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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CONDENSED SERVICE DATA

	Models			
	2090, 2094	2290, 2294	2390, 2394	2590, 2594
GENERAL				
Engine Make	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)

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Power to operate transmission system is provided by the main hydraulic system 23 gpm (88 L/min.) pump on Models 2090 and 2290 or 27 gpm (102 L/min.) pump on Models 2390 and 2590, through a pto and clutch flow divider valve while pressure lubrication is supplied by oil from the charging pump.

Refer to Figs. 118 and 119 for a pictorial schematic of the hydraulic system and power shift control valve.

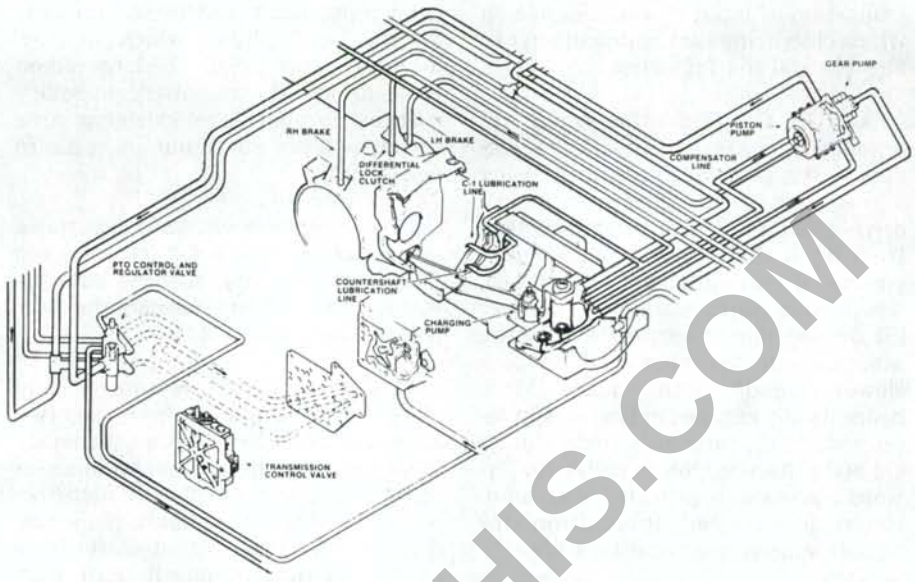


Fig. 118—Schematic illustration of hydraulic circuits to power shift unit on Model 2090 and 2290 tractors so equipped.

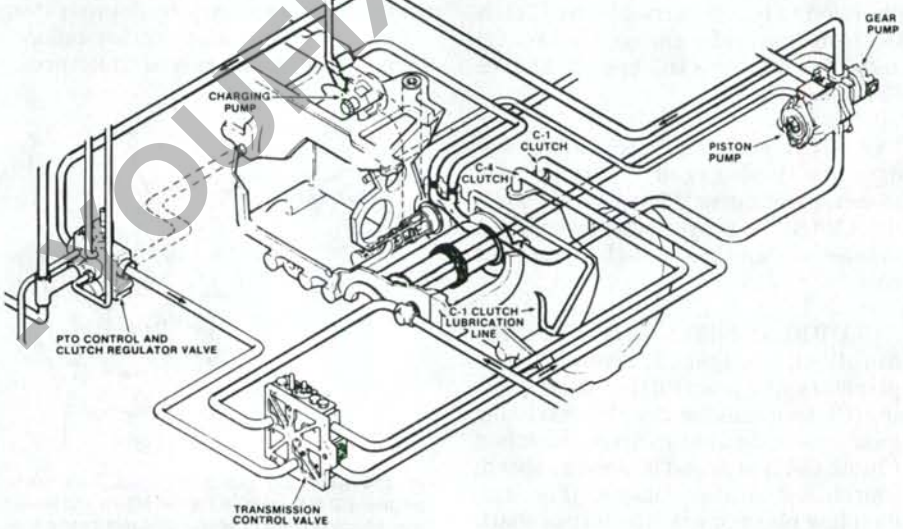


Fig. 119—Schematic illustration of hydraulic circuits to power shift unit on Model 2390 and 2590 tractors.

Power Shift Models 2094, 2294, 2394 and 2594

122. POWER TRAIN. The power shift unit is an electric solenoid actuated and hydraulic operated planetary gear unit shown in Figs. 120 and 121.

Control units consist of four clutches on the three-speed and six clutches on the six-speed unit. Clutches (C-1, C-2, C-3 and C-4) operate the same as clutches outlined in paragraph 120. Clutches (C-5 and C-6—Fig. 121) are the High/Low unit. During operation, one of these clutches is always applied. Refer to Figs. 122 and 123 for charts showing which clutches are applied for each speed.

The input shaft is driven by the torque limiter discs on the flywheel. The output shaft speed and direction of rotation depends on which clutches are applied.

Power to the pto clutch and hydraulic pumps is transmitted through two long shafts which pass through center of the drive train. The front shaft is splined to the flywheel by a drive sleeve. The two shafts couple at the hydraulic pump drive. Rear shaft drives the pto clutch.

The power shift unit is designed to permit selection of any of the forward speeds by moving the power shift lever without stopping the tractor. To shift to reverse, it is necessary to depress the inching pedal, stop tractor and move reverse lockout lever, before the power shift lever can be moved to reverse position. This prevents accidental overshifting into reverse when downshifting in the forward gears. The inching pedal is also depressed to shift the mechanical range shift lever to any of the four speed ranges or to neutral or park. When inching pedal is depressed, power shift selector lever is automatically moved to first speed position so that tractor always starts out in lowest power shift speed after selecting a mechanical transmission gear. When mechanical (gear) transmission is in fourth gear, power shift cannot be shifted to reverse or if power shift is in reverse, gear transmission cannot be shifted to fourth gear.

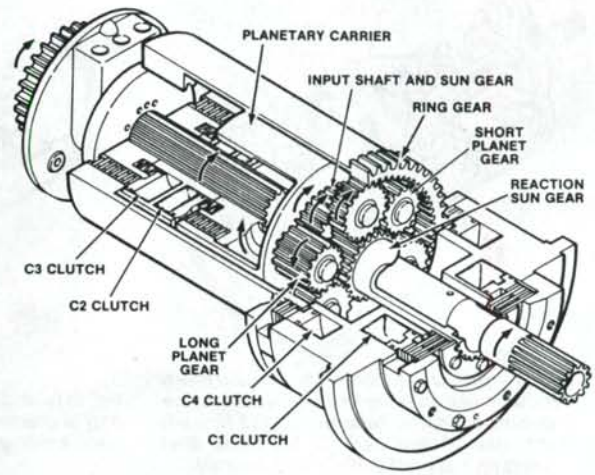


Fig. 120—Cutaway view of the three-speed power shift unit used on Models 2094, 2294, 2394 and 2594, showing relative location of major component parts.

123. CONTROL SYSTEM. The speed selector switch is mechanically operated

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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 ¼ 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).

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 mounting 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.

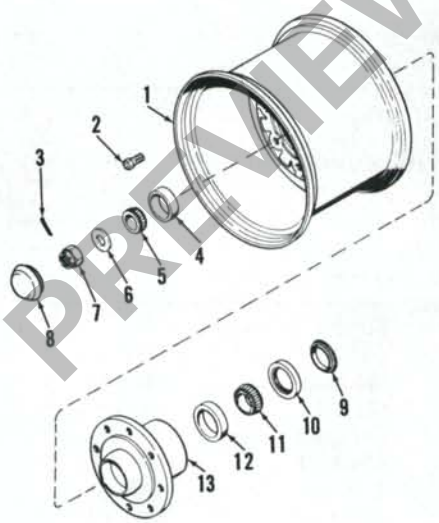


Fig. 1—Exploded view of wheel hub and bearing assembly used on all models.

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

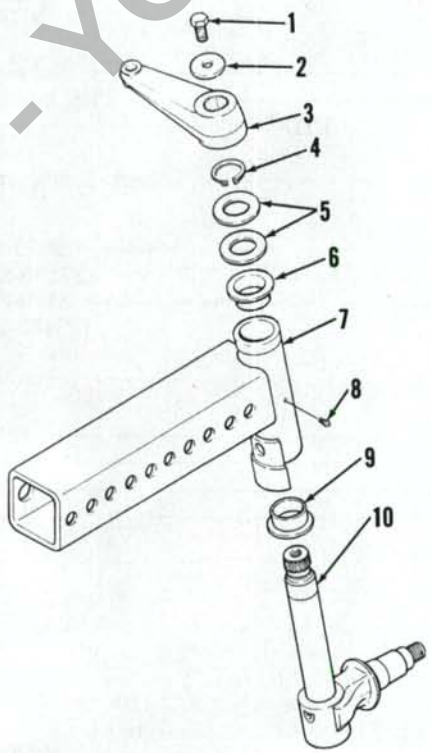


Fig. 2—Exploded view of steering spindle assembly typical of all models.

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

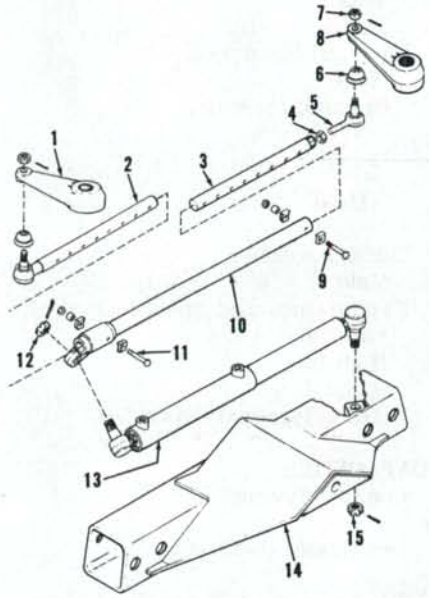


Fig. 3—Exploded view of steering tie rod, cylinder, and arms typical of all models. (Standard wheel base axle shown.)

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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bolts to 380-456 ft.-lbs. (515-618 N · m) torque. Refer to Fig. 40 for identification and location of bolts. Tighten the front 5/8 inch side rail cap screws to a torque of 150-180 ft.-lbs. (203-244 N · m). Tighten the rear 3/4 inch side rail cap screws to 380-456 ft.-lbs. (515-618 N · m) torque after making sure the rear three screws on each side are coated with a good sealant, since they enter the torque tube.

The balance of installation is the reverse of removal procedure. Refer to paragraph 73 for diesel fuel system bleeding and paragraph 25 to bleed power steering system.

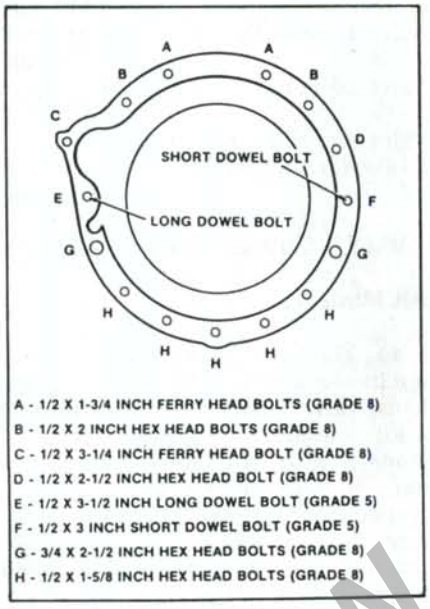


Fig. 40—View showing location and description of bolts used to secure torque tube to engine.

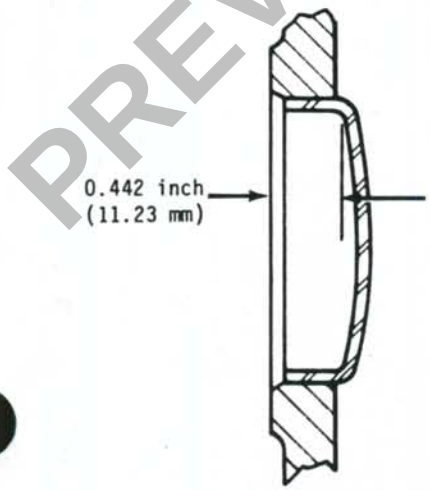


Fig. 41—Illustration showing correct installation depth of end expansion plugs in cylinder head.

CYLINDER HEADS

All Models

43. REMOVE AND REINSTALL. To remove any cylinder head, first drain cooling system and remove hood. Remove muffler, air filter assembly and breather tube. If so equipped, loosen clamp on intake elbow from turbocharger. Disconnect ether start tube (if so equipped) from intake manifold. Remove hood release mounting bracket, then remove intake manifold and gaskets. If so equipped, disconnect and remove turbocharger oil supply tube, exhaust elbow, seal ring and oil drain tube. Remove exhaust manifold heat shield and exhaust manifold with turbocharger, if so equipped. Remove exhaust manifold gaskets. Remove upper radiator hose and loosen water pump to manifold hose. Disconnect water temperature gage wire from sending unit and loosen rear clamp on cab heater hose. Remove water manifold and manifold gaskets. Remove fuel injectors and gaskets.

Remove rocker arm covers, rocker arms and push rods. Remove retaining bolts and lift cylinder head or heads from engine.

Check cylinder head for warpage using a straightedge and feeler gage. If measurement exceeds 0.005 inch (0.127 mm) in six positions, cylinder head must be machined or renewed. Renew cylinder head if head height is less than 4.080 inches (103.632 mm) after machining.

NOTE: After cylinder head is resurfaced, check the valve head recession specifications outlined in paragraph 45. Correct as necessary.

If expansion plugs are to be renewed, install end plugs to depth shown in Fig. 41, and install top plugs to depth shown in Fig. 42.

Head gaskets are equipped with an integral fire ring for each cylinder, which will compress to the necessary thickness required to seal each individual sleeve to cylinder head.

On all models, head gaskets have two smaller (guide) bolt holes for alignment purposes and aligning dowels are recommended for gasket installation as shown in Fig. 43. Dowels are available from Case as part No. CAS-1062A. Removal tong is Case part No. CAS-1061-2. Use tong to remove dowels after head is partially installed. Install gasket dry. Clean injector bores before installing head.

Install cylinder head bolts finger tight, then install intake manifolds, exhaust manifolds and water manifolds using new gaskets, tighten retaining cap screws finger tight and make sure heads are correctly aligned. Tighten cylinder head cap screws in three stages to 70, 140 and 210 ft.-lbs. (95, 190 and 285 N · m) using the sequence shown in Fig. 44.

When installing rocker arms, a clearance of 0.010-0.030 inch (0.254-0.762 mm) must be maintained at each end of the shaft. Clearance can be varied if necessary, by shifting rocker shaft brackets, or by adding or removing spacer washers. Adjust valve tappet gap as outlined in paragraph 44 after tractor is assembled.

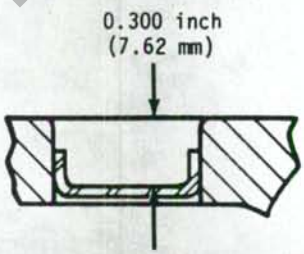


Fig. 42—Illustration showing correct installation depth of top expansion plugs in cylinder head.

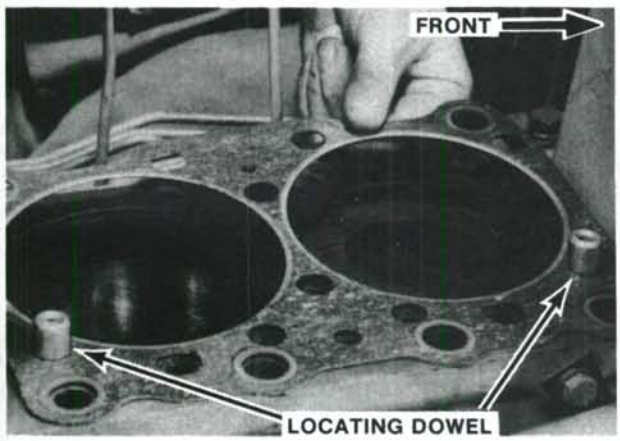


Fig. 43—Install dowel guides in the positions shown to position head gasket.

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POWER STEERING SYSTEM

All models are equipped with hydrostatic power steering using a Ross steering unit and an 8 gpm (30.3 L/min.) gear type hydraulic pump as the power source. One double acting cylinder (standard or ZF front drive axles) or two double acting cylinders (Carraro front drive axle) are used.

FLUID AND BLEEDING

All Models

25. The transmission and hydraulic system fluid is used in the power steering system. A dipstick located at the left rear of the tractor rear housing indicates fluid level. Use Hy-Tran Plus fluid in all models. Refer to CONDENSED SERVICE DATA tables for reservoir capacity and to HYDRAULIC SYSTEM SECTION for additional hydraulic system information.

Steering hydraulic circuit is combined with brake circuit and dual filter unit is located on right front side of transmission housing on Models 2090, 2290, 2094 and 2294 and at bottom front of transmission housing on Models 2390, 2590, 2394 and 2594. See Figs. 26 and 27 for exploded view of filter assemblies. Tractors are provided with a dash-mounted warning light, and filter elements should be renewed after first 20 hours of operation and when TRANS FILTER warning light flashes. Filters should be 10 to 12 micron rating. Relief valves (4—Fig. 26 and 27) should be tightened finger tight plus ¼ turn on all models. Wing nut (1—Fig. 27) should be tightened finger tight plus ¼ turn on Models 2390, 2590, 2394 and 2594. Filter cover bolts should be tightened to 35-42 ft.-lbs. (48-57 N · m) torque on all models.

To bleed the steering hydraulic system, run engine at half throttle and turn steering wheel from lock to lock several times until steering action is firm. Brake hydraulic system should also be bled as outlined in paragraph 185.

TROUBLESHOOTING

All Models

26. The following table lists some of the troubles which may occur in the operation of the power steering system.

1. No power steering or steers slowly.
   a. Binding mechanical linkage.
   b. Excessive load on front wheels and/or air pressure low in front tires.
   c. Steering cylinder piston seal faulty or cylinder damaged.
   d. Faulty power steering supply pump.
2. Will not steer manually.
   a. Binding mechanical linkage.
   b. Excessive load on front wheels and/or air pressure low in front tires.
   c. Pumping element in hand pump faulty.
   d. Faulty seal on steering cylinder or cylinder damaged.
3. Hard steering through complete cycle.
   a. Low pressure from supply pump.
   b. Internal or external leakage.
   c. Faulty steering cylinder.
   d. Binding mechanical linkage.
   e. Excessive load on front wheels and/or air pressure low in front tires.
   f. Cold hydraulic fluid.
4. Momentary hard or lumpy steering.
   a. Air in power steering circuit.

SYSTEM OPERATING PRESSURE AND RELIEF VALVE

All Models

27. The power steering operating pressure is controlled by a relief valve contained in brake valve housing. Relief pressure should be 2000-2250 psi (13790-15510 kPa) for all models.

To test steering relief pressure using a CAS-10280 flowmeter or equivalent, install outlet hose from flowmeter into transmission filler neck, then install a tee fitting between outlet hose on gear pump and pump. Install inlet hose of flowmeter to tee connector on pump. Close load valve on flowmeter, start and run tractor at 2000 rpm until hydraulic fluid reaches operating temperature of approximately 110° to 120° F (43°-49° C). Turn steering wheel to either left or right lock position and hold. Observe relief pressure on flowmeter pressure gage. If pressure is incorrect, adjustment is accomplished by loosening jam nut (14—Fig. 28) on power brake valve and turning steering pressure adjusting screw (15) as required. Turning adjusting screw clockwise will increase pressure. Turning screw counterclockwise will decrease pressure. When correct pressure is obtained, tighten locknut.

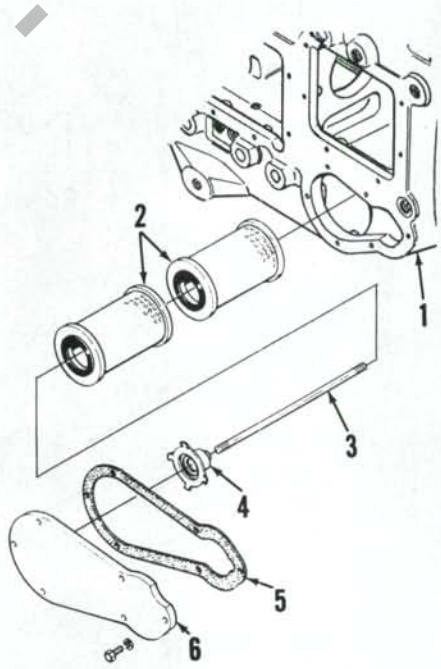


Fig. 26—Exploded view of hydraulic system filter assembly on Models 2090, 2290, 2094 and 2294 tractors.

1. Transmission housing
2. Filter elements
3. Rod
4. Bypass valve
5. Gasket
6. Cover

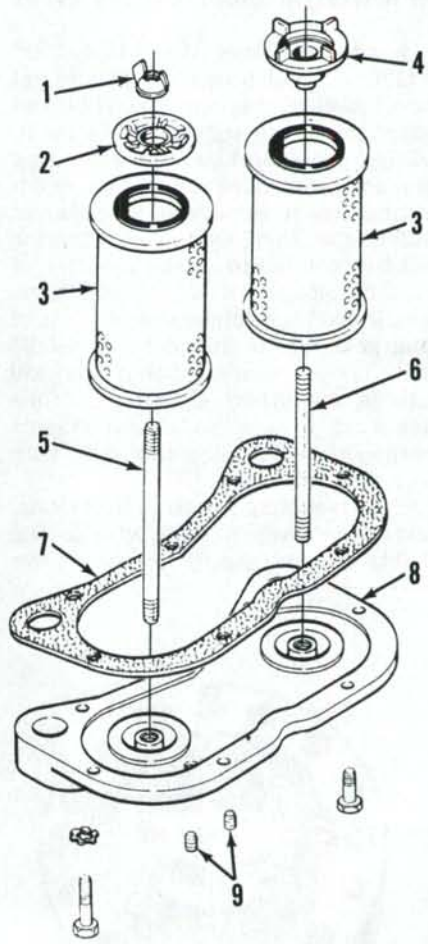


Fig. 27—Exploded view of hydraulic system filter assembly on Models 2390, 2590, 2394 and 2594 tractors.

1. Wing nut
2. Retainer
3. Filter element
4. Relief valve
5. Stud
6. Stud
7. Gasket
8. Cover
9. Drain plugs

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OIL COOLER

Model 504 BDT Engines

70. The engine oil cooler is horizontally mounted to oil filter manifold (5—Fig. 64) located on right side of engine. Removal and disassembly of unit is obvious after examination of unit and reference to Fig. 64. Inspect oil bypass valve (6) for freeness in its bore.

Normal cleaning of oil cooler consists of blowing out water tubes with compressed air and flushing oil passages with a suitable cleaning solvent. Renew "O" rings and gaskets when reassembling.

DIESEL FUEL SYSTEM

All Models are equipped with a Robert Bosch Model PES multiple plunger injection pump. American Bosch or Robert Bosch multi-hole injector nozzles are used on all models.

FUEL FILTERS AND LINES

All Models

71. The manufacturer recommends the use of a good grade No. 2 diesel fuel having a Cetane rating of 40 or better be used for normal operation. For winter operation, Cetane rating should be 45-55 and fuel pour point should be at least 10° F (5° C) below lowest expected ambient temperature.

The fuel transfer pump is a constant volume, positive displacement type plunger pump which is mounted on side of injection pump and driven by a cam or injection pump camshaft. Refer to Fig. 65 for a schematic view of fuel system.

On all models a water trap and drain cock is located in bottom of main fuel tank. It is recommended that a small quantity of fuel and any accumulated water be drained from the trap each day to prevent water accumulation.

72. FUEL FILTERS. Fuel filters are spin-on type (Fig. 66). Filters are available in a kit which consists of both units and both should be renewed each 500 hours or when noticeable power loss occurs.

To renew filters, first clean filter head, elements and surrounding area. Shut off fuel at fuel tank and remove drain plug from bottom of 1st stage filter. Use a clamp-type filter wrench which is supplied with tractor to remove filters. Remove and discard gasket located on final filter mounting stud. Lightly oil gaskets on new units and on mounting stud, install new units and hand tighten ½ to ¾ turn after contacting gasket surfaces. DO NOT overtighten. Bleed system as outlined in paragraph 73.

Fuel from tank comes directly to preliminary filter, which is part of transfer pump (Fig. 65). Service on this filter should be performed at the same interval as spin-on filters. Loosen locknut (Fig. 67), remove bowl and clean element with clean fuel, or renew if damaged or clogged. Clean and dry glass bowl with air or lint-free cloth, and renew gasket. Bleed system as outlined in paragraph 73.

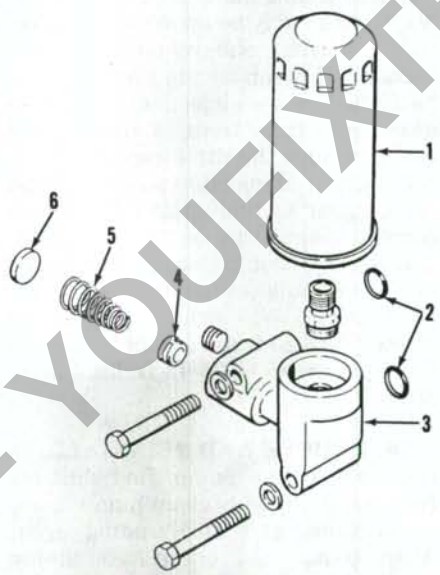


Fig. 63—Exploded view of single oil filter assembly.

1. Filter element
2. "O" rings
3. Manifold
4. Relief valve
5. Spring
6. Plug

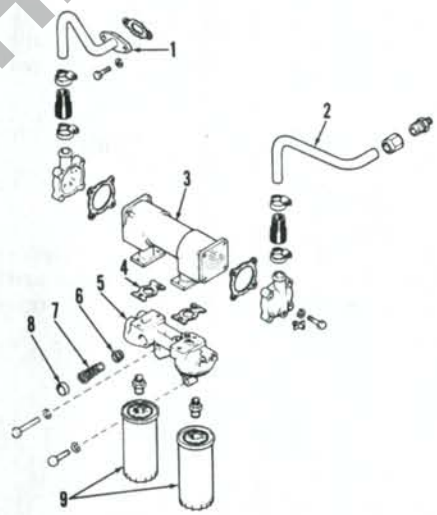


Fig. 64—Exploded view of dual oil filter assembly and heat exchanger assembly.

1. Outlet tube
2. Inlet tube
3. Heat exchanger
4. Gasket
5. Manifold
6. Relief valve
7. Spring
8. Plug
9. Filter element

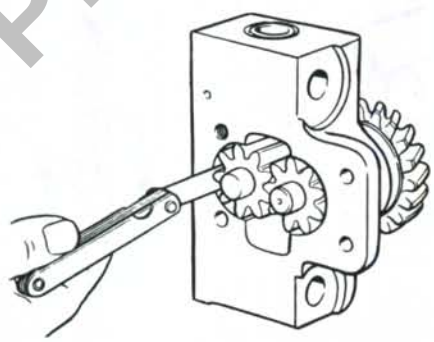


Fig. 62—Check radial clearance of pump as shown. Refer to paragraph 68 for specification.

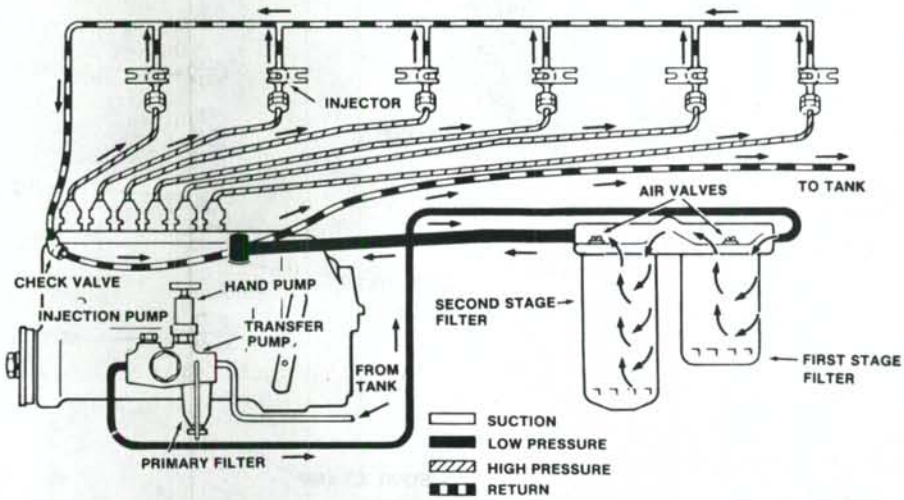


Fig. 65—Schematic view of fuel system and flow. Hand primer pump is located in transfer pump and fuel line from tank leads directly to transfer pump without passing through filter.

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discolored or does not meet the specifications which follow:

Free length ..... 2.18 in. (55.372 mm)
Test at length ..... 50-60 lbs. @ 1.94 in. (225-269 N @ 49.2 mm)
Test at length .... 153-167 lbs. @ 1.48 in. (681-743 N @ 37.69 mm)

VALVE ROTATORS

All Models

47. Positive type valve rotators are used on both inlet and exhaust valves. No maintenance is required but each valve should be observed while engine is running to be sure the valve rotates a slight amount. Renew the rotator on any valve which fails to turn when engine is running. Renew rotator and keepers on any new valve installed.

ROCKER ARMS

All Models

48. Refer to Fig. 48 for an assembled view of rocker arm shaft and associated parts. Exhaust valve rocker arms are right hand and left hand units and are installed on shaft with valve contact ends closer together as shown.

Rocker shaft must be assembled with feed holes toward valve side of cylinder. Examine shaft for wear on pressure (bottom) side of shaft in rocker area and check rocker arms for excessive looseness on shaft. Also examine valve stem contact button on rocker arm. Renew rocker arms and/or shaft if wear is excessive. Install a new "O" ring on oil tube before installation. Side clearance of end (exhaust) rocker arms should be limited to 0.010-0.030 inch (0.254-0.762 mm) at each end during shaft installation by adding or removing spacer washers behind snap ring. Tighten rocker arm stud nuts to 40-45 ft.-lbs. (54-61 N · m) during installation and adjust tappet gap as outlined in paragraph 44.

CAM FOLLOWERS

All Models

49. The mushroom type cam followers can be removed from below after first removing camshaft as outlined in paragraph 55.

The 0.8097-0.8102 inch (20.566-20.579 mm) diameter standard size followers have a normal clearance of 0.001-0.004 inch (0.0254-0.1016 mm) in cylinder block bores. If clearance is excessive, resize the bores to 0.815-0.8225 inch (20.866-20.891 mm) and install the 0.010 inch (0.254 mm) oversize followers provided in parts stocks.

TIMING GEAR COVER

All Models

50. To remove timing gear cover, drain engine oil and cooling system, disconnect headlight wiring; then remove hood, side panels and radiator grille. Remove air conditioning condenser and hose assembly from radiator support and carefully lay assembly aside with hoses connected. Disconnect transmission oil cooler lines at radiator. Cap or plug hydraulic openings to prevent contamination. Remove upper and lower radiator hoses. Remove radiator assembly. Remove fan and spacer. Unbolt and remove fuel pump drive gear cover (1—Fig. 49). Unbolt fuel pump drive gear (3) from fuel pump. Remove injection pump as outlined in paragraph 76. Remove alternator, A/C compressor belt and fan belts.

NOTE: Before timing gear cover can be removed, the front axle support must be separated from engine block and moved forward a minimum of 1-3/4 inches (44.45 mm).

Support tractor under torque tube with a suitable jack stand. One at a time, remove bolts securing front support to engine block and install longer bolts, approximately 4-1/2 inches (114.3 mm) long. Separate front support and roll away from engine block a minimum of 1-3/4 inches (44.45 mm). Remove A/C pulley and water pump pulley. Remove crankshaft pulley bolt and using a suitable puller with bolts, remove crankshaft pulley. Pry out front oil seal, remove bolts securing oil pan to timing gear cover then unbolt and carefully remove timing gear cover. Do not lose or damage the spring loaded thrust plunger in front end of camshaft when cover is removed.

Install cover and new gasket (7—Fig. 49) by reversing removal procedure. Tighten cover retaining bolts to a torque of 35-42 ft.-lbs. (48-57 N · m). Tighten crankshaft pulley cap screw (11) to 100-110 ft.-lbs. (136-149 N · m) torque. Tighten oil pan cap screws to 15-20 ft.-lbs. (20-27 N · m) torque. Tighten front support to engine block mounting bolts to 380-456 ft.-lbs. (515-618 N · m) torque.



Fig. 48—Assembled view of rocker arm units showing components properly positioned. Recommended side clearance of 0.010-0.030 inch (0.254-0.762 mm) for each end rocker arm is adjusted by adding or removing shim washers.

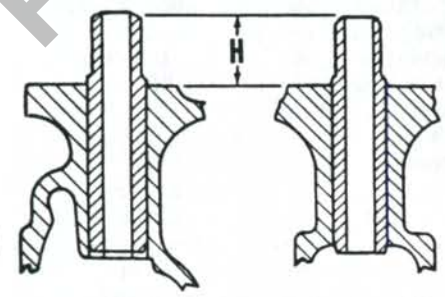


Fig. 47—Height (H) of installed valve guides should be 0.953 inch (24.206 mm). Guides must be reamed after installation.

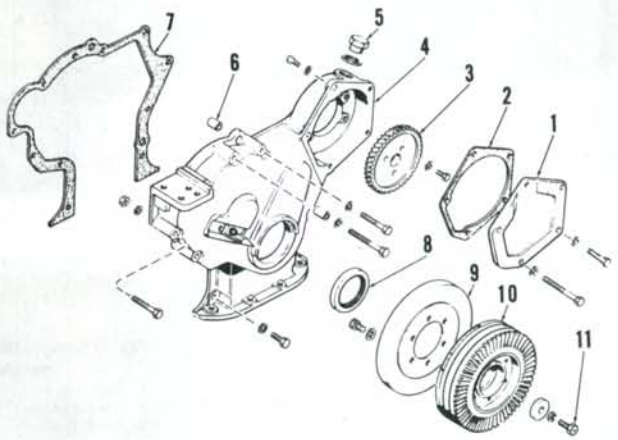


Fig. 49—Exploded view of engine timing gear cover showing component parts.

1. Cover
2. Gasket
3. Pump gear
4. Cover
5. Timing hole plug
6. Dowel
7. Gasket
8. Oil seal
9. Viscous dampner
10. Crankshaft pulley
11. Cap screw

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between torque tube and transmission as outlined in paragraph 106. Remove rear cab or platform mounts. With transmission suitably supported, remove wheels. Remove axle housings and final drive assemblies as outlined in paragraph 166. Remove pto housing assembly as outlined in paragraph 202. Remove brake assemblies as outlined in paragraph 192.

Disconnect differential lock oil fitting on right side of transmission then remove oil tube. Remove rear pto drive shaft. Disconnect hitch cable and remove oil tube from rear of transmission frame.

Support differential with wood blocks. Remove differential bearing carriers from both sides of transmission. Remove both differential bearing cones, shims and inner halves of brake cylinders from both sides of transmission. Attach a suitable chain or sling and hoist to differential assembly and remove from transmission.

Remove four speed transmission shift control cable bracket from top of transmission. Remove hitch cable upper mount bolts from top of rear transmission access cover, then remove cover. Remove front side transmission access cover.

Remove front bushing from pto shaft, pull shaft out approximately four inches, remove snap ring from rear of pto shaft, then withdraw pto shaft from input shaft.

Remove roll pins (13 and 17—Fig. 107) from both shifting forks. Remove detent balls and springs. Engage park lock and drive shift rail roll pin (6) out. Remove shift rail from rear of transmission. Remove shift forks.

Bend retainer nut (1—Fig. 108) lip from notch in countershaft and remove nut and thrust washer (2). Remove snap ring (6) from shaft. Using a brass drift, drive countershaft rearward approximately ¼ inch (6.35 mm) and install a suitable puller and remove front countershaft bearing cone (3). Push countershaft assembly rearward until out of park lock gear (8) and remove Woodruff key (7) (on models equipped with transmission S/N 10237494 and below) from countershaft. Push countershaft rearward while removing items (9 through 18) out top of access opening. Park lock gear cannot be removed until fourth, third and second gears are removed. Remove park lock gear (8) then remove remainder of items (19 through 23) out top of access opening and withdraw countershaft from rear of transmission.

Remove snap ring (5) from behind front bearing cup and drive out cup. Drive out rear bearing cup (25). Press rear bearing cone from countershaft.

116. Clean and inspect all parts for damage or excessive wear and renew as necessary. Check bearings for free smooth action and renew any bearing having a loose fit or rough action. Bearing (26—Fig. 108) may be heated to 250° F (120° C) for ease of assembly.

REASSEMBLY

117. COUNTERSHAFT. Assemble countershaft as follows: If rear pinion bearing cone (26—Fig. 108) was removed, heat and install bearing cone on countershaft with large side toward pinion gear. With countershaft standing vertical with pinion gear down assemble shaft components as follows: Install 1/8 inch (3.18 mm) thick thrust washer from thrust bearing (23), then install needle bearing and cup washer, cup side down. Install first gear (22), hub gear end up. Install pinion shaft hub (19) with ¼ inch (6.35 mm) recessed spline side down, then install shift collar (20). Install thrust bearing (18), cup side down; second gear (17), hub gear end down. Install thrust bearing (16), cup side down, then third gear (15), hub gear end up.

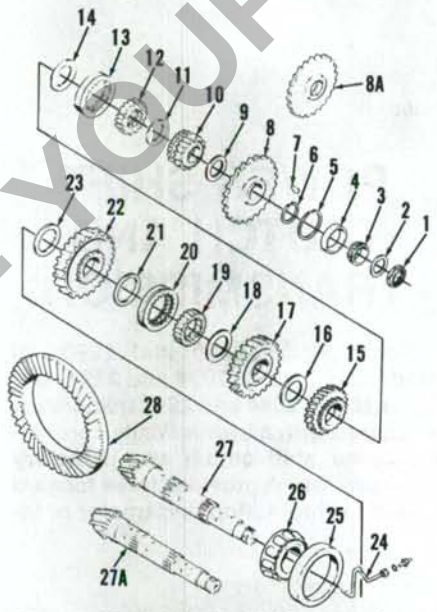


Fig. 108—Exploded view of four-speed gear countershaft used on all Model 2090 and 2290 tractors.

1. Locknut
2. Washer
3. Bearing cone
4. Bearing cup
5. Snap ring
6. Snap ring
7. Woodruff key (transmission S/N 10237494 & before)
8. Park lock gear (transmission S/N 10237494 & before)
8A. Park lock gear (transmission after S/N 10237494)
9. Thrust washer
10. Gear (4th driven)
11. Thrust washer
12. Hub (3rd & 4th)
13. Shift collar
14. Thrust washer
15. Gear (3rd driven)
16. Thrust washer
17. Gear (2nd driven)
18. Thrust washer
19. Hub (1st & 2nd)
20. Shift collar
21. Thrust washer
22. Gear (1st driven)
23. Thrust washer
24. Lube tube
25. Bearing cup
26. Bearing cone
27. Pinion shaft (transmission S/N 10237494 & before)
27A. Pinion shaft (transmission after S/N 10237494)
28. Ring gear

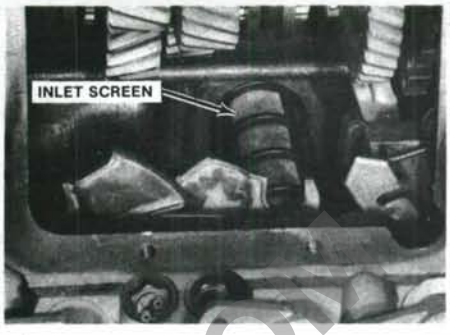


Fig. 109—Hydraulic inlet screen must be removed to remove shifter shafts.

Install thrust bearing (14), cup side up. Install pinion hub (12) with ¼ inch (6.35 mm) recessed spline side down, then install shift collar (13). Install thrust bearing (11) with 1/8 inch (3.18 mm) thrust washer first and remainder of assembly, cup side down. Install fourth gear (10) with hub gear end down. Install thrust bearing (9) with cup side up. Install park lock gear (8) and key (7) (on models equipped with transmission S/N 10237494 and below) on shaft. Tap park lock gear with hammer to make sure there is no clearance between assembled parts. Install a shim type snap ring (6) and measure clearance between snap ring and park lock gear. Install appropriate thickness snap ring until 0.003-0.011 inch (0.076-0.279 mm) clearance is obtained. Snap rings (6) are available in thicknesses of 0.078, 0.088, 0.098, 0.108, 0.118, 0.128 and 0.138 inch (1.98, 2.24, 2.49, 2.74, 3.0, 3.25 and 3.5 mm). See Fig. 110 for cross-sectional view of assembled countershaft. Remove all parts from countershaft for assembly into transmission.

If front bearing cup was removed, install snap ring (5—Fig. 108) and press cup (4) into bore against snap ring. Install countershaft through rear of transmission case assembling parts in order outlined previously in this paragraph and shown in Fig. 110. Install a bar and bolt as shown in Fig. 111 to hold countershaft rigid and in correct position for installation of front bearing. Heat front bearing cone (3—Fig. 108) and install on front of countershaft, then install thrust washer (2) and retainer nut (1).

118. COUNTERSHAFT BEARING PRELOAD. Remove bar and bolt shown in Fig. 111. Tighten countershaft retainer nut, while rotating countershaft to remove clearance between countershaft bearing cones and cups. With transmission in neutral, measure rolling torque with a torque wrench. Tighten retainer nut until an additional 25-35 in.-lbs. (2.8-3.9 N · m) rolling torque for new bearings or 15-25 in.-lbs. (1.7-2.8 N · m) additional rolling torque for

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fork. Remove shifter fork (13) with shift rail (21) and rail connector (23) as an assembly. Remove rear section of shift rail (25) from bore in transmission.

To remove shifter shafts (items 3 through 12), hydraulic inlet screen must be removed as outlined in paragraph 250. Remove outer shift levers from four-speed transmission. Remove snap ring (3—Fig. 175) from shifter shaft (6). Remove flat washer (4) and wave washer (5). First remove shifter shaft and shift fork lever (12) for third and fourth gear, then remove shifter shaft and shift fork lever (16) for first and second gear. Renew "O" rings (7) on shifter shafts when reassembling.

Reassemble by reversing disassembly procedure. Adjust shift linkage as outlined in paragraph 153, neutral start switches as in paragraph 155 and park lock linkage as in paragraph 176.

Models 2390, 2590, 2394 and 2594

157. REMOVE AND REINSTALL SHIFT RAIL AND FORKS. Shift rail (14—Fig. 176) must be removed before shifter forks (16 and 17) can be removed. Tractor must be split as outlined in paragraph 142 to gain access to shift rail. Remove power shift and mainshaft as an assembly as outlined in paragraph 143. Remove lube line for countershaft. Remove small cap screw (15—Fig. 176) in power shift carrier which holds shift rail, before removing power shift assembly. Drive out pins (18) and remove detent balls and springs. With power shift and mainshaft assembly removed, reinstall cap screw in shift rail, turn rail 90 degrees clockwise and pull out of transmission, using cap screw to extract rail.

When reassembling shifter forks, slip forks into sliding collars on countershaft with long hubs of forks forward and position forks in opening in side of transmission housing. Install shift rail into transmission with tapped hole to front and insert rail through shift forks. Rotate shift rail so that cap screw will align through power shift carrier into tapped hole in rail when power shift is installed. Place shifter forks in neutral, install detent balls and detent springs in bores of shifter forks. Compress springs and install groove pins. Note that groove pins are tapered and are installed small end first. Install power shift and mainshaft assembly in reverse order of disassembly. Make sure the countershaft bearing preload is re-established by aligning marks on retainer nut and countershaft. If rolling torque must be calibrated, refer to procedures outlined in paragraph 165. Rejoin tractor by reversing disassembly procedures as outlined in paragraph 142.

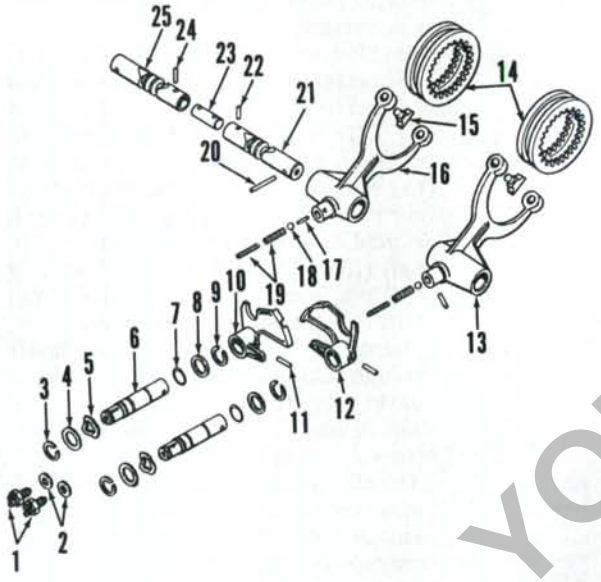


Fig. 175—Exploded view of shifter forks and shafts of gear transmission used on power shift Models 2090, 2290, 2094 and 2294.

1. Neutral start switches
2. Shims
3. Snap ring
4. Washer
5. Wave washer
6. Shifter shaft
7. "O" ring
8. Washer
9. Snap ring
10. Shift fork lever (1st & 2nd)
11. Roll pin
12. Shift fork lever (3rd & 4th)
13. Shifter fork (3rd & 4th)
14. Shift collars
15. Fork finger (4)
16. Shifter fork (1st & 2nd)
17. Roll pin
18. Detent ball
19. Detent springs
20. Roll pin
21. Front rail
22. Roll pin
23. Rail connector
24. Roll pin
25. Rear rail

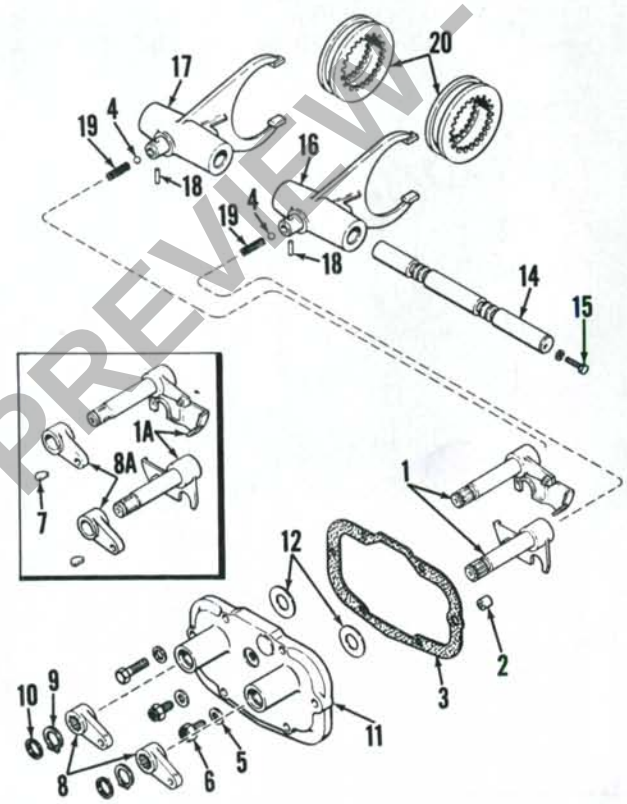


Fig. 176—Exploded view of shifter forks and shafts of gear transmission on Model 2390, 2590, 2394 and 2594 power shift tractors.

1. Shifter shaft (late)
1A. Shifter shaft (early)
2. Dowel
3. Gasket
4. Detent ball
5. Shim
6. Neutral start switch
7. Woodruff key
8. Shift levers (late)
8A. Shift levers (early)
9. Snap ring
10. Seal
11. Cover
12. Shim
14. Rail
15. Bolt
16. Shift fork
17. Shift fork
18. Pin
19. Spring
20. Shift collars

158. GEAR SHIFTER SHAFTS AND HOUSING OVERHAUL. It is not necessary to split tractor if only shifter shafts and housing are being serviced. Drain transmission and refer to Fig. 176. Disconnect shifter cables from shift levers, disconnect wires from neutral start switches and remove cap screws retaining housing (11). Pull housing and shaft assembly as a unit from transmission.

With shifter housing assembly removed, remove gasket (3) if necessary. Remove neutral start switches and keep shims (5) identified with switches. Punch timing marks on shifter shafts (1 or 1A) and levers and note that levers are installed 17 degrees below horizontal in neutral position. Remove lever retaining snap rings and remove levers. Pry out seals (10). Pull shifter shafts (1 or 1A) from housing (11). Remove shims (12) from shifter shafts.

Reassemble by reversing disassembly procedure and keep the following in mind.

Wave washers must take up all end play in shafts (1); if not, renew washers.

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scoring or other damage and renew as necessary. Valve body (1) and regulator spool (13) are not serviced separately. If regulator spool or body is scored or damaged, renew complete valve assembly. Shims (16) are available in thicknesses of 1/64 inch (0.397 mm) and 3/32 inch (2.3 mm). Reassemble by reversing disassembly procedure. Adjust overhauled valve assembly and linkage as outlined in paragraphs 195 and 196.

Models 2390 and 2590

200. OVERHAUL. Refer to Fig. 223 for exploded view. Remove pto clutch fitting (6), late model adjusting screw (7) or early model shims (A) and early model detent plunger (B) or late model detent ball (9). Remove modulator plug (28), pin (27), secondary spring (26), washer (25), primary spring (24), return spring (23) and poppet (22). Remove control spool (3) from bottom to prevent damage to wiper seal (1) and "O" ring (2), then remove wiper seal (1). Using a "C" clamp to relieve spring pressure of regulator spool, drive out pin (15), then slowly loosen "C" clamp and remove plug (21), shim(s) (19) and spring (18). Remove plug (4) on opposite side of regulator spool bore and remove spool (16) through large bore of housing. Remove snap ring (17) from spool (16). Remove relief poppet plug (11), spring (12), poppet (13) and seat (14).

Renew all "O" rings upon reassembly. Install new wiper seal (1). Check springs against following specifications:

Regulator spool spring (18)
Free length ..... 2.874 in. (73.0 mm)
Test length ..... 1.728 in. (43.89 mm)
Test load ..... 50.2-61.4 lbs. (223.4-273.0 N)

Relief valve spring (12)
Free length ..... 2.189 in. (55.6 mm)
Test length ..... 1.40 in. (35.56 mm)
Test load ..... 19.6-24.0 lbs. (87.3-106.8 N)

Control spool return spring (23)
Free length ..... 3.204 in. (81.38 mm)
Test length ..... 1.90 in. (48.26 mm)
Test load ..... 11.1-12.9 lbs. (49.4-57.4 N)

Primary spring (24)
Free length ..... 1.86 in. (47.44 mm)
Test length ..... 1.63 in. (41.4 mm)
Test load ..... 5.1-6.3 lbs. (22.8-27.9 N)

Secondary spring (26)
Free length ..... 0.642 in. (16.31 mm)
Test length ..... 0.437 in. (11.1 mm)
Test load ..... 0.41-0.51 lbs. (1.8-2.3 N)

Detent spring (8)
Free length ..... 1.67 in. (42.42 mm)
Test length ..... 1.0 in. (25.4 mm)
Test load ..... 19.1-19.7 lbs. (85-88 N)

Renew any springs which do not meet specifications. Inspect all parts for wear, scoring or other damage and renew as necessary. Valve housing (5), control spool (3) and regulator spool are available only as a complete assembly. Shims (19) are available in thickness of 0.0164 inch (0.42 mm). Reassemble by reversing disassembly procedure. Adjust overhauled valve assembly and linkage as outlined in paragraphs 194 and 196.

Models 2394 and 2594

201. OVERHAUL. To disassemble the pto control and flow-regulator valve, refer to Fig. 224 and remove connector (5), adjusting screw (6), springs (8 and 9), guide pin (10) and detent ball (11). Remove plug (33), with "O" ring (32) and pin (31), secondary spring (30), washer (29), primary spring (28), modulator poppet (26), return spring (27) and control spool (2) from bottom of valve body. Remove relief valve plug (17), spring (16) and relief valve (15). Valve seat (14) can be removed for renewal if necessary. Place a "C" clamp over pressure regulator plug (25), then drive out roll pin (19). Loosen "C" clamp to release spring pressure from plug (25). Remove plug, shims (23) and regulator spring (22). Remove plug (3)

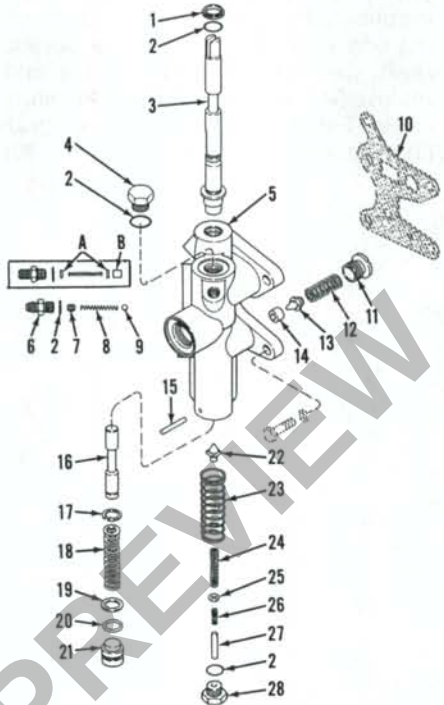


Fig. 223—Exploded view of flow divider and pto control valve for Model 2390 and 2590 tractors. "A" in insert are detent washers; "B" is detent spool.

1. Wiper ring
2. "O" ring
3. Pto control spool
4. Plug
5. Valve body
6. Connector
7. Adjusting screw
8. Spring
9. Ball
10. Gasket
11. Plug
12. Spring
13. Poppet
14. Seat
15. Roll pin
16. Pressure regulating spool
17. Snap ring
18. Spring
19. Shim
20. "O" ring
21. Plug
22. Point
23. Spring
24. Spring
25. Washer
26. Spring
27. Pin
28. Plug

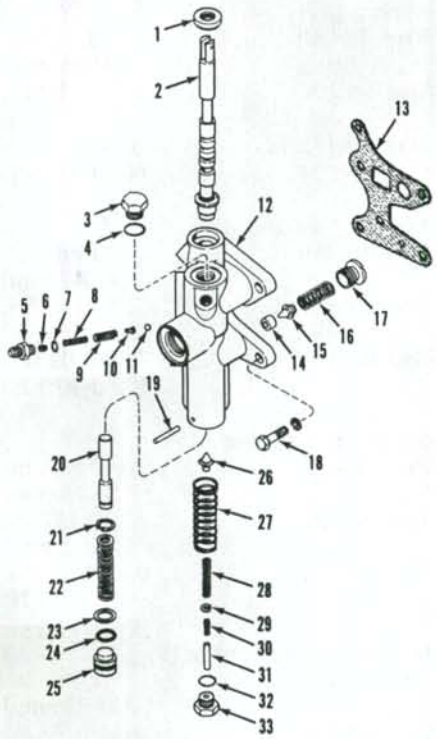


Fig. 224—Exploded view of pto valve and flow-regulator used on Models 2394 and 2594.

1. Oil seal
2. Pto control spool
3. Plug
4. "O" ring
5. Connector
6. Adjusting screw
7. "O" ring
8. Spring (inner)
9. Spring (outer)
10. Guide pin
11. Detent ball
12. Valve body
13. Gasket
14. Seat
15. Relief valve
16. Spring
17. Plug
18. Cap screw
19. Roll pin
20. Pressure regulator spool
21. Snap ring
22. Spring
23. Shim
24. "O" ring
25. Plug
26. Modulator poppet
27. Spring
28. Primary spring
29. Washer
30. Secondary spring
31. Pin
32. "O" ring
33. Plug

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