the cover o-ring is in place and not damaged. Replace the cover nuts and torque to the proper values. Running the pump with foreign objects in the pump or having the impeller making contact with either the cover or the casing will result in serious damage if not completely destroying the pump. If the shaft turns freely and the impeller is not rubbing either the casing or the cover, replace the shaft guard and the pump is ready to be reconnected to the piping system.

Note: Always turn the stub shaft by hand before start up making sure nothing is rubbing inside the motor, such as foreign objects or the impeller touching either the back inside of the casing or the cover. Also never run this pump dry. Seals will heat up instantly at operating RPMs score and may no longer seal when damaged.

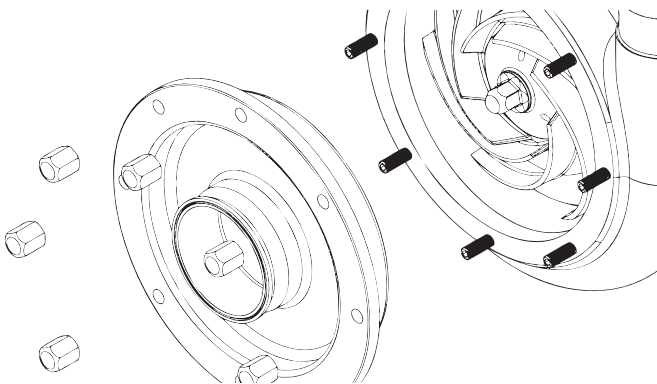
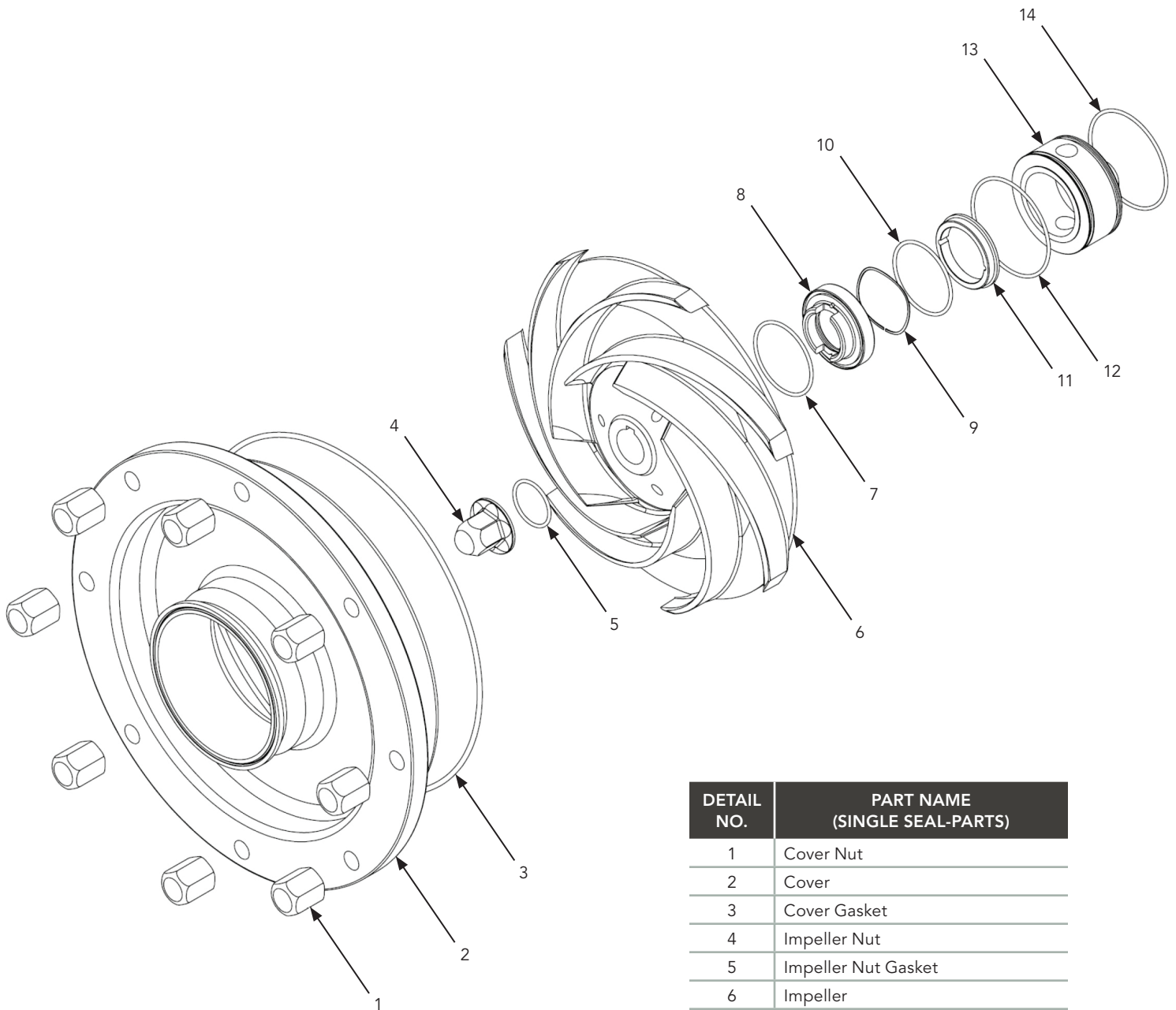


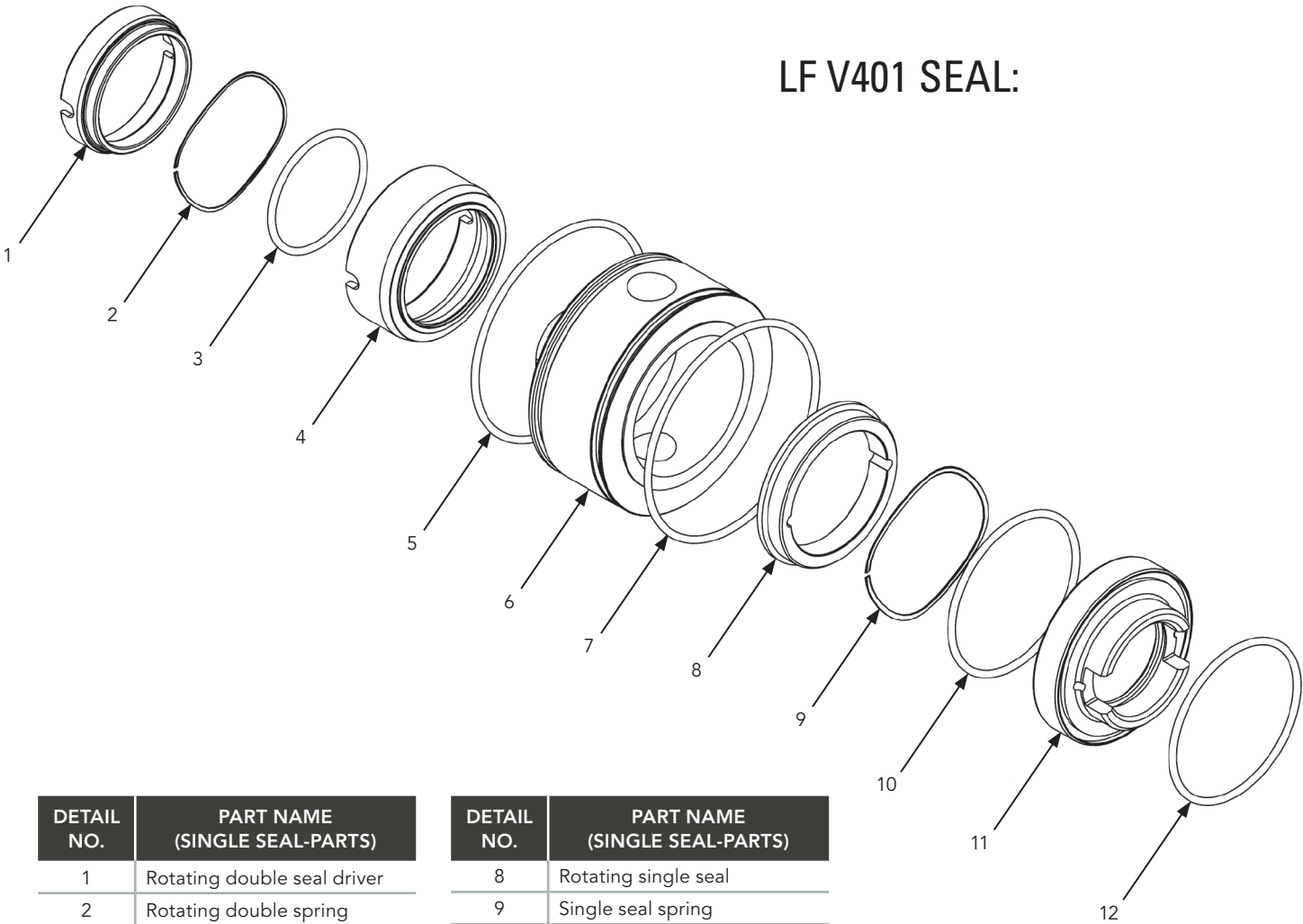
Figure 36

EXPLODED ASSEMBLY LF V401 PUMPS



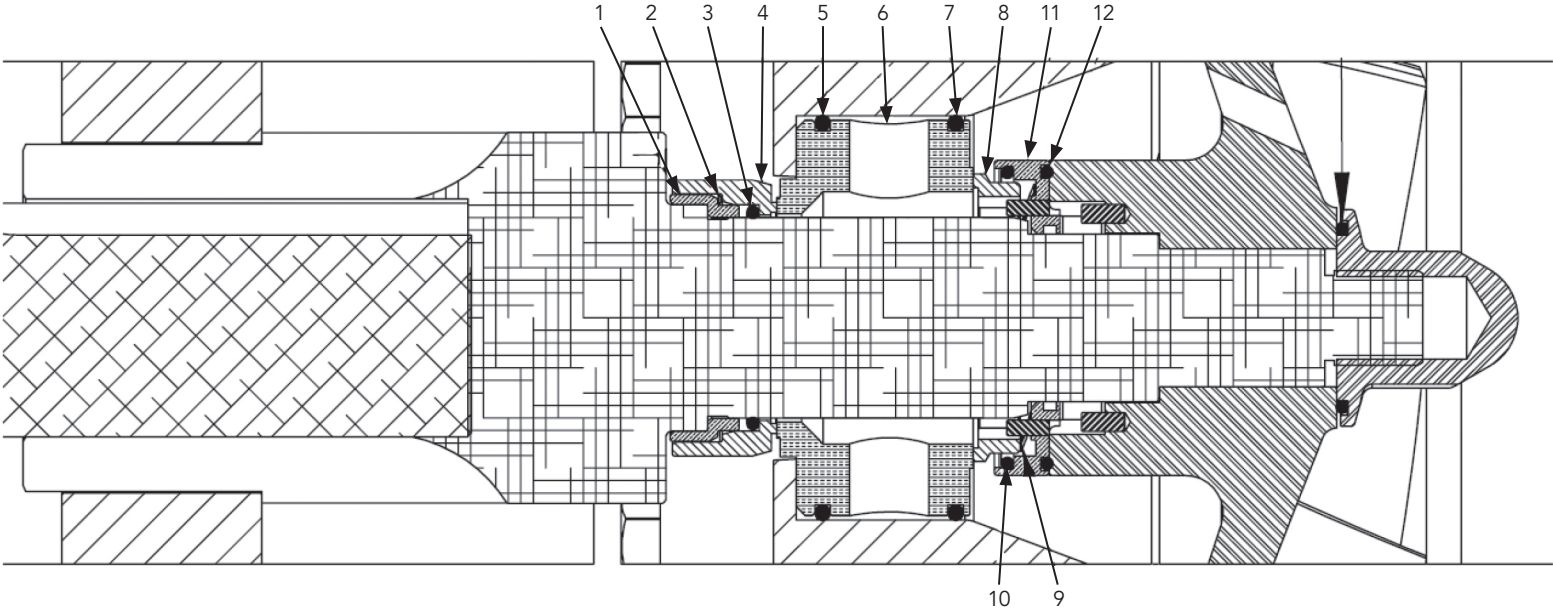
DETAIL NO.	PART NAME (SINGLE SEAL-PARTS)
1	Cover Nut
2	Cover
3	Cover Gasket
4	Impeller Nut
5	Impeller Nut Gasket
6	Impeller
7	O-Ring Outer Seal Driver
8	Seal Driver
9	Seal Driver Spring
10	O-Ring Inner Seal Driver
11	Rotating Seal
12	Stationary O-Ring
13	Stationary Seal
14	Stationary Double O-Ring

LF V401 SEAL:



DETAIL NO.	PART NAME (SINGLE SEAL-PARTS)
1	Rotating double seal driver
2	Rotating double spring
3	Rotating double o-ring
4	Rotating double seal
5	Stationary seal double o-ring
6	Stationary seal
7	Stationary seal single o-ring

DETAIL NO.	PART NAME (SINGLE SEAL-PARTS)
8	Rotating single seal
9	Single seal spring
10	Single seal o-ring
11	Seal driver
12	Seal driver o-ring
13	Impeller nut o-ring



FRONT LOADING MECHANICAL SEAL

AMPCO PUMPS COMPANY PARTS BREAKDOWN

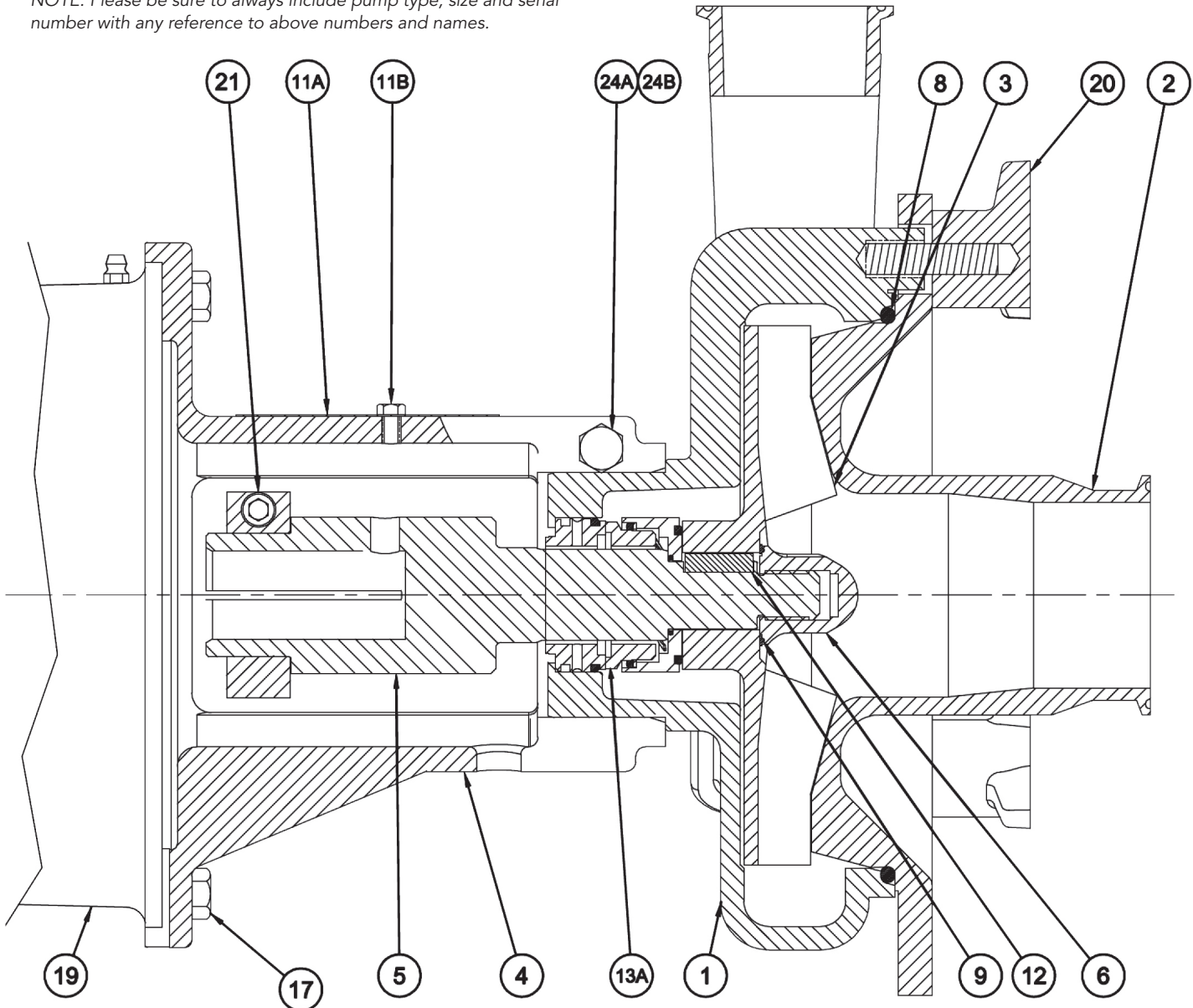
DETAIL NO.	REQ. NO.	PART NAME
24B	1	Adapter Tightening Bolt
24A	1	Adapter Nut
21	1	Shaft Collar
20	X ²	Wing Nut
19	1	Motor
17	4	Cap Screw (Motor/Adapter)
16 ¹	2	Drive Screw
15 ¹	1	Name Plate
13B ¹	1	Double Mechanical Seal
13A	1	Single Mechanical Seal

DETAIL NO.	REQ. NO.	PART NAME
12	1	Impeller Key
11B	1	Cap Screw (Shaft Guard)
11A	1	Shaft Guard
9	1	Impeller Nut Gasket
8	1	O-Ring (Casing /Cover)
6	1	Impeller Nut
5	1	Stub Shaft
4	1	Adapter
3	1	Impeller
2	1	Cover
1	1	Casing

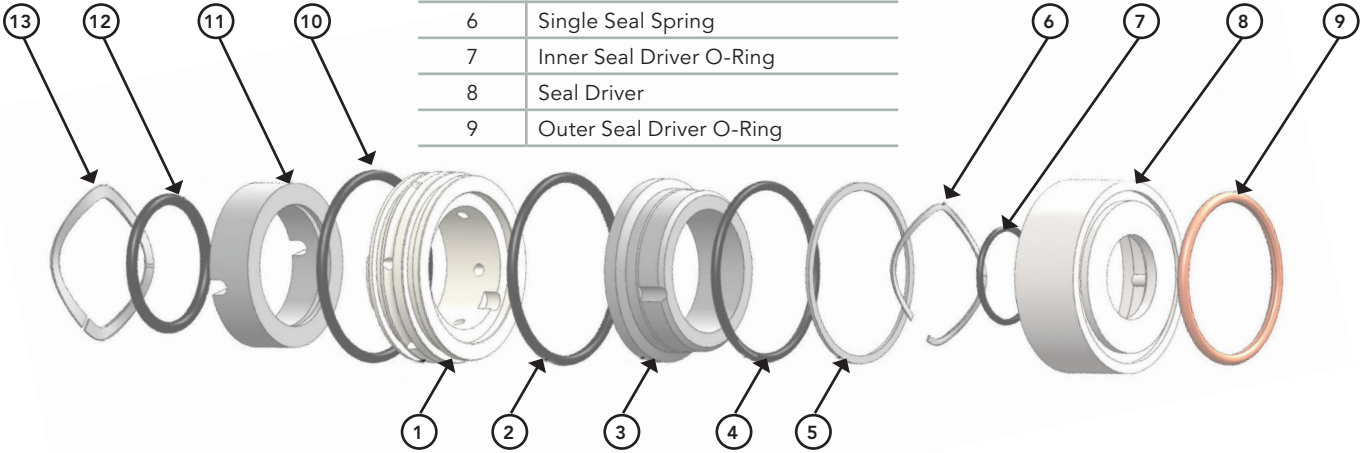
¹NOT SHOWN

²WING NUT QUANTITY VARIES WITH PUMP MODEL

NOTE: Please be sure to always include pump type, size and serial number with any reference to above numbers and names.



DETAIL NO.	PART NAME (SINGLE SEAL-PARTS)	DETAIL NO.	PART NAME (DOUBLE SEAL-PARTS)
1	Stationary Seal	10	Double Stationary Seal O-ring
2	Single Stationary Seal O-Ring	11	Double Rotating Seal
3	Rotating Seal	12	Double Rotating Seal O-ring
4	Single Rotating Seal O-Ring	13	Double Seal Spring
5	Back-up Ring		
6	Single Seal Spring		
7	Inner Seal Driver O-Ring		
8	Seal Driver		
9	Outer Seal Driver O-Ring		



PROPER TORQUES FOR LF SERIES PUMPS

ITEM	TORQUE FT-LBS	PUMPS INCLUDED
Motor Bolts	20	140 Frame
	55	180-250 Frame
	70	280 Frame
	110	320 Frame
Adapter Tightening Bolt	55	Single Flange
Volute Casing Nuts	50	Double Flange
Shaft Collar Bolt (s)	15	180 Frame
	30	210-250 Frame
	40	280-320 Frame
Impeller Nut	40	-320 Frame
	90	°See note below
Retaining Ring Bolts	4.5	-250 Frame
	10	280 + Frame

**impeller nut to be 90 ft-lbs only for LCF-X050, X150 & X160 model pumps*

PROPER IMPELLER GAPS FOR LF SERIES PUMPS

PUMP SERIES	IMPELLER TO VOLUTE	IMPELLER TO COVER
All R Models**	0.020"	0.020"
R50**	0.040"	0.040"
V520	0.020"	0.040"
V530	0.040"	0.020"
V540	0.040"	0.020"
V550	0.040"	0.020"
X050	0.060"	0.020"
X150	0.060"	0.060"
X160	0.060"	0.060"
V401	0.070"	0.090"

REQUIRED TOOLS:

1. Rubber Mallet
2. Ratchet
3. Torque Wrench
4. 1/16" Socket for 56-140 frame motor bolts
5. 3/4" Socket – for 180-280 frame motor bolts
6. 15/16" Socket – for impeller nut
7. 3/8" Diameter Steel Rod – to hold stub stuff
8. Two – 3/4" wrenches (single flange design) – Adapter tightening bolt
9. Flat blade screwdriver (single flange design) – for widening adapter
10. Food grade lubricant
11. 3/16" Allen wrench – shaft collar bolt 56-180 frames
1/4" Allen wrench – shaft collar bolt 210-250 frames
5/16" Allen wrench – shaft collar bolts 280-360 frames
12. Impeller puller / Pinch bars (May be necessary)
13. Feeler gauges (See Impeller Gap Chart for sizes)

*** All R Models have the same Impeller to Volute and Impeller to Cover values accept for the R50.*

SPECIFICATIONS

Maximum inlet pressure.....	150 psig
Operating Temperature Range	-40° F to 400° F
Product Contact Surface Finish	32 in Ra (standard) 15 in Ra electropolish (optional)

MATERIALS OF CONSTRUCTION

Casing.....	316L Stainless Steel
Cover	316L Stainless Steel
Impeller.....	316L Stainless Steel
Stub Shaft.....	316L Stainless Steel
Adapter.....	304 Stainless Steel
Seal Driver	316L Stainless Steel
Single Rotating Seal	Silicone Carbide (standard) Chrome Oxide coated 316L Steel (optional)
Stationary Seal	Carbon (standard) Silicon Carbide (optional)
Double Rotating Seal (if installed).....	Ceramic
Recommended Seal Flush Flow	1-2 GPH
Recommended Seal Flush Pressure.....	5 PSI Maximum
Gaskets/O-rings.....	Viton (standard) EPDM (optional)
Cover O-ring	Buna (standard) EPDM, Viton (optional)
Motor.....	NEMA TEFC C-face Painted Rolled Steel or Painted Cast Iron (standard) 3 Phase, 60 Hz, 208-230/460 VAC, 1750//3500 RPM Stainless Steel (optional)

COMMON TROUBLES AND THEIR CAUSES

It is to the user's advantage to be familiar with a systematic procedure to determine reasons and cause for unsatisfactory pump operation. The following list of troubles and causes is intended to assist users in determining the cause of any pumping trouble. Faulty installations can then be corrected and a clear description given the manufacturer if assistance is required. Human judgment should not be relied on to measure operation conditions. Use proper instruments to measure values of pressure, suction lift, speeds, temperature rise of motors, etc.

When motor speeds are incorrect, check connections and measure voltage at motor terminals.

1. NO LIQUID DELIVERED

- a. Pump and suction line not completely primed
- b. Speed too low
- c. Required discharge too high
- d. Suction lift too high
- e. Impeller, piping or fittings completely plugged up
- f. Wrong direction of rotation

2. NOT SUFFICIENT CAPACITY

- a. Air leaks in suction pipe or shaft seal
- b. Speed too low
- c. Required discharge head too high
- d. Suction lift too high or insufficient NPSH available
- e. Impeller, piping or fittings partially plugged
- f. Insufficient positive suction head for hot water or other volatile liquids
- g. Liquid viscosity too high
- h. Mechanical problems – impeller damaged, shaft seal defective
- i. Wrong direction of rotation
- j. Suction pipe entrance too close to surface of liquid
- k. Air pockets in pipe high points

3. NOT SUFFICIENT PRESSURE

- a. Speed too low
- b. Mechanical problems – impeller damaged, shaft seal defective
- c. Small impeller diameter
- d. Air or gas in liquid
- e. Wrong direction of rotation
- f. Air pockets in pipe high points

4. PUMP OPERATES FOR A WHILE, THEN QUILTS

- a. Leaky suction line
- b. Air leaking in through shaft seal
- c. Suction lift too high or insufficient NPSH available
- d. Air or gas in liquid
- e. Suction piping and fitting not completely freed of air during priming
- f. Air pockets in pipe high points

5. PUMP TAKES TOO MUCH POWER

- a. Speed too high
- b. Pumping too much water because required head is lower than anticipated
- c. Viscosity and/or specific gravity is higher than specified
- d. Mechanical problems – binding inside seal from distortion due to piping strains, shaft bent, impeller rubbing casing
- e. Wrong direction of rotation

TERMS AND CONDITIONS

AMPCO PUMPS Made of selected corrosion-resistant alloys

TERMS AND CONDITIONS OF SALE

1. **ENTIRE AGREEMENT.** This document contains all of the terms and conditions of the agreement ("the agreement") between Ampco Pumps Company, Inc. ("Seller") and the purchaser ("Purchaser") of the Products ("Products") to be sold to Purchaser, to the exclusion of any other statements and agreements, and to the exclusion of any terms and conditions incorporated in Purchaser's order or other documents of Purchaser. Seller's acceptance of Purchaser's order is expressly conditioned on Purchaser's acceptance of the terms and conditions contained herein, and Purchaser, upon placing an order, is presumed to have accepted all the terms and conditions without modification. No alteration, waiver, modification of or addition to the terms and conditions herein shall be binding on Seller unless set forth in writing and specifically agreed to by an officer of Seller. No course of dealing, usage of trade or course of performance will be relevant to supplement or explain any terms used in the agreement. All offers to purchase, quotations and contracts of sale are subject to final acceptance by Seller at its home office at Milwaukee, Wisconsin.
2. **PRICES.** Prices for Products manufactured by Seller pursuant to written accepted orders will remain firm for thirty (30) days from the date of any subsequent price change.
3. **TERMS OF PAYMENT.** Standard terms are 1/2% 10 days, 30 days net, from date of invoice unless otherwise stated. If, in the judgment of Seller, the financial condition of Purchaser at any time does not justify continuance of production or shipment on the terms of payment specified, Seller may require full or partial payment in advance. In cases of delays in payment, Seller reserves the right to charge interest on delinquent balances at the rate of 1 1/2% per month.
4. **DELIVERY.** Except as otherwise provided expressly stated in the agreement, Products are sold F.O.B. Milwaukee. Seller will use reasonable commercial efforts to fill orders within the time stated, but the stated delivery date is approximate only, and Seller reserves the right to readjust shipment schedules without liability. Acceptance by Purchaser of the Products waives any claim for loss or damage resulting from a delay, regardless of the cause of the delay. Except as otherwise provided herein, Seller will not be responsible for freight, transportation, insurance, shipping, storage, handling, demurrage or similar charges. Claims by Purchaser for shortages in the Products must be made to Seller in writing within ten (10) days after date of receipt of the Products. No such shortage shall entitle Purchaser to withhold payment for Products which were received by Purchaser. Each such claim shall set forth in detail the basis and amount of such claim.
5. **TAXES AND FEES.** Seller shall pay all present and future sales, excise, privilege, use or other taxes, customs duties, and all other fees or other costs, imposed by any federal, state, foreign, or local authorities arising from the sale, purchase, transportation, delivery, storage, use or consumption of the Products or will, if applicable, provide Seller with an appropriate exemption certificate. Seller shall be under no obligation to contest the validity of any such taxes or to prosecute any claims for refunds or returns.
6. **INSTALLATION.** The Products shall be installed by and at the expense of Purchaser.
7. **LOSS, DAMAGE OR DELAY.** Seller will not be liable for loss, damage or delay resulting from causes beyond its reasonable control, including, without limitation, strikes or labor difficulties, lockouts, acts or omissions of any governmental authority or Seller, insurrection or riot, war, fires, floods, Acts of God, breakdown of essential machinery, accidents, embargoes, cargo or material shortages, delays in transportation, lack of production capacity or inability to obtain labor, materials or parts from usual sources. In the event of any such delay, performance will be postponed by such length of time as may be reasonably necessary to compensate for the delay. In the event performance by Seller under the agreement cannot be accomplished by Seller due to any of the foregoing causes within a reasonable period of time, Seller may, at its option, terminate the agreement without liability.
8. **RETURNS.** No Products or parts may be returned by Purchaser without the prior written consent of Seller.
9. **WARRANTY.** Seller warrants that the Products manufactured by Seller will be free from defects, material and workmanship under normal use and service for a period of one (1) year from date of shipment. In addition, the specified rating of each pump is warranted; however, the characteristic shape of the performance curves may vary from the published standards, and the capacity, head and efficiency guarantees are based on actual shop tests using clear cold water, and therefore the rating is specified in equivalent units of clear cold water. The sole obligation of Seller and the exclusive remedy of Purchaser for breach of this warranty shall be the repair (at Seller's facility) or replacement by Seller (F.O.B. Milwaukee, Wisconsin), at Seller's option, of any parts found to be defective, without charge and shall be conditioned upon Seller receiving written notice of any alleged breach of this warranty within a reasonable time after discovery of the defects, but in no event later than the end of the warranty period. The parts alleged to be defective shall be returned to Seller upon its request, freight prepaid. This warranty does not cover ordinary wear and tear, abuse, misuse, overloading, alteration or Products or parts which have not been installed, operated or maintained in accordance with Seller's written instructions. Seller shall not be liable for any expenses for repairs, additions or modifications to the Products outside of Seller's factory without its prior written consent, and any such repairs without such consent shall void this warranty. THIS

WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES WHATSOEVER, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Seller may from time to time provide its facilities, personnel and experience to assist customers in the selection of materials, design, installation and operation of Products for maximum resistance to corrosion and abrasion with due consideration to the economy of the installation. This service is provided in an advisory capacity only and the final selection and operation of the Products and ancillary equipment shall be the sole responsibility of Purchaser or any user thereof. Accessories and parts manufactured by third parties are warranted only to the extent of such third party's warranty. IN NO EVENT SHALL SELLER BE LIABLE UNDER ANY CIRCUMSTANCES FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES (INCLUDING, WITHOUT LIMITATION, ANY LOST PROFITS OR LABOR COSTS) ARISING FROM THE BREACH OF THIS WARRANTY OR OTHERWISE ARISING FROM OR RELATING TO THE PRODUCTS OR THEIR SALE, USE OR INSTALLATION.

10. **CHANGES.** Changes in any work to be performed hereunder may be made only upon Purchaser's written instructions and acceptance by Seller in its discretion. Any change in drawings, materials or design of the Products, or to tools, fixtures or other items used to produce the Products, which affects Seller's cost to produce the Products will entitle Seller to adjust the price to take into account any additional costs. If work has been started, Seller shall be properly reimbursed for work already performed; if Products already produced are not accepted by Purchaser, Seller has the right to adjust the price to take into account any additional costs caused by an increase or decrease in quantities or in the time required for performance under the agreement.
11. **TERMINATION.** After Seller has commenced work, ordered any materials or made any other commitments pursuant to the agreement, it may be terminated only with the prior written agreement of Seller providing for equitable cancellation charges. Such charges shall reimburse Seller for any completed items at the contract price, and for any work-in-process items at the contract price less the cost to complete. Termination on any other basis must be specifically agreed on in writing in advance between Purchaser and Seller.
12. **DEFERRED DELIVERIES.** Orders or deliveries will be deferred only upon the prior written agreement of Seller in its discretion, and then only upon the following conditions:
 - a. The deferral period may not exceed sixty (60) days. At the end of the deferral period, if no release is provided by Purchaser, Seller reserves the right to render an invoice for and ship the completed portion of the order to the destination specified in Purchaser's order, or to store such material at Purchaser's expense at Seller's standard storage charges then in effect.
 - b. For the portion of the order that is not completed, if no release is provided by Purchaser at the expiration of the deferral period, Seller re-serves the right to render an invoice for any completed items at the contract price, and for any work-in-process items at the contract price less the cost to complete.
 - c. Purchaser shall bear the risk of loss or damage to materials held at Purchaser's request.
13. **LIMITATION OF LIABILITY.** IN NO EVENT SHALL SELLER BE LIABLE UNDER ANY CIRCUMSTANCES: (a) FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES (INCLUDING, WITHOUT LIMITATION, ANY LOST PROFITS OR LABOR COSTS) ARISING FROM OR RELATING TO THE PRODUCTS OR THEIR SALE, USE OR INSTALLATION; (b) FOR DAMAGES TO PROPERTY (OTHER THAN THE PRODUCTS PURCHASED FROM SELLER); (c) FROM ANY BREACH OF ITS WARRANTY OR ANY OTHER OBLIGATIONS TO BUYER; OR (d) FOR ANY OTHER CAUSE WHATSOEVER, WHETHER BASED ON WARRANTY (EXPRESSED OR IMPLIED) OR OTHERWISE BASED ON CONTRACT, OR ON TORT OR OTHER THEORY OF LIABILITY, AND REGARDLESS OF ANY ADVICE OR REPRESENTATIONS (WHETHER OR NOT IN WRITING) THAT MAY HAVE BEEN RENDERED BY SELLER CONCERNING THE DESIGN, MANUFACTURE, SALE, USE OR INSTALLATION OF THE PRODUCTS.
14. **INFRINGEMENT.** Seller at its expense will defend and hold Purchaser harmless from and against all damages, costs and expenses arising from any valid claim of infringement by a third party with respect to any patent or other intellectual property rights (collectively, the "Intellectual Property Rights") caused by Products originally manufactured by Seller, provided Purchaser (a) has not modified such Products, (b) gives Seller immediate notice in writing of any claim or commencement or threat of suit, and (c) permits Seller to defend or settle the same, and gives all immediate information, assistance and authority to enable Seller to do so. In the event any such originally manufactured Products are held to infringe an Intellectual Property Right and if Purchaser's use thereof is enjoined, Seller will, at its expense and option: (1) obtain for Purchaser the right to continue using the Products, (2) supply non-infringing Products, (3) modify the Products so that they become non-infringing, or (4) refund the then market value of such Products. In no event shall Seller's liability exceed the sale price of the infringing Products. THE FOREGOING REPRESENTS SELLER'S ENTIRE AND EXCLUSIVE OBLIGATION WITH RESPECT TO ANY CHARGE OF INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT AND IS IN LIEU OF ANY STATUTORY WARRANTY RELATING TO INFRINGEMENT. Notwithstanding the foregoing, Seller shall have no liability as to any Products or parts thereof that are manufactured or modified by Purchaser or a third party, or that are manufactured or modified by Seller in accordance with Purchaser's specifications. Purchaser will defend and hold Seller harmless from and against all damages, costs and expenses whatsoever arising from any claim for infringement of any Intellectual Property Rights relating to Products that have been manufactured or modified by Seller according to specifications provided by Purchaser.

15. **CERTAIN LAWS.** Seller will comply with the applicable requirements of the Fair Labor Standards Act of 1938, as amended, Executive Order 11246, and THE rules, regulations and orders of the Secretary of Labor relating thereto.
16. **PERIOD FOR ACCEPTING QUOTATIONS.** Unless accepted without modification within thirty (30) days of issuance, or prior to withdrawal by Seller if earlier, all quotations automatically expire at the end of such thirty (30) day period.
17. **PROVISIONS FOR INTERNATIONAL TRANSACTIONS.** The following provisions shall apply if the Products are to be shipped to Purchaser at a location outside the United States, and apply regardless of other provisions set forth in these Terms and Conditions:
 - a. The 1980 United Nations Convention on Contracts for the International Sale of Products shall not apply.
 - b. Except as otherwise provided expressly stated in the agreement, terms of delivery are Ex-Works (within the meaning of INCOTERMS 2000) and all customs fees, import duties, cargo insurance, taxes and other charges imposed on or relating to the purchase or sale of the Products shall be paid by Purchaser in addition to the stated price.
 - c. Except as otherwise provided expressly stated elsewhere in the agreement, payment shall be made by issuance to Seller of an irrevocable letter of credit which (i) is issued and confirmed by a U.S. bank acceptable to Seller, (ii) is governed by the Uniform Customs and Practice for Documentary Credits (UCP 600) and otherwise acceptable in form and substance to Seller, and (iii) provides for payment to Seller of the purchase price in U.S. dollars upon presentation by Seller of Seller's certification and/or such other documents as shall be required by the letter of credit. All banking and other charges for such letter of credit shall be for the account of Purchaser.
 - d. Prices include Seller's standard commercial export packaging which may vary depending on whether shipment is made by air, land or sea. Except as otherwise provided expressly stated in the agreement, Purchaser will bear any additional expenses required to satisfy Purchaser's packaging requirements. Packages will be marked in accordance with Purchaser's instructions, if any. Seller shall furnish packing lists and such other information as may be necessary to enable Purchaser's agent to prepare documents required for export shipment.
 - e. All shipments hereunder are subject to compliance with the U.S. Export Administration Act, as amended, regulations thereunder and all other U.S. laws and regulations concerning exports. Purchaser shall comply with all such laws and regulations concerning the use, disposition, re-export and sale of the Products provided hereunder.
18. **GENERAL.** No modification or waiver of the agreement or any of its provisions is valid unless expressly agreed to by Seller in writing, and no waiver by Seller of any default under the agreement is a waiver of any other or subsequent default. The unenforceability or invalidity of one or more of the provisions of the agreement will not affect the enforceability or validity of any other provision of the agreement. Purchaser may not assign any of its rights, duties or obligations under the agreement without Seller's prior written consent and any attempted assignment without such consent, even if by operation of law, will be void. The agreement is governed by and shall be construed in accordance with the laws of the State of Wisconsin, including the Uniform Commercial Code as enacted by such state, without giving effect to its conflict of laws principles.

AMPCO PUMPS COMPANY RETURN POLICY

This policy is intended for returns that are not covered by product warranty, i.e. wrong pump or part was ordered, customer canceled order, etc. Before returning any product, contact us for a Returned Material Authorization Number (RMA#). This will eliminate confusion when the parts are received and facilitate processing the return. No action will be taken on returned parts without an RMA.

Type of Return	Restocking Charge
Standard pump with a replacement order	10%
Standard pump without a replacement order	20%
Standard parts with a replacement order	5%
Standard parts without a replacement order	10%

Additional restocking charges may be assessed for any of the following circumstances.

1. Special order motors and seals are not returnable unless we have a use for them. Credit will be determined on a case-by-case basis.
2. Impellers that are trimmed to a diameter that we don't regularly use are not returnable. Credit will be determined on a case-by-case basis.
3. Used seals and motors are not returnable.
4. For any pumps and/or parts purchased over (1) year ago, credit will be determined on a case-by-case basis.

CREDITS

Credit will be issued only after parts are returned and inspected. Customer is responsible for packaging parts so they are returned in "as new" condition. Any labor required by Ampco to return the parts to "as new" condition will be deducted from the credit.



2045 W. Mill Road
Glendale, WI 53209

Phone: 800.737.8671
or 414.643.1852

ampcocs@ampcopumps.com

For additional information on the "LF" series
and other Ampco Pumps products, please
visit our website: www.ampcopumps.com