

Abex

DENISON

SERVICE LITERATURE

Axial Piston Motor, Constant Displacement

**GOLDCUP SERIES M6-MODEL C
GOLDCUP SERIES M7-MODEL A**

INSTALLATION AND OVERHAUL INSTRUCTIONS

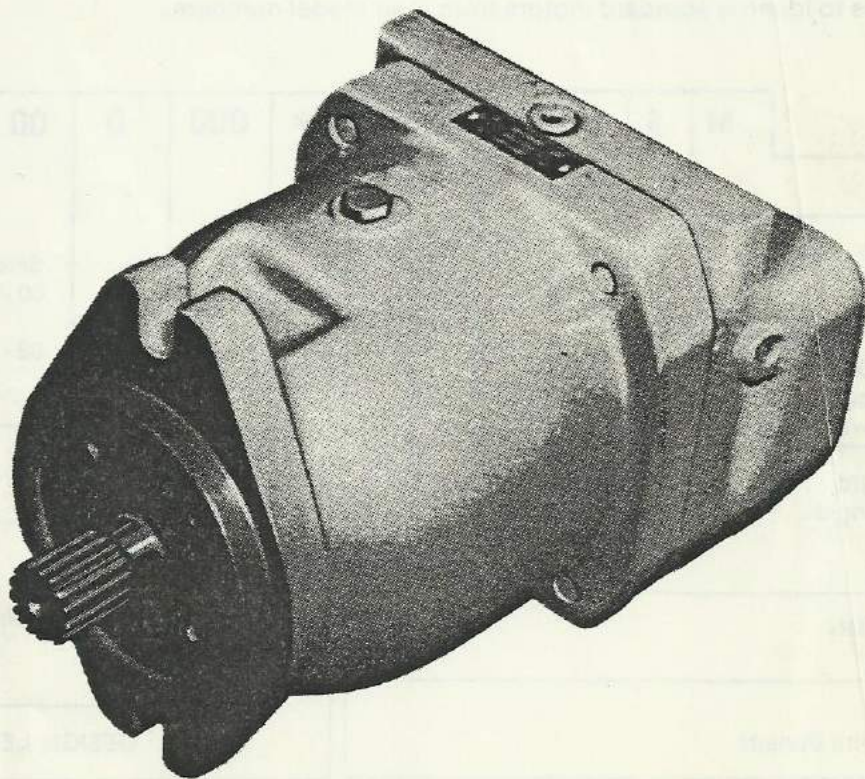


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SEAL KITS

Shaft Seal.....	S13-44302
Seal Kit.....	S13-44303

Series Model Code

Use these codes to identify standard motors from their Model numbers.

MOTORS

	M	6	G	-1	N	1	*	000	0	00
MOTOR										
DISPLACEMENT, max 6 - 6 in ³ /rev 7 - 7.25 in ³ /rev										
CONFIGURATION F - Fixed displacement G - Fixed displ. with valve pkg										
SHAFT SAE-C Std 1 - Splined, non-rigid 2 - Keyed, rigid 3 - Splined, rigid										
SHAFT ROTATION N - Bi-directional										
FLUID CLASS 1 - Compatible with Buna-N										
									SHUTTLE VALVE 00 - Internal drain 02 - Two .078 orifices int. drain (omit) - Fixed displ.	
									(omit) - Fixed displ.	
									DESIGN LETTER - Assigned by mfr	

Denotes change

SECTION I INTRODUCTION

General

This manual contains installation, operation, maintenance and overhaul instructions for Abex/Denison Gold Cup 6 and Gold Cup 7 constant volume motors.

Description

The Gold Cup motor is a fixed displacement, axial piston design which uses hydrostatically balanced piston shoes. This feature serves to lubricate as well as absorb much of the force generated by the shoes pressing against the cam, thereby increasing service life of the unit. Rotation of the unit is bi-directional.

TABLE I TYPICAL CHARACTERISTICS

Specification	Term	Gold Cup 6	Gold Cup 7
Displacement at max angle	in ³ /rev	6.00	7.25
Pressure ports A or B max contin. Intermittent (not to exceed 6 sec/min)	psi psi	5000 6000	5000 6000
Mounting Standard, SAE 2-bolt Fluid connections, ports A & B 4 bolt pad for 6000 psi split flange		SAE-C SAE-1-1/2"	SAE-C SAE-1-1/2"
Speed, max continuous at full displ.	rpm	3000	3000
Flow, theor. max at 100 rpm at 3000 rpm	gpm gpm	2.6 77.9	3.14 94.2
Torque, theor. max per 100 psi max at 5000 psi max at 6000 psi	in# in# in#	95.5 4777 5729	115.4 5769 6923
Power, theor. max at 5000 psi per 100 rpm at 3000 rpm	HP HP	7.57 227	9.15 274.3
Efficiency torque approx. stalled running	% theo	81 93	81 93
Weight, pkg. motor, fixed displ	lbs.	105	105

SECTION II INSTALLATION

Mounting

This motor is designed to operate in any position. The mounting hub and two bolt mounting flange are in full conformance with SAE standard. The motor shaft must be in alignment with the shaft of the driven load and should be checked with a dial indicator. The mounting pad or adaptor into which the fluid motor pilots must be concentric with the motor shaft within 0.010 TIR to prevent bearing failure. This concentricity is particularly important if the fluid motor shaft is rigidly connected to the driven load without a flexible coupling.

Piping

Connect inlet and outlet lines to the port block of the motor. It is recommended that the case leakage line be connected to the top of the motor, but it may be connected to the bottom or to the port block between the inlet and outlet ports. The case leakage line must be of sufficient size to prevent back pressure in excess of 75 PSI and returned to the reservoir below the surface of the oil as far from the supply suction as possible. All fluid lines, whether pipe, tubing or hose must be adequate size and strength to assure free flow through the motor. An undersize inlet line will prevent the motor from reaching full speed and torque. An undersize outlet line will create back pressure in the motor and cause improper operation. Flexible hose lines are recommended. If rigid piping is used, the workmanship must be accurate to eliminate strain on the motor port block or to the fluid connections. Sharp bends in the lines must be eliminated wherever possible. All system piping must be cleaned with solvent or equivalent before installing motor. Make sure the entire hydraulic system is free of dirt, lint, scale and other foreign material.

CAUTION

Do not use galvanized pipe. Galvanized coating can flake off with continued use.

Service Information

These hydraulic products are designed to give long dependable service when properly applied and their systems properly maintained. These general instructions apply to typical systems. Specific instructions for particular equipment can be developed from them.

Start Up Procedure for New Installation

1. Read and understand the instruction manual. Identify components and their function.
2. Visually inspect components and lines for possible damage.
3. Check reservoir for cleanliness and drain and clean as required.
4. Check fluid level and fill as required with filtered fluid at least as clean as that recommended. Fill motor case as necessary.
5. Check alignment of drive.
6. Check oil cooler and activate it, if included in circuit. Check fluid temperature.
7. Reduce pressure settings of relief valve. Make sure accurate pressure readings can be made at appropriate places.
8. If solenoids in system, check for actuation.
9. Start pump drive. Make sure pump and motor fill properly.
10. Bleed system of air. Recheck fluid level.
11. Cycle unloaded machine at low pressure and observe actuation (at low speed if possible).
12. Increase pressure settings gradually in steps. Check for leaks in all lines especially in pump and motor inlet lines.
13. Make correct pressure adjustments.
14. Gradually increase speed. Be alert for trouble as indicated by changes in sounds, system shocks and air in fluid.
15. Equipment is operational.

Fluid

It is recommended that a hydraulic fluid be used as specified in Denison Bulletin 1107.

Maintenance

This motor is self lubricating and preventive maintenance is limited to keeping the system fluid clean by changing filters frequently. Fluid cleanliness level per NAS 1638, Class 8 above 15 micron or Class 9 under 15 micron must be maintained. This usually can be accomplished by effective use of 10 micron filters. Do not allow dirt to accumulate on the motor especially around the shaft seal. Keep all fittings and screws tight. Do not operate the motor at pressures and speeds in excess of the recommended limit. If the motor does not operate properly, check the Troubleshooting Chart before attempting to overhaul the unit. Overhaul is relatively simple and may be accomplished by referring to the procedures in Section III.

TABLE II
TROUBLE-SHOOTING 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 compo-

nent failure is the *effect*, not the *cause* of the problem.

This general guide is offered to help in locating and eliminating the causes 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 motor	Piston and shoe looseness or failure Bearing failure
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

TABLE II CONTINUED

Effect of Trouble	Possible Cause	Fault Which Needs Remedy
High wear in motor	Unwanted water in fluid	Condensation Faulty breather, strainer Heat exchanger leakage Faulty clean-up practice Water in makeup fluid
Pressure shocks	Cogging load	Mechanical Considerations
	Worn relief valve	Needed repairs
	Slow response in check valves	Replace or relocate
	Excessive decompression energy rates	Improve decompression control
	Excessive line capacitance (line volume, line stretch, accumulator effects)	Reduce line size or lengths. Eliminate hose Bleed air
	Barrel blow-off	Recheck hold-down, rotating group, drain pressure
Heating of Fluid	Excessive motor leakage	Recheck case drain flow and repair as required Fluid too thin Improper assembly, port timing
	Reservoir	Too little fluid Entrained air in fluid Improper baffles Insulating air blanket that prevents heat rejection Heat pickup from adjacent equipment

REWORK LIMITS OF WEAR PARTS

6 and 7.25 in. ³	Original Dimension	Max. Rework From Original Dimension	Min. Dimension After Rework
Port plate face	.315/.305"	.010"	.295"
Cylinder barrel face	4.480"	.010"	4.470"
Shoe retainer face	.314/.312"	.005"	.307"
Piston shoe face (pocket)	.019/.014"	.011/.006"	.008"
Creep plate face	.293/.291"	.010"	.281"
Face plate		None	Replace

SECTION III UNIT DISASSEMBLY

General

The instructions contained in this section cover complete teardown of the motor. Disassemble as far as necessary to repair or replace worn parts. Drain all fluid from the motor and thoroughly clean the exterior surface. Prepare a clean, lint free surface on which to lay the internal parts for inspection and repair.

Barrel Holddown, Port Block and Shuttle Valve (See fig. 4)

1. Secure the motor in a vise or other suitable holding fixture with the shaft in a horizontal position.
2. Remove screws (44) that secure the shuttle valve (45) to the port block (10).
3. Remove the shuttle valve assembly and seals (46 & 47). The shuttle valve is a complete assembly and should not be disassembled.
4. Remove retaining ring (1), end cover (3) and O-ring (2).
5. Remove cotter pin (4), holddown nut (5), thrust washers (6), bearing (7) and seal ring (8).
6. Remove four screws (9) that secure the port block (10) to the housing (31).
7. Remove port block and gasket (13). Remove port plate (15) and port plate pins (14).

CAUTION

When removing port block, the port plate can cling to the face plate because of oil film. Make sure it does not fall and become damaged.

Barrel and Holddown Shaft

1. Remove face plate (16) and two face plate pins (14).
2. Remove barrel assembly (22) by grasping the holddown shaft (21) and lifting the entire assembly from the housing (31).

Piston and Shoe Assembly

1. Remove retaining ring (24) and thrust washer (25) from cam center post.
2. Remove piston and shoe assembly (26).

CAUTION

Use extreme care when removing piston and shoe assembly. Shoe faces must not be scratched or marred.

3. Remove creep plate (27) from cam (28).

Drive Shaft and Seal

1. Remove four screws (43), gaskets (42), seal retainer (41) and seal retainer gasket (40).

NOTE

Remove the screws in a criss-cross fashion, backing off the screws several turns at a time to relieve shaft seal spring tension from retainer.

2. Remove shaft seal assembly (39) from shaft (35).
3. Remove shaft and bearing assembly and cam (28) by grasping shaft and pulling out of housing from end of unit opposite mounting flange.
4. Carefully remove retaining ring (38) from back of cam. Remove shaft and bearing assembly from cam. Remove shim (34) if used.

CAUTION

When removing retaining ring and shaft from cam, use extreme care not to damage seal surface of shaft. Any scratches or marks on this surface will cause leaks around shaft seal.

5. Remove dowel pins (29) from bottom of housing (31).

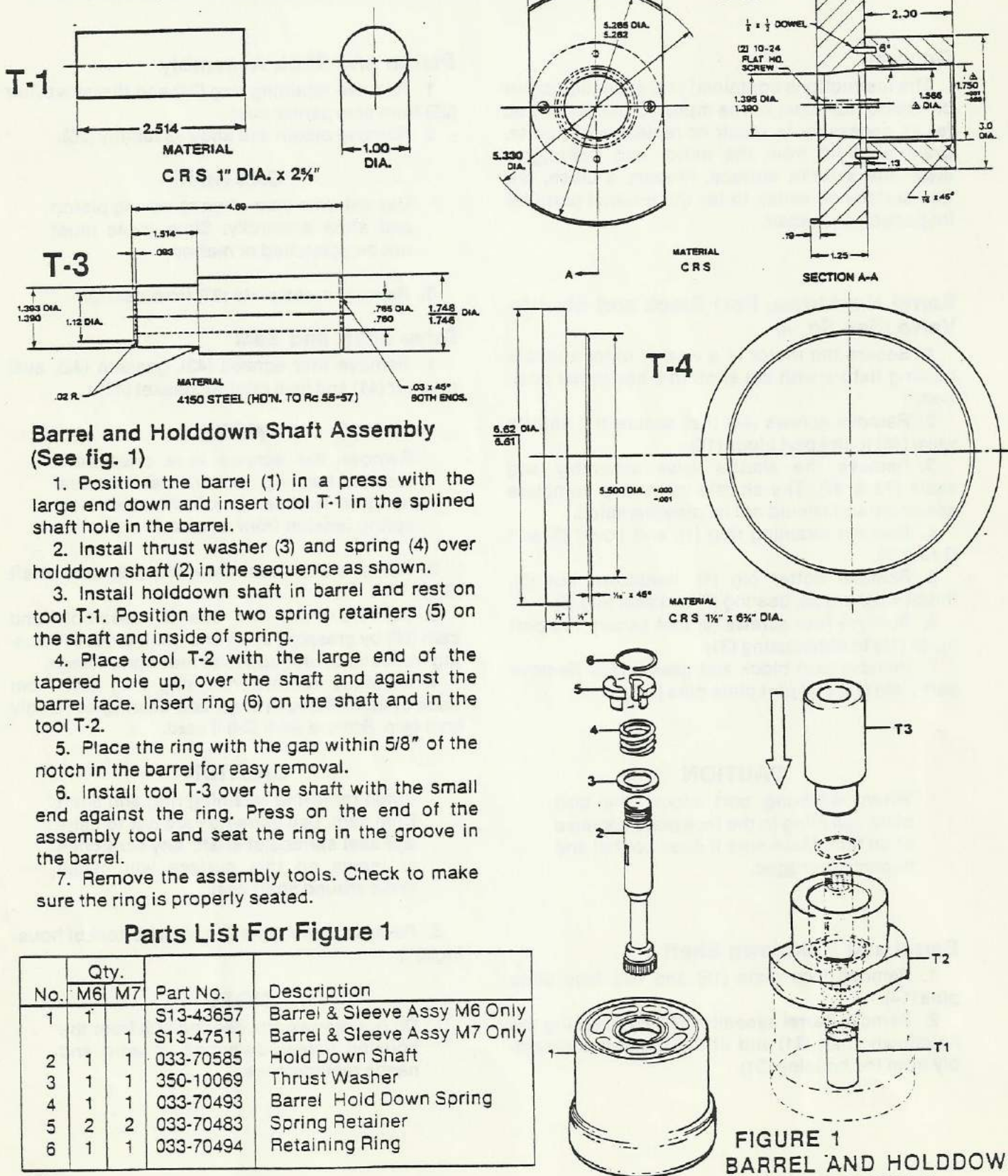
NOTE

Do not remove the bearing (23) from the housing unless damaged or worn and needs replacement.

SECTION IV ASSEMBLY PROCEDURES

Special Tools

The special tools T-1, T-2, T-3 and T-4 shown below are required in the assembly of this motor.



Barrel and Holddown Shaft Assembly (See fig. 1)

1. Position the barrel (1) in a press with the large end down and insert tool T-1 in the splined shaft hole in the barrel.
2. Install thrust washer (3) and spring (4) over holddown shaft (2) in the sequence as shown.
3. Install holddown shaft in barrel and rest on tool T-1. Position the two spring retainers (5) on the shaft and inside of spring.
4. Place tool T-2 with the large end of the tapered hole up, over the shaft and against the barrel face. Insert ring (6) on the shaft and in the tool T-2.
5. Place the ring with the gap within 5/8" of the notch in the barrel for easy removal.
6. Install tool T-3 over the shaft with the small end against the ring. Press on the end of the assembly tool and seat the ring in the groove in the barrel.
7. Remove the assembly tools. Check to make sure the ring is properly seated.

Parts List For Figure 1

No.	Qty.		Part No.	Description
	M6	M7		
1	1	1	S13-43657	Barrel & Sleeve Assy M6 Only
		1	S13-47511	Barrel & Sleeve Assy M7 Only
2	1	1	033-70585	Hold Down Shaft
3	1	1	350-10069	Thrust Washer
4	1	1	033-70493	Barrel Hold Down Spring
5	2	2	033-70483	Spring Retainer
6	1	1	033-70494	Retaining Ring

**FIGURE 1
BARREL AND HOLDDOWN
SHAFT ASSEMBLY**

Drive Shaft Assembly

1. Install one retaining ring (37) in the groove near the shaft seal surface. **DO NOT PASS THE RING OVER THE SEAL SURFACE.**
2. Install the bearing (36) 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.

NOTE

Do not use excessive force that would damage or distort the retaining ring.

3. Install the other retaining ring (37) in the remaining groove, make sure both rings are fully seated.

Cleaning and Inspection

1. All parts must be inspected and be free of material defects, dirt, scratches or any foreign material.
2. All parts must be cleaned with a suitable cleaning solvent and all holes and passages blown out with dry, clean compressed air.
3. After cleaning and inspection, all parts must be covered with a light film of oil and protected from dirt and moisture. Excessive handling of internal parts should be avoided prior to assembly.
4. During assembly, lapped and ground surfaces must be lubricated with clean oil and protected from nicks or surface damage.

Piston and Shoe Assembly

1. Place cam (28) flat side down on a clean surface.
2. Install creep plate (27), counterbored side first, over center post on cam until seated against face of cam.
3. Apply a light film of clean oil to face of creep plate and to the face of the piston shoes (26). Hold the piston and shoe assembly so the assembly will not fall from the retainer and lower over the center post of the cam. Gently seat face of shoes against face of creep plate.
4. Install thrust washer (25) over cam center post and seat against retainer plate. The flat on I.D. of thrust washer and the flat on the center post of cam must match. The grooved side of thrust washer must face the piston and shoe retainer.
5. Secure the piston and shoe assembly by installing the thickest of the five retaining rings (24) that will fit in the groove on the cam center post. Check clearance between shoe faces and creep plate with a feeler gauge. Grasp one piston and lift tightly against shoe retainer to obtain clearance. Gap should be between .002 and .004. Assembly must be free to rotate by hand with approximate force of 5 ft. lbs.

Port Block and Cylinder Barrel

1. Install two port plate pins (14) in dowel holes in face of port block (10).
2. Apply a liberal amount of grease to the port plate.
3. Place port plate so that the dowel holes line up with the assembled pins in port block, and seat against port block face. Make sure port plate is firmly seated on port block.
4. Rest cylinder barrel and holddown shaft assembly (21 and 22) on end with the shaft up.
5. Install two face plate pins (14) in the holes provided in the barrel face.
6. Apply grease to the face of the barrel and install the face plate (16) over the pins. Make sure the face plate is properly seated on the pins with steel side against the barrel.
7. Place the port block, port plate down, over the barrel and shaft and lower carefully until port plate is seated against the barrel face. Make sure the port plate is still firmly seated.
8. Install seal ring (8) over end of shaft and seat in counterbore in port block. Install thrust washer (6), thrust bearing (7) and second thrust washer. Install holddown nut (5) on shaft and finger tighten.

Rotating Group and Drive Shaft

1. Place assembled port block and cylinder barrel on a clean surface with the barrel facing up.
2. Apply a thin film of clean oil to the bores in the barrel and to the pistons of the cam assembly.
3. Hold cam so that the pistons are hanging down. Carefully engage pistons in the barrel bores and lower.
4. For a rigid shaft application use the shim (34) that results in the least clearance around the shaft bearing. Do not use a shim with a floating shaft.
5. Insert small splined end of drive shaft and bearing assembly through bore of cam and into cylinder barrel spline until shaft bearing rests against bearing bore. Gently press on the outer race of bearing until bearing is fully seated against bottom of bearing bore in cam.

Housing and Shaft Seal

1. Install dowel pins (30) in holes in face of port block.
2. Install gasket (13) over the two dowel pins in the port block.
3. Place housing (31) on the mounting flange and install dowel pins (29) in holes provided in bottom of housing cavity.
4. Position cam so the thick part of the cam is at the bottom of the port block (shuttle valve side).
5. Position housing above and directly over cam, shaft and cylinder barrel. Carefully lower housing, centering on shaft. At the same time align barrel bearing with barrel, the dowel pins in

housing flange to holes in port block and dowel pins in bottom of housing with holes in cam until seated firmly against port block and gasket.

6. Install the four bolts (9) and finger tighten.

7. Install retaining ring (38) that provides the tightest fit to secure shaft and bearing assembly.

CAUTION

The seal assembly (39) is available as a complete assembly only. Before installing the seal, examine all the parts. The lapped seal seat and the carbon ring have a precision finish and must be handled with care. Be certain that both parts are free from scratches, marks or cracks.

8. a. Install the spring retainer (e) over the shaft and against the retaining ring on the shaft assembly.

b. Place the spring (d) against the retainer. Apply oil to the inner surface of the ring (f) and position the shell containing the ring and carbon ring (c) over the shaft with the carbon ring exposed.

c. Apply grease to the square section seal (a) and install on the seat (b). Insert the seat and seal in the retainer (41) with the lapped side of the seat in position to contact the carbon seal. Install the seal retainer assembly and gasket over the shaft with the lapped surface against the carbon face. Install the gaskets (42) on the screws (43) and secure the seal retainer. Depress the seal retainer only far enough to start the four screws and tighten evenly. Torque to 10 ft. lbs.

9. Turn the motor upside down and place on mounting flange. Tighten bolts (9) and torque to 150 ft. lbs.

10. Install O-ring (12) and plug (11) in hole in top of port block.

11. Tighten holdown nut (5) until it bottoms out, 10 ft. lb. max. Then back off until second slot in nut aligns with pin hole in shaft.

12. Insert cotter pin (4) through nut and shaft. Bend one tang of pin over end of shaft.

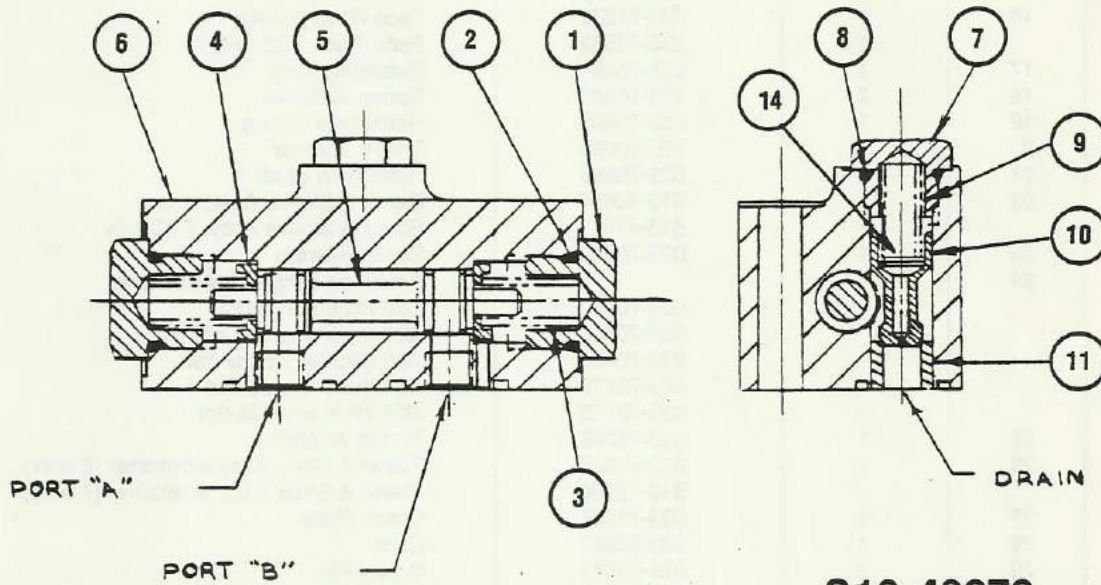
13. Install O-ring (2) on end cover (3). Lightly oil the O-ring and install assembled cover into port block. Secure with retaining ring (1).

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.
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 (17) in counterbore in the center of shuttle valve assembly. Hold in place with a coating of grease. Install two seals in remaining counterbores.
12. Install shuttle valve assembly on port block pad and secure with screws (19). Torque screws to 20 ft. lbs.



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

PARTS LIST

Item	Qty.	Part No.	Description
1	1	356-65095	Retaining Ring
2	1	671-00138	O-ring
3	1	033-70537	End Cover
4	1	322-03324	Cotter Pin
5	1	033-53922	Holddown Nut
6	2	350-10065	Thrust Washer
7	1	230-82131	Thrust Bearing
8	1	033-70510	Seal Ring
9	4	306-40181	Hex Hd Cap Screw
10	1	033-71295	Port Block
11	1	488-35041	Hex Socket Plug
12	1	691-00906	O-ring
13	1	033-70577	Housing Gasket
14	5	033-49825	Pin
15	1	033-71531	Port Plate, 6 only
	1	033-53775	Port Plate, 7.25 only
16	1	033-71530	Face Plate, 6 only
	1	033-72532	Face Plate, 7.25 only
17	1	033-70494	Retaining Ring
18	2	033-70483	Spring Retainer
19	1	033-70493	Holddown Spring
20	1	350-10069	Thrust Washer
21	1	033-70585	Holddown Shaft
22	1	S13-43657	Barrel & Sleeve Assy, 6 only
	1	S13-47511	Barrel & Sleeve Assy, 7.25 only
23	1	033-70580	Barrel Bearing
24	1		Retaining Ring—Use one only
		033-70490	.079 thick w/red dot
		033-70488	.081 thick w/green dot
		033-70484	.083 thick w/yellow dot
		033-72176	.084 thick w/blue dot
		033-72175	.086 thick w/white dot
25	1	033-72249	Thrust Washer
26	1	S13-43655	Piston & Shoe Assy w/retainer (6 only)
		S13-42308	Piston & Shoe Assy w/retainer (7 only)
27	1	033-71261	Creep Plate
28	1	033-53953	Cam
29	2	324-22412	Dowel Pin
30	2	033-70509	Dowel Pin
31	1	033-71282	Housing
32	2	488-35014	Hex Socket Plug
33	2	691-00912	O-Ring
34	1	033-53948	Shim (Use only one)
		033-53949	Shim (Use only one)
35	1	033-70581	Splined Drive Shaft
	1	033-70578	Keyed Drive Shaft
	1	033-71348	Shaft Key
36	1	230-82140	Shaft Bearing
37	2	033-70817	Retaining Ring
38	1	033-53901	Retaining Ring (Use one only for tightest fit)
		033-53902	Retaining Ring (Use one only for tightest fit)
		033-53903	Retaining Ring (Use one only for tightest fit)
39	1	623-00006	Shaft Seal
40	1	033-70549	Seal Retainer Gasket
41	1	033-70516	Seal Retainer
42	4	631-45003	Gasket
43	4	306-40144	Hex Hd Screw
44	3	306-40106	Hex Head Screw (For Shuttle Valve)
	3	306-40071	Hex Hd Screw (For Cover Plate)
	1	S23-00181	Cover Plate (not shown)
45	1	S13-48776	Shuttle Valve, Int. Drain (.078 orifices)
	1	S13-48273	Shuttle Valve, Int. Drained
46	3	691-10016	Seal
47			Not Used
48	1	358-10160	Screw, Soc Hd Cap

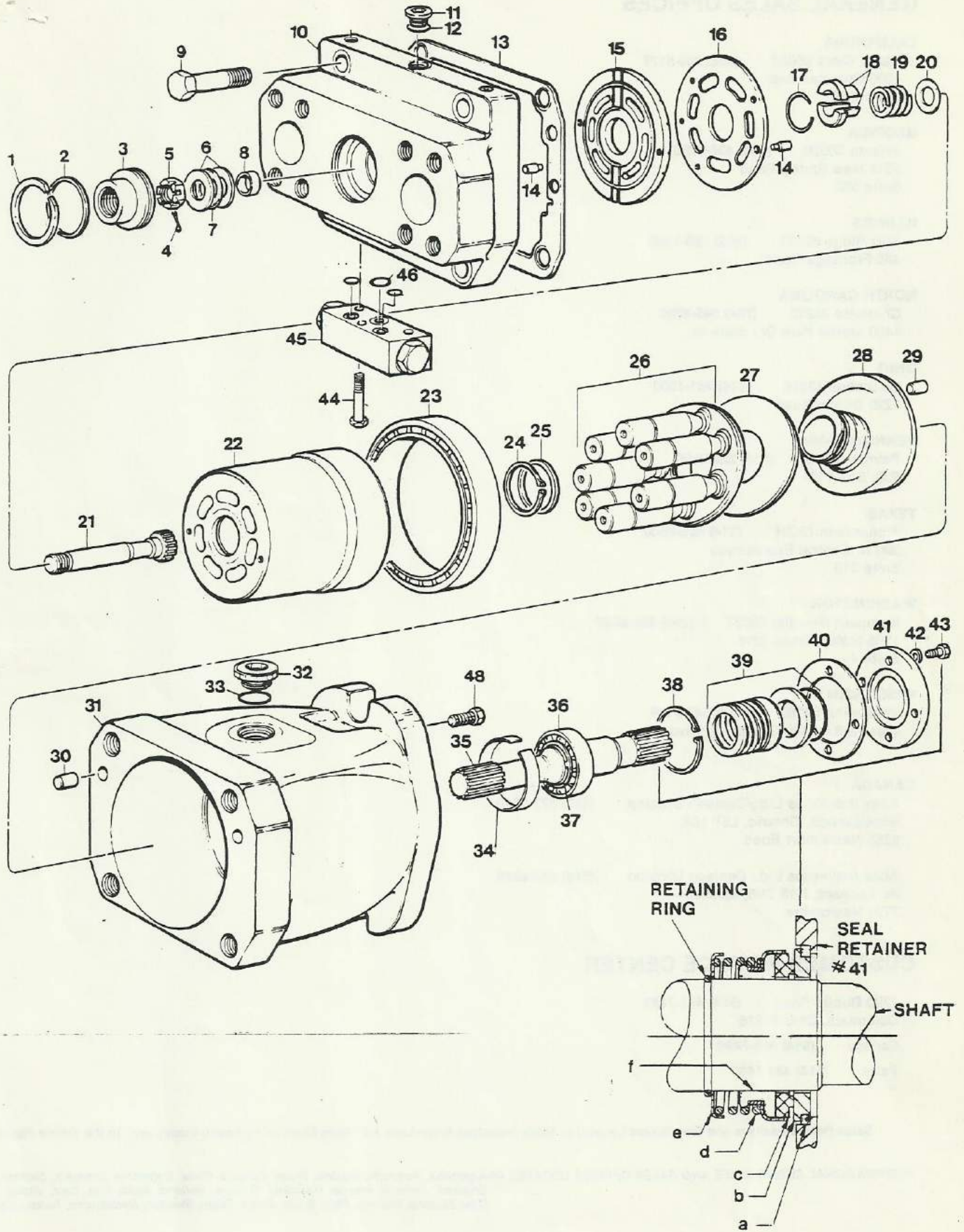


Figure 4

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