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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This service 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**				
Cylinder Head	95-101 N·m (70-75 ft.-lbs.)			
Connecting Rods	Refer to Text	54-61 N·m (40-45 ft.-lbs.)	Refer to Text	54-61 N·m (40-45 ft.-lbs.)
Main Bearings	149-156 N·m (110-115 ft.-lbs.)	115-129 N·m (85-95 ft.-lbs.)	149-156 N·m (110-115 ft.-lbs.)	115-129 N·m (85-95 ft.-lbs.)
Flywheel	101-108 N·m (75-80 ft.-lbs.)	95-101 N·m (70-75 ft.-lbs.)	101-108 N·m (75-80 ft.-lbs.)	95-101 N·m (70-75 ft.-lbs.)
Oil Pan	26-28 N·m (19-21 ft.-lbs.)	16-22 N·m (12-16 ft.-lbs.)	26-28 N·m (19-21 ft.-lbs.)	16-22 N·m (12-16 ft.-lbs.)
Intake Manifold	8-12 N·m (6-9 ft.-lbs.)	27-41 N·m (20-30 ft.-lbs.)	8-12 N·m (6-9 ft.-lbs.)	27-41 N·m (20-30 ft.-lbs.)
Exhaust Manifold	16-20 N·m (12-15 ft.-lbs.)	27-41 N·m (20-30 ft.-lbs.)	16-20 N·m (12-15 ft.-lbs.)	27-41 N·m (20-30 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	MF245 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

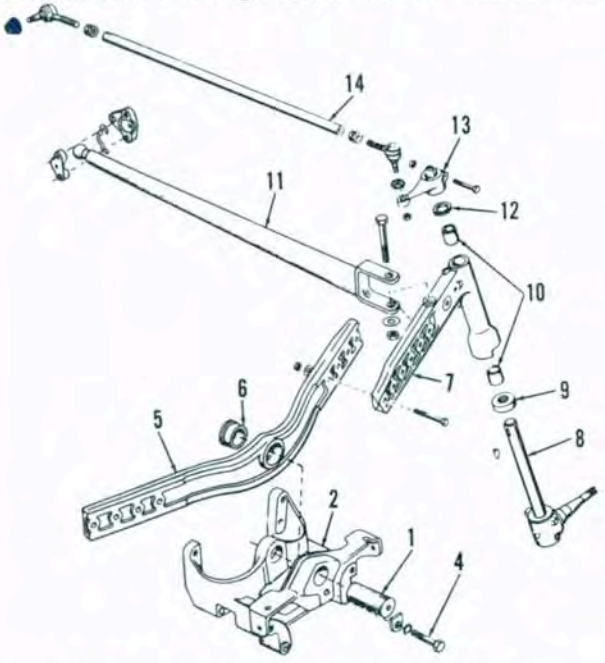

Fig. 1—Exploded view of swept back axle used on some MF230 and MF235 models. Refer to Fig. 2 for legend except radius rods (11).

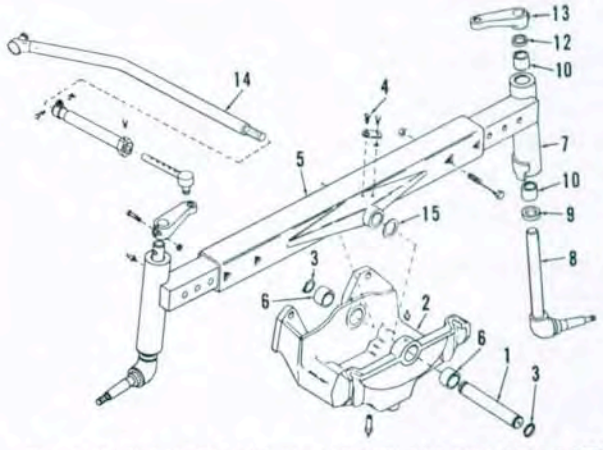

Fig. 2—Exploded view of typical straight axle standard on MF235 models and all Vineyard models.

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

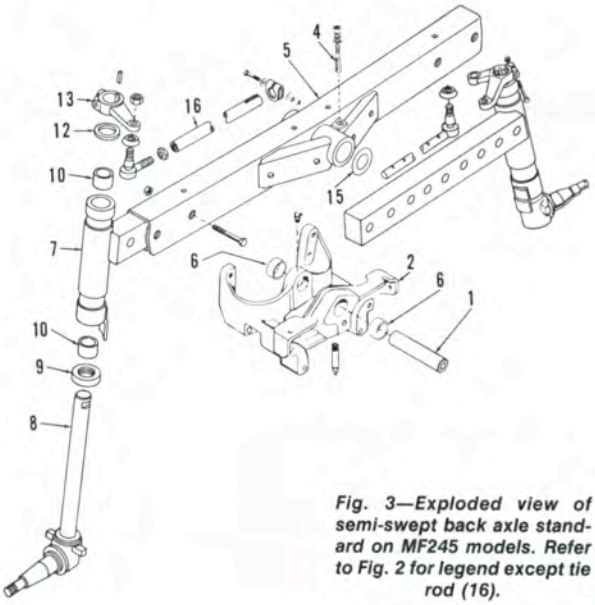

Fig. 3—Exploded view of semi-swept back axle standard on MF245 models. Refer to Fig. 2 for legend except tie rod (16).

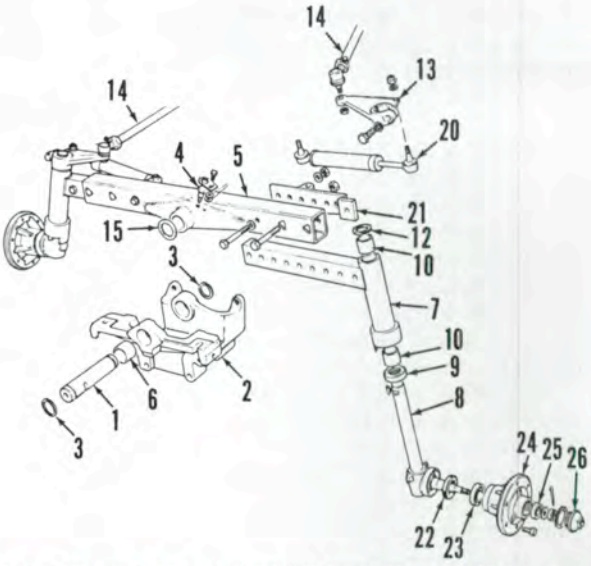

Fig. 5—Exploded view of adjustable front axle assembly used on Models MF240 and MF250. Refer to Fig. 2 for legend except for the following:

20. Steering cylinder
21. Cylinder bracket
22. Seal
23. Inner bearing
24. Wheel hub
25. Outer bearing
26. Hub cap

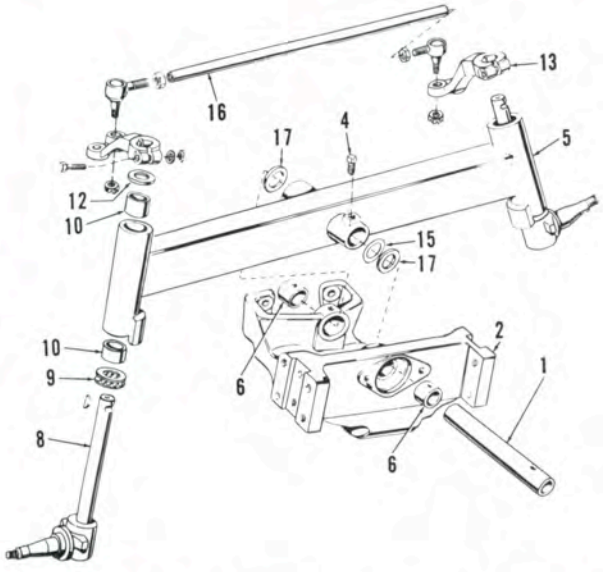

Fig. 4—Exploded view of nonadjustable front axle used on MF235 and MF245 Orchard models. Refer to Fig. 2 for legend except for washers (17) and tie rod (16).

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 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, ll 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

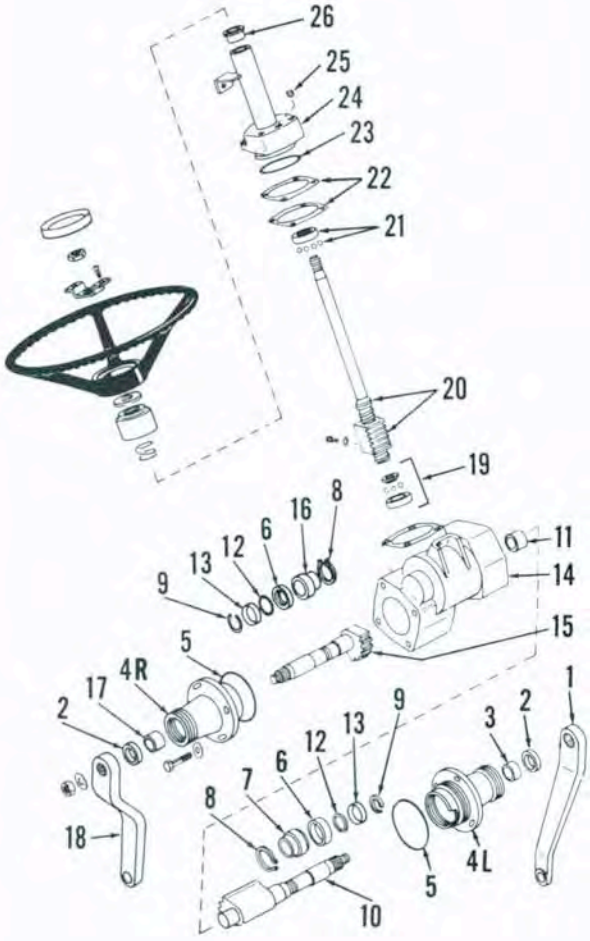

Fig. 6—Exploded view of typical manual steering gear used on MF230 and some MF235 models.

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.

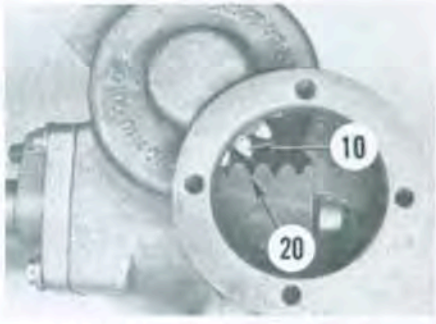

Fig. 8—The marked (3rd) tooth of the left pinion gear (10) should be aligned with the center valley of rack (20).

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) 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 (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 Permatran 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

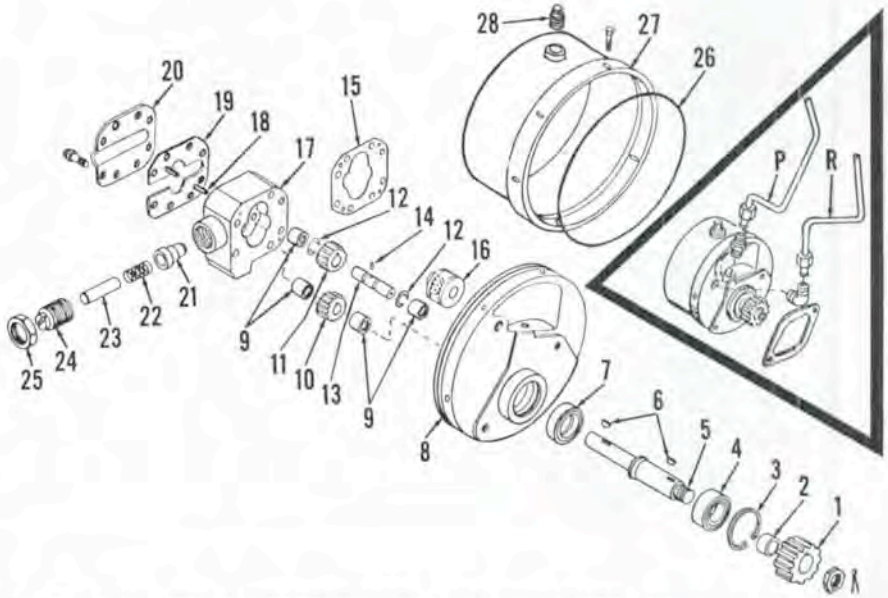

Fig. 10—Exploded view of power steering pump used on Models MF230, MF235 and MF245 equipped with diesel engine. Pump used on Models MF240 and MF250 is similar except dual springs are used on relief valve and spring guide pin (23) is not used. Inset shows location of pressure line (P) and return line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

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

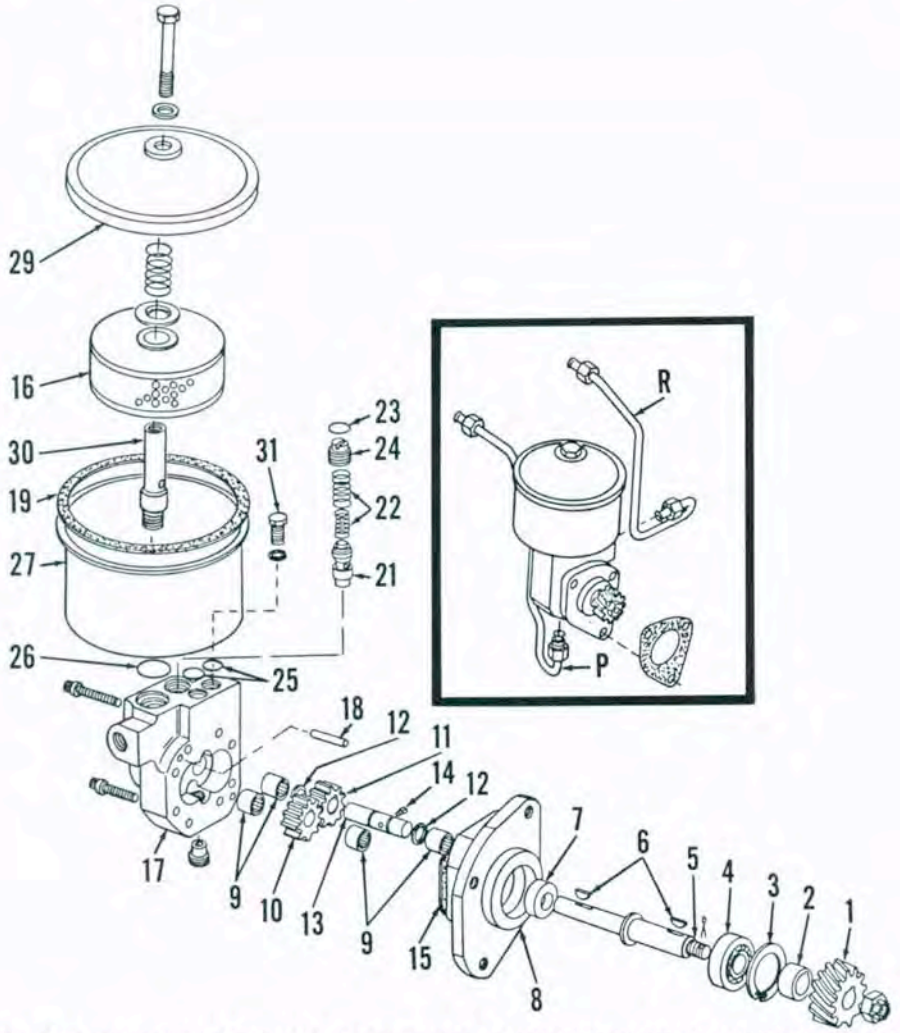

Fig. 11—Exploded view of power steering pump used on Models MF230, MF235 and MF245 equipped with gasoline engine. Inset shows location of pressure line (P) and return line (R).

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

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

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