



Installation and Service Instructions

L Series Pumps



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General Description

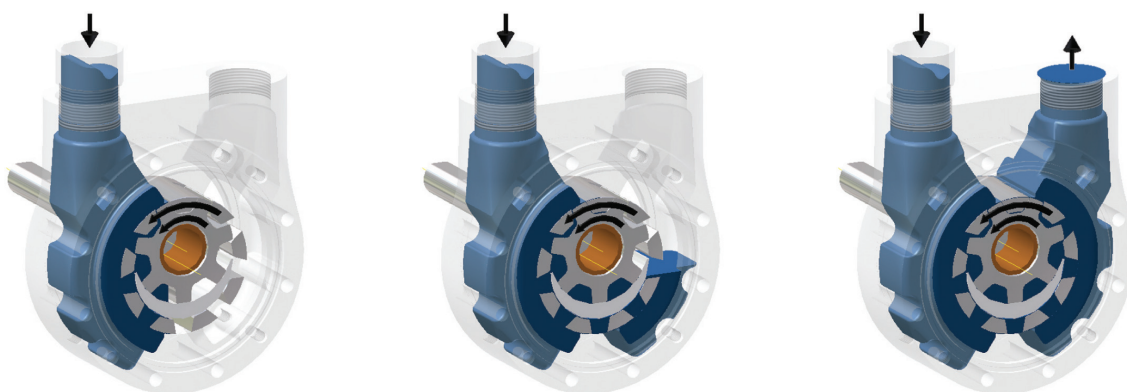
ARO's LE Series are compact, highly efficient, cast iron positive displacement rotary gear pumps with a mechanical seal. Built in six sizes, they provide nominal capacities from .5 gpm (1.9 L/Min) to 14 gpm (53 L/Min) and pressures up to 500 psi (300 psi in the 5LE). They are self priming and particularly suited to handle liquids of 35 to 1000 SSU viscosity. Higher viscosities can be handled at reduced speeds.

The LE Series with a three bolt flange. Optional mounting feet are available and internal relief valve. The LE Series is bi-rotational (unless outfitted with a relief valve) and designed for direct drive at standard motor speeds, with modifications available for indirect drive.

The Pumping Principle

ARO's LE Series employs the internal gear pumping principle. There are only two moving parts. Pumping action is based on a rotor, idler gear and crescent-shaped partition cast integral with the cover. Power applied to the rotor is transmitted to the idler gear with which it meshes. The space between the outside diameter of the idler and the inside diameter of the rotor is sealed by the crescent.

As the pump starts, the teeth come out of mesh, increasing the volume. This creates a partial vacuum, drawing the liquid into the pump through the suction port. The liquid fills the spaces between the teeth of the idler and the rotor and is carried past the crescent partition through the pressure side of the pump. When the teeth mesh on the pressure side, the liquid is forced from the spaces and out through the discharge port.



WARNING

Failure to follow these instructions could result in serious bodily injury or death. These pumps should not be used for handling plain water, corrosive or abrasive liquids or liquids not possessing adequate lubricity. Do not attempt to work on any ARO pump installation before completing the steps below. Disconnect the drive so that it cannot be started while work is being performed. Review the Material Safety Data Sheet (MSDS) applicable to the liquid being pumped to determine its characteristics and the precautions necessary to ensure safe handling. Vent all pressure within the pump through the suction or discharge lines. All ARO pumps contain residual 200 SSU lube oil from the factory production test. Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, consult the factory.

Location

LE Series pumps are designed for working pressures up to 500 psi (300 psi in the 5LE) and are required to develop 25" mercury vacuum at 0 psi on factory test. While these pumps will develop as high as 27" of vacuum, it is a sound engineering practice to avoid extreme vacuum whenever possible. Select a pipe size to reduce line friction loss to a minimum. The pump should be located as close to the source of supply as conditions permit and if possible, below the level of the liquid in the reservoir. When necessary to locate the pump in a pit, provisions should be made to safeguard against flooding. Care must be taken to properly support the suction and discharge piping so that no strain is put on the pump due to either weight or expansion. Piping strain can result in misalignment, hot bearings, worn couplings, and vibration. It is important that the piping used be clean and free of chips or scales.

Proper Installation

Unsatisfactory pump installations are usually characterized by poor suction conditions for the specific liquid being handled. Suction conditions should be minimized to prevent vaporization of the liquid. If vacuum conditions force the liquid to vaporize, cavitation will occur, resulting in loss of capacity, premature wear and noisy operation. When handling high viscosity liquids, the speed of the pump must be reduced and the size of the lines increased to prevent cavitation.

Note: Pipe line friction increases at a rapid rate with an increase in viscosity. For a given pump and motor, larger pipe lines are necessary to maintain the same pump pressure when changing from a thin fluid to a thick one.

ARO LE Series pumps are supplied with both ports on the same plane. Pumps with this type of porting arrangement should always be installed with both ports pointing upward to insure proper priming. If it is necessary to install the pump with the ports pointing to either side, it is recommended that the top port be the suction port. This will prevent gravity induced drainage of fluid through the suction port. When pipe lines are installed, an inverted "U" bend should be incorporated into the suction line close to the pump for priming purposes.

With the ports facing up, and viewing the pump from the shaft end, the inlet port is on the right for clockwise rotation and on the left for counter-clockwise rotation. Pumps with built in relief valves are directional. Therefore rotation must be specified at time of order. The adjusting screw of the internal relief valve must always be located on the suction side of the pump. Pumps should be filled with oil at installation and should never be allowed to run dry. Every pump installation should have a good foundation. Its structure should be sufficiently strong to hold the pump rigid and to absorb any strain or shock that may be encountered. The installation should be leveled, checked for proper piping alignment, and then fastened securely.

Method of Drive

Direct drive through a traditional flexible coupling is recommended. However, do not expect the flexible coupling to compensate for misalignment. Contact the coupling manufacturer to determine the maximum amount of misalignment to which the coupling can be subjected. LE Series pumps can be driven in either direction of rotation, unless outfitted with an internal relief valve. The seal chamber communicates with the neutral zone and therefore the seal is subjected to approximately one half of the discharge pressure.

All pump and motor units must be properly aligned during assembly and periodically checked since misalignment may occur later due to abuse or other conditions. Pipe strain can force the pump and motor shafts out of alignment. Therefore, all piping to the pump must be properly supported. Do not allow the pump to act as a pipe support. Provide for proper expansion of pipes when handling hot liquids. Allow pump to reach operating temperature slowly. Rapid temperature change can result in damage to the cast iron components. Recheck the alignment.

- Never align a pump and motor supplied with a pin type coupling without first removing the pins
- Never depend upon sight or feel. Use proper gauges when aligning the pump.
- Never operate the pump without all guards in place.

Relief Valve Protection

The LE Series is a positive displacement pump. As the pump rotates, liquid is positively delivered to the discharge side of the pump. If the discharge line is closed off, pressure will increase until the drive stalls and/or fails, the pump breaks or ruptures, or the piping bursts. To prevent this from happening, the use of a pressure relief valve is required. A relief valve that directs the flow back to the supply tank is recommended.

The internal relief valve available is designed for overpressure protection only. It is not intended as a flow control device or for any similar use. Continuous operation of the relief valve will result in excessive heat buildup within the pump cavity which could cause serious internal damage. Make certain the adjusting screw of the relief valve is located on the suction side of the pump. Unless otherwise specified at the time of order, all LEV pumps are supplied with the standard spring, with a range of 55-120 psi (40-70 in the 5LE), set to provide full bypass relief at 55 psi.

To adjust the relief setting within the range of a given spring's capability read below

- Remove the acorn nut not supplied with model 5LEV
- Insert a screwdriver into the slot of the adjusting screw and hold it steady
- Loosen the locking nut with a wrench by turning counterclockwise
- Throttle the outlet line until the differential pressure at the pump port is at the desired level
- Turning the adjusting screw inward (clockwise) raises the pressure setting
- Turning the adjusting screw outward (counterclockwise) lowers the pressure setting
- Retighten the nut to lock the setting in place and replace the acorn nut
- Recheck the pressure gauge reading

CAUTION

If the adjusting screw is backed out (counter clockwise) too far, the spring and poppet could fall into pump.

If an internal relief valve has not been supplied with the pump some other means of protection must be utilized. These include in-line safety relief valves, pressure shutdown switches or other similar devices.

Strainer Protection

Strainers are used to remove contaminated particles from the fluid system and extend pump life. Every pump should be protected from these particles by a strainer in the suction line. Strainer size and mesh of screen are determined by the rate of flow and viscosity of the fluid. Consult the strainer manufacturer for recommendations.

Never use a strainer with a built-in automatic by-pass on the suction line set to open under 30" Hg. vacuum.

Install the strainer according to the designated direction of flow, locating it so that it is accessible for servicing. Use a duplex type strainer when shutdown during service is not possible. Provide a vacuum gauge in the suction line for determining when the strainer requires cleaning. Make certain strainer baskets are properly reinforced so as not to collapse under 30" Hg. vacuum.

WARNING

All ARO pumps contain residual 200 SSU lube oil from the factory production test. Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, consult the factory. If the pump is to operate at elevated temperatures, it should be brought up to operating temperature gradually. Rapid or sudden introduction of liquid at an elevated temperature into the cold liquid chamber of the pump could cause damage to the seal or other internal parts. Do not run the pump dry. This could cause severe damage to the seal, bushings and/or metal parts.

Startup

Prior to starting the pump double check the following

- Pressure and vacuum gauges should be installed as close as possible to the pump
- Rotate pump shaft to ensure it turns freely without binding
- Recheck alignment and ensure all guards are in place
- Make sure piping is independently supported and no strain is being transmitted to the pump
- Make sure the safety relief valve is installed correctly
- Check pump rotation
- Open suction and discharge gate valves
- Check for any leaks once gate valves are open

After completing these checks the pump can be started.

CAUTION

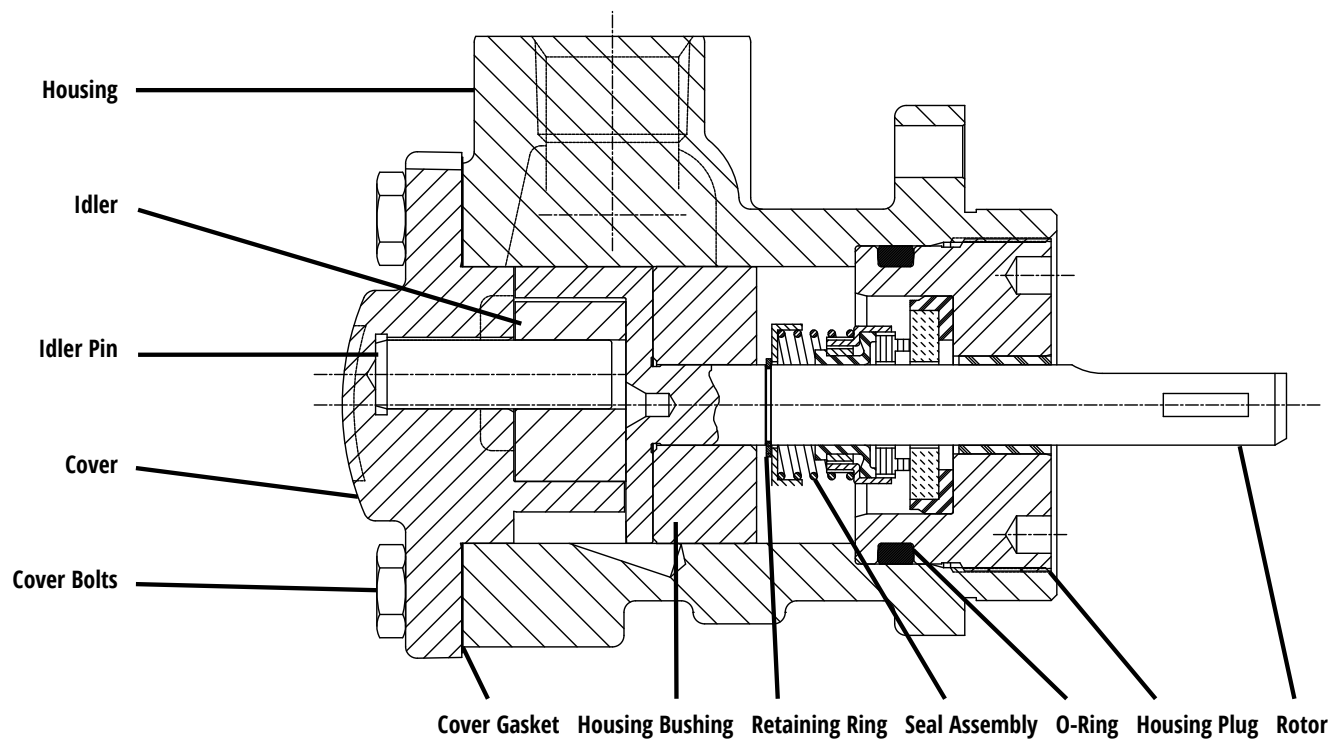
The pump should not be run dry. If after approximately 60 seconds there is no discharge of liquid, stop the pump and investigate the possible cause. Failure to comply with this could cause severe damage to internal seals, bushings and/or metal parts.

Pump Performance Data

Size	Capacity	Notes
30L	0.3	
00L	0.8	
0L	1.6	
1L	2.7	
2L	4.9	Based on pumping a fluid of 200 SSU
5L	12.9	viscosity at 100 psi and 1750 rpm

WARNING

Failure to follow these instructions could result in serious bodily injury or death. Do not attempt to work on any ARO pump installation before completing the steps below. Disconnect the drive so that it cannot be started while work is being performed. Review the Material Safety Data Sheet (MSDS) applicable to the liquid being pumped to determine its characteristics and the precautions necessary to ensure safe handling. Vent all pressure within the pump through the suction or discharge lines. All ARO pumps contain residual 200 SSU lube oil from the factory production test. Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, consult the factory.



Seal Replacement

The seal assembly in LE Series pumps can be changed without disassembly of the rest of the pump

- Place the pump in a vise with the shaft facing up so that one jaw grips across the two ports
- Do not tighten excessively as the pump housing may be distorted
- Inspect the shaft at the keyway, flat, or tang
- Any burrs will interfere with removal of the housing plug and bearing assembly
- Remove the housing plug with a face-type spanner wrench (part # OL 506) AND the seal from the shaft
- The rubber boot will be bonded to the shaft, so it is necessary to push down on the seal to break this bond
- Grasp the metal outer shell with any suitable device, pull the seal assembly upward, and remove the spring and washer
- Models 30LE through 1LE have a snap ring on the shaft to back up the seal assembly
- Do not remove this snap ring unless you are completely disassembling the pump
- Models 2LE and 5LE do not have a snap ring
- A step on the shaft is used as the seal backup
- Remove the stationary seal face from the housing plug by pressing out from the opposite side
- If damaged, remove the O ring from the OD of the housing plug

Assembly of Seal

- Clean all parts thoroughly using great care to eliminate all dirt
- Oil the shaft with a suitable lubricating oil (If the pump has an EPR seal apply a silicon based lubricant instead)
- Apply the appropriate lubricant to the inside of the new seal assembly

For standard full length shafts with flat and/or keyway

- Place seal assembly on the pump shaft.
- Push seal down with your fingers to a position approximately half way down the shaft.

For modification “A” tang shafts

- Use tapered plastic sleeve (ARO part number 1LPF 531 7010)
- Lubricate the sleeve
- Place seal assembly on the sleeve
- The tapered end of the sleeve fits into the spring end of the seal assembly
- Place the slotted end of the sleeve on a bench
- Press down on the carbon face of the seal with your fingers and slide the seal to about the midpoint on the sleeve
- Place the slotted end of the sleeve over the tang on the pump shaft
- Line up the outside diameters of the sleeve and shaft by eye
- Push seal down with your fingers so that it passes from the sleeve to a position approximately halfway down the shaft
- Press the stationary face into the housing plug
- The lapped surface must be up
- Protect this lapped surface by covering it with a piece of paper when pressing down on the face
- Use your fingers for this operation
- Place a new O ring on the OD of the housing plug, if required, and lubricate
- Lubricate the carbon face liberally
- Re-assemble the housing plug into position over the pump shaft
- Do not nick the seal face by hitting the pump shaft
- Tighten the housing plug with the spanner wrench
- The seal will automatically be positioned by this operation
- If the pump is equipped with a ball bearing (modification K), press the bearing onto the shaft
- Press on the bearing inner race with a suitable sleeve
- Do not hammer into position or press on the bearing outer race
- Check pump for free rotation by turning the shaft with a suitable wrench
- There will be a definite resistance to turning because of the seal load
- The pump must turn freely without binding

Disassembly of Pump

The seal assembly must be removed before the pump can be disassembled

- Remove the snap ring from the shaft on all models except 2LE and 5LE
- Mark the cover and housing of the pump for proper re-assembly
- Remove cover screws, cover, idler and rotor from the housing

Inspection

Check the pump housing, rotor, idler gear, idler pin and cover for wear and chipped or broken teeth. The housing bore and rotor OD may be checked for wear by positioning the rotor in the housing and checking for clearance in the bearing. The shaft must turn freely without any detectable side play. Any side play will require replacement of the housing and/or rotor. If either of these two parts must be replaced, it is economically advisable to replace the entire pump.

Assembly of Pump

The following must be carefully followed when the pump is re-assembled

- Clean all parts thoroughly using great care to eliminate all dirt
- Install the rotor in the pump housing
- Apply the gasket to the cover
- Use a new gasket if the old one is damaged
- Models 000LE, and 5LE are also supplied with an O ring in the cover (Replace if damaged)
- Place the idler gear on the pin in the cover assembly
- Place the cover assembly with gear on the pump, aligning the matching marks for proper location
- Install the cover screws by tightening gradually, alternating from a screw on one side to a screw on the opposite side
- Install the snap ring on the shaft (except models 2LE and 5LE)

Changing Rotation

LE Series pumps are bi-directional and will work equally well in either direction with no modification. However, if outfitted with an internal relief valve (model LEV), these pumps become rotational. Rotation cannot be changed in the field unless the housing is replaced.

Changing Location of Suction Port Outfitted with ARO's Unique Automatic Reversing Feature (Models RLE)

- Remove the cover screws
- Rotate the cover 180° so that the boss on the cover points to the new suction (inlet) port
- Align the mounting holes and reinstall the cover screws

Note: Location of the suction port cannot be changed in the field on RLEV pumps unless the housing is replaced.

Troubleshooting

No fluid is delivered

- Power is not on
- Net positive suction head (NPSHA) low for inlet conditions & vapor pressure of the liquid pumped Calculate NPSHA and redesign piping if necessary
- Leaks in suction line or port passages (Detect by submerging pressure line on discharge side into liquid to see bubbles)
- Direction of shaft rotation is incorrect
- Pump shaft is not rotating Coupling is defective or tongue and groove are not engaged
- The relief valve setting is too low (Liquid is discharging through the by-pass port)

Capacity is too low

- There are air leaks in the suction line
- Suction losses are high (suction lift is too great or the suction line too small or too long)
- This can be detected by installing a vacuum gauge directly at the pump suction
- The maximum vacuum at the pump suction should never exceed 15" of mercury
- Vaporization caused by higher vacuums will generally result in capacity drop off
- Suction conditions must be redesigned
- Pump speed is too slow
- The strainer is too small or obstructed
- The suction port or pipe is not immersed deeply enough in the liquid
- Piping is improperly installed, permitting an air pocket to form in the pump
- Increased clearances or wear in the pump will sometimes cause the pump to deliver an insufficient supply of fluid
- This can generally be corrected by reducing the thickness of the cover gaskets
- Folded gasket/dirt could cause leakage

Pump works spasmodically

- Leaky suction line, Varying suction conditions, or Air or vapor in the fluid

Excessive power draw

- Pressure too high
- Liquid is more viscous than originally expected
- Suction or discharge lines obstructed
- Insufficient horsepower
- Drive shaft and pump misaligned
- Pump binding due to insufficient end clearance
- Pump shaft is bent
- Misalignment within the pump due to bad piping or poor installation, causing strain or distortion

Pump is noisy

- Pump is cavitating due to inadequate suction conditions
- Misalignment of coupling
- Coupling is set too close to pump
- Vibration of pump due to worn or bent shaft
- Air leaks on suction side of pump or air entrainment in the fluid

Pump leaks

- Cover bolts need tightening or cover gasket is defective
- Worn or defective seal

Material Returns

If it becomes necessary to return a pump to the factory, a Return Goods Authorization (RGA) must be obtained from either your local Authorized Distributor or our Chicago plant. No RGA can be issued until a completed Material Safety Data Sheet (MSDS) has been forwarded to our Chicago plant and return of the pump approved.

- ARO pumps are precision built and must be handled with care
- Pumps must be drained of all fluid and the ports plugged to prevent foreign material from getting into the pump
- Pumps must be packaged securely to prevent damage while in transit

