



MASSEY- FERGUSON

SHOP MANUAL



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- Easy-to-use format for quick and handy reference
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Information and Instructions

This shop manual contains several sections each covering a specific group of wheel type tractors. The Tab Index on the preceding page can be used to locate the section pertaining to each group of tractors. Each section contains the necessary specifications and the brief but terse procedural data needed by a mechanic when repairing a tractor on which he has had no previous actual experience.

Within each section, the material is arranged in a systematic order beginning with an index which is followed immediately by a Table of Condensed Service Specifications. These specifications include dimensions, fits, clearances and timing instructions. Next in order of arrangement is the procedures paragraphs.

In the procedures paragraphs, the order of presentation starts with the front axle system and steering and proceeding toward the rear axle. The last paragraphs are devoted to the power take-off and power lift sys-

tems. Interspersed where needed are additional tabular specifications pertaining to wear limits, torquing, etc.

HOW TO USE THE INDEX

Suppose you want to know the procedure for R&R (remove and reinstall) of the engine camshaft. Your first step is to look in the index under the main heading of ENGINE until you find the entry "Camshaft." Now read to the right where under the column covering the tractor you are repairing, you will find a number which indicates the beginning paragraph pertaining to the camshaft. To locate this wanted paragraph in the manual, turn the pages until the running index appearing on the top outside corner of each page contains the number you are seeking. In this paragraph you will find the information concerning the removal of the camshaft.

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SHOP MANUAL

MASSEY-FERGUSON

MODELS

MF230-MF235-MF240-MF245-MF250

Tractor serial number is stamped on a name plate attached to the side of instrument console. Diesel engine serial number is stamped on right side of cylinder block near the fuel lift pump. Gasoline engine serial number is stamped on a plate attached to left side of cylinder block above the distributor.

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DUAL DIMENSIONS

This shop manual provides specifications in both Metric (SI) and U.S. Customary systems of measurement. The first specification is given in the measuring system perceived by us to be the preferred system when servicing a particular component, while the second specification (given in parenthesis) is the converted measurement. For instance, a specification of "0.28 mm (0.011 inch)" would indicate that we feel the preferred measurement is the metric system of measurement and the U.S. Customary equivalent of 0.28 mm is 0.011.

CONDENSED SERVICE DATA

	MF230		MF235	
	Diesel	Gasoline	Diesel	Gasoline
GENERAL				
Engine Make	Perkins	Continental	Perkins	Continental
Engine Model	AD3.152	Z-145	AD3.152	Z-145
Number of Cylinders	3	4	3	4
Bore	91.44 mm (3.6 in.)	85.72 mm (3.375 in.)	91.44 mm (3.6 in.)	85.72 mm (3.375 in.)
Stroke	127.0 mm (5.0 in.)	103.2 mm (4.063 in.)	127.0 mm (5.0 in.)	103.2 mm (4.063 in.)
Displacement	2.5 L (152 cu. in.)	2.4 L (145 cu. in.)	2.5 L (152 cu. in.)	2.4 L (145 cu. in.)
Cylinder Sleeves	Dry	Wet	Dry	Wet
Electrical System	12 Volt, Negative Ground			
TUNE-UP				
Firing Order	1-2-3	1-3-4-2	1-2-3	1-3-4-2
Valve Clearance, Cold—				
Intake	0.30 mm (0.012 in.)	0.33 mm (0.013 in.)	0.30 mm (0.012 in.)	0.33 mm (0.013 in.)
Exhaust	0.30 mm (0.012 in.)	0.38 mm (0.015 in.)	0.30 mm (0.012 in.)	0.38 mm (0.015 in.)
Valve Clearance, Hot—				
Intake	0.25 mm (0.010 in.)	0.28 mm (0.011 in.)	0.25 mm (0.010 in.)	0.28 mm (0.011 in.)
Exhaust	0.25 mm (0.010 in.)	0.33 mm (0.013 in.)	0.25 mm (0.010 in.)	0.33 mm (0.013 in.)
Valve Face Angle—				
Intake	35°	30°	45°	30°
Exhaust	35°	44°	45°	44°
Valve Seat Angle—				
Intake	35°	30°	45°	30°
Exhaust	35°	45°	45°	45°
Injection Timing, Static	24° BTDC	....	24° BTDC	....
Injector Opening Pressure....				
New	19235 kPa (2790 psi)	....	18755 kPa (2720 psi)	....
Used	17720 kPa (2570 psi)	....	17240 kPa (2500 psi)	....
Ignition Timing .....	....	8° BTDC	....	8° BTDC
Ignition Point Gap .....	....	0.45-0.55 mm (0.017-0.022 in.)	....	0.45-0.55 mm (0.017-0.022 in.)
Spark Plug Gap .....	....	0.63 mm (0.025 in.)	....	0.63 mm (0.025 in.)
Governed Speeds, Engine Rpm—				
Low Idle	725-775	725-775	725-775	725-775
High Idle	2135-2185	2200-2250	2400-2450	2425-2500
Full Load	2000	2000	2250	2250
Rated Power At Pto Shaft.....	25.75 kW (34.5 hp)	25.6 kW (34.3 hp)	31.6 kW (42.4 hp)	30.7 kW (41.1 hp)
CAPACITIES				
Cooling System	9.9 L (10.5 U.S. qts.)	9.5 L (10 U.S. qts.)	9.9 L (10.5 U.S. qts.)	9.5 L (10 U.S. qts.)
Crankcase*	4.7 L (5 U.S. qts.)			
Hydraulic System	30.3 L (8 U.S. gals.)			
Power Steering	0.95 L (1 U.S. qt.)			
Fuel Tank	53 L (14 U.S. gals.)			

* Add 0.95 L (1 U.S. quart) if filter is changed.

	MF230		MF235	
	Diesel	Gasoline	Diesel	Gasoline
SIZES—CLEARANCES				
Crankshaft Main Journal—				
Diameter	69.81-69.82 mm (2.7485-2.7490 in.)	57.13-57.15 mm (2.249-2.250 in.)	69.81-69.82 mm (2.7485-2.7490 in.)	57.13-57.15 mm (2.249-2.250 in.)
Bearing Clearance	0.08-0.13 mm (0.003-0.005 in.)	0.013-0.081 mm (0.0005-0.0032 in.)	0.08-0.13 mm (0.003-0.005 in.)	0.013-0.081 mm (0.0005-0.0032 in.)
Crankshaft Crankpin—				
Diameter	57.11-57.12 mm (2.2485-2.2490 in.)	49.49-49.21 mm (1.9365-1.9375 in.)	57.11-57.12 mm (2.2485-2.2490 in.)	49.19-49.21 mm (1.9365-1.9375 in.)
Bearing Clearance	0.06-0.10 mm (0.0025-0.0040 in.)	0.015-0.078 mm (0.0006-0.0031 in.)	0.06-0.10 mm (0.0025-0.0040 in.)	0.015-0.078 mm (0.0006-0.0031 in.)
Crankshaft End Play	0.05-0.38 mm (0.002-0.015 in.)	0.10-0.20 mm (0.004-0.008 in.)	0.05-0.38 mm (0.002-0.015 in.)	0.10-0.20 mm (0.004-0.008 in.)
Camshaft Journal Diameter—				
Front	47.47-47.50 mm (1.869-1.870 in.)	45.92-45.95 mm (1.808-1.809 in.)	47.47-47.50 mm (1.869-1.870 in.)	45.92-45.95 mm (1.808-1.809 in.)
Center	47.22-47.24 mm (1.859-1.860 in.)	44.34-44.36 mm (1.745-1.746 in.)	47.22-47.24 mm (1.859-1.860 in.)	44.34-44.36 mm (1.745-1.746 in.)
Rear	46.71-46.74 mm (1.839-1.840 in.)	42.75-42.77 mm (1.683-1.684 in.)	46.71-46.74 mm (1.839-1.840 in.)	42.75-42.77 mm (1.683-1.684 in.)
Camshaft Bearing Clearance	0.10-0.20 mm (0.004-0.008 in.)	0.065-0.115 mm (0.0025-0.0045 in.)	0.10-0.20 mm (0.004-0.008 in.)	0.065-0.115 mm (0.0025-0.0045 in.)
Piston Pins—				
Diameter	31.744-31.750 mm (1.2498-1.2500 in.)	21.821-21.826 mm (0.8591-0.8593 in.)	31.744-31.750 mm (1.2498-1.2500 in.)	21.821-21.826 mm (0.8591-0.8593 in.)
Clearance in Bushing	0.01-0.04 mm (0.0004-0.0017 in.)	0.005-0.015 mm (0.0002-0.0006 in.)	0.01-0.04 mm (0.0004-0.0017 in.)	0.005-0.015 mm (0.0002-0.0006 in.)

TIGHTENING TORQUES**

	95-101 N·m (70-75 ft.-lbs.)	
	Refer to Text	Refer to Text
Connecting Rods	54-61 N·m (40-45 ft.-lbs.)	54-61 N·m (40-45 ft.-lbs.)
Main Bearings	149-156 N·m (110-115 ft.-lbs.)	149-156 N·m (110-115 ft.-lbs.)
Flywheel	101-108 N·m (75-80 ft.-lbs.)	101-108 N·m (75-80 ft.-lbs.)
Oil Pan	26-28 N·m (19-21 ft.-lbs.)	26-28 N·m (19-21 ft.-lbs.)
Intake Manifold	8-12 N·m (6-9 ft.-lbs.)	8-12 N·m (6-9 ft.-lbs.)
Exhaust Manifold	16-20 N·m (12-15 ft.-lbs.)	16-20 N·m (12-15 ft.-lbs.)

** Torque figures apply with threads clean and lightly oiled.

CONDENSED SERVICE DATA

	MF240	MF245		MF250
	Diesel	Diesel	Gasoline	Diesel
GENERAL				
Engine Make	Perkins	Perkins	Continental	Perkins
Engine Model	AD3.152	AD3.152	Z-145	AD3.152
Number of Cylinders	3	3	4	3
Bore	91.44 mm (3.6 in.)	91.44 mm (3.6 in.)	85.72 mm (3.375 in.)	91.44 mm (3.6 in.)
Stroke	127.0 mm (5.0 in.)	127.0 mm (5.0 in.)	103.2 mm (4.063 in.)	127.0 mm (5.0 in.)
Displacement	2.5 L (152 cu. in.)	2.5 L (152 cu. in.)	2.4 L (145 cu. in.)	2.5 L (152 cu. in.)
Cylinder Sleeves	Dry	Dry	Wet	Dry
Electrical System	12 Volt, Negative Ground			

	MF240 Diesel	Diesel	MF245 Gasoline	MF250 Diesel
TUNE-UP				
Firing Order	1-2-3	1-2-3	1-3-4-2	1-2-3
Valve Clearance, Cold—				
Intake	0.30 mm (0.012 in.)	0.30 mm (0.012 in.)	0.33 mm (0.013 in.)	0.30 mm (0.012 in.)
Exhaust	0.30 mm (0.012 in.)	0.30 mm (0.012 in.)	0.38 mm (0.015 in.)	0.30 mm (0.012 in.)
Valve Clearance, Hot—				
Intake	0.25 mm (0.010 in.)	0.25 mm (0.010 in.)	0.28 mm (0.011 in.)	0.25 mm (0.010 in.)
Exhaust	0.25 mm (0.010 in.)	0.25 mm (0.010 in.)	0.33 mm (0.013 in.)	0.25 mm (0.010 in.)
Valve Face Angle—				
Intake	35°	45°	30°	35°
Exhaust	35°	45°	44°	35°
Valve Seat Angle—				
Intake	35°	45°	30°	35°
Exhaust	35°	45°	45°	35°
Injection Timing, Static	24° BTDC	16° BTDC	....	16° BTDC
Injector Opening Pressure—				
New	18755 kPa (2720 psi)	18755 kPa (2720 psi)	....	18755 kPa (2720 psi)
Used	17720 kPa (2570 psi)	17240 kPa (2500 psi)	....	17720 kPa (2570 psi)
Ignition Timing .....	....	....	8° BTDC	....
Ignition Point Gap .....	....	....	0.45-0.55 mm (0.017-0.022 in.)	....
Spark Plug Gap .....	....	....	0.63 mm (0.025 in.)	....
Governed Speeds, Engine Rpm—				
Low Idle	725-775	725-775	725-775	725-775
High Idle	2135-2185	2400-2450	2425-2500	2400-2450
Full Load	2000	2250	2250	2250
Rated Power at Pto Shaft	25.9 kW (34.8 hp)	32.0 kW (42.9 hp)	30.5 kW (41 hp)	30.4 kW (40.8 hp)
CAPACITIES				
Cooling System	9.9 L (10.5 U.S. qts.)	9.9 L (10.5 U.S. qts.)	9.5 L (10 U.S. qts.)	9.9 L (10.5 U.S. qts.)
Crankcase*	5.9 L (6.2 U.S. qts.)	4.7 L (5 U.S. qts.)	4.7 L (5 U.S. qts.)	5.9 L (6.2 U.S. qts.)
Hydraulic System	32.5 L (8.6 U.S. gals.)	30.3 L (8 U.S. gals.)	30.3 L (8 U.S. gals.)	41.8 L (11 U.S. gals.)
Power Steering	0.95 L (1 U.S. qt.)			
Fuel Tank	47.9 L (12.6 U.S. gals.)	53 L (14 U.S. gals.)	53 L (14 U.S. gals.)	47.9 L (12.6 U.S. gals.)
* Add 0.95 L (1 U.S. quart) if filter is changed.				
SIZES—CLEARANCES				
Crankshaft Main Journal—				
Diameter	69.81-69.83 mm (2.7485-2.7493 in.)	69.81-69.83 mm (2.7485-2.7492 in.)	57.13-57.15 mm (2.249-2.250 in.)	69.81-69.83 mm (2.7485-2.7493 in.)
Bearing Clearance	0.05-0.11 mm (0.002-0.004 in.)	0.08-0.13 mm (0.003-0.005 in.)	0.013-0.081 mm (0.0005-0.0032 in.)	0.05-0.11 mm (0.002-0.004 in.)
Crankshaft Crankpin—				
Diameter	57.11-57.12 mm (2.2485-2.2490 in.)	57.11-57.12 mm (2.2485-2.2490 in.)	49.19-49.21 mm (1.9365-1.9375 in.)	57.11-57.12 mm (2.2485-2.2490 in.)
Bearing Clearance	0.06-0.10 mm (0.0025-0.0040 in.)	0.06-0.10 mm (0.0025-0.0040 in.)	0.015-0.078 mm (0.0006-0.0031 in.)	0.06-0.10 mm (0.0025-0.0040 in.)
Crankshaft End Play	0.05-0.38 mm (0.002-0.015 in.)	0.05-0.38 mm (0.002-0.015 in.)	0.10-0.20 mm (0.004-0.008 in.)	0.05-0.38 mm (0.002-0.015 in.)
Camshaft Journal Diameter—				
Front	47.47-47.50 mm (1.869-1.870 in.)	47.47-47.50 mm (1.869-1.870 in.)	45.92-45.95 mm (1.808-1.809 in.)	47.47-47.50 mm (1.869-1.870 in.)
Center	47.22-47.24 mm (1.859-1.860 in.)	47.22-47.24 mm (1.859-1.860 in.)	44.34-44.36 mm (1.745-1.746 in.)	47.22-47.24 mm (1.859-1.860 in.)

	MF240 Diesel	MF245 Diesel	MF245 Gasoline	MF250 Diesel
SIZES—CLEARANCES (Cont.)				
Rear	46.71-46.74 mm (1.839-1.840 in.)	46.71-46.74 mm (1.839-1.840 in.)	42.75-42.77 mm (1.683-1.684 in.)	46.71-46.74 mm (1.839-1.840 in.)
Camshaft Bearing Clearance	0.10-0.20 mm (0.004-0.008 in.)	0.10-0.20 mm (0.004-0.008 in.)	0.065-0.115 mm (0.0025-0.0045 in.)	0.10-0.20 mm (0.004-0.008 in.)
Piston Pins—				
Diameter	31.744-31.750 mm (1.2498-1.2500 in.)	31.744-31.750 mm (1.2498-1.2500 in.)	21.821-21.826 mm (0.8591-0.8593 in.)	31.744-31.750 mm (1.2498-1.2500 in.)
Clearance in Rod Bushing	0.01-0.04 mm (0.0004-0.0017 in.)	0.01-0.04 mm (0.0004-0.0017 in.)	0.005-0.015 mm (0.0002-0.0006 in.)	0.01-0.04 mm (0.0004-0.0017 in.)

TIGHTENING TORQUES**

Cylinder Head	95 N·m (70 ft.-lbs.)	95 N·m (70 ft.-lbs.)	95-101 N·m (70-75 ft.-lbs.)	95 N·m (70 ft.-lbs.)
Connecting Rods	Refer to Text		54-61 N·m (40-45 ft.-lbs.)	Refer to Text
Main Bearings	150 N·m (110 ft.-lbs.)	150 N·m (110 ft.-lbs.)	115-129 N·m (85-95 ft.-lbs.)	150 N·m (110 ft.-lbs.)
Flywheel	105 N·m (78 ft.-lbs.)	105 N·m (78 ft.-lbs.)	95-101 N·m (70-75 ft.-lbs.)	105 N·m (78 ft.-lbs.)
Oil Pan	18 N·m (14 ft.-lbs.)	18 N·m (14 ft.-lbs.)	16-22 N·m (12-16 ft.-lbs.)	18 N·m (14 ft.-lbs.)
Intake Manifold	18 N·m (14 ft.-lbs.)	18 N·m (14 ft.-lbs.)	27-41 N·m (20-30 ft.-lbs.)	18 N·m (14 ft.-lbs.)
Exhaust Manifold	18 N·m (14 ft.-lbs.)	18 N·m (14 ft.-lbs.)	27-41 N·m (20-30 ft.-lbs.)	18 N·m (14 ft.-lbs.)

** Torque figures apply with threads clean and lightly oiled.

FRONT SYSTEM**AXLE ASSEMBLY****All Models**

1. Several different front axles are used as shown in Figs. 1,2,3,4 and 5.

Axle extension (7—Fig. 1,2,3 and 5) can be removed from adjustable axle models by first disconnecting drag link and/or tie rod and power steering cylinder (if so equipped) from steering arm. Remove bolts attaching axle extension to center member (5), then withdraw axle extension. To remove center member (5), first

support front of tractor and remove hood, side panels, grille support frame, radiator and axle extensions (if so equipped). Disconnect hydraulic lines from power steering cylinders (if so equipped). Remove axle pivot pin retaining screw (4) and inner snap ring (3). Withdraw pivot pin and remove axle center

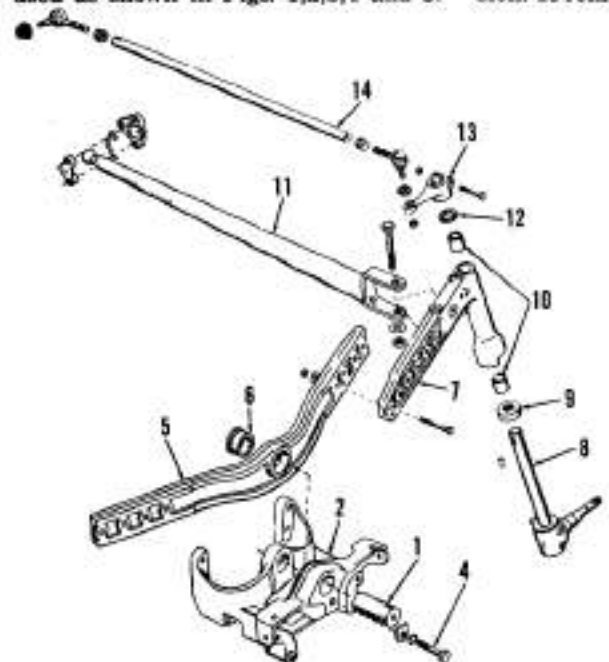


Fig. 1—Exploded view of swept back axle used on some MF230 and MF235 models. Refer to Fig. 2 for legend except radius rods (11).

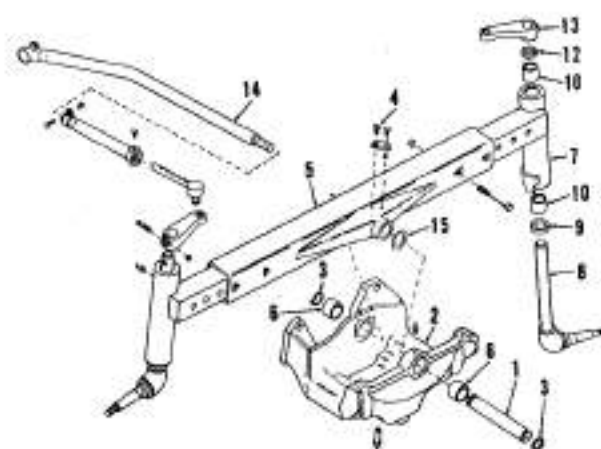


Fig. 2—Exploded view of typical straight axle standard on MF235 models and all Vineyard models.

- | | | |
|------------------------------|-------------------|------------------|
| 1. Pivot pin | 6. Bushing | 12. Dust seal |
| 2. Front support | 7. Axle extension | 13. Steering arm |
| 3. Snap ring | 8. Spindle | 14. Drag link |
| 4. Pivot pin retaining screw | 9. Bearing | 15. Shim |
| 5. Axle center member | 10. Bushing | |

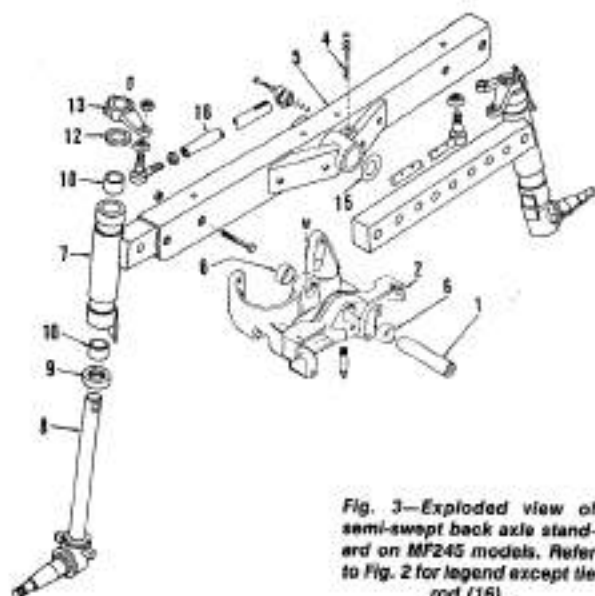


Fig. 3—Exploded view of semi-swept back axle standard on MF245 models. Refer to Fig. 2 for legend except tie rod (16).

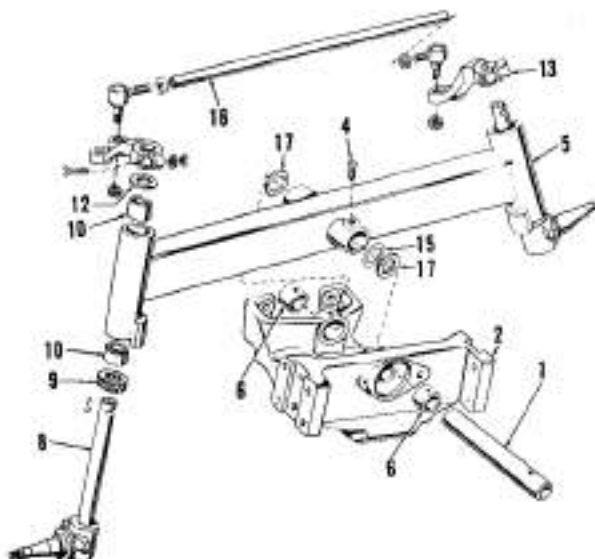


Fig. 4—Exploded view of nonadjustable front axle used on MF235 and MF245 Orchard models. Refer to Fig. 2 for legend except for washers (17) and tie rod (16).

member. Unbolt and remove front support (2) if necessary.

Axle pivot bushings (6) and spindle bushings (10) should be renewed if excessively worn. Pivot bushings (6) should be installed 0.5 mm (0.020 inch) below

flush with inner faces of support housing. Be sure bushings are installed with hole aligned with grease passage. Make certain pivot pin slides freely through bushings after installation. Spindle bushings (10) must be reamed to provide

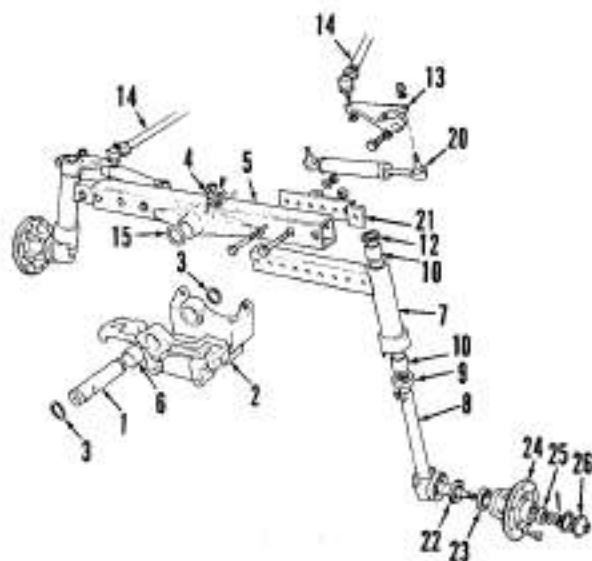


Fig. 5—Exploded view of adjustable front axle assembly used on Models MF240 and MF250. Refer to Fig. 2 for legend except for the following:

20. Steering cylinder
21. Cylinder bracket
22. Seal

23. Inner bearing
24. Wheel hub

25. Outer bearing
26. Hub cap

desired fit to spindle. To reinstall, reverse the removal procedure.

Measure axle center member end play in support housing using a feeler gage. Select shims (15) to provide 0.05-0.25 mm (0.002-0.010 inch) end play. Lubricate with multipurpose lithium base grease.

TOE-IN, TIE RODS AND/OR DRAG LINKS

All Models

2. Automotive type tie rod and drag link ends are used. Units are nonadjustable and should be renewed if excessively worn. Recommended toe-in is 3 mm (1/8 inch). On models with two drag links, adjust each an equal amount to obtain correct toe-in. On models with tie rod (16—Fig. 3 or 4), loosen locknuts and clamps, then turn adjusting sleeve to provide correct toe-in.

MANUAL STEERING GEAR

This section covers the manual steering gear used on MF230 and MF235 tractors without power assist steering or hydrostatic power steering.

All Models So Equipped

3. LUBRICATION AND ADJUSTMENT. The steering gear should be

filled to the level of the opening for plug (25—Fig. 6) with SAE 90 gear lubricant.

Backlash between the ball nut (20) and left sector gear (10) and between the right and left sector gears (10 and 15) can be adjusted while unit is installed. To adjust, loosen four screws that attach the left and right pinion housings (4L and 4R) to the steering gear housing,

then rotate the right pinion housing (4R) clockwise to the end of the bolt slots. Rotate the left pinion housing (4L) counterclockwise until all backlash is eliminated between left pinion and ball nut, then tighten the four screws retaining left pinion housing. Rotate the right pinion housing counterclockwise until all backlash is eliminated between the

two pinions, then tighten the four screws retaining the right pinion housing. If additional adjustment is required, refer to paragraph 5.

4. REMOVE AND REINSTALL. To remove the manual steering gear assembly, first remove the battery and the steering wheel. Disconnect the oil pressure line at the gage and tachometer cable at both ends, then remove the tachometer cable and cable housing. Mark all wires to facilitate assembly, then disconnect all wires from instrument panel gages. Remove lights from panel gages and disconnect fuel shut-off from injection pump (diesel models). Remove the complete instrument panel with gages. Disconnect wires from starter switch and light switch, then unbolt and remove the rear hood assembly with light switch and starter switch installed. Disconnect linkage from both ends of the throttle cross shaft, then slide shaft from left side of tractor. Remove the complete air cleaner assembly and the battery platform. Disconnect drag links from both pitman arms, remove the six retaining screws, then lift the steering gear from the tractor.

Reinstall by reversing the removal procedure. Be careful to connect wires to instruments correctly.

5. OVERHAUL. To overhaul the removed unit, first remove the right pinion housing (4R—Fig. 6) and shaft (15), then remove the left pinion housing (4L) and shaft (10). Unbolt shaft housing (24) and withdraw housing and shaft (20). Eleven loose balls should fall from upper bearing (21) and eleven from lower bearing (19). Pitman shafts (10 and 15) and related parts can be withdrawn from housing (4L or 4R) after snap ring (8) is removed as shown in Fig. 7. Parts of the ball nut and shaft (20—Fig. 6) are not available separately and should not be disassembled.

Press new bushings (3, 11 and 17) into bores of respective housings until flush to 0.8 mm (1/32 inch) below flush with outer edge of bore. Assemble parts (6, 7, 8, 9, 12 and 13) onto pitman shaft (10) and parts (6, 8, 9, 12, 13 and 16) onto pitman shaft (15) before inserting into housings (4L and 4R). Add more shims (12), if necessary, to remove all end play from bearing.

Use grease to hold the eleven balls (19 and 21) into each race, then insert shaft

and ball nut (20) into shaft housing (24). Place shims (22) and "O" ring (23) onto housing (24), then install into steering gear housing (14). Shims (22) are available in 0.13-0.25 mm (0.005-0.010 inch). Install only enough shims to provide 0.03-0.13 mm (0.001-0.005 inch) preload for bearings (19 and 21).

After steering shaft ball nut is installed, turn the steering shaft until the ball nut is at bottom. Position the steering gear as normally installed on the tractor, and install the left pitman shaft (10) and housing (4L) assembly. The flat identification boss on left housing (4L) should be down when installed. The marked (3rd) tooth on left pinion (10) should be aligned with center valley of ball nut rack (20) as shown in Fig. 8. Turn the steering shaft until ball nut is moved to top and install the right pitman shaft (15—Fig. 6) and housing (4R) assembly. The first tooth on right pinion (15) should be aligned with the first valley on left pinion (10) as shown in Fig. 9. The flat identification boss on right housing (4R—Fig. 6) should be toward front when installed correctly.

To adjust the backlash, rotate the right pinion housing (4R) clockwise to end of bolt slots and temporarily tighten retaining screw. Rotate the left pinion housing (4L) counterclockwise until all

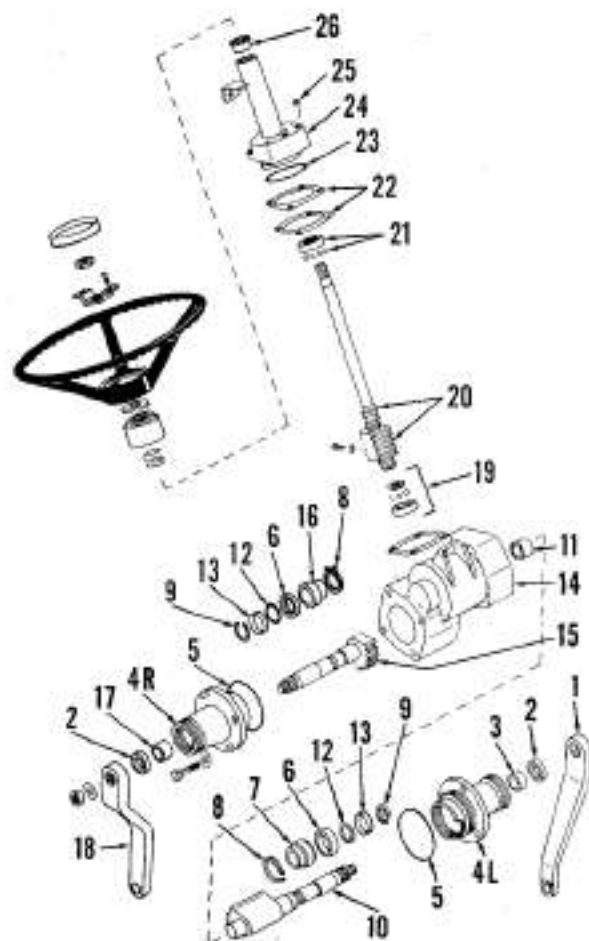


Fig. 6—Exploded view of typical manual steering gear used on MF230 and some MF235 models.

1. Left pitman arm
2. Oil seal
3. Bushing
- 4L. Left pinion housing
- 4R. Right pinion housing
5. "O" ring
6. Bearing
7. Left sleeve
8. Snap ring
9. Clip
10. Left pitman shaft
11. Bushing
12. Shim
13. Retainer
14. Steering gear housing
15. Right pitman shaft
16. Right sleeve
17. Bushing
18. Right pitman arm
19. Lower bearing
20. Shaft & ball nut
21. Upper bearing
22. Shims
23. "O" ring
24. Shaft housing
25. Fill plug
26. Top bushing

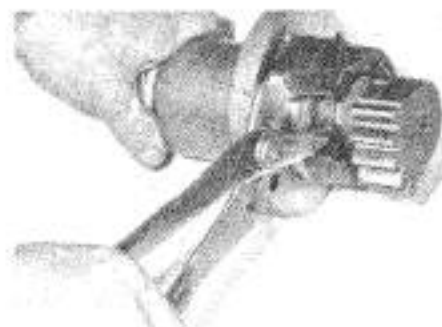


Fig. 7—The snap ring must be removed as shown before pitman shaft can be removed from housing.

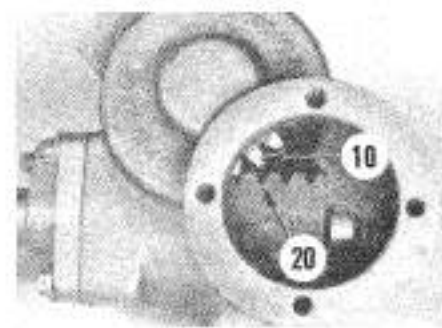


Fig. 8—The marked (3rd) tooth of the left pinion gear (10) should be aligned with the center valley of rack (20).

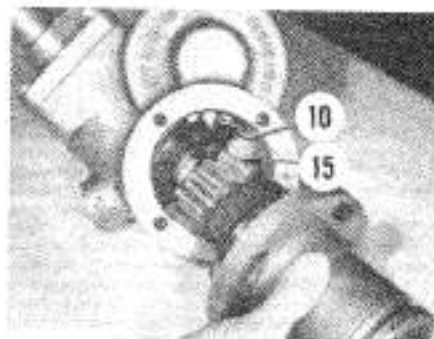


Fig. 9—Install the right pinion with first tooth (15) aligned with first valley (10) on the other pinion.

backlash is eliminated, then tighten the four housing retaining screws. Rotate the right pinion housing (4R) counter-clockwise until all backlash is removed from the right pitman shaft, then tighten the four retaining screws. Check for correct assembly by locating the center (straight ahead) position of the steering shaft (20). With steering shaft straight ahead, the blank splines on both pitman shafts (10 and 15) should be vertical. The small flat mounting boss at rear of steering gear housing will also be vertical when installed on tractor. Fill steering gear housing to level of plug (25) with SAE 90 gear oil.

POWER ASSIST STEERING SYSTEM

This section covers the power steering system available on Models MF230, MF235 (except Orchard), MF240, MF245 Vineyard and MF250.

LUBRICATION AND BLEEDING

All Models So Equipped

6. Recommended oil for power steering system is Massey-Ferguson Pormatran III Oil. Check power steering reservoir oil level with engine running after all air is bled from system. Power steering system capacity is approximately 0.95 L (1 U.S. quart).

Air can be bled from power steering system by running engine and cycling steering from full left to full right, then back to full left several times. Repeat until there are no air bubbles present in oil reservoir. Make certain oil level is maintained during bleeding process to avoid starving the pump of oil.

SYSTEM OPERATING PRESSURE AND RELIEF VALVE

All Models So Equipped

7. A pressure test of steering hydraulic system will disclose whether the pump relief valve or some other unit in the system is malfunctioning. To check relief pressure, install a "T" fitting at pump pressure port, reattach pressure hose to one port of "T" and a 20000 kPa (3000 psi) pressure gage to the other port. Start engine and operate at 2000 rpm. Turn steering wheel to full turn in either direction and observe gage pressure reading. Normal relief pressure is approximately 8300 kPa (1200 psi).

The relief valve on models equipped with gasoline engine is adjusted after

removing reservoir (27—Fig. 11) and turning screw (24). The relief valve on models equipped with diesel engine is also adjusted after removing reservoir (27—Fig. 10) and turning adjusting screw (24). One full turn of relief valve screw should change pressure approximately 2100 kPa (300 psi) on Models MF230, MF235 and MF245. On Models MF240 and MF250, a pressure change of approximately 3100 kPa (450 psi) should result from one turn of adjusting screw.

Reinstall reservoir, refill with oil and recheck pressure after changing relief valve setting.

POWER STEERING PUMP

The pump shown in exploded view Fig. 10 is used on diesel models; the pump in Fig. 11 on gasoline models. Refer to the appropriate following paragraphs for service.

All Models

8. REMOVE AND REINSTALL.

Clean the area thoroughly before disconnecting any lines. Disconnect lines, remove mounting screws and withdraw pump.

When reinstalling, tighten retaining bolts to 27 N · m (20 ft. lbs.) torque. Refill reservoir with fluid and bleed air from system as outlined in paragraph 6.

Diesel Models

9. OVERHAUL. Mark the pump housing (8—Fig. 10) and reservoir (27) before removing reservoir. Filter (16) can be removed after reservoir. Remove nut, gear (1), key and spacer (2). Establish the setting of the relief valve plug (24) before removing the plug. Remove the screws attaching body (17) and shield (20) to the housing (8). Remove gears (10 and 11), Woodruff key (6), idler shaft (13) and pin

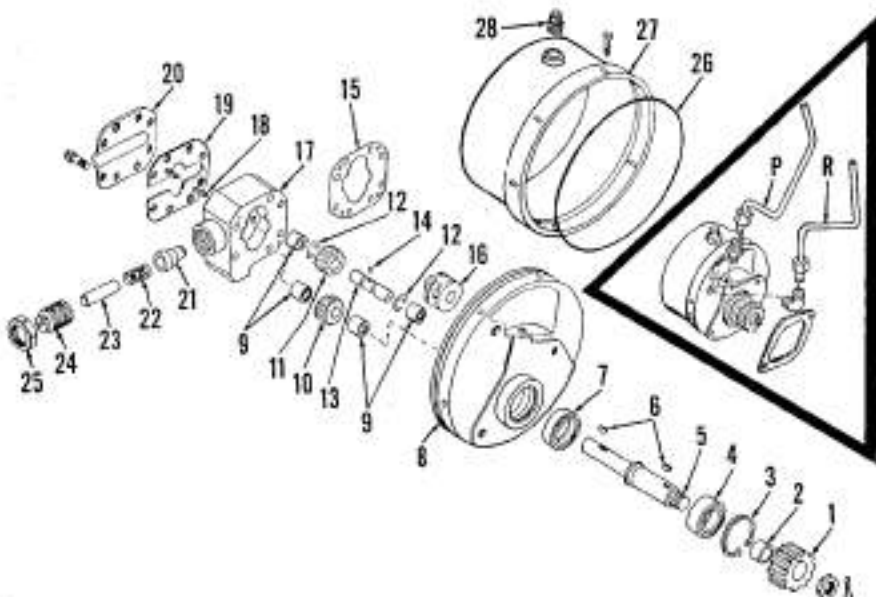


Fig. 10—Exploded view of power steering pump used on Models MF230, MF235 and MF245 equipped with diesel engine. Pump used on Models MF240 and MF250 is similar except dual springs are used on relief valve and spring guide pin (23) is not used. Inset shows location of pressure line (P) and return line (R).

- | | | | |
|------------------|--------------------|--------------------|---------------------------|
| 1. Gear | 8. Housing | 15. Gasket | 22. Spring |
| 2. Spacer | 9. Needle bearings | 16. Filter | 23. Pin |
| 3. Snap ring | 10. Drive gear | 17. Body | 24. Relief adjusting plug |
| 4. Bearing | 11. Driven gear | 18. Dowel pins | 25. Nut |
| 5. Shaft | 12. Rings | 19. Gasket | 26. "O" ring |
| 6. Woodruff keys | 13. Idler shaft | 20. Shield | 27. Reservoir |
| 7. Seal | 14. Pin | 21. Relief plunger | 28. Fill plug |

(14). Remove snap ring (3), then bump shaft (5) and bearing (4) out front of housing bore.

Inspect all parts for scoring, wear or other damage and renew if necessary. Always renew all "O" rings, gaskets and oil seal.

Install new oil seal (7) with lip facing inward and front of seal flush with outer surface of housing. When renewing needle bearings (9), press against numbered side of bearing. Bearings should be slightly below flush with machined surface of housing. Press bearing (4) onto shaft (5), then install the shaft and bearing in bore of housing (8). Install snap ring (3), spacer (2), key (6) and gear (1), then install retaining nut. Install the other key (6) in shaft and slide gear (10) onto key (6) in shaft and slide gear (10) onto shaft over the key. Install the idler

shaft and gear assembly (11, 12, 13 and 14). Position thin gasket (15) around gears and locate body (17) over gears being careful not to damage the gasket. Install the thicker gasket (19) and plate (20) and tighten the assembly screws to 11-14 N · m (8-10 ft.-lbs.) torque. Use care when assembling relief valve (21, 22, 23, 24 and 25). Install the adjusting plug (24) as near as possible to position from which it was removed. Reinstall pump and check relief pressure as outlined in paragraph 7.

Gasoline Models

10. OVERHAUL. Remove reservoir cover (29—Fig. 11), filter (16), stud (30) and screw (31), then lift off reservoir (27). Establish the setting of the relief valve plug (24) before removing plug. Remove

screws attaching body (17) to the housing (8) and remove body. Remove gears (10 and 11), Woodruff key (6), idler shaft (13) and pin (14). Remove nut, gear (1), sleeve (2) and snap ring (3), then bump shaft (5) and bearing (4) out front of housing.

Install new seal (7) with lip toward rear of pump and front of seal flush with the step in front of housing bore. Press new bearings (9) into bores in body (17) and housing (8) until bearing is just below flush. Press only on numbered side of bearing which should be toward gears (10 and 11). Press bearing (4) onto shaft (5), then install the shaft and bearing in bore of housing (8). Install snap ring (3), spacer (2), key (6) and gear (1), then install retaining nut. Install other key (6) in shaft and slide gear (10) onto shaft over key. Install the idler shaft and gear assembly (11, 12, 13 and 14). Position gasket (15) around gears and locate body (17) over gears being careful not to damage gasket. Install and tighten assembly screws to 11-14 N · m (8-10 ft.-lbs.) torque. Install relief valve (21, 22, 23 and 24). Install plug (24) as near as possible to original location to facilitate relief setting. Reinstall pump and check relief valve pressure setting as outlined in paragraph 7.

STEERING GEAR AND CONTROL VALVE

Models MF230-MF235-MF245

The steering gear assembly includes the power steering control valve, power assist piston and cylinder as well as steering shaft, rack, and pitman shafts necessary for manual steering.

11. REMOVE AND REINSTALL. To remove the power steering gear, first remove the battery and the steering wheel. Disconnect the oil pressure line at gage and tachometer cable at both ends, then remove the tachometer cable and cable housing. Mark all wires to facilitate reassembly, then disconnect all wires from instrument panel gages. Remove lights from panel gages and disconnect fuel shut-off from injection pump (diesel models). Remove the complete instrument panel with gages. Disconnect wires from starter switch and light switch, then unbolt and remove the rear hood assembly with starter and light switches installed. Disconnect linkage from both ends of the throttle cross shaft, then slide shaft from left side of tractor. Remove the complete air cleaner assembly and the battery platform. Clean the area thoroughly before disconnecting any power steering lines. Disconnect hydraulic lines and plug all openings to prevent entrance of

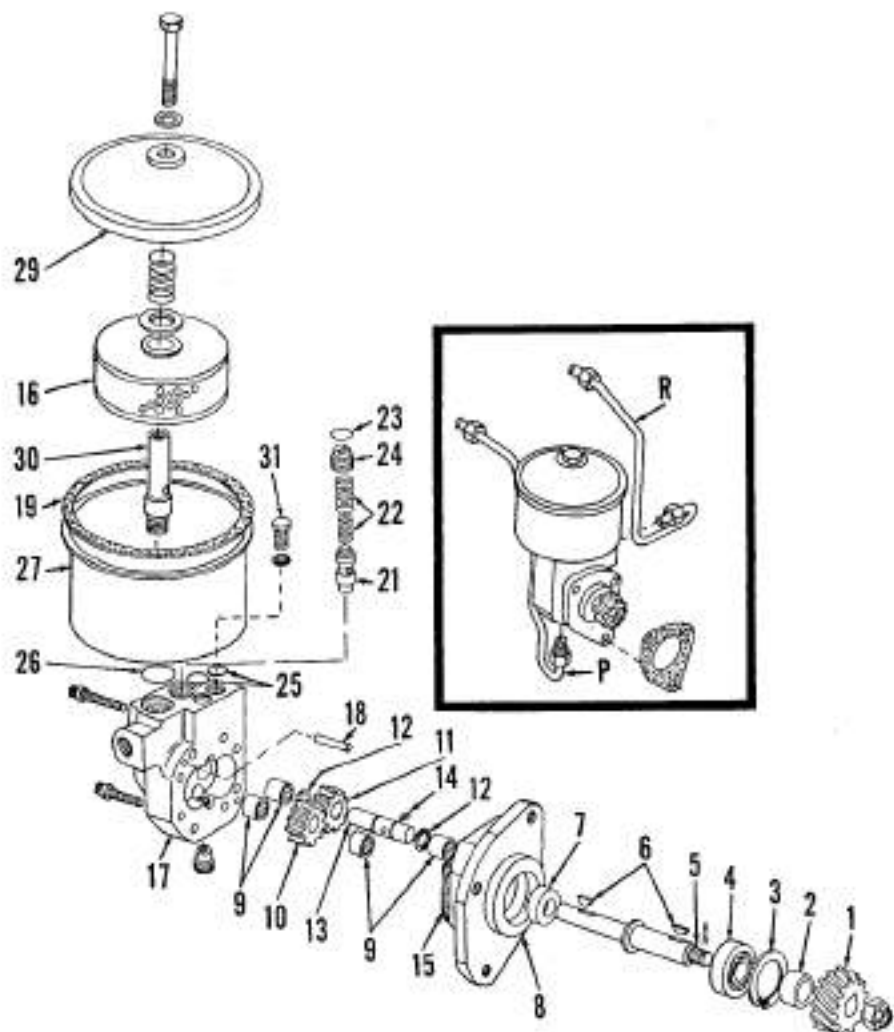


Fig. 11—Exploded view of power steering pump used on Models MF230, MF235 and MF245 equipped with gasoline engine. Inset shows location of pressure line (P) and return line (R).

- | | | | |
|------------------|--------------------|---------------------------|---------------|
| 1. Gear | 9. Needle bearings | 17. Body | 25. "O" rings |
| 2. Spacer | 10. Drive gear | 18. Dowel pin | 26. "O" ring |
| 3. Snap ring | 11. Driven gear | 19. Gasket | 27. Reservoir |
| 4. Bearing | 12. Rings | 20. Plate | 28. Cover |
| 5. Shaft | 13. Idler shaft | 21. Relief plunger | 29. Stud |
| 6. Woodruff keys | 14. Pin | 22. Springs | 30. Stud |
| 7. Seal | 15. Gasket | 23. "O" ring | 31. Screw |
| 8. Housing | 16. Filter | 24. Relief adjusting plug | |

dirt. Disconnect drag links from both pitman arms, remove the six retaining screws, then lift the steering gear from the tractor.

Reinstall reversing the removal procedure. Be careful to connect wires to instruments correctly. Bleed the hydraulic system as outlined in paragraph 6 after all lines are connected. Be sure that pump is not allowed to operate without fluid.

12. OVERHAUL. To overhaul the removed unit, unbolt right side pinion housing (49—Fig. 12) and remove pitman shaft (48), housing (49) and related parts. Turn unit over and drain oil from housing, then unbolt and remove the left pinion housing (44), pitman shaft (36) and related parts. Mark control valve head (1), valve body (14), bearing housing (20) and steering gear housing (34) before disassembly to facilitate correct reassembly. Unbolt and remove control valve housing, head, bearing housing, steering shaft and rack unit. Unscrew piston (27) and rack (32) as a unit from shaft (31), then remove bearing housing (20).

To disassemble control valve and steering shaft, use caution and carefully identify parts as they are removed. Some parts used may be slightly different than shown in Fig. 12. Remove top snap ring (3), washer (4) and seal (5). Remove second snap ring (3) and lift parts (6, 7, 8, 9 and 10) from shaft. Remove valve body (14) from valve spool (18). Be careful not to lose or damage parts of plungers (11). Remove return fitting and adapter (17), being careful not to lose check ball (15).

Pitman shafts (36 and 48) and related parts can be withdrawn from housings (44 and 49) after snap ring (37) is removed as shown in Fig. 13.

Inspect all parts for wear or damage and renew if necessary. Install new seal (2—Fig. 12) in head (1) with lip of seal towards valve body and end of seal flush with edge of housing bore. Press new bushings (35 and 45) into housings until flush to 0.8 mm (1/32 inch) below flush with outer edge of bore. Lips of seals (46) should face inward. Some models use a washer and snap ring to retain seals (46) in housings. When renewing "O" rings (21 and 29) and seals (22 and 30) in bearing housing, be sure "O" rings are installed under the seal rings.

Assemble lower snap ring (3), washers (6, 8 and 10), bearings (9) and spool (18) onto steering shaft. Install shims (7) until upper snap ring (3) will just fit into groove in shaft. End play of spool (18) on shaft must be less than 0.076 mm (0.003 inch). Remove upper snap ring, washers and thrust bearing from shaft after correct end play is obtained. Install check ball (15) and fitting (17) in valve body.

Temporarily thread piston (27) and rack (32) onto shaft (31). Install lower snap ring (3), lower thrust bearing (8, 9 and 10) and valve spool (18) onto shaft. The groove inside valve spool (18) must be towards top (steering wheel) end of shaft. Install centering springs (12) and plungers (11), then carefully install valve body (14). Install upper thrust bearing (10, 9 and 8), shims (7), washers (6) and snap ring (3). The centering springs will make it difficult to install the snap ring into its groove, however, a 25x110 mm (1x4-1/4 inch) piece of pipe can be used as shown in Fig. 14 to push snap ring in-

to place. Install washer (4—Fig. 12) with chamfer down over snap ring. Install top snap ring (3). Remove piston and rack from shaft.

Install bearing housing (20) over shaft being sure that "O" rings at (R) are aligned with corresponding holes in control valve body. Install piston and rack onto shaft. Install head (1) over shaft aligning scribe marks made prior to disassembly.

Install control valve, steering shaft, piston and rack assembly into the steering gear housing as shown in Fig. 15. Be careful not to damage piston seal ring.

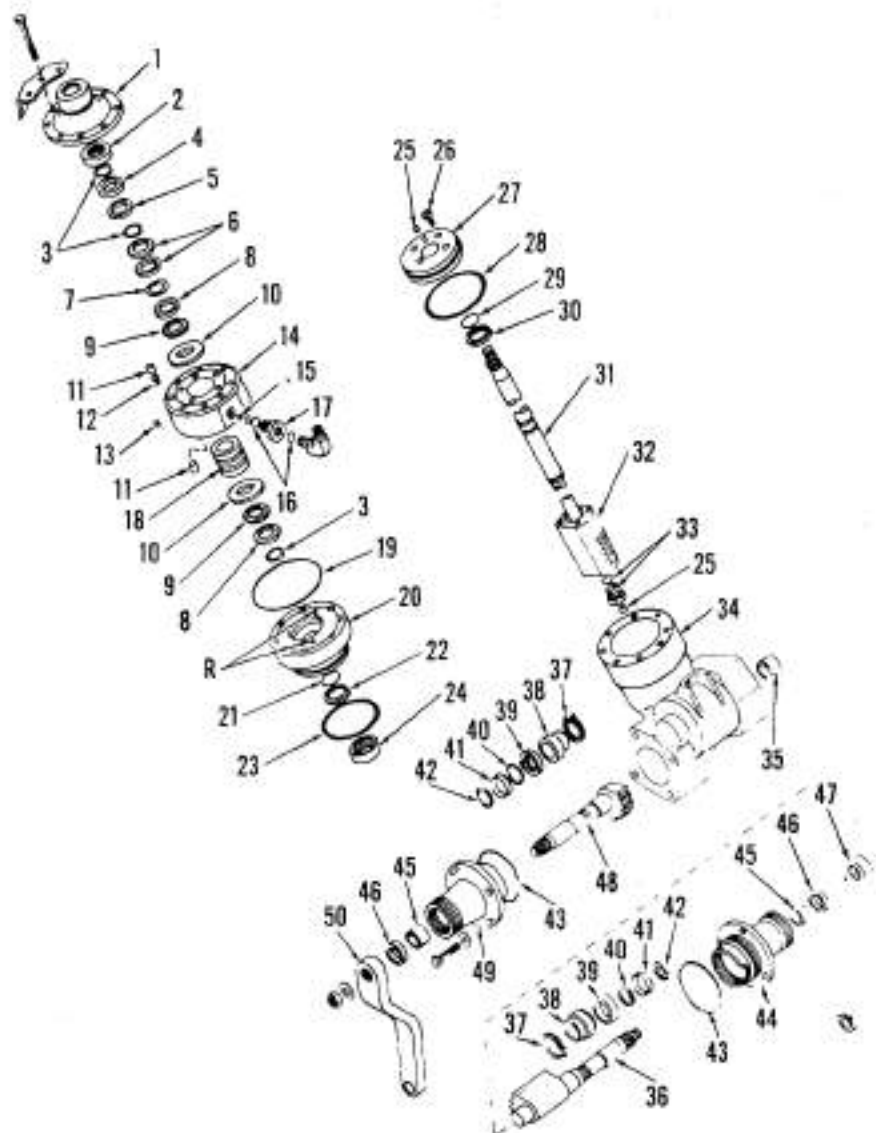


Fig. 12—Exploded view of power steering gear available on all MF230 models, all MF235 models except Orchard and MF245 Vineyard models.

1. Head assy.
2. Seal
3. Snap rings
4. Washer
5. Nylon seal
6. Washers
7. Shims
8. Race
9. Bearing
10. Thrust washer
11. Plunger
12. Spring
13. Ball

14. Valve body
15. Ball
16. "O" rings
17. Adapter
18. Valve spool
19. "O" ring
20. Bearing housing
21. "O" ring
22. Seal ring
23. "O" ring
24. Bearing
25. Valve

26. Screws
27. Piston
28. Piston ring
29. "O" ring
30. Seal ring
31. Steering shaft
32. Rack
33. Plug & "O" ring
34. Housing
35. Bushing
36. Left pitman shaft
37. Snap ring

38. Spacer
39. Bearing
40. Shims
41. Cover
42. Snap ring
43. "O" ring
44. Left pinion housing
45. Bushing
46. Seal
47. Left pitman arm
48. Right pitman shaft
49. Right pinion housing
50. Right pitman arm

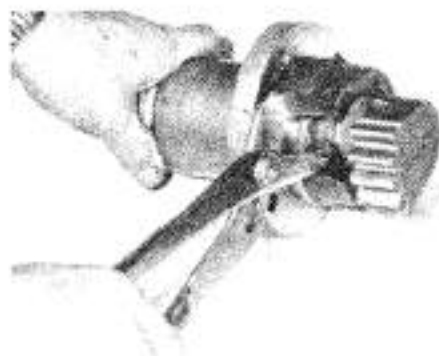


Fig. 13—Snap ring must be removed from housing before pitman shaft can be withdrawn.

and be sure to maintain alignment of housings. Secure in position with retaining screws.

Assemble parts (37, 38, 39, 40, 41 and 42—Fig. 12) onto pitman shafts before installing shafts into pinion housing. Adjust thickness of shims (40) as necessary to remove all end play from bearing (39).

Turn the installed steering shaft (31) until the rack (32) is at bottom of travel, position the steering gear housing (34) as normally installed on the tractor and install the left pitman shaft and housing assembly. The flat identification boss on left housing should be down when installed. The marked third tooth on left pinion should be aligned with the center valley of the rack as shown in Fig. 16. Install retaining screws, then turn steering shaft until rack (32) is all the way up in housing. Align the first tooth on right pinion (48—Fig. 17) with first valley on left pinion (36) as shown. The identification boss (B) on right housing should be toward front as installed on tractor. After correct alignment is obtained, the right side pinion housing can be temporarily removed (while maintaining correct alignment) and housing filled through opening to capacity with Massey-Ferguson Permtran Oil or equivalent. Install the right pinion housing and right pitman shaft after filling with oil.

Adjust gear backlash as follows: Rotate the right pinion housing (49—Fig. 12)

clockwise to end of bolt slots and temporarily tighten retaining screw. Rotate the left pinion housing (44) counterclockwise until all backlash is eliminated, then tighten the four housing retaining screws. Rotate the right pinion housing (49) counterclockwise until all backlash is removed from the right pitman shaft, then tighten the four retaining screws.

Check for correct assembly by locating the center (straight ahead) position of the steering shaft (31). With steering shaft straight ahead, the blank splines on both pitman shafts (36 and 48) should be vertical. The small flat mounting boss at rear of steering gear housing will also be vertical when installed on tractor.

STEERING GEAR AND CONTROL VALVE

Models MF240-MF250

A recirculating ball type steering unit is used on these models. Twin pitman arms transmit steering wheel movement to front wheels. The power steering control valve is mounted on the steering column tube. The valve is manually actuated by movement of the steering wheel to direct pressurized oil to two double-acting cylinders attached to spindle steering arms.

13. REMOVE AND REINSTALL STEERING GEAR. To remove steering gear box, first remove steering wheel hub cap and nut. Remove steering wheel



Fig. 15—Align scribe marks made prior to disassembly when assembling control valve, steering shaft, piston and rack assembly.

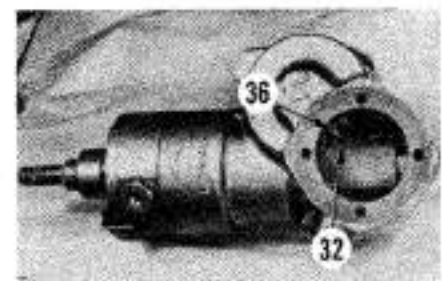


Fig. 16—The marked tooth of the left pinion (36) should be meshed with the center valley of rack (32).

using a suitable puller. Disconnect battery cables and remove battery. Disconnect fuse box mounting panel. Tag and disconnect electrical wiring between tractor wiring harness and instrument harness. Remove lower instrument panel. Disconnect tachometer cable. Disconnect hand throttle lever from throttle linkage. Remove instrument panel mounting cap screws, then lift instrument panel off the steering column. Remove pitman arms (30 and 49—Fig. 18) using a suitable puller. Disconnect hydraulic lines from power steering valve. Remove cap screws attaching steering box to the side support brackets and to the transmission housing. Shift transmission into neutral, then remove steering gear box with shift levers from the tractor.

To reinstall steering gear box, reverse the removal procedure while noting the following special instructions: Apply gasket maker compound to mounting surface of gear box. Tighten pitman arm retaining nuts to 340 N · m (250 ft.-lbs.) torque. Tighten steering wheel retaining nut to 47 N · m (35 ft.-lbs.) torque.

14. OVERHAUL STEERING

GEAR. To disassemble the removed unit, first disconnect and remove control valve (22—Fig. 18) from steering column. Remove plug from steering column (21) and drain oil from housing. Unbolt and remove cover plate (40) from housing. Withdraw the secondary pitman shaft (37). Remove retainer plate (45) and shims (44). Unbolt and remove steering column assembly from housing. Remove primary pitman shaft (38) and steel ball (43). Unscrew ball nut (26) from steering shaft (25).

Remove set screw securing housing retainer (16). Slide retainer and felt seal (15) away from steering shaft housing (9), then remove snap ring (20) from its groove. Remove nut (5) and washer (6) from shaft. Remove adjustable race nut (7), then lift housing (9) from shaft. Note

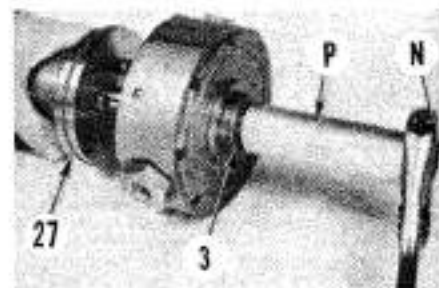


Fig. 14—A 25x110 mm (1x4-1/4 inch) piece of pipe (P) can be used together with steering wheel nut (N) to push snap ring (3) into groove.

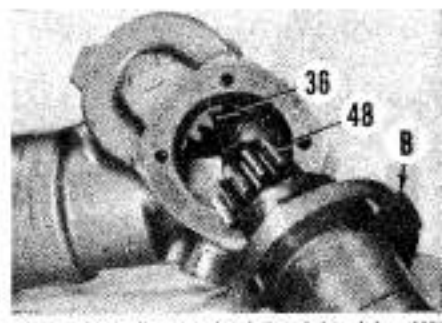


Fig. 17—The first tooth of the right pinion (48) should be meshed with first valley of left pinion (36). Identification boss is shown at (B).

that 12 steel balls (10) are contained in the housing. Withdraw steering shaft (25) from outer column (21). Remove felt seal and retainer from column tube.

Inspect all parts for wear or damage and renew if necessary. Replacement pitman arm bushings (33,36,41 and 46) are semi-finished and inside diameter must be reamed to correct size after installation. Attach cover plate to housing, then ream each pair of bushings using special tool number MF19A reamer. Thoroughly clean housing after reaming to remove all metal particles.

To reassemble, position retainer (16) with a new felt seal (15) on column tube. Insert steering shaft into tube. Assemble the 12 steel balls in outer race of housing (9) using grease to hold balls in place, then carefully slide housing over steering shaft. Install adjustable race nut (7) and tighten to 14 N·m (10 ft.-lbs.) torque, then loosen nut one flat. Install washer (6) and locknut (5) to secure adjustable race nut adjustment.

Thread ball nut (26) onto steering shaft while assembling the 28 steel balls into the nut. Turn the ball nut to top of steering shaft threads. Assemble primary pitman shaft (38) into housing. Use grease to hold steel ball (43) in place in pitman shaft. Insert steering shaft into housing and rotate pitman shaft and ball nut until steel ball is seated in the ball nut. Note that ball transfer tube on ball nut must be facing away from pitman shaft. Install and tighten cap screws attaching steering column tube (21) to housing. Install retainer plate (45) with extra shims (44) to ensure ball nut free play. Turn steering shaft until ball nut is centered on shaft threads, then remove shims as necessary until there is no end play in ball nut but nut still rotates freely. Install secondary pitman shaft (37) and cover plate (40). Refill housing with SAE 90 gear oil.

Install snap ring (20) into groove of column tube. Secure retainer (16) to bearing housing (9) with the set screw. Install control valve (22) with new "O" rings and tighten mounting cap screws to 22-25 N·m (16-18 ft.-lbs.) torque. Reinstall steering box as outlined in paragraph 13. Adjust power steering control valve linkage as outlined in paragraph 15.

15. REMOVE AND REINSTALL CONTROL VALVE. To remove control valve, first remove battery cover panel and disconnect battery cables. Unbolt and remove instrument panel lower cover. Disconnect hydraulic lines and control linkage from valve. Remove mounting cap screws and remove valve from steering column.

To reinstall valve, reverse the removal procedure. Be sure to renew "O" rings

in steering column oil ports. Tighten valve mounting cap screws to 22-25 N·m (16-18 ft.-lbs.) torque. Adjust con-

trol valve linkage as follows: Remove pin connecting control linkage to valve spool. Turn steering wheel to the right

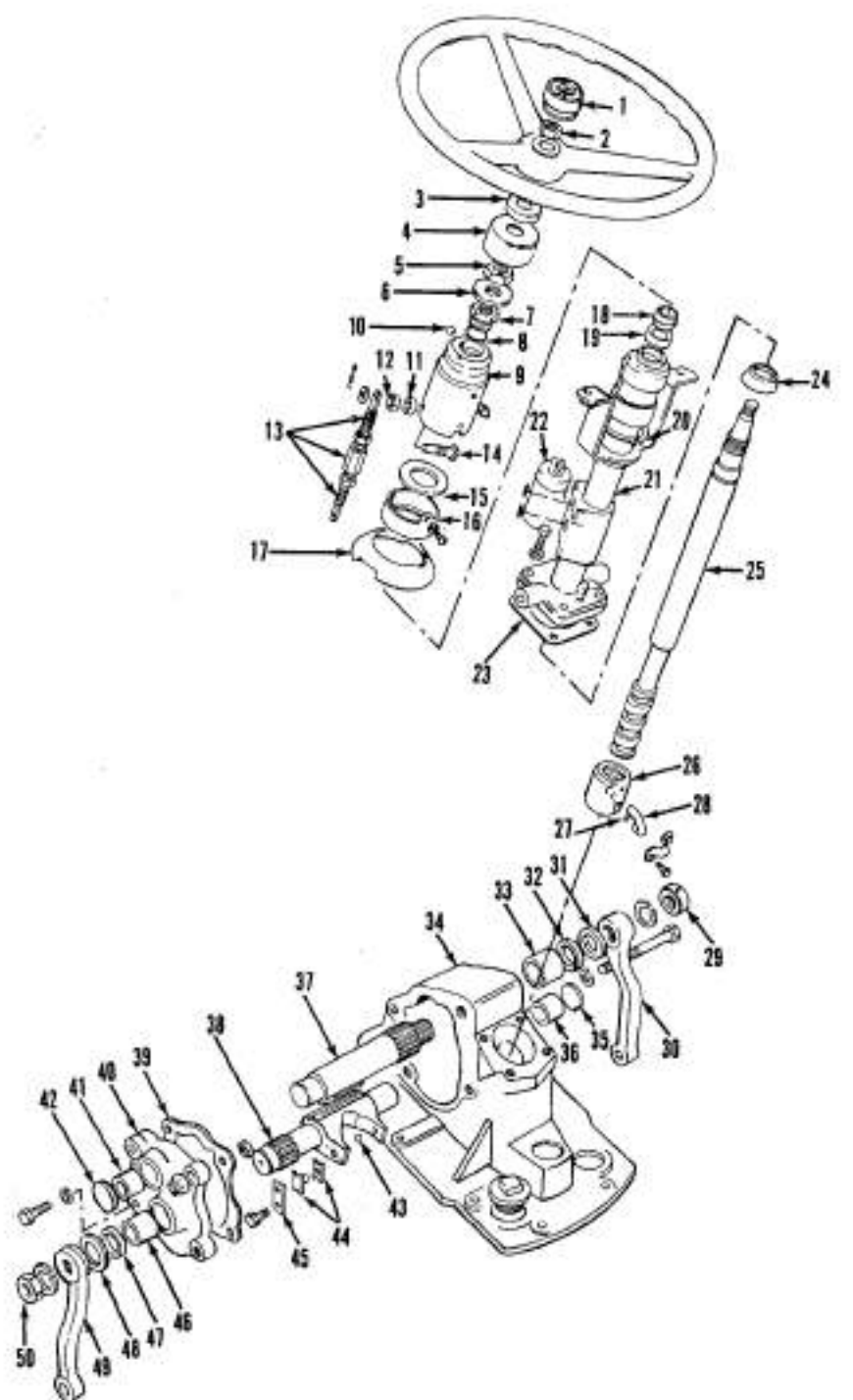


Fig. 15—Exploded view of steering gear assembly used on Models MF240 and MF250.

- | | | | |
|---------------------------|--------------------------|----------------------------|----------------------|
| 1. Cap | 14. Mounting pin | 27. Ball (28 used) | 39. Gasket |
| 2. Nut | 15. Felt washer | 28. Tube | 40. Side cover |
| 3. Spacer | 16. Retainer | 29. Nut | 41. Bushing |
| 4. Cover | 17. Cover | 30. Pitman arm, R.H. | 42. Plug |
| 5. Locknut | 18. Ball race | 31. Seal | 43. Ball |
| 6. Washer | 19. Seal ring | 32. Seal | 44. Shim |
| 7. Adjustable race nut | 20. Snap ring | 33. Bushing | 45. Retainer plate |
| 8. "O" ring | 21. Steering column tube | 34. Housing | 46. Bushing |
| 9. Bearing housing | 22. Control valve | 35. Plug | 47. Seal |
| 10. Ball (12 used) | 23. Gasket | 36. Bushing | 48. Seal |
| 11. Spacer | 24. Dust seal | 37. Secondary pitman shaft | 49. Pitman arm, L.H. |
| 12. Nut | 25. Steering shaft | 38. Primary pitman shaft | 50. Nut |
| 13. Control valve linkage | 26. Ball nut | | |

to remove all free play in steering box without turning the front wheels. Adjust length of linkage until retaining pin can be freely reinserted in spool, then remove pin and increase length of control link by unscrewing rod one full turn. Reattach linkage to valve spool. Start engine and check for full power assistance in both directions.

16. OVERHAUL CONTROL VALVE. To disassemble removed unit, remove snap ring (16—Fig. 19), washers and felt seal (15). Remove end cover mounting screws, then withdraw valve spool (7) assembly with end cover (2) and yoke (1). Unscrew yoke from spool and separate springs and washers from spool. Tap bypass valve piston (10), ball (12) and spring (13) from valve body. Remove relief valve spring and ball (17). Inspect all parts for wear or damage and renew if necessary. Renew all "O" rings when reassembling. Valve spool and body are available only as a matched set.

To reassemble valve, reverse the disassembly procedure. Lubricate all parts with oil during assembly.

Reinstall valve and adjust linkage as outlined in paragraph 15.

STEERING CYLINDERS

Models MF240-MF250

17. R&R AND OVERHAUL. Cylinders used on early models are retained by nuts on ball ends to each end. On later models, inner end of cylinder is retained by a pivot pin.

To disassemble steering cylinders, refer to appropriate Fig. 20 or 21 and proceed as follows: Remove oil from cylinder by working piston back and forth. Unscrew gland nut (13), then withdraw piston and rod assembly and the inner tube (3) from cylinder barrel (1). Unscrew piston (7) from rod (14), then remove remaining components from rod.

Inspect all parts for wear, scoring or damage and renew if necessary. Renew all seals and "O" rings.

To reassemble cylinder, reverse the disassembly procedure. Lubricate all parts with oil before assembling.

Fig. 20—Exploded view of early style power steering cylinder used on Models MF240 and MF250.

1. Cylinder barrel
2. "O" ring
3. Inner tube
4. Dust cover
5. Piston seal
6. "O" ring
7. Piston
8. Oil seal
9. "O" ring
10. Piston seal
11. Washer
12. Scraper seal
13. Gland nut
14. Piston rod

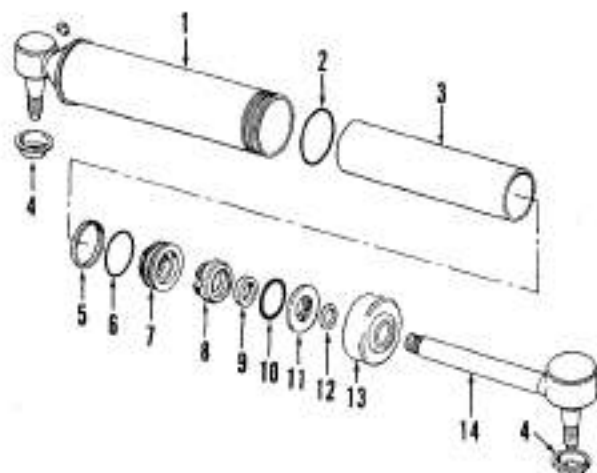


Fig. 21—Exploded view of late style power steering cylinder used on Models MF240 and MF250. Refer to Fig. 20 for legend except for orifice plugs (15).

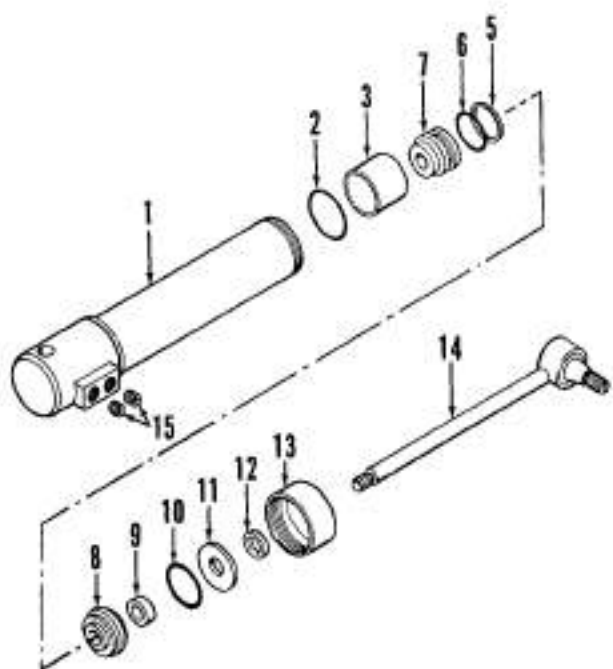


Fig. 19—Exploded view of steering control valve used on Models MF240 and MF250.

1. Yoke
2. Cover plate
3. "O" rings
4. Seal plug
5. Springs
6. Washer
7. Valve spool
8. Valve body
9. "O" ring
10. Bypass piston
11. "O" ring
12. Check ball
13. Spring
14. "O" rings
15. Washers & felt seal
16. Snap ring
17. Relief valve spring & ball

HYDROSTATIC STEERING SYSTEM

This section covers the steering system used on MF235 Orchard models and all MF245 models except Vineyard.

LUBRICATION AND BLEEDING

All Models So Equipped

18. The hydrostatic steering hand pump and steering cylinder assembly are lubricated by the operating fluid. Massey-Ferguson Permatran III Oil is recommended. The system is self bleeding, but steering should be cycled and reservoir refilled as often as necessary until level stops dropping.

SYSTEM OPERATING PRESSURE AND RELIEF VALVE

All Models So Equipped

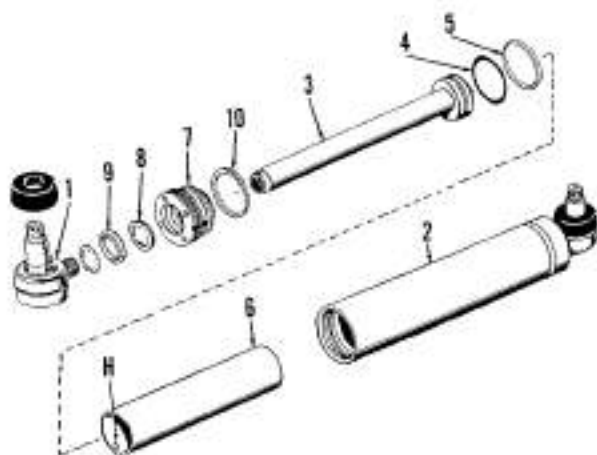
19. Normal system relief valve pressure is approximately 8300 kPa (1200 psi) with engine operating at 2000 rpm. Refer to paragraph 7 for testing and adjusting procedures.

STEERING CYLINDER

All Models So Equipped

20. **OVERHAUL.** Two types of steering cylinders have been used. If two

Fig. 23—Exploded view of one type of steering cylinder used on Models MF235 and MF245 equipped with hydrostatic steering system. Refer to Fig. 22 for other type cylinder and legend.



steering cylinders are used on the same tractor (Orchard models), both cylinders should be alike.

To disassemble the cylinder shown in Fig. 22 or 23, remove oil from cylinder by working piston back and forth. Remove rod end (1) and star washer, then unscrew cap (7). Renew all seals when assembling. Heat Teflon rings in warm oil to soften before installing. Install piston in inner tube (6) from end opposite hole (H—Fig. 23). Do not push piston and seal ring past the hole. Lip of scraper (9—Fig. 22 or 23) should be out. Lubricate all parts before assembling. Tighten cap (7) to approximately 400 N·m (300 ft.-lbs.) torque.

HYDROSTATIC HAND PUMP

All Models So Equipped

21. **REMOVE AND REINSTALL.** To remove the hydrostatic hand pump, first remove the battery and the steering wheel. Disconnect the oil pressure line at gage and tachometer cable at both ends, then remove the tachometer cable and cable housing. Mark all wires to facilitate reassembly, then disconnect all wires from instrument panel gages. Remove lights from panel gages and disconnect fuel shut-off from injection pump (diesel models). Remove the complete instrument panel with gages. Disconnect wires from starter switch and light switch, then unbolt and remove the rear hood assembly with starter and light switches installed. Disconnect linkage from both ends of the throttle cross shaft, then slide shaft from left side of tractor. Remove the complete air cleaner assembly and the battery platform. Clean the area thoroughly before disconnecting any power steering lines. Disconnect the four hydraulic lines and plug all openings to prevent entrance of dirt, then unbolt and remove the hydrostatic hand pump.

To reinstall, reverse the removal procedure. Be careful to connect wires to instruments correctly. Bleed the hydraulic system as outlined in paragraph 6 after all lines are connected. Be sure that system is not allowed to operate without fluid in reservoir.

Orchard Models

22. **OVERHAUL.** MF235 and MF245 Orchard models are equipped with a Char-Lynn open center type hydrostatic hand pump. The rotary valve sleeve

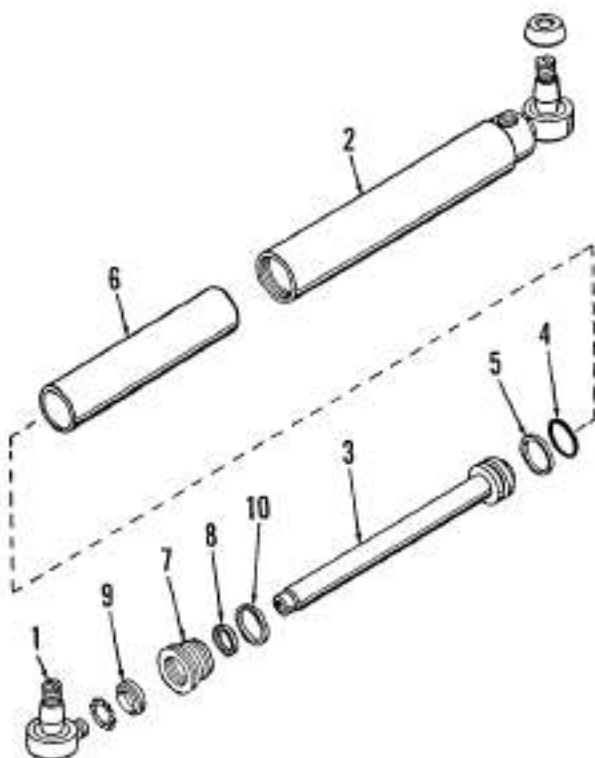


Fig. 22—Exploded view of one type of steering cylinder used on Models MF235 and MF245 equipped with hydrostatic steering system. Refer to Fig. 23 for other type cylinder.

1. Ball joint end
2. Cylinder barrel
3. Rod & piston
4. "O" ring
5. Seal ring
6. Inner tube
7. End cap
8. Seal
9. Scraper
10. Seal ring

spool (17—Fig. 24) and housing (18) are available as a matched set only.

To disassemble the removed unit, first remove cap screws (24) and withdraw end plate (23), gear set (21), spacer (20) and drive link (19) as a unit. Unbolt and remove upper housing (5) and input shaft (1) as a unit. Withdraw the control spool and sleeve (17) as a unit from bottom end of housing. Remove Teflon discs (11), then push pin (10) and centering springs (9) out of sleeve. Carefully slide spool (splined end first) from sleeve (Fig. 25). Insert a bent wire through port in valve body and push plug (12—Fig. 24) from body, then remove check valve seat (14) using an Allen wrench. Remove check ball (15) and spring (16).

Inspect centering springs (9) for cracks or distortion and renew if necessary. Inspect spacer plates (20 and 23) and gear set (21) for wear or scoring. Parts should be renewed if measurable wear exists. Inspect control spool and sleeve and housing bore for nicks, scoring or wear. If any part is damaged, renew steering pump assembly. Renew all "O" rings and seals.

When assembling the unit, tighten check valve seat (14) to a torque of 17 N·m (150 in.-lbs.). Assemble spool in sleeve making sure spool rotates smoothly in sleeve. Align spring slots in spool and sleeve, then insert centering springs (two sets of three each) so arched center sections are together as shown in Fig. 25A. Insert pin (10—Fig. 24) into spool and sleeve assembly and install a Teflon disc (11) at each end of pin.

Install assembled control spool unit from bottom of valve body using a twisting motion. Do not allow sleeve to move beyond flush with machined surface of metering end of valve body.

Install upper housing (5) with input shaft (1) over splined end of spool and onto valve body. Tighten retaining cap

screws evenly to 25 N·m (220 in.-lbs.) torque.

Be sure pin slot in drive shaft (Fig. 26) is aligned with a valley of inner rotor to ensure correct timing of control sleeve. If drive slot is improperly aligned, steering unit will operate in reverse or "kick back" when hydraulic pressure is applied. Assemble drive link (19—Fig. 24), spacer (20), gear set (21) and spacer (22) onto valve body. Note that spacer (22) should be flush with outer surface of gears if drive link is properly engaged with control spool pin. Install end cover (23) and tighten retaining cap screws evenly to 17 N·m (150 in.-lbs.) torque.

MF245 Standard Models

23. OVERHAUL. All MF245 models except Orchard are equipped with the hydrostatic hand pump shown exploded in Fig. 27. The valve spool (22) and body (25) are available only as a matched set.

To disassemble the removed steering control valve assembly, install a fitting in one of the four ports in valve body (25),

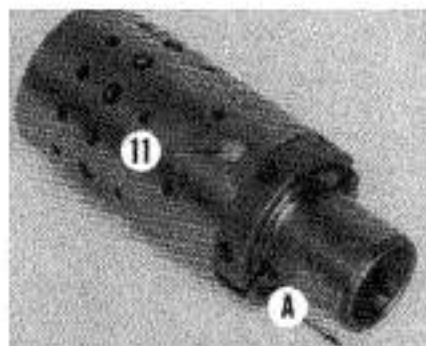


Fig. 25—View of control spool and sleeve assembly. Teflon discs (11) cover outer ends of internal pin. Withdraw spool from sleeve in direction of arrow (A).

then clamp fitting in a vise so input shaft (17) is pointing downward. Remove cap screws (39) and end cover (38).

NOTE: Lapped surfaces of end cover (38), commutator set (33 and 34), manifold (32), stator-rotor set (31), spacer (29) and valve body (25) must be protected from scratching, burring or any other damage as sealing of these parts depends on their finish and flatness.

Remove seal retainer (35) and seal (36), then carefully remove washer (37), commutator set (33 and 34) and manifold (32). Grasp spacer (29) and lift off the spacer, drive link (30) and stator-rotor set (31) as an assembly. Separate spacer and drive link from stator-rotor set.

Remove unit from vise, then clamp fitting in vise so input shaft is pointing upward. Place a light mark on flange of upper cover (9) and valve body (25) for aid in reassembly. Unbolt upper cover from valve body, then grasp input shaft and remove input shaft, upper cover and valve spool assembly. Remove and discard seal ring (10). Slide upper cover assembly from input shaft and remove Teflon spacer (16). Remove shims (12) from cavity in upper cover or from face of thrust washer (14) and note number



Fig. 25A—Schematic end view of steering control sleeve and spool showing correct assembly of centering springs (S) and drive pin (P).

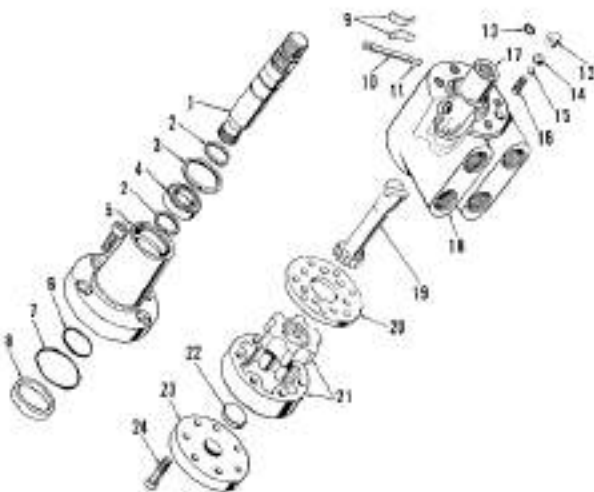


Fig. 24—Exploded view of Char-Lynn Orbital hydrostatic steering hand pump used on MF235 and MF245 Orchard models.

1. Input shaft
2. Snap ring
3. Snap ring
4. Bearing
5. Shaft housing
6. Quad ring
7. "O" ring
8. Bushing
9. Centering springs
10. Pin
11. Teflon disc
12. Plug
13. "O" ring
14. Ball seat
15. Check valve ball
16. Spring
17. Control spool & sleeve
18. Valve housing
19. Drive link
20. Spacer plate
21. Gear set
22. Spacer
23. End plate
24. Cap screw



Fig. 26—When properly assembled, slot in end of drive link must align with valley of inner gear as shown to provide correct valve timing.

of shims for aid in reassembly. Remove snap ring (4) and seal assembly (8).

Remove snap ring (13), thrust washers (14) and thrust bearing (15) from input shaft. Drive out pin (18) and withdraw torsion bar (21) and spacer (20). Place end of valve spool on top of bench and rotate input shaft until drive ring (19) falls free, then rotate input shaft clockwise until actuator ball (23) is disengaged from helical groove in input shaft. Withdraw input shaft and remove actuator ball. Do not remove actuator ball retaining spring (24) unless renewal is required.

Remove plug (28) and recirculating ball (26) from valve body. Thoroughly clean all parts in a suitable solvent, visually inspect parts and renew any showing excessive wear, scoring or other damage.

Using a micrometer, measure thickness of the commutator ring (33) and commutator (34). If commutator ring is 0.038 mm (0.0015 inch) or more thicker than commutator, renew the matched set.

Place the stator-rotor set (31) on the lapped surface of end cover (38). Make certain that vanes and vane springs are installed correctly in slots of the rotor.

NOTE: Arched back of springs must contact vanes.

Position lobe of rotor in valley of stator as shown at (V—Fig. 28). Center opposite lobe on crown of stator, then using two feeler gages, measure clearance (C) be-

tween rotor lobes and stator. If clearance is more than 0.15 mm (0.006 inch), renew stator-rotor assembly. Using a micrometer, measure thickness of stator and rotor. If stator is 0.05 mm (0.002 inch) or more thicker than rotor, renew the assembly. Stator, rotor, vanes and vane springs are available only as an assembly.

Before reassembling, wash all parts in clean solvent and air dry. All parts, unless otherwise indicated, are installed dry. Install recirculating ball (26)—Fig. 27) and plug (28) with new "O" ring (27) in valve body and tighten plug to a torque of 14-19 N·m (10-14 ft.-lbs.). Clamp fitting (installed in valve body port) in a vise so top end of valve body is facing upward. Install thrust washer (14), thrust bearing (15), second thrust washer (14) and snap ring (13) on input shaft (17).

If actuator ball retaining spring (24) was removed, install new retaining spring. Place actuator ball (23) in its seat inside valve spool (22). Insert input shaft into valve spool engaging the helix and actuator ball with a counterclockwise motion. Use the midsection of torsion bar (21) as a gage between end of valve spool and thrust washer, then place the assembly in a vertical position with end of input shaft resting on a bench. Insert drive ring (19) into valve spool until drive ring is engaged on input shaft spline. Remove torsion bar gage.

Install spacer (20) on torsion bar and insert the assembly into valve spool. Align cross holes in torsion bar and in-

put shaft and install pin (18). Pin must be pressed into shaft until end of pin is about 0.8 mm (1/32 inch) below flush. Place spacer (16) over spool and install spool assembly into valve body.

Position original shims (12) on thrust washer (14), lubricate new seal ring (10), place seal ring in upper cover (9) and install upper cover assembly. Align the match marks on cover flange and valve body and install cap screws finger tight. Tighten a worm drive type hose clamp around cover flange and valve body to align the outer diameters, then tighten cap screws to a torque of 24-30 N·m (18-22 ft.-lbs.).

NOTE: If either input shaft (17) or upper cover (9) or both have been renewed, the following procedure for shimming must be used. With upper cover installed (with original shims) as outlined above, invert unit in a vise so input shaft is pointing downward. Grasp input shaft, pull downward and prevent it from rotating. Engage drive link (30) splines in valve spool and rotate drive link until end of spool is flush with end of valve body. Remove drive link and check alignment of drive link slot to torsion bar pin. Install drive link until its slot engages torsion bar pin. Check relationship of spool end to body end. If end of spool is within 0.0635 mm (0.0025 inch) of being flush with end of body, no additional shimming is required. If not within 0.0635 mm (0.0025 inch) of being flush, remove cover and add or remove shims (12) as necessary. Reinstall cover and recheck spool to valve body position.

With drive link installed, place spacer plate (29) on valve body with plain side up. Install stator-rotor set over drive link splines and align cap screw holes. Make certain vanes and vane springs are prop-

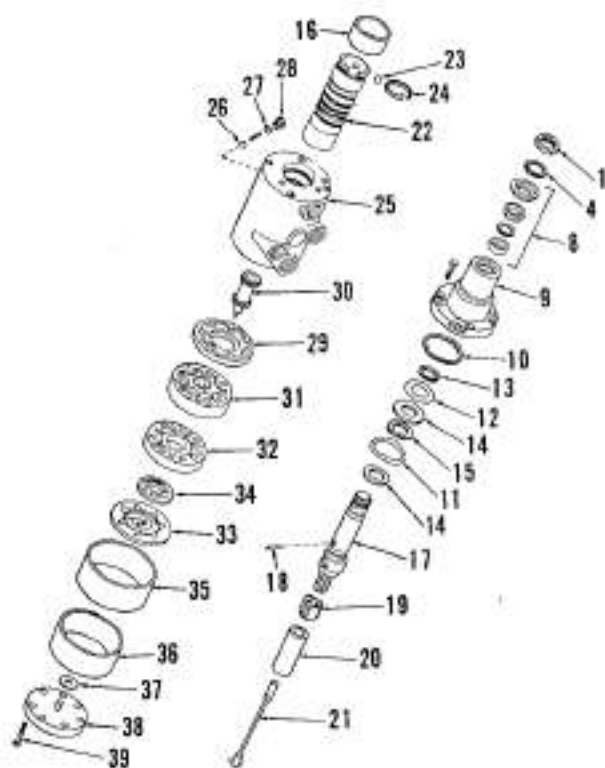


Fig. 27—Exploded view of steering control valve assembly (hydrostatic hand pump) used on standard MF245 models.

1. Nut
4. Snap ring
8. Seal assembly
9. Cover (upper)
10. Seal
11. Washer
12. Shims
13. Snap ring
14. Thrust washers
15. Thrust bearing
16. Teflon spacer
17. Input shaft
18. Pin
19. Drive ring
20. Spacer
21. Torsion bar
22. Valve spool
23. Actuator ball
24. Retaining spring
25. Valve body
26. Recirculating ball
27. "O" ring
28. Plug
29. Spacer plate
30. Drive link
31. Stator-rotor set
32. Manifold
33. Commutator ring
34. Commutator
35. Seal retainer
36. Seal
37. Washer
38. End cover
39. Cap screws

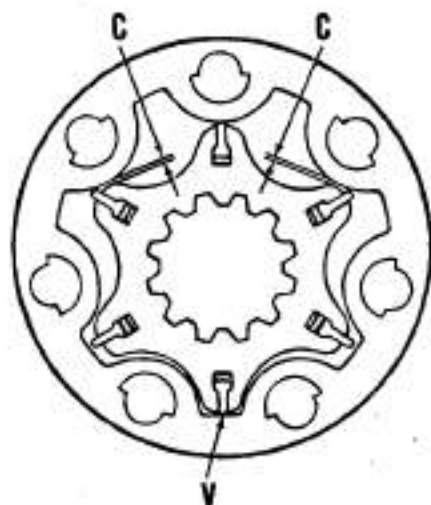


Fig. 28—With rotor positioned in stator as shown, clearances (C) must not exceed 0.15 mm (0.006 inch). Refer to text.

erly installed. Install manifold (32) with circular slotted side up and align cap screw holes with stator, spacer and valve body. Install commutator ring (33) with slotted side up, then install commutator (34) over drive link end making certain that link end is engaged in the smallest elongated hole in commutator. Install seal (36) and retainer (35). Apply a few drops of hydraulic fluid on commutator. Use a small amount of grease to stick washer (37) in position over pin on end cover (38). Install end cover making sure that pin engages center hole in commutator. Align holes and install cap screws (39). Alternately and progressively tighten cap screws while rotating input shaft. Final tightening should be 24-30 N·m (18-22 ft.-lbs.) torque.

Relocate the unit in vise so input shaft is up. Lubricate new seal (8) and carefully work seal over shaft and into bore with lip toward inside. Install snap ring (4) with rounded edge inward.

Remove unit from vise and remove fitting from port. Turn unit on its side with hose ports upward. Pour clean hydraulic fluid into inlet port, rotate input shaft until fluid appears at outlet port, then plug all ports until installation.

POWER STEERING PUMP

All Models So Equipped

24. The power steering hydraulic pump used on models equipped with hydrostatic power steering is the same as pumps used on tractors equipped with power assist steering systems. The pump used on tractors with diesel engine is shown in Fig. 10 and pump used on tractors with gasoline engine is shown in Fig. 11. Refer to paragraph 8 for removal procedure and to appropriate paragraph 9 or 10 for overhaul procedure.

GASOLINE ENGINE AND COMPONENTS

All gasoline models are equipped with Continental Z-145, four cylinder engine.

R&R ENGINE ASSEMBLY

All Gasoline Models

25. First drain cooling system and, if engine is to be disassembled, drain oil pan. Remove front grille panels and disconnect battery cables. Remove fuel tank cap, radiator cap and hood. Disconnect headlight wires and pull wiring free. Disconnect both radiator hoses, radiator brace and, on models so equipped, hydraulic oil lines and front mounted pump. Support tractor at front of transmission. Position wedge blocks between front axle and axle support. Support the front end assembly at front and rear. Disconnect drag links and radius rods at rear of models so equipped. On models with drag links, attach drag links to axle so wheels will be straight ahead and will not turn. On

models with power steering, disconnect lines and cover all hydraulic steering openings. Unbolt the front assembly and carefully roll away from tractor. Shut fuel off at tank, unclip headlight wires from side of tank, disconnect wire from fuel gage sending unit, detach fuel line from shut off valve, then remove the fuel tank. Disconnect battery ground strap and wires from alternator, starter motor, ignition coil and water temperature gage sending unit. Detach tachometer drive cable and housing, air cleaner hose, breather tube, throttle rod, choke cable, engine oil pressure line and muffler (or exhaust pipe). Disconnect the power steering lines along left side of cylinder head on models so equipped. Attach a hoist to engine, be sure that all wires, lines, hoses and rods are out of the way, then unbolt and separate engine from transmission.

NOTE: Separating and joining engine to transmission is more easily and more safely accomplished using guide studs.

Lubricate clutch shaft splines with lithium base grease before connecting engine to transmission. Install in reverse of removal procedure. Fill and bleed power steering system as outlined in paragraph 6.

CYLINDER HEAD

All Gasoline Models

26. **REMOVE AND REINSTALL.** Drain cooling system and remove hood. Shut off fuel, disconnect gage wire and remove fuel tank. Disconnect upper radiator hose from thermostat housing and wire from temperature gage sending unit. Disconnect air cleaner hose, fuel line, choke and throttle rod from carburetor, then remove the carburetor. Disconnect exhaust pipe on low exhaust models or remove muffler on vertical exhaust models. Remove intake and exhaust manifold, radiator brace, rocker arm cover and the rocker shaft assembly.

CAUTION: Don't let push rods fall down into the cylinder block while removing the rocker shaft assembly.

Lift all eight push rods out, remove spark plugs, then loosen cylinder head retaining screws in reverse of sequence shown in Fig. 29. Remove the cylinder head screws and lift head off.

Inspect cylinder for warpage, cracks or other damage. Original thickness of cylinder head is 86.52 mm (3.406 inches). Cylinder head may be machined up to 0.76 mm (0.030 inch) to obtain a flat gasket surface.

Install by reversing removal procedure and observing the following: Cylinder head gasket is marked "BOTTOM" which should be toward block. New gasket should need no sealer; however, if difficulties with gasket sealing are encountered, coat both sides of gasket with heat resisting aluminum paint or appropriate sealer immediately before assembling. Tighten the cylinder head retaining cap screws in sequence shown in Fig. 29. Tighten the screws evenly, increasing torque in 15-20 N·m (10-15 ft.-lbs.) increments until the final torque of 95-102 N·m (70-75 ft.-lbs.) is obtained. Be careful not to permit push rods to fall into block while installing rocker arm assembly. Make sure that caps are in position on all valve stems.

Tighten rocker arm shaft support screws to 27-34 N·m (20-25 ft.-lbs.) torque. Adjust valve clearance cold to 0.33 mm (0.013 inch) for intake and 0.38 mm (0.015 inch) for exhaust. Tighten intake and exhaust manifold screws to 34-40 N·m (25-30 ft.-lbs.) and spark plugs to 43-52 N·m (32-38 ft.-lbs.) torque.

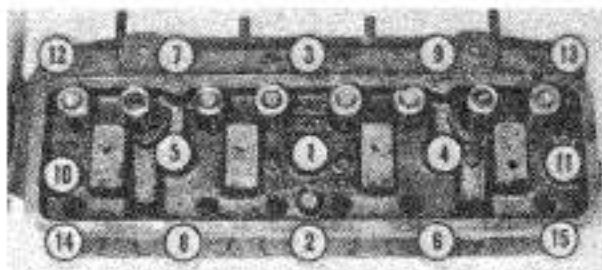


Fig. 29—Cylinder head retaining cap screws should be loosened in reverse of tightening sequence shown. Tighten screws in 15-20 N·m (10-15 ft.-lbs.) increments in order shown until final torque of 95-102 N·m (70-75 ft.-lbs.) is reached.

Retorque cylinder head retaining cap screws to 95-102 N·m (70-75 ft.-lbs.) and readjust valve clearance to "Hot" setting after engine has been started and reaches operating clearance. Refer to following paragraph for valve clearance adjustment procedure.

27. VALVE CLEARANCE ADJUSTMENT: The recommended valve clearance with engine cold is 0.33 mm (0.013 inch) for intake valves and 0.38 mm (0.015 inch) for exhaust valves. Recommended clearance with engine hot (normal operating temperature) is 0.28 mm (0.011 inch) for intake valves and 0.33 mm (0.013 inch) for exhaust valves. Valve clearance can be adjusted as follows:

Remove timing plug from left side of cylinder block and turn crankshaft until top dead center timing mark (DC—Fig. 31) is aligned with timing notch in housing as shown. Check rocker arms for No. 1 and No. 4 cylinders. If rocker arms on No. 4 cylinder are tight, No. 1 cylinder is on compression stroke and valves indicated in Fig. 32 can be adjusted. If rocker arms on No. 1 cylinder are tight, No. 4 cylinder is on compression stroke and valves indicated in Fig. 33 can be adjusted. After adjusting the four valves indicated in appropriate Fig. 32 or 33, rotate crankshaft one complete turn and adjust clearance of the remaining four valves.

VALVES AND SEATS

All Gasoline Models

28. Intake valves seat directly in cylinder head and valve stems are equipped with neoprene oil seals. Positive type valve stem seal kit is available; however, valve guides must be machined to accept seal. Exhaust valves have renewable seat inserts and stems are equipped with positive type valve rotators (Rotocaps).

Replacement exhaust valve seat inserts are provided in 0.25 mm (0.010 inch) oversize only. When renewing the seat inserts, remachine cylinder head so insert counterbore measures 31.991-32.017 mm (1.2595-1.2605 inches) to provide recommended 0.08-0.13

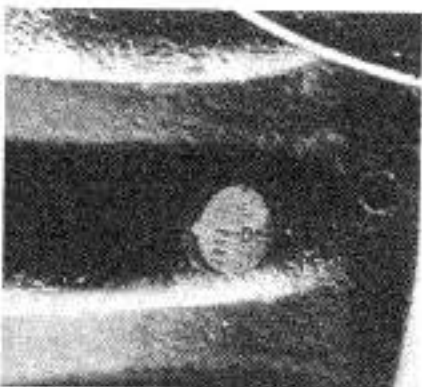


Fig. 31—Align the "DC" flywheel mark with notch as shown when adjusting valve clearance as described in paragraph 27.

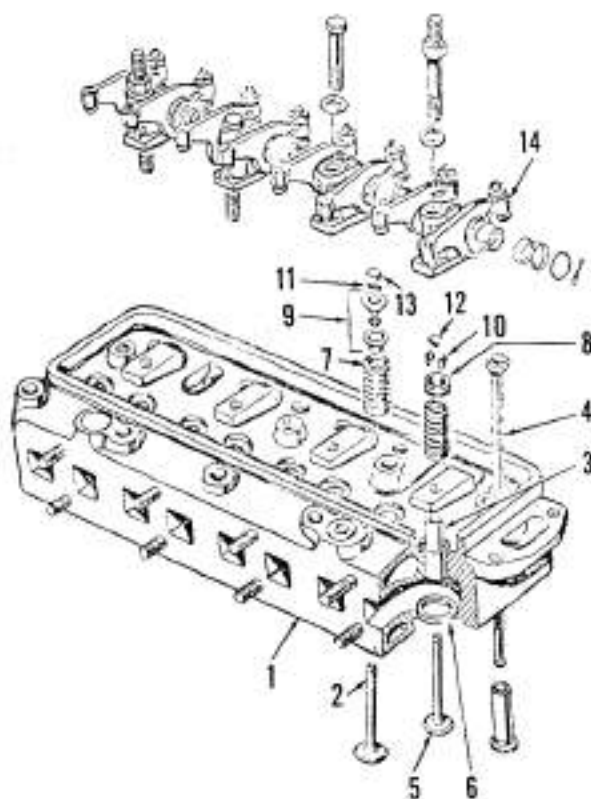


Fig. 30—Exploded view of cylinder head. Rocker arms should be assembled with offset as shown in Fig. 36.

1. Cylinder head
2. Intake valve
3. Valve guide
4. Push rod
5. Exhaust valve
6. Exhaust valve seat
7. Valve spring
8. Exhaust valve rotator cap
9. Intake valve seal & cap
10. Exhaust valve keepers
11. Intake valve keeper
12. Exhaust valve cap
13. Intake valve cap

mm (0.003-0.005 inch) interference fit.

Intake valve face and seat angle is 30°. Exhaust valves have a face angle of 44° and seat angle of 45° to provide the recommended 1° interference angle. Desired seat width is 1.6-2.4 mm (1/16-3/32 inch) for all valves. Seats can be narrowed using 15° and 75° stones.

VALVE GUIDES

All Gasoline Models

29. The presized intake and exhaust valve guides are interchangeable. Inside diameter of new guides is 8.019-8.057 mm (0.3157-0.3172 inch). Inner bore of new guides has a fine, spiral groove or rifling which gives guide an unfinished appearance upon inspection, but guide must not be reamed. To renew the guides, press old guides downward out of cylinder head using a piloted mandrel. Press new guide in from the top until distance (A—Fig. 34) measured from rocker arm cover gasket surface to top of guide is 2.38 mm (3/32 inch).

Valve stem diameters and clearance limits in guides are as follows:

Valve Stem Diameter—

Intake	7.978-7.998 mm (0.3141-0.3149 in.)
Exhaust	7.935-7.955 mm (0.3124-0.3132 in.)

Clearance—

Intake	0.021-0.079 mm (0.0008-0.0031 in.)
Exhaust	0.064-0.122 mm (0.0025-0.0048 in.)

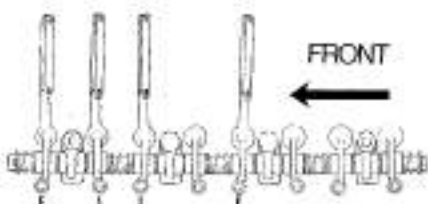


Fig. 32—With "DC" timing mark aligned as shown in Fig. 31 and No. 1 piston on compression stroke, adjust the indicated valves. Turn crankshaft one complete revolution until timing marks are again aligned as shown in Fig. 31, refer to Fig. 33 and adjust remainder of valves.

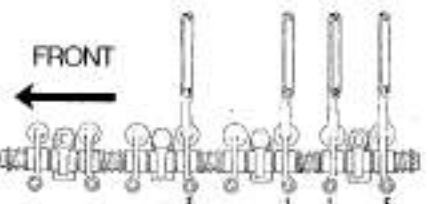


Fig. 33—With "DC" timing mark aligned as shown in Fig. 31 and No. 4 piston on compression stroke, adjust the indicated valves.

VALVE STEMS

All Gasoline Models

30. Intake and exhaust valve springs are interchangeable. Springs should be installed with damper end (closely wound coils) towards cylinder head. Renew any spring that is rusted, discolored, distorted or does not test within 10 percent of the following test specifications: Free length should be approximately 52.39 mm (2-1/16 inches). Spring pressure should be 209-235 N (47-53 pounds) when compressed to 43.25 mm (1-45/64 inches) and 427-462 N (96-104 pounds) when compressed to 36.12 mm (1-27/16 inches).

VALVE ROTATORS

All Gasoline Models

31. Normal servicing of the positive type exhaust valve rotators ("Rotocaps") consists of renewing the units. It is important, however, to observe the valve action after valve is assembled. The valve rotator can be considered satisfactory if the valve turns a slight amount each time the valve opens.

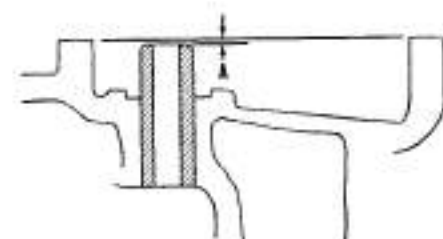
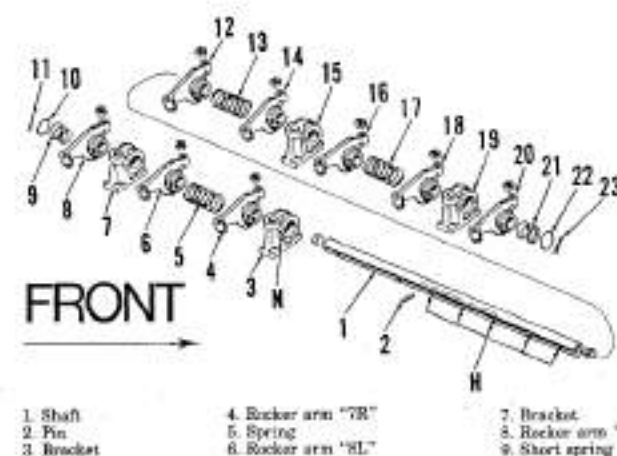
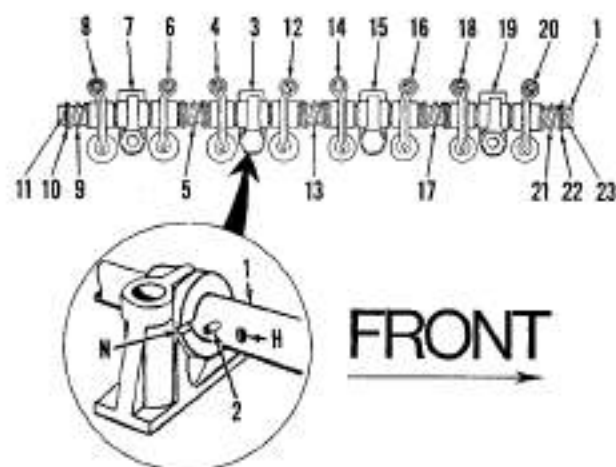


Fig. 34—When renewing valve guides, distance (A) from top of guide to rocker cover gasket surface should be 2.38 mm (3/32 inch).



1. Shaft
2. Pin
3. Bracket
4. Rocker arm "TR"
5. Spring
6. Rocker arm "RL"
7. Bracket
8. Rocker arm "TR"
9. Short spring

Fig. 36—Drawings showing the offset of rocker arms and installation of pin (2) in notch (N) of the third bracket (3). Refer to Fig. 35 for legend.



CAM FOLLOWERS

All Gasoline Models

32. The mushroom type cam followers (tappets) operate directly in machined bores of the cylinder block and are available only in standard size of 14.262-14.275 mm (0.5615-0.5620 inch). Clearance in bore should be 0.013-0.046 mm (0.0005-0.0018 inch).

The cam followers can be removed from below after removing camshaft as outlined in paragraph 36. Cam followers should be reinstalled in their original positions if being reused. Cam followers should be renewed if camshaft is renewed.

notch (N) in front face of the third support bracket (3). Begin assembly by installing pin in notch of bracket as shown in Fig. 36. Install one rocker arm (4—Fig. 35) stamped "TR", spring (5), rocker arm (6) stamped "SL", another bracket (7), another rocker arm (8) stamped "TR", short spring (9), washer (10) and cotter pin (11) to the short end of shaft. Install remaining parts to longer end of shaft as shown in Figs. 35 and 36. Rocker arms (4, 8, 14 and 18) are alike and stamped "TR". Rocker arms (6, 12, 16 and 20) are alike and stamped "SL". Springs (5, 13 and 17) are identical as are support brackets (3, 7, 15 and 19). Short spring (9 or 21), washer (10 or 22) and cotter key (11 or 23) are used at each end.

ROCKER ARMS

All Gasoline Models

33. Rocker arm bushings are not renewable. Renew rocker arms and/or shaft if clearance between shaft and bushing is not within limits of 0.013-0.046 mm (0.0005-0.0018 inch). Rocker shaft is positioned by locating pin (1—Fig. 35) in shaft (1) which fits in a

TIMING GEAR COVER

All Gasoline Models

34. REMOVE AND REINSTALL. First separate the front system from the engine as follows: Drain cooling system, remove front grille panels and disconnect battery cables. Remove fuel tank cap, radiator cap and hood. Disconnect headlight wires and pull wiring free. Disconnect both radiator hoses, radiator brace and, on models so equipped, hydraulic oil lines and front mounted pump. Support tractor at front of transmission. Position wedge blocks between front axle and axle support. Support the front end assembly at front and rear. Disconnect drag links and radius rods at rear of models so equipped. On models with drag links, attach drag links to axle so wheels will be straight ahead and will not turn. On models with power steering, disconnect lines, remove the power steering pump and cover all hydraulic steering openings. On all models, unbolt the front assembly and carefully roll away from tractor.

Remove the fan belt and crankshaft pulley. Detach the spring and rod from