3030 and 3130 Tractors

JOHN DEERE

TECHNICAL MANUAL

3030 and 3130
Tractors

TM4277 (01JUN79) English

John Deere Werke Mannheim
TM4277 (01JUN79)

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3030 and 3130 Tractors
Technical Manual
TM-4277 (June-79)

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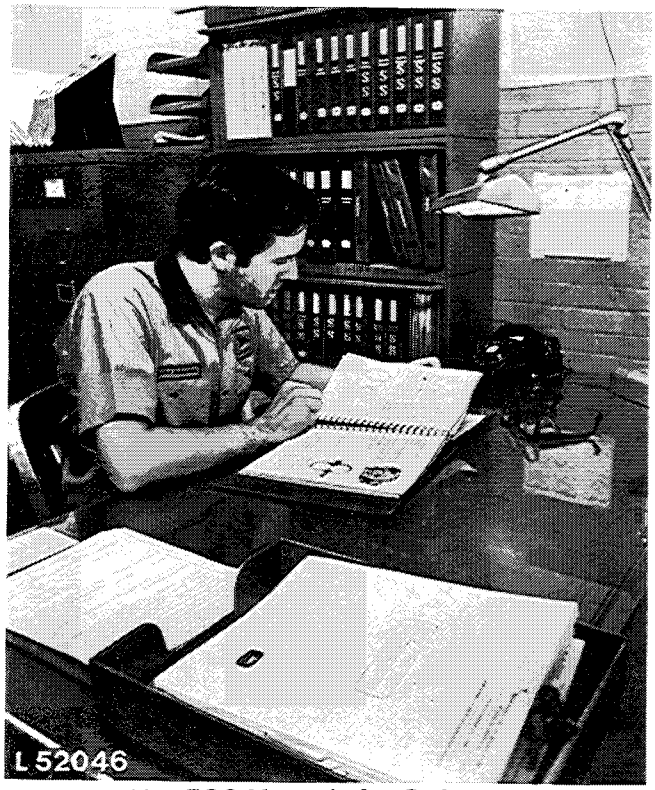
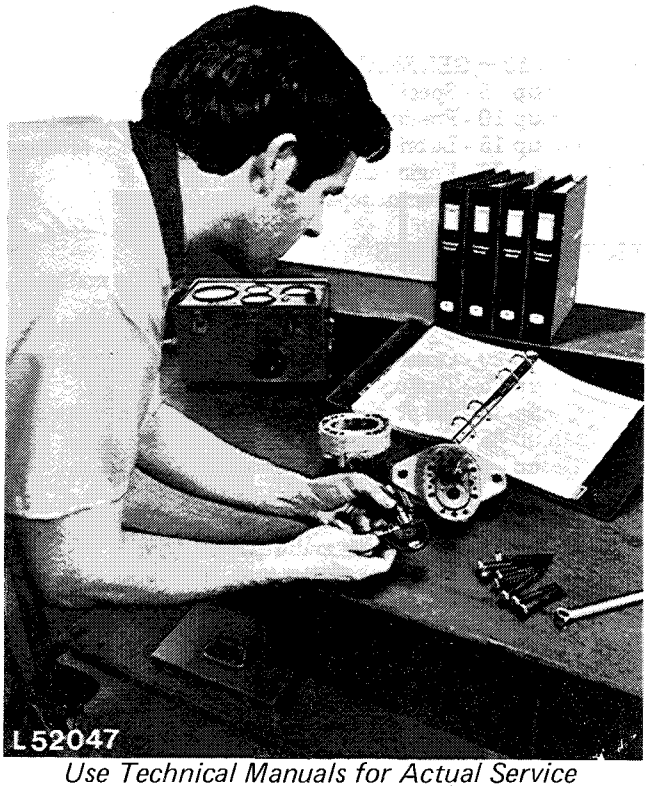
Printed in Germany (M 8)

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.

IMPORTANT! Your technical manual contains the international standardized SI metric measurement system.

When a technician 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 on page 1*
- *Contents at front of each Section*
- *Specifications at end of each Group*
- *Torques for hardware at end of each Group*
- *Special tools at end of each Group*

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.

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Section 10
General

CONTENTS OF THIS SECTION

Group 5
Specifications

SERIAL NUMBERS

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

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

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

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

MODEL NUMBERS

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

ENGINE

Number of cylinders 6

Cylinder liner bore . . . . . 102 mm (4.02 in.)

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

Displacement. . . . . .5390 cm^3 (329 cu.in.)

Compression ratio . . . . . 16.2 : 1

Maximum torque:

3030 at 1200 rpm . . . . . .285 Nm (28.5 mkp 210 ft-lb)
3130 at 1300 rpm . . . . . .300 Nm (30 mkp; 218 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 . . . . . .2660 rpm

Slow idle . . . . . .750 rpm

Working speed range:

3030 . . . . . 1200 to 2500 rpm
3130 . . . . . 1300 to 2500 rpm

Flywheel horsepower at 2500 rpm according to DIN 70020:

3030 . . . . . .63 kW (86 HP)
3130 . . . . . .68 kW (92 HP)

PTO horsepower*:
(at 2500 rpm engine speed)

3030 according to DIN 70020 57 kW (78 HP)
according to SAE J 816 B 55 kW (74 HP)
3130 according to DIN 70020 61 kW (83 HP)
according to SAE J 816 B 60 kW (80 HP)

ENGINE CLUTCH

Single dry disk clutch with torsion damper (isolator), foot-operated.

ELECTRICAL SYSTEM

Batteries . . . . . .2 x 12 volts, 88 ampere-hours

Starting motor. . . . . 12 volt, 3 kW (4 HP)

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

Battery terminal grounded . . . . . negative

TRANSMISSION

Collar shaft transmission with helical cut gears.

The tractor has 6 forward gears and three reverse gears. However, by shifting the High-Low shift unit, 12 forward and 6 reverse speeds may be selected.

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

HIGH-LOW SHIFT UNIT

Hydraulically controlled reduction gear which can be shifted under load, with "wet" multiple disk clutch and "wet" multiple disk brake. Allows reduction of the individual gear speeds by 21%.

DIFFERENTIAL AND FINAL DRIVES

Planetary reduction gear and differential with spiral bevel gears.

DIFFERENTIAL LOCK

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

POWER TAKE-OFF (PTO)

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

The independent PTO is engaged by a hydraulically operated disk clutch. Disengaging the PTO is achieved by operating the hydraulically actuated disk brake.

Changing PTO shaft speed from 540 rpm to 1000 rpm or vice-versa is effected by changing the PTO stub shaft.

PTO Speeds (in rpm)

Engine speed in rpm	540 rpm shaft	1000 rpm shaft
750	185	346
2175	540	1000
2500	620	1150
2660	660	1225

HYDRAULIC SYSTEM

Closed center, constant pressure system; also includes rockshaft, power steering and selective control valves.

System pressure . . . . . 155 bar (2250 psi)

Pump . . . . . 8-piston pump driven by the engine crankshaft

POWER STEERING

The steering system is a "closed center" type incorporated in the hydraulic system and supplied with oil by the hydraulic pump. It is connected to the front wheels by means of a steering linkage.

HYDRAULIC BRAKES

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

HANDBRAKE

Band-type locking brake acting on differential.

CAPACITIES

	Liters	U.S.gals.
Fuel tank	106.0	28.0
Cooling system	19.0	5.0
Engine crankcase incl. filter	11.5	3.0
Transmission-hydraulic system		
Dry system	57.0	15.0
At service intervals.	49.0	12.9
Belt pulley	1.0	0.3

TRAVEL SPEEDS

See Operator's Manual.

FRONT AND REAR WHEELS

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

DIMENSIONS

See Operator's Manual.

Group 10
Cylinder Head and Camshaft

GENERAL INFORMATION

The intake and exhaust valves are set in the cylinder head. The valve guides are integral with the head. The valve seats are ground directly into the cylinder head. Replaceable valve seat inserts are available as spare parts. Between each valve stem and the rocker arm is a hardened stem cap.

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

The camshaft has an eccentric lobe to actuate the fuel transfer pump and an axial, pressed-in lug to drive the speed-hour meter.

DIAGNOSING MALFUNCTIONS

For diagnosing malfunctions see group 5.

NOTE: For additional information see "Fundamentals of Service, Engines" manual.

Cylinder Head

REMOVAL

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

Immediately cover or plug holes of all removed or exposed fuel pipes with plastic caps or plugs.

Remove fuel injection nozzles (nozzle points are protruding from cylinder head sealing face and might be damaged).

Disconnect battery ground straps.

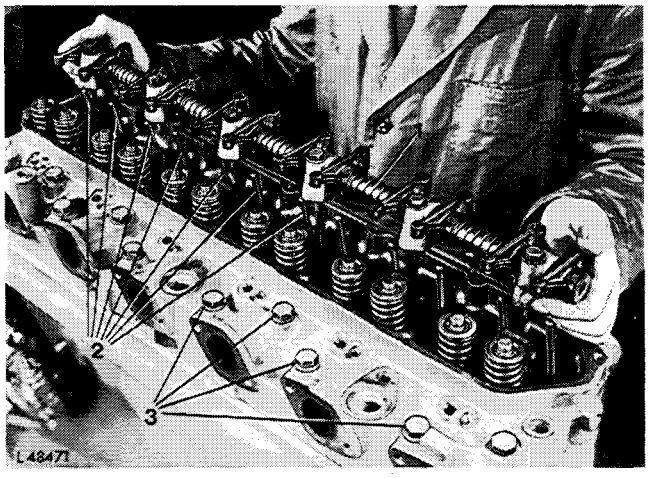

Fig. 1 — Removal of Rocker Arm Shaft Assembly

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

When removing, identify parts to facilitate reinstallation.

After removal of cylinder head, do not turn crankshaft until all liners have been secured with cap screws and washers.

REPAIR

DISASSEMBLY

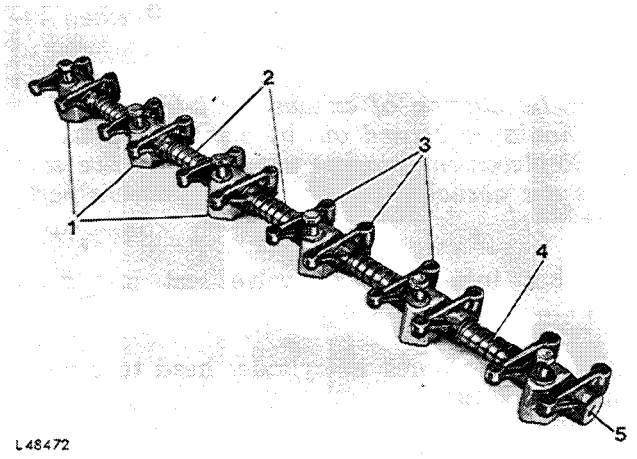

Fig. 2 — Rocker Arm Shaft Assembly

1 Rocker arm support
2 Springs
3 Rocker arms
4 Rocker arm shaft
5 Plug

Remove plug from one end of rocker arm shaft and slide all parts off the shaft (see fig. 2). Identify parts for correct reinstallation.

When several valves are being removed, identify each to facilitate replacement in its original position.

Compress valve spring with commercial tool and remove both retainer locks from the spring cap. Release spring and remove spring cap and spring. Pull valves out of the cylinder head.

INSPECTION

Check all parts for wear or damage.

Valve Seats

Measure diameter of valve guides. Replace valves, if necessary and ream the cylinder head bores. Beside standard sized valves, there are valves with oversize stems available (see Specifications). Check if new valves move freely in the cylinder head.

Reface valve seats in cylinder head with commercial tools, if necessary, observing specified measurements (see Specifications).

Reconditioning of valve seats is possible only up to a specified limit. Valve recesses should not be more than 3 mm (0.118 in.) below surface of cylinder head (see dimension "a", fig. 4).

When intake or exhaust valve seat recess exceeds 3 mm (0.118 in.), the cylinder head can be rebored and replacement valve seat inserts installed.

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 specialised workship. Replacement exhaust and instake valve seat inserts are available from your John Deere parts depot.

Carry out installation of valve seat inserts as follows:

Machine insert bores in cylinder head to dimensions given in fig. 3.

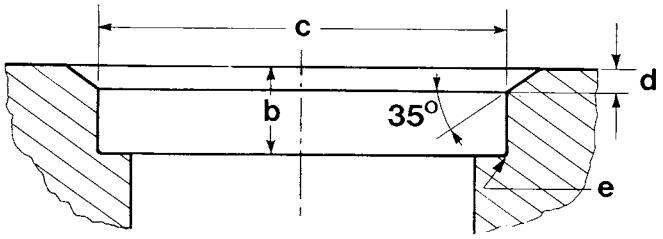

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Fig. 3 — Dimensions for Boring Valve Insert Bores in Cylinder Head

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 (0.327 to 0.332 in.)
c 47.16 to 47.18 mm (1.856 to 1.857 in.)
d 2.69 to 2.95 mm (0.106 to 0.116 in.)
e Radius - 0.5 mm (0.019 in.)

NOTE: The surface finish of bore "c" (fig. 3) should not exceed 0.00158 mm (63 micro-inch).

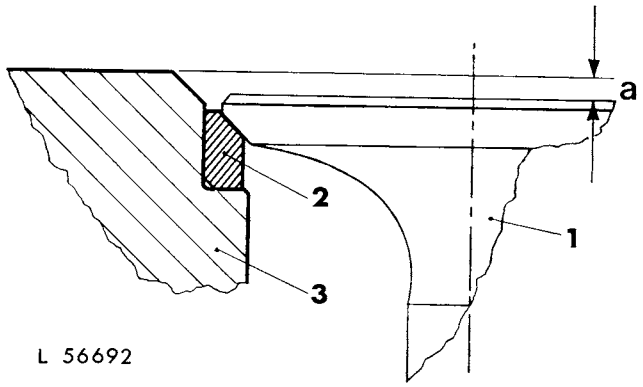

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Fig. 4 — Valve and Valve Seat Insert

a Minimum clearance between valve and surface of cylinder head
1 Valve
2 Valve seat (replaceable steel insert)
3 Cylinder head

After having reconditioned valve insert bores in cylinder head, dip replacement inserts into liquid nitrogen and freeze 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.

Install valves and check measurement "a" (fig. 4). If a valve recess measurement is not within specifications, remove valve and grind valve seat to dimensions (see Specifications).

Replace valve stem caps, if necessary.

Valve Springs

Check tension of valve springs.

Valve springs may have different free lengths, however, they must have the same length when compressed at the specified load.

Rocker Arm Shaft Assembly

Make sure that all oil bores in the rocker arm shaft, rocker arms and the adjusting screws are clear. Thoroughly clean cavities of rocker arm supports. This is especially important for the rear support through which the oil passes to the rocker arm shaft. Check all rocker arms for excessive wear and tear on points of rocker arm contact. Check spring tension.

If a valve is replaced, the accompanying rocker arm and push rod should be replaced at the same time.

Fuel Injection Nozzle Bores

Remove carbon deposits from bores, using special tool No. JDE 39.

IMPORTANT: Always turn the tool clockwise as turning it counterclockwise will dull the tool.

ASSEMBLY

Rocker Arm Shaft Assembly

Assemble the individual parts, according to fig. 5 finally placing the plug on the shaft end. Make sure rocker arms are installed in their original positions.

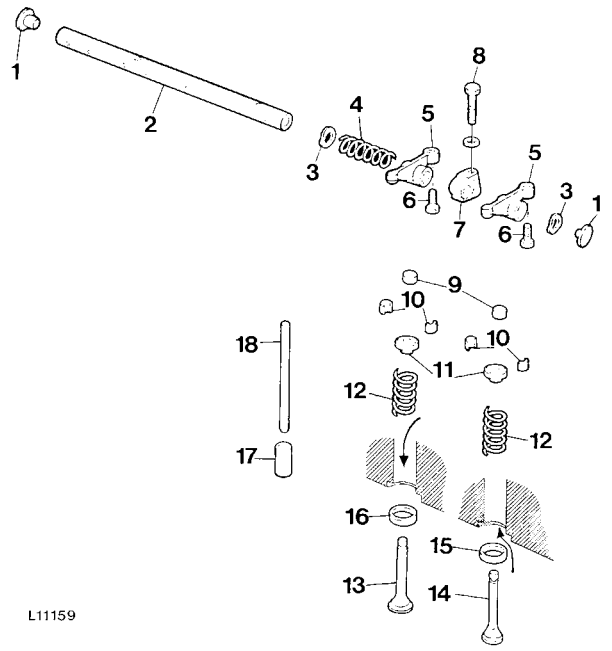

Fig. 5 — Rocker Arm Shaft Assembly and Valves, Exploded View

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

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.

Lubricate all rocker arms liberally with oil and see that they move freely.

Cylinder Head

Apply clean oil to valve stems and install the valves in the same guide ports from which they were removed. Move valves up and down several times to ascertain that they slide freely and are properly seated.

When assembling observe the following:

1. Always use new keepers.

2. When replacing valve springs, make sure that the end contacting the cylinder head is properly seated in the machined counterbore of the head.

3. After the valves are installed, give the stems two or three taps with a rubber or nylon hammer, so that the parts will seat properly and thus ensure the proper positioning of the keepers.

INSTALLATION

CYLINDER HEAD

Use a new, dry cylinder head gasket (without any sealant) and place on cylinder block.

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

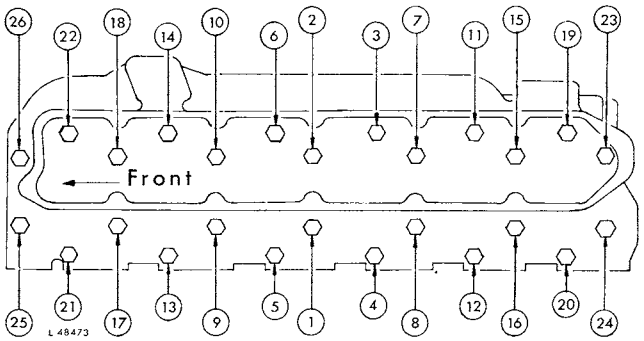

Fig. 6 — Correct Sequence for Tightening Cylinder Head Cap Screws

Gradually tighten cylinder head cap screws (coated with oil) evenly, following the sequence outlined in fig. 6 and finally tighten to specified torque. Install push rods into their original bores according to the marks made on removal. Place a valve cap on each stem and make certain that they turn freely.

ROCKER ARM SHAFT ASSEMBLY

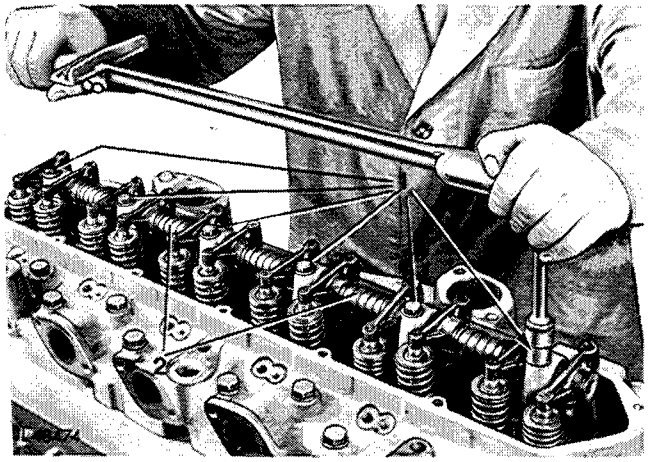

Fig. 7 — Tightening Rocker Arm Shaft Assembly

1 Cap screws 2 Rocker arm shaft assembly

Install rocker arm shaft assembly on cylinder head so that the lubrication holes are at the flywheel end. Turn the rocker arm shaft so that these holes are facing down. Tighten cap screws (see fig. 7) to specified torque.

ADJUSTING VALVE CLEARANCE

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

Using engine rotation tool 19.58-90.282 rotate engine flywheel and therefore crankshaft in running direction until no. 1 piston has almost reached top dead center (TDC).

Guide timing pin (8 mm; 0.32 in. diameter and a minimum length of 80 mm; 3.15 in.) into bore of flywheel housing. Rotate flywheel a little and timing pin will enter its bore in flywheel as soon as flywheel reaches TDC position.

NOTE: After inserting timing pin into flywheel bore, piston No. 1 is at TDC of its compression stroke when the valves of cylinder No. 6 are rocking.

Adjust clearance of the exhaust valves of cylinders No. 1, 3 and 5, and the intake valves of cylinders No. 1, 2 and 4.

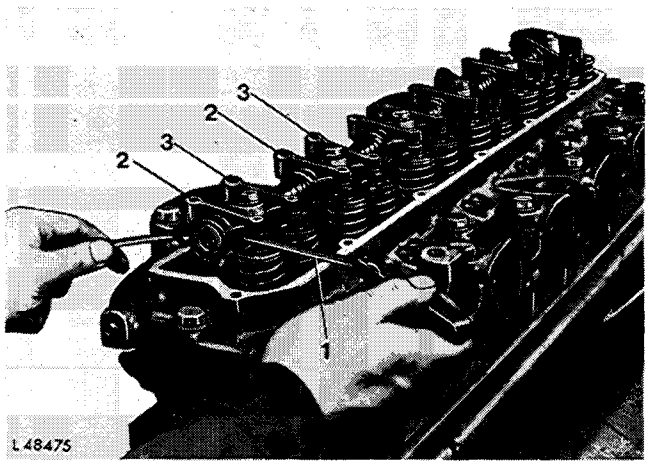

Fig. 8 — Adjusting Clearance of the Intake Valve of Cylinder No. 1

1 Feeler gauge
2 Adjusting screw of intake valve
3 Adjusting screw of exhaust valve

Adjust the valve clearance, using a feeler gauge (see fig. 8 and Specifications).

Pull timing pin out of flywheel bore, turn crankshaft one complete revolution (=360°) and insert timing pin again into flywheel bore.

Adjust clearance of exhaust valves of cylinders Nos. 2, 4 and 6 and intake valves of cylinders Nos. 3, 5 and 6 (see Specifications).

NOTE: After the engine has run for some time on a specified load (see Specifications), tighten cylinder head screws to specified torque. Check clearance of all valves and readjust, if necessary.

Camshaft

REMOVAL

To remove the camshaft and related parts it is not necessary to remove the engine. However, the front of the loader must be separated to get access to the front of engine (see section 10, group 25).

Disconnect battery ground straps.

Remove cylinder head, timing gear cover and fuel transfer pump.

Remove all push rods and cam followers and identify them to facilitate replacement in their original bores.

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

Replace speed-hour meter drive lug, if necessary.

Install new drive lug in camshaft so that its slot faces away from the camshaft. Support camshaft at rear journal.

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 specified torque.
4. Check camshaft end play (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.

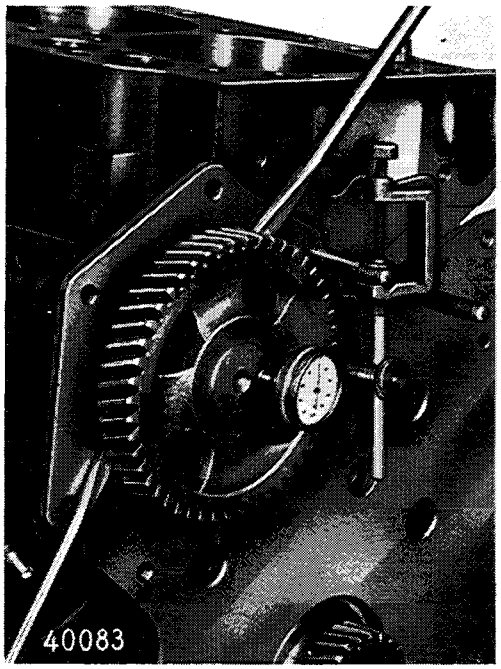

Fig. 9 — Measuring Camshaft End Play

6. Use timing tool No. JD 254 to align timing mark "b" on camshaft gear (fig. 10) with center of crankshaft.

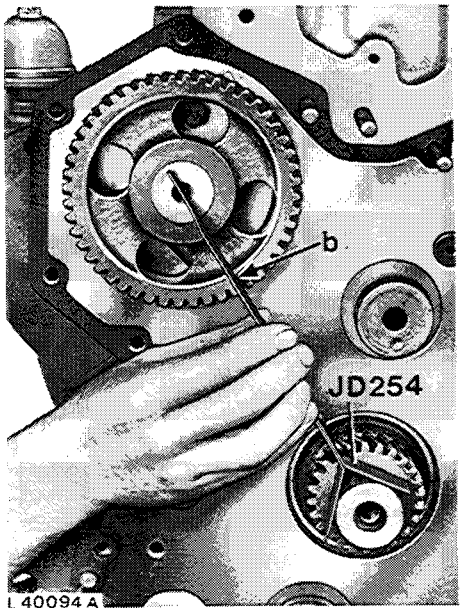

Fig. 10 — Timing Camshaft Gear by Means of Timing Tool No. JD 254

b Timing mark

7. With camshaft gear in this position, install upper idler gear and tighten cap screw to specified torque (see Torques for Hardware).

Install cam followers, cylinder head, timing gear cover and fuel transfer pump.

Run engine for some time at a specified load (see Specifications) and then retighten cylinder head cap screws to specified torque. Check valve clearance and readjust, if necessary.

SPECIFICATIONS

	Dimensions of New Parts	Wear Tolerance
CYLINDER HEAD		
Thickness of new cylinder head	104.87 to 105.13 mm 4.129 to 4.139 in.	
Maximum permissible amount to be machined from cylinder head	.0.76 mm 0.03 in.	
Minimum thickness of cylinder head	.104.11 mm 4.099 in.	
Valve stem dia. (standard)	9.43 to 9.46 mm 0.371 to 0.372 in.	
Bore for valve stem	9.50 to 9.53 mm 0.374 to 0.375 in.	0.025 mm 0.001 in.
Clearance between bore and valve stem	0.05 to 0.10 mm 0.002 to 0.004 in.	0.152 mm 0.006 in.
Valve stem oversize, stem dia. larger than standard by	.0.08; 0.38; 0.76 mm 0.003; 0.015; 0.030 in.	
Valve seat angle	.45°	
Angle of valve faces	43.5°	
Concentricity tolerance of valve seat (max.)		.0.05 mm 0.002 in.
Minimum clearance between a valve and cylinder head surface (see "a", fig. 4)		
Intake valve	.0.90 mm 0.035 in.	
Exhaust valve	.1.40 mm 0.055 in.	
Maximum clearance between a valve and cylinder head surface (see "a", fig. 4)		3 mm 0.118 in.
Valve seat width		
Intake and exhaust valve without replaceable valve seat insert	1.45 to 1.85 mm 0.057 to 0.073 in.	
Intake valve with replaceable valve seat insert	2 mm 0.0787 in.	
Exhaust valve with replaceable valve seat insert	1.30 to 1.45 mm 0.051 to 0.057 in.	
Valve head dia., intake valve	44.88 to 45.13 mm 1.767 to 1.777 in.	
Valve head dia., exhaust valve	39.88 to 40.13 mm 1.570 to 1.580 in.	

SPECIFICATIONS (Contd.)

	Dimensions of New Parts	Wear Tolerance
CYLINDER HEAD—Contd.		
Valve length	130.66 to 131.29 mm 5.144 to 5.169 in.	0.13 mm 0.005 in.
Valve clearance		
Intake valve	0.35 mm 0.014 in.	
Exhaust valve	0.45 mm 0.018 in.	
Valve lift (clearance adjusted)		
Intake valve	11.7 to 12.5 mm 0.460 to 0.490 in.	11.0 mm 0.430 in.
Exhaust valve	11.6 to 12.2 mm 0.456 to 0.482 in.	10.8 mm 0.426 in.
Rocker arm shaft dia.	19.99 to 20.02 mm 0.787 to 0.788 in.	0.05 mm 0.002 in.
Rocker arm bore dia.	20.07 to 20.12 mm 0.790 to 0.792 in.	0.05 mm 0.002 in.
Rocker arm shaft spring		
Spring tension at a length of 46 mm (1.81 in.)	18 to 27 N 4 to 6 lb	
Valve springs		
Free length	approx. 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 690 N (133 to 153 lb) Valves opened	34.5 mm 1.359 in.	

Retightening cylinder head cap screws — Run engine for half an hour at 2500 rpm. Loosen screws by 5° to 10° and tighten again to the specified torque.

CAMSHAFT		
Dia. of camshaft bearing journal	55.87 to 55.90 mm 2.200 to 2.201 in.	0.025 mm 0.001 in.
Dia. of camshaft bearing bores in cylinder 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.	0.18 mm 0.007 in.
End play	0.05 to 0.23 mm 0.002 to 0.009 in.	0.38 mm 0.015 in.
Thickness of thrust plate	3.96 to 4.01 mm 0.156 to 0.158 in.	0.13 mm 0.005 in.

TORQUES FOR HARDWARE

Rocker arm shaft to cylinder head, cap screws	50 Nm	5 mkp	35 ft-lb
Cylinder head to cylinder block, cap screws (dipped in oil)	130 Nm	13 mkp	95 ft-lb
Fuel injection nozzles to cylinder head, cap screws	30 Nm	3 mkp	23 ft-lb
Fan to V-belt pulley of water pump, cap screws	30 Nm	3 mkp	23 ft-lb
Intake manifold, cap screws	50 Nm	5 mkp	35 ft-lb
Exhaust manifold, cap screws	50 Nm	5 mkp	35 ft-lb
Camshaft thrust plate to cylinder block, cap screws	50 Nm	5 mkp	35 ft-lb
Upper idler gear to cylinder block, cap screw	90 Nm	9 mkp	65 ft-lb
Lower idler gear to cylinder block, cap screw	130 Nm	13 mkp	95 ft-lb
Timing gear cover to cylinder block, cap screws	50 Nm	5 mkp	35 ft-lb
Rocker cover to cylinder head, cap screws	10 Nm	1 mkp	7 ft-lb

SPECIAL TOOLS*

Part No.	Description	Use
JDE 39	Cleaning tool	Cleaning cylinder head nozzle bores
JDE 254	Timing tool	Adjusting camshaft gear
19.58-90.282 JDE 83	Engine rotation tool	Manually rotating engine flywheel

*For ordering instructions please contact your sales branch service department

Group 15
Cylinder Block, Liners, Pistons and Connecting Rods

GENERAL INFORMATION

The cylinder block is a one-piece casting comprising cylinders and crankcase. Inside the cylinder block are the bearings for the crankshaft and camshaft. The cylinder block also contains bores for the cylinder liners, the cam followers, various oil channels, coolant passages etc.

On later engines the cylinder block has six jets located in the oil galleries for crankshaft main bearings. With these jets, oil is sprayed underneath the pistons for cooling.

Cylinder liners are the wet-sleeve replaceable type. A packing of square section fits on a shoulder of the cylinder liner. Together with two O-rings located in cylinder block grooves it forms the lower seal of each liner against the cylinder block. The top of the liner is sealed by means of the cylinder head gasket.

The pistons are forged aluminium alloy. The outer surface of the pistons is camground. The piston crown has a cut-out swirl cup with a truncated cone in the center. Every piston has two compression rings and one oil control ring.

The connecting rods have a bronze bushing serving as bearing surface for the piston pins. The replaceable steel-backed bearing insert halves are aluminium-lined and tin-plated.

DIAGNOSING MALFUNCTIONS

For diagnosing malfunctions, see group 5.

REMOVAL

Pistons connecting rods and cylinder liners may be removed even with the engine installed.

With the cylinder head removed, do not rotate crankshaft until all cylinder liners have been secured by means of screws and washers.

Secure cylinder liners before removing the pistons. Carefully remove any carbon from cylinder liners.

Keep bearing inserts with their respective rods and caps.

Each connecting rod and piston should be installed in their original bore. Therefore mark connecting rod, piston and rod cap for identification. Observe the "FRONT" mark stamped into every piston crown and connecting rod. After installation, this mark should face the radiator side of the cylinder block.

Measure height of bolted down liners before removal from the block (see Specifications).

Before removal, mark cylinder liners for identification so that they can be reinstalled in their original bores in cylinder block.

REPAIR

NOTE: For additional information see manual: "Fundamentals of Service, Engines".

PISTONS

Place pistons in a cleaning solvent to allow carbon deposits to soak. Then clean, flush and dry pistons. Do not use a steel brush to clean piston rings and piston skirt.

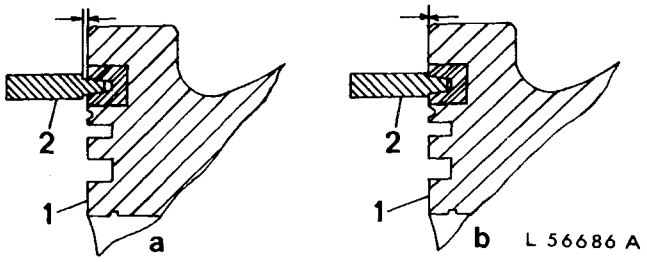

Fig. 1 — Checking Top Piston Groove for Wear

1 Piston
2 Gauge No. 19.58-90.281
a Piston can be used again
b Discard piston and replace

Check piston ring grooves for wear as follows: Clean piston ring grooves carefully. Using gauge 19.58-90.281 (see 2, fig. 1) check the groove of the top compression ring (keystone-shaped) for excessive wear. As long as there is a gap between the shoulder of the feeler gauge and the piston (see "a", fig. 1) the piston can be used again. If shoulder of feeler gauge comes into contact with the piston (see "b", fig.1), wear is excessive and the piston must be replaced. When checking the center piston ring groove, insert a new piston ring. Measure clearance between ring and groove at several points around the ring, using a feeler gauge.

Using a micrometer, measure piston skirt diameter at right angles to the piston pin; piston skirt diameter see Specifications.

Check piston pins and replace them, if excessively worn (see Specifications).

Always use new piston pins when installing new pistons.

CONNECTING RODS AND BEARINGS

Replace connecting rod bearings, rod screws and piston pin bushings at every major engine overhaul.

Connecting rods and rod caps are only available as matched sets. Connecting rod bearing insert halves are available in standard sizes and several undersizes (see Specifications).

Insert bearing insert halves, install rod cap and tighten old rod screws to the specified torque. Measure each bearing bore and its respective crankshaft journal at several places. The difference between the two measurements in the bearing clearance (see Specifications).

Check piston pin bushing and replace, if necessary.

NOTE: Always install a new bushing when installing a new piston pin. Press in new bushing and hone until the respective piston pin can be inserted by "thumb-press" fit.

CYLINDER BLOCK

Remove all gaskets and scrape off any residual deposits. Remove O-rings sealing liners from cylinder block grooves and discard.

Thoroughly clean the block outside and particularly inside with cleaning solvent or by pressure steam cleaning. Make sure all passages and orifices are free from sludge, rust and grease and remove all scale or lime deposits.

On later engines: Inspect the six jet nozzles in cylinder block and replace, if necessary. Tighten spray jets to specified torque (see Torques for Hardware).

Replacement cylinder blocks are supplied with jet nozzles and plugs. When old cylinder block is equipped with jet nozzles then install nozzles supplied with replacement block. On earlier engines without jet nozzles install plugs.

Valve Seat Bushing of Oil Pressure Regulating Valve

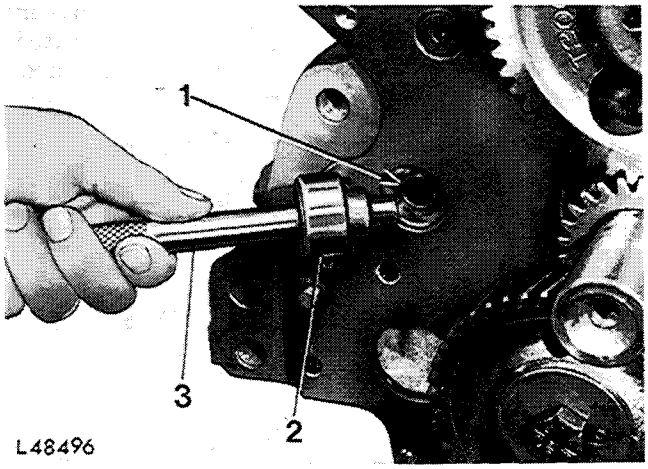

Fig. 2 — Driving in Valve Seat Bushing of Oil Pressure Regulating Valve

1 Valve seat bushing
2 Special tool No. JD 248
3 Special tool (driver) No. 813

Check the bushing with sealing edge for lubricating oil pressure regulating valve located in the front cylinder block for serviceability. If necessary, remove unserviceable bushing from cylinder block and drive in a new bushing until driver contacts cylinder block, using special tools JD 248 and 813 (see fig. 2).

IMPORTANT: Do not use other unsuitable tools. Above all do not press tool against the slightly protruding inner edge of the bushing since it is a delicate sealing face.

Dowel Pins, Plugs and Studs

Check these parts for tight fit or proper sealing in cylinder block. If necessary, replace by new parts. Coat part to be inserted in cylinder block with a suitable sealant resistant to oil and water.

Threaded Bushing for Dip Stick

If the threaded bushing for the dip stick has to be replaced, coat threaded end of new bushing with an oil-resistant sealant. Thread into cylinder block as indicated under Specifications.

Adapter in Cylinder Block

If oil filter adapter has to be replaced, press in new adapter so that threaded end faces outward (farthest point from cylinder block).

CYLINDER LINERS

Measure each cylinder liner as explained below, using a suitable gauge (dimensions see Specifications):

1. Measure liner bore parallel to piston pin at top end of ring travel.

2. Measure bore in same position at bottom end of ring travel.

3. Measure bore at right angles to piston pin at top end of ring travel.

4. Measure bore in same position at bottom end of ring travel.

Compare all four measurements to determine if liner has worn tapered. Maximum taper at the ring land area see Specifications.

If a cylinder liner is excessively worn (see Specifications), the piston, too, may be so worn that it needs replacement.

Deglazing Cylinder Liner Bores

NOTE: Remove cylinder liners and place in a suitable clamping device or in an old cylinder block for deglazing.

For deglazing cylinder liners 0.0004 to 0.0009 mm (15 to 35 micro-in.) use an 180 grit deglazing tool or a cylinder hone.

When deglazing, move the tool up and down 10 to 12 times and adapted to driving speed of tool, guide the latter so that a 45° criss-cross hone pattern is produced.

NOTE: For additional information on deglazing cylinder liners see manual: "Fundamentals of Service — Engines".

Clean cylinders thoroughly. Wipe out cylinder liners with a cloth until a clean white cloth shows no discoloration when wiped through cylinder bore.

ASSEMBLY

CONNECTING RODS, PISTONS AND PISTON RINGS

Make sure that the marks for identifying matched pistons and connecting rods, applied prior to disassembly, do tally.

Apply a coat of clean, thin engine oil to the piston pin and insert in piston bore and through connecting rod bushing. A properly fitting piston pin can be positioned by thumb pressure.

Installing Piston Rings

NOTE: New piston rings are furnished with the correct end gap. This should not be altered.

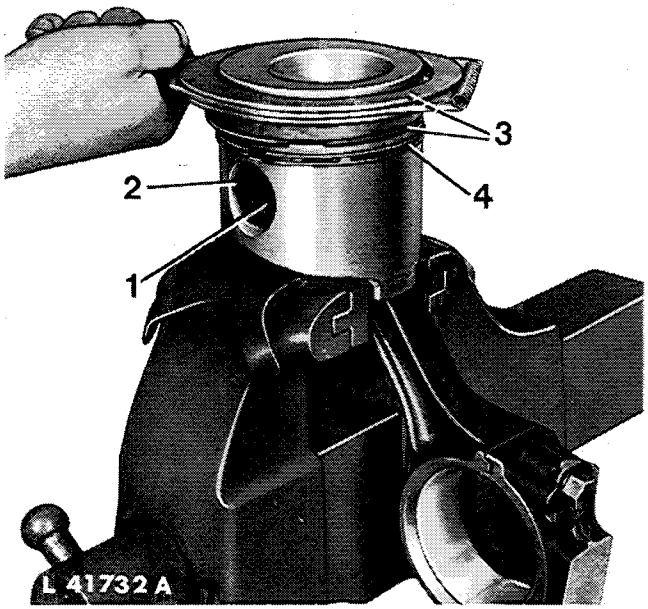

Fig. 3 — Installing Piston Rings

1 Piston pin
2 Snap ring
3 Compression rings
4 Oil control ring

Install piston rings, using a commercial piston ring expander.

1. Install the expander ring in groove of oil control ring so that its gap is over a piston pin bore. Then install oil control ring in ring groove with the gap opposite the expander gap.

2. Install second compression ring in center groove with "TOP" mark facing upward and with its gap shifted 120° from expander ring gap.

3. Then install upper compression ring with its gap shifted 120° from the gap of the second compression ring.

Coat exterior of piston and all piston rings with a film of clean engine oil.

INSTALLATION

CYLINDER LINERS

Make sure cylinder block is completely clean and that the O-rings are removed from cylinder block grooves.

Install cylinder liner WITHOUT square packing and secure by means of a washer and cap screw.

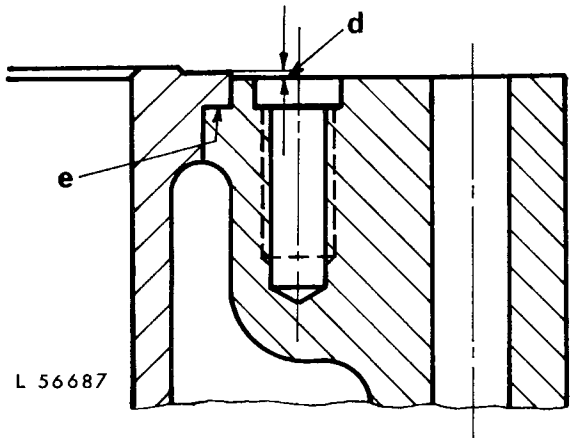

Fig. 4 — Upper Fit and Sealing Face of Cylinder Liner in Cylinder Block

d Check dimension
e Seating area

Measure dimension "d" (see Specifications) shown in fig. 4 by which the sealing face of the cylinder liner protrudes over the cylinder block sealing face. Measure at several places around the circumference and compare measurements to make sure sealing face of cylinder liner is parallel to sealing face of cylinder block.

If the protrusion of the cylinder liner sealing face over the cylinder block sealing face is less than specified, remove liner and install one shim R 46906 (for proper thickness see Specifications) between liner and cylinder block.

Re-install liner with shim but WITHOUT **packing** in cylinder block. Again measure dimension "d" (fig. 4) and record. Remove cylinder liner and shim.

NOTE: Do not soak packings and O-rings in oil before installing them as they would swell up and could get damaged when installing the cylinder liners.

Carefully slide new packing 1 (fig. 5), coated with lubricating grease over liner until it contacts liner shoulder. Be sure packing is not twisted or crimped. Also make sure inner flank of packing contacts liner face when packing is installed.

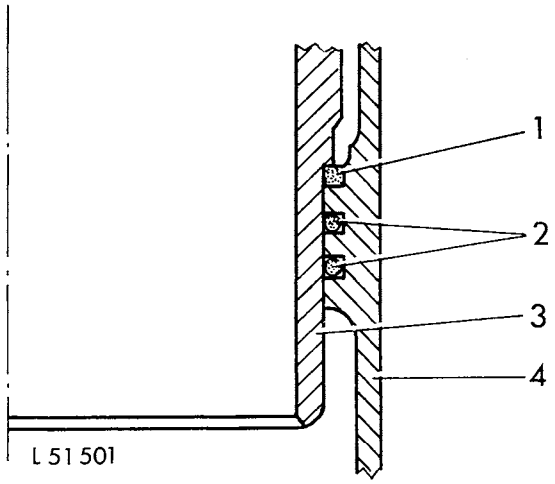

Fig. 5 — Lower Liner Sealing

1 Square-section packing
2 O-rings
3 Cylinder liner
4 Cylinder block

Install two new O-rings coated with lubricating grease in grooves of cylinder block.

Before installing liner, make sure O-rings are properly seated in cylinder block grooves. If part of an O-ring projects into bore for liner, the O-ring could be pressed onto groove edge, thus getting damaged without the serviceman noticing it.

Slide liner with shim into its bore in cylinder block. Observe the mark applied during disassembly to identify the liner and its corresponding bore in the block. Work the liner gently in by hand. Finally use a block of hardwood to drive the liner into its proper position by tapping lightly with a hammer.

IMPORTANT: Do not yet compress packing.

The cylinder liner will now protrude over the sealing surface of the block by slightly more than dimension "d" (see fig. 4).

Measure protrusion and record. Subtract dimension "d" (with shim, but without packings) measured above from amount of protrusion. The difference indicates how much the liner packings will be compressed. The minimum dimension is given under "Specifications".

If this dimension is not attained, the check must be repeated with another cylinder liner.

If the minimum dimension can still not be attained, replace the cylinder block. Do not place more than one shim between liner and cylinder block under any circumstances.

PISTON WITH CONNECTING ROD

Retain all cylinder liners in the block, using large washers and cap screws.

Coat pistons and cylinder liners with a film of thin engine oil.

NOTE: Observe the identification marks which were applied to the pistons and connecting rods during removal and insert them into the liners from which they were removed.

Make sure that the "FRONT" mark which is stamped into the head of each piston and into the shaft of each connecting rod faces toward the radiator before installing them.

Be sure piston rings and oil control ring are still in the original position.

Apply a film of thin engine oil to bore of 19.58—90.616 ring compressor.

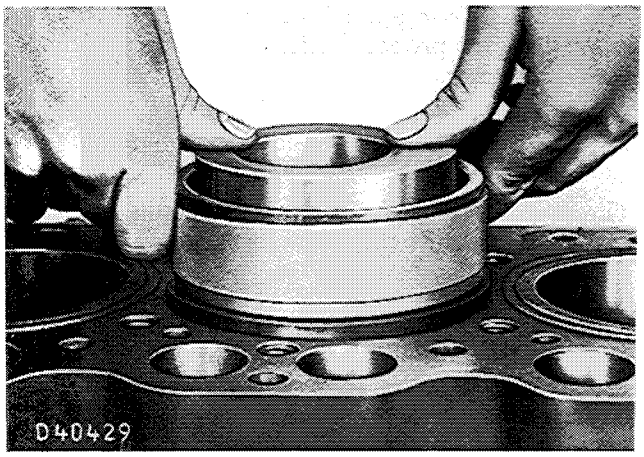

Fig. 6 — Installing Piston, Using Ring Compressor 1958-90.616

Position ring compressor 19.58-90.616 exactly in the middle of the cylinder bore. Insert connecting rod and piston through this tool until piston rings touch the tool. Then press or tap piston downward until all piston rings are in the cylinder liner. Remove the special tool.

Apply a film of clean, thin engine oil to the bearing inserts and crankshaft rod journals. Install bearing inserts (if used bearings are reinstalled, observe the identification marks applied during removal). Make sure small tangs on each half of the inserts fit in recesses in rod and cap.

Install cap so that large slot in cap fits large tang on connecting rod and small slot in cap fits small tang on rod. Install new cap screws, coated with a film of oil. First tighten them alternately, and finally to specified torque.

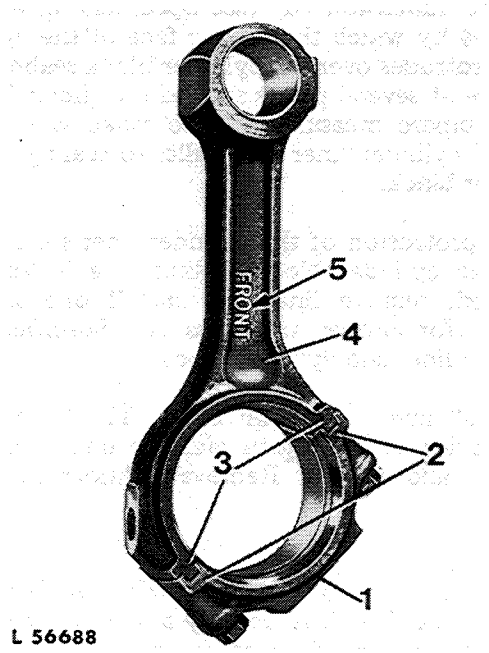

Fig. 7 — Installing Connecting Rod Caps

1 Connecting rod cap
2 Slots
3 Tangs
4 Connecting rod
5 "FRONT" mark

Rotate the crankshaft several revolutions to make sure there is no binding of parts or unusual resistance.

Install oil pan and cylinder head. Fill crankcase with oil of proper viscosity. Fill cooling system with clean soft water or with antifreeze and corrosion inhibitor solution (see Operator's Manual).

INSTALLING REPLACEMENT PISTONS

IMPORTANT: Two types of pistons marked "B" and "H" on their top faces are available as replacement parts. To determine the piston type to use, proceed as follows:

1. Install liners in cylinder bores.

2. Install a "B" type piston with its connecting rod and secure with cap.

3. Using a dial indicator measure protrusion of each piston (at TDC) above top face of cylinder block center line as shown by 1, fig. 8).

Install a "B" type piston if protrusion is above or equal to 0.1 mm (0.004 in.) and an "H" type piston if protrusion is below 0.1 mm (0.004 in.).

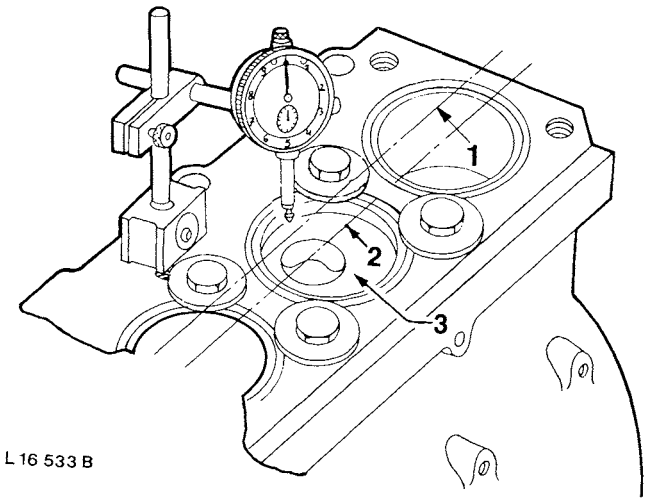

Fig. 8 — Measuring Clearance Between Top of Piston (at TDC) and Surface of Cylinder Block

1 Centerline of cylinder block
2 Centerline of cylinder liner bore
3 "B" type piston

This piston selecting procedure must be carried out on the following engines:

*Up to engine serial no. 269 540 CD**. Only when replacing pistons. If cylinder block is replaced, install original pistons.

From engine serial no. 269 541 CD to 284 163 CD:* When replacing pistons and/or cylinder block.

From engine serial no. 284 164 CD to 341 067 CD: When replacing "B" type pistons and/or cylinder block. If engine is originally equipped with "H" type pistons then reinstall these pistons.

From engine serial no. 341 068 CD: When replacing pistons, install same piston type in corresponding cylinder. Should cylinder block have to be replaced, then use piston selecting procedure as described previously.

* On these engines adjustmnet of fuel injection pump must be altered so that mark on pump flange is 2 mm (0.0788 in.) below mark on front plate.

SPECIFICATIONS

	Dimensions of New Parts	Wear Tolerance
CYLINDER BLOCK		
Camshaft bearing bores	55.98 to 56.01 mm 2.204 to 2.205 in.	
Bores for crankshaft bearings	84.45 to 84.48 mm 3.325 to 3.326 in.	
Dimension from center of dipstick bushing nipple end to base of cylinder block	158 mm 7.16 in.	
Lower bore for seating liners	111.07 to 111.13 mm 4.373 to 4.375 in.	
Upper bore for seating liners	119.07 to 119.12 mm 4.688 to 4.690 in.	