4430
Tractor

TECHNICAL MANUAL

4430

Tractor

4430 TRACTOR
Serial No. (-33109)
TECHNICAL MANUAL

CONTENTS

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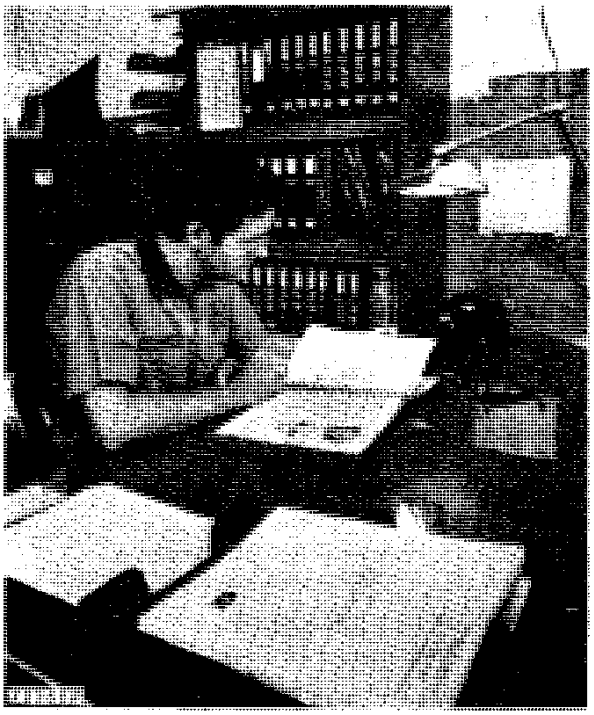
INTRODUCTION



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 identify the reference.

Use Technical Manuals for Actual Service

Some features of this technical manual:

- *Table of contents at front of manual*
- *Exploded views showing parts relationship*
- *Photos showing service techniques*
- *Specifications grouped for easy reference*

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 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.

Section 10
GENERAL

CONTENTS OF THIS SECTION

Group 5
GENERAL TRACTOR SPECIFICATIONS

PTO HORSEPOWER (Official test at 2200 engine rpm): 125.88

ENGINE:
Type .....6-cylinder, in-line, valve-in-head, diesel, turbocharged
Bore and stroke ..... 4¼ in. x 4¾ in.
Displacement ..... 404 cu. in.
Compression ratio ..... 15.5 to 1
Firing order 1-5-3-6-2-4
Valve clearance ..... Intake—0.018 in. Exhaust—0.028 in.
Injection pump timing ..... TDC
Engine Speeds:
Working range .....1500 to 2200 rpm
Maximum transport speed ..... 2400 rpm
Engine speeds:
Slow idle ..... 800 rpm
Fast idle ..... 2400 rpm

LUBRICATION SYSTEM:
Full pressurized with full-flow micronic oil filter, water cooled oil cooler, and bypass valves for filter and cooler.

FUEL SYSTEM:
Type ..... Direct Injection
Filters ..... Two-stage with replaceable impregnated paper element
Injection pump type ..... Multiple plunger, in-line
Air cleaner ..... Dry type, with safety element

COOLING SYSTEM:
Type ..... Pressurized with centrifugal pump
Temperature control ..... Heavy-duty thermostats

CAPACITIES:
Fuel tank ..... 46 U.S. gals.
Cooling system ..... 30 U.S. qts.
Crankcase (with filter change) ... 17 U.S. qts.
Transmission—hydraulic system (add 4½ gals. to capacity if equipped with Power Front Wheel Drive):
Quad-range or Syncro-range .. 13 U.S. gals.
Power shift transmission ..... 11 U.S. gals.
Hi-crop final drive housing ..... 1¾ U.S. qts.

SYNCRO-RANGE TRANSMISSION:
Type ..... Syncro-range, constant mesh

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SYNCRO-RANGE TRANSMISSION (Continued)
- Clutch
  - Perma-Clutch ..... Hydraulically operated, wet clutch, multiple disk
  - Gear selections .... 8 forward and 2 reverse
  - Shifting .... 4 stations, synchronized forward speed shifting within stations

QUAD-RANGE TRANSMISSION:
- Type ..... 2-speed, power shifted, planetary and 8-speed, syncro-range transmission with constant mesh gears
- Perma-Clutch ..... Hydraulically operated multiple disk wet clutch
- Gear selections ..... 16 forward and 6 reverse
- Shifting
  - Range selector lever ..... Collar shifted between ranges
  - Speed selector lever
    - Forward-rearward lever movement Mechanically synchronized forward speed shifting of syncro-range transmission
    - Sideways lever movement .... Power shifted planetary transmission speeds

POWER SHIFT TRANSMISSION:
- Type ..... Planetary gears, hydraulically actuated wet disk clutches and brakes
- Gear selections ..... 8 forward and 4 reverse
- Shifting ..... Hydraulic, powershifting controlled by speed selector

POWER TAKE-OFF
- Type ..... Independent PTO with rear power take-off controlled by hand-operated clutch lever stub shafts used for dual speed PTO speed conversion
- Speed (2200 engine rpm) .... Dual speed—540 or 1000 rpm; single speed—1000 rpm
- PTO ahead of drawbar hitch point ..... 540 rpm—14 in. 1000 rpm—16 in.

ELECTRICAL SYSTEM
- Type ..... 12-volt, negative grounded
- Batteries:
  - Diesel ..... Two, 6-volt, 5D group, 800 amps cold cranking at 0°F, 376 minutes reserve capacity at 25 amps
- Alternator ..... 12-volt, 55 amp with Sound-Gard body, 37 amp without Sound-Gard body

POWER FRONT-WHEEL DRIVE
- Type ..... Hydraulic motor driven with planetary gear reduction in wheel hub, uses pressure oil from hydraulic system
- Torque ..... Low (series connected) and high (parallel connected)
- Controls ..... Solenoid-operated control valves, synchronized with transmission controls

HYDRAULIC SYSTEM
- Type ..... Closed center, constant pressure Actuates power steering, power brakes, power front-wheel drive, and implement control
- Standby pressure .....2250 psi

BRAKES
- Type ..... Hydraulically actuated power disk type operating in oil

STEERING
- Type ..... Hydraulically actuated power, manual operation in case of hydraulic failure

FRONT TIRES* ..... 7.50-15, 6-ply rating

REAR TIRES* ..... 20.8-34, 6-ply rating

WHEEL TREADS ..... See tractor operator's manual

**Additional tire sizes available.*

GROUND SPEEDS (IN MPH, 18.4-38 REAR TIRES)

SYNCRO-RANGE AND POWER SHIFT TRANSMISSION

Gear	Syncro-Range 1500 rpm	Syncro-Range 2200 rpm	Power Shift 1500 rpm	Power Shift 2200 rpm
1st	1.4	2.0	1.2	1.8
2nd	2.2	3.2	1.7	2.5
3rd	2.9	4.2	2.6	3.8
4th	3.7	5.4	3.4	4.9
5th	4.6	6.8	4.4	6.5
6th	6.1	8.9	5.7	8.3
7th	7.8	11.5	7.6	11.2
8th	12.8	18.8	12.9	18.9
1st reverse	2.8	4.1	1.5	2.2
2nd reverse	4.5	6.6	2.1	3.1
3rd reverse	—	—	3.2	4.7
4th reverse	—	—	4.1	6.0

QUAD-RANGE TRANSMISSION

Range	Speed	Forward 1500 rpm	Forward 2200 rpm	Reverse 1500 rpm	Reverse 2200 rpm
A	1	1.4	2.0	2.2	3.2
	2	1.8	2.6	2.8	4.1
	3	2.3	3.4	—	—
	4	2.9	4.3	—	—
B	1	3.2	4.7	5.1	7.5
	2	4.0	5.9	6.5	9.5
	3	5.3	7.7	—	—
	4	6.7	9.8	—	—
C	1	3.8	5.5	6.0	8.8
	2	4.8	7.0	7.7	11.2
	3	6.2	9.1	—	—
	4	7.9	11.6	—	—
D	1	5.8	8.5	—	—
	2	7.3	10.8	—	—
	3	9.6	14.0	—	—
	4	12.2	17.8	—	—

DIMENSIONS

	Tractor without Roll-Gard	Tractor with Sound-Gard Body
Wheel base	106⅝ in.	106⅝ in.
Over-all length	160¾ in.	160¾ in.
Height to muffler cover	108⅝ in.	125¼ in.
Height to steering wheel	85¼	—
Height to top of Sound-Gard Body	—	114 in.
Over-all width (regular axle)	89⅝ in.	89⅝ in.
SHIPPING WEIGHT**	9,732 lbs.	10,762 lbs.

**With equipment for average field service, less fuel and ballast. Add 125 lbs. if equipped with a Quad-Range transmission. Add 375 lbs. if equipped with a Power Shift transmission. Add 450 lbs. for a 4-post Roll-Gard, and add approximately 1000 lbs. for Power Front Wheel Drive.

Group 10
PREDELIVERY, DELIVERY, AND AFTER-SALE SERVICES

PREDELIVERY SERVICE

Because of the shipping factors involved, plus extra finishing touches that are necessary to promote customer satisfaction, proper predelivery service is of prime importance to the dealer.

A tag pointing out the factory-recommended procedure for predelivery service is attached to each new tractor before it leaves the factory.

NOTE: A Caplug is placed in the muffler outlet to prevent turbocharger rotation during transit. Remove Caplug before unloading tractor. Reinstall Caplug before transporting the tractor to the customer.

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 certify that the tractor has received the proper predelivery service when that portion of the customer's John Deere Delivery Receipt is completed.

Temporary Tractor Storage

Service	Specification	Reference
Check radiator for coolant loss and antifreeze protection	2 inches above baffle	
Reduce shipping pressure of tires		Operator's manual
Cover tractor and tires for protection and cleanliness		

Before Delivering Tractor

ELECTRICAL SYSTEM		
Install electrolyte and charge batteries		FOS-20 Manual
Punch date code on battery tag		FOS-20 Manual
Connect Power Front-Wheel Drive wiring harness at connector near control valves		Section 40, Group 5
Install light switch knob		
Clean terminals and connect battery cables		Section 40, Group 5
Check light operation and adjustment. Remove flasher if required by local governmental regulations		Operator's manual
COOLING SYSTEM		
Inspect radiator for coolant loss	2 inches above baffle	
Check antifreeze protection		
TIRES AND WHEELS		
Adjust pressure of tires		Operator's manual
Check front wheel hub bolts, rear wheel rim clamp nuts, and rear wheel retainer cap screws for tightness	Front hub bolts—100 ft-lbs Rear hub bolts—300 ft-lbs Rim clamp nuts—170 ft-lbs	

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Before Delivering Tractor—Continued

Service	Specification	Reference
Check installation of wheel-stop snap ring on outside ends of rear axle		
LUBRICATION		
Check crankcase oil level	To upper marks on dipstick	Operator's manual
Check transmission-hydraulic system oil level	To top of "SAFE" range on dipstick. Type 303 Special-Purpose Oil	Operator's manual
Lubricate grease fittings	John Deere Multipurpose lubricant	Operator's manual
ENGINE		
Check air intake system — air cleaner and hose connections		Operator's manual
Fill fuel tank and start engine	Capacity—46 U.S. gallons	Operator's manual
Check operation of starter, gauges, and indicator lights		Operator's manual
Check engine timing	TDC	Section 30, Group 15
Check speed control and fuel shut-off linkages for free operation and adjustment		Section 30, Group 25
Check engine speeds	800 rpm, slow idle speed 2400 rpm, fast idle speed	Section 30, Group 20
OPERATION		
Shift transmission through all speeds		Operator's manual
Check throttle linkage for free operation		Section 30, Group 20
Adjust headlights. Check operation of all lamps		Operator's manual
Check Power Front-Wheel Drive operation		Operator's manual
Check power takeoff operation		Operator's manual
Check differential lock operation		Operator's manual
Check brakes and accumulator	3 in. maximum travel for one emergency application immediately after stopping engine	Operator's manual
Check hydraulic system operation: Rockshaft, steering, and remote cylinder		Operator's manual
Check implement hitch operation		Operator's manual
Check seat operation		Operator's manual

Before Delivering Tractor—Continued

Service	Specification	Reference
Check operation of pressurizer blowers, air conditioning system and heater system (if equipped)		Operator's manual
Check air conditioner compressor drive belt	¼ in. deflection, 15 lb. pull	Operator's manual
Check Sound-Gard Body mount caps	Tighten until effort is required to rotate cap by hand (early models); 9-11 ft-lbs torque required to rotate cap (late models with holes)	Section 10, Group 25
Check window, door, and cowl seals for proper installation		
Check windshield wipers for proper sweep angle and park in off position		Operator's manual
GENERAL		
Check 4-post Roll-Gard mounting bolts for correct torque	150 ft-lbs.	Section 10, Group 25
Check front axle-to-knee bolts for correct torque	Narrow, regular, wide, and PFWD — 370 ft-lbs Hi-Crop — 445 ft-lbs.	Section 80, Group 5
Tighten accessible nuts and cap screws		
Clean tractor and touch up paint		

DELIVERY SERVICE

A thorough discussion of the operation and service of a new tractor at the time of delivery helps to assure complete customer satisfaction. Proper delivery should be an important phase of a dealer's program. A portion of the John Deere Delivery Receipt emphasizes the importance of proper delivery service.

Many complaints have arisen simply because the owner was not shown how to operate and service his new tractor properly. Enough time should be devoted, at the customer's convenience, to introducing the owner to his new tractor and explaining to him how to operate and service it.

IMPORTANT: Install Caplug in muffler outlet if transporting tractor to customer. This will prevent damage to the turbocharger caused by air passing through the turbocharger and rotating it without lubrication when the engine is stopped.

The following procedure is recommended before the serviceman and owner complete the delivery acknowledgments portion of the delivery receipt.

Using the tractor operator's manual as a guide, be sure the owner understands these points thoroughly:

1. Controls and instruments.
2. How to start and stop the engine.
3. The importance of the break-in period.
4. How to use liquid or cast-iron ballast.
5. All functions of the hydraulic system.
6. Using the power takeoff.
7. The importance of safety.
8. The importance of lubrication and periodic services.

After explaining and demonstrating the above features, have the owner sign the delivery receipt and give him the operator's manual.

AFTER-SALE INSPECTION

The purchaser of a new John Deere tractor is entitled to a free inspection within the warranty period after the equipment has been "run in". The terms of this after-sale inspection are outlined on the back of the John Deere Delivery Receipt.

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.

If the recommended after-sale service inspection is followed, the dealer can eliminate a needless volume of service work by preventing minor irregularities from developing into serious problems later on. This will promote strong dealer-customer relations and present the dealer an opportunity to answer questions that may have arisen during the first few days of operation. During the inspection service, the dealer has the further opportunity of promoting the possible sale of other new equipment.

The following inspection program is recommended within the first 100 hours of tractor operation.

Service	Specification	Reference
COOLING SYSTEM		
Check radiator coolant level	2 inches above baffle	
Clean external surface of radiator		
Check hoses and connections for leaks		
FUEL SYSTEM		
Remove water and foreign matter from filter sediment bowl		Operator's manual
Bleed fuel system		Operator's manual
Tighten loose conections and check entire system for leaks. Correct if necessary		
Check air cleaner element and unloading valve. Clean element if necessary		Operator's manual
ELECTRICAL SYSTEM		
Check specific gravity of battery(s)	Full charge—1.260 at 80° F	Operator's manual
Check level of battery electrolyte	To bottom of filler neck in each cell	Operator's manual
Check fan belt tension	1 inch deflection with a 25 pound force	Operator's manual

Service	Specification	Reference
Start engine and check operation of starter, lights, indicator lamps, and controls		Operator's manual
LUBRICATION		
Check crankcase oil level	To upper marks on dipstick	Operator's manual
Check transmission-hydraulic system oil level	In "SAFE" range on dipstick Use John Deere Type 303 Special-Purpose Oil	Operator's manual
ENGINE		
Check valve clearance	Intake—0.018 inch Exhaust—0.028 inch	Operator's manual
Check engine speed under load, fuel consumption, and horsepower	Specification	Group 15 of this section
CLUTCHES AND DIFFERENTIAL LOCK		
Shift transmission through all speeds		Operator's manual
Check Power Front-Wheel Drive operation		Operator's manual
Check PTO clutch and brake operation		Section 50, Groups 45, and 50
Check Differential Lock Operation		Operator's manual

Service	Specification	Reference
HYDRAULIC SYSTEM		
Check rockshaft and remote cylinder operation		Section 70, Group 30
Check negative signal adjustment		Section 70, Group 30
Check power steering	Smooth, easy operation	Section 70, Group 20
Check brakes and accumulator	3 in. maximum travel for one emergency application immediately after stopping engine	Operator's manual
NUTS AND CAP SCREWS		
Tighten accessible nuts and cap screws that seem to require adjustment		

RECOMMENDED TORQUE IN FOOT-POUNDS

Bolt Diameter	Plain Head*	Three Radial Dashes*	Six Radial Dashes*
1/4	6	10	14
5/16	13	20	30
3/8	23	35	50
7/16	35	55	80
1/2	55	85	120
9/16	75	130	175
5/8	105	170	240
3/4	185	300	425
7/8	160	445	685
1	250	670	1030

*The types of bolts and cap screws are identified by head markings as follows:

Plain Head: regular machine bolts and cap screws.

3-Dash Head: tempered steel high-strength bolts and cap screws.

6-Dash Head: tempered steel extra high-strength bolts and cap screws.

Group 15
TUNE-UP

Before tuning up a tractor, determine whether a tune-up will restore operating efficiency. When there is doubt, the following preliminary tests will help to determine if the engine can be tuned up. If the condition is satisfactory, proceed with the tune-up. Choose from the following procedures only those necessary to restore the unit.

Preliminary Engine Testing

Operation	Specification	Section-Group Reference
Dynamometer Test (at 2200 engine rpm full load)	Compare with previous recorded output; compare with output after tune-up. See chart below	FOS—30 Manual, Chapter 12
Compression Test	330-370 psi at 200-250 rpm	FOS—30 Manual, Chapter 12
Engine Coolant Check Test	No air bubbles or oil film in radiator	FOS—30 Manual, Chapter 12

Engine Tune-Up

Operation	Specification	Section-Group Reference
Air Intake System		
Service air cleaner and check system for leaks		FOS—30 Manual, Chapter 12
Check system for restrictions using water manometer		FOS—30 Manual, Chapter 12
Normal reading (with clean filter elements at full load)	10½ in. of water at 2200 rpm (tractors with extension) 11 in. of water at 2200 rpm (tractors without extension)	30-10
Maximum permitted reading	25 in. of water at 2200 rpm	30-10
Check intake manifold pressure	15-17 psi at full load	30-10
Check restriction indicator light operation	24-26 in. at 2200 rpm	30-10

ENGINE-PTO SPEED RELATIONSHIP

Engine RPM	PTO Speed	Rated PTO Horsepower*
2200 (SRT & QRT, full load)	540 or 1002	125.88
2200 (PST, full load)	544 or 1011	———
2400 (SRT & QRT, fast idle)	589 or 1093	———
2400 (PST, fast idle)	594 or 1103	———

*Official test

Engine Tune-Up—Continued

Operation	Specification	Section-Group Reference
Exhaust System		
Check system for leaks	FOS—30	Manual, Chapter 12
Check muffler and exhaust pipe for restrictions	FOS—30	Manual, Chapter 12
Crankcase Ventilating System		
Check system for restrictions	FOS—30	Manual, Chapter 12
Cooling System		
Clean grille screen, radiator core, and oil cooler core		20-30
Clean and flush system; check thermostats	Opening range 177°F to 182°F	20-30
Check pressure cap	6.25 to 7.50 psi release pressure	20-30
Cylinder Head and Valves		
Torque cylinder head cap screws	130 ft-lbs in sequence	20-10
Set valve clearance	Intake—0.018 in. Exhaust—0.028 in.	20-10
Diesel Fuel System		
Check fuel tank for water		30-15
Check fuel pump pressure	20-25 psi at 2200 rpm full load	30-15
Change filter		30-15
Injection Pump:		
Service and check timing	TDC	30-15
Adjust throttle linkage	800±20 rpm, slow idle speed 2375±50 rpm, fast idle speed 2200 rpm, full load speed	30-20
Lubrication system		
Check engine oil pressure	40-50 psi (1900 rpm)	20-25
Charging System		
Check battery specific gravity	1.240-1.260	40-10
Check battery water consumption and electrolyte level		40-10
Clean battery, cables, and box		40-10
Check alternator belt tension	25 lbs. at 1 in. belt deflection	40-10
Check alternator output	32 amps at 13 to 15 volts (1880 engine rpm)—tractors without Sound-Gard Body 50 amps at 13 to 15 volts (1880 engine rpm)—tractors with Sound-Gard Body	40-10
Check alternator regulated voltage	14.2-14.6 volts (operating)	40-10

Engine Tune-Up—Continued

Operation	Specification	Section-Group Reference
Starting System		
Check start-safety switch operation		40-15 & 20
Check battery voltage when starting	Min. 9 volts (cranking)	40-15 & 20
Check starter current draw	Diesel—approx. 500-600 amps	40-15 & 20
Check operation of alternator, oil pressure, and Power Shift transmission filter restriction indicator lights		40-25

Final Engine Test

Operation	Specification	Section-Group Reference
Dynamometer Test (at 2200 engine rpm)	Compare with previous recorded output; record for future use	FOS—30 Manual, Chapter 12

Tractor Tune-Up

Operation	Specification	Section-Group Reference
Transmission		
Check shifting		50-15
Check for proper operation without excessive noise		50-15 & 20
Perma-Clutch actuating pressure	170-180 psi at 1900 engine rpm	50-10
Power Shift transmission pump pressure	175-195 psi	50-25
Power Shift engaged element pressure		50-25
Check differential lock operation	420-480 psi	50-30
Check brake pedal travel and even position	3 in. max. for one emergency application immediately after stopping engine	70-25
Check power take-off		50-45, 50, & 55
Check front wheel bearing adjustment and lubrication	35 ft-lbs; back-off to nearest hole	
Check front wheel toe-in	⅛-⅜ in.	
Check tire inflation		Operator's manual

Tractor Tune-Up—Continued

Operation	Specification	Section-Group Reference
Check Power Front Wheel Drive operation		50-60
Transmission pump	12 gpm at 1900 rpm—Quad-Range or Syncro-range 12 gpm at 1900 rpm—Power Shift	70-5
Main hydraulic pump	Standby—2200-2300 psi (2300-2400 psi for Power Front-Wheel Drive) Capacity—22 gpm (2000 psi and 1900 rpm); 29 gpm (2000 psi and 1900 rpm) for Power Front-Wheel Drive	70-5
Pressure control valve	1650-1700 psi at 800 rpm (approximately 5 gpm flow)	70-5
Rockshaft:		
Lift cycle time (75 degrees) rotation	2.6-2.8 seconds at 1900 rpm	70-30
Maximum oil flow	12 to 13 gpm at 2000 psi and 1900 rpm	70-30
Lever position (depth control)	Complete raise when control lever is moved rearward and stopped with front edge of lever in contact with stop in lever guide	70-30
Lever position (load control)	At 0 mark quadrant to raise (rear lever edge)	
Negative signal adjustment		70-30
Selective control valve	2 to 20 gpm at 1200 psi and 1900 rpm	70-5
Power Front Wheel Drive pressure control	1930-1970 psi at 2150 rpm, 4th gear, high torque (or B-1 Quad-Range)	50-60

Hydraulic system pressures, flow rates, or cycle times are for conditions specified in Section 70 (tractor at operating temperature, transmission-hydraulic oil at 140° F to 160° F proper test equipment, correct test sequence, etc.).

Group 20
LUBRICATION

GENERAL INFORMATION

Carefully written and illustrated instructions are included in the tractor operator's manual. Remind your customer to follow the recommendations in these instructions.

For your convenience when servicing the tractor, the following chart shows capacities and types of lubricants for the various components. Additional lubrication information is on page 20-2.

Component	Capacity	Type of Lubricant	Interval of Service
Engine Crankcase	17 U.S. quarts (includes filter)	See "Engine Lubricating Oils" on page 20-2	10 Hours—Check level 50 Hours—Change oil 200 Hours—Replace filter
Transmission and Hydraulic System	*13 U.S. gallons (Syncro-range or Quad-Range) *11 U.S. gallons (Power Shift)	John Deere Type 303 Special-Purpose Oil	200 Hours—Check level 200 Hours—Change filter on Perma-Clutch tractors 600 Hours—Replace filter on Power Shift tractors 1200 Hours—Change oil
Hi-Crop Final Drive Housing	1¾ U.S. quarts	Above 32° F, use John Deere SAE 90 Gear Lubricant or its equivalent; below 32° F, use John Deere SAE 80 Gear Lubricant or its equivalent	200 Hours—Check level 1200 Hours—Change oil
Front Wheel Bearings	.....	Wheel Bearing Grease	1200 Hours—Repack bearing
Grease Fittings	.....	John Deere Multipurpose Lubricant	See Operator's Manual

*Add 4½ gals. to capacity if equipped with Power Front Wheel Drive.

LUBRICANTS

Engine Lubricating Oils

Fig. 1—Torq-Gard Engine Oil

We recommend John Deere Torq-Gard or Torq-Gard Supreme engine oil for use in the engine crankcase. This oil is compounded specifically for use in John Deere engines, and provides superior lubrication under all conditions. NEVER PUT ADDITIVES IN THE CRANKCASE. Torq-Gard oil was formulated to provide all the protection your engine needs. Additives could reduce this protection rather than help it.

If oil other than Torq-Gard or Torq-Gard Supreme is used, it must conform to the following specifications:

SINGLE VISCOSITY OILS

API Service CD/SD
MIL-L-2104C
Series 3*

MULTI-VISCOSITY OILS

API Service CC/SE, CC/SD, or SD
MIL-L-46152

*As further assurance of quality, the oil should also be identified as suitable for API service designation SD.

Depending on the expected prevailing temperature for the fill period, use oil of viscosity as shown in the following chart.

Air Temperature	John Deere Torq-Gard Oil	Other Oils: Single Viscosity Oil	Other Oils: Multi-Viscosity Oil
Above 32° F	SAE 30	SAE 30	Not recommended.
—10° F to 32° F**	SAE 10W-20	SAE 10W	SAE 10W-30
Below —10° F	SAE 5W-20	SAE 5W	SAE 5W-20

***SAE 5W-20 oil may be used where required to insure optimum lubrication at starting, particularly for an engine subjected to —10° F or lower for several hours.*

Some increase in oil consumption may be expected when SAE 5W-20 or SAE 5W oils are used. Check oil level more frequently.

Transmission Hydraulic Oils

Use only John Deere Type 303 Special-Purpose Oil or its equivalent in the transmission-hydraulic system. Other types of oil will not give satisfactory service, and may result in eventual damage. This special oil may be used in all weather conditions.

Greases

John Deere Multi-Purpose Lubricant or an equivalent SAE multipurpose-type grease is recommended for most grease fittings. Wheel bearing grease is recommended for front wheel bearings. Application of grease as instructed in the lubrication section of the operator's manual will provide proper lubrication and will keep contamination out of bearings.

Storing Lubricants

A tractor can operate at top efficiency only if clean lubricants are used. Use clean containers to handle all lubricants. Store them in an area protected from dust, moisture, and other contamination.

Group 25
SEPARATION

REMOVING SOUND-GARD BODY

When the tractor is equipped with a Sound-Gard Body (or a 4-post Roll-Gard), it may be necessary to remove the body or Roll-Gard in order to service components that would otherwise be inaccessible.

Disconnect the battery ground cable. Remove the cowl and floor mat. Then remove the control island floor panel and disconnect body wiring harness at connectors.

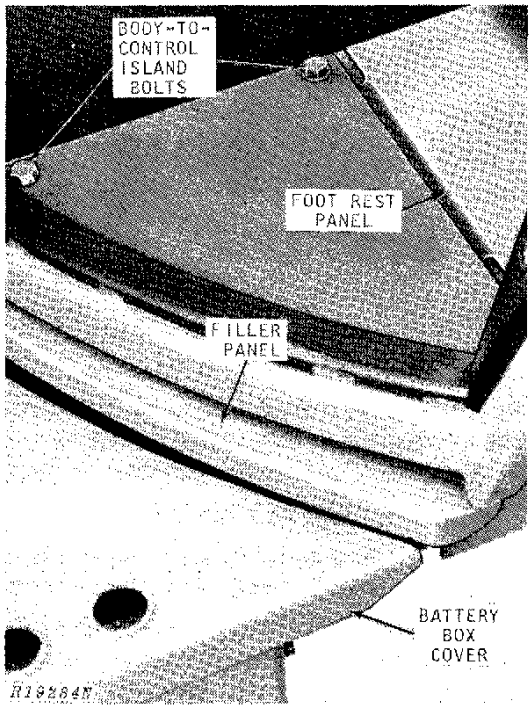


Fig. 1—Removing Panels

Remove the battery box covers, body filler panels, foot rest panels, and body-to-control island bolts (Fig. 1).

Remove the front mounting bolts (Fig. 2).

⚠ CAUTION: Follow all safety precautions found on page 80-10-6 when working with the air conditioning system.

Disconnect refrigerant couplers on tractors with air conditioning by holding the coupler body stationary with a wrench, and unscrewing coupler with another wrench. If refrigerant can be heard escaping as the coupler is loosened, retighten coupler and loosen again (Fig. 3).

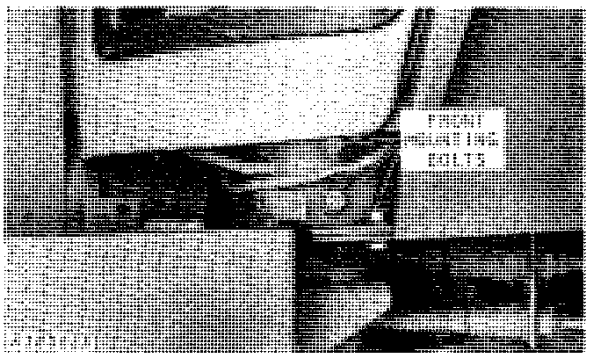


Fig. 2—Front Mounting Bolts

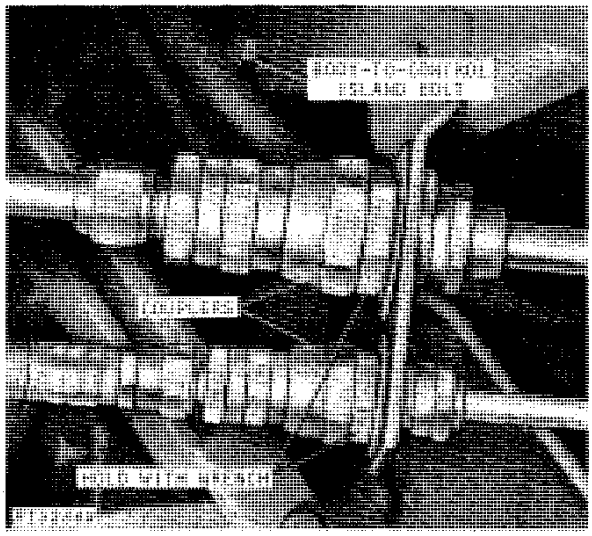


Fig. 3—Air Conditioning Couplers

Remove the body-to-rear control island bolts (Fig. 3, 4).

Disconnect transmission and speed control rods (Fig. 4). Disconnect control valve operating rod on Quad-Range tractors. On Power Shift tractors, disconnect the park lock and transmission shifter cables.

Disconnect rockshaft and selective control valve rods at the front end (Fig. 5).

Remove the mounting cap screws and lock plate.

On tractors equipped with a heater, drain the cooling system to a level below heater hose connections. Disconnect the heater hoses at connections under right-hand fender next to rear post.

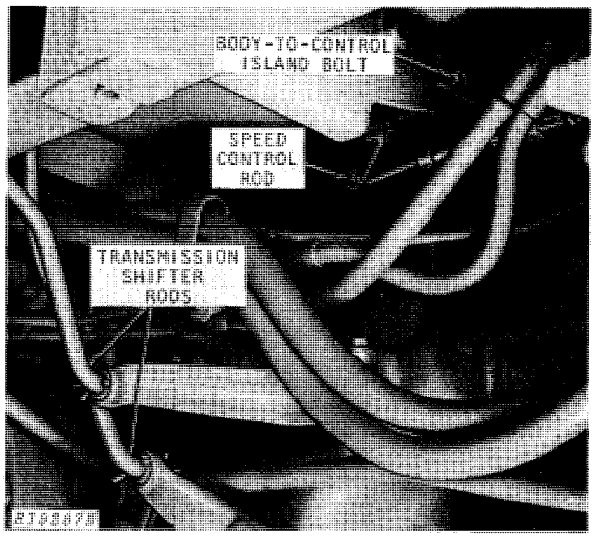


Fig. 4—Disconnecting Transmission and Speed Control Rods

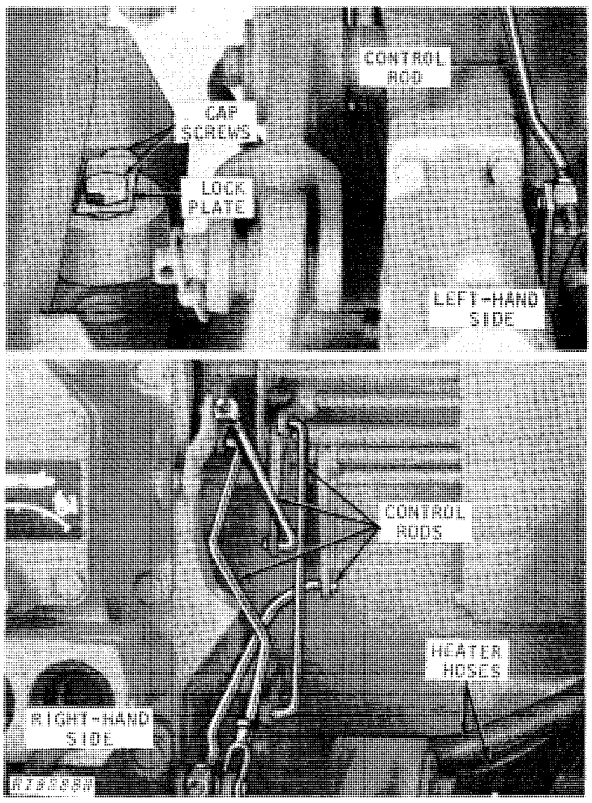


Fig. 5—Body Removal Steps (Rear)

Remove the two cap screws from on top of roof. Fasten lifting chains and connect to JDG-1 engine lift sling (Fig. 6).

IMPORTANT: Lifting chains should be as nearly vertical as possible when lifting body, to prevent undue stress on roof.

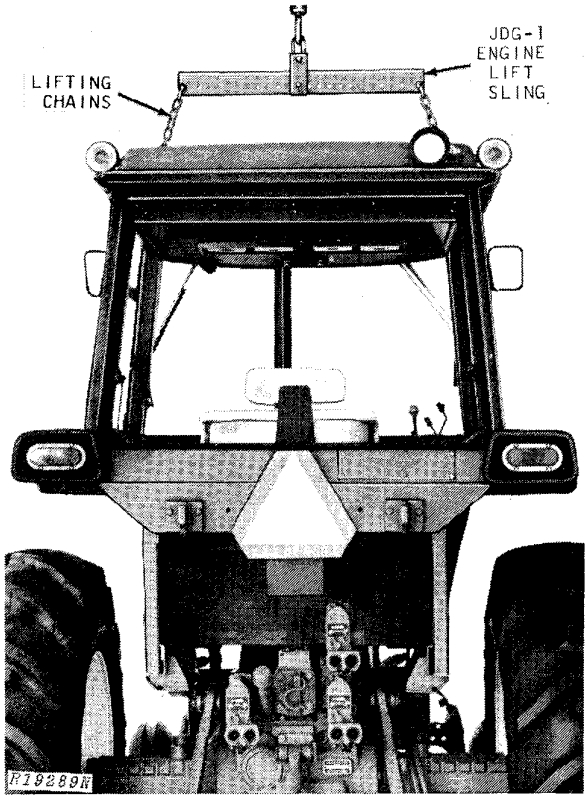


Fig. 6—Removing Sound-Gard Body

To make body removal easier, lower tilt steering wheel (if equipped). Move 3-point hitch upper lift link pins inward to provide clearance for body.

INSTALLATION

Before installing body, be sure rubber seal that contacts the control island is in good condition.

Place spacers (Fig. 7) in position (short spacer to rear) on rear axle. Tractors having 4-post Roll-Gard use steel blocks in place of the rubber mounts used on the Sound-Gard Body.

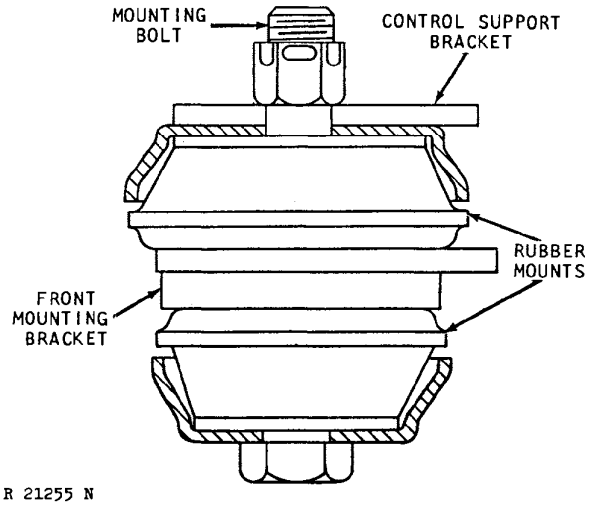
Install body on tractor (Fig. 7). Tighten the rear-most cap screw on each side first until effort is required to rotate metal retaining cap by hand. On late model tractors having retaining caps with punched holes (to receive JDG-11 wrench), tighten cap screw until 8-10 ft-lbs torque is required to rotate cap. Position lock plate and install front cap screw.

IMPORTANT: Tighten the stop bolts (front cap screws on each side) to a minimum of 110 ft-lbs torque but not more than 150 ft-lbs torque. Doing so may deform the stepped washer and crush the bushing. Roll-Gard (4-post) mounting bolts should be tightened to the same specification as the stop bolts.

Reverse the removal procedures given on the previous two pages.

Fill cooling system to proper level, start engine and check operation of controls.

Check for leaks around couplers on tractors with air conditioning.



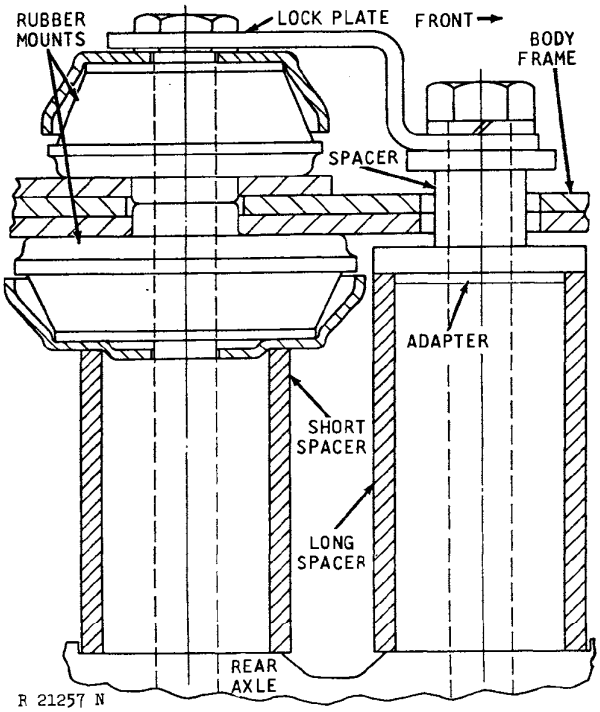


Fig. 7—Sound-Gard Body Mounts

SEPARATING ENGINE FROM CLUTCH HOUSING

CAUTION: Before separating tractor, be sure that the brake accumulator is discharged. The accumulator can be discharged by opening the right-hand brake bleed screw, and holding the brake pedal down for a few minutes.

Drain cooling system and remove cowl, side shields, grille screens, hood, and muffler.

Remove battery box covers, and disconnect battery cables. Remove batteries and battery boxes. Remove tractor step when removing left-hand battery box. Remove the long battery cable that connects both batteries.

Remove body filler panels (Fig. 1).

CAUTION: Follow all safety precautions found on page 80-10-6 when working with the air conditioning system.

Disconnect refrigerant couplers on tractors with air conditioning by holding the coupler body stationary with a wrench. If refrigerant can be heard escaping as the coupler is loosened, retighten coupler and loosen again.

IMPORTANT: Keep ends of couplers clean to prevent possible contamination in system.

On tractors with Perma-Clutch, remove the hexagonal transmission pump drive shaft from rear of transmission case (Fig. 50-15-2).

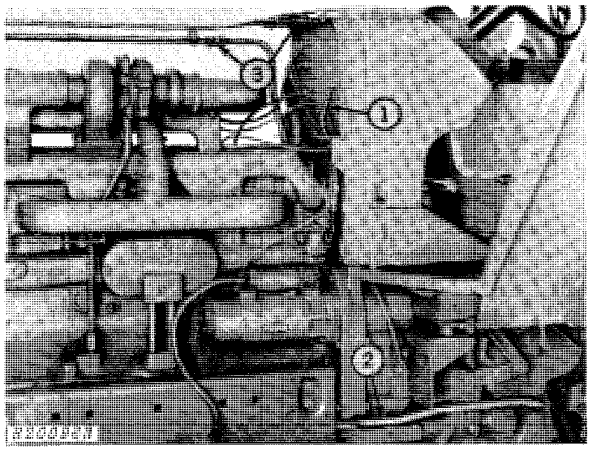


Fig. 8—Left-Hand Separation Steps

1. Disconnect primary wiring lead (Fig. 8).

2. Disconnect hydraulic pump inlet pipe. On tractors with Power Front-Wheel Drive, also disconnect the drain pipe.

3. Thoroughly clean area around steering pipes. Disconnect steering pipes and hydraulic cooler return pipe. Steering pipes on late model tractors are connected to steering valve at firewall (Fig. 9).

4. Disconnect wiring harness at connectors on firewall (Fig. 9). To do so, remove cap screw located in center of connector. Remove upper connector from lower connector. Disconnect start-safety switch and light wiring from connectors inside control support housing.

5. Remove crankcase vent hose.

6. Disconnect hydraulic pump pressure pipe and pump seal bleed line. Disconnect heater hoses from engine.

7. Disconnect tachometer drive cable, oil pressure sending unit wire, and the speed control rod.

8. Disconnect the fuel shut-off cable.

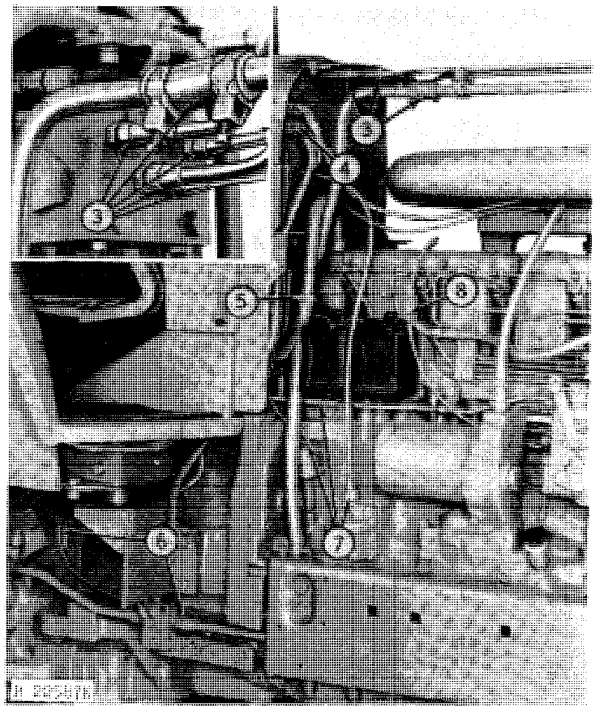


Fig. 9—Right-Hand Separation Steps

Place a drain pan under engine and clutch housing on tractors with Perma-Clutch to catch the oil from clutch housing as separation is made.

Install JDG-2C support stand (Fig. 10) on side frames. Support clutch housing with a floor jack.

Remove engine-to-clutch housing cap screws and roll rear portion of tractor away.

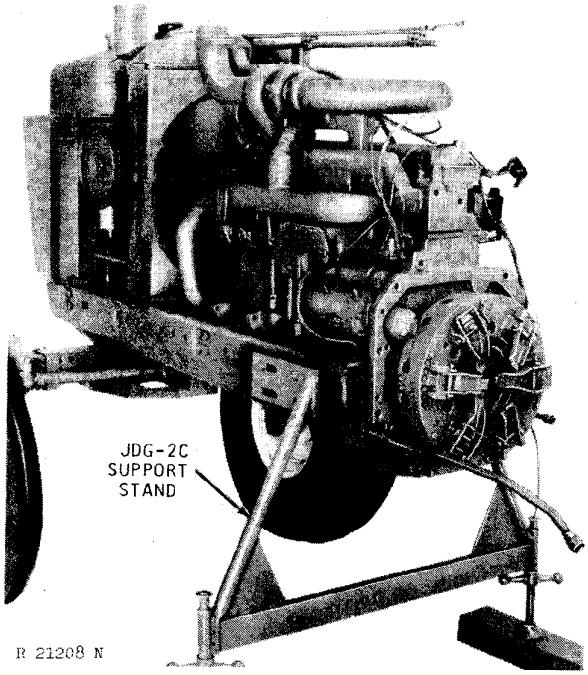


Fig. 10—Engine Separated From Clutch Housing

INSTALLATION

Apply a light coating of Permatex No. 3 to the rear engine block bolting flange in the two areas where the oil pan and block join. Install a new gasket between the clutch housing and engine on tractors with Perma-Clutch.

Tighten engine-to-clutch housing cap screws to 85 ft-lbs torque for ½ inch cap screws, and to 300 ft-lbs torque for ¾ inch cap screws.

Reverse the numbered separation procedures. Connect the air conditioning couplers, and install body filler panels, batteries, battery cables, and covers. Install hex. drive shaft.

Bleed the steering system (Section 70, Group 20) and check for leaks.

Install muffler, hood, grille screens, and side shields.

REMOVING ENGINE

Separate tractor between engine and clutch housing as previously instructed.

Drain the cooling system.

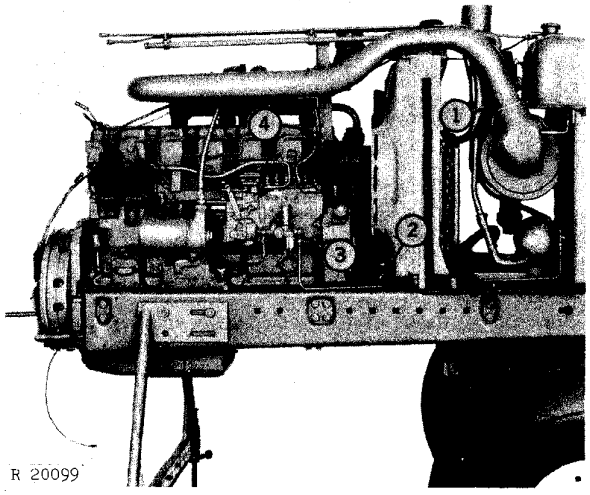


Fig. 11—Right-Hand Side of Engine

1. Remove the air intake pipe (up to turbocharger) (Fig. 11).

2. Disconnect hydraulic pump drive coupling and pump support bracket.

3. Close fuel shut-off valve and disconnect fuel pump inlet pipe.

4. Disconnect and remove the fuel return pipe.

5. Disconnect and remove upper and lower radiator hoses (Fig. 12).

Remove compressor on tractors equipped with air conditioning, leaving refrigerant hoses attached. Place compressor out of way.

⚠ CAUTION: Follow all safety precautions listed on page 80-10-6 if the air conditioning pipes or hoses are to be disconnected.

On tractors with Power Front-Wheel Drive, remove the drain pipe (Fig. 13).

Install JDE-63 engine lifting brackets (Fig. 14). Connect a JDG-1 engine lift sling to lifting brackets and to an overhead hoist.

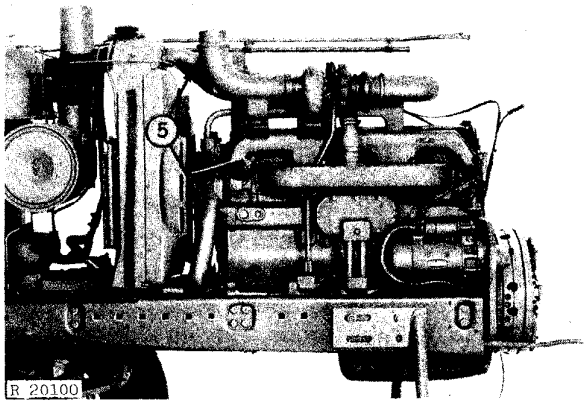


Fig. 12—Left-Hand Side of Engine

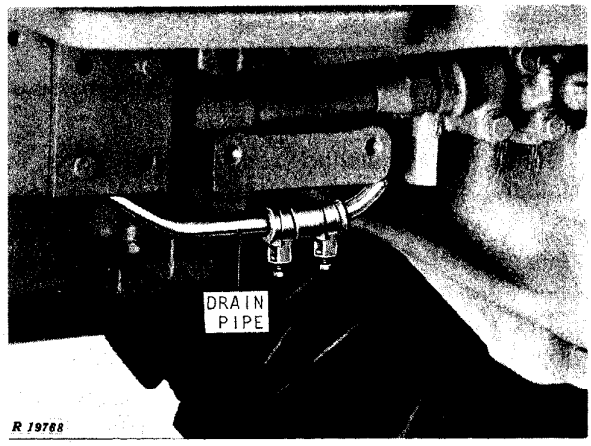


Fig. 13—Power Front-Wheel Drive Drain Pipe

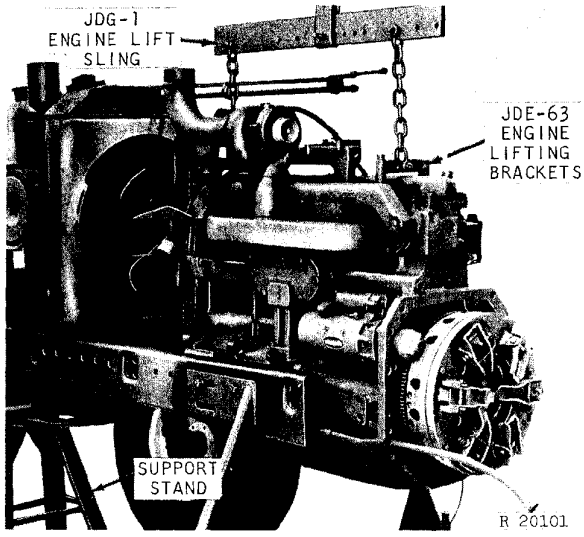


Fig. 14—Removing Engine

CAUTION: Position a metal stand under tractor front end to prevent tipping when engine is removed.

Remove side frame-to-engine cap screws, and move engine out of side frame.

INSTALLATION

Slide engine into place and reverse the removal procedures to install engine. Fill cooling system.

Tighten hydraulic pump support-to-engine cap screws to 85 ft-lbs torque. Tighten pump drive coupling to 30 ft-lbs torque. Tighten side frame-to-engine cap screws to 275 ft-lbs torque.

Install air conditioning compressor and tighten drive belt to deflect ¼ inch with a 15 lb. force. Tighten fan belts to deflect 1 inch with a 25 lb. force.

On tractors with Power Front Wheel Drive, install the front drain pipe.

Refer to "Installation", page 25-4 for final installation instructions.

SEPARATING TRACTOR FRONT END FROM ENGINE

Drain cooling system and remove side shields, grille screens, air stack, hood, and muffler.

Remove battery box covers, and disconnect battery cables. Remove batteries and battery boxes. Remove tractor step when removing left-hand battery box.

Remove body filler panels (Fig. 1).

CAUTION: Follow all safety precautions found on page 80-10-6 when working with the air conditioning system.

Disconnect refrigerant couplers on tractors with air conditioning by holding the coupler body stationary with a wrench, and unscrewing coupler with another wrench. If refrigerant can be heard escaping as the coupler is loosened, retighten coupler and loosen again (Fig. 3).

IMPORTANT: Keep ends of couplers clean to prevent possible contamination in system.

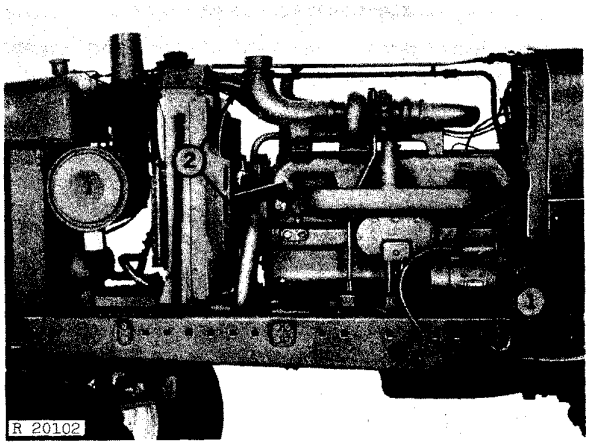


Fig. 15—Left-Hand Side of Tractor

1. Disconnect hydraulic pump inlet pipe (Fig. 15). On tractors with Power Front-Wheel Drive, also disconnect the drain pipe (Fig. 13).

Remove compressor on tractors equipped with air conditioning, leaving refrigerant hoses attached.

2. Disconnect upper and lower radiator hoses.

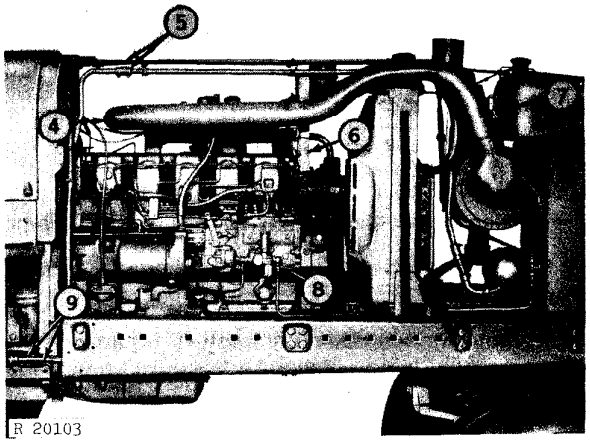


Fig. 16—Right-Hand Side of Tractor

3. Remove the air intake assembly (up to turbocharger (Fig. 16).

4. Disconnect hydraulic pump drive coupling and pump support bracket.

5. Disconnect steering and cooler return pipes (Fig. 16). Steering pipes connect to steering valve at firewall on tractors having late model steering. See Fig. 9.

6. Remove the support bracket from engine. Disconnect the fuel return pipe.

7. Disconnect and remove wiring leads from connections in front of radiator.

8. Close the fuel shut-off valve, and disconnect fuel pipe at the fuel pump.

9. Disconnect the hydraulic pump discharge pipe and pump seal bleed line. Disconnect heater hoses.

Install JDE-63 engine lifting brackets and JDG-1 engine lift sling. Install JDG-2 front support stand.

⚠ CAUTION: Position a metal stand under tractor front end to prevent tipping when engine is removed.

Remove side frame-to-engine cap screws. Roll engine and rear portion of tractor out from side frames. Place a support stand under clutch housing (Fig. 17).

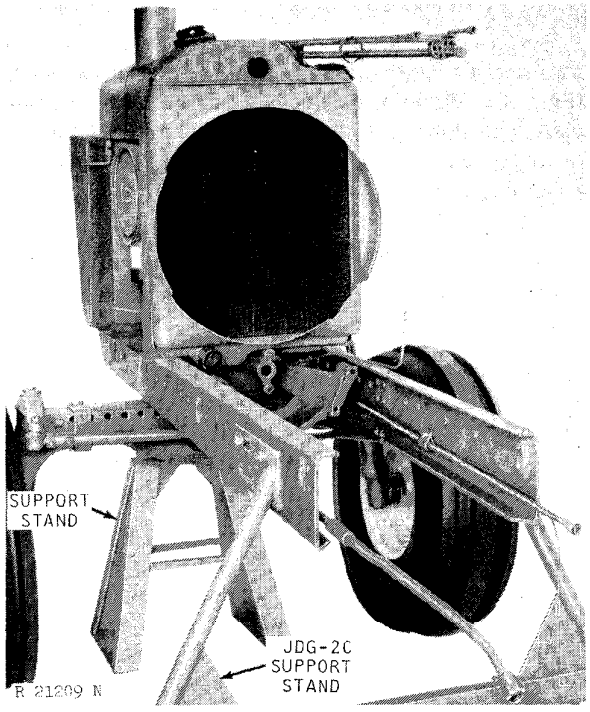


Fig. 17—Tractor Front End After Separation

INSTALLATION

Move the tractor sections together. Never use excessive force.

Tighten hydraulic pump support-to-engine cap screws to 85 ft-lbs torque. Tighten pump drive coupling to 30 ft-lbs torque. Tighten side frame-to-engine cap screws to 275 ft-lbs torque.

Install air conditioning compressor and tighten drive belt to deflect ¼ inch with a 15 lb. force. Tighten fan belt to deflect 1 inch with a 25 lb. force.

On tractors with Power Front-Wheel Drive, install the front drain pipe.

Reverse the numbered separation procedures. Connect the air conditioning couplers, and install body filler panels, batteries, battery cables, and covers. Remove support stands.

Bleed the steering system (Section 70, Group 20) and check for leaks.

Install muffler, hood, grille screens, and side shields.

SEPARATING CLUTCH HOUSING FROM TRANSMISSION CASE

Discharge accumulator (open brake bleed screw and depress pedal). Drain the transmission.

Remove battery box covers, and disconnect battery cables.

Remove body filler panels (Fig. 1).

Remove Sound-Gard Body or 4-post Roll-Gard, if equipped (page 10-25-1). On Power Shift tractors, first separate the engine from the clutch housing. See page 10-25-3.

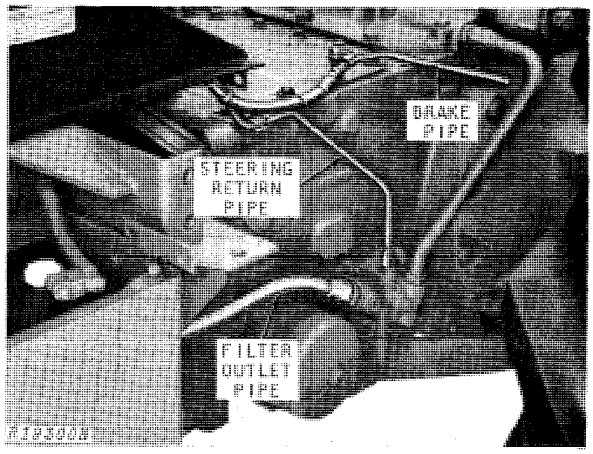


Fig. 18—Left-Hand Side of Transmission Case (Syncro-Range Shown)

IMPORTANT: Remove hexagonal transmission pump drive shaft (Fig. 2, page 50-15-2) on tractors with Perma-Clutch, before beginning separation. Install drive shaft last.

Disconnect filter outlet pipe, steering return pipe, and left-hand brake pipe (Fig. 18). On tractors with Perma-Clutch, disconnect sending unit wiring from filter relief valve housing.

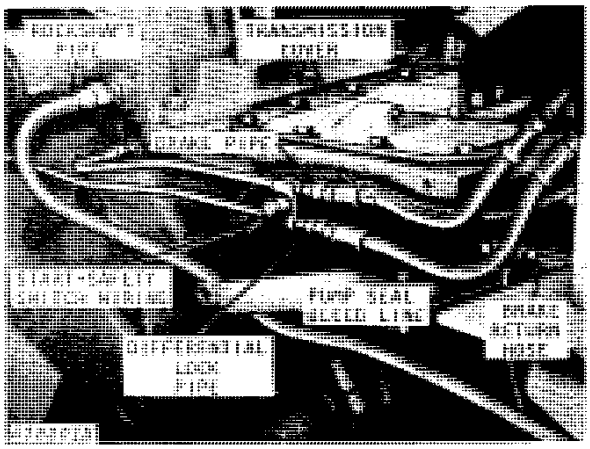


Fig. 19—Right-Hand Side of Transmission Case (syncro-range Shown)

Disconnect rockshaft pressure pipe, differential lock pipe, and brake pipe (Fig. 19).

Disconnect start-safety switch wiring, pump seal bleed line, and brake return hose. Disconnect heater hoses.

On tractors without Sound-Gard Body or 4-post Roll-Gard, remove the operator's platform and disconnect the control support from platform support frame. Disconnect Quad-Range control valve operating rod linkage.

Remove the cover from top of transmission case, and remove the two clutch housing-to-transmission case cap screws inside case (Syncro-range and Quad-Range).

On tractors with Power Shift transmission, disconnect the transmission pump intake elbow from clutch housing, and disconnect Power Front-Wheel Drive wiring from switches on control valve. Remove clutch pack, C1 and C2 shafts, snap ring, and PTO clutch gear (Section 50, Group 25). Then remove the two clutch housing-to-transmission cap screws from inside clutch housing.

On tractors with syncro-range transmission and Power Front-Wheel Drive, disconnect the Power Front-Wheel Drive drain pipe.

Remove batteries and battery boxes. Install JDG-2C front support stand, and positon a floor jack under transmission case.

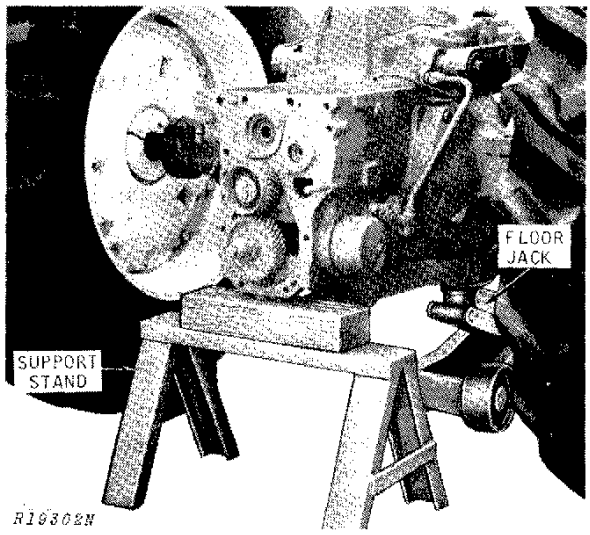


Fig. 20—Transmission Separated From Clutch Housing

Remove the clutch housing-to-transmission case cap screws, and roll rear portion of tractor away (Fig. 20). Place a support stand under transmission. The floor jack may then be placed under the drawbar support to give additional stability to assembly.

INSTALLATION

Move both sections together. Reverse the removal steps.

On Syncro-range and Quad-Range tractors, tighten the clutch housing-to-transmission cap screws to 170 ft-lbs torque (⅝ in. screws) and 300 ft-lbs torque (¾ in. screws). Install hexagonal transmission pump drive shaft (Perma-Clutch).

On Power Shift tractors, install the PTO clutch gear, snap ring, C1 and C2 shafts. Then install the two internal clutch housing-to-transmission cap screws, and tighten to 170 ft-lbs torque. Install transmission pump and clutch pack assembly. Assemble engine and tractor front end to clutch housing.

Install Sound-Gard Body or 4-post Roll-Gard (see page 10-25-3). On tractors without Sound-Gard Body or 4-post Roll-Gard, install platform and connect control linkages.

Install battery boxes, batteries, and tractor sheet metal. Connect heater hoses.

Fill transmission with the proper grade and viscosity oil (page 10-20-1). Fill cooling system to proper level.

After completing installation, start engine and check tractor operation.

REMOVING REAR AXLE HOUSING

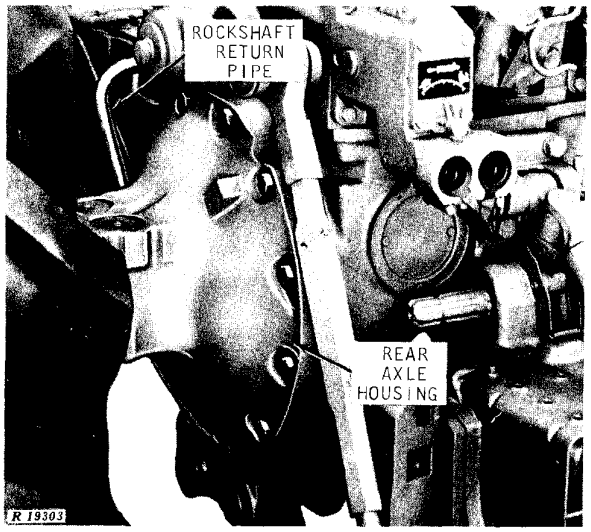


Fig. 21—Rear Axle Housing (Sound-Gard Body removed for illustration purposes)

Drain transmission.

Raise tractor and remove rear wheel. Place a support stand under the drawbar support.

It is not necessary to completely remove the Sound-Gard Body or Roll-Gard to remove the rear axle housing from tractor. However, it is necessary to loosen the mounting bolts or cap screws in addition to removing the mounting cap screws from housing being removed.

On tractors without Sound-Gard Body or Roll-Gard, disconnect the wiring harness from fender, and remove fender.

When removing left-hand housing, remove the rockshaft return pipe (Fig. 21). When removing the right-hand housing, remove the differential lock pressure pipe.

Fasten a chain around the axle housing and attach to an overhead hoist.

Remove the axle housing-to-transmission case cap screws.

Remove axle housing from transmission case (Fig. 22), and remove brake disk to keep it from falling on floor. Then remove sun pinion and brake backing plate.

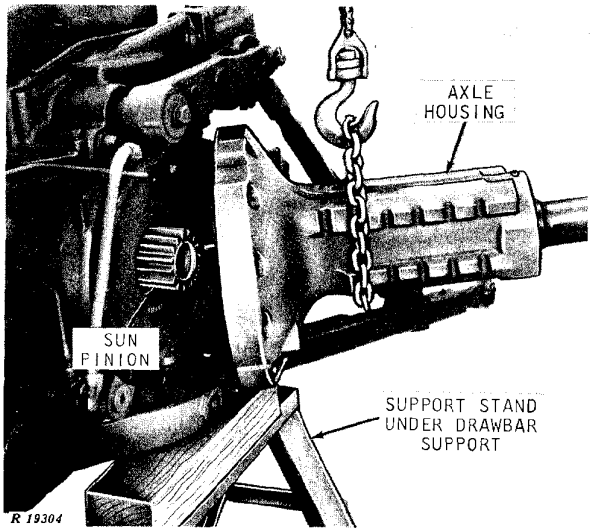


Fig. 22—Removing Rear Axle Housing

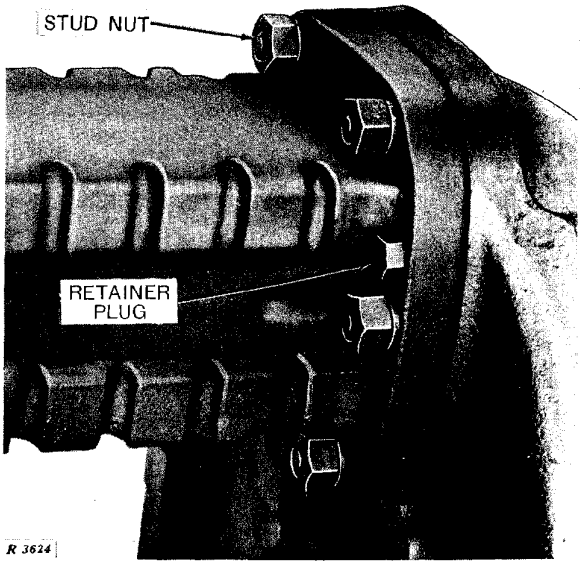


Fig. 23—Stud Nuts and Retainer Plug

On Hi-Crop tractors it is necessary to remove the drawbar, 3-point hitch, draft link, and lift link. Remove the retainer plugs from the jack screw holes, and use jack screws to force the final drive gear housing away from the drive shaft housing (Fig. 23).

Use the procedure given on the previous page for removal of drive shaft housing.

INSTALLATION

Reverse the removal procedures to install axle housing assemblies.

IMPORTANT: To prevent serious damage, be sure that the sun pinion does not work outward far enough to allow the brake disk to drop inside the sun pinion teeth when installing the final drive housing.

Tighten axle housing-to-transmission case cap screws to 170 ft-lbs torque. Tighten drive shaft housing-to-final drive gear housing stud nuts to 275 ft-lbs torque on Hi-Crop tractors.

Fill transmission with proper grade and viscosity oil as instructed on page 20-1.

Check tractor for proper operation.

Group 30
SPECIFICATIONS AND SPECIAL TOOLS

SPECIFICATIONS

Item	Specification
Air conditioning compressor drive belt	¼ in. deflection—15 lb. pull
Alternator drive belts	1 in. deflection—25 lb. pull
Sound-Gard Body and Control Island rubber mounts	Metal retainer caps require effort to be rotated by hand
Sound-Gard Body and Control Island rubber mounts (early models)	Metal retainer caps require effort to be rotated by hand

Item	Torque (ft-lbs)
Sound-Gard Body and Control Island rubber mounts (late models)	9-11
Hydraulic pump drive coupling	30
Hydraulic pump support to cylinder block	85
Side frames-to-engine	275
Clutch housing-to-engine	½ in.—85 ¾ in.—300
Clutch housing-to-transmission case screws and nuts	⅝ in.—170 ¾ in.—300
Axle housing or drive shaft housing-to-transmission case	170
Drive shaft housing-to-final gear housing stud nuts (Hi-Crop)	275
Fender bracket to rear axle housing U-bolt nuts	125
Nylon hydraulic bleed line	Finger tight, then 1/6-1/3 turn more

SPECIAL TOOLS

No.	Name	Use
JDE-63*	Engine Lift Brackets	Engine removal
JDG-1*	Engine Sling	Removing engine, Sound-Gard Body, or 4-post Roll-Gard
JDG-2C*	Support Stands	Tractor separation
JDG-10-1	Sound-Gard body lifting adapter	Removing Sound-Gard bodies using tractor 3-point hitch
JDG-10-2	Sound-Gard body support stand	Storage stand for Sound-Gard bodies
JDG-11*	Wrench Adapter	Measuring rotational torque on Sound-Gard body retainer caps
JDST-29	Weatherstrip Installing Tool	Installing window and windshield moulding strips on Sound-Gard bodies

**Order from: Service Tools, Inc., 1901 Indiana Avenue, Chicago, Illinois 60616.*

Litho in U.S.A.

Litho in U.S.A.

Section 20
ENGINE

CONTENTS OF THIS SECTION

Litho in U.S.A.

Group 5
GENERAL INFORMATION AND DIAGNOSIS

GENERAL INFORMATION

This is a turbo-charged, liquid cooled, 6-cylinder, diesel fueled valve-in-head, vertical in-line four-cycle engine.

For basic theory of engine operation see FOS Manual 30 — ENGINES.

DIAGNOSING ENGINE MALFUNCTIONS

Will Not Start

Fuel System Malfunction—See Section 30
- Foreign matter in fuel
- Improper fuel
- Faulty fuel pump
- Fuel shut off at tank
- Restricted air intake system
- Faulty injection nozzles
- Plugged fuel filter

Electrical System Malfunction—See Section 40
- Corroded or loose battery
- Weak battery

Uneven Running or Frequent Stalling

Basic Engine Problem—See This Section
- Improper valve clearance
- Cylinder head gasket leaking
- Valves sticking or burned
- Worn or broken compression rings
- Low compression
- Incorrect timing
- Coolant temperature below normal
- Engine overheating

Service Problem—See Section 10
- Low fuel supply

Fuel System Malfunction—See Section 30
- Restricted fuel lines or filters
- Faulty fuel pump
- Faulty injection pump
- Faulty injection nozzles
- Exhaust system restricted

Engine Misses

Basic Engine Problem—See This Section
- Weak valve springs
- Incorrect valve clearance
- Burned, warped, pitted or sticking valves
- Low compression
- Worn camshaft lobes (could be caused by faulty damper)
- Incorrect timing
- Engine overheating

Fuel System Malfunction—See Section 30
- Air in fuel
- Faulty injection nozzles
- Faulty injection pump
- Detonation
- Water in fuel
- Mixture of gasoline and diesel fuels

Lack of Power

Basic Engine Problem—See This Section
- Blown cylinder head gasket
- Worn camshaft lobes
- Incorrect valve clearance
- Incorrect valve timing
- Burned, warped, pitted or sticking valves
- Weak valve springs
- Low compression
- Incorrect timing
- Wrong viscosity crankcase oil
- Engine overheating

Service Problem—See Section 10
Dirty or obstructed air cleaners
- Improper fuel
- Wrong oil viscosity

Fuel System Malfunction—See Section 30
- Plugged fuel filters
- Faulty injection pump
- Faulty injection nozzles
- Faulty fuel pump
- Restricted exhaust system
- Low intake manifold pressure
- Incorrect throttle linkage
- Plugged fuel tank vent

Power Train Malfunction—See Section 50
- Clutch slipping

Engine Overheats

Basic Engine Problem—See This Section
- Defective head gasket
- Incorrect engine timing
- Crankcase oil level low
- Low coolant level
- Radiator or side grille screen dirty
- Loose or broken fan belt
- Faulty thermostats
- Cooling system limed up
- Defective radiator pressure cap
- Faulty water pump

Service Problem—See Section 10
- Engine overloaded
- Crankcase oil level low
- Improper fuel

Fuel System Malfunction—See Section 30
- Excessive fuel delivery
- Improper injection pump timing

Excessive Oil Consumption

Basic Engine Problem—See This Section
- Restricted oil passage from valve cover
- Worn valve guides or valve stems
- Oil control rings worn or broken
- Scored liners or pistons
- Excessive ring groove wear in piston
- Rings sticking in grooves of piston
- Oil return holes in piston clogged
- Insufficient piston ring tension
- Piston ring gaps not staggered
- Excessive main or connecting rod bearing clearance
- Worn crankshaft thrust bearing (misaligned piston and rod)
- Front or rear crankshaft oil seal faulty
- Crankcase oil too thin
- Oil pressure too high
- Oil level too high
- Plugged oil cooler: oil or water passages

Service Problem—See Section 10
- Crankcase oil too thin
- Oil level too high

Fuel System Malfunction—See Section 30
- Restricted air intake system

Low Oil Pressure

Basic Engine Problem—See This Section
- Excessive main and connecting rod bearing clearance
- Low oil level
- Leakage at internal oil passages
- Faulty oil pump
- Improper regulating valve adjustment
- Improper oil
- Defective engine oil cooler

Service Problem—See Section 10
Low oil level
- Improper oil

Electrical System Malfunction—See Section 40
- Defective oil pressure indicator lamp
- Faulty oil pressure sending unit

High Oil Pressure

Basic Engine Problem—See This Section
- Stuck or improperly adjusted regulating valve

Excessive Fuel Consumption

Basic Engine Problem—See This Section
- Low compression
- Incorrect engine timing

Service Problem—See Section 10
- Engine overloaded

Fuel System Malfunction—See Section 30
- Leaks in fuel system
- Restricted air cleaners
- Faulty injection pump
- Faulty injection nozzles

Black or Gray Exhaust Smoke

Basic Engine Problem—See This Section
- Incorrect engine timing

Service Problem—See Section 10
- Improper grade of fuel
- Engine overloaded

Fuel System Malfunction—See Section 30
- Excessive fuel delivery
- Faulty injection nozzles
- Restricted air cleaners
- Defective muffler
- Defective turbocharger

White Exhaust Smoke

Basic Engine Problem—See This Section
Low Compression

Fuel System Malfunction—See Section 30
Faulty Injection nozzles
Improper fuel

Slow Acceleration

Fuel System Malfunction—See Section 30
Faulty injection pump
Faulty injection nozzles

Detonation

Basic Engine Problem—See This Section
Carbon buildup in compression chambers

Fuel System Malfunction—See Section 30
Oil picked up by intake air stream
Faulty injection nozzles

Abnormal Engine Noise

Basic Engine Problem—See This Section
Excessive valve clearance
Worn cam followers
Bent push rods
Worn rocker arm shafts
Worn main or connecting rod bearings
Foreign material in combustion chamber
Worn piston pin bushings and pins
Scored piston
Incorrect engine timing
Excessive crankshaft end play
Loose main bearing caps
Worn timing gears
Worn oil pump gears
Broken pump shaft
Low engine oil level
Camshaft oil pump drive gear worn or broken

Group 10
CYLINDER HEAD, VALVES, AND CAMSHAFT

GENERAL INFORMATION

The cylinder head holds the rocker arm assembly, valve springs, and valves.

Cylinder head valve seats have replaceable inserts. Valve guides are integral with the cylinder head. Exhaust valve guides are threaded.

Both intake and exhaust valves are equipped with valve rotators and valve stem wear caps. Intake and exhaust valves are nearly identical except that the exhaust valve is longer and the intake valve face is recessed in the center.

The camshaft is cast with an integral oil pump drive gear. All camshaft lobes are tapered and contact mushroom type cam followers

DIAGNOSING MALFUNCTIONS

The following is a list of possible valve train malfunctions and causes:

Sticking Valves

Carbon deposits on valve stem
Worn valve guides
Warped valve stems
Cocked or broken valve springs
Worn or distorted valve seats
Insufficient lubrication

Warped, Worn, or Distorted Valve Guides

Lack of lubrication
Cylinder head distortion
Excessive heat
Unevenly tightened cylinder head cap screws

Distorted Cylinder Head and Cylinder Head Gasket Leakage

Improperly tightened cylinder head cap screws
Faulty gasket installation
Excessive oil pressure
Improper cylinder liner height above cylinder block

Worn or Broken Valve Seats

Misaligned valves
Distorted cylinder head
Carbon deposits on seats due to incomplete combustion
Valve spring tension too weak
Excessive heat
Improper valve clearance
Improper valve timing

Camshaft Failures

Scored camshaft lobes due to inadequate lubrication
Excessive end play due to thrust plate wear
Broken or warped camshaft due to improper timing

Burned, Pitted, Worn, or Broken Valves

Worn or distorted valve seats
Worn valve guides
Insufficient cooling
Insufficient lubrication
Cocked or broken valve springs
Detonation
Improper engine operation
Improper valve train timing
Faulty valve rotators
Warped or distorted valve stems
"Stretched" valves due to excessive spring tension
Distorted cylinder head
Bent push rods
Carbon buildup on valve seats
Rocker arm failure

PRELIMINARY VALVE CHECKS

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

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

Checking Valve Clearance

Check valve clearance. Intake valve clearance should be 0.018 inch. Exhaust valve clearance should be 0.028 inch.

Checking Valve Lift

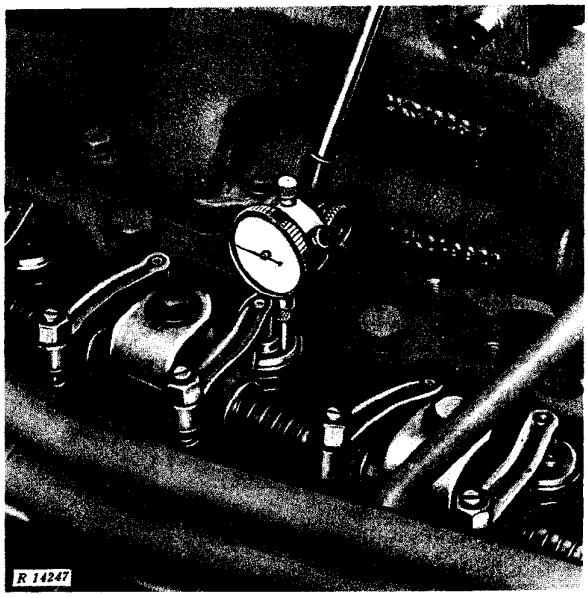


Fig. 1—Checking Valve Lift

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 rotator. Manually turn engine in running direction with JDE-81 engine rotation tool. When rocker arm contacts valve stem, check dial indicator travel as rocker arm moves valve to full open. Indicator should read 0.4310 to 0.4610 inch on intake valves and 0.4270 to 0.4570 inch on exhaust valves.

CYLINDER HEAD AND VALVES

Removal

Remove battery ground straps.

The engine need not be removed to service the cylinder head. It will be necessary to remove parts that will interfere or be damaged if the cylinder head is removed.

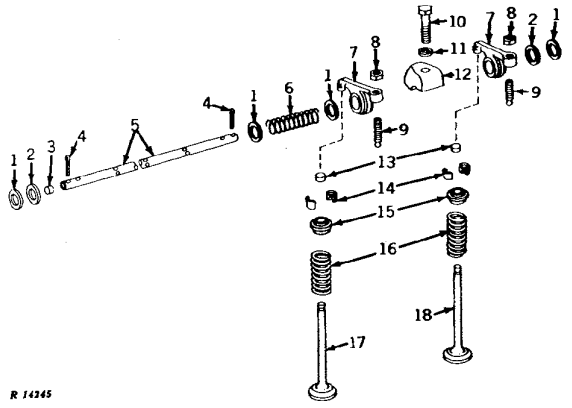
Drain cooling system and relieve hydraulic pressure. Remove and identify parts for later reassembly.

NOTE: Do not rotate crankshaft with cylinder head removed unless all cylinder liners are secured with cap screws and washers.

Repair

Remove cotter pin, spring washers, washer, and plugs from rocker arm shaft. Slide parts from shaft and identify for reassembly.

Remove valve spring retainer locks, valve springs, rotators and valves. Identify each valve for reassembly into the guide from which it was removed.



1—Washer
2—Spring Washer
3—Plug
4—Cotter Pin
5—Rocker Arm Shaft
6—Spring
7—Rocker Arm
8—Nut
9—Adjusting Screw
10—Cap Screw
11—Washer
12—Clamp
13—Valve Wear Cap
14—Retainer Locks
15—Valve Rotators
16—Valve Springs
17—Intake Valve
18—Exhaust Valve

Fig. 2—Valve Train

Valve Springs

Inspect valve springs (16, Fig. 2) for alignment, wear and damage. Place springs on a flat surface to see that they are square and parallel. Do not use springs that are cocked, crooked, broken, or rusty.

Check valve spring tension on a spring tester. Free length of each spring may differ, but compressed length for each spring must be the same. Free length of spring is 2.12 inch. The following are the specified compressed lengths of the springs:

Compressed at	
54 to 62 lbs.—valve closed	1.81 in.
133 to 153 lbs.—valve open	1.36 in.

Valve Rotators

Inspect valve rotators. If rotators will not turn freely in one direction, replace with new.

Valve Face and Stem

Valve stem wear caps should be replaced if pitted or worn.

Litho in U.S.A.

Check valve face and stem for wear or damage. See "Diagnosing Malfunctions" page 20-10-1 for causes of valve failures.

The O.D. of a new valve stem is 0.3715 to 0.3725 inch. Compare with valve guide I.D. to determine guide-to-stem clearance.

Valve face angle on a new valve is 30°. The face O.D. of both valves is 1.7450 to 1.7550 inches.

FOS For information on valve refacing, see FOS Manual 30—ENGINES.

Valve Guides

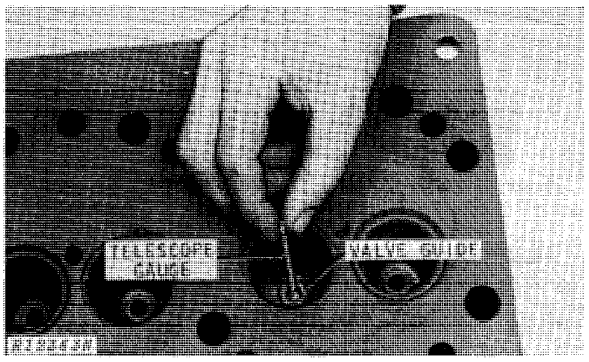


Fig. 3—Checking Valve Guides

Measure valve guides (Fig. 3) for wear or damage. The I.D. of the guide in a new head is 0.3745 to 0.3755 inch. Clearance between new guide and new valve stem is 0.0020 to 0.0040 inch. Worn guides can allow a clearance of 0.0060 inch and still be acceptable.

Worn guides can be knurled if they do not allow more than 0.0060 to 0.0080 inch clearance. Use No. 1002 knurling tool from United Tool Processes Co. EXACTLY as directed by the manufacturer.

Valve Seats

Check valve seats for cracks, pits, carbon deposits and excessive wear. Measure width and concentrictiy with valve guide. The width of the seat is 0.0830 to 0.0930 inch. Runout between guide and seat should be no more than 0.0020 inch.

Repair seats as directed in FOS Manual 30—ENGINES and by directions given by the seat refacing tool manufacturer.

In a new cylinder head, the valve face is 0.0240 to 0.0380 inches above the head surface (protruded). The valve face can be 0.0060 inches below head surface (recessed) and still be acceptable.

If necessary, replace valve seat inserts using JDE-41295 puller.

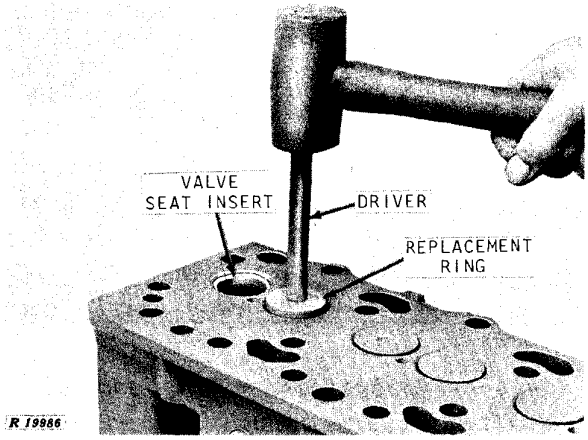


Fig. 4—Installing Valve Seat Inserts

Chill both new insert and JDE-79 valve seat insert driver before installation. Use JDE-7 driver to drive insert and replacement ring into place (Fig. 4).

Rocker Arm Assembly

Examine rocker arms and rocker arm shaft for unusual signs of wear. Wear could indicate weak valve springs, bent push rods, or loose rocker arm shaft clamps. If rocker arms ends show only normal wear, resurface them.

If the rocker arm has been damaged by a valve failure, replace it and the push rod, when replacing valves.

Clean holes in rocker arms, rocker arm shaft, and rocker arm mounting brackets to insure proper lubrication of the rocker arm assembly.

Assembly

Assemble parts on rocker arm shaft in the sequence removed. Position plugs correctly in each end of the rocker arm shaft.

Apply AR44402 Lubricant to valve stems and guides and install valves in guides from which they were removed. Valves must move freely and seat properly. Be certain that exhaust and intake valves are in the correct guides.

Install valve springs, making certain that cylinder head end of spring is located correctly in the machined counterbore of the head.

Install rotators and retainer locks on valves. "Pop" each valve three or four times with a soft mallet to insure proper positioning of the retainer locks.

Installation

Install cylinder head gasket dry. Dip cap screws in engine oil before installation. Install cylinder head, using hardened flat washers under all cap screws. Tighten cap screws evenly to 115 ft-lbs torque following sequence shown in Fig. 5.

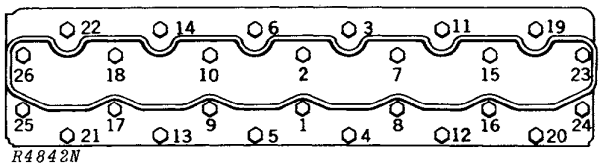


Fig. 5—Cylinder Head Cap Screw Tightening Sequence

NOTE: After engine assembly has been completed, run engine at 2100 rpm for one-half hour and retighten cap screws in same sequence to 125 to 135 ft-lbs torque.

Install push rods in holes from which they were removed.

Install valve stem wear caps on diesel valves, making certain caps rotate freely.

Install rocker arm assembly. Make sure that spring pin in head aligns with pin hole in rocker arm shaft. This will align lubricating holes in shaft and head. Tighten rocker arm shaft clamps to 50 to 60 ft-lbs torque.

Valve Clearance Adjustment

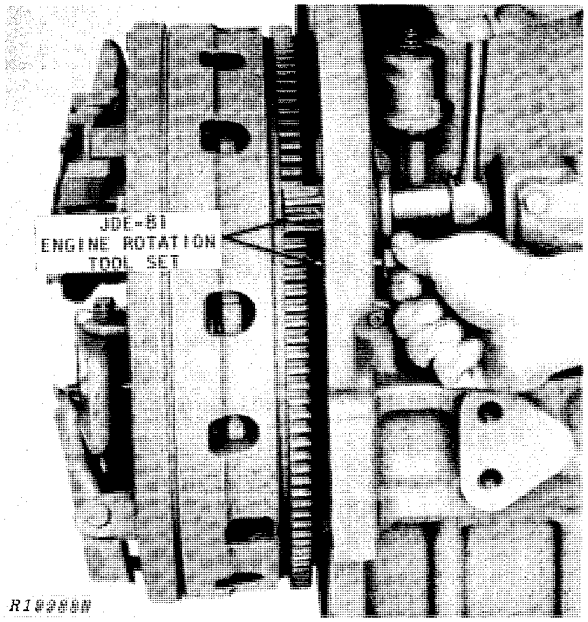


Fig. 6—Setting "TDC"

Use JDE-81 engine rotation tool to position No. 1 piston at "TDC" of its compression stroke (Fig. 6). Turn flywheel until rotation tool timing pin engages timing hole in flywheel.

Valve clearance is 0.018 inch on intake valves and 0.028 inch on exhaust valves. Adjust valve clearance on No. 1, 3, and 5 exhaust valves and 1, 2, and 4 intake valves (Fig. 7).

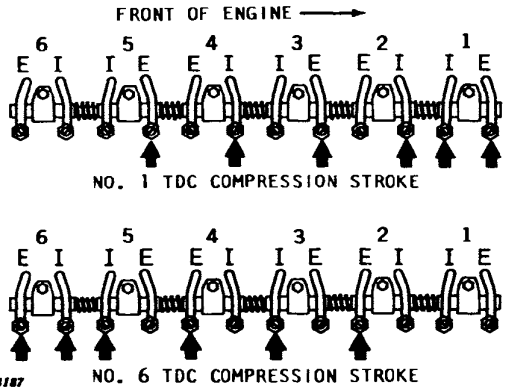


Fig. 7—Valve Clearance Adjustment

Rotate flywheel 360 degrees until No 6. piston is at "TDC" of its compression stroke and Tool timing pin engages flywheel timing hole.

Adjust valve clearance to the above listed specifications on No. 2, 4 and 6 exhaust and 3, 5, and 6 intake valves.

Remove engine rotation tool.

NOTE: Run engine for specified time and load. Retorque head and readjust valves.

CAMSHAFT

Removal

To service camshaft, engine normally need not be removed from the tractor.

Disconnect battery ground straps.

Remove parts necessary to separate engine from tractor front end.

NOTE: See Section 10, Group 25, for separation instructions. Use caution if fuel tank is full. Support front end as necessary.

Remove all parts as necessary to remove camshaft. Cylinder head need not be removed unless desired. Remove crankshaft damper pulley with puller. Identify parts for reassembly.

NOTE: Set No. 1 piston at "TDC" on compression stroke to align timing marks on crankshaft and camshaft gears. This will aid timing on reassembly.

Remove push rods. Use ND425 magnetic holding tool set to hold cam followers away from camshaft.

Before removing camshaft, check camshaft end play. End play on a new engine should be 0.0025 to 0.0085 inch. However, end play of 0.0150 inch on an engine that has been in operation is acceptable. Excessive end play would indicate a worn thrust washer.

Remove oil pan and oil pump.

Remove four cap screws from thrust plate and remove camshaft from cylinder block.

Do not allow cam lobes to drag in bores when removing camshaft.

Repair

Bushings

Check camshaft bushing journals and bushings for wear or damage. Journal O.D. is 2.3745 to 2.3755 inches on a new camshaft. New bushing I.D. is 2.3775 to 2.3795 inches. However, a total 0.0060 inch clearance between the two is acceptable.

To remove and install camshaft bushings, (Fig. 8) use JDE-6 camshaft bushing replacement set. The first three bushings can be reached from the front of the engine. To reach the fourth bushing, separate the engine from the clutch housing. See Section 10, Group 25 for separation instructions. When bushings are installed, make sure that bushing oil holes align with oil holes in block. The elongated bushing hole is to the top.

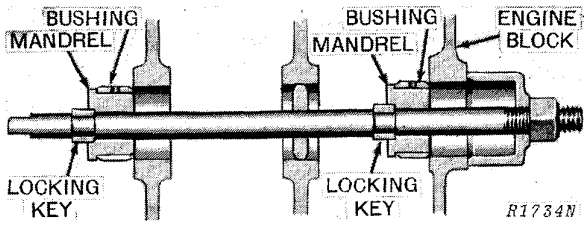


Fig. 8—Details of Installation

Gears and Lobes

Check camshaft lobes and oil pump drive gear for wear or damage. Replace camshaft if necessary. If camshaft is replaced due to a damaged oil pump drive gear, check gear and shaft on oil pump for damage and replace as necessary.

If camshaft is replaced, cam followers must also be replaced.

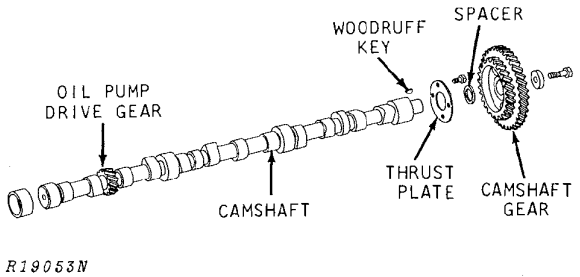


Fig. 9—Camshaft and Gears

Examine camshaft gear (Fig. 9) and injection pump gear for worn, or broken teeth and damage. If either gear must be replaced, both gears must be replaced with a matched set.

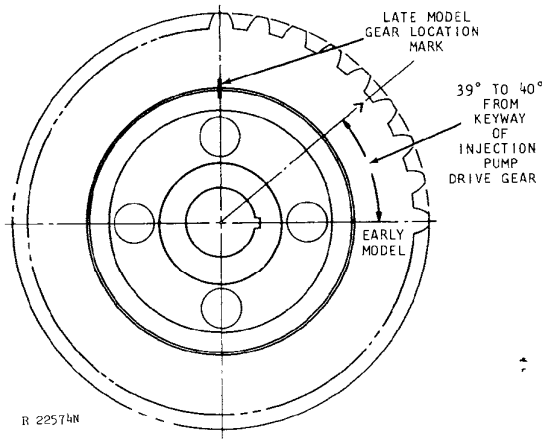


Fig. 10—Position of Two Camshaft Gear Parts

Check camshaft gear for slippage between the two partsof the gear.

On early models, slippage is checked by measuring the angle between the keyway in the inner part and the timing mark on the outer part (Fig. 10). The angle should be 39° to 40°. If angle is more or less, gear should be replaced.

On late models, a location mark has been placed across the parting line of the two parts of the gear (Fig. 10). If mark has separated, the gear should be replaced.

If necessary, replace camshaft gear by removing cap screw and special washer and pressing shaft from gear.

NOTE: Do not separate the injection pump drive portion of the camshaft gear from the outer portion.

Thrust Plate

Check thrust plate for proper thickness. New part dimension is 0.1860 to 0.1890 inch. Thrust plate wear to 0.1820 inch is acceptable. If thrust plate wear or camshaft end play are excessive, check camshaft lobes, journals and bushings for wear or damage.

Camshaft Assembly

To reinstall gear, install thrust plate and spacer. Support camshaft under first journal, install Woodruff key, and place gear on camshaft with timing mark facing away from camshaft. Press gear on until tight against camshaft shoulder.

Installation

If the cam followers have been removed, reinstall, using the magnetic holding tools to hold them away from the camshaft bore until camshaft is installed.

Coat camshaft with high temperature grease such as Texaco "Molytex Grease O" or its equivalent and install camshaft in block.

See Section 30 for information regarding injection pump and injection pump drive gear installation.

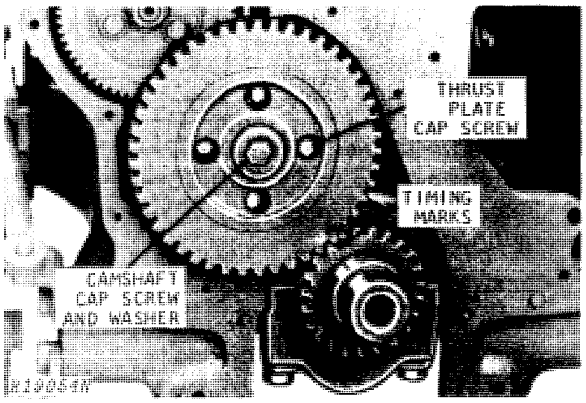


Fig. 11—Camshaft Adjustment

With No. 1 piston on "TDC" of compression stroke, align timing marks on camshaft and crankshaft (Fig. 11).

Use the following torque specifications for reassembly. Torque specifications for engine parts not covered in this group may be found in Group 35.

Location	Torque (ft-lbs)
Oil pan — ½" cap screws	85
— ⅜" cap screws	35
Cylinder head cover to cylinder	20-25
Intake manifold to cylinder head	35

Turn camshaft gear to align thrust plate holes with cylinder block holes. Secure thrust plate, washer, and cap screw in camshaft.

Tighten thrust plate cap screws to 20 ft-lbs torque. Install special washer on camshaft and tighten cap screw to 85 ft-lbs torque.

Check camshaft for 0.0025 to 0.0085 inch end play.

Install cylinder head, push rods, and timing gear cover. Tighten cylinder head as described on page 20-10-4.

Check injection pump timing and valve clearance. See Section 30 for injection pump information.

Install remaining tractor parts.

Glue rocker arm cover gasket on rocker arm cover and install.

Group 15
CYLINDER BLOCK, LINERS, PISTONS AND RODS

GENERAL INFORMATION

The cylinder block is a one-piece casting equipped with seven main bearings.

The cylinder liners are wet-sleeve replaceable type. Each liner has a square rubber packing that seals at a shoulder on the liner. Two O-ring packings fit in grooves in the liner bore. The square and O-ring packings aid in sealing the liner at the bottom of the liner bore. The top of the liner is sealed by cylinder head gasket compression.

The pistons are forged aluminum alloy, cam ground, and weight controlled. Each has two compression rings of keystone design, and one oil control ring.

The piston pins fit into bronze bushings in the connecting rod. The connecting rod has replacable bearing inserts.

DIAGNOSING MALFUNCTIONS

Scuffed or Scored Pistons

Insufficient lubrication
Insufficient cooling
Improper piston-liner clearance
Insufficient ring gap
Pre-detonation
Coolant leakage in crankcase
Misaligned or bent connecting rod
Improperly installed piston
Low oil level
Improper operation
Incorrect connecting rod bearing clearance
Carbon buildup in ring groove
Improper break-in
Worn piston
Contaminated oil
Distorted cylinder liner

Worn or Broken Compression Rings and Grooves

Pre-detonation
Insufficient lubrication
Insufficient cooling
Improper ring installation
Improper combustion
Improper timing
Abrasives in combustion chamber
Failure to remove cylinder liner wear ridge (top ring)

Clogged Oil Control Ring

Improper oil
Excessive blow-by
Improper periodic service
Low operating temperature

Stuck Rings

Pre-detonation
Improper oil
Improper periodic service
Poor operating conditions
Coolant leakage in crankcase
Excessive cylinder liner taper

Cylinder Liner Wear and Distortion

Incorrectly installed compression rings
Insufficient lubrication
Uneven cooling around liner
Improper piston-liner clearance
Liner bore damage

Warped Cylinder Block

Insufficient cooling

Broken Connecting Rod

Inadequate piston-liner clearance
Distorted cylinder liner
Piston pin failure

Piston Pin and Snap Ring Failure

Misaligned connecting rod
Excessive crankshaft end play
Incorrect snap rings

Mottled, Grayish or Pitted Compression Rings

Internal coolant leaks

Dull Satin Finish and Fine Vertical Scratches on Rings

Dirt and abrasive in air intake system

Thank you very much for your reading.

Please Click Here Then Get More Information.