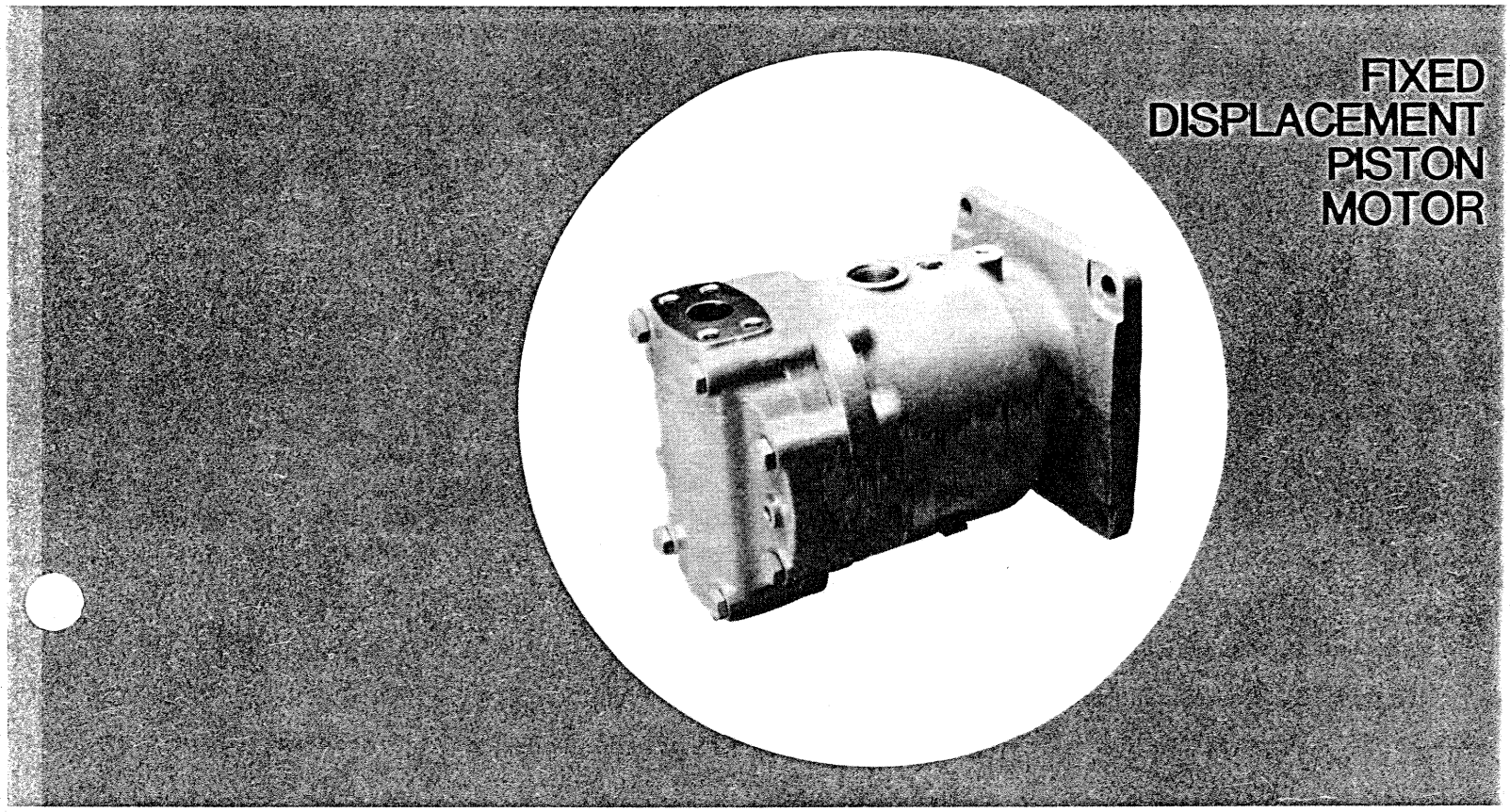
SPERRY VICKERS



FIXED DISPLACEMENT PISTON MOTOR

OVERHAUL MANUAL

MFD35-20/-21
MFD45/80/120-11/-12

80-485
Revised 8-1-83

SPERRY VICKERS, TROY, MI 48084
VICKERS, INCORPORATED, IS A SUBSIDIARY OF SPERRY CORPORATION
SPERRY VICKERS IS A REGISTERED TRADEMARK OF SPERRY CORPORATION

M-2770-S

TABLE OF CONTENTS

Section I · INTRODUCTION

A. PURPOSE OF MANUAL

This manual describes the basic operational characteristics and provides service and overhaul information for Sperry Vickers fixed displacement "D" series piston motors. Models included in this series are shown in Table 1.

MODEL	INSTALLATION DRAWING	PARTS & SERVICE DRAWING
MFD35-20/21	MB202A	M-2766-S
MFD45-11/12		M-2767-S
MFD80-11		M-2768-S
MFD120-11		M-2769-S
MFD80-12		M-2753-S
MFD120-12		M-2755-S

Table 1. Service Drawings

B. GENERAL INFORMATION

1. Related Publications - Service parts information and installation dimensions are not contained in this manual. The parts and installation drawings listed in Table 1 are available from any Sperry Vickers Sales Engineering office or from:

Sperry Vickers
Technical Publications
1401 Crooks Road
Troy, Michigan 48084-9880

2. Model Codes - Variations within each basic model are covered in the model code. Service inquiries should always include a complete unit model code number as stamped on the nameplate. See Table 2 for a breakdown of the model codes covering "D" series piston motors.

MODEL CODE BREAKDOWN

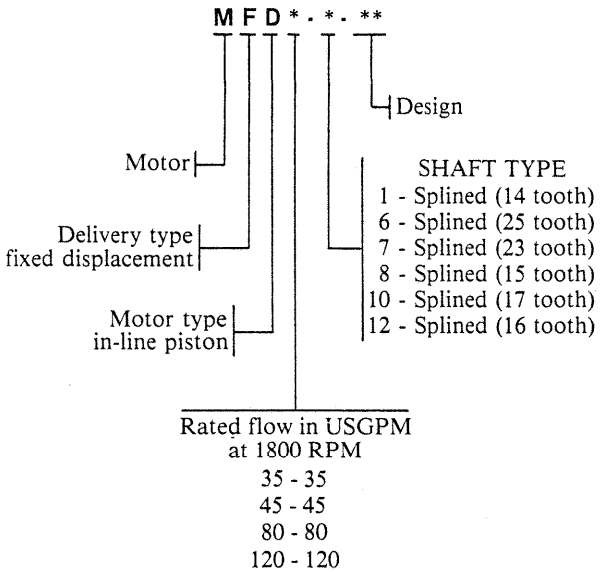


Table 2. Model Code Breakdown

Section II · DESCRIPTION

A. GENERAL

Sperry Vickers piston motors are of the axial piston positive displacement type, capable of high pressure operation.

B. ASSEMBLY AND CONSTRUCTION

A sectional view of a typical fixed displacement motor together with its ASA symbol, is shown in Figure 1. The motor's major components are: the housing, drive shaft, rotating group, swash plate, valve plate, and valve block. The valve block contains the inlet and outlet ports and also serves as the back cover of the motor. Bearings located in the cover and housing support the drive shaft.

C. APPLICATION

The installation drawings shown in Table 1 define normal motor performance characteristics, and theoretical output torque. For applications outside the given limits, a Sperry Vickers sales engineer should be consulted.

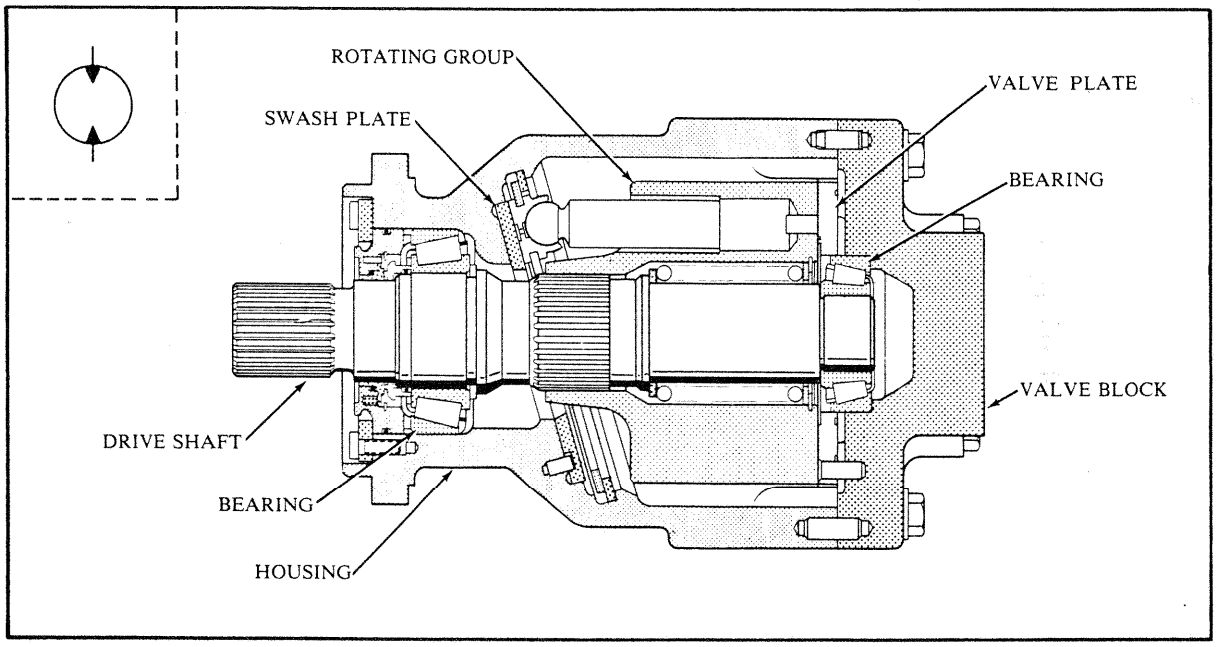


Figure 1. Basic MFD motor parts
(MFD45 shown)

Section III · PRINCIPLES OF OPERATION

GENERAL

Although nearly identical in design, pumps and motors essentially operate in reverse of each other. A pump forces fluid through the system as it rotates and the motor is rotated by the fluid. Piston motors are positive displacement units capable of producing a variable torque and speed. Speed (RPM) is a function of input fluid volume and motor displacement while output torque is a function of pressure differential and displacement.

In operation, fluid under pressure moves into the inlet of the piston motor, causing pressure to be applied to all pistons located within the inlet kidney slot. Each piston converts this pressure to a force acting through the piston shoes to the swash plate. The angle of the swash plate converts this force into rotary motion and the piston and shoe S/A's slide along the swash plate in the direction of rotation. The turning force developed by this sliding motion is transmitted to the cylinder block and subsequently to the motor shaft through a connecting spline. See Figure 2. When the pistons move over the outlet kidney slot, fluid discharges and returns to the reservoir. Rotation is reversed by reversing the fluid supply to the motor. Motors can be used for continuous, intermittent, or continuously reversing service. They can be stalled indefinitely under load without damage, when protected by a relief valve and heat exchanger.

Maximum output torque generated is limited by the system relief valve.

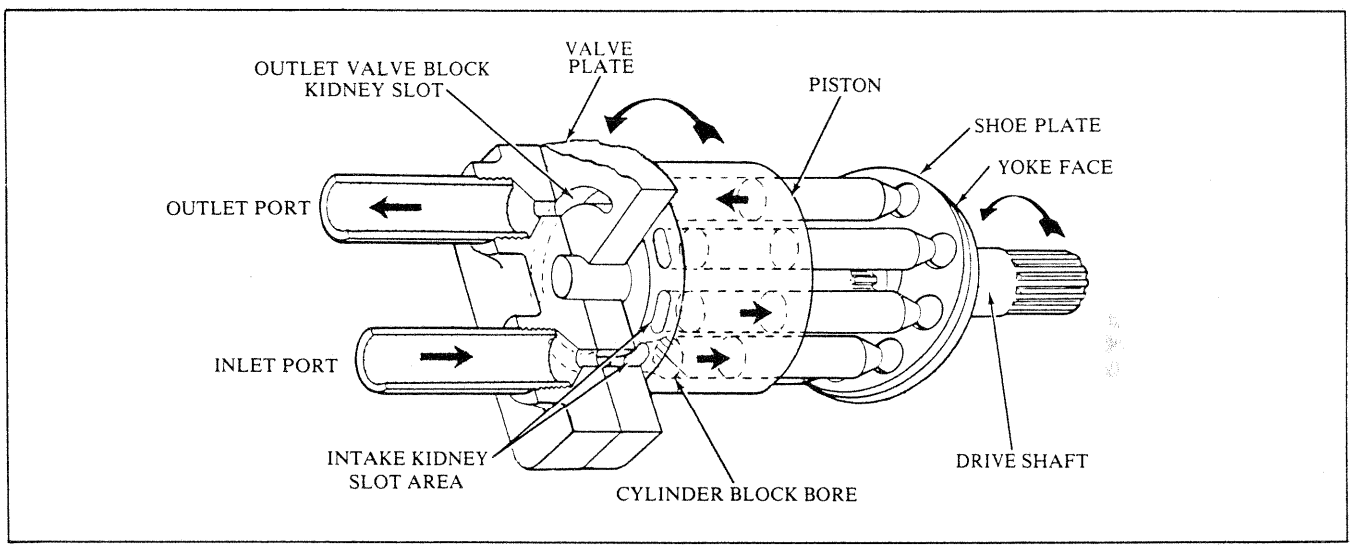


Figure 2. Basic motor operation

A. INSTALLATION DRAWINGS

Installation drawings shown in Table 1 should be consulted for installation information.

B. MOUNTING AND DRIVE CONNECTIONS

CAUTION

Sperry Vickers motor shafts are designed to be installed in flexible couplings with a slip fit or very light tap. Pounding can injure the bearings. Shaft tolerances are shown on the installation drawings. See Table 1.

1. Mounting - Mounting position is unrestricted. An unrestricted housing drain line must be connected from the uppermost drain port directly to the reservoir, in such a manner that the housing remains filled with system fluid at all times. The drain line should be full size, or oversize depending on its length. Proper drain line size will prevent a build up of housing pressure and also allows system fluid to flow freely from the motor housing, under severe operating conditions. No other drain line should connect into the housing drain line.

The housing drain line to the reservoir must be submerged at all times. If the drain line is above the fluid level, air could get into the motor and damage to the unit may result.

If the mounting position of the motor will not permit the drain line to be connected at the highest point, a rigid metal pipe or tube should be looped above the highest point of the motor. See Figure 3. This will prevent system fluid from siphoning or draining from the pump during shut-down periods.

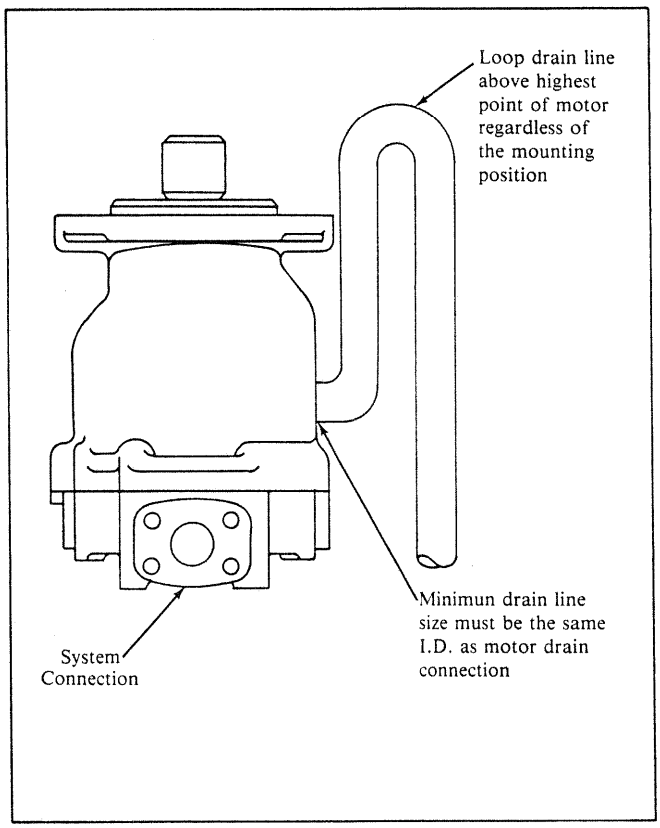


Figure 3. Mounting Drain Line

Before initial start-up, fill the motor housing with system fluid through the uppermost drain port. The housing must be kept full to provide internal lubrication.

2. Direct Drives - Care must be exercised when mounting the motor so that the pilot diameter fits properly into the machined accessory pad of the load. See Figure 4. The pilot should not be forced into the accessory pad under any condition. Care should be exercised in tightening all flange mounting screws to prevent misalignment of the shaft.

Shaft alignment is critical. Displacement or installation into the coupling at an angle can cause shaft breakage or bearing problems almost immediately.

3. Indirect drive is not recommended for these motors without Sperry Vickers engineering approval.

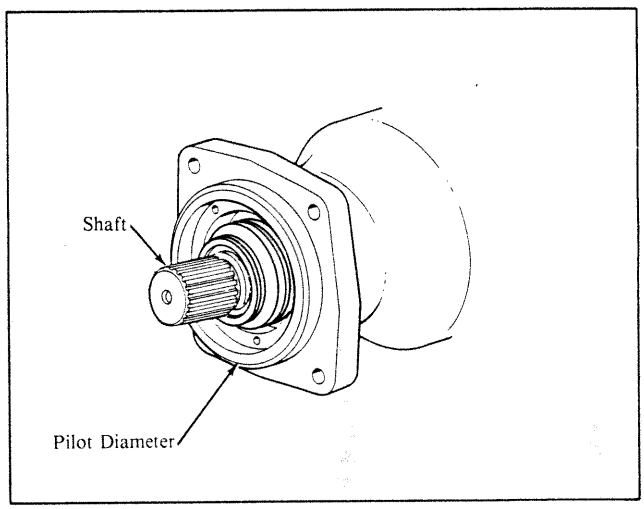


Figure 4. Drive Connections

C. SHAFT ROTATION

See the installation drawing to determine the direction of rotation when port A or B is the inlet. Determine rotation of Sperry Vickers motors by viewing from the shaft end of the motor.

D. HYDRAULIC TUBING

1. The number of bends in tubing should be kept to a minimum to prevent excessive turbulence and friction of fluid flow. Tubing must not be bent too sharply. The recommended minimum radius for bends is three times the inside diameter of the tube. In high pressure systems (5000 PSI), steel elbows should be used instead of bending tubing; this provides an increase in circuit life.

2. To minimize flow resistance and the possiblity of leakage, only as many fittings and connections as are necessary for proper installation should be used.

3. All tubing must be thoroughly cleaned before installation. Recommended methods of cleaning are wire brushing and pickling.

NOTE

For information on pickling, refer to instruction sheet 1221-S.

E. HYDRAULIC FLUID RECOMMENDATIONS

GENERAL DATA

Fluid in a hydraulic system performs the dual function of lubrication and transmission of power. It constitutes a vital factor in a hydraulic system, and careful selection of it should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components with particular emphasis on hydraulic motors. Any fluids selected for use with motors is acceptable for use with valves or pumps.

Data sheet M-2950-S for oil selection is available from Sperry Vickers Technical Publications, Troy, MI.

Fluid recommendations noted in the data sheet are based on our experience in industry as a hydraulic component manufacturer.

Where special considerations indicate a need to depart from the recommended fluids or operating conditions, contact your Sperry Vickers representative.

CLEANLINESS

Thorough precautions should always be observed to insure the hydraulic system is clean:

1. Clean (flush) entire new system to remove paint, metal chips, welding shot, etc.

2. Filter each change of fluid to prevent introduction of contaminants into the system.

3. Provide continuous filtration to remove sludge and products of wear and corrosion generated during the life of the system.

4. Provide continuous protection of system from entry of airborne contamination by sealing the system and/or by proper filtration of the air.

5. During usage, proper fluid filling and servicing of filter, breathers, reservoir, etc., cannot be over emphasized.

6. Thorough precautions should be taken by proper system and reservoir design, to insure that aeration of the fluid will be kept to a minimum.

SOUND LEVEL

Noise is only indirectly affected by the fluid selection, but the condition of the fluid is of a paramount importance in obtaining optimum reduction of system sound levels.

Some of the major factors affecting the fluid conditions that cause the loudest noises in a hydraulic system are:

1. Very high viscosities at start-up temperatures can cause pump noises due to cavitation.

2. Running with a moderately high viscosity fluid will impede the release of entrained air. The fluid will not be completely purged of such air in the time it remains in the reservoir, before recycling through the system.

3. Aerated fluid can be caused by ingestion of air through the pipe joints of inlet lines, high velocity discharge lines, cylinder rod packings or by fluid discharging above the fluid level in the reservoir. Air in the fluid causes a noise similar to cavitation.

F. OVERLOAD PROTECTION

Relief valves are required to limit pressure in the system to a prescribed maximum and protect components from excessive pressure.

G. STARTING AND PRIMING

NOTE

In most cases "break in" is not a problem, but when it is, it can be compared with new engines, gear boxes and other products. A by-product of "break in" is self generated contaminant. Generous filters and good filter maintenance are required during operating life of a hydraulic motor.

1. Precautions

a. Make sure the reservoir air cleaner is clean and sized to handle the system breathing requirements.

b. Make sure all inlet and system return line fittings are tight

c. Check shaft rotation and make sure coupling alignment is correct.

CAUTION

Be absolutely sure the housing is full of oil before starting. Fill the housing with system fluid through the uppermost drain port.

d. Bleed the pump outlet line until a clear stream of fluid results with no air bubbles present. This is best accomplished by loosening an inlet fitting next to the motor. Slowly extend and retract all hydraulic cylinders in the circuit and again bleed the inlet line. It may be necessary to bleed the circuit several times in order to remove all the air trapped in the circuit.

If the air is not expelled from the circuit after several attempts, check the inlet lines to the pump to make sure all the fittings are tight. When a hose is used for the inlet line for the pump, it is not uncommon for it to leak where it is attached to the fitting, and allow air to be drawn into the system.

e. Allow the unit to run at minimum operating speed for as long as possible, while checking the system for leaks and bleeding air out of the lines.

Section V - SERVICE, INSPECTION AND MAINTENANCE

A. INSPECTION

Periodic inspection of the fluid condition and tube or piping connections can save time-consuming breakdowns and unnecessary parts replacement. The following should be checked regularly:

1. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the fluid to leak out. If the fluid level becomes so low as to uncover the inlet pipe open-

ing in the reservoir, extensive damage to the pump can result. In suction or return lines, loose connections permit air to be drawn into the system resulting in noisy and/or erratic operation.

2.Clean fluid is the best insurance for long service life. Therefore, the reservoir should be checked periodically for dirt or other contaminants. If the fluid becomes contaminated, the system should be drained and the reservoir cleaned before new fluid is added.

3. Filter elements also should be checked and replaced periodically. A clogged filter element results in a higher pressure drop. This can force particles through the filter, which would ordinarily be trapped, or can cause the by-pass to open, resulting in a partial or complete loss of filtration.

4. Air bubbles in the reservoir can ruin the motor and other components. If bubbles are seen, locate the source of the air and seal the leak. See Table 4.

5. A motor which is running excessively hot or noisy is a potential failure. Should a motor become noisy or overheated, the machine should be shut down immediately and the cause of improper operation corrected.

B. ADDING FLUID TO THE SYSTEM

When hydraulic fluid is added to replenish the system, it should always be poured through a clean fine wire screen (200 mesh or finer) or preferably pumped through a 10 micron (absolute) filter.

It is important that the fluid be clean and free of any substance which could cause improper operation or wear of the motor or other hydraulic units. Therefore, the use of cloth to strain the fluid should be avoided to prevent lint getting into the system.

C. ADJUSTMENTS

No periodic adjustments are required, other than to maintain proper shaft alignment with the driven medium.

D. LUBRICATION

Internal lubrication is provided by the fluid in the system. Lubrication of the shaft couplings should be as specified by their manufacturers. Coat shaft splines with a dry lubricant (Molycoat or equivalent) to prevent wear.

E. REPLACEMENT PARTS

Reliable operation throughout the specified operating range is assured only if genuine Sperry Vickers parts are used. Sophisticated design processes and material are used in the manufacture of our parts.

Substitutes may result in early failure. Part numbers are shown in the parts drawings listed in Table 1.

F. TROUBLE-SHOOTING

Table 3 lists the common difficulties experienced with pumps and hydraulic systems. It indicates probable causes and remedies for each of the troubles listed.

Trouble	Cause	Remedy
I. Excessive noise in system	Low oil in the reservoir	Fill reservoir to proper level with the recommended fluid. DO NOT overfill or damage may result.
	Air in the system	1. Bleed high pressure closed loop at highest point in circuit. Both pressure lines must be bled to eliminate air. 2. "Bleed" hydraulic lines at highest point downstream of pump and while system is under pressure.
	Oil too thick	Be certain correct type oil is used for refilling or adding to the system.
	Cold weather	Run hydraulic system until unit is warm to the touch and noise disappears.
II. Hydraulic motor overheating	Internal leakage	If established that excessive internal leakage exists, return motor to maintenance shop for evaluation and repair.
	Heat exchanger not functioning	Locate trouble and repair or replace.
	Fluid level low	Add oil to operating level.
III. System not developing torque	Relief valve open	Repair or replace.
	Loss of fluid internally (slippage)	Return motor to maintenance shop for repair.
IV. Loss of fluid	1. Ruptured hydraulic lines 2. Loose fittings 3. Leaking gaskets or seals	1. Check all external connections, tubing and hoses. Tighten connections, replace ruptured tube or hose. 2. Observe mating sections of motor for leaks. Replace seals or gaskets as necessary.
V. Miscellaneous	Disconnected or broken drive mechanisms.	Locate and repair.

Table 3. Trouble Shooting Chart

G. SERVICE TOOLS

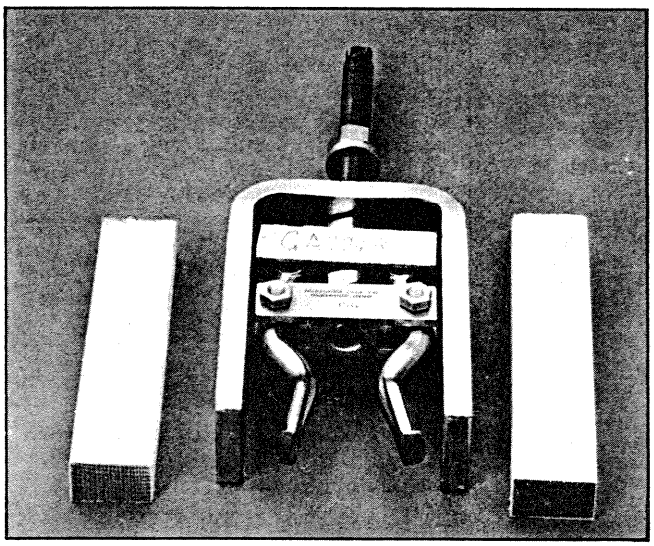
The following tools are needed to perform a complete overhaul of an MFD fixed displacement motor. It is manditory that both standard and special tools be available before overhaul is attempted.

STANDARD TOOLS

1. Two torque wrenches (0-200 lb.ft. and 0-125 lb.in.) with short extension and sockets.
2. 25.4 mm (1 inch) depth micrometer
3. 25.4 mm (1 inch) micrometer
4. Standard pliers or vice grips
5. Internal retaining ring pliers
6. Rubber or plastic hammer
7. Small ball peen hammer
8. Viscosity improver (STP or equivalent)

SPECIAL TOOLS

1. TX-30 insert bit (not required for MFD80)
2. Dial indicator with accessories
3. One length of 3.175 mm (1/8 inch) drill rod approx. 45.72 cm (18 inches) long
4. Cylinder block removal tool (Figure 5)
5. Bearing race removal tool (Figure 6)
6. Rotating seal assembly tool (Figure 7)
7. Shaft end play tool (Figure 8)
8. Valve block alignment studs (Table 4)
9. Rotating group assembly tools (Figure 9)
10. Retainer replacement tool (Figure 10)

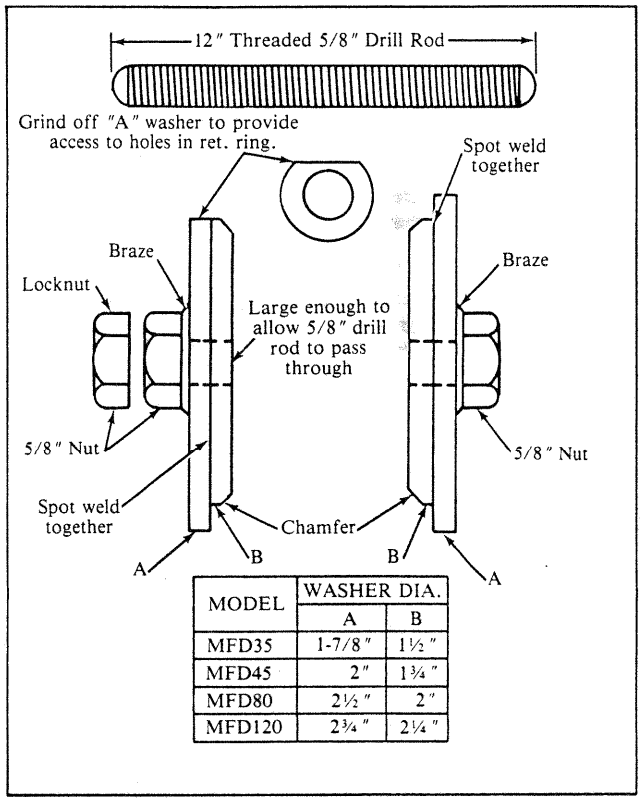


Tool #MD956
This tool is manufactured by:
Owatanna Tool Co.
376 North Street
Owatanna, WI 55060

Figure 6. Bearing Race Removal Tool

Obtain two long studs tabulated in Table 4. These studs will be used to support the valve block during disassembly and assembly.

Obtain a set of nine (9) piston assembly rods per Table 5. The rods will be used to align the pistons within the cylinder block bores at assembly.



MODEL	WASHER DIA.	
	A	B
MFD35	1-7/8"	1½"
MFD45	2"	1¾"
MFD80	2½"	2"
MFD120	2¾"	2¼"

Figure 5. Cylinder Block Spring Decompression Tool

MODEL	STUD PART NUMBER (2 Req'd)	DIA. THD. INCHES	SAE COARSE
MFD35	266398	.437 - 14	CL - 2A
MFD45			
MFD80	147901	.500 - 13	
MFD120	407966	.625 - 11	

Table 4. Disassembly/Assembly Studs

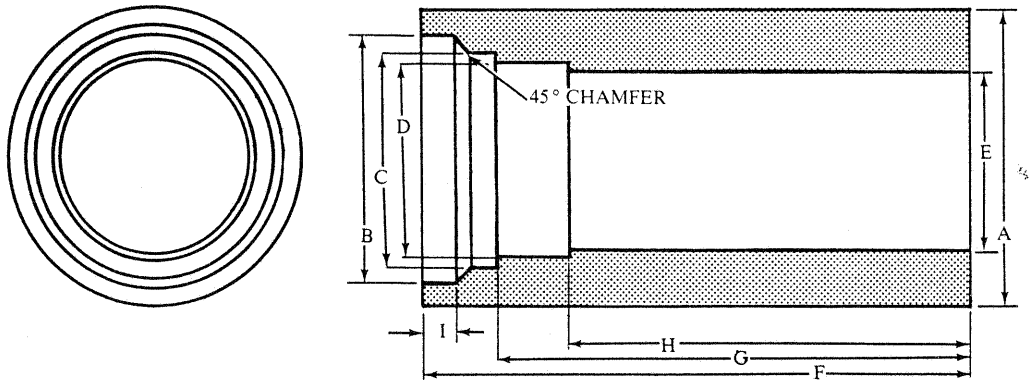
MODEL	ROD DIAMETER		ROD LENGTH		
	mm	inches	cm	inches	
MFD35	6.35	.25	20	8-10	Reference Figure 9
MFD45					
MFD80			*25.4	*10-12	
MFD120	*3.175-12.32	*.125-.485			

NOTE: 1 set = 9 assembly rods or strips.
*Use 12 gage steel to make strips for MFD120.

Table 5. Piston Assembly Rods or Strips

NOTE

In addition to the tools shown, an arbor press is required to service bearings, etc. Also, a chain fall is required to handle weight of the motor and valve block assembly. Repair of this unit is intricate and should not be attempted without proper tools.



MODEL		DIMENSION								
		A	B	C	D	E	F	G	H	I
MFD35	MM	76.2	53.47 / 53.59	46.99	39.67 / 39.75	37.69 / 37.82	120.65	104.14	78.74	8.89
	IN.	3.00	2.105 / 2.110	1.850	1.562 / 1.565	1.484 / 1.489	4.750	4.100	3.100	.350
MFD45	MM	88.9	60.76 / 60.88	54.4 / 54.53	44.75 / 44.83	37.69 / 37.82	120.65	104.14	80.01	6.35
	IN.	3.50	2.392 / 2.397	2.142 / 2.147	1.762 / 1.765	1.484 / 1.489	4.750	4.100	3.150	.250
MFD80	MM	88.9	75.59 / 75.69	68.38 / 68.5	58.06 / 58.14	52.10 / 52.22	120.65	101.6	80.01	6.35
	IN.	3.50	2.976 / 2.980	2.692 / 2.697	2.286 / 2.289	2.051 / 2.056	4.750	4.000	3.150	.250
MFD120	MM	88.9	77.32 / 77.39	68.96 / 69.08	62.08 / 62.15	60.02 / 60.15	120.65	101.6	80.01	6.35
	IN.	3.50	3.044 / 3.047	2.715 / 2.720	2.444 / 2.447	2.363 / 2.368	4.750	4.000	3.150	.250

Figure 7. Rotating Seal Assembly Tool

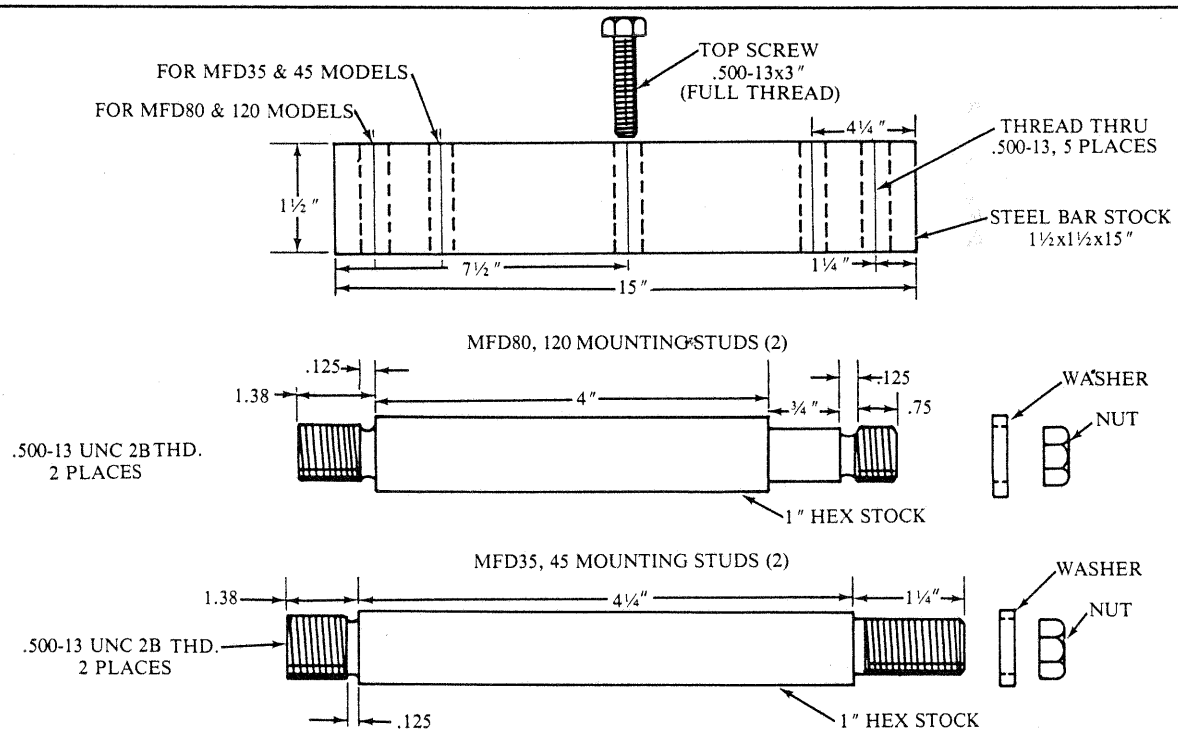
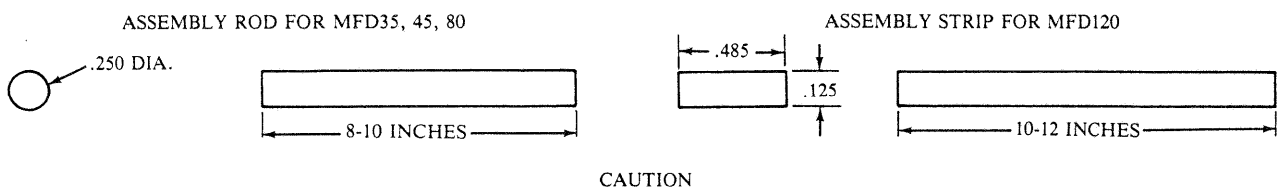


Figure 8. Shaft End Play Tool



CAUTION

Four edges must be deburred with sandpaper or file; failure to deburr edges may cause cylinder bore damages during assembly.

Figure 9. Rotating Group Assembly Tools

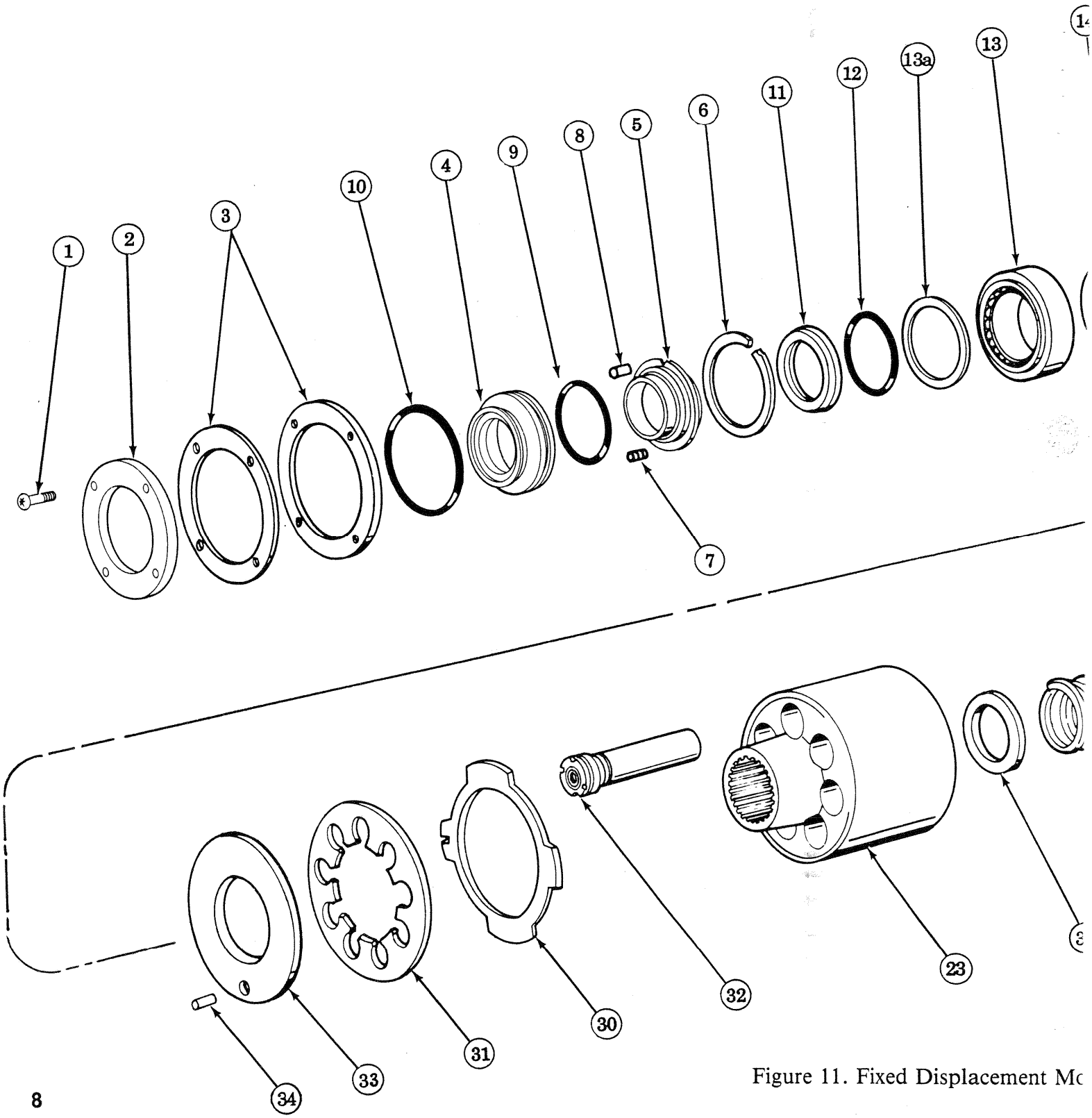
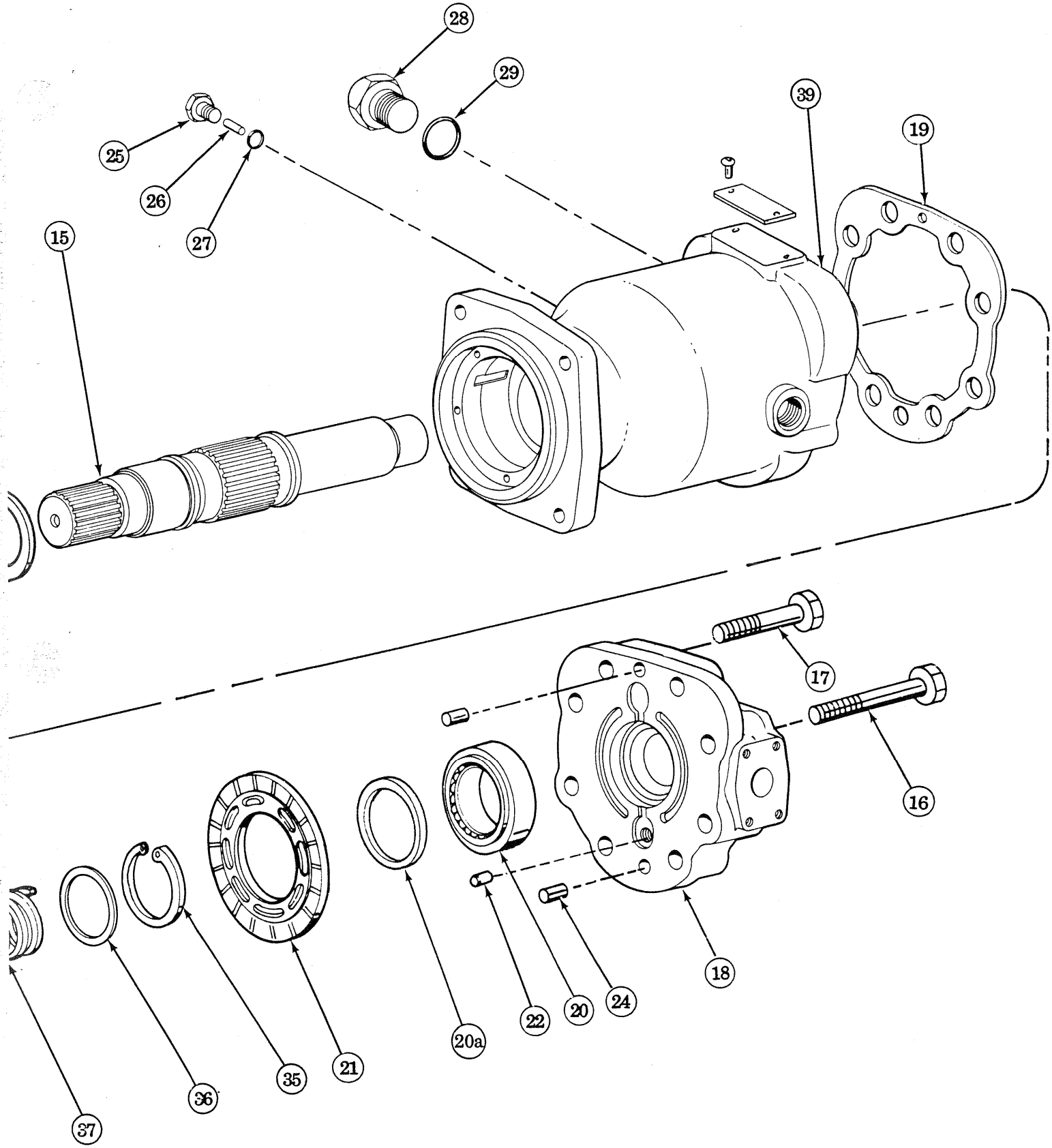
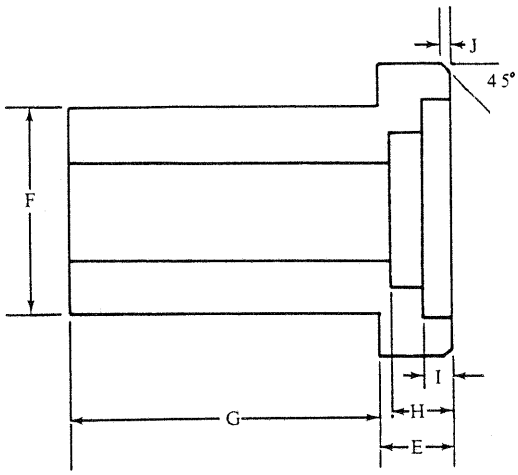


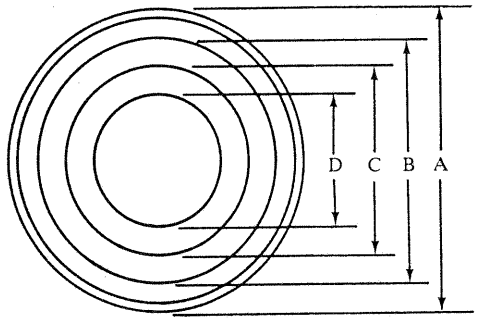
Figure 11. Fixed Displacement Mc



s "D" Series—Exploded View

ITEM	DESCRIPTION	QTY
1.	Screw	6
2.	Retainer	1
3.	Shim	A/R
4.	Seal Retainer	1
5.	Stationary Seal	1
6.	Retaining Ring	1
7.	Spring	A/R
8.	Pin	1
9.	"O" Ring	1
10.	"O" Ring	1
11.	Rotating Seal	1
12.	"O" Ring	1
13.	Bearing	1
13a.	Washer	1
14.	Retaining Ring	1
15.	Shaft	1
16.	Screw	4
17.	Screw	4
18.	Valve Block	1
19.	Gasket	1
20.	Bearing	1
20a.	Spacer	1
21.	Valve Plate	1
22.	Pin	1
23.	Cylinder Block	1
24.	Pin	2
25.	Plug	1
26.	Pin	1
27.	"O" Ring	1
28.	Plug	1
29.	"O" Ring	1
30.	Limiter	1
31.	Shoe Plate	1
32.	Pistons	9
33.	Swash Plate	1
34.	Pin	1
35.	Retaining Ring	1
36.	Washer	1
37.	Spring	1
38.	Washer	1
39.	Housing	1





NOTE: Make tool out of aluminum stock

MODEL		DIM. A	DIM. B	DIM. C	DIM. D	DIM. E	DIM. F	DIM. G	DIM. H	DIM. I	DIM. J
MFD35	IN.	3.48 / 3.53	2.88 / 2.89	2.63 / 2.64	1.77 / 1.78	.766 / .770	2.95 / 3.03	2.95 / 3.03	.546 / .557	.180 / .182	.157 / .162
	MM	89.40 / 89.66	73.20 / 73.25	66.68 / 66.73	45.0 / 45.03	19.46 / 19.56	75.0 / 77.0	75.0 / 77.0	13.84 / 14.15	4.57 / 4.62	4.0 / 4.1
MFD45	IN.	3.48 / 3.53	3.0 / 3.01	2.61 / 2.63	1.97 / 1.98	.672 / .677	2.95 / 3.03	3.25 / 3.35	.562 / .572	.185 / .189	.157 / .162
	MM	88.40 / 89.66	76.20 / 76.30	66.42 / 66.93	50.02 / 50.04	17.09 / 17.20	75.0 / 77.0	82.55 / 85.10	14.30 / 14.55	4.7 / 4.8	4.0 / 4.1
MFD80	IN.	4.30 / 4.35	3.93 / 3.94	3.25 / 3.26	2.28 / 2.29	.654 / .659	3.74 / 3.75	3.40 / 3.50	.580 / .585	.285 / .290	.113 / .118
	MM	109.2 / 110.5	100.0 / 100.1	82.7 / 82.8	58.0 / 58.03	16.61 / 16.74	94.0 / 95.0	86.0 / 89.0	14.73 / 14.86	7.24 / 7.37	2.87 / 3.00
MFD120	IN.	4.76 / 4.78	4.56 / 4.57	4.17 / 4.18	2.63 / 2.64	.787 / .791	4.25 / 4.26	3.40 / 3.50	.293 / .295	.292 / .295	.157 / .162
	MM	121.0 / 121.5	116.0 / 116.1	106.0 / 106.1	66.71 / 66.73	20.0 / 20.1	108.0 / 108.1	86.0 / 89.0	7.45 / 7.50	7.40 / 7.50	4.0 / 4.1

Figure 10. Shaft Stabilizer Tool

Section VI - OVERHAUL

A. GENERAL

CAUTION

Block vehicle if it is on a slope to prevent uncontrolled movement.

CAUTION

Before breaking a circuit connection, make certain that power is off and system pressure has been released. Lower all vertical cylinders, discharge accumulators and block any load whose movement could generate pressure.

CAUTION

Absolute cleanliness is essential when working on a hydraulic system. Always work in a clean area. The presence of dirt and foreign materials in the system can result in serious damage or inadequate operation.

Drain oil from the vehicle hydraulic system. Use new clean oil when restoring the unit to service.

Before breaking a circuit connection, hose off or otherwise clean the outside of the unit thoroughly to prevent entry of dirt into the system.

After removing the MFD motor from the vehicle and before disassembly, cap or plug all ports and disconnected hydraulic lines.

Repair of the MFD motor will generally not require disassembly to the extent described here. The sequence can also be used as a guide for partial disassembly. In general, disassembly is accomplished in the item number sequence shown in Figure 11. Special procedures are included in the following steps:

NOTE

Discard and replace all "O" rings, gaskets and shaft seals removed during disassembly.

NOTE

All parts must be thoroughly cleaned and kept clean during inspection and assembly. The close tolerance of the parts makes this requirement very important. Clean all removed parts using a commercial solvent that is compatible with the system fluid. Compressed air may be used in cleaning, but it must be filtered to remove water and contamination. Clean compressed air is particularly useful in cleaning valve block passages.

B. DISASSEMBLY (Refer to Figure 11)

WARNING

The following steps (1 through 5) are necessary to prevent destruction of the face type shaft seal by the application of radial force on the shaft. Installation of the retainer replacement tool also prevents the possibility of scratching the valve plate during installation of the cover end parts.

NOTE

Set the motor on its cover with the shaft pointing up.

1. Remove six retainer screws (1). Special Torx bit TX-30 is required for removal of all MFD retainer screws, except on the MFD80 series. The MFD80 uses standard hex headscrews.

2. Remove retainer (2) and shims (3). NOTE: Shims do not exist on twelve (-12) design units. If the shaft, housing and valve block are not replaced, the same shims can be used for establishing nominal shaft end play at assembly.

3. Use two screwdrivers to remove stationary seal retainer (4) and its associated parts: stationary seal (5), retaining ring (6), springs (7), a pin (8), and "O" rings (9 and 10) from the housing (39).

4. Reach into housing (39) and slide rotating seal (11) and its "O" ring (12) from the shaft. Be careful not to scratch the mating surface of the seal during this operation. Set all parts of the face type shaft seal aside for inspection.

5. Install special retainer replacement tool (See Figure 10) over the shaft and into housing (39). Then, install retainer (2) with two or three screws (1) hand tight. This arrangement will hold the shaft in position during disassembly of the rotating group and prevent the shaft from falling against the pistons with catastrophic results.

6. Turn the unit on its side and remove two valve block screws (16) located across from each other. Install studs noted in Table 4 (Special Tools). Tighten the studs in place with vise grip pliers.

7. Remove the remaining valve block screws (16) and (17) from housing (39).

8. Use a chain fall to maneuver valve block (18) from housing (39). Slide valve block (18) slowly away from housing (39). If the valve block will not break free from the housing, tap sides of the valve block with a rubber or plastic hammer. If the valve block still will not dislodge, insert a wedge between the valve block and housing.

During removal, valve plate (21) may stick to cylinder block (23). Be careful not to damage the valve block, valve plate or housing during this operation. Once the valve block moves away, do not allow it to move back against the housing as the valve plate may be damaged. Discard gasket (19).

NOTE

In the following step it is sometimes difficult to remove valve plate (21) from cylinder block (23). If this is the case, remove bearing (20). This allows valve plate to drop down for easy removal.

9. Remove valve plate (21) and then remove bearing (20) from shaft (15). NOTE: A bearing spacer (20a) exists on the twelfth (-12) design units. DO NOT remove shaft bearing race (20) from the valve block unless damage is evident. If removal is required, use bearing race removal tool shown in Figure 6, then refer to Figure 12.

Do not remove pins (24) or pin (22) from valve block unless damage is evident.

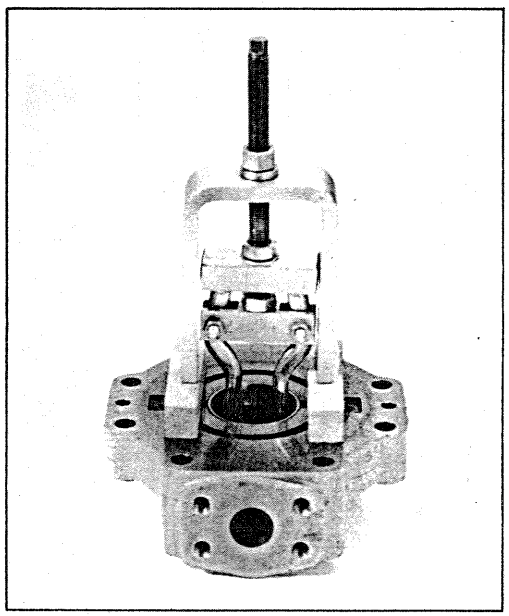


Figure 12. Removal of bearing race from valve block

10. Reach in housing and slowly remove cylinder block (23) from housing. The pistons (32) will now be exposed in the housing.

11. Remove plugs (25), (28) and pin (26) from housing. Discard "O" rings (27) and (29).

12. Reach into housing with a length of 3.175 mm (1/8 inch) drill rod (noted in special tool section) and rotate limiter (30) with the drill rod to unlock shoe plate (31) from housing.

13. Remove limiter (30), shoe plate (31), and nine pistons (32) from housing (39).

14. Remove screws (1) and retainer ring (2). Then, remove shaft (15) and slide special retainer tool from the shaft. Remove bearing washer (13a) from shaft (MFD45 models only).

15. If shaft bearing (13) needs to be replaced, set shaft (15) in arbor press and remove bearing (13). DO NOT remove retaining ring (14) and bearing (13) unless inspection reveals the parts defective.

16. Remove swash plate (33) from housing (39). If pin (34) is damaged, remove it from housing.

17. If necessary, remove items (35) through (38) from cylinder block (23). See Figure 13 for disassembly instructions.

WARNING

Spring (37) located within the cylinder block (23) is under high compression and can cause bodily harm if retaining ring (35) is removed without adequate caution.

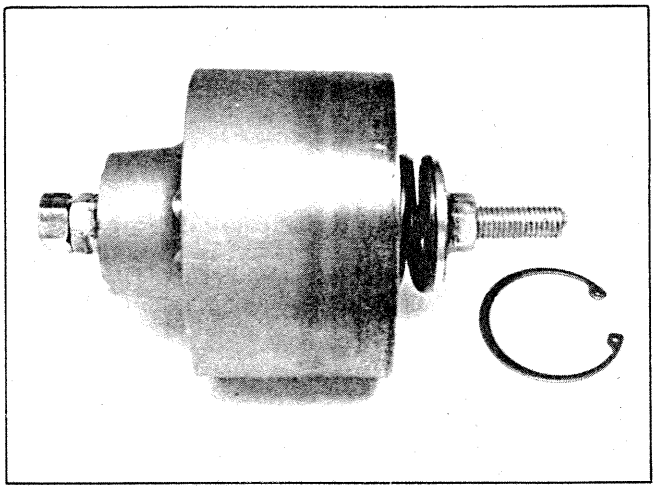


Figure 13. Cylinder Block Subassembly Disassembly Tool (Tighten nut, remove snap ring, loosen nut to relieve spring tension.)

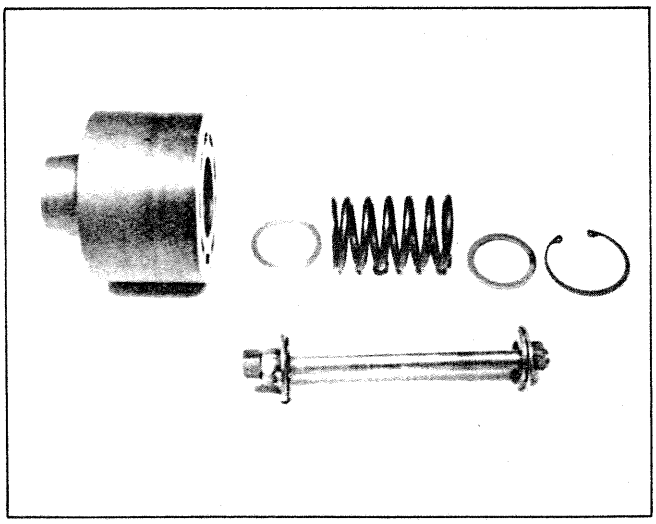


Figure 13a. Cylinder Block Subassembly Parts

Cylinder Block Disassembly Procedure

Install tool with slotted washer toward retaining ring end of cylinder block S/A. Position slot so retaining ring can be removed. Tighten nuts to compress spring and washer. Remove retaining ring. Loosen nuts to relieve spring compression.

C. INSPECTION, REPAIR & REPLACEMENT

NOTE

Replace all parts that do not meet the following specifications.

1. Inspect all screws for burrs, broken or stripped threads and worn corners on the hex head. Use an India stone to clean up burrs. If threads or heads are defective, replace the screw.

NOTE

All parts must be thoroughly cleaned and kept clean during inspection and assembly. Clean all removed parts using a commercial solvent that is compatible with the system fluid. Compressed air may be used in cleaning, but it must be filtered to remove water and contamination. Clean compressed air is particularly useful in cleaning valve block passages, cylinder blocks, etc.

2. Inspect the threaded plugs for worn corners on the hex head, stripped threads and burrs in the "O" ring groove. Use an India stone to remove burrs. If threads are defective replace the plug.

3. Inspect springs for wear and damaged coils. Replace spring if worn or damaged. Inspect springs for distortion. The ends of the spring must be parallel to each other and ground square with axis within 3°. Replace if distorted.

4. Inspect bearings (13) and (20) for brinelling, pitting of rollers and roughness when turned in the bearing race. If a bearing is defective, both the bearing cone and bearing race must be replaced. If bearing race located in valve block (18) requires removal, refer to the procedure shown in Figure 12.

5. Inspect cylinder block (23) for wear, scratches and/or erosion between cylinders. Check each cylinder block bore for excessive wear. Use the piston and shoe subassemblies (32) for this purpose. The piston should be a very close fit and slide easily in and out of the bore. No bind can be tolerated. If binding is evident, clean the cylinder block and piston. Lubricate with clean system fluid and try again. Even minor containimation of the fluid could cause the piston to freeze up within the cylinder block bore.

6. Inspect each piston shoe subassembly (32) for a maximum end play of 0.762 mm (0.003 inch); also, check for freedom of movement of the shoe. The shoe must be free to rotate through 17° minimum (spherical). Piston shoe face thickness should not vary greater than .0254 mm (.001 inch) from one shoe to another.

At overhaul, the replacement of all 9 piston and shoe subassemblies in the unit, as well as the cylinder block, is recommended for maximum overhaul life. Figure 14 illustrates piston (32) specifications.

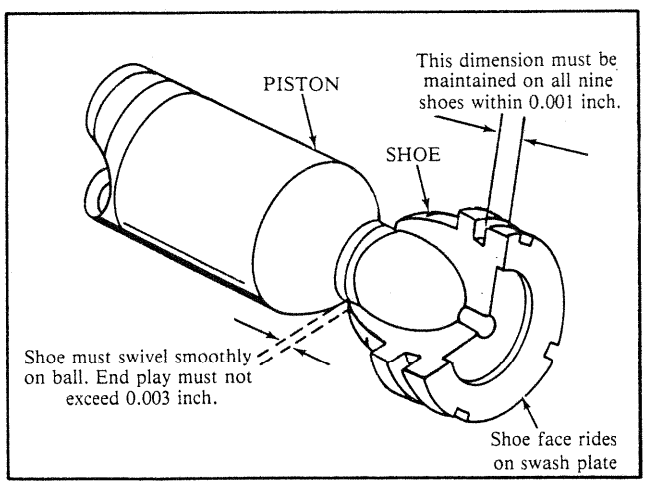


Figure 14. Piston Shoe S/A Inspection

7. Inspect the bronze face of valve plate (21) for excessive wear, scratches, and possible damage. If the valve plate is damaged, make sure the new plate rests flat (line to line) against the valve block at assembly.

8. Check retainer (2) for burrs and heavy scratches. Remove scratches and burrs with an India stone or small file.

9. Check retaining ring (35), back washer (36), spring (37), and front washer (38) for wear and burrs if removed from cylinder block (23). Replace if defective.

10. Inspect shaft (15) for wear and chipped splines. Do not remove retaining ring (14) from the shaft unless it shows evidence of wear or the shaft requires replacement.

11. Inspect swash plate (33) for metal pickup, heavy scratches, and excessive wear. Replace the swash plate if such evidence is found.

12. Inspect housing (39) for burrs, nicks, cracks, cross threads and wear. Inspect housing mounting face for deep scratches that could cause leakage past the gasket (19). Clean up burrs and small scratches with an India stone.

13. Inspect valve block (18) for burrs, nicks, wear and cracks. Clean up with an India stone. If valve block is scored, replace it.

14. Inspect face type shaft seal assembly parts (4 through 11) for cracks and/or scratches on the face of sealing parts. If defective, replace both the stationary and rotating seal member as a set, along with the springs, parts (5, 7, & 11). Use extreme care when handling these parts, as they can be easily damaged.

D. ASSEMBLY (Refer to Figure 11)

Assembly is basically the reverse of disassembly unless noted. Lubricate parts with a light film of hydraulic fluid prior to assembly. "O" rings may be lubricated with a viscosity improver. Obtain necessary special tools.

NOTE

If cylinder block (23) was disassembled during inspection, perform the following step. Omit the following step if cylinder block was not disassembled.

1. Cylinder block assembly:

a. Install front washer (38), spring (37), back washer (36) and retaining ring (35). Refer to Figure 13 and reverse removal procedure. MAKE SURE that sharp edge of retaining ring (35) points outward and is seated properly within its groove, before removing threaded tool from cylinder block.

b. Install shaft (15) through cylinder block (23). If shaft does not go through cylinder block, tap on side of block with rubber or plastic hammer. This procedure will center spring (37) and washers (36 & 38) with shaft (15).

NOTE

Perform the following step if bearing (13) and retaining ring (14) was removed from shaft (15) during inspection. Omit the following step if bearing was not removed from the shaft.

2. Bearing Assembly:

a. Press bearing (13) on shaft (15). Make sure small end of cone points toward spline end of shaft at completion of press. Use an arbor press for this operation.

b. Clean bearing with a solvent compatible with system fluid. Lubricate and set bearing race in place over the cone.

c. Rotate the bearing race and cone to verify freedom of movement and smooth operation. Bearing must not bind or have a feeling of roughness.

NOTE

If bearing race (20) was removed from valve block (39), press a new bearing race in place as noted in the following step. If the bearing race is in place within the valve block, omit the following step.

3. Position valve block (18) on the clean surface of an arbor press. Use a piece of wood to protect lower surface of valve block. Position new bearing race (20) with small I.D. facing into valve block. Press in place. Use a suitable socket wrench or piece of hardwood as a pressing tool. Press bearing race (20) into valve block until it bottoms against shoulder.

NOTE

The following step describes setting shaft end play if shaft end play tool is not available. (See special tool section, Figure 8). If end play tool is available, omit following step.

4. Procedure for setting shaft end play (without tool):

NOTE

MFD35-20 units and MFD45/80/120-11 units utilize shims to set shaft end play. The MFD35-21 and MFD45/80/120-12 designs use a spacer to accomplish the end play adjustment. To provide ease of adjustment in the field, both the spacer and shims will be used to set shaft end play. Refer to the appropriate service parts drawing and use the thickest spacer (20a) available in the spacer kit, then shim the shaft end of the pump as follows.

a. Measure thickness of outer seal retainer (2) and record.

b. With a depth micrometer, measure from flange end of housing (39) to shoulder within the housing. Record this dimension.

c. Install shaft (15) with bearing from the flange end of housing (39), then install bearing cone (20) on the other end of shaft. (Install bearing spacer (20a) on the -12/-21 design units.)

d. Assemble gasket (19) and valve block (18) to housing (39), without valve plate or rotating group. Torque screws (16) and (17) as noted in Table 6.

e. Install bearing washer (13a) on bearing (13) (MFD45 models only). Install inner seal retainer (4) less "O" rings and seal(s) into housing (39). Slide retainer up against bearing race (13).

f. Install outer retainer (2) without shims. Thread screws (1) hand tight.

g. Torque screws evenly to 0.339 N.m (3 in.lb.), while turning shaft to seat the bearings.

h. Measure depth of outer seal retainer (2) from the front of the housing. Add to this figure the thickness of the seal retainer noted in step 4.a. Subtract this total from the depth of the shoulder noted in step. 4.b. This will provide a line to line dimension. Since the shaft bearings are set at 0.0254-0.1016 mm (0.001-0.004 inch) end play, if we add 0.0508 mm (0.002 inch) to the line to line dimension, we obtain a nominal shim pack thickness.

i. Remove outer seal retainer (2) and install the calculated shim pack (3); then, install outer seal retainer and torque screws (1) to 7-9.5 N.m (5-7 lb.ft.). Check end play to be within the 0.0254-0.1016 mm (0.001-0.004 inch) dimension. Rotate the shaft through at least four revolutions before measuring end play. If shaft end play is not within the specifications noted, remove or add shims until the correct end play is obtained. See Figure 11 for location of shims.

j. Remove screws (1), outer retainer (2), shims (3), and inner retainer (4) from pump housing (39).

k. Remove valve block screws (16) and (17), then remove valve block (18) from housing (39). Remove gasket (19) and set aside for assembly.

l. Remove bearing cone (20) and spacer (20a) if used from end of shaft (15).

m. Remove shaft (15) with bearing (13) and bearing washer (13a) if applicable, from housing (39).

5. Install swash plate pin (34) into housing if previously removed. Place swash plate (33) in place over the pin (34). The swash plate should rest flat against housing surface. Check height of pin in housing and depth of hole in swash plate if swash plate does not set flat.

6. Assemble 9 pistons (32) on shoe plate (31) and then install them into housing (39) against swash plate (33).

7. Install limiter (30) (chamfer side up) into housing (39) until it rests against shoe plate (31). Use a drill rod to rotate limiter until the limiter slot lines up with the pin hole in the housing.

8. Install "O" ring (27) on plug (25). Apply a little viscosity improver into the hole of plug (25). Install pin (26) about 6.35 mm (¼ inch) into plug (25). Insert plug and pin into housing and MAKE SURE pin (26) fits into limiter (30) slot. If the pin is not located properly, the rotating group will bind up and possible distruction of the motor will occur at start-up.

NOTE
Plug (25) will not screw down all the way if pin (26) is not engaged. Torque plug (25) to 47-54 N.m (35-40 lb.ft.).

9. Install shaft (15) and bearing (13) into housing (39).

10. Install retainer tool (see special tool section) over spline end of shaft and into housing (39). This will hold shaft during installation of cylinder block (23). Secure the retainer with screws (1).

11. Obtain assembly rods noted in special tool section. Lubricate cylinder block bores and feed pistons into cylinder block. See Figure 15 for assembly instructions.

12. Install bearing spacer (20a) if required and cone (20) (small diameter up) on end of shaft.

13. Install valve plate pin (22) into valve block (18) if removed during disassembly. Make sure pin (22) is bottomed out in valve block (18).

14. Install valve plate (21) over valve plate pin (22) and against face of valve block (18). Use a little viscosity improver on back of valve plate to prevent separation from valve block during installation. Make sure valve plate is flush against valve block. Lubricate face of valve plate and cylinder block with hydraulic fluid.

15. If roll pins (24) were removed during disassembly, install roll pins (24) into housing (39). Be careful not to damage housing face when installing roll pins.

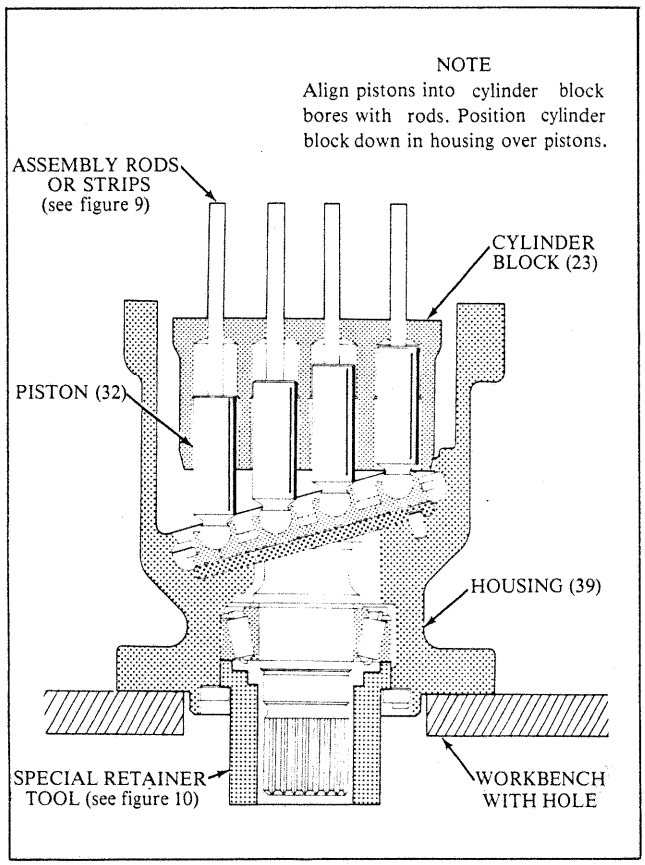


Figure 15. Piston/Cylinder Block Assembly

CAUTION
In the following step, DO NOT allow valve plate (21) to touch cylinder block (23) and then back away. Valve plate (21) may adhere to the cylinder block and if pulled away, can fall out of position with valve plate pin (22). If valve block (18) is then moved against housing (39), damage to valve plate and cylinder block may result.

16. Install gasket (19) over the two alignment studs, reposition motor so shaft is horizontal then locate valve block (18) on alignment studs and slide up against housing (39). Make sure shaft (15) is aligned with bearing and does not hit against the valve plate during installation. Thread screws (16) and (17) through valve block and into housing (39). Remove alignment studs and replace them with the appropriate screws. Torque valve block screws as indicated in Table 6.

MODEL	Torque Screws to:	
	N. m	lb. ft.
MFD35	47 - 54	35 - 40
MFD45		
MFD80	110 - 140	81 - 103
MFD120	200 - 240	148 - 177

Table 6. Valve Block Screws

17. Install "O" rings and shaft seals as follows:

a. Position the motor so shaft is pointing up. Set motor on valve block end.

b. Remove retainer screws (1) from retainer (2).

c. Remove special retainer replacement tool.

d. Install bearing washer (13a) on bearing (13) (MFD45 models only).

e. Lubricate shaft with a viscosity improver.

f. Lubricate "O" rings (12) (yellow coated) and place it into rotating seal (11). Then position rotating seal on seal assembly tool noted in special tool section (Figure 7). Position seal assembly tool squarely over shaft (15) and assemble rotating seal (11) on shaft (15) against bearing (13). See Figure 16.

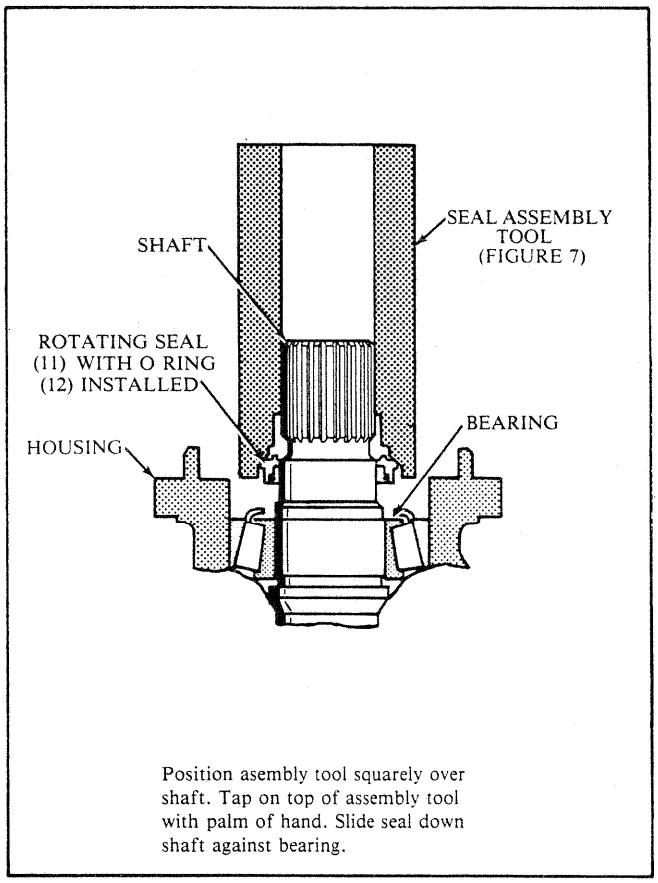
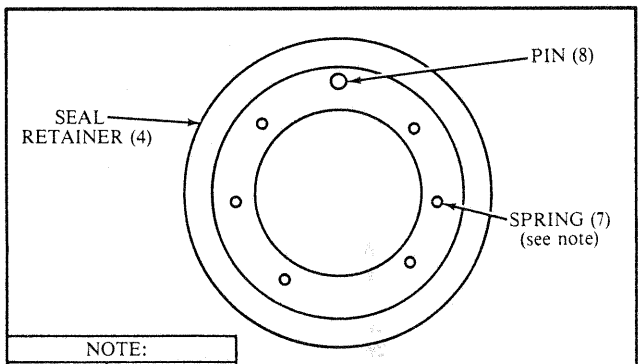


Figure 16. Rotating Seal Installation

NOTE

If seal assembly tool is not available, carefully place rotating seal (11) squarely over shaft (15). Push seal (11) down shaft (15) with fingers until it rests against bearing (13).

g. Perform this step (f) and the following (g) only if stationary seal (5) was disassembled from seal retainer (4). If pin (8) was removed, tap it into designated hole of seal retainer (4). Install springs (7) into remaining holes of seal retainer. Refer to Figure 17 for pin and spring locations.



NOTE:	
MODEL	SPRINGS (7) REQ'D
MFD35	6
MFD45	4
MFD80	5
MFD120	6

Figure 17. Pin (8) and Spring (7) Location

h. Assemble "O" ring (9) onto stationary seal (5). Install stationary seal (5) into seal retainer (4). Position stationary seal slot to straddle pin (8). Install retaining ring (6) into seal retainer groove to secure stationary seal (4). MAKE SURE retaining ring is in stationary seal groove.

i. Assemble "O"ring (10) on seal retainer (4). Lubricate "O" rings and seal face and then carefully place seal retainer over shaft (15) and slide against rotating seal (11).

NOTE

The following step describes the installation of shims (3), retainer (2), and retainer screws (1). If shims were calculated per step 4.a. through 4.1, perform the following step. If shims (3) were not calculated and use of shaft end play tool is intended, omit step 18 and proceed to step 19.

18. Install calculated shims (3). Install retainer (2). Thread screws (1) through retainer (2) and shims (3) into housing (39). Torque screws (1) to value shown in Table 7.

MODEL	Torque Screws (19) to:	
	N. m.	lb. ft.
MFD35	7 - 8	6 - 7.5
MFD45		
MFD80	25 - 30	18 - 22
MFD120	11 - 13	8 - 10

Table 7. Retainer Screws (1)

19. Adjustment of shaft end play using shaft end play tool:

a. Install approximately 1.016 mm (.040) shims (3). Assemble retainer (2). Thread screws (1) through retainer (2) and shims (3) into housing (39). Torque screws (1) to value noted in Table 7.

b. Assemble shaft end play tool and dial indicator on motor per Figure 18. To measure shaft end play, perform the following steps.

1. Set dial indicator for zero (top screw loose).

2. Torque top screw per Table 8.

MODEL	Torque Screw to:	
	N. m.	lb. in.
MFD35	48	35
MFD45	61	40
MFD80	109	80
MFD120	163	100

Table 8. Torque Screw Limits

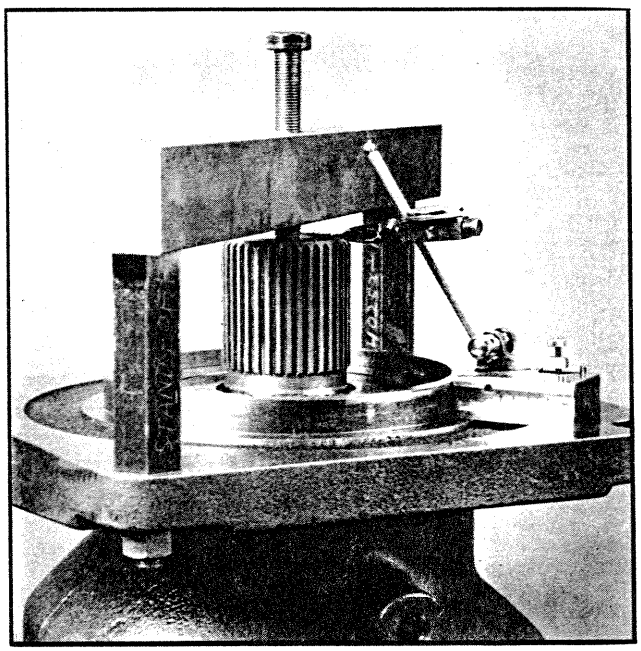


Figure 18. Shaft End Play Tool on MFD Motor

3. With top screw torqued to required value per Table 8, read dial indicator. If dial indicator shows a reading of 0.254-.1016 mm (0.001-0.004 inch) the amount of shims (3) installed is correct. If the dial indicator does not fall within this range, subtract shims (3) accordingly and repeat Step 19. Remove fixture from motor.

20. Turn the motor shaft (360°) in both directions with a wrench. Breakaway torque shall be as noted in Table 9. The shaft should turn free in both directions. If resistance to turning is found in either direction, investigate.

MODEL	Maximum Break Away Torque	
	N. m.	lb. in.
MFD35	9	80
MFD45	11.86	165
MFD80	39.5	350
MFD120	42.37	375

Table 9. Break Away Torque

21. Assemble "O" ring (29) on plug (28). Install plug (28) into housing (39). Torque plug (28) to values noted in Table 10.

MODEL	Torque Plug To:	
	N. m.	lb. ft.
MFD35	20 - 25	15 - 18
MFD45		
MFD80	54 - 59	39 - 43
MFD120	55 - 61	75 - 83

Table 10. Plug (28) Torque Values

22. Install motor and reconnect pressure lines. FILL THE MOTOR CASE WITH CLEAN HYDRAULIC FLUID BEFORE START UP. (Reference Installation drawing, Table 1).

Section VII · TESTING

Sperry Vickers application engineering personnel should be consulted for test stand circuit requirements and contruction. If test equipment is available, the motor should be tested at recommended speeds and pressures shown on the installation drawing.

INTENTIONALLY BLANK

LITHO IN U.S.A.