

INSTALLATION AND SERVICE

INSTRUCTIONS

C SERIES PUMPS



**Tuthill Pump Group
12500 South Pulaski Road Alsip, Illinois
USA 60803**

**P: 708.389.2500
F: 708.388.0869**

Email: tutpump@tuthill.com

General Description

Model AC

Model AC pumps are available in six sizes, ranging in capacity from 2 to 84 gpm with differential pressures to 100 psi. The maximum discharge pressure capability is 125 psi. They have an integrally cast mounting foot and are supplied in four different mounting styles. This pump is suitable for driving at direct motor speeds and will pump equally well in either direction of rotation (unless supplied with an internal relief valve). It is equipped with a sleeve bushing, aluminum packing and an adjustable packing gland.

Model C1G

Model C1G is similar to model AC except that it is equipped with spring loaded V type leather packing. Model C1G pumps have the packing chamber vented to the suction side of the pumping zone. Therefore, the pump must operate in the direction for which it is assembled. Model C1G is available in six sizes, ranging in capacity from 2 to 84 gpm with differential pressures to 100 psi. The maximum discharge pressure capability is 125 psi. Like the model AC, these pumps are available in four different mounting styles.

Models C1E, C1EN, C1F and C1FA

Model C1E and C1F pumps are sleeve bushing lip seal units designed for direct drive service. Model C1E has an integral foot mount. Model C1F is a flange mount pump. Model C1FA pumps are similar to model C1F but are supplied without a seal. Model C1EN pumps are sleeve and ball bearing units with a lip seal and integral mounting foot designed for indirect (belt, chain, gear) drive.

The seal chamber on these pumps is vented to the suction side of the pumping zone. Therefore, the pump must operate in the direction for which it is assembled.

All models are available in five sizes, ranging in capacity from 6 to 84 gpm with differential pressures to 100 psi. The maximum discharge pressure capability is 100 psi.

Model C1B

Model C1B is a flange mount pump with two sleeve type bushings and a mechanical seal. It is bi-rotational, unless equipped with an internal relief valve. This pump is available in five sizes, with capacities from 6 to 84 gpm and differential pressures to 150 psi. The maximum discharge pressure capability is 300 psi. A mounting foot is optional.

Model CK1B

Model CK1B pumps are equipped with a mechanical seal and incorporate heavy-duty features, including special double bearing construction with an inboard double ball bearing and an outboard roller bearing. This pump is available in five sizes, with capacities from 6 to 84 gpm and differential pressures to 250 psi. The maximum discharge pressure capability is 300 psi. A mounting foot is optional.

The seal chamber is vented to the suction side. Therefore, the pump must operate in the direction for which it is assembled.

Model CC

Model CC pumps are designed to mount directly to NEMA 56 143 TC or 145 TC C Face motors, with modifications available for mounting to metric C motors. They are equipped with a mechanical seal and will pump equally well in either direction of rotation (unless equipped with an internal relief valve).

These pumps are available in four sizes, with capacities from 6 to 30 gpm and can handle inlet pressures to 25 psi and differential pressures to 100 psi.

The Pumping Principle

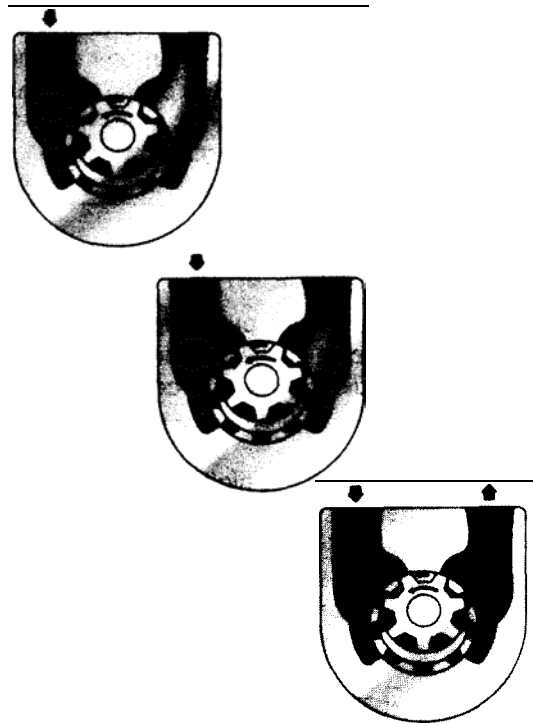
Tuthill C Series cast iron pumps employ the internal gear pumping principle. There are only two moving parts. Pumping action is based on a rotor, idler gear and crescent-shaped partition cast integral with the cover.

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 Tuthill 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 Tuthill 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.

Most Tuthill C Series pumps 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 and 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: Pipeline friction increases at a rapid rate with an increase in viscosity. For a given pump and motor, larger pipelines are necessary to maintain the same pump pressure when changing from a thin fluid to a thick one.

Most Tuthill C Series pumps are supplied with both ports on the same plane. Pumps with this type of porting arrangement should always be installed with the ports facing 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 pipes are installed, an inverted "U" bend should be incorporated into the suction line close to the pump for priming purposes.

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. On pumps with built in relief valves, the adjusting screw of the 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. (CC pumps are direct driven by the motor shaft as an integral part of the pump.) 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.

Model AC, C1B and CC pumps can be driven in either direction of rotation, unless outfitted with an internal relief valve. All other C Series pumps are directional. Rotation must be specified at the time of order. The seal chamber communicates with the neutral zone and therefore the seal/packing 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.

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

All C Series models are positive displacement pumps. 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 on C Series pumps 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 that 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 C Series pumps with an internal relief valve (except CC models) are supplied with the standard spring, with a range of 30-225 psi (10 - 200 psi in size 2 pumps), set to provide full bypass relief at 90 psi. The standard spring in CC model pumps has a range of 0 -110 psi, set to provide full bypass relief at 100 psi.

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

- Remove the cap nut (model CC pumps only).
- With a small wrench, hold the adjusting screw steady.
- With a second wrench, loosen the locking nut by rotating counterclockwise.
- Throttle the outlet line until the differential pressure at the pump port reaches the desired level.
- If the pressure fails to reach this level with the throttling valve closed, turn the adjusting screw inward (clockwise) until the desired pressure is reached. (Adjusting clockwise raises the pressure setting.)
- If the pressure reaches the desired level before the throttling valve is completely closed, turn the adjusting screw outward (counterclockwise) until the desired pressure is reached. (Adjusting counterclockwise lowers the pressure setting.)
- Retighten the nut to lock the setting in place.
- Replace the cap nut (model CC pumps only).
- Recheck the pressure gauge reading.

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 Tuthill pumps contain residual 200 SSU lube oil from the factory 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 (gpm)	Size	Capacity (gpm)
1C	3	CC009	9
2C	8	CC015	15
3C	17	CC020	20
4C	36	CC030	30
5C	61		
6C	84		

Based on pumping a fluid of 200 SSU viscosity at 50 psi and 1750 rpm.

Based on pumping a fluid of 100 SSU viscosity at 50 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 Tuthill 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 Tuthill 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.

Service - Specific Models

Model AC

Lubrication

Model AC pumps are provided with a grease cup or grease gun fitting at the outer bearing which also lubricates the packing. A good grade of medium cup grease, such as Fiske Bros. Lubriplate #907, should be used. Apply until visible at the outer end of the packing gland. If the pump is overheating, it may be due to lack of lubricant. Add lubricant as needed or at least every 60 days or 500 hours of operation.

Repacking

- Grip the pump firmly across the ports and opposite side of the housing in a vise with the shaft end up.
- Remove the lock wire and packing gland screws.
- Inspect the shaft at the flat and keyway area. Any burrs will interfere with removal of the packing gland. Use a small, fine file if necessary.
- Slide the packing gland off the shaft.
- Remove the old packing from the bracket.
- Inspect the shaft. If the shaft is too badly worn or scored at the packing area, the rotor must be replaced.

- Position the new packing over the shaft and slide into the bracket.
- Install the packing gland and the screws. Take care when tightening up the packing gland screws so as not to cause undue pressure in the stuffing box. Pull up firmly on the packing gland screws, back off to finger tight and lock the screws in place with the lock wire.

Aluminum packing is the standard in models 1AC through 6AC. Following is a table of packing sizes:

Size	ID	OD	Length
1	1/2"	55/64"	5/8"
2	5/8"	59/64"	3/4"
3 & 4	3/4"	1 1/8"	3/4"
5 & 6	1"	1 1/2"	1 1/2"

Changing Rotation

Model AC pumps in sizes 1 through 6 are bi-directional and will work equally well in either direction of rotation with no modification.

If outfitted with an internal relief valve (model ACV), these pumps become rotational. Rotation cannot be changed in the field unless the cover/valve assembly is replaced.

To change the location of the suction port on pumps supplied with Tuthill's unique automatic reversing feature (model RAC):

- 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.

Model C1G

Lubrication

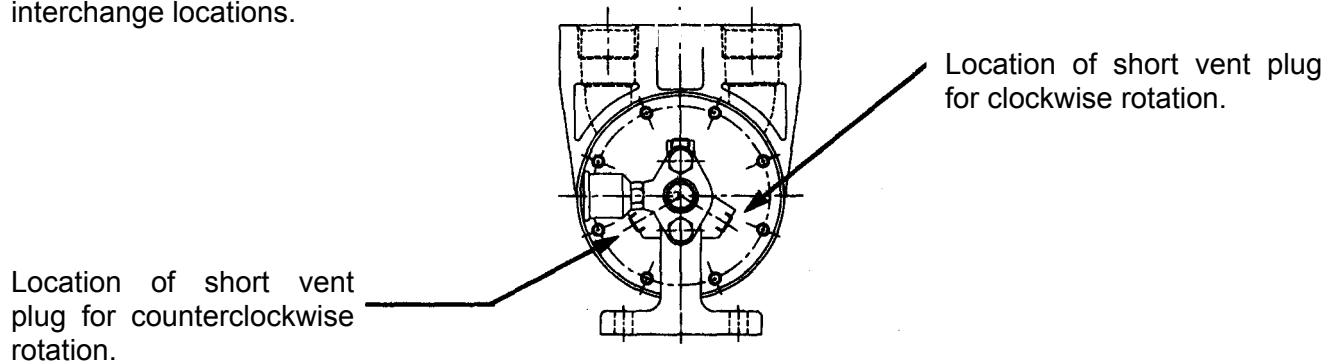
Model C1G pumps are provided with a grease cup or grease gun fitting at the outer bearing which also lubricates the packing. A good grade of medium cup grease, such as Fiske Bros. Lubriplate #907, should be used. Apply until visible at the outer end of the packing gland. If the pump is overheating, it may be due to lack of lubricant. Add lubricant as needed or at least every 60 days or 500 hours of operation.

Repacking

- Grip the pump firmly across the ports and opposite side of the housing in a vise with the shaft end up.
- Inspect the shaft at the flat and keyway area. Any burrs will interfere with removal of the packing gland. Use a small, fine file if necessary.
- Remove the two packing gland screws at the shaft end and slide the packing gland assembly off the shaft.
- Remove the old packing, packing retainer and spring.
- Inspect the shaft. If badly scored, the rotor must be replaced.
- Clean the packing chamber thoroughly. Carefully remove any sharp ridges from the shaft end. This will eliminate possible damage to the lips of the packing and ease installation.
- Replace the spring and packing retainer. Be certain that the spring is properly located on the packing retainer and that the beveled surface of the packing retainer is facing the shaft end of the pump.
- Install the V type packing rings. Rings should be installed separately and not in sets. Three rings are required per pump. Exercise care when sliding the rings into place so that the lips of the packing rings are stacked in line and positioned on the beveled surface of the packing retainer ring.
- Replace the packing gland assembly and fasten it securely to the bracket assembly with the packing gland screws. The tension of the spring is such that normal wear on the packing is taken up automatically.

Changing Rotation

Looking at the pump from the shaft end with the ports up, locate the short vent plug (painted red). This is the suction (inlet) side of the pump. If on the right, rotation is clockwise; if on the left, counterclockwise. On the opposite side is a long vent plug. Remove both plugs and interchange locations.



If outfitted with an internal relief valve (model C1GV), the rotation cannot be changed in the field unless the cover/valve assembly is also replaced.

To change the location of the suction port on pumps supplied with Tuthill's unique automatic reversing feature (model RC1G), the following must be done in addition to the steps above:

- 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.

Models C1E, C1EN, C1F and C1FA

Seal Replacement - Models C1E, C1EN and C1F

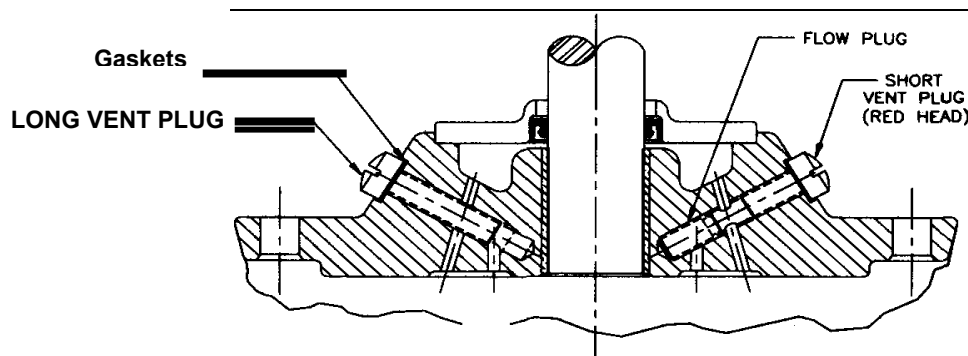
- Grip the pump firmly across the ports and opposite side of the housing in a vise with the shaft end up.
- **For model C1EN only:** Note the location of the red vent plug. This is the suction (inlet) side of the pump. Loosen the setscrew on the collar of the outboard ball bearing. While holding the pump shaft steady, turn the collar away from the red vent plug to loosen it. Remove the collar from the shaft.
- Remove the three screws and slide the seal housing cap assembly off the shaft.
- Pry the seal from the housing cap and clean out the seal cavity with a cloth. Press the new seal into the housing cap with the lip spring side facing the mounting face.
- Inspect the shaft. If badly scored at the seal area, the rotor must be replaced. Carefully remove any sharp edges from the shaft and polish with crocus cloth or very fine sandpaper. This will eliminate possible damage to the seal lip and ease installation.
- Install new gasket into bracket if necessary.

- Apply a dab of petroleum jelly to the seal lip and install it over the shaft. (If the seal is EPR, apply a silicon-based lubricant). The seal lip must retain its position on the shaft. Work the housing cap assembly up and down the shaft to make certain the seal lip slides freely.
- Align the holes in the housing cap with the holes in the bracket and reinstall the three screws.

Changing Rotation - Models C1E and C1EN

Looking at the pump from the shaft end with the ports up, locate the short vent plug (painted red). This is the suction (inlet) side of the pump. If on the right side, rotation is clockwise; if on the left, counterclockwise. Behind this short vent plug is a small flow plug.

- Remove both the long and short vent plugs as well as the small flow plug (with a hex wrench).
- Interchange the locations of the short vent plug and flow plug with the long vent plug.



Model C1 E, C1 EN

If outfitted with an internal relief valve (models C1EV and C1ENV), the rotation cannot be changed in the field unless the cover/valve assembly is also replaced.

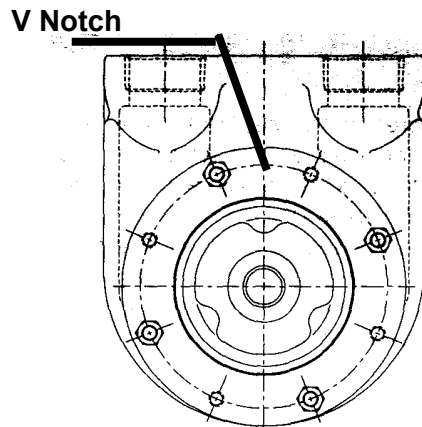
To change the location of the suction port on pumps supplied with Tuthill's unique automatic reversing feature (models RC1E and RC1EN), the following must be done in addition to the steps above:

- 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.

Changing Rotation - Models C1F and C1FA

Looking at the pump from the shaft end with the ports up, note the location of the V notch in the bracket. If at the top (12 o'clock), rotation is clockwise; if at the bottom (6 o'clock), counterclockwise.

- Remove the cover screws so that the bracket moves freely.
- Rotate the bracket 180°.
- Align the mounting holes and reinstall the cover screws.



Model C1F, C1FA

If outfitted with an internal relief valve (models C1FV and C1FAV), the rotation cannot be changed in the field unless the cover/valve assembly is also replaced

To change the location of the suction port on pumps supplied with Tuthill's unique reversing feature (models RC1F and RC1FA), the following must be done in addition to the above steps:

- When rotating the bracket, also rotate the cover 180°.

Model C1B

Seal Replacement

- Grip the pump firmly across the ports and opposite side of the housing in a vise with the shaft end up.
- Remove any burrs or nicks on the shaft. Use a small, fine file if needed.
- Remove the bearing cap screws.
- Slide the bearing cap off the shaft.
- Remove the stationary seat of the seal from the bearing cap.
- Slide the seal cartridge off the shaft.
- Polish the pump shaft with crocus cloth or very fine sandpaper and clean the seal chamber thoroughly with a clean cloth. This will prevent damage to the new seal and ease installation.
- Place the new seal cartridge on the shaft and slide into place.

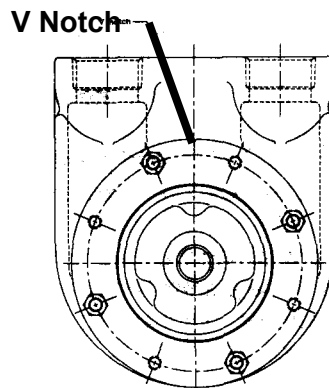
- Install the new stationary seat into the bearing cap.
- Place the bearing cap on the shaft and slide into place.
- Align the mounting holes and reinstall the bearing cap screws

Changing Rotation

Model C1B pumps manufactured after 1996 are bi-directional and will work equally well in either direction of rotation with no modification. Older C1B pumps are directional, carrying model designations of C1B-C or C1B CC.

To change the rotation of these pumps:

- Look at the pump from the shaft end with the ports up and note the location of the V notch in the bracket. If at the top (12 o'clock), rotation is clockwise; if at the bottom (6 o'clock), counterclockwise.
- • Remove the cover screws so that the bracket moves freely.
- • Rotate the bracket 180°.
- • Align the mounting holes and reinstall the cover screws.



Model C1B

If outfitted with an internal relief valve (model C1BV), these pumps become rotational. Rotation cannot be changed in the field unless the cover/valve assembly is replaced.

To change the location of the suction port on pumps supplied with Tuthill's unique automatic reversing feature (model RC1B):

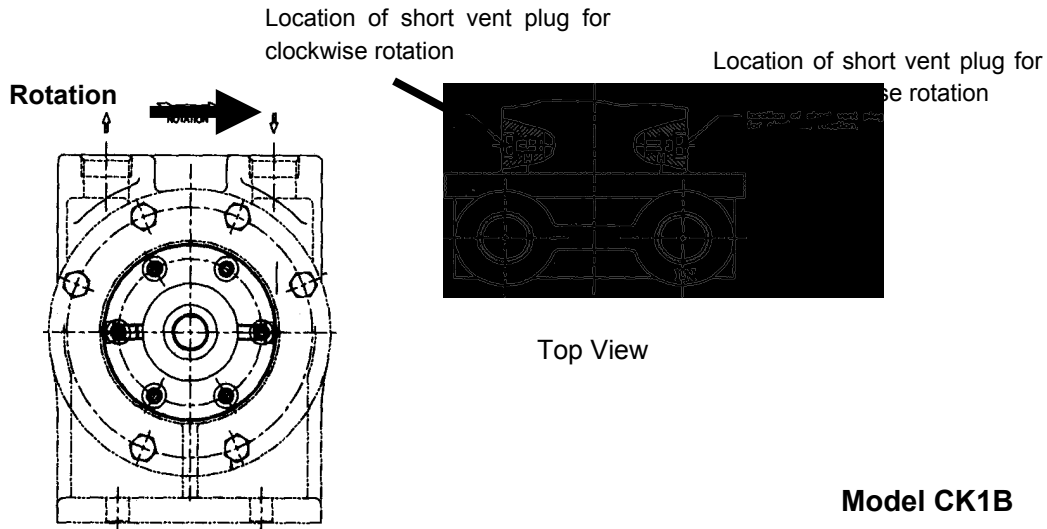
- Remove the cover screws.
- Rotate the cover 180° so that the boss on the cover points to the new suction (inlet) port.
- Align the mounting holes and reinstall the cover screws.

Seal Replacement

- Remove the cover, idler assembly and cover gaskets.
- Place the pump, cover side down, on blocks set wide enough apart so that the rotor will clear when pressed out.
- Remove the screws from the bearing housing and pull it off. The inner bearing sleeve will remain pressed onto the rotor shaft.
- Press out the rotor from the shaft end. The inner bearing sleeve will pop off.
- Remove the seal from the rotor shaft.
- Remove the housing plug.
- Remove the stationary seat from the bearing housing.
- Inspect the rotor for scratches, burrs or gouges. Removal of the inner bearing sleeve will frequently score the rotor shaft, necessitating replacement of the rotor.
- Inspect all internal parts for wear or damage. Replace any parts as needed.
- To reassemble the pump, first slide the washer and ball bearing over the rotor shaft.
- Replace the shims in the housing, using the same thickness as before.
- **This step is extremely important.** Insert the rotor with the washer and ball bearing into the housing. The shims should allow enough clearance so that the rotor will turn freely. The face of the housing should be even with the ends of the rotor teeth when gently pressed. If there is not enough clearance the rotor will not turn freely, causing severe scoring. There cannot be any metal-to-metal contact between the rotor and the housing.
- Replace the cover gaskets, idler assembly and cover.
- Lay the pump on the cover end. Replace the washer over the ball bearing on the rotor shaft.
- Apply a dab of petroleum jelly over the rotor shaft. (If the seal is EPR, apply a silicon-based lubricant).
- Slide the replacement mechanical seal over the shaft and down until it seats against the retaining ring.
- With the smooth face up, press the stationary seat into the bearing housing.
- Install the new lip seal into the housing plug.
- Slide the housing plug assembly over the shaft and press it into place.
- Replace the inner sleeve from the roller bearing. Press over the rotor shaft until it is flush with the seal on the housing plug.
- Replace the bearing housing (still containing the roller bearing) on the rotor shaft.
- Test the pump by turning by hand. Use a small wrench on the shaft over the flat. The pump will turn with some drag from seal tension, but there should be no binding or high spots.

Changing Rotation

Looking at the pump from the shaft end with the ports up, locate the short vent plug (painted red). This is the suction (inlet) side of the pump. If on the right, rotation is clockwise; if on the left, counterclockwise. On the opposite side is a long vent plug. Remove both plugs and interchange locations.



If outfitted with an internal relief valve (model CK1BV), the rotation cannot be changed in the field unless the cover/valve assembly is also replaced.

To change the location of the suction port on pumps supplied with Tuthill's unique automatic reversing feature (model RCK1B), the following must be done in addition to the steps above:

- 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.

Model CC

Disassembly and Seal Replacement

- Remove the internal relief valve and gasket assembly (if so equipped) by loosening the four screws holding it to the pump housing.
- Disconnect the pump from the motor by removing the four screws holding them together. Using three of these screws as jackscrews in the threaded holes provided on the pump flange, pull the pump from the motor. Save the key from the motor shaft.
- Mark the position of the cover in relation to the housing.
- Remove the cover screws, cover and idler.

- Remove the rotor by pressing on the hollow drive shaft with an arbor of approximately 1.375" (35 mm). With model CC009 pumps, the mechanical seal will remain in the housing. With model CC015, CC020 and CC030 pumps, the rotating element of the seal will come out with the rotor.
- For model CC009, remove the retaining ring in the bore of the motor mounting and the mechanical seal.
- For models CC015, CC020 and CC030, remove the seal spring and rotating member from the rotor and the seal seat from the housing.

Inspection

- Check the pump housing, rotor, idler gear, idler pin and cover for wear and chipped or broken teeth. There must not be any deep scratches or grooves on the following:
 - ID surface of the housing
 - OD of the rotor
 - End face of the rotor
 - OD of the idler
 - Either face of the idler
 - Inside surfaces of the cover, including the crescent.
- Replace worn parts as needed.

Assembly of Pump

- Place the idler onto the cover assembly.
- Position the gaskets on the cover.

Note: Gaskets are supplied with each pump so that proper internal end clearances are maintained. The typical end clearance for CC model pumps is .003" to .005".

When pumping thinner viscosity fluids or a drop-off in capacity has occurred because of excessive endplay of the rotor, removal of one or more of the cover gaskets may moderately improve performance.

- Install the mechanical seal. For model CC009, insert the spring, rotating member and seal seat into the seal bore cavity. Reinstall the retaining ring. For models CC015, CC020 and CC030, place the spring and rotating member on the rotor and insert the seal seat into the housing bore. A light lubricant will aid this procedure.
- Install the rotor. It should go in without much force.
- Replace the cover/idler/gasket assembly. Align the matching marks for proper location.
- Install the cover screws. Tighten gradually, alternating from a screw on one side to a screw on the opposite side.
- Install the relief valve and gasket assembly, making sure the adjusting screw points to the suction side of the pump.
- Check the end clearance.
- Reconnect the pump to the motor, making sure the key has been installed on the motor shaft and the four screws are securely fastened.

Changing Rotation

Model CC pumps are bi-directional and will work equally well in either direction of rotation with no modification.

If outfitted with an internal relief valve (model CCV), these pumps become rotational. To change rotation:

- Remove the four screws holding the relief valve and gasket assembly to the housing.
- Rotate the relief valve and gasket assembly 180° so that the adjusting screw points to the new suction side of the pump.
- Replace the four screws.



WARNING!

Failure to follow these instructions could result in serious bodily injury or death.

Do not attempt to work on any Tuthill pump installation before completing the steps below.

Disconnect the drive so that it cannot be started while work is being performed.

Review the Material Data Safety 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 Tuthill 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.

Service - All Models Except CC

Disassembly of Pump

The seal or packing must be removed before the pump can be disassembled.

- Mark the cover, housing and bracket for proper re-assembly.
- Remove the cover screws, cover, housing, idler and rotor from the bracket.

Inspection

- Check the pump housing, rotor, idler gear, idler pin and cover for wear and chipped or broken teeth. There must not be any deep scratches or grooves on the following:
 - ID surface of the housing
 - OD of the rotor
 - End face of the rotor
 - OD of the idler
 - Either face of the idler
 - Inside surfaces of the cover, including the crescent.
- Replace worn parts as needed.
- The rotor should be positioned in the housing or bracket and checked for clearance in the bearing. The shaft must turn freely without any detectable side play. Any side play will require replacement of the housing, bracket, rotor or all three parts.

Assembly of Pump

- Clean all parts thoroughly using great care to eliminate all dirt.
- Install the rotor in the pump bracket.
- Position the selected gaskets over the mounting registers of the bracket and cover.

Note: Gaskets are supplied with each pump so that proper internal clearances are maintained. In sizes 2 through 6, composite gaskets are supplied for standard pumping applications and consist of a steel shim enclosed in a Buna N rubber. Size 1 pumps utilize paper gaskets. The typical end clearances for these pumps are as follows:

Pump size	Clearance
1	.003 to .006"
2	.004 to .009"
3&4	.004 to .009"
5&6	.007 to .010"

When pumping thinner viscosity fluids, fluids that are not compatible with Buna N, or a drop-off in capacity has occurred because of excessive end play of the rotor, paper or plastic shim type gaskets should be used. These are available from Tuthill as spare parts. The minimum end clearances for proper pump operation are as follows:

Pump size	Clearance	Spare part number
1	.0005 to .001"	1C34.006
2	.001 to .002"	2M34.003/.004/.005
3 & 4	.002 to .003"	3M34.003/.004/.005
5 & 6	.003 to .005"	5C34.003/.004/.005

- Install the housing over the rotor head positioned on the bracket register.
- Place the idler gear on the pin in the cover assembly and position in the housing register.
- Align the matching marks for proper location.
- Install the cover screws. Tighten gradually, alternating from a screw on one side to a screw on the opposite side.
- Install the packing or seal, following the instructions for the specific model in question.
- Check the end clearance.

Troubleshooting

No fluid is delivered.

- Power is not on.
- Net positive suction head available (NPSHA) is lower than required for the inlet conditions and the vapor pressure of the liquid pumped. Calculate NPSHA and redesign piping if necessary.
- Leaks in suction line or port passages. These can be detected by submerging the pressure line from the discharge side of the pump into a pail of liquid where the air will be seen in the form of bubbles.
- Direction of shaft rotation is incorrect.
- Pump shaft is not rotating. The coupling is defective or the 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 leaks in the suction line.
- Suction losses are too high. The 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. A folded gasket or a slight amount of dirt can exaggerate the problem and cause leakage.

Pump works spasmodically.

- Leaky suction line.
- Varying suction conditions.
- 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.

- Tuthill 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.