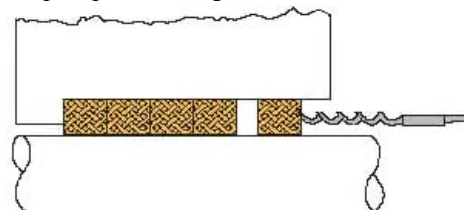


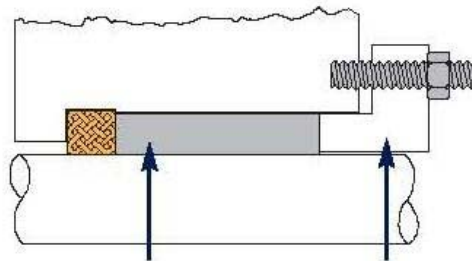
OPERATING AND MAINTENANCE INSTRUCTIONS (RECEIVER MOUNTED & PRE-SEPARATOR PUMPS)

Carver Model 55 tank-mounted filtrate pumps are designed to operate under vacuum conditions up to 660 mm Hg (26" Hg). These units are used on tanks equipped with a special mounting flange and require no suction piping. They are continuously self-priming and eliminate concerns about low NPSH available.

1. **Discharge Position:** The pumps are built for top horizontal or bottom horizontal discharge position, provided the small hole (vent port) in the suction sideplate is always located at the 12 o'clock position, i.e. at the very top. (See paragraph 7)
2. **Discharge Piping:** Discharge piping may be installed with an increaser to reduce pipe friction losses. A check valve should be installed in the discharge line to prevent reverse flow and loss of vacuum when the pump loses prime. Lack of a check valve can allow the tank to overflow. A shut-off valve is recommended after the check valve to isolate the pump. Horizontal discharge lines should be installed with a continuous upward slope away from the pump.
3. **Speed:** Pump speeds for close coupled (Model 55) units are generally limited to 1750 RPM. Pump speeds for belt driven (Model 55-OH) units are limited to 2400 RPM. Speeds above 2000 RPM may require factory engineering modifications.
4. **Rotation:** Direction of rotation is clockwise as viewed from motor or pulley end.
5. **Packing:** Pumps equipped with packing have a lantern ring which is located inside the flush water connection on the stuffing box. Flow should be adjusted as described in t.-v. below (20 to 30 drops per minute is typical). Flush water pressure should be approximately 70 kPa (10 PSI) more than the pump discharge pressure to ensure flow of water through the packing. Use the following procedure when replacing the packing:
 - a. Ensure the new packing is of proper type and size.
 - i. Typical is six rings, 6mm x 6mm (1/4" x 1/4").
 - ii. Standard shaft diameter is 32mm (1 1/4").
 - iii. Pre-cut sets of packing and lantern rings are available from stock from Krogh Pump Company.
 - b. Shut off, lock out, & tag out pump and all pipes leading to and from pump, including flush water.
 - c. Carefully bleed off pressure.
 - d. Remove stuffing box gland follower.
 - e. Remove all old packing rings and the lantern ring by using the proper size packing removal hook.
 - i. Do not use system pressure to blow out (remove) packing.
 - f. Check the shaft & sleeve for nicks and score marks; repair or replace as necessary.
 - g. Clean stuffing box bore if required.
 - h. Install the first ring with joint at approximately the 1 o'clock position (30° right of vertical).



Twist Ring in "S" shape and place around shaft



Split Bushing

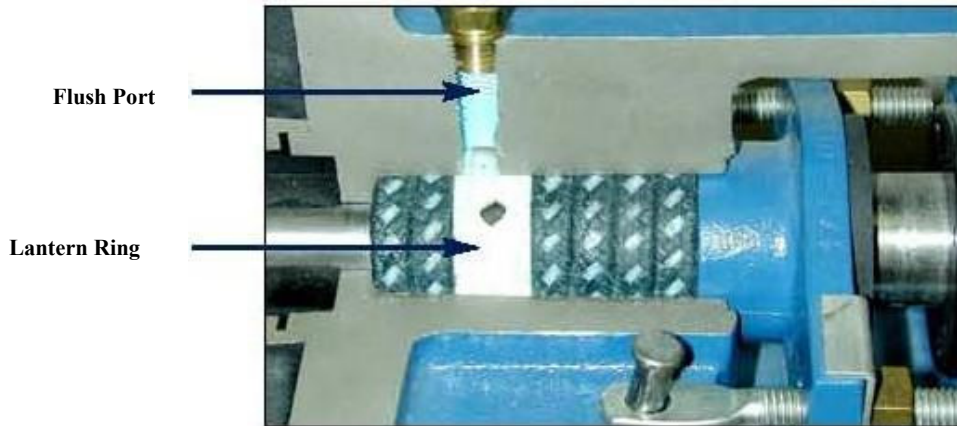
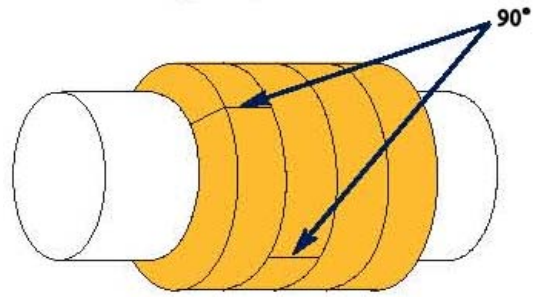
Gland Follower



Split Bushing

- i. Twist ring slightly in an "S" shape and place it around the shaft.
 - j. Seat ring firmly against bottom of stuffing box using a split bushing and the gland follower.
 - k. Repeat procedure as described in i. & j. above.

- i. Ring joints should be staggered 90° apart.
- l. Install enough rings (typically 2 rings) until lantern ring will align with flush water port.
- m. Install lantern ring.
- n. Install remaining packing rings as described in i. & j. above.
- o. Seat final ring firmly with the gland follower, using a wrench to tighten.
 - i. In tightening the gland, nuts should be adjusted evenly to avoid cocking the gland and subjecting the packing to uneven pressure.
- p. Ensure that lantern ring is still properly aligned with the flush port.



- q. Loosen gland nuts and retighten, using only fingers.
 - r. At minimum, gland follower should be into the stuffing box approximately 3 - 5mm (1/8" - 3/16").
 - i. The remaining exposed portion of gland follower should be at least 6mm (1/4") to allow future gland adjustments.
 - s. Rotate shaft by hand to ensure shaft is not binding.
 - t. Allow liberal leakage at start up.
 - u. Slowly adjust leakage to an acceptable level by tightening gland nuts slowly and evenly.
 - i. Final adjustments should be made by rotating gland nuts one (1) flat at a time.
 - v. Packing may run warm during break-in period, one day or two.
 - i. If stuffing box is hot to the touch (approximately 65°C or 150°F), there is not enough flush water entering the stuffing box.
 - w. Do not adjust the packing unless necessary.
 - x. If uncontrolled excessive leakage occurs, lantern ring is pushed out of alignment with flush water port, or gland follower cannot be tightened further; re-pack the pump.
6. **Mechanical Seals:** A mechanical seal may be supplied in place of a packed stuffing box when specified by the customer. Many variations of types and materials are available. Mechanical seals should be checked regularly, particularly during the first hours of operation. Minor leakage through the seal usually stops after a short time; however, if it continues, stop the pump and examine the seal. Excessive leakage from a mechanical seal usually indicates worn or broken parts requiring replacement.
7. **Impeller:** The special semi-open impeller in the Model 55 series should run with a clearance between its vanes and the matching conical section of the sideplate of about 0.41 - 0.61 mm (0.016" - 0.024") or 0.64 - 0.75 mm (0.025" - 0.030") for rubber lined pumps. Wider clearances than this may result in a loss of efficiency. A chattering or squealing noise is an indication that the impeller is rubbing against the sideplate. This may be corrected by adding appropriate flange gaskets between the case and sideplate. Please note that the sideplate should be assembled with the recirculation port uppermost, i.e. in the 12 o'clock position. (This is a 5 mm (3/16") hole drilled near the periphery of the conical section of the sideplate).
8. **Shaft:** A shaft sleeve is provided to protect the shaft from wear. However, a solid shaft (no sleeve) with a larger diameter at the stuffing box can be provided to minimize deflection.

9. **Disassembly:** After removing the pump from the receiver, remove the two cap screws holding the sideplate to the case flange. Remove impeller cap screw, washer, lockwasher and the keyed-on impeller. To remove a threaded impeller, secure the shaft at the coupling end and turn the impeller counter clockwise (looking from the suction end).
10. **Gasket:** Sideplate is aligned to the case by a registered fit, and sealed by a 0.8 mm (1/32") thick gasket made from a service sheet appropriate for the filtrate being pumped. Because the mating receiver - tank flange may be un-machined and/or slightly irregular, a soft 5 mm (3/16") thick rubber gasket should be used between the receiver flange and the sideplate flange.
11. **Spare Parts:** When ordering spare parts, please give the pump's serial number, the part number (reference parts list drawing #G-1028R-N), or an accurate description. Material of construction should always be specified.
12. **V-belt Drive:** The Model 55-OH, when supplied with belts and pulleys, should be checked for proper belt tension as recommended by the belt manufacturer. Guidelines are on the pump datasheet. Tight belts overload bearings and shorten their life. Loose belts cause slippage and excessive wear, as well as poor performance.

PRE START-UP CHECKLIST

1. Check sheaves alignment & belt tension.
2. Lubricate the driver, if required.
3. Check the directional rotation of the driver with the belts removed (should be clockwise as viewed from pulley end).
4. For pumps equipped with packed stuffing boxes, the gland nuts must be loose.
5. The pump must be filled with liquid before the pump is started.
6. If the unit is equipped with an independent flush water line to the stuffing box, open the valve the external on the water flush supply line.

STARTING

The procedure for starting the unit will vary somewhat with each installation, but the following steps will generally apply:

1. Turn the pump shaft by hand; if it is bound, or tight, do not operate the pump until the cause of the trouble is found.
2. Start driver per manufacturer's instructions.
3. Open the discharge valve slowly as pressure is built up on the discharge side of the pump.
4. When in service for about one-half hour check for quiet operation, temperature of bearings, and stuffing box operation. After the pump reaches operating temperature shut it down and recheck for rubbing or binding.

STOPPING

1. Close the discharge valve slowly.
2. Shut down the driver according to driver manufacturer's instructions.
3. Close the valve on the the external water flush line to the lantern ring or mechanical seal if there is no possibility of grit or contaminants entering the stuffing box
4. Do not tighten the gland to stop the liquid from leaking out, or the air from leaking in, unless provision is made to relieve the gland before restarting.

GENERAL BEARING GUIDELINES

THE FOLLOWING APPLIES TO BOTH OLD-STYLE OIL LUBRICATED BEARINGS AND THE NEW HEAVY DUTY SEALED FOR LIFE BEARINGS

KEEP CLEAN:

Dirt causes 90% of all bearing failures. Cleanliness is a must when working on bearings. Some things which help:

1. Do not open bearing housings unless absolutely necessary.

2. Spread clean newspapers on work benches and under pump. Set tools and bearings on paper only.
3. Wash hands. Remove dirt, chips and grease from tools.
4. Keep bearings, housings and shaft covered with clean cloths whenever they are not being worked on.
5. Do not unwrap new bearings until ready to install.
6. Flush shaft and housing with clean solvent before reassembly.

PULL BEARINGS CAREFULLY:

1. Use a sleeve or puller which contacts only the inner race of the bearing.
2. Never press against the bearing's shields, only against the races.
3. Do not cock the bearing. Use sleeve which is cut square, or puller which is adjusted square.
4. When using a bearing housing to pull a bearing, pull evenly, do not hammer on housing or shaft. With both races locked, shock will be carried to the balls and ruin the bearing.

INSPECT BEARINGS AND SHAFT:

1. Examine the bearing carefully. Scrap it if there are flat spots, nicks, or pits on the balls or races. Bearings should be in perfect condition.
2. Turn bearing over slowly by hand. It should turn smoothly and quietly. Scrap it if "catchy" or noisy.
3. Whenever in doubt about the condition of a bearing, scrap it. A few dollars worth of new bearings may prevent serious loss from down time and/or pump damage. In severe or critical services, replace bearings at each overhaul.
4. Check condition of shaft. Bearing seats should be smooth and free from burrs. Smooth burrs with very fine emerycloth. Shaft shoulders should be square and not run over.

CHECK NEW BEARINGS:

Be sure bearing is of correct size and type. For instance, an angular contact bearing which is dimensionally the same as a deep groove bearing may fit perfectly in the pump. However, the angular contact bearing is not suitable for end thrust in both directions, and may quickly fail. Also, check to see that the shields are the same as in the original unit.

INSTALL BEARINGS CAREFULLY:

1. Oil bearing seat on shaft lightly.
2. Press bearing on squarely. Do not allow it to cock on the shaft. Be sure that the sleeve used to press the bearing on is clean, cut square and contacts the inner race only.
3. Press bearing firmly against shaft shoulder. The shoulder helps support and square the bearing.
4. Check shaft end play which should be about 125 μm (0.005").
5. Sealed bearings are lubricated for life and do not need to be "regreased".

END PLAY ADJUSTMENT:

1. Temporarily fit the outboard bearing cap over the shaft and against the back of the bearing housing WITHOUT A GASKET.
2. Install two capscrews in opposing holes. Snug cap screws by hand but DO NOT OVER TIGHTEN. Measure the gap between the face of the bearing cap and the end of the bearing housing with a feeler gauge. Find the largest feeler blade that will enter the gap and select a gasket that is about its thickness plus five thousandths of an inch, 125 μm (0.005"), ie., if the feeler blade is five thousandths of an inch, 125 μm (0.005"), then select a ten thousandths, 250 μm (0.010") thick gasket. This will allow five thousandths, 125 μm (0.005") end play for thermal growth along the shaft. Remove the two cap screws and pull the bearing cap off the end of the shaft. Install the correct thickness of gasket and put the bearing cap back into its register fit against the end of the bearing housing. Install four capscrews and make up tight, using about 24 N-m (18 lbs-ft) of torque.

TROUBLE SHOOTING

1. DOES NOT PUMP:
 - A. Plugged discharge line or closed valve in the system.
 - B. Speed too low; motor speed incorrect, belts slip, line voltage too low.
 - C. System pressure too high; refer to curve, contact factory.

- D. Impeller plugged; Clean impeller.
 - E. Reverse Rotation; (May reach shutoff head but will not deliver capacity.) Check for proper motor rotation with the belts removed.
 - F. Liquid level in the receiver tank or pre-separator tank is too low for the pump to sustain flow
3. DISCHARGE VOLUME OR PRESSURE LOW:
- A. Suction leaks air.
 - B. Speed too low.
 - C. Discharge head too high.
 - D. Impeller and/or case partially plugged.
 - E. Low suction head or high temperature liquid.
 - F. Mechanical defects.
 - G. Reverse rotation.
 - H. Excessive pipe friction in the discharge line.
 - I. Vent hole at the side plate is clogged.
 - J. Excessive impeller running clearance
 - K. Air or gas in liquid
4. PUMP OVERLOADS MOTOR:
- A. Speed too high.
 - B. System head lower than rated, therefore pump's volume is too high.
 - C. Specific gravity of liquid is higher than rated.
 - D. Viscosity of liquid is higher than rated.
 - E. Line voltage low.
 - F. Broken impeller cap screw or lock washer allowing impeller to rub.
 - G. Stuffing boxes too tight
5. PUMP VIBRATES:
- A. Misalignment.
 - B. Impeller partially clogged.
 - C. Mechanical; i.e. shaft bent, worn bearings, defective couplings, belts, out of balance impeller, etc.

Shipping Preparation / Corrosion Protection

Following are Carver Pump Company practices for corrosion protection of all export shipments and when long-term storage of the pump is planned. These steps are completed prior to shipping. For domestic shipments, there is an additional fee if the pump is to be prepared as described below.

1. Prior to final assembly, all internal and external pump surfaces are cleaned and left free of dust, scale, body salts, machine cuttings, filings, grease and oil.
2. Internal surfaces of the bearing housing are coated with a polyurethane insulator.
3. External metal surfaces (except stainless steel) are coated with a rust inhibitive primer and final coated with an alkyd industrial gloss enamel paint; or as agreed in the contract.
4. For added protection, the external surfaces of the pumps, belt guards, motor brackets, support studs, nuts and others metal parts are sprayed with a heavy duty rust inhibitor. The effective life of the rust inhibitor can be up to two years of outside storage depending on the severity of the environment.
5. The entire pump unit is sealed in a 6 μ m (2.5 mil) clear plastic liner with a 170g (6 ounce) desiccant package to absorb any moisture.
6. The pump unit is then lag bolted to a plywood skid platform and fully enclosed in 10mm (3/8") plywood.

Storage

The following storage instructions are to be applied. For the customer's convenience, a Maintenance & Inspection Storage Log is provided. Failure to adhere to the following instructions can void the warranty.

1. Pump should be stored in its original crate until it is ready for installation and operation.
 - a. Temperatures below 0°C (32°F) and above 38°C (100°F) should be avoided.
2. Pump is to be kept away from heavy equipment (including fork trucks) and other machines which may cause vibration, as this can damage the bearings.
3. Once every three months, the pump shaft is to be rotated approximately ¼ turn to shift the point loads in the ball bearings to another location.
4. If the pump is fully assembled and tank-mounted prior to beginning the storage period, Krogh Pump Company recommends re-coating any exposed carbon steel or cast iron components with LPS 3 Heavy Duty Rust Inhibitor or equivalent.
 - a. This must also be done to the belt sheaves, as installation of these sheaves often exposes steel.
 - i. Prior to actual startup, the rust inhibitor should be cleaned from the sheaves, as it may cause belt slippage.
5. Tension is to be removed from drive belts during storage.
6. Any elastomer components are to be protected from direct sunlight.
7. Personnel in charge of storage are to adhere to all other long-term storage requirements mentioned above, including those regarding possible bearing damage.

Carver Centrifugal Pumps
Maintenance and Inspection Storage Log
Every Three Months

1. Is vibration noted from surrounding equipment or other sources?

- No – Corrective Action is not Required
- Yes – Check “Corrective Action Required Box at Right”

Describe Corrective Action Taken – Note Date & Time _____

2. Are any carbon steel or cast iron surfaces exposed?

- No – Corrective Action is not Required
- Yes – Check “Corrective Action Required Box at Right”

Describe Corrective Action Taken – Note Date & Time _____

3. Are there any signs of damage or deterioration?

- No – Corrective Action is not Required
- Yes – Check “Corrective Action Required Box at Right”

Describe Corrective Action Taken – Note Date & Time _____

4. Rotate Pump Shaft?

- No – Check “Corrective Action Required Box at Right”

Describe Corrective Action Taken – Note Date & Time _____

- Yes – Corrective Action is not Required

Date: _____

Corrective Action Required

Signature: _____

Carver Pump Company

Model 55-OH Lubrication List

Standard Bearings

- Permanently Sealed and Lubricated – Cannot be lubricated after manufacture
 - MT47 grease
 - Lithium soap thickener
 - Mineral oil base
 - NLGI consistency class 2
 - Operating temperature -30°C to +110°C
 - Base oil viscosity at 40°C = 70 mm²/s
 - Base oil viscosity at 100°C = 7.3 mm²/s

Optional Oil Bath Bearings

- Ambient Temperature -7°C to 49°C (20°F to 120°F)
 - Use ISO viscosity grade 68 turbine oil
- Ambient Temperature -23°C to -7°C (-10°F to 20°F)
 - Use ISO viscosity grade 32 turbine oil

Swing-Out Mount

Assembly Procedure:

1. If tank flange is not drilled and tapped for swing-out arm, use swing-out assembly as template for 4 new tapped holes (see Figure 2).
2. Mount Bracket 2 (w/large holes) to back of tank flange, using three spacers (not shown) between bracket and flange.
3. Temporarily mount pump & gasket to tank flange for alignment to swing-out arm. Do not install the four fasteners on left side that will bolt through the swing-out arm (located approximately 7:30 – 10:30 o'clock positions).
4. Place Adjusting Nuts in top and bottom positions of Bracket 2.
5. Assemble Brackets 1 & 2 by inserting hex bolt through Adjusting Nut and securing with retaining ring and hex nut.
6. Adjust vertical & horizontal alignment of Brackets 1 & 2 by alternately rotating top and bottom Adjusting Nuts with wrench (see figures 3 & 4).
7. As needed, fit spacers (normally 3) between Bracket 1 & pump flange.
8. When holes on Bracket 1 align with holes on pump flange, alignment is complete. Use hex bolts to secure Bracket 1 to pump flange.
9. Remove temporary pump mounting bolts (from step 3) from tank flange.
10. By rotating Adjusting Nuts on Brackets 1 & 2, check pump swing-out operation and adjust to suit.
11. When adjustments are complete, secure pump, gasket and swing-out assembly to tank flange (including all mounting bolts for pump).

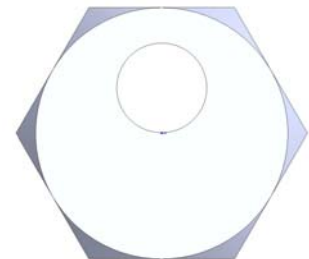
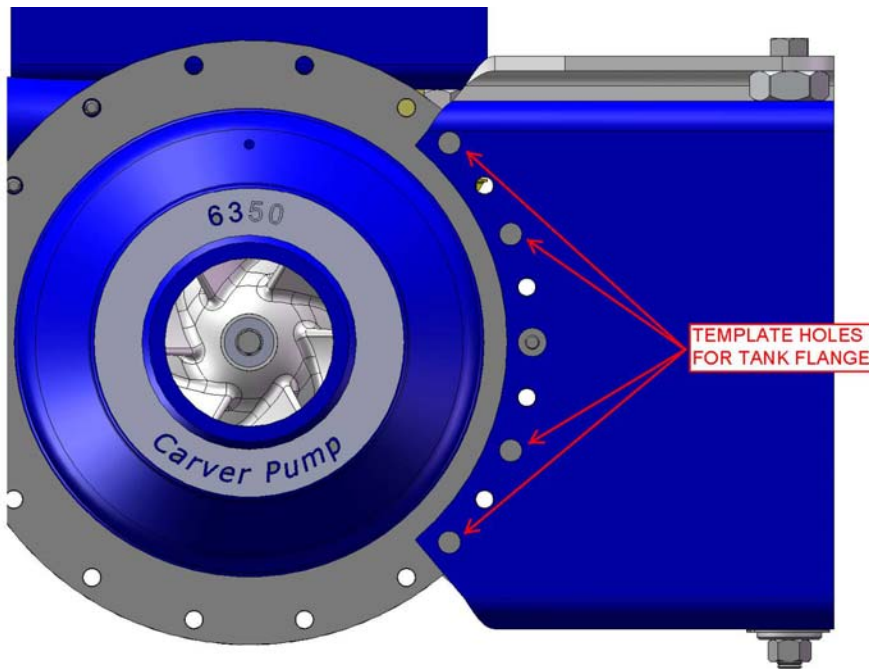
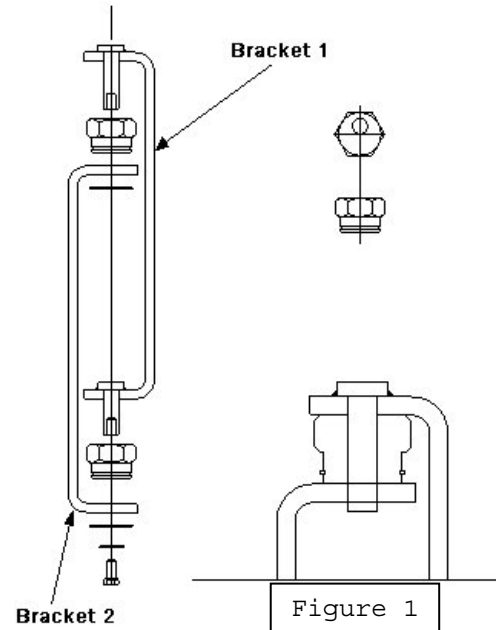


Figure 3
Adjusting Nut
(closed position)

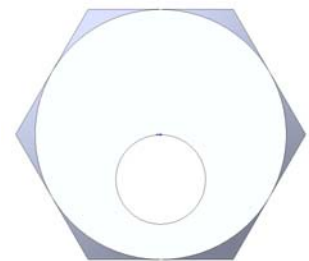


Figure 4
Adjusting Nut
(open position)