SERVICE INSTRUCTIONS

OILGEAR TYPE "PVWC" CLOSED LOOP HYDROSTATIC PUMPS*

**** If the characters of your pump's type designatin, following the second dash (-), are "A1" or "B1"; see Bulletin 947018 for applicable instructions.***

PURPOSE OF INSTRUCTIONS

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

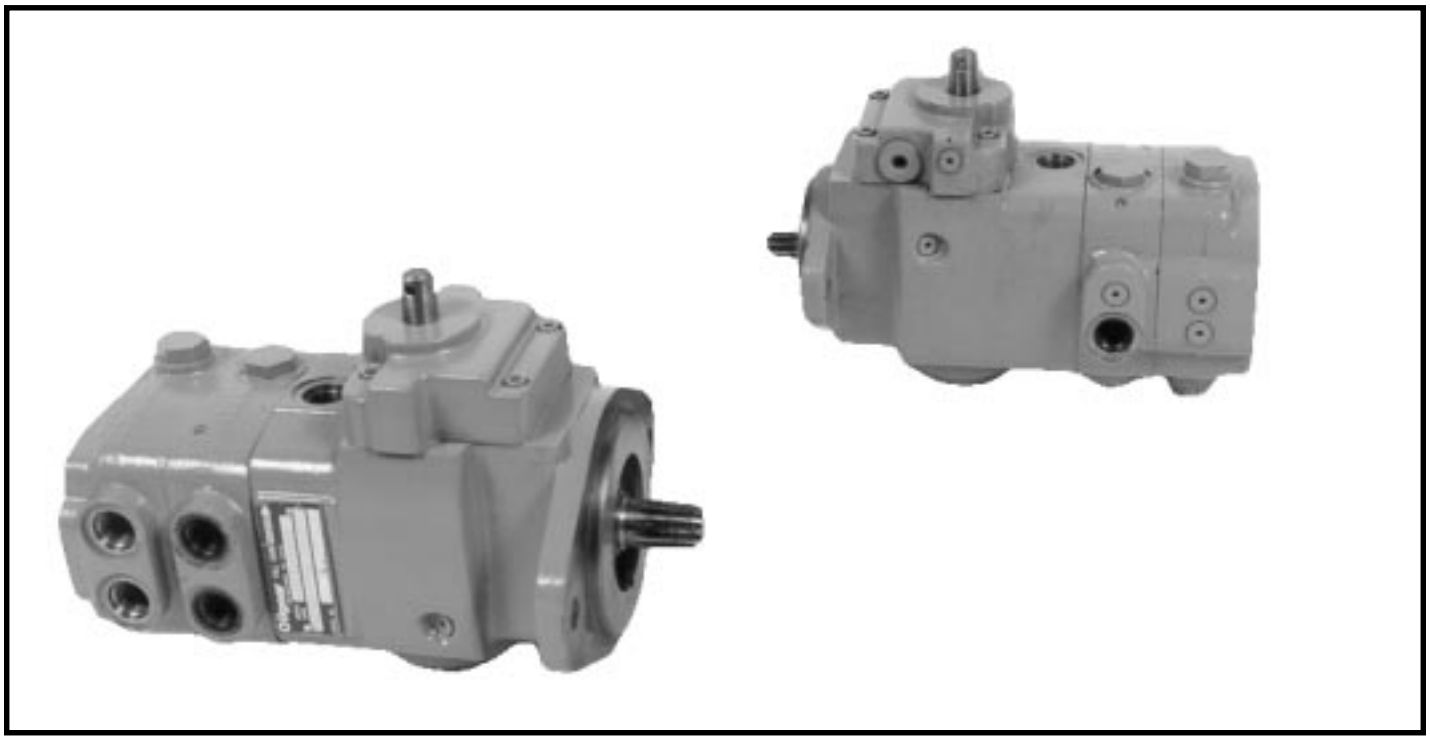

Figure 1. Typical Oilgear "PVWC" Closed Loop Pumps (00006).

REFERENCE MATERIAL

Specifications	Bulletin	47018
Fluid Recommendations	Bulletin	90000
Contamination Evaluation Guide	Bulletin	90004
Filtration Recommendations	Bulletin	90007
Piping Information	Bulletin	90011

Controls: Note - when referring to control sizes, 011 = 04, 014 = 06 and 022 = 10.

Volume Controls

"MN & MS" Pintle for Lever	Bulletin	947116
"VS" Servo Valve Operated	Bulletin	947717
"RU & RR" Solenoid Operated	Bulletin	947815
"RS & RY" Solenoid Operated	Bulletin	947816

I. PREPARATION AND INSTALLATION

NOTE: Parts drawings and lists are located on page 12 thru 15. To aid in location of parts, numerals parenthesized (##) in text correspond to Parts List Item Numbers.

A. MOUNTING

PUMP WITHOUT RESERVOIR. The pump may be mounted in any position. But, for convenience, the recommended mounting position is with the driveshaft axis on a horizontal plane and with case drain "Port 1" on this top side. Secure the unit to a rigid mounting surface. See Section B on "Piping & Fittings".

PUMP WITH RESERVOIR. These units are usually fully piped and equipped. Mount reservoir on level foundation with reservoir bottom at least six inches above floor level to facilitate fluid changes.

B. PIPING AND FITTINGS

See referenced "Piping Information" bulletin and individual circuit diagram before connecting pump to system.

An inlet strainer is not recommended. Supercharge inlet should be unrestricted and have a minimum of fittings, it should reach within 1 to 2 times it's diameter from the bottom of reservoir - **do not "bottom-out" tubes in reservoir**.

Arrange case drain line so case remains full of fluid (non-siphoning) at less than 25 psi (1,7 bar) and case pressure must **not be 10 psi** (0,7 bar) **greater than return pressure**. Each drain line must be separate, unrestricted, full sized and connect directly to reservoir below the lowest fluid level. Drain tubing should **NOT** incorporate a "suction break". Provisions for opening this line without draining (siphoning) reservoir should be made.

WARNING:

Running pump in "Neutral" position (zero delivery) for long period of time without ADEQUATE supercharge (when supercharge pump delivery is being used for auxiliary circuit operation etc.) can damage pump. Be sure operation of auxiliary circuits does not prevent supercharge of the variable delivery pump.

Pump is protected against overloads by built in relief valves but **additional system** high pressure relief valves **may be required** by your system. Install bleed valves (use of Oilgear automatic bleed valves is recommended) at highest points in system. Consult The Oilgear Company for other recommendations.

C. POWER

Power is required in proportion to volume and pressure used. Drive 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 The Oilgear Company. It may be necessary to provide delivery bypass for some circuits.

D. DRIVE

See rotation direction plate on unit's housing. Units are available for left hand (CCW) or right hand (CW) rotation but are not reversible. Use direct drive. Size and install coupling per manufactures 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 drive motor shaft 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 referenced bulletins on "Filtration Recommendations" and "Contamination Evaluation". Oilgear recommends the use of a filter in an auxiliary (or supercharge) pump circuit. Use of ten micron filtration (Beta 10 of four or better) is recommended. Replace filter element(s) when filter condition indicator reaches "change" areas at normal fluid temperature. Drain and thoroughly clean filter case.

F. FLUID COOLING

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

G. AIR BREATHER

On most installations, an air breather is mounted on top of fluid reservoir. It is important for the 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 every six months, remove cover, wash screen in solvent, clean and refill case to "fluid level" mark and install dry screen. See manufacture's recommendations.

H. FLUID, FILLING AND STARTING RECOMMENDATIONS

Use **150-300 SSU VISCOSITY FLUID,** at 100°F (37,7°C) meeting or exceeding lubricating specifications of SAE 10W AP1 Engine Service Classifications - SC, CC or SE (or ISO VG32 thru 68). **For fire resistant fluids**, phosphate ester hydraulic fluids can be used in accordance with manufacture's recommendations.

Refer to instruction plate on unit, reservoir, machine and/or referenced "Fluid Recommendation" bulletin. Pump all fluids into reservoir through a clean (see Section E for Beta ratings) filter. Fill reservoir to, but not above, "high level" mark on sight gage with hydraulic fluid. Remove case drain line and fill 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	Approx. torque to turn shaft	
	foot pounds	N.m.
011, 014 & 022	1.5 - 2.5	2,0 - 3,4

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 the fluid level in the reservoir and stop pump if the level reaches "low level" mark.

Add fluid and start again. Use automatic bleed valves or bleed air from system by cautiously opening air bleed petcocks at highest point in the system. Close connections or petcocks tightly when solid stream of fluid appears.

CAUTION!

Fluid may be under high pressure and caution is advised to prevent stream from hitting personnel or other machinery. Use of an Oilgear automatic air bleed valve is recommended.

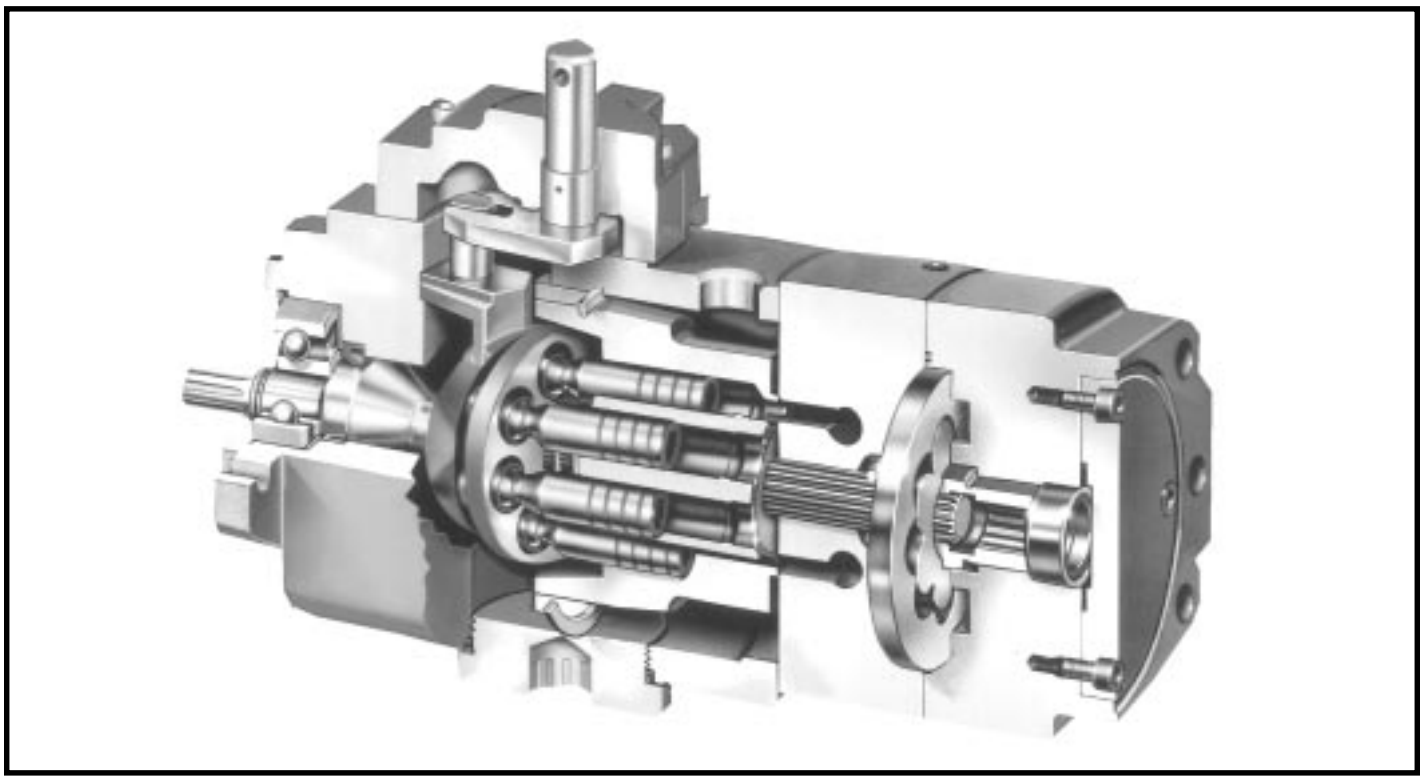

Figure 2. Cut-a-way (cross section) of Typical “PVWC” Pump (00005).

II. CONSTRUCTION

Refer to Figures 2, 10, and 11. A driveshaft (1) runs through the centerline of pump housing (5), valve plate (51) and generated rotor pump (64). A front driveshaft bearing (3) supports the outboard end of the driveshaft and the inboard end is inserted into a splined coupling (62) (for the supercharge pump) which is supported by coupling bushing (55) in the rear plate (68). The pump cylinder barrel (18) is carried in a journal type hydrodynamic cylinder bearing (12). The valve plate (51) has two crescent shaped ports. Pumping piston/shoe assemblies (15) in the cylinder are held against a swashblock (11) by a shoe retainer (14). The shoe retainer is held in position by a fulcrum ball (16) which is forced outward by shoe retainer spring (17). The spring acts against the pump cylinder forcing it against the valve plate (51) while also forcing the piston shoes against the swashblock (11). The semi-cylinder shaped swashblock limits piston stroke and can be swivelled in arc shaped saddle bearings (10A & 10B) fitted (located) into front housing. The swashblock is swivelled by a control (covered in referenced material). Non-adjustable high pressure relief valves and check valves (54) for Ports A and B are installed in the valve plate housing (51).

The supercharge pump (64) is a generated rotor (Gerotor) design which is spline coupled (62) to the inboard end of the driveshaft. Relief valve assemblies for implement pressure (69) and supercharge pressure (71) are of the non-adjustable poppet type and are installed in the rear plate (68).

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

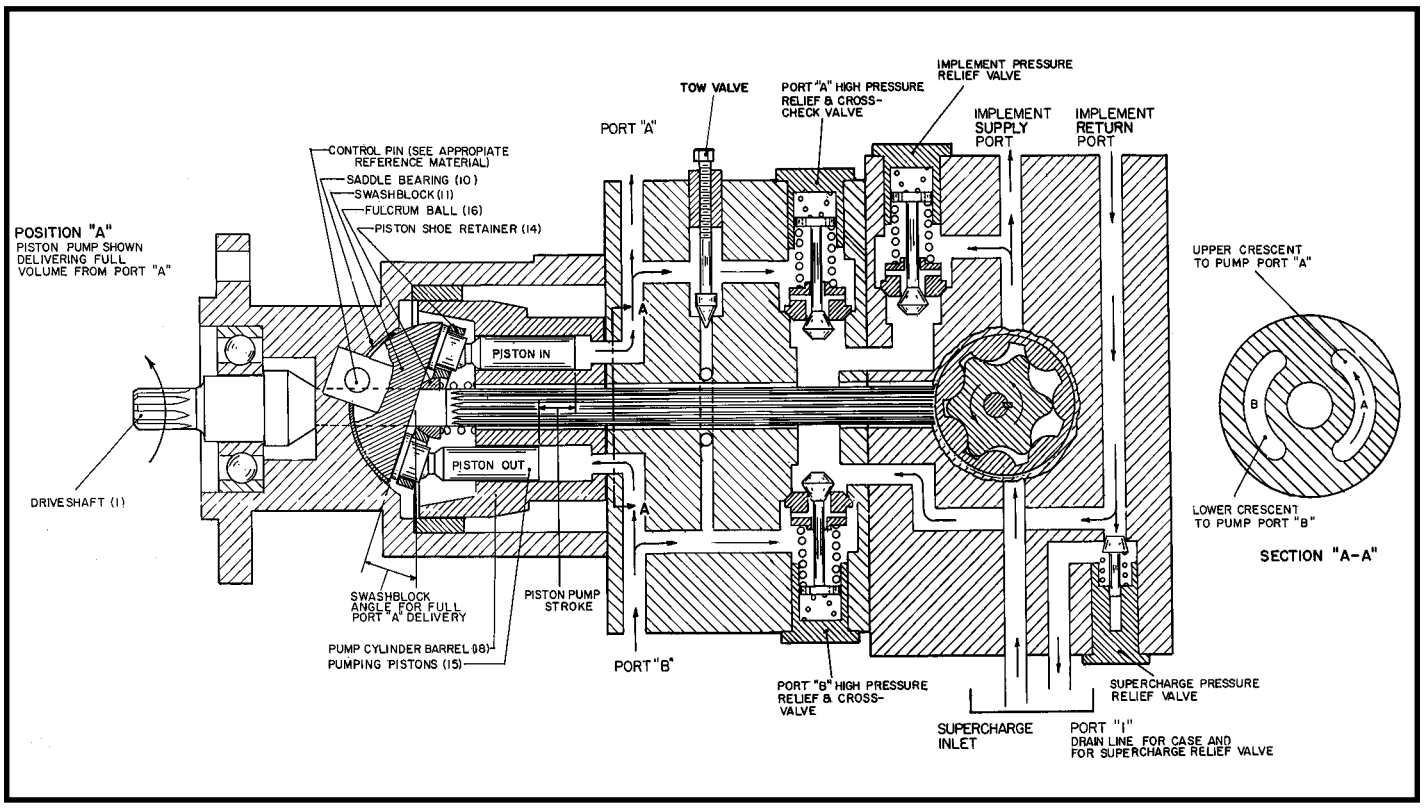

Figure 3. Cut-a-way Circuit Diagram of "PVWC" Pump Without Controls. POSITION A Plan View, Swashblock Positioned for Full Delivery from Port A. (E51837 sh. 6).

III. PRINCIPLE OF OPERATION

A. VARIABLE DELIVERY PUMP

See Figure 3. Turning the driveshaft (1) rotates the splined pump cylinder barrel (18) which contains pumping pistons with swivel shoes (15). A shoe retainer (14), backed up by a spring loaded fulcrum ball (16), holds piston shoes against a swashblock (11).

A COUNTERCLOCKWISE DRIVEN (LEFT HAND) PUMP IS DESCRIBED.

SEE FIGURE 3. POSITION A. When the control positions the swashblock for full delivery from Port A, the swashblock is at maximum angle (to the cylinder face). When cylinder is rotated, the pistons move in and out of their bores as shoes "ride" against the angled swashblock.

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

While rotating across the upper crescent, each piston moves across the angled swashblock face. Thus, each piston is forced **inward**. Each piston displaces fluid thru the upper crescent port to Port A until its' innermost stroke is reached. At that point, the piston bore passes from the upper to the lower crescent again and the operating cycle is repeated.

SEE FIGURE 4. POSITION A/2. A study of the diagram will show that the degree of swashblock angle determines the length of piston stroke (difference between outermost and innermost position) thereby determining the amount of delivery from the pump.

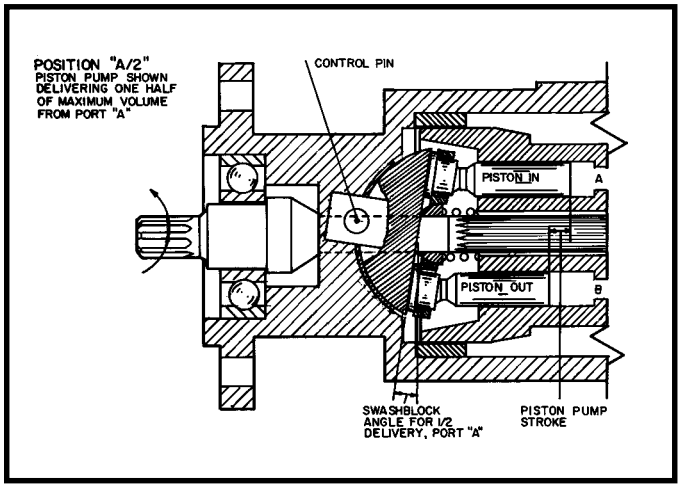

Figure 4. POSITION A/2 Plan View, Swashblock Positioned for Partial Delivery from Port A (E51837 sh. 7).

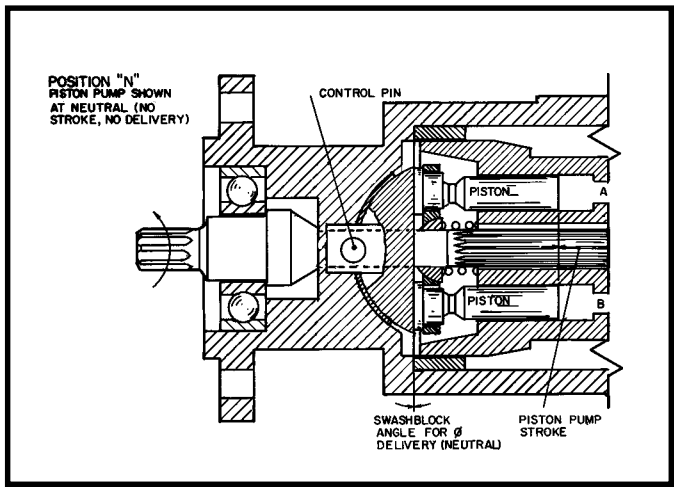

Figure 5. POSITION N Plan View, Swashblock Positioned for "Neutral" (no stroke, no delivery) (E51837 sh. 7).

SEE FIGURE 5. POSITION N. Neutral position results when the control 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 exist 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 consequently no delivery from pump ports.

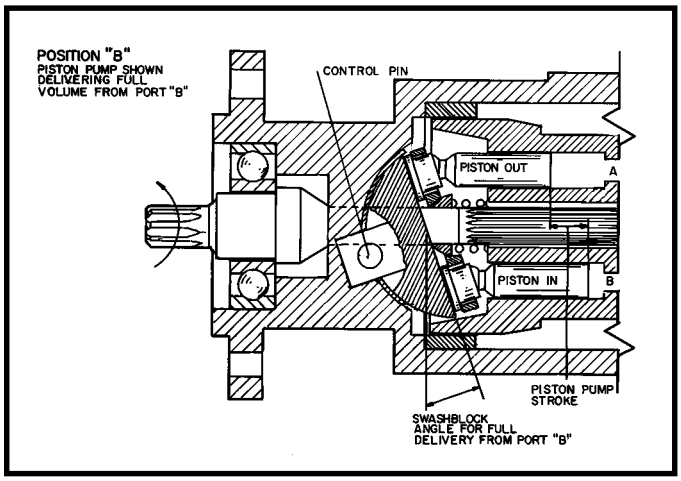

Figure 6. POSITION B Plan view, Swashblock Positioned for Full Delivery from Port B (E51837 sh. 8).

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

It should be noted that when a two-way pump reverses flow ports - the rate of delivery is decelerated as the swashblock moves toward neutral position - flow is stopped as it crosses neutral position - flow rate accelerates from the other port as 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 reversal.

B. SUPERCHARGE (IMPLEMENT) PUMP (Optional Gerotor type.

See Figure 3. The inner element of the Gerotor rotor pump has one "tooth" less than the outer element and thus forms a series of "pockets". As the inner element is rotated, the outer element also rotates. During the lower half revolution, the size of the "pockets" increase and fluid is drawn from the reservoir. As the rotation continues, the "pockets" of fluid are squeezed during the upper half revolution and fluid is delivered to supercharge the variable delivery pump, operate controls and implement circuits.

Be sure operation of implement circuits does not prevent supercharge to the variable delivery pump.

C. COMBINATION H.P.R.V. AND C.C.V. (Optional)

See Figure 7. A Combination High Pressure Relief Valve (HPRV) and Cross-Check Valve (CCV) is used for Port "A" H.P.R.V. and is used for Port "B" H.P.R.V. A similar type of assembly is used for the Implement Pressure Relief Valve (IPRV). The main components in the cartridge consist of a relief valve poppet, a relief valve compression spring, a relief valve spring holder, a (seat washer) check valve poppet and a check valve spring.

In the **"at rest"** state, the HPRV poppet is pressed against (seat washer) check valve poppet and the cartridge is retained in position by the check valve spring. To **"open** the **relief valve"**, relief valve poppet is actuated by the pressure on the top side (as shown) of the relief valve poppet. When the opening pressure is reached, the poppet pulls down the relief valve spring holder against the pre-loaded relief valve spring, the relief valve poppet opens and fluid flows into the supercharge circuit.

The **"cross-check valves open"** when the pressure on the supercharge circuit side is higher than the pressure on the top side (as shown) [as would be the case when pump is delivering from the other port]. The entire cartridge compresses the cross-check valve spring and fluid flows from the supercharge circuit to the "return" side of the high pressure piston pump.

D. SUPERCHARGE (IMPLEMENT) PRESSURE RELIEF VALVE (Optional)

See Figure 3. The high pressure piston pump is supercharged by exhaust from I.P.R.V. or return flow from the "implement" circuit. If the flow from any one or any combination of these is more than is necessary to supercharge the piston pump, the pressure acting on the face of the Supercharge Pressure Relief Valve (SPRV) poppet compresses the poppet spring allowing the poppet to move off of it's seat and permit flow into the pump case (and subsequently out the case drain).

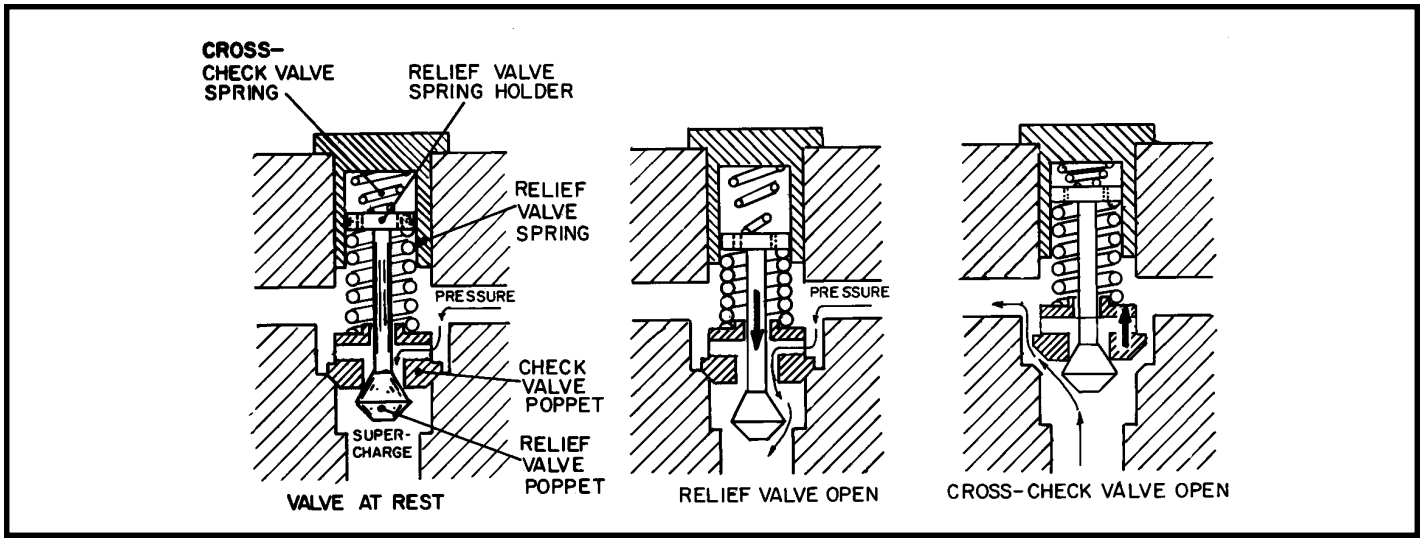

Figure 7. Diagram of Combination High Pressure Relief Valve and Cross-Check Valve (E51837 sh. 7).

E. TOW VALVE (Optional)

See Figure 3. An optional "Tow Valve" package may be included for mobile applications allowing "free wheeling" of the (connected) hydraulic motor without disconnecting the drive (train) while the unit is being towed.

When the "tow valve" is in the closed position (as shown) the pump operates as previously described.

When the "tow valve" is (backed out two turns) in the open position it bypasses the pump ports and connected device ports (such as a hydraulic motor) to each other and (back) pressure is not raised in the piston pump system.

IV. SPECIFICATIONS

See reference material, pump control material and individual application circuit for exceptions.

Table 2. NOMINAL PERFORMANCE DATA

150-300 SSU VISCOSITY FLUID		Piston Pump Sizes		
		011	**014**	**022**
Theoretical Maximum	in. ^{3}/rev	0.66	0.86	1.35
Displacement	ml/rev	10,8	14,1	22,1
Rated **Continuous**	psi	5000	4000	3000
Pressure	bar	350	275,9	205,9
Maximum	psi	5000	4500	3500
Pressure	bar	350	310,3	241,4
"Peak" (high pressure relief	psi	5000	5000	5000
valve settings) Pressure*	bar	350	350	350
Piston Pump				
Flow Rate at 1800 rpm	gpm	4.1	5.4	8.5
and rated pressure	lpm	15,5	20,4	32.2
Maximum **Continuous**				
Speed	rpm	3600	3600	3600
Intermittent Speed	rpm	4000	4000	4000
Supercharge Pump	in. ^{3}/rev	0.425	0.425	0.425
Displacement	ml/rev	7,0	7,0	7,0
Implement Relief	psi	1000	1000	1000
Valve Setting	bar	69	69	69
Supercharge Relief Valve	psi	60	60	60
Setting (at 1800 rpm & neutral)	bar	4,1	4,1	4,1
Supercharge Pump				
Flow Rate at 1800 rpm	gpm	2.6	2.6	2.6
and rated pressure	lpm	9,8	9,8	9,8
Power Input at rated	hp	18.7	20.1	22.6
pressure and 1800 rpm	kw	13,9	15,0	16,9

* Some units may be furnished with (optional) relief valves set at low pressures or with cross line checks only.

Total torque to the front unit shaft (when multiple units are thru-shaft coupled together) may not exceed that shown in Table 3. The torque may be divided between the units in any fashion as long as the **total does not exceed this value.**

Table 3. MAXIMUM TORQUE ON FRONT UNIT

	Unit Size 011, 014 & 022
Inch Pounds	1290
N. m.	145,8

V. MALFUNCTIONS AND CAUSES

A. UNRESPONSIVE OR SLUGGISH CONTROL

1. See reference control instruction material.
2. Swashblock saddle bearings (10) worn or damaged.
3. Orifice plugged.

B. INSUFFICIENT PUMP VOLUME

1. Delivery limited by faulty control (see appropriate control instruction bulletin).
2. Obstructed return circuit or insufficient supercharge available to piston pump. Auxiliary (implement valve) circuits starving supercharge.
3. Insufficient drive motor speed.
4. Worn or grooved cylinder barrel (18) and/or valve plate (51) matching surface.
5. Worn piston/shoe assemblies (15) or piston bores in cylinder (18).
6. Worn or damaged piston shoe or swashblock (11).
7. High Pressure Relief Valves and/or check valves (54) stuck in open position, worn or dirty seats, or broken springs.

C. IRREGULAR OR UNSTEADY OPERATION

1. Faulty control.
2. Insufficient supercharge.
3. Air entering hydraulic system.
4. Worn piston pump.
5. Faulty output circuit components (motors, valves, etc.).

D. LOSS OF TORQUE (PRESSURE)

1. Worn or grooved piston pump.
2. Worn or grooved cylinder barrel (18) and/or valve plate (51) matching surfaces.
3. Worn piston/shoe assemblies (15) or piston bores in cylinder.
4. High pressure relief valves (54) and/or check valve poppets stuck open; worn or dirty seats or brokensprings.
5. Faulty output circuit components.

E. EXCESSIVE OR HIGH PEAK PRESSURES

1. Binding high pressure relief valves (54).
2. Clogged cross drilled holes in check valve poppet.
3. Unwanted back pressure in high pressure relief valve discharge circuits; supercharge pressure relief valve malfunction or circuit clogged with contamination.

F. EXCESSIVE NOISE

1. Low fluid level in reservoir or insufficient supercharge.
2. Supercharge inlet restriction.
3. Air entering hydraulic system.
4. Fluid too cold or viscosity too high.
5. Starting or stopping pump under load.
6. Broken or worn piston/shoe assembly (15).
7. Pump rotating in wrong direction.

G. EXCESSIVE HEATING

1. Operating pump above rated or peak pressure and excessive blowing of high pressure relief valves.
2. Low fluid level in reservoir or insufficient supercharge.
3. Air entering hydraulic system.
4. Worn piston pump.
5. Worn or grooved cylinder barrel (18) and/or valve plate (51).
6. Faulty output circuit components (“slip” thorough valves, motors, etc.), continuous blowing of relief valves.
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.

A. HIGH PRESSURE RELIEF VALVES (HPRVs) & CROSS-OVER CHECK VALVES

To check pressure at pump high pressure Ports “A” and “B” connect a 6000 psi (415 bar) gage to lines (auxiliary ports) leading from these ports. **Do not block these lines with the gages**. To check pressure, fluid should be warm. Start pump with control at “neutral” and adjust control for approximately 1/2 volume from Port “A” Stall output shaft of driven motor or ram.

Discharge fluid past relief valves only long enough to check pressure or excessive heating and damage may result.

Gage in Port “A” line will read High Pressure Relief Valve (HPRV). Compare reading with “IV - SPECIFICATION” or your individual application circuit. Shift control for 1/2 delivery from Port “B” and repeat the procedure.

The HPRVs are non-adjustable. If relief valves prove to be faulty; remove them, flush them to remove contamination etc. and retest. If still faulty, they will have to be replaced as an assembly.

B. IMPLEMENT RELIEF VALVE (IPRV)

To check pressure, fluid should be warm. Connect 1500 psi (104 bar) gage to line (auxiliary ports) from the Implement Valve Outlet. **Do not block line with gage.** Compare gage reading with “IV. SPECIFICATIONS” or your individual application circuit drawing. If the non-adjustable relief valve proves to be faulty, remove it, flush it to remove contamination etc. and retest. If still faulty, replace as an assembly.

CAUTION:

Dirty filter elements in the implement circuit may cause pressure drop, in turn, restricting available pilot pressure.

C. SUPERCHARGE (IMPLEMENT) PUMP

For drive speeds other than 1800 rpm, test result will have to be ratioed accordingly. If pilot pressure is still insufficient after completing aforementioned section "B", check the rest of the implement circuit to be sure fluid is not bypassed or leaking in the circuit. If not, remove the piping from the Implement Valve Supply Port, install a pipe "tee" fitting to it, a needle valve in a leg of the fitting and a 1500 psi (104 bar) gage in the remaining leg. Place a container of a known volume near the needle valve outlet to catch the auxiliary pump fluid. Start pump with control at neutral (zero delivery), and needle valve "wide" open. Close needle valve until the gage reads 1000 psi (bar), then measure volume pumped into container over a specific time period. **Limit discharge to prevent reservoir fluid going below "low" level.** Volume measured should be as listed in Section "IV. (SPECIFICATIONS)". Reduced delivery indicates wear, but does not become critical until pressure and/or delivery necessary to supercharge pump or to operate implements can't be obtained.

D. SUPERCHARGE PRESSURE RELIEF VALVE (SPRV)

To check supercharge pressure relief valve setting place a piping "tee" in the implement valve return line Port, reconnect line to "tee" and place a 500 psi (35 bar) gage in the remaining "leg". Supercharge pump delivery must be warm. With control set at "neutral" (zero delivery), compare gage reading with that listed in Section "IV SPECIFICATION" or your individual application circuit drawing. If the non-adjustable relief valve proves to be faulty, remove it, flush it and re-test. If still faulty, replace as an assembly.

E. PISTON PUMP

For drive speeds other than 1800 rpm, test results will have to be ratioed accordingly. To check for worn piston pump, measure pump flow from both Port "A" and Port "B" after the unit is warm and while the pump is under pressure.

Install a flow meter at Port "A" and connect 6000 psi (415 bar) gage to line (auxiliary port) leading from Port "A". **Do not block this line with the gage.** Start pump, put it on stroke for Port "A" and raise system pressure to rated continuous pressure per Table 2. Read the flow meter and compare to rating in Table 2. Install flow meter and pressure gage at Port "B" and repeat procedure putting pump on stroke for delivery from Port "B". Reduced flow indicates wear, but does not become critical until it impairs performance.

F. CONTROL

Refer to applicable (referenced) pump control instruction material. NOTE:- When referring to control sizes PVWH 04 = PVWC 011, PVWH 06 = PVWC 014 and PVWH 10 = PVWC 022.

VII. DISASSEMBLY

A. GENERAL

Refer to Figures 10 and 11. It will be advantageous to tag similar parts (particularly screws, plugs and o'rings) during disassembly to be certain they don't become confused with similar parts and assure that they will be returned to original location. Do not remove (locator) roll pins unless they are deformed or otherwise in need of replacement.

B. PREPARATION

For pump disassembly and assembly, a crane and/or sling capable of handling 200 lbs will be useful.

When disassembling or assembling unit, we recommend choosing an 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 to use CLEAN solvents. All tools and gages should be CLEAN and threadless rags used to handle and dry parts.

WARNING: NEVER attempt to remove or install any components or assemblies 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 unit without causing the line to drain (siphon) the reservoir.

Disconnect pump from drive motor and piping. Usually, it is necessary to remove pump from it's mounting before the case can be drained. Drain case.

After removing pump from mounting, but before disassembly, cap or plug all ports and clean the outside thoroughly to prevent entry of dust into the system.

Refer to Figures 10 and 11. Depending upon what part or parts are to be inspected, it may not be necessary to completely take apart all assemblies. **NOTE: disassembly of pump not required if only shaft seal needs replacing - see section "H. Driveshaft Group" instructions.**

C. CONTROL GROUP

See reference material for applicable information on the control your unit is equipped with. Remove four hex head cap screws and lift the control group assembly, with control pin, straight up from the top of the pump assembly. Control pin may or may not remain in the swashblock (11). Remove control gasket and o'rings from pump housing.

D. VALVE PLATE GROUP

If another unit is coupled to thru shaft and rear of unit, it may be necessary to remove unit before removing the rear assembly.

Block unit on bench with driveshaft facing down. Alternately disengage (but do not remove) socket head screws (50). Lift valve plate (51) and rear assemblies straight up and place on a bench with the valve plate (51) on top. Remove valve plate gasket (21) and o'rings (28).

Lift valve plate (51) off of rear assembly stack.

CAUTION:

Be sure to tag HPRV assemblies when removed so they can be returned to proper (Port A or Port B) position upon reassembly.

Remove both pressure relief valve caps (52) with o'rings (53) withdraw HPRV cartridges w/cross-line check valve springs (54). Loosen lock nut (81) and turn tow valve stem (76) partially out. Remove tow valve bonnet (79) with valve stem (76) back-up ring (78) and o'ring seal (77) in place.

E. GEROTOR PUMP GROUP

Remove o'rings (60 and 61).The outer ring of the Gerotor assembly (64) can be lifted out from rear plate (68). Grasp Gerotor

coupling (62) and pull assembly straight up from rear assembly. Remove retaining ring (63) and the inner gear of the Gerotor assembly (64) can be removed as well as the Gerotor coupling key (65).

F. REAR PLATE

The rear plate (68) can now be disassembled. Remove Implement Pressure Relief Valve (IPRV) cap (52) with o'ring (53). Withdraw implement pressure relief valve assembly (69) from rear plate (68).

CAUTION:

Be sure to tag IPRV assembly so it can be returned to original location upon assembly.

Remove Supercharge Pressure Relief Valve cap (70) with o'ring (53) and lift out (SPRV) Poppet (71) with spring (72). If used, remove socket head cap screws (92), rear cover (90) and o'ring (91). Gerotor coupling bushing (55) can also be removed if required.

G. ROTATING GROUP

WARNING: Extreme care must be taken not to damage cylinder wear surface (that matches against the valve plate), bearing diameters or piston shoes. For larger units, the use of a sling, and/or assistance from others and use of proper lifting techniques are strongly recommended to prevent personal injury.

Place the pump in a horizontal position and remove the rotating group by turning driveshaft (1) slowly while pulling the cylinder barrel (18) from the housing.

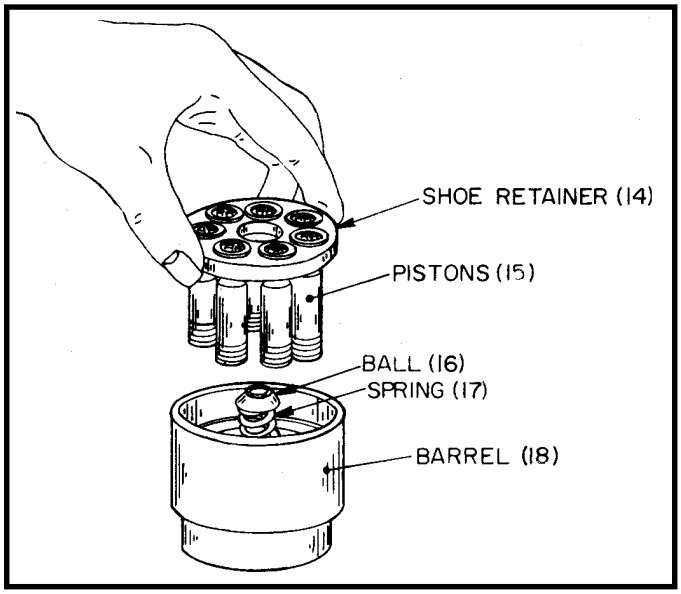

Figure 8. Rotating Group Disassembly (511783).

See Figure 8. Lift off shoe retainer (14) with piston/shoe assemblies (15) and remove fulcrum ball (16) and shoe retainer spring (17).

Remove retaining ring (13) and pull hydrodynamic cylinder bearing (12) from pump housing. Note -position of hydrodynamic cylinder bearing roll (locating) pin (12A) in relation to the housing (5) for reassembling.

H. DRIVESHAFT GROUP

Remove driveshaft bearing retainer ring (29). Grasp outboard end of driveshaft (1) and pull out from pump housing. Remove shaft retainer ring (4) and front driveshaft bearing (3). Remove seal retainer (6) and shaft seal (7) from housing only if necessary.

I. SWASHBLOCK GROUP

Reach inside the case and remove swashblock (11). Note and tag which saddle bearing is top (10A) and which is bottom (10B) and remove if necessary from housing.

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 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 GROUP

See applicable reference material on pump controls. Be sure to carefully check control pin for cracks and/or signs of fatigue. Check fit of control pin in swashblock. It should be a slip fit without "side-play".

B. VALVE PLATE GROUP

Inspect the valve plate (51) surface that mates with the cylinder barrel (18) for excessive wear or scoring. Remove minor defects by lightly stoning the surface with a hard stone that is flat to within 0.001" (0,03mm). Be sure to stone lightly. Any excessive stoning will remove the hardened surface. If wear or damage is extensive, replace the valve plate (as part of Valve Plate Assembly Kit No. 279) and cylinder barrel (18).

Wash and dry High Pressure Relief Valve assemblies. Examine poppets and seats for scratches or signs of erosion. If assemblies show signs of wear and/or malfunction; they must be replaced as an assembly. If check valve seats are grooved or eroded, it maybe necessary to replace valve plate (51) and/or rear plate (68).

C. ROTATING GROUP

Inspect cylinder barrel (18) piston bores and the face that mates with valve plate for wear or scoring. Remove minor defects by lightly stoning the surface with a hard stone that is flat to within 0.001" (0.03 mm). Be sure to stone lightly. Any excessive stoning will remove the hardened surface. If defects can not be removed by this method, replace the cylinder barrel as part of Rotating Group Kit No. 273. Inspect hydrodynamic cylinder bearing (12) and matching cylinder barrel surface for galling, pitting, and roughness, or other damage and replace if necessary. Check all piston/shoe assemblies (15) to be sure they ride properly on the swashblock.

See Figure 9. Piston shoes must pivot smoothly, but end play should 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 must rotate and pivot on the piston ball. Inspect each shoe face for nicks and scratches. Measure shoe thickness [the part held between

shoe retainer (14) and swashblock (11)]. All shoes must be equal within 0.001" (0,025 mm). If a single piston/shoe assembly needs to be replaced, all piston/shoe assemblies must be replaced. Replace as part of Rotating Group Kit No. 273. When installing a new rotating group kit, make sure pistons are free in their bores.

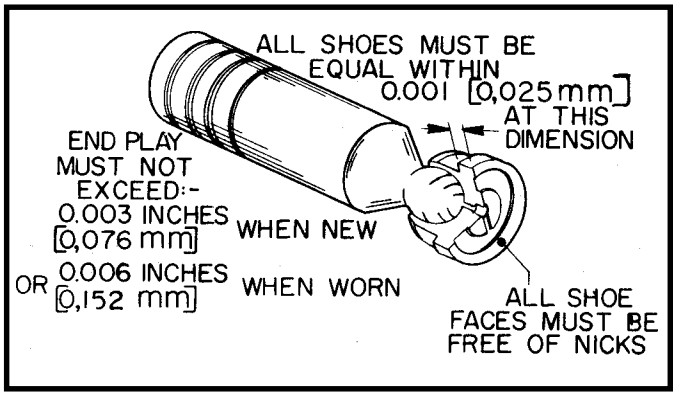

Figure 9. Piston and Shoe Inspection (511783).

D. SWASHBLOCK GROUP

Inspect the swashblock (11) for wear or scoring. If damage is extensive, replace the swashblock as part of Swashblock Kit No. 282.

Compare saddle bearing (10A & 10B) thickness in worn area to thickness in an unworn area. Replace saddle bearings if difference is greater than 0.010 in. (0,25mm). Check mating surface of swashblock for cracks or excessive wear. Swashblock movement in saddle bearings must be smooth. Replace as part of Saddle Bearing Kit No. 285.

E. DRIVESHAFT GROUP

Check shaft seal (7) for deterioration or cracks. Replace if necessary. Examine the sealing area of the driveshaft (1) for scoring or wear. Inspect front shaft bearing (3) for roughness, galling, pitting or binding. Check shaft and splines for wear. If driveshaft is bent, scored or worn excessively or if bearing is bad, replace as part of Shaft and Bearing Kit No. 274. Inspect bushings (55).

F. GEROTOR PUMP GROUP

Check the faces of the Gerotor pump assembly (64) and the matching faces of the valve plate (51) and rear plate (68) for scratches or grooves. Remove minor defects by lightly stoning or lapping the surface. Only stone or lap Gerotor pump mating surfaces. If wear or damage is extensive, it may be necessary to replace the Gerotor pump assembly (64) as well as valve plate (51) and rear plate (68).

G. REAR PLATE

Wash and dry Implement Pressure Relief Valve (IPRV) assembly. Examine poppet and seat for scratches or signs of erosion. If assembly shows sign of wear and/or malfunction, it must be replaced as an assembly.

Check Supercharge Pressure Relief Valve (SPRV) poppet (71) and its' seat for signs of wear. Replace poppet and/or rear plate (68) [poppet seat can not be refinished] if necessary.

IX. ASSEMBLY

Refer to Figures 10 and 11. The procedure for assembling the pump is basically the reverse order of disassembly. During assembly, install new gaskets seals and o'rings (Kit No. 277). Apply a thin film of CLEAN grease or hydraulic fluid to sealing components to ease assembly. If a new rotating group (Kit No. 273) is used, lubricate thoroughly with CLEAN hydraulic fluid. Apply fluid generously to all wear surfaces.

A. SWASHBLOCK GROUP

If removed, press shaft seal (7) into front of pump housing (5) until it is flush with the bore, then place housing on bench with mounting flange side down. Be sure to replace saddle bearing (10A & 10B) in their original positions.

Place the swashblock (11) into the case and be sure the swashblock swivels in the saddle bearings. With new bearings, swivelling may be stiff (not always smooth).

Position the cylinder hydrodynamic bearing (12) into the case so the pin (in the bearing) will fit at 3:00 or 9:00 position in the wide slot found across the inside of the pump housing (5). The bearing should fit into place with little difficulty and be square to the axis of the pump. Tap bearing into place if necessary, using extreme care not to damage the bearing. Insert retaining ring (13) to hold bearing in place.

B. DRIVESHAFT GROUP

Place housing on its side with axis horizontal and then install seal retainer (6). Place front driveshaft bearing (3) onto driveshaft (1) and lock in place with shaft retaining ring (4). Lubricate shaft seal (7) and shaft, then carefully insert driveshaft and bearing assembly into pump housing (5) and lock in place with driveshaft bearing retainer ring (29).

C. ROTATING GROUP

See previous Figure 8. Place the cylinder barrel (18), wear surface down, on a clean cloth. Place the shoe retainer spring (17) in the center of the barrel with the fulcrum ball's (16) flat face on top of it. Before dropping the pistons/shoe assemblies (15) into holes of the shoe retainer (14), hold the retainer horizontally so the curved surface of the inside (shaft) bore is on the bottom side. **This is necessary so the curved surface of the retainer will mate with the curved surface of the fulcrum ball.** As a unit, fit the pistons into their corresponding bores in the cylinder barrel. **DO NOT FORCE**. If aligned properly, the pistons will fit smoothly.

WARNING: Assistance from others and proper lifting techniques is strongly recommended to prevent personal injury while assembling larger sized pump rotating groups into the pump. The rotating group can now be carefully installed over the rear spline of the driveshaft (1) and into the pump housing (5). Push the cylinder forward until it encounters the hydrodynamic cylinder bearing (12). Lifting the tailshaft slightly helps cylinder barrel (18) and cylinder bearing (12) engagement. Continue pushing cylinder forward until the piston shoes contact the swashblock. At this point, the back of the cylinder should be located slightly outside the back of the pump housing.

D. REAR PLATE

If removed, place Gerotor coupling bushing (55) in rear plate (68). If used, place o'ring (91) in the groove, mount rear cover (90) on plate and secure with screws (92). Slip spring (72) on SPRV poppet (71) and place in cap (70) bore. With o'ring (53) in place on supercharge pressure relief valve cap (70), screw cap (70) with o'ring (53) tightly into place. Check to be sure you have the **Implement Pressure Relief Valve** (69) and then slip it into place with the check valve spring largest diameter coil towards cap (52). With o'ring (53) in place, secure with cap (52). Insert screws (50) thru bores in the rear plate (68) and place assembly on work bench with the threaded end of screws pointing up.

E. GEROTOR PUMP GROUP

Place the Geortor pump key (65) in the Gerotor coupling (62), slide the inner gear of the Gerotor assembly (64) onto the coupling, and lock in place with retaining ring (63). Insert the coupling assembly into the rear plate. Put o'rings (60 & 61) in place and insert outer Gerotor assembly into the counter bore of the rear plate (68).

F. VALVE PLATE GROUP

If removed, place o'ring seal (77) and back-up ring (78) on tow valve stem (76). Screw stem into bottom side of tow valve bonnet (79) as far as possible. With o'ring (80) in place, screw bonnet assembly into valve into valve plate (51). Turn tow valve stem in until it closes (seats). Install lock nut (81) and tighten.

Place the Port "A" HPRV assembly (54) and cross-line check valve spring into its' bore with the large diameter coil towards the cap (52). With o'ring (53) in place secure assembly with cap (52). Repeat procedure for Port "B" HPRV assembly (54). Position valve plate assembly so locating pins (58) will be received by the rear plate (68). Lower valve plate assembly (51) over screws (50) onto the rear plate assembly.

Place pump housing on bench with open end facing up. Install new o'rings (28) and gasket (21) on housing. Use your hands or another aid to hold (clamp) the rear plate/Geortor pump/valve plate assembly together, lift assembly and turn upside down (so Sock. Hd. Cap end of screws (50) is on top). Slowly lower this assembly onto the pump housing assembly. Make sure the rear spline of the shaft engages Gerotor pump coupling while positioning the valve plate (51) on pins (19) and housing. Finger tighten socket head cap screws (50) and then alternately tighten cap screws per Table 5.

Table 5. TORQUES

Pump Size	Valve Plate		Control	
	Ft. lbs.	N.m.	In. lbs.	N.m.
011, 014 & 022	45	61,2	140	15,8

G. CONTROL GROUP

See reference material for applicable information on the control your unit is equipped with. See appropriate control reference for control group mounting. See Table 5 for torques to secure control group to pump housing.

SEE SECTION "I. PREPARATION and INSTALLATION".

Parts Drawings and Parts List follow on Pages 12, 13, 14 and 15

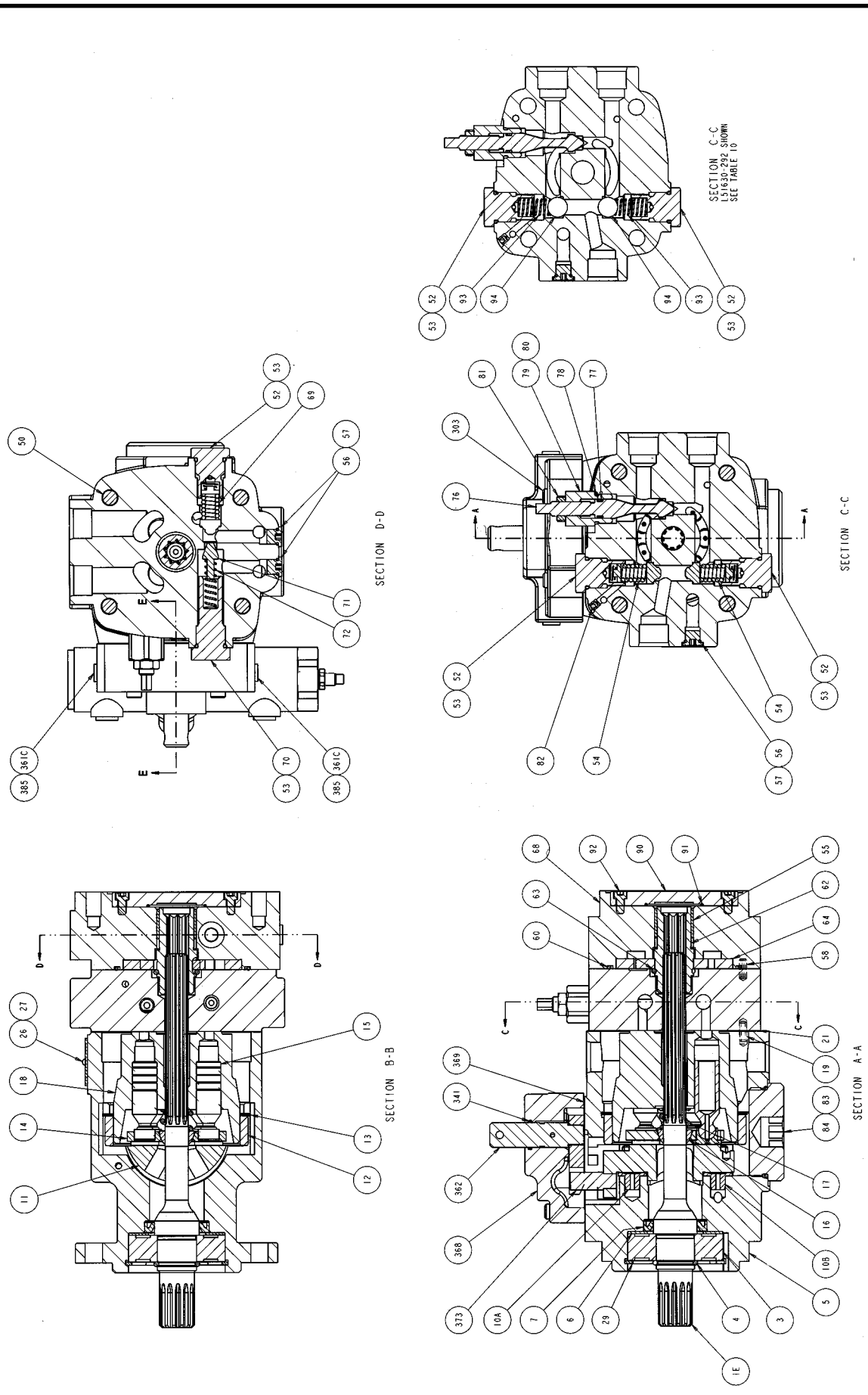

Figure 10. Cross Section Drawing (E51837-301 sh. 6).

Parts list on pages 14 & 15

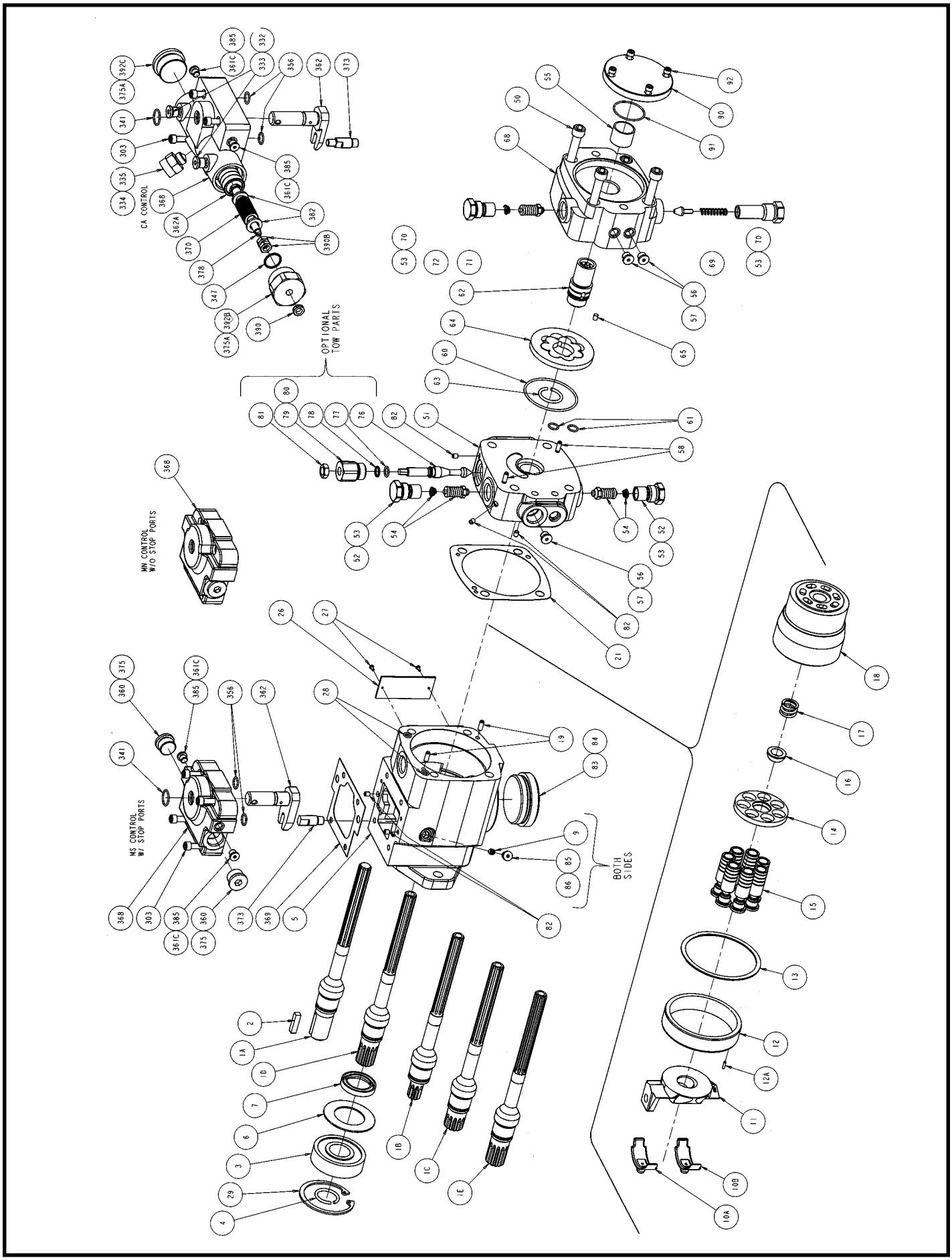

Figure 11. Exploded Parts Drawing (E51837-300 sh. 1).

Parts list on pages 14 & 15

X. PARTS LIST

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

ITEM NO.	DESCRIPTION
1A.	Driveshaft, Keyed
1B	Driveshaft, w/SAE 9T 5/8 Spline
1C	Driveshaft, W/SAE 13T 7/8 x .73 Spline
1D	Driveshaft, w/SAE 13T 7/8 x 1.10 Spline
3	Bearing, Front Driveshaft
4	Ring, Shaft Retainer
5	Housing, Pump (only available as kit 272)
6	Retainer, Seal
7	Seal, Shaft
9	Orifice
10A	Bearing Top, Saddle (sold as kit 285)
10B	Bearing, Bottom Saddle (sold as kit 285)
11	Swashblock (sold as kit 282)
12	Bearing, Cylinder Hydrodynamic (sold as kit 281with item 13)
13	Ring, Retainer (sold as kit 281 with item 12)
14	Retainer, Shoe (sold only as kit 286 with item 16)
15	Assembly, Piston/Shoe (sold only as kit 287)
16	Ball, Fulcrum (sold only as kit 286 with item 14)
17	Spring, Shoe Retainer
18	Barrel, Cylinder
19	Pin, Roll
21	Gasket, Valve Plate
26	Nameplate, Identification
27	Screw, Drive
28	Seal, O'ring
29	Ring, Driveshaft Bearing Retainer
50	Screw, Sock. Hd. Cap
51A	Valve Plate, Left Hand
51B	Valve Plate, Right Hand
52	Cap, Relief Valve
53	Seal, O'ring

ITEM NO.	DESCRIPTION
54	Assembly, HPRV w/Cross-Check
55	Bushing, Gerotor Coupling
56	Plug, Hex.
57	Seal, O'ring
58	Pin, Locating
60	Seal, O'ring
61	Seal, O'ring
62	Coupling, Gerotor
63	Ring, Retaining
64	Assembly, Gerotor Pump
65	Key, Gerotor Pump
68A	Rear Plate, Left Hand
68B	Rear Plate, Right Hand
69	Assembly, IPRV
70	Cap, SPRV
71	Poppet, SPRV
72	Spring, SPRV
76	Stem, Tow Valve
77	Seal, O'ring
78	Ring, Back-up
79	Bonnet, Tow Valve
80	Seal, O'ring
81	Nut, Lock
82	Plug, Construction
83	Plug, Access
84	Seal, O'ring
85	Plug, SAE
86	Seal, O'ring
90	Cover, Rear
91	Seal, O'ring
92	Screw, S.H.C.
93	Spring
94	Ball

303 thru 385 - "See reference Bulletin 947116

O'RING SIZES

Cross Section x OD Duro +5

ITEM NO.	PUMP SIZE 011, 014 & 022
28	.062 x .375 - 90
53	ARP 908
57	ARP 903
60	.093 x 3.44 - 90
61	.062 x 0.500 - 90
77	.062 x 0.500 - 90
80	ARP 908
84	.093 x 2.31 - 70
86	ARP 902
91	.062 x 1.50 - 70

IT IS RECOMMENDED THAT SPARE OR REPLACEMENT PARTS BE ORDERED AS PART OF THE FOLLOWING KITS.

HOUSING & PINS
Kit No. 272
5 Housing, Pump
7 Seal, Shaft
9 Orifice
19 Pin, Roll
82 Plug
83 Plug, Access
84 Seal, O'ring
85 Plug, SAE
86 Seal, O'ring

ROTATING GROUP
Kit No. 273
14 Retainer, Shoe
15 Assembly, Piston/Shoe
16 Ball, Fulcrum
17 Spring, Shoe Retainer
18 Barrel, Cylinder

SHAFT & BEARING
Kit No. 274S
1 Driveshaft
3 Bearing, Front Driveshaft
4 Ring, Front Driveshaft
6 Retainer, Seal
29 Ring, Driveshaft Bearing Retainer

GASKET & SEAL
Kit No. 277
7 Seal, Shaft
21 Gasket, Valve Plate
28 Seal, O'ring
53 Seal, O'ring
57 Seal, O'ring
60 Seal, O'ring
61 Seal, O'ring
77 Seal, O'ring
78 Ring, Back-up
80 Seal, O'ring
84 Seal, O'ring
86 Seal, O'ring
91 Seal, O'ring

COMPLETE VALVE PLATE ASSEMBLY
Kit No. 279
21 Gasket, Valve Plate
28 Seal, O'ring
50 Screw, Sock. Hd. Cap
51 Valve, Plate
52 Cap, Relief Valve
53 Seal, O'ring
54 Assembly, HPRV
55 Bushing, Gerotor Coupling
56 Plug, Hex
57 Seal, O'ring
58 Pin, Locating
60 Seal, O'ring
61 Seal, O'ring
62 Coupling, Gerotor
63 Ring, Retaining
64 Assembly, Gerotor Pump
65 Key, Gerotor Pump
68 Rear Plate
69 Assembly, IPRV
70 Cap, SPRV
71 Poppet, SPRV
72 Spring, SPRV
76 Stem, Tow Valve
77 Seal, O'ring
78 Ring, Back-up
79 Bonnet, Tow Valve
80 Seal, O'ring
81 Nut, Lock

SCREWS & TAG
Kit No. 280
26 Nameplate, Identification
27 Screw, Drive
50 Screw, Hex. Hd.

ROTATING GROUP BEARING
Kit No. 281
12 Bearing, Cylinder Hydrodynamic
12A Pin, Locating
13 Ring, Retainer

SWASHBLOCK
Kit No. 282
11 Swashblock

SADDLE BEARING
Kit No. 285
10A Bearing, Saddle
10B Bearing, Saddle

SHOE RETAINER & BALL ASSEMBLY
Kit No. 286
14 Retainer, Shoe
16 Ball, Fulcrum

PISTON & SHOE ASSEMBLY
Kit No. 287
15 Assembly, Piston/Shoe

VALVE PLATE FRONT HALF
Kit No. 288
51 Valve Plate
52 Cap, RV
53 Seal, O'ring
54 Assembly, HPRV
55 Bushing, Gerotor Coupling
56 Plug, Hex
57 Seal, O'ring
58 Pin, Locating
76 Stem, Tow Valve
77 Seal, O'ring
78 Ring, Back-up
79 Bonnet, Tow, Valve
80 Seal, O'ring
81 Nut, Lock

REAR PLATE ASSEMBLY W/GEROTOR
Kit No. 290
52 Cap, RV
53 Seal, O'ring
55 Bushing, Geortor Coupling
56 Plug, Hex
57 Seal, O'ring
68 Rear, Plate
69 Assembly, IPRV
70 Cap, SPRV
71 Poppet, SPRV
72 Spring, SPRV

TOW VALVE
Kit No. 291
76 Stem, Tow Valve
77 Seal, O'ring
78 Ring, Back-up
79 Bonnet, Tow Valve
80 Seal, O'ring
81 Nut, Lock

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-Stream" 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 personal. 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 an 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 and 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.

THE OILGEAR COMPANY
2300 So. 51st. Street
Milwaukee, WI 53219

BULLETIN 947011

Litho in USA