

SHOP MANUAL

CASE/INTERNATIONAL

MODELS

2090	2290	2390	2590
2094	2294	2394	2594

IDENTIFICATION

Tractor model number and identification serial number are located on a plate on right fender of tractors not equipped with a cab, or on a plate on upper right of cab interior on tractors so equipped. Cab serial number is located on a plate on upper right of cab interior. Engine serial number is located on a plate on right rear of cylinder block. Transmission serial number is on right side of transmission housing. On models so equipped, front-wheel drive serial number is located on a plate on rear of front drive axle housing.

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DUAL DIMENSIONS

This service manual provides specifications in both the U.S. Customary and Metric (SI) system of measurements. The first specification is given in the measuring system used during manufacture, while the second specification (given in parenthesis) is the converted measurement. For instance, a specification of "0.011 inch (0.279 mm)" would indicate that the equipment was manufactured using the U.S. system of measurement and the metric equivalent of 0.011 inch is 0.279 mm.

CONDENSED SERVICE DATA

	Models			
	2090, 2094	2290, 2294	2390, 2394	2590, 2594
GENERAL				
Engine Make	Own		Own	
Engine Model	504BD	504BDT	504BDT	504BDT
Cylinders, No. of	6			
Bore	4-5/8 in. (117.5 mm)			
Stroke	5 in. (127 mm)			
Displacement	504 cu.in. (8.26 L)			
Compression Ratio	16.0:1	15.8:1	15.8:1	15.8:1
Main Bearings, No. of	7			
Cylinder Sleeves, Type	Wet			
Forward Speeds	8,12*	8,12*	12,24**	12,24**
*Models 2090 and 2290 with mechanical shift transmission have 8 forward speeds. Models 2090, 2290, 2094 and 2294 power shift tractors have 12 forward speeds.				
**Models 2394 and 2594 equipped with power shift High/Low unit have 24 forward speeds. All other power shift models have 12 forward speeds.				
TUNE-UP				
Firing Order	1-5-3-6-2-4			
Valve Tappet Gap, Warm—				
Intake	0.015 in. (0.381 mm)			
Exhaust	0.025 in. (0.635 mm)			
Compression at Cranking Speed	400 psi (2758 kPa)			
Injection Pump—				
Make	Robert Bosch			
Model	PES Multiple Plunger			
Timing	27° BTDC			25° BTDC
Injection Nozzles—				
Make	Robert Bosch or American Bosch			
Opening Pressure, New	3950-4100 psi (27235-28270 kPa)			
Used	3400-3950 psi (23443-27235 kPa)			
Turbocharger—				
Make	Garret (AiResearch) T04B			
Engine Governed Speeds (Rpm)—				
Low Idle	725-775			
High Idle	2280-2320			
Rated Load	2100			
Battery Terminal Grounded	Negative			
CAPACITIES				
Cooling System	38 qts. (36 L)	38 qts. (36 L)	44 qts. (41.6 L)	44 qts. (41.6 L)
Crankcase (w/filters)	19 qts. (17.8 L)	23 qts. (22 L)	30 qts. (28.4 L)	30 qts. (28.4 L)
Transmission & Hydraulic System	100 qts. (94.6 L)	100 qts. (94.6 L)	128 qts. (121.1 L)	128 qts. (121.1 L)
Oil Type	Hy-Tran Plus			
Fuel Tank	65 gal. (246 L)	65 gal. (246 L)	85 gal. (322 L)	85 gal. (322 L)

FRONT AXLE (TWO WHEEL DRIVE)

FRONT WHEEL BEARINGS

All Models

1. Refer to Fig. 1 for typical wheel hub and bearing assembly.

The tapered inner and outer roller bearings are not interchangeable. Clean and inspect bearing cups and cones and renew as necessary. Install inner seal (9) with lip facing spindle flange. Install outer seal (10) with lip facing away from bearing (11). Fill hub cavity and pack bearings with No. 2 lithium grease. Coat surface of seal lips with grease.

When adjusting wheel bearings, tighten nut (7) until drag on hub is felt, then back nut off 1/4 turn or until next pin hole lines up. Bearings should have zero end play. Install cotter pin.

SPINDLES

All Models

2. R&R SPINDLES. To remove spindle, lift and support front of tractor and remove wheel. Disconnect tie rod ball joint from steering arm (3—Fig. 2). Remove bolt (1) and washer (2) from arm (3). Note index punch marks on arm and shaft indicating location of tapered splines for left or right steering arm, then remove steering arm. Support spindle and remove snap ring (4) and shims (5), then remove spindle (10) from axle extension (7).

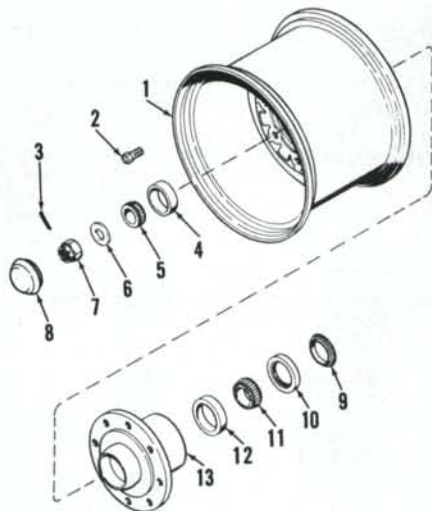


Fig. 1—Exploded view of wheel hub and bearing assembly used on all models.

- 1. Wheel
- 2. Bolt
- 3. Cotter pin
- 4. Bearing cup
- 5. Bearing cone
- 6. Washer
- 7. Nut
- 8. Cap
- 9. Seal (inner)
- 10. Seal (outer)
- 11. Bearing cone
- 12. Bearing cup
- 13. Hub

3. SPINDLE BUSHINGS. With spindles removed, spindle bushings (6 and 9—Fig. 2) can be removed using a suitable drift punch. New bushings are presized and should not require reaming if carefully installed. Press new bushings into axle ends until bushing flange seats against surface of axle ends.

Assemble by reversing disassembly procedure making sure punch marks on shaft and steering arm align. Tighten bolt (1) to 200-250 ft.-lbs. (271-339 N·m) torque. Lubricate through grease fitting (8) with No. 2 lithium grease. Tighten tie rod slotted nut to 100-125 ft.-lbs. (136-169 N·m) torque and install new cotter pin.

4. TIE RODS AND TOE-IN.

Disassembly of tie rod assembly is obvious after examination of unit and reference to Fig. 3. However, upon reassembly make sure clamp bolt (9) for left side drag link (3) is installed in same number hole as left side axle extension outer bolt; and that right side drag link bolt (11) is installed in one less number hole of drag link (2) than outer mount-

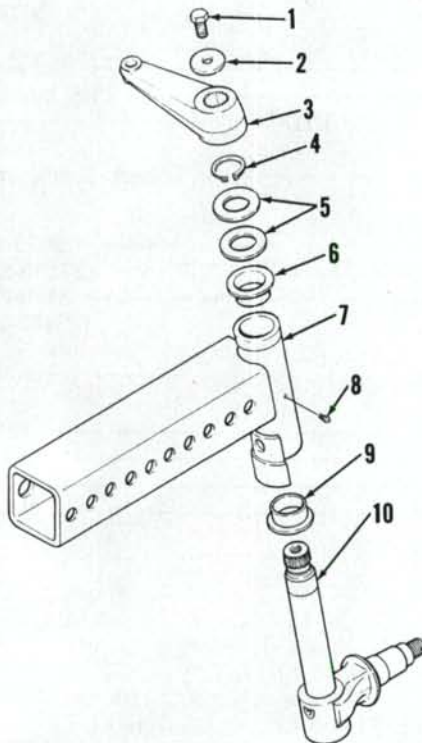


Fig. 2—Exploded view of steering spindle assembly typical of all models.

- 1. Bolt
- 2. Washer
- 3. Steering arm
- 4. Snap ring
- 5. Shims
- 6. Bushing (upper)
- 7. Axle extension (left hand shown)
- 8. Grease fitting
- 9. Bushing (lower)
- 10. Spindle

ing bolt of right axle extension. Tighten tie rod ball joint slotted nuts to 100-125 ft.-lbs. (136-169 N·m) torque. Install new cotter pins. Tighten drag link clamp bolt nuts to 45-54 ft.-lbs. (61-73 N·m) torque.

Front wheel toe-in must be 1/8 to 1/2 inch (3.2-12.7 mm). To adjust toe-in, remove clamp bolt (9—Fig. 3) on left drag link. Loosen jam nut (4), then turn drag link (3) in or out until desired toe-in is obtained. Install clamp bolt and tighten nut on clamp bolt to 45-54 ft.-lbs. (61-73 N·m) torque. Tighten jam nut (4) against drag link.

AXLE MAIN MEMBER AND PIVOT PIN

Models 2090 and 2290 (S/N prior to 9905953)

5. To remove axle main member, first raise and support tractor under engine side rails with suitable jack stands. Disconnect tie rods from steering arms, then refer to Fig. 3 and disconnect power steering cylinder (13) from axle main member and tie rod lug. Secure steering cylinder up and out of the way. Be careful not to damage hydraulic lines to cylinder.

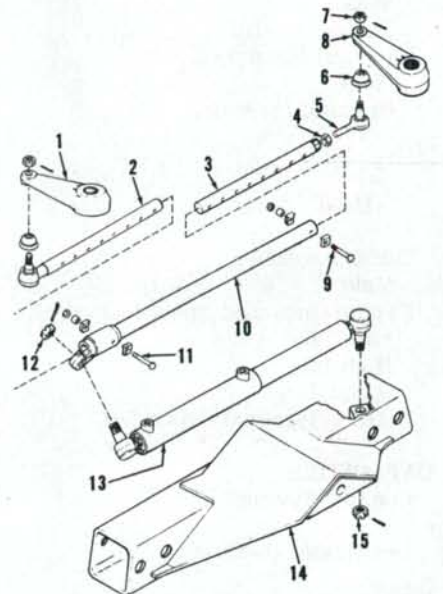


Fig. 3—Exploded view of steering tie rod, cylinder, and arms typical of all models. (Standard wheel base axle shown.)

- 1. Steering arm (R.H.)
- 2. Drag link (R.H.)
- 3. Drag link (L.H.)
- 4. Jam nut
- 5. Ball joint
- 6. Dust cover
- 7. Slotted nut
- 8. Steering arm (L.H.)
- 9. Clamp bolt (L.H.)
- 10. Tie rod tube
- 11. Clamp bolt (R.H.)
- 12. Slotted nut
- 13. Steering cylinder
- 14. Axle main member
- 15. Slotted nut

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Paragraph 6

Refer to Fig. 4, unpin and remove nut (10) from rear of pivot pin (4). Remove collar (11) and thrust washer (12). Remove bolt (17) from lock collar (14). Remove grease fitting (8) and install a slide hammer to pivot pin (4). Support axle main member with a rolling floor jack, then pull pivot pin out front of axle assembly. Catch thrust washers (12), lock collar (14) and shim washer (5) as pin (4) is withdrawn. Lower axle main member enough to clear front support and roll forward away from tractor.

Pin bushings (2 and 3—Fig. 4) can be removed using a suitable drift punch. Drive new bushings into front axle support until flush with axle support casting. Bushings are presized and should require no reaming if carefully installed.

When assembling, raise axle main member into position in axle support aligning pivot pin holes. Place retaining

ring (7—Fig. 4) and washer (6) onto pivot pin (4). Insert threaded end of pivot pin into axle support front bushing. Place shim thrust washer (5) between axle main member and axle support and slide pivot pin through washer and into axle main member front block. Install lock collar onto pin behind front block of axle member. Install bolt (17), washer (16) and lock tab (15) into lock collar (14) but do not tighten bolt at this time. Push pivot pin through rear of axle member and into rear of axle support.

Move axle main member as far forward as possible, withdraw pin and install as many shim washers (12) as possible between axle support and rear of axle main member. Move axle member rearward against washers, drive pivot pin rearward until a 1/8 inch (3.2 mm) gap exists between washer (6) and front of axle support as shown in Fig. 5. Tighten lock collar bolt (17) to 50 ft.-lbs.

(68 N·m) torque and bend lock tab (15—Fig. 4) over bolt head. Install collar (11) and pivot pin nut (10) on rear of pin and tighten nut against collar (11). Back nut off 1/4 turn or until cotter pin hole aligns and install cotter pin. Install grease fittings (8 and 9) and lubricate with No. 2 lithium grease.

All Other Models

6. To remove axle main member, first raise and support tractor under engine side rails with suitable jack stands. Refer to Fig. 3 and disconnect power steering cylinder (13) from axle main member and tie rod lug. Secure cylinder up and out of the way. Be careful not to damage hydraulic lines to cylinder.

Model 2390 and 2590 tractors with S/N prior to 9905953 are equipped with pivot pin lock collar (A—Fig. 6). All models with S/N 9905953 and above are equipped with axle main member with a keyway and Woodruff key (B) on pivot pin shaft (4).

On Models 2390 and 2590 (S/N prior to 9905953) remove bolt on lock collar (A). Loosen pinch bolt on shaft nut (8). Remove front snap ring (9) and grease fitting (10). Unscrew locknut (8), then remove front collar (7) and thrust washers (5 and 6). Remove rear snap ring (14), cup washer (15) and attach a slide hammer to front of pivot pin (4). Support axle main member with a rolling floor jack and pull pivot pin out front of axle and support. Catch split collars (16), shim washers (17 and 11) and lock collar (A) as pivot pin is withdrawn. Lower axle member enough to clear front support and roll forward away from tractor.

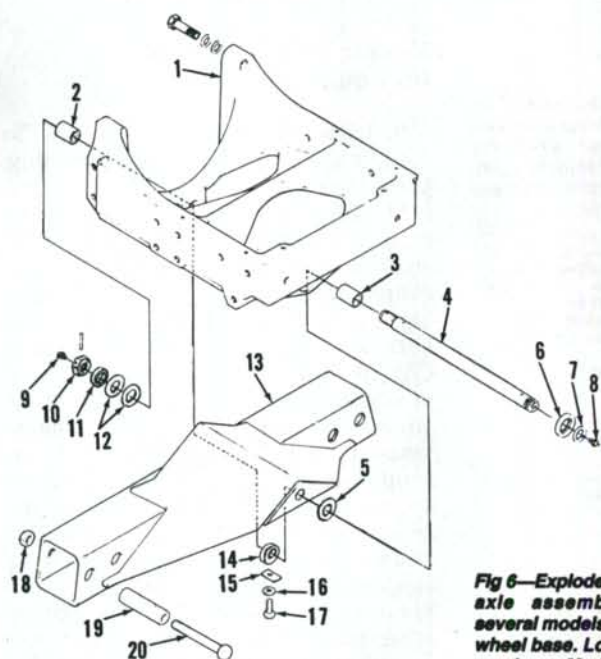


Fig. 4—Exploded view of front axle assembly used on Model 2090 and 2290 tractors (S/N prior to 9905953).

1. Front support
2. Rear bushing
3. Front bushing
4. Pivot pin
5. Shim washer
6. Collar
7. Snap ring
8. Grease fitting
9. Grease fitting
10. Pin nut
11. Collar
12. Thrust washers
13. Axle main member
14. Lock collar
15. Lock tab
16. Washer
17. Bolt
18. Nut
19. Spacer
20. Bolt

Fig. 6—Exploded view of front axle assembly used on several models with standard wheel base. Lock collar (A) is used on Models 2390 and 2590 prior to S/N 9905953. Refer to text.

1. Front support
2. Rear bushing
3. Front bushing
4. Pivot pin
5. Shim washer
6. Thrust washer
7. Collar
8. Shaft nut
9. Snap ring
10. Grease fitting
11. Shim washer
12. Axle main member (standard wheelbase)
13. Grease fitting
14. Snap ring
15. Cup washer
16. Split collars
17. Thrust washer
18. Nut
19. Spacer
20. Bolt

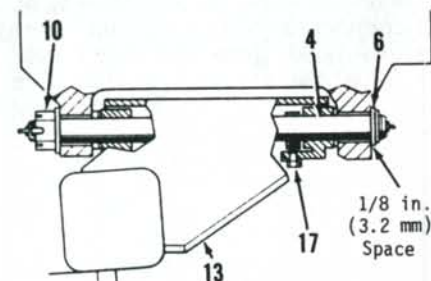
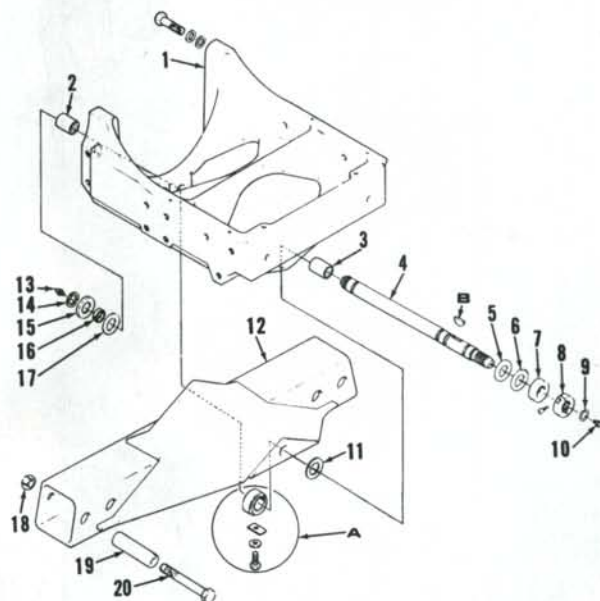


Fig. 5—Cross-sectional view showing pivot pin installation on Model 2090 and 2290 tractors (S/N prior to 9905953). Refer to legend in Fig. 4.

Paragraphs 7-9

On Models 2090, 2290, 2390 and 2590 (S/N 9905953 and above) and Models 2094, 2294, 2394 and 2594, remove front grease fitting (10—Fig. 6) and snap ring (9), loosen pinch bolt on shaft nut (8) and remove nut, then remove front collar (7) and thrust washer (6). Support axle main member with a rolling floor jack. Using a brass drift, bump pivot pin (4) rearward enough to allow removal of Woodruff key (B). Remove rear snap ring (14), cup washer (15), then using a slide hammer, pull pivot pin forward and out of axle and front support. Catch split collars (16) and thrust washers (11 and 17) as pivot pin is withdrawn.

Pin bushings (2 and 3—Fig. 6) can be removed using a suitable drift punch. Drive new bushings into front axle support until flush with axle support casting. Bushings are presized and should require no reaming if carefully installed.

Reinstall front axle on all models by reversing disassembly procedure.

EXTENDED WHEELBASE FRONT AXLE

Models 2390, 2590, 2094, 2294, 2394, and 2594 So Equipped

7. Models 2390, 2590, 2094, 2294, 2394 and 2594 tractors have an optionally available extended wheel base front axle which increases tractor wheelbase from 104 inches (264 cm) on standard units to 110 inches (279 cm) on Models 2094 and 2294 or 118 inches (300 cm) on Models 2390, 2590, 2394 and 2594. See Fig. 7. Removal of axle main member is similar to that of all model tractors outlined in paragraph 6 except the following: Tie rods and power steering cylinder pass through axle main member (12—Fig. 7); therefore hydraulic lines to steering cylinder must be disconnected for removal of axle. Cap or plug all hydraulic openings to prevent contamination of hydraulic system.

Reassemble by reversing disassembly procedure. Bleed power steering system as outlined in paragraph 25.

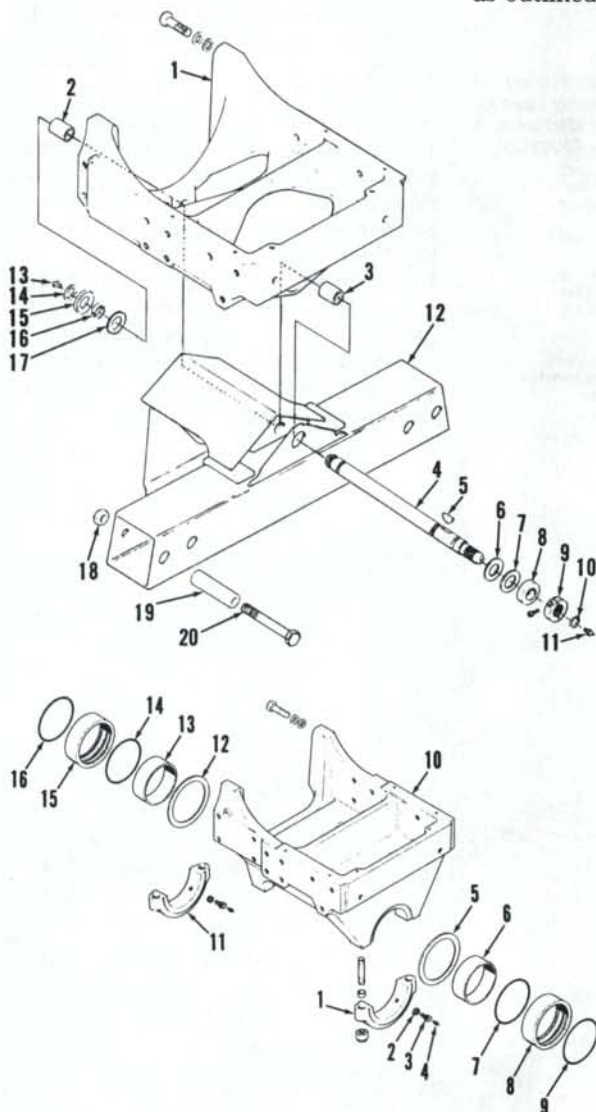


Fig. 7—Exploded view of extended wheelbase front axle main member assembly available on Models 2390, 2590, 2094, 2294, 2394 and 2594.

1. Front support
2. Rear bushing
3. Front bushing
4. Pivot pin
5. Woodruff key
6. Shim washer
7. Thrust washer
8. Collar
9. Shaft nut
10. Snap ring
11. Grease fitting
12. Axle main member
13. Grease fitting
14. Snap ring
15. Cup washer
16. Split collars
17. Shim washer
18. Nut
19. Spacer
20. Bolt

Fig. 8—Front support and component parts used on Models 2094 and 2294 equipped with Carraro front drive axle.

1. Support cap (front)
2. Washer
3. Bushing lock
4. Grease fitting
5. Thrust washer
6. Sleeve
7. "O" ring
8. Bushing
9. "O" ring
10. Front support
11. Support cap (rear)
12. Thrust washer
13. Sleeve
14. "O" ring
15. Bushing
16. "O" ring

CASE/INTERNATIONAL

FRONT SUPPORT

All Models

8. To remove front support (1—Figs. 4, 6 or 7), first disconnect headlight wiring then remove grille, hood and side panels. Remove radiator as outlined in paragraph 90. Remove front axle main member as outlined in paragraphs 6 or 7. Attach suitable hoist to front support, then unbolt and remove.

Assemble by reversing removal procedure. Tighten front support mounting bolts to 380-450 ft.-lbs. (515-610 N·m) torque.

FRONT-WHEEL DRIVE (CARRARO AXLE)

DRIVE AXLE ASSEMBLY AND SUPPORT

Models 2094 and 2294 So Equipped

9. REMOVE AND REINSTALL. To remove the front drive axle assembly, place transmission in PARK and securely block rear wheels. Unbolt and remove drive shaft shield and the front drive shaft assembly. Disconnect steering cylinder lines and cap or plug all openings. Loosen front wheel to hub nuts on both wheels. Install a side frame jack CAS-10500-1 or equivalent on each side of tractor. Raise front of tractor until wheels are off the ground. Remove wheel nuts and using a hoist, remove front wheels. Place a floor jack or special axle carrier CAS-10500-4 under front axle. Remove bearing lock (3—Fig. 8) and grease fitting (4) from bearing support caps (1 and 11), then unbolt and remove caps. Lower axle (floor jack) or raise tractor (axle carrier) and roll assembly forward from tractor. Remove bushings (8 and 15) with "O" rings (7, 9, 14 and 16), sleeves (6 and 13) and thrust washers (5 and 12).

To remove front support (10—Fig. 8), disconnect headlight wiring, then remove hood, grille and side panels. Remove radiator as outlined in paragraph 90. Attach a hoist to front support, then unbolt and remove.

Reinstall front support by reversing removal procedure. Tighten front support mounting bolts to a torque of 380-450 ft.-lbs. (515-610 N·m).

Inspect thrust washers (5 and 12—Fig. 8), sleeves (6 and 13) and bushings (8 and 15) for excessive wear or other damage and renew as necessary. Install

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Paragraphs 10-11

sleeves (6 and 13) on axle housing, then install thrust washers (5 and 12). Lubricate sleeves and install bushings (8 and 15) with new "O" rings. Reinstall axle assembly to front support (10). Install support caps (1 and 11), making certain the lube holes in bushings are aligned with holes in caps. Tighten support cap nuts to a torque of 400-480 ft.-lbs. (542-650 N·m). Install bushing locks (3) and grease fittings (4). Connect steering cylinder hoses and drive shaft. Tighten drive shaft bolts to a torque of 35-42 ft.-lbs. (48-57 N·m). Install drive shaft shield. Install front wheels and remove jacks. Tighten front wheel to hub nuts to 400-480 ft.-lbs. (542-650 N·m) torque.

WHEEL HUB AND PLANETARY

Models 2094 and 2294 So Equipped

10. R&R AND OVERHAUL. To remove the wheel hub and planetary, support axle housing and remove wheel and tire assembly. Rotate wheel hub until drain plug (8—Fig. 9) is at bottom, remove plug and drain oil. Unbolt and remove cover and carrier assembly (7). Drive out roll pins (9) and remove planetary pins (6) with "O" rings (5).

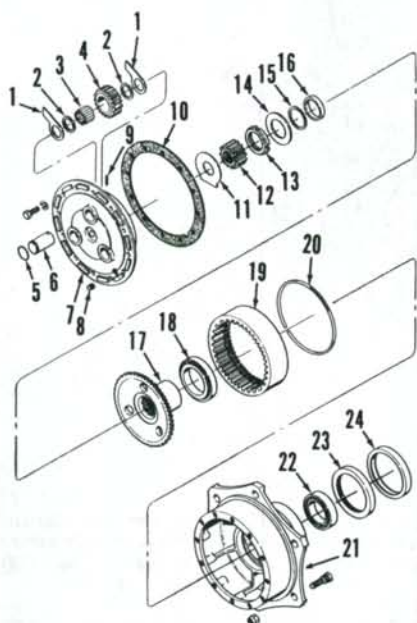


Fig. 9—Exploded view of wheel hub and planetary unit used on Carraro front drive axle.

- | | |
|--------------------|--------------------|
| 1. Thrust washers | 13. Locknut |
| 2. Spacers | 14. Thrust washer |
| 3. Bearing rollers | 15. Shim |
| 4. Planetary gear | 16. Ring |
| 5. "O" ring | 17. Gear hub |
| 6. Planetary pin | 18. Bearing |
| 7. Cover & carrier | 19. Ring gear |
| 8. Drain plug | 20. Retaining ring |
| 9. Roll pin | 21. Wheel hub |
| 10. Gasket | 22. Bearing |
| 11. Washer | 23. Oil seal |
| 12. Sun gear | 24. Dust seal |

Remove planetary gears (4) with thrust washers (1), spacers (2) and bearing rollers (3). Remove washer (11) from carrier and sun gear (12) from axle.

Using a spanner wrench, remove locknut (13), thrust washer (14) and shims (15). Measure total thickness of shim pack (15) and retain for reassembly. Attach a hoist to hub (21). Pull hub outward about one inch (25.4 mm), then push hub back into place. Remove centering ring (16) from the ring gear, then remove ring gear assembly. Carefully remove the wheel hub.

Remove cone of bearing (22), from stub shaft (17—Fig. 10) and cone of bearing (18—Fig. 9) from gear hub (17). Remove dust seal (24) and oil seal (23). If necessary, remove bearing cups from hub. Remove retaining ring (20) and lift gear hub (17) from ring gear (19).

Clean and inspect all parts and renew any showing excessive wear or other damage.

When reassembling, heat bearing cones to a temperature of 250° F (120° C) for aid in installation. Install hub (21) without oil seal (23) and dust seal (24). Install ring gear and gear hub assembly, centering ring (16), original shim pack (15), thrust washer (14) and locknut (13). Tighten locknut to a torque of 400-480 ft.-lbs. (542-650 N·m). Using a special fixture and torque wrench as shown in Fig. 11, check the torque needed to

rotate the hub. A torque of 35 in.-lbs. (4 N·m) will give the correct wheel bearing preload. Add or remove shims (15—Fig. 9) to obtain correct bearing preload. Shims are available in thicknesses of 0.004, 0.012 and 0.020 inch (0.1, 0.3 and 0.5 mm).

When correct bearing preload has been obtained, remove hub and install new oil seal (23) and dust seal (24). Reinstall hub assembly and tighten locknut (13) to a torque of 400-480 ft.-lbs. (542-650 N·m). Install sun gear (12) on axle shaft. Install thrust washer (11) in carrier (7), then install planetary gears (4) with bearing rollers (3), spacers (2) and thrust washers (1). Install new "O" rings (5) on planetary pins (6). Insert planetary pins and secure with roll pins (9). Use new gasket (10) and install cover and carrier assembly making certain that drain hole is aligned with cutout in wheel hub. Tighten retaining cap screws to a torque of 66-90 ft.-lbs. (89-122 N·m). Rotate hub until the filler (drain) hole is horizontal to center of hub. Fill hub with lubricant to filler plug opening. Capacity is 4.5 U.S. quarts (4.25 L). Use GL5 85/140 EP gear oil. Install filler plug.

Install wheel and tire assembly and lower tractor to ground. If necessary, repeat operation for opposite side.

STUB AXLE AND AXLE SHAFT

Models 2094 and 2294 So Equipped

11. REMOVE AND REINSTALL. To remove the stub axle (17—Fig. 10) and axle shaft (1), first remove wheel hub as outlined in paragraph 10. Then, remove the 12 stud nuts and lift off breather shield (19) and deflector (18). Remove the two dust plugs and install jack screws in stub axle. Tighten jack screws to separate stub axle from pivot housing (11). Remove stub axle, then remove dust seal (12), oil seal (13) and if necessary, bushing (14).

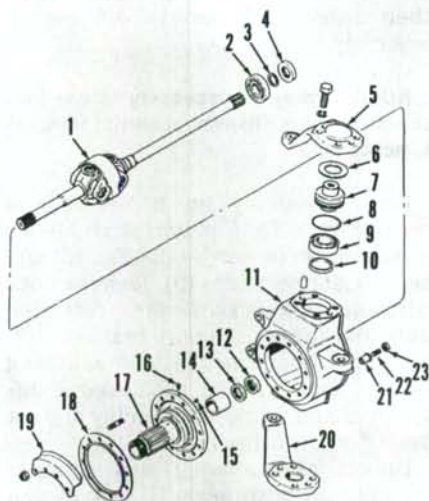


Fig. 10—Exploded view of pivot housing and components used on Carraro front drive axle. Items (6 through 10) are also used in bottom of pivot housing (11).

- | | |
|---------------------------|--------------------------|
| 1. "U" joint & axle assy. | 12. Dust seal |
| 2. Ball bearing | 13. Oil seal |
| 3. Snap ring | 14. Bushing |
| 4. Oil seal | 15. Plug |
| 5. Steering arm (upper) | 16. Breather |
| 6. Shim | 17. Stub axle |
| 7. Pivot pin | 18. Deflector ring |
| 8. "O" ring | 19. Breather shield |
| 9. Bearing | 20. Steering arm (lower) |
| 10. Cup | 21. Stop |
| 11. Pivot housing | 22. Stud |
| | 23. Nut |

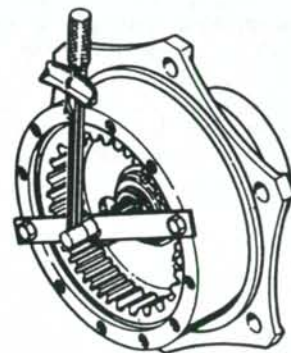


Fig. 11—Use special fixture and torque wrench to check wheel bearing preload. Refer to text.

Paragraphs 12-13

Remove upper and lower hole plugs at outer end of axle housing, then loosen locknuts and remove bearing locating screws. Withdraw axle shaft assembly. Remove snap ring (3) and bearing (2). Oil seal (4) can be pulled from axle housing, if desired. All parts for the double "U" joint axle shaft are available separately. Procedures for renewing "U" joint crosses and bearings are conventional.

When reassembling, install oil seal (4) with lip facing inward. Install bearing (2) and secure with snap ring (3). Lubricate oil seal (4) and carefully install axle shaft (1). Install and tighten upper and lower bearing locating screws. Then, install locknuts and tighten to a torque of 195 ft.-lbs. (264 N · m).

If removed, install new bushing (14) in stub axle. Install new oil seal (13), but DO NOT bottom in bore. Install dust seal (12) until flush with face of bore. Lubricate seals and install stub axle, deflector (18) and breather shield (19). Install stud nuts and tighten to a torque of 203 ft.-lbs. (275 N · m).

Reinstall wheel hub as outlined in paragraph 10.

PIVOT HOUSING

Models 2094 and 2294 So Equipped

12. REMOVE AND REINSTALL. To remove the pivot housing (11—Fig. 10), first remove wheel hub as in paragraph 10 and stub axle and axle shaft as in paragraph 11. Then, disconnect steering cylinder from upper steering arm (5) and tie rod from lower steering arm (20). Unbolt and remove lower steering arm (20) and lower shims (6). Attach a slide hammer to lower pivot pin (7) and remove pivot pin and bearing cone. Unbolt and remove upper steering arm (5) and upper shims (6). Using a slide hammer, remove upper pivot pin (7) and bearing cone. Lift off pivot housing (11). If necessary, use a slide hammer puller to remove bearing cups from axle housing.

Clean and inspect all parts and renew as necessary. Heat bearing cones to 250° F (120° C) for aid in installation. Allow to cool and install new "O" rings (8). If removed, install bearing cups in axle housing. Pack bearing cones with grease and put grease in cups (10) in axle housing. Install pivot housing and insert pivot pins and bearing cones. Use a plastic hammer and tap pivot pins into position. Install lower steering arm (20) without shims and tighten cap screws to a torque of 30 ft.-lbs. (40 N · m). Place all the shims (6) removed from upper and lower pivot pins plus another shim of 0.020 inch (0.5 mm) thickness on the

upper pivot pin. Install upper steering arm (5) and tighten cap screws to a torque of 30 ft.-lbs. (40 N · m). Using a feeler gage, measure the distance between upper steering arm and machined surface on pivot housing. Remove upper steering arm and all shims. Measure shim pack thickness. Subtract shims equal to the measured distance between steering arm and pivot housing from shim pack. Divide remaining shims by two. Place each shim pack half plus an additional 0.006-0.008 inch (0.15-0.20 mm) shim under each steering arm to provide 0.012-0.016 inch (0.3-0.4 mm) total bearing preload. Tighten upper and lower steering arm cap screws to a torque of 317 ft.-lbs. (430 N · m).

Complete balance of installation by reversing the removal procedure.

DIFFERENTIAL AND BEVEL DRIVE GEARS

Models 2094 and 2294 So Equipped

13. R&R AND OVERHAUL. To remove the differential assembly, first remove front drive axle assembly as outlined in paragraph 9. Then, remove wheel hubs and planetarys as in paragraph 10 and stub axles and axle shafts as in paragraph 11. Remove steering cylinders and tie rod. Remove drain plug and drain lubricant from axle housing. Attach a hoist to differential carrier, then unbolt and remove differential assembly.

NOTE: It may be necessary to use jack screws to force differential carrier from axle housing.

Place assembly on a bench and remove yoke from pinion shaft. Place match marks on carrier (8—Fig. 12) and bearing support caps (9). Remove both adjusting ring locks. Remove retaining nuts and lift off support bracket (10), bearing support caps (9) and adjusting rings (1 and 17—Fig. 13). Remove differential and ring gear assembly and set aside for later disassembly.

Unbolt and remove seal retainer (3—Fig. 12) with seals (1 and 2) and gasket (4). Remove locknut (5), pull bevel pinion shaft out and catch bearing cone (6). Remove spacer (12), first shim (13), bearing cone (14) and second shim (13A) from bevel pinion shaft (15). Use a slide hammer puller and remove bearing cups (6 and 14).

If bevel pinion shaft (15), pinion bearings (6 and 14) or carrier (8) are renewed, pinion shaft protrusion must be set as follows: Install both pinion bearing cups. Install carrier bearing caps and

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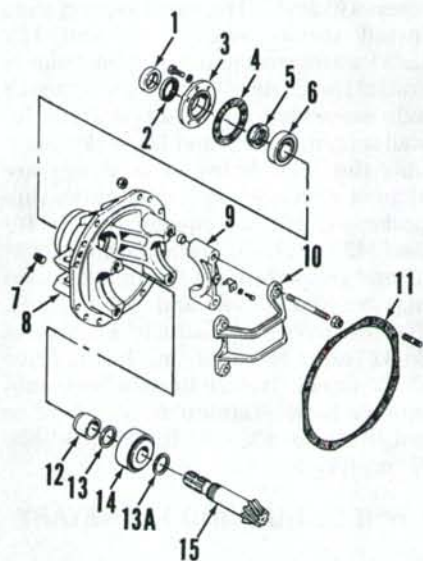


Fig. 12—View of bevel drive pinion and component parts removed from carrier (8).

- | | |
|-------------------------|--------------------------|
| 1. Dust seal | 9. Bearing support cap |
| 2. Oil seal | 10. Support bracket |
| 3. Seal retainer | 11. Gasket |
| 4. Gasket | 12. Spacer |
| 5. Nut | 13. Shim |
| 6. Taper roller bearing | 13A. Shim |
| 7. Drain plug | 14. Taper roller bearing |
| 8. Carrier | 15. Bevel drive pinion |

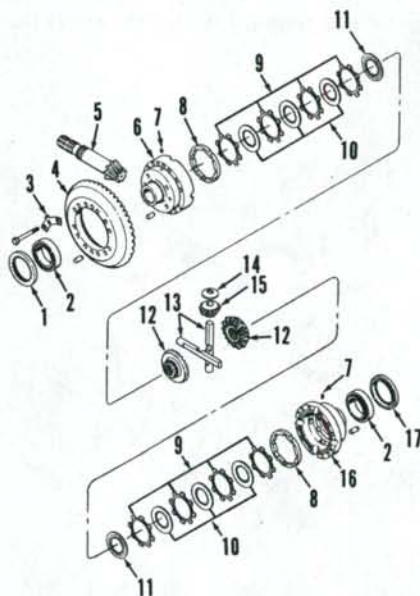


Fig. 13—Exploded view of late type Carraro limited slip front drive axle differential. On earlier type, discs (10), spacers (11) and side gears (12) had four tangs instead of 21 teeth.

- | | |
|----------------------------------|------------------------------------|
| 1. Adjusting ring | 10. Friction disc (internal teeth) |
| 2. Bearing cup & cone | 11. Spacer |
| 3. Lockplate | 12. Side gears |
| 4. Ring gear | 13. Cross pins |
| 5. Bevel drive pinion | 14. Thrust washer |
| 6. Differential case half | 15. Differential pinions |
| 7. Set screw | 16. Differential case half |
| 8. Disc carrier ring | 17. Adjusting ring |
| 9. Friction disc (external tang) | |

tighten retaining nuts securely. Measure and record the bore diameter. This is

SERVICE MANUAL

Paragraph 14

dimension (D—Fig. 14). Install pinion bearing cones and using a fixture as shown in Fig. 14 or a bolt and washers, tighten nut to hold bearings tight in position. Place a 25 mm diameter rod having a cross hole drilled through it across bearing bore as shown in Fig. 14. Using a depth gage, measure from top of rod to face of inner bearing cone and record measurement. This is dimension (Y—Fig. 14). Subtract 25 mm (diameter of rod) from measurement of depth gage (Y). Add this to one-half the diameter of carrier bearing bore (D). This will be dimension (B). Then, subtract dimension etched on pinion shaft gear end from (B) if it is a minus (-) dimension or add if it is a plus (+) dimension (this dimension is in millimeters), for result. This dimension will be correct shim thickness to install between bearing cone (14—Fig. 12) and pinion shaft gear (15) for correct pinion shaft protrusion. Remove bearing cones from carrier.

Install the determined shim (13A) on pinion shaft. Heat bearing cone (14) to 250° F (120° C) and install on pinion shaft. Measure shim (13), removed during disassembly, and select a shim 0.5 mm thicker and install on pinion shaft. Install spacer (12) and insert pinion shaft into position in carrier. Heat bearing cone (6) to 250° F (120° C) and install on pinion shaft. Install a new locknut (5) and tighten to a torque of 100 ft.-lbs. (135 N·m). Using a dial indicator, measure pinion shaft end play. This measurement plus 0.05 mm is the correct shim thickness to be removed. Select and install correct shim (13), then tighten locknut to a torque of 442 ft.-lbs. (599 N·m). Using a torque wrench, measure amount of torque needed to rotate pinion shaft. A torque of 1.5-2.0 in.-lbs. (0.17-0.23 N·m) will be correct bearing preload. Install new oil seal (2) in seal retainer (3). DO NOT bottom seal in retainer. Install new dust seal (1) until flush with face of retainer. Lubricate seals and using new gasket (4), install retainer. Tighten cap screws to a torque of 60 ft.-lbs. (82 N·m).

Remove carrier bearings (2—Fig. 13). Place a match mark across both halves of differential case for aid in reassembly. Straighten lock plates (3), then unbolt and remove ring gear (4). Separate differential case halves (6 and 16). Remove friction discs (9 and 10), spacer (11) and side gear (12) and lift out cross pins (13) with differential pinions (15) and thrust washers (14). Then, remove second side gear (12), spacer (11) and friction discs (9 and 10). Remove set screws (7) and withdraw disc carrier rings (8).

Clean and inspect all parts and renew as necessary. Ring gear (4) and pinion shaft (5) are available only as a matched set and must be installed as such.

When reassembling, install disc carrier rings, aligning the set screw holes. Install set screws and tighten to a torque of 15 ft.-lbs. (20 N·m). Apply one or two drops of Loctite 290 in set screw holes after set screws are tightened. Measure thickness of each friction disc and renew any measuring less than 0.070 inch (1.77 mm). Measure total thickness of friction discs (9 and 10) for each side. Add correct spacer (11) to give a total thickness of 0.602-0.614 inch (15.3-15.6 mm) for each side. Apply a coating of grease to spacers and friction discs to hold them together on side gears during assembly. Install side gear with spacer and friction discs in each differential case half. Install cross pins with differential pinions and thrust washers on one case half, then install second case half, aligning match marks. If necessary, heat ring gear to a maximum of 400°-450° F (204°-232° C) and install over dowel pins. Install lockplates and cap screws and tighten cap screws to a torque of 88 ft.-lbs. (119 N·m). Bend lockplates up against cap screw heads. Heat carrier bearing cones (2) to 250° F (120° C) and install on differential case. Install bearing cups on cones and place differential in position in carrier. Install bearing support caps (9—Fig. 12) aligning match marks on carrier and caps. Install support bracket (10), install retaining nuts and tighten nuts lightly. Make certain there is some clearance between ring gear and pinion. Install bearing adjusting rings (1 and 17—Fig. 13) and turn them in against carrier bearings. Tighten retaining nuts on support bracket to 442 ft.-lbs. (599 N·m) torque.

Turn adjusting ring clockwise on ring gear side until ring gear contacts pinion shaft. Turn adjusting ring on opposite side clockwise until all clearance in the bearings is removed. Clearance is removed when the adjusting ring becomes difficult to turn. Attach a dial indicator to carrier and check ring gear

to pinion backlash which should be 0.006-0.010 inch (0.15-0.25 mm). To increase backlash, turn adjusting ring on ring gear side counterclockwise one notch and opposite ring clockwise one notch. If necessary, repeat procedure until backlash is correct. Adjustment is opposite to decrease backlash.

When backlash is correct, turn each adjusting ring clockwise one notch to preload carrier bearings. Install adjusting ring locks and tighten cap screws to a torque of 18 ft.-lbs. (25 N·m).

Use new gasket (11—Fig. 12) and install assembly in axle housing. Tighten retaining nuts to a torque of 144 ft.-lbs. (195 N·m).

The balance of reassembly is the reverse of disassembly procedure. After installation, fill axle and differential housing to level plug opening. Capacity is 16 U. S. quarts (15 L). Use GL5 85/140 EP gear oil. Manufacturer recommends that oil in front drive axle be changed each 1000 hours of operation.

FRONT DRIVE SHAFT

Models 2094 and 2294
So Equipped

14. R&R AND OVERHAUL. To remove the front drive shaft, first unbolt and remove drive shaft shield (4—Fig. 15). Remove cap screws (14) and separate cross and bearing assemblies from front and rear yokes (5 and 1). Remove lube fittings (8 and 12). Remove cap screws (9 and 13) and separate cross and bearing assemblies (7 and 11) from drive shaft (10). Cross and bearing units (7 and 11) are serviced only as assemblies.

Reassemble and reinstall by reversing disassembly and removal procedures. Tighten cap screws (9 and 13) to a torque of 37-49 ft.-lbs. (50-66 N·m) and cap screws (14) to a torque of 35-42 ft.-lbs. (48-57 N·m).

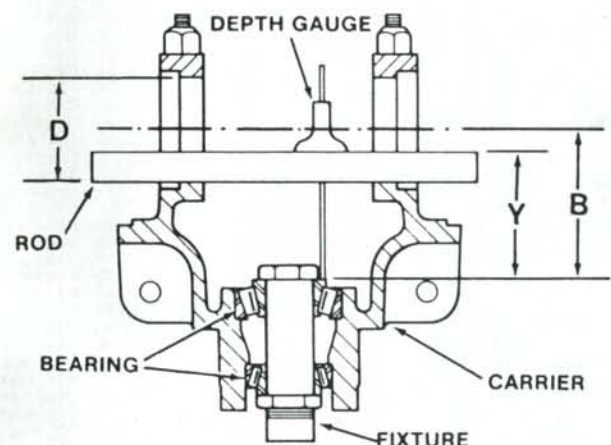


Fig. 14—Diagram showing method of securing pinion bearings in carrier to allow depth gage measurement to be taken. Refer to text.