

SHOP MANUAL

MASSEY-FERGUSON

MODELS

340, 350, 355, 360 AND 399

The tractor serial number is located in two locations, on the serial number plate (Fig. 1) located on the right side of the tractor and stamped on the rear axle casting (Fig. 2). The tractor serial number is coded to identify the machine type, year of manufacture, week of manufacture (during specific year) and specific unit during week.

The illustration shown in Fig. 3 identifies a two-wheel-drive 360 tractor which was the 132nd tractor manufactured during the 33rd week of 1988.

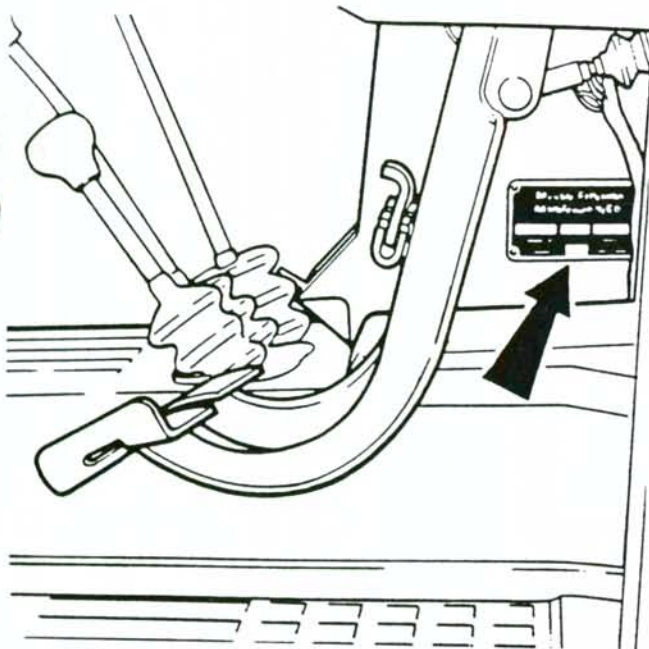


Fig. 1—The tractor serial number is located on plate attached to tractor right side as shown as well as stamped on axle housing as shown in Fig. 2.

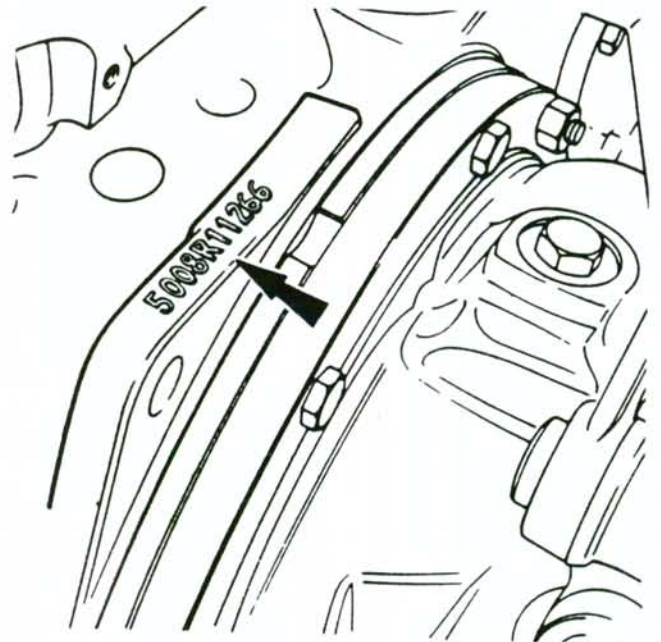


Fig. 2—Tractor serial number is stamped into rear axle housing as shown as well as on plate shown in Fig. 1. Numbers match on original assembly.

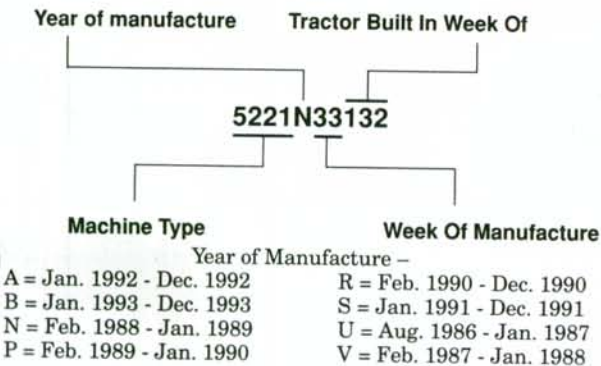


Fig. 3—The tractor serial number identifies machine type, year of manufacture, week of manufacture during specific year, and specific unit manufactured during that week. The illustration shown identifies a two-wheel-drive 360 tractor which was the 132nd tractor manufactured during the 33rd week of 1988.

Machine Type —	
5000 M-F 350 2WD	5222 M-F 360 4WD
5001 M-F 350 4WD	5309 M-F 355 2WD
5012 M-F 399 2WD	5310 M-F 355 4WD
5013 M-F 399 4WD	5747 M-F 340 4WD
5221 M-F 360 2WD	5812 M-F 340 4WD

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DUAL DIMENSIONS

This service manual provides specifications in both U.S. Customary and Metric (SI) 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 0.011 inch (0.28 mm) would indicate that we feel the preferred measurement in this instance is the U.S. Customary system of measurement and the Metric equivalent of 0.011 inch is 0.28 mm.

CONDENSED SERVICE DATA

	340-350	355	Models 360	Early 399*	Late 399†
GENERAL					
Engine Make	Perkins				
Model	AD3.152S	AT3.1524		A6.3544	1006.6
Build Code	CE31160	CN31187	CN31185	TW31159	YA31240
Number of Cylinders	3			6	
Bore	91.4 mm (3.6 in.)			98.4 mm (3.875 in.)	100 mm (3.937 in.)
Stroke	127 mm (5.0 in.)				
Displacement	2.5 L (152 cid)			5.8 L (354 cid)	6.0 L (365 cid)
Compression Ratio	16:1	15.5:1		16:1	16.5:1
Firing Order	1-2-3			1-5-3-6-2-4	1-5-3-6-2-4
Valve Clearance (Cold) -					
Inlet	0.3 mm (0.012 in.)	0.2 mm (0.008 in.)			
Exhaust		0.3 mm (0.012 in.)			0.45 mm (0.018 in.)
Valve Face Angle -					
Inlet and Exhaust		35°		45°	
Valve Seat Angle -					
Inlet and Exhaust		36°		46°	
Injection timing - BTDC					
Static	16°	16°‡	17°	23°	22°
Fuel Pump -					
Make	CAV				
Model	DPA				
Engine Low Idle, rpm	725-775	725-775‡		725-775	
Engine High Idle, rpm	2470	2370‡	2470	2420#	2310
Engine Rated Speed, rpm	2250			2200	
Battery Terminal Grounded	Negative				
SIZES					
Crankshaft Main					
Journal Diameter	See Paragraph 58			See Paragraph 87	See Paragraph 118

DUAL DIMENSIONS

This service manual provides specifications in both U.S. Customary and Metric (SI) 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 0.011 inch (0.28 mm) would indicate that we feel the preferred measurement in this instance is the U.S. Customary system of measurement and the Metric equivalent of 0.011 inch is 0.28 mm.

CONDENSED SERVICE DATA

	340-350	355	Models 360	Early 399*	Late 399†
GENERAL					
Engine Make	Perkins				
Model	AD3.152S	AT3.1524		A6.3544	1006.6
Build Code	CE31160	CN31187	CN31185	TW31159	YA31240
Number of Cylinders	3			6	
Bore	91.4 mm (3.6 in.)			98.4 mm (3.875 in.)	100 mm (3.937 in.)
Stroke	127 mm (5.0 in.)				
Displacement	2.5 L (152 cid)			5.8 L (354 cid)	6.0 L (365 cid)
Compression Ratio	16:1	15.5:1		16:1	16.5:1
Firing Order	1-2-3			1-5-3-6-2-4	1-5-3-6-2-4
Valve Clearance (Cold) -					
Inlet	0.3 mm (0.012 in.)		0.2 mm (0.008 in.)		
Exhaust	0.3 mm (0.012 in.)			0.45 mm (0.018 in.)	
Valve Face Angle -					
Inlet and Exhaust	35°			45°	
Valve Seat Angle -					
Inlet and Exhaust	36°			46°	
Injection timing - BTDC					
Static	16°	16°‡	17°	23°	22°
Fuel Pump -					
Make	CAV				
Model	DPA				
Engine Low Idle, rpm	725-775	725-775‡	725-775		
Engine High Idle, rpm	2470	2370‡	2470	2420#	2310
Engine Rated Speed, rpm	2250			2200	
Battery Terminal Grounded	Negative				
SIZES					
Crankshaft Main					
Journal Diameter	See Paragraph 58			See Paragraph 87	See Paragraph 118

CONDENSED SERVICE DATA (CONT.)

	340-350	355	Models 360	Early 399*	Late 399†
SIZES (Cont.)					
Crankshaft Crankpin Diameter	See Paragraph 58			See Paragraph 87	See Paragraph 118
Camshaft Journal Diameter	See Paragraph 53			See Paragraph 82	See Paragraph 113
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Camshaft Bearing Diametral Clearance	See Paragraph 53			See Paragraph 82	See Paragraph 113
Crankshaft End Play	See Paragraph 58			See Paragraph 87	See Paragraph 118
Piston Skirt to Cylinder Clearance	See Paragraph 55			See Paragraph 84	See Paragraph 115
CAPACITIES					
Cooling System	9.8 L (10.4 qts.)			20.1 L (21.2 qts.)	23 L (24 qts.)
Crankcase With Filter	6.8 L (7.2 qts.)			15.4 L (16.2 qts.)	14.3 L (15.2 qts.)
Transmission - Without Spacer	43.4 L (11.5 gal.)				
Transmission - With Spacer or Transfer Housing	47.4 L (12.5 gal.)				
Final Drive Rear Planetary Hub - Each side	0.9 L (5 pints)	0.9 L (5 pints)
Hydrostatic Steering	0.7 L (1.2 pints)			1.2 L (2.2 pints)	

CONDENSED SERVICE DATA (CONT.)

	340-350	355	Models 360	Early 399*	Late 399†
CAPACITIES (Cont.)					
Front Drive Axle Hubs (Each Side)		1.2 L (2.3 pints)		1.3 L (2.6 pints)	
Front Drive Axle Housing		4.0 L (1.1 gal.)		5.8 L (1.5 gal.)	

- * M-F 399 tractors before 1990 (serial number S00000).
- † M-F 399 tractors beginning with serial number S01001 (1991 and later).
- ‡ Low idle speed should be 750 rpm, high idle rpm should be 2470 rpm and static timing should be 17° BTDC for M-F 355 models after engine serial number U796441P.
- # High idle no load speed should be 2310 rpm for M-F 399 after S. N. U793030P.



FRONT AXLE SYSTEM (TWO-WHEEL DRIVE)

FRONT AXLE ASSEMBLY AND STEERING LINKAGE

Two-Wheel-Drive Models

1. WHEELS AND BEARINGS. To remove front wheel hub and bearings, raise and support the front axle extension, then unbolt and remove the tire and wheel assembly. Remove cap (2 or 3—Fig. 4), cotter pin (4), castellated nut (5), washer and outer bearing cone (7). Slide the hub assembly from spindle axle shaft. Remove dust shield (12), seal (9) and inner bearing cone (11). Drive bearing cups (8 and 10) from hub if renewal is required. Pack wheel bearings liberally with a multi-purpose lithium based grease. Reassemble by reversing disassembly procedure. Tighten castellated nut (5) to a torque of 80 N·m (60 ft.-lbs.), then back nut off to the nearest hole and install cotter pin (4). Be sure to install cap (2 or 3) securely.

2. TRACK ROD AND TOE-IN. All models are equipped with hydrostatic steering. On 340-360 models, a single track rod connects the left and right steering arms which are attached to the steering spindles. On 399 models, the two track rods are

attached to each end of the hydrostatic steering rod, which is located between the steering arms. The track rod of all models assures that both left and right wheels turn in unison and the distance between ends of track rod establishes front wheel toe-in.

Ends of track rod are automotive type and should be renewed if wear is excessive. The procedure for removing and installing ends is self-evident. Recommended toe-in is 0-5 mm (0-3/16 inch) for all models. Toe-in should be measured between the wheel rims on center line of axle, parallel to ground. Rotate wheels and remeasure to be sure that wheels are not bent giving incorrect reading.

Distance between front wheels is adjustable to seven different widths by relocating axle extensions and changing length of track rod using the pre-existing attachment holes.

On 340-360 models, axle extension and hydrostatic steering cylinder bracket retaining screws (1—Fig. 5) should be tightened to 180-230 N·m (135-170 ft.-lbs.) torque. Tighten track setting screw (2) to 45-55 N·m (33-40 ft.-lbs.) torque before tightening locknut. Note that spacers are used on the outer screws between steering cylinder brackets and axle extensions when axle width is at the four widest settings. To make small toe-in adjustments, remove track adjusting screw (2) from left end of track rod, loosen rod end clamp bolt on right end, then turn center section of track rod until toe-in is correct. Reinstall track adjusting screw (2) and tighten rod end clamp bolt to 45-55 N·m (33-41 ft.-lbs.) torque.

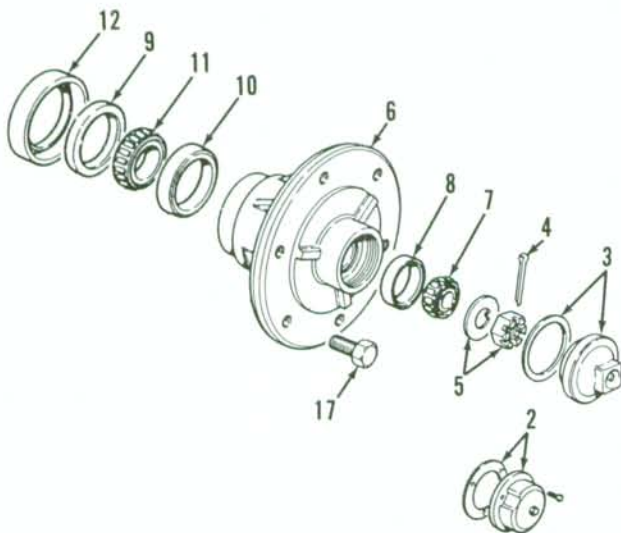


Fig. 4—Exploded view of wheel hub typical of two-wheel-drive models.

- | | |
|---------------------------------------|----------------------------|
| 2. Hub cap | 8. Outer bearing cup |
| 3. Hub cap | 9. Seal |
| 4. Cotter pin | 10. Inner bearing cup |
| 5. Castellated nut
and tang washer | 11. Inner bearing cone |
| 6. Hub | 12. Dust shield |
| 7. Outer bearing cone | 17. Wheel retaining screws |

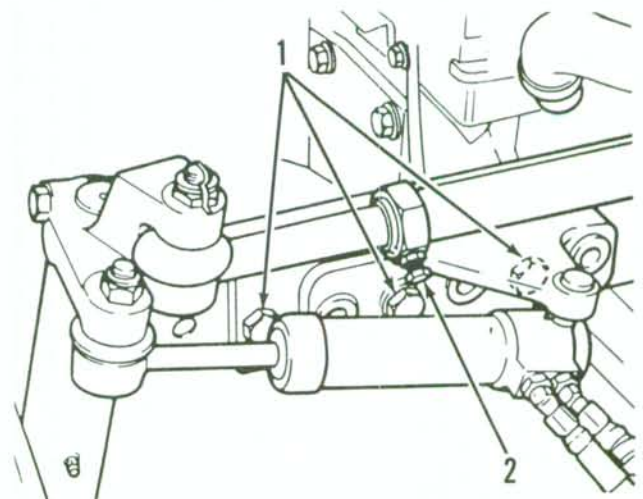


Fig. 5—View of axle left end typical of 340-360 models. Track adjusting screw and lock nut (2) and cylinder bracket and axle extension screws (1) must be properly installed and tightened.

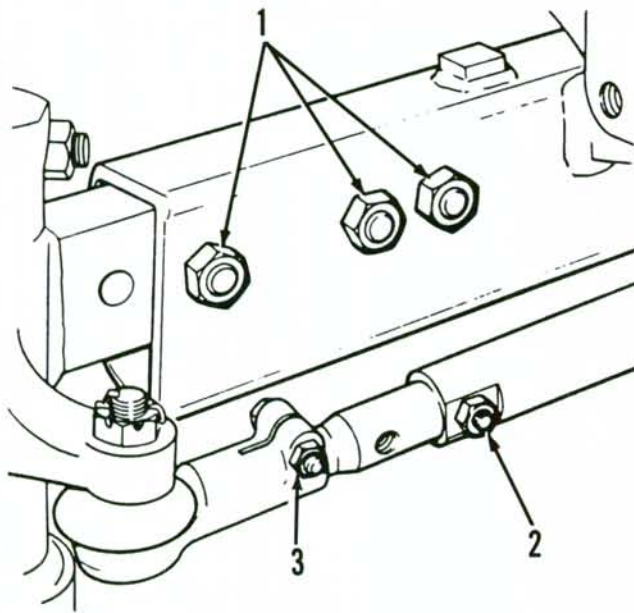


Fig. 6—View of axle left end typical of type used on 399 models. Right side is equipped with a similar track rod, adjusting bolt (2) and rod end. Rod end may be locked with clamp bolt (3) as shown or jam nut.

On 399 models, axle extension retaining screws (1—Fig. 6) should be tightened to 340-450 N·m (250-330 ft.-lbs.) torque. Tighten track setting bolt (2) to 120-160 N·m (90-120 ft.-lbs.). To make small toe-in adjustments, remove track adjusting bolt (2), loosen rod end clamp bolt (3) or jam nut, then turn track rod until toe-in is correct. Reinstall track adjusting bolt (2) and tighten to 120-160 N·m (90-120 ft.-lbs.) torque. Tighten rod end clamp bolt (3) to 45 N·m (33 ft.-lbs.) torque or jam nut to 160-200 N·m (120-130

ft.-lbs.) torque. Equal toe-in adjustments should be made to both sides to center steering.

3. SPINDLES, AXLE EXTENSIONS AND BUSHINGS. To remove spindle (12—Fig. 7 or Fig. 8), first remove the wheel and hub. Disconnect rod end (2) from steering arm (1), remove clamp screw (13) from steering arm, then remove steering arm. Remove key (14) and seal (20) from top of spindle, then lower spindle out of axle extension (19). Remove thrust bearing (11) from spindle. Clean and inspect parts for wear or other damage and renew as necessary.

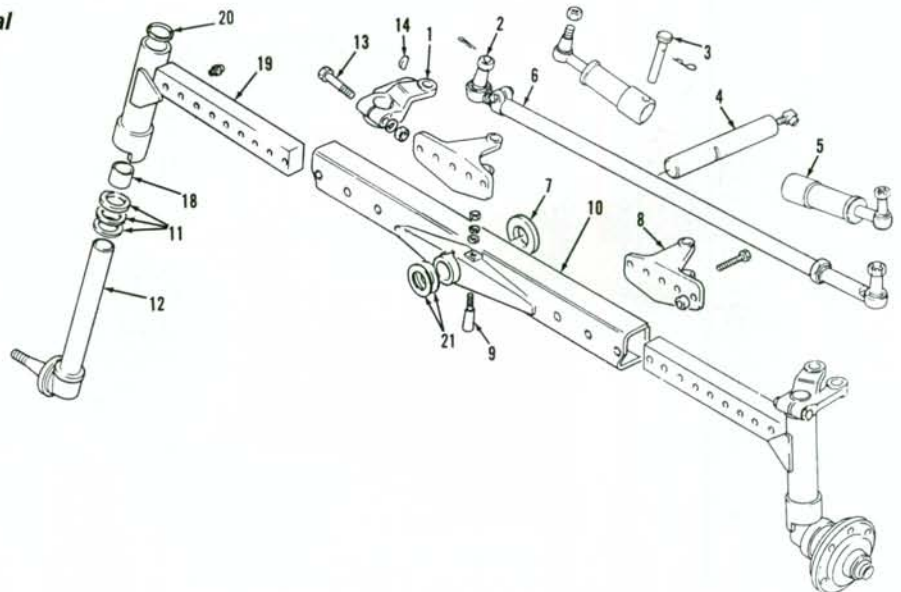
Each axle extension (19) is equipped with two spindle bushings that must be reamed after pressing into position. Clean all metal particles from bore and be sure that hole for grease fitting is clean and open before assembling.

When reassembling, install thrust bearing (11) on spindle so that numbered side of bearing is facing upward and insert spindle through axle extension. Install seal (20) and key (14) then locate steering arm on top of spindle. Tighten steering arm retaining clamping screw to a torque of 125-165 N·m (94-122 ft.-lbs.) for 340-360 models; 280-370 N·m (207-273 ft.-lbs.) torque for 399 models. Refer to paragraph 2 for track and toe-in adjustment and other recommended torques. Balance of reassembly is the reverse of disassembly.

4. AXLE CENTER MEMBER, PIVOT PIN AND BUSHINGS. To remove front axle assembly, first remove any front mounted equipment, guards, weights and weight frame. Raise front of tractor in such a way that it will not interfere with the removal

Fig. 7—Exploded view of front axle typical of two-wheel-drive 340-360 models.

1. Steering arm
2. Rod end
3. Cylinder pivot pin
4. Axle pivot pin
5. Steering cylinder
6. Track rod
7. Thrust washer
8. Steering cylinder bracket
9. Tapered retaining pin
10. Axle center member
11. Thrust washers
12. Spindle
18. Bushing
19. Axle extension
20. Seal
21. Shims



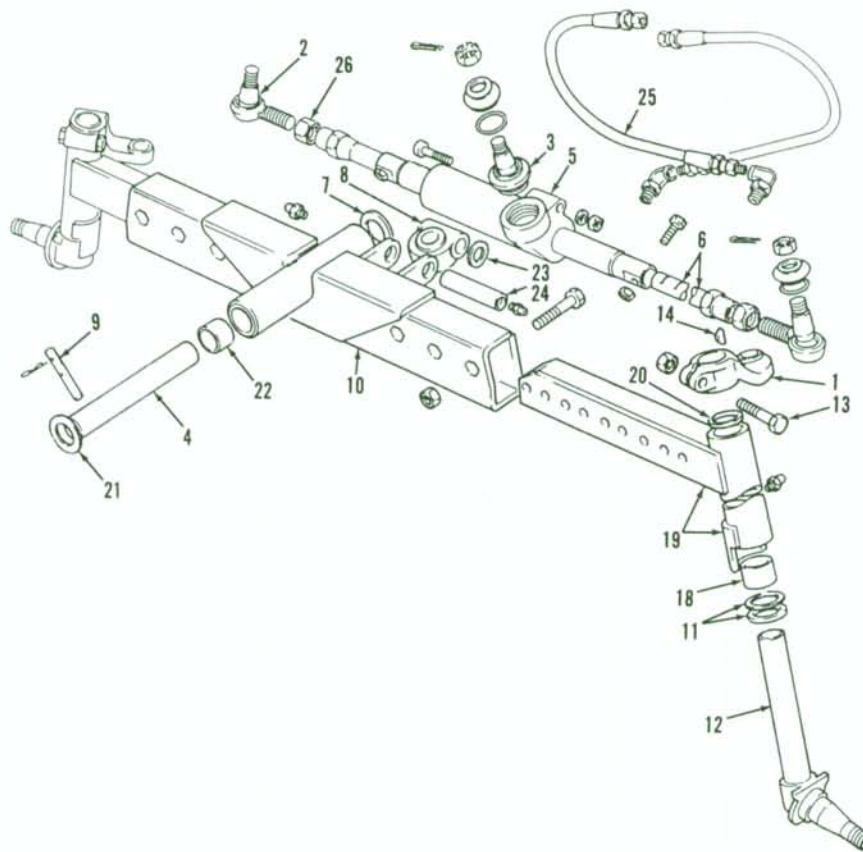


Fig. 8—Exploded view of front axle typical of type used on two-wheel-drive 399 models.

1. Steering arm
2. Rod end
3. Cylinder ball joint
4. Axle pivot pin
5. Steering cylinder
6. Track rod
7. Thrust washer
8. Pivot block
9. Retaining pin
10. Axle center member
11. Thrust washers
12. Spindle
14. Key
18. Bushing
19. Axle extension
20. Seal
21. Shims
22. Bushing
23. Shims
24. Pivot pin
25. Hydraulic hoses
26. Jam nut

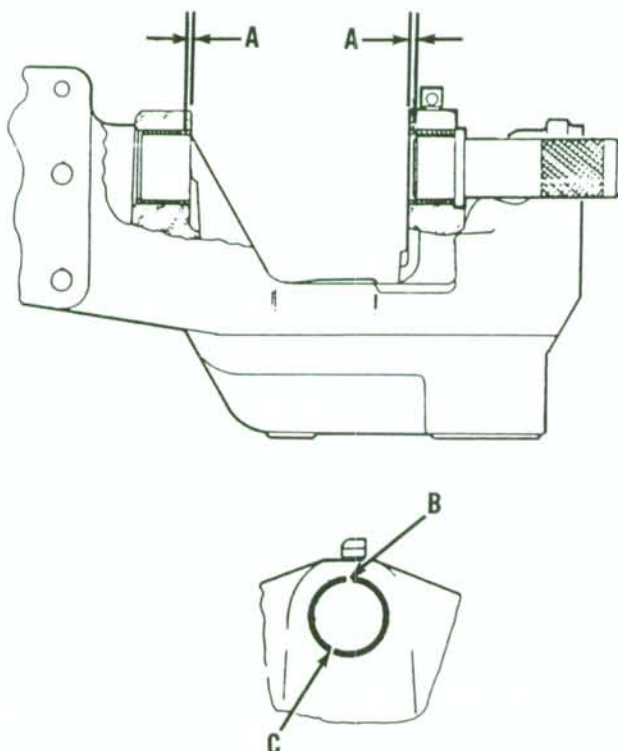


Fig. 9—Axle pivot bushings should be installed as shown for 340-360 models. Hole (B) should be aligned with grease passage and slot (C) should be in position indicated.

of the axle, such as with a support located under engine sump. Removal of wheels, spindles and axle extensions will reduce weight and may make handling the center member easier; however, the complete axle assembly can be removed as a unit. Disconnect hydrostatic steering hoses from the steering cylinder or cylinders and cover openings to prevent the entry of dirt. Support the axle with a suitable jack to prevent tipping while permitting the axle to be lowered and moved safely. Remove retaining pin (9—Fig. 7 or Fig. 8), then use a suitable puller to withdraw axle pivot pin (4). Carefully lower the axle assembly and roll axle from under tractor.

Check axle pivot bushings and renew if necessary. Bushings are located in support housing of 340-360 models and should be installed flush to 0.5 mm (0.020 inch) below flush (A—Fig. 9) with housing bore. Split (Fig. 9) in bushing should be down and hole (B) for grease passage should be up as shown. Axle pivot bushings (22—Fig. 8) are located in axle of 399 models. On all models, it may be necessary to ream bushings after installation. Reverse removal procedure when assembling. Axle end play should be 0.05-0.25 mm (0.002-0.010 inch) on pivot pin. Push the axle toward rear on pivot pin, then measure axle end play with a feeler gauge as shown in Fig. 10 or Fig. 11. Shims (21—Fig. 7 or Fig. 8) are available in various thick-

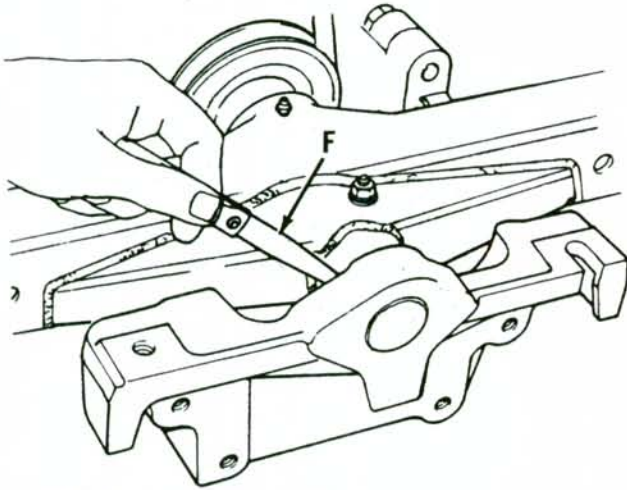


Fig. 10—End play of front axle should be measured with a feeler gauge as shown for 340-360 model with two-wheel drive.

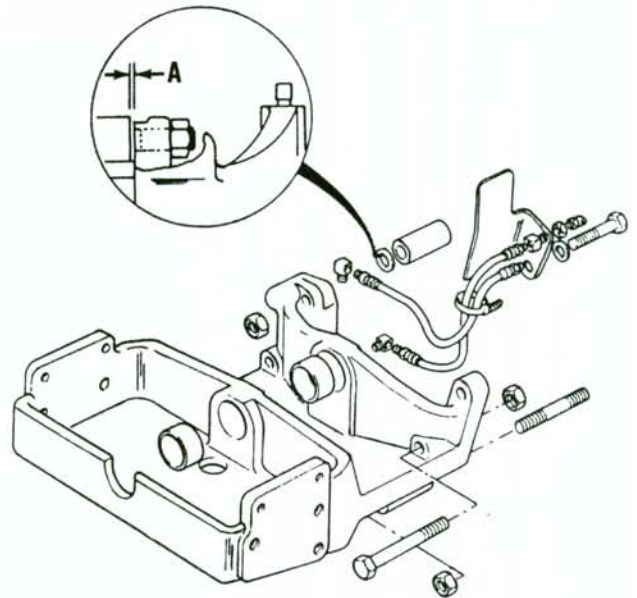


Fig. 12—Measure gap (A) between the top spacer tube on right side and front support of 340-360 models.

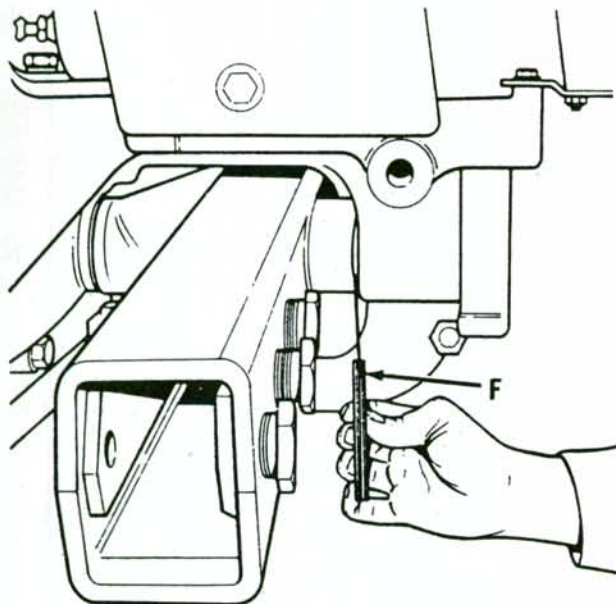


Fig. 11—Measure end play of front axle with a feeler gauge as shown for model 399 with two-wheel drive.

nesses for adjusting end play. On 340-360 models, make sure that tapered pin (9—Fig. 7) is correctly and firmly seated, then tighten retaining nut to 80-140 N·m (70-110 ft.-lbs.) torque. On all models, refer to paragraphs 2 and 3 for additional torque values and assembly notes.

5. FRONT SUPPORT. To remove the front support, the axle must be removed, the radiator must be removed and the front support must be unbolted from the front of engine. The front axle, the front support and the remainder of the tractor must each be supported separately while removing, while separated

and while assembling. Be sure that sufficient equipment is available before beginning.

To remove front axle support from 340-360 models, first remove any front mounted equipment, guards, weights and weight frame. Remove grille, hood, hood side panels, air cleaner and battery. Drain cooling system, disconnect radiator hoses and disconnect wires to headlights. Remove radiator and oil cooler assembly, then refer to paragraph 4 and remove the axle assembly. Attach a hoist or other supporting device to the front support, then unbolt and separate the front support from the front of the engine. Be careful not to lose shims which may be located between front support casting and front of engine.

To remove front axle support from 399 models, first remove any front mounted equipment, guards, weights and weight frame. Remove fuel tank and radiator and radiator support frame, then refer to paragraph 4 and remove the axle assembly. Attach a hoist or other supporting device to the front support, then unbolt and separate the front support from the front of the engine. Be careful not to lose shims which may be located between front support casting and front of engine.

Reattach front support to engine of all models by reversing the removal procedure, but omitting any shims originally installed between support and engine. On 340-360 models, tighten the retaining screws to 240-320 N·m (177-236 ft.-lbs.) torque. Measure any gap (A—Fig. 12) between the top spacer tube on right side and front support with a feeler gauge. Loosen retaining screws and install shims equal to the measured gap plus 0.13 mm (0.005 inch).

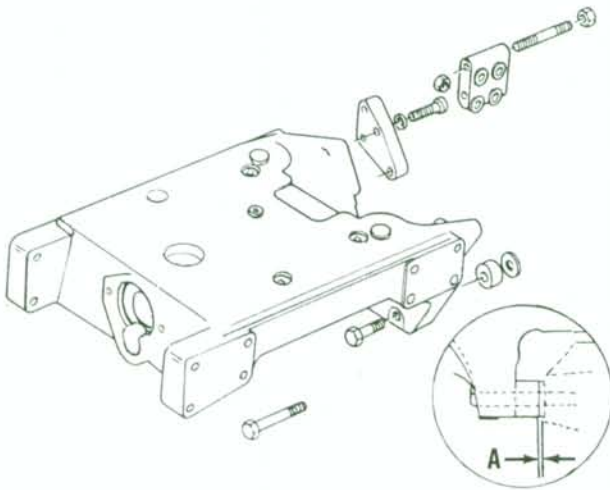


Fig. 13—Use a feeler gauge to measure gap (A) between the lower ears of casting and spacer tubes for 399 models.

Tighten screws retaining front support of 399 models to 230-255 N·m (170-190 ft.-lbs.) torque. Use a feeler gauge to measure any gap between the lower ears of front support casting and spacer tubes of 399 models as shown in Fig. 13. Loosen retaining screws

and install shims equal to the measured gap plus 0.13 mm (0.005 inch).

On all models, complete assembly by reversing the removal procedure.

FRONT-WHEEL DRIVE

7. A mechanical front-wheel drive is available on these models. There are some differences between the Front-Wheel Drive Systems used on these models that will be referred to in the servicing instructions which follow.

The front drive is engaged by an electric solenoid/hydraulic valve which directs oil pressure to move a dog clutch or by a dog clutch which is moved manually by shift fork by way of mechanical linkage. The transfer gearbox is attached to the left side of the range gearbox of models with twelve-speed shuttle transmissions or located between the rear of the transmission housing and the front of the rear axle housing of other models. On all models, a drive shaft with two "U" joints connects the transfer gearbox to front axle.

TRACK ROD AND TOE-IN

All Four-Wheel-Drive Models

8. All models are equipped with hydrostatic steering. A single track rod connects the left and right steering arms which are attached to the steering spindles. The track rod assures that both left and right wheels turn in unison, and the distance between ends of track rod establishes front wheel toe-in.

Ends of track rod are automotive type and should be renewed if wear is excessive. The procedure for removing and installing ends is self-evident. Recom-

mended toe-in is 0 for all models. Toe-in should be measured between the wheel rims on center line of axle, parallel to ground. Rotate wheels and remeasure to be sure that wheels are not bent giving incorrect reading.

Distance between front wheels is adjustable to different widths by relocating the wheel on the center disc or by reversing the wheels. If wheels are reversed, they must be moved to opposite sides of tractor to maintain correct tire tread direction.

To adjust toe-in, loosen the locknuts at each end of the track (tie) rod, then turn the tie rod tube to set the toe-in. Tighten locknuts at each end when adjustment is correct. Nut retaining ball-joint of track rod end in the steering arm should be tightened to 78-86 N·m (58-63 ft.-lbs.) torque for 340-360 models, 108-118 N·m (80-87 ft.-lbs.) torque for 399 models.

DRIVE SHAFT

All Models So Equipped

9. REMOVE AND REINSTALL. To remove drive shaft, first loosen clamps (1 and 2—Fig. 14), then slide guard (3) into the center tube. Remove spring clip (6) from guard at front. Remove bolts (4 and 5) from ends, then remove the shield and drive shaft assembly. Unscrew seal retaining ring from the sliding coupling, remove sliding coupling from rear end

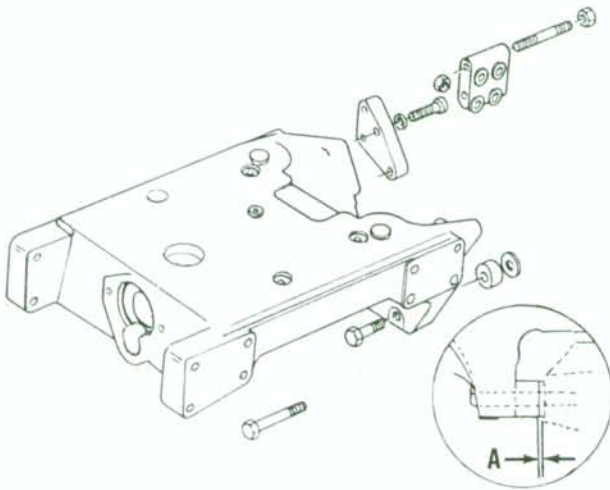


Fig. 13—Use a feeler gauge to measure gap (A) between the lower ears of casting and spacer tubes for 399 models.

Tighten screws retaining front support of 399 models to 230-255 N·m (170-190 ft.-lbs.) torque. Use a feeler gauge to measure any gap between the lower ears of front support casting and spacer tubes of 399 models as shown in Fig. 13. Loosen retaining screws

and install shims equal to the measured gap plus 0.13 mm (0.005 inch).

On all models, complete assembly by reversing the removal procedure.

FRONT-WHEEL DRIVE

7. A mechanical front-wheel drive is available on these models. There are some differences between the Front-Wheel Drive Systems used on these models that will be referred to in the servicing instructions which follow.

The front drive is engaged by an electric solenoid/hydraulic valve which directs oil pressure to move a dog clutch or by a dog clutch which is moved manually by shift fork by way of mechanical linkage. The transfer gearbox is attached to the left side of the range gearbox of models with twelve-speed shuttle transmissions or located between the rear of the transmission housing and the front of the rear axle housing of other models. On all models, a drive shaft with two "U" joints connects the transfer gearbox to front axle.

TRACK ROD AND TOE-IN

All Four-Wheel-Drive Models

8. All models are equipped with hydrostatic steering. A single track rod connects the left and right steering arms which are attached to the steering spindles. The track rod assures that both left and right wheels turn in unison, and the distance between ends of track rod establishes front wheel toe-in.

Ends of track rod are automotive type and should be renewed if wear is excessive. The procedure for removing and installing ends is self-evident. Recom-

mended toe-in is 0 for all models. Toe-in should be measured between the wheel rims on center line of axle, parallel to ground. Rotate wheels and remeasure to be sure that wheels are not bent giving incorrect reading.

Distance between front wheels is adjustable to different widths by relocating the wheel on the center disc or by reversing the wheels. If wheels are reversed, they must be moved to opposite sides of tractor to maintain correct tire tread direction.

To adjust toe-in, loosen the locknuts at each end of the track (tie) rod, then turn the tie rod tube to set the toe-in. Tighten locknuts at each end when adjustment is correct. Nut retaining ball-joint of track rod end in the steering arm should be tightened to 78-86 N·m (58-63 ft.-lbs.) torque for 340-360 models, 108-118 N·m (80-87 ft.-lbs.) torque for 399 models.

DRIVE SHAFT

All Models So Equipped

9. REMOVE AND REINSTALL. To remove drive shaft, first loosen clamps (1 and 2—Fig. 14), then slide guard (3) into the center tube. Remove spring clip (6) from guard at front. Remove bolts (4 and 5) from ends, then remove the shield and drive shaft assembly. Unscrew seal retaining ring from the sliding coupling, remove sliding coupling from rear end

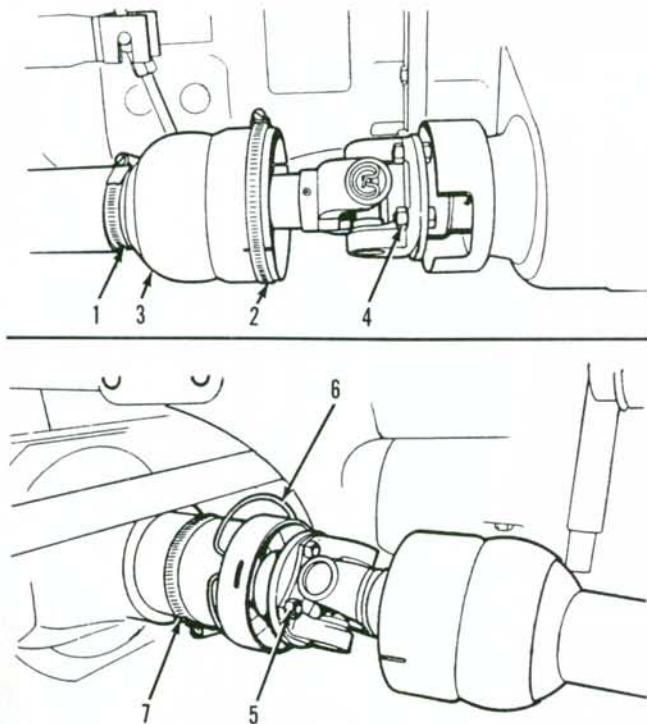


Fig. 14—View showing both ends of drive shaft and shield. Front (axle) end of shield is retained by clip (6).

- | | |
|--------------------|--------------------|
| 1. Clamp | 5. Retaining bolts |
| 2. Clamp | 6. Clip |
| 3. Guard | 7. Clamp |
| 4. Retaining bolts | |

of drive shaft, then remove drive shaft from guard tube.

When reassembling, grease splines of sliding coupling and both universal joints. Insert the long section of drive shaft into guard, then assemble sliding coupling at rear, making sure that arrows on drive shaft and sliding coupling are aligned. Coat threads of bolts (4 and 5) with "Loctite 270," then attach drive

shaft flanges with bolts (4 and 5) tightened to 55-75 N.m (40-55 ft.-lbs.) torque. Install clip (6) at front (axle end), making sure that drain hole in guard is toward bottom. Distance from step in axle and front of guard should be approximately 90 mm (3.5 inches).

FRONT DRIVE AXLE

All Models So Equipped

10. R&R ASSEMBLY. First remove the drive shaft and shield as outlined in paragraph 9. Raise front of tractor in such a way that it will not interfere with the removal of the axle. Remove front wheels and weights, then support the axle with a suitable jack or special safety stand to prevent tipping while permitting the axle to be lowered and moved safely. Disconnect hoses from the steering cylinder and cover openings to prevent the entry of dirt. Remove retaining pin or screw from the front pivot, then use a suitable puller to withdraw axle pivot pin. Lower axle until free, then carefully roll axle away.

Reinstall front drive axle by reversing the removal procedure. A spacer is located at the rear of the axle pivot and sufficient thickness of shims should be located in front of axle to reduce end play to 0.05-0.25 mm (0.002-0.010 inch). Grease pivot after correct thickness of shims and pivot pin retaining screw or pin have been installed.

PLANETARY ASSEMBLY

All Models So Equipped

11. R&R AND OVERHAUL. Refer to Fig. 15. Either planetary assembly can be serviced without

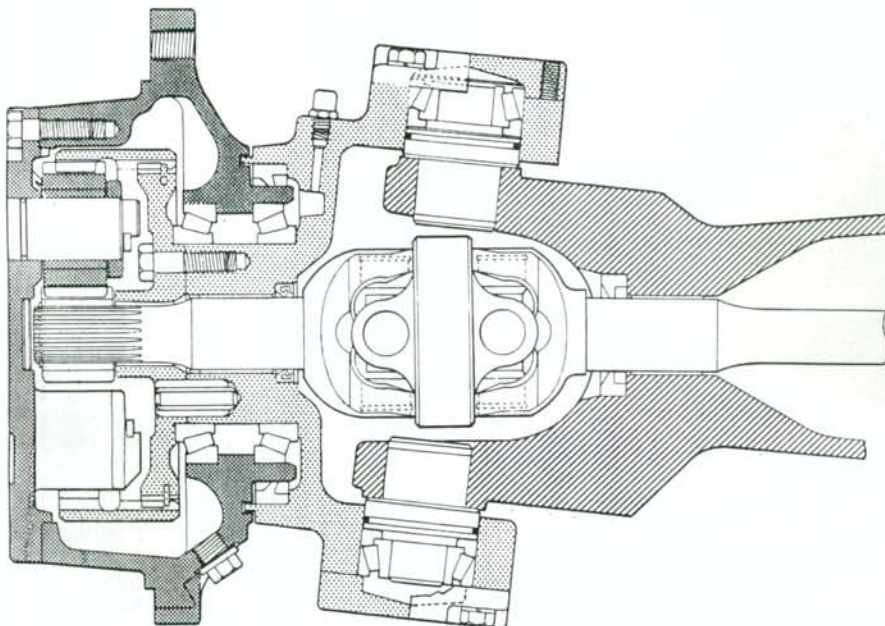


Fig. 15—Cross section of typical front drive axle.

removing the steering knuckle housing (26—Fig. 16). However, if seal (24) or bearings (20 and 23) are to be serviced, hub (22) and knuckle housing (26) must first be removed as outlined in paragraph 12. Support front axle housing and remove front wheel. Rotate hub (22) until drain plug (1), is down, then remove plug and drain oil from hub assembly. Remove screws (2) and lift off planetary carrier (3). Remove snap ring (12), then bump shafts (10) from housing bores. Keep each planet assembly, consisting of shaft (10), gear (7), bearings (8) and thrust washers (6), separate so that they can be reinstalled as a set. The sun gear (13) can be removed after removing snap ring (9).

Clean and inspect all parts for excessive wear or other damage and renew as necessary.

Install snap rings (11), bearings (8), planetary gears (7) and thrust washers (6), then secure with snap ring (12). Opening in snap ring (12) must be positioned in center of one of the three blocks, not in an open area. Make sure thrust plate (5) is in place. Clean mating surfaces of wheel hub (22) and planet carrier (3), then coat face with "Loctite 515 Instant Gasket" and install carrier assembly. Coat screws (2) lightly with oil before installing, then tighten to 96-118 N·m (71-87 ft.-lbs.) torque.

Turn wheel hub (22) until hole for plug (1) is horizontal, fill hub and planetary to the level of opening for plug (1) with an approved oil, then install and tighten plug. Recommended oil for use in front drive axle is Massey-Ferguson Super 500 multi-use 10W-

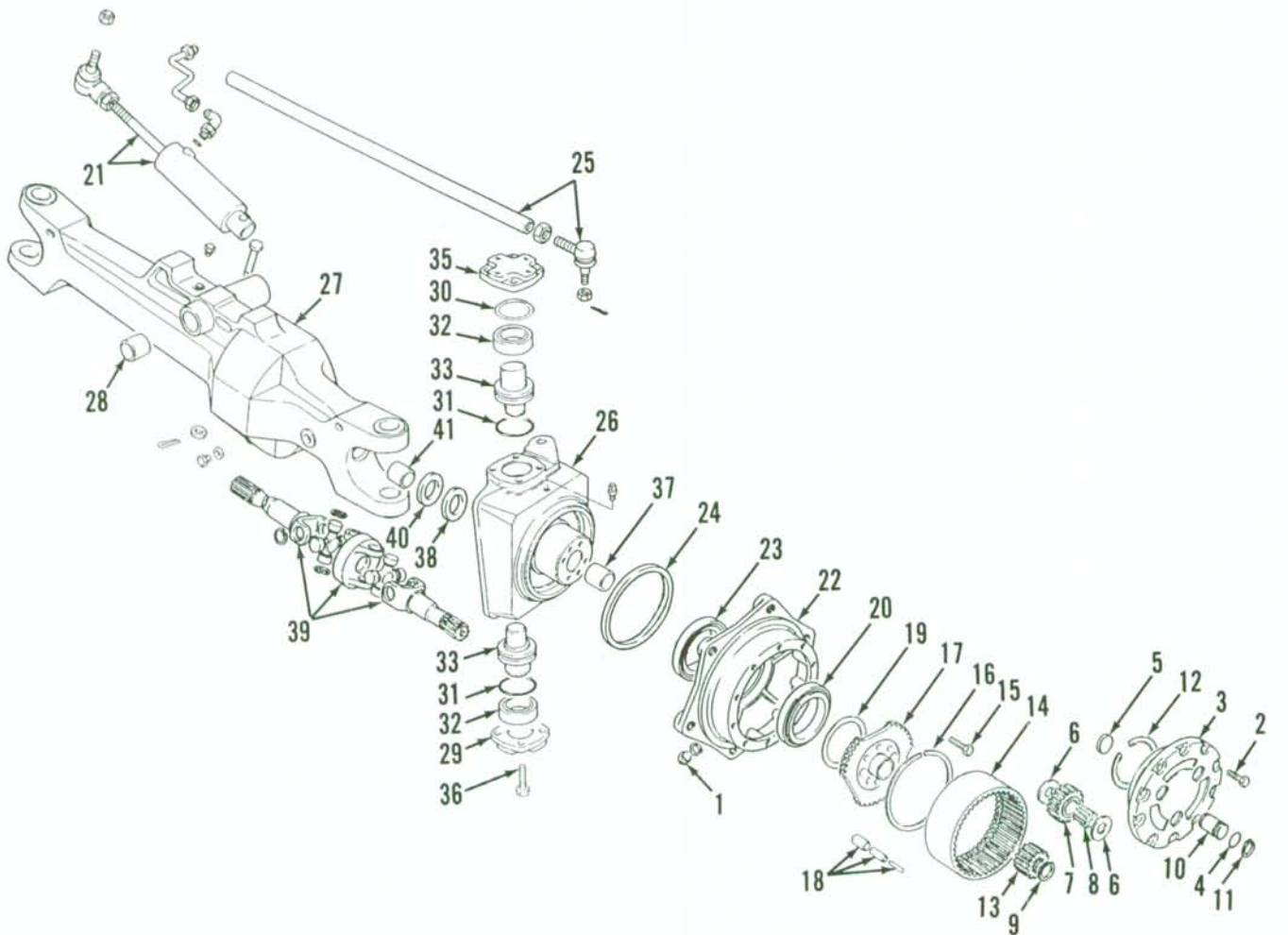


Fig. 16—Exploded view of front-wheel-drive steering knuckle and planetary assembly.

- | | | | |
|-----------------------|---------------------------------------------------|---------------------------|----------------------|
| 1. Drain plug | 12. Snap ring | 31. "O" ring | 31. "O" ring |
| 2. Screws | 13. Sun gear | 32. Wheel hub | 32. Bearings |
| 3. Planet carrier | 14. Ring gear | 33. Bearing cup and cone | 33. Pivot pin |
| 4. "O" ring | 15. Screws | 34. Seal | 34. Seal |
| 5. Thrust pin | 16. Snap ring | 35. Track rod and rod end | 35. Upper retainer |
| 6. Thrust washer | 17. Ring gear hub | 36. Steering knuckle | 36. Screw |
| 7. Planet gear | 18. Pins | 37. Bushing | 37. Bushing |
| 8. Rollers (50/gear) | 19. Shims (0.10, 0.15, 0.30, 0.50, 0.70, 1.00 mm) | 38. Seal | 38. Seal |
| 9. Snap ring | 20. Bearing cup and cone | 39. Axle shaft assy. | 39. Axle shaft assy. |
| 10. Planet gear shaft | 21. Steering cylinder | 40. Seal | 40. Seal |
| 11. Snap ring | | 41. Bushing | 41. Bushing |

30 oil, Massey-Ferguson Permatran or equivalent. Install front wheel and tighten disc to hub nuts to 270 N·m (200 ft.-lbs.) torque. Disc to wheel rim nuts should be tightened to 190 N·m (140 ft.-lbs.) torque.

STEERING KNUCKLE HOUSING AND WHEEL HUB

All Models So Equipped

12. R&R AND OVERHAUL. To remove either steering knuckle housing, first remove planetary as outlined in paragraph 11. Remove snap ring (9—Fig. 16) and sun gear (13). Disconnect steering cylinder (21) from right side steering knuckle arm, and disconnect track rod (25) from steering knuckle arms on both sides. Unbolt and remove upper and lower retainers (29 and 35) and shims (30). Measure and note thickness and number of shims (30) under each retainer for aid in reassembly. Carefully remove the bearing cups for upper and lower bearings (32). Use a suitable puller such as MF 451A or equivalent to pull upper and lower pivot pins (33). Carefully remove steering knuckle housing (26) and wheel hub assembly (22) from axle center housing (27), leaving axle shafts (39) with center housing.

Axle shaft and double “U” joint assembly (39) may be withdrawn from center housing for inspection or repair. If renewal is required, oil seal (38) and bushing (37) can be removed from knuckle housing (26) and oil seal (40) and bushing (41) can be removed from axle housing. Bushings (37 and 41) should be pressed into position with external groove toward top and internal arrow-shaped grooves pointing toward inside of oil-filled housing (away from seal). Be careful not to damage seals (38 and 40) when installing axle and knuckle housing.

To disassemble the wheel hub and steering knuckle, remove the six cap screws (15). Attach an internal bearing puller as shown in Fig. 17 and pull ring gear hub (17—Fig. 16) and ring gear (14) from pins (18). Be careful not to lose or damage shims (19). If puller is not available, it may be possible to use a punch through hole for plug (1) to carefully drive hub and ring gear from pins. Solid pins are used on later models in place of the three split pins (18). Remove pins only if necessary. Bump hub (22) and bearings (20 and 23) from steering knuckle (26). Remove cups for bearings (20 and 23) and seal (24) from hub. If necessary, remove inner bearing cone from knuckle housing.

Clean and inspect all parts for excessive wear or other damage and renew as necessary.

The steering knuckle and wheel hub can be assembled, then attached to the axle center member; however, the assembly is heavy and difficult to handle. End play of the steering knuckle bearings (32) must

be measured and adjusted to provide 0.2 mm (0.008 inch) preload. End play measurement and adjustment is easier if the steering knuckle (26) is attached to the axle center member (27) before wheel hub and ring gear are assembled to the knuckle.

Be sure bushings (37 and 41) and seals (38 and 40) are installed, carefully locate the drive shaft and “U” joint assembly (39) in axle center member, then slide steering knuckle (26) over outer end of axle shaft. Lubricate “O” rings (31) and install in grooves of pivot pins (33) then press pins through steering knuckle bores and into bores in axle center member. Caps (29 and 35) and retaining screws (36) can be used to press pins (33) into bores if opposing screws (36) are carefully and evenly tightened. Be sure pins are fully seated in axle center member, remove caps (29 and 35) and install inner cones for both bearings (32) on pins. Install outer race for the lower bearing, install lower bearing cap and tighten the four retaining screws (36) to 96-118 N·m (71-87 ft.-lbs.) torque. Install the outer race for upper bearing, install upper cap (35) without shims (30) and tighten retaining screws to 96-118 N·m (71-87 ft.-lbs.) torque. Use a dial indicator and measure end play of the steering knuckle (26). Be sure that pins (33) and bearings (32) are fully seated. Without any shims (30), steering knuckle should have some end play. Remove upper cap (35), install shims (30) equal to the measured end play plus the desired bearing preload of 0.2 mm (0.008 inch), then reinstall upper cap (35). Tighten

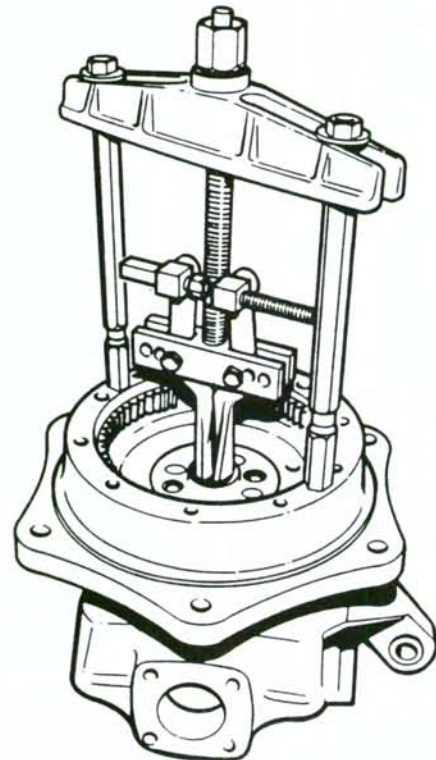


Fig. 17—View showing bearing puller attached for pulling the ring gear from steering knuckle. Refer to text.

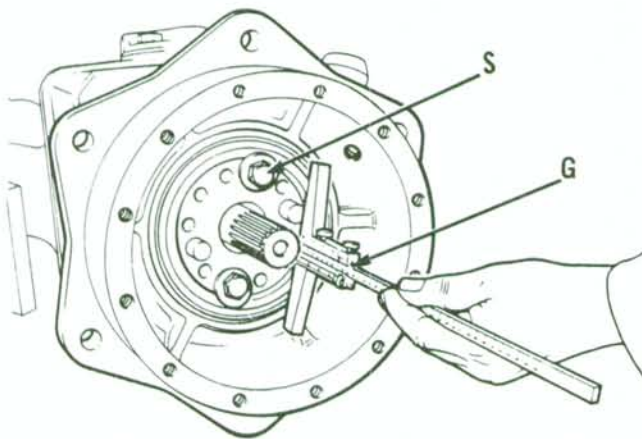


Fig. 18—Measure standout of inner bearing race as shown when selecting shims (19—Fig. 16). Refer to text.

cap retaining screws to 96-118 N·m (71-87 ft.-lbs.) torque. Shims (30) can normally be added to the upper cap (35), but if a large number of shims are necessary, shims may be divided between the upper and lower caps to center the bearings (41 and 37) for axle (39).

Observe the following when reassembling wheel hub (22) to the steering knuckle (26). Drive the cups for bearings (20 and 23) and the oil seal (24) into hub (22). Lubricate bearings, bushings and seals liberally.

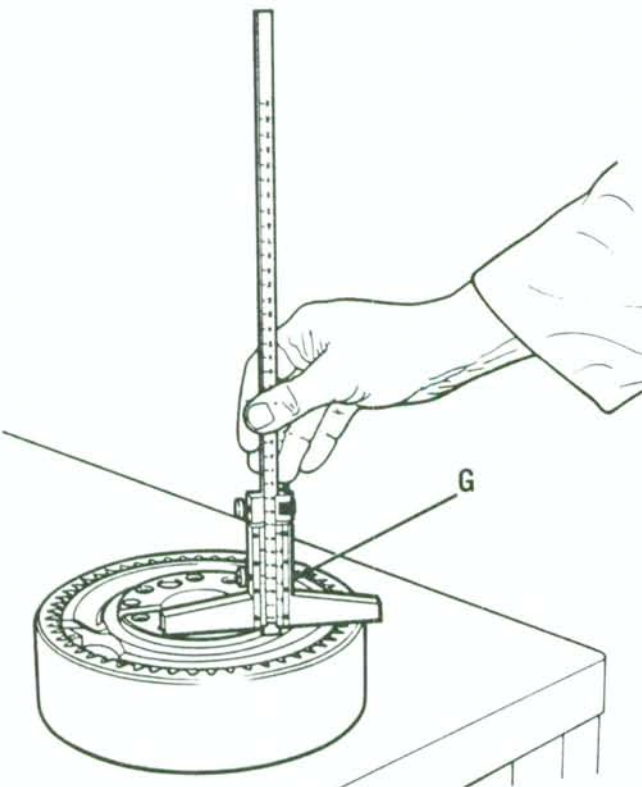


Fig. 19—Measure standout of ring gear hub as shown when selecting shims (19—Fig. 16). Refer to text.

If removed, install new cone for inner bearing (23) on knuckle housing (26). Install hub (22) and cone for outer bearing (20) onto knuckle housing. It may be necessary to heat bearing cones before installing. Install two screws with washers in opposing holes as shown in Fig. 18 to hold bearing (20—Fig. 16) in position while measuring standout of bearing race. Be sure that bearings are fully seated, then measure distance from end of steering knuckle hub and outer surface of outer bearing inner race. Measure standout of ring gear hub from the bearing contact surface to the steering knuckle hub contacting surface as shown in Fig. 19. Subtract measurement of ring gear hub (Fig. 19) from the bearing standout (Fig. 18), then add the desired bearing preload, 0.05 mm (0.002 inch) to determine the correct thickness of shims to install.

An example is:

Measurement shown in

Fig. 18 8.10 mm 0.319 inch

Measurement shown in

Fig. 19 - 6.20 mm - 0.244 inch

1.90 mm 0.075 inch

Desired bearing preload + 0.05 mm + 0.002 inch

Thickness of shims to

install 1.95 mm 0.077 inch

Please note that measurements above are only examples to indicate the method of determining the correct thickness of shims to install. Selecting and installing the proper thickness of shims (19—Fig. 16) for each combination of parts will provide bearings (20 and 23) with correct, 0.05 mm (0.002 inch), preload.

After selecting the correct thickness of shims (19), install pins (18) if removed. If pins (18) are split type, install largest pin first, followed by medium size with gap located 180° from gap of the largest pin. Install smallest of the three pins with gap 180° from the middle size pin or nearly aligned with groove of the largest pin. On all models, remove screws (S—Fig. 18) and washers used while measuring. Install wheel hub (22), steering knuckle (26), ring gear (14), hub (17), shims (19) and related parts. Coat threads of screws (15) with "Loctite 270" and tighten evenly to 112-123 N·m (83-91 ft.-lbs.) torque.

Make sure thrust plate (5) is in place. Clean mating surfaces of wheel hub (22) and planet carrier (3), then coat face with "Loctite 515 Instant Gasket" and carrier assembly. Coat screws (2) lightly with oil before installing, then tighten to 96-118 N·m (71-87 ft.-lbs.) torque. Nut retaining ball-joint of track rod end in the steering arm should be tightened to 78-86 N·m (58-63 ft.-lbs.) torque for 340-360 models, 108-118 N·m (80-87 ft.-lbs.) torque for 399 models. Nut retaining ball-joint of steering cylinder end in the steering arm should be tightened to 98-108 N·m (72-80 ft.-lbs.)

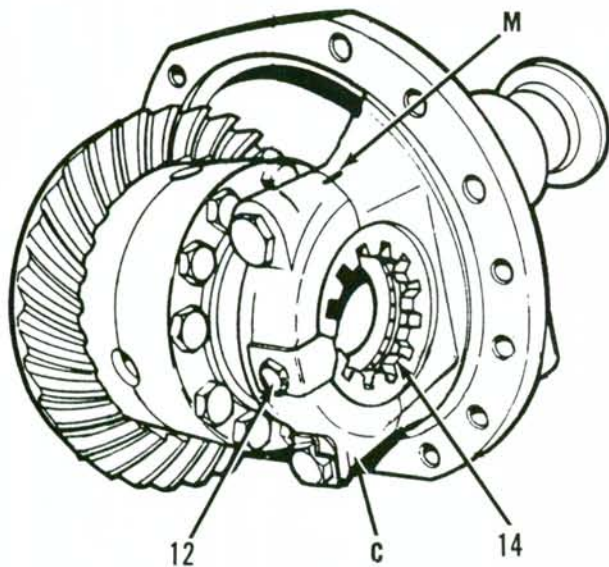


Fig. 20—View of removed differential assembly, showing marks (M) on one of the caps (C) and housing. Mark the other cap so that caps can be quickly identified for assembly to the correct side and in the correct position.

torque for 340-360 models, 177-196 N·m (130-145 ft.-lbs.) torque for 399 models.

Turn wheel hub (22) until hole for plug (10) is horizontal, fill hub and planetary to the level of opening for plug (1) with an approved oil, then install and tighten plug. Recommended oil for use in front drive axle is Massey-Ferguson Super 500 multi-use 10W-30 oil, Massey-Ferguson Permatran or equivalent. Install front wheel and tighten disc to hub nuts to 270 N·m (200 ft.-lbs.) torque. Disc to wheel rim nuts should be tightened to 190 N·m (140 ft.-lbs.) torque.

DIFFERENTIAL

All Except Models With "Hydralock"

13. REMOVE AND REINSTALL. The pinion shaft oil seal can be removed and a new seal installed, without removing the complete differential assembly. Mark the position of the pinion nut before removing, so that nut can be reinstalled without disturbing pinion bearing preload. Other service to the differential assembly requires removal of the unit.

To remove the differential assembly from front axle, refer to paragraph 9 and remove the drive shaft, then paragraph 12 and remove steering knuckles and axle shaft assemblies (39—Fig. 16) from both sides. Unbolt and remove the differential housing from the axle center housing. Some mechanics prefer to remove the front axle from tractor as outlined in paragraph 10 before removing steering knuckles and axle shafts.

Before reinstalling differential, clean mating surface of differential housing (1—Fig. 21) and axle center housing (27—Fig. 16), then coat mating surface with "Loctite 515 Instant Gasket." Lubricate screws attaching differential to axle housing, install differential assembly and tighten retaining screws to 96-118 N·m (71-87 ft.-lbs.) torque. Install drive shaft coupling on pinion shaft, coat threads of center retaining screw with "Loctite 270," then tighten center screw to 60 N·m (44 ft.-lbs.) torque. Complete assembly by reversing the removal procedure. Refer to paragraph 9 for installing drive shaft.

14. OVERHAUL. Before disassembling, mark both bearing caps and housing as shown at (M—Fig. 20) to facilitate alignment when reassembling. Straighten tabs of lock plate (13—Fig. 21), then remove cap screw (12) and lock plate (13). Loosen, but do not remove, the four screws attaching caps (C), then unscrew adjusting rings (14). Remove both bearing caps and lift differential, bearing cups and adjusting rings from housing.

NOTE: Some models are equipped with threaded adjusting rings (14—Fig. 20 and Fig. 21) on both sides, while others are equipped with spacer and shims (24 and 25—Fig. 22) on one side.

To remove the bevel pinion (10—Fig. 21), unstake nut (2), then remove nut and spacer (3). Push pinion out toward inside. Cone of bearing (7) will slide from shaft as pinion is removed.

Mark differential case (16 or 27) and ring gear (11) to facilitate alignment when reassembling. On models with "Autolock" differential, refer to Fig. 24 and install washers of proper size and through-bolt as shown to hold the differential together. On all models, remove screws (17—Fig. 21), then remove ring gear (11) and separate case (16). Note that two of the screws (17) are close fitting dowel screws and must be installed in same location when reassembling. Individual parts of the "Autolock" differential (Fig. 23) are not available and parts must be assembled in original location. Regardless of type, assembly of original parts is easier if parts are kept together for each side and not mixed.

Clean and inspect all parts for wear or other damage. Lubricate all parts while assembling. Align previously affixed marks on case (16 or 27—Fig. 21) and ring gear (11) while assembling. Coat threads of screws (17) with "Loctite 270," install and tighten screws to 79-87 N·m (58-64 ft.-lbs.) torque. Press bearing cones (15) onto case (16) until seated. Remove through-bolt and washers (Fig. 24) from "Autolock" models.

On all models, thickness of shims (9—Fig. 21) should be selected to change mesh position of bevel pinion (10) if gear set (10 and 11), pinion bearings (7 and 8) and/or differential housing (1) is renewed or if

previous mesh position is questioned. The number stamped on the end of the pinion gear is the deviation from the standard distance of 118 mm or 113 mm (early axles with two adjuster rings for differential). Determine machined (cone) position by adding the stamped number (if marked with "+") or subtracting the stamped number (if marked with "-") from the standard distance. Install cup for bearing (8) in housing (1), then position cone for bearing (8) in cup as shown in Fig. 25. Measure distance (A—Fig. 25) from center line of the differential, as measured across the bearing saddle, to the face of inner race for pinion bearing (8). Subtract the measured distance (A—Fig. 25) from the machined cone distance (determined by adding or subtracting the number stamped on end of pinion to or from the standard dimension). The result is the thickness of shims (9—Fig. 21) to add under the bearing cup (8).

An example is:

Standard measurement	118.00 mm
Dimension stamped on pinion	+ 0.20
<hr/>	

Machined distance	118.20 mm
Measurement (A—Fig. 25)	119.50 mm
Machined distance	- 118.20 mm
<hr/>	

Required shim thickness 1.30 mm

Please note that measurements above are only examples to indicate the method of determining the correct thickness of shims to install. Selecting and installing the proper thickness of shims (9—Fig. 21) for each combination of parts will provide gear set with proper mesh position. Also, note standard measurement (cone point) of some models is 113 mm.

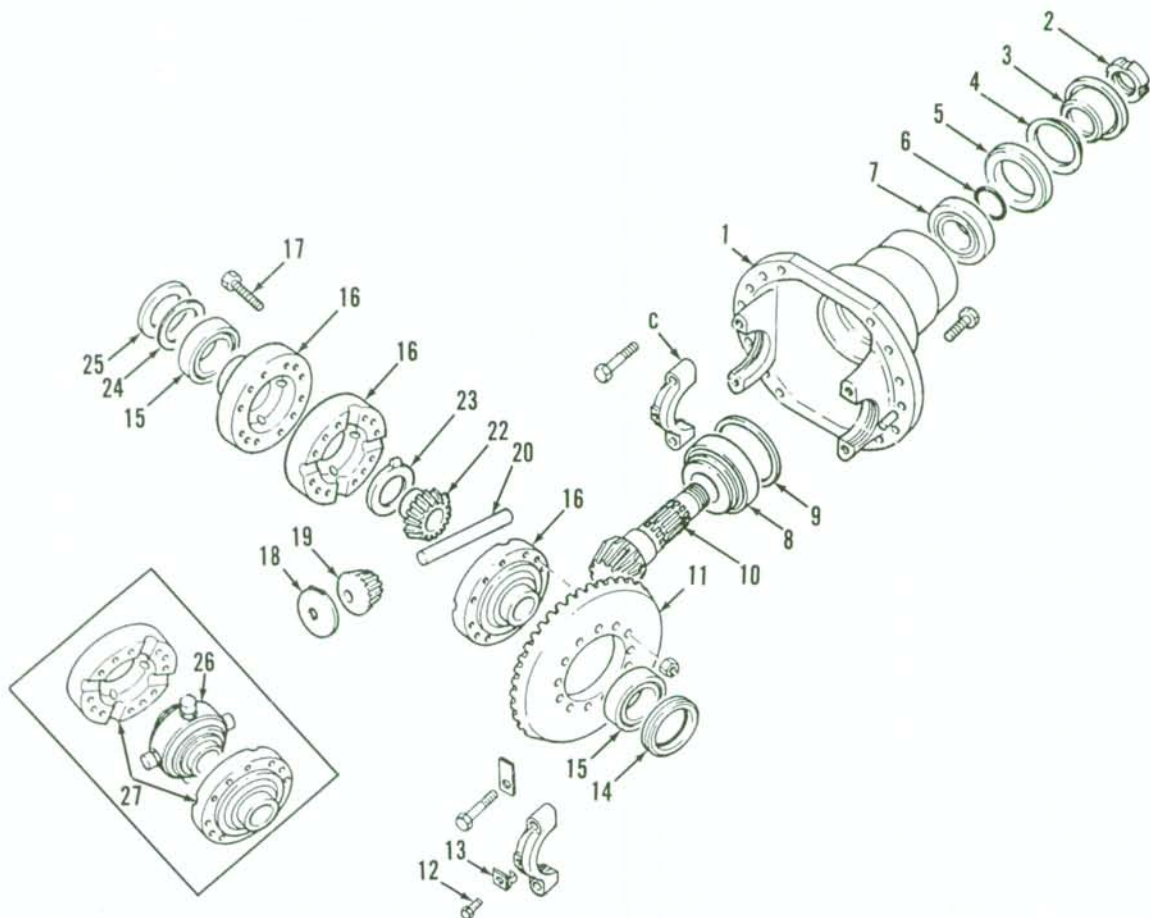


Fig. 21—Exploded view of standard differential assembly typical of the type used on many models. Gears (10 and 11) are available only as matched sets. "Autolock" differential unit (26) is shown in Fig. 23.

- | | | | |
|-----------------------|-----------------------|------------------------|----------------------------------|
| 1. Housing | 8. Bearing cup & cone | 14. Adjusting ring | 20. Pinion shaft |
| 2. Nut | 9. Shim | 15. Bearing cup & cone | 22. Side gears |
| 3. Spacer | 10. Bevel pinion | 16. Differential case | 23. Thrust washer |
| 4. Seal | 11. Ring gear | 17. Screws | 24. Shims |
| 5. Seal | 12. Screw | 18. Thrust washers | 25. Spacer |
| 6. "O" ring | 13. Locking clip | 19. Pinion gears | 26. "Autolock" differential |
| 7. Bearing cup & cone | | | 27. "Autolock" differential case |

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