# SERVICE INSTRUCTIONS

## OILGEAR TYPE "PVK" OPEN LOOP PUMPS

### PURPOSE OF INSTRUCTIONS

These instructions are written to simplify your work of installing, operating and maintaining Oilgear type "PVK" pumps. Your acquaintance with the construction, principle of operation and characteristics of these units will help you attain satisfactory performance, reduce shut-downs and increase the unit's life. Some units have been modified from those described in this bulletin and other changes may be made without notice.

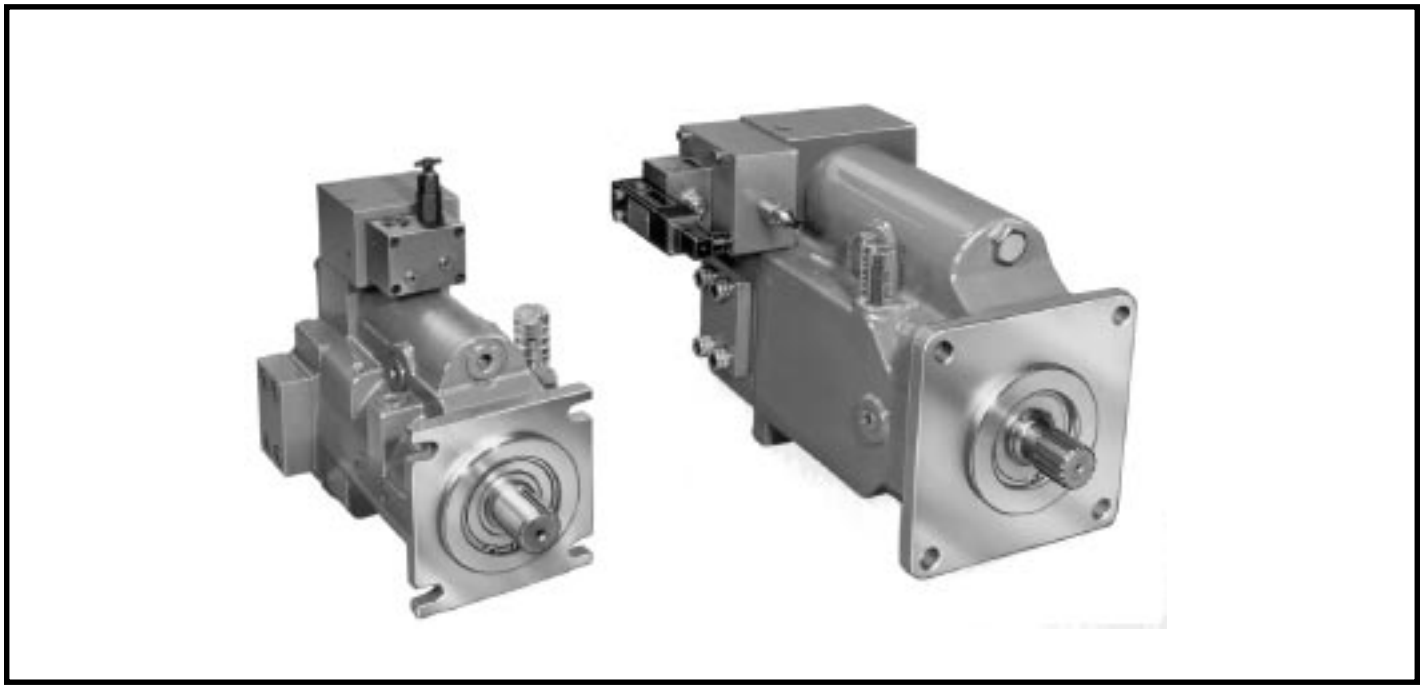

Figure 1. Typical Oilgear "PVK-140" (left) and "PVK-270 or 370" (right) open loop pumps (88074BR).

### REFERENCE MATERIAL

| | | |
|---|---|---|
| Fluid Recommendations | Bulletin | 90000 |
| Contamination Evaluation Guide | Bulletin | 90004 |
| Filtration Recommendations | Bulletin | 90007 |
| Piping Information | Bulletin | 90011 |

### I. PREPARATION AND INSTALLATION

#### A. MOUNTING

PUMP WITHOUT RESERVOIR. The pump may be mounted in any position. Secure the unit to a rigid mounting surface. See section “B” on “Piping and Fittings” as well as referenced bulletin on “Piping Information”.

PUMP WITH RESERVOIR. These units are usually fully piped and equipped although it may be necessary to connect to supercharge circuit when used. Mount reservoir on level foundation with bottom at lease six (6) inches above floor level to facilitate fluid changes.

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## B. PIPING AND FITTINGS

See referenced "Piping Information" Bulletin 90011 and individual circuit before connecting pump to the system.

Arrange case drain line from port "1" or "1A" so case remains full of fluid (non-siphoning). Case pressure must be less than 20 psi above the level of the inlet pressure for speeds up to 1800 rpm. Each drain line must be a separate line, unrestricted, full sized and connected directly to reservoir below fluid level. Provisions for opening this line without draining (siphoning) reservoir should be made. System and pump must be protected against overloads by separate high pressure relief valves. Install bleed valve(s) at highest point(s) in system.

## C. POWER

Power is required in proportion to volume and pressure used. Motor size recommendations for specific applications can be obtained from The Oilgear Company. Standard low starting torque motors are suitable for most applications.

**CAUTION**

**Never start or stop unit under load unless system is approved by Oilgear. It may be necessary to provide delivery bypass in some circuits.**

## D. DRIVE

See rotation direction plate on units' housing. Clockwise units should not be driven counter-clockwise nor counter-clock units driven clockwise. Use direct drive. Size and install coupling per manufacture's instructions.

**CAUTION**

**Do not drive coupling onto pump driveshaft. If fit is too tight, it may be necessary to heat coupling (see manufacture's instructions).**

Misalignment of pump shaft to driveshaft should not exceed 0.005" (0.13 mm) Total Indicator Readout (TIR) in any plane.

## E. FILTRATION

To assure long life from your hydraulic system, keep fluid clean at all times. See reference Bulletin 90007 on "Filtration Recommendations" and referenced Bulletin 90004 on "Contamination Evaluation". Oilgear recommends the use of a filter in an auxiliary (pilot) pump circuit. Replace filter element(s) when filter condition indicator reaches change area at normal fluid temperature. Drain and thoroughly clean filter case. Use replacement element(s) of same beta 10 ratio (normally a ratio of 4 or more).

## F. FLUID COOLING

When pump is operated continuously at rated pressure or frequently at peak load, auxiliary cooling of fluid may be necessary. Fluid temperature should not exceed the limits specified in Oilgear bulletin on "Fluid Recommendations".

## G. AIR BREATHER

On most installations, an air breather is mounted on top of fluid reservoir. It is important for breather to be of adequate size to allow air flow in and out of reservoir as fluid level changes. Keep breather case filled to the "fluid level" mark. About once every six months, remove cover, wash screen in solvent, clean and fill case to level mark and install dry screen. See manufacture's recommendations.

## H. FLUID, FILLING, AND STARTING RECOMMENDATIONS

Refer to instruction plate on unit, reservoir, machine and/or "Fluid Recommendations" bulletin. Pump all fluid into reservoir through a clean (beta 10 ratio 4 or more) filter. Fill reservoir to, but not above, "high level" mark on sight gage. Remove case drain line and refill pump case with hydraulic fluid.

Turn driveshaft a few times by hand with a spanner wrench to be sure parts are free.

**Table 1. TORQUE to TURN SHAFT**

| Size Unit | 140 | 270 | 370 |
|---|---|---|---|
| Approx. Torque to turn driveshaft - in foot pounds | 15 | 60 | 60 |
| Nm. | 20,4 | 81,4 | 81,4 |

With pump under "no load", or with pump control at "neutral", turn drive unit on and off several times before allowing pump to attain full speed. The system can usually be filled by running the pump and operating the control. Watch fluid level in the reservoir and stop pump if level reaches "low level" mark. Add fluid and start again. With differential (cylinder) systems, fluid must not be above "high level" when ram is retracted or below "low level" when extended. Bleed air from the system by loosening connections or opening petcocks at the highest point in system. Close connection or petcocks tightly when solid stream of fluid appears.

# II. CONSTRUCTION

Refer to Figures 8 and 9 (size 140) or Figures 10 and 11 (size 270 and 370). A driveshaft (301) runs through the center line of pump housing (001) and valve plate (1A, 1B, 1C or 1D) with pump cylinder barrel (101) splined to it. A roller bearing (304) supports the outboard end of the driveshaft and a (bushing type) bearing (3) supports the inboard end. The pump cylinder barrel is carried in a polymerous (journal type) bearing (002). The valve plate (1A, B, C or D) [and port plate (6) in the case of sizes 270 and 370 ] has two crescent shaped ports. Pumping pistons (102) in the cylinder barrel are held against a swashblock wear plate (208) [size 270 and 370] or swashblock (203) [size 140] by a shoe retainer (105). The shoe retainer is held in position by the fulcrum ball (103) which is forced outward by retainer springs (104). The springs act against the pump cylinder barrel forcing it against the valve plate (or port plate in the case of size 270 and 370) while also forcing the piston shoes against swashblock or swashblock wear plate (size 270 and 370). The semi-cylindrical shaped swashblock limits the piston stroke and can be swivelled in arc shaped saddle bearings (202). The cradle is swivelled by the control piston (501), which is operated by the control (covered in referenced material). A stroke indicator (010) is operated by a pin (206) in the swashblock giving a visual indication of swashblock position.

**(See Pages 4 and 5 for III PRINCIPLE OF OPERATION)**

## IV. SPECIFICATIONS

See reference material, pump control material and individual application circuit for exceptions. Stroke indicator movement from neutral to full stroke (either side) is 0.50" for size 140 and 0.62" for sizes 270 and 370.

Table 2. NOMINAL PERFORMANCE DATA WITH 80-550 SSU viscosity fluids.

| UNIT | THEORETICAL MAXIMUM DISPLACEMENT | | RATED CONTINUOUS PRESSURE | | MAXIMUM PRESSURE | | FLOW RATE at 1800 rpm, rated continuous pressure | | POWER INPUT at continuous pressure and 1800 rpm | |
|---|---|---|---|---|---|---|---|---|---|---|
| | in. 3/rev | ml/rev. | psi | bar | psi | bar | gpm | l/min. | hp | kw |
| 140 | 8.61 | 141 | 5000 | 345 | 5800 | 400 | 63.0 | 238,7 | 207.2 | 154,6 |
| 270 | 16.3 | 267 | 5000 | 345 | 5800 | 400 | 120.0 | 454,8 | 392.3 | 292,8 |
| 370 | 22.4 | 367 | 3500 | 241 | 4250 | 293 | 162.1 | 614,4 | 389.4 | 290,6 |

Table 3. NOMINAL DIMENSIONS and WEIGHTS without controls

| UNIT | LENGTH | | WIDTH | | HEIGHT | | WEIGHT | | PORT FLANGES | | FACE MOUNTING FLANGE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | in. | mm | in. | mm | in. | mm | lb. | kg. | Port A Pressure Connections | Port B Inlet Connections | |
| 140 | 26.19 | 665,2 | 8.25 | 209,6 | 10.78 | 273.8 | 200 | 91 | 1.500 SAE (Pattern per code 62) | 2.500 SAE (Pattern per code 61) | SAE "D" 4 Bolt |
| 270 | | | | | | | | | 2.000 SAE | 3.5000 SAE | SAE "F" 4 Bolt |
| 370 | 34.50 | 876,3 | 11.75 | 298,5 | 15.69 | 398.5 | 550 | 250 | (Pattern per code 61) | (Pattern per code 61) | |

Table 4. PORT CONFIGURATION for one-way units

| Shaft Rotation | Left Hand (CCW) | Right Hand (CW) |
|---|---|---|
| Port A left side facing shaft | Pressure | Suction |
| Port B right side facing shaft | Suction | Pressure |

## V. MALFUNCTIONS AND CAUSES

### A. UNRESPONSIVE OR SLUGGISH CONTROL

1. See reference control instruction bulletins.
2. Low control input (pilot pressure) or restricted exhaust from control piston. For “R” and “V” volume type controls only.
3. Control piston seals (506, 507, 512) broken or damaged.
4. Swashblock saddle bearings (202) worn or damaged.

### B. INSUFFICIENT PUMP VOLUME

1. Delivery limited by faulty control (see appropriate control instruction bulletin).
2. Maximum volume stop (707 or 708 [two-way units]) limiting pump stroke.
3. Obstructed suction circuit or insufficient supercharge volume.
4. Insufficient drive motor speed.
5. Worn or grooved cylinder wear plate (106) and/or port plate (6).
6. Worn pistons (102) or piston bores (101).
7. Worn or damaged piston (102) shoes, swashblock (203) or swashblock wear plate (208).

### C. IRREGULAR OR UNSTEADY OPERATION

1. Faulty control [an oscillating stroke indicator pin (010) is indicative of an unstable control].
2. Fluid level in reservoir is low or supercharge is insufficient.
3. Air entering hydraulic system.
4. Worn axial piston pump.
5. Faulty output circuit components (cylinders, motors, valves, etc.).

(Continue on Page 6)

## III. PRINCIPLE OF OPERATION

A TWO-WAY PUMP DRIVEN CLOCKWISE (RIGHT HAND) IS DESCRIBED.

SEE FIGURE 3. POSITION B. Rotating the driveshaft clockwise turns the splined cylinder, which contains the pumping pistons. When the cylinder is rotated, the pistons move in and out of their bores as the piston shoes “ride” against the angled swashblock.

As the cylinder rotates, the individual piston bores are connected, alternately to the left (port A) and right (port B) crescent shaped ports in valve plate. While connected to left side (suction) port A, each piston moves outward, drawing fluid from Port A into the piston bore until it’s outermost stroke is reached. At that point, the piston bore passes from the left crescent port to the right crescent port.

While rotating across the right side crescent, each piston moves downward on the angled swashblock face. Thus, each piston is forced inward. Each piston displaces fluid thru the right side crescent to port B until it’s innermost stroke is reached. At that point, the piston bore again passes from the right to the left side crescent and the operating cycle is repeated.

SEE FIGURE 4. POSITION B/2. A study of the diagram will show that the linear position of the control piston sets the angular position of the swashblock which determines the length of piston stroke (difference between outmost and innermost position) thereby determining the amount of delivery from the high pressure pump. In this case, the stroke angle is one-half of the former stroke angle. Therefore, the piston stroke is one half the former and pump delivery is one half the former delivery.

SEE FIGURE 5. POSITION N. Neutral position results when control piston centers the swashblock. The swashblock angle is now zero and swashblock face is now parallel to cylinder face. Therefore, no inward or outward motion of the pump pistons exists as piston shoes rotate around the swashblock face. The lack of inward and outward motion results in no fluid being displaced from the piston bores to the crescents in the valve plate and subsequently no delivery from pump ports.

SEE FIGURE 6. POSITION A. For two-way pumps, the direction of swashblock angle determines which port is inlet or outlet. If swashblock angle is reversed (from POSITION B), the piston will stroke outward during right half revolution and draw fluid from port “B”. During the left half revolution, the pistons stroke inward and deliver fluid from port “A”.

It should be noted that when a two-way pump reverses flow direction – the rate of delivery is decelerated as the swashblock moves toward neutral position – flow is stopped as it crosses neutral position – flow rate is then accelerates from the other port as the swashblock moves in that direction. Thus, flow reversal is “cushioned” by the pump itself. The degree of “cushion” is determined by the rate (speed) of swashblock position reversal.

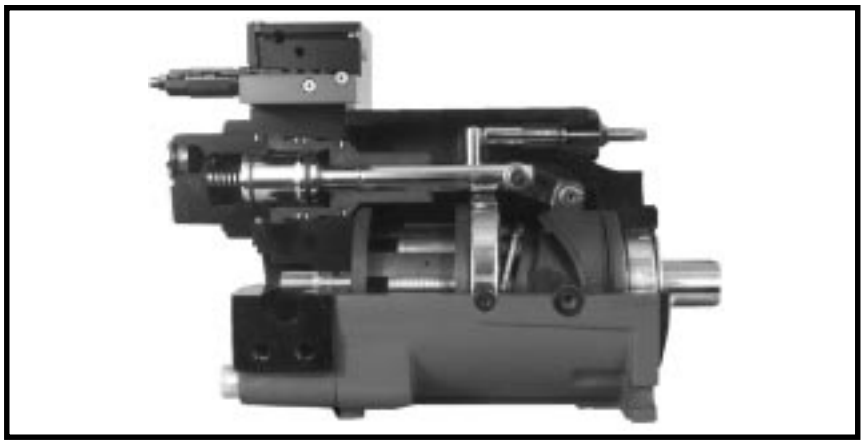


Figure 2. Cut-a-way view of typical Oilgear “PVK” Pump. (92034)

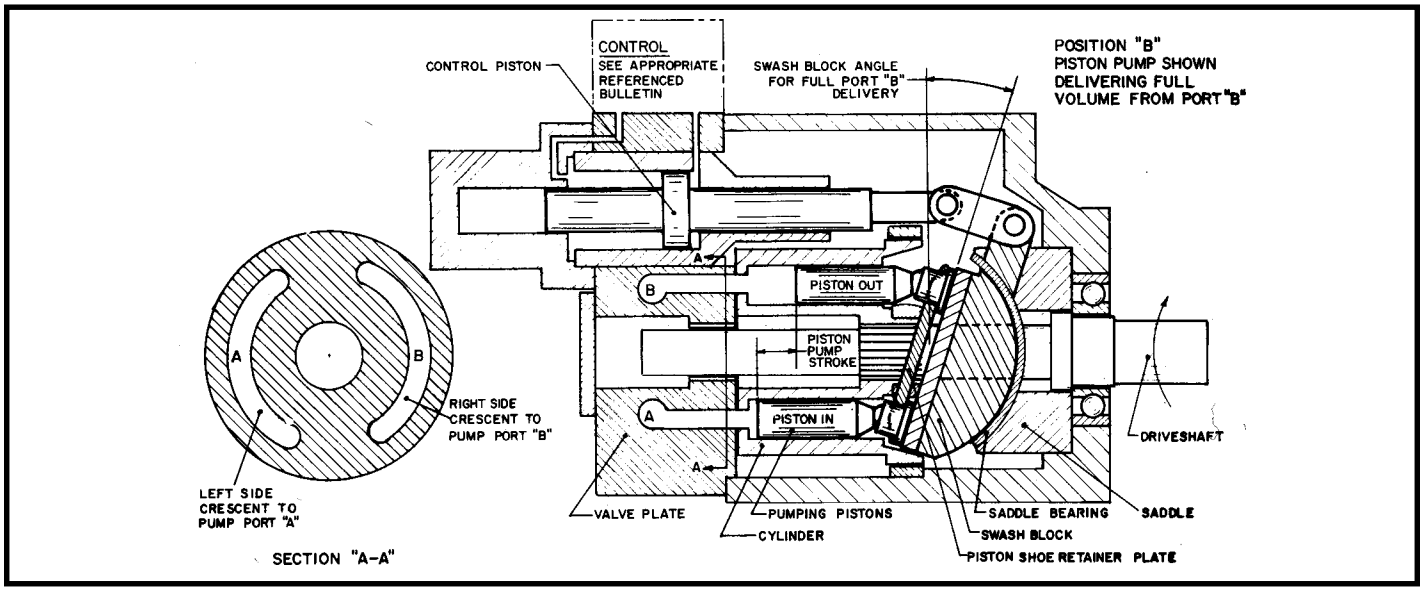



Figure 3. POSITION B (5V-12010-L)

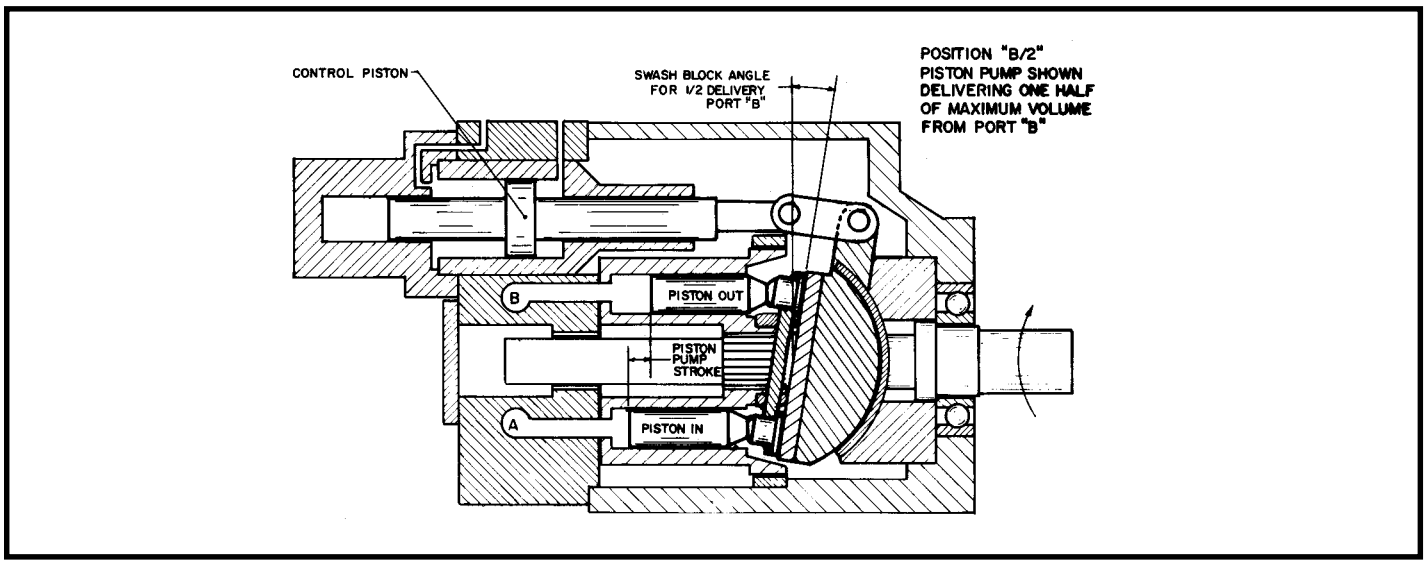



Figure 4. POSITION B/2 (5V-12010-L)

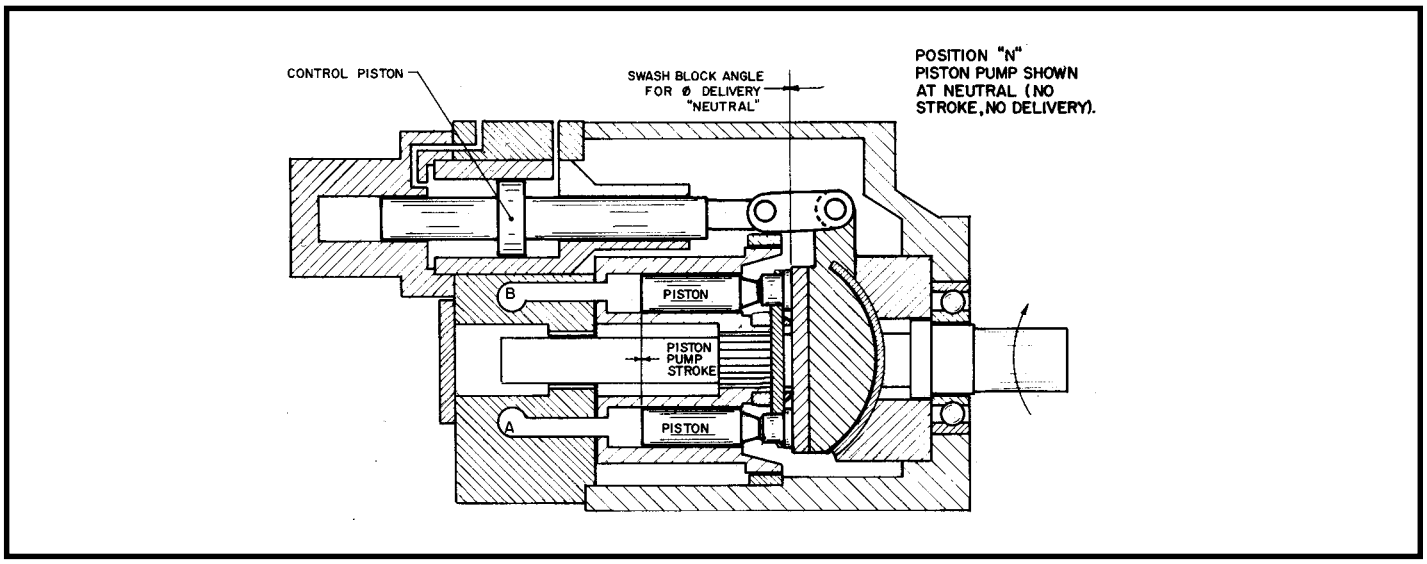



Figure 5. POSITION N (5V-12010-L)

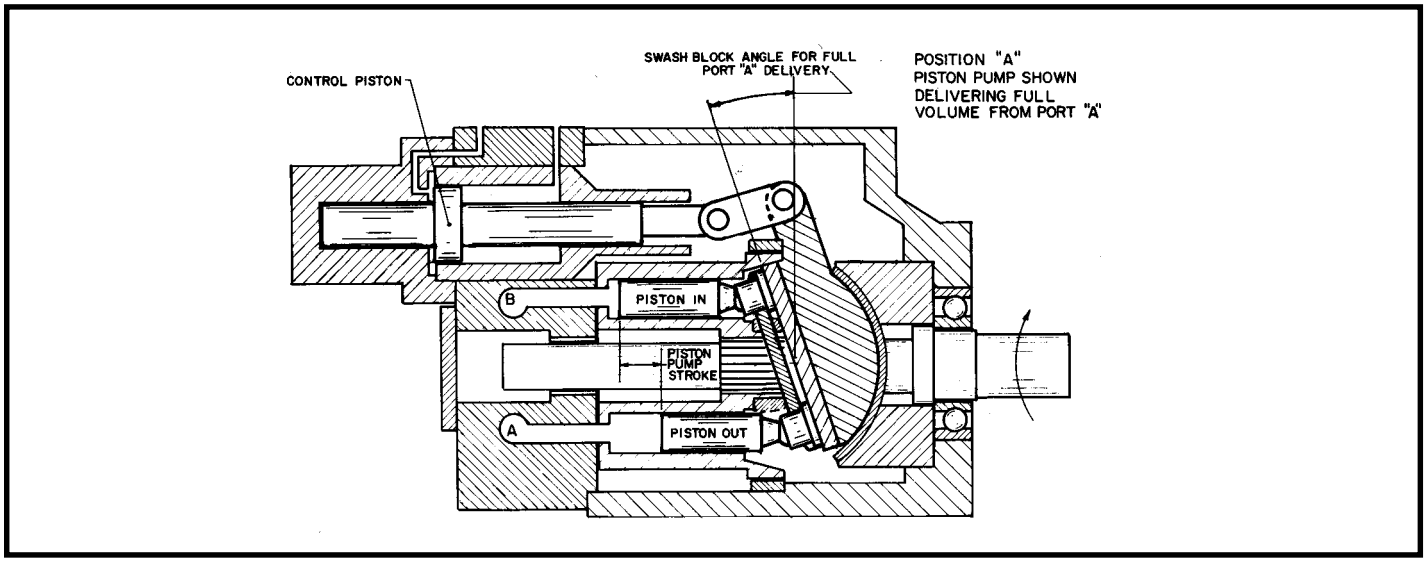



Figure 6. POSITION A (5V-12010-L)

**(See Page 3 for IV. SPECIFICATIONS)**

## D. LOSS OF PRESSURE

1. Worn piston pump.
2. Worn or grooved cylinder wear plate (106) and/or port plate (6); wear plate and/or port plate separation from cylinder, each other or valve plate (1).
3. Worn pistons (102), shoes, or piston bores.
4. Faulty output circuit components.

## E. EXCESSIVE or HIGH PEAK PRESSURE

1. Faulty output circuit components (pay particular attention to relief valves).

## F. EXCESSIVE NOISE

1. Pump incorrectly being stopped or started under load.
2. Low fluid level in reservoir or insufficient supercharge resulting in cavitation.
3. Air entering hydraulic system.
4. Fluid too cold or viscosity too high.
5. Suction line problem i.e.; obstructions in line, line too long, line diameter too small or too many bends or loops in line.
6. Broken or worn piston/shoe assembly (102).
7. Pump rotating in wrong direction.

## G. EXCESSIVE HEATING

1. Operating pump above rated or peak pressure.
2. Low fluid level in reservoir or insufficient supercharge.
3. Air entering hydraulic system.
4. Worn piston pump.
5. Worn or grooved cylinder wear plate (106) and/or port plate (6).
6. Faulty output circuit components (continuous blowing relief valves or slip through valves, cylinders, etc.).
7. Insufficient cooling provision or clogged coolers.

# VI. TESTING AND ADJUSTING

**WARNING: - Shut pump off and release pressure from the system before disassembling components.** Failure to comply with these instructions could result in personal injury or death. **Blocking pressure line between pump and system (or pump) high pressure relief valve will result in damage and could result in serious personal injury.**

## A. AXIAL PISTON PUMP

**It is not recommended that stroke indicator be used to determine percent of slip stroke. Removal of the plastic stroke indicator cap (008) can result in the stroke indicator pin (010) dropping into the pump case where it can damage the unit.**

To check for worn piston pump, measurement of the leakage can be made from the case drain while the pump is under pressure. After the unit is warm, either install a flow meter in the drain line or have the flow from the drain line directed into a large container or reservoir. The pump case, must remain full of liquid during this test.

**Caution: Do not run a pump on stroke against a blocked output unless it is protected by a high pressure relief valve and then run no longer than necessary to check slip. Limit discharge to prevent dropping reservoir fluid below low level.** With an accurate high pressure gage in the pressure line, start the pump and stall (or block) output device to raise system pressure to maximum (as set by system relief valve). Read the flow meter or time the case drain flow used to fill a known size container and calculate the flow rate in terms of cubic inches per minute (cipm). The leakage should conform with table 5. Additional leakage indicates wear, but does not become critical until it impairs performance.

# VII. DISASSEMBLY

## A. PREPARATION

When disassembling or assembling unit, we recommend choosing a work area where no traces of dust, sand or other abrasive particles, which could damage the unit, are in the air. We also recommend not working near welding, sand-blasting, grinding benches and the like. Place all parts on a CLEAN surface. To clean parts which have been disassembled, it is important CLEAN solvents are used. All tools and gages should be clean prior to working with these units and new, CLEAN and threadless rags used to handle and dry parts.

**WARNING: NEVER attempt to remove or install any component or assembly while unit and system is running. Always stop the pump, shut-off power and release pressure from the system before servicing or testing. Be sure provisions have been made so case drain line can be disconnected from the unit without causing the line to drain (siphon) the reservoir.**

Table 5. NOMINAL CASE SLIP vs High Pressure at 1800 rpm

| Pump Size | | Case Slip at Full Stroke and Indicated Pressure | | | | |
|---|---|---|---|---|---|---|
| | | 1000 psi | 2000 psi | 3000 psi | 4000 psi | 5000 psi |
| 140 | cipm<br>l/min. | 100<br>(1,64) | 200<br>(3,28) | 300<br>(4,92) | 400<br>(6,56) | 500<br>(8,20) |
| 270 | cipm<br>l/min. | 400<br>(6,56) | 700<br>(11,48) | 1000<br>(16,41) | 1400<br>(22,97) | 1800<br>(29,53) |
| 370 | cipm<br>l/min. | 500<br>(8,20) | 1000<br>(16,41) | 1500<br>(24,61) | 2000<br>(32,81) | 2500<br>(41,01) |

Disconnect case drain line from port "1" or "1A" and drain pump case through plug on bottom of case. If plug is inaccessible, it may be necessary to loosen the four valve plate bolts (013) pull back on valve plate to allow fluid to seep out of the case. Refer to Figures 8 and 9 for size 140 or Figures 10 and 11 for size 270 and 370. Depending upon what part or parts are to be inspected, it may not be necessary to completely take apart all assemblies.

## B. CONTROL PISTON GROUP

Remove large plug (007) and o'ring (017) from port "1A" or port "1" (opposite case drain connection). Control piston (501) must be in "neutral" position. Check stroke indicator (010). If pump is at "neutral", control link pin (403) should be centered in port "1" or "1A". If it is in neutral position, skip ahead to next paragraph. For one-way pumps with single acting control, be sure minimum volume stop (708) is backed out, de-stoke pump by turning maximum volume stop (707) clockwise until control link pin (403) is visually centered in the case drain opening. For one way pumps with twin acting control or for two-way pumps, it may be necessary to turn either the minimum volume stop clockwise or the maximum volume stop clockwise to center control link pin (403). Using appropriate snap ring pliers, remove retaining ring (404) on both sides of the pin and remove control link washers (405). For handling purposes, insert a (0.250-20 UNC for size 140, 0.375-16 UNC for size 220 and 370) bolt into the threaded end of the control link pin (403). Using a brass rod and hammer tap on end opposite the bolt to remove the control link pin (403).

**CAUTION** Maximum volume stop **MUST** be removed **BEFORE** further disassembly of control piston. Unscrew maximum volume stop gland (704 or 701). Back out four bolts (611), then remove cap (601A, B or C). Bias control spring (610) can be removed when used and the minimum and maximum volume stops can be further disassembled. Further control piston disassembly in described in part "C".

## C. VALVE PLATE GROUP

NOTE:- valve plate (1A, B, or C) is a slight press fit in the pump housing (001).

Support valve plate (1A, B or C) from an overhead crane (lifting lug holes are provided) and remove four bolts (013) from valve plate. Remove valve plate (1A, B or C) from pump housing (001) by tapping away from the housing with a mallet until valve plate pilot diameter disengages from the case (1/4" for sizes 140) or valve plate and port plate disengages from case (5/8" for sizes 270 and 370). With the weight of the valve plate still suspended from the overhead crane, slide valve plate back until it disengages from driveshaft (301 A or B) and set valve plate aside. The port wear plate (6A, B or C) used on size 270 and 370 can be separated from valve plate after removal of shoulder screws (7). Care must be taken not to damage wear face of valve plate (1A, B or C) or wear face of port wear plate (6) used on size 270 and 370.

To further disassemble control piston assembly, move control piston (501A, B or C) into sleeve (502A, B or C) until control piston maximum stop pin (503) contacts the sleeve. Use a large mallet to drive piston and sleeve assembly outward from the valve plate. When all sleeve seals (504, 505, 509, 510, 512) are clear of the valve plate, re-extend control piston (501A, B or C). While tipping the assembly enough to clear the hole, pull the assembly from the valve plate. Remove pin (511) from control piston by pressing or tapping it out through the hole on opposite side, control stop pin (503) can be removed and control piston (501) slipped out of sleeve (502).

## D. ROTATING GROUP

**WARNING: Size 140 rotating group weights approximately 30 lbs. and the size 270 and 370 approximately 65 lbs.** Extreme care must be taken not to damage cylinder wear face or cylinder wear plate face, bearing diameters or piston shoes. Assistance from others and use of proper lifting techniques is strongly recommended to prevent personal injury.

To remove rotating group, firmly grasp the cylinder barrel (101) and pull assembly outward until cylinder spline disengages driveshaft spline (about 2.5" for size 140 and 3.5" for sizes 270 and 370). Once clear, rotate cylinder barrel a revolution or two to break any contact between piston/shoe assemblies (102) and swashblock (203) wearface. Slide rotating group off the driveshaft (301A or B) and out of the pump housing and place it on a clean, protective surface with piston shoes facing upward. Mark each piston, it's cylinder bore and location in shoe retainer for ease of inspection and assembly. Piston/shoe assemblies (102) can be removed individually or as a group [pulling upward on shoe retainer (105)]. Fulcrum ball (103) can be removed. If shoe retainer springs (104) [with shims (108) on size 270 and 370] are removed, mark which spring (and shims) came from which bores as they must be returned to that individual bore on assembly. Remove pin (005) on size 140 or retainer ring (005) on size 270 and 370 and pull the cylinder bearing (002) [with pins (018) on size 270 and 370] straight out of the pump housing.

## E. SWASHBLOCK GROUP

Remove swashblock retaining pins (204), tilt the bottom of the swashblock (203) outward and remove the swashblock from the pump case. Saddle bearings (202) can be removed at this point – a very short screwdriver or back hammer will be required to pry them loose, or see section F for further disassembly which will make their removal easier.

## F. DRIVESHAFT GROUP

To remove driveshaft (301A or B) and bearing (304) assembly, remove shaft bearing retaining ring (306). Use a mallet on the tail shaft and tap driveshaft (301A or B) out from the front of the pump housing. Remove seal retainer (303) and using a mallet tap saddle (201) out from the inside of the pump housing. Saddle bearings (202) can then be easily removed and saddle o'ring (015) may also be removed at this time.

# VIII. INSPECTION

Clean all parts thoroughly. Inspect all seals and o'rings for hardening cracking or deterioration and replace if necessary. Check all locating pins for damage and all springs for cracking or signs of fatigue.

**WARNING Always wear safety goggles when using solvents or compressed air. Failure to wear safety goggles could result in serious personal injury.**

## A. CONTROL PISTON GROUP

See applicable reference material on pump controls. Control piston (501A, B or C) must slide smoothly in sleeve (502A, B or C). Linkage to cradle should operate smoothly but not loosely (with slop), check piston and bore in sleeve for signs of scratching or galling. Polish with fine emery if needed.

## B. VALVE PLATE GROUP

For size 140 units, closely examine mating faces of valve plate (1A, B, C or D) and cylinder barrel (101) for flatness, scratches or grooves. For size 270 and 370 units, closely examine mating faces of port plate (6A, B, C or D) and cylinder wear plate (106) for flatness, scratches or grooves. If faces are not flat and smooth, the cylinder side will "lift off" from the port plate (valve plate) resulting in delivery loss and damage to the pump. Replace if necessary. NOTE: wear faces on size 270 and 370 units are coated

with a gray colored epoxy based dry film lubricant for "break-in" purposes. Scratching or wear of this coating **is not detrimental** as long as the metal surface underneath the coating is not scored or "picked-up".

## C. ROTATING GROUP

Check all pump piston assemblies (102) for smooth action in their bores. Check piston walls and bores for scratches or other signs of excessive wear (pistons should not have more than a few thousandths clearance). Replace if necessary. Piston shoes must pivot smoothly, but end play must not exceed 0.003" (0,076 mm). Check end play as follows: Place square end of piston on bench and hold down firmly. Pull on end of shoe with other hand and note end play. A good piston/shoe fit will have no end play, but the shoe may rotate and pivot on the piston ball. Inspect each shoe face for nicks or scratches. Measure shoe thickness (the part held between retainer (105) and cradle [(203) on size 140] or cradle wear plate [(208) on size 270 and 370]. All shoes must be equal within 0.0001" (0,003 mm). If one or more piston/shoe assemblies (102) needs to be replaced, all piston/shoes assemblies must be replaced. Inspect cylinder bearing (002) and matching cylinder (101) surface for galling, pitting or roughness. Replace if necessary.

## D. SWASHBLOCK GROUP

Inspect swashblock (203) or swashblock wear plate (208) [for size 270 or 370] for scratches, grooves, cracks or uneven surface. Replace if defective. NOTE: wear face is coated with a gray colored epoxy based dry film lubricant for break-in purposes. Scratching or wear of this coating is not scored or "picked-up".

Compare saddle bearing (202) thickness in wear area to thickness in an unworn area. Replace saddle bearings if difference is greater than 0.004" (0,102 mm). Check mating surface of swashblock for cracks or excessive wear. Replace if necessary. Swashblock movement in saddle and saddle bearing (202) must be smooth.

## E. DRIVESHAFT GROUP

Check shaft seal (003) for deterioration or cracks. Replace if necessary. Check shaft bearing (304) for galling, pitting, binding or roughness. Check shaft and its splines for wear. Replace any parts necessary.

# IX. ASSEMBLY

Refer to figures 8 and 9 for size 140 units or figures 10 and 11 size 270 and 370. The procedure for assembling the pump are basically the reverse order of disassemble procedures. During assembly, install new gaskets, seals and o'rings. Apply a thin film of CLEAN grease or hydraulic fluid to sealing components to ease assembly. If a new rotating group is used, lubricate thoroughly with CLEAN hydraulic fluid. Apply fluid generously to all wear surfaces.

## A. SWASHBLOCK GROUP

Press or tap roll pin (004) into pump housing (001). Press shaft seal (003) into saddle (201) preferably using an arbor press. Install o'ring (015) into the groove in the saddle. Press four roll pins (205) into the saddle until they bottom, then press saddle bearing (202) onto the pins to locate the bearing in the saddle.

**CAUTION: Extreme care should be used not to damage saddle bearing surfaces while installing the saddle (201) into the pump housing.** Using a long brass bar and a mallet or an arbor press, tap **ONLY** on the area of the saddle that is exposed between the saddle bearings (do **NOT** tap on bearing surfaces). (**NOTE**- Saddle is fully seated when a distinct metallic sounds is heard when installing the saddle into the pump housing). Fasten control link (401) to swashblock (203) using swashblock link pin (403) [402] for size 270 and 370] and retaining rings (404). Be sure pin (206), and (209) for sizes 270 and 370, is pressed into swashblock (203). Insert swashblock (203) into pump housing (001) until it engages saddle (201) and allow swashblock to settle to it's lowest natural position. Retain by installing swashblock retaining pins (204) with o'rings (207) in place. Once pinned, make certain swashblock strokes smoothly in the saddle by pulling firmly on the free end of control link (401). Wear plate (208) for size 270 and 370 units may be installed at this point or (preferably) just prior to installation of the rotating group.

## B. DRIVESHAFT GROUP

**NOTE: for size 140, be sure punch marks on cylinder bearing (002) will face toward shaft end of pump. For size 270 and 370 be sure small (0.188) drill holes face toward shaft end of pump and roll pins (018) are in cylinder bearing (002).** Insert cylinder bearing (002) straight into pump housing. For size 140, be sure bearing is positioned so bearing retainer pins (005) with o'rings (028) in place can be inserted through the case, into the bearing to prevent it from spinning within the case. Install o'ring (28) and pins (005). For size 270 and 370 be sure roll pins (018) are positioned so they are pointing towards the top of the pump, when bearing is properly seated the pins will prevent it from spinning, install retaining ring (005) making certain the ends of the spiral ring are located in the bottom of the pump housing. An arbor press is required to install shaft bearing (304) onto driveshaft (301A or B). **IMPORTANT – press ONLY on the inner race of the bearing.** Press until bearing contacts the shoulder on driveshaft. Install shaft retaining ring (305) by supporting driveshaft (NOT ON THE BEARING). Use a long (6" or 153 mm) sleeve, with an I.D. slightly larger than the retaining ring I.D., and press retaining ring (305) towards bearing until it seats in the groove. Place seal retainer (303) on seal (003) and install entire driveshaft (301A or B) assembly through the front of the pump housing. A mallet will be required to drive the driveshaft through the shaft seal (303). Once the driveshaft assembly is properly located within the pump housing, install shaft bearing retainer ring (306).

## C. ROTATING GROUP

For size 270 and 370 units, be sure swashblock wear plate (208) is installed and place cylinder wear plate (106) on dowel pins (107) locating it on rear of cylinder barrel (101). Mating surfaces should be greased. Place cylinder assembly on clean table with the valve plate side down. During disassemble, shoe retainer springs and shims (when used) were referenced to individual bores. Assemble rotating group by inserting shoe retainer spring (104) [and cylinder spring shims (108) for size 270 and 370] into the same spring bores located in cylinder barrel (101) that they came from. Slide fulcrum ball (103) over the nose of the cylinder. All nine slots in fulcrum ball for size 270 and 370 units must engage all nine shoe retainer springs (104). Place shoe retainer (105) over fulcrum ball and align holes in retainer with corresponding (marked up on disassembly) holes in the cylinder barrel. Once aligned, insert piston/shoe assemblies (102) into corresponding (marked on disassembly) holes completing the rotating group.

**WARNING The assembled rotating group weights approximately (140 = 30 lbs., size 270 and 370 = 65 lbs.) assistance from others and proper use of proper lifting** techniques is strongly recommended to prevent personal injury. The rotating group can now be carefully installed over the tail of the driveshaft (301A or B) and into the pump housing (001). When installing

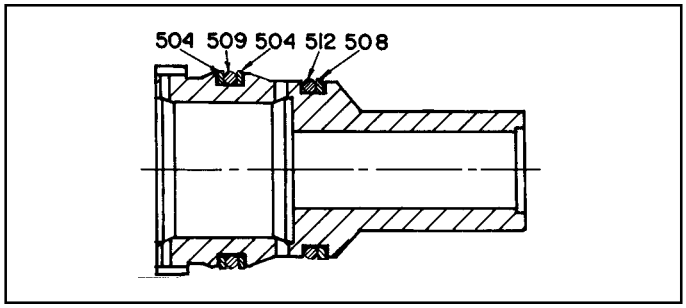
the rotating group, support the weight of the cylinder barrel (101) as cylinder spline is passed over the tailshaft to avoid scratching or damage. Push cylinder forward until the cylinder spline reaches the driveshaft spline and rotate the cylinder slightly to engages shaft splines. Continue to slide cylinder forward until it encounters the cylinder bearing (002). Lifting the tailshaft slightly helps cylinder (101) and cylinder bearing engagement. Continue pushing cylinder forward until the piston shoes contact swashblock (203) or swashblock wear plate (208) on size 270 or 370 units. At this point the back of the cylinder should be located approximately (140 = 1/4", 270 and 370 = 1/2") inside the back of the pump housing.

## D. CONTROL PISTON GROUP

**NOTE-unless held carefully during the assembly, the stroke indicator pin (010) and spring (009) will fall off pin (206) and drop into pump case.** Carefully slide indicator pin (101) through bore in case and balance on pin (206), hold pin while slipping stroke indicator spring (009) into it and carefully slide stroke indicator cap (008) with o'ring (016) in place over the spring and pin and secure cap to case by turning it in.

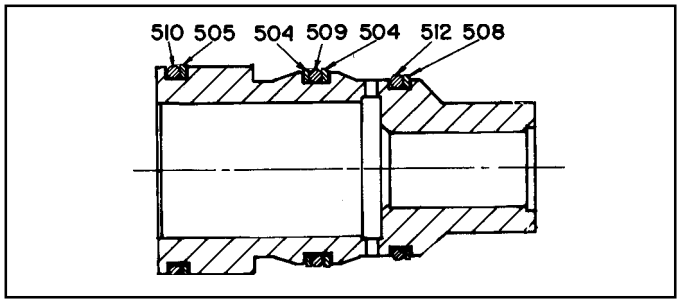
**CAUTION**

**Do not over tighten plastic indicator cap (008), snug only.** On size 270 and 370 units, use shoulder screws (7) and install port plate (6A, B, C or D) on valve plate (1A or B). For single acting, one-way control pistons (501A), install seals or rings (507 and 515) into their respective grooves using care to assure they are in proper location as seals are not the same size (515 is smaller of the two). For twin-acting, (one or two-way) control pistons (501B or 501C), install seals or rings (507 and 506) into their respective grooves. Insert control piston assembly into sleeve (502A or C). While supporting the control piston, press or slip in pin (503) and secure with cotter or roll pin (511). Order of piston sleeve seal installation starts at widest end of sleeve.

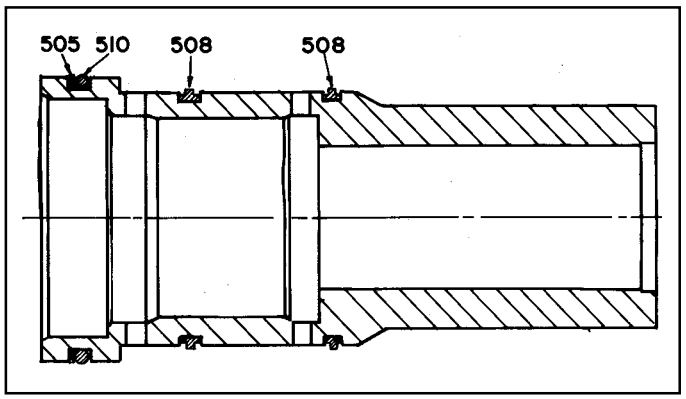



Size 140 One-way Pumps

On size 140 one-way control piston sleeve (502A), install back-up ring (504), o'ring (509) and back-up ring (504) in rear most groove; install o'ring (512) and back-up ring (508) in remaining groove. On size 140 two-way control piston sleeve (502C), install o'ring (510), back-up ring (505) in largest diameter groove; back-up ring (504), o'ring (509) and back-up ring (504) in middle groove; o'ring (512) and back-up ring (508) in remaining groove.

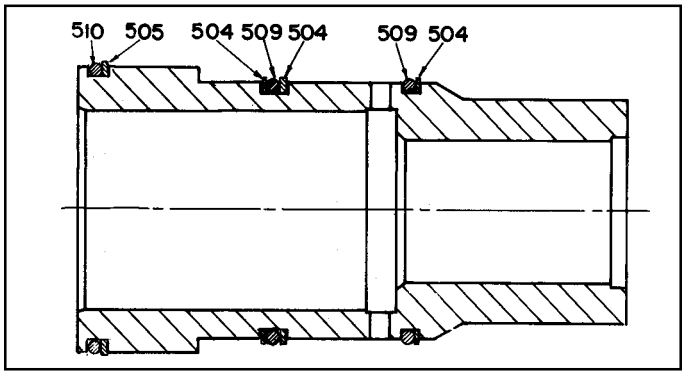



Size 140 Two-way Pumps




Size 270 and 370 One-way Pumps

On size 270 and 370 one-way control piston sleeve (502A), install back-up ring (505) and o'ring (510) in largest diameter groove, GT ring (508) in middle groove, and GT ring (508) in remaining groove. On size 270 and 370 two-way control piston sleeve (502C), install o'ring (510) and install back-up ring (505) in largest diameter groove; back-up ring (504), o'ring (509) and back-up ring (504) in middle groove; o'ring (509) and back-up ring (504) in remaining groove.




Size 270 and 370 Two-way Pumps

For two-way pumps insert o'ring (5) in bore and insert piston and sleeve assembly (502) into valve plate (1A, B, C or D). NOTE: - for size 270 and 370 using either a mallet or an arbor press, press sleeve in until seated. Install o'ring (604) with back up rings (603) in seal groove of control cover cap (601A, B or C). For single acting one-way control pistons, insert bias control piston spring (610) [two springs used for size 140] into control piston (501A). Use four bolts (611) to fasten control cover cap to back of valve plate (1A or B). NOTE:- torque bolts (611) evenly as indicated in "Bolt Torque Table 6".

Install o'ring (4) in rear of valve plate and plug (605 or 607) with o'ring (606 or 608) in cap. Use four bolts (902) to fasten cover plate (901) over through shaft opening in valve plate (1A, B, C or D). Pull free end of control link (401) toward back of pump housing until the open hole in the link lines up with case drain port "1 or 1A" as stamped on case. Insert a suitable object through opening where maximum volume stop gland (704) fits to temporarily wedge swashblock in place.

Table 6. BOLT TORQUES in foot lbs. (Nm.)

| | Pump Size | |
|---|---|---|
| Item No. | 140 | 270 & 370 |
| 611 | 138 (187) | 244 (331) |
| 013 | 244 (331) | 382 (518) |

## E. VALVE PLATE GROUP

Be sure tailshaft bearing (3) is in place. Using assembly grease (to hold desired position), place valve plate gasket (2) into position on valve plate (1). Support valve plate assembly from an overhead crane (lifting lug holes are provided) in preparation for mating to the pump housing. Assemble one control link retainer ring (404) and one control link washer (405) onto the threaded hole side of the control link pin (403), then thread a (size 140 = 0.250 – 20UNC, size 270 and 370 = 0.375 – 16UNC) bolt into pin to ease holding. Carefully maneuver valve plate assembly, supported by overhead crane, over tailshaft and into pump housing so slot on control piston (501) engages control link (401). With hole in control piston lined up with hole in the link, carefully insert control link pin (403). IMPORTANT – care should be taken during this next step to prevent the washer and retaining ring from falling into pump housing. Assemble second control link washer (405) and control link retaining ring (404) onto pin. Once assembled, remove (holding) bolt from pin and temporary swashblock support from maximum volume stop gland (704) opening.

NOTE: - valve plate is a slight press fit into pump housing. Make sure pilot diameter on valve plate (1A, B, C or D) is aligned reasonably well with mating diameter on the pump housing. Insert four bolts (013) and alternately tighten until valve plate is drawn up to the pump housing (001). Torque bolts (013) evenly to the torque specified in previous Table 6. Bolt Torques. If removed, replace maximum and/or minimum volume stop assemblies (parts 701 through 710 or 716). Be sure plugs/o'ring assemblies (014 and 016, 007 and 017, 020 and 019) are installed in pump housing.

## X. PARTS LIST

Parts used in this assembly are per Oilgear specifications. Use Oilgear parts to insure compatibility with assembly requirements. When ordering replacement parts, be sure to include pump type and serial number, bulletin number and item number. To assure seal and packing compatibility, specify type of hydraulic fluid.

| ITEM NO. | DESCRIPTION |
|---|---|
| 0 | VALVE PLATE ASSEMBLY GROUP |
| 1A | Valve Plate, L.H. One-way Pump at "A" |
| 1B | Valve Plate, R.H. One-way Pump At "B" |
| 1C | Valve Plate, L.H. Two-way Pump |
| 1D | Valve Plate, R.H. Two-way Pump |
| 2 | Gasket, Valve Plate |
| 3 | Bearing, Tailshaft |
| 4 | O'ring |
| 5 | O'ring |
| 6A* | Port Plate, L.H. One-way Pump |
| 6B* | Port Plate, R.H. One-way Pump |
| 6C* | Port Plate, L.H. Two-way Pump |
| 6D* | Port Plate, R.H. Two-way Pump |
| 7* | Screw, Shoulder |
| 000 | COMMON ASSEMBLY GROUP |
| 001 | Housing, Pump |
| 002 | Bearing, Cylinder |
| 003 | Seal, Shaft |
| 004 | Pin, Roll |
| 005 | Bearing Retainer Pin (140 only)<br>Bearing Retainer Ring (270 and 370 only) |
| 006 | Eyebolt |
| 007 | Plug, SAE |
| 008 | Cap, Stroke Indicator |
| 009 | Spring, Stroke Indicator |
| 010 | Pin Assembly, Stroke Indicator |
| 013 | Screw, Sock. Hd. Cap |
| 014 | Plug, SAE |
| 015 | Seal, O'ring |
| 016 | Seal, O'ring |
| 017 | Seal, O'ring |
| 018* | Pin, Roll |
| 019 | Seal, O'ring |
| 020 | Plug, SAE |
| 024 | Nameplate, Identification |
| 025 | Nameplate, Rotation |
| 026 | Screw, Drive |
| 027 | Nameplate, CAUTION |
| 028 | Seal, O'ring (140 only) |

| ITEM NO. | DESCRIPTION |
|---|---|
| 100 | ROTARY ASSEMBLY GROUP |
| 101 | Barrel, Cylinder |
| 102 | Assembly, Piston/Shoe |
| 103 | Ball, Fulcrum |
| 104 | Spring, Shoe Retainer |
| 105 | Retainer, Shoe |
| 106* | Wear Plate, Cylinder |
| 107* | Pin, Dowel |
| 108* | Shim, Shoe Retainer Spring |
| 200 | SWASHBLOCK ASSEMBLY GROUP |
| 201 | Saddle |
| 202 | Bearing, Saddle |
| 203 | Swashblock |
| 204 | Pin, Swashblock |
| 205 | Pin, Roll |
| 206 | Pin, Dowel |
| 207 | Seal, O'ring |
| 208* | Wear Plate, Swashblock |
| 209* | Pin, Roll |
| 210* | Seal, O'ring |
| 300 | DRIVESHAFT ASSEMBLY GROUP |
| 301A | Driveshaft w/keyway |
| 301B | Driveshaft w/spline |
| 302 | Key, Driveshaft |
| 303 | Retainer, Seal |
| 304 | Bearing, Front Driveshaft |
| 305 | Ring, Shaft Retainer |
| 306 | Ring, Driveshaft Bearing Retainer |
| 400 | CONTROL LINK ASSEMBLY GROUP |
| 401 | Link, Control Piston |
| 402 | Pin, Swashblock Link |
| 403 | Pin, Control Piston Link |
| 404 | Ring, Retainer |
| 405 | Washer, Control Piston Link |

| ITEM NO. | DESCRIPTION |
|---|---|
| 500 | CONTROL PISTON ASSEMBLY GROUP |
| 501A | Piston, Single Acting Control (one-way pump) |
| 501B | Piston, Twin Acting Control (one-way pump) |
| 501C | Piston, Twin Acting Control (two-way pump) |
| 502A | Sleeve, Control Piston (one-way pump) |
| 502C | Sleeve, Control Piston (two-way pump) |
| 503 | Pin, Control Piston Max. Stop |
| 504 | Ring, Back-up |
| 505* | Ring, Back-up |
| 506 | Ring, Control Piston (twin-acting) |
| 507 | Ring, Control Piston (single and twin-acting) |
| 508 | Ring, Back up (140 single only)<br>Ring, Back up (270 and 370 single and twin acting) |
| 509 | Seal, O'ring (140 single and twin)<br>Seal, O'ring (270 and 370 twin two-way only) |
| 510* | Seal, O'ring (single and twin acting) |
| 511 | Pin |
| 512 | Seal, O'ring (140) |
| 512* | Seal, Ring (270 and 370 single acting) |
| 515 | Seal, Control Piston (one-way pump) |
| 600 | CONTROL CAP ASSEMBLY GROUP |
| 601A | Cap, Single Acting One-way Pump Control Piston |
| 601B | Cap, Twin-acting One-way Pump Control Piston |
| 601C | Cap, Twin-acting Two-way Pump Control Piston |
| 603 | Ring, Back-up |
| 604 | Seal, O'ring |
| 605 | Plug, SAE (140 two-way only) |
| 606 | Seal, O'ring (140 two-way only) |
| 607* | Plug, SAE |
| 608* | Seal, O'ring |
| 610 | Spring, Single Acting Control Bias Piston |
| 611 | Screw, Sock Hd. Cap |
| 613 | Screw, Sock Hd. Cap (two-way pumps) |
| 700 | VOLUME STOP ASSEMBLY GROUP |
| 701 | Stop, Non-adjusting Max. Flow |
| 702 | Seal, O'ring |
| 703 | Plug, SAE |
| 704 | Gland, Max. Flow Stop |
| 705 | Gland, Min. Flow Stop |
| 706 | Nut, Jam |
| 707 | Stem, Max. Flow Stop (one-way) |
| 708 | Stem, Min. Flow Stop (one-way) |
| 709 | Seal, O'ring |
| 710* | Stem, Flow Stop (two-way) |
| 716 | Stop, Non-adjustable Max. Flow (two-way) |
| 900 | TAILSHAFT ASSEMBLY GROUP |
| 901 | Cover, Valve Plate |
| 902 | Screw, Sock, Hd. Cap. |

*Use only on size 270 and 370 units.

**O'RING and BACK-UP RING SIZES**

**Cross Section x O.D. Duro ± 5**

| ITEM NO. | PUMP SIZE 140 | PUMP SIZE 270 and 370 |
|---|---|---|
| 4 | .188 x 3.25 70 | .188 x 5.62 70 |
| 5 | .070 x .625 70 | .070 x .625 70 |
| 015 | .125 x 5.62 70 | .125 x 4.50 70 |
| 016 | 912 ARP 70 | 912 ARP 70 |
| 017 | 916 ARP 70 | 924 ARP 70 |
| 019 | 910 ARP 70 | 910 ARP 70 |
| 028 | 906 ARP 70 | ---------- |
| 207 | 910 ARP 70 | 910 ARP 70 |
| 210 | --------- | .062 x .37 70 |

| ITEM NO. | PUMP SIZE 140 | PUMP SIZE 270 and 370 |
|---|---|---|
| 504 | .188 X 3.00 | .188 X 4.00 |
| 505 | ---------- | .188 X 4.50 |
| 508 | .188 X 2.75 | GT |
| 509 | .188 x 3.00 90 | .188 x 4.00 90 |
| 510 | ---------- | .188 x 4.50 90 |
| 512 | .188 x 2.75 90 | ---------- |
| 603 | .65 x 3.25 | .188 x 3.75 |
| 604 | .188 x 3.250 90 | .188 x 3.750 90 |
| 606 | 902 ARP 70 | ---------- |
| 702 | 916 ARP 70 | 916 ARP 90 |
| 709 | .094 x .812 70 | .094 x 812 90 |
| 712 | .062 x .688 70 | ---------- |

## PARTS DRAWINGS ON PAGES 12, 13, 14 AND 15

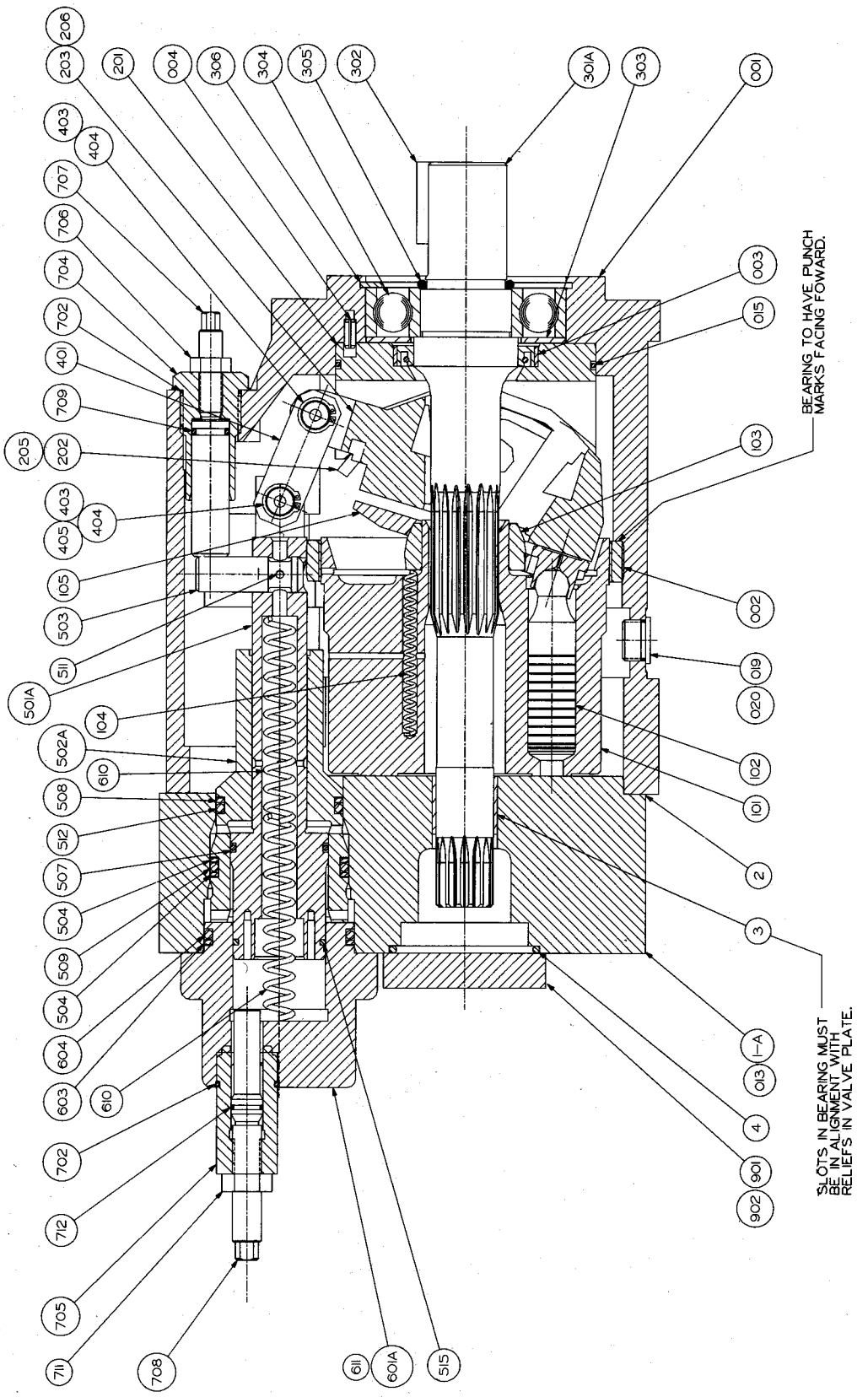



Figure 8. Cross Section Parts Drawing, Size 140 (514259-001).

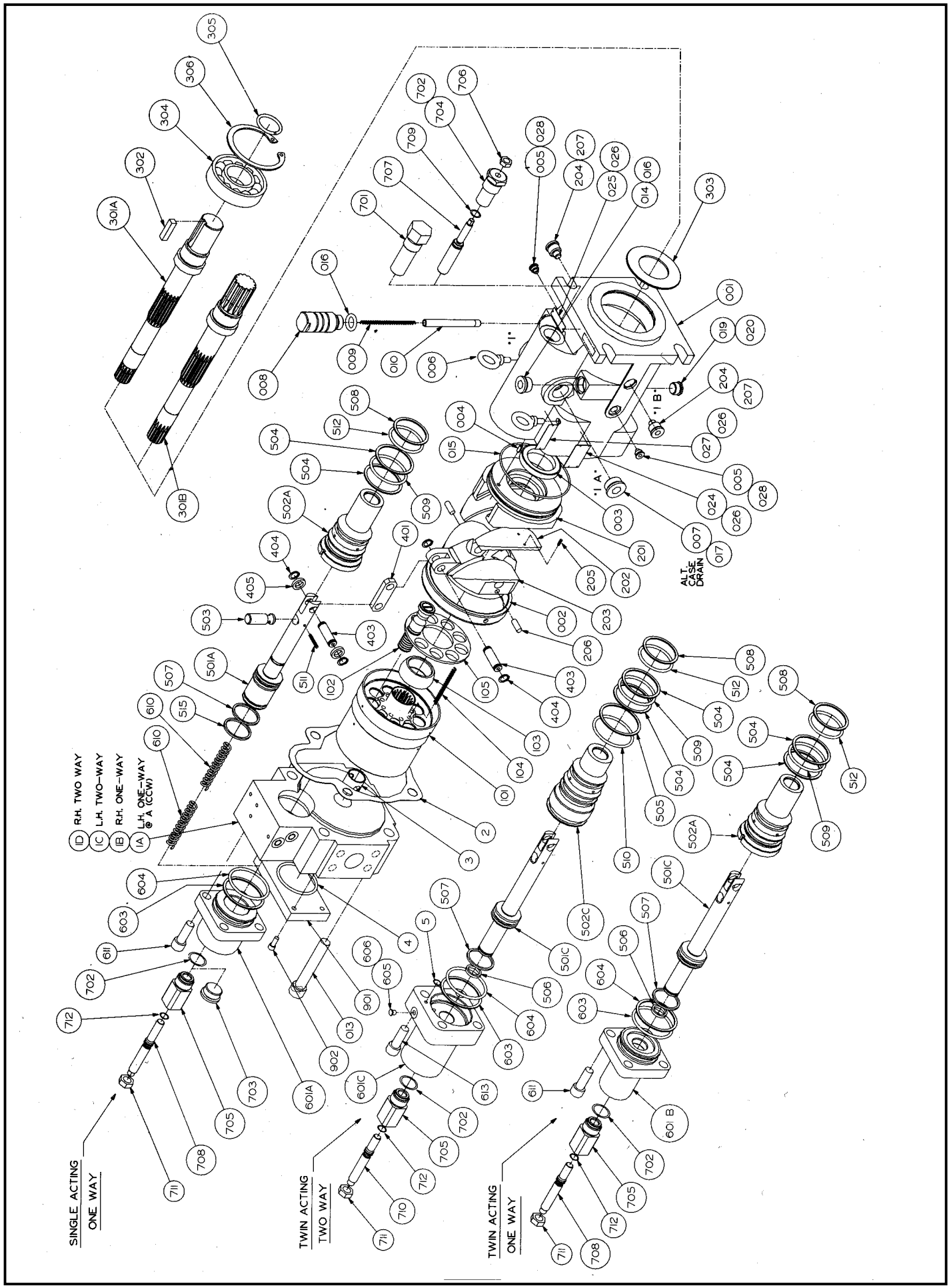



Figure 9. Exploded Parts Drawing, Size 140 (514529-002)

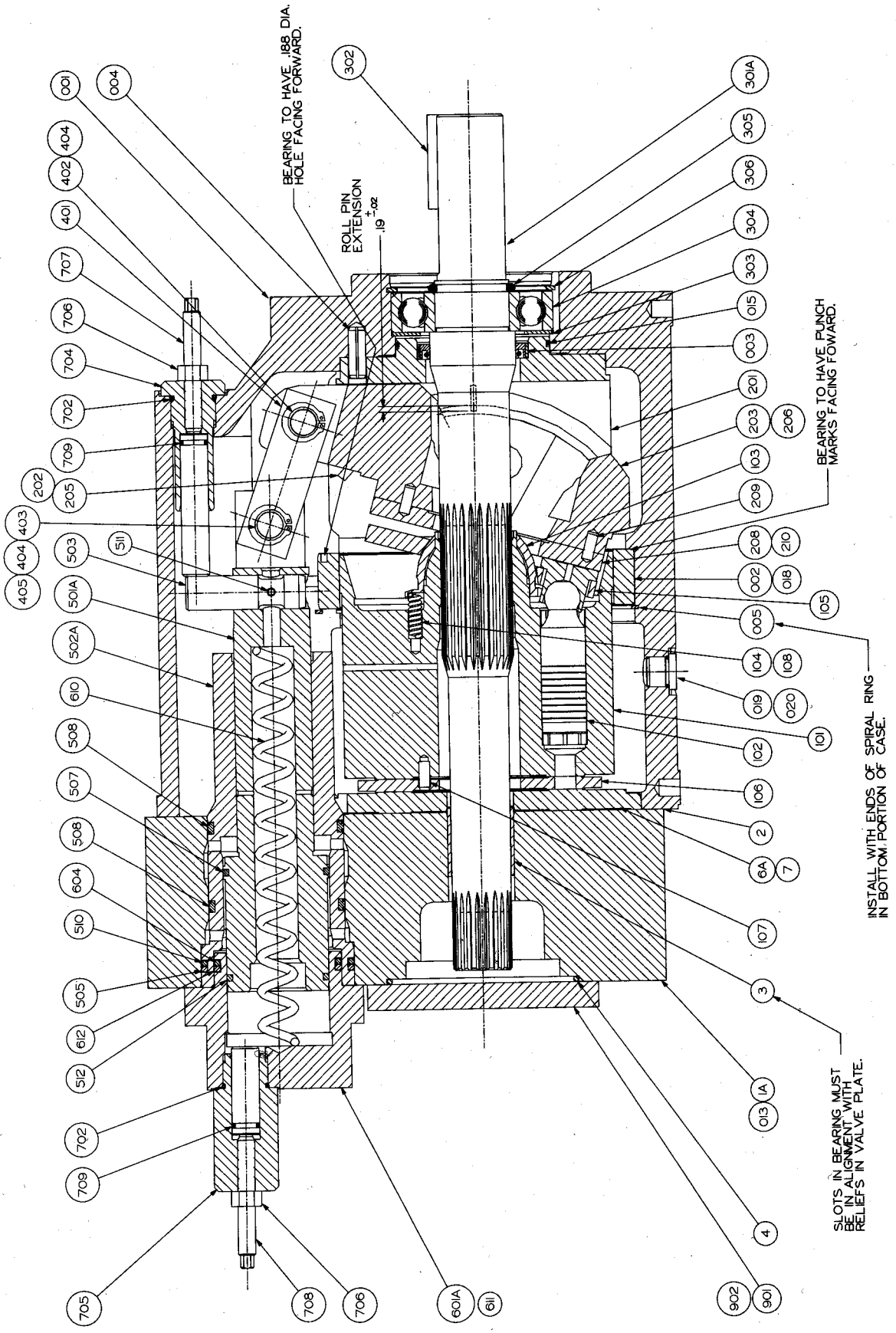



Figure 10. Cross Section Parts Drawing, Size 270 and 370 (515915-001).

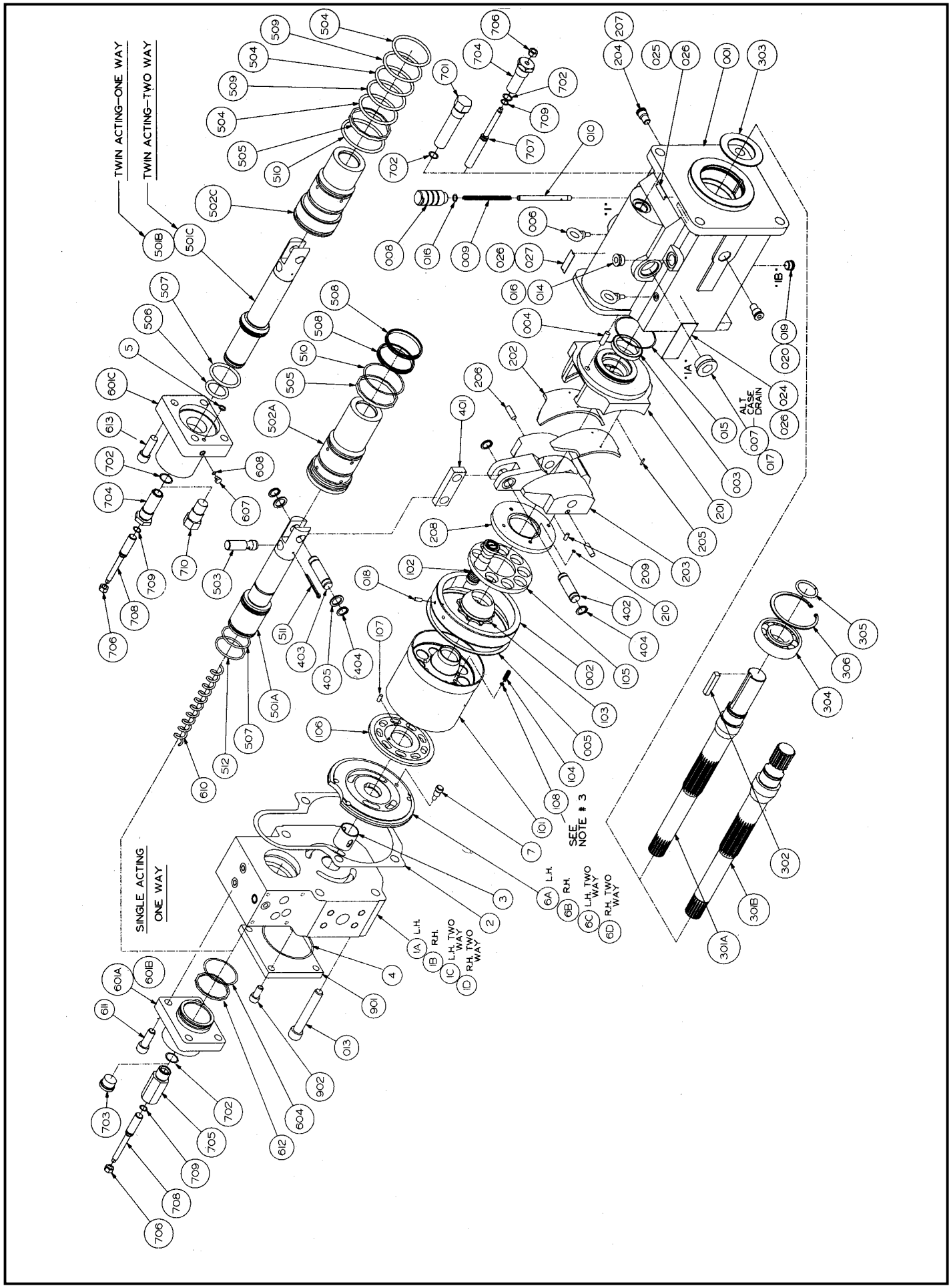



Figure 11. Exploded Parts Drawing, Size 270 and 370 (515915-002).

## XI. AFTER SALES SERVICES

Oilgear builds products that last. However, it is the nature of this type of machinery to require proper maintenance regardless of the care that goes into its manufacture. Oilgear has several service programs to help you.

### "STAY-ON-STREAM" SERVICE

By signing up for Oilgear's "Stay-On-Steam" program you can prepare for problems before they happen. Certain field tests such as fluid testing, slip testing and electronic profile recording comparisons can be performed by our field service people or your own trained personnel. These tests can indicate problems before they become "down-time" difficulties.

### SERVICE SCHOOLS

Oilgear holds schools to train your maintenance personnel. A "general" hydraulic or electronic school is conducted in our Milwaukee plant on a regular basis. "Custom" schools, specifically addressing your particular hydraulic and electrohydraulic equipment can be conducted in your plant.

### SPARE PARTS AVAILABILITY

Prepare for future needs by stocking Oilgear original factory parts. Having the correct parts and necessary skills "in-plant" enables you to minimize down-time. Oilgear has developed parts kits to cover likely future needs. Oilgear field service technicians also stand ready to assist your maintenance people in trouble-shooting and repairing equipment.

### OILGEAR EXCHANGE SERVICE

Standard replacement pumps and motors are available to users of Oilgear equipment where comparable units will be returned in exchange. When standard replacements must be modified to replace units which are special, shipment will depend on availability of parts, assembly and test time necessary.

To obtain this service, place and order for an exchange unit and provide the serial number and type designation. The replacement unit will be shipped F.O.B. our factory, Milwaukee, Wisconsin. User retains the replacement and returns the worn unit prepaid to The Oilgear Company for reconditioning and test. When the unit is reconditioned or stocked, the user is billed the cost of reconditioning or a flat rate exchange price if one has been applied to that particular type of unit.

Oilgear
PERFORMANCE
ASSURANCE

**THE OILGEAR COMPANY**
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BULLETIN 947025

Litho in USA