John Deere
JD480 Forklift

Technical Manual

TM1016
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JD480 FORKLIFT

TECHNICAL MANUAL

TM-1016 (Dec-73)

CONTENTS

The specifications and design information contained in this manual were correct at the time this machine was manufactured. It is John Deere's policy to continually improve and update our machines. Therefore, the specifications and design information are subject to change without notice. Wherever applicable, specifications and design information are in accordance with SAE and IEMC standards.

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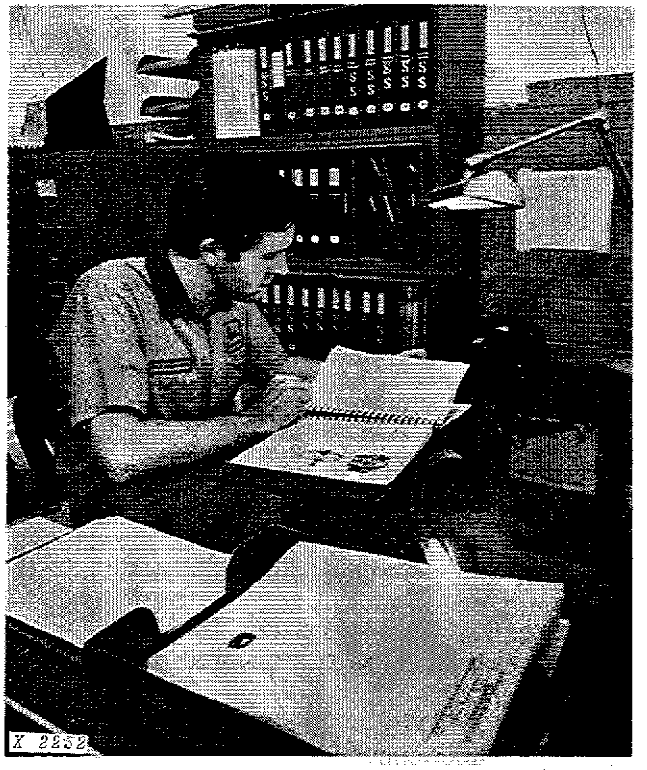
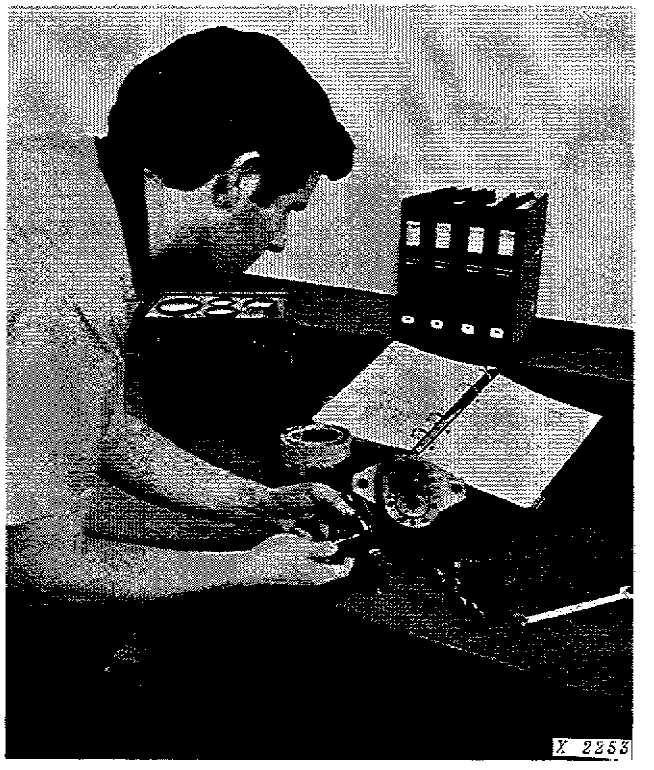
INTRODUCTION



Use FOS Manuals for Reference



Use Technical Manuals for Actual Service

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

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

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

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

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.

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Section 10
GENERAL

CONTENTS OF THIS SECTION

Group 5
SPECIFICATIONS

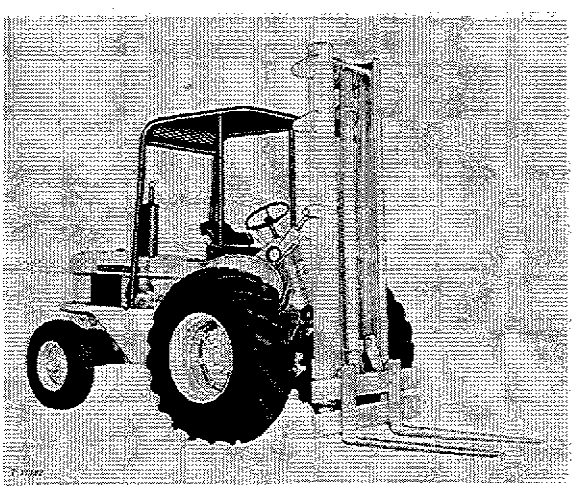

Fig. 1–JD480 Forklift

FORKLIFT DESIGN

The JD480 Forklift is designed for handling, lifting, and stacking materials and other miscellaneous products either loose, strapped, bundled, or on pallets.

All references in this manual to front, rear, left, and right are determined by facing in the direction of the forklift forward travel.

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SPECIFICATIONS

ENGINE

	Diesel	Gasoline
Flywheel horsepower (observed at 2500 rpm)	59.0	59.0
Max. torque in ft-lbs. at 1300 rpm (observed-nominal)	145.0	145.0
N.A.C.C. or A.M.A. horsepower rating for tax purposes	23.84	23.84
Number of cylinders	4	4
Bore and stroke (inches)	3.86 x 4.33	3.86 x 3.86
Displacement (inches)	202.2	180.0
Compression ratio	16.7 to 1	7.5 to 1*
Firing order	1-3-4-2	1-3-4-2

ELECTRICAL SYSTEM

Battery voltage (nominal)	12 volts
Battery specific gravity at full charge (corrected to 80° F.)	1.260 0.010
Battery terminal grounded	Negative
Alternator regulation	Voltage regulator
Ignition system type	Battery-distributor
Spark plugs Size	14 mm

TRANSMISSION

Constant mesh, 8 forward speeds; helical gears and sliding collars; mechanical shuttle.

REVERSER

Hydraulic wet clutches, no clutching required. Provides reverse speeds for gear selections 1 through 8 which are 16% slower than corresponing forward speeds.

DISCONNECT CLUTCH

11-inch dry-type clutch operated by a pedal (early units) or a hand disconnect lever (later units).

**8.6 to 1 with high-altitude pistons*

TRAVEL SPEEDS (mph at 2500 engine rpm with 14.9 — 28 tires, without slip).

Gear	Forward	Reverse
1st	1.7	1.4
2nd	2.3	2.0
3rd	3.4	2.9
4th	4.3	4.1
5th	6.4	5.5
6th	9.0	7.8
7th	13.4	11.6
8th	18.8	16.2

DRIVE AXLES

Two planetary reduction drive axles with spiral bevel gear drive differential.

FORKLIFT HYDRAULIC SYSTEM

Type - Open center, constant volume system to operate forklift functions.

Pump - Engine crankshaft driven, positive displacement, gear-type pump.

STEERING AND BRAKES HYDRAULIC SYSTEMS

Type - Open center, constant volume system to operate the forklift power steering and hydraulic brake systems.

Pump - Engine drive, positive-displacement gear type pump.

Relief Valve - Relief mechanism is contained in the metering valve located at the pump.

TIRE OPTIONS

Front	14.9 - 28, 8 PR
	16.9 - 24, 8 PR
Rear	7.50 - 16, 10 PR
	11.00L - 15, 6 PR

WHEEL TREADS

Front	62 in.
Rear (with 7.50-16 tires)	56 in.
Rear (with 11.00L-15 tires)	62 in.

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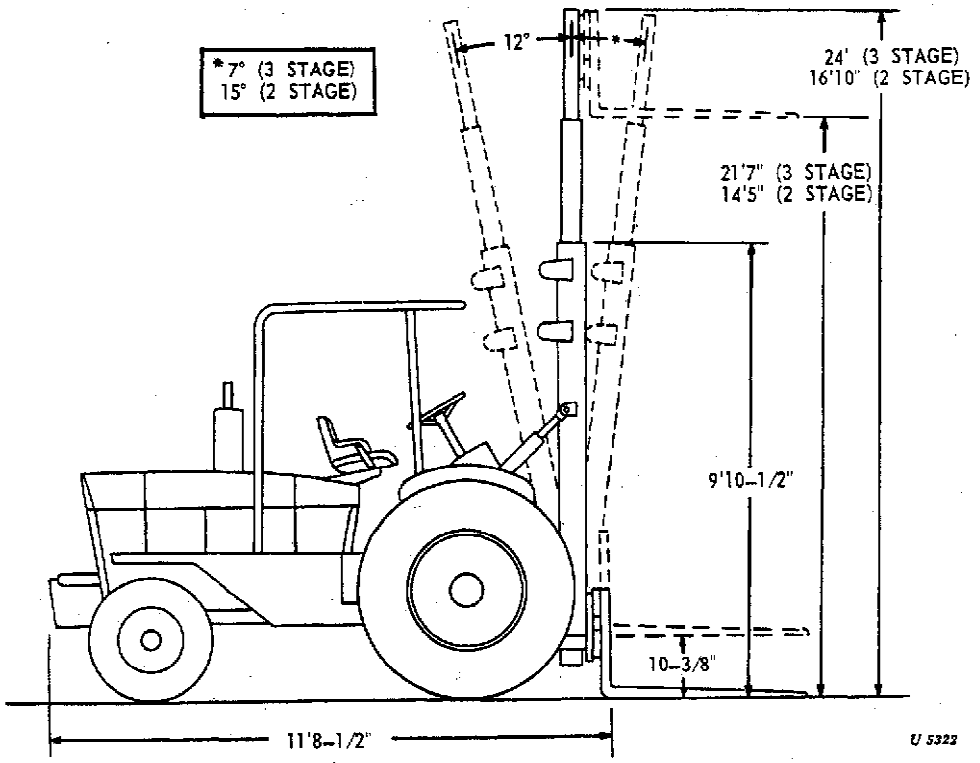

Fig. 2–Forklift Dimensions

CAPACITIES (U.S. Standard Measures)

Cooling system	3 gal.
Fuel tank	19-1/2 gal.
Engine crankcase (with filter)	6 qt.
Transmission (includes steering and brake hydraulic system)	10 gal.
Forklift hydraulic system	
14-foot mast	15 gal.
21-foot mast	14 gal.

FORKLIFT DIMENSIONS

Over-all length (without forks)	11 ft. 8-1/2 in.
Over-all width	6 ft. 7 in.
Over-all Height:	
Mast retracted	9 ft. 10-1/2 in.
Mast raised-14-foot mast	16 ft. 10 in.
21-foot mast	24 ft.
Wheelbase	6 ft. 10 in.
Freelift (max. with forks in transport position and mast fully retracted)	10-3/8 in.

Shipping weight (approx. without forks or attachments)	Diesel	Gasoline
14-foot mast (lbs)	10,790	10,708
21-foot mast (lbs)	11,140	11,058

FORKLIFT OPERATING INFORMATION

Maximum Lifting Height	
14-foot mast (2 stage)	14 ft. 5 in.
21-foot mast (3 stage)	21 ft. 7 in.
Load Capacity (At Full Lift Height and 24-inch Load Center)	
14-foot mast	5000 lbs.
21-foot mast	2500 lbs.
Tilt of Mast	
Forward-14-foot mast	15 degrees
21-foot mast	7 degrees
Rearward-14-foot mast	12 degrees
21-foot mast	12 degrees

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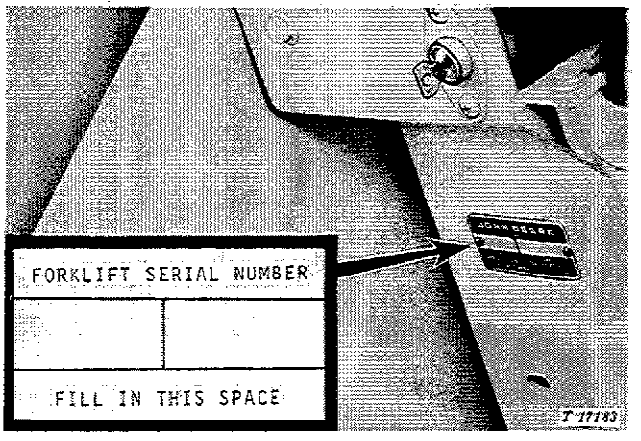
Side-shift of Mast	3 in. to right or left of center
Rate of Lift (2500 engine rpm)	70 fpm
Rate of Drop	
Maximum load	63-3/4 fpm
Empty	46-1/2 fpm
Turning Radius	
Brakes applied (approx.)	127 in.
Turning Clearance Circle (Without Forks) (depending on brake application and direction of turn)	21 ft. 3 in. to 23 ft. 6 in.

SERIAL NUMBERS

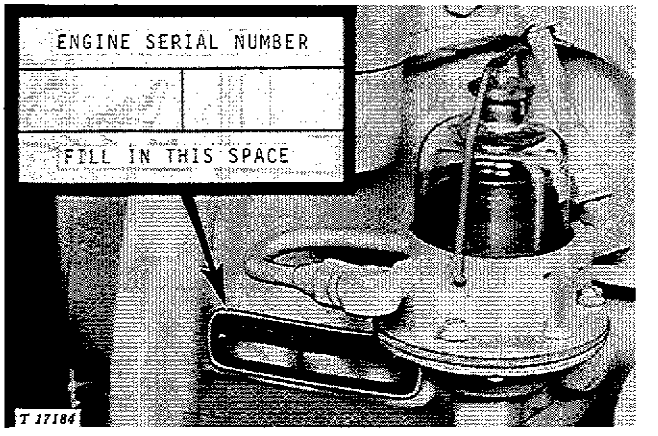
The basic forklift (chassis) serial number plate is located on the left side of the control console mounting plate.

The engine serial number plate is mounted on the left side of the engine cylinder block.

Early model forklifts had a separate serial number plate located at the top and to the rear of the upper mast.



Forklift Serial Number



Engine Serial Number

(Specifications and design subject to change without notice. Wherever applicable, specifications are in accordance with IEMC standards.)

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Group 10
PREDELIVERY, DELIVERY, AND AFTER-SALES 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 forklift before it leaves the factory.

After completing the factory-recommended dealer checks and services listed on the predelivery tag, remove the tag from the forklift and file it with the shop order for the job. The tag will then serve as a basis for certifying that the machine has received the proper predelivery service when that portion of the customer's John Deere Delivery Receipt is completed.

TEMPORARY FORKLIFT STORAGE

Service	Specifications	Reference
Check radiator for coolant loss and antifreeze protection.	Midway between core and filler neck.	Operator's manual
Drain fuel system (gasoline).	----	Operator's manual.
Remove battery electrolyte. (Dry Charge).	Store at room temperature.	----
Remove battery (Wet Charge).	Store at room temperature.	----
Reduce shipping pressure of tires.	----	Operator's manual.
Cover forklift and tires for protection and cleanliness.	----	----

BEFORE DELIVERING FORKLIFT

COOLING SYSTEM		
Inspect radiator for coolant loss.	Midway between core and filler neck.	Operator's manual.
Check antifreeze protection	----	----
ELECTRICAL SYSTEM		
Remove resistor from output terminal of alternator and connect two output wires (red) to terminal. Do not attempt to polarize alternator.	----	Instruction card attached to the forklift.
Check battery terminals to be sure they are tight.	----	----
Install electrolyte and charge batteries.	----	"Storage Batteries" FOS Manual - "ELECTRICAL SYSTEMS"
Punch warranty tag on top of battery.	----	----
TIRES AND WHEELS		
Test pressure of tires.	----	Operator's Manual.
Check front and rear wheel retainers for tightness.	----	Operator's Manual.

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BEFORE DELIVERING FORKLIFT - Continued

Service	Specifications	Reference
LUBRICATION		
Check crankcase oil level.	To upper mark on dipstick.	Operator's manual.
Check transmission-hydraulic system oil level.	----	Operator's manual.
Lubricate grease fittings.	----	Operator's manual.
Check distributor lubrication.	----	Operator's manual.
Check forklift hydraulic system oil level.	----	Operator's manual.
ENGINE		
Check air cleaner.	----	Operator's manual
Fill fuel tank and start engine.	----	Operator's manual.
Check operation of lights, gauges, and indicator lights.	----	Operator's manual.
Check speed control and governor linkage for free operation.	----	Section 20, Group 20.
Check engine idle speeds.	----	Section 20, Group 20.
OPERATION		
Check pedal linkage adjustment.	----	Section 50, Group 10.
Shift transmission through all gears.	----	Operator's manual.
Check hydraulic system operation.	----	Section 60, Group 5. Section 70, Group 5.
Check brake operation.	----	Section 60, Group 5.
Check seat operation.	----	Operator's manual.
GENERAL		
Tighten accessible nuts and cap screws.	----	----
Clean forklift and touch up paint.	----	----

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DELIVERY SERVICE

A thorough discussion of the operation and service of a new forklift 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.

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

Using the 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. All functions of the hydraulic system.
5. The importance of safety.
6. 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-SALES INSPECTION

The purchaser of a new John Deere forklift is entitled to a free inspection "at some mutually agreeable time within the warranty period after the equipment has been run in." The terms of this after-sales inspection are outlined on the back of the customer's John Deere Delivery receipt.

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

If the recommended after-sales 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 further opportunity of promoting the possible sale of other new equipment.

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AFTER-SALES INSPECTION PROCEDURE

Service	Specifications	Reference
COOLING SYSTEM		
Check radiator coolant level.	Midway between core and filler neck.	----
Clean external surface of radiator.	----	----
Check hoses and connections for leaks.	----	----
FUEL SYSTEM		
Remove water and foreign matter from fuel pump and filter sediment bowls.	----	Operator's manual.
Check fuel line connections.	----	Operator's manual.
ELECTRICAL SYSTEM		
Check specific gravity of battery.	Full charge at 80° F. is 1.260.	Operator's manual.
Check level of battery electrolyte.	To bottom of filler neck in each cell.	Operator's manual.
Check alternator belt tension.	3/4-inch deflection with a 20-pound force.	Operator's manual.
Start engine and check action of electrical components.	----	Operator's manual.
LUBRICATION		
Check crankcase oil level.	To upper mark on dipstick.	Operator's manual.
Check air cleaner dust unloading valve, cup, and element.	----	Operator's manual.
Check transmission-hydraulic system oil level.	----	Operator's manual.
Check distributor lubrication.	----	Operator's manual.
ENGINE		
Check valve tappet adjustment.	----	Operator's manual.
Check engine speeds.	----	Operator's manual.
GENERAL		
Check clutch linkage adjustment.	----	Section 50, Group 10.
Check hydraulic system operation.	----	Section 60, Group 5.
Check steering.	----	Section 70, Group 5. Section 60, Group 20.
Check brakes.	----	Section 60, Group 25.
Tighten accessible nuts and cap screws.	----	----
Tighten accessible hydraulic oil lines.	----	----
Visual inspection.	----	----

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Group 15

TUNE-UP AND ADJUSTMENT

GENERAL INFORMATION

Before tuning up an engine, determine if it is in condition so that performance can be restored by tune-up. Perform the following tests:

PRELIMINARY ENGINE TESTING

Operation	Specifications	Reference
Manifold vacuum test (gasoline only)	15 to 20 inches of mercury at fast idle	See "Testing and Diagnosis of Engines" in FOS Manual - "ENGINES"
Vacuum test (at air cleaner)	14 to 25 inches of water at fast idle	See "Testing and Diagnosis of Engines" in FOS Manual - "ENGINES"
Check radiator for air bubbles and indication of oil	. . . . .	Section 20, Group 25
Cylinder compression	120 psi - gasoline 300 psi - diesel	See "Testing and Diagnosis of Engine" in FOS Manual - "ENGINES"

ENGINE TUNE-UP

AIR INTAKE SYSTEM		
Air Cleaner - Clean element and dust unloading valve	. . . . .	Section 30, Group 10
Check crankcase breather pipe for restrictions	. . . . .	. . . . .
Retighten cylinder head cap screws	110 ft-lbs	Section 20, Group 10
Check engine valve clearances	Gasoline - 0.022 in. -Exhaust - 0.014 in. -Intake Diesel - 0.018 in. -Exhaust - 0.014 in. -Intake	Section 20, Group 10
IGNITION SYSTEM		
Clean, test, or replace spark plugs.	0.025 inch	Section 40, Group 15.
Check distributor cap, rotor, and wiring	. . . . .	Section 40, Group 15
Clean, adjust, or replace points	0.020 in. gap - 66° to 72° dwell.	Section 40, Group 15

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ENGINE TUNE-UP - Continued

Operation	Specifications	Reference
IGNITION SYSTEM (Cont.)		
Lubricate distributor cam	Cam lubricant	. . . . .
Time distributor	. . . . .	Section 40, Group 15
BATTERY		
Check electrolyte level	. . . . .	. . . . .
Clean cables, terminals, and box	. . . . .	. . . . .
Tighten cable clamp	. . . . .	. . . . .
ALTERNATOR		
Check belt tension	20 lb. at 3/4 in.	. . . . .
GASOLINE FUEL SYSTEM		
Check fuel tank and lines for leaks or restrictions	. . . . .	Operator's manual.
Clean fuel transfer pump bowl	. . . . .	. . . . .
Check carburetor choke disk operation	. . . . .	. . . . .
Clean carburetor fuel inlet screen	. . . . .	. . . . .
Adjust speed control linkage	Slow idle 600 rpm Hand throttle 2680 rpm Foot throttle 2800 rpm	Section 20, Group 20
DIESEL FUEL SYSTEM		
Check fuel tank and lines for leaks or restrictions	. . . . .	Operator's manual.
Clean fuel transfer pump bowl	. . . . .	. . . . .
Replace fuel filter elements	. . . . .	. . . . .
Time injection pump	. . . . .	Section 30, Group 20
Check injection pump advance	. . . . .	Section 30, Group 20
Bleed fuel system	. . . . .	. . . . .
Adjust speed control linkage	Slow idle 800 rpm Hand throttle 2650 rpm Foot throttle 2800 rpm	Section 20, Group 20

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FORKLIFT ADJUSTMENT

Make the following adjustments whenever the engine is tuned up.

Operation	Specifications	Reference
ENGINE LUBRICATION SYSTEM		
Check engine oil pressure	45 to 65 psi at 2500 rpm (180° to 220° F.)	Section 20, Group 15
COOLING SYSTEM		
Clean and flush system	. . . . .	Operator's manual.
Inspect hoses	. . . . .	. . . . .
Clean trash from radiator	. . . . .	. . . . .
DISCONNECT CLUTCH		
Adjust clutch linkage	. . . . .	Section 50, Group 10
REAR WHEELS		
Check toe-in	. . . . .	Section 80, Group 10
Check bearings	. . . . .	Operator's Manual
STEERING AND BRAKES HYDRAULIC SYSTEM		
Check performance	. . . . .	Section 60, Group 5
Check for leaks	. . . . .	. . . . .
FORKLIFT HYDRAULIC SYSTEM		
Check cycle times	. . . . .	Section 70, Group 5
Check for leaks	. . . . .	. . . . .
TIRES		
Check tire inflation	. . . . .	See Operator's Manual
TORQUE-ACCESSIBLE BOLTS AND CAP SCREWS	. . . . .	Group 25

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Group 20
LUBRICATION

GENERAL INFORMATION

Carefully written and illustrated lubrication instructions are included in the operator's manual furnished with your customer's machine. Remind him to follow these instructions.

For your convenience, the following chart shows capacities and types of lubricants for the forklift components and systems. Specifications for lubricants follow the chart.

Component	Capacity	Lubricant	Interval of Service
Engine crankcase	6 U.S. quarts (with filter)	See page 10-20-2	10 hours - Check 100 hours - Change oil 200 hours - Change filter
Transmission - steering and brakes hydraulic system	10 US gals.	JD303 Special-Purpose Oil (or an equivalent)	50 hours - Check 50 hours - Change filter (after initial break-in) 500 hours - Change filter 1000 hours - Change oil
Forklift hydraulic system	14 ft mast - 15 US gals. 21 ft mast - 14 US gals.	JD303 Special-Purpose Oil (or an equivalent)	10 hours - Check 500 hours - Change micronic filter - clean wire filter 1000 hours - Change oil
Cooling system	3 US gals.	Clean water or antifreeze	10 hours - Check Spring and Fall - Drain and refill
Grease fittings	Several strokes of grease gun	John Deere Multi-Purpose Lubricant or an equivalent	10 hours
Carriage chains	Lubricate with brush	Engine oil	50 hours
Mast channels	Lubricate with brush	John Deere Multi-Purpose Lubricant or an equivalent	50 hours
Front axle bearings	Several strokes of grease gun	John Deere Multi-Purpose Lubricant or an equivalent	1000 hours
Rear wheel bearings	Repack bearings	John Deere Multi-Purpose Lubricant or an equivalent	1000 hours
Distributor cam	Trace	Cam lubricant or high temperature grease	500 hours
Starter	Saturate wicks	SAE10 engine oil	1000 hours

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LUBRICANTS

Effective use of lubricating oils and greases is perhaps the most important step towards low upkeep cost, long forklift life, and satisfactory service. Use only lubricants specified in this section; apply them at the intervals and according to the instructions in the lubrications and periodic service section.

ENGINE LUBRICATING OILS

X3377

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 is 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/SD
MIL-L-46152

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

		Other Oils	
Air Temperature	John Deere Torq-Gard Oil	Single Viscosity Oil	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 also be used to insure optimum lubrication at starting, particularly when engine is subjected to −10°F. or lower temperatures 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 an 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.

GREASES

Use John Deere Multi-Purpose Lubricant or an equivalent SAE Multi-Purpose 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 forklift 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.

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Group 25
SEPARATION

REMOVING AND INSTALLING COUNTERWEIGHT

REMOVAL

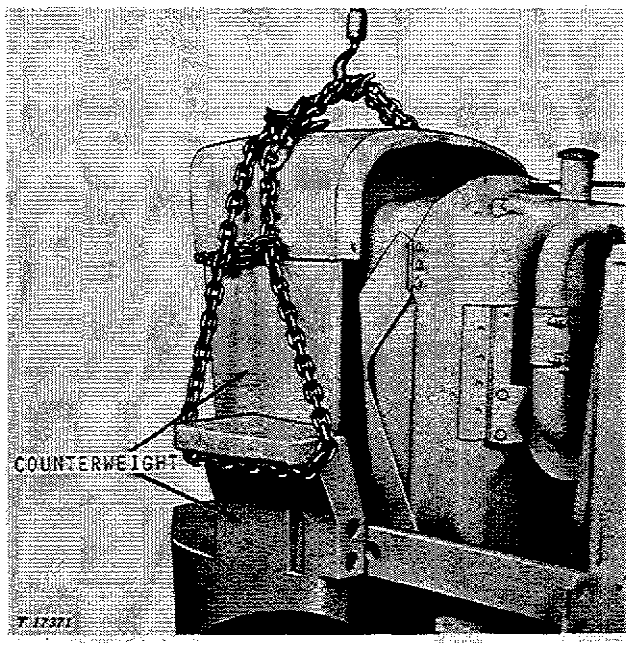

Fig. 1–Removing Counterweight

Disconnect battery ground strap and remove hood and grille screens.

Remove anchor bar located under forklift which secures counterweight to forklift side frames.

Attach chains around counterweight as shown in Fig. 1 and remove counterweight from unit.

CAUTION: Be sure to balance counterweight properly. Counterweight with top hood weighs approximately 2500 pounds.

INSTALLATION

Installation procedure is reverse of removal. See "Specifications" for correct torque values.

REMOVING AND INSTALLING MAST

REMOVAL

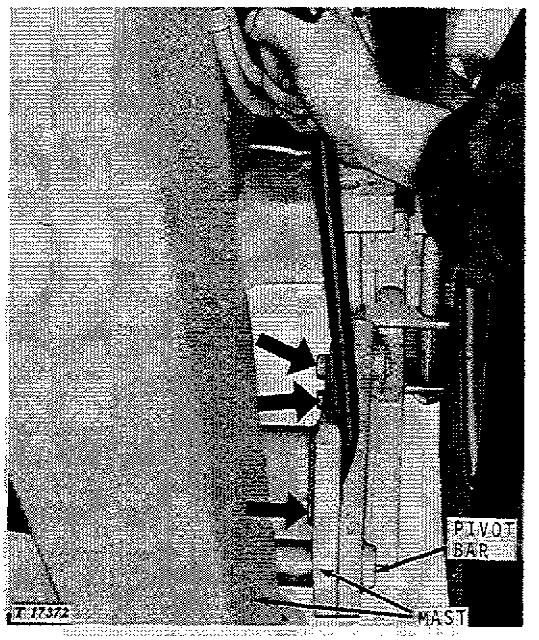

Fig. 2–Mast Attaching Points

Release forklift hydraulic oil pressure by actuating control levers and opening reservoir filler cap.

Disconnect hydraulic hoses at the mast lift cylinder and the side shift cylinder (if used).

Remove tilt cylinder rod ends from mast.

Support mast and side frames. Remove side frame to axle housing anchor bolts. Remove mast to side frames attaching cap screws.

Pry side frames away from mast to free pivot bar and dowels. Remove mast from unit.

An alternate method of removing mast is to support transmission and mast. Then remove front wheels and drive out pivot bar.

INSTALLATION

Installation procedure is reverse of removal. Bleed mast lift cylinder (see Operator's Manual).

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REMOVING AND INSTALLING REAR END SUPPORT

REMOVAL

Removal of rear end support with tires, rear axle, and fuel tank as an assembly, will allow the engine to be removed as a unit for a complete overhaul.

Remove counterweight assembly.

Remove fan shroud from radiator and slip back over fan. Disconnect and remove radiator from unit.

Disconnect lines from forklift hydraulic pump.

Remove steering cylinder.

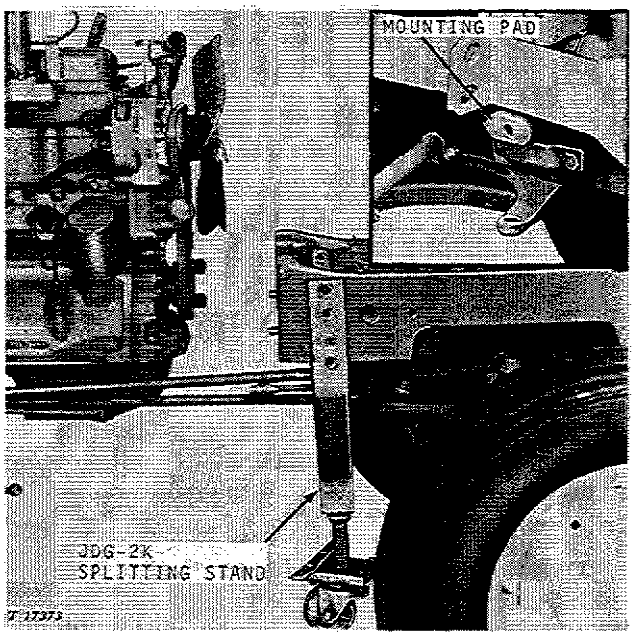

Fig. 3–Removing Rear End Support Assembly

Remove rear mounting pads between side frames and rear end support. Attach JDG-2K splitting stand or chain hoist as shown in Fig. 3.

Support middle of unit under clutch housing. Insert wooden blocks between rear axle and rear end support. Remove rear end support attaching cap screws, pull side frames apart, and roll support away from engine (Fig. 3).

INSTALLATION

Install rear end support by reversing removal procedure.

REMOVING AND INSTALLING ENGINE

REMOVAL

Most service procedures on the engine can be accomplished with the engine in the unit. If the crankshaft is to be removed or in event of a general overhaul, remove the engine.

Remove counterweight and rear end support assemblies.

Disconnect all the necessary wiring, linkage, and lines from both sides of engine.

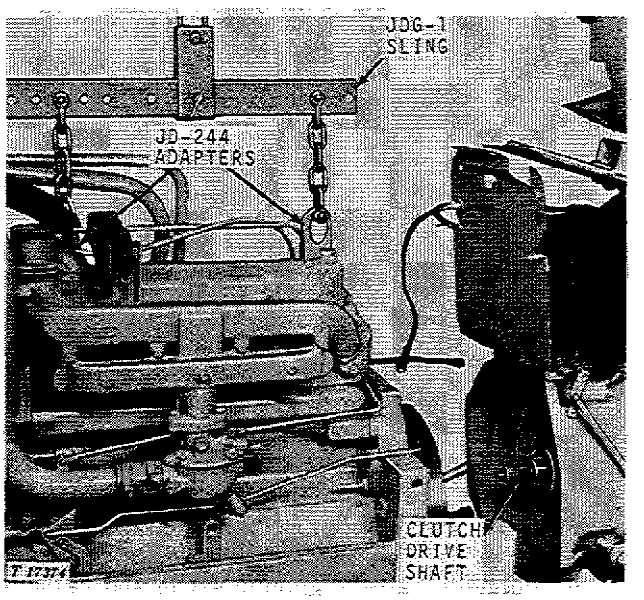

Fig. 4–Removing Engine

Install two JD-244 engine lifting adapters in cylinder head.

Attach JDG-1 sling to lifting adapters. Remove cap screws securing engine flywheel housing to reverser housing and with a hoist remove engine from unit.

INSTALLATION

Bar engine over to index clutch drive shaft with clutch disk.

Coat tachometer cable gasket with Lubriplate. **Do not tighten cable too tight or gasket will be damaged.**

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REMOVING AND INSTALLING REVERSER HOUSING

REMOVAL

Remove counterweight assembly. Disconnect all wires, oil lines, and linkage between engine and reverser housing and between reverser housing and transmission case.

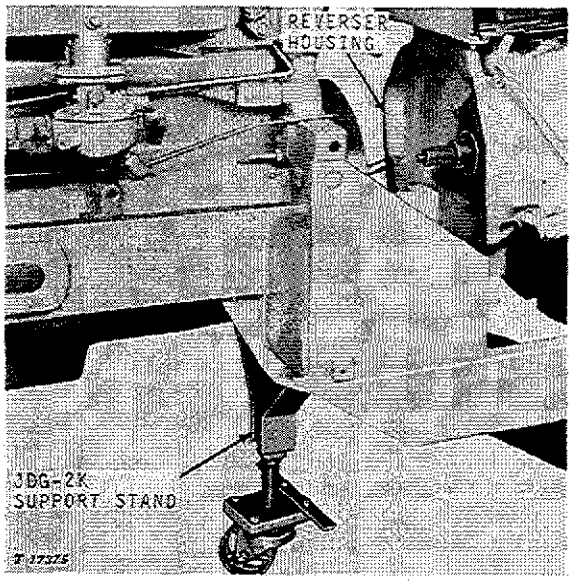

Fig. 5–Separating Engine and Reverser Housing

Insert wooden blocks between rear axle and rear end support. Position JDG-2K splitting stand on flywheel housing. Support front of transmission and forklift mast and roll engine with rear end support from unit. Remove reverser housing (Fig. 6).

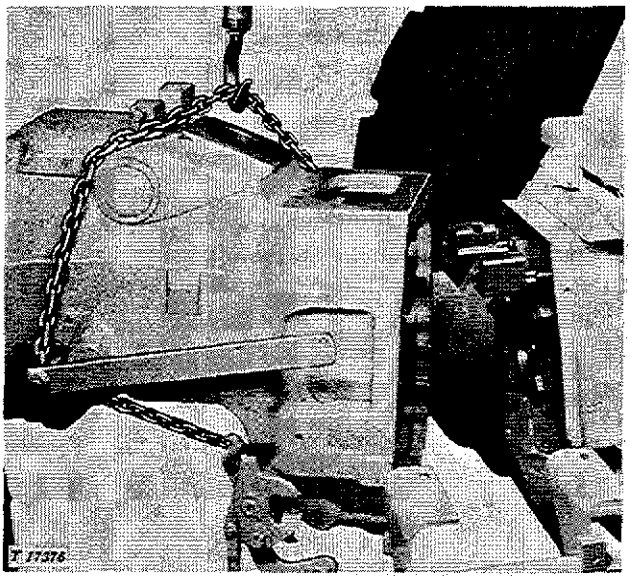

Fig. 6–Removing Reverser Housing

INSTALLATION

Install transmission by reversing removal procedure.

REMOVING AND INSTALLING AXLE ASSEMBLIES

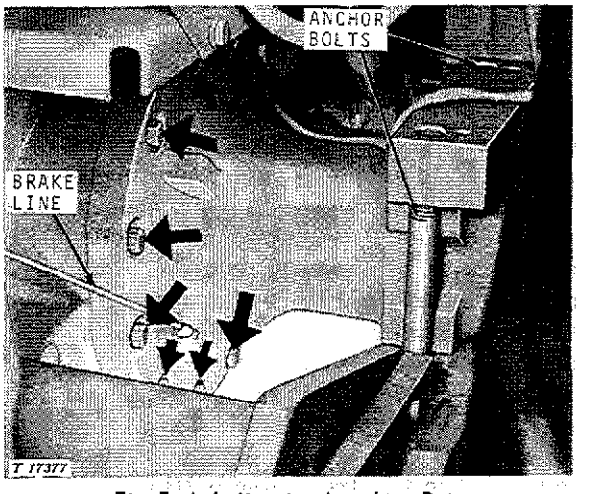

Fig. 7–Axle Housing Attaching Points

Block up mast, side frames, and transmission case. Remove front wheels. Remove side frame to axle housing anchor bolts.

Pull housings from transmission case. *If brake disk (or floating facing) was removed with axle, install disk with thicker facing in against transmission case.*

REMOVING TRANSMISSION

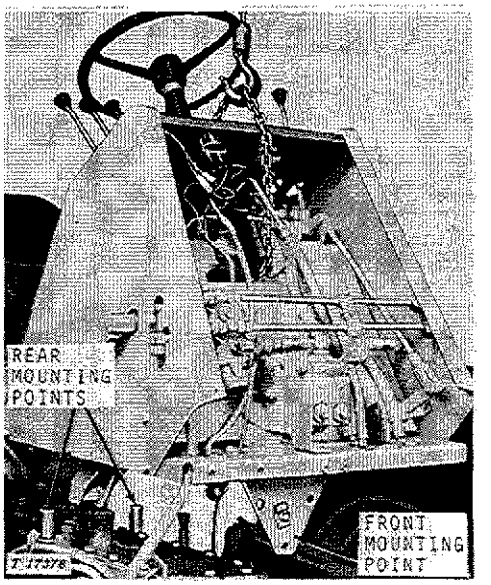

Fig. 8–Removing Control Console

Remove mast assembly and control console.

Remove forklift reservoirs and support transmission. Install JDG-2K splitting stand to engine flywheel housing and separate unit between reverser housing and transmission housing as described under "Removing and Installing Reverser Housing". Support counterweight assembly and remove transmission.

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SPECIFICATIONS

TORQUE VALUES

Item	Torque (ft-lbs)
Side frames to counterweight	475
Side frames to counterweight anchor bar	300
Counterweight anchor bar to counterweight	475
Rear end support-to-engine (5/8-inch cap screws)	170
(9/16-inch cap screws)	130
Side frame to front mounting pads	170
Front mounting pads to rear support	170
Side frame anchor bolts to axle spacers	475
Mast cross mount to side frame	300
Engine to reverser housing	170
Reverser housing to transmission case	85
Axle housing to transmission case	85
Rear wheel to hub (retaining bolts)	120
(adjusting nut)	35
Front wheel (to axle)	170
(to hub)	120
Power steering cylinders attaching nuts (Advance nut to align cotter pin hole)	55
Forklift hydraulic pump to rear support	85
Reverser control valve housing to clutch housing	35

TORQUE CHART

RECOMMENDED TORQUE IN FT-LBS COARSE AND FINE THREADS

Bolt Diameter	Plain Head	Three Radial Dashes	Six Radial Dashes
1/4	Not used	10	14
5/16	Not used	20	30
3/8	Not used	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
1-1/8	330	910	1460
1-1/4	480	1250	2060

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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.

Machine bolts and cap screws 7/8 inch and larger are sometimes formed hot rather than cold, which accounts for the lower torque.

SPECIAL TOOLS

No.	Name	Use
TIME-SAVING TOOLS		
JD244*	Lifting Eyes	To Remove Engine
JDG-1*	Sling	To Remove Engine
JDG-2K*	Support Stand	To Support Engine and Front End

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

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Section 20
ENGINE

CONTENTS OF THIS SECTION

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Group 5
DIAGNOSIS

DIAGNOSING ENGINE MALFUNCTIONS

The following is a quick guide for diagnosing engine malfunctions. Each malfunction is elaborated further in the section or group in this manual pertaining specifically to the component or system.

ENGINE HARD TO START, WILL NOT START

- Check fuel system (Section 30)
- Check electrical system (Section 40)
- Check ignition (Section 40)
- Check air system (Section 30)
- Low compression (Group 10)

ENGINE STARTS, WON'T CONTINUE TO RUN

- Check fuel system (Section 30)
- Check ignition (Section 40)
- Check air system (Section 30)

LACK OF ENGINE POWER

- Too high viscosity oil in crankcase
- Check fuel system (Section 30)
- Check ignition (Section 40)
- Check air system (Section 30)
- Low compression (Group 10)

DIESEL ENGINE EMITS BLACK OR GRAY EXHAUST SMOKE

- Check air intake system (Section 30)
- Check fuel system (Section 30)
- Low compression (Group 10)

LOW ENGINE OIL PRESSURE

- Check lubrication system (Group 15)

ENGINE SPEED IS ERRATIC

- Check fuel injection pump (Section 30)
- Check governor (Group 20)
- Check speed control linkage (Group 20)

ABNORMAL ENGINE NOISE

- Check timing (Section 40; Section 30)
- Improper fuel (Section 30)
- Worn or improperly adjusted engine parts (Group 10)
- Plugged injection nozzles (Section 30)

ABNORMAL ENGINE OPERATING TEMPERATURE

- Check cooling system (Group 25)
- Check ignition timing (Section 40)
- Check fuel injection timing (Section 30)

HIGH FUEL CONSUMPTION

- Check fuel system (Section 30)
- Check ignition (Section 40)
- Check air intake (Section 30)
- Low compression (Group 10)

ENGINE MISSES

- Low compression (Group 10)
- Check fuel system (Section 30)
- Check ignition system (Section 40)

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Group 10

BASIC ENGINE

DIAGNOSING BASIC ENGINE MALFUNCTIONS

ENGINE NOISE (VALVE TRAIN)

Improperly adjusted valve clearance
Valve rotators inoperative (gasoline)
Worn shaft or rocker arm bore
Bent push rods
Worn camshaft or cam followers

ENGINE NOISE (PISTON AND PINS)

Worn piston
Worn piston pin or bushings
Broken piston

ENGINE NOISE (BEARINGS)

Worn connecting rod bearings
Excessive crankshaft end play
Excessive main bearing clearance

ENGINE NOISE (TIMING GEAR TRAIN)

Worn gears

ENGINE USES EXCESSIVE AMOUNT OF OIL

Worn valve guides
Valve deflectors worn or missing (gasoline)
Stuck piston rings or worn rings
Excessive connecting rod bearing clearance
Excessive oil pressure
Crankcase oil diluted with fuel
Engine overloaded
Clogged breather pipe

LOW COMPRESSION

Worn rings
Burned valves
Damaged pistons
Failed head gasket

ENGINE MISSES

Improperly adjusted valves
Burned valves
Weak valve springs
Low compression on one or more cylinders
(Also see Ignition, Section 40; Fuel System, Section 30)

LACK OF ENGINE POWER

Low compression on some or all cylinders
Improperly adjusted valves
Burned valves (check compression)
Valves sticking
(Also see Ignition, Section 40; Fuel System. Section 30)

COOLANT IN CRANKCASE

Failure of head gasket
Cracked head or block
Leakage at cylinder liner seal

CYLINDER HEAD, VALVES, AND ROCKER ARMS

REMOVAL

The engine need not be removed from unit to service cylinder head, valves, and related parts.

Plug all open injection lines. Remove injection nozzles from head. (Nozzle tips extend below face of cylinder head and may be accidentally damaged.)

REPAIR

Do not rotate crankshaft with cylinder head removed unless all cylinder liners are bolted down.

INSPECTING CYLINDER HEAD

Measure inside diameter of valve guides. Valves are available with standard size or oversize stems.

Valve guides must be precision reamed to match oversized valves. Make sure valves fit freely in guides.

Worn valve guides should be sized by knurling. Use knurling tool exactly as recommended by the manufacturer (see "TOOLS").

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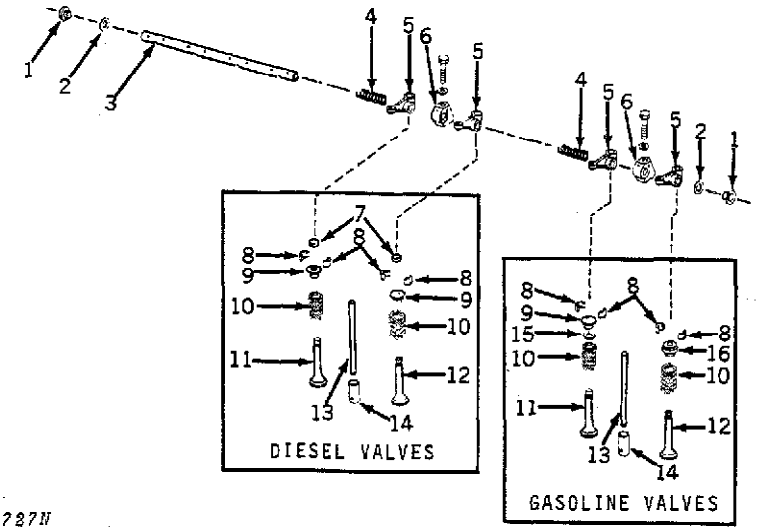

1 – Plug (2 used)
2 – Washer (2 used)
3 – Rocker Arm Shaft
4 – Spring (3 used)
5 – Rocker Arm with Adjusting Screw (8 used)
6 – Bracket (4 used)
7 – Valve Stem Caps (Diesel) (8 used)
8 – Keepers (16 used)
9 – Valve Spring Cap (8 used Diesel) (4 used Gasoline)
10 – Spring (8 used)
11 – Intake Valve (4 used)
12 – Exhaust Valve (4 used)
13 – Push Rod (8 used)
14 – Cam Follower (8 used)
15 – Intake Valve O-Ring (Gasoline) (4 used)
16 – Exhaust Valve Spring Cap Rotator (Gasoline) (4 used)

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Fig. 1–Exploded View of Rocker Arm Assembly

Check to determine if cylinder head is flat and smooth. If it is necessary to resurface the bottom deck of the head, remove no more material than absolutely necessary (not to exceed 0.030 inch).

On diesel engines check distance from the bottom deck of the cylinder head to the valves when seated. The distance for intake valves must be 0.023 to 0.047 inch, the distance for exhaust valves must be 0.038 to 0.072 inch.

REFACING VALVES

If end of valve stem on gasoline engine is excessively pitted or worn by rocker arm, grind down end of valve until squared. On diesel engines, replace valve stem caps if worn or damaged.

INSPECTING VALVE SPRINGS

Check compression strength of springs.

INSPECTING ROCKER ARM ASSEMBLY

Make sure that rocker arm oil holes are not plugged.

If ends of arms are worn, resurface them.

Thoroughly clean holes in rocker arm mounting brackets. This is especially important for the rear bracket, because oil is fed to the rocker arm shaft through this hole.

On gasoline engines, replace the intake valve stem O-ring.

If failed valve has been replaced, also replace the rocker arm and push rod for that valve.

VALVE ROTATORS (GASOLINE)

On gasoline, engines, inspect valve rotators. If rotator will not turn freely in one direction, replace with a new part.

ASSEMBLY

Rocker Arm Assembly

Assemble parts to rocker arm shaft in sequence that they were removed (Fig. 1).

Oil hole in rocker arm shaft to shaft support must face downward when assembly is installed on cylinder.

Apply John Deere Valve Stem Lubricant AR44402 to valve stems and install valves in valve guides, working them back and forth to make sure they slip through the guides easily and seat properly.

On gasoline engines, place oil deflectors (O-rings) on intake valve stems and place Roto-caps on exhaust valves.

Note also the following:

1. Use new valve keepers.
2. After assembly, "pop" each spring and valve assembly three or four times by tapping the end of each valve stem with a soft mallet.

INSTALLATION

When installing T20040 Head Gasket, coat both sides with a thin coat of Permatex No. 3 Sealing Compound. When installing R52790, install dry.

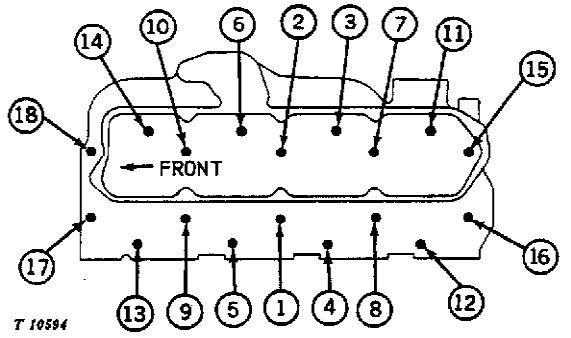

Fig. 2–Proper Sequence for Tightening Cylinder Head Cap Screws

Use specified flat washers under all cap screws. Do not dip cap screws in oil prior to installation. Start cylinder head to cylinder block cap screws by hand and tighten evenly to 110 ft-lbs torque, following sequence in Fig. 2.

Install push rods in location from which they were removed.

On diesel engines, position valve stem caps over ends of valve stems. Make certain the caps rotate freely on the stems.

Install rocker arm and shaft assembly on cylinder head. Tighten cap screws to 35 ft-lbs torque.

ADJUSTING VALVE TAPPET CLEARANCE

The engine may be either hot or cold during valve adjustment.

Position No. 1 cylinder (located at fan end) on TDC. Timing cover screw will enter its hole in flywheel (Fig. 3).

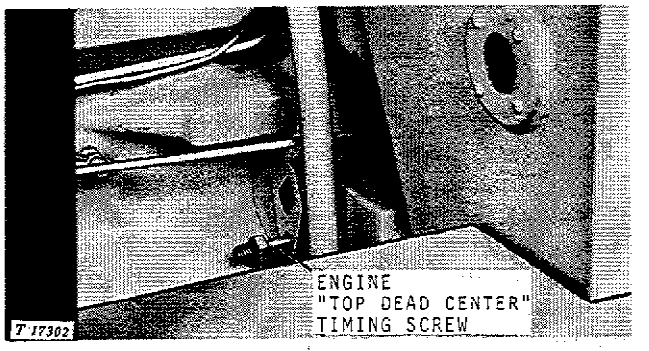

Fig. 3–Setting No. 1 Cylinder at Top Dead Center

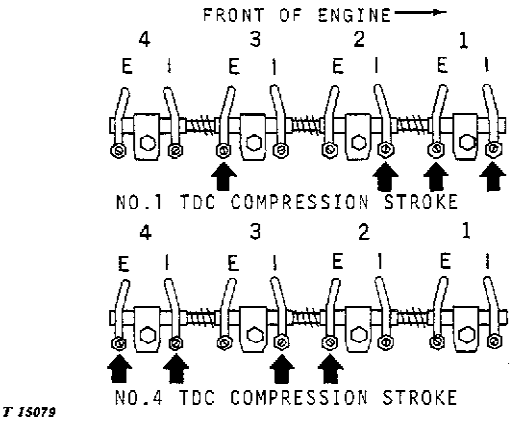

Fig. 4–Adjusting Valve Tappet Clearance

Adjust valve clearance on No. 1 and 3 exhaust valves to 0.018-inch for diesel and 0.022 inch for gasoline, and on No. 1 and 2 intake valves to clearance of 0.014 inch for both gasoline and diesel. Using a feeler gauge to measure clearance, turn valve adjusting nut up or down until clearance is correct.

Remove timing screw from flywheel. Rotate engine flywheel 360 degrees and reinsert timing screw into hole on flywheel rim.

Adjust valve clearance on No. 2 and 4 exhaust and No. 3 and 4 intake valves to clearances shown above.

Remove timing screw from flywheel and reinstall timing cover.

Retighten cylinder head cap screws and recheck valve clearances after one hour run-in with engine at 2500 rpm with 1/2 load.

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CYLINDER BLOCK, LINERS, PISTONS, AND RODS

GENERAL INFORMATION

CYLINDER BLOCK and crankcase are cast in one piece.

CYLINDER LINERS are of the replaceable wet-sleeve type, made of hardened alloy cast iron and are a slip fit in the cylinder block. The flange of each liner rests on a shoulder within the block and is sealed by a square rubber packing on early models. Later models have two additional packings in the engine block to seal the lining.

The top edge of the liner is sealed flush with the cylinder block by the compression of the cylinder head and gasket.

PISTONS are aluminum-alloy, cam ground and weight controlled, with two compression rings and one oil control ring. The crown of each diesel piston has a cut-out swirl cup.

CONNECTING RODS have a bronze bushing for the piston pin and a replaceable, steel-backed, aluminum-lined bearing insert.

REMOVAL

Remove the pistons and connecting rods noting the following:

1. Engine normally need not be removed from unit to service pistons, connecting rods, and cylinder liners. If engine has to be removed, see Section 10, Group 25.

2. Do not rotate crankshaft with cylinder head removed unless all cylinder liners are bolted down. Bolt down cylinder liners before removing pistons.

3. Keep rod bearing inserts with their respective rods and caps to assure correct reassembly.

4. Each connecting rod and piston must be reinstalled in the cylinder bore from which it was removed. Observe the word "FRONT" stamped on the head of all pistons and in the rib of the diesel connecting rods. These must face toward the fan end of the engine at the time of reassembly. *Observe the "pip" marks on both the connecting rod and cap of a gasoline engine. These "pip" marks must both face towards the fan end of the engine at the time of reassembly.*

REPAIR

5. Measure cylinder liners for clearance before removal from the cylinder block. See "Repair" in this group.

Inspect all parts and compare with "Specifications". Refer to "Basic Engine" in FOS Manual - ENGINES - for additional repair information.

Use a strong household detergent to remove all dirt and carbon from pistons. Clean carbon from piston ring grooves. Wash all parts thoroughly in cleaning solvent.

Inspect and measure piston pin, pin bore in piston, and connecting rod bushing for wear or damage. Excessive wear can cause scored pistons or broken connecting rods. Specifications are as follows:

Item	New Part	Wear Tolerance
O.D. of pin	1.1875 to 1.1879 in.	0.0005 in.
I.D. of bore	1.1880 to 1.1883 in.	0.0010 in.
I.D. of bushing	1.1886 to 1.1896 in.	0.0020 in.

Check ring grooves for excessive wear by inserting a new ring in the proper groove at several points around the piston. Measure clearance between ring and groove with a feeler gauge. If the clearance exceeds 0.008 inch, replace the piston.

Check clearance between piston and cylinder liner bore to determine if replacement is necessary. Measure clearance with a feeler gauge at the bottom of piston skirt 90° to pin bore. To establish taper and out-of-round, check liner 1 inch from bottom and 1 inch from top, lengthwise and crosswise. Wear limits are as follows:

Specifications	Measurement
Liner Taper (maximum)	0.0020 in.
Liner Out-of-Round (maximum) . .	0.0020 in.
Clearance Between Liner and Piston at Bottom of Skirt (maximum) . .	0.0060 in.

Piston rings should never be reinstalled on a piston once they have been removed. Throw away old rings and replace with new ones.

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