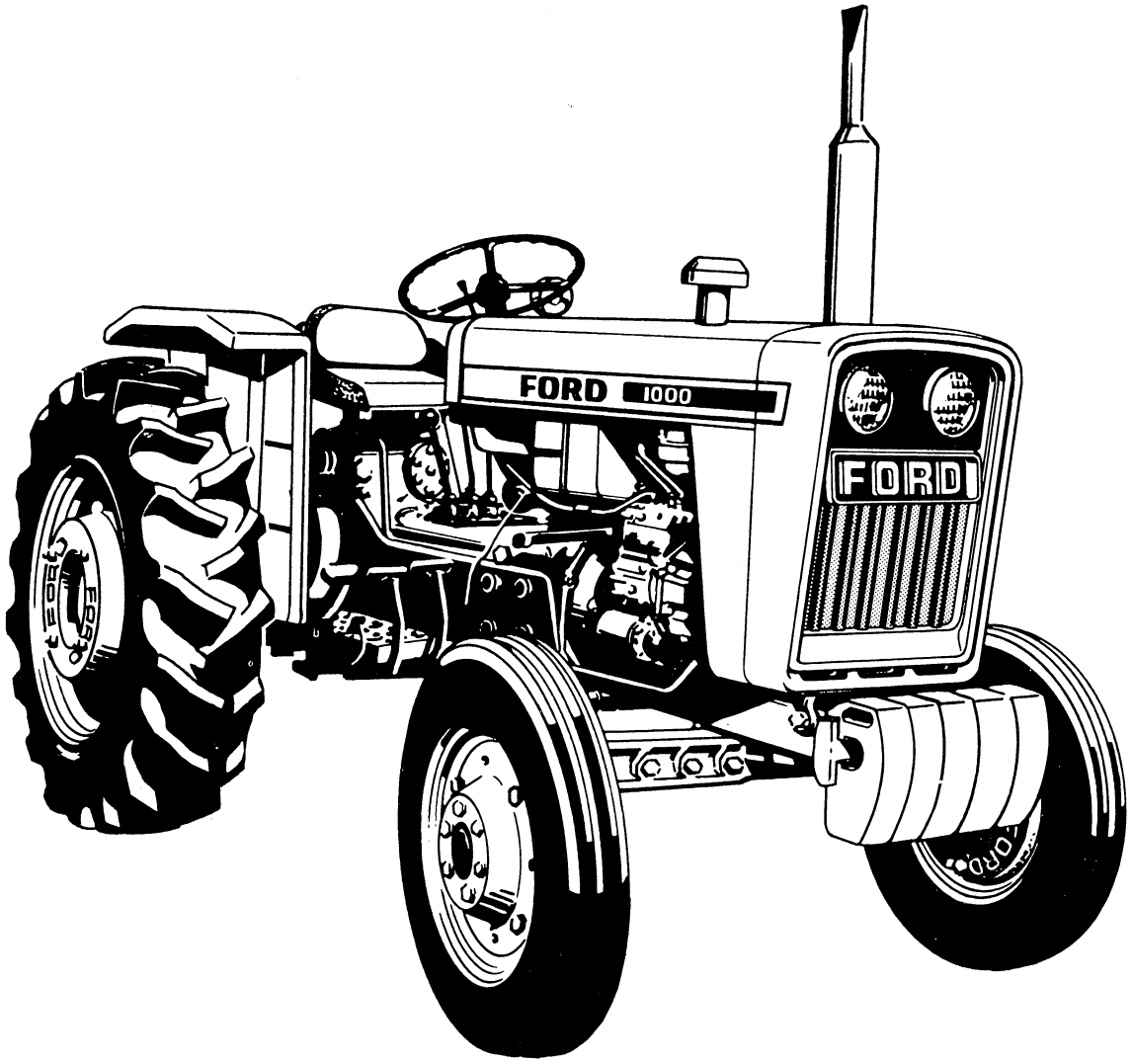
FORD

Service Manual

FORD
NEW HOLLAND

Tractors
1000,1600



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Part 1

ENGINE

Chapter 1

ENGINE AND LUBRICATION SYSTEM

1. DESCRIPTION AND OPERATION

The Ford 1000 engine is a two cylinder four cycle diesel engine. This part of the manual deals with the removal, disassembly, inspection and repair, and assembly of the engine and the lubrication system, plus the cooling system.

CYLINDER HEAD AND ROCKER ARMS

The cylinder head assembly incorporates the valves, valve springs, and rocker arm assembly. The cylinder head is retained to the block by six studs. This provides a four bolt circle for each cylinder.

There is one complete rocker arm and support assembly for each cylinder. The rocker arms are retained to the rocker shaft by snap rings. The rocker arm support is located on a stud in the cylinder head and is aligned by means of a roll pin in the head which protrudes into a counter bore in the base of the rocker arm support.

The cylinder head incorporates a pre-combustion chamber. The injectors are located in the cylinder head and spray fuel into the pre-combustion chamber.

CYLINDER BLOCK ASSEMBLY

The crankshaft is supported by two main bearings. The main bearings are full circle bearings and are press fit bearings. The front bearing is located in a bore in the front of the block and the rear bearing is located in the flywheel cover. For proper alignment, the cover is dowelled to the block assembly.

There are also two thrust bearings controlling end movement of the crankshaft, one is on the flywheel cover and the other on the inside face of the front of the block. The thrust bearings are held in position by a roll pin.

The camshaft is mounted on the right side of the block assembly as viewed from the front of the engine. The camshaft is supported by ball bearings at each end. The rear of the camshaft is sealed with an O-ring which fits in a counterbore in the block and is held in position by the flywheel cover.

LUBRICATION SYSTEM

The oil pump assembly consists of a body, gear set, cover and drive gear. The oil pick up tube attaches to the rear of the body and extends into the sump. The body is located in a bore in the front of the block assembly below and to the left of the crankshaft location as viewed from the front. The gear set is positioned in the body and retained in position by the cover. The front cover is bolted to the oil pump body and to the block assembly. The oil pump drive gear is driven by the crankshaft gear.

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Oil is picked up from the sump by the intake tube and drawn into the lower side of the oil pump body. Oil from the pump flows through passages in the block, past the relief valve, through the oil filter and returns to the area of the drilled bolt located directly above the oil pump. (The relief valve is mounted in the front of the block and intersects the main oil passage. When the oil pressure becomes higher than the rated value, page 30, oil is discharged through the relief valve and into the crankcase.) At this point, part of the oil is directed to the crankshaft front main bearing and passes through a drilling in the crankshaft to the No. 1 cylinder rod bearing. The remaining portion of the oil is directed through the external tube to the idler gear shaft. Inter connecting drilled passages in the idler gear shaft provide lubrication to the idler gear and connect with the external tube located between the idler gear shaft and the drilled bolt located above the camshaft. Oil flows from the tube and bolt to the main oil gallery. The main oil gallery flows the full length of the block assembly to the rear main bearing and to the No. 2 cylinder rod bearing by way of the crankshaft. The crankshaft and rod bearings are lubricated by means of oil passages through the block to the main bearings. The crankshaft is drilled from the main bearing journals to the rod bearing journals for lubrication of the rod bearings.

The tappet bores are also located within the main oil gallery. Oil flows around the tappets for lubrication and into a cross drilling in the tappet. From here it flows through the center of the tappet and up the hollow push rod to the rocker arm assembly.

The adjusting screw and the rocker arm have drilled passages which provide pressurized lubrication to the rocker arm shaft. Controlled oil leakage at this point lubricates the valve stems. Oil flows from the top of the head back to the sump in the same manner as other Ford Tractor engines. Cylinder walls, pistons, and piston pins are splash-lubricated by the crankshaft.

2. ENGINE REMOVAL AND DISASSEMBLY

A. REMOVAL

1. Disconnect and remove the battery cables, the starter relay terminals, the headlight terminals, the oil pressure sensor terminals, glow plug terminals and the water temperature gauge, then remove the battery.
2. Remove the nuts, the wiring harness, the air cleaner cap, and unlatch the back of the hood panel and remove the panel.
3. Remove the cotter pin, washer, and accelerator rod.
4. Close the fuel tank valve, loosen the clamps, and remove the fuel pipe and return pipe. Then remove the fuel tank and base.
5. Loosen the hose clamps, nuts and bolts, and remove the radiator and hose.
6. Remove the hydraulic pump suction and delivery tubes.
7. Remove the cotter pin, nut and steering drag link from the pitman arm.
8. Support the tractor by placing a suitable jack under the clutch housing.
9. Install a chain hoist to the engine and raise the hoist until the chain is taut.
10. Remove the six bolts on each side of the front axle support and remove the entire front axle assembly.
11. Loosen the bolts and clamps and remove the muffler and air cleaner.
12. Remove the bolts retaining the cylinder block to the clutch housing and remove the engine.
13. Loosen the bolts and remove the pressure plate and clutch disc from the flywheel.

B. DISASSEMBLY

1. To remove the flywheel nut, raise the lock washer and remove the nut.
2. Remove the oil pressure sensor, Figure 1.
3. Pull out the oil level dipstick.
4. Remove the three bolts and the air cleaner flange.
5. Remove the injection pipes from the injectors.
6. Loosen the four nuts and remove the fan.

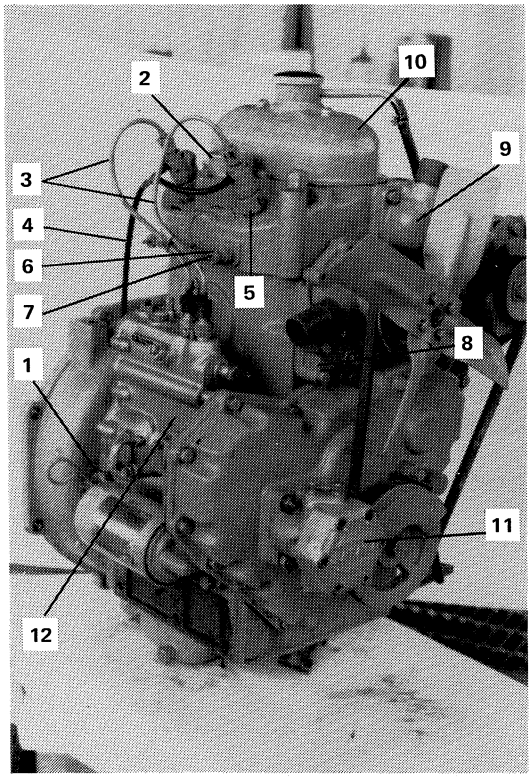

Figure 1
Engine External Components

1. Oil Pressure Sensor
2. Air Cleaner Flange
3. Injection Pipes
4. Return Pipe
5. Nozzle Holder
6. Glow Plug Connector
7. Glow Plug
8. Water Pump
9. Thermostat Cover
10. Rocker Arm Cover
11. Hydraulic Pump
12. Injection Pump

7. To remove the alternator assembly, remove the adjusting plate holder nuts and take out the alternator assembly and V-belt.

8. Remove the return pipe.

9. Remove the nozzle holder.

10. Disconnect and remove the glow plug assembly from the cylinder head.

11. Remove the starting motor.

12. Remove the six bolts and the water pump.

13. Remove the thermostat cover.

14. Remove the nuts and the rocker arm cover assembly.

15. Loosen the center nut and remove the rocker arm assembly and push rods, Figure 2.

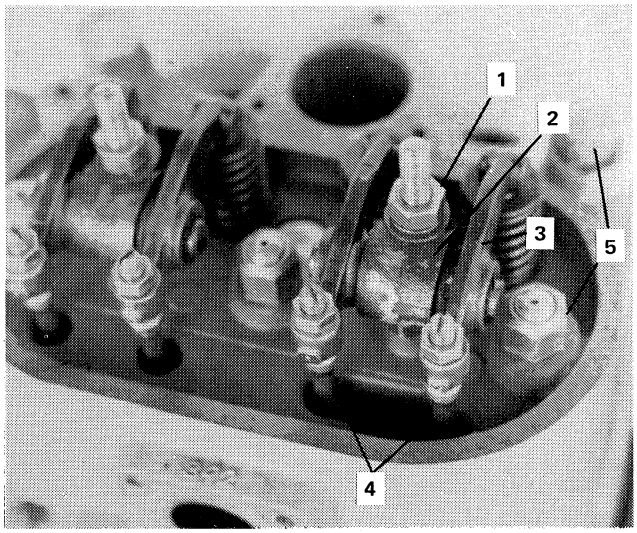

Figure2
Rocker Arm Assembly

1. Center Nut
2. Rocker Arm Shaft Support
3. Rocker Arm
4. Push Rods
5. Cylinder Head Nuts

16. Loosen the nuts evenly and remove the cylinder head and gasket from the cylinder block.

17. Remove the oil filter.

18. Remove the bolts and the crankshaft pulley and key.

19. Loosen the nuts and lockwashers and remove the hydraulic pump.

20. Remove the bolts and timing gear cover.

21. Remove the nut and the oil pump gear and key, Figure 3.

22. Loosen the nut and remove the injector coupling.

23. Remove the three bolts and the injection pump gear.

24. Remove the nuts and camshaft gear.

25. After removing the camshaft gear remove the bolt and tachometer assembly.

NOTE: The relief valve should be removed only when servicing of the valve is necessary.

26. Remove the bolts and idler gear, idler gear shaft and oil pipe.

27. Remove the bolts and injection pump from the front plate.

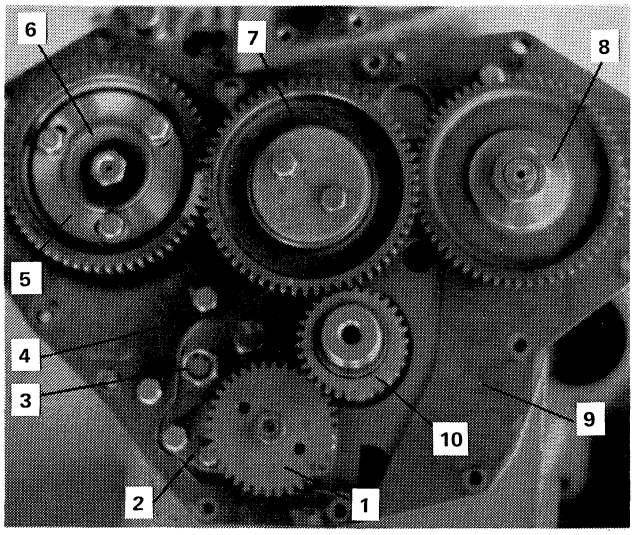

Figure 3
Timing Gears

1. Oil Pump Gear
2. Oil Pump Assembly
3. Relief Valve
4. Oil Pipe
5. Injection Pump Gear
6. Injection Pump Coupling
7. Idler Gear
8. Camshaft Gear
9. Front Plate
10. Crankshaft Gear

28. Loosen the bolts and remove the front plate.

29. To remove the flywheel, place a block of wood on the end of the crankshaft and tap with a hammer.

30. Turn the cylinder block upside down and remove the bolts and oil pan.

31. Remove the capscrews and oil suction filter, Figure 4.

32. Remove the two bolts and oil pump assembly.

33. Remove the bolts and bearing caps from the connecting rods. Then remove the piston and connecting rod assembly by tapping the assembly out towards the top of the cylinder block with a hammer handle, Figure 5.

    NOTE: Before removing the piston assembly, it may be necessary to use a cylinder ridge reamer to remove any ridge or carbon from the top of each cylinder.

34. Remove the bolts and flywheel cover. Take care not to damage the thrust bearing or oil seal.

35. Remove the crankshaft from the rear of the block.

36. Remove the rear camshaft bearing and the camshaft.

37. Pull out the tappets from the bottom of the cylinder block.

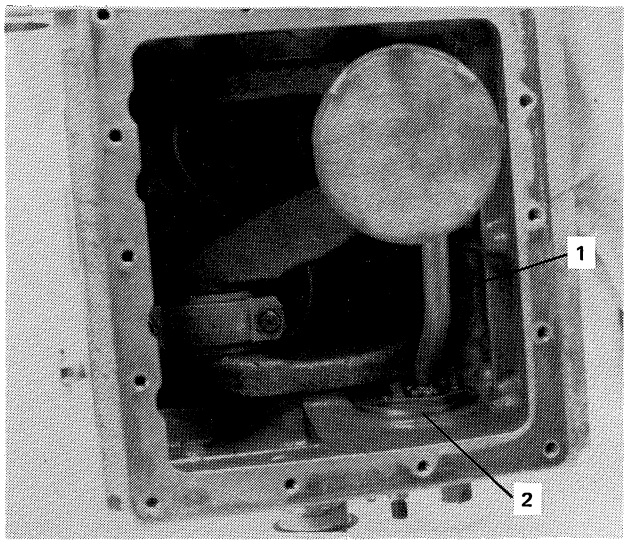

Figure 4
Oil Pump and Suction Filter

1. Oil Suction Filter
2. Oil Pump

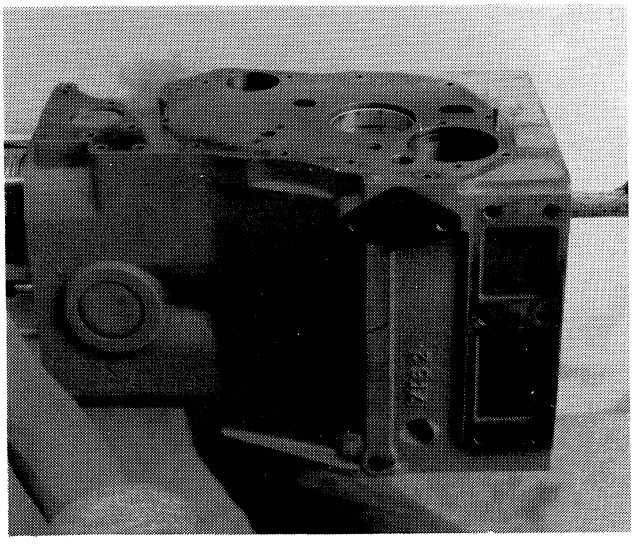

Figure 5
Piston and Connecting Rod Removal

3. CYLINDER HEAD, VALVES, AND RELATED PARTS

CYLINDER HEAD

A. Disassembly

1. Position the valve spring compressor over the valve and spring as shown in Figure 6, and compress the spring. Remove the valve keeper, the valve spring retainer, the valve spring and valve.

   NOTE: Mark the valves with their appropriate cylinder to aid in re-assembly.

2. Remove the valve guide oil seal.

B. Inspection and Repair

1. Inspect the cylinder head for cracks, nicks or burrs. Install a new head if necessary. Minor nicks or burrs can be removed with an oil stone. Make sure that the gasket contact area is clean.

2. Place the cylinder head on a surface plate. Measure for distortion of the cylinder head by inserting a feeler gauge at four points, A thru D, Figure 7. If distortion is more than the specified limit, page 27, it may be skimmed with a surface grinder to within specifications, page 27.

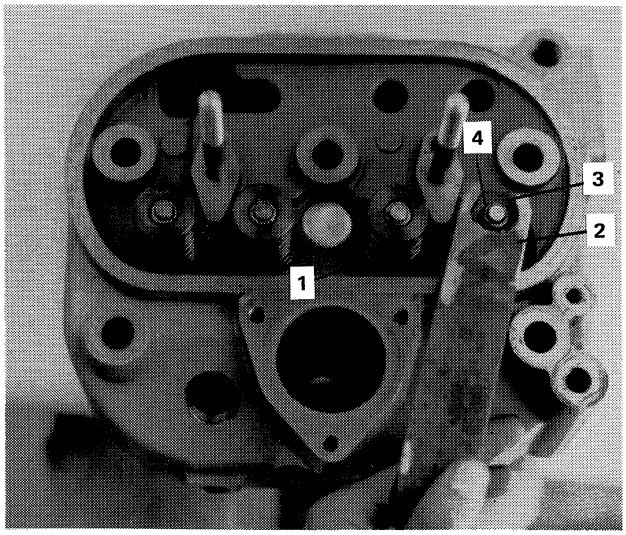

Figure 6
Valve Spring Removal

1. Valve Spring
2. Valve Spring Compressor
3. Valve Spring Retainer
4. Valve Keeper

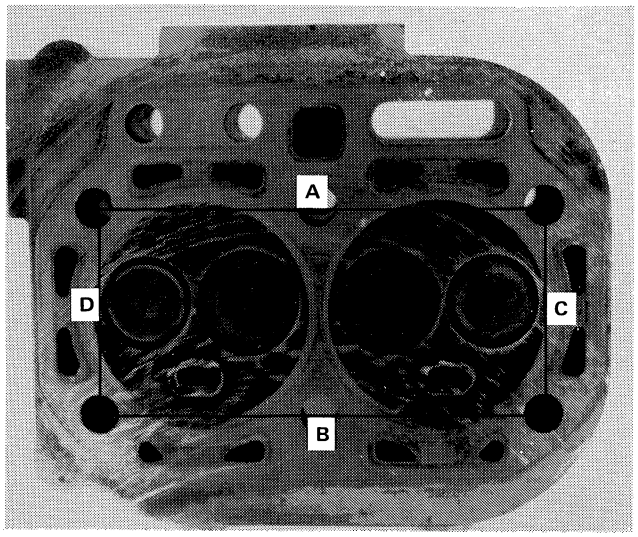

Figure 7
Checking Cylinder Head Distortion

VALVE GUIDE AND VALVE STEM

Inspection and Repair

1. Measure the valve stem diameter with a micrometer at three points I, II, and III, Figure 8. Valve stem size and allowable wear limits are listed in "Specifications" page 27. If wear exceeds these limits, replace the valve.

2. Measure the gap between the valve guide and valve stem, Figure 9. If the gap exceeds specified limits page 27, replace the cylinder head and valves.

VALVE SEAT

Inspection and Repair

1. Valve guide wear should be measured first to determine if valve seat repair is necessary. Refer to "Valve Guide and Valve Stem" inspection, above.

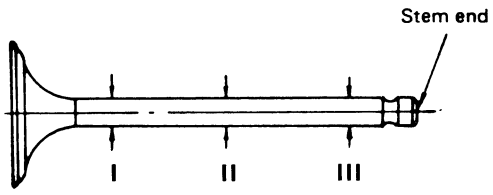

Figure 8
Measuring Valve Stem Diameter

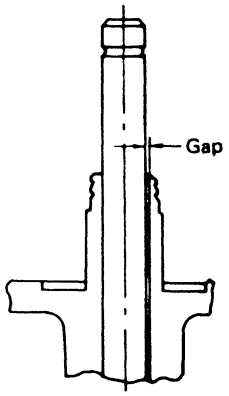

Figure 9
Valve Guide-to-Valve Stem Clearance

2. Seat cutters of 15°, 45°, and 75° are used to correct the valve seat so that the contacting width becomes equivalent to the standard, see Figure 10. Contacting width of both intake and exhaust valve seats are specified on page 28.

3. If the depth of the seat, Figure 11, exceeds the specified limit page 28, regrind the valve seats or replace the cylinder head.

4. Check the head and stem of the intake and exhaust valves for any seizure, wear or deformation. If any of these conditions exist, replace the valves.

5. Check the thickness of the valve head, Figure 12. If the thickness is less than specified limits page 28, replace the valve.

6. Check the valve seat contact by applying compound on the valve seat and then rotate the valve, Figure 13. Check that the valve contacting width is within the specified limit and that the contact is even.

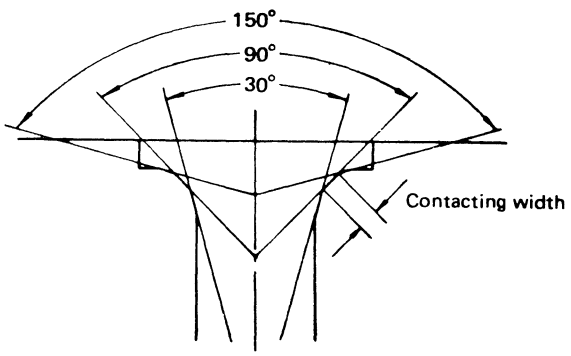

Figure 10
Valve Seat Contacting Width

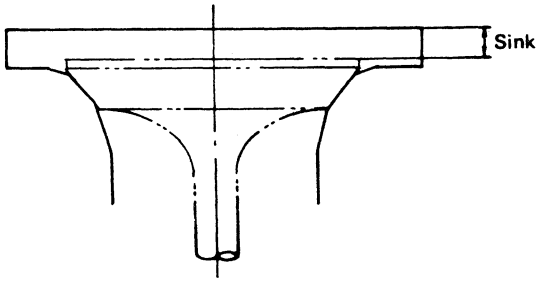

Figure 11
Valve Seat Depth

NOTE: If the contacting width is too wide, carbon will accumulate on the valve. If the contact is too narrow, rapid wear will result.

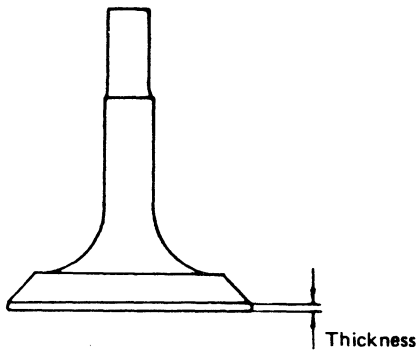

Figure 12
Valve Head Thickness

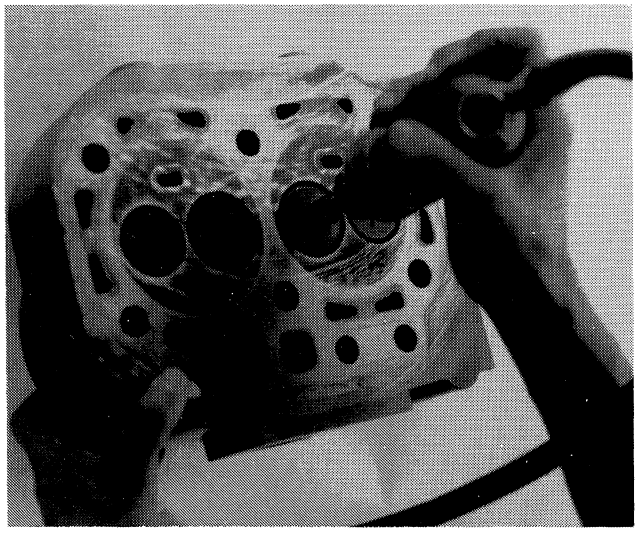

Figure 13
Checking Valve Seat Contact

VALVE SPRINGS

Inspection

1. Discard any valve springs that show signs of erosion or rust.

2. Check each valve spring for squareness, and free length. Measure the spring vertically with a square on a surface plate, Figure 14. Discard any valve springs that do not meet the specified limits page 27.

3. Measure each valve spring with a spring tester. Weak valve springs cause poor engine performance, therefore; if the springs do not meet specified limits page 27, replace the spring.

PUSH RODS AND TAPPETS

Inspection

1. Check the ends of the push rods for nicks, grooves, roughness or excessive wear. If the push rods are not straight, or if any of the above wear conditions exist, replace the rods. Do not attempt to straighten push rods.

2. Check the tappets for nicks, grooves, roughness, or excessive wear. If any of these conditions exist, replace the tappets.

ROCKER ARM ASSEMBLY

A. Disassembly

1. Identify the rocker arms with their appropriate cylinders to assure reassembly in the same location.

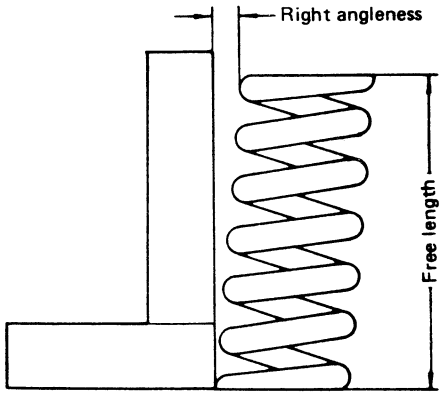

Figure 14
Checking Valve Spring Squareness

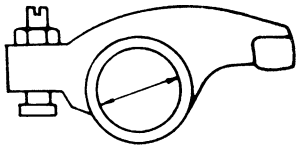

Figure 15
Measuring the Rocker Arm I.D.

2. Remove the snap rings at both ends of the rocker arm shaft and slide the rocker arms off the shaft.

B. Inspection and Repair

1. Measure the diameter of the rocker arm shaft with a micrometer. If the shaft diameter does not meet the specified limits page 28, replace the shaft.

2. Measure the inside diameter of the rocker arm, see Figure 15. Replace the rocker arm if wear exceeds the specified limits page 28.

3. Check for any uneven wear or damage on the valve end of the rocker arm. Remove imperfections with an oil stone or grinder, see Figure 16. If wear or damage is severe, replace the rocker arm.

4. If rocker arm assembly parts are within specifications, clean them thoroughly in solvent and make sure oil passages are clean of obstructions.

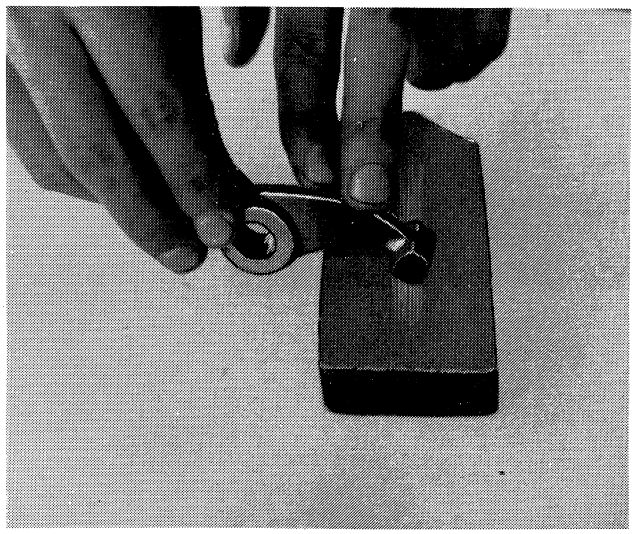

Figure 16
Removing Imperfections from Rocker Arm

C. Assembly

1. Coat the rocker arm shaft with engine oil prior to assembly. Lubricate the valve pads on all rocker arms.

2. Coat the inside bore of the rocker arms with engine oil prior to assembly.

3. Slide the rocker arm shaft through the rocker arm support.

4. Install the rocker arms in their original position on each end of the rocker arm shaft and retain in place by installing the snap rings on each end of the rocker arm shaft.

CYLINDER HEAD

Assembly

1. Insert each valve into the guide bore from which it was removed and lap it into position to give an even seat around the valve. On completion of this operation remove the valve and carefully clean the valve seat and seat insert of any lapping compound.

2. Lubricate all moving parts with engine oil prior to installation.

3. Insert each valve in the guide bore from which it was removed or to which a new valve was fitted. Position a new valve seal over each intake valve and guide.

4. Install the valve spring and retainer over the valve guide.

5. Compress the spring and spring retainer and install the valve keeper.

4. PISTON, RINGS, CONNECTING RODS, BEARINGS, AND CYLINDER BLOCK

PISTON, PISTON PIN AND RINGS

A. Disassembly

1. Using a ring expander, remove the piston rings.

Figure 17
Removing Piston Pin

2. Remove the piston pin snap ring with snap ring pliers.

3. Heat the piston to 122-140°F (50-60°C) and remove the piston pin, Figure 17.

B. Inspection and Repair

1. Inspect pistons for cracks, streaks, seizure, damage at the ring lands, skirts, and pin bosses. Replace any piston that has these characteristics.

2. Measure the gap between the longer diameter of the piston skirt and the cylinder body, Figure 18. If the gap exceeds the specified limit page 29, a new piston should be installed.

3. Replace the piston rings if they are worn or damaged, or if the engine is being overhauled.

4. Place the ring at a right angle to the cylinder bore and measure the end gap with a thickness gauge, Figure 19. If the ring end gap exceeds the specified limit page 29, install new rings.

5. Measure the gap between the piston ring groove and

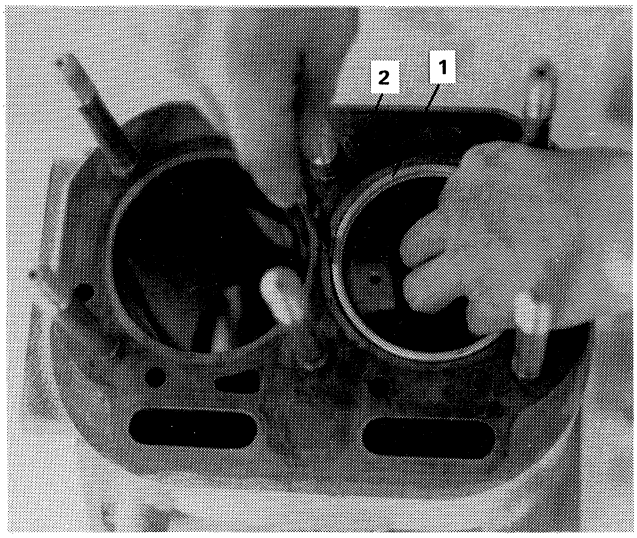

Figure 18
Measuring Piston Skirt-to-Cylinder Bore Clearance
1. Piston Skirt **2. Feeler Gauge**

the ring. If the gap exceeds specified limits page 29, install new rings.

NOTE: Piston rings should be installed with the R mark upward and with each ring gap being offset by 90°.

6. Measure the diameter of the piston pin. If the wear exceeds the specified limit page 29, install a new pin.

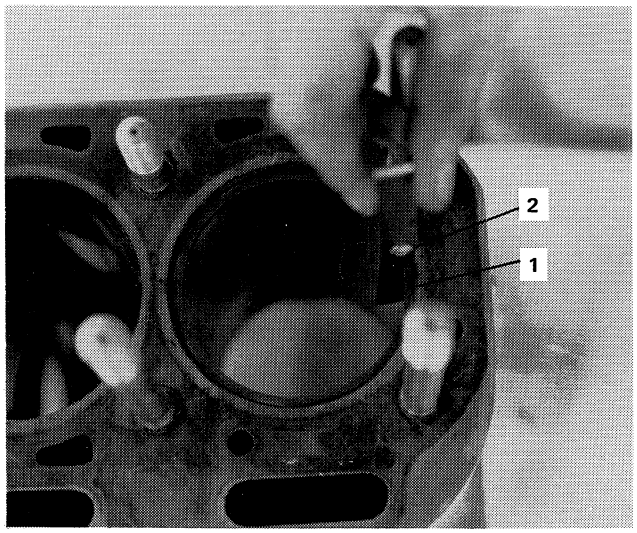

Figure 19
Measuring Piston Ring End Gap
1. Piston Ring **2. Feeler Gauge**

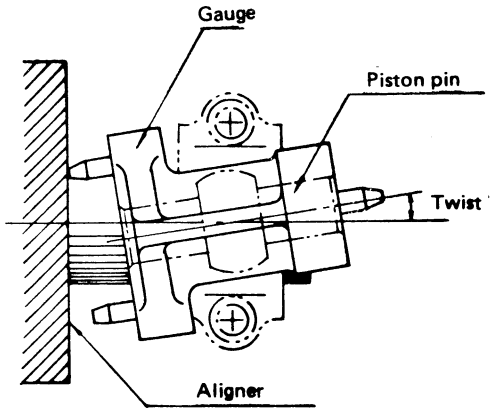

Figure 20
Measuring Rod Torsion

7. The piston pin fit with the connecting rod small end bushing is proper if the piston pin, with oil on its surface, can be pushed in under slight pressure when the piston is at normal room temperature.

CONNECTING RODS AND BEARINGS

Inspection and Repair

1. Measure the connecting rod for twist, warpage or other signs of damage, Figure 20.

2. Measure the large-end and small-end twist and straightness by using a connecting rod alignment fixture, Figure 21. If the measured value exceeds specified limits page 29, install a new connecting rod.

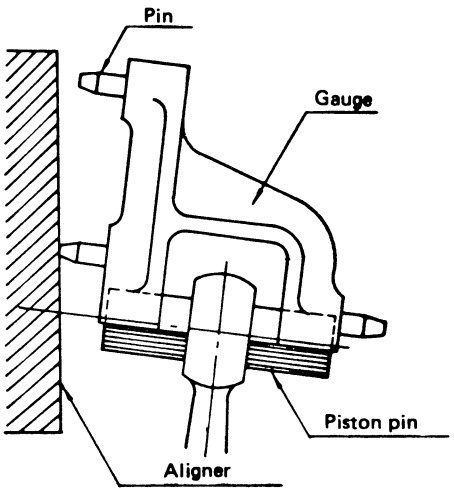

Figure 21
Measuring the Rod End Twist

3. Check the connecting rod bolts. Any part that shows signs of wear or damage should be replaced.

4. Inspect the connecting rod bearings for signs of wear, uneven contact, fatigue failure, scratches, seizure, or improper tension. Replace the bearings if any of these conditions exist.

5. Replace the bearing or crankshaft when oil clearance is excessive resulting from wear in the crankpin and bearing. Oil clearance limits are specified on page 28.

6. Insert the bearings into the connecting rod cap, Figure 22.

PISTON AND CONNECTING ROD

Assembly

1. Heat the piston up to 158°-212° F (70-100°C) and install the rod and pin. Make sure that the piston head mark and the connecting rod "F" mark are set as shown in Figure 23. Alignment marks of figures are inscribed on the connecting rod.

2. When replacing the connecting rod, piston or piston pin, choose one of the nearest in weight to the old part. Difference in weight between cylinders should be kept within 10 grams, (.35 oz.).

3. When fitting the connecting rod to the crankshaft, install the connecting rod so that the piston mark "*" faces toward the combustion chamber jet, and measure the play in axial direction, Figure 24. If the play exceeds the specified limits page 29, replace the connecting rod.

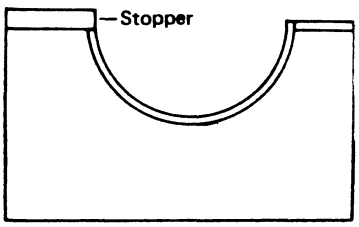

Figure 22
Rod Cap Bearing Installation

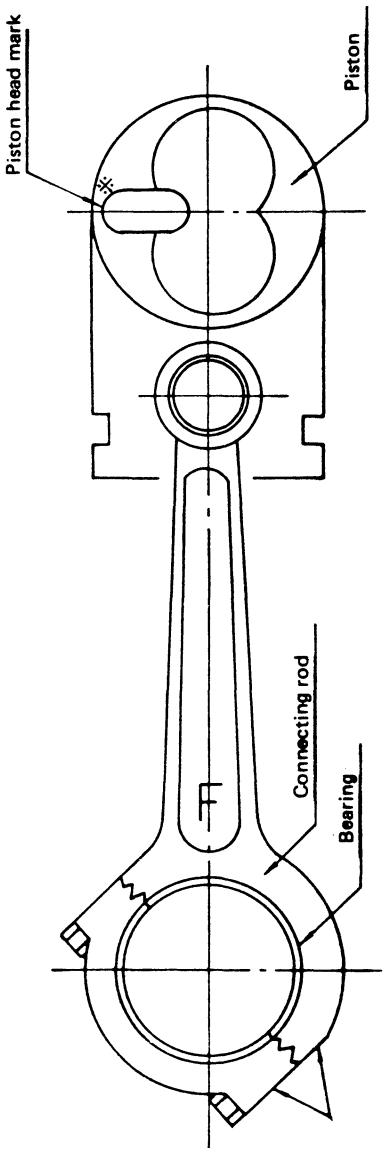

Figure 23
Installment of Piston Head with Connecting Rod

CYLINDER BLOCK

Inspection and Repair

1. Inspect the expansion plugs for evidence of rust. If rust is present this indicates leakage and new plugs should be installed. Remove the defective plugs. Apply sealer to the new plugs and install them securely.

2. Inspect the cylinder block for cracks, nicks, or burrs. Minor nicks and burrs may be removed from the top of the cylinder block with a surface grinder. Replace the cylinder block if severe damage has occured.

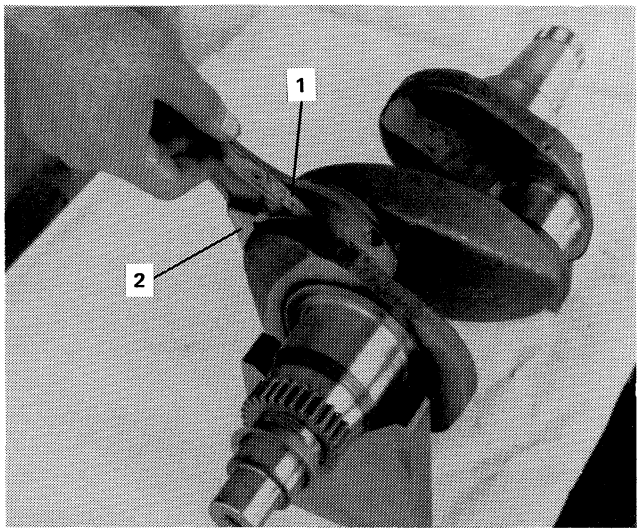

Figure 24
Measuring Connecting Rod Side Float
1. Feeler Gauge **2. Connecting Rod**

3. Check for distortion in the cylinder block in the same manner as for the cylinder head. Refer to page 5, "Cylinder Head." If distortion exceeds the specified limits page 27, resurfacing of the cylinder block must be performed.

4. Check the cylinder bores for waviness, scratches, scuffing, out of round, wear, and taper. These irregularities and scratches, although in most cases too small to be measured with the naked eye, usually can be felt by running a finger over the cylinder surface. Minor imperfections can be removed with a cylinder bore. If more severe damage is apparent the cylinder block should be rebored and new oversize pistons should be fitted.

5. Check the cylinder bore wear at the top, middle, and bottom of the bore with a cylinder bore gauge. Bore top is at the top piston ring position with the piston at TDC or about 11 mm (.433 in.) below the top of the cylinder block and bore bottom is at the piston skirt position at BDC. Wear is usually more severe at the top than at the bottom of the bore. Therefore, wear can be calculated by deducting the minimum diameter at the skirt from the maximum measured bore diameter. If the wear in the cylinder bore exceeds the specified limit page 27, rebore the cylinder and fit oversize pistons to the block.

5. CRANKSHAFT, MAIN BEARINGS, CAMSHAFT, FLYWHEEL AND TIMING GEARS

CRANKSHAFT

Inspection and Repair

1. Clean the crankshaft with a suitable solvent. Clean all drilled passages and blow out the passages with compressed air.

2. Place the crankshaft on V-blocks to check the crankshaft run-out. Measure the run-out by fitting a dial gauge to the crankshaft pulley and flywheel side oil seal surface area, Figure 25. Read the T.I.R. value after rotating the crankshaft one full turn. If the T.I.R. exceeds the specified limit page 28, replace the crankshaft.

3. Inspect the main and connecting rod journals and oil seal contact area of the crankshaft for cracks, scratches, grooves or scores. Minor imperfections may be dressed with an oil stone or crocus cloth. A severely damaged crankshaft should be replaced.

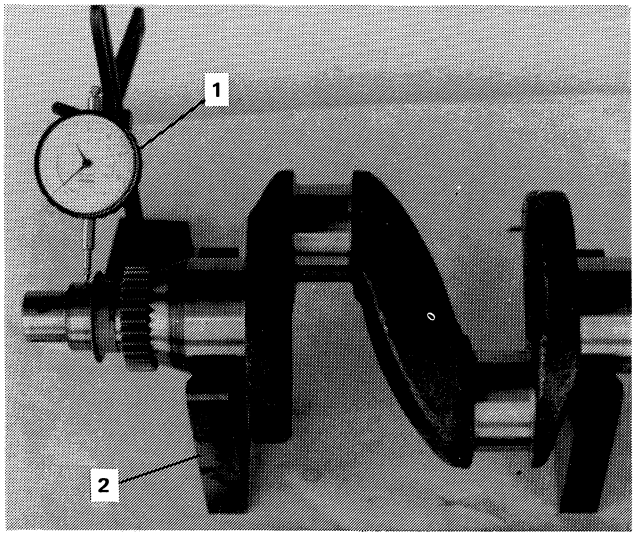

Figure 25
Measuring Crankshaft Run-Out
1. Dial Gauge **2. V-Blocks**

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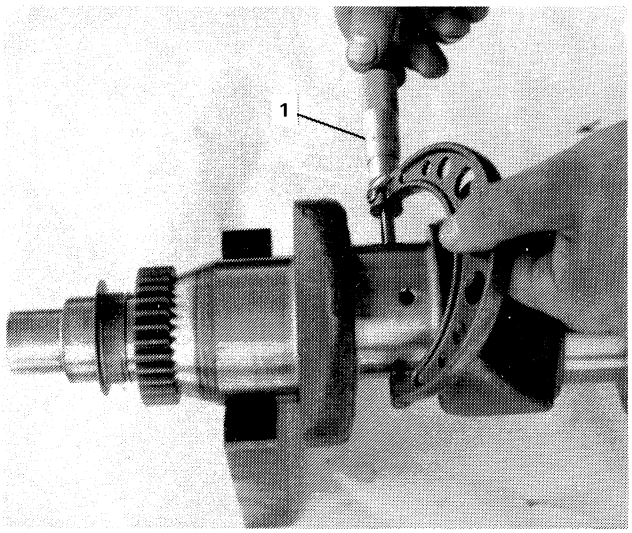

Figure 26
Measuring Crankshaft Journal
1. Micrometer

4. Measure the roundness and taper of the journals and pin with a micrometer, Figure 26. If the measured valve exceeds specified limits page 28, replace the crankshaft.

5. Measure the end float of the crankshaft with a feeler gauge at the crankshaft rear bearing position as shown in Figure 27. If the end float exceeds the specified limit page 28, replace the thrust bearing.

NOTE: Install the thrust bearing with the oil groove facing the crankshaft thrust surface.

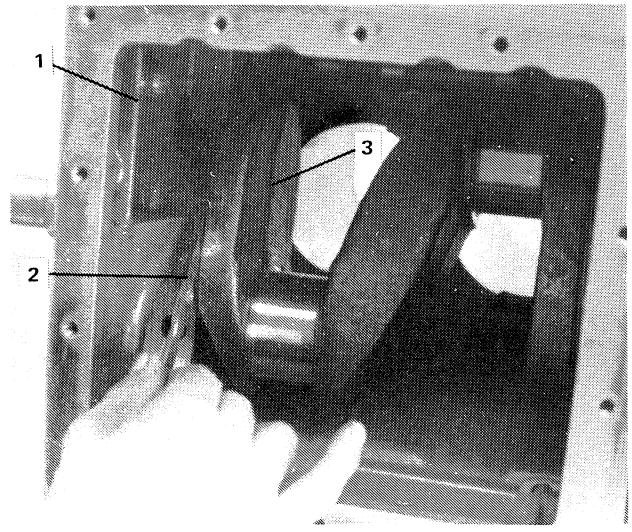

Figure 27
Measuring Crankshaft End Float
1. Rear of Cylinder Block
2. Feeler Gauge
3. Crankshaft

MAIN BEARINGS

Inspection and Repair

1. Clean the bearing liners and caps thoroughly. Inspect each bearing carefully. Bearings that have signs of wear, fatigue failure, scratches, chipped or scored surfaces should be replaced.

2. Replace the bearing when oil clearance is excessive resulting from wear between the bearing and crankshaft. Oil clearance limits are specified on page 28.

3. When replacing the main bearings, the oil hole in the bearing must align with the oil passages in the block and flywheel cover.

CAMSHAFT

Inspection and Repair

1. Inspect the camshaft journals and lobes for roughness, scores, nicks, pits, or discoloration from heat. Minor imperfections can be removed with an oil stone or crocus cloth.

2. Place the camshaft on V-blocks to check the camshaft run-out. Measure the camshaft run-out by placing a dial gauge at the center of the camshaft, see Figure 28. Read the maximum value after rotating the camshaft one full turn. If the T.I.R. exceeds the specified limit page 28, replace the camshaft.

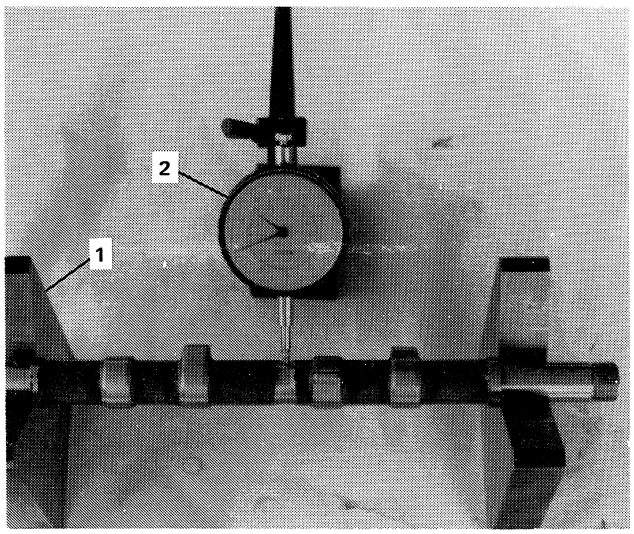

Figure 28
Measuring Camshaft Run-Out
1. V-Blocks
2. Dial Gauge

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