



INSTRUCTIONS

OILGEAR TYPE "MFS" CONSTANT DISPLACEMENT BI-DIRECTIONAL MOTORS

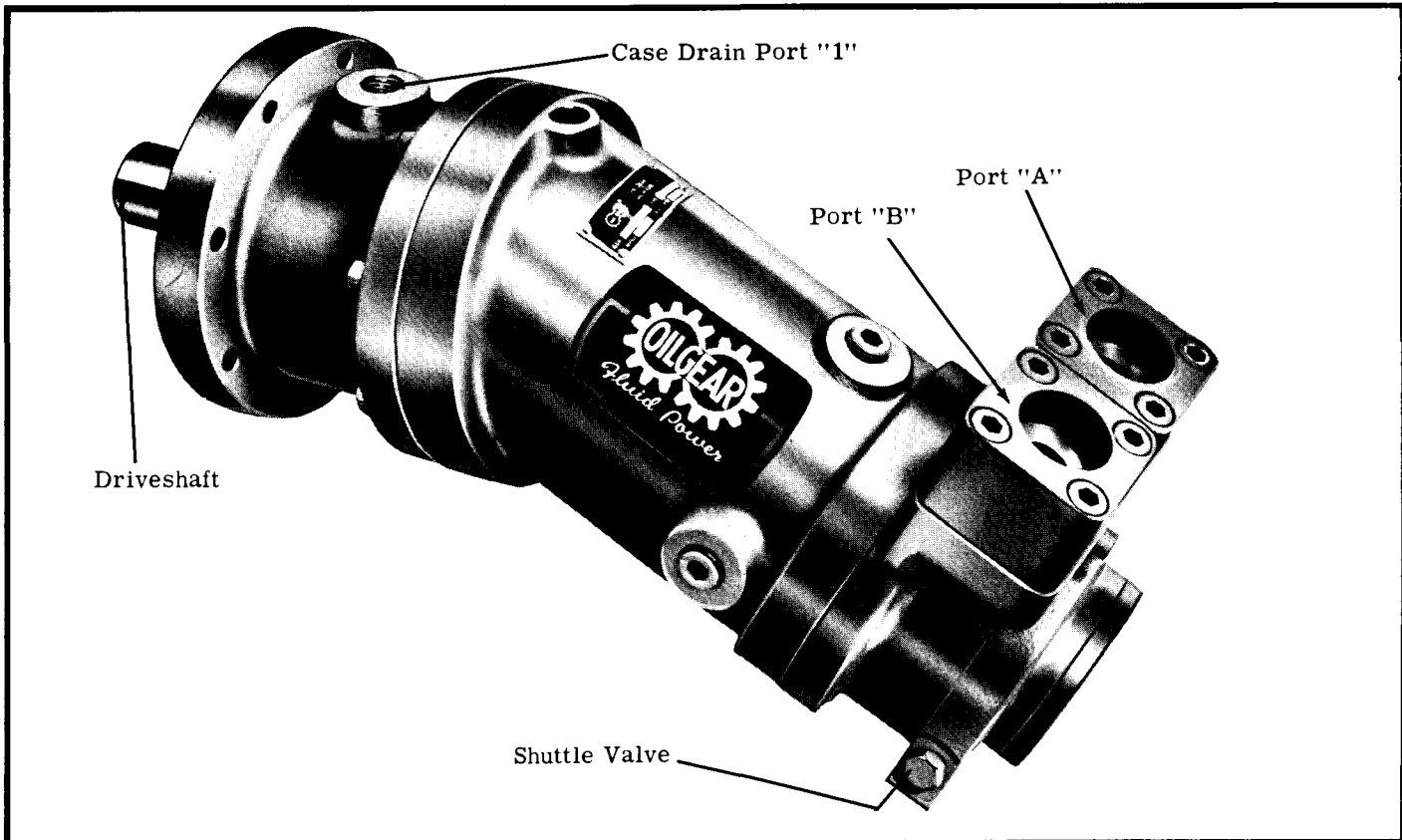


Figure 1. Oilgear Type "MFS" Axial Piston Motor (54715-1)

REFERENCE BULLETINS

Fluid Recommendations	90000
Piping Information	90011
Drives Operating and Maintenance, Recommendations	910600

TO THE USER AND OPERATOR OF OILGEAR "MFS" MOTORS:

These instructions will aid in the installation, operation and maintenance of the Oilgear units. Acquaintance with the construction, principle of operation and characteristics of these units will help you attain satisfactory performance, reduce shut-downs and increase their life. Some Oilgear units have been modified from those described in this bulletin and other changes may be made without notice.

I. PREPARATION AND INSTALLATION

A. MOUNTING

Type "MFS" motors can be mounted in any position. Secure motor to a rigid mounting surface. For motors with tachometer shafts, install an Oldham coupling and mount tach on shuttle valve housing. On motors with tachometer extension shafts, provide rigid mounting for tachs.

B. PIPING

See Oilgear "Piping Recommendations" bulletin. With rear head (32) mounted as shown in parts drawing, pressure at port "A" provides clockwise rotation and pressure at port "B" counter-clockwise facing driveshaft. If rear head position is 180° from that shown, rotation functions are reversed. If rear

head is rotated 180° after shipment, remove flat stamping in original position relative to long side of housing, (31). Pump or circuit must be arranged to maintain back pressure on these units. If back pressure will be greater than 150 psi, install a orifice of .062" Dia. for 150-500 psi range, .040" Dia. for 500-1200 psi range and .031 Dia. for 1200-2500 psi range in port "8C". Fill case with hydraulic fluid prior to initial startup. Connect case drain line from port "1" to reservoir above the high fluid level. Drain must be arranged (a loop or 1-10 psi check valve in line) so case remains full of fluid. **CAUTION:** Be sure system is protected against overload by pump or system high pressure relief valves.

C. DRIVE

Turn driveshaft a few revolutions manually to make sure all parts are free. Motor driveshaft may rotate in either direction. Use direct, belt, silent chain or gear drive. Provide an easy slip fit for coupling, pulley sheave, sprocket or gear and fasten with a set screw above key. **CAUTION: Do not use a drive fit.** Torque load on tachometer shaft must be limited to that listed in "IV-B Specifications" and coupling should be an easy slip fit.

D. FLUID RECOMMENDATIONS

See reference bulletins. To assure long unit life, keep hydraulic fluid clean at all times.

E. COOLING

When units are operated at full or peak load, auxiliary cooling may be necessary. Fluid temperature should not exceed the limits specified in the reference bulletins. Cooling system recommendations can be obtained from The Oilgear Company.

II. CONSTRUCTION

The principle components are a driveshaft (1) connected through a universal joint (43) to cylinder (2). Driveshaft and cylinder axes are set at a fixed angle to each other. Axial pistons (10) are joined to the driveshaft and operate within the cylinder. Driveshaft rotates in antifriction bearings (3, 17, 18, and 19). Pintle (58) supports the cylinder which rotates on antifriction bearings (4 and 50). Balanced flat valve (12) has two crescent shaped ports, separated by bridges. Optional tachometer shafts are inserted in a spline keyed to the cylinder and rotate in bearing (106).

III. PRINCIPLE OF OPERATION

Fluid under pressure delivered to one port of the rear head flows through the corresponding flat valve (12) crescent port into the bores behind pistons (10) in the cylinder (2) open to that crescent. Pressure in the bores force the pistons outward. Piston forces transmitted by connecting rods rotate the driveshaft. The driveshaft turns the "U" joint (43) and cylinder. As each piston reaches the outermost position and the cylinder rotates, the piston bore crosses the bridge to the other flat valve crescent port. Then, the piston moves inward and returns fluid through the other flat valve crescent to the other rear head port. Reversing motor pressure and return port, reverses driveshaft rotation. Speed is proportional to volume delivered to the motor and torque is a function of system pressure.

IV. SPECIFICATIONS

A. STANDARD RATINGS

1. Displacement in cubic inches per revolution.
2. Speed range in revolutions per minute. *
3. Continuous net pressure in psi.
4. Continuous torque in pound inches. *

Size	1	2*	3	4*
024	2.4	5-1800	2500	840
060	6.0	5-1200	2500	2110
113	11.25	5-1200	2500	3800
225	22.5	5-1200	2500	7900
440	44.0	5-900	2500	15600

* Applications may use higher speeds and torques if approved by The Oilgear Company.

B. TACHOMETER

Maximum tachometer torque load is 20 in lbs.

C. PIN & SEAL DIMENSIONS (see parts drawing)

Size	a	d	f	g
024		1-13/32	.578 + .015	.500 + .015
060	5/16	1-1/2	.578 + .030	.500 + .015
113	5/16	1-21/32	.593 + .015	.500 + .015
225	5/16	1-3/4	.656 + .015	.500 + .015
440	7/16	2-1/4	.687 + .015	.500 + .015

V. MALFUNCTIONS AND CAUSES

A. LOSS OF SPEED

1. Insufficient delivery volume.
2. Worn, scratched or grooved flat valve (12), wear plate (11) or cylinder (2) end face.
3. Sticking compensating (26) or hold-up (14) pistons.
4. Sticking (non shifting) shuttle plunger (87).
5. Cylinder (2) and pistons (10) leaking.

B. EXCESSIVE NOISE

1. Insufficient back pressure.
2. Air entering system.
3. Worn bearings (3, 4, 17, 18, 19 and 50).
4. Worn driveshaft (1), cylinder (2) and piston (10) assembly.
5. Worn "U" joint shoes (44).
6. Broken or sticking pistons.

C. EXCESSIVE HEAT

1. Excessive peak load operation.
2. Worn flat valve (12) or wear plate (11).
3. Worn bearings (3, 4, 17, 18, 19 and 50).
4. Worn cylinder (2) & piston (10) assembly.
5. Clogged orifices (88 & 93) or drain line.

D. GENERAL

1. Worn or broken tachometer shaft coupling.
2. Binding Tach, requiring excessive torque.

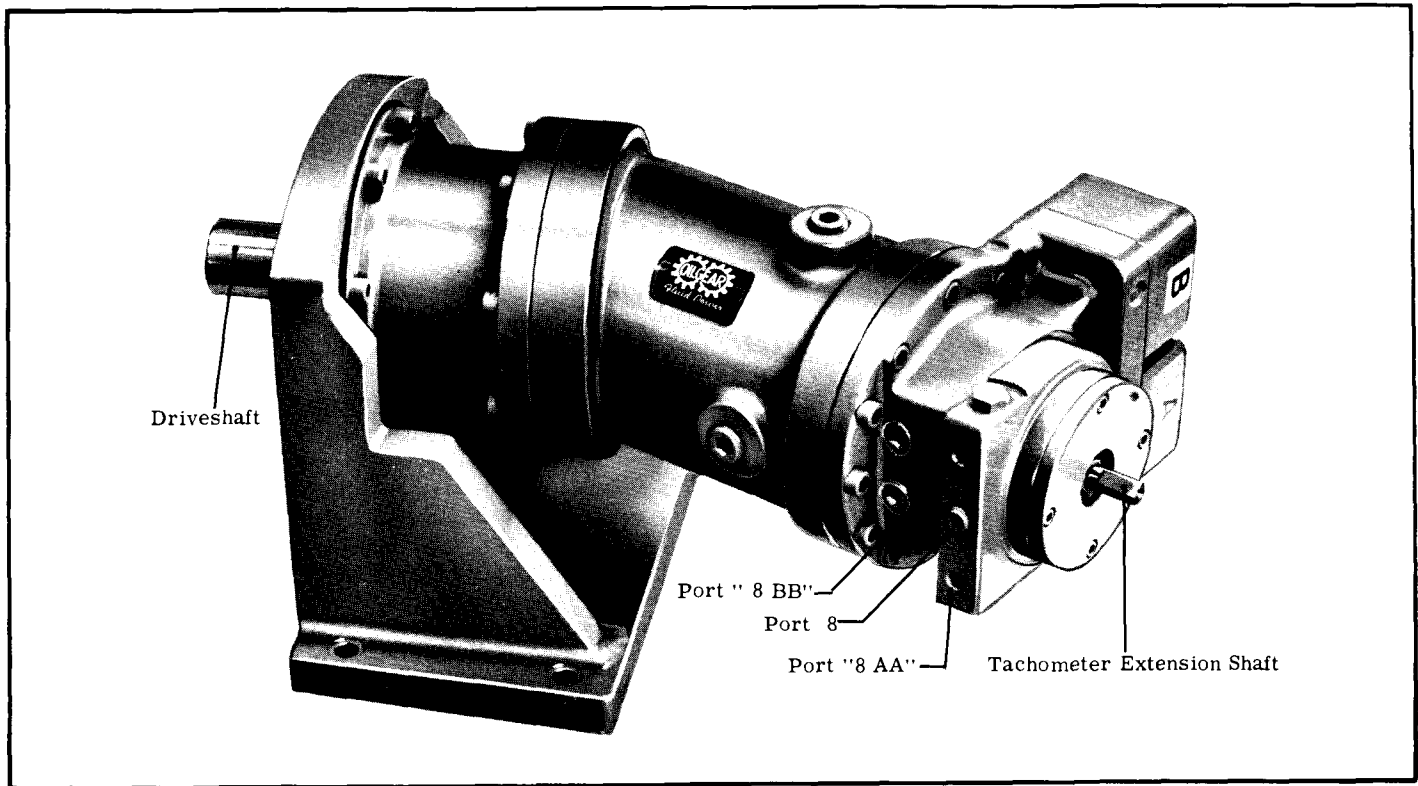


Figure 2. Oilgear Type "MFS" Motor with Extension Tachometer Shaft and Right Angle Bracket. (54715-2).

VI. TESTING

Motors can be checked for excessive slip by removing case drain line and observing flow under no load and load conditions or by making a positive slip check. To make a positive slip check, first block off the pump and make a positive slip check on it (see pump instruction bulletin) to see how much stroke is required to raise 1000 psi. Then, connect motor to pump, stall motor output shaft, and determine the amount of pump stroke now needed to raise 1000 psi. A new unit requires approximately an additional 2.5% of total pump stroke to raise pressure. NOTE: Only if slip is excessive for the particular application, is repair necessary.

VII. DISASSEMBLY

Depending upon what parts are to be inspected or replaced, complete disassembly may not be necessary. A careful study of the parts drawing will determine which parts or sub-assemblies must be removed.

Remove cover (16 or 107), O'ring (63) and shuttle valve housing (23). On units with tach shafts (100 or 101), the shafts can be pulled straight out with shuttle valve housing. Straighten bent prong of lock washer (84) and turn lock nut (83) off pintle (58). Remove screws (32A and 32B) and carefully pull rear head (32), with flat valve (12) assembly, from unit while holding pintle inward to maintain its relative position within housing (31). Do not allow key (70) to drop into housing. Lift out wear plate (11).

Remove retaining rings (69) and separate flat valve assembly from rear head. Withdraw compensating pistons (26), tumblers (14A), hold-up pistons (14) and springs (13) from flat valve.

Remove screws (5A) and carefully lift off cylinder housing (31), maneuvering housing and pintle so pin (22) does not pull cylinder (2) off "U" joint (43). On large units, jacking pin (22) part way out will ease disassembly. Late model units will have drive-shaft assembly and cylinder indexed with a stamped number for one piston and its corresponding bore. On early model units, mark one piston and its corresponding cylinder bore before separating them. Marking is necessary for proper assembly. Separate the cylinder and pintle assembly (2 and 58) from pistons (10) and "U" joint (43). Protector wrap pistons so they are not damaged during driveshaft disassembly.

Remove snap ring (54) and pull pintle (58) assembly from cylinder. Remove socket (48) and key (36) from cylinder. Parts drawing shows bearing and spacer arrangements on pintle for different size units. Study applicable illustration if further disassembly is necessary. NOTE: Two drive holes are provided in socket (48) to aid in removal of bearing (50) outer race after removal of snap ring (49). Withdraw seat (46) and key (47) from socket.

Withdraw "U" joint shaft (43) with shoes (44), seat (40) and spring (41). Remove key (1A) and cover keyway with tape to avoid damaging seal. Block housing (5) in position with shaft end upward and support shaft so it will not drop from inside housing. Remove screws (24B) and gland (24). Remove re-

Continued on Page 6

X PARTS LIST

<u>Part No.</u>	<u>Description</u>	<u>Part No.</u>	<u>Description</u>	<u>Part No.</u>	<u>Description</u>
1.	Driveshaft	30.	Pin, Flat Valve Locating	S64.	Seal, O'ring
1A.	Key, Driveshaft	30A.	Pin, Flat Valve Locating	66.	Spacer, Bearing
2.	Cylinder	31.	Housing, Cylinder	68.	Guide, Spring
3.	Bearing, Frt. Driveshaft	32.	Head, Rear	69.	Ring, Retaining
**3A.	Spacer, Bearing	32A.	Screw, Sock, Hd. Cap.	70.	Key, Pintle
4.	Bearing, Rear Cylinder	32B.	Screw, Sock, Hd. Cap.	73.	Spacer, Pintle
5.	Housing, Driveshaft	*34.	Pin, Wear Plate Locating	80.	Retainer, Driveshaft Seal
5A.	Screw, Sock, Hd. Cap.	S35A.	Rotor, Shaft Seal	80A.	Screw, Flt. Hd. Mach.
S†5B.	Seal, O'ring	S35B.	Stator, Shaft Seal	81.	Shims, Driveshaft Seal
S6.	Seal, O'ring	36.	Key, Cylinder	S82.	Seal, O'ring
8.	Spacer, Driveshaft Brg.	37.	Flange, Pressure Port	83.	Nut, Pintle Lock
9.	Nameplate	37A.	Screw, Sock, Hd. Cap.	84.	Washer, Lock
9A.	Screw, Drive	S38.	Seal, O'ring	85.	Plug, Hex.
10.	Assembly, Piston	38A.	Retainer, O'ring	S86.	Seal, O'ring
*11.	Plate, Wear	39.	Socket, Driveshaft	87.	Plunger, Shuttle
12.	Valve, Flat	40.	Seat, Driveshaft "U" -Joint	88.	Orifice
13.	Spring, Hold-up Piston	41.	Spring, "U" - Joint Seat	S89.	Seal, O'ring
14.	Piston, Hold-up	42.	Pin, Driveshaft "U"-Joint	90.	Retainer, O'ring
14A.	Tumbler, Hold-up Piston	43.	Shaft, "U" - Joint	91.	Decal, Caution
16.	Cover, Rear	44.	Shoe, "U" - Joint	92.	Adapter, Orifice
16A.	Screw, Sock, Hd. Cap.	45.	Shaft, "U" - Joint Shoe	93.	Orifice
17, 18.	Bearing Assembly, Driveshaft	46.	Seat, Cylinder "U" Joint	# 94.	Spacer, Driveshaft Seal
19.	Bearing, Rear Driveshaft	47.	Key, Cylinder Seat	#95.	Ring, Spacer Retaining
20.	Spacer, Driveshaft Brg. Outer	48.	Socket, Cylinder "U" Joint	96.	Spacer, Pintle Lock Nut
21.	Spacer, Driveshaft Brg. Inner	49.	Ring, Snap	97.	Spring, Plunger
22.	Pin, Driveshaft Retaining	49A.	Spacer, Cylinder Bearing	100.	Shaft, Extension Tach.
23.	Housing, Shuttle Valve	50.	Bearing, Front Cylinder	101.	Shaft, Tach.
23A.	Screw, Sock, Hd. Cap.	51.	Sleeve, Pintle	102.	Ring, Retaining
24.	Gland, Driveshaft	52.	Nut, Cylinder Brg. Lock	103.	Spacer, Seal
†24A.	Pin, Gland Locating	53.	Washer, Lock	S104.	Assembly, Seal
S25.	Seal, O'ring	53A.	Washer, Bearing	105.	Ring, Retaining
26.	Piston, Compensating	54.	Ring, Snap	106.	Bearing, Tach. Shaft
27.	Ring, Retaining	55.	Key, Driveshaft Socket	107.	Cover, Ext. Tach. Shaft
S28.	Seal, O'ring	58.	Pintle	108.	Ring, Snap
		S63.	Seal, O'ring	109.	Spacer, Tach. Brg.

(S) Indicates included in "A" Seal Kit.

The following items furnished as ASSEMBLIES ONLY 1 and 10; 43 and 45; 35A and 35B; 12, 13, 14A and 26.

* Not used on size 024

† Not used on size 113 and 225

Not used on size 060

**Used on some size 060

Parts used in this assembly are per Oilgear specifications. Use Oilgear supplied parts to insure compatibility with assembly requirements. When ordering replacement parts, be sure to include unit type designation, serial number, part number, and bulletin number. Specify type of hydraulic fluid used when ordering O'rings and seals.

O'RING SIZES

Cross Section X O. D. - Duro + 5

Part No.	024	060	113	225	440
5B.	1/16 x 3/8-70	1/16 x 3/8-70			
6.	1/8 x 4-3/8-70	1/8 x 5-3/4-70	1/8 x 7-1/4-70	1/8 x 9-1/4-70	1/8 x 10-1/4-70
25.	1/8 x 4-1/8-70	1/8 x 5-1/4-70	1/8 x 6-1/2-70	1/8 x 7-3/4-70	1/8 x 9-3/4-70
28.	1/8 x 3-3/8-70	3/16 x 4-1/4-70	1/8 x 5-1/2-70	1/8 x 6-1/4-70	1/8 x 7-1/2-70
38.	1/8 x 1-1/2-90	1/8 x 1-3/4-90	1/8 x 2-90	1/8 x 2-3/4-90	1/8 x 2-3/4-90
63.	1/8 x 3-70	1/8 x 3-70	1/8 x 3-70	1/8 x 3-70	1/8 x 3-70
64.	1/8 x 2-1/2-70	1/8 x 3-70	1/8 x 3-70	1/8 x 3-70	1/8 x 3-70
82.	3/32 x 1-5/8-70	3/32 x 2-3/8-70	3/32 x 2-7/16-70	3/32 x 2-7/8-70	1/8 x 3-1/2-70
86.	# 906	# 906	# 906	# 906	906
89.	1/16 x 9/16-70	1/16 x 9/16-70	1/16 x 9/16-70	1/16 x 9/16-70	1/16 x 9/16-70

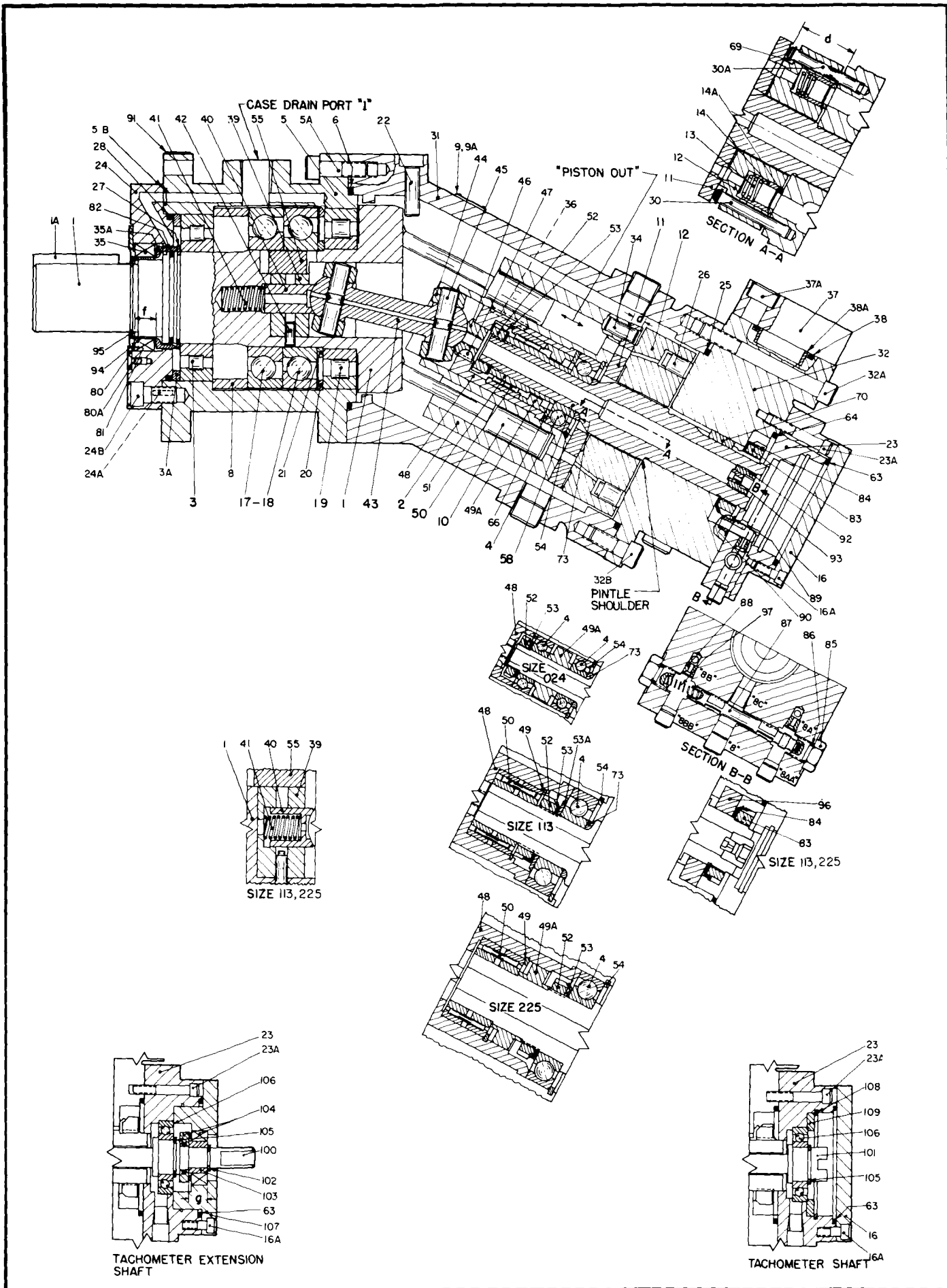


Figure 3. Parts Drawing, Oilgear "MFS" Constant Displacement Units. DS-956900C (503343C)

taining ring and shaft spacer (95 and 94, when used) and shaft seal rotor (35A). Withdraw O'rings (28 & 5B). If shaft seal must be replaced, remove flat head screws (80A), retainer (80), shims (81) and press seal stator (35B) from gland.

Push driveshaft downward to remove it from housing (5) being careful not to let it fall. Remove retaining ring (27), bearings and spacers from housing and driveshaft if necessary. NOTE: If bearings are pressed off shaft, they likely will have to be replaced. Bearings (17 & 18) should slip off. Withdraw key (55), press out pin (42), and remove socket (39).

Shuttle plunger (87) can be removed for inspection by removing plugs (85), springs (97) and pushing it from the bore. Tachometer shaft assemblies with bearing (106) can be pushed out of shuttle valve head. Bearing (106) can be pressed off shaft after removal of retaining ring (105). On units with extension, remove retaining ring (102), spacer (103) and seal rotor (104) first.

VIII. INSPECTION

Inspect all bearings (3, 4, 17, 18, 19 and 50) for signs of pitting, galling, binding or wear and replace if necessary. Inspect flat valve (12) and wear plate (11) to be sure they are not scratched or grooved. Be sure compensating pistons (26) and hold-up pistons (14) are free in their bores. If damaged, they must be replaced. Inspect pistons (10) and their bores for signs of excessive wear, scratches or grooves. Pistons and connecting rods should move smoothly in their sockets without binding. Check "U" joint assembly and shoes (44) for wear. Shuttle plunger (87) movement in it's bore should be smooth and free, lap if necessary, but be sure to clean out all lapping compound. Check all O'rings and seals for hardening or deterioration and replace if necessary. Be sure lubrication passages in all parts and orifices are clean and unrestricted. If tachometer is used, be sure it rotates smoothly at specified (or less) torque. Check tach shaft (100 or 101) spline and spline in seat (46) for wear. Wash all parts thoroughly prior to assembly.

IX. ASSEMBLY

If bearing races are heated in oil to ease assembly, exercise extreme care to prevent heating over 300°F.

On size 440, insert spring (41), and guide (68). Position socket (39) in driveshaft (1), insert key (55) and press in pin (42). Pressing on the inner race, install complete bearing (19) — inner race wide face should "butt" against driveshaft shoulder. Install spacers (20 and 21) — chamfer edge of spacer (20) faces bearing (19). Slip bearing assemblies (17 and 18) on driveshaft — both inner race thrust

faces, face bearing (19). Press only the inner race of bearing (3) on driveshaft, with wide face towards bearing (19), until it "butts" against shoulder and secure with retaining ring (27). Place spacer (8) in front bearing housing (5). Carefully install driveshaft assembly all the way into housing. Insert outer race of bearing (3) with rollers in place. Install O'ring (82) and shaft seal rotor (35A) on driveshaft with lapped face outward. Insert O'rings (28 and 5B) in their grooves and spacer (3A) if used. Secure gland (24) to housing. Pull driveshaft forward as far as it will go and measure distance from gland face, adjoining seal bore, to lapped surface of seal rotor (35A). On size 024, 060 and 113; subtract dimension "f" (see "IV-C-f, Specifications") from this measurement — the remainder equals the thickness of shims (81) to place on top of seal stator (35B). On size 225; subtract the measurement from "f" — the remainder equals the thickness of shims to be placed in gland counterbore. On sizes 024, 060 and 113, place shims (81) on top of seal stator (35B) and press in until shims are flush with counterbore. On size 225, place shims (81) in counterbore and press in seal until flush with shims. Secure with retainer (80). Insert spacer (94) and retaining ring (95) if used. Block assembly in position with driveshaft pointed downward and insert spring (41) and "U" joint seat (40). Rotate driveshaft in housing to be sure it turns freely.

Study applicable view of parts drawing and assemble spacers, bearing, etc. on pintle (58). NOTE: Bearing (4) inside race thrust face is toward lock nut (52). Be sure lock nut is pulled up snug and secured by bending a prong of lock washer (53). NOTE: on sizes 113 and 225, the outer race of bearing (50) is placed in socket (48) and secured with retaining ring (49). On size 060, the inner race of bearing (50) is pintle sleeve (51).

Check pin (34) protrusion dimension ("IV-C-a Specifications"). Insert key (47) in "U" joint seat (46) and press seat into socket (48). Be careful not to damage spherical bearing surface of seat. Place key (36) in it's slot and insert socket (48) into cylinder (2). Carefully insert pintle assembly into cylinder and secure with snap ring (54). Rotate cylinder on pintle to be sure it turns freely.

Check to be sure shafts (45) protrude equi-distant on either side of "U" joint shaft (43). Slots in shafts (45) should face front and rear of unit. Place shoes (44) on shafts (45). Insert assembled "U" joint into both sockets (39 and 48) to check fit. NOTE: shoes are not square, if they do not fit, rotate them 90° — be sure shoes are a sliding fit, replace shoes if sloppy. Place assembled "U" joint in socket (39) and lubricate pistons (10) with hydraulic fluid.

Suspend cylinder (2) and pintle (58) assembly with its axis at an angle to driveshaft approximating assembled position. The indexed bore in the cylinder should be the lowest bore. Rotate driveshaft and piston assembly so the indexed piston will be received by indexed piston bore. Carefully lower pintle assembly so piston is engaged in corresponding bore. Take care not to scuff pistons or bores.

Gradually lower cylinder part way while starting all remaining pistons in their respective bores. Position "U" joint shaft so shoes (44) are aligned properly with their slots in socket (48). Lower cylinder assembly all the way until "U" joint is seated. If piston connecting rods are skewed, indexed piston was not engaged in indexed bore — disassemble and re-assemble again.

Insert O'ring (6) in place and carefully slide housing (31) down over assembly and secure it to housing (5). Be sure pin (22) is pressed in flush with counterbore. Lubricate faces of wear plate (11) and install on locating pin (34) with "Cylinder Face" note inward against the cylinder.

Insert compensating pistons (26) with tapped hole outward, springs (13), hold-up pistons (14) and tumblers (14A) in flat valve (12). Check locating pins (30 & 30A) protrusion dimension — ("IV - C-d Specifications"). Observe the "Piston Out" note on the flat valve, position flat valve on rear head (32) accordingly, and secure with retaining rings (69). Push down on flat valve face to make sure it moves and returns freely on pins. Position O'ring (25) in place, and slide entire assembly down over the pintle. Rotate pintle until it's keyway lines up with keyway in rear head and insert key (70). A socket head cap screw in the end of the pintle and an Allen wrench can be used to rotate the pintle. Align rear head with housing and secure. Place spacer (96) if used, and washer (84) on pintle and

loosen lock nut (83) until pintle shoulder is pulled up light against rear head (32). Bend prong of washer to lock nut. Place O'rings (64) and (89) with retainers (90) in rear head. For units without tach shafts, be sure adapter (92) and orifice (93) are installed in the pintle. Insert O'rings (38), retainers (38A) and secure flanges (37) to rear head.

Be sure all orifices (88) are open and installed in shuttle housing (23) as well as plugs for ports 8, 8AA and 8BB. Install shuttle plunger (87) with springs (97) on both ends and carefully screw plugs (85) with O'rings (86) into housing so springs seat in their bores. Secure housing (23) to head (32). If tach shafts are not used, install O'ring (63) and cover (16).

If tach shafts (100 or 101) are used, press bearing (106) onto shaft and secure with retaining ring (105). Slide shaft through pintle until splines engage in socket (46). For units with shaft (101); install spacer (109), lock in place with snap ring (108), insert O'ring (63) and secure cover (16). For units with extension shaft (100), place seal rotor (104) with lapped face outward, on shaft. Insert spacer (103) and secure with retaining ring (102). Press seal stator (104) into cover (107), secure cover with O'ring (63) in place to housing (23).

Refer to sections I and VI for installation and testing.

OILGEAR EXCHANGE SERVICE

Standard replacement pumps and motors are available to users of Oilgear equipment where comparable units will be returned in exchange. These rebuilt and tested replacements are usually carried in stock for quick delivery, subject to prior requests. When standard replacements must be modified to replace units which are special, shipment will depend on availability of parts and assembly and test time necessary.

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

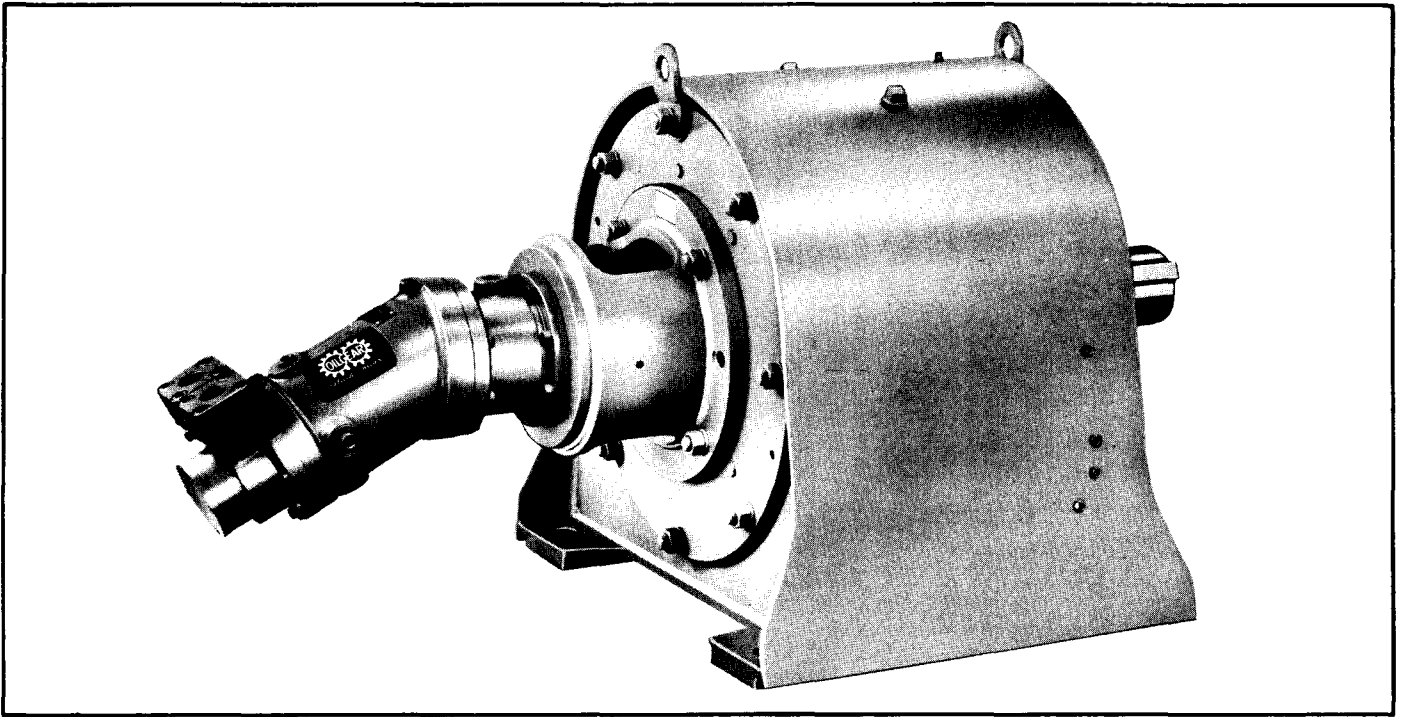


Figure 4. Type "MFS" Oilgearducer. Oilgear motor coupled and flanged to Falk reducer provides high torque in the low speed range. (54529).

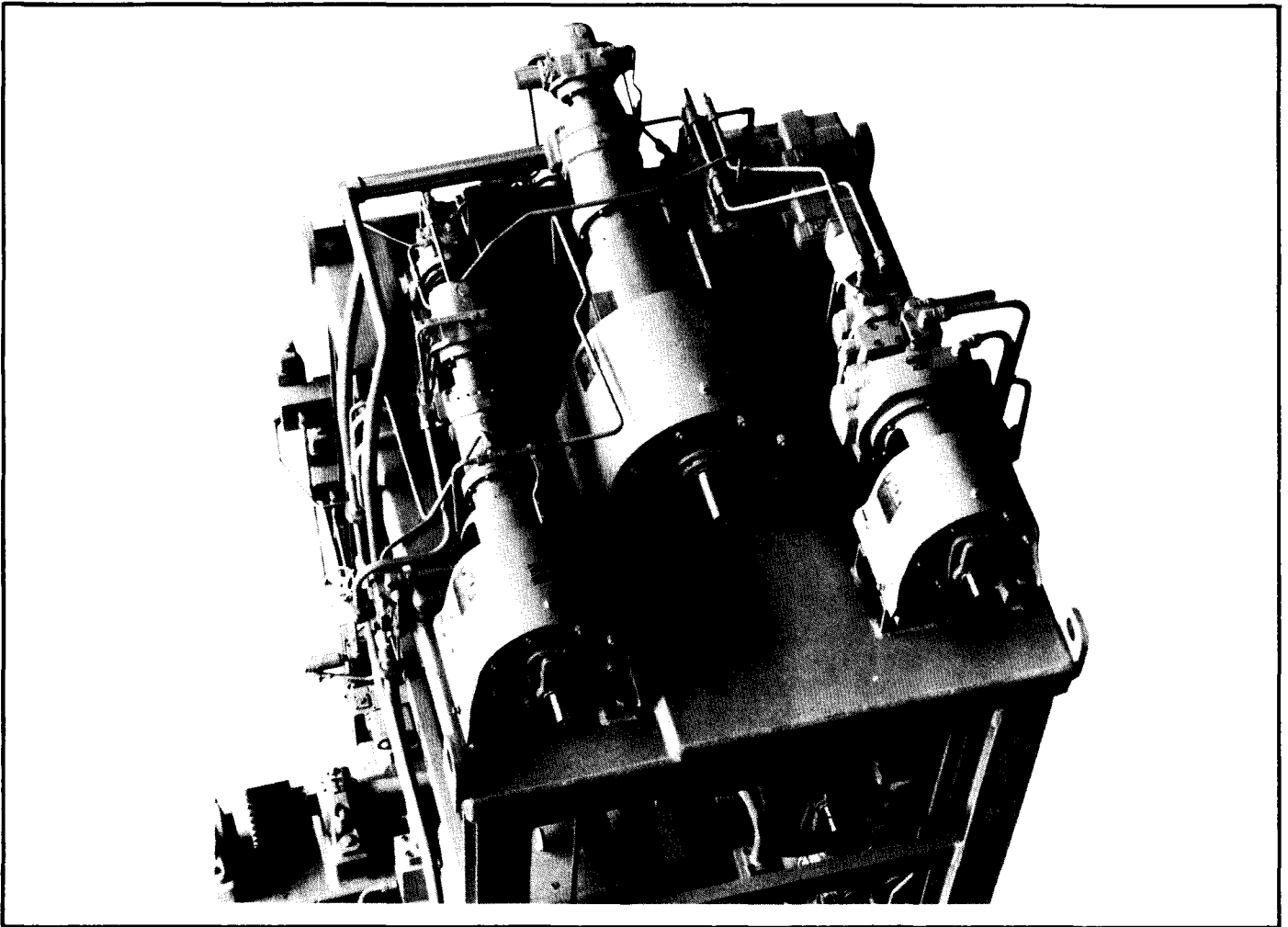


Figure 5. Oilgearducers on paper coating machine drive. (54295).