Group 5

Specifications

SERIAL NUMBERS

The engine serial number is stamped into the name plate located on the lower front right-hand side of the cylinder block.

Flywheel horsepower at rated engine speed of 2500 rpm according to DIN 70020 . . . . . 55 kW (75 HP)

PTO horsepower*

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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.

On tractors with operator's cab: Before removing hood disconnect turn-signal light cables at plug.

Install radiator and fuel tank caps.

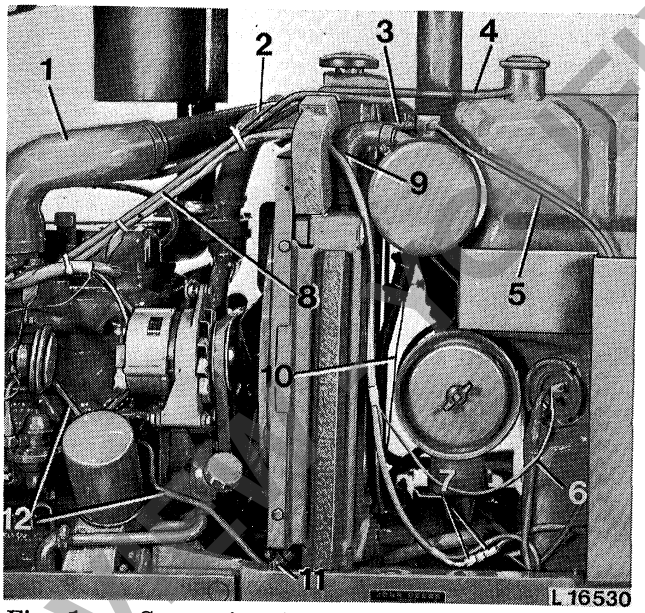

Fig. 1 — Separating between Tractor Front End and Engine

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

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

Disconnect leak-off and bleed lines 3 and 5 at hydraulic oil reservoir.

Remove support rod 8 at top of radiator. Disconnect fuel return line 4 at fuel tank.

Disconnect cable 6 of fuel gauge sending unit at fuel tank.

Disconnect cables leading to headlights at distributor 7.

On headlights with parking lights disconnect cables at distributor.

Disconnect cable 10 at air cleaner restriction warning switch.

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

Remove hose elbow 9 between hydraulic oil reservoir and oil cooler at oil cooler end. Disconnect return oil line 11 at bottom of oil cooler.

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.

Up to serial no. 294 961 L: Close fuel shut-off valve at bottom of fuel tank.

Disconnect fuel inlet line 12 at fuel tank and fuel transfer pump. Remove fuel inlet line.

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Group 10
Cylinder Head, Camshaft and Balancer Shafts

GENERAL INFORMATION

The intake and exhaust valves are set in the cylinder head. The valve guides are integral with the head. The inlet valve seats are ground directly into the cylinder head, whereas the exhaust valve seats are ground into replaceable steel inserts. Replaceable steel inserts for both intake and exhaust valves are available as spare parts. Between each valve stem and the rocker arm is a hardened stem cap.

The camshaft is driven at half engine speed by the upper idler gear of the timing gear train. It is supported by three pressure lubricated bores, integral with the cylinder block.

The camshaft has an eccentric lobe to actuate the fuel transfer pump and an axial, pressed-in lug to drive the speed-hour meter.

Both balancer shafts are arranged in the lower half of the cylinder block. They are driven at double engine speed in opposite direction to each other, revolving in three replaceable, pressure-lubricated bushings. The right-hand balancer shaft is driven by the lower idler gear and the left by the oil pump gear.

DIAGNOSING MALFUNCTIONS

For diagnosing malfunctions see group 5.

FOS *NOTE: For additional information see "Fundamentals of Service, Engines" manual.*

Cylinder Head

REMOVAL

NOTE: It is not necessary to remove the engine in order to work on the cylinder head, valves and associated parts.

Immediately cover or plug holes of all removed or exposed fuel pipes with plastic caps or plugs.

Remove injection nozzles (nozzle tips are protruding from cylinder head sealing face and might be damaged).

Disconnect battery ground straps.

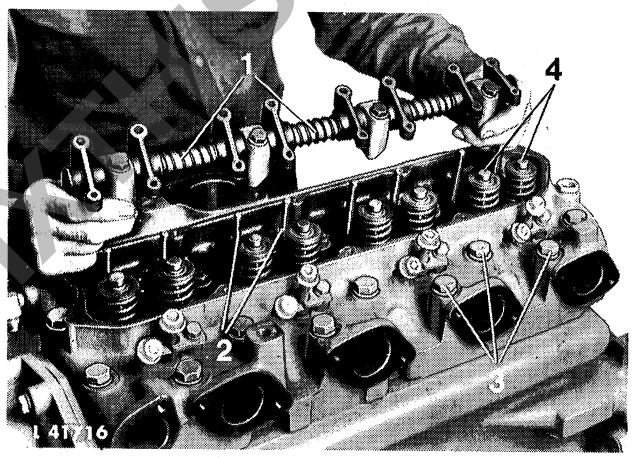

Fig. 1 — Removal of Rocker Arm Shaft Assembly

1 Rocker arm shaft
2 Push rods
3 Cylinder head cap screws
4 Valve stem caps

When removing, identify parts to facilitate reinstallation.

Do not turn crankshaft after removal of cylinder head, before all liners are secured with screws and washers.

REPAIR

DISASSEMBLY

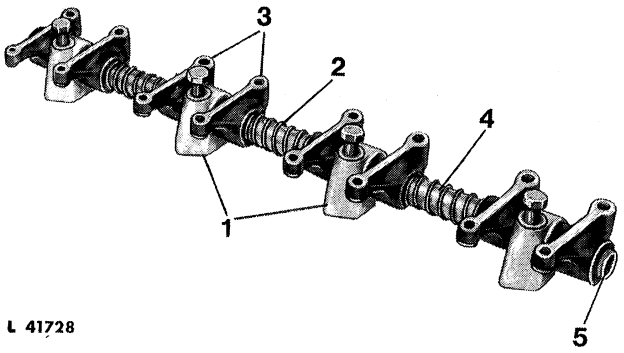

Fig. 2 — Rocker Arm Shaft Assembly

1 Rocker arm support
2 Springs
3 Rocker arms
4 Rocker arm shaft
5 Plug

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TESTING FUEL INJECTION NOZZLE WITH NOZZLE TESTER

NOTES: Testing the performance of a nozzle while the engine is running (see previous page) 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 tester, use special tool (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).

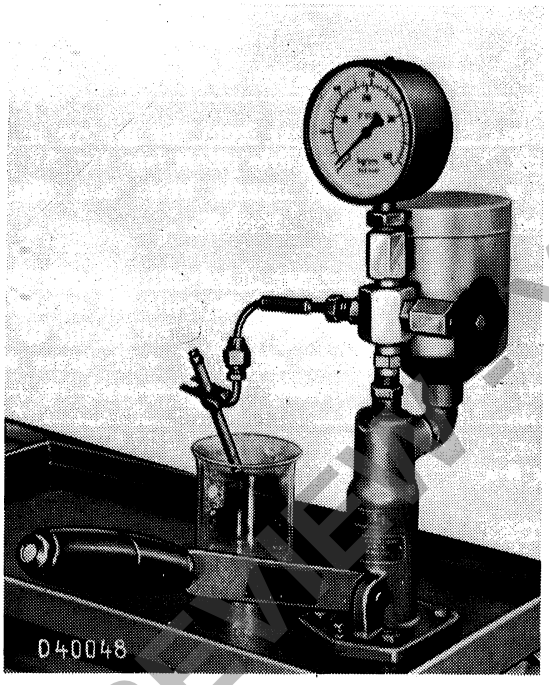

Fig. 6 — Injection Nozzle Connected to BOSCH Tester

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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STANDARD TORQUES

Recommended torques in Nm, mkp and ft.lbs. for UNC and UNF cap screws			
Head marking (identifying strength)	 or 6.8 *	 or 10.9 **	 or 12.9 ***

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Group 5

General Information, Diagnosing Malfunctions

GENERAL INFORMATION

The tractor is equipped with a 4-cylinder vertical in-line, valve-in-head, 4-cycle Diesel engine with direct fuel injection.

The "wet" cylinder liners can be replaced one at a time. The pistons are of forged aluminium alloy and cam-ground. Each piston has two single, cast-iron compression rings and one oil control ring. All ring grooves are above the piston pin. The case-hardened piston pins are full floating and are held in place by two snap rings each.

The crankshaft is a one-piece, heat-treated, steel forging. It is supported in four replaceable two-piece main bearings machined to close tolerances.

The connecting rods are provided with a bronze bushing and a two-piece, replaceable bearing cap each.

A camshaft supported in the cylinder block controls the valves and drives the fuel transfer pump.

The intake and exhaust valves are supported in the cylinder head. The valve stems slide in bores in the cylinder head. The rocker arm shaft assembly is fitted on top of the cylinder head.

The engine is supplied with lubricating oil by a gear pump. The lubricating oil passes through a full-flow oil filter in the main oil circuit. To ensure engine lubrication, the oil filter is provided with a by-pass valve which opens when the filter element is restricted. Lubrication oil is cooled by means of an oil cooler.

The engine has a pressure cooling system consisting of the radiator, water pump, multi-blade fan and thermostat.

DIAGNOSING MALFUNCTIONS

ENGINE WILL NOT CRANK

Dead batteries

Bad battery connections

Defective main switch or start safety switch.

Starting motor solenoid defective

Starting motor defective

ENGINE HARD TO START OR WILL NOT START

Loose or corroded battery connections
Low battery output

Excessive resistance in starter circuit

Too high viscosity crankcase oil

Water, dirt or air in fuel system

Fuel filter restricted

Stuck shut-off knob

Dirty or faulty fuel injection nozzles

Defective injection pump

Defective fuel transfer pump

Shut-off valve at fuel tank closed

Injection pump incorrectly timed

ENGINE RUNS IRREGULARLY OR STALLS FREQUENTLY

Coolant temperature too low

Insufficient fuel supply

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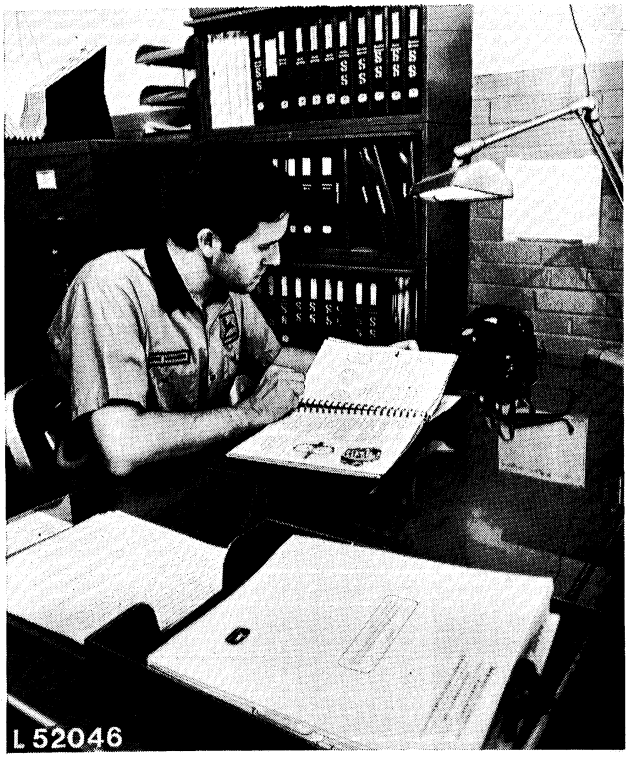
Introduction



Use FOS Manuals for Reference

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.

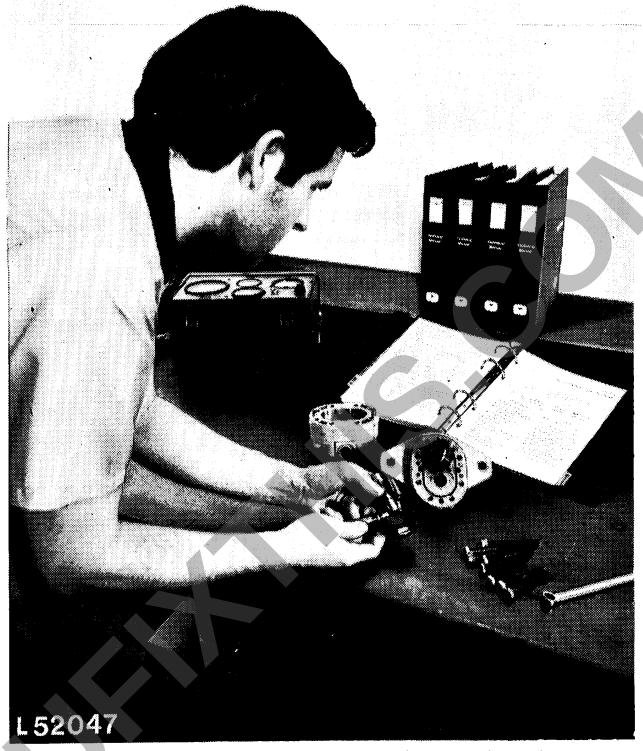
Technical Manuals are concise service guides for a *specific* machine. Technical Manuals are on-the-job guides containing only the vital information needed by an experienced technician.

IMPORTANT: Your technical manual contains the new SI metric measurements which have been standardized internationally.

Example:

New		Old
10 N (Newton)	≈	1 kp
10 Nm (Newton-Meter)	≈	1 mkp
1 bar	≈	1 kp/cm^2
1 kW = 1.36 PS (1.34 HP)		

Exact conversion: 1 kp = 9.81 N; 1 mkp = 9.81 Nm; 1 kp/cm^2 = 0.981 bar



Use Technical Manuals for Actual Service



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 follow.

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2. When replacing valve springs, make sure that the end contacting the cylinder head is properly seated in the machined counterbore of the head.

3. After the valves are installed, give the stems two or three taps with a rubber or nylon hammer, so that the parts will seat properly and thus ensure the proper positioning of the keepers.

INSTALLATION

CYLINDER HEAD

Place new cylinder head gasket on cylinder block; gasket must be dry (do not coat with sealant!).

IMPORTANT: Use hardened flat steel washers under all cylinder head cap screws.

Gradually tighten cylinder head cap screws (dipped in oil) evenly, following the sequence outlined in fig. 6 and finally tighten to specified torque. Install push rods into their original bores according to the marks made on removal. Place a valve cap on each stem and make certain that they turn freely.

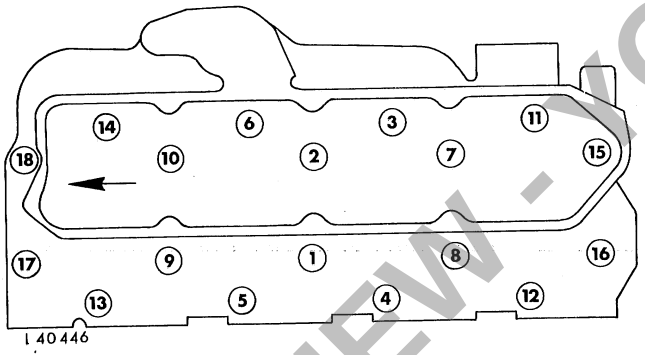

Fig. 6 — Correct Sequence for Tightening Cylinder Head Cap Screws

ROCKER ARM SHAFT ASSEMBLY

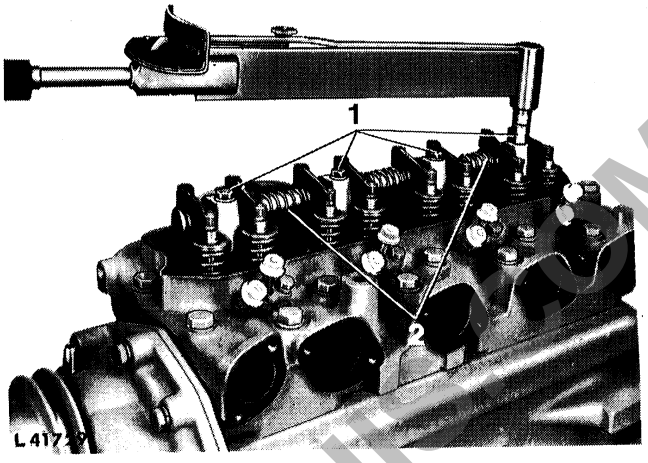

Fig. 7 — Tightening Rocker Arm Shaft Assembly

1 Cap screws
2 Rocker arm shaft assembly

Install rocker arm shaft assembly on cylinder head so that the lubrication holes are at the flywheel end. Turn the rocker arm shaft so that these holes are facing down. Tighten cap screws (see fig. 7) to specified torque.

ADJUSTING VALVE CLEARANCE

The valve clearance can be adjusted with the engine cold or warm.

Using engine rotation tool 19.58-90.282 rotate engine flywheel and therefore crankshaft in running direction until no. 1 piston has almost reached top dead center (TDC).

Guide timing pin (8 mm; 0.32 in. diameter and a minimum length of 80 mm; 3.15 in.) into bore of flywheel housing. Rotate flywheel a little and timing pin will enter its bore in flywheel as soon as flywheel reaches TDC position.

Adjust clearance of exhaust valves of cylinders nos. 1 and 3 and intake valves of cylinders nos. 1 and 2.

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SPECIFICATIONS

RADIATOR		
Capacity of cooling system	11.4 liters	3.0 U.S. gals.
Relief valve of radiator filler cap opens at a pressure of	0.4 to 0.5 bar	6 to 7 psi
Radiator test pressure	0.5 bar	7 psi
THERMOSTAT		
Thermostat opens at	82° C	180° F
WATER PUMP		
Impeller flush with pump housing within	± 0.12 mm	± 0.005 in.
FAN BELT		

The fan belt should have 19 mm (0.75 in.) flex with 90 N (20 lb) pull midway between crankshaft and alternator or water pump (use a spring scale).

TORQUES FOR HARDWARE

Flanged cover to thermostat housing, cap screws	30 Nm	3 mkp	23 ft-lb
Cover to water pump housing, cap screws	50 Nm	5 mkp	35 ft-lb
Fan to securing plate, cap screws	30 Nm	3 mkp	23 ft-lb

SPECIAL TOOLS*

Part No.	Description	Use
JD 262	Special tool	Installation of pumpshaft bearing

* For ordering instructions please contact your sales branch service department

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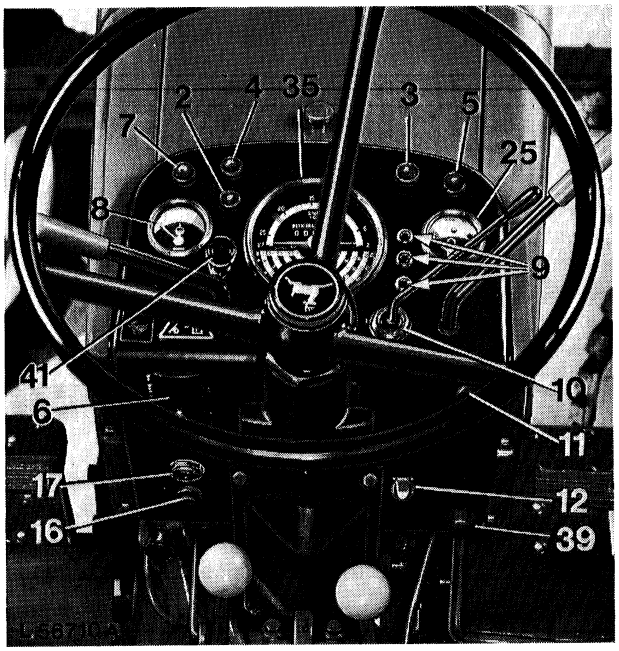

Fig. 1 — Dashboard, Controls and Instruments

2 Transmission oil pressure indicator light
3 Engine oil pressure indicator light
4 Alternator indicator light
5 Full-beam indicator light
6 Fuse box
7 Air cleaner restriction indicator light
8 Coolant temperature gauge
9 Tractor and trailer turn signal indicator lights
10 Turn signal light switch
11 Horn button
12 Socket for handlamp
16 Starter button
17 Main switch
25 Fuel gauge
35 Speed-hour meter
39 Thermostart button
41 Hazard warning light switch*

* On tractors equipped with hazard warning lights.

ALTERNATOR INDICATOR LIGHT

The alternator indicator light is located in the dash (see 4, fig. 1). When switching on the main switch, this light goes on. It fades out as soon as the engine is running.

If all components of the electrical system, including the indicator light, are functioning properly and the indicator light fades out, the batteries are being charged by the alternator. However, if the indicator light stays or goes on when the engine is running, this indicates a fault which should be remedied immediately (see group 5).

FUSES

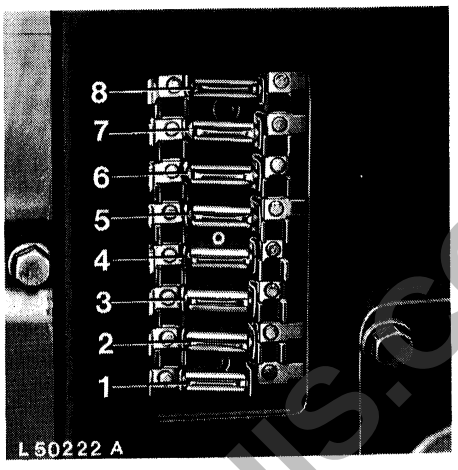

Fig. 2 — Fuse Box with Fuses

The fuses 1 to 8 shown in fig. 2 refer to the following circuit:

1 Horn, socket for handlamp, and hazard warning lights (if equipped)

2 Engine oil pressure indicator light, coolant temperature gauge, fuel gauge and air cleaner restriction indicator light

3 Stop light switch and transmission oil pressure indicator light

4 Left-hand tail light of tractor and trailer(s) and rear work light

5 Right-hand tail light of tractor and trailer(s)

6 Turn signal and clearance lights, lamps of coolant temperature gauge, fuel gauge and speed-hour meter

7 Dim headlights

8 Full beam headlights and full beam indicator light

8-ampere fuses are used for all these circuits. If fuses keep blowing in one circuit, check where the circuit is overloaded (usually through faulty wires causing short circuit to ground).

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DISASSEMBLY

Remove cover from High-Low housing and pull High-Low shift assembly out of housing, taking care of the thrust washer located between housing and clutch drum.

Remove three short cap screws 26 (fig. 7) and three long cap screws 25 from cover plate 27. Remove cover plate as well as planet pinion carrier.

Store disks in installation sequence.

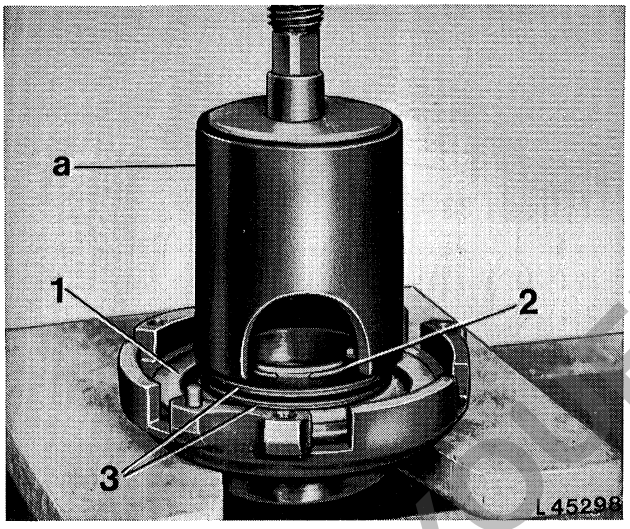

Fig. 6 — Removing Annular Piston of High Disk Clutch

a Special tool No. 19.58-90.617
1 Annular piston
2 Snap ring
3 Spring washers

To facilitate removal of annular piston 1 (fig. 6) from planet pinion carrier or High clutch drum, first remove snap ring 2 retaining spring washers 3 in planet pinion carrier or clutch drum.

Position special tool No. 19.58-90.617 (see "a", fig. 6) on spring washers and press washers down so that the snap ring can be removed.

⚠ CAUTION: Make sure special tool is centered over spring washer pack. After snap ring is removed, release pressure slowly and keep fingers away.

Remove spring washers and annular piston. Mark annular pistons for easier reassembly. Do not mix up annular pistons.

The planet pinions rotate in a carrier on pins 45 (fig. 7) and are supported by two needle bearings 42.

Prior to removal, rotate planet pinions until "V" marks match the "V" marks on sun gear. Then identify planet pinions and sun gear so that marks on pinions exactly match the SAME marks on sun gear when reassembling.

NOTE: Identification is necessary only if old planet pinions are to be installed again.

To remove planet pinions, pull bearing pins slightly out of planet pinion carrier by means of a 1/4 in. cap screw and remove detent ball at end of each bearing pin. Be careful not to lose the balls.

Pull bearing pins completely out of carrier and remove planet pinions, needle bearings, and thrust washers.

Remove sun gear and thrust washer from planet pinion carrier.

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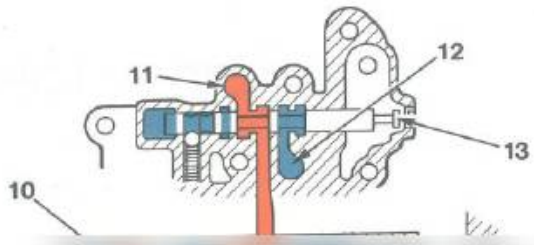

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ADJUSTMENT AND BLEEDING

BLEEDING AIR FROM BRAKE SYSTEM

Attach a plastic bleed tube to the brake bleed screw located on top of rear axle housing and insert other end of tube in transmission filler hole. Insert hose in filler hole far enough so that hose end is submerged in oil. Turn out bleed screw by a 3/4 turn, *slowly* depress brake pedal on brake being bled and then allow it to return *slowly*. Continue operating pedal until oil in tube is free of air bubbles.

IMPORTANT: Never allow brake pedal to return sharply until brakes are completely adjusted. By permitting brake valve piston to release quickly, damage may occur to valves as piston travel is not yet closely adjusted.

Close bleed screw securely while brake pedal is depressed. Remove plastic bleed tube and repeat bleeding operation on other brake. Then adjust brakes.

ADJUSTING BRAKE PEDALS

IMPORTANT: This adjustment must be made any time the brake valve is disassembled. Failure to adjust pedal stop screws will allow the brake pistons to knock against the reservoir check valves, causing damage or undue wear on valve parts.

Make this adjustment after the brake system has been bled.

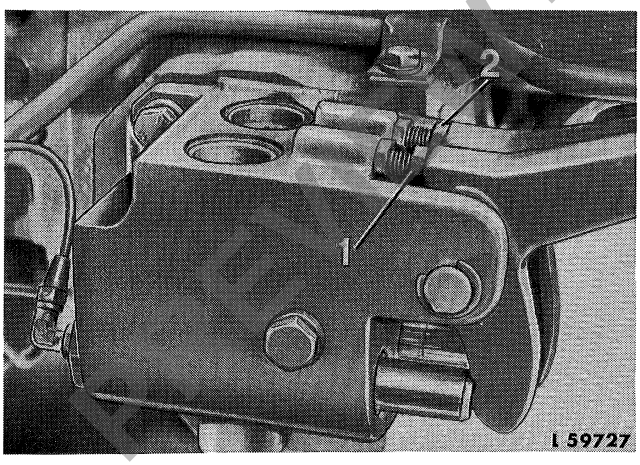

Fig. 4 — Adjusting Brake Pedals

1 Stop screw of right-hand brake pedal
2 Stop screw of left-hand brake pedal

Adjust stop screw 1 or 2 (fig. 4) of brake pedal to be adjusted so that brake piston is fully extended from the housing and the brake pedal arm is tight against the piston (not so tight as to move piston with no piston free travel).

In this position turn out stop screw by 1/3 turn.

When adjusting the right-hand brake pedal, apply a specified force to the left-hand brake pedal (see Specifications).

When adjusting the left-hand brake pedal, apply a force to the right-hand brake pedal.

When the loaded brake pedal starts to settle, turn out stop screw of pedal to be adjusted by another 1/3 turn. The loaded brake pedal should now stop settling. If it does not, this indicates a leak (see "Diagnosing Malfunctions").

After both brake pedals have been adjusted, align them by turning the stop screw on the higher pedal in or out.

CHECKING BRAKE PEDAL ADJUSTMENT

Apply a specified force (see Specifications) to each brake pedal for one minute. The loaded pedal should not settle by more than the specified value (see Specifications).

NOTE: Do not check both brake pedals simultaneously, but each separately.

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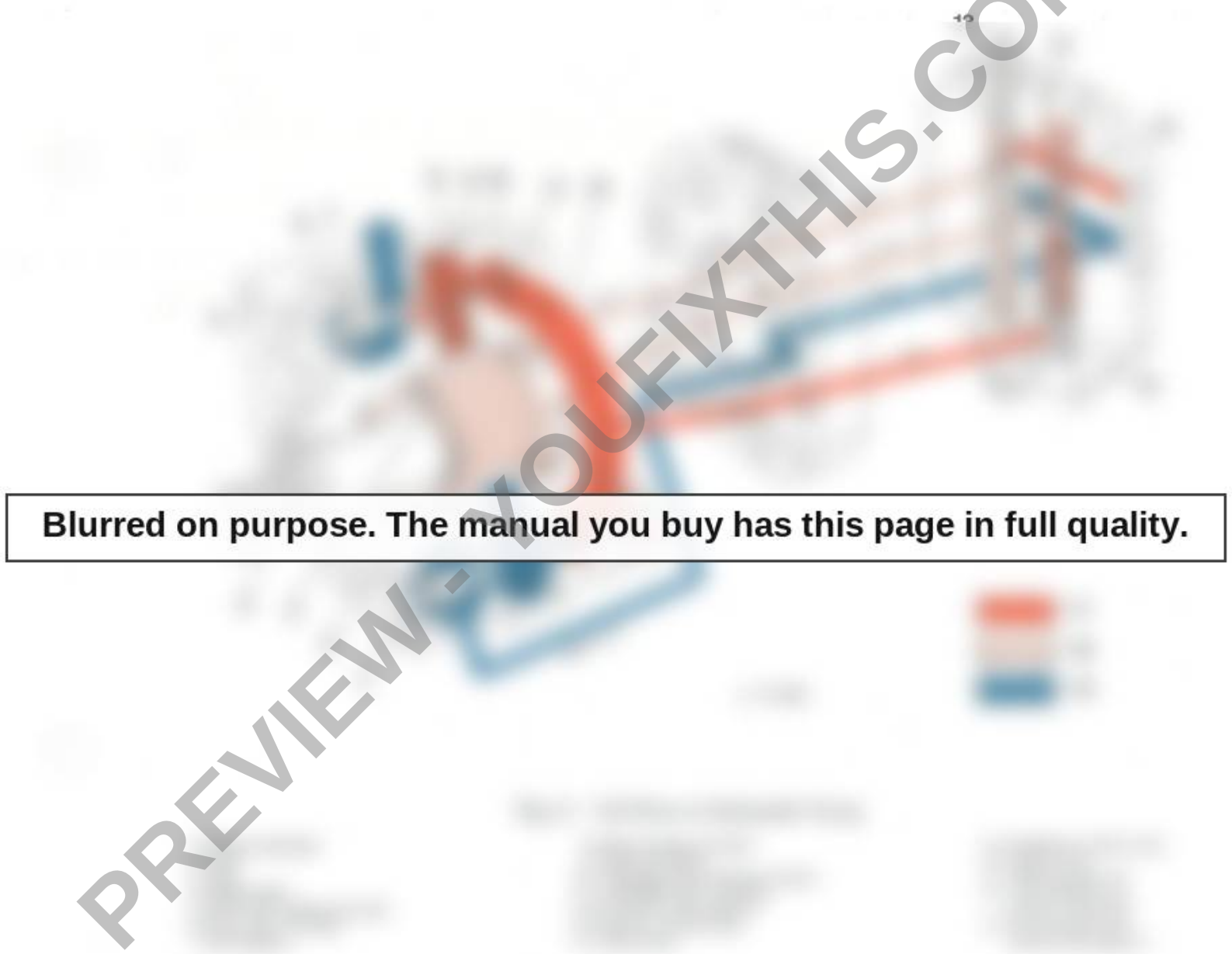
Hydraulic Pump

(39.5 cm^3 = 2.40 cu.in.)



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ASSEMBLY

For assembly of selective control valves reverse removal procedure and refer to figs. 2, 3 or 4.

Take care not to mix up valve spools or housings if more than one valve has been disassembled.

Install new V-packings 11, new seal rings 18 and new O-rings.

After assembly make sure valve spool moves freely in valve housing.

Install one washer 12 (figs. 3 and 4) between one control valve and end cover protrusion. Install two washers 12 between other control valve and end cover.

Install each pinion shaft 37 so that lock ball engages shaft in neutral position of valve spool and control lever.

INSTALLATION

When installing control valves, use new seal rings 26 (figs. 2, 3 and 4). When several control valves are installed, mount the valve with closed side at the top.

Install oil lines.

ADJUSTMENT

Every selective control valve is provided with a rate of drop screw 9 (figs. 1 and 2) to control return oil flow.

Extending or retracting a remote cylinder of 63.5 mm (2.5 in.) piston diameter and a stroke of 203 mm (8 in.) should require 2 seconds. Faster extending or retracting of cylinder may cause damage.

If necessary, adjust both rate of drop screws 9 of double acting control valve to obtain correct return oil flow and therefore correct time cycle.

On single acting control valves adjust return oil flow and thus rate of drop according to the implement attached. Time cycle is indicated in the Operator's Manual of the implement concerned.

To decrease return oil flow and thus rate of drop, turn in adjusting screw. Turn out screw to increase rate of drop.

SPECIFICATIONS

	Dimensions of New Parts	
O.D. of valve spool lands	12.01 to 12.04 mm	0.473 to 0.474 in.
O.D. of valve spool at V-packing area	9.96 to 10.00 mm	0.388 to 0.390 in.
Dia. of valve housing bore	12.01 to 12.04 mm	0.473 to 0.474 in.
Clearance between valve housing and spool	0.003 to 0.006 mm	0.00012 to 0.00024 in.
Spring of valve spool		
Free length	approx. 26 mm	1.02 in.
Spring tension at a length of 15 mm (0.59 in.)	210 to 260 N	49 to 58 lbs.
Lock spring		
Free length	approx. 30 mm	1.18 in.
Spring tension at a length of 17 mm (0.7 in.)	170 to 210 N	38 to 46 lb

TORQUES FOR HARDWARE

Selective control valves to oil manifold, cap screws	25 Nm	2.5 mkp	20 ft-lb
End cover to valve housing, hex. socket screws	15 Nm	1.5 mkp	11 ft-lb

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