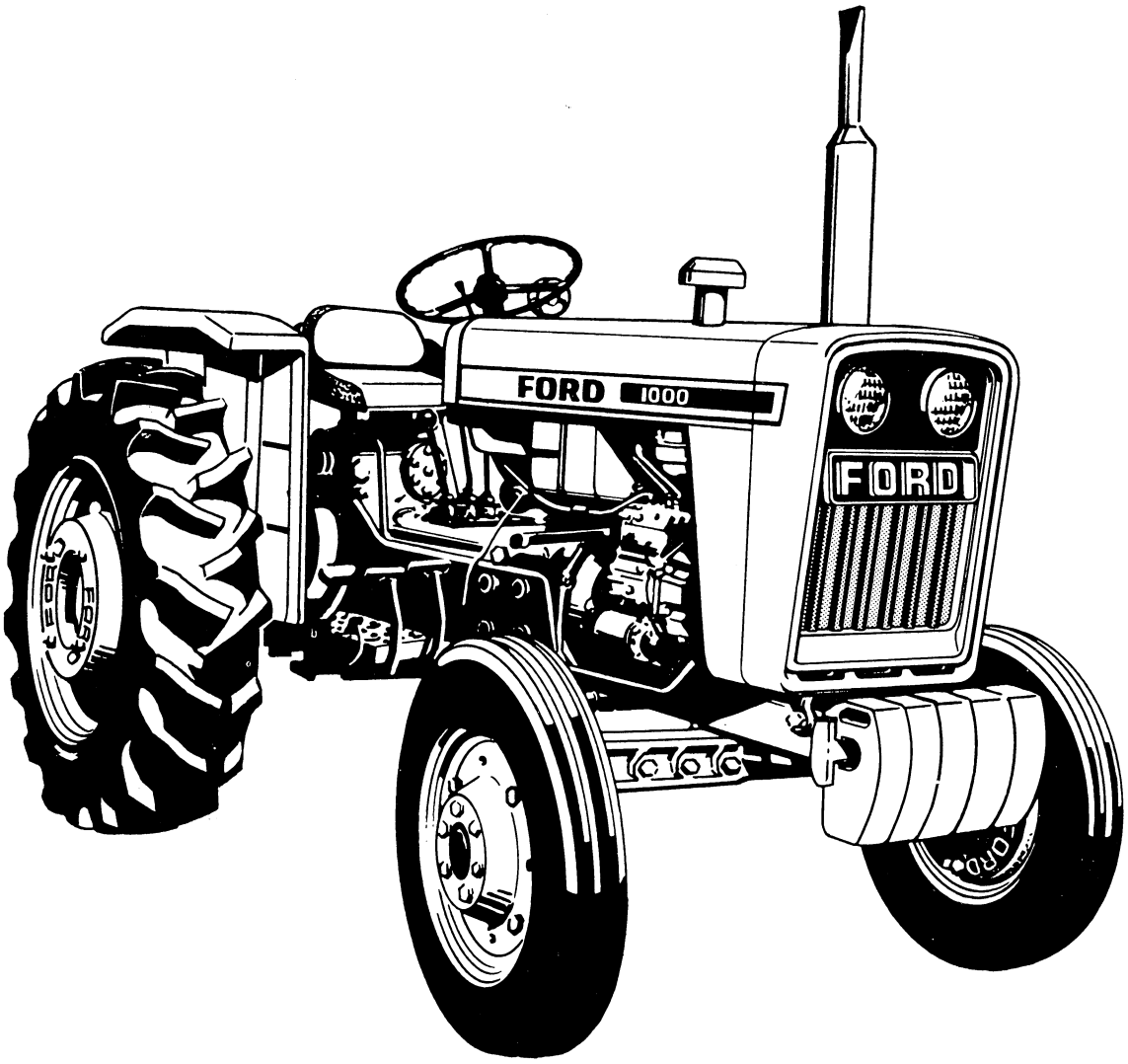
FORD

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.

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.

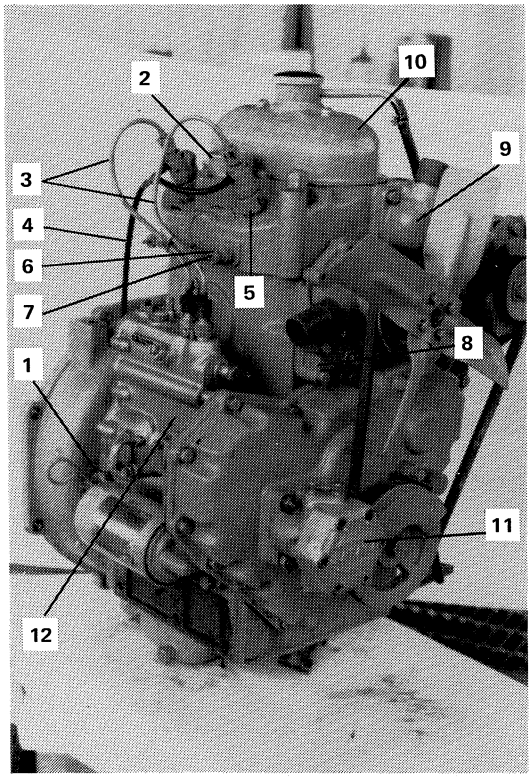

Figure 1
Engine External Components

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.

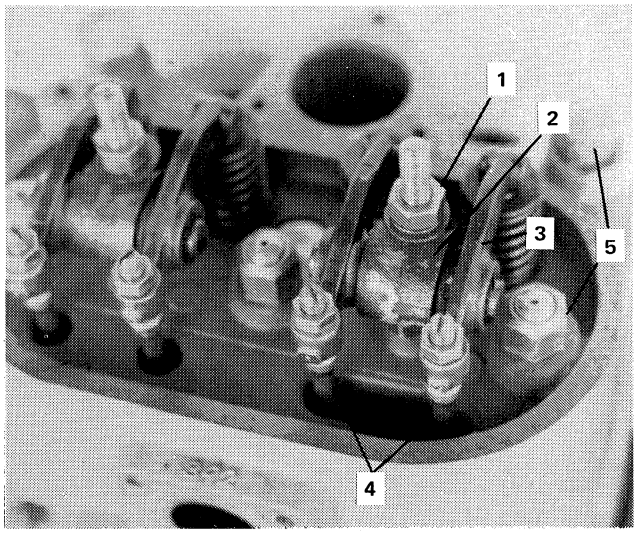

Figure2
Rocker Arm Assembly

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.

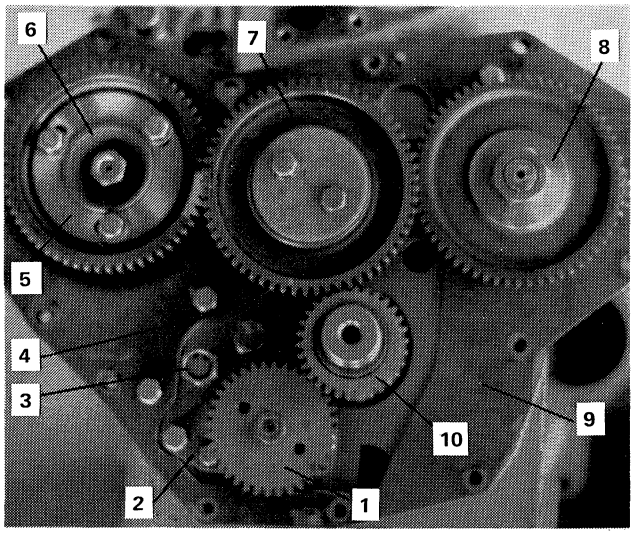

Figure 3
Timing Gears

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.

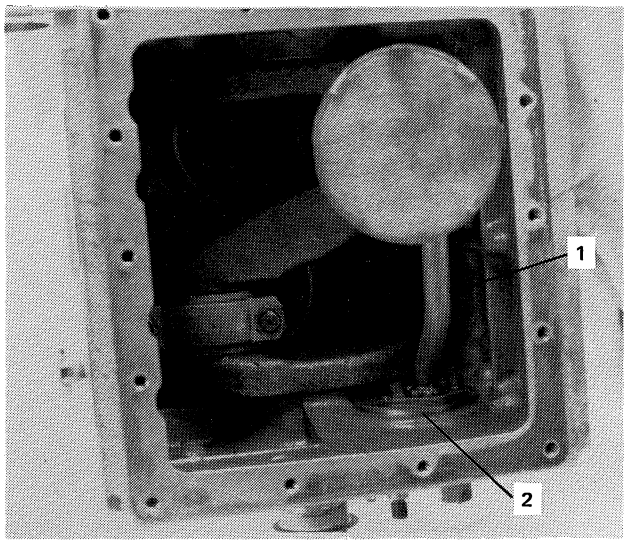

Figure 4
Oil Pump and Suction Filter

1. Oil Suction Filter
2. Oil Pump

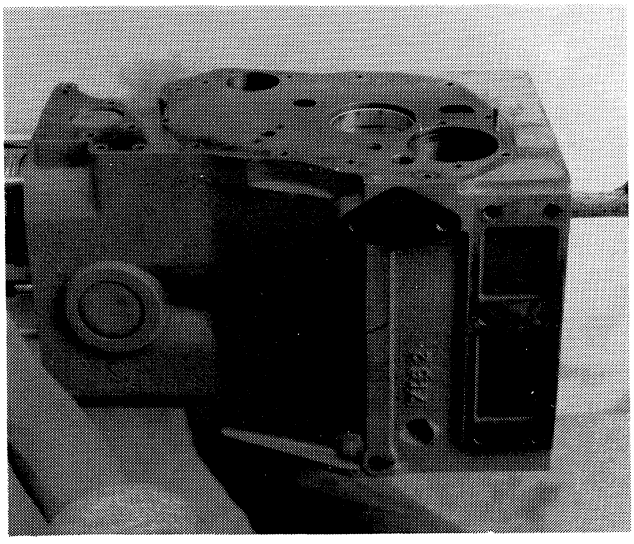

Figure 5
Piston and Connecting Rod Removal

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.

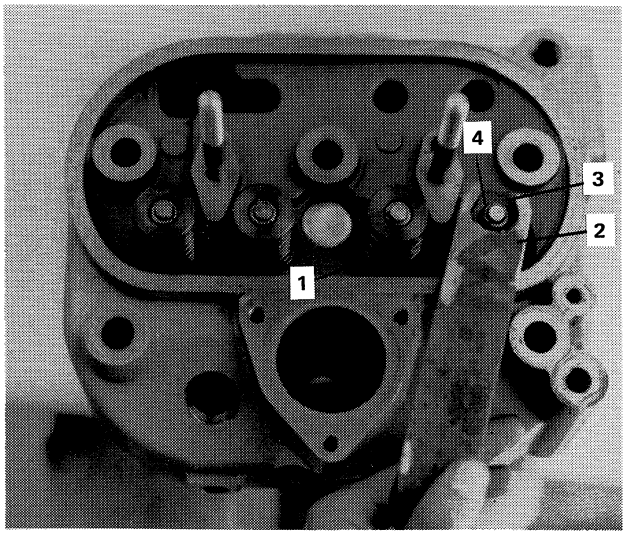

Figure 6
Valve Spring Removal

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

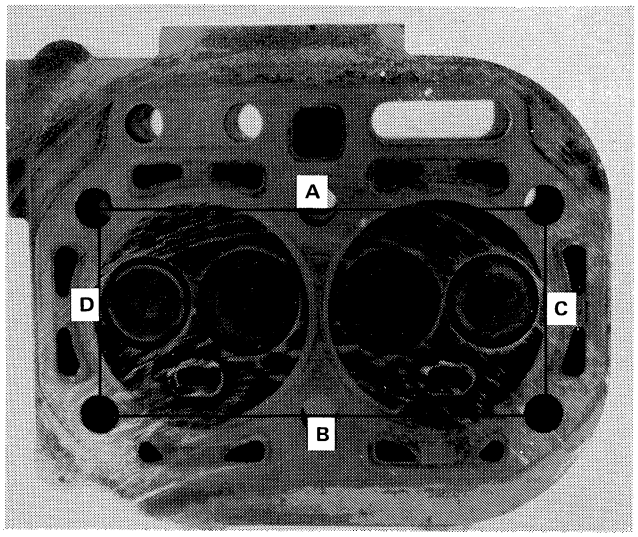

Figure 7
Checking Cylinder Head Distortion

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.

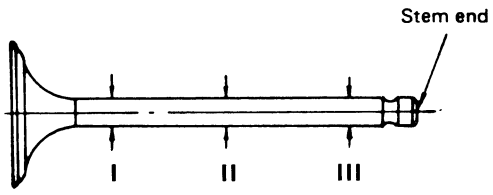

Figure 8
Measuring Valve Stem Diameter

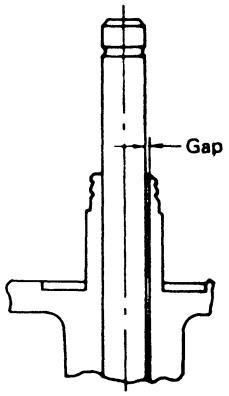

Figure 9
Valve Guide-to-Valve Stem Clearance

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.

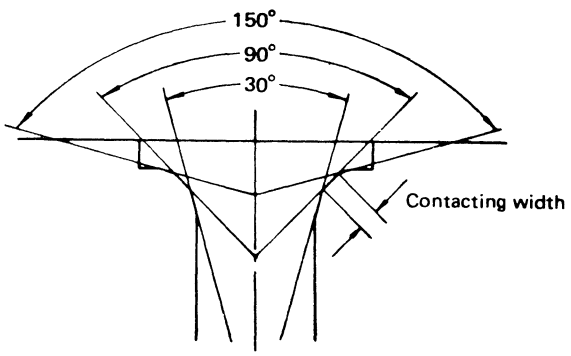

Figure 10
Valve Seat Contacting Width

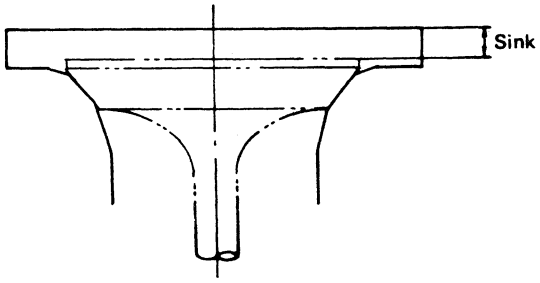

Figure 11
Valve Seat Depth

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

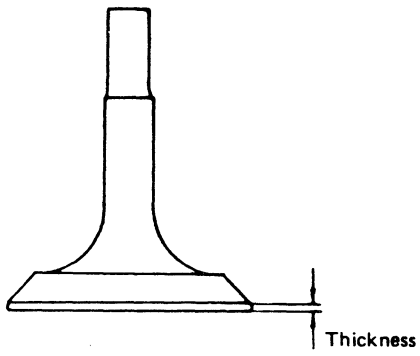

Figure 12
Valve Head Thickness

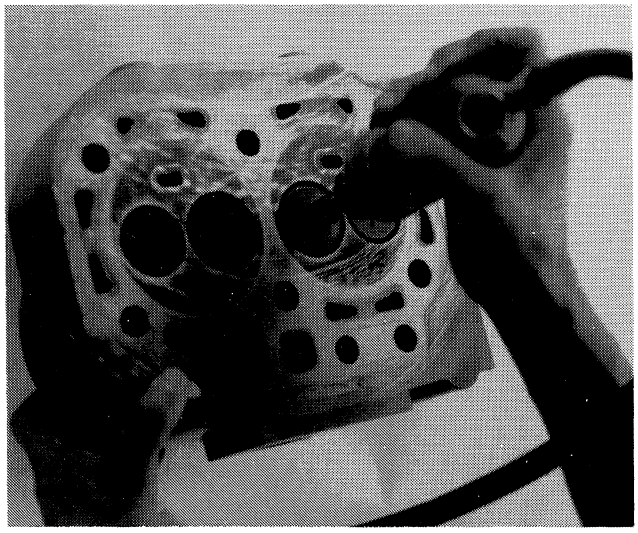

Figure 13
Checking Valve Seat Contact

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.

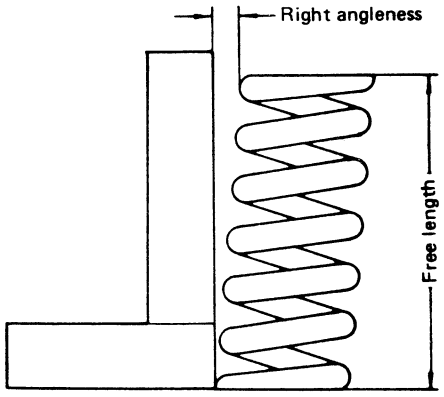

Figure 14
Checking Valve Spring Squareness

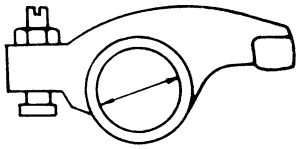

Figure 15
Measuring the Rocker Arm I.D.

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.

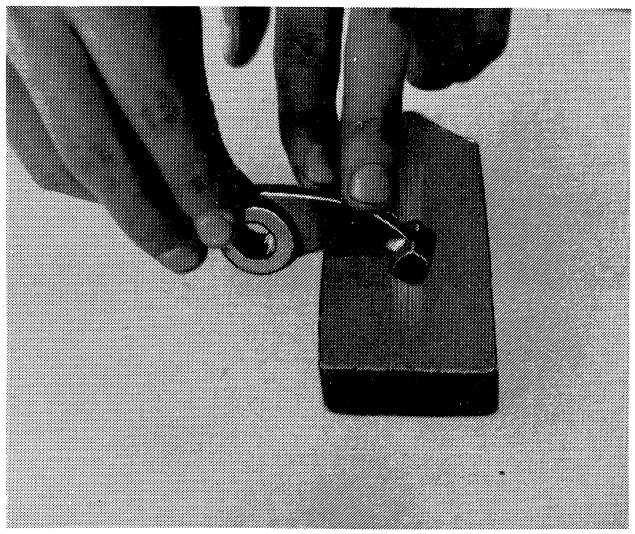

Figure 16
Removing Imperfections from Rocker Arm

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

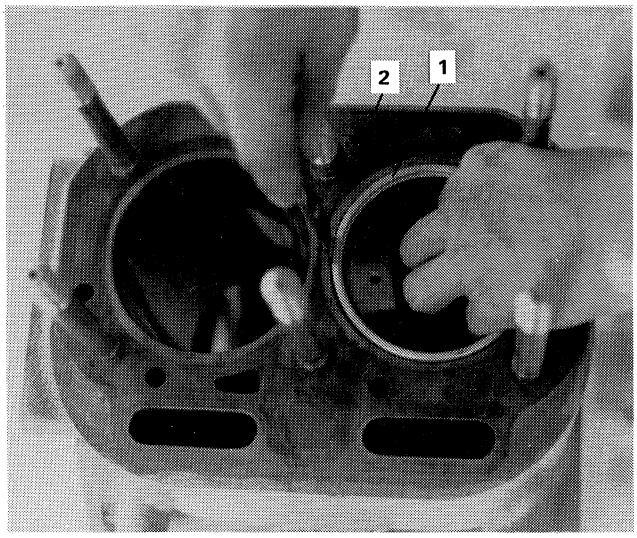

Figure 18
Measuring Piston Skirt-to-Cylinder Bore Clearance
1. Piston Skirt **2. Feeler Gauge**

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.

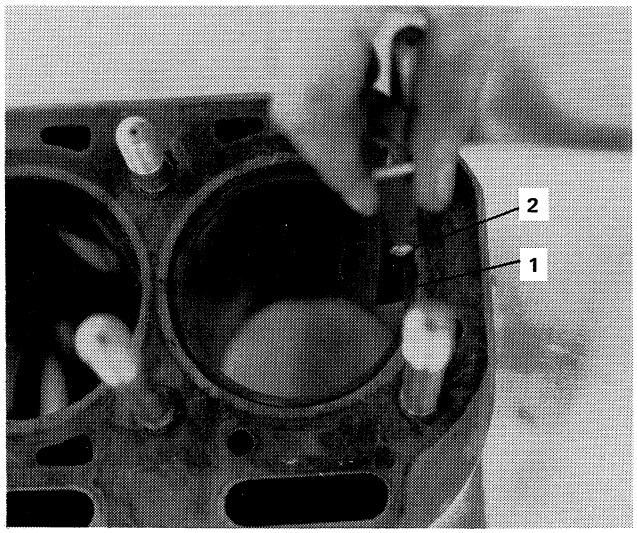

Figure 19
Measuring Piston Ring End Gap
1. Piston Ring **2. Feeler Gauge**

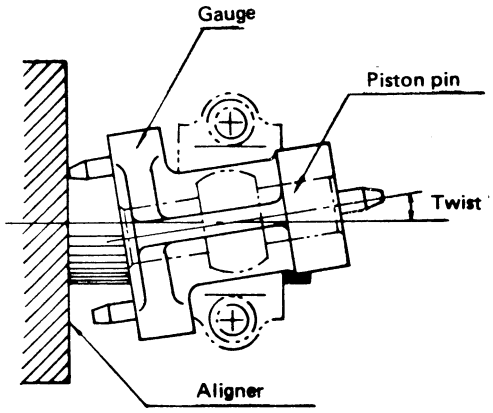

Figure 20
Measuring Rod Torsion

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.

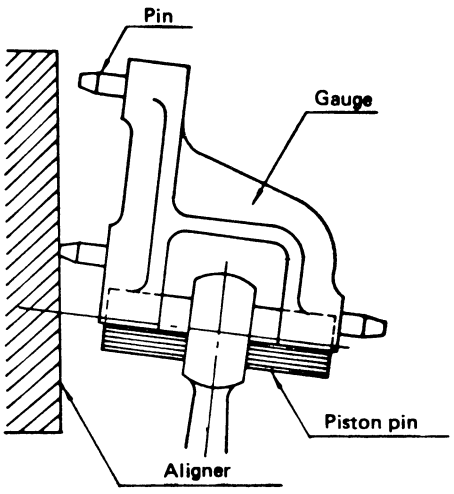

Figure 21
Measuring the Rod End Twist

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.

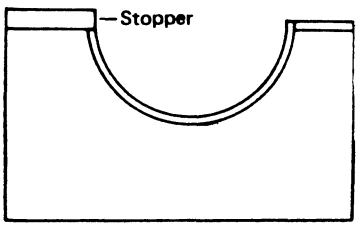

Figure 22
Rod Cap Bearing Installation

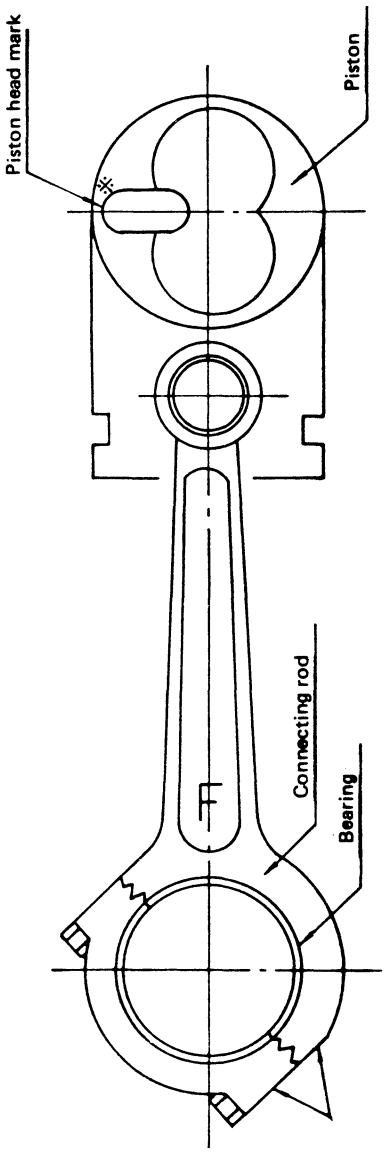

Figure 23
Installment of Piston Head with Connecting Rod

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.

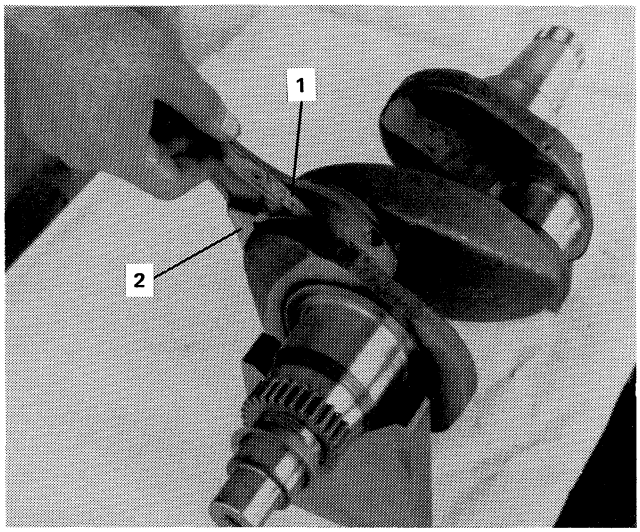

Figure 24
Measuring Connecting Rod Side Float
1. Feeler Gauge **2. Connecting Rod**

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.

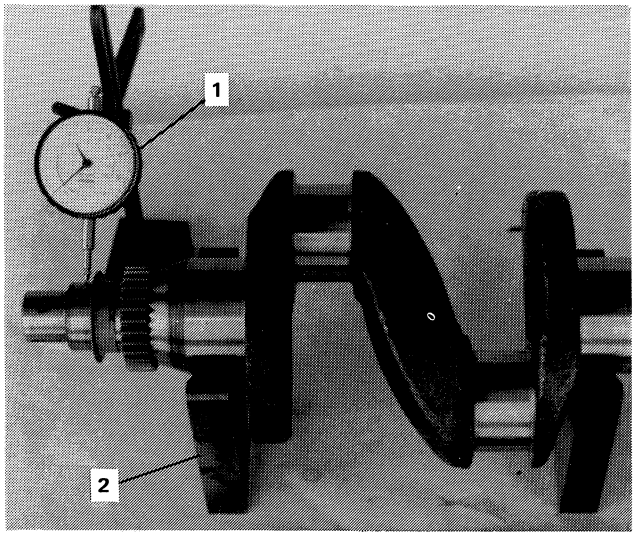

Figure 25
Measuring Crankshaft Run-Out
1. Dial Gauge **2. V-Blocks**

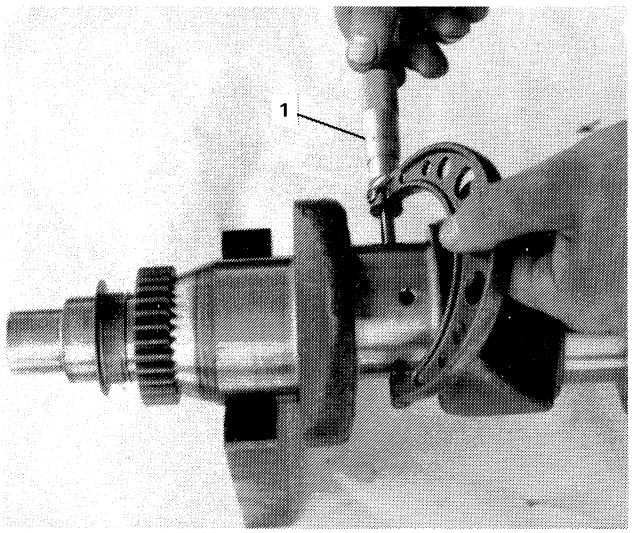

Figure 26
Measuring Crankshaft Journal
1. Micrometer

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.

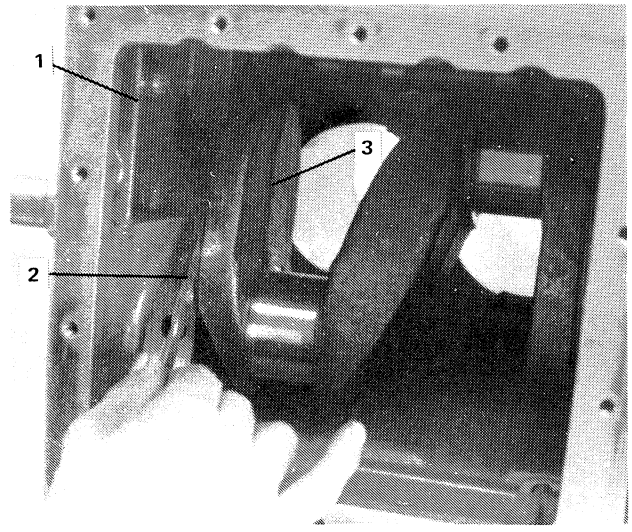

Figure 27
Measuring Crankshaft End Float
1. Rear of Cylinder Block
2. Feeler Gauge
3. Crankshaft

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.

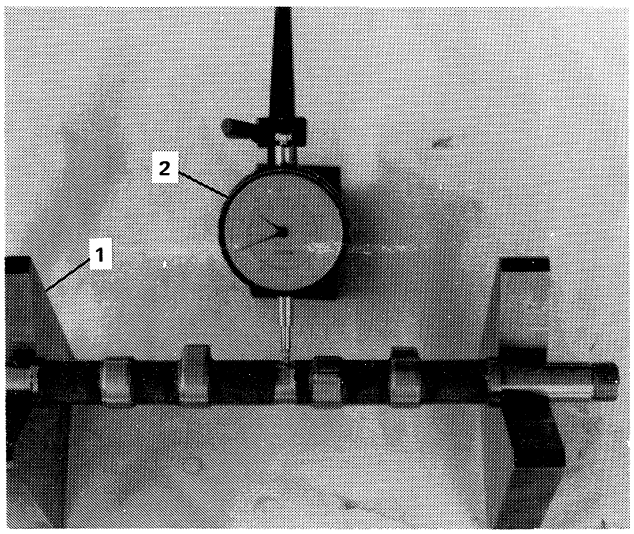

Figure 28
Measuring Camshaft Run-Out
1. V-Blocks
2. Dial Gauge

3. Measure the height of the camshaft lobes with a micrometer, see Figure 29. If the height of the camshaft lobes does not meet the specified limit page 28, replace the camshaft.

4. Check the camshaft roller bearings for wear. Ball bearings can be checked by rotating the outer race with one hand while holding the inner race with the other. Good bearings produce smooth movement while worn bearings produce vibration in the inner race. If any type of roughness, discoloration, or looseness of the balls is apparent, replace the bearing.

FLYWHEEL AND RING GEAR

Inspection and Repair

1. Inspect the flywheel for cracks, scores, or excessive roughness. Minor imperfections can be removed by re-surfacing the flywheel. If excessive warpage or damage is apparent, the flywheel should be replaced.

2. Measure the flywheel run-out with a dial indicator. Measure the run-out in the area where the clutch disc contacts the flywheel, see Figure 30. If the run-out exceeds the specified limit page 29, the flywheel should be machined to within specifications.

3. Check the ring gear for rough edges and for missing teeth which could scuff or gouge the teeth on the drive gear. If necessary, dress the teeth with a wire wheel to smooth up the edges. If the ring gear has signs of minor wear it can still be used by changing the position of the gear by 90°.

4. When installing a new ring gear, heat the gear to approximately 248-302°F (120-150°C). Quickly place the hot gear on the flywheel with the flat gear face against the shoulder of the flywheel. Be sure the ring gear face is flush with the flywheel then quench the gear with water to cool it rapidly.

TIMING GEAR

Inspection and Repair

1. Inspect the timing gears for missing teeth, scores, nicks, burrs, and the condition of the teeth wear pattern. Minor imperfections can be removed with a wire wheel. More severely damaged gears should be replaced.

2. To check timing gear backlash refer to page 17, "Engine Assembly."

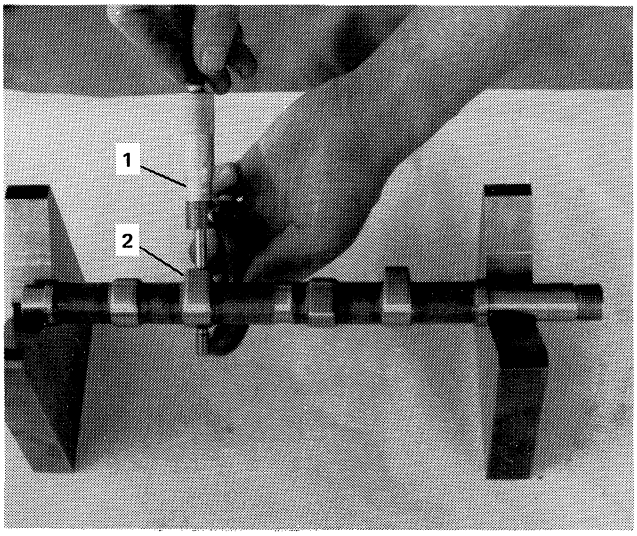

Figure 29
Measuring Height of Camshaft Lobes
1. Micrometer **2. Camshaft Lobe**

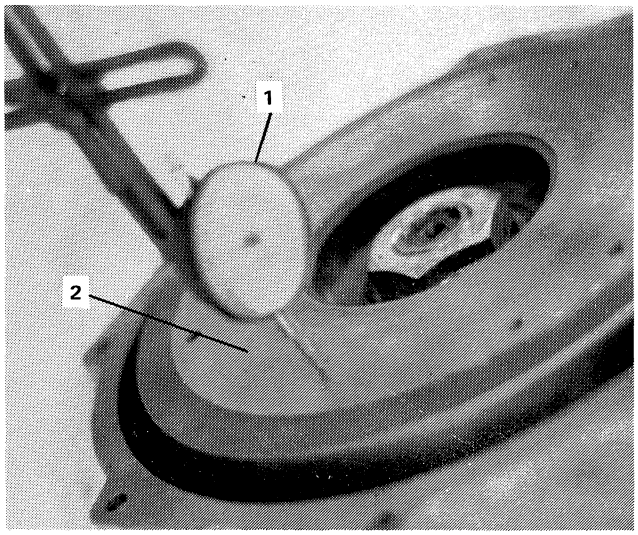

Figure 30
Measuring Flywheel Run-Out
1. Dial Gauge **2. Flywheel**

6. OIL PUMP AND FILTER

OIL PUMP

A. **Disassembly and Inspection**
Refer to Figure 31.

1. Remove the cover from the oil pump.
2. Pull out the oil pump gears.
3. Inspect the oil pump housing cover, and gears for excessively worn or damaged parts. Replace any parts that are in poor condition.
4. Measure the clearance between the oil pump gear

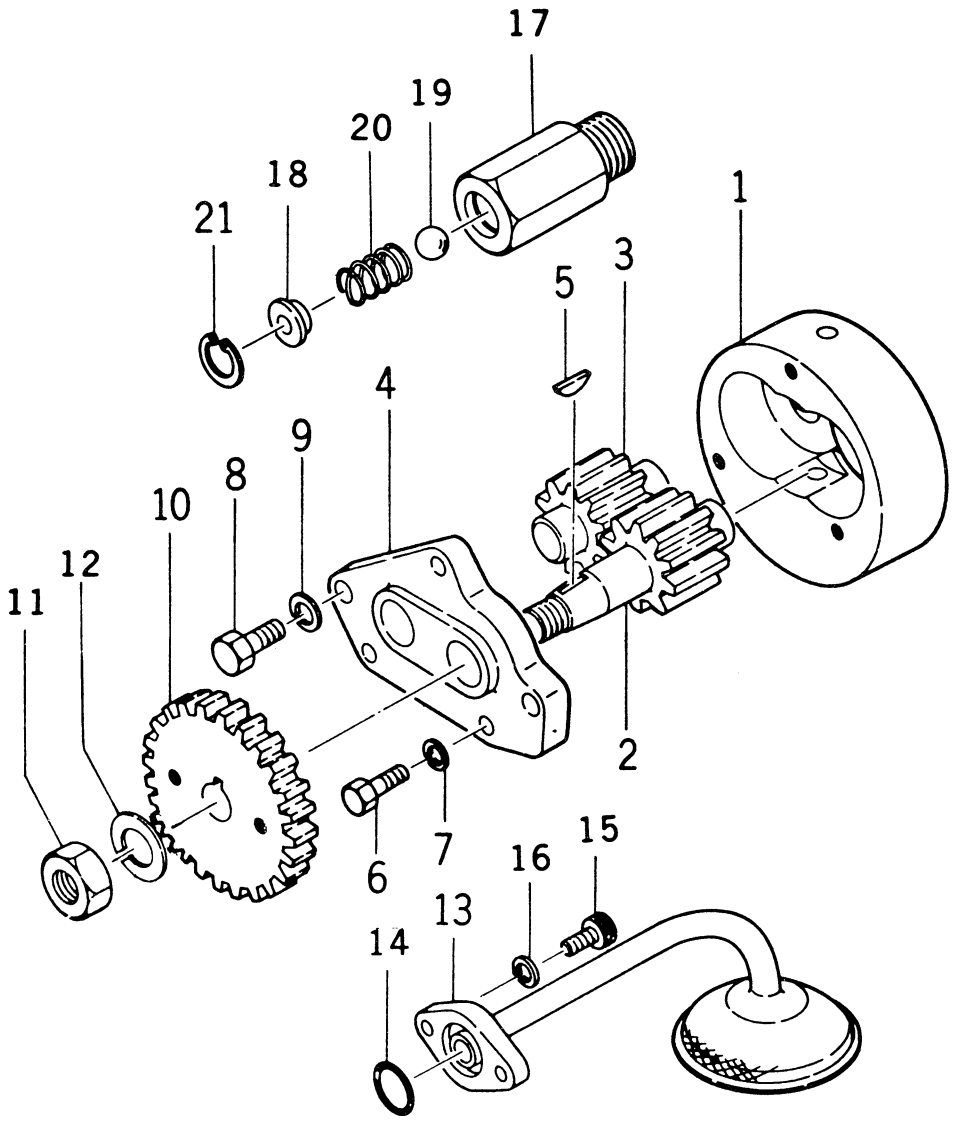

Figure 31
Exploded View of Oil Pump, Filter and Pressure Relief Valve

1. Pump Housing
2. Gear, Long Shaft
3. Gear, Short Shaft
4. Pump Cover
5. Key
6. Bolt
7. Washer
8. Bolt
9. Washer
10. Gear
11. Nut
12. Lock Washer
13. Filter
14. O-Ring
15. Capscrew
16. Lockwasher
17. Relief Valve Housing
18. Spring Holder
19. Ball
20. Spring
21. Snap Ring

and oil pump case, Figure 32. If the measured value exceeds the specified limit page 30, replace the gear.

5. Measure the clearance between the oil pump gear teeth and the oil pump case, Figure 33. If the clearance exceeds the specified limit page 30, replace the gear.

B. Assembly

1. Coat all moving parts with clean engine oil.

2. Insert the oil pump gears into the oil pump housing.

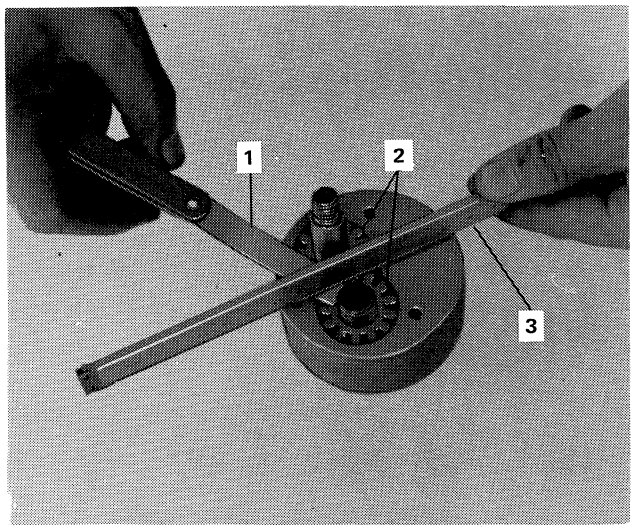

Figure 32
Checking Oil Pump Gear-to Case Clearance
1. Feeler Gauge **3. Straight Edge**
2. Oil Pump Gears

3. Place the oil pump cover onto the oil pump housing.

FILTER

Removal and Installation

1. To remove the oil filter, turn the cartridge body counter-clockwise and then discard the filter.

2. Place a thin coat of engine oil on the seal of the new filter. Install the filter and hand tighten only.

NOTE: The oil filter should be replaced after every 200 hours of operation.

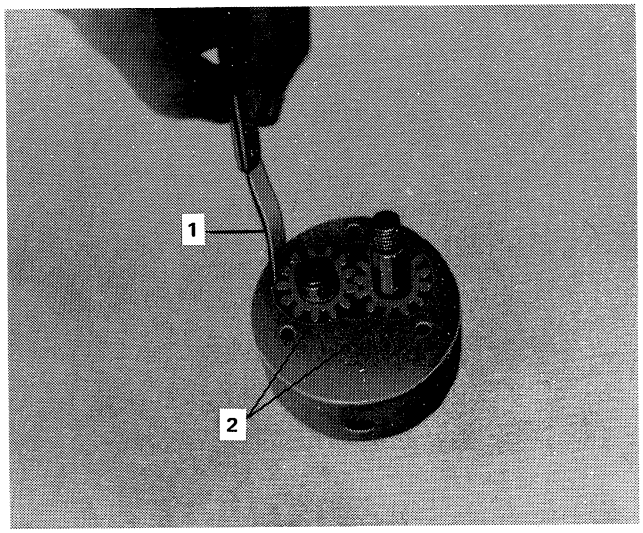

Figure 33
Checking Oil Pump Gear Tooth-to-Case Clearance
1. Feeler Gauge **2. Pump Gears**

7. ENGINE ASSEMBLY AND INSTALLATION

ENGINE

A. Assembly

1. Prior to assembly, apply clean engine oil to all moving and sliding components. Replace all old gaskets and packings with new ones. If necessary, use liquid packing to prevent oil leaks.

2. Insert the tappets into the cylinder block. Make sure that the tappets move up and down easily.

3. Insert the camshaft into the front camshaft bearing, and install the rear camshaft bearing. Make sure the camshaft rotates easily within the bearings.

4. Insert the front thrust bearing into the inside front wall of the cylinder block. Insert the crankshaft from the rear of the block into the front bearing. Take care not to damage the bearing.

5. If a new thrust bearing is being installed use a spring pin in the procedure. Make sure that the oil groove

is facing the crankshaft thrust area and that the spring pin sinks 0.5 mm (.020 in.) below the thrust bearing. See Figure 34.

6. To install the flywheel cover, fit the greased O-ring to the camshaft bearing, apply liquid packing to both sides of the packing, and secure the flywheel cover with bolts tightened diagonally to the torque specified on page 30. Take care not to damage the thrust bearing during the installation of the flywheel cover.

7. Before inserting the pistons make sure each piston ring end gap is offset by 90°.

8. Insert the piston into the cylinder bore using a piston ring compressor, Figure 35. Tap the piston into the cylinder bore using a hammer handle. Make sure that the piston head front mark notch is facing the injection pump. Refer to "Piston and Connecting Rod," page 10.

   NOTE: When installing the piston make sure that the top ring gap is not at a right angle to the piston pin. Also, make sure to install the connecting rod with the alignment mark of the smaller figure in the No. 1 cylinder.

9. Install the connecting rod caps and tighten to the specified torque page 30. Measure crankshaft end float in the axial direction to make sure that it is within specified limits page 28. After tightening the connecting rod caps check to see if the crankshaft can be rotated.

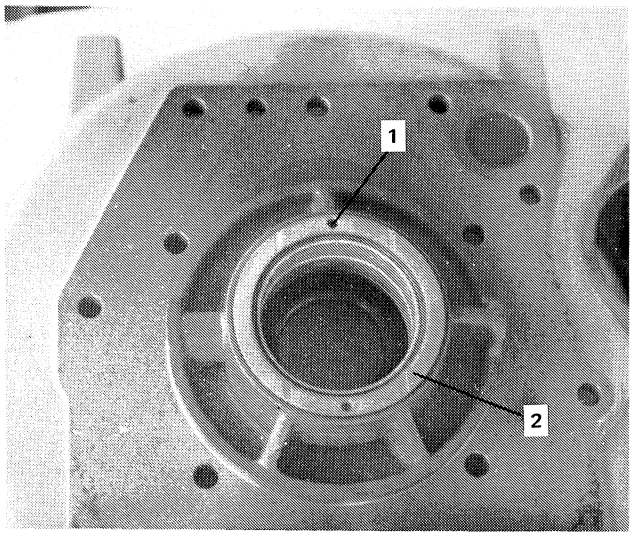

Figure 34
Installing Thrust Bearing

1. Spring Pin **2. Thrust Bearing**

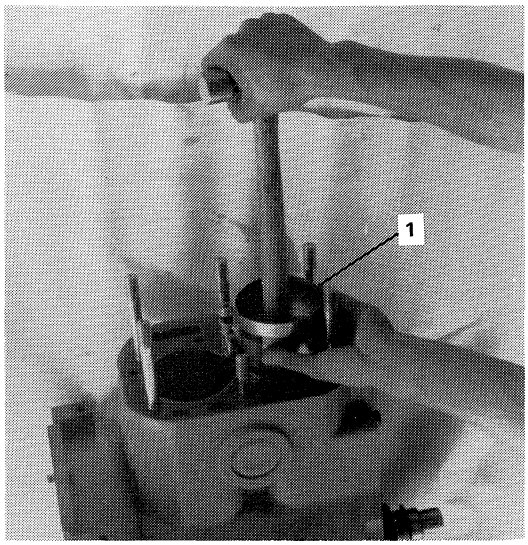

Figure 35
Installing Pistons Into Cylinder Block

1. Ring Compressor

10. Place the oil pump assembly into position and secure with the two washers and bolts. Make sure that the oil pump gear moves freely.

11. Place the oil suction filter into position and secure it with the two capscrews.

12. Position the gasket and oil pan on the cylinder block and tighten the bolts to the specified torque on page 30.

13. Position the flywheel key on the crankshaft.

14. When installing the flywheel, make sure that there is clearance between the key head and the groove in the flywheel. Install the lockwasher and nut and tighten the nut until it is snug. The nut is torqued later in the assembly procedure.

15. Place the front plate into position and secure with the bolts. Tighten bolts to specified torque page 30.

16. Position the injection pump on the front plate and secure into position with the bolts.

17. Install the idler gear shaft and oil pipe. Do not overtighten the bolt.

18. To install the idler gear, coat the bearing with oil and align the idler gear mark with the crankshaft gear mark, Figure 36. Tighten to the torque specified on page 30.

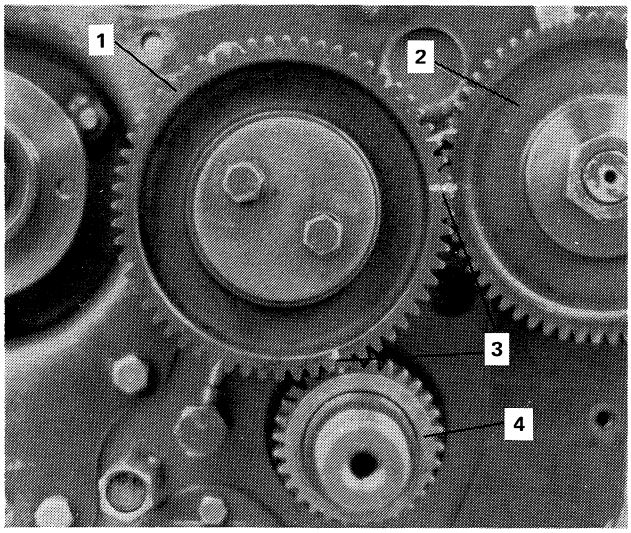

Figure 36
Installing Idler Gear

1. Idler Gear
2. Camshaft Gear
3. Matching Marks
4. Crankshaft Gear

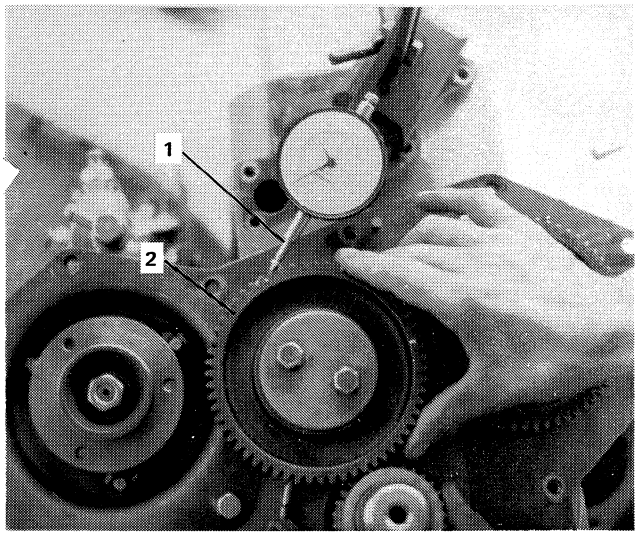

Figure 37
Checking Timing Gear Backlash

1. Dial Gauge
2. Idler Gear

19. If the relief valve has been serviced then install the relief valve and tighten to the specified torque page 30.

20. Install the tachometer assembly and secure it with the two bolts.

21. Engage the two tachometer gears together and then install the camshaft gear onto the end of the camshaft. Align the mark on the camshaft gear with the "O" mark on the idler gear, Figure 36, and tighten the camshaft gear nut to specified torque page 30.

22. At this time it is necessary to check the timing gear backlash.
    a. Measure the backlash of the timing gear with a dial gauge. See Figure 37.
    b. If the backlash exceeds the specified limit page 28, then the timing gear unit should be replaced.

23. Position the injector pump coupling over the injection pump shaft and key and secure with the washer and nut. Tighten the nut to the specified torque page 30.

24. Align the injection pump gear mark with the idler gear mark by turning the crankshaft counter-clockwise. Align the injection pump coupling with the slash (/) mark on the injection pump gear, see Figure 38, and tighten the bolts.

    NOTE: When the injection pump gear, or injection pump coupling is replaced, the injection timing must be set through the following procedure.

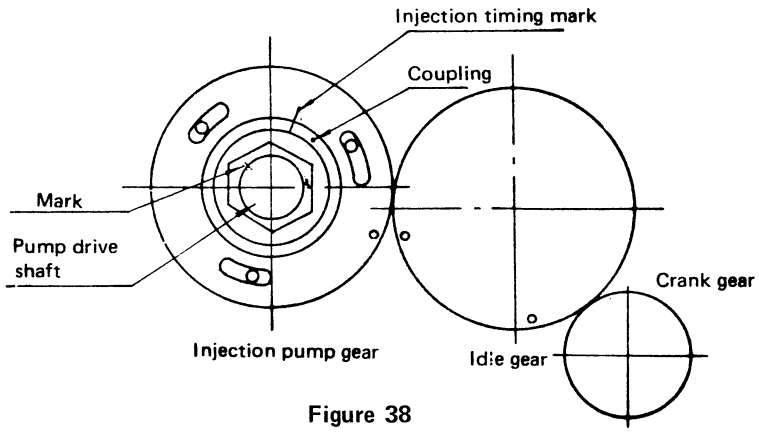

Figure 38
Injection Pump Timing

25. Injection timing is set at 21° BTDC and the following procedure must be followed:
    a. Align the injection pump gear mark with the idler gear mark as previously stated.
    b. Remove the delivery valve from the No. 1 cylinder pumping element on the injection pump.
    c. Align the injection pump drive shaft mark with the elongated hole in the injection pump gear which is opposite the injection pump-to-idler gear timing mark, Figure 38.
    d. Install the three pump gear to coupling retaining bolts but do not tighten.
    e. Rotate the injection pump coupling drive shaft until fuel ceases to flow out of the delivery valve holder. This is the spill-timing location.
    f. Tighten the injection pump gear-to-coupling retaining bolts to the specified torque, page 30.
    g. Using a chisel, inscribe a injection timing mark on the injection pump gear and coupling as shown in Figure 38.
    h. Replace the delivery valve in the No. 1 cylinder pumping element.

26. Install the oil pump gear and key over the oil pump shaft and secure with the washer and nut. Tighten the nut to the specified torque page 30.

27. Position the timing gear case and gasket on the cylinder block and secure with the bolts. Be careful not to damage the oil seal in the timing gear case.

28. Place the hydraulic pump into position and secure with the nuts and lockwashers.

29. Install the crankshaft pulley and key over the end of the crankshaft and secure it with the washer and nut. Tighten the nut to the specified torque, page 30.

30. Install the oil filter and hand tighten only.

31. Place a new head gasket on the cylinder block, then carefully position the cylinder head on the gasket. Coat the cylinder head bolts and nuts with engine oil and install the nuts finger tight.

32. Tighten the cylinder head nuts in the proper sequence, as shown in Figure 39. Tighten the head nuts in three steps progressively. Finally, tighten the head nuts to the specified torque on page 30.

33. Insert the push rods into the holes in the cylinder head from which they were removed. Make sure that the oil holes in the push rods are free from obstructions.

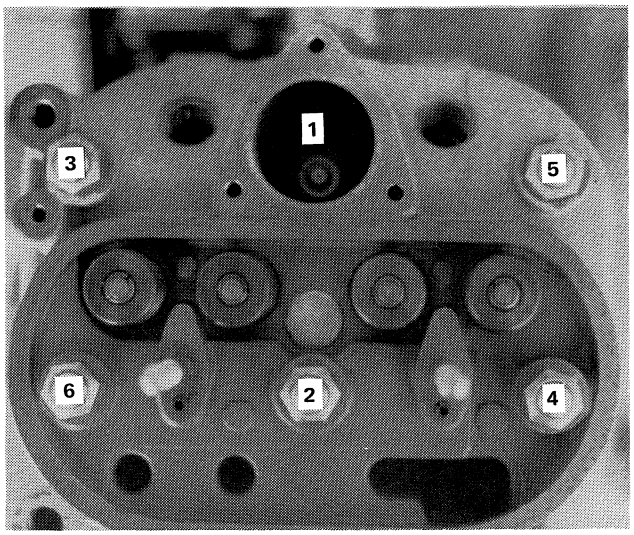

Figure 39
Cylinder Head Nuts Tightening Sequence

34. Position the rocker arm assembly on the cylinder head. Make sure that the holes in the rocker arm support are aligned with the roll pins in the cylinder head, and that the ends of the rocker arm adjusting screws are seated in the push rods.

35. Install the center nuts over the rocker arm assembly support bracket and tighten to the torque specified on page 30.

36. Rotate the engine and set the valve lash, Figure 40. The clearance for both the intake and exhaust valves should be as specified on page 28. The adjustment should be made while the engine is cool.

37. Position the gasket and rocker cover over the cylinder head and tighten the cap nuts to the specified torque, page 30. Take care not to damage the oil seal washer.

38. Place a light coat of liquid packing on the area of the flywheel cover where the starting motor and cover meet. Then position the starting motor in the flywheel cover and secure with the bolts.

39. Install the thermostat, cover, and gasket onto the cylinder head and secure with the bolts. Make sure that the thermostat spring is installed inside the cylinder head.

40. Position the gasket and water pump onto the cylinder block and secure with the bolts.

41. Fit the alternator to the holder and secure it to the gear case with the bolts. (Models up to No. 1375 have no holder.)

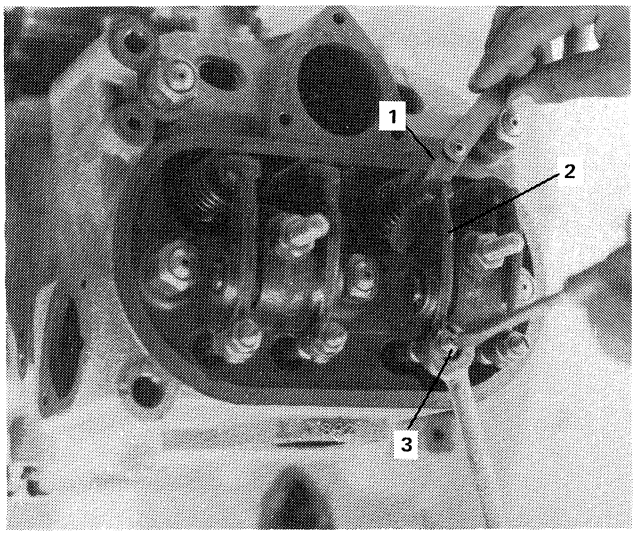

Figure 40
Adjusting Valve Lash

1. Feeler Gauge
2. Rocker Arm
3. Adjusting Screw

42. Fit the V-belt over the water pump pulley, the crankshaft pulley, and the alternator pulley and adjust the alternator so that the V-belt can be pressed down approximately 10-15 mm (7/16 to 9/16 in.) and then tighten the adjusting plate bolt.

43. Install the fan and secure with the four bolts.

44. Install the nozzle holder and tighten to the specified torque page 30.

45. Install the return pipe.

46. Install the glow plug assembly into the cylinder head.

47. Position the air cleaner flange and gasket onto the cylinder head and secure with the bolts.

48. Install the injection pipes onto the injectors and tighten. Do not over tighten the injection pipes, as damage may occur.

49. Insert the oil level dipstick.

50. Apply liquid packing to the threads of the oil pressure sensor and install the sensor into the cylinder block.

51. Tighten the flywheel nut to the torque specified on page 30. After tightening, bend the lockwasher tab over the flywheel nut.

B. Installation

1. Center the clutch disc assembly to the flywheel using a tool such as a pilot shaft or the transmission input shaft, and then position the pressure plate over the clutch disc and tighten the pressure plate bolts evenly to the flywheel to the specified torque page 30.

2. Using a chain hoist, position the engine in line with the clutch housing. Move the engine slowly towards the clutch housing making sure that the transmission input shaft is aligned with the clutch disc. Once the clutch disc and the transmission input shaft have been aligned secure the engine block to the clutch housing with the bolts. Tighten the bolts to the specified torque page 30.

3. Install the muffler and air cleaner and tighten the bolts and clamps.

4. Position the front axle assembly under the engine cylinder block and secure the front axle support to the cylinder block using the six bolts on each side of the front axle support. Tighten the bolts to the specified torque page 30.

5. At this time the floor jacks can be removed from under the clutch housing and the chain hoist can also be removed.

6. Position the steering drag link on the pitman arm, tighten the nut and install the cotter pin.

7. Install the hydraulic pump suction and delivery tubes.

8. Position the radiator, radiator support, and hoses, and tighten all nuts, bolts, and clamps. Tighten nuts and bolts to specified torque page 30.

9. Place the fuel tank base into position and tighten the bolts. Place the fuel tank on the base and tighten the fuel tank bands to secure the tank.

10. Place the fuel pipe and return pipe into position and install the clamps. Then open the fuel tank valve.

11. Install the accelerator rod, washer, and cotter pin.

12. Move the hood panel into position over the engine. Install the nuts under the hood support assembly, the wiring harness, the air cleaner cap, and latch the back of the hood panel.

13. Install the battery, the water temperature gauge, glow plug terminals, oil pressure sensor terminal, headlight terminals, starter relay terminals and connect the battery cables.

Part 1

ENGINE

Chapter 2

COOLING SYSTEM

1. DESCRIPTION AND OPERATION

The cooling system incorporates a radiator, water pump, thermostat, and cooling fan. The coolant is drawn from the bottom tank of the radiator by the water pump which delivers the coolant to the cylinder block. As the coolant enters the cylinder block it passes through cored passages to cool the cylinder walls. The coolant moves through the cylinder block and into the cylinder head assembly where it flows through cored passages in the cylinder head. The coolant continues to flow through the cylinder head to the thermostat.

If the thermostat is closed, a recirculating bypass is provided, allowing a portion of the coolant to recirculate from the head to the block for faster warm-up. When the thermostat is open, the coolant flows from the outlet connection of the head to the top of the radiator. Cooling is accomplished as the coolant flows down through the radiator tubes which are exposed to the cooler air temperatures created by the fan blast.

MAINTENANCE

Cleaning the Cooling System:

Normally, rust, sludge, and other foreign material can easily be removed from the cooling system by using a cooling system cleaning solvent. However, in severe cases, pressure flushing may be required. If pressure flushing is to be used, always remove the thermostat and make sure the cylinder head bolts are tightened properly before flushing. After the cooling system has been cleaned and filled, a good rust inhibitor should be added. However, the rust inhibitor is not necessary if the cooling system is to be conditioned with permanent antifreeze containing rust inhibitor.

Draining and Filling the Cooling System:

To drain the cooling system, open the drain cock in the cylinder block, and the radiator drain cock. Open the radiator pressure cap to speed draining. To fill the system, close the drain cocks, fill the system with coolant and add rust inhibitor or antifreeze, according to the season and locality. All permanent antifreeze sold by reputable manufacturers contains an anti-rust additive. Therefore, the addition of rust inhibitor, when permanent antifreeze is used, will not generally be necessary.

2. RADIATOR AND THERMOSTAT

RADIATOR

A. Removal

1. Drain the cooling system as previously outlined.
2. For easy accessibility, remove the hood panel as outlined under "Engine Removal", page 2.
3. Loosen the hose clamps and slide the clamps toward the middle of the hose.
4. Remove the nuts from the rubber bumpers located at the bottom of the radiator.
5. Disconnect the radiator support bracket and remove the radiator from the tractor.

B. Inspection and Repair

1. Check the upper tank for leaks.
2. Check the fins to be sure they are not bent or clogged.

3. Check the lower tank for leaks.

   NOTE: Any repairs done on the radiator should be performed by a qualified radiator repair shop.

C. Installation

1. To install the radiator, reverse the procedure outlined above, "Removal – Steps 1-5".

2. Fill the cooling system with coolant and add the proper amount of antifreeze, depending upon the season and locality.

3. Run the engine for several minutes and check for leaks in the radiator and at the hose connections.

THERMOSTAT

The thermostat is located in the coolant outlet connection on the front of the cylinder head. Thermostat opening and full open temperatures are listed in the "Specifications," page 30.

A. Removal

1. Drain the cooling system to below the level of the coolant outlet connection.

2. Remove the thermostat cover retaining bolts and slide the cover with the hose attached to one side.

3. Remove the thermostat and gasket.

B. Inspection

Place the thermostat in a container of water and heat the water, Figure 41. If the thermostat valve does not open at or near the opening temperature as specified on page 30, or if it fails to close when the water temperature decreases, install a new thermostat.

C. Installation

1. Clean the thermostat cover and the cylinder head surface of any foreign material.

2. Coat the new gasket with a sealer and position the gasket on the cylinder head.

3. Position the thermostat so that the heat element will be in the cylinder head.

4. Position the thermostat cover over the thermostat and install the retaining bolts.

5. Fill the radiator and operate the engine. Check for leaks around the thermostat cover.

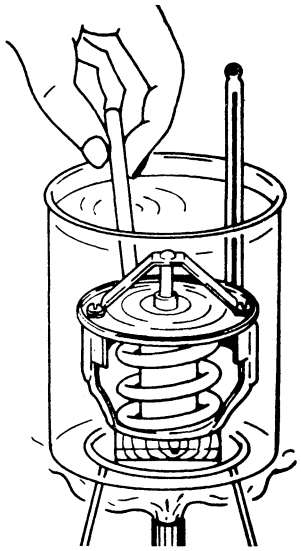

Figure 41
Checking Thermostat Operation

3. WATER PUMP

A. Removal

1. Drain the cooling system as previously outlined.

2. Remove the radiator as outlined on page 20, " Radiator Removal".

3. Loosen the alternator adjusting arm bolt and the two pivot bolts and relax the tension on the belt.

4. Remove the six water pump attaching bolts and loosen the hose clamp and remove the water pump and gasket.

B. Disassembly

1. Remove the four attaching bolts and remove the fan from the pump pulley.

2. Using a gear puller, remove the pump pulley from the shaft.

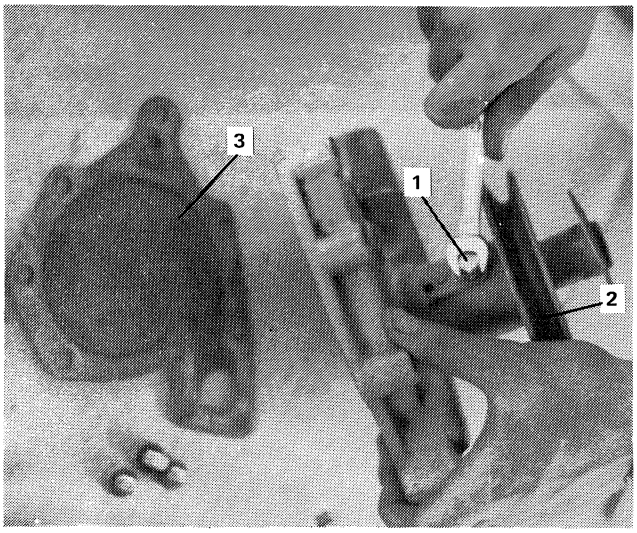

Figure 42
Water Pump Disassembly

1. Set Bolt
2. Pulley
3. Set Plate

3. Remove the three attaching bolts and remove the set plate and gasket from the casing. Loosen the water pump bearing set bolt. See Figure 42.

4. Using a press, remove the impeller and shaft from the pump casing, see Figure 43.

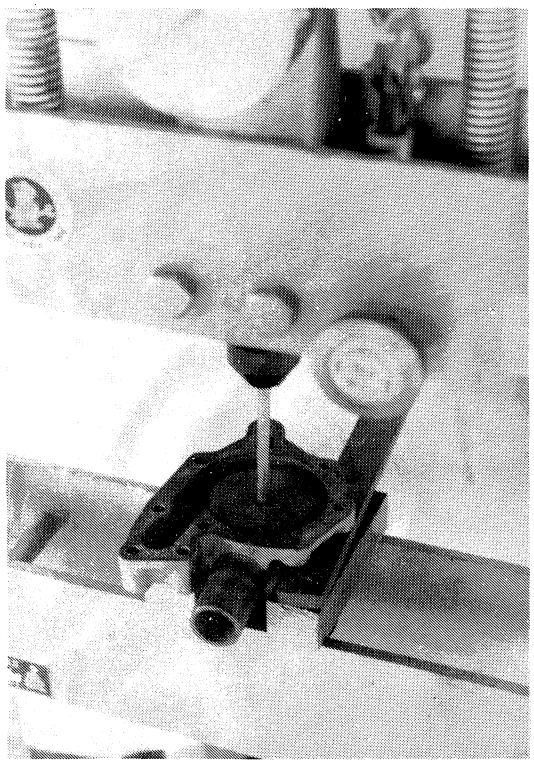

Figure 43
Impeller Removal

NOTE: Avoid using a hammer on the impeller. It is made of cast iron and can be easily broken if hit with a hammer.

C. Inspection and Repair

1. Check each component of the water pump for any cracks, wear or damage, Figure 44. Components which are damaged should be replaced.

2. Check the impeller for worn or damaged vanes and check the seal seat to be sure it is in good condition. Install a new impeller if the seat or vanes are damaged.

3. Check the bearing shaft for nicks, scores, or other damage. If the shaft is damaged a new shaft should be installed.

4. Check the water pump bearing for looseness in the radius direction and if it exceeds the specified limit on page 30, then replace the bearing.

5. Check the pump casing for cracks, fractures, or signs of leakage.

D. Assembly

1. Figure 45 is an exploded view of the water pump

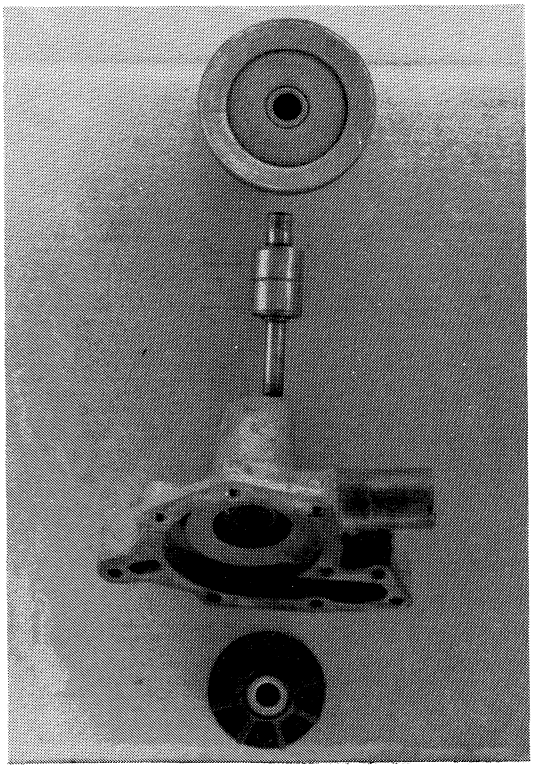

Figure 44
Water Pump Components

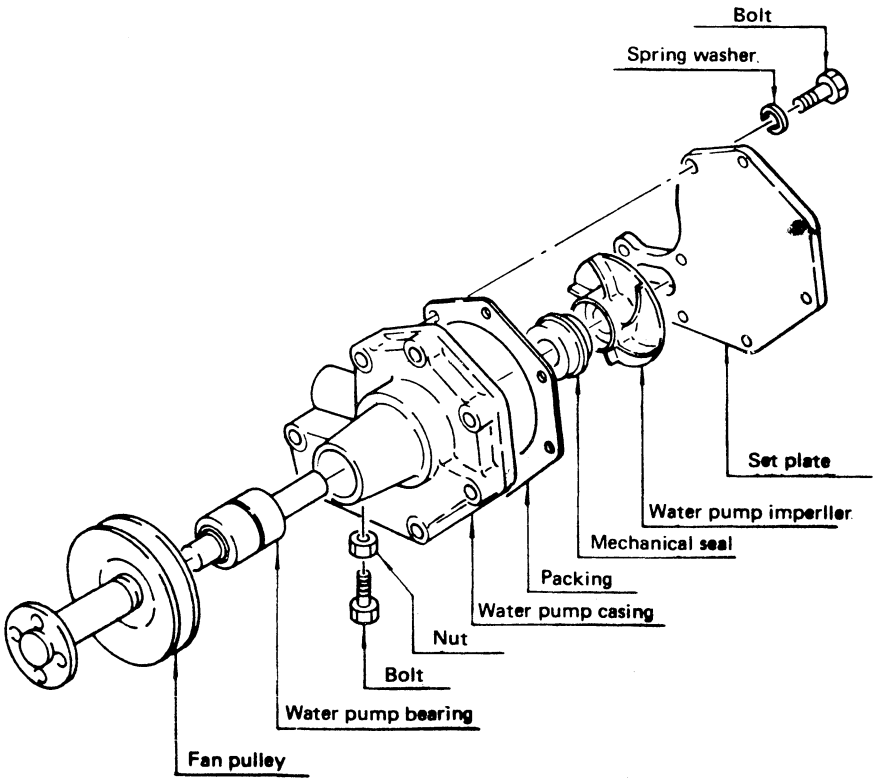

Figure 45
Exploded View of Water Pump

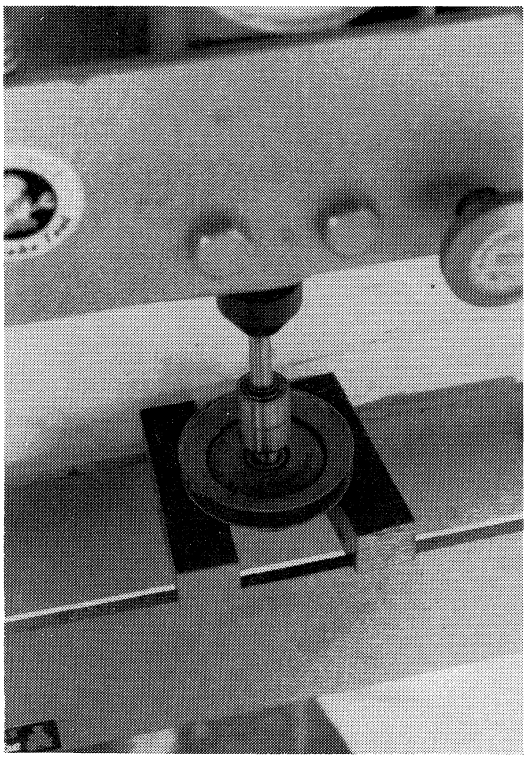

Figure 46
Bearing Installation

components. Use this figure for reference during reassembly. Using a press, install the bearing into the fan pulley, Figure 46.

2. Place the bearing into the pump casing using a press. Align the water pump casing bolt hole with the bearing outer race set hole.

3. Coat the casing side of the mechanical seal with a sealer and insert the seal into the casing.

4. Coat the mechanical seal impeller side with oil and install the impeller over the shaft using a press. Make sure that there is a standard clearance as shown in Figure 47.

5. Coat a new water pump gasket with a sealer and install the gasket and set plate onto the pump. Tighten the bolts to the specified torque, page 30.

6. Install the fan on the pulley. Tighten the bolts to the specified torque, page 30.

7. Rotate the pulley to make sure that the water pump operates smoothly.

E. Installation

1. Coat a new water pump gasket with a sealer and position the gasket and water pump onto the front of the cylinder block and install the six attaching bolts. Tighten the bolts to the specified torque, page 30. Position the hose onto the pump and tighten the clamp.
2. Position the V-belt and adjust the belt tension to within specification, page 30. Tighten the adjusting arm bolt and the two alternator pivot bolts.
3. Install the radiator as outlined on page 21. "Radiator-Installation".
4. Fill the cooling system. Run the engine for several minutes and check for leaks.

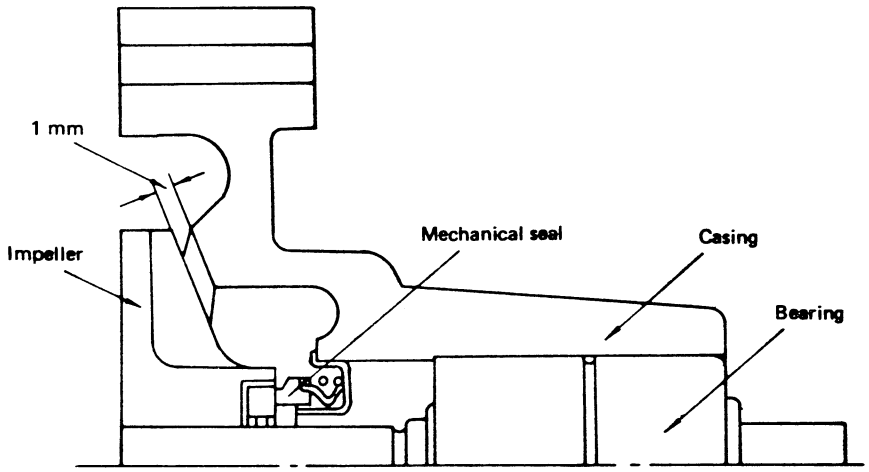

Figure 47
Impeller Installation

Part 1

ENGINE

Chapter 3

TROUBLE SHOOTING AND SPECIFICATIONS

1. TROUBLE SHOOTING

Trouble	Possible Causes
Engine Does Not Develop Full Power	1. Clogged air cleaner. 2. Fuel line obstructed. 3. Improper injection timing. 4. Improper nozzle injection pressure and angle. 5. Low cylinder compression. 6. Insufficient fuel injection. 7. Improper valve lash adjustment. 8. Burned, worn or sticking valves. 9. Blown head gasket. 10. Worn or sticking piston ring.
Low Cylinder Compression	1. Burned, worn, or sticking valves. 2. Bent valve stem. 3. Broken or weak valve spring. 4. Blown cylinder head gasket. 5. Worn or sticking piston ring. 6. Blown piston.
Poor Engine Idling	1. Improper injection timing. 2. Air in injection pump. 3. Improper governor adjustment.
Engine Knocks	1. Diluted or thin oil. 2. Insufficient oil supply. 3. Low oil pressure. 4. Worn crankshaft thrust bearing. 5. Excessive flywheel runout. 6. Excessive connecting rod or main bearing clearance. 7. Seized bearing. 8. Clogged oil passages. 9. Bent or twisted connecting rod. 10. Crankshaft journals out-of-round. 11. Excessive piston-to-cylinder bore clearance. 12. Excessive piston ring side clearance. 13. Broken or damaged rings. 14. Excessive piston pin clearance. 15. Seized piston. 16. Piston pin retainer loose or missing. 17. Improper valve lash adjustment. 18. Worn valve lifter. 19. Excessive timing gear backlash.

1. TROUBLE SHOOTING (CONT'D)

Trouble	Possible Causes
Low Oil Pressure	1. Engine oil level low. 2. Wrong grade of oil. 3. Clogged oil pump filter. 4. Faulty oil pressure relief valve. 5. Worn oil pump drive shaft or gears, or broken oil pipe. 6. Excessive main or connecting rod bearing clearances.
Oil Pressure Warning Light Fails to Operate	1. Bulb burned out. 2. Oil pressure sensor is faulty. 3. Warning light circuit faulty.
Excessive Oil Consumption	1. Engine oil level too high. 2. Leakage in the cylinder head gasket. 3. Oil loss past the pistons and rings. 4. Worn, broken, or sticking piston rings. 5. Clogged return hole of oil ring. 6. Worn valves and/or valve guides or worn seals. 7. Leakage past oil seals and gaskets. 8. External oil leaks from the engine.
Engine Overheats	1. Insufficient amount of coolant in the radiator. 2. Hose connection leaking or collapsed hose. 3. Radiator leakage. 4. Loose, worn, or broken V-belt. 5. Radiator fins bent or clogged. 6. Radiator cap not sealing. 7. Thermostat operating improperly. 8. Insufficient amount of engine oil. 9. Water pump operating improperly. 10. Improper valve clearance. 11. Resistance in the exhaust system. 12. Improperly installed cylinder head gasket. 13. Rust and/or scale clogged water ports. 14. Extended engine idling.
Temperature Gauge Fails to Reach Normal Operating Temperature	1. Faulty temperature sender. 2. Faulty thermostat. 3. Faulty temperature gauge.
Excessive Fuel Consumption	1. Improper injection timing. 2. Leakage at the injection pipe connectors. 3. Leakage at the fuel shut-off valve. 4. Improperly adjusted nozzle.

2. SPECIFICATIONS

ENGINE

Type	Diesel
Number of Cylinders	2
Displacement	1272cc (77.7 cu. in.)
Compression Ratio	21:1
Stroke	100mm (3.94 in.)
Bore	90mm (3.54 in.)
Firing Order	1–2
Rated Engine Speed	2500 rpm
Idle Speed	750–850 rpm
Maximum No-Load Speed	2650–2700 rpm

CYLINDER BLOCK

Cylinder Arrangement	In-line vertical
Cylinder Bore Diameter	90mm (3.543 in.)
Taper of Cylinder Bore	.2mm (.0079 in.)
Cylinder Bore Out-of-Round	.2mm (.0079 in.)
Rebore to Maximum Oversize	1.0mm (.0394 in.)
Cylinder Block Flatness	.05mm (.002 in.)
Allowable Limit for Cylinder Block Distortion	.12mm (.0047 in.)

CYLINDER HEAD

Valve Design	Overhead Valves
Bolt Pattern	4 Bolts per Cylinder
Cylinder Head Flatness	.05mm (.002 in.)
Allowable Limit for Cylinder Head Distortion	.12mm (.0047 in.)
Intake and Exhaust Valve Seat Angle	45°
Top Clearance	.98mm (.038 in.)

VALVE SPRINGS

Number per Valve	1
Type	Cylindrical Coil
Free Length	48mm (1.890 in.)
Tension at 36mm (1.4 in.)	14kg (30.8 lbs.) to 12kg (26.6 lbs.)
Valve Spring Squareness	1.0mm (.0394 in.)

VALVES

Valve Stem Diameter	8mm (.315 in.)
Valve Head Diameter:	
Intake	40mm (1.57 in.)
Exhaust	34mm (1.24 in.)
Valve Stem-to-Guide Clearance	
Intake	.03-.06mm (.0012-.0024 in.)
Exhaust	.04-.065mm (.0020-.0026 in.)

2. SPECIFICATIONS (CONT'D)

VALVES (CONT'D)

Allowable Valve Stem-to-Guide Wear Limit	
Intake	.2mm (.008 in.)
Exhaust	.25mm (.0098 in.)
Valve Seat Contacting Width	1.2-1.5mm (.0472-.0591 in.)
Allowable Valve Seat Wear Limit	2.0mm (.0787 in.)
Valve Seat Sink	.7-1.0mm (.027-.0394 in.)
Allowable Valve Seat Sink Wear Limit	2.0mm (.0787 in.)
Valve Head Thickness	1.3mm (.0512 in.)
Allowable Valve Head Wear Limit	1.0mm (.0394 in.)
Valve Lash (Intake and Exhaust)	.3mm (.012 in.)
Injection Timing	21° BTDC

CRANKSHAFT DRIVE GEAR

Number of Teeth	30
Timing Mark	Mark on Gear

CAMSHAFT DRIVE GEAR

Number of Teeth	60
Timing Mark	Mark on Gear
Timing Gear Backlash	.1mm (.004 in.)
Allowable Timing Gear Backlash	.3mm (.012 in.)

ROCKER ARM SHAFT

Shaft Diameter	13.7mm (.5394 in.)
Wear Limit	13.55mm (.5334 in.)

ROCKER ARM

Inside Diameter	.04mm (.0016 in.)
Wear Limit	.2mm (.008 in.)

CRANKSHAFT

Main Bearing Clearance	.04-.104mm (.0016-.0055 in.)
Crankshaft Bearing Oil Clearance	.056-.131mm (.002-.0051 in.)
Wear Limit for Bearing Clearance	.25mm (.010 in.)
Crankshaft Run-out	.06mm (.0024 in.)
Allowable Crankshaft Run-out	.12mm (.0048 in.)
Journal Out-of-Round, Taper	.05mm (.002 in.)
Crankshaft End Float	.1-.45mm (.0040-.017 in.)
Wear Limit for Crankshaft End Float	.7mm (.027 in.)

CAMSHAFT

Cam Lobe Height	32.05mm (1.26 in.)
Allowable Cam Lobe Wear Limit	31.65mm (1.25 in.)
Camshaft Run-out	.1mm (.004 in.)
Allowable Camshaft Run-out	.2mm (.008 in.)