4620 Tractor

JOHN DEERE

TECHNICAL MANUAL
4620 Tractor

TM1030 (01Apr76) English

TM1030 (01Apr76)

LITHO IN U.S.A.
ENGLISH

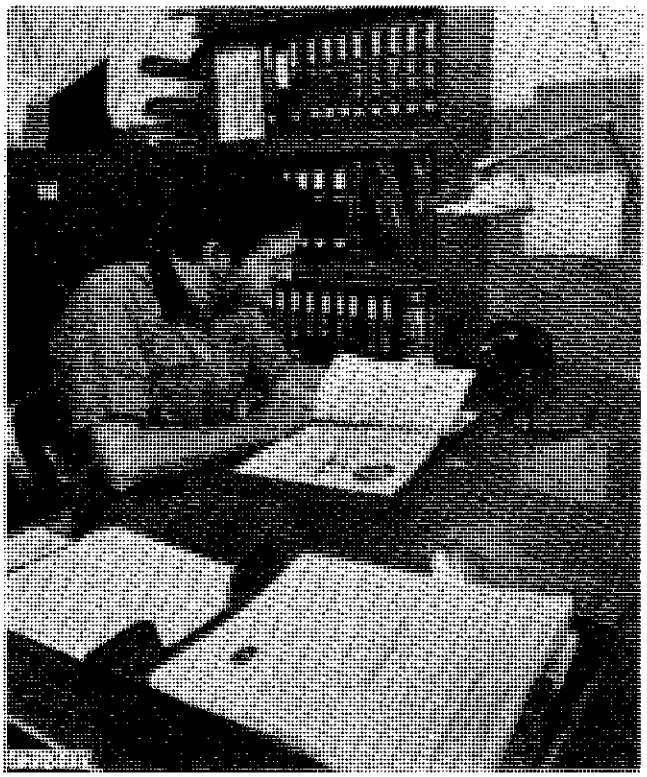
4620 TRACTOR

TECHNICAL MANUAL
TM-1030 (APR-76)

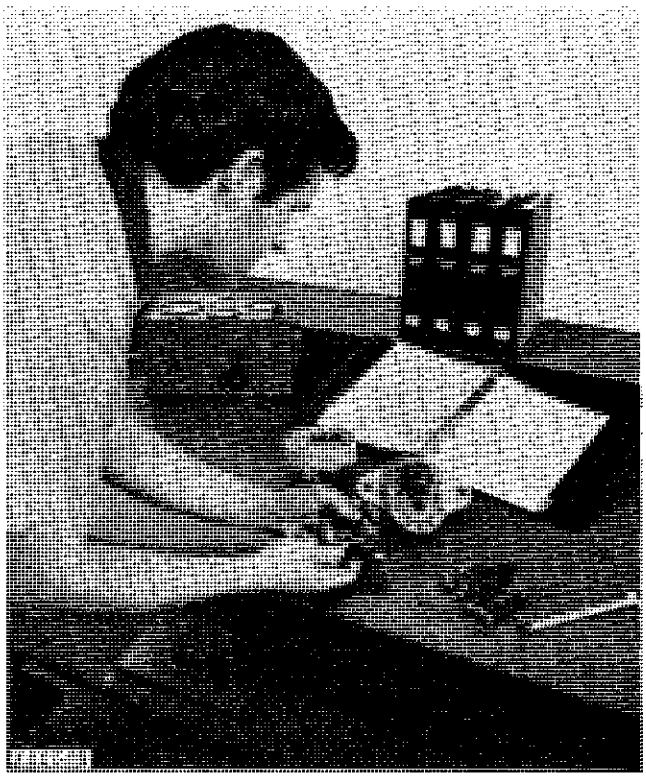
CONTENTS

Litho in U.S.A.

INTRODUCTION



Use FOS Manuals for Reference



Use Technical Manuals for Actual Service

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

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

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

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

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

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

Some features of this technical manual:

- *Table of contents 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—an experienced technician. Keep it in a permanent binder in the shop where it is handy. Refer to it whenever in doubt about correct service procedures or specifications.

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

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

Litho in U.S.A.

Section 10
GENERAL

CONTENTS OF THIS SECTION

Group 5
GENERAL TRACTOR SPECIFICATIONS

HORSEPOWER:*
- Syncro-Range 135
- Power Shift 135

ENGINE:
- Type . . . . . 6-cylinder, in-line, valve-in-head, diesel, turbocharged
- Bore and stroke . . . . . 4-1/4 in. x 4-3/4 in.
- Displacement . . . . . 404 cu. in.
- Compression ratio . . . . . 16.8 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 . . . . . 2500 rpm
  - Engine speeds:
    - Slow idle . . . . . 800 rpm
    - 1900 rpm load . . . . . 2150 rpm idle
    - 2200 rpm load . . . . . 2400 rpm idle
    - 2500 rpm load . . . . . 2650 rpm idle

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

* *Factory observed hp. measured at the PTO at 2200 engine rpm*

FUEL SYSTEM:
- Type . . . . . Direct injection
- Filter . . . . . Two-stage with replaceable impregnated paper element.
- Injection pump type . . . . . Inlet metering, distributing type
- Air cleaner . . . . . Dry type, with safety element

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

CAPACITIES:
- Fuel tank . . . . . 50 U.S. gals.
- Cooling system . . . . . 28 U.S. qts.
- Crankcase (with filter change) . . . . . 17 U.S. qts.
- Transmission-hydraulic system (add 4-1/2 gals. to capacity if equipped with Power Front -Wheel Drive):
  - Syncro-Range Transmission . . . . . 18 U.S. gals.
  - Power Shift Transmission . . . . . 16 U.S. gals.

SYNCRO-RANGE TRANSMISSION:
- Type . . . . . Syncro-Range, constant mesh
- Clutch . . . . . 14-3/4 in. plate, foot operated foot operated
- Gear selections . . . . . 8 forward and 2 reverse
- Shifting . . . . . 4 stations, synchronized shifting within forward gears

Litho in U.S.A.

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 rear power take-off controlled by hand-operated clutch lever
- Clutch:
  - Syncro-Range ..... One dry-disk, hydraulically actuated
  - Power Shift ..... Multiple disk, wet clutch hydraulically actuated
- Speed (1900 engine rpm) ..... 1000 rpm
- PTO ahead of drawbar hitch point ..... 16 in.

HYDRAULIC SYSTEM:
- Type ..... Closed center, constant pressure. Includes power steering, power brakes, implement control, and transmission and differential lubrication.
- Standby pressure ..... 2250 psi

BRAKES ..... Hydraulically power actuated, disk-type operating in oil Provision for manual operation with brake accumulator to supply oil.

STEERING ..... Full power, hydrostatic type. Provision for manual operation.

ELECTRICAL SYSTEM:
- Type ..... 12-volt, negative grounded
- Batteries ..... Two, 6-volt, 75-plate 172-ampere-hour, 3 EH type, connected in series
- Alternator ..... 12-volt, 55-amp, with integral transistorized regulator. Air conditioned tractors have 12-volt, 72-amp capacity.

FRONT TIRES* 10.00-16, 6-ply
14.9-24, 6-ply

REAR TIRES* 20.8-38, 10-ply

* *Additional tire sizes available.*

FRONT WHEEL TREAD:
- 10.00-16 tire ..... 57-1/2 to 83-1/4 in.
- 14.9-24 tire ..... 72 to 88 in.

REAR WHEEL TREAD:
- 20.8-38 tire, regular axle ..... 63 to 107-1/2 in.

GROUND SPEEDS IN MILES PER HOUR (2200 engine rpm and with 20.8-38 rear tires):

Gear	Syncro-Range	Power Shift
1st	2.0	1.7
2nd	3.1	2.5
3rd	4.1	3.8
4th	5.3	5.0
5th	6.6	6.5
6th	8.7	8.5
7th	11.2	10.9
8th	18.3	18.5
1st reverse	4.0	2.1
2nd reverse	6.4	3.0
3rd reverse	..	4.7
4th reverse	..	6.3

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
- Planetary disconnect ..... Hydraulic wet brake on ring gear releases when drive is disengaged

DIMENSIONS:
- Wheelbase (Subtract 1 inch for tractors equipped with Power Front-Wheel Drive) ..... 106-1/4 in.
- Over-all length ..... 170-3/4 in.
- Over-all height ..... 106 in.
- Height to steering wheel ..... 87 in.
- Over-all width ..... 95-7/8 in.
- Turning radius
  - Without Power Front-Wheel Drive (minimum tread and brakes applied) ..... 151 in.
  - Power Front-Wheel Drive (with drive engaged in "High Torque", brakes applied and minimum wheel tread) ..... 137 in.

SHIPPING WEIGHT (With equipment for average field service, less fuel and ballast) 13,030 lbs.

Subtract 50 lbs. if equipped with Syncro-Range transmission. Add 575 lbs. if equipped with Roll Gard. Add 1,000 lbs. for Power Front Wheel Drive.

(Specifications and design subject to change without notice.)

Litho in U.S.A.

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 safisfaction, 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
Stamp date code on battery	.....	FOS-20 Manual
Connect alternator. Do not attempt to polarize	.....	Section 40, Group 10
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

Litho in U.S.A.

Before Delivering Tractor—Continued

Service	Specification	Reference
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	Frong hub bolts - 100 ft-lbs Rear hub bolts - 300 ft-lbs Rim clamp nuts - 170 ft-lbs	
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	SAE multipurpose-type grease.	Operator's manual
Engine		
Check air cleaner		Operator's manual
Fill fuel tank and start engine	Capacity - 50 U.S. gallons	Operator's manual
Check operation of starter, alternator, gauges, and indicator lights		Operator's manual
Check engine timing	TDC	Section 30, Group 10
Check engine speeds	800 rpm, slow idle speed 2650 rpm idle speed, 2500 max. transport speed	Section 30, Group 10
Operation		
Check transmission clutch free travel (Syncro-Range transmission)	Approximately 1-1/2-inch free travel (at least 3/4 in.).	Operator's manual
Check engine disconnect clutch (Power Shift transmission)	No tendency for tractor to creep with disconnect clutch disengaged.	Section 50, Group 15
Shift transmission through all speeds		Operator's manual

Litho in U.S.A.

Before Delivering Tractor—Continued

Service	Specification	Reference
Check throttle linkage for free operation		Section 30, Group 10
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 cab controls and seat operation		Operator's manual
General		
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 that 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.

Litho in U.S.A.

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.

Inspection Procedure

Service	Specification	Reference
Cooling System		
Check radiator coolant level	2 inches above baffle	
Clean external surface of radiator core		
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 connections 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. Tractors with air conditioning, adjust belt 1-inch deflection, 20-pound force.	Operator's manual

Inspection Procedures—Continued

Service	Specification	Reference
Start engine and check operation of starter, lights, indicator lamps, and cab 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		
Check transmission clutch free travel (Syncro-Range transmission)	Approximately 1-1/2 inch free travel.	Operator's manual
Check engine disconnect clutch (Power Shift transmission)	No tendency for tractor to creep with disconnect clutch disengaged.	Section 50, Group 15
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 35 & 40
Check differential lock operation		Operator's manual

Inspection Procedures—Contined

Service	Specification	Reference
Hydraulic System		
Check rockshaft and remote cylinder operation		Section 70, Group 30
3-point hitch negative stop adjustment	1/8th turn back out after contacting transmission case.	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.

Litho in U.S.A.

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)	Compare with previous recorded output; compare with output after tune-up.	FOS - 30 Manual, Chapter 12
Compression Test	450 psi at 130 rpm	FOS - 30 Manual, Chapter 12
Vapor Flow Test (average engine condition and without turbo-charger blowby)	Normal blowby - 120-150 cu. ft./hr. Excessive blowby - 200 cu. ft./hr.	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)	11 in. of water at 2200 rpm	. . . . .
Maximum permitted reading	25 in. of water at 2200 rpm	. . . . .
Check restriction indicator light operation	24-26 in. of water	. . . . .
Check manifold pressure	14.2-17.3 psi	
Exhaust System		
Check system for leaks	. . . . .	FOS - 30 Manual, Chapter 12
Check muffler and exhaust pipe for restrictions	. . . . .	FOS - 30 Manual, Chapter 12

Litho in U.S.A.

Engine Tune-Up—Continued

Operation	Specification	Section-Group Reference
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	. . . . .	30-10
Check fuel pump pressure	3-1/2 - 4-1/2 psi	30-10
Change filter	. . . . .	30-10
Service injection nozzles	. . . . .	30-10
Injection Pump:		
Service and check timing	TDC 6° advance at 1900 rpm (no load)	30-10 30-10
Adjust throttle linkage	2650 rpm idle speed, 2500 max. transport speed 2150 rpm idle speed, 1900 load speed 2400 rpm idle speed, 2200 load speed 800 rpm, slow idle speed	30-10
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, 20 lbs at 1 in. deflection on air conditioned tractors.	40-10
Check alternator output	45 amps at 13 to 15 volts (1440 engine rpm) 65 amps at 13 to 15 volts (1440 engine rpm) on tractors with air conditioning	40-10
Check alternator regulated voltage	14.2 - 14.6 volts (operating)	40-10

Litho in U.S.A.

Engine Tune-Up—Continued

Operation	Specification	Section-Group Reference
Starting System		
Check start-safety switch operation		40-15
Check battery voltage when starting	Min. 9 volts (cranking)	40-15
Check starter current draw	Diesel - approx. 400 amps	40-15
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
Adjust Syncro-Range transmission clutch free travel	1-1/2 in.	50-5
Check Power Shift transmission disconnect lever operation	6 in. travel	50-10
Transmission		
Check shifting		50-15
Check for proper operation without excessive noise		50-15 & 20
Power Shift transmission pump pressure	165 - 185 psi	50-20
Power Shift engaged element pressure	Max. of 15 psi less than pump	....
Check differential lock operation	420 - 480 psi	50-25
Check brake pedal travel and even position	3 in. max. for one emergency application immediately after stopping engine	70-25
Check front wheel bearing adjustment and lubrication	35 ft-lbs; back-off to nearest hole	....
Check front wheel tow-in	1/8 - 3/8 in.	....
Check tire inflation		Operator's manual

Tractor Tune-Up—Continued

Operation	Specification	Section-Group Reference
Check Power Front-Wheel Drive operation		50-45
Transmission pump	9 gpm at 1900 rpm - Syncro-Range 12 gpm at 1900 rpm - Power Shift	70-5
Main hydraulic pump	Standby - 2200 - 2300 psi (2300 psi for Power Front-Wheel Drive) Capacity - 22 gpm (2000 psi and 1900 rpm)	70-5
Pressure control valve	1650 - 1700 psi at 800 rpm (approximately 5 gpm flow)	70-5
Rockshaft:		
Lift cycle time (75 degrees rotation)	2.5 - 2.7 seconds at 1900 rpm	70-30
Maximum oil flow	10.5 to 11.5 gpm at 2000 psi and 1900 rpm	70-30
Lever position (depth control)	Complete raise at 1/32-inch from end of slot	70-30
Lever position (load control)	0 of quadrant to raise (rear lever edge)	
Negative stop adjustment	1/8th turn back out after contacting transmission case	70-30
Selective control valve	2 to 12-1/2 gpm at 1500 psi and 1900 rpm	70-5
Power Front-Wheel Drive pressure control	1900 - 2000 psi at 1200 rpm, 4th gear, high torque, and 2 gpm flow through jumper hose at breakaway coupler	50-45

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.).

Litho in U.S.A.

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 showing capacities and type of lubricant for the various components has been included. Additional lubrication information in on page 20-2.

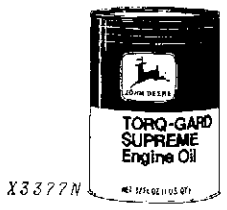
Component	Capacity	Type of Lubricant	Interval of Service
Engine Crankcase	17 U.S. quarts (includes filter)	See "Engine Lubricating Oils" on page 20-2	10 Hours - Check level 100 Hours - Change oil 200 Hours - Replace filter
Transmission and Hydraulic System	* 18 U.S. gallons (Syncro-Range) * 16 U.S. gallons (Power Shift)	John Deere Hy-Gard Transmission and Hydraulic Oil	200 Hours - Check level 600 Hours - Replace filter 1200 Hours - Change oil
Front Wheel Bearings	. . . . .	Wheel Bearing Grease	1200 Hours - Repack bearing
Grease Fittings	. . . . .	SAE Multipurpose Grease	See Operator's Manual

* *Add 4-1/2 gals. to capacity if equipped with Power Front-Wheel Drive.*

Litho in U.S.A.

LUBRICANTS

ENGINE LUBRICATING OILS



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

If Torq-Gard Supreme is not used, use an engine oil that conforms to one of 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 atmospheric temperature at start for the fill period, use oil of viscosity as shown in the following chart.

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

Air Temperature	John Deere Torq-Gard Supreme Oil	Other Oils	
		Single Viscosity Oil	Multi-Viscosity Oil
Above 32°F (0°C)	SAE 30	SAE 30	Not recommended
-10 to 32°F** (-23 to 0°C)	SAE 10W-20	SAE 10W	SAE 10W-30
Below -10°F (-23°C)	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.*

TRANMISSION HYDRAULIC OILS

Use only John Deere Hy-GARD Transmission and Hydraulic 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, available from your John Deere dealer, may be used in all weather conditions.

NOTE: John Deere Hy-GARD Transmission and Hydraulic Oil may be added to or mixed with John Deere Type 303 Special-Purpose Oil.

GREASES

Use John Deere Multi-Purpose Lubricant or an equivalent SAE multipurpose-type grease for all grease fittings. Application of grease as instructed in the lubrication section will provide proper lubrication and will keep contamination out of bearings.

STORING LUBRICANTS

Your 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 ROLL-GARD CAB

When the tractor is equipped with a Roll-Gard cab, it may be necessary to remove the cab in order to service tractor. Individual service requirements will dictate whether the serviceman will remove cab panels or the complete cab. For example, to remove the rockshaft housing, it is necessary only to remove the covers over the housing. However, service of the differential or final drives will require complete cab removal.

Use the following procedure to remove the cab.

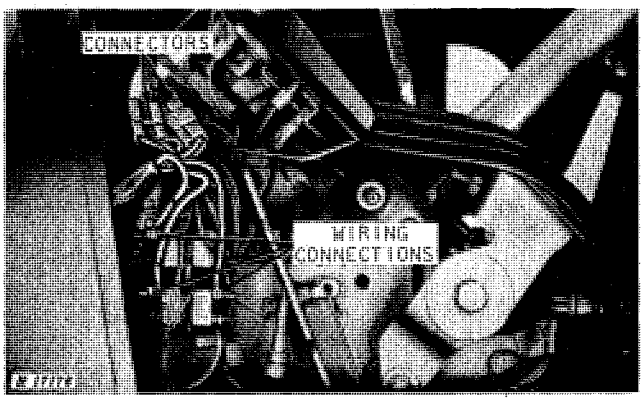


Fig. 1-Cab Wiring Connections

Disconnect battery ground cable and remove cowl. Disconnect cab wiring at connectors and circuit breakers under the instrument panel (Fig. 1). Disconnect wire from headlight dimmer switch.

Remove cab floor mat, platform, floor panels, side shields, and front panels (Fig. 3).

Remove perforated foam insulation from cab panels over rockshaft housing inside cab. Remove panels.

On tractors with air conditioning, loosen the compressor drive belt, and remove the compressor (Fig. 2) with regrigerant hoses connected to the compressor. Bend hoses so that the compressor can be placed inside the cab or fastened to the cab. Do not disconnect the refrigerant hoses unless absolutely necessary.

CAUTION: Whenever the refrigerant hoses are to be disconnected, first discharge the compressor or the complete system as explained in SM-2089, Tractor Air Conditioning and Heating Systems under DISCHARGING THE SYSTEM. Follow all safety precautions listed in the manual to avoid personal injury.

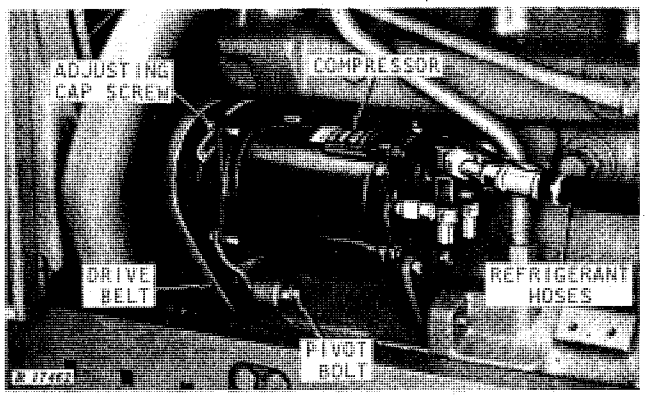


Fig. 2-Compressor Mounting

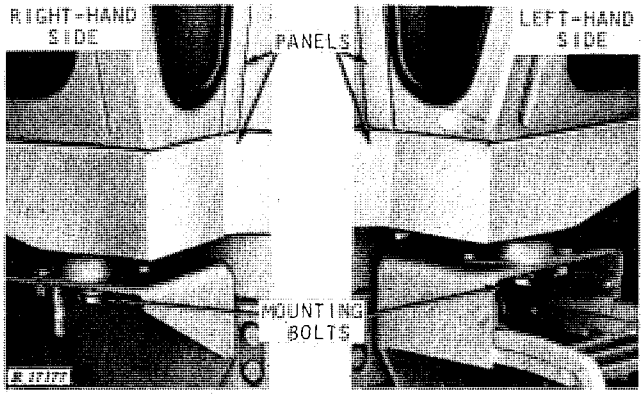


Fig. 3-Front Mounting Bolts and Panels

On tractors with a heater, drain a sufficient amount of coolant from the cooling system, and disconnect the heater hoses from the engine.

Fasten a chain to the lifting straps on roof of cab, and attach to a suitable overhead hoist.

Remove the cab front (Fig. 3) and rear mounting bolts. Lift cab from tractor.

INSTALLING ROLL-GARD CAB

Reverse the removal steps. The centerline of cab should line up with centerline of tractor. The foam rubber seal on center cowl panel of cab should be equally compressed around the contour of hood. Shift cab as required to align correctly. Tighten the rear mounting bolts to specification. Adjust the compressor drive belt (on air conditioned cabs) to specification.

After the cab panels and extensions are in place, seal all holes and openings with tape; foam material, or sealant before installing floor pads and mats. All openings must be carefully sealed for the pressurizer to be effective in keeping out dust and dirt.

Install floor pads and mats.

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. The Power Front-Wheel Drive accumulator should discharge by itself within a few minutes after the engine is stopped.

Drain engine cooling system and remove muffler, cowl, side shields, grille screens, hood, and control support covers. Remove left and right-hand steps.

Disconnect battery ground cable from left-hand battery.

1. Disconnect hydraulic pump oil seal drain tube (Fig. 4).
2. Disconnect tachometer cable.
3. Disconnect wire from oil pressure switch.
4. Disconnect speed control rod from injection pump.
5. Disconnect alternator harness from main harness and detach alternator harness from control support.
6. Disconnect hydraulic pressure pipe.
7. Loosen hose clamps on oil cooler return pipe.

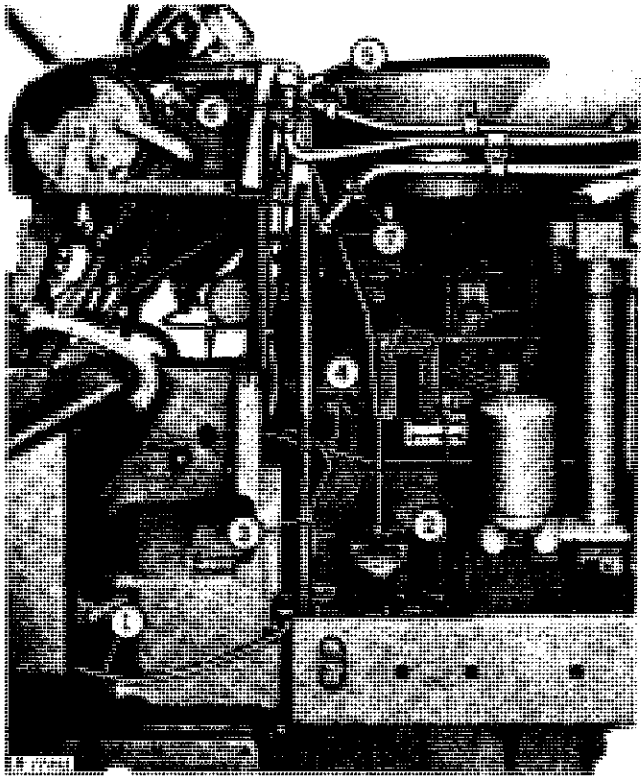


Fig. 4-Right-Hand Side Separation Procedures

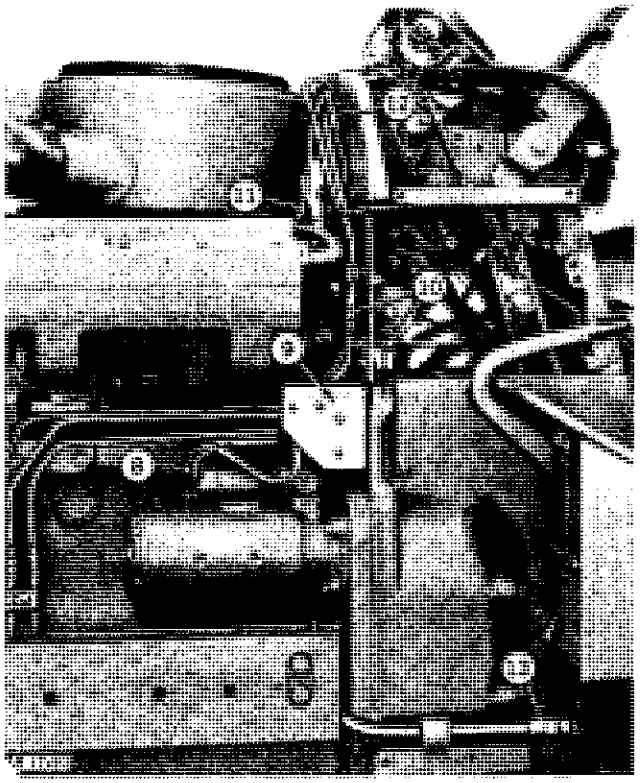


Fig. 5-Left-Hand Side Separation Procedures

8. Disconnect battery cable from starter (Fig. 5).

9. Remove starter circuit relay from clutch housing and disconnect wire to battery from relay.

10. Disconnect steering pipes.

11. Remove engine temperature bulb from engine.

12. Disconnect ether starting aid pipe.

13. Disconnect hydraulic pump inlet pipe.

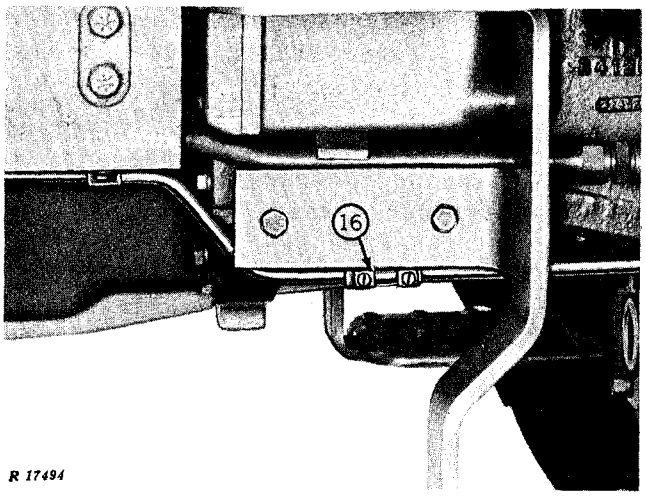


Fig. 6-Power Front-Wheel Drive Drain Pipe

14. Disconnect Power Front-Wheel Drive drain pipe (Fig. 6).

Use JDG-2M rear stand at the drawbar front support. Install front support stand JDG-2C.

Remove cap screws securing engine to clutch housing and roll rear half of tractor away.

ASSEMBLY

Apply a light coating of Permatex to the engine and clutch housing mating surfaces.

Move both halves of tractor together. Never use excessive force.

Tighten clutch housing-to-engine cap screws to specified torque and remove support stands.

Reverse the numbered separation procedures.

Fill the engine cooling system. Connect battery ground (tap cable on battery post first). Check engine crankcase and transmission oil levels.

Disconnect injection pump electrical shut-off solenoid wire. Crank the engine with starter until the engine oil pressure indicator light goes out. Do not overheat the starter. After the indicator light goes out, reconnect injection pump shut-off solenoid wire and start the engine.

Bleed steering system (Section 70, Group 20).

After checking for leaks, install tractor sheet metal and muffler.

SEPARATING CLUTCH HOUSING FROM POWERSHIFT TRANSMISSION CASE

Separate the engine from the clutch housing as previously instructed.

Open right-hand brake bleed screw and discharge the brake accumulator. See page 25-2.

Drain the transmission.

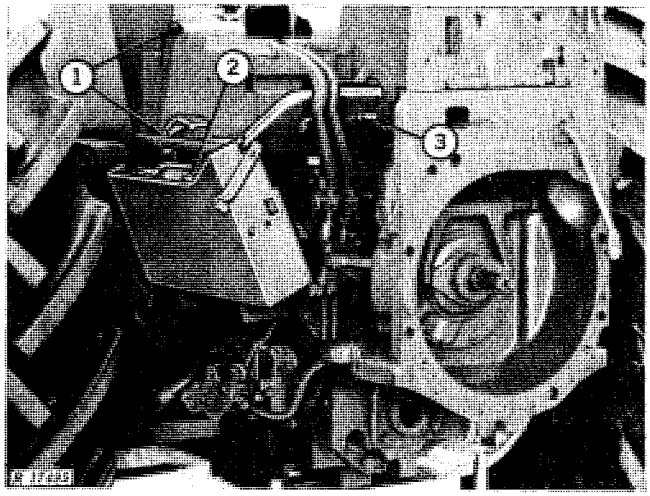


Fig. 7-Rear Portion of Tractor

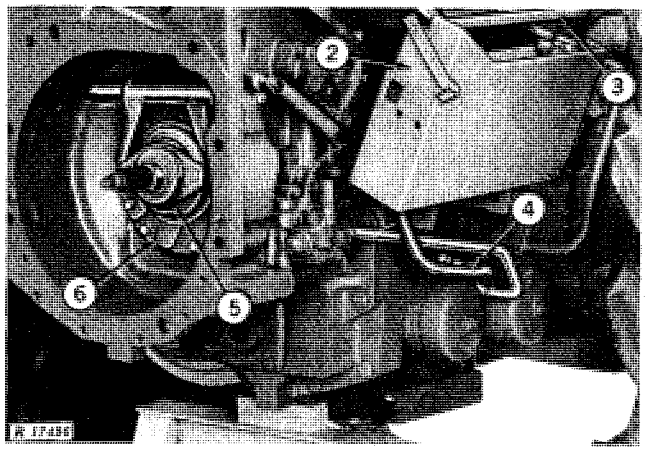


Fig. 8-Left-Hand Side of Clutch Housing

1. Remove differential lock pedal pivot pin (Fig. 7). Do not remove differential lock return valve. Remove rockshaft selector lever knob.

2. Remove batteries (Figs. 7 and 8), and disconnect wiring from dimmer switch.

3. Remove front platform support screws and platform.

4. Remove transmission filter inlet pipe and hydraulic filter-to-clutch pressure regulator housing pipe.

Litho in U.S.A.

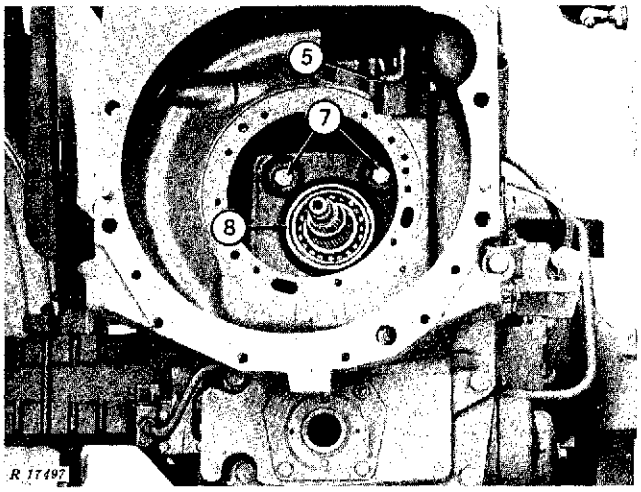


Fig. 9-PTO, Low, and High Range Drive Shafts

5. Disconnect the clutch rod (Figs. 8 and 9). Remove clutch fork shaft retainer, shaft, fork, and bearing carrier.

6. Remove transmission pump and clutch pack assembly.

7. Remove the two hidden clutch housing-to-transmission case cap screws.

8. Refer to illustrations in Section 50 and remove the retaining ring and the PTO, low, and high range drive shafts. If shafts are difficult to remove, use a slide hammer puller. Disassemble the low and high range drive shafts to inspect for damage to washer and bushing in high or C2 clutch shaft. If too difficult, this assembly may be removed after separating the clutch housing. However, do not damage shafts when removing clutch housing.

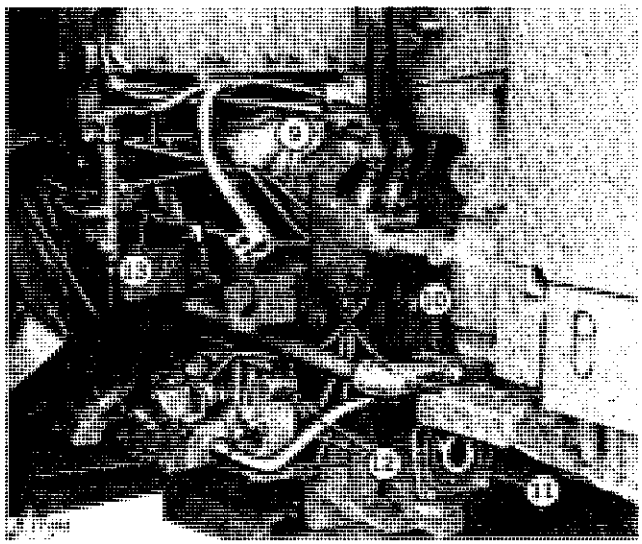


Fig. 10-Right-Hand Side of Transmission Case

9. Disconnect the right-hand and left-hand brake pipes (Fig. 10).

10. Remove the transmission pump oil intake elbow.

11. Remove PTO shaft quill.

12. Remove transmission control valve pressure inlet pipe. Loosen transmission control valve to disconnect the shifter rods. If transmission control valve housing gasket is in poor condition, remove the valve housing.

13. Disconnect the park lock cable.

14. Disconnect the hydraulic pressure pipe to the rockshaft or transmission cover.

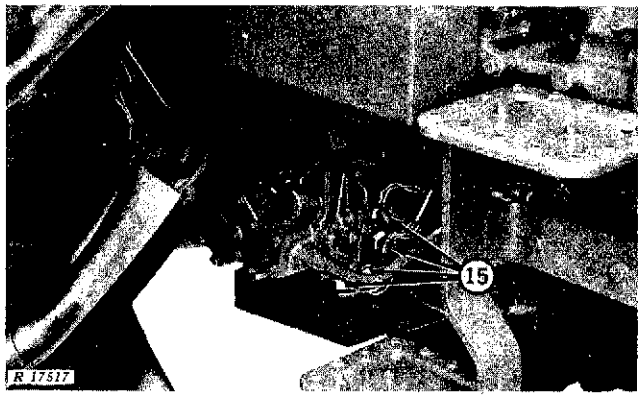


Fig. 11-Power Front-Wheel Drive Switches (Power Shift Tractor)

15. On tractors with Power Front-Wheel Drive, disconnect wiring harness from switches (Fig. 11).

Move drawbar to extreme rearward position. Place support at rear of drawbar and install JDG-2M rear stand at front of transmission case.

Install a suitable lift sling and remove clutch housing assembly.

ASSEMBLY

Before assembling, check to see that the PTO thrust washer, PTO brake return spring (Fig. 12), and the PTO brake (Fig.13) are in position. Remove cap plugs from oil passages and install gasket and O-rings.

Assemble clutch housing to transmission case and tighten all cap screws to specified torque.

Reverse the numbered separation procedures.

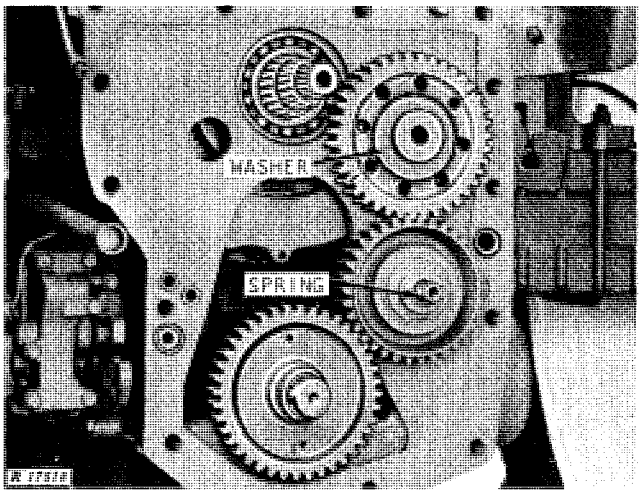


Fig. 12-PTO Thrust Washer and Brake Spring

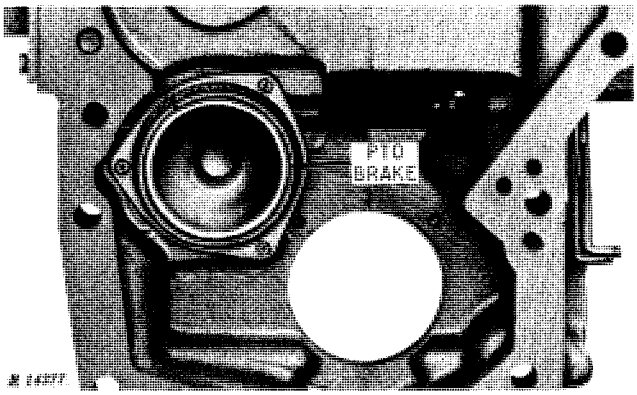


Fig. 13-PTO Brake

Install rockshaft selector knob and differential lock pedal.

Join the clutch housing to the engine as previously instructed.

Fill transmission with John Deere Type 303 Special-Purpose Oil to the correct oil level.

Bleed the brakes. See the operator's manual.

Check the brakes, transmission, differential lock, and lights for proper operation.

SEPARATING CLUTCH HOUSING FROM SYNCRO-RANGE TRANSMISSION CASE

Loosen right-hand brake bleed screw and discharge the accumulator. See page 10-25-2.

Drain the transmission.

Disconnect battery ground cable from left-hand battery first. Then disconnect and remove the batteries. Disconnect wiring from dimmer switch.

Disconnect the clutch return spring. Remove differential lock pedal pivot pin, rockshaft selector knob, platform support, and platform.

On tractors with Power Front-Wheel Drive, remove the rear drain pipe (Fig. 14).

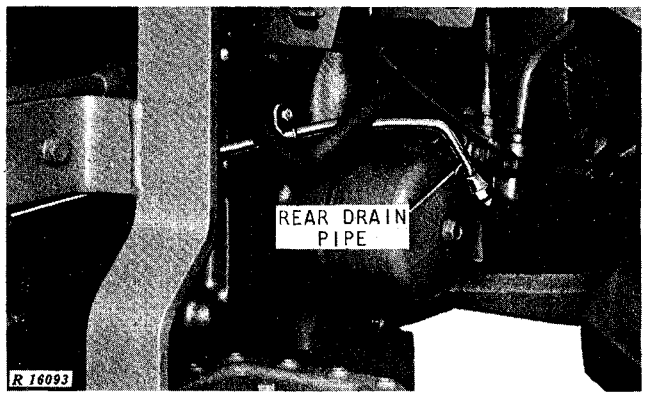


Fig. 14-Power Front-Wheel Drive Drain Pipe

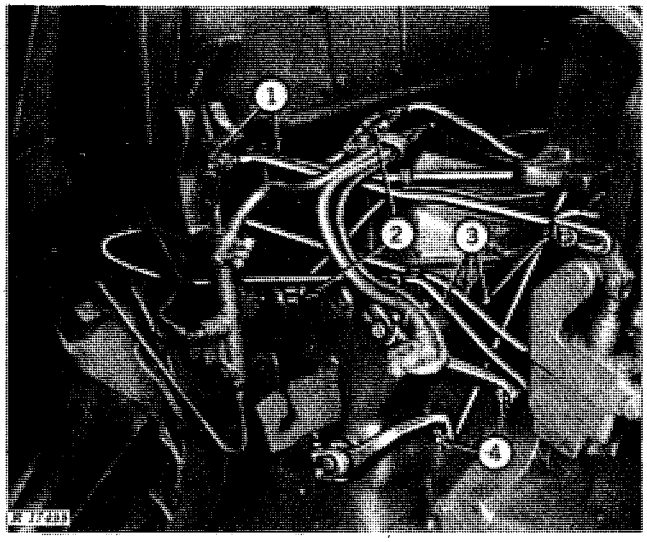


Fig. 15-Right-Hand Side of Transmission Case

1. Disconnect pressure pipe from rockshaft housing (Fig. 15), and differential lock link.
2. Disconnect wiring harness from start-safety switch and lighting harness.
3. Disconnect right-hand brake pipe, left-hand brake pipe, and brake return pipe.
4. Place shift lever in tow. Pull levers outward and disconnect shifter rods.
5. Remove PTO shaft quill (Fig. 16). Catch the trapped oil.
6. Disconnect transmission oil temperature bulb, main hydraulic pump inlet pipe, and steering return pipe.

Remove transmission cover.

Install JDG-2C front support stand. On tractors without a Quik-Coupler, place JDG-2M rear stand under drawbar front support. On tractors with a Quik-Coupler, extend drawbar rearward and place jack under rear of drawbar.

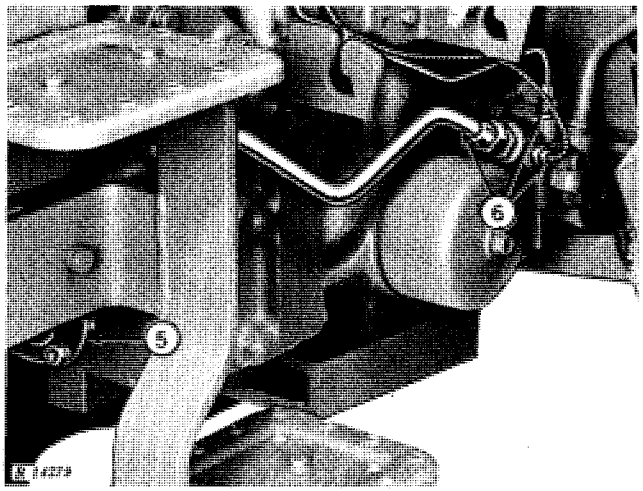


Fig. 16-Left-Hand Side of Transmission Case

Separate transmission case from clutch housing and roll transmission away. Place supports under front and back of transmission.

ASSEMBLY

Before joining tractor be sure cap screw in upper right-hand corner of transmission case is in place (Fig. 17). Also be sure gasket (Fig. 17), and PTO thrust washer (Fig. 18) are in position.

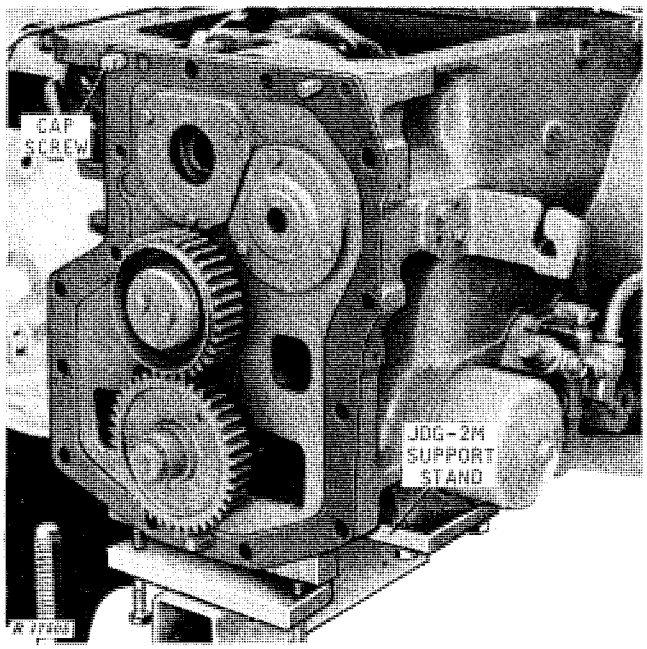


Fig. 17-Cap Screw

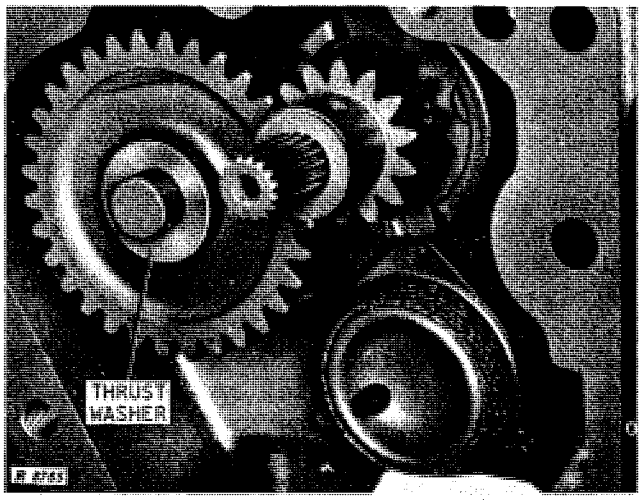


Fig. 18-Thrust Washer in Position

Mesh the PTO and transmission drive when joining the tractor sections. Tighten all cap screws to specified torque and remove support stands.

Install oil temperature sensing bulb. Connect main hydraulic pump inlet pipe and steering return pipe.

Connect shifter rods. Tap arms inward to obtain specified end play.

Pour oil in transmission and install transmission cover.

Connect right-hand brake pipe, left-hand brake pipe, and brake return pipe.

Connect hydraulic oil pressure pipe to rockshaft housing.

Connect wiring harness and dimmer switch wire.

Install platform, platform supports, rockshaft selector knob, and differential lock pedal. Connect clutch pedal return spring.

Connect Power Front-Wheel Drive rear drain pipe (Fig. 14).

Install and connect batteries. Make ground connection last (tap cable on battery post first).

Bleed brakes (Section 70, Group 25) and recheck transmission oil level.

REMOVING ENGINE

Separate engine from clutch housing as previously instructed.

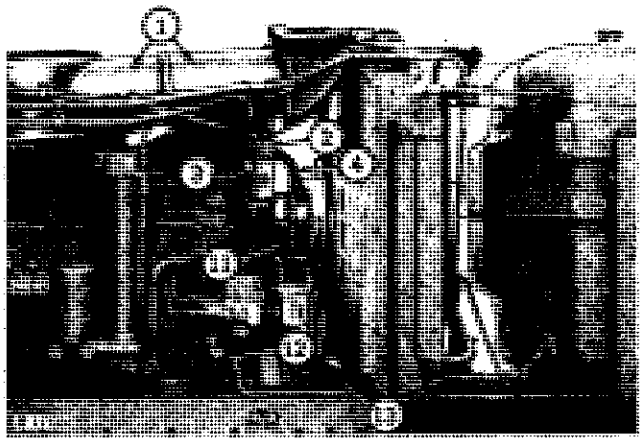


Fig. 19-Right-Hand Side of Engine

1. Remove pre-cleaner, and air cleaner body (Figs. 19 and 20).
2. Remove vertical support bracket (Fig. 19).
3. Remove fuel leak-off pipe.
4. Remove bypass pipe, and upper water hose.
5. Disconnect wiring harness from the starter, injection pump, oil pressure switch, and alternator.
6. Disconnect and remove steering pipes.
7. Remove lower water hose.
8. Disconnect turbocharger oil inlet and outlet pipe and hose.

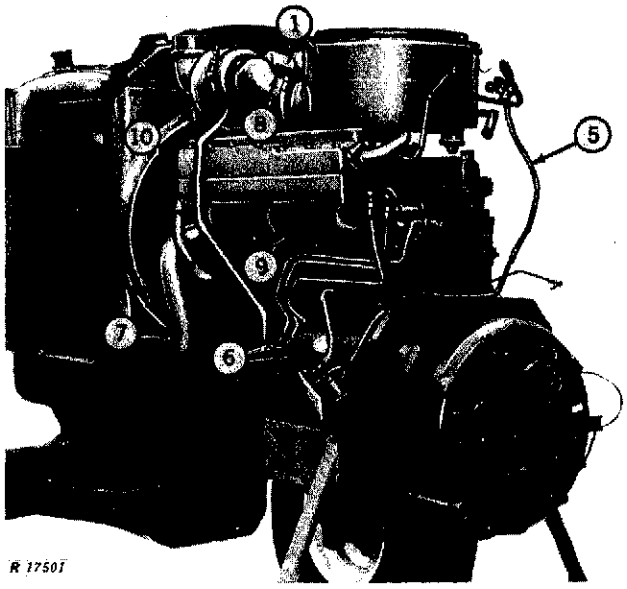


Fig. 20-Left-Hand Side of Engine

9. Remove intake manifold.
10. Remove exhaust manifold and turbocharger.
11. Remove alternator (Fig. 19).
12. Shut off fuel valve, and disconnect fuel pipe at the fuel pump.
13. Remove hydraulic pump drive coupler.

Disconnect hydraulic pump support from the engine.

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

Install JDE-63 engine lift brackets and JDG-1 engine lifting sling. Place wedges between front axle and side fromes to prevent tipping. Lower JDG-2C front support stand legs. Install JDG-7 front hoist bracket. Place a horse or stand and blocking under the front hoist bracket. Raise front support stand legs to transfer most of the weight from the tires to the bracket and stand.

Remove side frame-to-engine block cap screws and slide engine from front end.

INSTALLATION

Slide the engine into place and reverse the removal procedures to install the engine. Tighten the engine mounting cap screws, hydraulic pump support cap screws, and hydraulic coupler cap screws to specified torque.

Join the clutch housing to the engine as previously instructed.

If equipped with a Power Front-Wheel Drive, install the front drain pipe and the control valve assembly.

Be sure the air cleaner element support is installed in the air cleaner housing before inserting elements.

SEPARATING ENGINE FROM TRACTOR FRONT END

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

Disconnect battery ground cable from left-hand battery.

1. Remove muffler. Remove water pump bypass pipe (Fig. 22) and intercooler outlet pipe to permit installation of JDE-63 engine lifting brackets.

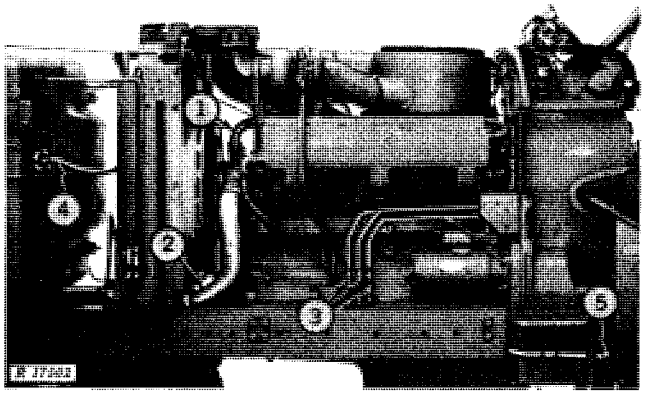


Fig. 21-Left-Hand Side of Tractor

2. Disconnect lower water hose (Fig. 21).
3. Disconnect steering pipes.
4. Disconnect wire from fuel gauge sender and remove from clips to fuel tank.
5. Disconnect the hydraulic pump inlet pipe.
6. Disconnect hydraulic pump oil seal drain tube (Fig. 22).
7. Loosen clamps on hydraulic oil return pipe hose.
8. Disconnect hydraulic oil pressure pipe.
9. Separate wiring harness from hydraulic pipes and air cleaner body.
10. Remove air cleaner.
11. Remove pre-cleaner and pre-cleaner support.
12. Disconnect fuel leak-off line.

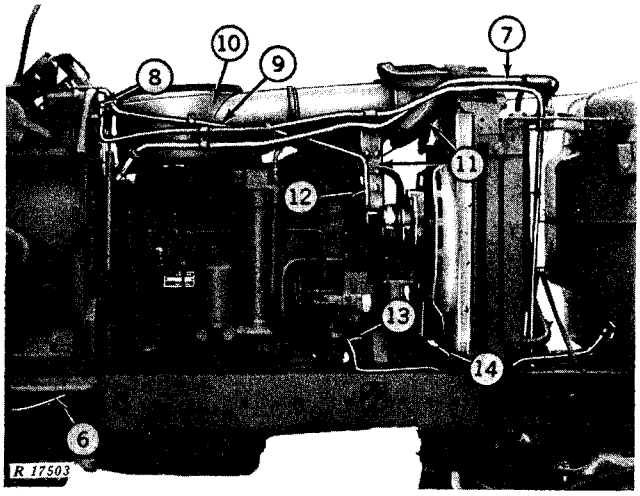


Fig. 22-Right-Hand Side of Tractor

13. Shut off fuel valve, and disconnect fuel pipe at the fuel pump.
14. Remove hydraulic pump drive coupler.

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

Detach hydraulic pump support from engine. Install JDE-63 engine lift brackets, JDG-1 engine lifting sling, JDG-2C front tractor stand, and JDG-7 front lifting bracket.

Place wedges between front axle and side frames to prevent tipping. Lift tractor front with movable hoist to remove most of weight from front tires. Place a horse or stand and blocking under JDG-7 lifting bracket to support the front end. Adjust legs of JDG-2C stand to touch the floor.

Remove the side frame-to-engine cap screws. With the engine and tractor supported by the engine lift sling, roll tractor away from front end and frames.

ASSEMBLY

Move tractor sections together. Never use excessive force. Tighten side frame-to-engine, hydraulic pump support, and hydraulic pump coupler cap screws to specified torque.

On Power Front-Wheel Drive models, install front drain pipe.

Lift tractor and remove horses or stands and blocking. Remove lift brackets, front support stand, and front lifting bracket.

Reverse the numbered separation procedures.

Fill the engine cooling system. Connect the battery ground (tap cable on battery post first.)

Check engine crankcase and transmission oil levels.

Bleed steering system (Section 70, Group 20).

After checking for leaks, install muffler and tractor sheet metal.

REMOVING FINAL DRIVE ASSEMBLY

Drain the transmission.

Disconnect fender wiring harness and remove fender.

Raise tractor and use a suitable means to support rear of tractor. Remove rear wheel.

Remove protector and place wiring harness away from rear axle.

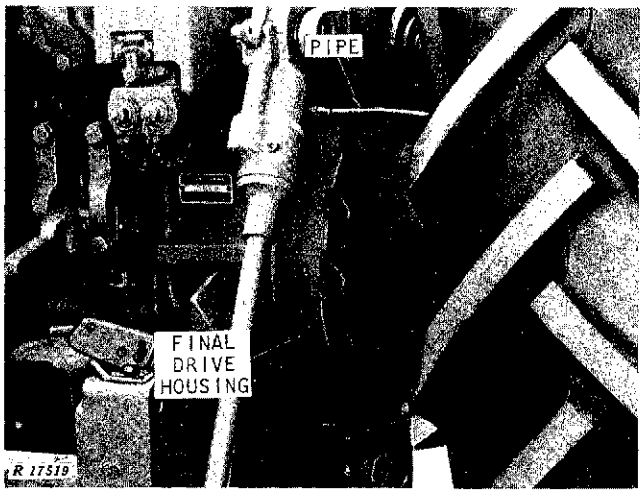


Fig. 23-Pressure Oil Pipe to Differential

If removing right-hand housing on a tractor with a differential lock, remove the pressure oil pipe to differential (Fig. 23).

Use a chain to support final drive housing. Hold brake backing plate to transmission case when removing the housing.

To prevent damage from falling parts, remove sun pinion, brake backing plate, and brake disk.

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

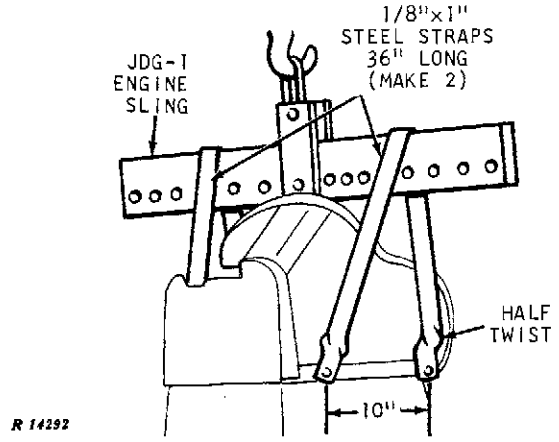


Fig. 24-Lift Bracket

SPECIFICATIONS

Item	Specification
Air conditioning compressor drive belt deflection (at 15 lbs. pull)	0.25 in.
Alternator drive belts:	
Tractors with air conditioning	1-inch deflection, 20 lbs. pull
Tractors without air conditioning	1-inch deflection, 25 lbs. pull

TORQUES FOR HARDWARE

Item	Torque (Ft-Lbs)
Hydraulic pump drive coupling	30 ft-lbs
Hydraulic pump support-to-engine	85 ft-lbs
Side frames-to-engine	250 ft-lbs
Clutch housing-to-engine	300 ft-lbs
Clutch housing-to-transmission case screws and nuts	5/8 in. -170 ft-lbs 3/4 in. -300 ft-lbs
Transmission control valve housing to transmission case	45 ft-lbs
Clutch oil manifold and transmission pump assembly-to-clutch housing	45 ft-lbs
Axle housing-to-transmission case	170 bt-lbs
Axle housing-to-Roll-Gard frame	445 ft-lbs
Roll-Gard cab rear mounting bolts	445 ft-lbs
Roll-Gard cab front mounting bracket-to-clutch housing	85 ft-lbs

SPECIAL TOOLS

No.	Name	Use
JDE-63*	Engine Lift Brackets	Engine removal
JDG-1*	Engine Sling	Engine removal
JDG-2C*	Support Stand	Tractor front support
JDG-2M*	Rear Stand	
JDG-7*	Lift Bracket	Lifting tractor front end
....	Lift Bracket	Lifting clutch housing assembly

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

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 liquid cooled, 6-cylinder, turbocharged, diesel fueled, valve-in-head, vertical in-line four-cycle engine.

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
- Faulty injection pump solenoid

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 (may 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

Power Train Malfunction—See Section 50
- Clutch slipping

Litho in U.S.A.

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 thermostat
- 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

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 slots in piston clogged
- Insufficient piston ring tension
- Piston ring gaps not staggered
- Excessive main or connecting rod bearing clearance
- Worn crankshaft thrust washer (misaligned piston and rod)
- Excessive main or connecting rod bearing clearance
- Front or rear crankshaft oil seal faulty
- Crankcase oil too thin
- Oil pressure too high
- Oil level too high

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

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

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 oil pressure indicator lamp
- Faulty oil pressure sending unit

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 Grey 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 mufflers

Litho in U.S.A.

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 build-up 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 gears
Broken pump shaft
Low engine oil level
Camshaft oil pump drive gear worn or broken

INSTRUCTIONS FOR ENGINE BREAK-IN

Use a dynamometer to perform the following break-in procedure. If necessary, engine break-in can be performed without a dynamometer if under controlled operating conditions.

Fill engine crankcase with Torq-Gard Supreme 10W-20 oil to proper level for use during the break-in operation.

5 Minutes	No Load	800 RPM	Check
5 Minutes	No Load	1500 to 2000 RPM	oil pressure,
5 Minutes	1/4 Load	1900 to 2200 RPM	coolant
10 Minutes	1/2 Load	1900 to 2200 RPM	temperature
10 Minutes	1/2 to 3/4 Load	1900 to 2200 RPM	and leakage.
10 Minutes	3/4 to Full Load	2200 to 2500 RPM	

After break-in, run engine 1 to 2 minutes at 1500 RPM, No Load before shut-down. Loosen, then retighten cylinder head cap screws per specified sequence and torque. Loosen, then retighten rocker arm shaft clamps to specified torque. Check and reset valve clearance to specifications.

During the first 100 hours of operation, avoid over-loads, excessive idling, and no-load operations. Do NOT use foot throttle. After 100 hours, drain crankcase oil and change oil filter. Fill crankcase with oil of proper viscosity and service classifications.

Litho in U.S.A.

Group 10
CYLINDER HEAD, VALVES, AND CAMSHAFT

GENERAL INFORMATION

The valve guides are integral with the cylinder head. Valve seats are replaceable steel inserts.

The valves have chrome-plated stems and replaceable wear caps. The intake valves are stellite-faced for greater heat resistance. The exhaust valves are made of inconel. Valve rotators are mounted above both intake and exhaust valve springs.

The camshaft is driven at one-half engine speed by the crankshaft gear and supported by four bushings in the cylinder block.

The camshaft lobes are tapered. The cam followers are mushroom-shaped with a crowned face.

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 build-up 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 for specified clearance.

Valve Lift Check

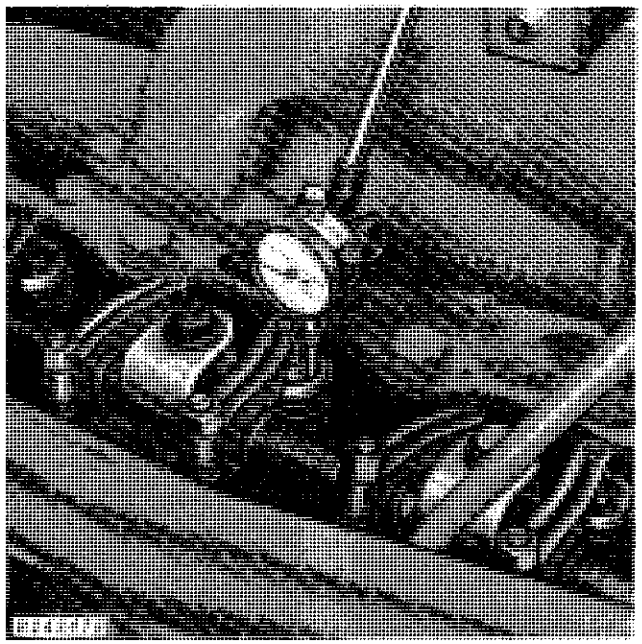


Fig. 1-Checking Valve Lift

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. (Be sure that valve is fully closed and the rocker arm moves freely.) Zero dial indicator.

Manually turn engine in running direction. When rocker arm contacts valve, check indicator travel as the rocker arm moves valve to full open. See "Specifications."

CYLINDER HEAD AND VALVES

REMOVAL

Remove battery ground straps.

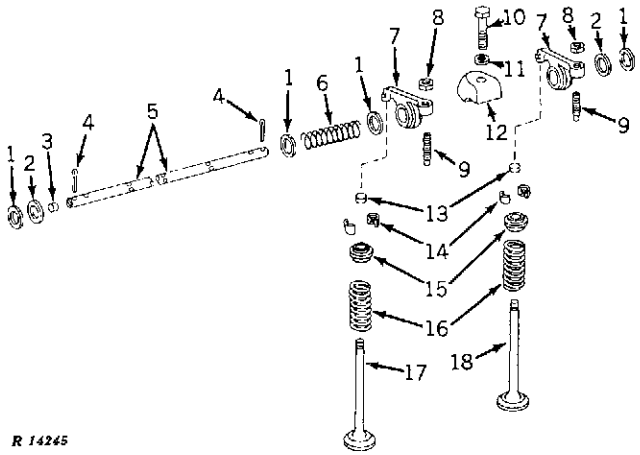
The engine need not be removed to service the cylinder head and its related parts; however, the air intake and exhaust system including precleaner, air cleaners, turbocharger, intake and exhaust manifolds must be removed. The intercooler must also be removed.

Remove the water manifold and parts related to the fuel system that are connected to the cylinder head. Identify all parts during removal for re-assembly.

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 washer, washer, and plugs from rocker arm shaft. Slide parts from shaft and identify for reassembly.



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-Valves and Rocker Arm Assembly

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

Inspect valve springs 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 or contain broken or rusty coils.

Check valve spring length on a spring tester. Free length of each spring may differ, but the compressed length for each spring must be the same.

Valve wear caps should be replaced if pitted or worn.

Thank you very much for your reading.

Please Click Here Then Get More Information.