SHOP MANUAL

CASE INTERNATIONAL

(DAVID BROWN)

MODELS

1190-1194-1290-1294-1390-1394-1490-1494-1594-1690

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CONDENSED SERVICE DATA

	MODELS				
	1190	1290	1390	1490	1690
GENERAL					
Engine Make	Own				
No. of Cylinders	3	4	4	4	6
Bore	100 mm (3.939 in.)				
Stroke	114.3 mm (4.5 in.)	*	114.3 mm (4.5 in.)		
Displacement	2.7 liter (164 cu. in.)	*	3.6 liter (219 cu. in.)	3.6 liter (219 cu. in.)	5.4 liter (329 cu. in.)
Compression Ratio	17:1	17:1	17:1	16:1	16:1
Battery	12-Volt, Negative Ground				
No. of Forward Speeds	12				

* 1290 models with independent pto clutch manufactured before P.I.N. 11052369, or 1290 models with continuous pto clutch manufactured before P.I.N. 11052410 use a 3.2 liter (195 cu. in.) engine which has a stroke of 101.6 mm (4.0 inches). All 1290 models manufactured after these used 3.6 liter (219 cu. in.) engines which have a 114.3 mm (4.5 inches) stroke. Service procedures are the same for either engine.

TUNE-UP					
Firing Order	1-2-3	1-2-4-3			1-5-3-6-2-4
Valve Clearance (Cold)	0.25 mm (0.010 in.)				
Injection Timing	16° BTDC	17° BTDC	17° BTDC	20° BTDC	25° BTDC
Engine Low Idle Rpm	750				
Engine High Idle (No-Load) Rpm	2350-2375				2450
Engine Rated Speed (Full Load)	2200				2300
Power Rating	37 kW (49 hp)	45 kW (60 hp)	52 kW (70 hp)	66 kW (88 hp)	82 kW (110 hp)
SIZES AND CLEARANCES					
Crankshaft Main Journal Diameter	63.474-63.487 mm (2.4990-2.4995 in.)			66.65-66.66 mm (2.6240-2.6245 in.)	69.84-69.85 mm (2.749-2.750 in.)
Crankpin Journal Diameter	60.27-60.29 mm (2.3730-2.3735 in.)			63.45-63.46 mm (2.4980-2.4985 in.)	60.27-60.28 mm (2.3728-2.3732 in.)
Main and Rod Bearing Running Clearance	0.05-0.10 mm (0.002-0.004 in.)				
Crankshaft End Play	0.05-0.25 mm (0.002-0.010 in.)				0.15-0.25 mm (0.006-0.010 in.)
Cylinder Bore	100.046-100.066 mm (3.9388-3.9396 in.)				
Piston Diameter	99.86-99.88 mm (3.9315-3.9323 in.)				
Valve Stem Diameter	9.454-9.479 mm (0.3722-0.3732 in.)				
Camshaft Journal Specifications, See Paragraph	97	98	98	98	99
CAPACITIES					
Cooling System	8.5 liters (9 qts.)	14.2 liters (15 qts.)			15.3 liters (16 qts.)
Crankcase (With Filter)	6.25 liters (6.6 qts.)	7.4 liters (7.8 qts.)			12.5 liters (13.2 qts.)
Transmission, Hydraulic and Differential Case	27.5 liters (29 U.S. qts.)			42 liters (44.5 U.S. qts.)	
Fluid Type	Case PTF Fluid or Hy-Tran Plus				

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FRONT AXLE (TWO-WHEEL DRIVE)

FRONT WHEEL BEARINGS

All Models

1. A typical front wheel spindle, wheel hub and bearing assembly are shown in Fig. 1.

It is recommended that wheel bearings be lubricated with multipurpose lithium base grease using a pressure grease gun after every 50 hours of normal operation.

To adjust wheel bearings, tighten slotted nut (17—Fig. 1) to 95 N·m (70 ft.-lbs.) torque while turning the wheel. Loosen the nut, then retighten to 40 N·m (30 ft.-lbs.) torque while turning the wheel. Make certain wheel turns freely. Loosen nut, if necessary, to align hole for cotter pin, then install a new pin.

SPINDLES

All Models

2. REMOVE AND REINSTALL. To remove spindle (9—Fig. 1), support front of tractor and remove wheel from side to be serviced. Remove cap screw (1) and washer (2) which retains steering arm (3), and remove steering arm from spindle.

NOTE: If steering arm (3) is tight on spindle (9), reinstall cap screw (1) minus washer (2) and rap head of cap screw sharply to loosen steering arm. Care should be taken not to damage cap screw or threads in spindle.

Remove spindle and upper "O" ring (4—Fig. 1). Remove thrust washer (6) on all models and thrust bearing (7) on 1490, 1494, 1594 and 1690 models. On all models remove lower "O" ring (8).

With spindle removed, upper and lower spindle bushings (8 and 10—Fig. 2) can be removed from axle extension (9) using a suitable puller or drift punch. New bushings should be pressed into axle extension until flush with outer surface of axle extension. Bushings are presized and should not require reaming if carefully installed.

Reinstall by reversing removal procedure making certain thrust bearing (7—Fig. 1) and thrust washer (6) are in proper sequence on 1490, 1494, 1594 and 1690 models. On all models, tighten steering arm retaining cap screw (11) to 163 N·m (120 ft.-lbs.) torque.



Fig. 1—Exploded view of typical front spindle assembly showing component parts and their relative positions.

1. Cap screw
2. Special washer
3. Steering lever
4. "O" ring
5. Bushings
6. Thrust washer
7. Thrust bearing
8. "O" ring
9. Spindle
10. Dirt seal
11. Oil seal wear sleeve
12. Oil seal
13. Bearing
14. Hub
15. Bearing
16. Washer
17. Slotted nut
18. Gasket
19. Hub cap

TIE RODS AND TOE-IN

All Models

3. Toe-in of front wheels should be 3 mm (⅛ inch), measured between wheel rims at front and rear of wheels. Toe-in can be adjusted by lengthening or shortening threaded tie rod ends equally.

Tie rod ends are nonadjustable. If excessively worn, they must be renewed as complete units.

AXLE MAIN MEMBER

All Models

4. REMOVE AND REINSTALL. Refer to appropriate Fig. 2, 3 or 4 for an exploded view of front axle assembly. Disconnect drag link (manual steering), steering cylinder lines (power steering) or steering cylinder as necessary for model being serviced. Support front of tractor with suitable stand. Loosen trunnion pin retaining bolt (15) about five turns, then rap head of bolt with a hammer to dislodge threaded insert (23). Remove bolt and insert. Remove expansion plug from trunnion pin bore if so equipped. Screw slide hammer puller into trunnion pin (4) and remove pin. Raise front of tractor until axle is clear. Remove thrust washer (21) and "O" rings (2 and 22). Drive bushings (3 and 20) out of bore noting placement if different in size or length. Models 1190 and 1194 have a blind hole at the rear, remove bushing with a chisel.

On all models, drive new bushings in until flush with housings. Bushings are presized and should not require reaming if carefully installed. Check trun-

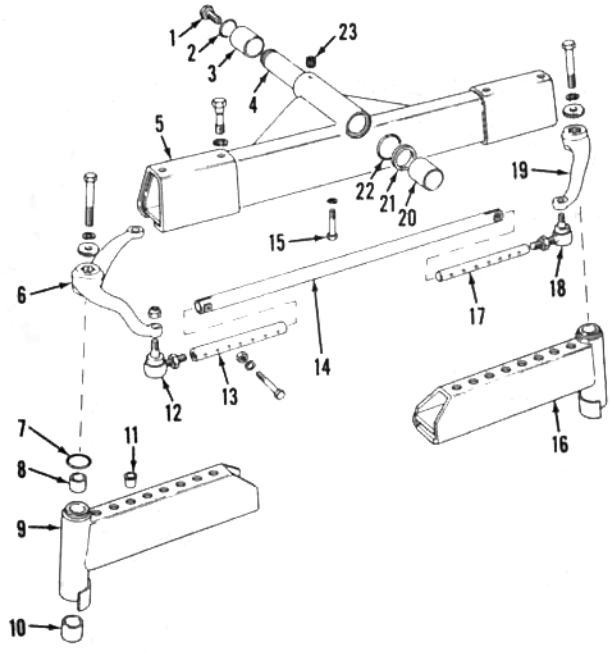


Fig. 2—Exploded view of front axle used on Models 1190 and 1194. Front axle used on Model 1294 and early Model 1394 (before P.I.N. 11504412) is similar.

1. Bolt adapter
2. "O" ring
3. Bushing
4. Trunnion pin
5. Center beam
6. Steering lever
7. "O" ring
8. Bushing
9. Axle extension
10. Bushing
11. Plastic plug
12. Tie rod end
13. Tie rod
14. Spacer tube
15. Axle retaining bolt
16. Axle extension
17. Tie rod
18. Tie rod end
19. Steering lever
20. Bushing
21. Thrust washer
22. "O" ring
23. Threaded insert

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using jack screws in threaded hole of bearing pins. Retain shims (7) for use in reassembly. Hold axle shaft in place while removing stub axle assembly to prevent damage to oil seals. Remove axle shaft from housing.

Remove upper and lower sealing discs (28 and 17—Fig. 5), "O" rings (27 and 16) and bearings (26 and 15) from axle housing (13). Use a suitable puller to remove upper and lower bearing cups from axle housing. Remove upper and lower shields (25 and 14).

Remove seal (2—Fig. 8) from inside stub axle (8). Using a suitable bushing driver, drive bushing (3) out oil seal end of stub axle. Install new bushing from seal end until it seats in stub axle. Install new oil seal with lip of seal entering bore first.

To reassemble, reverse disassembly procedure using care not to let axle shafts damage oil seals and noting preload must be set on bearing pin bearings and stub axle bearings.

To set bearing pin preload, reassemble unit minus shims (7—Fig. 8). Tighten lower bearing pin mounting bolts to 68 N·m (50 ft.-lbs.) torque and upper bearing pin mounting bolts to 20 N·m (15 ft.-lbs.) torque. Push stub axle up tight against bottom of axle housing and use a feeler gage to measure gap between upper bearing pin flange and stub axle. See Fig. 9. Remove upper bearing pin, then assemble shims so total thickness is 0.381 mm (0.015 inch) less than feeler gage measurement. This will correctly preload bearings to 0.10-0.15 mm (0.004-0.006 inch) when full load is on axle. Tighten upper bearing pin bolts to 68 N·m (50 ft.-lbs.) torque. Refer to paragraph 11 to set stub axle bearing preload.

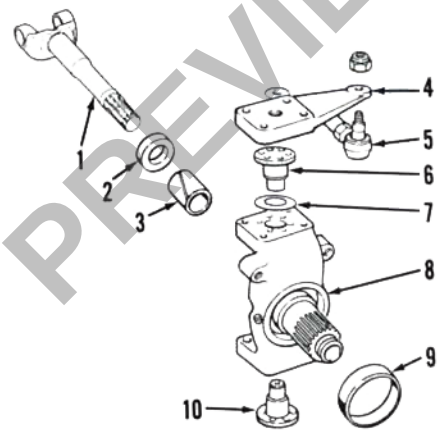


Fig. 8—Exploded view of David Brown front drive stub axle showing component parts and their relative positions.

1. Axle drive shaft
2. Oil seal
3. Bushing
4. Steering lever
5. Tie rod end
6. Bearing pin
7. Shim
8. Stub axle
9. Wear sleeve
10. Bearing pin

11. WHEEL HUB BEARING PRELOAD. To set stub axle bearing preload, install shims (5—Fig. 7) having a total thickness of 2 mm (0.080 inch) next to spacer (6). Install planetary ring gear (3) and nut (1) minus tab washer (2). Using special spanner wrench (CAS-1607), tighten nut (1) to 203 N·m (150 ft.-lbs.) torque. Mount dial indicator so point of probe contacts outside face of hub. See Fig. 10. Measure and record amount of end play. Correct amount of bearing preload is 0.08-0.13 mm (0.003-0.005 inch). Subtract shims equal to measured end play plus 0.10 mm (0.004 inch) from previously installed shim pack to obtain correct bearing preload.

Reassemble unit installing tab washer (2—Fig. 7) and making sure flat side of nut (1) faces inward. Tighten nut to 203 N·m (150 ft.-lbs.) torque, then secure with tab washer. Fill each final drive with 0.9 L (1 quart) of Case FDL SAE 90 gear lubricant or equivalent.

12. PLANETARY GEAR ASSEMBLIES. Drain fluid, then remove end plate (12—Fig. 7). Remove lockplates (22) and bolts retaining planetary gear carrier (20) to end plate (12). Mark gear carrier, pins, gears and bearings prior to disassembly so they can be reassembled in their original positions. Remove carrier, gears and bearings.

Reassemble by reversing disassembly procedure making certain gears, bearings and pins are reinstalled in their original positions. Install lockplates so they cover dowel pin holes and tighten bolts to 40 N·m (30 ft.-lbs.) torque. Reinstall end plate, tighten bolts to 100 N·m (75 ft.-lbs.) torque and fill hub to proper level with Case FDL SAE 90 gear lubricant or equivalent.

13. AXLE HOUSINGS. Axle shaft seal (23—Fig. 5) and bushings (24) can be renewed with axle housings in place.

If removal of housing is necessary, raise and support front of tractor and remove tire and wheel from side to be serviced. Drain oil from differential housing. Capacity is approximately 8 L (8.5 quarts). Attach hoist to axle housing so weight is equally balanced. Disconnect steering linkage and remove bolts retaining axle housing to differential housing, then remove axle housing. Remove final drive from axle housing if necessary.

To reinstall axle housing, reverse the removal procedure. Tighten housing mounting bolts to 110-130 N·m (80-95 ft.-lbs.) torque. Fill differential housing to correct level with Case FDL SAE 90 gear lubricant or equivalent.

14. R&R DIFFERENTIAL ASSEMBLY. Differential assembly may be removed with differential housing and axle housing installed on tractor. It is necessary, however, to first remove left and right stub axle assemblies as outlined in paragraph 10.

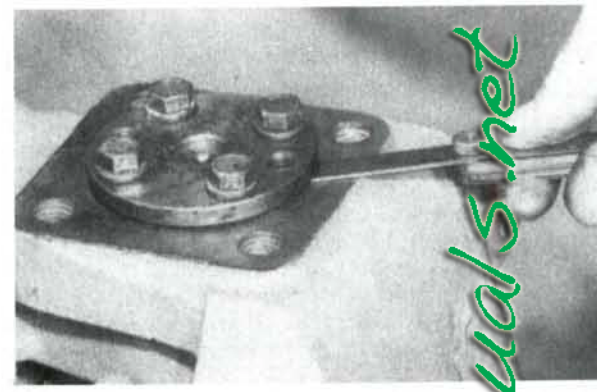


Fig. 9—To set bearing pin preload, use a feeler gage to measure gap between bearing pin flange and stub axle housing. Refer to text.

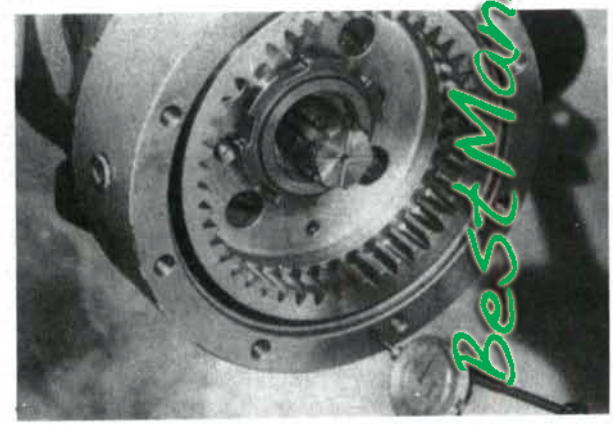


Fig. 10—To set stub axle bearing preload, mount a dial indicator so probe contacts face of wheel hub. Measure end play and refer to text.

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Note protrusion correction mark etched on end of pinion shaft gear. This will be "O" or a plus (+) or minus (−) dimension. Note that dimension is given in thousandths of an inch.

Noting that special tool has a built in dimension of 0.030 inch (0.76 mm), substitute actual gap measurement and shaft correction number for figures shown in the following example to determine thickness of shims (18—Fig. 11) needed to correctly set pinion shaft protrusion.

Tool built in dimension . . .	0.030 in. (0.76 mm)
Add or subtract dimension etched on pinion shaft . .	-0.005 in. (0.13 mm)
Result is setting dimension "A" .	0.025 in. (0.63 mm)
Measured gap . . .	0.055 in. (1.40 mm)
Minus setting dimension "A" determined above	-0.025 in. (0.63 mm)
Result is thickness of shims required .	0.030 in. (0.77 mm)

Remove special tool, pinion shaft and inner bearing cup. Assemble correct thickness of shims into housing bore, then reinstall inner bearing cup. Be sure cup seats against shims and housing counterbore.

Reassemble pin shaft with spacers (22 and 24—Fig. 11) using 1.27 mm (0.050 inch) thick shims (23), but without spacer (26), oil seal (27) and sealing washer (29). Install flange (28), washer (30) and nut (31) on pinion shaft and tighten nut to 190 N·m (140 ft.-lbs.) torque. Turn shaft in both directions to seat bearings, then mount a dial indicator on carrier so probe contacts end of pinion gear as shown in Fig. 14 and measure shaft end play. Remove pinion shaft and reduce thickness of shims (23—Fig. 11) an amount equal to measured end play. This procedure will provide zero end play and zero preload. However, a tolerance of plus or minus 0.05 mm (0.002 inch) is acceptable.

Reinstall pinion shaft with all spacers and seals. Tighten retaining nut to 190 N·m (140 ft.-lbs.) torque.

17. DIFFERENTIAL CARRIER BEARINGS AND BEVEL GEAR BACKLASH. On all models, adjustment of differential carrier bearings to provide proper bevel gear backlash and bearing adjustment is correlated with pinion shaft protrusion adjustment as outlined in paragraph 16.

Install differential assembly, but do not securely tighten carrier bearing caps. Install adjuster rings and turn in until end play of differential in carrier is less than 0.05 mm (0.002 inch) without preloading bearings. Mount dial indicator as shown in Fig. 15, then move carrier assembly sideways as required to obtain correct bevel gear backlash of 0.18-0.23 mm (0.007-0.009 inch) by loosening one adjuster ring one notch at a time and tightening opposite adjuster ring the same amount each time. When bevel gear backlash and differential carrier bearings are properly adjusted, install adjuster ring locks and tighten carrier bearing cap bolts to 163 N·m (120 ft.-lbs.) torque.

18. MAIN DRIVE SHAFT. Main drive shaft consists of a sliding yoke, drive shaft tube and two universal joints. To remove sliding yoke, mark its position for reassembly on correct splines, unscrew threaded cap and slide slip yoke off splines. Use conventional procedure to renew universal joints.

Install drive shaft with slip yoke at differential end and tighten bolts to 54 N·m (40 ft.-lbs.) torque.

19. R&R TRANSFER GEARBOX. Drain oil from transfer case and transmission. Capacity is approximately 42 L (44 quarts). Remove front drive shaft. Engage front-wheel drive, then remove output shaft flange retaining nut (20—Fig. 16). Remove platform or cab, if equipped, as outlined in paragraph 348 or 349. Remove fuel tanks. Disconnect selector cable from selector shaft (4). Remove left and right shift lever housings from transmission top cover. Remove bolts from transmission top cover, remove wedge and shims between top cover and clutch housing, and remove top cover using a suitable hoist. Remove bolt (37) and locknut (39), then slide coupler (38) connecting transfer gearbox input shaft to transmission bevel pinion shaft rearward. Remove selector cable bracket (44) and hydraulic pump inlet pipe connector. Support transfer gearbox with a hydraulic jack, then remove gearbox mouting bolts and lower gearbox from transmission housing.

When reinstalling, laminated gasket (1—Fig. 16) must be the same thickness as original gasket, or layers peeled off to allow coupler (38) to slide freely onto input shaft (12) and bevel pinion shaft. Tighten transfer gearbox mounting bolts to 165 N·m (120 ft.-lbs.) torque. Tighten output shaft flange nut (20) to a torque of 190 N·m (140 ft.-lbs.). Install transmission top cover with wedge and same thickness of shims that were removed. Tighten three middle ⅝ inch bolts securing rear axle housing to top cover to 205-245 N·m (150-180 ft.-lbs.) torque. Tighten re-



Fig. 14—View showing proper dial indicator position for setting pinion shaft bearing preload.

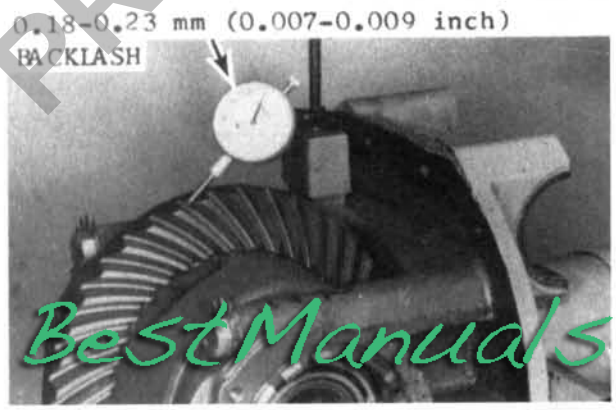


Fig. 15—View showing proper placement of dial indicator for setting backlash in front drive differentials.

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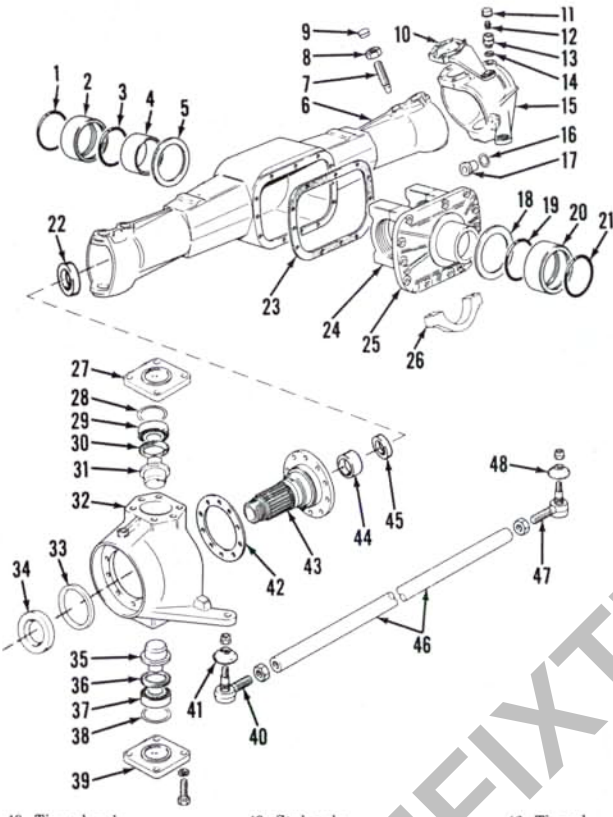


Fig. 17—Exploded view of Carraro front drive axle typical of AEl, AE2 and AE3 type axles showing component parts and their relative positions.

1. "O" ring
2. Bushing
3. "O" ring
4. Sleeve
5. Thrust washer
6. Axle case
7. Locating screw
8. Locknut
9. Dust cover
10. Steering lever
11. Cover
12. Breather
13. Retainer
14. Washer
15. Stub axle housing
16. Shims
17. Stop
18. Thrust washer
19. "O" ring
20. Bushing
21. "O" ring
22. Seal
23. Gasket
24. Differential carrier bearing cap
25. Differential carrier housing
26. Bushing cap
27. Bearing pin cover
28. Shim
29. Bearing
30. Seal
31. Bearing pin
32. Stub axle housing
33. Seal
34. Seal
35. Bearing pin
36. Seal
37. Bearing
38. Shim
39. Bearing pin cover
40. Tie rod end
41. Dirt seal
42. Gasket
43. Stub axle
44. Bushing
45. Stub axle seal
46. Tie rod
47. Tie rod end
48. Dirt seal

CARRARO AXLE

On tractors so equipped, a Carraro Type 790/19 mechanical front drive axle is used on Model 1394 with product identification number (P.I.N.) 11503001 and after, Model 1494 with P.I.N 11518001 and after and Model 1594 with P.I.N. 11221501 and after. A Carraro AE3 front drive axle is used on Model 1594 prior to P.I.N. 11221501 and all 1690 tractors so equipped. On all other models equipped with a Carraro mechanical front drive axle, either an AEl or an AE2 axle is used. Service procedures for AEl, AE2 and AE3 axles are the same.

All Models So Equipped

24. TIE RODS AND TOE-IN. Front wheel toe-in is measured from wheel rim to wheel rim at front and rear of wheels. Toe-in should be 0-5 mm (0-3/16 inch) on tractors with Type 709/19 axle. On all other tractors, toe-in should be 0-1.5 mm (0-1/16 inch). Toe-in is adjusted by lengthening or shortening the threaded tie rod ends equally.

Tie rod ends that are excessively worn must be renewed as complete units.

25. R&R AXLE ASSEMBLY. To remove front drive axle assembly, raise and support front of tractor. Remove drive shaft and disconnect all steering lines and cap openings. Mark positions of bushing caps (26—Fig. 17). Support axle assembly on floor jack and remove bushing caps. Raise front of tractor and remove axle assembly.

To reinstall, reverse removal procedure making certain bushing caps are reinstalled in their original positions. Tighten mounting bolts to 210 N·m (155 ft.-lbs.) torque. Bleed steering system as outlined in paragraph 59.

26. PIVOT BUSHINGS. To renew axle pivot bushings (2 and 20—Fig. 17), first remove axle as outlined in paragraph 25. On AEl, AE2 and AE3 axles, put marks (B—Fig. 18) on oil seal carrier and differential carrier so seal carrier can be reinstalled in original position. On all axles, put mark (A) on differential carrier and axle housing in line with hole in bushings prior to removing bushings. Remove oil seal carrier, then pry bushings from housings. Remove sleeve (4—Fig. 17) and thrust washers (5 and 18) as necessary.

Install new "O" rings in pivot bushings and lubricate with grease before reinstalling bushings. Make certain holes in bushings are aligned with marks made previously on case and carrier housing (Fig. 18). Install oil seal carrier aligning mark on carrier with mark on differential carrier.

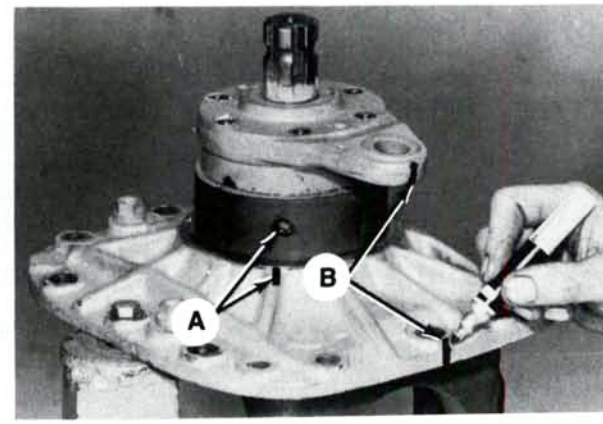


Fig. 18—Before disassembling differential carrier, place alignment marks (A and B) as shown for repositioning of bushings and oil seal carrier. On Type 709/19 axles, oil seal carrier (B) alignment is not required.

Models With AEl, AE2 or AE3 Carraro Axle

27. FINAL DRIVE AND STUB AXLE. Raise and support front of tractor, then remove tire and wheel. Rotate hub (4—Fig. 19) until drain plug (18) is at bottom, then drain oil from housing. Remove bolts retaining end plate (19) to hub (4) and install two guide studs opposite each other in hub. Remove end plate (19) with planetary gears. Remove snap ring (15) and sun gear (22). Support hub with a chain hoist. Remove locknut (23) and spacer (24). On Model 1690 and early Model 1594, remove and retain shims (25—Fig. 20). On all models, remove planetary ring gear and hub assembly.

To remove stub axle (43—Fig. 17) and pivot housing (32), remove felt seal (34) and oil seal (33). Loosen nuts securing stub axle to housing. Disconnect tie rod ends (40 and 47). Disconnect steering cylinder from right-hand steering arm. Remove bearing pin covers (27 and 39) and shims (28 and 38). Use special puller (CAS-1652) to remove bearing pins (31 and 35). Remove stub axle and housing assembly.

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Fig. 22—Proper tightening sequence used to install bearing pin cover prior to setting bearing pin preload.

removed during disassembly. Install washer (24) and locknut (23). Use special socket (CAS-1645) to tighten locknut to 1200 N·m (885 ft.-lbs.) torque. Install special fixture as shown in Fig. 23 on wheel hub, then use a torque wrench to measure amount of torque needed to turn wheel hub.

Correct bearing preload requires 2.3 N·m (20 in.-lbs.) torque to turn hub. Add or subtract from shim thickness (25—Fig. 20) until correct preload is obtained.

After preload is correctly adjusted, remove ring gear assembly and install oil seal and felt seal in hub. Reinstall ring gear with correct amount of shims and tighten locknut to 1200 N·m (885 ft.-lbs.) torque.

30. PLANETARY GEARS. Drain oil from hub, then remove planetary gear carrier (19—Fig. 19 or 18—Fig. 20). Mark location of planetary gear pins and gears in the carrier so they can be reassembled in their original positions. Remove roll pins (14), then drive planetary gear pins outward from gear carrier. Cup plugs (16—Fig. 19 or 15—Fig. 20) will be driven out with pins. Remove gears, thrust washers, spacers and bearing rollers. Keep these parts with their respective gear pins.

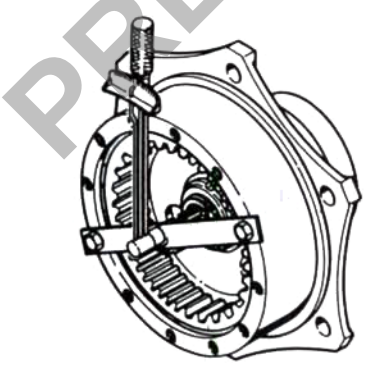


Fig. 23—When setting wheel hub bearing preload on Models 1594 and 1690, use special fixture and a torque wrench to check torque required to turn wheel hub.

Reassemble by reversing disassembly procedure. Apply sealant to cup plugs before installation. Make certain that notch in carrier gasket and drain hole in carrier is aligned with notch in wheel hub. Tighten retaining bolts to 80 N·m (60 ft.-lbs.) torque. Fill hub to correct level with Case FDL SAE 90 gear lubricant or equivalent.

31. AXLE SHAFTS. Axle halfshafts (7 and 12—Fig. 24), bearing (6) and oil seal (4) can be renewed with axle housing in place. Refer to paragraph 27 for removal of final drive, swivel housing and stub axle. Loosen bearing lock screws (3), then pull axle shaft from housing using a suitable slide hammer puller. Use a puller to remove oil seal from housing.

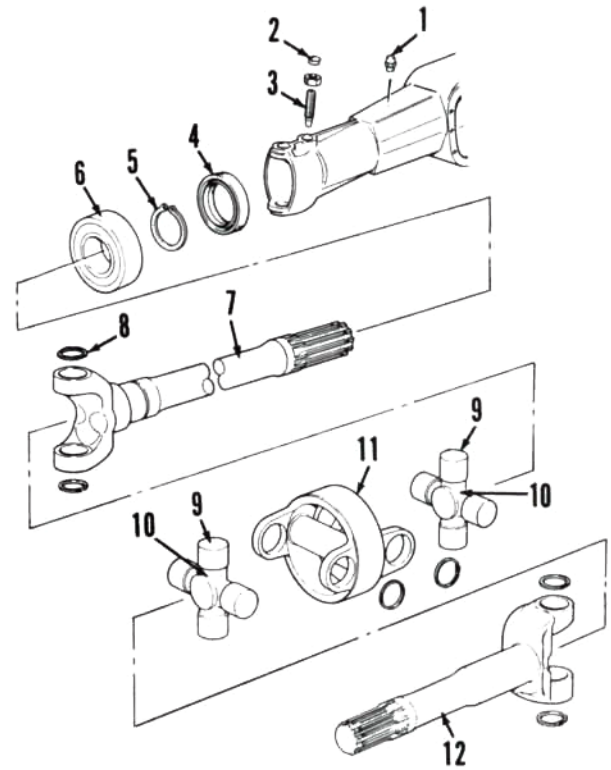


Fig. 24—Exploded view of typical front axle shafts used AEI, AE2 and AE3 Carraro axles.

1. Breather
2. Dust plug
3. Bearing lock screw
4. Oil seal
5. Snap ring
6. Bearing
7. Long shaft
8. Snap ring
9. Bearing cup
10. Cross
11. Housing
12. Short shaft

Install new oil seal with lip facing inward. Lubricate seal lip before installing axle shaft. Be sure bearing is seated in housing bore, then tighten upper and lower bearing lock screws (3) to secure bearing.

32. R&R DIFFERENTIAL. To remove front drive differential assembly, it is first necessary to remove final drives and stub shafts as outlined in paragraph 27. Remove axle shafts as outlined in paragraph 31. Remove axle housing as outlined in paragraph 25. Remove differential carrier mounting bolts and remove differential assembly from housing.

To reinstall differential, reverse the removal procedure. Tighten differential carrier retaining bolts to 87 N·m (65 ft.-lbs.) torque. Fill axle housing to correct level with Case FDL SAE 90 gear lubricant or equivalent.

33. OVERHAUL DIFFERENTIAL. Place differential unit in a stand with pinion shaft pointing downward. Mark bearing caps and carrier housing so caps can be reinstalled in their original positions. Remove bearing caps and bearing adjuster rings (8 and 35—Fig. 25). Remove bevel ring gear and differential assembly from carrier housing.

Mark position of oil seal carrier as shown in Fig. 18, then remove carrier. Using special spanner wrench (CAS-1597), remove pinion shaft locknut

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Remove main drive shaft. Disconnect selector cable from selector arm (23—Fig. 42). Remove mounting bolts and lower gearbox from transmission case.

To disassemble, remove selector shaft (1) and forks (3). Remove front and rear covers (21 and 18). Drive output shaft (10) out of housing and withdraw drive gear (17) and sliding clutch assembly.

Inspect parts and renew if necessary. Renew oil seal (20) in front cover.

To reassemble, reverse the disassembly procedure.

MANUAL STEERING GEAR

Model 1190 may be equipped with manual steering utilizing a recirculating ball type steering box bolted to the gearbox cover.

REMOVE AND REINSTALL

Model 1190

50. To remove steering gear unit, remove steering wheel (4—Fig. 43) and dust seal (5). Disconnect controls and wiring to instrument panel. Remove drop arm (13—Fig. 44) and unbolt and remove instrument panel as a unit. Unbolt and remove steering gear assembly from transmission noting spacer (6, 7 and 24—Fig. 44) placement.

Reinstall by reversing removal procedure.

STEERING GEAR AND COLUMN OVERHAUL

Model 1190

51. DISASSEMBLY. With steering gear and steering wheel removed, remove locknut (6—Fig. 43) and unscrew adjustable bearing cone (7). Remove the 12 loose bearing balls (9). Remove both ball nut pegs (17 and 22—Fig. 44) and shims (18 and 21), then withdraw steering shaft (19—Fig. 43) and ball nut assembly (16) from bottom of unit. Lower bearing race (10) and spherical seat (11) can now be removed from steering column (14) and rubber baffle (12) from steering shaft (19). Unscrew ball nut assembly (16) from steering shaft (19) and retrieve the 28 loose steel balls (17). Remove locating screw (20—Fig. 44) and withdraw cross-shaft (15).

If cross-shaft bushings (1 and 25—Fig. 44) are to be renewed, note size and location before removal for proper in-

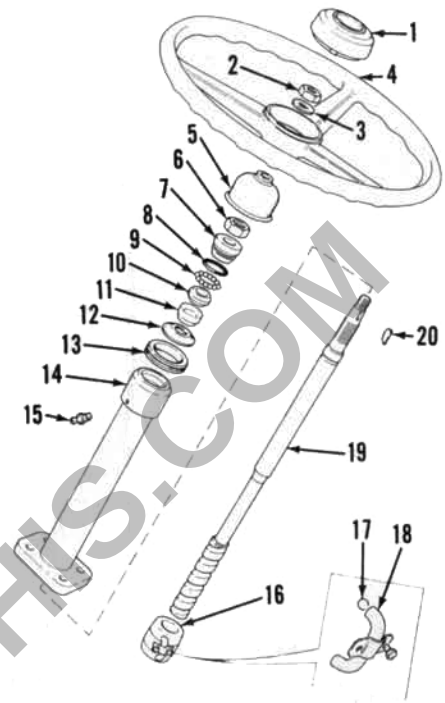


Fig. 43—Exploded view of steering column and related parts for 1190 models equipped with manual steering.

1. Cap
2. Nut
3. Washer
4. Steering wheel
5. Dust seal
6. Locknut
7. Adjustable bearing cone
8. "O" ring
9. Steel balls
10. Lower bearing race
11. Spherical seat
12. Rubber baffle
13. Grommet
14. Steering column
15. Grease zerk
16. Steering nut
17. Steel ball
18. Transfer tube
19. Steering shaft
20. Woodruff key

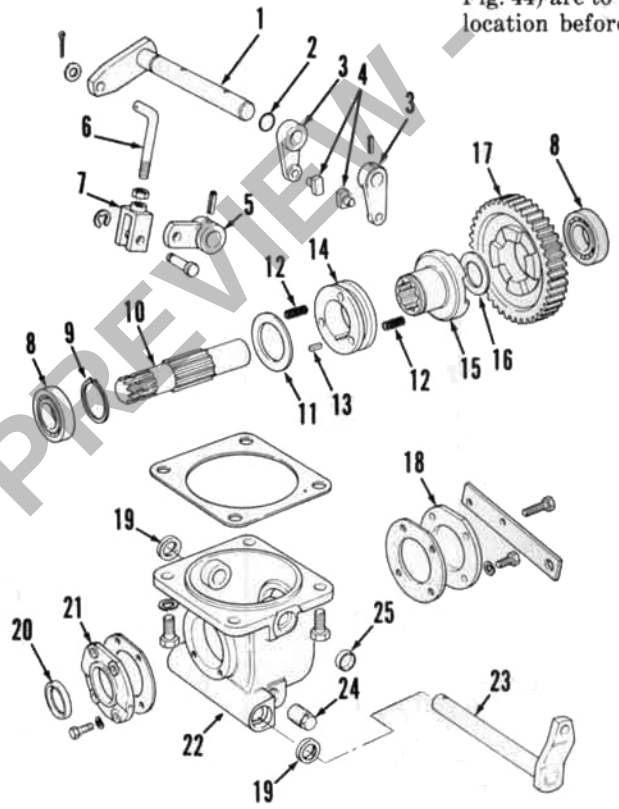


Fig. 42—Exploded view of transfer gearbox used on models with powershift transmission and Carraro front drive axle. Note that selector linkage is slightly different on 1594 models.

1. Selector shaft
2. "O" ring
3. Selector arms
4. Trunnion pins
5. Selector lever
6. Link
7. Clevis
8. Bearing
9. Snap ring
10. Output shaft
11. Thrust washer
12. Springs
13. Key
14. Clutch sleeve
15. Sliding clutch
16. Thrust washer
17. Drive gear
18. Rear cover
19. Oil seals
20. Oil seal
21. Front cover
22. Housing
23. Selector shaft
24. Drain plug
25. Plug

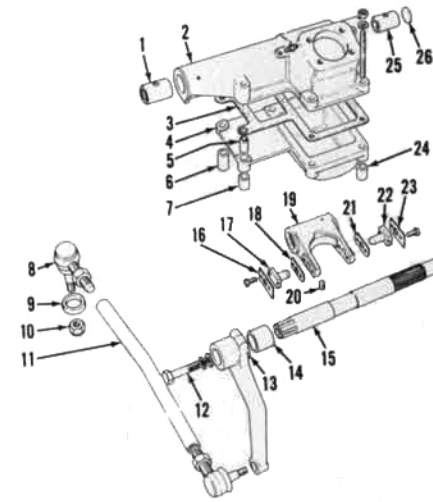


Fig. 44—Exploded view of steering box and its related parts used on 1190 models with manual steering.

1. Bushing (long)
2. Steering box
3. Gasket
4. Sump
5. Dowel
6. Spacer
7. Spacer
8. Drag link end
9. Dust shield
10. Nut
11. Drag link tube
12. Bolt
13. Drop arm
14. Dust shield
15. Cross-shaft
16. Tab washer
17. Ball nut peg
18. Shim
19. Rocker arm
20. Locating screw
21. Shim
22. Ball nut peg
23. Tab washer
24. Spacer
25. Bushing (short)
26. Core plug

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CONDENSED SERVICE DATA CONT.

	MODELS				
	1190	1290	1390	1490	1690
CAPACITIES (Cont.)					
Final Drive (Each)	2.3 liters (2.5 U.S. qts.)			6.8 liters (7 U.S. qts.)	7.5 liters (8 U.S. qts.)
Fluid Type	Case ET HB Fluid				
Power Steering	0.9 liters (1 U.S. qt.)	1.25 liters (1.5 U.S. qts.)			
Fluid Type	Case TCH Fluid				
Manual Steering Gear	1.2 liters (1.3 U.S. qts.)	....	....	....	....
Fluid Type	Case FDL SAE 140	....	....	....	....
Front Drive Axle Differential—					
David Brown	....	8 liters (8.5 U.S. qts.)			....
Fluid Type	....	Case FDL SAE 90			....
Carraro	....	....	....	4 liters (4.25 U.S. qts.)	
Fluid Type	....	....	....	Case FDL SAE 90	
Front Drive Axle Final Drive (Each)—					
David Brown	....	0.9 liters (1 U.S. qt.)			....
Fluid Type	....	Case FDL SAE 90			....
Carraro	....	....	....	1.4 liters (1.5 U.S. qts.)	
Fluid Type	....	....	....	Case FDL SAE 90	

	MODELS				
	1194	1294	1394	1494	1594
GENERAL					
Engine Make	Own				
No. of Cylinders	3	4	4	4	6
Bore	100 mm (3.939 in.)				
Stroke	114.3 mm (4.5 in.)				
Displacement	2.7 liter (164 cu. in.)	3.6 liter (219 cu. in.)			5.4 liter (329 cu. in.)
Compression Ratio	17:1	17:1	16:1		
Battery	12 volts, Negative Ground				
No. of Forward Speeds	12				
TUNE-UP					
Firing Order	1-2-3	1-2-4-3			1-5-3-6-2-4
Valve Clearance (Cold)	0.25 mm (0.010 in.)				
Injection Timing	16° BTDC	17° BTDC	17° BTDC	20° BTDC	25° BTDC
Engine Low Idle Rpm	750	600-650			
Engine High Idle (No-Load) Rpm	2350-2375				2450
Engine Full Load Rpm	2200				2300
Power Rating	35 kW (49 hp)	45 kW (62 hp)	53 kW (77 hp)	61 kW (85 hp)	72 kW (97 hp)

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rod. Remove and discard all "O" rings, backup rings and seals.

Cylinder tube must be smooth and free of score marks. Piston and piston rod must be free of nicks or burrs. Slight blemishes may be removed using fine emery cloth lubricated with kerosene.

Soak backup rings in clean hydraulic oil for a minimum of 30 minutes prior to assembly. Lubricate all parts during assembly. Refer to Fig. 64 for correct placement of backup rings and "O" rings. Assemble oil seal, backup rings and "O" rings in sleeves as shown in Fig. 65. Install sleeves and piston and rod assembly into cylinder and secure with two snap rings in each end.

Install tie rod ends on each end of piston rod. Adjust one of the ends so distance from center of ball socket to end of cylinder rod is 41.3-42.9 mm (1⅝ to 1 11/16 inches), measured as shown in Fig. 66. Then adjust the other tie rod end so distance from center of one ball socket to center of the other ball socket is 727-730 mm (28⅝ to 28¾ inches). Tighten locknuts when adjustment is complete. Make certain tops of ball sockets are aligned with air bleed screws on cylinder as shown in Fig. 66.

Reinstall cylinder and tighten cylinder cap mounting bolts to 68 N·m (50 ft.-lbs.) torque. Bleed air from system as outlined in paragraph 58.

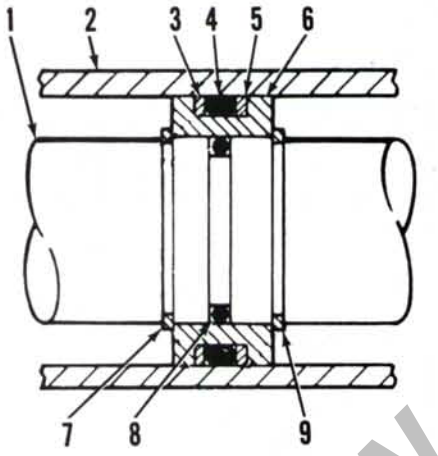


Fig. 64—Diagram showing correct placement of "O" rings and backup rings on piston and rod of steering cylinder used on David Brown front drive axles.

1. Piston rod
2. Cylinder tube
3. Backup ring
4. "O" ring
5. Backup ring
6. Piston
7. Snap ring
8. "O" ring
9. Snap ring

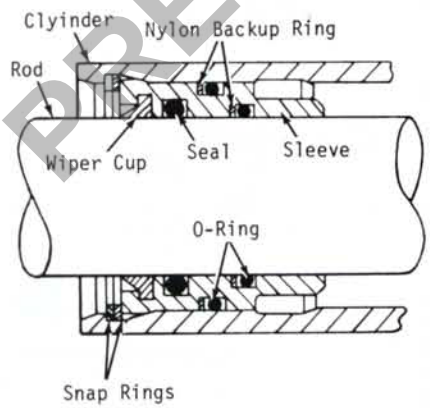


Fig. 65—Diagram showing correct placement of "O" rings and backup rings on sleeves of steering cylinder used on David Brown front drive axle.

Models 1294-1490-1690 and Early Models 1394-1494-1594 With Carraro Axle

73. OVERHAUL. Clear cylinder of oil as necessary by moving piston rod through its complete stroke. Unscrew end cap (8—Fig. 67) and pull piston rod (1) and piston (4) out of cylinder body (12). Remove retaining nut (2), washer (3), piston assembly (4), "O" ring (5) and washer (6). Slide end cap (8) off of piston rod (1), then remove "O" ring (7) and seals (9 and 10).

Clean and inspect all parts. Cylinder body must be smooth and free of score marks. Piston and piston rod must be free of nicks and burrs. Slight blemishes may be removed using fine emery cloth lubricated with kerosene, but all parts must be thoroughly cleaned before reassembly.

Lubricate all parts during assembly, install thick washer (6) and a new "O" ring (5) on piston rod. Install piston (4) with chamfered side towards end cap. Install thin washer (3) and a new nut (2). Tighten nut to 80 N·m (60 ft.-lbs.) torque. Install end cover and piston rod assembly into cylinder. Turn cylinder into end cap and align oil ports.

Reinstall cylinder and tighten retaining nuts to 353 N·m (260 ft.-lbs.) Bleed air from system as outlined in paragraph 59.

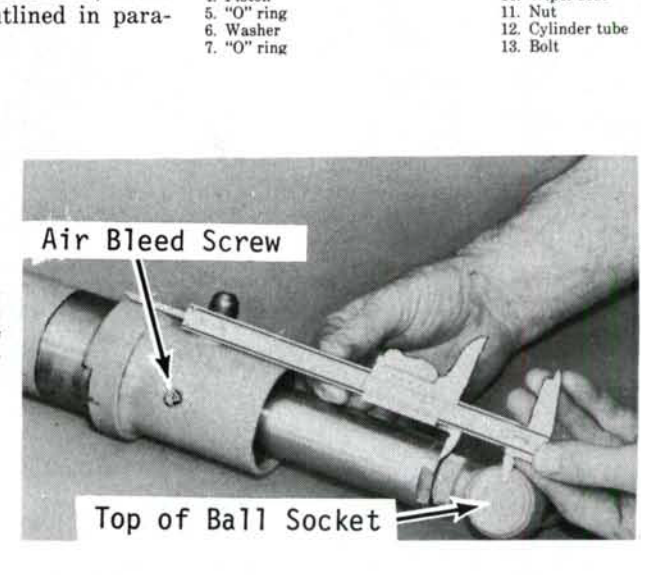


Fig. 66—Tie rod ends must be adjusted to obtain correct distance between centers of ball sockets. Refer to text for details.

Late Models 1394-1494-1594 With Carraro Axle

74. OVERHAUL. Clear cylinder of oil as necessary by moving piston rod through its complete stroke. Remove outer retaining ring (11—Fig. 69). Push end cap (7) inward to clear inner retaining ring (10). Insert a small diameter rod through hole in side of cylinder to disengage inner retaining ring from its groove, then pry inner retaining ring out using a small screwdriver or similar tool. Pull piston rod assembly and end cap from cylinder. Remove piston nut (3) and separate piston and end cap from piston rod.

Cylinder bore, piston and piston rod must be free of score marks, nicks and

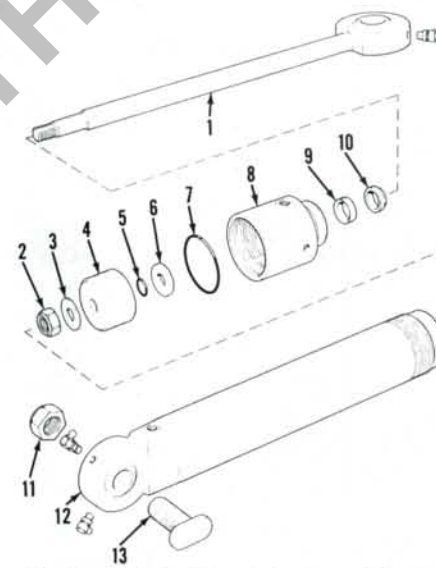


Fig. 67—Exploded view of steering cylinder used on 1490 models, some 1690 models and early 1394, 1494 and 1594 models equipped with Carraro front drive axle.

1. Piston rod
2. Nut
3. Washer
4. Piston
5. "O" ring
6. Washer
7. "O" ring
8. End cap
9. Seal
10. Wiper seal
11. Nut
12. Cylinder tube
13. Bolt

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184. INSULATED BRUSH BOX TEST. Two of the brush boxes on brush holder assembly must be insulated from the assembly itself. Connect a 110 volt, 15 watt, AC current test light as shown in Fig. 142 and touch test light lead to each insulated brush holder in turn. If test light comes on, insulation between brush box and brush holder assembly is faulty and brush holder assembly must be renewed.

185. REASSEMBLY. Reassemble by reversing disassembly procedure. Make certain slots in brake shoes align with cross pin in armature shaft.

Armature end play must be 0.13-0.63 mm (0.005-0.025 inch) and is controlled by thickness of shims (16—Fig. 139) between intermediate support and armature core.

Pinion clearance is set by connecting a 6 volt battery to solenoid on assembled starter to activate solenoid. Push back lightly on starter drive clutch (1—Fig. 143) to remove any free play. Measure with a feeler gage as shown in Fig. 143. Turn pivot bolt (1—Fig. 139) to adjust clearance and when set, lock pivot bolt in place with locknut. Standard-duty starter pinion clearance must be 0.13-0.38 mm (0.005-0.015 inch) and heavy-duty starter pinion clearance is 0.13-1.14 mm (0.005-0.045 inch).

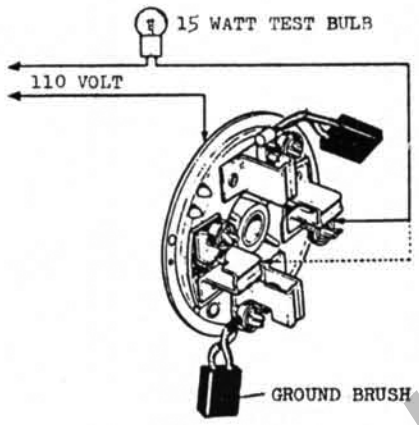


Fig. 142—Check both insulated brush holders as outlined in paragraph 184.

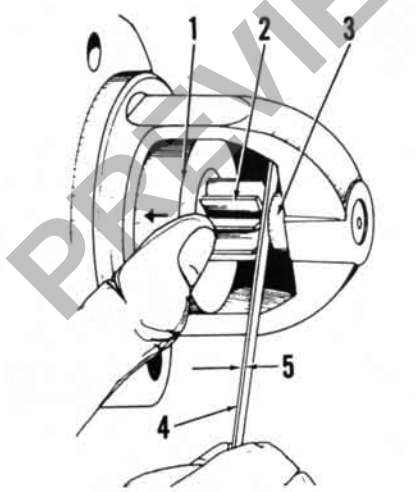


Fig. 143—Measure pinion clearance with a feeler gage as shown. Refer to paragraph 185 for specifications.

1. Starter drive clutch
2. Starter drive
3. Thrust collar
4. Feeler gage
5. Clearance

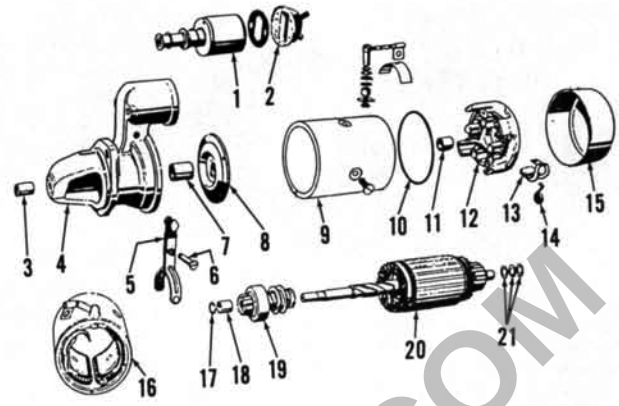


Fig. 144—Exploded view of Bosch starter showing component parts and their relative positions.

1. Solenoid
2. End cap
3. Bushing
4. Drive housing
5. Link
6. Pivot pin
7. Bushing
8. Intermediate support
9. Field housing
10. Sealing ring
11. Bushing
12. Brush holder
13. Brush
14. Brush spring
15. End cover
16. Field coil
17. Snap ring
18. Bushing
19. Starter drive
20. Armature
21. Shims

Bosch Starter

186. DISASSEMBLY. Remove solenoid assembly (1—Fig. 144 and pivot pin (6). Remove through-bolts and end cover (15). Lift brushes (13) from brush boxes and remove brush holder assembly and note number and thickness of shims (21). Remove field housing (9) and drive housing (4). Remove starter drive (19) and intermediate support (8). Inspect bushings (3, 7, 11 and 18) for excessive wear or damage. Renew as required. Soak new bushings in oil for 24 hours prior to installation. Inspect brushes and springs and renew if excessively worn or damaged.

187. ARMATURE. Inspect armature commutator for wear, roughness or pitting. Light sanding with nonconductive emery cloth to clean and smooth surface is permissible. Check insulation as outlined in paragraph 182.

188. FIELD COIL. Inspect field coil for overheating and burnt insulating wrap. Test as outlined in paragraph 183.

189. INSULATED BRUSH BOX TEST. Locate the two insulated brush boxes on brush holder assembly and test as outlined in paragraph 184.

190. REASSEMBLY. Reassemble by reversing disassembly procedure. Install shims (21—Fig. 144) to original thickness noted during disassembly.

SOLENOID

All Models

191. Solenoids differ slightly in appearance but basic construction and operating principles are the same. When electrical current is applied to start terminal, it energizes closing coils. This pulls plunger in which energizes hold in coil and maintains starter drive engagement. If solenoid fails to hold starter drive in engaged position, hold in coil circuit of solenoid is faulty.

All models have serviceable end caps and service kits include new terminals, insulating and sealing washers and nuts, washers and contact strips. If an excessive voltage drop between solenoid and starter is apparent, contact surfaces in end cap should be cleaned or renewed.

WIRING

All Models

192. When a problem is suspected in wiring harness, follow an orderly, step by step check of the problem circuit. Always check protective circuits (fuses, circuit breakers and diodes) first, then locate the primary point of current supply for circuit in question. Using a 12 volt test light or voltmeter, check for adequate voltage at this point. If voltage is present at this point, continue to check for voltage at appropriate connections along harness working towards unit malfunctioning until problem area is isolated. Harness connectors (plugs), sockets and connection terminals being corroded, loose or broken are most often the cause for interruptions in power supply.

If voltage was not present at primary point of current supply, check wiring moving toward battery until interruption of current is isolated. Repair as needed.

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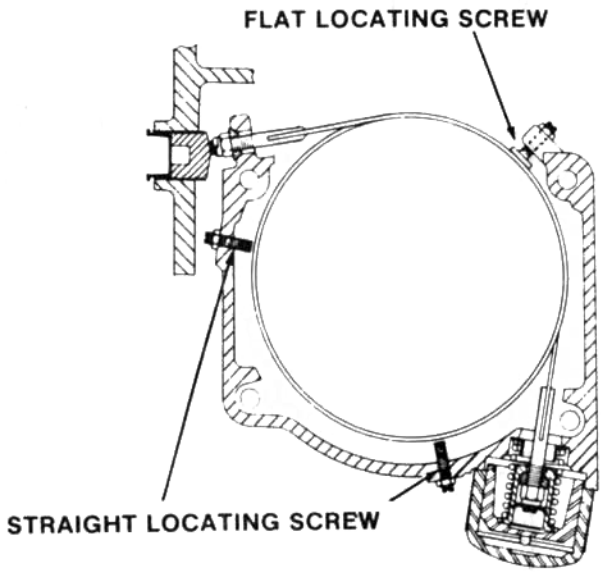


Fig. 203—View of front planetary brake band and housing showing correct position of the three locating screws.

clockwise during installation. Install front brake band.

Install front cover and tighten mounting bolts to 20 N·m (15 ft.-lbs.) torque. Install new "O" rings (21—Fig. 196) on support sleeve (25) and tube (20). Position support tube (20) on front cover so oil hole in tube is towards bottom of power shift housing and tighten mounting bolts to 12 N·m (9 ft.-lbs.) torque.

Install brake band springs and adjusting nuts. Tighten adjusting nut on spring end of band until spring length is 33.33 mm (1 5/16 inches) if new bands were installed, or 35 mm (1 3/8 inches) if old bands are being reused. Install brake piston and cylinder and tighten mounting bolts to 23-28 N·m (17-20 ft.-lbs.) torque. Connect brake hydraulic lines. Turn brake band locating screws clockwise until they contact brake bands, then turn rear band locating screws counterclockwise ½ turn and turn front band locating screws counterclockwise ¾ turn. Tighten locknuts to secure locating screw adjustment.

Final planetary brake band adjustment must be made with tractor running as outlined in paragraph 265.

265. PLANETARY BRAKE BAND ADJUSTMENT. Planetary brake bands provide braking on overrun, and wear will be indicated by delay in shifting down or failure to hold in gear. Brake bands may be adjusted if not worn beyond limits of adjustment.

Transmission fluid must be at normal operating temperature. Remove plugs from right side of transmission cover. Remove test port plug from power shift control valve and install gage manifold (CAS-1242) with a 0-700 kPa (0-100 psi) gage in control valve test port. See Fig. 205.

266. FRONT BRAKE BAND. Start engine, put range selector in neutral and put power shift in fourth. Adjust engine speed until pressure gage reads 515 kPa (75 psi). Tighten brake band adjusting nut (3—Fig. 205) until engine speed drops 25 rpm. Depress clutch pedal, then loosen adjusting nut four turns.

Apply sealer to threads of plug which covers adjusting nut. Install plug and tighten until it contacts end of brake band, then loosen plug ¼ turn.

267. REAR BRAKE BAND. Remove jam nut, adjusting screw (1—Fig. 206) and plug (2) from left side of transmission cover to gain access to rear brake band adjusting nut. Start engine, put range selector in neutral and put power shift in fourth. Increase engine speed until pressure gage (1—Fig. 205) reading reaches 515 kPa (75 psi). Turn brake band adjusting nut clockwise until engine speed drops 25 rpm. Depress clutch pedal, then turn adjusting nut counterclockwise four turns.

Apply sealer to threads of plug, then install plug. Install adjusting screw in plug and tighten screw until it contacts end of brake band, then loosen ½ turn. Tighten jam nut.

Remove pressure gage and manifold. Install test port plug into control valve. Install plugs in transmission cover.

RANGE GEARBOX

All Power Shift Models

268. DISASSEMBLY. Power shift transmission incorporates a three-speed range gearbox located directly behind the power shift unit. Except for removal of bevel pinion shaft (19—Fig.



Fig. 204—Install sprag clutch into carrier housing with wide edge facing inward as shown.

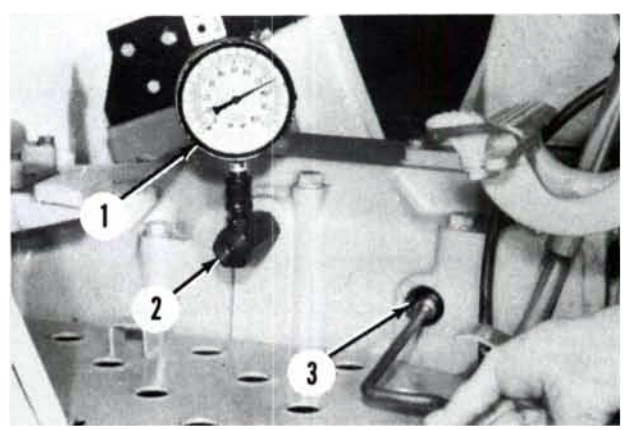


Fig. 205—View showing installation of pressure gage (1) using adapter CAS-1242 (2) in control valve test port for adjusting planetary brake bands. Adjustment screw (3) for front brake band is shown.

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