



# 2940 Tractor



JOHN DEERE

## TECHNICAL MANUAL 2940 Tractor

TM1220 (01MAR83) English

**John Deere Tractor Works**  
**TM1220 (01MAR83)**

LITHO IN U.S.A.  
ENGLISH



# 2940 TRACTOR TECHNICAL MANUAL TM-1220 (MAY-82)

## CONTENTS

### SECTION 10 - GENERAL

- Group 00 - Specifications and Special Tools
- Group 05 - Predelivery, Delivery, and After-Sales Inspections
- Group 10 - Lubrication and Service
- Group 15 - Tune-Up
- Group 20 - Tractor Separation

### SECTION 20 - ENGINE

- Group 00 - Specifications and Special Tools
- Group 05 - General Information, Diagnosing Malfunctions
- Group 10 - Cylinder Head, Valves and Camshaft
- Group 15 - Cylinder Block, Liners, Pistons and Rods
- Group 20 - Crankshaft, Main Bearings and Flywheel
- Group 25 - Timing Gear Train
- Group 30 - Engine Lubrication System
- Group 35 - Engine Cooling System

### SECTION 30 - FUEL SYSTEM

- Group 00 - Specifications and Special Tools
- Group 05 - General Information, Diagnosing Malfunctions
- Group 10 - Fuel Tank, Transfer Pumps, and Filter
- Group 15 - Roto Diesel Fuel Injection Pump
- Group 20 - Fuel Injection Nozzles
- Group 25 - Ether Starting Aids
- Group 30 - Speed Control Linkage
- Group 35 - Air Intake System

### SECTION 40 - ELECTRICAL SYSTEM

- Group 00 - Specifications and Special Tools
- Group 05 - Description and Diagnosing Malfunctions
- Group 10 - Wiring Harnesses
- Group 15 - Controls and Instruments
- Group 20 - Lighting System
- Group 25 - Wiring Diagram
- Group 30 - Starting Motor
- Group 35 - Alternator

### SECTION 50 - POWER TRAIN

- Group 00 - Specifications and Special Tools
- Group 05 - Description, Operation and Lubrication System
- Group 10 - Clutch Operating Assemblies
- Group 15 - Engine Clutches
- Group 20 - Hi-Lo Shift Unit
- Group 25 - Transmission Shift Linkage
- Group 30 - Synchronized Transmission and Transmission Oil Pump
- Group 35 - Differential
- Group 40 - Final Drive
- Group 45 - Independent PTO
- Group 50 - Mechanical Front Wheel Drive

### SECTION 60 - STEERING SYSTEM AND BRAKES

- Group 00 - Specifications and Special Tools
- Group 05 - Steering System
- Group 10 - Brakes

All information, illustrations and specifications contained in this technical manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

COPYRIGHT© 1982  
DEERE & COMPANY  
Moline, Illinois  
All rights reserved  
Previous Edition  
Copyright© 1980 Deere & Company

---

**CONTENTS - Continued****SECTION 70 - HYDRAULIC SYSTEM**

- Group 00 - Specifications and Special Tools
- Group 05 - Hydraulic System Operation and Tests
- Group 10 - Oil Reservoir, Filter, Valves and Oil Cooler
- Group 15 - Hydraulic Pump
- Group 20 - Rockshaft
- Group 25 - Selective Control Valve and Breakaway Coupler
- Group 30 - Remote Cylinder

**SECTION 80 - MISCELLANEOUS**

- Group 00 - Specifications
- Group 05 - Front Axle
- Group 10 - Front and Rear Wheels

**SECTION 90 - OPERATOR'S STATION**

- Group 00 - Specifications and Special Tools
- Group 05 - Air Conditioning System
- Group 10 - Cab Ventilation and Heating
- Group 15 - Seats
- Group 20 - Sound Gard Body
- Group 25 - Roll-Gard Protective Structure

# Section 10 GENERAL

## CONTENTS OF THIS SECTION

	Page		Page
<b>GROUP 00 - SPECIFICATIONS AND SPECIAL TOOLS</b>		<b>GROUP 05 - PREDELIVERY, DELIVERY AND AFTER-SALES INSPECTIONS</b>	
Specifications .....	10-00-3	Tractor Storage .....	10-05-1
Serial Numbers .....	10-00-3	Predelivery Inspection .....	10-05-2
Model Numbers .....	10-00-3	Delivery Inspection .....	10-05-8
Engine .....	10-00-3	After-Sales Inspection .....	10-05-9
Engine Clutch .....	10-00-4		
Cooling System .....	10-00-4	<b>GROUP 10 - LUBRICATION AND SERVICE</b>	
Fuel System .....	10-00-4	Lubrication and Service .....	10-10-1
Electrical System .....	10-00-4		
Synchronized Transmission .....	10-00-4	<b>GROUP 15 - TUNE-UP</b>	
Hi-Lo Shift Unit .....	10-00-4	Preliminary Engine Testing .....	10-15-1
Differential and Final Drives .....	10-00-5	Dynamometer Test .....	10-15-1
Differential Lock .....	10-00-5	Testing Compression Pressure .....	10-15-2
PTO .....	10-00-5	Tune-Up .....	10-15-3
Mechanical Front Wheel Drive .....	10-00-5	Checking Tractor Operation .....	10-15-8
Hydrostatic Steering .....	10-00-6	Standard Torques .....	10-15-9
Foot Brakes .....	10-00-6		
Handbrake .....	10-00-6	<b>GROUP 20 - TRACTOR SEPARATION</b>	
Hydraulic System .....	10-00-6	Separating between Engine and	
Capacities .....	10-00-6	Tractor Front End .....	10-20-1
Travel Speeds .....	10-00-6	Removal and Installation of Engine .....	10-20-5
Front and Rear Wheels .....	10-00-6	Removal and Installation of	
Dimensions and Weights .....	10-00-6	Clutch Housing .....	10-20-7
Predelivery, Delivery and		Removal and Installation of	
After-Sales Inspections .....	10-00-7	Final Drives .....	10-20-9
Lubrications and Service .....	10-00-8	Removal and Installation of	
Tune-up .....	10-00-9	Rockshaft .....	10-20-11
Tractor Separation .....	10-00-10	Removal of Sound-Gard Body .....	10-20-13
Standard Torques .....	10-00-11	Installation of Sound-Gard Body .....	10-20-17
Special Tools .....	10-00-13		

**Group 00**

# SPECIFICATIONS AND SPECIAL TOOLS

## SPECIFICATIONS

### Serial Numbers

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

*NOTE: When ordering engine parts, quote all digits of serial number stamped on the plate*

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

*NOTE: When ordering tractor service parts (excluding engine parts), quote all digits of serial number stamped on the plate.*

A plate showing the tractor type, transmission serial number, cone point measurement etched into pinion face of differential drive shaft (as well as reduction of differential) is located on the right-hand side of the transmission case.

### Model Numbers

The fuel injection pump, fuel injection nozzles, alternator, starting motor, hydrostatic steering valve and hydraulic pump have model numbers to facilitate identification of different makes of a given unit.

### Engine

Number of cylinders .....	6
Cylinder liner bore .....	106.5 mm (4.19 in.)
Stroke .....	110 mm (4.33 in.)
Displacement .....	5883 cm <sup>3</sup> (359 cu. in.)
Compression ratio .....	16.8:1
Maximum torque at 1400 rpm .....	320 N·m (236 ft·lb)
Firing order .....	1-5-3-6-2-4
Valve clearance (engine hot or cold)	
Intake valve .....	0.35 mm (0.014 in.)
Exhaust Valve .....	0.45 mm (0.018 in.)
Fast idle speed .....	2660 rpm
Slow idle speed .....	750 rpm
Rated engine speed .....	2500 rpm
Working speed range .....	1400 to 2500 rpm

PTO\* Horsepower at engine rated speed—2500 rpm ..... 60 kW (80 HP)

Lubrication system ..... Full internal force feed system with full flow filter

**Engine Clutch** ..... Single dry disk clutch with torsion damper, foot-operated

**Cooling System**

Type ..... Pressurized system with centrifugal pump

Temperature regulation ..... Two thermostats

**Fuel System**

Type ..... Direct injection

Fuel injection pump timing to engine ..... TDC

Fuel injection pump type ..... Distributor type

Air cleaner ..... Dry-type air cleaner with secondary (safety) element

**Electrical System**

Batteries ..... 2 x 12 volts, 88 Ah

Alternator with internal regulator ..... 14 volts, 33 or 55 amps.

Starting motor ..... 12 volts (3 kW) (4 HP)

Battery terminal grounded ..... Negative

**Synchronized Transmission**

Type ..... Synchronized transmission

Gear selections ..... 8 forward and 4 reverse

Gear shifting ..... Two forward groups and one reverse group  
Synchronized forward and reverse shifting within groups

**Hi-Lo Shift Unit**

Type ..... Hydraulic gear reduction unit which can be shifted under load with "wet" multiple disk clutch and brake packs

Travel speed decreases in each gear by ..... Approx. 20 percent

Shifting to reduced (Low) speed ..... Preloaded cup springs

Shifting to normal (High) speed ..... Hydraulic

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

**Differential and Final Drives**

Type of differential ..... Spiral bevel gears

Type of final drive ..... Planetary reduction drive

**Differential Lock**

Operation ..... Hand or foot operated

Disengage ..... Will disengage automatically as soon as traction has equalized

**PTO**

Type ..... Independent of transmission, can be engaged and disengaged under load

PTO speeds (with engine speed of 2400 rpm) ..... 540/1000 rpm

PTO clutch ..... Hydraulically operated "wet" disk clutch

PTO brake ..... Hydraulically operated "wet" disk brake

**ENGINE/PTO SPEED RELATIONSHIPS**

Engine speed	540 rpm shaft	1000 rpm shaft
800	180	335
2400	540	1000
2500	565	1040
2660	600	1110

**Mechanical Front Wheel Drive**

Type ..... Engaged hydraulically, under full load with "wet" disk clutch

Control ..... Electrical/hydraulic solenoid switch

Engagement ..... Preloaded cup springs

Disengagement ..... Hydraulic

## Group 10

**CYLINDER HEAD, VALVES AND CAMSHAFT****GENERAL INFORMATION**

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

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

The camshaft has an eccentric lobe to actuate the fuel transfer pump.

**DIAGNOSING MALFUNCTIONS****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

**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

**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



**PRELIMINARY VALVE CHECKS**

**Checking Valve Clearance**

*NOTE: Valve clearance can be checked with engine cold or warm.*

1. Disconnect battery ground straps.
  2. Remove radiator and fuel tank caps as well as muffler extension. Remove radiator side grille screens and engine hood.
  3. Reinstall radiator and fuel tank caps.
  4. Remove muffler.
  5. *On tractors with air conditioning, loosen compressor attaching screws and lift off compressor.*
- NOTE: The two refrigerant lines may remain attached to the compressor.*
6. Remove rocker arm cover and breather tube.

7. Using engine rotation tool JDE-83 (see Fig. 1) rotate engine flywheel and therefore crankshaft in running direction until No. 1 piston (front) has reached top dead center (TDC) on the compression stroke. **IMPORTANT!** Do not confuse with exhaust stroke.

*NOTE: With No. 1 piston at "TDC," intake and exhaust valve springs of No. 1 cylinder are not under tension.*

8. Insert timing pin JDE-81-4 in flywheel housing bore (Fig. 1). Timing pin can be inserted further into flywheel bore as soon as "TDC" is exactly reached.

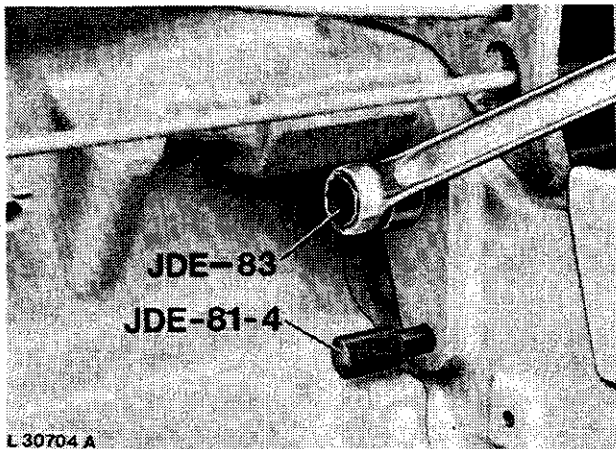
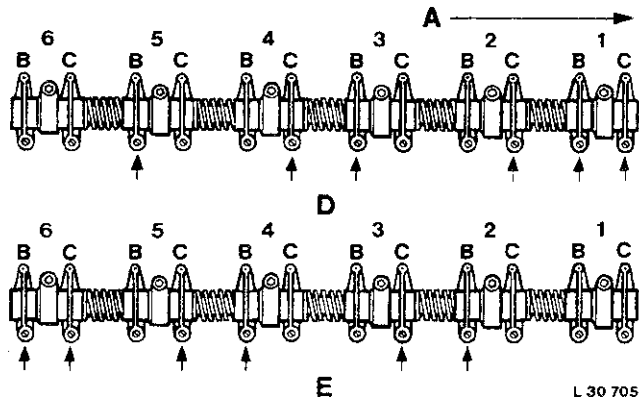


Fig. 1 - Obtaining "TDC"



- A—Front of Engine
- B—Exhaust Valves
- C—Intake Valves
- D—No. 1 Piston at TDC Compression Stroke
- E—No. 6 Piston at TDC Compression Stroke

Fig. 2 - Checking Valve Clearance

**Valve Clearance Specifications**

Intake Valves	0.35 mm (0.014 in.)
Exhaust Valves	0.45 mm (0.018 in.)

9. Using a feeler gauge, check clearance of the exhaust valves of cylinders No. 1, 3 and 5 and the intake valves of cylinders No. 1, 2 and 4 (Fig. 2).

10. Pull timing pin out of flywheel bore, turn crankshaft one complete revolution (360°) and insert timing pin again into flywheel bore. No. 6 cylinder is now at "TDC."

*NOTE: With No. 6 piston at "TDC," intake and exhaust valve springs of No. 6 cylinder are not under tension.*

11. Check clearance of exhaust valves of cylinders No. 2, 4 and 6 and intake valves of cylinders No. 3, 5 and 6 to the specifications listed above (see also Fig. 2).

12. When necessary, adjust valve clearances (see page 12).

**Checking Valve Lift**

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

1. Set valve clearance to specifications as previously indicated.
2. Place dial indicator on rotator (Fig. 3). Make sure valve is fully closed and rocker arm moves freely.
3. Manually turn engine in running direction with JDE-83 Engine Rotation Tool.
4. After rocker arm contacts valve stem, observe dial indicator reading as valve is moved to full open position. Repeat valve lift check on each valve.

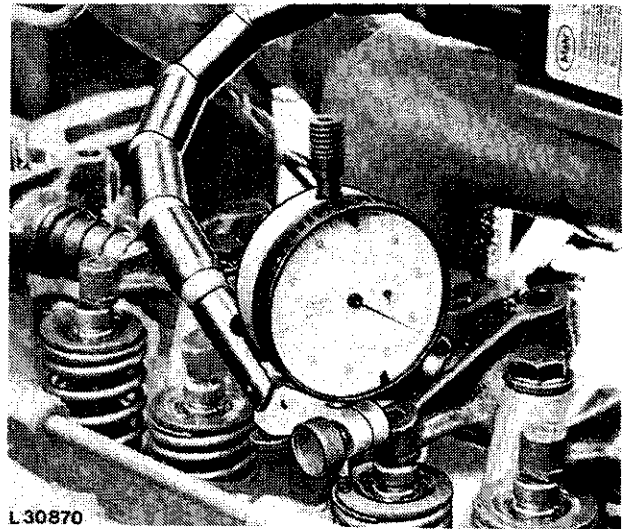


Fig. 3 - Checking Valve Lift

**Valve Lift Specifications**

Intake Valves	11.7 to 12.5 mm
	0.460 to 0.490 in.
Wear tolerance	11.0 mm
	0.430 in.
Exhaust Valves	11.6 to 12.2 mm
	0.456 to 0.482 in.
Wear tolerance	10.8 mm
	0.426 in.

5. Coat upper side of rocker arm cover gasket evenly with a thin layer of "Scotch Grip 10009" from "3M."
6. Install gasket and cover and tighten cover cap screws to 10 N·m (7 ft-lb) torque.
7. Complete installation of all parts removed, reversing removal procedure.

## CYLINDER HEAD AND VALVES

### Removal

#### CYLINDER HEAD

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

*When removing, identify parts to facilitate reinstallation.*

1. Disconnect battery ground straps.
2. Remove radiator grille screens and engine hood.
3. Drain coolant into a suitable container
4. Remove muffler and exhaust manifold.
5. Disconnect fuel lines at fuel injection nozzles and fuel injection pump and remove lines. Plug open ends with plastic caps.
6. Remove fuel injection nozzles.
7. Disconnect fuel leak-off line.
8. Pull off cable at coolant temperature gauge sending unit.
9. Disconnect upper coolant hose.
10. Remove thermostat housing.
11. Remove fuel filter and disconnect fuel lines.
12. *When equipped:* Disconnect/remove starting fluid aid.
13. Remove air intake support.
14. *On tractors with air conditioning,* loosen compressor attaching screws. Lift off compressor.

*NOTE: The two refrigerant lines may remain attached to the compressor.*

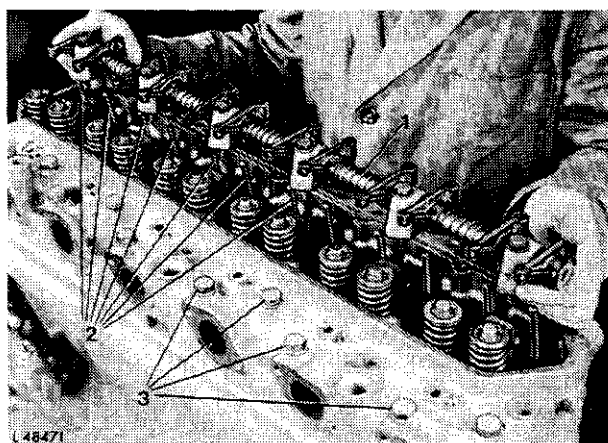
15. Remove rocker arm cover together with engine breather.

16. Remove rocker arm shaft (see below).

17. Remove cylinder head cap screws and lift off cylinder head assy.

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

#### ROCKER ARM SHAFT



- 1—Rocker Arm Shaft
- 2—Push Rods
- 3—Cylinder Head Cap Screws

*Fig. 4 - Removal of Rocker Arm Shaft Assembly*

1. Remove rocker arm shaft support cap screws and lift out complete rocker arm shaft assembly.

#### VALVES

*NOTE: Before removing valves, mark all valves and valve springs so that they can be reinstalled in their original positions.*

1. Using a commercial valve spring compressor, remove valves from cylinder head.

## Inspection and Repair

### CYLINDER HEAD

#### Checking for Warpage

1. Thoroughly clean cylinder head externally and internally.
2. Check cylinder head for cracks.
3. Check machined surface of cylinder head for damage.
4. Clean all carbon deposits from cylinder head by scraping or brushing with a wire brush.
5. Remove carbon deposits from bores for fuel injection nozzles. Use special tool JDE-39.

**IMPORTANT:** Always turn the tool clockwise through the bore even when pulling back, otherwise tool will get dull.

6. Check cooling passages for lime deposits. If necessary, clean using a suitable cooling system cleaner.

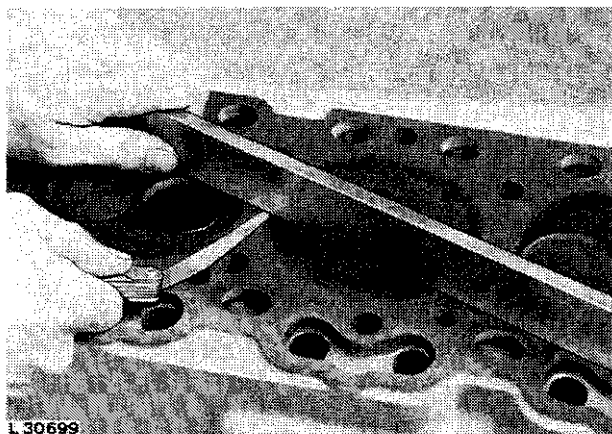


Fig. 5 - Checking Cylinder Head for Warpage

7. Using a heavy, accurate straight-edge and feeler gauge (see Fig. 5), check machined surface of cylinder head for warpage. Check at several places.

8. Maximum permissible warpage is 0.025 mm (0.001 in.) for each 127 mm (5 in.) length of cylinder head.

9. Machined surface of cylinder head must be refaced if warpage is more than specified maximum.

*NOTE:* Maximum permissible amount to be machined from cylinder head is 0.76 mm (0.03 in.).

#### Checking Valve Guides

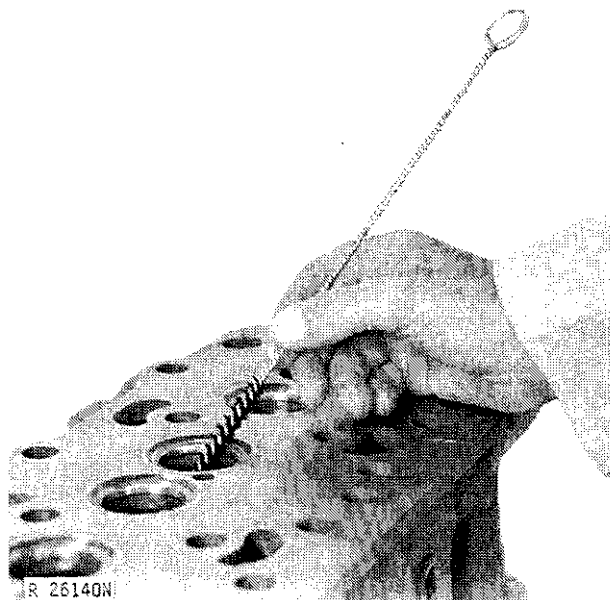
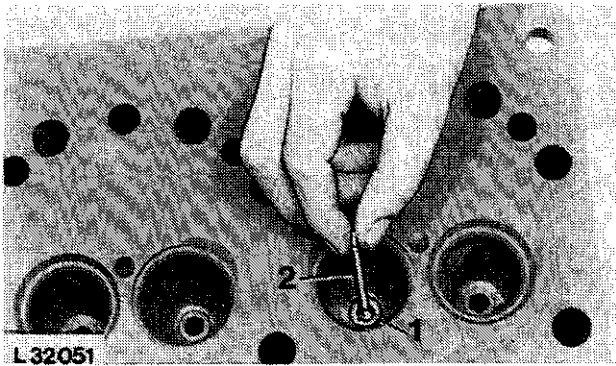


Fig. 6 - Cleaning Valve Guides

1. Use a valve guide cleaning brush D-17011 BR to clean valve guides before inspection or repair.

*NOTE:* A few drops of light oil or kerosene will help to fully clean the guide.



1—Valve Guide  
2—Telescope Gauge

Fig. 7 - Checking Valve Guide

2. Measure valve guides for wear as shown in Fig. 7.

I.D. of guide bore in a new head . . . . . 9.51 to 9.53 mm  
0.374 to 0.375 in.

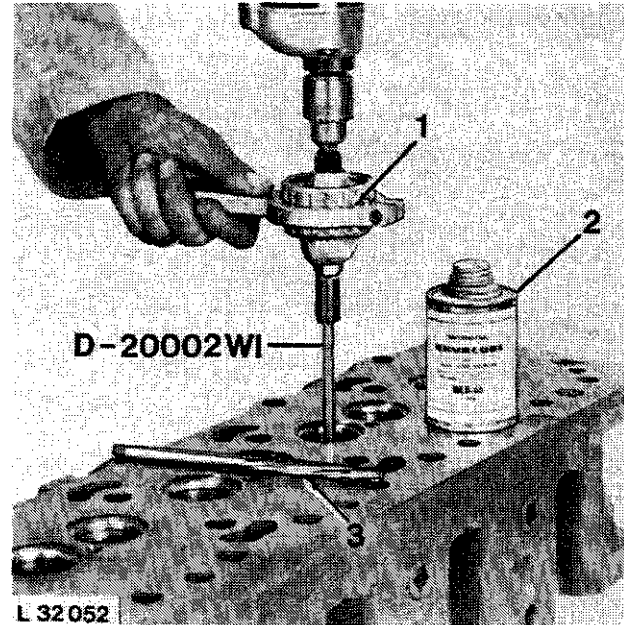
New guide-to-valve system  
clearance . . . . . 0.05 to 0.10 mm  
0.002 to 0.004 in.

Max. permissible clearance . . . . . 0.15 mm  
0.006 in.

**NOTE:** Worn guides can allow a clearance of 0.15 mm (0.006 in.) and still be acceptable. Worn guides may be knurled to return them to specified clearance if valve-to-guide clearance is 0.25 mm (0.010 in.) or less. If clearance exceeds 0.25 mm (0.010 in.) install oversize valves.

3. Use No. D-20002WI Knurling Set to knurl valve guides (Fig. 8).

**NOTE:** Use tool set exactly as directed by the manufacturer.



1—Speed Reducer  
2—Lubricant  
3—Reamer

Fig. 8 - Knurling Valve Guides

**Cleaning Valve Seats**

1. Use an electric hand drill with wire cleaning brush (Fig. 9) and remove all carbon.
2. Check valve seats for cracks, pits, or excessive wear.
3. If necessary, recondition valve seat by grinding.

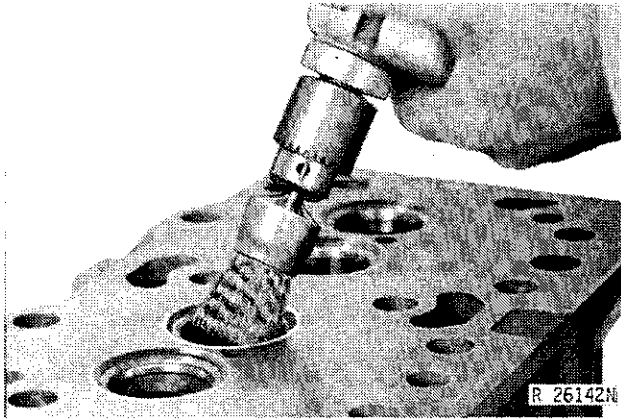


Fig. 9 - Cleaning Valve Seats

**Grinding Valve Seats**

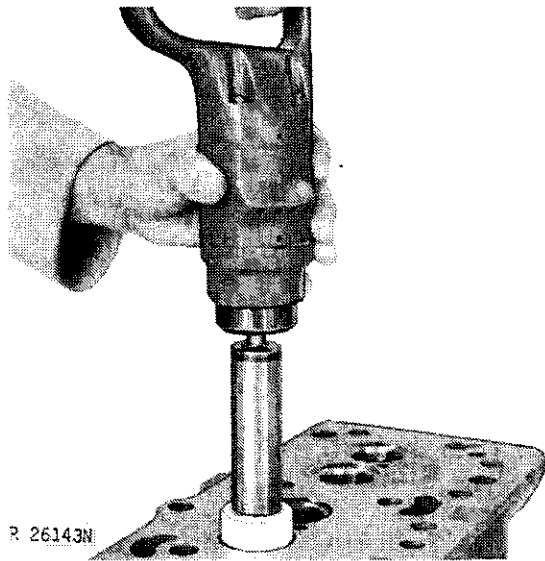


Fig. 10 - Grinding Valve Seats

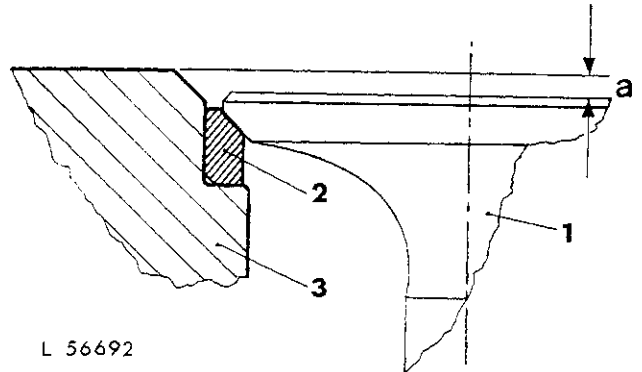
*NOTE: Keep your working area clean.*

1. Do not grind too long. Only a few seconds are required to recondition the average valve seat. Avoid the natural tendency to grind off too much.

2. Do not use too much pressure. While grinding, support the weight of the driver to avoid excess pressure on the stone.

3. Check the seat width and contact pattern between the seat and valve with blueing.

**Measuring Valve Recess**



- a—Clearance between valve and surface of cylinder head
- 1—Valve
- 2—Valve seat (replaceable steel insert)
- 3—Cylinder head

Fig. 11 - Valve and Seat Insert

Minimum clearance between an intake valve and surface of cylinder head .....	0.60 to 1.20 mm 0.024 to 0.047 in.
--	---------------------------------------

Minimum clearance between an exhaust valve and surface of cylinder head .....	1.00 to 1.80 mm 0.039 to 0.071 in.
---	---------------------------------------

Reconditioning of valve seats is possible only up to a specified limit. Valve recess should not be more than 3 mm (1.118 in.) below surface of cylinder head (see dimension "a," Fig. 11).

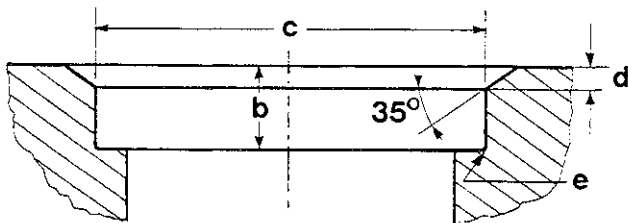
Therefore the replaceable exhaust valve seats (steel inserts) must be replaced as soon as valve recess exceeds 3 mm (0.118 in.) (see "a," Fig. 11). If this dimension is reached by an intake valve, the cylinder head can be rebored and a replacement valve seat insert installed.

**Replacing Valve Seats**

**IMPORTANT: Regrind replacement 30° intake valve seat inserts to an angle of 45° when installed.**

*NOTE: Installation of exhaust or intake valve inserts should be carried out by a specialized workshop. Replacement exhaust and intake valve seat inserts are available from your John Deere parts depot.*

1. Grind used valve to valve seat I.D.
2. Spot weld ground valve to valve seat I.D.
3. Using a hammer, drive out valve seat.



L 56693 A

**Exhaust valve:**  
 b—9.08 to 9.20 mm (0.357 to 0.362 in.)  
 c—41.57 to 41.59 mm (1.636 to 1.637 in.)  
 d—2.31 to 2.57 mm (0.091 to 0.101 in.)  
 e—Radius - 0.5 mm (0.019 in.)

**Intake valve:**  
 b—8.32 to 8.44 mm (0.327 to 0.332 in.)  
 c—47.16 to 47.18 mm (1.856 to 1.857 in.)  
 d—2.69 to 2.59 mm (0.106 to 0.116 in.)  
 e—Radius - 0.5 mm (0.019 in.)

Fig. 12 - Dimensions for Boring Valve Insert Bore in Cylinder Head

*NOTE: The surface finish of bore ("c," Fig. 12) should not exceed 0.00158 mm (63 micro-inch).*

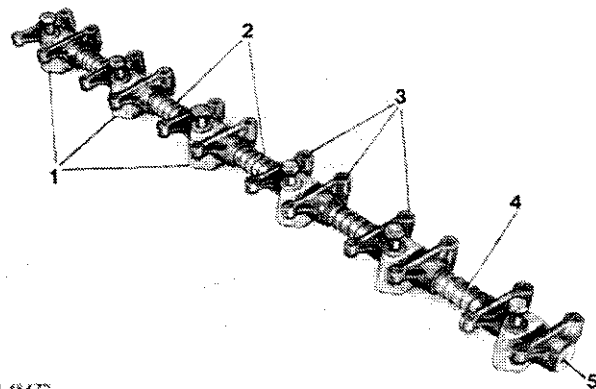
4. Machine insert bores in cylinder head to dimensions given in Fig. 12.

*NOTE: Replacement valve seat inserts have a larger diameter than original (factory installed) inserts.*

5. Freeze valve seat inserts to -30°C (-22°F). Place inserts into cylinder head bores, maintaining a pressure of 1000 N (220 lb) on each insert for one minute, to ensure that inserts do not "creep" out when warming up.
6. Regrind valve seats until a valve seat width of 1.5 to 2.0 mm (0.06 to 0.08 in.) has been obtained (intake or exhaust valve).
7. Install valves and check measurement ("a," Fig. 11). If necessary, grind valve seat to dimensions.

**ROCKER ARM SHAFT**

*NOTE: When removing, identify parts of correct reinstallation.*



L 48472

- 1—Rocker Arm Support
- 2—Springs
- 3—Rocker Arms
- 4—Rocker Arm Shaft
- 5—Plug

Fig. 13 - Rocker Arm Shaft Assembly

1. Remove rocker arm shaft end plugs (5, Fig. 13) and slide components from shaft.
2. Inspect rocker arm shaft for scratches, scores, or excessive wear at points of rocker arm contact.

*NOTE: Wear could indicate weak valve springs, bent push rods, or loose rocker arm shaft clamps.*

3. Make sure that all oil bores in the rocker arm shaft, the rocker arms, and the adjusting screws are clear.
4. Thoroughly clean cavities of rocker arm supports, especially cavity of rear support, through which the oil passes to the rocker arm shaft.
5. Check rocker arm adjusting nuts and screws for damage.
6. Check concave wear on ends of rocker arms where they contact valve ends.
7. Examine spacer springs on shaft between rocker arms, and be sure they are strong enough to exert a positive pressure on arms.

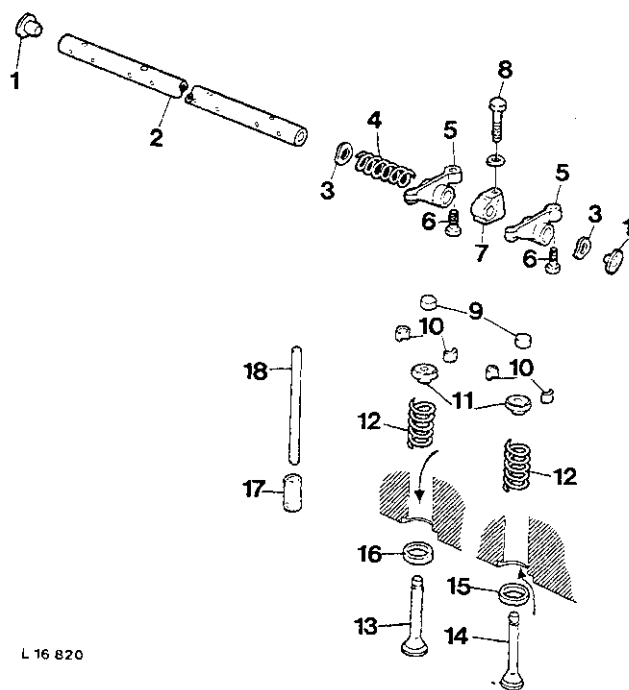
Spring tension at a length of  
 46 mm (1.81 in.) ..... 18 to 27 N  
 4 to 6 lb

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

**VALVES**

1. Check valve spring caps (11, Fig. 14) for wear or damage.
2. Replace valve stem caps (9) if pitted or worn.

3. Visually check valve face and stem for wear or damage.
4. Perform the following cleaning procedure before measuring or repairing valves.



- |                      |                              |
|----------------------|------------------------------|
| 1—Plug               | 10—Keepers                   |
| 2—Rocker Arm Shaft   | 11—Valve Spring Cap          |
| 3—Special Washer     | 12—Valve Spring              |
| 4—Spring             | 13—Intake Valve              |
| 5—Rocker Arm         | 14—Exhaust Valve             |
| 6—Adjusting Screw    | 15—Exhaust Valve Seat Insert |
| 7—Rocker Arm Support | 16—Intake Valve Seat Insert  |
| 8—Cap Screw          | 17—Cam Follower              |
| 9—Valve Stem Cap     | 18—Push Rod                  |

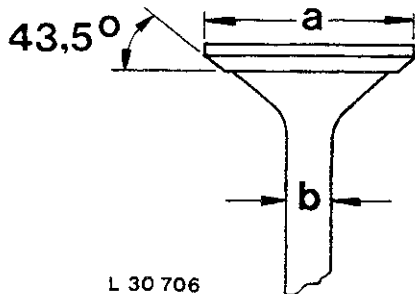
Fig. 14 - Rocker Arm Shaft Assembly and Valves, Exploded View



**Cleaning and Checking Valves**

1. Hold each valve firmly against a wire brush in a bench grinder.
2. Make sure all carbon is removed from the valve head, face, and stem.

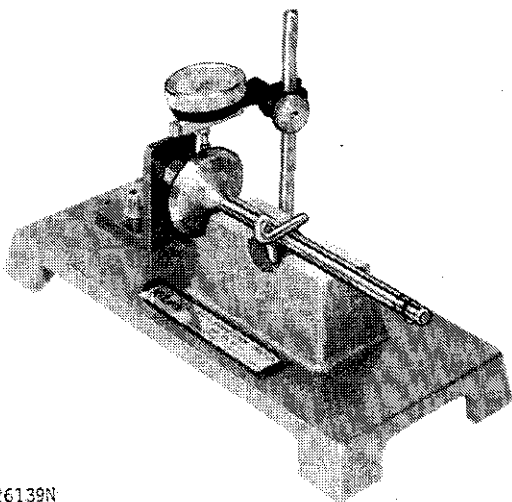
**IMPORTANT:** Any carbon left on the stem will affect alignment in valve refacer if valves need to be refaced.



- a—Intake valve: 44.88 to 45.13 mm (1.767 to 1.777 in.)  
Exhaust valve: 39.88 to 40.13 mm (1.570 to 1.580 in.)
- b—9.43 to 9.46 mm (0.371 to 0.372 in.)

Fig. 15 - Valve Specifications

3. Polish the valve stems with steel wool or fine emery cloth to remove any scratch marks left by the wire brush.
4. Compare valve stems O.D. ("b," Fig. 15) with valve guide I.D. to determine stem-to-guide clearance (see page 20-10-6).



R 26139N

Fig. 16 - Inspecting Valves

5. Use D-05058ST Valve Inspection Center (Fig. 16) to determine if valves are out-of-round, bent, or warped.

**Valve Springs**

1. Inspect valve springs for alignment, wear, and damage.
2. Place springs on a flat surface to see that they are square and parallel.
3. Check valve spring tension on a spring tester.

*NOTE:* Free length of springs may differ slightly, but compressed length must be the same.

Free length .....	54 mm 2.125 in.
Length compressed at 240 to 280 N (54 to 62 lb) Valves closed .....	46 mm 1.813 in.
Length compressed at 600 to 680 N (133 to 153 lb) Valves opened .....	34.5 mm 1.359 in.

**Installation**

**VALVES**

1. Apply engine oil to valve stems and guides.
2. Install valves in guides from which they were removed.

*NOTE:* Valves must move freely and seat properly.

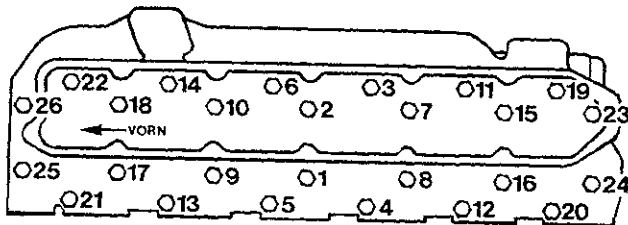
3. Install valve springs making certain that cylinder head end of spring is located correctly in machined counter bore of the head.
4. Install rotators.
5. Compress valve springs with valve spring compressor.
6. Install new retainers on valves.
7. Strike the end of each valve three or four times with a soft mallet to insure proper positioning of the retainers.

**CYLINDER HEAD**

1. Check cylinder liner protrusion (see Group 15).
2. Install new cylinder head gasket dry (without sealant).
3. Place cylinder head in correct position on engine block.

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

4. Dip cylinder head cap screws and washers in clean engine oil.



L 30707

Fig. 17 — Correct Sequence for Tightening Cylinder Head Cap Screws

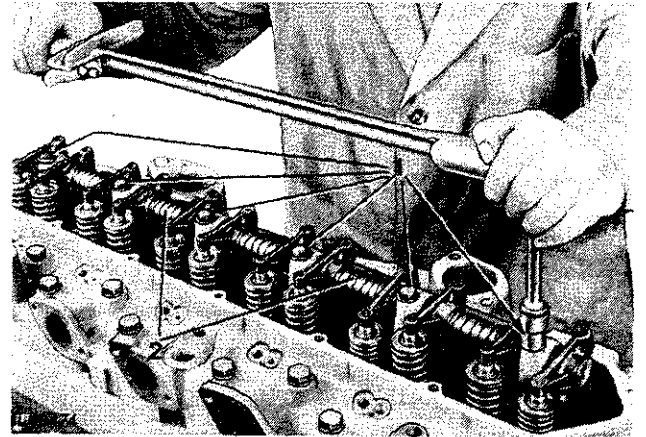
5. Gradually tighten cylinder head cap screws (dipped in oil) evenly, following the sequence outlined in Fig. 17 and finally tighten to 130 N·m (95 ft·lb) torque.
6. Place push rods into their original bores.
7. Place a valve cap on each stem and make certain that they turn freely.

**ROCKER ARM SHAFT**

1. Assemble the individual parts according to Fig. 14.
2. Place plugs on shaft ends.

**IMPORTANT: Make sure that oil bore in rocker arm shaft is at the side of the flywheel and facing down when assembly is installed on cylinder head.**

3. Lubricate all rocker arms liberally with engine oil and make sure that they move freely.



1—Cap Screws  
2—Rocker Arm Shaft Assembly

Fig. 18 - Tightening Rocker Arm Shaft Assembly

4. Install rocker arm shaft assembly and tighten attaching cap screws to 50 N·m (35 ft·lb) torque.

### Adjusting Valve Clearance

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

1. Using engine rotation tool JDE-83 rotate engine flywheel and therefore crankshaft in running direction until No. 1 piston (front) has reached top dead center (TDC) on the compression stroke. **IMPORTANT!** Do not confuse with exhaust stroke.

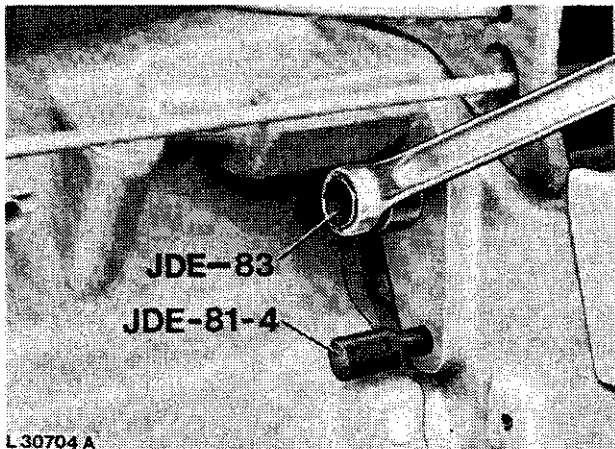
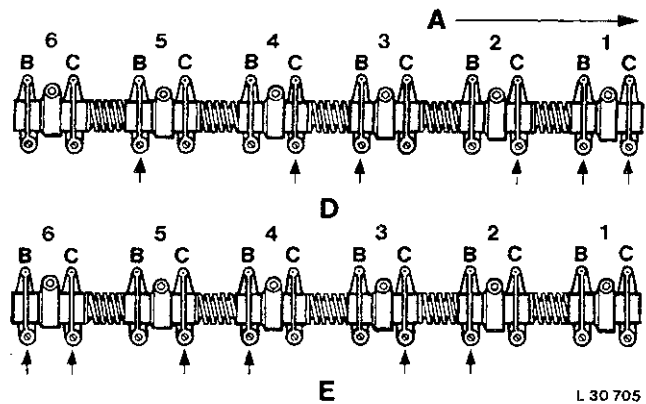


Fig. 19 - Obtaining "TDC"

**NOTE:** With No. 1 piston at "TDC," intake and exhaust valve springs of No. 1 cylinder are not under tension.

2. Insert timing pin JDE-81-4 in flywheel housing bore (Fig. 19). Timing pin can be inserted further into flywheel bore as soon as "TDC" is exactly reached.



A—Front of Engine  
 B—Exhaust Valves  
 C—Intake Valves  
 D—No. 1 Piston at TDC Compression Stroke  
 E—No. 6 Piston at TDC Compression Stroke

Fig. 20 - Checking Valve Clearance

#### Valve Clearance Specifications

Intake valves .....	0.35 mm (0.014 in.)
Exhaust valves .....	0.45 mm (0.018 in.)

3. Adjust valve clearance on No. 1, 3 and 5 exhaust valves and No. 1, 2 and 4 intake valves.

4. Thereby turning the self-locking valve adjusting screws (6, Fig. 14) up or down until specified valve clearance has been obtained.

**NOTE:** Gauge feeler should slide with slight resistance, but without jamming between valve stem cap and adjusting screw.

5. Pull timing pin out of flywheel bore, turn crankshaft one complete revolution (360°) and insert timing pin again into flywheel bore No. 6 cylinder is now at "TDC."

**Thank you very much for  
your reading. Please Click  
Here. Then Get COMPLETE  
MANUAL. NO WAITING**

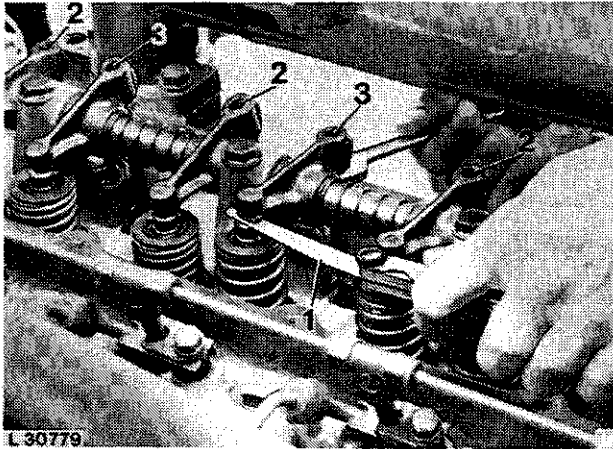


**NOTE:**

**If there is no response to  
click on the link above,  
please download the PDF  
document first and then  
click on it.**

*NOTE: With No. 6 piston at "TDC," intake and exhaust valve springs of No. 6 cylinder are not under tension.*

6. Adjust clearance of exhaust valves of cylinders No. 2, 4 and 6 and intake valves of cylinders No. 3, 5 and 6.



- 1—Feeler Gauge
- 2—Adjusting Screw of Intake Valve
- 3—Adjusting Screw of Exhaust Valve

*Fig. 21 - Adjusting Valve Clearance*

7. Run engine for 30 minutes at 2500 rpm.
8. Loosen cylinder head cap screws by 5° to 10°, then retighten in the sequence shown in Fig. 17 to 130 N·m (95 ft-lb) torque. Use torque wrench adapter JD-307 when tightening the cylinder head cap screws.
9. Recheck valve clearances and adjust, when necessary.
10. Coat upper side of rocker arm cover gasket evenly with a thin layer of "Scotch Grip 10009" from "3M."
11. Install gasket and cover and tighten cover cap screws to 10 N·m (7 ft-lb) torque.
12. Complete installation of all parts removed, reversing removal procedure.

## CAMSHAFT

### Checking Camshaft End Play

To remove and/or check the camshaft and related parts, it is not necessary to remove the engine. However, the front of the tractor must be separated to get access to the front of engine (see Section 10, Group 20).

1. Disconnect battery ground straps.
2. Separate tractor front end from engine.
3. *On tractors with air conditioning*, loosen compressor attaching screws and lift off compressor.

*NOTE: The two refrigerant lines may remain attached to the compressor.*

4. Remove muffler.
5. Remove rocker arm cover.
6. Remove rocker arm assembly.
7. Remove push rods.
8. Pull off torsion damper (see Group 20).
9. Remove oil pressure regulating valve.

*NOTE: Loosen all oil pan attaching screws to prevent gasket damage.*

10. Remove timing gear cover.
11. Remove upper idler gear.
12. Install a dial indicator as shown in Fig. 22.
13. Check camshaft end play.

New engine end play ..... 0.05 to 0.23 mm  
0.002 to 0.009 in.

Maximum permissible end play ..... 0.38 mm  
0.015 in.

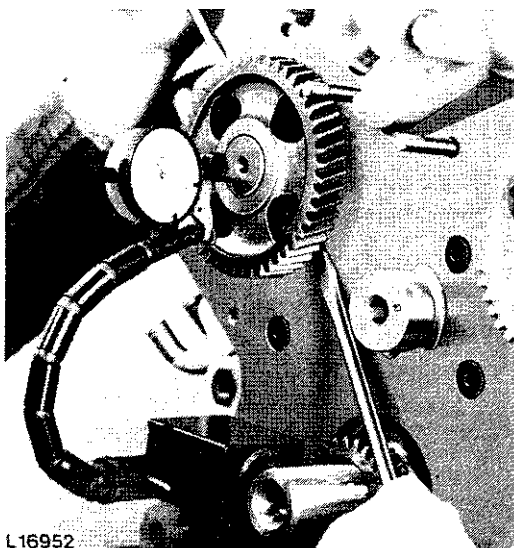


Fig. 22 - Measuring Camshaft End Play

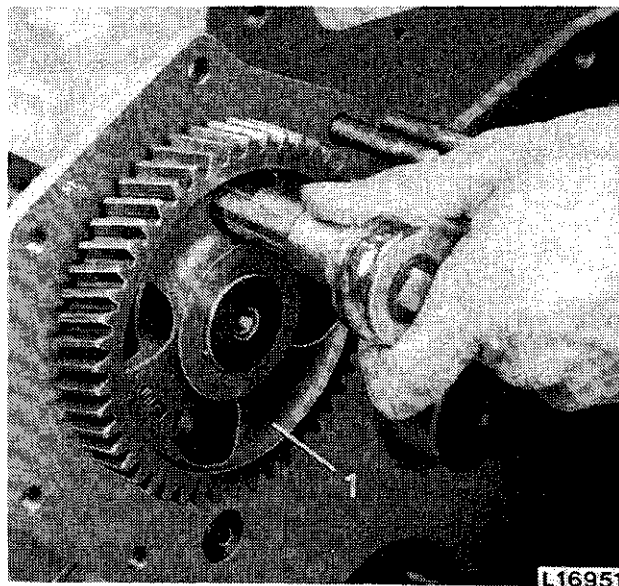
**NOTE:** If end play exceeds specifications then check thickness of thrust plate as this determines end play.

Thickness of new thrust plate .....	3.96 to 4.01 mm 0.156 to 0.158 in.
Maximum permissible wear .....	0.13 mm 0.005 in.

**Removal**

1. Remove cylinder head.
2. Remove all push rods and mark them so they can be reinstalled in their original bores.
3. Remove fuel transfer pump.
4. Remove thrust plate located behind camshaft gear (see Fig. 23).
5. Remove camshaft.

**NOTE:** When removing camshaft, be careful that lobes do not damage the bearing surfaces in bores.



1—Camshaft gear

Fig. 23 - Removing Camshaft Thrust Plate

**Repair**

1. Check camshaft journals and lobes for excessive wear. If necessary, replace camshaft and gear.
2. Measure each of the four journals of the camshaft as well as the corresponding bores in two opposing planes.

O.D. of journals on new camshaft .....	55.87 to 55.90 mm 2.200 to 2.201 in.
--	---

Dia. of camshaft journal bores in engine block .....	55.98 to 56.01 mm 2.204 to 2.205 in.
--	---

Clearance .....	0.10 to 0.15 mm 0.004 to 0.006 in.
-----------------	---------------------------------------

3. Measure thickness of thrust plate since this plate determines camshaft end play.
4. If necessary, replace camshaft with gear.

**NOTE:** ALWAYS replace cam followers when installing a new camshaft.

## Installation

Install camshaft, observing the following:

1. Coat camshaft with light, clean engine oil.
2. When installing, make sure that cam lobes do not damage bearing bores in block.
3. Rotate camshaft until cap screws attaching thrust plate can be installed and tighten them to 50 N·m (35 ft-lb) torque.
4. Check camshaft end play (see Fig. 22). A new camshaft and a new thrust plate should add up to the proper end play.
5. With crankshaft at TDC and piston No. 1 (front) on compression stroke, adjust camshaft for valve timing.
6. Use timing tool No. JD-254 to align timing mark "b" on camshaft gear (Fig. 24) with center of crankshaft and camshaft.
7. Check timing of fuel injection pump gear and if necessary, adjust as described in Group 25.
8. With camshaft and fuel injection pump gears timed correctly, install upper idler gear and tighten cap screw to 90 N·m (65 ft-lb) torque.
9. Install cam followers, cylinder head, timing gear cover and fuel transfer pump.
10. Attach tractor front-end to engine (see Section 10, Group 20).
11. Run engine for 30 minutes at 2500 rpm.
12. Loosen cylinder head cap screws by 5° to 10°, then retighten in the sequence shown in Fig. 17 to 130 N·m (95 ft-lb) torque. Use torque wrench adapter JD-307 when tightening the cylinder head cap screws.

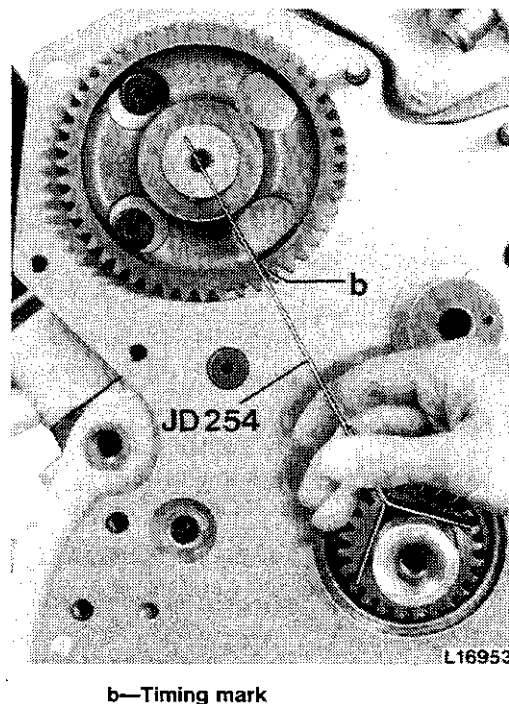


Fig.24 - Timing Camshaft Gear by Means of Timing Tool No. JD 254

13. Recheck valve clearances and adjust, when necessary.
14. Coat upper side of rocker arm cover gasket evenly with a thin layer of "Scotch Grip 10009" from "3M."
15. Install gasket and cover and tighten cover cap screws to 10 N·m (7 ft-lb) torque.
16. Complete installation of all parts removed, reversing removal procedure.