Group 25
TRACTOR SEPARATION

SEPARATING BETWEEN ENGINE AND TRACTOR FRONT END

REMOVAL

For safety disconnect ground straps from batteries.

Remove front end weights (if equipped).

Remove radiator cap and fuel tank cap. Remove radiator side grille screens and hood. Install radiator and fuel tank caps. Remove tool box and side frames.

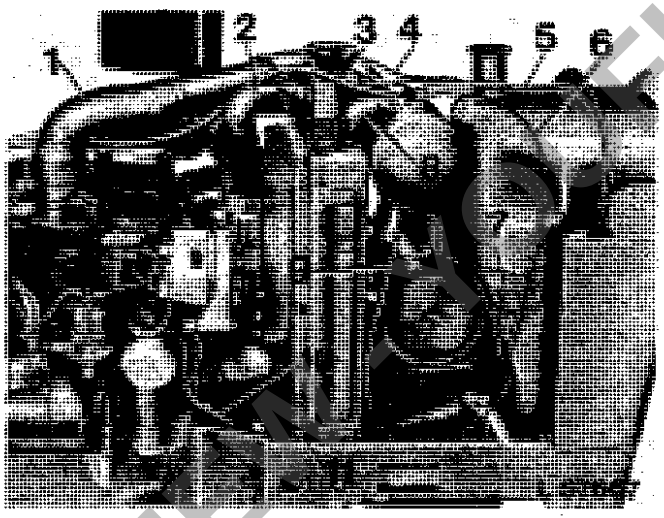


Fig. 1 — Separating between Tractor Front End and Engine

1 Air intake pipe
2 Upper water hose
3 Leak-off and bleed line
4 Fuel return line
5 Support rod
6 Leak-off and bleed line
7 Cable of fuel gauge sending unit
8 Hose elbow
9 Cable of air cleaner restriction warning switch
10 Fuel inlet line, tank to fuel transfer pump
11 Oil cooler return line

Disconnect air intake pipe (see 1, fig. 1) at engine intake manifold and at air cleaner.

Disconnect leak-off and bleed lines 3 and 6 at hydraulic oil reservoir.

Remove support rod 5 at top of radiator. Disconnect fuel return line 4 at fuel tank.

Disconnect cable 9 on models having an air cleaner restriction warning switch and disconnect cable 7 at fuel gauge sending unit.

Drain coolant and disconnect upper and lower water hoses at radiator.

Only on tractors equipped with oil cooler: Remove hose elbow 8 between hydraulic oil reservoir and oil cooler at oil cooler end. Disconnect return oil line 11 at bottom of oil cooler.

Only on tractors without oil cooler: Disconnect return oil line at top and bottom hose and remove.

NOTE: Plug lines and openings immediately with plugs or caps to prevent loss of oil and entering of dirt into the system.

Remove screws securing fan shroud to radiator and slide over fan to the rear.

Remove screws securing radiator to front axle support and lift out radiator to the left of tractor.

Close fuel shut-off valve at bottom of fuel tank.

Disconnect fuel inlet line 10 at fuel tank and fuel transfer pump. Remove transfer pump and fuel inlet line.

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REMOVAL

OIL PUMP

Drain engine oil and remove oil pan.

Place a clean cloth between the teeth of the lower idler gear and the teeth of the oil pump gear.

Remove hex. nut which is secured by three center punch marks. Pull pump gear off the tapered seat on the pump shaft.

OIL PRESSURE REGULATING VALVE

Turn plug 5 (fig. 2) out of timing gear cover and remove with all parts shown in fig. 2.



Fig. 2 — Oil Pressure Regulating Valve, Removed

1 Valve cone
2 Pressure spring
3 Shims
4 Aluminium washer
5 Plug

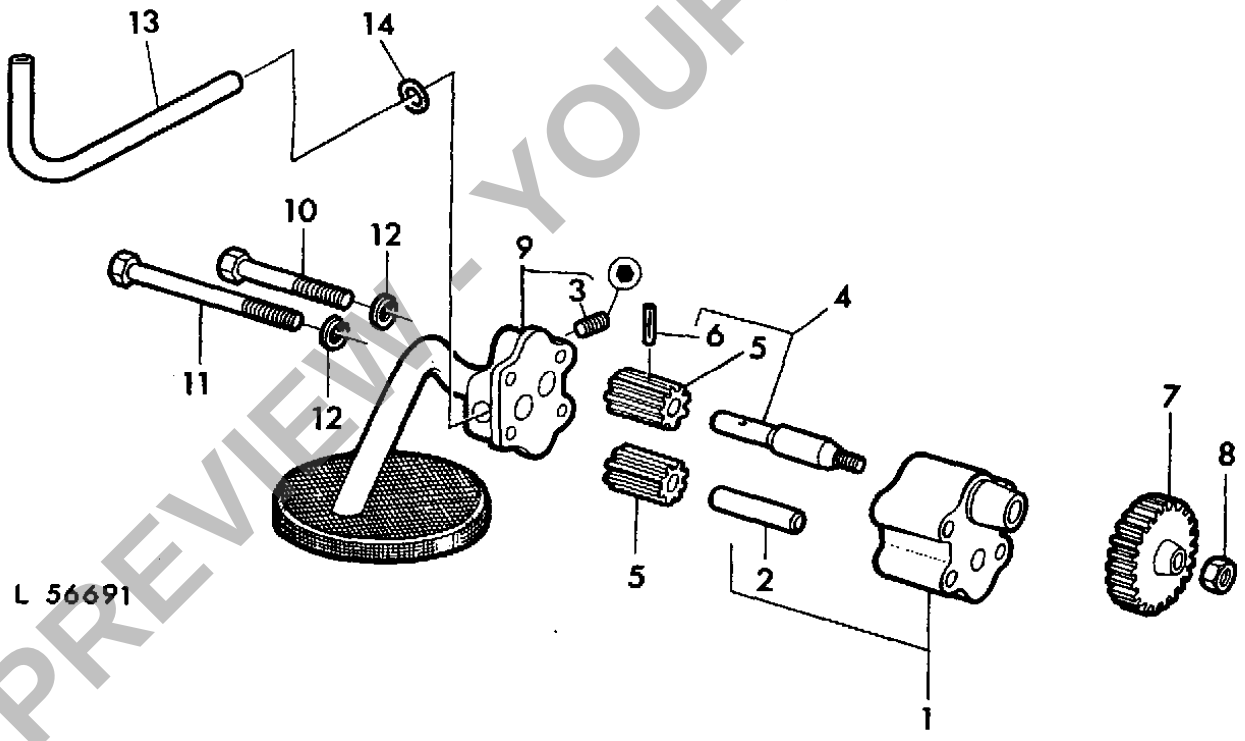
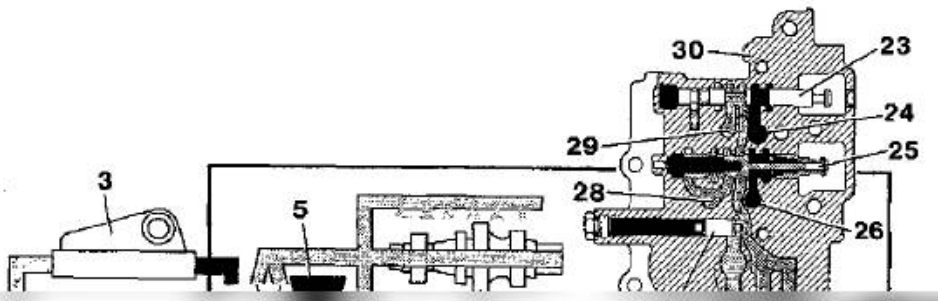


Fig. 3 — Oil Pump Assembly

1 Pump housing
2 Idler shaft
3 Plug
4 Pump drive shaft assembly
5 Pump gears
6 Groove pin
7 Gear on pump shaft
8 Hex. nut
9 Pump cover with intake tube and strainer
10 Cap screw (3 used)
11 Cap screw
12 Spring washers
13 Outlet tube
14 O-ring

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CONTENTS

SECTION 10 — GENERAL
Group 5 - Specifications
Group 10 - Pre-delivery, delivery and after-sales inspections
Group 15 - Lubrication and periodic service
Group 20 - Engine and tractor tune-up
Group 25 - Tractor separation

SECTION 20 — ENGINE
Group 5 - General information, diagnosing malfunctions
Group 10 - Cylinder head and camshaft
Group 15 - Cylinder block, liners, pistons and connecting rods
Group 20 - Crankshaft, main bearings and flywheel
Group 25 - Timing gear train
Group 30 - Oil pump, oil pressure regulating valve and oil filter
Group 35 - Engine cooling system
Group 40 - Speed control linkage

SECTION 30 — FUEL SYSTEM
Group 5 - Diagnosing malfunctions
Group 10 - Fuel tank, transfer pump, fuel filter
Group 15 - Fuel injection pumps
Group 20 - Injection nozzles
Group 25 - Cold weather starting aid

SECTION 40 — ELECTRICAL SYSTEM
Group 5 - Diagnosing malfunctions
Group 10 - Components and wiring diagram
Group 15 - Bosch starting motor
Group 17 - Delco-Remy starting motor
Group 20 - Bosch alternator and regulator
Group 22 - Motorola alternator and regulator

SECTION 50 — POWER TRAIN
Group 5 - Engine clutches and clutch linkage
Group 10 - Hi-Lo shift unit
Group 15 - Collar-shift transmission
Group 20 - Differential
Group 25 - Final drives
Group 30 - Continuous-running PTO
Group 35 - Independent PTO

SECTION 60 — FRONT AXLE, STEERING SYSTEM AND BRAKES
Group 5 - Front axle
Group 10 - Steering system
Group 15 - Hydraulic brakes

SECTION 70 — HYDRAULIC SYSTEM
Group 5 - General information, diagnosing malfunctions and tests
Group 10 - Oil reservoir, filter, valves and oil cooler
Group 15 - Hydraulic pump and transmission oil pump
Group 20 - Rockshaft
Group 25 - Selective control valve and breakaway coupler
Group 30 - Remote cylinder

SECTION 80 — MISCELLANEOUS
Group 5 - Belt pulley
Group 10 - DE LUXE seat
Group 15 - Front and rear wheels

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Section 10
GENERAL

CONTENTS OF THIS SECTION

GROUP 5 — SPECIFICATIONS

Page

Serial numbers 5-2
Model numbers 5-2
Engine 5-2
Engine clutch 5-2
Electrical system 5-2
Transmission 5-3
Hi-Lo shift unit 5-3
Differential and final drives 5-3
Differential lock 5-3
PTO 5-3
Hydraulic system 5-3
Power steering 5-3
Manual steering 5-3
Hydraulic brakes 5-3
Capacities 5-3
Travel speeds 5-3
Front and rear wheels 5-3
Dimensions and weights 5-3

GROUP 10 — PREDELIVERY, DELIVERY AND AFTER-SALES INSPECTIONS

Predelivery inspection 10-1
Delivery inspection 10-4
After-sales inspection 10-4

GROUP 15 — LUBRICATION AND PERIODIC SERVICE

Page

Lubrication and periodic service 15-1

GROUP 20 — ENGINE AND TRACTOR TUNE-UP

General information 20-1
Preliminary engine testing 20-1
Engine tune-up 20-2
Checking engine performance 20-3
Tractor tune up 20-3
Standard torques 20-5

GROUP 25 — TRACTOR SEPARATION

Separating between engine and tractor front end 25-1
Removing and installing engine 25-3
Removal and installation of clutch housing 25-5
Removal and installation of final drives 25-7
Removal and installation of rockshaft 25-8
Torques for hardware 25-9
Special tools 25-10

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Cylinder liner seals leaking

ABNORMAL ENGINE NOISE

Incorrect engine timing

Worn main or connecting rod bearings

Excessive crankshaft end play

Loose main bearing caps

Foreign material in combustion chamber

Worn piston pin bushings and pins

Scored pistons

Worn timing gears

Excessive valve clearance

Worn cam followers

Bent push rods

Worn camshaft

Worn rocker arm shaft

Insufficient engine lubrication

DETONATION OR PRE-IGNITION

Oil picked up by intake air stream (intake manifold)

Dirty or faulty fuel injectors

Improper engine timing

Injector tip holes enlarged

Injector tips broken

Carbon build-up in combustion chamber



NOTE: Overall and detailed information on engine troubles and repair see also "Fundamentals of Service, Engines" manual.

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Loosen fuel filter bleed plug; operate primer lever of fuel transfer pump and pump fuel through the filter until a solid stream of fuel without air bubbles is obtained. Tighten bleed plug again.

NOTE: If the fuel transfer pump does not deliver and no resistance is felt in the top position of the lever, rotate crankshaft a small amount by means of the starter to find a more suitable position for the camshaft.

Loosen bleed plug "m" (fig. 2) on injection pump, bleed and retighten to the specified torque.

Loosen hollow screw "w" of the bleed and return line 7 at the pump and after bleeding, re-tighten to the specified torque.

After bleeding, keep the primer lever of the fuel transfer pump in the lowest position.

Loosen the union nut of the pressure line on at least two injection nozzles by one turn and rotate the crankshaft by means of the starter until sufficient fuel without air issues from the connections.

IMPORTANT: Do not loosen the line more than one turn. Tighten nozzle line nut just enough to prevent leaks with the engine running. When tightening the union nut, do not forget to hold the line male union as explained above.

CHECKING THE ENGINE SPEED

After bleeding the fuel system, check the slow and the fast idle speed; for details see section 20, group 40. If necessary, re-adjust the speed control linkage.

ROOSA-MASTER Injection Pump

GENERAL INFORMATION

The Roosa Master Model DB fuel injection pump is a speed-advance, single-cylinder, opposed-plunger, inlet-metering, distributor type.

REMOVAL

REMOVING INJECTION PUMP FROM DRIVE SHAFT

Clean the pump, fittings and all connections to be broken, with diesel fuel or a steam cleaner. This will eliminate any chance of dirt entering the fuel system when the lines are disconnected.

IMPORTANT: Never steam clean or spray cold water on a running or warm injection pump. This could cause seizure of the pump.

Close the fuel shut-off valve at fuel tank.

Remove timing hole cover on side of injection pump next to name plate.

Remove timing cover and pin from engine flywheel, and install JDE-281 turning tool.

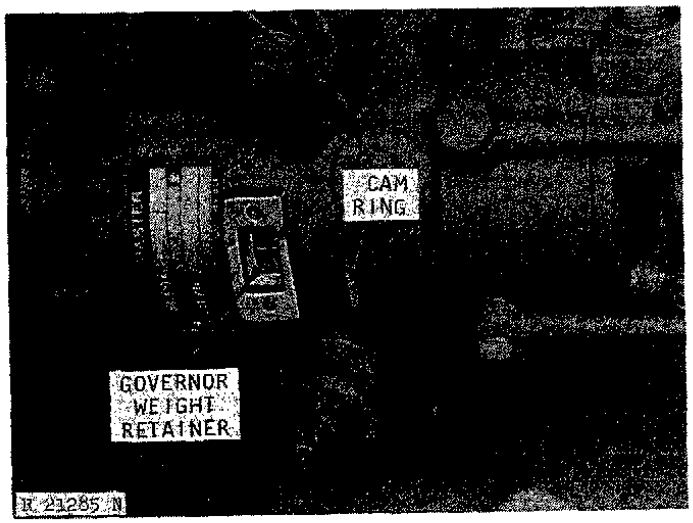


Fig. 8 — Injection Pump Timing Marks

Rotate the engine until timing mark on governor weight retainer is in line with timing mark on cam ring (fig. 8).

Disconnect the speed control rod and fuel shut-off rod from injection pump.

Disconnect injection pump fuel return pipe, inlet pipe, and pump-to-nozzle fuel pipes.

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Transmission drive shaft

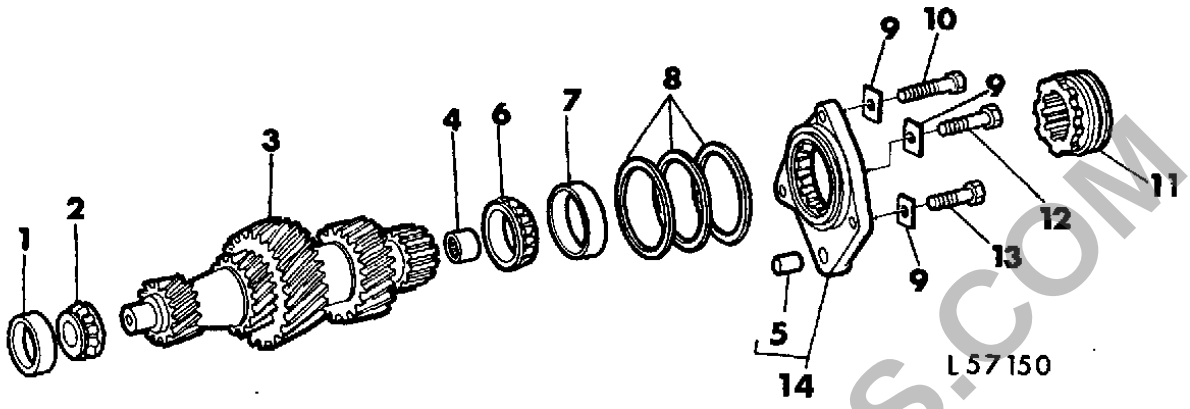


Fig. 8 — Exploded View of Transmission Drive Shaft

1 Taper roller bearing cup
2 Taper roller bearing cone
3 Transmission drive shaft
4 Needle bearing
5 Dowel pin
6 Bearing cone
7 Bearing cup
8 Shims (use as required)
9 Lock plates
10 Cap screw
11 Range II shifter collar
12 Cap screw
13 Cap screw
14 Quill

Examine transmission drive shaft, especially its gears, for damage and excessive wear.

Check taper roller bearings of shaft, needle bearing, quill, shifter collar of range II, lock plates and shims for serviceability. Replace parts, if necessary.

Countershaft

Inspect countershaft gears as well as shifter collar and sleeve for proper condition. Replace parts, if necessary.

Examine front bearing support assembly with countershaft and transmission drive gear as well as splines of countershaft and its gear for damage. Check taper roller bearings of countershaft as well as needle bearing for serviceability. Replace damaged parts.

Only on tractors equipped with independent PTO: If necessary, remove PTO brake piston 29 (fig. 10) from bearing support bore and check for serviceability. Replace O-rings 28 and 30. Servicing other PTO brake components see group 35.

If front bearing support, countershaft, transmission drive gear or ball bearings have to be replaced, remove snap rings (see 1, fig. 9) securing bearings to support and shafts. Press both shafts out of bearing support or bearings, as shown in fig. 9.

NOTE: Transmission drive gear must be removed before countershaft can be removed.

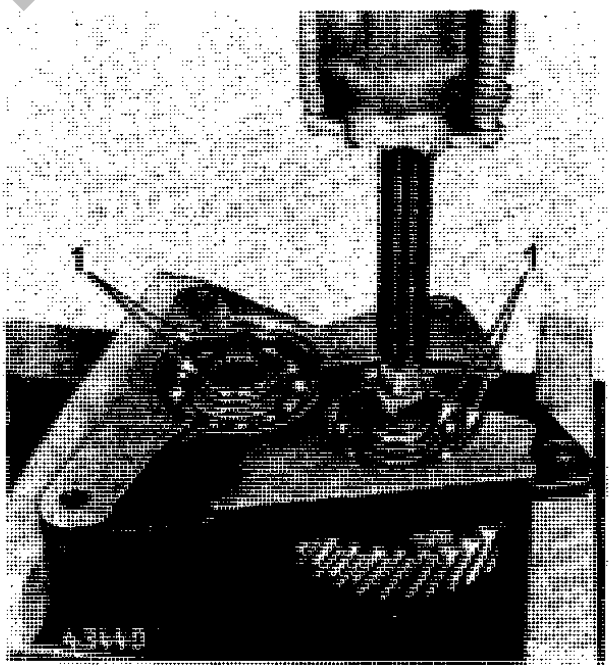


Fig. 9 — Pressing Countershaft and Transmission Drive Gear from Bearing Support

1 Snap rings

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GENERAL INFORMATION

The tractor may be equipped with an adjustable swept back front axle or with an adjustable straight front axle. The rotation of the steering wheel is transmitted to the front axle and thus to the front wheels through a steering linkage consisting of a drag link, a bell crank, the tie rods and the steering arms.

REMOVAL

Install a JDG-3 lift bracket to the front support (at front end). Attach a suitable hoist to lift bracket.

Disconnect drag link 14 (fig. 2) at bell crank 13. Support front axle, using a floor jack.

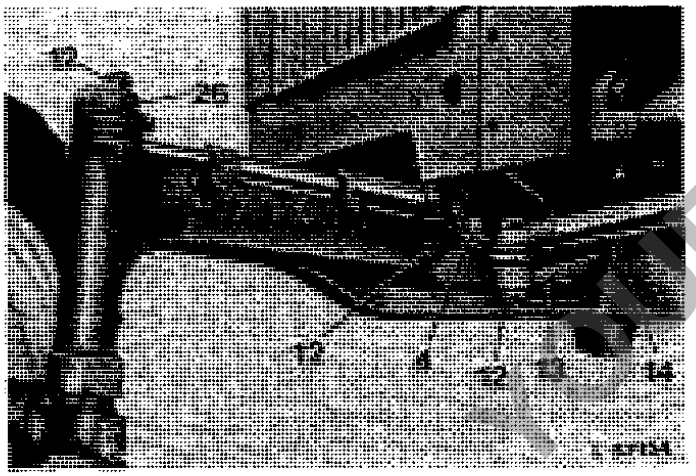


Fig. 2 — Removal of Front Axle Assembly

4 Special cap screw
12 Slotted nuts
13 Bell crank
14 Drag link
26 Steering arm

Remove special cap screw 4 (fig. 2) and slotted nut 8 (figs. 1 and 3) with shims 7. Slide front axle assembly rearward to clear front end support pivot pins. Raise tractor front end to permit moving tractor rearward or to permit moving axle forward.

REPAIR

Disassemble complete front axle and check parts for cracks, wear or damage. Repair or replace, if necessary.

Check seal rings 29 and 34 (figs. 1 and 3) for serviceability.

Inspect thrust bearings 32 for pitting and scoring and replace, if necessary.

Check both bell crank needle bearings 3 for wear. Press new needle bearings 3 into axle center so that front, inscribed side of each bearing faces toward installation tool and is flush with bottom of chamfer on each end.

If equipped: Check bushings 39 (fig. 3) for wear. Press new bushings 39 into axle center so that front face of each bushing is flush with bottom of chamfer in bore. Align grease hole of upper bushing with grease bore in axle center.

Check rear pivot pin bushing 2 for wear. If required, press new bushing 2 in eye of axle center so that its face is flush with bottom of chamfer in bore and with grease holes aligned.

If necessary, press new spindle bushings 30 (figs. 1 and 3) in axle knees so that their front faces are flush with bottom of chamfer in bore.

If front pivot pin 6 is excessively worn or damaged, install new pin in front bearing bore of axle center so that it is flush with rear face of axle.

If rear pivot pin is worn or damaged, drive out old pin. Place snap ring on the new pivot pin and press into bore until snap ring rests against shoulder of bore.

Assemble front axle, observing the following:

Slide thrust bearings 32 on spindles so that the numbered side faces away from knuckle.

Adjust end play of spindles by means of steering arm 26 so that spindles are free to turn easily. However, do not exceed the specified end play (see Specifications).

Tighten cap screws 25 to the specified torque (see Torques for Hardware).

Tighten screws attaching axle knees 31 to axle center 1 to the specified torque.

Tighten slotted nuts 12 (fig. 2) for attaching tie rods to steering arms 26 to the specified torque.

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Slide lift arms onto rockshaft splines and tighten cap screws to the specified torque.

After installing lift arms and tightening cap screws, slide rockshaft to the left until the right-hand lift arm lies against the rockshaft housing. Then swing crank arm 2 to the rear of the rockshaft housing. Position spacer plate 9 so it contacts crank arm. Tighten cap screw 7 attaching rockshaft cam and spacer to the specified torque.

INSTALLING ROCKSHAFT CYLINDER AND VALVE HOUSING

Install flow control valve, using the same number of shims 22 (fig. 5) as removed previously. Insert shims 22 in bore of rockshaft housing. Then install spring 23, valve spool 24 (open end first) and plug 26.

Place seal rings 29 and 30 (fig. 2) on flange of valve housing. Insert seal ring 16 in valve housing bore for front attaching screw 17.

Install rockshaft cylinder and valve housing in rockshaft housing, simultaneously inserting load selector arm in slot of load selector link and piston rod in piston bore.

Install front attaching screw 17 (fig. 2) of valve housing and tighten carefully.

IMPORTANT: Tighten this front attaching screw first, before tightening the four locking screws 31 (fig. 2), to draw rockshaft cylinder and valve housing into proper position in the rockshaft housing.

Tighten rockshaft cylinder and valve housing attaching screw and locking screws to the specified torque.

Hook return spring into special bolt located in rockshaft housing.

Insert rate-of-drop valve ball in rockshaft cylinder bore through tapped hole of rockshaft housing. Install lock nut 5, link 6, second lock nut 5, seal ring 4 and O-ring 3 on special screw 7 as shown in fig. 2. Turn lock nuts sufficiently on special screw 7 so that the O-ring is seated in screw groove.

Turn pre-assembled special screw into rockshaft housing until it is seated on the ball. Turn down lower nut until it starts to compress seal ring 4. Then tighten nut another 1/2 to maximum 1 turn. Place link 6 in extreme right front position and tighten upper nut against link.

Insert control lever shaft 3 (fig. 6) in housing bore and in bore of pivot pin. Secure shaft by means of spring pin 4.

Connect control lever to its shaft.

Connect selector lever to its shaft.

Screw remote cylinder adapter in bore on left side of rockshaft housing.

Check operation of control lever and selector lever by moving them several times fully backwards and forwards.

Adjust cam 7 (fig. 3) by means of special adjusting screw 9 so that there is a small gap between one cam and the discharge valve when the pressure valve contacts the other cam, and vice versa.

INSTALLATION

Move selector lever in position "L" (load control). Install rockshaft assembly as explained in section 10, group 25. Tighten screws to the specified torque.

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Make sure clutch housing is flush against transmission case before tightening cap screws to the specified torque.

NOTE: Before installing the third (from top) retaining screw at right-hand side of clutch housing (see arrow, fig. 6), coat screw with oil-resistant sealant.

NOTE: If clutch housing has also been separated from engine, assemble as explained under "Installation of Engine".

Insert hydraulic pump inlet line (see 5; fig. 2) and oil cooler or oil reservoir return line 3 in bore of clutch housing and secure by means of screw and retainer. Tighten screw to the specified torque.

On tractors not equipped with HIGH-LOW unit and independent PTO: Make sure check valve is inserted in hydraulic pump inlet line before line is installed.

Install hydraulic pump pressure line.

On tractors equipped with power steering: Connect power steering pressure line.

As regards further installation operations reverse removal procedure.

IMPORTANT: Connect ground straps of batteries to negative(-) poles.

REMOVAL AND INSTALLATION OF FINAL DRIVES

REMOVAL

NOTE: The removal of both final drives is explained below. If only one final drive is to be removed, do necessary work only.

For safety disconnect ground straps at batteries.

Lift up rear of tractor by means of a suitable jack or hoist and remove rear wheels.

CAUTION: Support transmission safely to prevent tipping of tractor.

Disconnect rear wiring harness at connector.

Remove rear fender and roll-over guard.

Disconnect brake lines on both final drive housings.

On tractors equipped with selective control valve(s): Disconnect hydraulic lines and remove both screws securing bracket to the right-hand final drive housing.

Cover connections and exposed openings with plastic plugs or caps to prevent particles of dirt from entering the system.

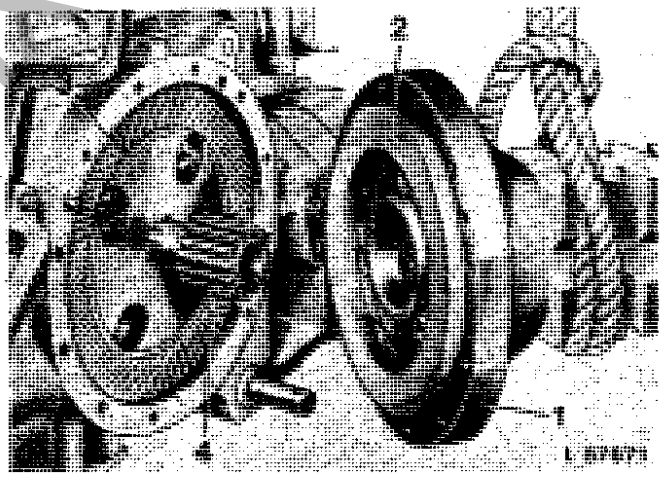


Fig. 8 — Removing Final Drive

1 Final drive housing
2 Pressure ring
3 Brake disk
4 Final drive shaft

Remove selective control valve(s).

Attach final drive to hoist. Remove final drive attaching screws. Separate final drive housing from transmission case. Withdraw housing evenly until final drive shaft gear is no longer in mesh with planetary gears of final drive.

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Group 35
ENGINE COOLING SYSTEM

GENERAL INFORMATION

COOLING SYSTEM

The pressure cooling system includes mainly the radiator, the water pump, the multi-blade fan and the thermostat.

The pump draws coolant from the radiator and pumps it through a passage integral with the pump housing to the cylinder block. After the coolant has passed the cylinder liners, it flows through the cylinder head to the thermostat housing where the thermostat is located. With the engine hot, the thermostat is open and the coolant returns to the radiator. If the engine has not yet reached operating temperature, the thermostat remains closed; the coolant flows from the manifold through a by-pass hose back into the water pump (suction side). In this case it only circulates through the engine and the pump. This way the coolant temperature is automatically regulated by the thermostat. For observing the coolant temperature, a temperature gauge is provided on the dashboard.

RADIATOR

The radiator is of the conventional design with cooling tubes through which the coolant passes and with soldered exterior cores.

The filler neck of the radiator is provided with a filler cap with built-in relief valve.

THERMOSTAT

The thermostat is located in a housing attached to the cylinder head and is available in two types to suit different operating conditions. These thermostats open at varying temperatures of the coolant (see Specifications).

WATER PUMP

The coolant is circulated by means of the centrifugal-type pump which is mounted on the front of the cylinder block. The pump is driven by a V-belt which also drives the alternator and the fan. The pump shaft runs in a prelubricated special bearing. The pump housing is sealed against the bearing with a seal ring. If this seal ring leaks, water escapes through a bore in the pump housing (see "c". fig. 1).

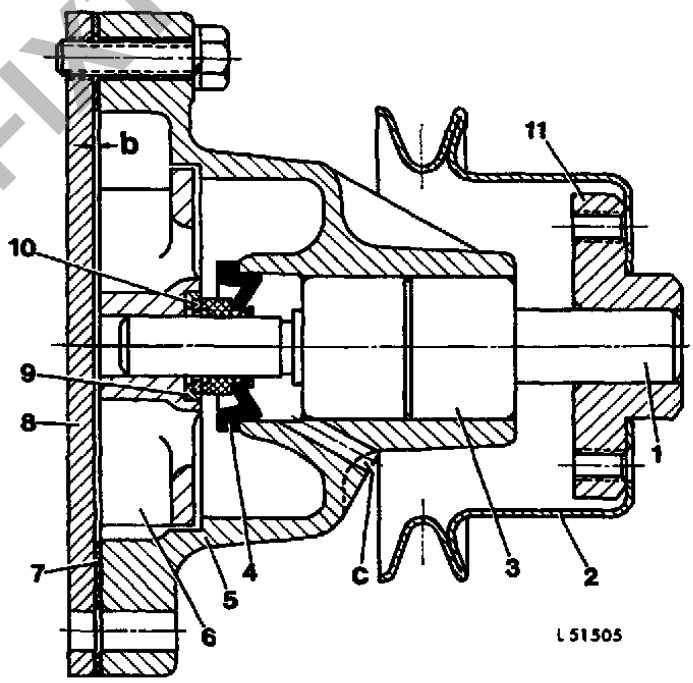


Fig. 1 — Water Pump, Sectional View

1 Pump shaft
2 V-belt pulley
3 Pump shaft bearing
4 Seal ring
5 Pump housing
6 Impeller
7 Gasket
8 Cover
9 Rubber cup
10 Ceramic washer
11 Fan securing plate
b Clearance
c Leakage hole

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Group 22

MOTOROLA ALTERNATOR AND REGULATOR

ALTERNATOR

NOTE: When servicing any part of an alternator charging circuit, observe the precautions in Group 10 of this Section.

GENERAL INFORMATION

The Motorola alternator has a 3-phase, Y-connected stator and a 12-pole rotor with two sealed ball bearings. Six semi-conductor diodes are used to rectify stator current. Current for the rotor field is obtained from the positive diode regulator terminal. An isolation diode prevents battery discharge through the field circuit and permits an indicator lamp to indicate whether the alternator is operating.

For additional information, see FOS Manual 20—ELECTRICAL SYSTEMS.

REPAIR

Disconnect the battery ground before removing the alternator.

Never immerse stator, rotor, brushes, or bearings in cleaning solution.

Hammering or jarring may ruin the diodes.

Remove isolation diode and brushes. Remove thru bolts. Pry stator and slip ring end frame from the rotor and drive end frame. Inserting screwdriver deeper than 1/16-inch may damage windings.

SLIP RING END BEARING

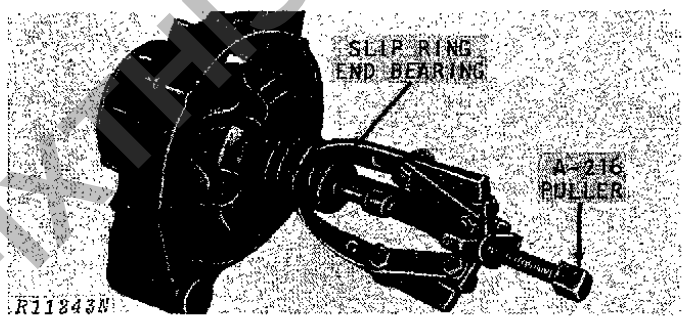


Fig. 1 — Removing Slip Ring End Bearing

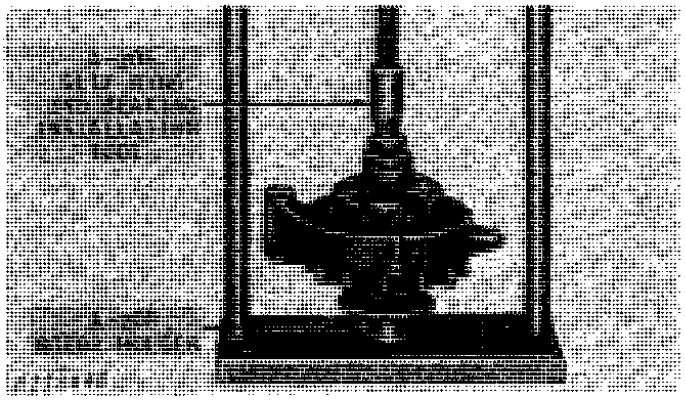


Fig. 2 — Installing Slip Ring End Bearing

Figs. 1 and 2 show slip ring end bearing replacement. Also replace O-ring bearing retainer in slip ring end frame.

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Group 10
HI-LO SHIFT UNIT

GENERAL INFORMATION

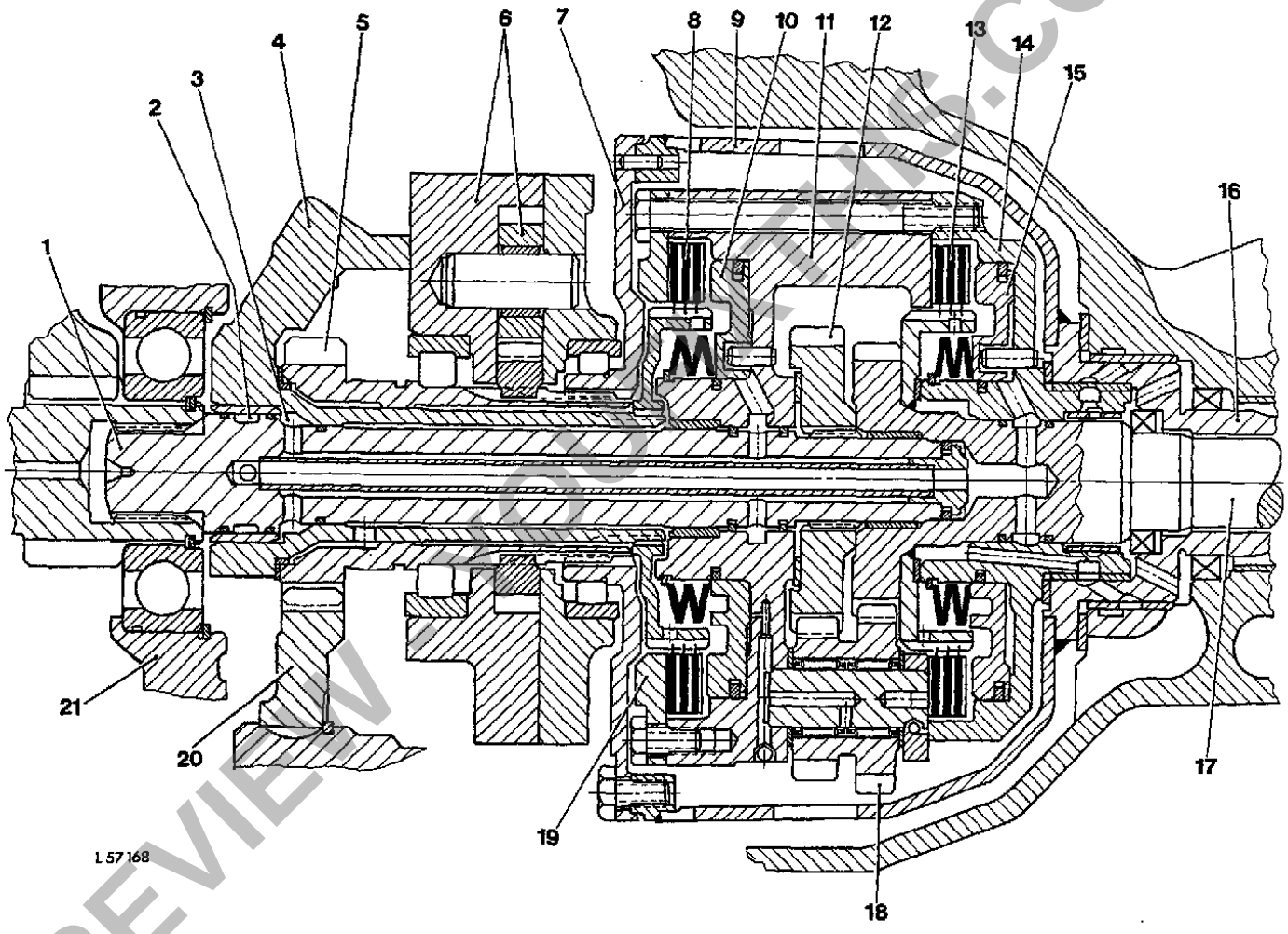


Fig. 1 — Hi-Lo Shift Assembly, Sectional View

1 Transmission input shaft
2 Oil inlet from control valve to Hi- clutch
3 Oil inlet from control valve to Lo- brake
4 Oil manifold
5 Hollow gear shaft (for driving transmission oil pump and PTO)
6 Transmission oil pump
7 Hi-Lo cover
8 Lo- brake
9 Hi-Lo housing
10 Lo- brake piston
11 Planet pinion carrier
12 Planet sun gear
13 Hi- clutch for normal travel speed
14 Hi- clutch drum
15 Hi- clutch piston
16 Hollow drive shaft (integral with Hi-Lo housing 9)
17 Drive shaft
18 Planet gear (3 used)
19 Backing plate
20 PTO driven gear (for independent PTO shown)
21 Front bearing support of transmission case

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Check the internally splined clutch disks 14 and externally splined separator plates 13 for wear, making sure that the grooved pattern of the disk facings is not worn or rubbed off. If so, replace disks. Check the internal splines for damage. For thickness of a clutch disk, see Specifications.

Check piston 8 and clutch drum 3 for cracks or any other damage, and replace if necessary. Check piston sealing ring 7 and both clutch drum sealing rings 1 for serviceability.

Check bushings of clutch drum and bushing of PTO clutch shaft seated in transmission case.

If clutch drum gear 4 has to be replaced, heat new gear in an oil bath to 180°C (360°F) before pressing on.

NOTE: On tractors equipped with Hi-Lo unit, install gear with offset toward large end of drum (see fig. 1) and on tractor not equipped with Hi-Lo unit towards small end of drum (see fig. 2).

Check spring 9 (fig. 5) for damaged or broken coils. Check tension of spring (see Specifications).

ASSEMBLY

When assembling, reverse disassembly procedure, watching the following points:

Install new packing 6 in clutch drum 3 (fig. 5).

Install retainer 10 so that the fins face away from piston.

Install the correct number of clutch disks 14 and separator plates 13 alternately on hub 12 so that a separator plate is on the piston side and a clutch disk on the side of backing plate 15.

INSTALLATION

When installing, reverse removal procedure.

PTO BRAKE

REMOVAL

Separate tractor between transmission case and clutch housing. Remove PTO clutch and PTO clutch shaft (see page 35-6).

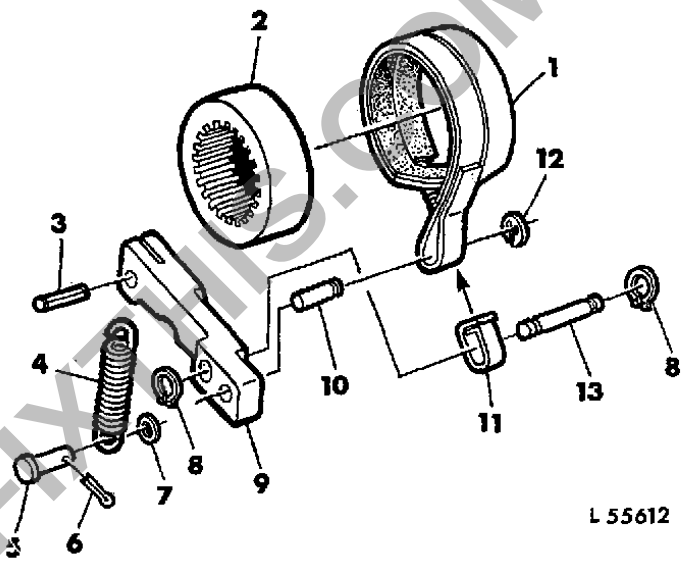


Fig. 6 — Exploded View of PTO Brake

1 Brake band	6 Cotter pin	10 Pin
2 Brake hub	7 Washer	11 Retainer
3 Spring pin	8 Snap rings	12 Snap ring
4 Spring	9 Brake arm	13 Guide pin
5 Headed pin		

Remove transmission front bearing support (see group 15).

Disconnect spring (see 4, fig. 6). Remove inner snap ring 8 from guide pin 13. Remove brake band 1 together with brake hub 2 and arm 9.

Remove brake piston from transmission front bearing support.

REPAIR

Check all parts for wear and damage. Test spring tension (see Specifications).

Replace brake piston O-ring.

INSTALLATION

Slide brake band (see 1, fig. 6) onto brake hub 2 and secure to arm 9 and to transmission front bearing support by means of retainer 11, guide pin 13 and pin 10. Do not yet install inner snap ring 8 onto guide pin 13.

Reconnect spring 4.

Install brake piston into transmission front bearing support.

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ASSEMBLY

When attaching yoke 4 (fig. 8) to ball nut, make sure that closed side of yoke faces ball guides of ball nut (see fig. 8).

Secure yoke with two cap screws provided and tighten to the specified torque.

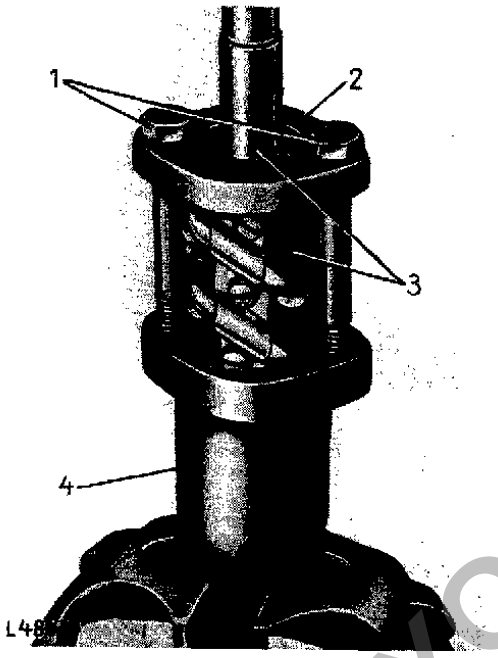


Fig. 8 — Ball Nut and Yoke Assembled

1 Cap screws
2 Retainer
3 Steering wheel shaft and ball nut
4 Yoke

Turn steering wheel shaft counterclockwise out of ball nut, until it stops.

Install steering wheel shaft assembly (take care of steering housing oil seal) so that ball guides of ball nut face front side of steering housing. Pack one of the two barrel bearings with grease and install on steering wheel shaft with bearing cone facing upward. Insert both thrust washer halves and secure by means of snap ring.

Push steering wheel shaft into housing until barrel bearing is against housing shoulder. Pack bearing and thrust washers liberally with grease. Then slide second barrel bearing on steering wheel shaft so that cone bottoms on thrust washers (opposite that of lower barrel bearing).

Make sure that all parts are well greased and screw bearing adjuster in steering housing.

ADJUSTMENT

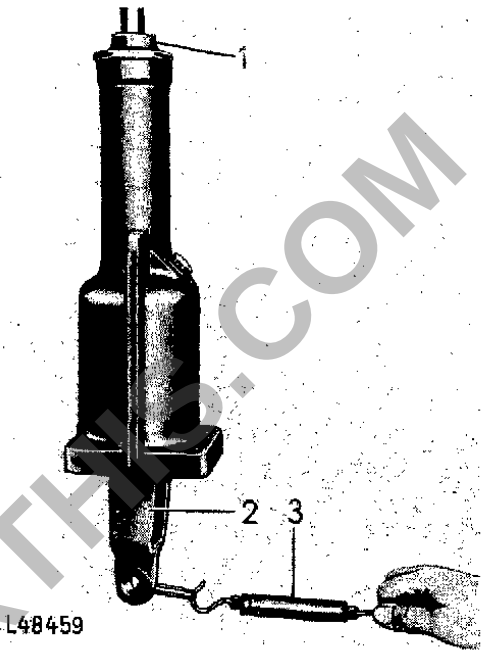


Fig. 9 — Adjusting Preload of Barrel Bearings

1 Bearing adjuster 2 Yoke 3 Spring scale

Turn ball nut so that it is at the bottom of the steering wheel shaft worm. Hook spring scale into bore of yoke as shown in fig. 9 and tighten bearing adjuster 1 (fig. 9) until a specified force is required to move the yoke (see Specifications).

Tighten adjuster lock nut to specified torque. Hold adjuster while tightening.

INSTALLATION

For installation, reverse removal procedure.

Use new gasket between steering housing and clutch housing.

IMPORTANT: Make sure inside tab of gasket is located under left rear corner of steering housing.

Tighten attaching screws of steering housing assembly to the specified torque (see "Torques for Hardware").

Tighten cap screw of steering shaft lock plate to the specified torque (see "Torques for Hardware").

NOTE: When positioning steering housing assembly, be sure that side of yoke marked "R" is toward the right side of the tractor (see inset, fig. 7).

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Examine valve pin of plug for damage or wear and replace, if required. Bottom new valve pin in plug bore.

Check tension of valve spring 2 (see Specifications).

When installing, provide plug with a new O-ring.

CHECK VALVE IN INLET LINE OF HYDRAULIC PUMP

(Tractors without Hi-Lo unit and without independent PTO)

GENERAL INFORMATION

A spring loaded check valve 1 (fig. 4) is installed in the end of the hydraulic pump inlet line, connected to the clutch housing. This check valve prevents oil from returning to transmission case from the pump and inlet line when transmission oil pump is not working. This insures a ready supply of oil for the hydraulic pump upon demand under most operating conditions.

REPAIR

Remove retainer securing hydraulic pump inlet line and return line to clutch housing. Disconnect inlet line at hydraulic pump and push forward. Remove check valve assembly from inlet line (see fig. 4).

Check valve spring for cracks and broken or compressed coils and replace, if necessary. Check tension of valve spring (see Specifications).

Check seat of check valve and spring guide for wear and damage and replace, if necessary.

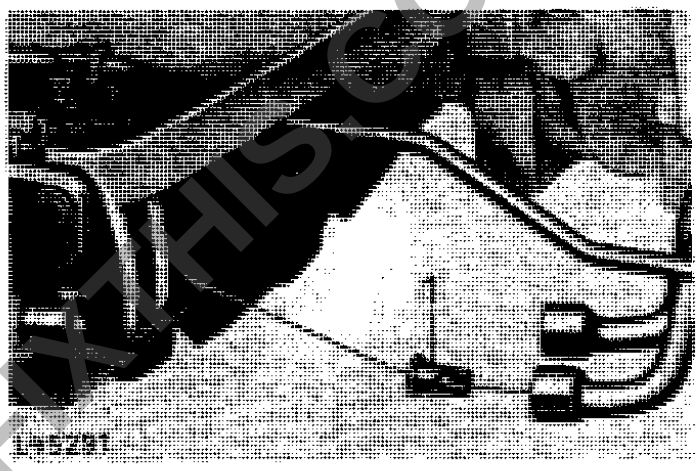


Fig. 4 — Check Valve in Hydraulic Pump Inlet Line

1 Check valve assembly

When installing lines, place retainer over lines before plugging it into the clutch housing. Make sure seal washers have been installed between lines and housing. Tighten retainer cap screw to specified torque (see Torques for Hardware).

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Section 80
MISCELLANEOUS

CONTENTS OF THIS SECTION

GROUP 5 — BELT PULLEY

Page

General information 5-1
Removal and disassembly 5-1
Repair 5-4
Assembly and adjustment 5-4
Specifications 5-6

GROUP 10 — DE LUXE SEAT

General information 10-2
Repair 10-2

GROUP 15 — FRONT AND REAR WHEELS

Page

Front wheels
Repair 15-1
Adjusting front wheel bearings 15-2

Rear wheels (tractors with rack-and-pinion axle)
General information 15-2
Removal 15-3
Repair 15-3
Installation 15-3

Torques for hardware 15-3

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Group 5
BELT PULLEY

GENERAL INFORMATION

The belt pulley assembly is driven by the PTO stub shaft. It is a straight bevel gear type unit and is attached to the transmission case.

REMOVAL AND DISASSEMBLY

Drain oil from pulley case by removing filler plug. Remove pulley guard. Remove pulley from shaft, using a puller if necessary.

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