

DENISON HYDRAULICS

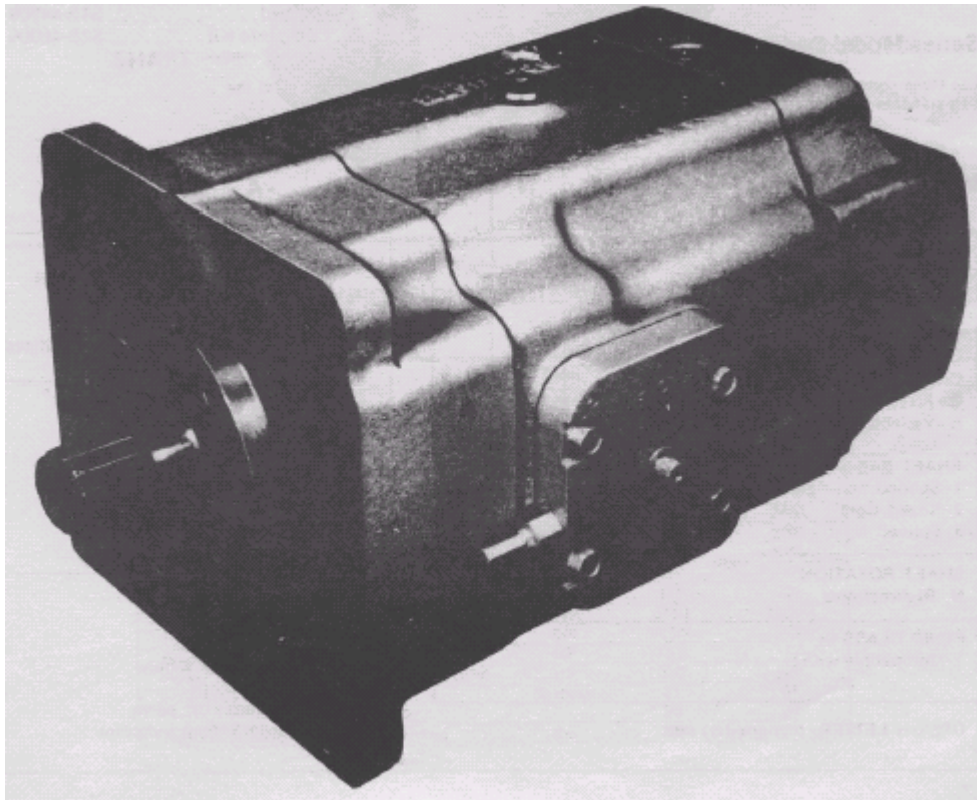
Axial Piston Motor

Variable Displacement

Installation and Overhaul Instructions

Goldcup Series M11

Goldcup Series M14



SVM-M11/M14-D
Revised 7/03

DENISON | **Hydraulics**

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See catalog S1-2AM-7501-A for all available kits.

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INTRODUCTION

GENERAL

The Denison Goldcup series 11 and 14 axial piston motors feature advanced design concepts which are time proven and aid in providing smooth controlled power in a compact package. The instructions contained in this manual cover installation, maintenance and repair of the Goldcup series motors. Before proceeding with the disassembly or reassembly of any unit, study this manual to become familiar with the basic fit and function of the internal parts. Refer to the troubleshooting chart when diagnosing any malfunction. Disassemble only as far as necessary to replace or repair any worn parts.

DESCRIPTION

The Goldcup series axial piston motors feature the use of a rocker cam and cradle stroking control to vary displacement. This allows a compact unit while retaining the flow capacity of a larger motor, as well as reducing wear and speeding control response. A vane actuator with a rotary servo operates the stroking control thus varying flow.

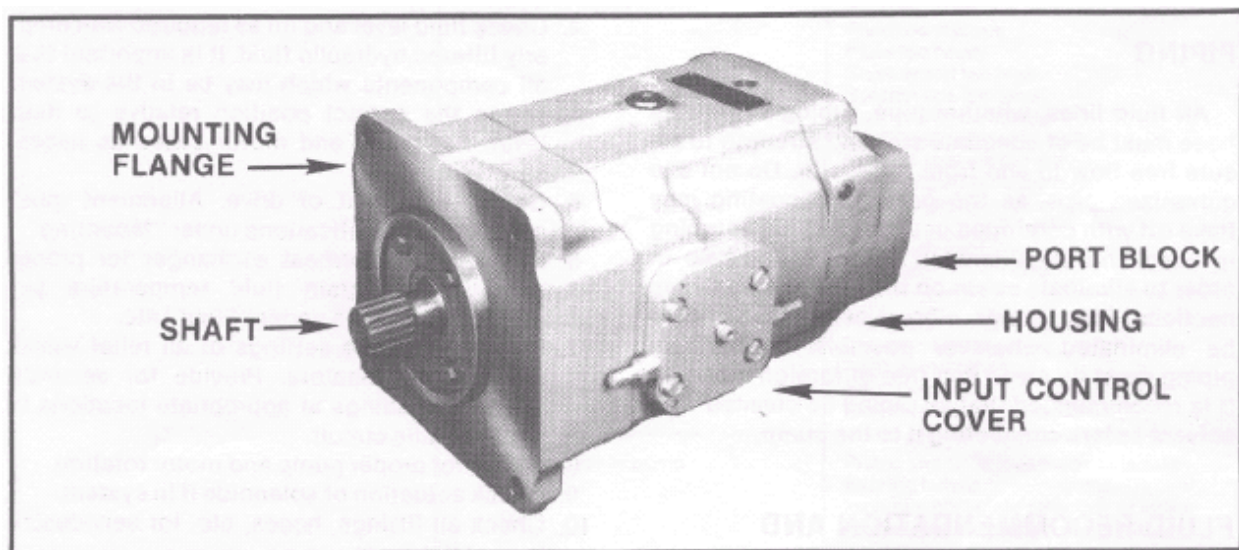


Table 1
TYPICAL CHARACTERISTICS

Specification	Term	Goldcup 11	Goldcup 14
Displacement at max. angle	In. 3/rev	11	14
Pressure Ports A or B max. continuous	PSI	5000	5000
Intermittent (not to exceed 6 sec/min)	PSI	6000	6000
Mounting Standard SAE 4-Bolt fluid connections, Ports A & B		SAE-E	SAE-E
4-Bolt Pad for 6000 PSI Split Flange		SAE - 1 1/2"	SAE - 1 1/2"
Speed, max. continuous @ full displ.	RPM	2400	2400
Speed, max. continuous @ 50% displ.	RPM	2800	2800
Flow, Theor. max @ 100 RPM	GPM	4.75	6.06
Flow, Theor. max @ 2400 RPM	GPM	114	145
Torque Theor. max. per 100 PSI	IN#	175	222
Torque Theor. max. @ 5000 PSI	IN#	8750	11,100
Torque Theor. max @ 6000 PSI	IN#	10,500	13,300
Power Theor. max @ 5000 PSI per 100 RPM	HP	13.8	17.6
Power Theor. max @ 5000 PSI per 2400 RPM	HP	330	425
Efficiency Torque approx.—stalled	% theor.	81	81
-- running		93	93
Pkg. motor variable displ. 2AO control	lbs.	300	300

INSTALLATION

MOUNTING

The mounting hub and four bolt mounting flange conform to SAE-E configuration. The motor must be mounted on a base or bracket of sufficient strength to support the unit without flexing or movement. It is recommended that a dial indicator be used when checking alignment. The concentricity of the pump shaft and driven load shaft must not exceed .010" T.I.R. and ideally should be .006"-.008" T.I.R. maximum. Shaft concentricity is particularly important if the motor is rigidly connected without a flexible coupling or a coupling that allows only for minor misalignment.

PIPING

All fluid lines, whether pipe, tubing or flexible hose must be of adequate size and strength to assure free flow to and from the motor. Do not use galvanized pipe, as the galvanized coating may flake off with continued use. If rigid pipe or tubing is used, the workmanship must be accurate in order to eliminate strain on the pump or fluid connections. Sharp bends, elbows or reducers should be eliminated wherever possible. All system piping must be clean and free of foreign material. It is recommended that all piping be cleaned with solvent before connecting it to the pump.

FLUID RECOMMENDATION AND MAINTENANCE

Satisfactory operation depends on many factors, the most important of which is the selection of the proper hydraulic fluid and its subsequent maintenance. Select only high quality fluids which conform to Denison HF-0 and HF-1 specifications. If in doubt concerning the correct fluid for use, contact a Denison sales representative. Efficient filtration is essential and cannot be overemphasized. Fluid cleanliness must conform to NAS class 8 or 9, 15 micron and under. Effective continuous use of 10 micron filters will assure compliance to this standard. Operating temperature is determined by the viscosity characteristics of the fluid selected. Because high operating temperatures degrade seals, reduce the service life of the fluid and pose potential hazards, fluid temperatures should not exceed 180°F at the case drain.

START UP PROCEDURE AND INSTALLATION

1. Read and understand the equipment manual before installation of the Goldcup motor. Identify system components (relief valves, solenoids, etc.) and their function is essential to satisfactory operation.
2. Visually inspect system components. Their proper placement and function is essential to satisfactory operation.
3. Check reservoir for cleanliness per instructions outlined under "Fluid Recommendation and Maintenance". Drain and/or filter system fluid as required.
4. Check fluid level and fill as required with properly filtered hydraulic fluid. It is important that all components which may be in the system are in the correct position relative to fluid level. Fill pump and motor cases as necessary.
5. Check alignment of drive. Alignment must conform to specifications under "Mounting".
6. Check oil cooler/heat exchanger for proper operation. Maintain fluid temperature per recommendations under "Fluid". etc.
7. Reduce pressure settings of all relief valves and/or compensators. Provide for accurate pressure readings at appropriate locations in the hydraulic circuit.
8. Check for proper pump and motor rotation.
9. Check actuation of solenoids if in system.
10. Check all fittings, hoses, etc. for serviceability and tightness.
11. Start pump drive at reduced speed if possible and make sure units fill properly.

INSTALLATION *(continued)*

12. Cycle unloaded equipment at low speed and pressure. Observe for proper function of all components.
13. Bleed system of any trapped air. Re-check fluid level and fill as necessary.
14. Gradually increase speed and pressure settings. Be alert for leaks, particularly in pump and motor inlet lines, as these may cause cavitation and eventual pump failure.
15. Check for possible trouble indicated by changes in sounds, system shocks and air in fluid.
16. Equipment is now operational.

**TABLE II
TROUBLESHOOTING CHART**

TROUBLE SHOOTING

Component problems and circuit problems are often inter-related. An improper circuit may operate with apparent success but will cause failure of a particular component within it. The component failure is the effect, not the cause of the problem. This general guide is offered to help in locating and eliminating the cause of problems by studying their effects.

EFFECT OF TROUBLE	POSSIBLE CAUSE	FAULT WHICH NEEDS REMEDY
Noisy Motor	Air in Fluid	Leak in suction line Leak at shaft seal Low fluid level Turbulent fluid Return lines above fluid level Gas leak from accumulator Excessive pressure drop in the inlet line from a pressurized reservoir Suction line strainer acting as air trap
	Cavitation in motor rotating group	Fluid too cold Fluid too viscous Fluid too heavy Shaft speed too high Suction line too small Suction line collapsed Suction strainer too small Suction strainer too dirty Operating altitude too high Boost or replenishment pressure too low Replenishment flow too small for dynamic conditions
	Misaligned shaft	Faulty installation Distortion in mounting Axial interference Faulty coupling Excessive overhung loads
	Mechanical fault in pump	Piston and shoe looseness or failure Bearing failure Incorrect port plate selection or index Eroded or worn parts in the displacement control
Erosion on barrel ports and port plate	Air in fluid	See above
	Cavitation	See above
High wear in motor	Excessive loads	Reduce pressure settings Reduce speeds
	Contaminant particles in fluid	Improper filter maintenance Filters too coarse Introduction of dirty fluid to system Reservoir openings Reservoir breather Improper line replacement
	Improper fluid	Fluid too thin or thick for operating temperature range Breakdown of fluid with time/temperature/shearing effects Incorrect additives in new fluid Destruction of additive effectiveness with chemical aging
	Improper repair	Incorrect parts Incorrect procedures, dimensions, finishes
	Unwanted water in fluid	Condensation Faulty breather, strainer Heat exchanger leakage Faulty clean-up practice Water in make-up fluid

**TABLE II
TROUBLESHOOTING CHART (continued)**

EFFECT OF TROUBLE	POSSIBLE CAUSE	FAULT WHICH NEEDS REMEDY
Pressure shocks	Cogging load Worn relief valve	Mechanical considerations Needed repairs
	Servo pressure too low to maintain firm control	Increase pressure and check pressure drop through servo filter
	Excessive line capacitance (line volume, line stretch, accumulator effects)	Reduce line size or lengths. Eliminate hose.
	Barrel blow-off	Re-check pump hold-down, rotating group, drain pressure
Heating of fluid	Excessive motor leakage	Re-check case drain flow and repair as required Fluid too thin Improper assembly, port timing
	Relief valve	Set too low (compared to load or to compensator) Instability caused by back pressure, worn parts
	Heat exchanger	Water turned off or too little flow Water too hot Fan clogged or restricted Efficiency reduced by mud or scale deposits Intermittent hydraulic fluid flow
	Reservoir	Too little fluid Entrained air in fluid Improper baffles Insulating air blanket that prevents heat rejection Heat pick-up from adjacent equipment

REWORK LIMITS OF WEAR PARTS

11 and 14 in.3	Original Dimension	Max. Rework From Original Dimension	Min. Dimension After Rework
Port plate face	.725/.715"	.010"	.705"
Cylinder barrel face	5.880"	.010"	5.870"
Shoe retainer face	.438/.437"	.005"	.432"
Piston shoe face (pocket)	.020"	.010"	.010"
Creep plate face	.251/.250"	.010"	.240"
Face plate		None	Replace

UNIT DISASSEMBLY

The instructions contained in this section cover complete disassembly of the Denison Goldcup 11 and 14 motors. Disassemble only as far as necessary to replace or repair any worn parts. A clean bench or similar surface capable of supporting unit should be used. After disassembly, internal parts should be coated with a film of clean oil and protected from dirt and moisture. Excessive handling will cause parts to rust and should be avoided.

CONTROLS (Figure 9)

1. Remove the four screws (15) from the side cover (17) and remove the input shear seal valve assembly.
2. Remove the four screws (15) from the remaining side cover (16) and remove the counter balance shear seal assembly.
3. Remove the two screws (13) and spacers (12). Remove the balance plate (11).
4. Remove the two screws (10) and balance stem (9).

BARREL HOLD-DOWN (Figure 8)

1. Remove retaining ring (3), end cover (5) and O-ring (4).
2. Remove cotter pin (6), hold-down nut (7), thrust washers (10), bearing (9) and seal ring (8).

PORT BLOCK (Figure 7)

1. Remove four screws (1) that secure the port block (2) to the housing (6).
2. Remove port block, gasket (5), port plate (4) and port plate pins (3).

CAUTION: The port plate may cling to the barrel face because of oil film. Do not allow the port plate to fall and become damaged.

SHUTTLE VALVE (Figure 9)

1. Remove the screws (20) that secure the shuttle valve (18) to the port block.
2. Remove the shuttle valve and O-rings (19) from the port block. The valve is a complete assembly and should not be disassembled.

BARREL AND HOLD-DOWN SHAFT (Figure 6)

1. Remove the face plate (2) and face plate pins (1) from face of the barrel assembly.
2. Remove barrel assembly by grasping hold-down shaft and lifting entire assembly from the housing.

DRIVE SHAFT (Figure 9)

1. Remove four screws (8), gaskets (7), seal retainer (6), gasket (5), seal stop (4a), and stationary part of shaft seal assembly (4). Refer to view of item 4.
2. Remove the carbon ring and the remainder of the shaft seal from the shaft.
3. Remove retaining ring (3), shaft and bearing assembly (1) and shim (2) if used.

HOUSING (Figure 6)

1. After removal of the shaft and bearing assembly, position the unit so that it rests on the mounting flange.
2. Push the ends of pressure feed tubes away from the housing so as not to bend or damage them.
3. Lift the housing from the mounting flange. Remove the gasket and dowel pins. Mounting flange must be driven off housing.

NOTE: Do not remove the roll pins or bearing from the housing unless bearing is damaged and replacement is necessary.

ROCKER CAM AND CONTROL STROKING ASSEMBLY (Figure 4)

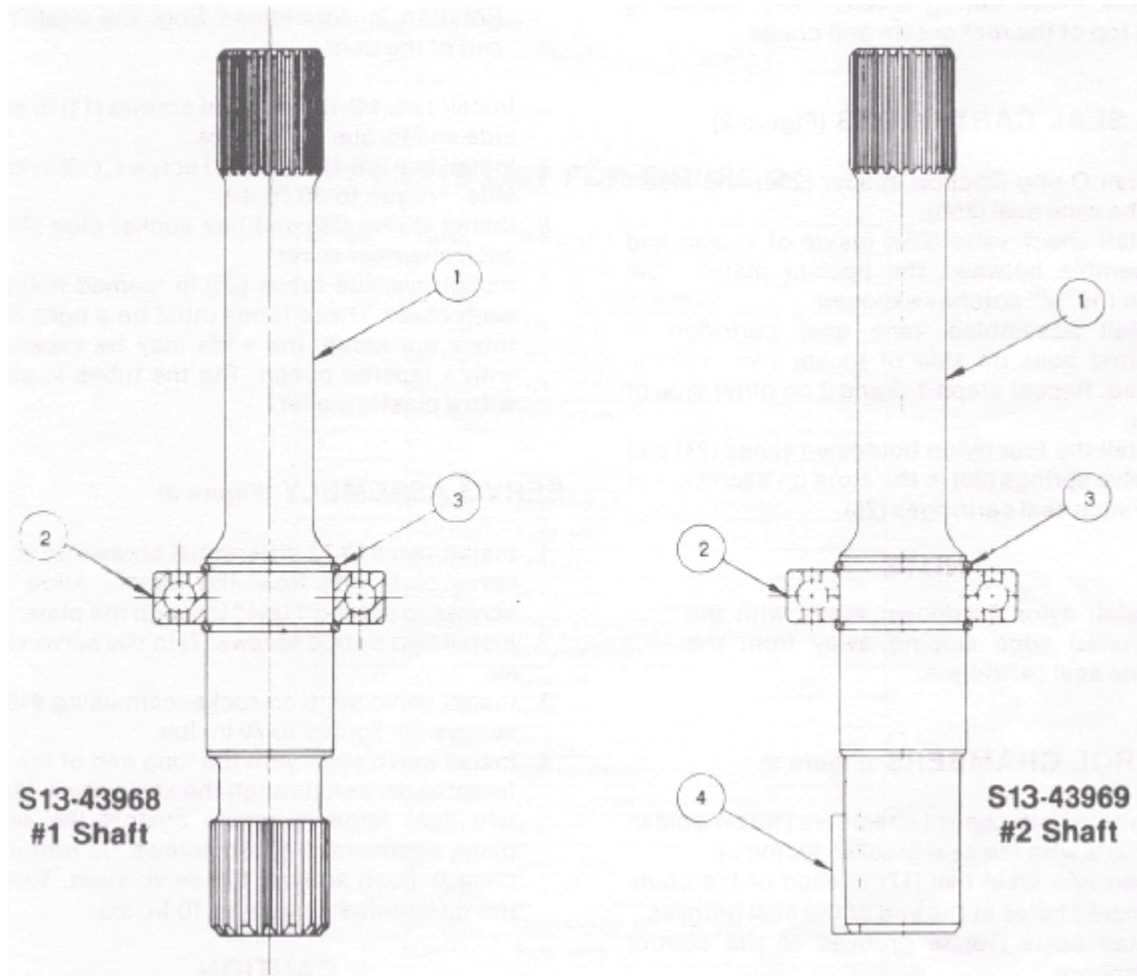
1. Remove pressure feed tubes (5 and 6) from the cradle. **DO NOT BEND THESE LINES.**
2. Remove the assembly from the mounting flange and position on a clean surface with the override tubes (2) in a horizontal position and located at the top.
3. Mark the cam (24) and cradle (20) as indicated in Figure 2. These marks will determine positioning of parts during reassembly.
4. Position the assembly in an upright position on the flat surface of the cradle (see Figure 2).
5. Remove the retaining ring (1), thrust washer (2), flange bearing (3), piston and shoe assembly (4) and creep plate (5) from the rocker cam (22).
6. Remove the two differential screws (9) from the rocker cam and remove the servo input parts (6, 7, 8 and 10).

CAUTION: Differential screws must be alternately removed one turn at a time.

7. Remove the four 1/2" screws (11) and four 3/8" screws (13) from the control chamber covers (14R and 14L).
8. Remove the control chambers (16). Remove the seals (18), four steel balls (17) and dowel pins (15).
9. Remove the vane seal cartridges (25), hold-down vanes (24) and springs (23) from the rocker cam (22).
10. Remove the rocker cam from the cradle (19).

DRIVE SHAFT ASSEMBLY

Figure 1



1. Pass one retaining ring (3) over the internal end of drive shaft (1) and install in the groove near the shaft seal surface. **DO NOT PASS THE RING OVER THE SEAL SURFACE.**
2. Slide the bearing (2) over the same end of the shaft and seat against the ring. *Support only the inner race of the bearing and press on the coupling end of the shaft.* **DO NOT USE EXCESSIVE FORCE AND DISTORT OR DAMAGE THE RETAINING RING.**
3. Install the other retaining ring (3) in the remaining ring groove. Be sure that both rings are fully seated.

PARTS LIST FOR FIGURE 1

S13-43968 #1 Drive Shaft Assembly (Splined)
 S13-43969 #2 Drive Shaft Assembly (W/Keyway)

Item	Qty.		Part Number	Description
	#1	#2		
1	1	--	033-71604	#1 (Splined) Drive Shaft
	--	1	033-71601	#2 (W/7/16/KW) Drive Shaft
2	1	1	230-82148	Shaft bearing MRC 110 KS
3	2	2	033-71641	Retaining Ring
4	--	1	033-71514	Square Key 7/15 x 1-1/2

ROCKER CAM ASSEMBLY *(Figure 2)*

1. Position the rocker cradle (19) on a clean surface with the large flat side down.
2. Lightly oil curved surface of cradle. Position the rocker cam (22) on the cradle. Note the marks made during disassembly indicating the top of the rocker cam and cradle.

VANE SEAL CARTRIDGES *(Figure 2)*

1. Install O-ring (25c) on spacer (25d) and insert in the vane seal (25b).
2. Install check valve (25e) inside of spacer and assemble between the backup plates (25a) with the "V" notches exposed.
3. Install assembled vane seal cartridge in slotted boss on side of rocker cam as indicated. Repeat steps 1, 2 and 3 on the other side of cam.
4. Install the four nylon holddown vanes (24) and twelve springs (23) in the slots on each side of the vane seal cartridges (25).

NOTE: Install nylon holddown vanes with the beveled edge sloping away from the vane seal cartridges.

CONTROL CHAMBERS *(Figure 2)*

1. Position both control chambers (16) on a clean surface with the seal grooves facing up.
2. Insert one steel ball (17) in each of the counter-bored holes at the end of the seal grooves.
3. Install seals (18) in grooves of the control chambers.

NOTE: The tapered side of the seals must be pushed into the grooves and the ends must cover the steel balls.

4. Install the assembled control chambers (16) over the vane seal cartridges by rotating the chambers until they slip over the vane seal cartridges, then rotate in the opposite direction until the 3/8" dowel pin holes in the chambers align with the dowel pin holes in the rocker cradle (19). Install dowel pins (15) through the control chambers and into the cradle.
5. Install chamber covers (14R) and (14L) on the control chambers (16). The covers must be installed with the override tube (26) holes at the top. Note the marks made during disassembly to indicate the top of rocker cam and cradle.

NOTE: Two sets of control chamber covers are available. The set marked CW must be installed in the right hand rotation pump and the set marked CCW must be installed in the left hand rotation pump. Rotation is determined from the shaft end of the unit.

6. Install two 1/2-13 hex head screws (11) in each side and torque to 75 ft.-lbs.
7. Install two 3/8-16 hex head screws, (13) in each side. Torque to 30 ft.-lbs.
8. Install O-ring (20) and hex socket plug (21) in each chamber cover.
9. Install override tubes (26) in reamed holes in each cover. These tubes must be a tight fit. If tubes are loose, the ends may be expanded with a tapered punch. Tap the tubes in place with a plastic mallet.

SERVO ASSEMBLY (Figure 2)

1. Install two #10-32 differential screws (9) in the servo plate (10) from the inside. Allow the screws to extend 11/64" through the plate.
2. Install two orifice screws (7) in the servo stem (6).
3. Install servo stem on rocker cam using #10-32 screws (8). Torque to 70 in. lbs.
4. Install servo plate with the long end of the differential screws through the servo stem. Maintain light finger pressure against the servo plate, alternately tighten screws 1/2 turn until plate is flush against the servo stem. Torque the differential screws to 10 in.-lbs.

CAUTION: When tightened, screws must be .03-.10" below surface of servo plate.

NOTE: Install the servo stem and plate on the rocker cam input side. (9 o'clock position on "B" suffix models, 3 o'clock position on "A" suffix models). Refer to control location column of series model code.

PISTON AND SHOE ASSEMBLY (Figure 2)

1. Install creep plate (5) over center post of rocker cam (22).
2. Insert pistons and shoes into retainer and install entire assembly (4) against creep plate.
3. Install flange bearing (3) and thrust washer (2) over center post of cam and against shoe retainer.
4. Install the thickest retaining ring (1) that will fit in the groove on the rocker cam center post which will allow a maximum clearance of .002-.004" between the creep plate and shoe faces. There are four different retaining rings available for this tolerance. Each retaining ring is marked: .102/.101 thick, blue dot; .104/.103 thick, red dot; .106/.105 thick, green dot; and .108/.107 thick, yellow dot. The piston and shoe assembly must be free to move by hand. (5 ft./lbs. or less.)

ASSEMBLY PROCEDURES

PARTS LIST FOR FIGURE 2

No.	Qty.	Part No.	Description
1	1		Retaining ring – use one only
		033-71556	107 – 108 thick w/yellow dot
		033-71557	105-106 thick w/green dot
		033-71558	103-104 thick w/red dot
		033-71559	101-102 thick w/blue doe
2	1	033-71565	Thrust washer
3	1	033-71563	Bearing
4	1	S13-48761	Piston shoe & retainer assy. M11 only
		S13-48760	Piston shoe & retainer assy. M14 only
5	1	033-71569	Creep plate
6	1	033-71596	Servo stem
7	2	033-20641	Orifice screw
8	2	359-09240	Socket head cap screw
9	2	033-71651	Differential screw
10	1	033-70548	Servo plate
11	4	306-40189	Hex head screw 1/2-13 x 3
13	4	306-40140	Hex head screw 3/8-16x2-3/4
**14R	1	033-71598	Right side chamber cover C. W. rotation
**14L	1	033-71597	Left side chamber cover C.W. rotation
15	4	324-22428	Dowel pin
16	2	033-71615	Control chamber
17	4	201-06001	Steel ball
18	2	606-25040	Control chamber seal
19	1	033-71582	Rocker cradle
20	2	691-00905	O-ring
21	2	488-35020	Hex socket plug
22	1	033-71580	Rocker cam
23	12	033-72233	Vane hold-down spring
24	4	033-72234	Hold-down vane
25	2	See below	Vane seal cartridge
25a	4	033-71608	Vane seal back-up plate
25b	2	033-71611	Vane seal
25c	2	691-00125	O-ring
25d	2	033-71607	Vane spacer
25e	2	033-70803	Check valve
26	2	033-71609	Override tube
27	4	447-00017	Lee plug

Items 6 through 24 can be ordered as a complete rocker cam & stroking assembly.
S13-43958 is for clockwise rotation motors with "B" suffix (input control on right side)

*Newer model motors don't require screws #12

**Newer chamber covers are not drilled for use of screw #12.

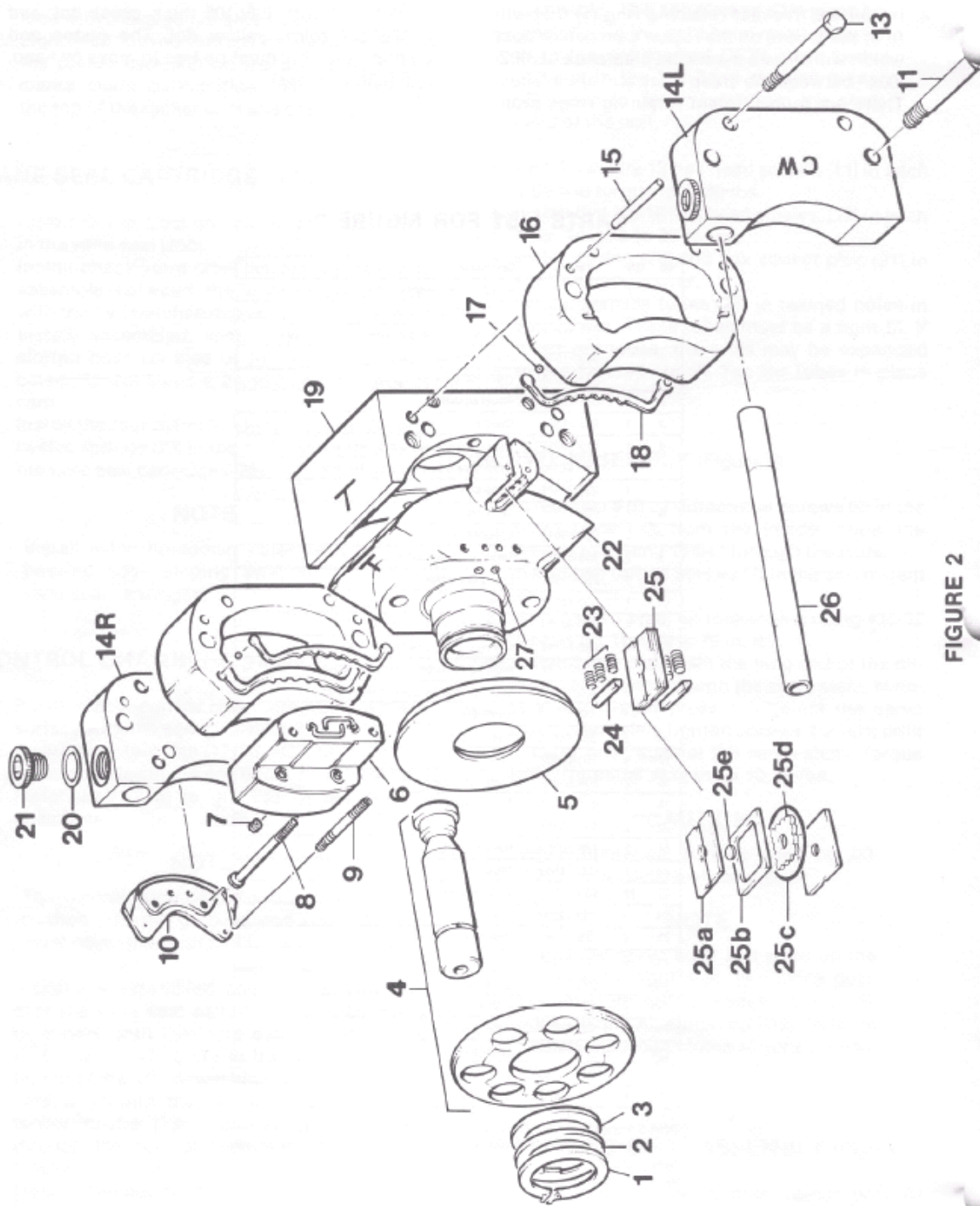


FIGURE 2

BARREL AND HOLD-DOWN SHAFT ASSEMBLY (Figure 3)

1. Position the barrel (1) with the bores facing down on a clean surface.
2. Install hold-down spring (3) into barrel counter-bore.
3. Install spring retainer (5) into counter-bore and seat against spring.
4. Install retaining ring (6) into barrel counter-bore groove. Make sure retaining ring is fully seated in groove.
5. Position barrel stop (4) over hold-down shaft (2). Turn barrel on side and install shaft and barrel stop through barrel spline and hold-down spring.

PARTS LIST FOR FIGURE 3

No.	Qty.		Part Number	Description
	M11	M14		
1	1	--	S13-45381	Barrel & sleeve assy. M11 only
	--	1	S13-43965	Barrel & sleeve assy. M14 only
2	1	1	033-71573	Hold-down shaft
3	1	1	033-71562	Hold-down spring
4	1	1	033-71561	Barrel stop
5	1	1	033-71560	Spring retainer
6	1	1	033-71564	Retaining ring

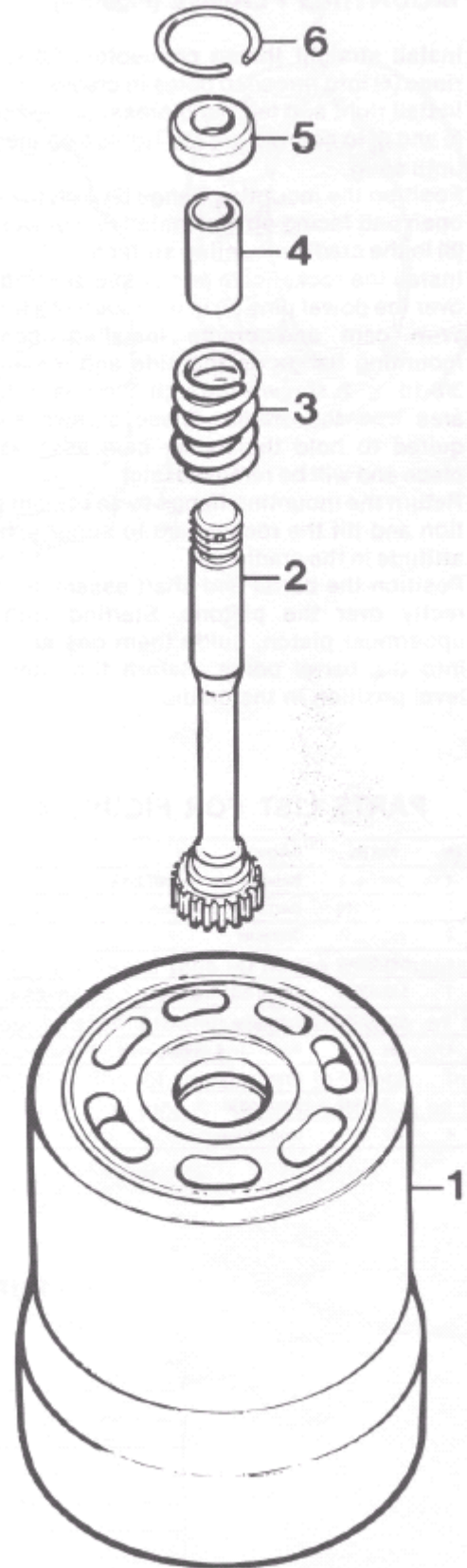
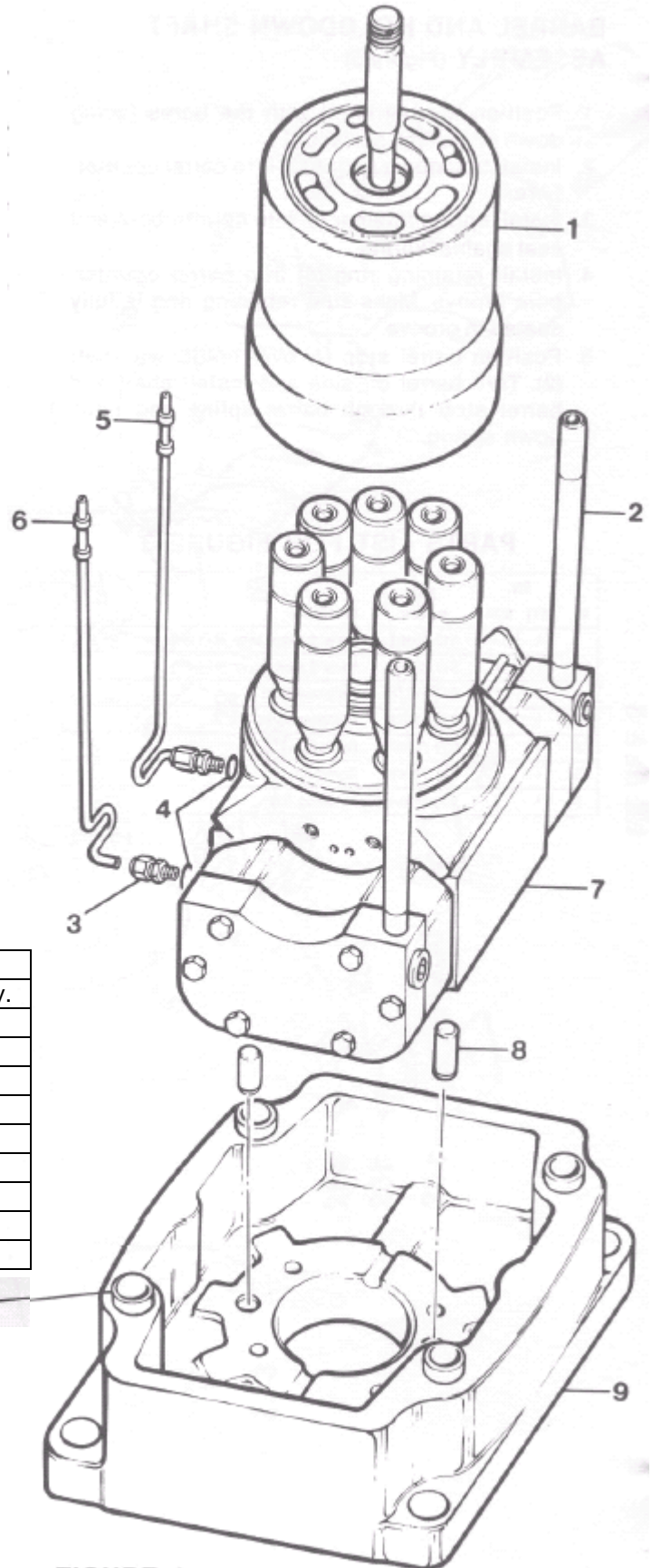


FIGURE 3

BARREL AND STROKING ASSEMBLY TO MOUNTING FLANGE (Figure 4)

1. Install straight thread connectors (3) and O-rings (4) into threaded holes in cradle.
2. Install right and left hand pressure feed tubes (5 and 6) to connectors (3). Tighten connectors until snug.
3. Position the mounting flange (9) with the large open end facing up and install two dowel pins (8) in the cradle mounting surface.
4. Install the rocker cam and cradle assembly (7) over the dowel pins (8) in the mounting flange.
5. With cam and cradle installed, position mounting flange on the side and install two 3/8-16 x 2 screws through the seal retainer area into the cradle. The screws are required to hold the rocker cam assembly in place and will be removed later.
6. Return the mounting flange to an upright position and tilt the rocker cam to either extreme attitude in the cradle.
7. Position the barrel and shaft assembly (1) directly over the pistons. Starting with the uppermost piston, guide them one at a time into the barrel bores. Return the cam to a level position in the cradle.



PARTS LIST FOR FIGURE 4

No.	Qty.	Part No.	Description
1	1	See Fig. 3	Barrel & hold-down shaft assy.
2	2	033-71609	Override pressure tubes
3	2	492-15265	Connector
4	2	691-00902	O-ring
5	1	S13-43967	Tubing assy. (right side)
6	1	S13-43966	Tubing assy. (left side)
7	1	See Fig. 2	Rocker cam & stroking assy.
8	2	324-23216	Dowel pin
9	1	033-71546	Mounting flange
10	4	033-72664	Locating sleeve

FIGURE 4

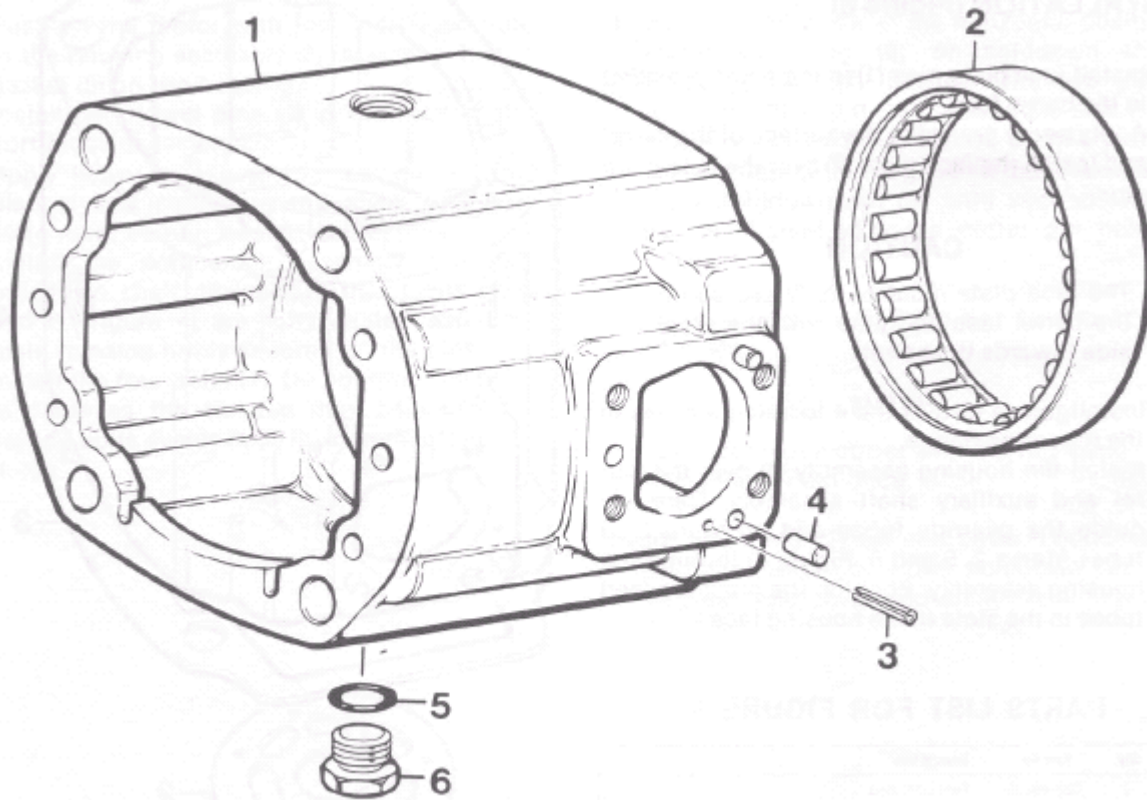


FIGURE 5

**S13-43962
HOUSING ASSEMBLY (Figure 5)**

1. Position housing (1) on a flat surface with the large open end up.
2. Press the bearing (2) into the housing bore until seated. **DO NOT HAMMER OR BEAT BEARING INTO PLACE.**
3. Position housing on side and install roll pin (3) through hole in control cover pad. Roll pin must be installed 3/8" below pad surface. Install two dowel pins (4) in the blind holes in the same pad.
4. Repeat step 3 on the opposite side of the housing.
5. Install O-ring (5) and plug (6) in the bottom of housing. Roll pins (3) are in the bottom half of the housing.

**PARTS LIST FOR FIGURE 5
Housing Assembly S13-43962**

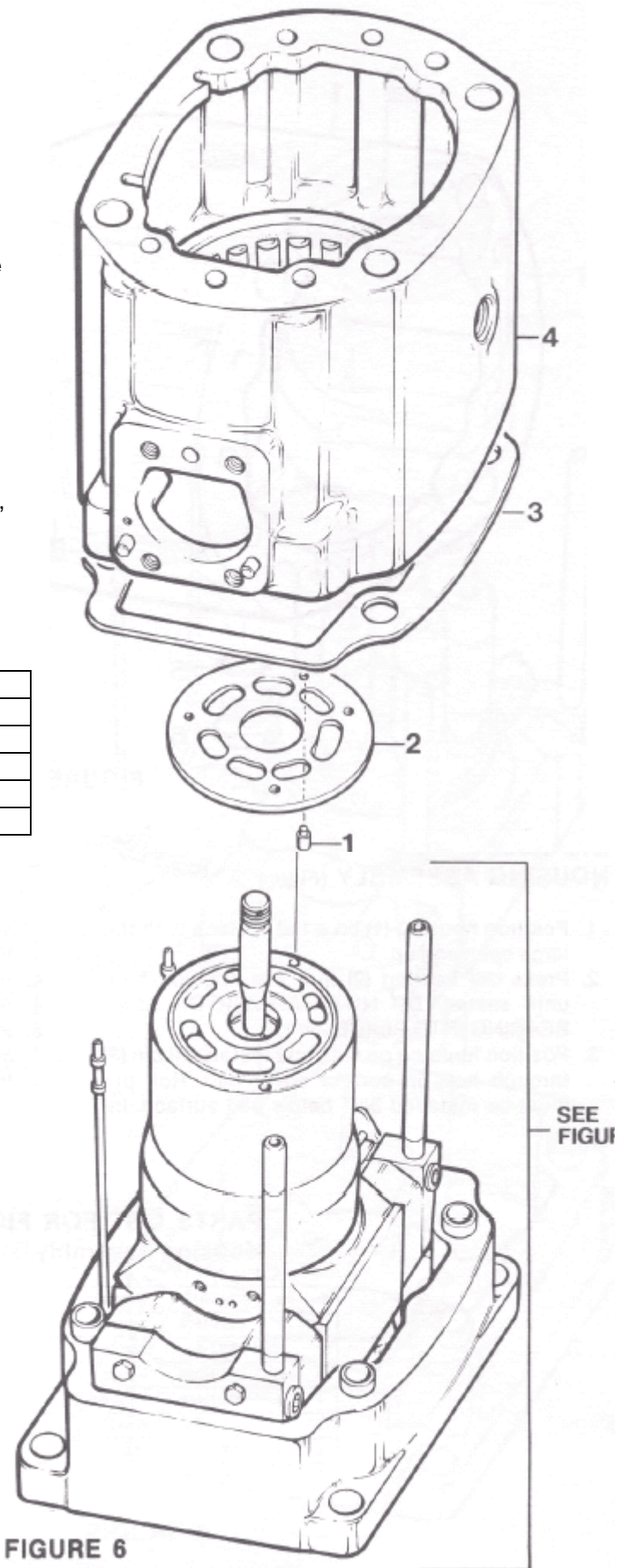
No.	Qty.	Part No.	Description
1	1	033-71578	Housing
2	1	033-71516	Bearing
3	2	325-16320	Roll pin
4	4	324-21608	Dowel pin
5	2	691-00912	O-ring
6	2	488-35014	Plug

HOUSING ASSEMBLY INSTALLATION (Figure 6)

1. Install face plate pins (1) in the holes provided in the barrel face.
2. Apply heavy grease to the surface of the barrel and install the face plate (2) over the face plate pins.

CAUTION: The face plate must be fully seated on the barrel face and pins with the steel side towards the barrel.

3. Install gasket (3) over the 4 locating sleeves in the mounting flange.
4. Install the housing assembly (4) over the barrel and auxiliary shaft assembly. Carefully guide the override tubes and pressure feed tubes (items 2,5 and 6, Figure 4) through the housing assembly. Position the pressure feed tubes in the slots in the housing face.



PARTS LIST FOR FIGURE 6

No.	Qty.	Part No.	Description
1	2	033-49825	Face plate pins
2	1	033-71921	Barrel face plate M11 only
	1	033-71575	Barrel face plate M14 only
3	1	033-71602	Housing gasket
4	1	S13-43962	Housing assembly

ASSEMBLY PROCEDURES

PORT BLOCK INSTALLATION *(Figure 7)*

1. Position the motor with the unplugged hole in the housing assembly (6) facing up. Install gasket (5) on the housing.
2. Install two dowel pins (3) in the face of the port block assembly (2).
3. Apply heavy grease to the rear of the port plate (4) and install over the dowel pins. Port plate must be fully seated on the pins.
4. Install the port block assembly over the hold-down shaft. Make sure that tubes (2, 5 and 6, Figure 4) are fully seated and port plate remains firmly secured on the pins.
5. Install the four bolts (1). Do not drop the bolts in place as the threads may be damaged. Torque bolts evenly in 50 lb. increments to 350 ft.-lbs.

BARREL HOLD-DOWN *(Figure 8)*

1. Position the motor in the horizontal position.
2. Install seal ring (6) on hold-down shaft. Place bearing (7) between the two thrust washers (8) and install around the seal ring.
3. Install hold-down nut (4) on auxiliary shaft and tighten until snug (10 ft.-lbs. maximum). Back hold-down nut off until second slot in nut is aligned with the cotter pin hole in shaft.
4. Install cotter pin (5) through hold-down nut and auxiliary shaft. Bend one tang over end of shaft.

NOTE: DO NOT RE-USE COTTER PIN. DO NOT BEND TANG OVER MORE THAN ONCE.

5. Install O-ring (2) on end cover. Lubricate O-ring and install cover over hold-down nut.
6. Depress end cover and install retaining ring (1)

PARTS LIST FOR FIGURE 7

No.	Qty.	Part No.	Description
1	4	306-40112	Hex head cap screw
2	1	033-71521	Port block
3	2	324-21610	Dowel pin
4	1	033-71916	Port plate M11 only
	1	033-71551	Port plate M14 only
5	1	033-71579	Port block gasket
6	1	488-35041	Plug
7	1	691-00906	O-ring
8	4	488-35001	Plug
9	4	691-00904	O-ring

PARTS LIST FOR FIGURE 8

No.	Qty.	Part No.	Description
1	1	356-65095	Retaining ring
2	1	671-00138	O-ring
3	1	033-70537	End cover
4	1	033-72026	Hold-down nut
5	1	322-03324	Cotter pin
6	1	033-72101	Seat ring
7	1	230-82164	Thrust bearing
8	2	350-10081	Thrust washer

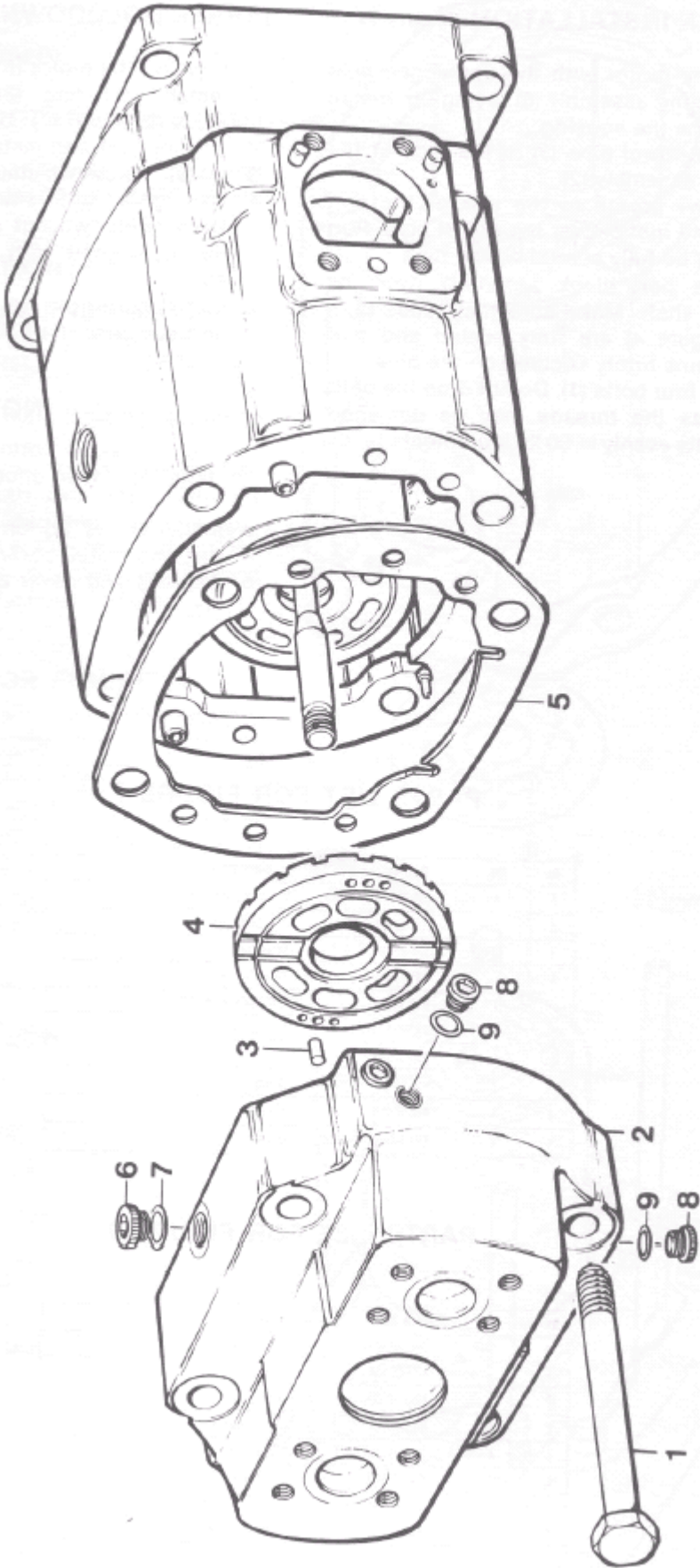


FIGURE 7

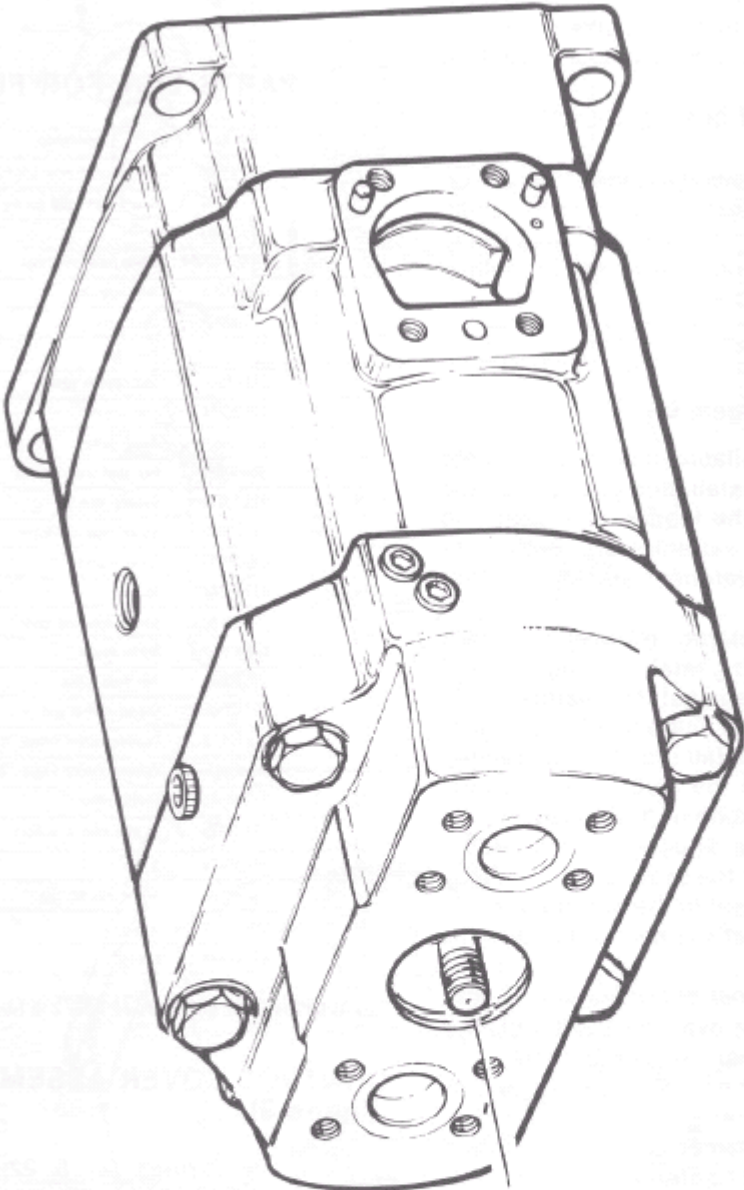
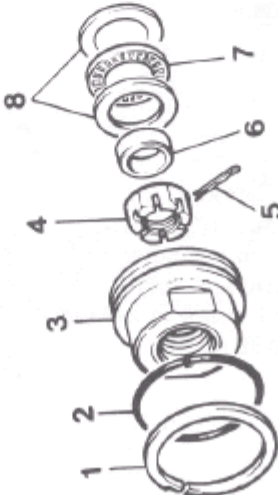


FIGURE 8



SHAFT ASSEMBLY INSTALLATION *(Figure 9)*

1. Position motor in horizontal position. Remove the two screws that were temporarily used to hold the cradle in the mounting flange.
2. Install the shaft and bearing assembly (1) in the mounting flange.
3. For a rigid shaft application use the shim (2) that results in the least clearance around the shaft bearing. Do not use a shim with a floating shaft.
4. Install the retaining ring (3) in the mounting flange.

SEAL ASSEMBLY *(Figure 9)*

1. The shaft seal is available only as a complete assembly. Prior to installation, examine all the seal parts. Handle the lapped seal seat and the carbon ring with extreme care. Both parts must be free of scratches, cracks or other damage.
2. Install the spring retainer (e) over the shaft and against the bearing retaining ring.
3. Install the spring (d) against the retainer.
4. Apply oil to the inner surface of the rubber friction ring (f) and install the shell containing the friction ring and the carbon ring (c) over the shaft with the carbon ring exposed.
5. Apply grease to the square section rubber seal (a) and install on the seat (b).
6. Install the seal and seat in the seal retainer (6). The lapped surface of the seat must face the carbon ring.
7. Install the seal retainer assembly and gasket (5) and seal stop (4a) over the shaft with the lapped surface against the carbon face.
8. Place the gaskets (7) on the screws (8) and install in the seal retainer.
9. Depress the seal retainer only far enough to start the screws and tighten evenly in a crisscross pattern. Torque to 10 ft./lbs.

COUNTER BALANCE SERVO STEM ASSEMBLY *(Figure 9)*

1. Install balance stem (9) on rocker cam using two #10-32 screws (10). Torque to 70 in./lbs.
2. Place the two spacers (12) on the screws (13) and install through the balance plate (11).
3. Align screws with threaded holes in balance stem and tighten. Torque to 70 in./lbs.

ASSEMBLY PROCEDURES

PARTS LIST FOR FIGURE 9

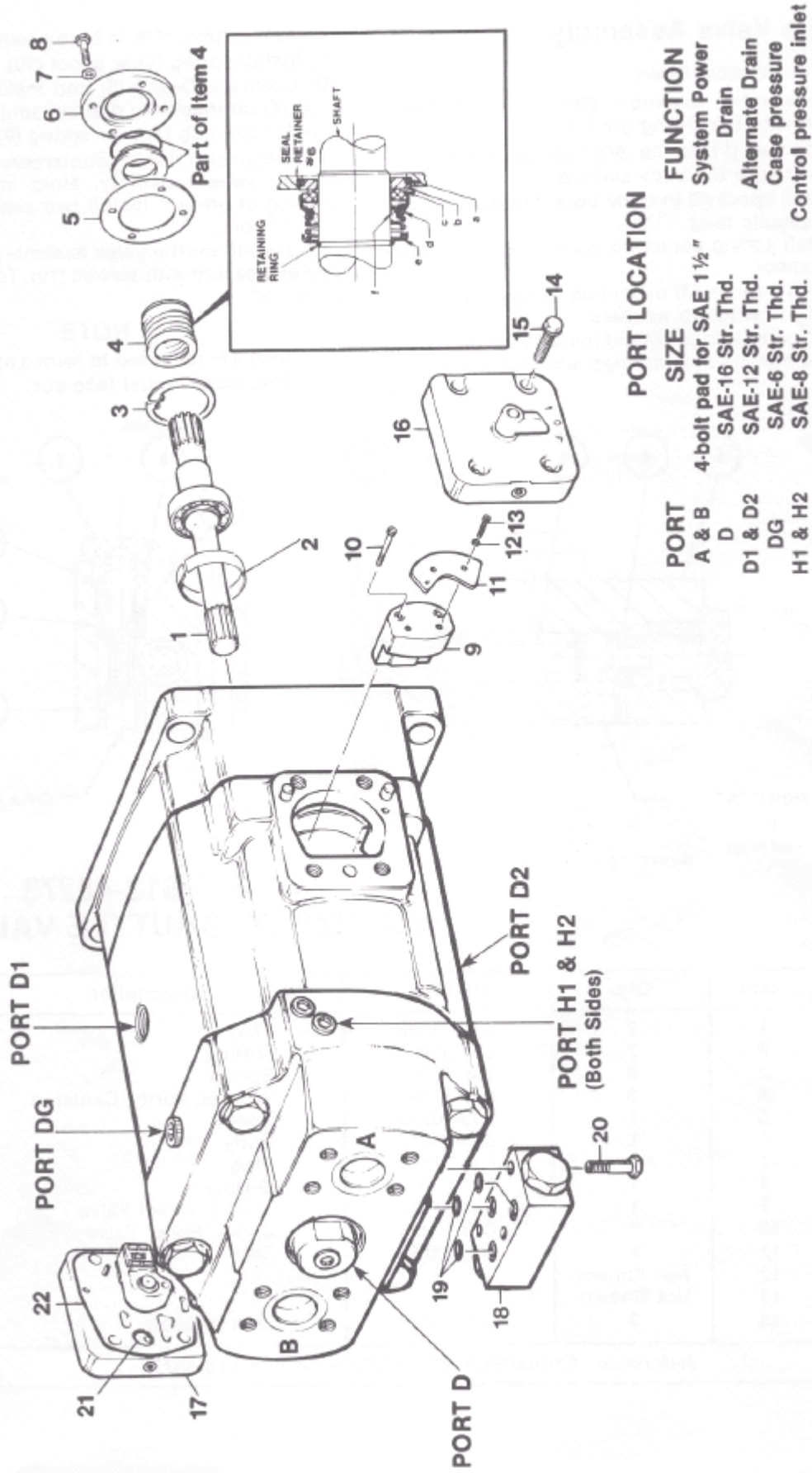
No.	Qty.	Part No.	Description
1	1	513-43968	Splined shaft assy. See fig. 1
	1	513-43696	Keyed shaft assy. See fig. 1
2	1	033-53983	
	1	Or 033-53984	Shim (use only one)
3	1	356-65013	Retaining ring
4	1	623-00008	Shaft seal
5	1	033-71567	Seal retainer gasket
6	1	033-71574	Seal retainer
7	4	631-45007	Nylite gasket
8	4	306-40021	Hex head tap screw
9	1	033-71616	Balance stem
10	2	359-09240	Socket head tap screw
11	1	033-70546	Balance plate
12	2	033-71247	Spacer
13	2	359-09180	Socket head cap screw
14	8	631-45007	Nylite washer
15	8	353-25081	Hex head screw
16	1	S13-42064	Output control assy.
17	1	S13-42072	Cylinder control (input "A" side)
	1	S13-42068	Cylinder control (input "B" side)
18	1	S13-48273	Shuttle valve
	1	S13-48776	Shuttle valve w/orifices
19	3	701-10016	O-ring
20	3	306-40106	Screw hex head cap
21	1	671-00017	O-ring*
22	1	671-00048	O-ring*

* Some controls use gasket #033-53575 in lieu of O-rings.

CONTROL COVER ASSEMBLIES (Figure 9)

1. Lubricate O-rings (21 & 22) and install in counter-bores and grooves in the covers (16 & 17).
2. Install the cover assemblies over the dowel pins on the housing pads and secure with seals (13) and screws (14). Torque to 30 ft.-lbs.

The input cover assembly must be installed on the right hand side of the housing on motors with "B" suffix. Install the output cover assembly on the right hand side on models with "A" suffix.



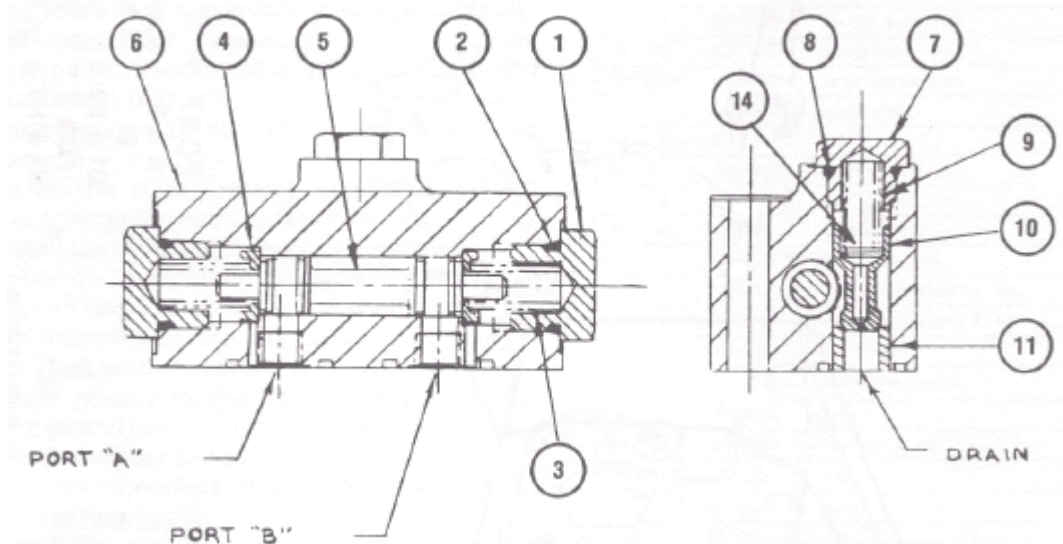
PORT	SIZE	PORT LOCATION	FUNCTION
A & B	4-bolt pad for SAE 1 1/2"		System Power
D	SAE-16 Str. Thd.		Drain
D1 & D2	SAE-12 Str. Thd.		Alternate Drain
DG	SAE-6 Str. Thd.		Case pressure
H1 & H2	SAE-8 Str. Thd.		Control pressure inlet

FIGURE 9

SHUTTLE VALVE ASSEMBLY
Internal Drain

1. Place valve assembly (20) in a horizontal position with the O-ring groove up.
2. Press seat (11) in the .500" diameter bore until it is flush with the body surface.
3. Install spool (5) in body bore. Lubricate parts with hydraulic fluid.
4. Install spring centering washer (4) over each end of spool.
5. Install springs (3) over ends of spool and into sockets of centering washers.
6. Lubricate O-rings (2) and install over plugs (1). Install the plugs over springs and into body.
7. Install spool (10) in bore against seat (11).
8. Install spring (9) in spool (10).
9. Lubricate O-ring (8) and install in groove of plug (7) on internally drained shuttle.
10. Install plug (7) over spring (9) and tighten.
11. Install seal (19) in counter-bore in the center of shuttle valve assembly. Hold in place with a coating of grease. Install two seals in remaining counter-bores.
12. Install shuttle valve assembly on port block pad and secure with screws (19). Torque screws to 20 ft.-lbs.

NOTE: Item 4 is recessed to form a spring seat. This recess must face out.



ASSEMBLY PROCEDURES

S13-48273 ASSEMBLY, SHUTTLE VALVE

Item	Qty.	Part No.	Description
1	2	488-35002	Plug
2	2	691-00908	O-ring
3	2	033-70515	Spring
4	2	033-70495	Washer, Spring Centered
5	1	033-70529	Spool
6	1	033-53117	Body
7	1	033-72129	Plug
8	1	691-00906	O-ring
9	1	033-71923	Spring, Relief Valve
10	1	033-71925	Spool, Relief Valve
11	1	033-53154	Seat
12	Not Shown		
13	Not Shown		
14	2	345-20004	Shim Washer
Reference – Orifice P/N 033-53523 for Shuttle S13-48776			

ORDERING CODE

Gold Cup motors										Model number sheet					
Example model code:															
	M	11	R		-2	N	1	*	-9A	5	-B	0	0	-B	0
Motor	M														
Displacement															
6.00 cu.in./rev. (98 cc/rev.)		6													
7.25 cu.in./rev. (119 cc/rev.)		7													
8.00 cu.in./rev. (131 cc/rev.)		8													
11.0 cu.in./rev. (180 cc/rev.)		11													
14.0 cu.in./rev. (229 cc/rev.)		14													
24.6 cu.in./rev. (403 cc/rev.)		24													
30.6 cu.in./rev. (501 cc/rev.)		30													
Type															
Fixed displacement			F												
Fixed displacement with shuttle package			G												
Fixed displacement with thru-drive			M												
Fixed displacement with thru-drive & shuttle package			N												
Variable displacement			V												
Variable displacement with shuttle package			H												
Variable displacement with thru-drive			R												
Variable displacement with thru-drive & shuttle package			L												
Efficiency															
High efficiency (for M24 only)			H												
Standard efficiency			leave blank												
Shaft															
Keyed SAE - mechanical shaft seal (single lip seal on M6/7/8F/GM/N)					-2 or -02										
Splined SAE - mechanical shaft seal (single lip seal on M6/7/8F/GM/N)					-3 or -03										
Keyed SAE-D (mounting & shaft) - mechanical shaft seal (for M6/7/8 only)(single lip seal on M6/7/8F/GM/N)					-4 or -04										
Splined SAE-D (mounting & shaft) - mechanical shaft seal (for M6/7/8 only)(single lip seal on M6/7/8F/GM/N)					-5 or -05										
Keyed SAE - double lip shaft seal					-7 or -07										
Splined SAE - double lip shaft seal					-8 or -08										
Keyed (long) SAE - double lip shaft seal					-9 or -09										
Keyed (long) SAE - mechanical shaft seal					-10										
Rotation															
Bi-directional						N									
Seals															
Nitrile (Buna N)															1
EPR (not available when using "5A" primary control)(pump will be unpainted unless otherwise specified)															4
Fluorocarbon (Viton)															5
Design letter (assigned by manufacturer)									*						
Primary controls															
None (for fixed displacement units only)															omit
Cylinder control w/ adjustable maximum volume stops															-2A
Cylinder control - 2 position electro-hydraulic w/ adjustable maximum volume stop (spring offset to maximum displacement)															-2M
Electro-hydraulic stroker w/ adjustable maximum volume stops															-5A
Hydraulic stroker w/ adjustable maximum volume stops (required for M 24/30 reverse compensator units)															-8A
Electro-hydraulic stroker w/ adjustable maximum volume stops															-9A
Secondary controls															
None (for fixed displacement units only)															omit
Volume indicator															0
Reverse compensator (spring offset to maximum displacement) + volume indicator															3
Reverse compensator (spring offset to minimum displacement) + volume indicator															5
Cam position feedback potentiometer															6
Cam position feedback RVDT (AC)															7
Cam position feedback RVDT (DC)															8
Reverse compensator (3) + cam position feedback potentiometer (6)															U
Reverse compensator (3) + cam position feedback RVDT (7)															V
Reverse compensator (3) + cam position feedback RVDT (8)															W
Reverse compensator (5) + cam position feedback potentiometer (6)															X
Reverse compensator (5) + cam position feedback RVDT (7)															Y
Reverse compensator (5) + cam position feedback RVDT (8)															Z

ORDERING CODE

Gold Cup motors										Model number sheet														
Example model code:										M	11	R		-2	N	1	*	-9A	5	-B	0	0	-B	0
Control location																								
None (for fixed displacement units only)										omit														
Primary control on port A side										-A														
Primary control on port B side										-B														
Control and displacement features																								
2M control																								
4D01 valve, 110VAC/60Hz with Hirschmann connector										0														
4D01 valve, 12VDC with Hirschmann connector										1														
4D01 valve, 240VAC/50Hz with Hirschmann connector										2														
4D01 valve, 110VAC/60Hz wiring box										3														
4D01 valve, 12VDC, wiring box										4														
Cetop3 (D03)(NG6) interface, no directional valve										5														
4D01 valve, 24VDC with Hirschmann connector										6														
4D01 valve, 110VAC/50Hz with Hirschmann connector										7														
5A control																								
with deadband										0														
without deadband										1														
8A control																								
75-250 psi (5-17 bar)										0														
250-450 psi (17-31 bar)										1														
9A control																								
24VDC										0														
12VDC										1														
All other controls										0														
Reduced displacement options for M^F, M^G, M^M, & M^N																								
Standard cam (19-degree)										0														
M6 with 17-degree cam (5.3 cu.in./rev. (87 cc/rev.))										1														
M7 with 17-degree cam (6.4 cu.in./rev. (105 cc/rev.))										1														
M8 with 17-degree cam (7.1 cu.in./rev. (116 cc/rev.))										1														
M6 with 15-degree cam (4.6 cu.in./rev. (76 cc/rev.))										2														
M7 with 15-degree cam (5.6 cu.in./rev. (92 cc/rev.))										2														
M8 with 15-degree cam (6.2 cu.in./rev. (102 cc/rev.))										2														
M6 with 13-degree cam (4.0 cu.in./rev. (66 cc/rev.))										3														
M7 with 13-degree cam (4.8 cu.in./rev. (79 cc/rev.))										3														
M8 with 13-degree cam (5.3 cu.in./rev. (88 cc/rev.))										3														
M11 with 17-degree cam (9.7 cu.in./rev. (160 cc/rev.))										1														
M14 with 17-degree cam (12.5 cu.in./rev. (205 cc/rev.))										1														
M11 with 15-degree cam (8.5 cu.in./rev. (140 cc/rev.))										2														
M14 with 15-degree cam (10.9 cu.in./rev. (179 cc/rev.))										2														
M24 with 17-degree cam (22.0 cu.in./rev. (360 cc/rev.))										1														
M30 with 17-degree cam (27.2 cu.in./rev. (446 cc/rev.))										1														
Shuttle valve features																								
without orifices										0 (omit for M ^F /M ^V /R units)														
with orifices										2														
External drive																								
None (for M ^F /G ^V /H units only)										omit														
SAE-A (SAE 82-2)(for M6/7/8/11/14M/N/R/L units only)										-A														
SAE-B (SAE 101-2 for M6/7/8M/N/R/L)(SAE 101-2 & SAE 101-4 for M11/14/24/30M/N/R/L)										-B														
SAE-C (SAE 127-2 for M6/7/8M/N/R/L)(SAE 127-2 & SAE 127-4 for M11/14/24/30M/N/R/L)										-C														
SAE-D (SAE 152-4)(for M11/14/24/30M/N/R/L units only)										-D														
SAE-E (SAE 165-4)(for M11/14/24/30M/N/R/L units only)										-E														
SAE-F (SAE 177-4)(for M24/30M/N/R/L units only)										-F														
External mounting																								
No external motor mounted										0														
External motor mounted (requires special modification "-M2")(must be separately specified)										1														
Special modification																								
None										omit														
No paint										-NP														
Other special modification (example: bronze caged barrel bearing for low viscosity fluids, tandem motors, etc.)										-M2														

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