SERVICE INSTRUCTIONS

OILGEAR TYPE "PVWH", "PVWW" AND "PVW" OPEN LOOP VARIABLE DISPLACEMENT PUMPS

PURPOSE OF INSTRUCTIONS

These instructions are written to simplify your work when installing, operating and maintaining these Oilgear pumps. Your acquaintance with the construction, 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.

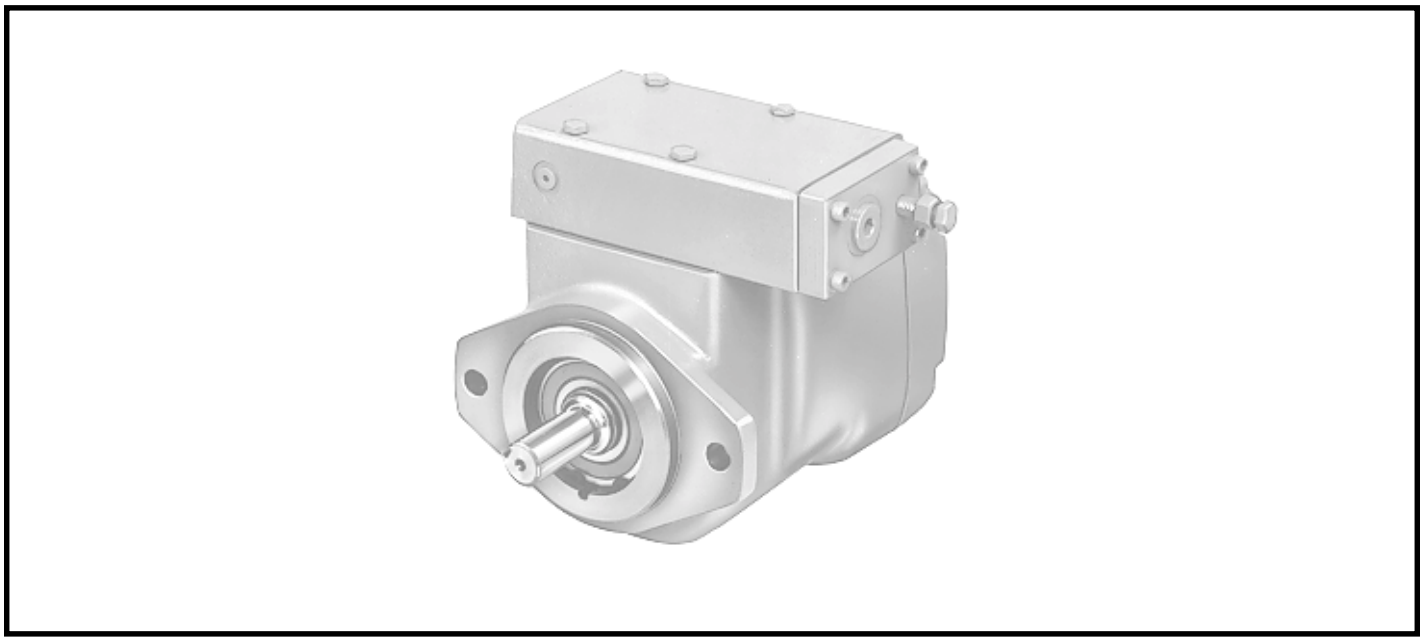

Figure 1. Typical Oilgear “PVWH" Open Loop Pump (55503R).

REFERENCE MATERIAL

Specifications, "PVWW" Pumps ..... Bulletin 47013
Specifications, "PVW" Pumps ..... Bulletin 47014
Specifications, "PVWH" Pumps ..... Bulletin 47015
Fluid Recommendations ..... Bulletin 90000
Contamination Evaluation Guide ..... Bulletin 90004
Filtration Recommendations ..... Bulletin 90007
Piping Information ..... Bulletin 90011

Pump Control Instructions
Pressure Compensating Controls
"CN & CL" Single Pressure ..... Bulletin 947515
"C2 & C3" Multiple Pressure ..... Bulletin 947518
"CU" Soft Start Pressure ..... Bulletin 947517
"CH" High-Low Pressure ..... Bulletin 947514
"HP" Horsepower Limiter ..... Bulletin 947513

Volume/Pressure Sensing Controls
"CF" Single Pressure/Load Sense ..... Bulletin 947516
"2F" Dual Pressure/Load Sense ..... Bulletin 947512
"HF" Horsepower Limit/Load Sense ..... Bulletin 947511

Volume Controls
"HN" Handwheel ..... Bulletin 947115
"MN & MS" Lever ..... Bulletin 947116
"RU & RR" Solenoid, Two Volume ..... Bulletin 947815
"RS & RY" Solenoid Two Volume & Neutral ..... Bulletin 947816

Electronic
"VU" Solenoid Operated Servo ..... Bulletin 947715
"VV" Servo Valve ..... Bulletin 947716

I. PREPARATION AND INSTALLATION

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" to the top side. Secure the unit to a rigid mounting surface. See section "B" on "Piping & Fittings".

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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 reservoir bottom at least six (6) inches above floor level to facilitate fluid changes.

B. PIPING AND FITTINGS

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

For "PVWH" and "PVW" Pumps using 150-300 SSU VISCOSITY FLUIDS, an inlet strainer is not required. Inlet should be unrestricted and have a minimum of fittings. See reference "Specification Bulletin" for minimum inlet "psia" requirements at selected input rpm. If suction line is used, it should reach within 1 to 2 times its diameter from the bottom of reservoir - do not "bottom-out" tubes in reservoir.

For "PVWW" Pumps using 27-30 SSU VISCOSITY FLUIDS, pumps should have a flooded inlet and an inlet filter should **not** be used. Inlet should not be restricted and have a minimum of fittings. Inlet velocity should not exceed 3 fps. (0,9 m/s).

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 inlet pressure.** Each drain line must be separate, unrestricted, full sized and connected directly to the 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 periods of time without supercharge (or a case bleed thru circuit) can damage the pump.

System and pump must be protected against over-loads by separate high pressure relief valves. Install bleed valve(s) at highest point(s) in system. Consult The Oilgear Company for other recommendations.

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 The Oilgear Company. It may be necessary to provide delivery bypass in some circuits.

D. DRIVE

See rotation direction plate on units' 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 manufacturer's instructions.

CAUTION:

Do not drive coupling onto pump driveshaft. If fit is too tight, it may be necessary to heat coupling (see manufacturer'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 bulletins on "Filtration Recommendations" and "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.

FOR 150-300 SSU VISCOSITY FLUID, use of ten micron filtration (Beta 10 of four or better) in pressure or return line is recommended.

FOR 27-30 SSU VISCOSITY FLUID, use of ten micron filtration (Beta 10 of fifteen or better) in pressure or return line is recommended. **Continuous filtration is required.**

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 oil bath type 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 once every six months, remove cover, wash screens in solvent, clean and refill case to "fluid level" mark and install dry screen. See manufactures' recommendations.

H. FLUID, FILLING AND STARTING RECOMMENDATIONS

"PVWH" and "PVW" Pumps use 150-300 SSU VISCOSITY FLUIDS, meeting or exceeding lubricating specifications of SAE 10W AP1 Engine Service Classifications - SC, CC or SE (or ISOVG32 thru 68) is recommended, viscosity range 150-300 SSU at 100°F (37,7°C). **For fire resistant fluids,** phosphate ester hydraulic fluids can be used in accordance with manufacturer's recommendations.

"PVWW" Pumps may use 27-30 SSU VISCOSITY FLUIDS, it is suggested you confirm your selection with your Oilgear representative before you specify the type of hydraulic fluid. High Water Content Fluids (HWCF) 95-5, water glycol and oil emulsion fluids can be used in accordance with fluid manufacturer's recommendations.

Refer to instruction plate on unit, reservoir, machine and/or referenced "Fluid Recommendations" bulletin. Pump all fluid into reservoir thorough 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 at the pump 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	Nm
04, 06, 10	1.7 - 2.1	2,3 - 2,8
11, 15, 20	2.9 - 3.3	4,0 - 4,5
25, 34, 45, 60	7.9 - 8.3	10,8 - 11,3

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. 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 opening air bleed petcocks at highest point in the system. Close connections or petcocks tightly when solid stream of fluid appears.

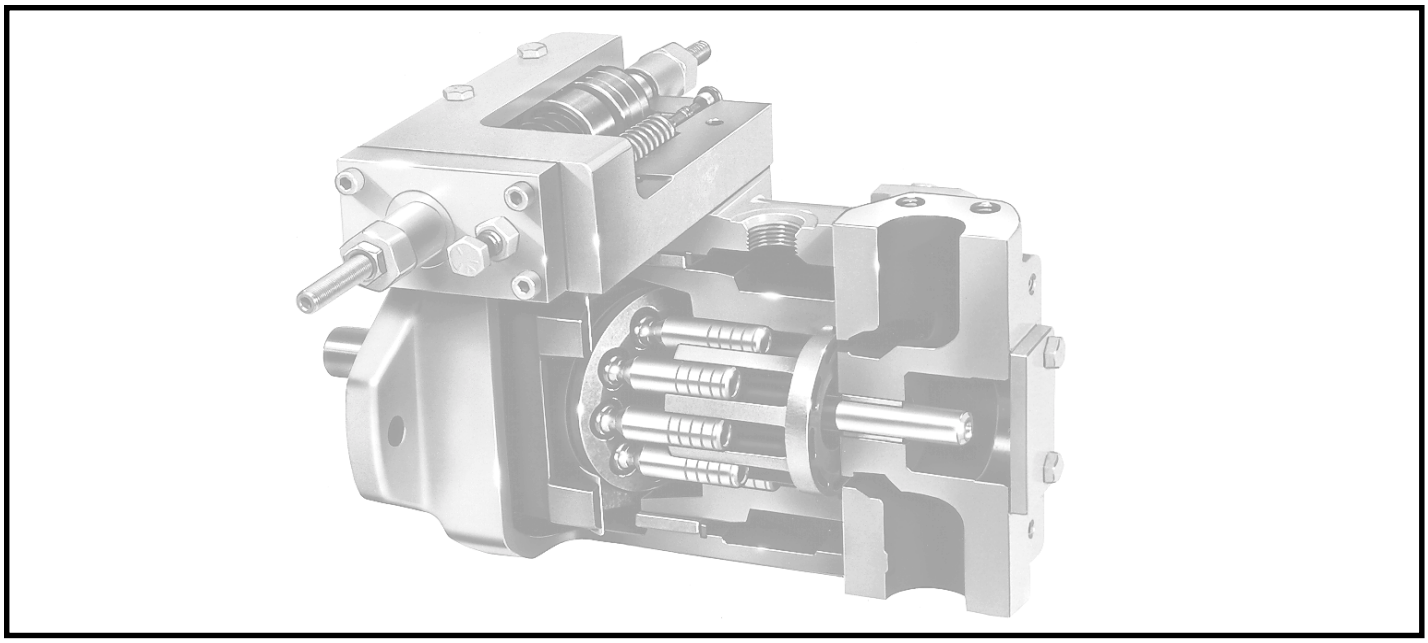

Figure 2. Cut-a-Way (cross section) of Typical "PVWH" Pump from the right side. (88050R)

II. CONSTRUCTION

Refer to Figures 2, 10 and 11. A driveshaft (1) runs through the centerline of pump housing (5), saddle block (8) and valve plate (22). Pump cylinder barrel (18) is splined to driveshaft. A bearing (3) supports the outboard end of the driveshaft and a bushing integral with the valve plate supports the inboard end. The pump cylinder barrel is carried in a journal type hydrodynamic cylinder bearing (12). The valve plate (22) has two crescent shaped ports. Pumping piston/shoe assemblies (15) in the cylinder barrel 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 barrel forcing it against the valve plate while also forcing the piston shoe against the swashblock (11). The semi-cylinder shaped swashblock limits the piston stroke and can be swivelled in arc shaped saddle bearings (10A and 10B) which are pinned (9) into the saddle (8). The swashblock is swivelled by a control (covered in referenced material).

For **"PVWH"** Pumps **(only)**, the ("pressure" side) saddle bearing is force lubricated. A small hole in the face of the swashblock (11) provides "porting" for the hydrostatic balance fluid [of the piston/shoe assembly (15)] through the swashblock to a rectangular shaped groove milled in one of the two arc shaped swashblock faces, to lubricate the face of the mating saddle bearing. **"PVW" and "PVWW" Pumps are not provided with this feature.**

SEE PAGES 4 and 5 "III. PRINCIPLE OF OPERATION" and "IV. SPECIFICATIONS"

V. MALFUNCTIONS AND CAUSES

A. UNRESPONSIVE OR SLUGGISH CONTROL

1. See reference control instruction material.
2. Low control input (pilot) pressure for "R" and "V" volume type controls only.
3. Swashblock saddle bearings (10A & 10B) worn or damaged.

B. INSUFFICIENT PUMP VOLUME

1. Delivery limited by faulty control (see appropriate control instruction material).
2. Obstructed suction circuit or insufficient supercharge volume.
3. Insufficient drive motor speed.
4. Worn or grooved cylinder barrel (18) and/or valve plate (22) matching surfaces.
5. Worn piston/shoe assemblies (15) or piston bores in cylinder (18).
6. Worn or damaged piston shoe or swashblock (11).

C. IRREGULAR OR UNSTEADY OPERATION

1. Faulty control.
2. Fluid level in reservoir is low or supercharge is insufficient.
3. Air entering hydraulic system.
4. Worn axial piston pump.
5. Faculty output circuit components (cylinder, motors, valves, etc.).

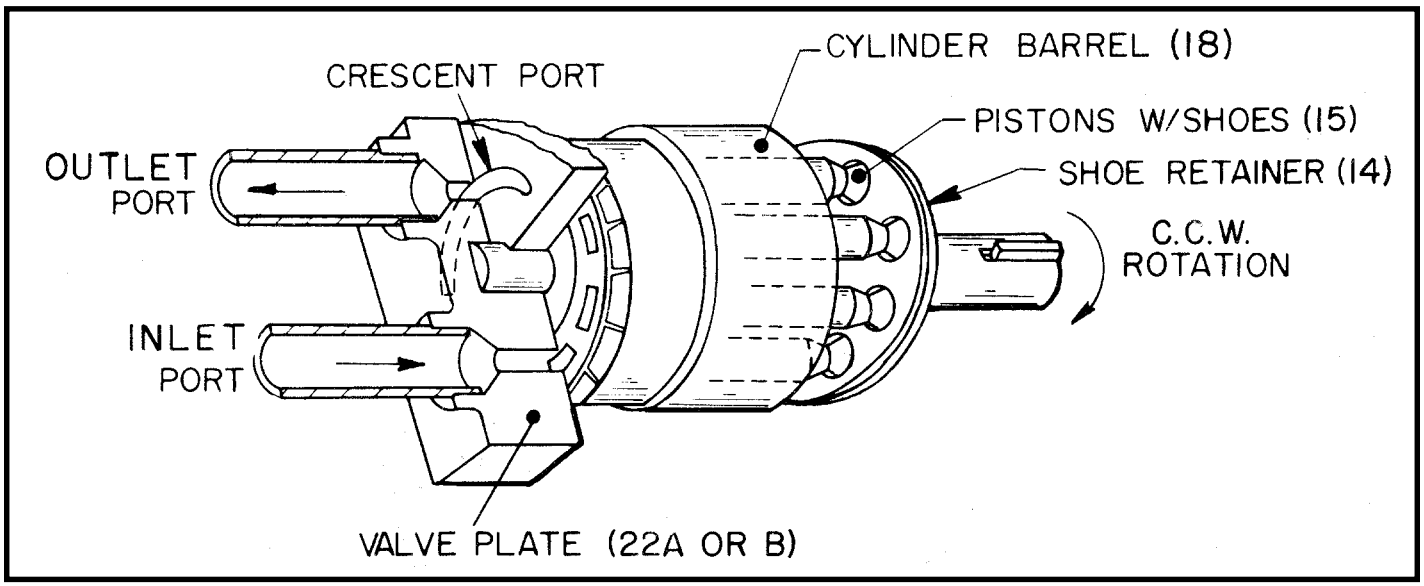

Figure 3. Type "PVWH" Pumping Mechanism (511783).

III. PRINCIPLE OF OPERATION

A ONE-WAY PUMP DRIVEN COUNTERCLOCKWISE (LEFT HAND), IS DESCRIBED.

See Figure 3. Turning the driveshaft rotates the splined cylinder barrel (18) which contains pumping pistons with swivel shoes (15). A shoe retainer (14), backed up by a spring (17) loaded fulcrum ball (16), holds piston shoes against a swashblock (11).

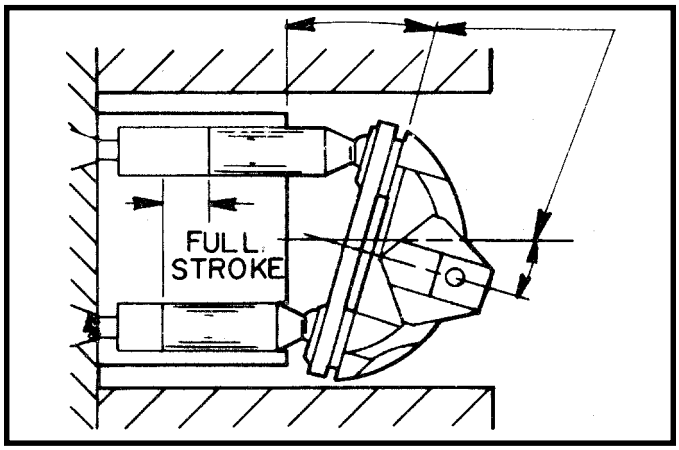

Figure 4. POSITION A Plan (Top) View, Swashblock Positioned for Full Delivery Port A. (511783)

SEE FIGURE 4. POSITION A. When the control positions the swashblock for full delivery from Port A, the swashblock face is at maximum angle (to the cylinder face). When cylinder is rotated, the piston move in and out of their bores as the 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 (suction) Port B, each piston moves outward, drawing fluid from Port B 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 it's 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.

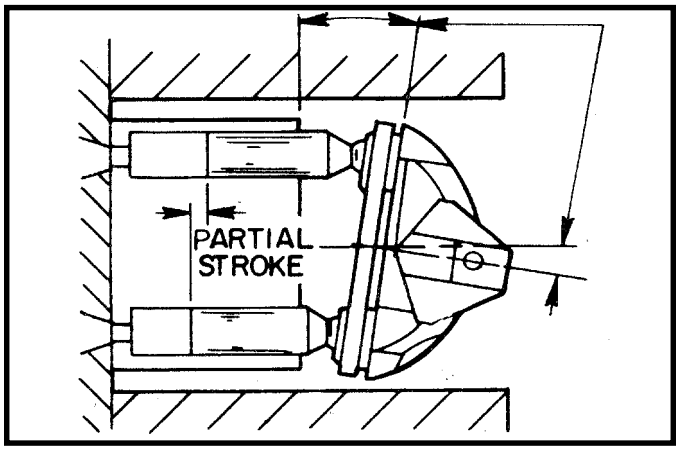

Figure 5. POSITION A/2 Plan (Top) View, Swashblock Positioned for Partial Delivery from Port A (511783).

SEE FIGURE 5. POSITION A/2. A study of the diagram will show that the degree of swashblock angle determines the length of the piston stroke (difference between outermost and innermost position) thereby determining the amount of delivery from the pump.

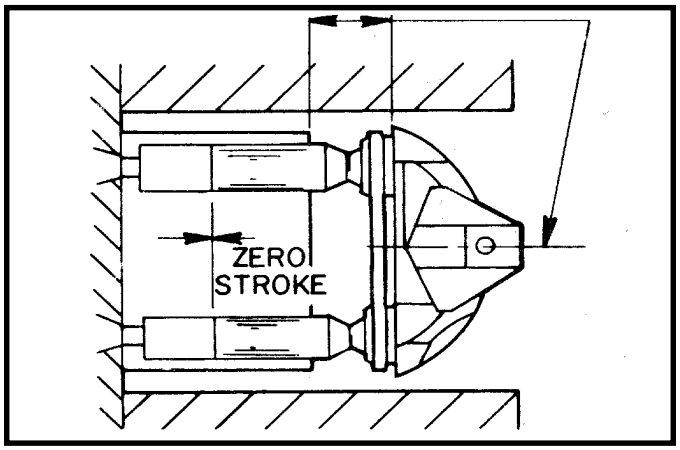

Figure 6 POSITION N, Plan (Top) View, Swashblock Positioned for "Neutral" (no stroke, no delivery) (511783).

SEE FIGURE 6. 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 piston 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.

IV. SPECIFICATIONS

See referenced material, pump control material and individual application circuits for exceptions.

Tables 2. NOMINAL PERFORMANCE DATA

"PVWH" AND "PVW" PUMPS with 150-300 SSU VISCOSITY FLUID

FRAME SIZE	UNIT SIZE	THEORETICAL MAXIMUM DISPLACEMENT		RATED CONTINUOUS PRESSURE		MAXIMUM PRESSURE		FLOW RATE at 1800 rpm, rated continuous pressure & 14.7 psia (1 bar_{abs}) inlet condition		MINIMUM INLET PRESSURE* psia (bar_{abs})			MAXIMUM SPEED†	POWER INPUT at rated continuous pressure and 1800 rpm	
		in^3/rev	ml/rev	psi	bar	psi	bar	gpm	l/min	1200 rpm	1500 rpm	1800 rpm	rpm	hp	kw
A	04	0.66	10,8	5000	344,8	5800	400,0	4.2	15,9	5.4 (,37)	5.7 (,39)	6.1 (,42)	3000	16.3	12,2
	06	0.86	14,1	4000	275,9	4500	310,3	5.9	22,4	5.5 (,38)	5.9 (,41)	6.4 (,44)	3000	17.7	13,2
	10	1.35	22,1	3000	206,9	3500	241,4	9.5	36,0	5.5 (,38)	6.0 (,41)	7.0 (,48)	3000	20.2	15,1
B	11	1.55	25,4	5000	344,8	5800	400,0	10.9	41,3	7.0 (,48)	7.3 (,50)	8.2 (,57)	3000	36.5	27,2
	15	2.06	33,8	3500	241,4	4000	275,9	14.7	55,7	7.0 (,48)	7.6 (,52)	8.4 (,58)	3000	35.5	26,5
	20	2.83	46,4	2500	172,4	3000	206,9	20.6	78,1	7.2 (,50)	7.9 (,54)	9.0 (,62)	2400	35.0	26,1
C	25	3.88	63,6	5000	344,8	5800	400,0	27.4	103,8	7.6 (,52)	8.5 (,59)	9.5 (,66)	2400	95.1	70,9
	34	4.67	76,5	3500	241,4	4000	275,9	33.7	127,7	8.0 (,55)	8.6 (,59)	9.6 (,66)	2400	80.4	60,0
	45	6.00	98,3	2500	172,4	3000	206,9	43.3	164,1	7.6 (,52)	8.6 (,59)	9.8 (,68)	2400	74.1	55,3
	60	7.94	130,2	1500	103,4	2000	137,9	58.2	220,3	8.0 (,55)	9.3 (,64)	14.5 (1,00)	1800	64,0	47,8

* For higher speeds see suction curves.

Higher speeds available - consult factory Note: Minimum speed 600 rpm

"PVWW" Pumps with 27-30 SSU VISCOSITY FLUID

FRAME SIZE	UNIT SIZE	THEORETICAL MAXIMUM DISPLACEMENT		RATED CONTINUOUS PRESSURE		MAXIMUM PRESSURE *		FLOW RATE at 1800 rpm, rated continuous pressure & 14.7 psia (1 bar_{abs}) inlet condition		MAXIMUM SPEED at 1800 rpm and 14.7 psia inlet condition	POWER INPUT at rated continuous pressure and 1800 rpm	
		in^3/rev	ml/rev	psi	bar	psi	bar	gpm	l/min	rpm	hp	kw
A	06	0.86	14,1	3000	206,9	3500	241,4	5.5	20,8	1800	12.9	9,6
	10	1.35	22,1	2000	137,9	2500	172,5	9.0	34,1	1800	13.3	9,9
B	15	2.06	33,8	3000	206,9	3500	241,4	12.7	48,1	1800	30.4	22,7
	20	2.83	46,4	2000	137,9	2500	172,5	20.3	76,9	1800	27.8	20,7
C	34	4.67	76,5	3000	206,9	3500	241,4	32.6	123,6	1800	68.4	51,0
	45	6.00	98,3	2000	137,9	2500	172,5	42.8	162,2	1800	59.7	44,5
	60	7.94	130,2	1200	82,7	1500	103,4	56.6	214,2	1800	47.0	35,1

* Higher pressure available— consult factory.

Note: Minimum speed 600 rpm

Table 3. NOMINAL DIMENSIONS and WEIGHTS without controls.

UNIT SIZE	LENGTH		WIDTH		HEIGHT		WEIGHT	
	in.	mm.	in.	mm.	in.	mm.	lbs.	kg.
04, 06 & 10	7.20	182,9	4.32	109,7	4.50	114,3	32	14,5
11, 15 & 20	8.50	215,9	4.80	147,3	6.11	155,2	68	30,9
25, 34, 45 & 60	10.44	265,2	6.76	171,7	7.18	182,4	103	46,8

See Page 3 for "V". Malfunctions and Causes"

D. LOSS OF PRESSURE

1. Worn piston pump.
2. Worn or grooved cylinder barrel (18) and/or valve plate (22) matching surfaces.
3. Worn piston/shoe assemblies (15) or piston bores in cylinder.
4. Faulty output circuit components.
5. Faulty control.

E. EXCESSIVE OR HIGH PEAK PRESSURE

1. Faulty output circuit components (pay particular attention to relief valves). **The use of a "spike" relief valve (fast acting) is recommended.**

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 to high.
5. Suction line problem i.e.; obstruction in line, line too long, line diameter too small, too many bends and/or loops in line.
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.
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 (22) matching surfaces.
6. Faulty output circuit components (continuous blowing relief valve or "slip" through valves, cylinder, 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 before (up-stream from) pump relief valve or system high pressure relief valve will result in damage and could result in serious personal injury.**

A. PISTON PUMP

To check for worn piston pump, measurement of the leakage can be made from the case drain while the pump is under pressure, but pressure control (when used) is not "unloading". 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 fluid 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 pump, put it on stroke 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 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 4 or 5. Additional leakage indicates wear, but does not become critical until it impairs performance.

B. CONTROL

Refer to applicable (referenced) pump control instructions material.

Table 4. **"PVWH" Pump** NOMINAL CASE SLIP vs. High Pressure at 1800 rpm (viscosities of 160 SSU).

PUMP	1500	psi	2500	psi	3000	psi	3500	psi	4000	psi	5000	psi
	cipm	lpm	cipm	lpm	cipm	lpm	cipm	lpm	cipm	lpm	cipm	lpm
04											200	3,3
06									200	3,3	NA	NA
10					200	3,3	NA	NA	NA	NA	NA	NA
11											300	4,9
15							300	4,9	NA	NA	NA	NA
20			300	4,9	NA	NA	NA	NA	NA	NA	NA	NA
25											460	7,6
34							460	7,6	NA	NA	NA	NA
45			460	7,6	NA	NA	NA	NA	NA	NA	NA	NA
60	530	8,7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 5. **"PVWW & PVW" Pump** NOMINAL CASE SLIP vs. High Pressure at 1800 rpm (viscosity of 160 SSU).

PUMP SIZE	Case Slip at Full Stroke and Indicated Pressure									
	1500 psi/PVW 1200 psi/PVWW		2500	psi	3000	psi	3500	psi	4000	psi
	cipm	lpm	cipm	lpm	cipm	lpm	cipm	lpm	cipm	lpm
06									150	2,5
10					150	2,5	NA	NA	NA	NA
15							230	3,8	NA	NA
20			230	3,8	NA	NA	NA	NA	NA	NA
34							350	5,7	NA	NA
45			350	5,7	NA	NA	NA	NA	NA	NA
60	390	6,4	NA	NA	NA	NA	NA	NA	NA	NA

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 to assure 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 disassembly and assembly, a crane and/or sling capable of handling 200 lb. loads 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 prior to working with these units and new CLEAN lint free 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 the pump from it's mounting before the case can be drained.

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 Figure 10 and 11. Depending upon what part or parts are to be inspected, it may not be necessary to completely take apart all assemblies.

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 units, it will be necessary to remove coupling (half) (180 or 190) before removing valve plate (22). Block unit on bench with driveshaft facing down. Remove valve plate (22) by alternately removing four hex head screws (25) and lifting straight up. Remove valve plate gasket (21) and o'ring (28).

E. 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. 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 shaft (1) slowly while pulling the cylinder barrel (18) from the housing.

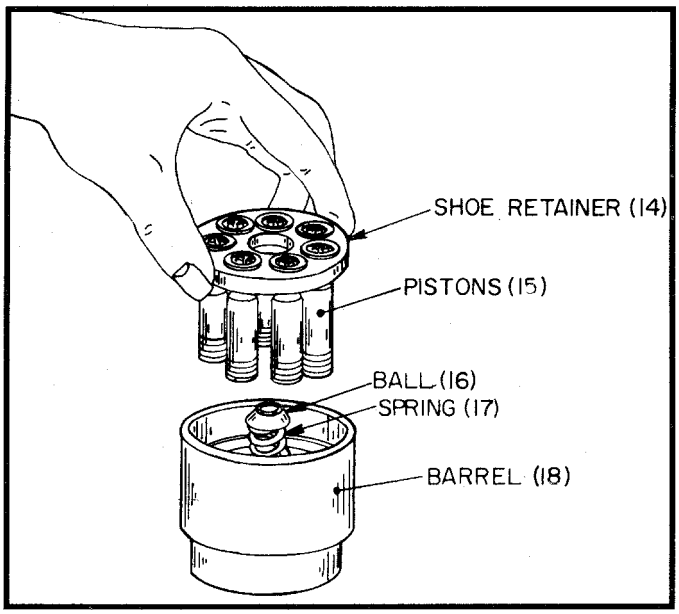

Figure 7. Rotating Group Disassembly (511783).

See Figure 7. Lift out 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.

F. DRIVESHAFT GROUP

Remove drive key (2) if used and 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.

G. SWASHBLOCK GROUP

Reach inside the case and remove swashblock (11). **Note which saddle bearing is in the upper (10A) position and which is in the lower (10B) position**. Remove saddle bearings (10A and 10B) from the saddle (8) if necessary. If necessary, the saddle itself can be pulled out. On most units, the saddle is located by pin (20) and can be pulled from the housing. On early units, the saddle is located in the case by two dowel pins (not shown) and the saddle is secured to the case by two nylock socket head cap screws (not shown) which will have to be removed before the saddle can be withdrawn from the 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 spring 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.

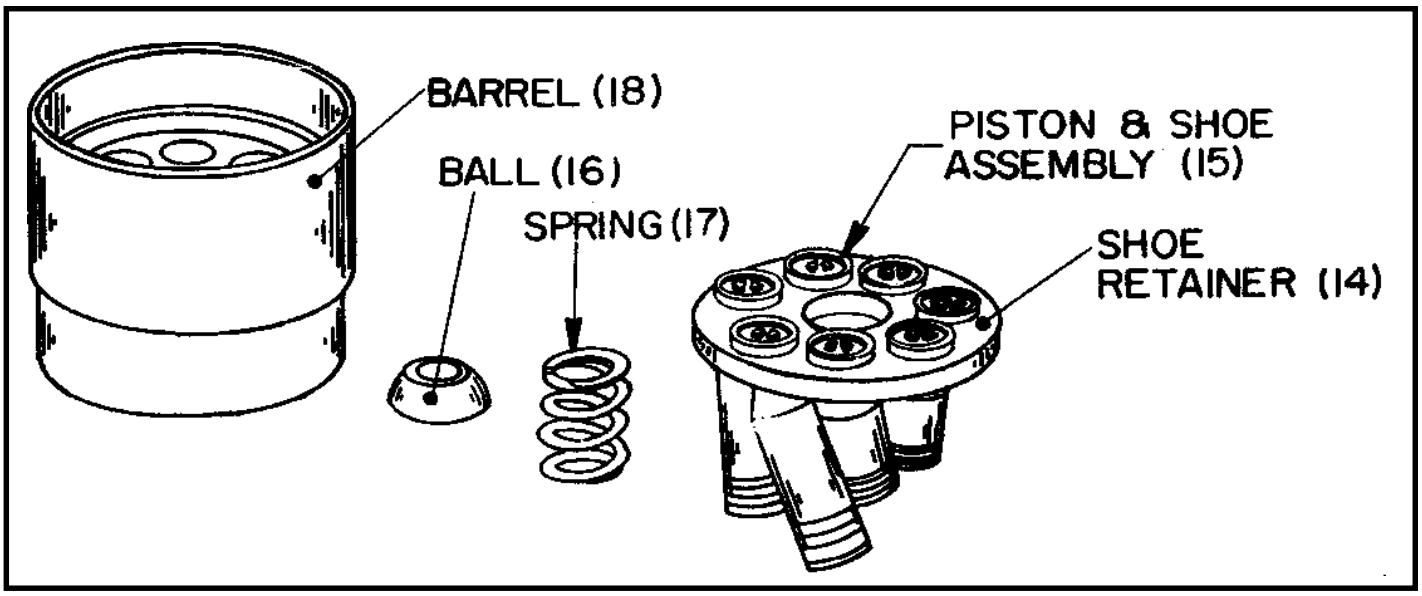

Figure 8. Rotating Group Inspection (511783)

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 (22) 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. 79L or 79R) and cylinder barrel (18).

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. 73. Inspect hydrodynamic cylinder bearing (12) and matching cylinder barrel surface for galling, pitting, roughness, damage and replace if necessary.

Check all piston/shoe assemblies (15) to be sure they ride properly on the swashblock.

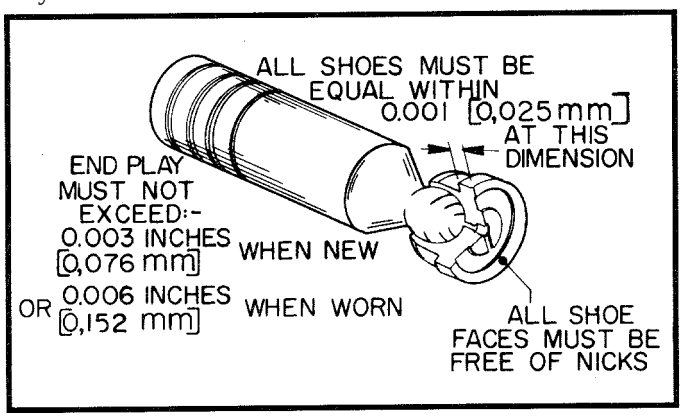

Figure 9. Piston and Shoe Inspection (511783).

See Figure 9. Piston shoes must pivot smoothly, but end play should not exceed 0.006" (0,152 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. 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 Piston/Shoe Kit No. 87 . When installing a new rotating group kit, make sure pistons are free in their bores.

D. SWASHBLOCK GROUP

Inspect the swashblock (11) for wear or scoring. In the case of size 60 units, inspect the swashblock wearplate (11A). If damage is extensive, replace the swashblock and/or wearplate as part of Swashblock Kit No. 82.

"PVWH" Pumps **(only)**, check the very small holes in the face of the swashblock. This hole provides "porting" for the hydrostatic balance fluid (of the piston/shoe assembly) to be channelled through the swashblock to the face of the saddle bearing (providing pressure lubrication).

Compare saddle bearing (10A and 10B) thickness in worn area to thickness in an unworn area. Replace saddle bearings if difference is greater than 0.008 in (0,2mm). 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. 85.

E. DRIVESHAFT GROUP

Check shaft seal (7) for deterioration or cracks. Replace if necessary. Examine the sealing area of the shaft (1) for scoring or wear. Inspect 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. 74K or 74S. Inspect bushing in valve plate (22). If replacement is necessary, the bushing is not available as a loose item, it is included when ordering Valve Plate Assembly Kit No. 79L or 79R.

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. 77). Apply a thin film of CLEAN grease or hydraulic fluid to sealing components to ease assembly. If a new rotating group (Kit No. 73) 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) and then place housing on bench with mounting flange side down. Place saddle block (8) into housing - center properly [a locating hole in the saddle and a pin (20) in the housing must match]. On early units, two dowel pins (not shown) locate the saddle and saddle is secured to housing by two nylock socket head cap screws.

The saddle bearings (10A and 10B) and swashblock (11) can now be installed. Check the swashblock faces that mate with the saddle bearings (10A and 10B). One of these faces has a rectangular groove cut into it. The groove should be on the control (upper) side of the swashblock for left hand driven pumps and on the (lower) side for right hand driven pumps.

For size **04, 06, 10 and 25 "PVWH"** Pumps **only**, the plastic backed saddle bearing should be positioned on pin (9) to mate with the rectangular groove milled in arc shaped swashblock (11). Place steel backed saddle bearing on pin (9) in other location.

For size **11, 15, 20, 34, 45 and 60 "PVWH"** Pumps **only**, both saddle bearings are steel backed. It is recommended they be put back in their original locations. If replacement saddle bearings are used - it makes no difference which is placed in which location.

For **all size "PVWW" and "PVW"** Pumps **only**, both bearings are the same. It is recommended they be put back in their original locations. If replacement saddle bearings are used - it makes no difference which is placed in which location.

NOTE: - Install saddle bearings on size 04 thru 20 with notched corners toward shaft and bearing. Does not apply to 25 thru 60 size.

Place the swashblock 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 hydrodynamic bearing (12) into the case so the pin (in the bearing) will fit (per Table 6) a corresponding slot in the housing. 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.

Table 6. HYDRODYNAMIC BEARING LOCATION PIN POSITION

Left Hand (CCW) Pumps = Pin at 8:00 o'clock position between saddle protrusion and pump housing.
Right Hand (CW) Pumps = Pin at 4:00 o'clock position between saddle protrusion and pump housing.

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 insert driveshaft and bearing assembly into pump housing (5) and lock in place with driveshaft bearing retainer ring (29).

C. ROTATING GROUP

See Figure 7. 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 (16) on top of it. Insert the pistons/shoe assemblies (15) into the shoe retainer (14). As a unit, fit the pistons into their bores in the cylinder barrel. **DO NOT FORCE**. If aligned properly, the pistons will fit smoothly.

WARNING: Assistance from others and proper lifting technique 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 tail of the driveshaft (1) and into the pump housing (5). When installing the rotating group, support the weight of the cylinder barrel (18), 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 engage shaft splines. Continue to slide 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. VALVE PLATE GROUP

Place pump housing on bench with open end facing up. Install new o'ring (28) and gasket (21) on housing. Make sure the tail end of shaft engages bushing while positioning the valve plate (22) on pins (19) and housing. Finger tighten hex head cap screw (25) closest to o'ring (28) first and then alternately tighten other cap screws per Table 7. On thru shaft units connected to another pump or device, install coupling half.

Table 7. TORQUES

SIZE UNIT	VALVE PLATE		CONTROL	
	Ft. Lbs.	N.m.	Ft. Lbs.	N.m.
04, 06, 10	15	20,4	8.3	11,3
11, 15, 20	37	50,3	8.3	11,3
25, 34, 45, 60	56	76,2	16.6	22,6

E. 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 8 for Torques to secure control group to pump housing.

SEE SECTION "I. PREPARATION and INSTALLATION".

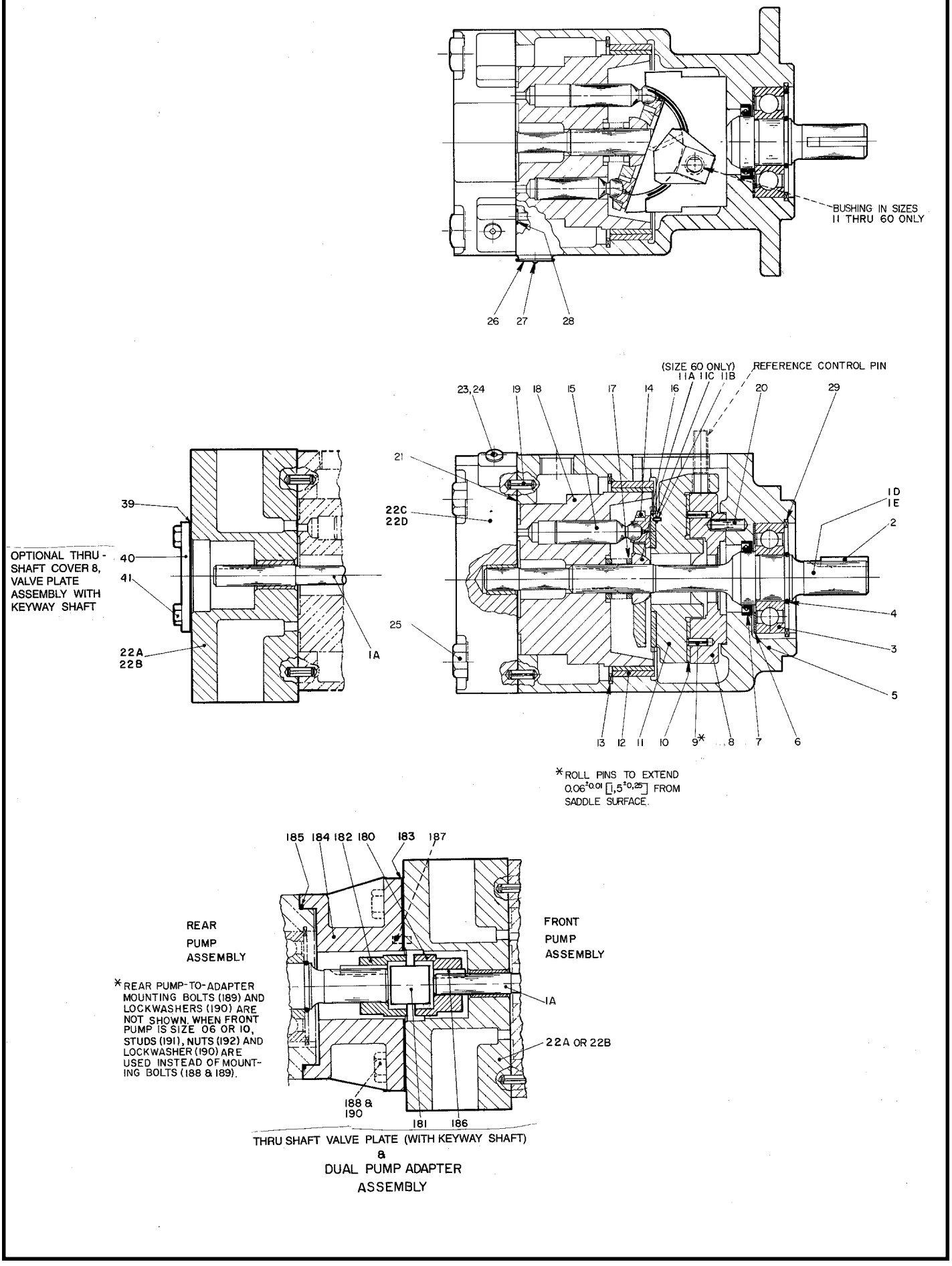

Figure 10. Parts Drawing, Basic "PVWH", "PVWW" and "PVW" Pumps without Controls. DS-SW-8A (511783)

X. PARTS LISTS

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 and serial number. To assure seal and packing compatibility, specify type of hydraulic fluid used.

ITEM NO.	DESCRIPTION
1A	Driveshaft w/Keyway (side port)
1B	Driveshaft w/SAE Spline (side port)
1D	Driveshaft w/Keyway (rear port)
1E	Driveshaft w/SAE Spline (rear port)
2	Key, Driveshaft
3	Bearing, Front Driveshaft
4	Ring, Shaft Retainer
5	Housing, Pump
6	Retainer, Seal
7	Seal, Shaft
8	Block, Saddle (items 8 & 9 sold as an assembly)
9	Pin, Roll (items 8 & 9 sold as an assembly)
10A	Bearing, Upper Saddle
10B	Bearing, Lower Saddle
11	Swashblock
11A	Wearplate, Swashblock (size 60 only)
11B	Pin, Roll (size 60 "PVWH" only)
11C	Seal, O'ring (size 60 "PVWH" only)
12	Bearing, Cylinder Hydrodynamic
13	Ring, Retainer
14	Retainer, Shoe
15	Assembly, Piston/Shoe

ITEM NO.	DESCRIPTION
16	Ball, Fulcrum
17	Spring, Shoe Retainer
18	Barrel, Cylinder
19	Pin, Roll
20	Pin, Saddle Locating
21	Gasket, Valve Plate
22A	Valve Plate, Side Port/rear shaft, LH
22B	Valve Plate, Side Port/rear shaft, RH
22C	Valve Plate, Rear Port, LH
22D	Valve Plate, Rear Port, RH
23	Seal, O'ring
24	Plug, SAE Hollow Hex
25	Screw, Hex. Hd.
26	Nameplate, Identification
27	Screw, Drive
28	Seal, O'ring
29	Ring, Driveshaft Bearing Retainer
39	Gasket
40	Cover
41	Screw, Hex. Hd. Cap

DUAL PUMP ADAPTER AND COUPLING KITS

SIZE 04, 06 & 10

ITEM NO.	DESCRIPTION
*185	Seal, O'ring
*190	Lockwasher
*191	Stud
*192	Nut

*Used when 04, 06 or 10 is front pump in dual arrangement instead of bolts (188 and 189).

SIZE 11 THRU 60

ITEM NO.	DESCRIPTION
180	Coupling, Front
181	Key, Coupling
182	Coupling, Rear
183	Gasket, Adapter
184	Adapter
185	Seal, O'ring
186	Key, Coupling
187	Pin, Roll
188	Screw, Hex. Hd. Cap
189	Screw, Hex. Hd. Cap (not shown)
190	Lockwasher (not shown)
191	Coupling, Spline
192	Pin, Roll

O'RING SIZES

ARP 568 Uniform Size Number with Durometer

ITEM NO.	PUMP SIZE		
	04, 06, 10	11, 15, 20	25, 34, 45, 60
11C			"PVWH" 60 Only 006 - 70
23	902 - 90	902 - 90	902 - 90
28	010 - 90	010 - 90	*010 - 90 012 - 90
185	**	**	**

* Used on early units.

** Consult factory.

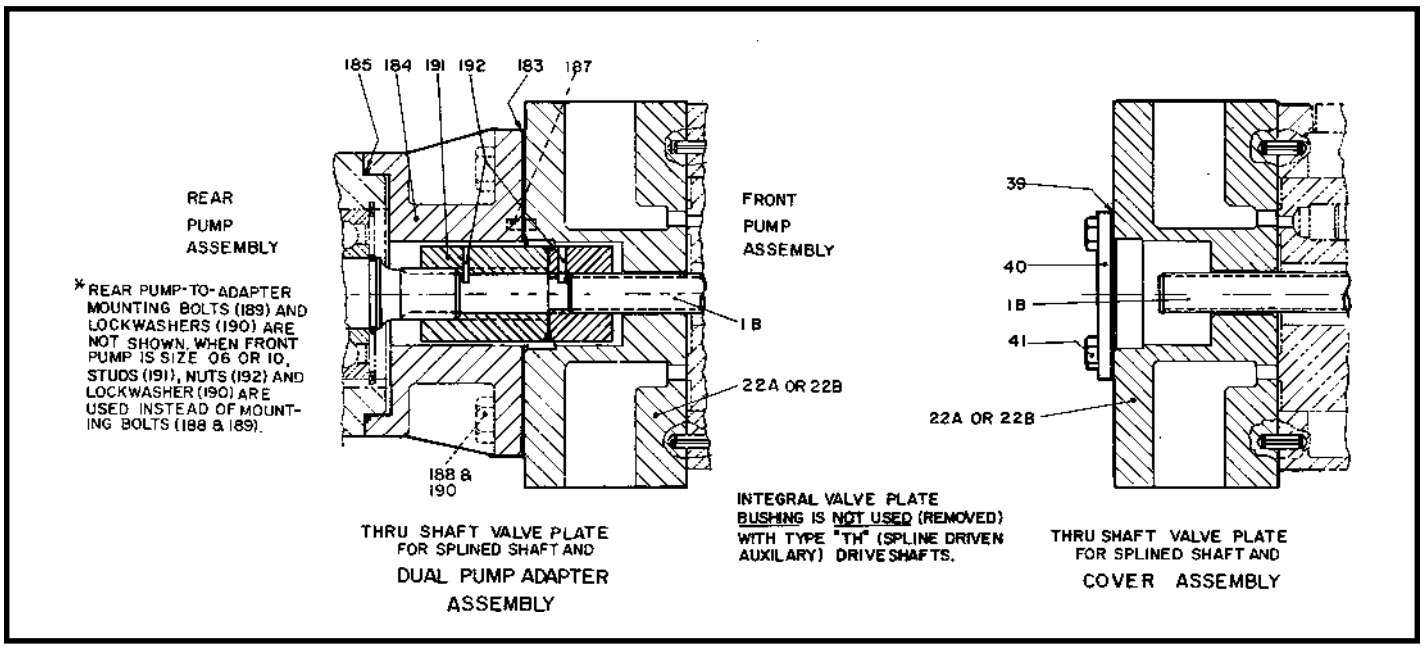

Figure 11. Parts drawing Showing Driveshaft w/SAE Spline Shaft (Side Ports) DS-SW-8A. (511783)

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

HOUSING & PINS
KIT No. 72

ITEM	DESCRIPTION
5	Housing, Pump
7	Seal, Shaft
19	Pin, Roll
20	Pin, Saddle Locating

ROTATING GROUP
Kit No. 73

14	Retainer, Shoe
15	Assembly, Piston/Shoe
16	Ball, Fulcrum
17	Spring, Shoe Retainer
18	Barrel, Cylinder

SHAFT & BEARING
Kit No. 74

1	Driveshaft
2	Key, Driveshaft
3	Bearing, Front Driveshaft
4	Ring, Front Driveshaft
6	Retainer, Seal
29	Ring, Driveshaft Bearing Retainer

GASKET & SEAL
Kit No. 77

7	Seal, Shaft
21	Gasket, Valve Plate
23	Seal, O'ring
28	Seal, O'ring

VALVE PLATE
Kit No. 79

21	Gasket, Valve Plate
22	Valve, Plate
23	Seal, O'ring
24	Plug, Hollow Hex
25	Screw, Hex. Hd.
28	Seal, O'ring

SCREWS, KEY & TAG
Kit No. 80

ITEM	DESCRIPTION
2	Key, Driveshaft
25	Screw, Hex. Hd.
26	Nameplate, Identification
27	Screw, Drive

ROTATING GROUP BEARING
Kit No. 81

12	Bearing, Cylinder Hydrodynamic
13	Ring, Retainer

SWASHBLOCK
Kit No. 82

11	Swashblock

SADDLE
Kit No. 84

8	Block, Saddle
9	Pin, Roll
10A	Bearing, Upper Saddle
10B	Bearing, Lower Saddle

SADDLE BEARING
Kit No. 85

10A	Bearing, Upper Saddle
10B	Bearing, Lower Saddle

Fold out for Parts Drawing and Parts List (page 11 and 12).

NOTES:

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 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 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 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
2300 So. 51st. Street
Milwaukee, WI 53219

BULLETIN 947015A

Litho in USA