3030 and 3130 Tractors

JOHN DEERE

TECHNICAL MANUAL

3030 and 3130
Tractors

TM4277 (01JUN79) English

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Section 10
General

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Group 25
Tractor Separation

SEPARATING BETWEEN ENGINE AND TRACTOR FRONT END

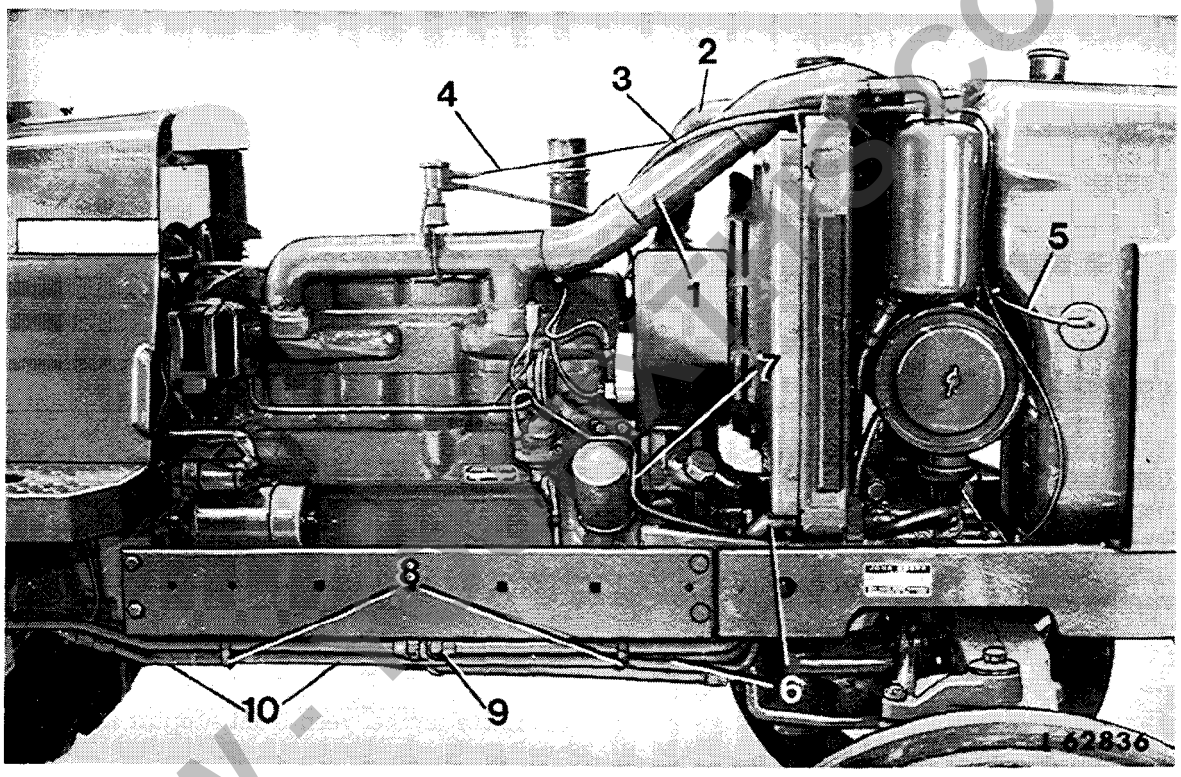


Fig. 1 — Separating between Tractor Front End and Engine

1 Air intake pipe
2 Upper water hose
3 Leak-off and vent line
4 Fuel return line
5 Cable of fuel gauge sending unit
6 Oil cooler return line
7 Fuel inlet line, tank to transfer pump
8 Hose clamps
9 Hydraulic pump inlet line
10 Hydraulic pump pressure line

REMOVAL

For safety disconnect ground straps from batteries. Remove front end weights (if equipped). Remove radiator cap and fuel tank cap. Remove radiator side grilles and hood.

Remove side frames.

If necessary, before removing hood, disconnect turn-signal light cables at plug.

Reinstall radiator and fuel tank caps.

Disconnect fuel return line 4 at tank.

Disconnect cable 5 of fuel gauge sending unit at tank.

Disconnect cables leading to headlights at distributor.

Disconnect cable at air cleaner restriction warning switch.

Disconnect air intake pipe 1 at engine intake manifold or at turbocharger (if equipped).

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On earlier tractor models: Install fuel transfer pump and connect fuel lines. Make sure transfer pump inlet line is below and behind fuel pressure line.

Open fuel tank shut-off valve.

Connect cables to air cleaner restriction warning switch and fuel gauge sending unit.

Connect headlight cables to distributor.

Attach water hoses to radiator.

Connect leak-off and vent line to hydraulic oil reservoir. Install spacers and clamps of hydraulic lines.

Attach air intake pipe to air intake manifold or turbocharger (if equipped).

Attach drag link to bell crank and tighten slotted nut to the specified torque.

Install hood and radiator side grilles.

If necessary, connect turn-signal light cables at plug.

Fill radiator with clear soft water, adding an anti-freeze-rust inhibitor mixture (see Operator's Manual).

Connect ground straps to batteries.

IMPORTANT: Always connect ground straps to negative (-) pole of batteries.

Start engine and check fuel lines, hydraulic lines and water hoses for leaks.

REMOVING AND INSTALLING ENGINE

NOTE: For most engine service operations the engine need not be removed. However, if the crankshaft has to be removed or in case of major overhaul, remove engine.

REMOVAL

For safety disconnect ground straps from batteries.

Separate tractor front end engine, as explained previously.

On tractors without operator's cab:

Remove attaching screw of right-hand, front half of foot rest from flywheel housing.

Disconnect cables between alternator and regulator by removing three-terminal plug at alternator. Disconnect red cable at terminal B+ of alternator.

Disconnect all cables at starting motor.

Disconnect oil pressure warning switch cable 4 (fig. 3) and cable at signal horn.

Disconnect flexible shaft 2 (fig. 3) of speed-hour meter at clutch housing and camshaft. If necessary, replace rubber gasket of flexible shaft (it may remain in bore of clutch housing).

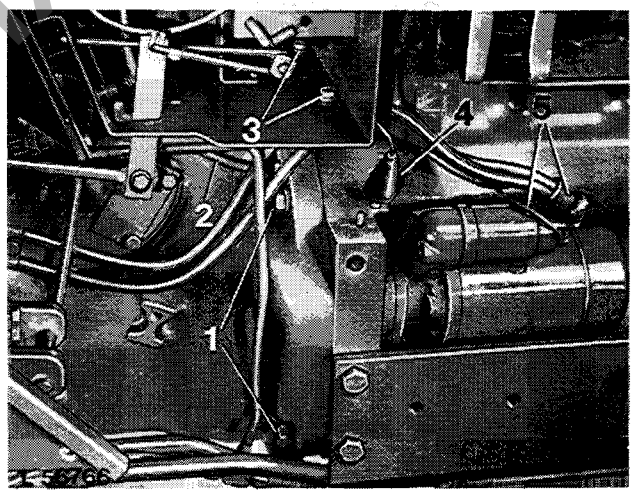


Fig. 3 — Separating between Engine and Clutch Housing, R.H. Side

1 Engine attaching screws
2 Flexible shaft of speed-hour meter
3 Cap screws attaching cowl
4 Oil pressure warning switch
5 Starter cables

Remove cap screws 3 attaching cowl to flywheel housing.

On tractors with starting fluid adapter: Disconnect starting fluid line at intake manifold.

On tractors with Thermostart aid: Disconnect cable at heater of intake manifold.

Free engine wiring harnesses as well as leak-off and vent line of hydraulic oil reservoir.

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INSTALLATION

Install camshaft, observing the following:

1. Coat camshaft with light, clean engine oil.
2. When installing, make sure that cam lobes do not damage bearing bores in block.
3. Rotate camshaft until cap screws attaching thrust plate can be installed and tighten them to specified torque.
4. Check camshaft end play (a new camshaft and a new thrust plate should add up to the proper end play).
5. With crankshaft at TDC and piston No. 1 (front) on compression stroke, adjust camshaft for valve timing.

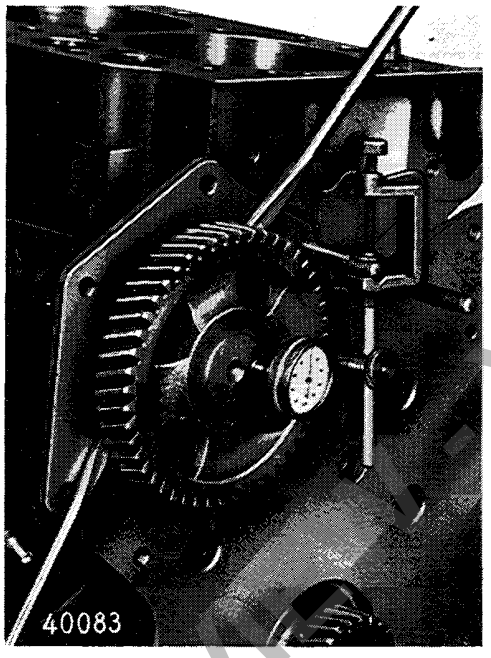


Fig. 9 — Measuring Camshaft End Play

6. Use timing tool No. JD 254 to align timing mark "b" on camshaft gear (fig. 10) with center of crankshaft.

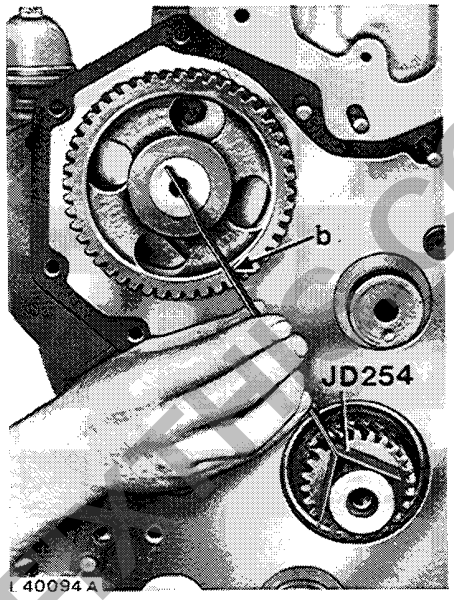


Fig. 10 — Timing Camshaft Gear by Means of Timing Tool No. JD 254

b Timing mark

7. With camshaft gear in this position, install upper idler gear and tighten cap screw to specified torque (see Torques for Hardware).

Install cam followers, cylinder head, timing gear cover and fuel transfer pump.

Run engine for some time at a specified load (see Specifications) and then retighten cylinder head cap screws to specified torque. Check valve clearance and readjust, if necessary.

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GENERAL INFORMATION

The Roto Diesel fuel injection pump is a horizontally installed distributor pump with mechanical governor and automatic hydraulic speed advance. The moving parts of the pump are simultaneously lubricated and cooled by the Diesel fuel flowing through the pump. No lubricant is required.

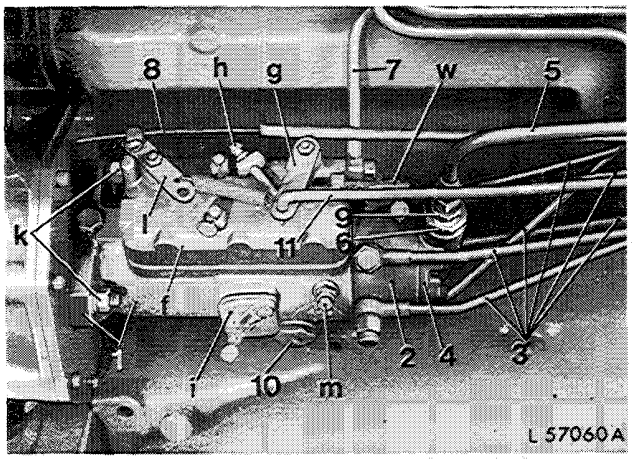


Fig. 2 — Fuel Injection Pump Installed (Up to Engine No. 213 211 CD)

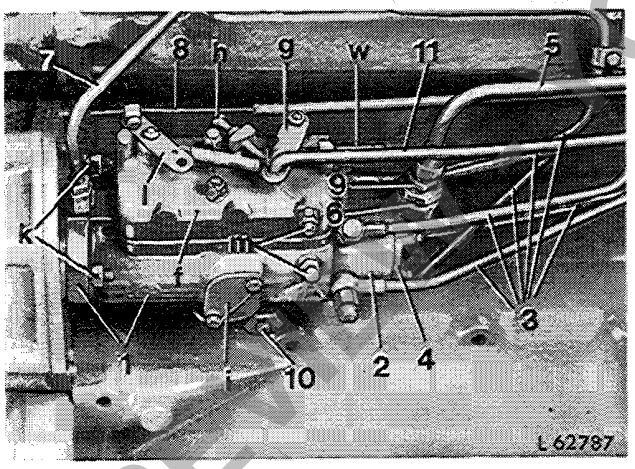


Fig. 3 — Fuel Injection Pump Installed (From Engine No. 213 212 CD)

1 Pump housing with mounting flange
2 Pump head
3 Fuel pressure lines
4 Pump cover
5 Fuel supply line
6 Fuel inlet screen
7 Bleed and fuel return line to tank
8 Shut-off cable
9 Adapter
10 Hydraulic, automatic speed advance
11 Speed control rod
f Governor housing
g Speed control lever
h Adjusting screw for slow idle speed
i Cover
k Hex. nuts for attaching the pump (3 used)
l Shut-off lever
m Bleed plugs
w Adjusting screw for high idle speed

Transfer Pump and Metering

The diesel fuel for injection is fed to the cylinders — regardless of their number — by a single unit. Its pump and distributor rotor is fitted with two opposed plungers controlled by a cam ring. The distribution to the individual cylinders is done by the rotor in conjunction with the pump head (see fig. 4). This design assures an equal quantity of fuel being injected into each cylinder at any moment.

On the other end of the rotor, opposite the two pump plungers, there is a transfer pump which delivers the fuel, sucked from the fuel filter, through the metering valve into inlet bore "a", (see fig. 4) in the pump head, at a pressure which varies with engine speed.

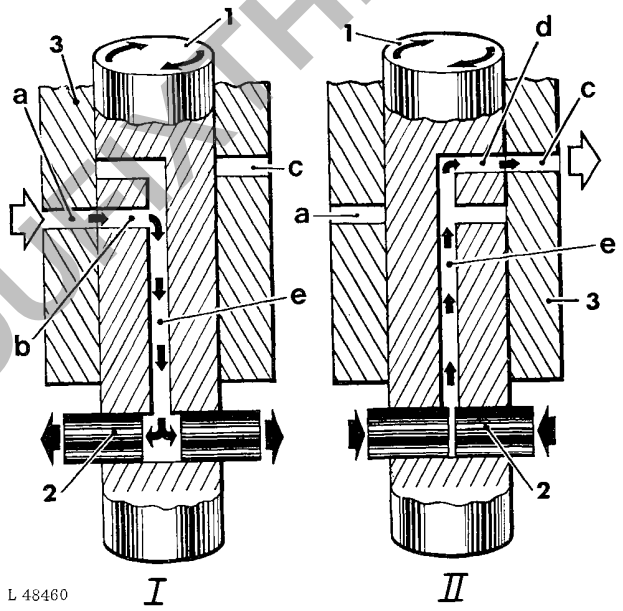


Fig. 4 — Diagram of Fuel Distribution by Rotor Action

I Filling the rotor with the fuel quantity adjusted to load requirements
II Fuel supply to cylinder, adjusted to load requirements
1 Pump and distributor rotor
2 Pump plungers
3 Pump head
a Inlet bore in pump head
b Inlet bore in pump- and distributor rotor
c Outlet bore in pump head
d Distributor bore in pump- and distributor rotor
e Longitudinal bore in pump- and distributor rotor

Filling Process (see I, fig. 4): As rotor 1 rotates, the inlet bore "a" in pump head 3 aligns with the inlet bore "b" in the rotor. The fuel coming from the transfer pump reaches the pump plunger chamber through bores "a" and "e" (regulated by the metering valve) and forces the two plungers 2 apart.

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MEASURING AND ADJUSTING GEAR BACKLASH

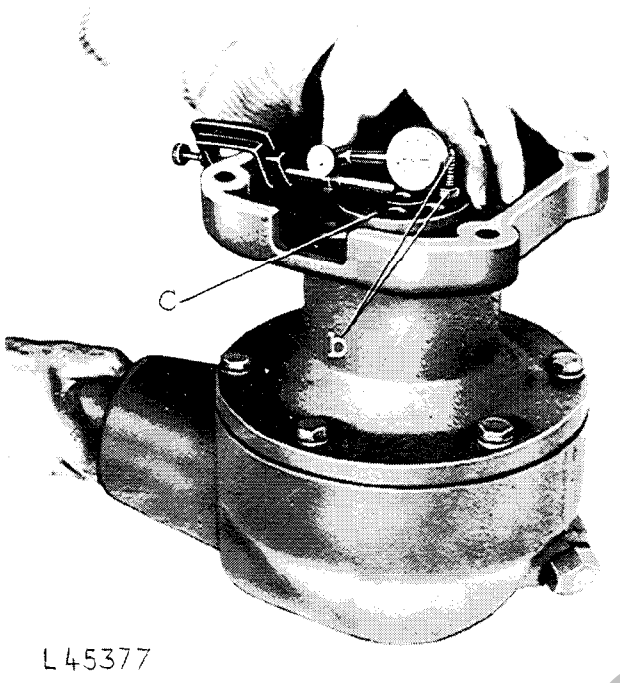


Fig. 8 — Measuring Gear Backlash

b Cap screw and nut
c PTO stub shaft

Use a dial indicator as shown on fig. 8. Prior to measuring, insert a cap screw in PTO stub shaft and secure it with a nut (see "b"). Install 1000 rpm PTO stub shaft (or 540 rpm stub shaft respectively), and tap lightly to insure proper seating. Fasten dial indicator on quill so that its pin touches the cap screw in the stub shaft, then rotate drive shaft slightly to the left and right and take backlash reading.

To establish correct backlash (see Specifications), remove hub assembly and quill. Add or deduct shims beneath inner bearing cone 8 (see fig. 2).

CHECKING AND ADJUSTING END PLAY OF DRIVE GEAR HUB ASSEMBLY

Use a dial indicator to check end play of hub assembly roller bearings. If required, add or remove shims between the quill and belt pulley case to obtain correct end play (see Specifications).

ADJUSTING DRAG TORQUE

Install belt pulley, washer and slotted hex. nut.

Tighten slotted nut to specified roll drag torque (see Specifications).

If slot in nut does not match cotter pin hole in shaft, tighten until next slot matches cotter pin hole. Install cotter pin.

Mount belt pulley drive assembly to transmission case and fill belt pulley case to level of filler hole with recommended oil (see Operator's Manual).

Install pulley guard.

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PREDELIVERY INSPECTION (Contd.)

Service	Specifications	Reference
COOLING SYSTEM		
Check radiator for coolant loss	Coolant level should be midway between radiator core and bottom edge of filler neck.	Operator's manual
Check gravity of antifreeze and rust inhibitor mixture	. . . . .	Operator's manual
ELECTRICAL SYSTEM		
If the tractor is to be operated for a short time without battery (using a slave battery for starting), do not, under any circumstances, interrupt the circuit by switching off the main switch before stopping the engine by means of fuel pump shut off cable. Use additional current (lights) whilst engine is running. Insulate terminal of battery cable before starting the engine by means of slave battery. **If this advice is disregarded, damage to alternator and regulator may result.**	. . . . .	Section 40, group 10
If the batteries are to be installed, connect them in the proper polarity (negative to ground). If they are improperly connected, the rectifier diodes will be immediately destroyed.	. . . . .	Section 40, group 10
First connect positive (+) cable and then ground (-) strap of each battery. Only then start tractor engine.	. . . . .	Section 40, group 10

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Pressure Rings and Brake Disks

REMOVAL

Removal of final drives see section 10, group 25.

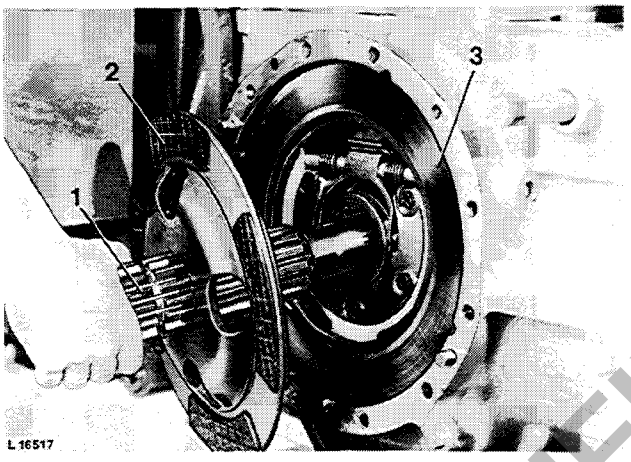


Fig. 5 — Removing Brake Disk (Later Tractor Series Shown)

1 Final drive shaft
2 Brake disk
3 Brake ring (from serial no. 301 275 lb)

Remove final drive shaft and brake disk.

From serial no. 301 275 L, remove brake ring 3 (fig. 5).

Lift pressure ring with the two packings from the final drive housing.

REPAIR

Check facing as well as internal splines of brake disk 2 (fig. 5) for excessive wear. If necessary, replace disk.

Inspect pressure rings and, from serial no. 301 275 L the brake ring for scoring or other damage and replace, if necessary.

Discard packings of pressure rings and replace with new ones.

INSTALLATION

Up to serial no. 301 274 L, slide brake disk on final drive shaft so that the thicker facing interwoven with brass faces the transmission housing when final drive shaft is installed.

From serial no. 301 275 L, install brake ring 3 (fig. 5) in transmission case with protruding side of lugs facing inward. Slide brake disk on final drive shaft.

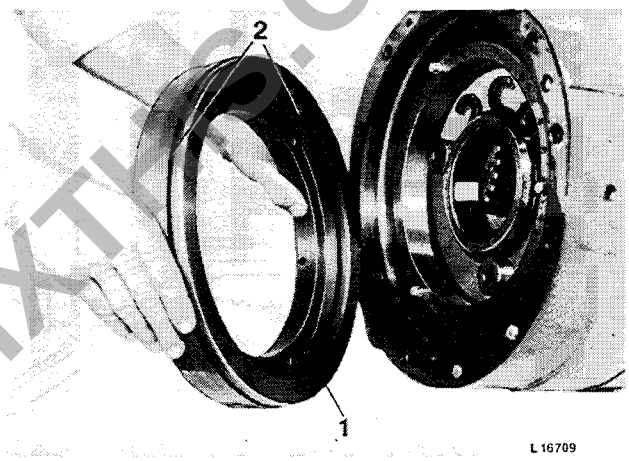


Fig. 6 — Installing a Pressure Ring with Packings

1 Pressure ring
2 Packings

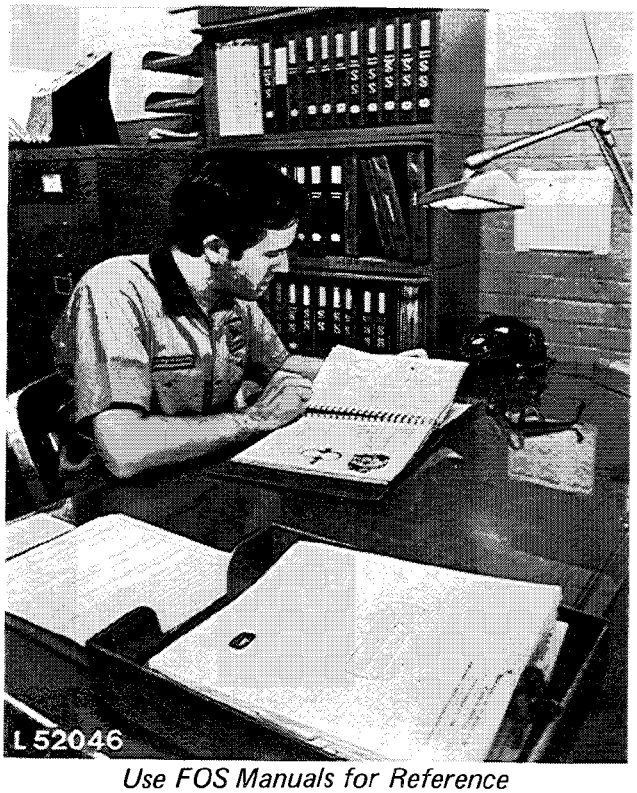
Install pressure ring in recess of brake housing, aligning pressure ring bores with dowel pins in brake housing.

Make sure pressure ring is seated on bottom of bore and that the packings have not been damaged or turned over during installation.

Install final drives as explained in section 10, group 25. Bleed brake system (see page 4).

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Introduction



Use FOS Manuals for Reference



Use Technical Manuals for Actual Service

This technical manual is part of a twin concept of service:

- **FOS Manuals — for reference**
- **Technical Manuals — for actual service**

The two kinds of manuals work as a team to give you both the general background and technical details of shop service.

Fundamentals of Service (FOS) Manuals cover *basic* theory of operation, *fundamentals* of trouble shooting, *general* maintenance, and *basic* types of failures and their causes. FOS Manuals are for training new personnel and for reference by experienced technicians.

Technical Manuals are concise service guides for a *specific* machine. Technical Manuals are on-the-job guides containing only the vital information needed by an experienced technician.

IMPORTANT! Your technical manual contains the international standardized SI metric measurement system.

When a technician should refer to a FOS Manual for more information, a FOS symbol like the one at the left is used in the TM to identify the reference.

Some features of this technical manual:

- *Table of contents on page 1*
- *Contents at front of each Section*
- *Specifications at end of each Group*
- *Torques for hardware at end of each Group*
- *Special tools at end of each Group*

This technical manual was planned and written for you — an experienced technician. Keep it in a permanent binder in the shop where it is handy. Refer to it whenever in doubt about correct service procedures or specifications.

Using the technical manual as a guide will reduce error and costly delay. It will also assure you the best in finished service work.

This safety alert symbol identifies important safety messages in this manual. When you see this symbol, be alert to the possibility of personal injury and carefully read the message that follows.

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ASSEMBLY

CONNECTING RODS, PISTONS AND PISTON RINGS

Make sure that the marks for identifying matched pistons and connecting rods, applied prior to disassembly, do tally.

Apply a coat of clean, thin engine oil to the piston pin and insert in piston bore and through connecting rod bushing. A properly fitting piston pin can be positioned by thumb pressure.

Installing Piston Rings

NOTE: New piston rings are furnished with the correct end gap. This should not be altered.

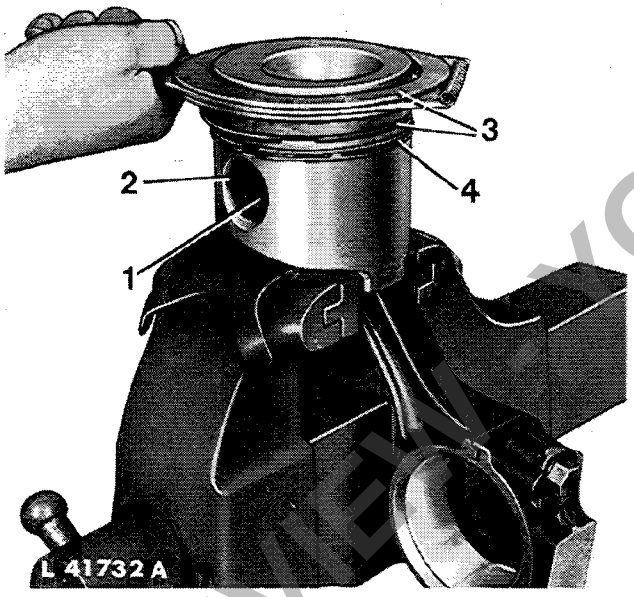


Fig. 3 — Installing Piston Rings

1 Piston pin
2 Snap ring
3 Compression rings
4 Oil control ring

Install piston rings, using a commercial piston ring expander.

1. Install the expander ring in groove of oil control ring so that its gap is over a piston pin bore. Then install oil control ring in ring groove with the gap opposite the expander gap.

2. Install second compression ring in center groove with "TOP" mark facing upward and with its gap shifted 120° from expander ring gap.

3. Then install upper compression ring with its gap shifted 120° from the gap of the second compression ring.

Coat exterior of piston and all piston rings with a film of clean engine oil.

INSTALLATION

CYLINDER LINERS

Make sure cylinder block is completely clean and that the O-rings are removed from cylinder block grooves.

Install cylinder liner WITHOUT square packing and secure by means of a washer and cap screw.

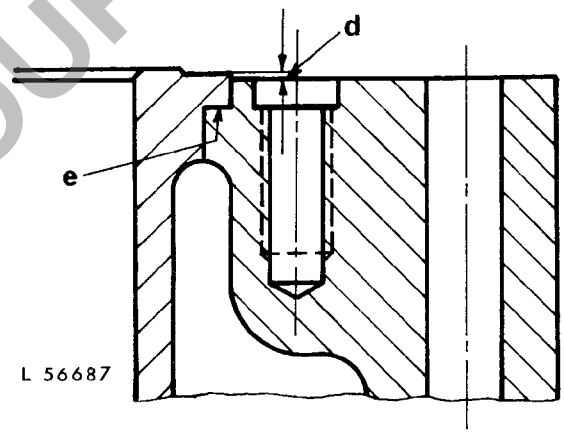


Fig. 4 — Upper Fit and Sealing Face of Cylinder Liner in Cylinder Block

d Check dimension
e Seating area

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TESTING INJECTION NOZZLE WITH NOZZLE TESTER

NOTES

Testing the performance of a nozzle while the engine is running is just a rough test. To obtain a true check of nozzle performance, use a nozzle tester (see Special Tools). To connect a nozzle to the BOSCH tester a special tool is necessary (see Special Tools).

Use only carefully filtered Diesel fuel for testing the injection nozzles, since dirty fuel will severely damage the precision parts of a nozzle.

CAUTION: The nozzle tip must always point away from the operator. The fuel issuing from an orifice can penetrate clothes and skin and thus cause severe infection. It is therefore advisable to direct the jet of atomised fuel into a transparent container (see fig. 6).

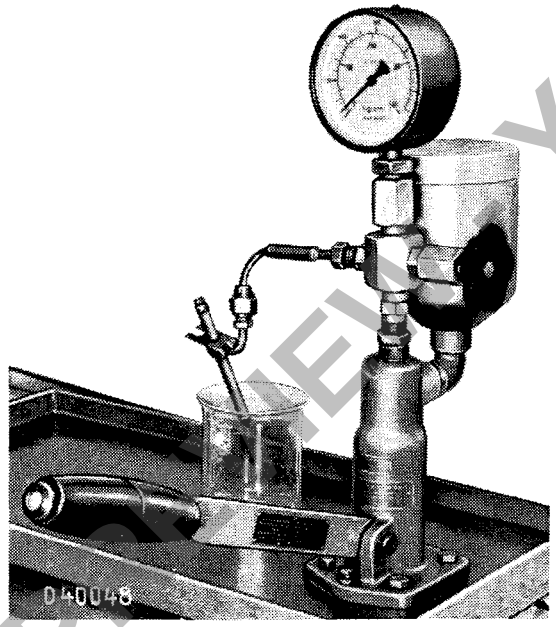


Fig. 6 — Injection Nozzle Connected to BOSCH Tester

Connect the injection nozzle to the tester as shown in fig. 6 so that the axis of the injection nozzle forms an angle of approx. 30° to the vertical, and the spray of fuel is directed downwards and all of it is collected in the container underneath. Make sure that all connections are leakproof to avoid false results when testing.

Close the gauge shut-off valve and flush (bleed) the nozzle by operating test pump rapidly. Thus, the nozzle valve, too, will seat.

SPRAY PATTERN TEST

Close gauge shut-off valve and operate the pump lever at 60 strokes per minute. If the injection nozzle is working properly, the fuel should issue through all nozzle orifices in a fine, evenly shaped spray cone. This spray cone is inclined from the centerline of the nozzle body, but should be evenly distributed. For a better check, place a piece of paper or cardboard at a suitable distance below the nozzle and check the appearance of the damp circular spots made by the fuel. Deviations from the regular spray pattern or angle may be due to the complete or partial clogging of a nozzle orifice. In this case the fuel issues in a jet rather than in a fine spray.

CHATTER TEST

Make sure nozzle orifices are free. When working pump of injection nozzle tester at 60 strokes per minute (gauge shut-off valve closed), a definite characteristic "chatter" should be heard. If this is not the case, the nozzle valve may be bent, or tight in its guide because of the laquer deposits which have accumulated. This can be corrected only by disassembling the nozzle.

TESTING OPENING PRESSURE

NOTE: Absolute opening pressure is less important than equal opening pressure of all nozzles. Max. permissible variation see Specifications.

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No.	Cables and Wires mm^2	Color	from Component No.	from No.	from Terminal	to Component	to No.	to Terminal No.
105*	1	red	Cab heater relay	57	86	Fuse (radio)	53	
106*	1	green	Cab heater relay	57	86	Fuse box (fuse 3)	34	15
107*	2.5	black	Main switch	37	15	Cab heater relay	57	30/51
108*	1.5	red	Cab ventilation and heater fan switch	41	B	Cab heater relay	57	87
109*	1.5	brown	Cab heater relay	57	85	Windshield wiper	31	31
110*	1.5	yellow	Cab ventilation and heater fan switch	41	M	Cab ventilation and heater fan	43	
111*	1.5	red	Cab ventilation and heater fan switch	41	H	Cab ventilation and heater fan	43	
112*	1.5	green	Cab ventilation and heater fan switch	41	L	Cab ventilation and heater fan	43	
113*	1.5	brown	Cab ventilation and heater fan	43		Cab roof		Ground

* On later tractors (see wiring diagram, fig. 5)
** On earlier tractors (see wiring diagram, fig. 4)

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CHECKING OPERATION OF HIGH-LOW SHIFT UNIT

Operate tractor in both High and Low ranges, carefully observing both operations. Use the brakes to simulate a load condition on the tractor. Low oil pressure in the High-Low control valve assembly will be indicated by equal disk pack slippage in both ranges. If operation is normal in one range and not in the other, a mechanical failure in the High-Low shift unit is probably the cause.

Always check operating pressure before disassembling the High-Low shift unit.

NOTE: Speed of shifting on High-Low unit is not adjustable. However, the unit should shift instantly, when the control lever is moved. The correct pressure adjustment assures oil for fast engagement of High-Low disk packs.

REMOVAL

Separate tractor between transmission case and clutch housing, see section 10, group 25.

Pull PTO clutch out of bearing support 10 (fig. 5) and clutch housing.

Pull transmission input shaft 1 out of High-Low housing.

Remove retainer holding oil lines 2, 3 and 4.

Lift both pressure lines 2 for High-Low disk packs upward out of clutch housing.

Remove control valve assembly and intermediate plate 11.

Pull PTO clutch inlet line 9 out of bearing support 10. Remove inlet line 4 and lube oil line 5.

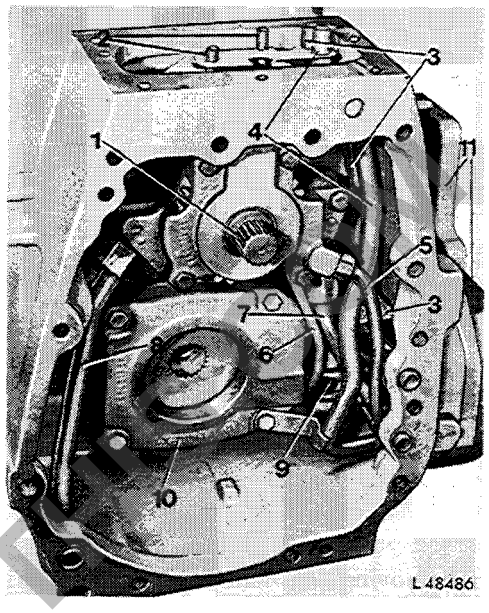


Fig. 5 — Removing Oil Lines (PTO Clutch Removed)

1 Transmission input shaft
2 Pressure lines to disk packs
3 Pressure line from transmission oil filter to High-Low control valve assembly and PTO clutch control valve assembly
4 Inlet line to hydraulic pump
5 Lube oil line to Low disk brake
6 Lube oil line to High disk clutch (up to tractor no. 153 092 L* shown)
7 Pressure line of transmission oil pump
8 Suction line of transmission oil pump
9 PTO clutch inlet line
10 PTO brake oil manifold
11 Intermediate plate and control valve assembly of PTO clutch

Up to tractor no. 139 092 L: Also remove lube oil line 6.

Remove pressure line 7 and suction line 8 of transmission oil pump.

Remove cap screws attaching High-Low oil manifold and transmission oil pump to clutch housing. Remove oil manifold with hollow gear shaft and transmission oil pump as shown in fig. 6.

Remove PTO brake oil manifold 10 (fig. 5), PTO brake and PTO brake bearing cover (see Group 30).

* From tractor no. 153 093 L the lube oil line 6 is connected direct to pressure line 3 (see fig. 6)

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MANUAL TURNS

The steering wheel shaft and piston rod provide sufficient mechanical advantage to turn the tractor, when engine is not running or when there is a malfunction in the hydraulic system.

Turning the steering wheel will actuate the special washers, valve sleeves and steering valves the same as for a power turn. The vertical thrust is taken up mainly by the thrust bearings and valve bodies.

As the steering wheel shaft continues to turn, the piston rod will move causing the piston to push oil out of the steering cylinder, allowing the front wheels to turn. The stops are the same as in power steering operation.

TESTING STEERING SYSTEM

NOTE: Key numbers refer to fig. 4 if not otherwise indicated.

Should trouble on the power steering occur, always check hydraulic pump and pressure control valve first for proper operation, as described in section 70, group 5. If hydraulic pump and pressure control valve operate properly, use testing procedure as follows.

Shut off engine. Jack up front wheels and steer manually. Turn steering wheel left and right to steering limits. There should be no binding and no extreme hard spots in steering. If hard turning exists, check the mechanical linkage.

With wheels on the ground and engine running, turn steering wheel to both steering limits. Steering effort and reponse should be the same in both directions. Slow steering or excessive steering effort in one direction may indicate faulty operation of that valve body assembly (23 or 24, fig. 3) which controls pressure oil for that steering direction. Steering trouble in both directions indicates a fault in both valve body assemblies 23 and 24.

Check for front wheel steering drift when tractor is moving, when it is standing still and with its front wheels jacked up. Drift is usually caused by steering valve or O-ring leakage in the circuit of the steering direction affected.

Steering valve leakage can be caused by a worn or distorted seat or dirt on valve seat, or improper adjustment of valve body shims "a" (see figs. 4 and 5).

NOTE: The number and thickness of shims "a" (fig. 3) and thus the clearance between special washers "c" and valve sleeves "d" has been determined at the factory. Should it become necessary to replace shims "a", then adjust using special tool KCE 10001 (see under "Adjustment"). When removing and disassembling valve body assemblies 23 and 24 be extremely careful not to change the shim pack adjustment or to mix up the other components of the valve body assemblies.

A large volume of oil leakage past seal 6 in adjuster 7 indicates a restricted or blocked return oil passage. This can be caused by improper installation of the thrust washers 18 and 20 of the lower thrust bearing. If the large chamfer of thrust washer 20 does not face the lower valve body assembly 24 (fig. 3), the return passage will be restricted.

The return oil passage in the clutch housing may be blocked by improper installation of gasket 32 between steering valve housing and clutch housing.

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PUMP TESTS AND DIAGNOSING MALFUNCTIONS

See group 5 for diagnosing malfunctions, as well as for testing the hydraulic pump before removal.

OPERATION

The pump crankcase (see 1, fig. 8) where the pump shaft, cam and race are located, contains oil under pressure to hold pistons away from race (piston stand-by position). The pistons are held in this "stand-by" position until a demand for oil is placed on the pump by one of the tractor hydraulic functions.

All eight pistons are connected together by two separate annular passages which serve as inlet gallery 7 and pressure outlet gallery 12 for the pump. Each piston is connected by an individual inlet valve 6 to the inlet gallery and by an individual discharge valve 11 to the pressure outlet gallery.

Operation of one or more of the hydraulic functions reduces pressure in the outlet gallery of the pump and therefore also in the crankcase outlet valve 15. This pressure reduction causes the crankcase outlet valve spring to move the valve up, permitting oil from the pump crankcase to enter the inlet gallery of the pump.

Reduced pressure in outlet gallery also reduces pressure in pump crankcase. This allows spring-loaded pistons 9 to move toward race 2.

As the pistons move toward the race, a partial vacuum is created at the outer or spring end of the pistons. This pressure differential and the oil pressure in the inlet gallery cause the inlet valves 6 to open, allowing oil to enter and fill the spring area of pistons. At the end of the intake stroke, the partial vacuum no longer exists and the inlet valve spring closes the inlet valve against inlet oil pressure.

Further rotation of the pump shaft, cam and race causes the pistons to move out, forcing the trapped oil through the discharge valves 11 into the pressure outlet gallery. At the end of the pressure stroke, discharge valve spring 10 closes discharge valve 11.

This sequence of operation continues until the combined effort of all eight pistons increases oil pressure in the outlet gallery.

This increased pressure also occurs in the center and upper area of crankcase outlet valve 15. As the upper part of valve is larger than the bottom, the valve is forced down when pressure overcomes resistance of crankcase outlet valve spring. The valve thus stops oil flow from pump crankcase to inlet gallery of pump.

Pressure oil in upper part of crankcase outlet valve 15 flows to stroke control valve 13, forcing it open as oil reaches operating pressure. This allows oil to flow into crankcase, increasing crankcase pressure.

The race moves the pistons out and the increased crankcase pressure, which is approximately 4 bar (60 psi) higher than in the piston spring chamber, holds the pistons away from the race in "stand-by" position.

The bleed hole 14 located between spring chamber below stroke control valve and crankcase outlet valve maintains a permanent slight oil flow from the crankcase to the inlet gallery. Because of the consequent slow pressure drop in the crankcase, the pump must go on stroke intermittently to bring the oil to its previous pressure.

In the pump "standby" position the pistons also deliver a small amount of oil. This oil circulation serves to cool the pump.

The stroke control valve 13 can be adjusted to give more or less pressure in the outlet gallery and pump crankcase.

Piston movement toward the race is influenced by the demand for pressure oil (varying pressure drops in crankcase and pressure outlet gallery). Less demand for oil causes less movement of each piston toward the race so that less oil is delivered by the pistons (pistons contact race later). The greater the drop in pressure, the greater the supply from each piston (variable displacement).

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