830
TRACTOR

JOHN DEERE

TECHNICAL MANUAL

830
TRACTOR

TM4279 (01FEB73) English

JOHN DEERE TRACTOR WORKS
TM4279 (01FEB73)

LITHO IN THE U.S.A.
ENGLISH

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Tractor-830

Technical Manual
TM-4279 (Feb-73)

CONTENTS

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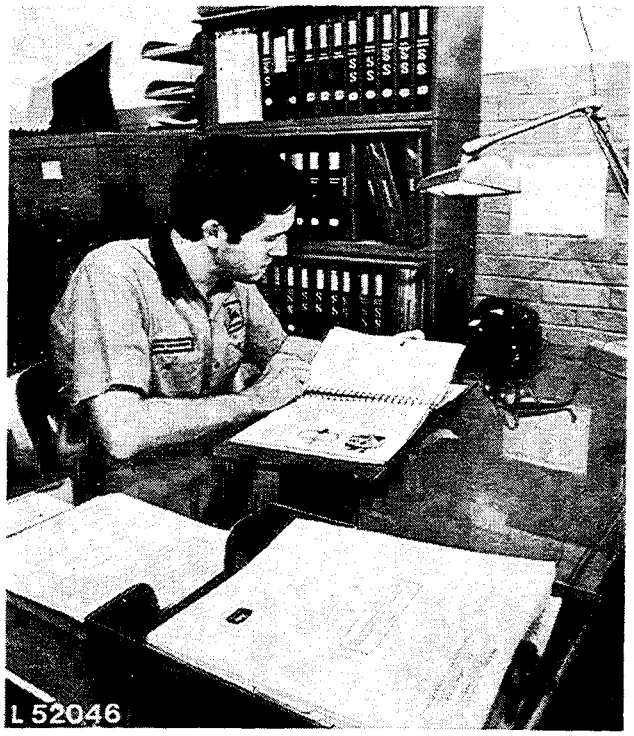
INTRODUCTION



Use FOS Manuals for Reference

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

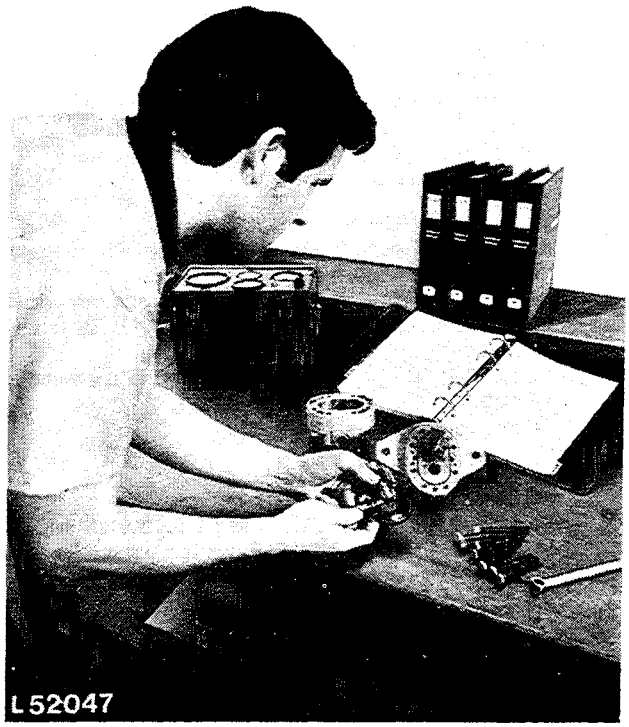
- **FOS Manuals — for reference**
- **Technical Manuals — for actual service**

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 men and for reference by experienced men.

Technical Manuals are concise service guides for a specific machine. Technical Manuals are on-the-job guides containing only the vital information needed by a journeyman mechanic.

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



Use Technical Manuals for Actual Service

Some features of this technical manual:

- *Table of contents at front of whole Manual.*
- *Contents at front of each Section*
- *Exploded views showing parts relationship*
- *Photos showing service techniques*
- *Specifications at end of each Group*
- *Special tools at end of each Group*

This technical manual was planned and written for you — a journeyman mechanic. 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 indicates 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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Section 10
GENERAL

CONTENTS OF THIS SECTION

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Group 5
SPECIFICATIONS

SERIAL NUMBERS

The engine serial number is stamped into the name plate at the lower right of the front cylinder block.

NOTE: If ordering engine parts, indicate all digits of the serial number on the name plate.

The name plate showing the tractor serial number is located on the right-hand side of the front support.

NOTE: If ordering tractor parts, (excluding engine parts), indicate all digits of the serial number on the name plate.

MODEL NUMBERS

The injection pump, injection nozzles, the alternator, starter and the hydraulic pump have model numbers to facilitate identification of different makes of a given unit.

SPECIFICATIONS

ENGINE

Number of cylinders 3

Cylinder liner bore . . . . . 98 mm (3.86 in.)

Stroke . . . . . 110 mm (4.33 in.)

Displacement . . . . . 2490 cm^3 (152 cu.in.)

Compression ratio . . . . . 16.7 : 1

Maximum torque at
1400 rpm . . . . . 14.1 mkp (102 ft.lbs.)

Firing order . . . . . 1 - 2 - 3

Valve clearance (engine hot or cold)
Intake valve . . . . . 0.35 mm (0.014 in.)
Exhaust valve . . . . . 0.45 mm (0.018 in.)

Fast idle . . . . . 2545 rpm

Slow idle . . . . . 650 rpm

Working speed range . . . . . 1400 to 2400 rpm

PTO power. . . . . 35 HP (26.2 kW)
(at 2400 rpm engine speed and
624 rpm powershaft speed)

ENGINE CLUTCH

Dual dry disk clutch, foot-operated.

ELECTRICAL SYSTEM

Batteries . . . . . 2 x 12 volts,
55 ampere-hours

or . . . . . 1 x 12 volts,
70 ampere-hours

Starter . . . . . 12 volts, 4 HP

Alternator . . . . . 14 volts, 28 amps.

Battery terminal grounded . . . . . negative

* With the engine run in above 100 hours of operation) and having reached operating temperature (engine and transmission); measured by means of a dynamometer. Permissible variation ± 5%.

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TRANSMISSION

Type . . . . . Collar shift
Gear selections . . . . . 8 forward and 4 reverse
Shifting . . . . . 4 speeds each in high, low, and reverse ranges. Park lock included.

DIFFERENTIAL AND FINAL DRIVES

Planetary reduction gear and differential with spiral bevel gears.

DIFFERENTIAL LOCK

Hand or foot operated; spring-loaded out of engagement.

PTO

Single, 540 rpm rear powershaft continuous-running.

Power Shaft Speeds (in rpm)

Engine Speed in rpm	540 rpm shaft
650	170
2070	540
2400	624
2545	662

HYDRAULIC SYSTEM

Open center, constant oil flow system; also includes rockshaft and selective control valves.

Relief valve setting . . . . . 148 to 150 kp/cm^2 (2105 to 2130 psi)
Pump . . . . . gear pump driven by the engine

POWER STEERING

The steering system is an "open center" type independent from the tractor hydraulic system. It is connected to the front wheels by means of a steering linkage.

Relief valve setting . . . . . 148 to 150 kp/cm^2 (2105 to 2130 psi)
Pump . . . . . gear pump driven by the engine

MANUAL STEERING

The manual steering is a recirculating ball bearing, worm and nut type. A number of steel balls between ball nut and steering wheel shaft provide for positive engagement of steering wheel and steering linkage.

HYDRAULIC BRAKES

The disk brakes run in an oil bath and are hydraulically controlled.

CAPACITIES

	Ltr.	US.gals.	Imp.gals.
Fuel tank	62.5	16.5	13.75
Cooling system	10.5	2.75	2.3
Engine crankcase incl. filter	5.7	1.5	1.25
Transmission-hydraulic system			
Dry system	30.0	7.9	6.6
At service intervals	28.0	7.4	6.2
Belt pulley	1.1	0.3	0.25

TRAVEL SPEEDS

See Operator's Manual

FRONT AND REAR WHEELS

For tire sizes, treads, inflation pressure and weights see Operator's Manual.

DIMENSIONS AND WEIGHTS

See Operator's Manual.

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Group 10
PREDELIVERY, DELIVERY AND AFTER-SALES INSPECTIONS

PREDELIVERY INSPECTION

To promote complete customer satisfaction, proper predelivery service including mending of possible shipping damage and giving the finishing touches to the tractor, are of prime importance to the dealer.

A tag pointing out the factory-recommended procedure for predelivery service is attached to every new tractor before it leaves the factory. The reverse side of this tag is filled in by the factory after the tractor has undergone a thorough inspection prior to shipping.

After completing the factory-recommended dealer checks and services listed on the predelivery tag, remove the tag from the tractor and file it with the shop order for the job. The tag will then serve as a basis for certifying that the unit has received the proper predelivery service.

TEMPORARY TRACTOR STORAGE

Service	Specifications	Reference
Check radiator for coolant loss and antifreeze protection (gravity of anti-freeze and rust inhibitor mixture)	Coolant level should be mid-way between radiator core and bottom edge of filler neck	Operator's manual
IMPORTANT: When the machine is delivered, red cable is not connected to alternator terminal "B+". Further, the alternator three-terminal plug is not connected. Connect cable and plug before operating tractor for the first time.	. . . . .	Section 40, group 10
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 starter switch before stopping the engine by means of fuel pump shut off cable. Further, it is recommended to use additional current (lights) whilst engine is running. Insulating tape on battery cable end leading to starting motor should not be removed. If this advice is disregarded, damage to alternator and regulator may result.		
Remove batteries. Drain electrolyte and store batteries	Store at room temperature	. . . . .
Reduce shipping pressure of tires	. . . . .	Operator's manual
Cover tractor and tires for protection and cleanliness	. . . . .	. . . . .

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BEFORE DELIVERING TRACTOR

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		
IMPORTANT: When the machine is delivered, red cable is not connected to alternator terminal "B+". Further, the alternator three-terminal plug is not connected. Connect cable and plug before operating tractor for the first time.	. . . . .	Section 40, group 10
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 starter switch before stopping the engine by means of fuel pump shut off cable. Further, it is recommended to use additional current (lights) whilst engine is running. Insulating tape on battery cable end leading to starting motor should not be removed.		
If this advice is disregarded, damage to alternator and regulator may result.		
If the batteries are to be installed in the tractor, remove insulating tape on terminal of battery cable. This is to be done if the tractor was shipped with dry- charged batteries or without batteries.	. . . . .	. . . . .
Connect batteries 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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BEFORE DELIVERING TRACTOR - Continued

Service	Specification	Reference
TIRES AND WHEELS		
Check tire inflation pressure	. . . . .	Operator's manual
Retighten wheel bolts	. . . . .	Section 80, group 15 and Operator's manual
LUBRICATION		
Check crankcase oil level	Top mark on dip stick	Operator's manual
Check transmission-hydraulic system oil level	. . . . .	Operator's manual
Lubricate all lubrication points on the tractor	. . . . .	Operator's manual
ENGINE		
Check air cleaner	. . . . .	Operator's manual
Fill fuel tank and start engine	Capacity: 62,5 liters (13.75 Imp.gals. = 16,5 U.S.gals.)	Operator's manual
Check lighting system, indicator lights and instruments for proper operation	. . . . .	Operator's manual
Check if speed control linkage moves easily	. . . . .	Section 20, group 40
Check engine idle speeds	. . . . .	Section 20, group 40
Check injection timing	. . . . .	Section 30, group 15
OPERATION		
Check clutch pedal adjustment	Approx. 25 mm (1 in.) clutch pedal free travel	Section 50, group 5
Shift transmission through all speeds	. . . . .	Operator's manual
Check differential lock operation	. . . . .	Operator's manual
Check power shaft operation	. . . . .	Operator's manual
Check 3-point hitch operation	. . . . .	Operator's manual
Check hydraulic system operation	. . . . .	Section 70, group 5
Check brake system	. . . . .	Section 60, group 15

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BEFORE DELIVERING TRACTOR - Continued

Service	Specifications	Reference
Check steering operation	. . . . .	Section 60, group 10
Check seat operation	. . . . .	Operator's manual
Check operation of remote hydraulic cylinder (if equipped)	. . . . .	Section 70, group 5
GENERAL		
Tighten accessible nuts and attaching screws	. . . . .	Section 10, group 20
Attach roll guard (if equipped)	Tighten cap screws cross-wise 1. Step = 7 mkp (50 ft.lbs.) 2. Step = 41,5 mkp (300 ft.lbs.)	Section 80, group 20
Clean tractor and touch up paint	. . . . .	. . . . .

DELIVERY INSPECTION

A thorough discussion of the operation and service of the tractor at the time of its delivery helps to assure complete customer satisfaction.

Proper delivery should be an important phase of the dealer's program.

It is a well-known fact that many complaints have arisen simply because the owner was not shown how to operate and service his new tractor properly. Therefore, enough time should be devoted, at the customer's convenience, to introducing him to his new tractor and explaining to him how to operate and service it.

Using the tractor operator's manual as a guide, be sure that the owner understands the following points properly.

1. Adjusting the seat
2. Operation of control levers and instruments
3. Starting and shutting off the engine
4. The importance of the tractor break-in period
5. Use of weights and proper inflation pressure as well as filling of tires with water and calcium chloride, if required.
6. Operating the complete hydraulic system
7. Operating the power shaft and belt pulley (if equipped)
8. The importance of the safety rules
9. The importance of lubrication and periodic service

AFTER-SALES INSPECTION

In the interest of the purchaser and the dealer an after-sales inspection should be carried out by the dealer after the first 100 hours of using a new John Deere tractor.

The purpose of this inspection is to make sure that the customer is receiving satisfactory performance from his tractor. At the same time, the inspection should reveal whether or not the tractor is being operated, lubricated and serviced properly.

Through this inspection a needless volume of service work can be eliminated by preventing minor difficulties from developing into serious problems later on. It also will promote stronger dealer-customer relations and give the customer an opportunity to ask questions that may have arisen during the first few days of use.

Thereby the dealer has the further opportunity of promoting the possible sale of other new equipment.

The following inspection program is recommended:

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AFTER-SALES INSPECTION

Service	Specifications	Reference
COOLING SYSTEM		
Check coolant level	Coolant level should be midway between radiator core and bottom edge of filler neck	Operator's manual
Clean exterior of radiator	. . . . .	. . . . .
Check hose connections	. . . . .	. . . . .
FUEL SYSTEM		
Check fuel filter for water or sediment and clean transfer pump screen	. . . . .	Operator's manual
Check line connections	. . . . .	. . . . .
ELECTRICAL SYSTEM		
Check gravity of battery electrolyte	Gravity should be 1.260 at an electrolyte temperature of 27°C (80°F)	
Check electrolyte level of batteries	To bottom of filler neck in each cell	Operator's manual
Check tension of fan belt	19 mm (3/4 in.) deflection with a 9 kp (20 lbs.) force	Operator's manual and section 20, group 35
Start engine and check operation of lights, indicator lamps and instruments	. . . . .	Operator's manual
LUBRICATION		
Check crankcase oil level	Top mark on dip stick	Operator's manual
Check transmission oil level	. . . . .	Operator's manual
Check oil level of manual steering gear housing	Add oil up to filler hole	Operator's manual
Check oil level of belt pulley housing	Add oil up to filler hole	Operator's manual
Lubricate clutch throw-out bearing	. . . . .	Operator's manual
Lubricate 3-point hitch	. . . . .	Operator's manual

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AFTER-SALES INSPECTION

Service	Specifications	Reference
ENGINE		
Check air cleaner	. . . . .	Operator's manual
Check valve clearance	Intake valve: 0.35 mm (0.014 in.) Exhaust valve: 0.45 mm (0.018 in.)	Section 20, group 10
Check engine speed under load as well as fast and slow idle speed	. . . . .	Section 20, group 40
Check engine performance	. . . . .	Section 10, group 20
GENERAL		
Check clutch pedal adjustment	Approx. 25 mm (1 in.) free travel	Section 50, group 5
Shift transmission through all speeds	. . . . .	Operator's manual
Check operation of PTO	. . . . .	Operator's manual
Check differential lock	. . . . .	Operator's manual
Check operation of hydraulic system	. . . . .	Section 70, group 5
Check steering system	. . . . .	Section 60, group 10
Check brakes	. . . . .	Section 60, group 15
Tighten accessible nuts and cap screws	. . . . .	Section 10, group 20
Tighten roll guard attaching screws and nuts	41.5 mkp (300 ft.lbs.)	. . . . .
Tighten accessible hydraulic lines	. . . . .	. . . . .
Visual inspection of tractor	Damaged paint, loose connections, proper positioning of hoses and lines, leaks, operation of all mechanical parts	. . . . .

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Group 15
LUBRICATION AND PERIODIC SERVICE

For brands of oil and lubricants to be used as well as for lubricating and servicing the tractor 830, see operator's manual.

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Group 20
ENGINE AND TRACTOR TUNE-UP

GENERAL INFORMATION

Before tuning up the engine, determine whether a tune-up will restore operating efficiency. If there is doubt, the following preliminary tests will help to determine if the engine can be tuned up.

PRELIMINARY ENGINE TESTING

Service	Specifications	Reference
Checking air intake system by means of vacuum gauge	355 to 635 mm (14 to 25 in.) water head; engine running at fast idle speed	"Fundamentals of Service, Engine" manual under "Diagnosis and Testing"
Check radiator for air bubbles or oil film	. . . . .	. . . . .
Check compression which should be at least using special tool No. 19.58-90.578	21 kp/cm^2 (300 psi)	"Fundamentals of Service, Engine" manual under "Diagnosis and Testing"
Measure engine horsepower at powershaft (using a dynamometer)	Record measured performance and compare with performance measured after carrying out "Engine Tune-up"	. . . . .

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ENGINE TUNE-UP

Service	Specifications	Reference
AIR INTAKE SYSTEM		
Service air cleaner and check system for leaks	. . . . .	Operator's manual and "Fundamentals of Service, Engine" manual
Check crankcase vent tube for foreign particles (restriction)	. . . . .	. . . . .
Tighten cylinder head cap screws	15 mkp (110 ft.lbs.)	Section 20, group 10
Check and adjust valve clearance	Intake valve: 0.35 mm (0.014 in.) Exhaust valve: 0.45 mm (0.018 in.)	Section 20, group 10
BATTERIES		
Thoroughly clean wires, connections and batteries	. . . . .	. . . . .
Tighten cable clamp screws	. . . . .	. . . . .
Liberally coat battery terminals and cable connectors with petroleum jelly	. . . . .	. . . . .
Check electrolyte level of battery	. . . . .	Operator's manual
Check specific gravity of electrolyte	. . . . .	Operator's manual
ALTERNATOR		
Check fan belt tension	19 mm (3/4 in.) deflection with 9 kp (20 lbs.) force	Section 20, group 35
FUEL SYSTEM		
Check fuel tank and lines for leaks or restriction	. . . . .	. . . . .
Clean screen of fuel transfer pump	. . . . .	Operator's manual
Check fuel filter element and replace, if necessary	. . . . .	Section 30, group 10
Check injection timing and adjust, if necessary	. . . . .	Section 30, group 15
Bleed fuel system	. . . . .	Section 30, group 15
Check engine speeds and adjust speed control linkage, if necessary	. . . . .	Section 20, group 40

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ENGINE TUNE-UP - Continued

Service	Specifications	Reference
ENGINE LUBRICATION SYSTEM		
Check engine oil pressure	3.5 to 4.2 kp/cm^2 (50 to 60 psi) at 2400 rpm	Section 20, group 30
COOLING SYSTEM		
Clean and flush cooling system	. . . . .	FOS "Fundamentals of Service, Engine" manual
Check radiator hoses for damage and leaks	. . . . .	. . . . .
Clear radiator core of restrictions	. . . . .	. . . . .

CHECKING ENGINE PERFORMANCE

FOS After the engine has been tuned up as explained above, determine powershaft horsepower by means of a dynamometer, see "Fundamentals of Service, Engine" manual.

Compare measured performance in HP with output measured before carrying out "Engine tune-up".

TRACTOR TUNE-UP

After carrying out engine tune-up, make the following adjustments on the tractor:

Service	Specifications	Reference
ENGINE CLUTCH		
Adjust clutch pedal free travel	Approx. 25 mm (1 in.)	Section 50, group 5
FRONT WHEELS		
Clean and lubricate front wheel bearings	. . . . .	Section 80, group 15
Adjust front wheel bearings	. . . . .	Section 80, group 15
Check toe-in	3 to 6.5 mm (0.125 to 0.25 in.)	Section 60, group 5
Check torque of front wheel bolts	12 mkp (87 ft.lbs.)	. . . . .
HYDRAULIC BRAKES		
Bleed brake system	. . . . .	Section 60, group 15

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TRACTOR TUNE-UP - Continued

Service	Specifications	Reference
HYDRAULIC SYSTEM		
Check max. system pressure	148 kp/cm^2 (2105 psi)	Section 70, group 5
Check max. power steering system pressure (if equipped)	150 kp/cm^2 (2130 psi)	Section 70, group 5
Check rockshaft lift cycle time at 2100 rpm engine speed	2,5 sec.	Section 70, group 5
Check time required for extending or retracting remote cylinder at 2100 rpm engine speed	2 sec.	Section 70, group 5
TIRES		
Check tire inflation pressure	. . . . .	Operator's manual
TORQUES		
Check all accessible cap screws and nuts of tractor for proper torque	. . . . .	Torque chart

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STANDARD TORQUES

Recommended torques in mkp and ft.lbs. for UNC and UNF cap screws						
Head marking (identifying strength)	 or 6.8 (6. S)*		 or 10.9 (10 K)**		 or 12.9 (12 K)***	
Thread-O.D. (in.)	mkp	ft.lbs.	mkp	ft.lbs.	mkp	ft.lbs.
1/4	1	7	1.5	10	2	14
5/16	2	14	3	20	4	30
3/8	3	21	5	35	7	50
7/16	5	35	8	55	11	80
1/2	8	55	12	85	18	130
9/16	10	75	18	130	26	185
5/8	15	105	23.5	170	34.5	250
3/4	25.5	185	41.5	300	58	420
7/8	22****	160****	61.5	445	92,5	670
1	34.5	250	92.5	670	138.5	1000

NOTE: A variation of ± 10% is permissible for all torques indicated in this chart.

Torque figures indicated above and in the various sections of this manual are valid for non-greased or non-oiled threads and heads unless otherwise specified. Therefore, do not grease or oil bolts or cap screws unless otherwise specified in this manual.

* Regular bolts and cap screws
** Tempered steel high strength bolts and cap screws
*** Tempered steel extra high strength bolts and cap screws
**** Bolts and screws 7/8 in. and larger are often formed hot rather than cold, which accounts for the lower torque.

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

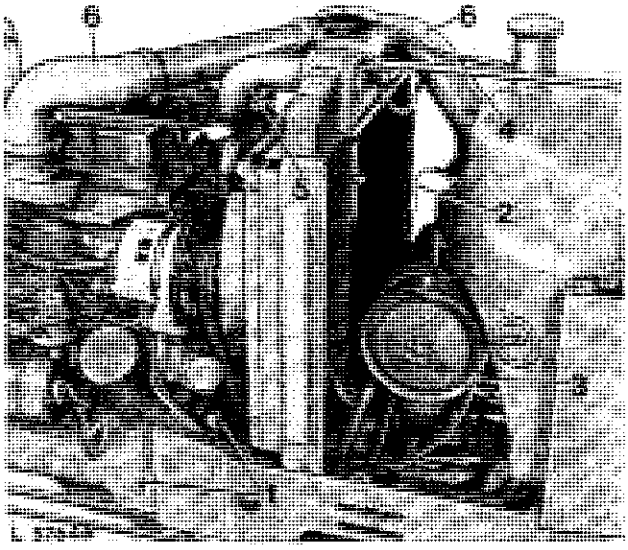

Fig. 1 — Separating between Tractor Front End and Engine

1 Cap screws
2 Cable of air cleaner restriction warning switch
3 Cable of fuel gauge sending unit
4 Fuel return line
5 Upper water hose
6 Air intake pipe

Disconnect air intake pipe 6 (fig. 1) at engine intake manifold and air cleaner.

Disconnect fuel return line 4 at fuel tank.

Disconnect cable 2 at air cleaner restriction warning switch and disconnect cable 3 at fuel gauge sending unit.

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

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

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

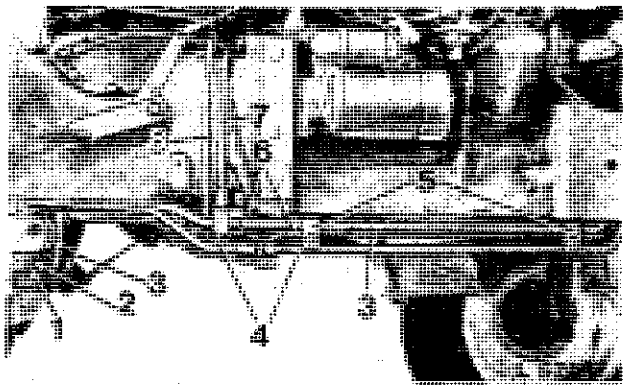

Fig. 2 — Disconnecting Hydraulic Oil Lines

1 Retainer
2 Cap screw
3 Hydraulic pump suction line
4 Pressure line of tractor hydraulic system pump
5 Pipe clamps
6 Pressure line of power steering system pump
7 Power steering return line
8 Power steering pressure line

Remove pipe clamps 5 (fig. 2). Remove cap screw 2 and retainer 1 for attaching suction line 3 to front of clutch housing. Disconnect pressure line 4 at union.

On tractors with power steering only: Disconnect pressure line 6 of power steering system pump at union. Disconnect power steering return line 7 from hydraulic pump suction line 3.

NOTE: Plug lines and openings immediately with plugs or caps.

Disconnect drag link at bell crank. Securely support rear of tractor under clutch housing.

Insert wood blocks between front axle and front support to prevent the latter from tipping sideways.

Install JDG-9 support stand on flywheel housing.

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Remove cap screws 1 (fig. 1) of front support and separate front end from engine. Take measures to prevent front of tractor from tipping to the front. If tank contains too much fuel, drain it or safely support tractor front end.

IMPORTANT: When separating tractor front end, keep hydraulic pump drive shaft in alignment with pump couplings until drive shaft comes completely free.

INSTALLATION

Install hydraulic pump drive shaft into front coupling. Make sure both dowels are in place on front support.

Move tractor front end toward engine.

Engage pump drive in rear coupling and at the same time slide hydraulic pump suction line 3 (fig. 2) into clutch housing bore, making sure seal washer has been installed.

Attach front end of tractor to engine, using cap screws 1 (fig. 1). Tighten screws to the specified torque.

Install retainer 1 (fig. 2) of suction line 3 and tighten cap screw 2 of retainer to the specified torque.

Remove JDG-9 support stand, and connect pressure line 4 (fig. 2) at union.

On tractors with power steering only: Connect power steering return line 7 to hydraulic pump suction line 3 and connect power steering system pump pressure line 6 at union.

Install pipe clamps 5.

Install fuel transfer pump and connect fuel lines. Make sure transfer pump inlet line is below and behind fuel pressure line.

Connect fuel return line to fuel tank.

Open fuel tank shut-off valve.

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

Attach water hoses to radiator.

Attach air intake pipe to intake manifold and air cleaner.

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

Install hood and radiator side grille screens.

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 (-) poles of batteries.

Start engine and check fuel lines, hydraulic lines and water hoses for possible 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 at batteries.

Separate tractor front end from engine, as explained above.

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

Disconnect all cables 4 (fig. 3) at starting motor. Disconnect cable at oil pressure warning switch 3.

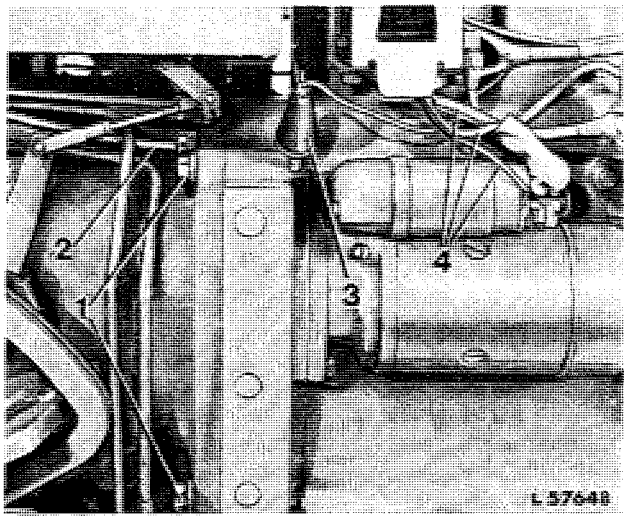

Fig. 3 — Separating between Engine and Clutch Housing, R.H. Side

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

Remove flexible shaft 2 (fig. 3) of speed-hour meter from clutch housing and cam shaft. Replace gasket of flexible shaft, if required (gasket will possibly remain in housing bore).

On tractors with ether starting aid: Disconnect starting aid pipe at intake manifold.

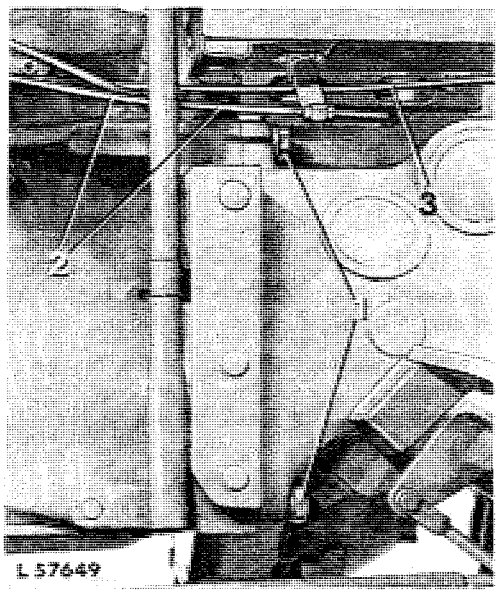

Fig. 4 — Separating between Engine and Clutch Housing, L.H. side

1 Engine attaching screws
2 Speed control rod
3 Shut-off cable

Disconnect speed control rod 2 (fig. 4) at injection pump.

Disconnect shut-off cable at injection pump.

Disconnect temperature gauge sensing bulb from cylinder head and withdraw sensing bulb from head.

Remove left dash panel as well as both batteries.

Remove cap screws attaching cowl to flywheel housing.

Attach JD 244 engine lifting eyes to JDG-1 engine lift sling and to cylinder head. Attach lift sling to a suitable hoist.

Remove cap screws 1 (figs. 3 and 4) attaching flywheel housing to clutch housing.

Remove engine from clutch housing.

IMPORTANT: Move engine properly in line with drive shaft and hollow drive shaft until these shafts come free of the engine dual-stage clutch disks.

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INSTALLATION

Align engine properly with drive shaft and hollow drive shaft and move toward rear of tractor. Align splines of both shafts with splines of clutch disks. Also align screw holes of flywheel housing with screw holes of clutch housing. Slide engine evenly toward clutch housing, inserting two dowels of flywheel housing in bores of clutch housing, until engine fully contacts clutch housing.

IMPORTANT: Make sure flywheel housing is flush against clutch housing before tightening cap screws to the specified torque.

Secure cowl to flywheel housing.

Connect speed control rod and shut-off cable to injection pump.

Insert flexible tube of coolant temperature gauge in cylinder head and tighten retaining screw.

Connect three-terminal plug to alternator and red cable to alternator terminal B+.

Connect cables to starting motor.

Connect cable to oil pressure warning switch.

Install both batteries.

IMPORTANT! Connect starter cable to positive poles of batteries.

Lubricate gasket of speed-hour meter flexible shaft and attach shaft to clutch housing (see 2, fig. 3). Make sure driving tab of flexible shaft engages in slot of camshaft. Do not tighten excessively to avoid damage to the gasket resulting in leakage.

On tractors with ether starting aid: Connect starting fluid line to intake manifold.

Attach tractor front end to engine.

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

NOTE: If engine has been overhauled, tune up engine as explained in group 20.

REMOVAL AND INSTALLATION OF CLUTCH HOUSING

NOTE: Separating and joining the tractor between engine and clutch housing as well as between clutch housing and transmission case is explained below. Where the tractor is to be separated depends on the individual repair operation. If, e.g., repair work has to be carried out on the transmission, separation between the clutch housing and the transmission case will be sufficient.

REMOVAL

Disconnect battery ground straps.

Drain transmission oil.

Separate engine from clutch housing as explained under "REMOVING ENGINE"; the tractor front end may remain attached to the engine.

Disconnect drag link at bell crank.

Insert wood blocks between front axle and front support to prevent front support from tipping sideways.

Safely support rear end of tractor.

Remove cap screw 2 (fig. 2) and retainer 1 for fastening suction line 3 (figs. 2 and 5) to front clutch housing. Disconnect pressure line 4 at front and rear union (see fig. 5).

Remove pipe clamp 9 (fig. 5) and pressure line 4.

On tractors with power steering only: Remove power steering pressure line 8 and return line 7. Disconnect power steering system pump pressure line 6 at union and at power steering pressure relief valve elbow and remove pressure line 6.

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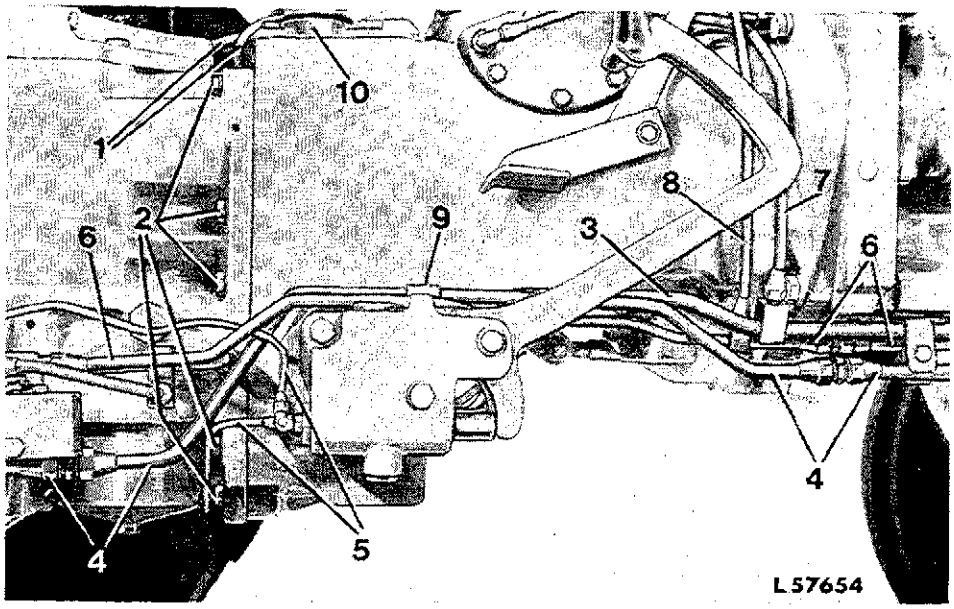

Fig. 5 — Separating between Clutch Housing and Transmission Case, R.H. Side

1 Wiring harness
2 Attaching screws
3 Hydraulic pump suction line
4 Pressure line of tractor hydraulic system pump
5 Brake lines
6 Pressure line of power steering system pump
7 Power steering return line
8 Power steering pressure line
9 Pipe clamp
10 Gear shift cover

Install JDG 9 front support stand on flywheel housing. Remove engine-to-clutch housing cap screws.

Roll engine and tractor front end away from clutch housing.

Disconnect brake lines 5 (fig. 5) at brake valve. Remove transmission shield.

Disconnect rear harness at connector. Disconnect cable at start safety switch.

Remove transmission gear shift cover 10 (fig. 5), and remove gear shifter lever guide spring.

Remove transmission oil filter.

Remove cap screws 2 (fig. 5) on both sides and both inner cap screws. Separate clutch housing from transmission case.

Discard seal rings provided between the two housings.

INSTALLATION

Install new seal rings in clutch housing front facing transmission case.

Slide clutch housing against transmission case.

Slide PTO drive shaft into needle bearing of clutch housing quill. Mesh PTO gear with hollow PTO drive shaft gear.

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

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

Install suction line 3 (fig. 2) in bore of clutch housing and secure by means of screw and retainer; make sure seal washer is installed. Tighten cap screw to the specified torque.

Connect pressure line 4 (figs. 2 and 5) at front and rear union. Install pipe clamp 9 (fig. 5).

On tractors with power steering only: Connect pressure line 6 (fig. 5) of power steering system pump at power steering pressure relief valve and at union. Install power steering pressure line 8 and return line 7.

For further installation operations reverse removal procedure.

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

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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 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 fenders and roll-over guard.

Disconnect brake lines on both rear axle housings.

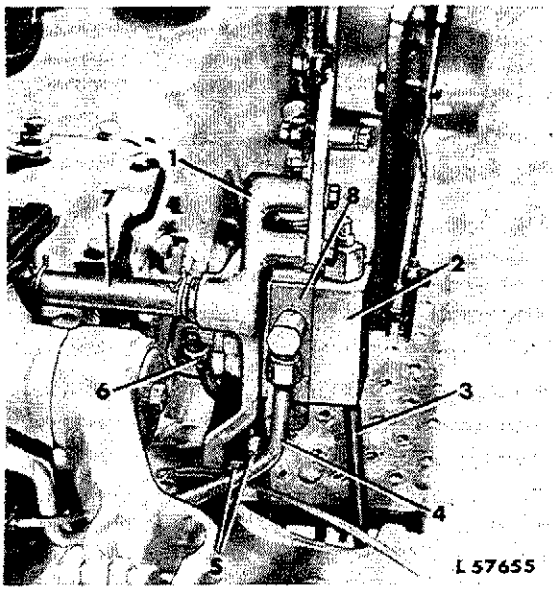

Fig. 6 — Oil Manifold and System Pressure Relief Valve Installed

1 Oil manifold
2 System pressure relief valve
3 Pressure line from hydraulic pump
4 Pressure line to quick coupler (tractor with selective control valve)
5 Oil manifold and final drive attaching screws
6 Pressure line to dump valve and rockshaft
7 Return line
8 Selective control valve (if equipped)

Disconnect pressure lines 3 and 6 (fig. 6) at elbows and return line 7 at oil manifold 1. Disconnect pressure line 4 at selective control valve 8 (if equipped). Remove two cap screws 5 attaching oil manifold to right-hand final drive housing. Lift off oil manifold together with system pressure relief valve 2 and selective control valve 8 (if equipped).

Cover connections and exposed openings with plastic plugs or caps to keep out foreign particles.

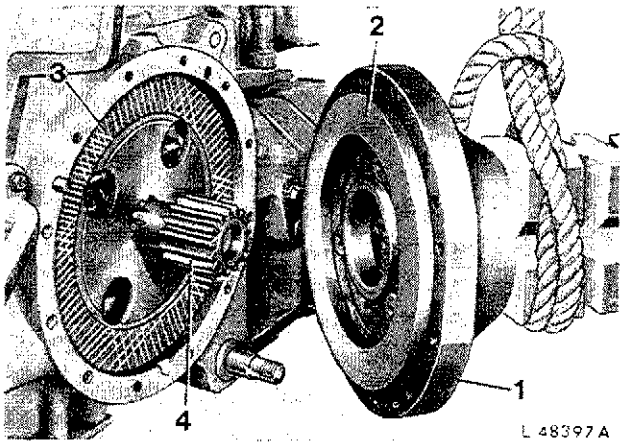

Fig. 7 — Removing Final Drive

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

Attach final drive to hoist. Remove final drive attaching screws and pull 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.

INSTALLATION

NOTE: If the brake disk was removed, install it with the brass-interwoven upper facing toward brake surface of the transmission case.

Position new gasket between final drive housing and transmission case.

Attach final drives to transmission case by means of a suitable hoist. Make sure final drive shaft gear indexes with planetary gears and that the dowels are properly aligned.

Tighten final drive attaching screws to the specified torque.

Attach oil manifold with system pressure relief valve and selective control valve (if equipped) to final drive housing.

Connect all oil lines.

Connect brake lines and bleed brakes, as explained in section 60, group 15.

Install rear fenders. Connect rear wiring harness at connector.

Install rear wheels and tighten to the specified torque.

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

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REMOVAL AND INSTALLATION OF ROCKSHAFT

REMOVAL

IMPORTANT: Work on the hydraulic system requires extreme care and cleanliness. Minute dirt or foreign particles, scratches, nicks or burrs may put the hydraulic system out of function. Before removing the rockshaft, check hydraulic system for leaks.

For safety, disconnect ground straps from batteries.

Remove transmission shield. Disconnect cable 1 (fig. 8) of start safety switch.

Remove operator's seat. Disconnect both lift links at lift arms.

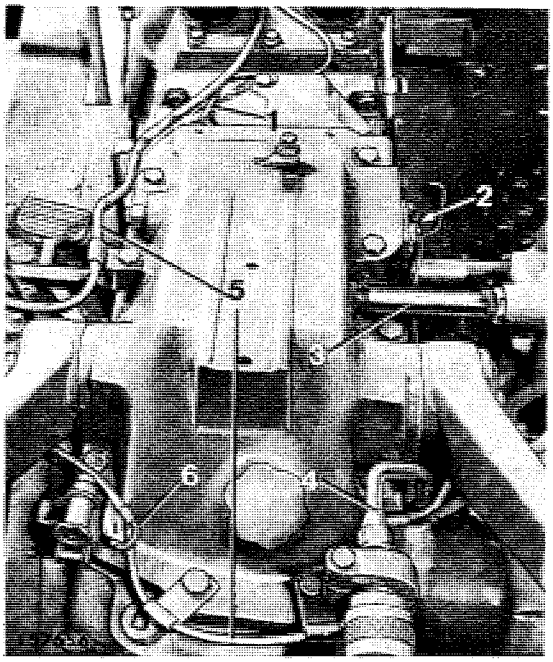

Fig. 8 — Rockshaft, Installed

1 Cable of start safety switch
2 Pilot line
3 Oil return line
4 Pressure line to quick coupler (tractor with selective control valve)
5 Rear wiring harness
6 Cable to socket (for handlamp)

Disconnect return line 3 (fig. 8) at rockshaft.

Remove pressure line 4 (tractors equipped with selective control valve).

Disconnect pilot line 2 (fig. 8) at elbow on rockshaft.

Free rear wiring harness.

Disconnect socket cable 6 at connector.

Move selector lever in position "L" so that the control linkage roller slides along the cam of the control arm when removing the rockshaft.

Attach engine lifting eye No. JD 244 to top of rockshaft housing.

Remove rockshaft attaching screws. Lift rockshaft assembly off transmission case by means of a hoist.

Take care not to damage rear wiring harness.

NOTE: After removing rockshaft, cover transmission case to prevent foreign particles from falling into the transmission.

INSTALLATION

Use a new gasket between transmission case and rockshaft. Make sure dowels in transmission case and seal ring of oil inlet passage are installed.

Move selector lever in position "L" so that the control linkage with roller can be slided over the cam.

Lift rockshaft on transmission case, using a suitable hoist.

Connect oil return line 3 and pilot line 2 to rockshaft. Install pressure line 4 (if equipped).

Tighten rockshaft attaching screws to the specified torque.

Connect cable of start safety switch and hand lamp socket.

Connect rear wiring harness to rockshaft.

Install transmission shield on transmission case.

For adjustment of rockshaft see section 70, group 20.

IMPORTANT: Connect ground straps to negative poles of batteries.

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TORQUES FOR HARDWARE

Front support to engine		
front cap screws (4 used)	23.5 mkp	170 ft.lbs.
rear cap screws (2 used)	18.0 mkp	130 ft.lbs.
Drag link to bell crank or steering arm slotted nut	7.7 mkp	55 ft.lbs.
Clutch housing to engine cap screws	23.5 mkp	170 ft.lbs.
Clutch housing to transmission case cap screws	11.7 mkp	85 ft.lbs.
Retainer of suction line to clutch housing cap screw	4.5 mkp	32 ft.lbs.
Final drives to transmission case cap screws	11.7 mkp	85 ft.lbs.
Rockshaft housing to transmission case cap screws	11.7 mkp	85 ft.lbs.
Rear wheels to rear axle wheel bolts	11.7 mkp	85 ft.lbs.
Roll-over guard cap screws (tighten crosswise)		
1. First tightening	7.0 mkp	50 ft.lbs.
2. Second tightening	41.5 mkp	300 ft.lbs.

SPECIAL TOOLS

No.	Description	Use
JDG-1*	Engine lift sling	Removing and installing engine
JDG-9*	Support stand	Tractor separation
JD 244*	Lifting eyes	Removing and installing engine

* ORDER FROM: SERVICE TOOLS INC., INDIANA AVENUE, CHICAGO, ILLINOIS 60616, USA

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Section 20
ENGINE

CONTENTS OF THIS SECTION

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Group 5
GENERAL INFORMATION, DIAGNOSING MALFUNCTIONS

GENERAL INFORMATION

The tractor is equipped with a 3-cylinder vertical in-line, valve-in-head, 4-cycle Diesel engine with direct fuel injection. The engine is our own design. 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 outlet 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 clogged.

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

Starter solenoid defective

Starter 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 clogged

Stuck shut-off knob

Dirty or faulty fuel injectors

Defective injection pump

Defective fuel transfer pump

Shut-off valve at fuel tank closed

Injection pump out of time

ENGINE RUNS IRREGULARLY OR STALLS FREQUENTLY

Coolant temperature too low

Insufficient fuel supply

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Injector tips defective or leaking

Fuel filter or fuel lines clogged

Defective fuel transfer pump

Incorrect engine timing

Improper valve clearance

Cylinder head gasket leaking

Worn or broken compression rings

Valves stuck or burnt

Excessive back pressure

Engine compression too low

Engine overheated

Defective fuel injection pump

ENGINE MISSES

Water in fuel

Mixture of gasoline and Diesel fuel

Air in fuel system

Defective fuel injectors

Defective fuel injection pump

Fuel injectors improperly installed

Leaking fuel injector seals

Engine overheated

Lobes of camshaft worn

Worn valve springs

Worn or defective fuel transfer pump

Engine backfiring

Incorrect engine timing

Engine compression too low

Improper valve clearance

Burnt, damaged or stuck valves

LACK OF ENGINE POWER

Air cleaner clogged or dirty

Excessive resistance in air intake system

Fuel filter clogged

Defective fuel transfer pump

Defective fuel injection pump

Defective fuel injectors

Improper crankcase oil

Engine overheated

Engine clutch drags

Defective cylinder head gasket

Lobes of camshaft worn

Improper valve clearance

Improper valve timing

Burnt, damaged or stuck valves

Worn valve springs

Incorrect engine timing

Piston rings and cylinder liners excessively worn

Engine compression too low

Improper coolant temperature

ENGINE OVERHEATS

Lack of coolant in cooling system

Radiator core and/or side grille screens dirty

Loose or defective fan belt

Defective thermostat

Cooling system limed up

Engine overloaded

Injection pump delivers too much fuel

Damaged cylinder head gasket

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Incorrect engine timing

Defective water pump

Too low crankcase oil level

Defective radiator cap

HIGH OIL CONSUMPTION

Oil control rings worn or broken

Scored cylinder liners or pistons

Excessive resistance in air intake system

Oil passages restrict free oil flow

Worn valve guides or stems

Too low viscosity crankcase oil

Excessive oil pressure

Piston ring grooves excessively worn

Piston rings sticking in ring grooves

Insufficient piston ring tension

Piston ring gaps not staggered

Excessive main or connecting rod bearing clearance

Crankcase oil level too high

External oil leaks

Front and rear crankshaft oil seal faulty

LOW OIL PRESSURE

Low crankcase oil level

Leakage at internal oil passages

Defective oil pump

Excessive main and/or connecting rod bearing clearance

Improper regulating valve adjustment

Improper crankcase oil

Defective oil pressure warning switch or indicator lamp

HIGH OIL PRESSURE

Stuck or improperly adjusted regulating valve

Stuck or damaged filter by-pass valve

EXCESSIVE FUEL CONSUMPTION

Engine overloaded

Compression too low

Leaks in fuel system

Air cleaner restricted or dirty

Fuel injectors dirty or faulty

Injection pump defective (delivers too much fuel)

Incorrect engine timing

BLACK OR GREY EXHAUST SMOKE

Excess fuel

Engine overloaded

Air cleaner restricted or dirty

Defective muffler (causing back-pressure)

Fuel injectors dirty or faulty

Incorrect engine timing

WHITE EXHAUST SMOKE

Engine compression too low

Defective fuel injectors

Incorrect engine timing

Thermostat defective

COOLANT IN CRANKCASE

Cylinder head gasket defective

Cylinder head or block cracked

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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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Group 10
CYLINDER HEAD AND CAMSHAFT

GENERAL INFORMATION

The intake and exhaust valves are set in the cylinder head. The valve guides are integral with the head. The valve seats are ground directly into the cylinder head. 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.

DIAGNOSING MALFUNCTIONS

For diagnosing malfunctions see group 5.

FOS *NOTE: For comprehensive and detailed repair instructions see "Fundamentals of Service, Engines" manual.*

Check condition of visible valve train parts for indication of malfunctions.

Prior to cylinder head removal, inspect and check engine operation.

CHECKING VALVE CLEARANCE

Intake valve clearance is 0.35 mm (0.014 in.). Exhaust valve clearance is 0.45 mm (0.018 in.).

CHECKING VALVE LIFT

Measuring valve lift can give an indication of wear to cam lobes, cam followers and push rods.

Set valve clearance to specifications.

Place dial indicator on valve spring cap or rotator. Manually turn engine in running direction with JDE-83 engine rotation tool. When rocker arm contacts valve stem, check dial indicator travel as rocker arm moves valve to full open. Indicator should read 11.7 to 12.5 mm (0.4600 to 0.4900 in.) on intake valves and 11.6 to 12.2 mm (0.4560 to 0.4820 in.) on exhaust valves. If lift is less than 10.9 mm (0.4300 in.) on intake valves and 10.8 mm (0.4260 in.) on exhaust valves, camshaft should be replaced.

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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 points are protruding from cylinder head sealing face and might be damaged).

Disconnect both battery ground straps.

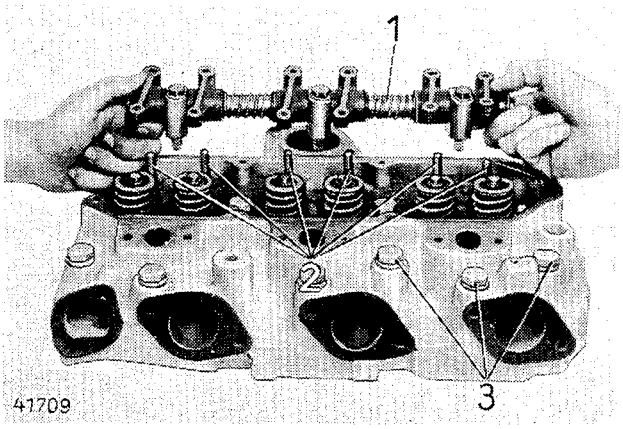

Fig. 1 - Removal of Rocker Arm Shaft Assembly

1 Rocker arm shaft
2 Push rods
3 Cylinder head cap screws

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.