SERVICE REPAIR

Hyster E001 (H1.50-1.75XM, H2.00XMS) Forklift

MANUAL





SAFETY PRECAUTIONS MAINTENANCE AND REPAIR

- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand, use a lifting mechanism.
- Wear safety glasses.
- DISCONNECT THE BATTERY CONNECTOR before doing any maintenance or repair on electric lift trucks.
- Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See HOW TO PUT THE LIFT TRUCK ON BLOCKS in the **Operating Manual** or the **Periodic Maintenance** section.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **HYSTER APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure all nuts, bolts, snap rings, and other fastening devices are removed before using force to remove parts.
- Always fasten a DO NOT OPERATE tag to the controls of the unit when making repairs, or if the unit needs repairs.
- Be sure to follow the **WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG), and Diesel fuel are flammable. Be sure to follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area is well ventilated.

NOTE: The following symbols and words indicate safety information in this manual:

Indicates a condition that can cause immediate death or injury!



Indicates a condition that can cause property damage!

General

This section has the repair instructions for the engine. Removal, disassembly, repair, assembly, installation, checks and adjustments, and troubleshooting are included. The specifications are given at the end of the section.

Description

The Mazda M4-2.5D engine is a four-cylinder diesel engine that has a displacement of 2522 cm^3 (153.9 in.³). See Figure 1. The firing order is 1-3-4-2. The number one cylinder is toward the end of the engine with the cooling fan.

An arrangement of timing gears is driven by the crankshaft. These gears operate the camshaft and the fuel injection pump. The camshaft operates the rocker arms that actuate the valves.

The crankshaft has five main bearings. The thrust bearing for the crankshaft is at the center main bearing cap.

The pistons are aluminum alloy and have three piston rings. Each of the two compression rings has a special shape designed for its position on the piston. The third piston ring is the oil control ring.



- FUEL FILTER
 FUEL INJECTOR
- 3. AIR INTAKE 4. OIL FILTER

- 5. FUEL INJECTION PUMP
- Figure 1. Engine

Engine Removal and Installation

Some gaskets used in this engine can contain asbestos or other fibers. Breathing asbestos dust is a cancer or lung disease hazard. Do not create dust! Use vacuum equipment for asbestos or follow the cleaning procedure described below.

The solvent for cleaning carburetors is very flammable. Carefully follow the instructions of the manufacturer.

- Make sure the gasket material is wet with water or oil to prevent particles in the air.
- Use a hand scraper to remove old gasket material. Do not use a power tool or compressed air.
- Discard all asbestos material in a closed container while it is still wet.

Put an ASBESTOS warning label on the container. Discard asbestos material safely.

Disconnect the battery cables before doing any disassembly and repair to the engine or parts of the electrical system.

The diodes and resistors in the electrical system can be damaged if the following cautions are not followed:

- Do not disconnect the battery when the engine is running. The voltage surge can damage the diodes and resistors.
- Do not disconnect an electric wire before the engine is stopped and the key switch is OFF.
- Do not cause a short circuit by connection of the electric wires to the wrong terminals. Make sure a correct identification is made of the wire before it is connected.
- Make sure a battery is the correct voltage and polarity before it is connected.
- Do not check for current flow by making a spark because the transistors can be damaged.

The removal and installation procedures for the engine are not included in this section. See the section **Frame** 100 SRM 545 for more information.

Cylinder Head and Valve Mechanism Repair

REMOVE

- 1. Disconnect connections at battery.
- 2. Drain cooling system.
- 3. Remove coolant hoses.
- **4.** Remove air cleaner. Remove inlet and exhaust manifolds.
- **5.** Remove fuel lines between fuel pump and fuel injectors.
- **6.** Remove valve cover. Remove nuts for rocker arm assembly. Remove rocker arm assembly. Remove push rods.

- **7.** Loosen capscrews for cylinder head slowly and evenly in sequence shown in Figure 2. Carefully remove cylinder head.
- **8.** Use valve spring compressor to remove valve retainers, springs, and valves from head. See Figure 3.
- **9.** If necessary, remove combustion chamber inserts. Use a soft drift through hole for glow plug or fuel injector. Hit drift with a hammer to remove insert and retainer.
- **10.** Remove rocker arms, springs, and supports from rocker shaft.

Thanks very much for your reading, Want to get more information, Please click here, Then get the complete manual



NOTE:

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

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A. FRONT OF ENGINE





Figure 3. Valves Removal

CLEAN

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

Clean all parts in solvent. Make sure all oil passages are clean. Make sure all machined surfaces are smooth.

INSPECT AND REPAIR

Cylinder Head

1. Check bottom surface of cylinder head for distortion. Use straight edge and thickness gauge. Do measurements at positions shown in Figure 4.

The maximum amount of distortion across the width of the cylinder head (along lines A and B) is 0.10 mm (0.004 in.). The maximum amount of distortion along the length of lines C, D, E, and F is 0.25 mm (0.010 in.). If distortion exceeds specifications, install new cylinder head.

2. Check combustion chamber inserts for cracks or damage caused by heat. See Figure 5. Check retainer for insert. If insert or retainer is loose or damaged, install new parts.



Figure 4. Cylinder Head Inspection

Rocker Shaft Assembly

- **1.** Clean oil passages in rocker shafts and rocker arms.
- **2.** Check clearance between rocker arms and rocker shafts. Normal clearance is 0.016 to 0.061 mm (0.0006 to 0.002 in.). The maximum clearance is 0.07 mm (0.0028 in.). The correct dimension for the inside diameter of a rocker arm is 15.876 to 15.896 mm (0.625 to 0.626 in.). The correct

dimension for the outside diameter of a rocker shaft is 15.835 to 15.860 mm (0.623 to 0.624 in.).



- 1. COMBUSTION CHAMBER INSERT
- 2. RETAINER

Figure 5. Combustion Chamber Insert

3. If parts do not meet specifications, install new bushings in rocker arm(s) or use new rocker shaft. Use reamer to get correct inside diameter of rocker arm bushing. See Figure 6.

Valve Guides

1. Measure clearance between valve stems and valve guides. See Figure 7. Use dial indicator to measure side-to-side movement of valve stem in the guide.

Maximum clearance is 0.127 mm (0.005 in.). Install new valve or valve guide if clearance exceeds specification.

- **2.** If replacement is necessary, use tool to remove valve guide(s). During removal, push valve guide toward combustion chamber.
- **3.** Install valve guide from the top of the cylinder head. See Figure 8. The correct height of valve guide above valve spring seat is 16.5 mm (0.65 in.).

Valve Seats

- **1.** Inspect condition of valve seats. If valve seats have cracks, the cylinder head must be replaced.
- **2.** If valve seats are in good condition, check contact pattern of valve and valve seat. Use valve

seat grinder to make sure valve seats are within specifications shown in Figure 9. Use valve compound to make sure valves fit seats.



Figure 6. Rocker Arm Bushing





Valves

1. Inspect stem of each valve for wear. See Figure 10. Use micrometer to measure outside diameter of stem.

The standard dimension for an intake valve is 8.955 to 8.980 mm (0.352 to 0.353 in.). The minimum dimension for an intake valve is 8.884 mm (0.349 in.). The standard dimension for an exhaust valve is 8.935 to 8.960 mm (0.351 to 0.352 in.). The minimum dimension for an exhaust valve is 8.864 mm (0.349 in.).

2. Inspect valves for cracks, burned faces, and distortion. Inspect seat face of valves for wear and damage.



A. DIMENSION A = 16.5 mm (0.650 in.)

Figure 8. Valve Guide Installation



A. EXHAUST VALVE B. INTAKE VALVE

Figure 9. Valve Seat Specifications

3. Measure thickness of valve head. See Figure 10.

Minimum thickness for all valves is 1.0 mm (0.040 in.). If valves need grinding, correct surface angle is 45 degrees for intake valves and 30 degrees for exhaust valves. Standard width for all valve seats is 2.0 mm (0.0780 in.).



1. DIAMETER 2. THICKNESS (VALVE HEAD)

Figure 10. Valves Inspection

Valve Springs

1. Check valve springs for damage. See Figure 11. Measure free length of outer valve springs.

The minimum length of an inner spring is 43.6 mm (1.72 in.). The minimum length of an outer spring is 52.9 mm (2.08 in.).

2. Check valve springs for squareness. See Figure 11.

The maximum dimension for an inner spring is 1.25 mm (0.049 in.). The maximum dimension for an outer spring is 1.37 mm (0.054 in.). If they exceed dimensions, install new valve spring(s).

3. Use valve spring tester to check tension of valve springs.

At a height of 37.8 mm (1.49 in.), the correct measurement for the inner valve spring is 12.1 to 13.3 kg (26.7 to 29.3 lb). At a height of 40.3 mm (1.58 in.), the correct measurement for the inner valve spring is 32.4 to 34.2 kg (71.4 to 75.4 lb). Use new valve springs if their tension is less than specifications.





Figure 11. Valve Springs Inspection

Push Rods

1. Put push rod on flat plate as shown in Figure 12. Roll push rod on flat plate and check variation with spacer gauge. If push rod is more than 0.19 mm (0.007 in.) from straight, it must be straightened or new one must be installed.



Figure 12. Push Rods Check

2. Check push rod for wear or damage. Use new push rods as necessary.

CYLINDER HEAD

Assemble

1. Install each valve and measure distance from surface of cylinder head to end of valve stem. See Figure 13. Standard dimension is 48.05 mm (1.892 in.).



- 1. VALVE SPRING SEAT
- 2. SHIM (WASHER)
- 3. DIMENSION = 48.05 mm (1.892 in.)

Figure 13. Measure Valve Depth

- If the measurement is up to 0.5 mm (0.020 in.) longer than dimension (3), the valve can be used.
- If the measurement is 0.5 to 1.5 mm (0.020 to 0.059 in.) longer than dimension (3), use a shim under the valve spring seat to obtain dimension (3).
- If the measurement is 1.5 mm (0.059 in.) or longer than dimension (3), use a new valve. If the measurement is still too long, the valve seat is worn.
- **2.** Install seals on valve guides for intake valves. Install valve spring seats and inner and outer valve springs.
- **3.** Install valves. See Figure 3. Use valve spring compressor to install valve, spring caps, and retainers.
- **4.** Assemble parts of rocker arm assembly. See Figure 15.

Install

- **1.** Clean surface of cylinder head and surface of block.
- **2.** Install new cylinder head gasket on block. Install cylinder head.
- **3.** Install push rods, making sure they are fully installed in tappets.

- 4. Lubricate rocker arms and shaft with engine oil. Then install rocker arm assembly on cylinder head.
- 5. Install capscrews and washers for cylinder head. Tighten capscrews in several steps to 118 to 125 N•m (87 to 92 lbf ft) as shown in Figure 14. Tighten nuts for rocker shaft supports to 118 to 125 N•m (87 to 92 lbf ft).
- 6. Adjust valves.
- 7. Install new gasket and valve cover. Tighten capscrews to 30 to 45 N • m (22 to 33 lbf ft).



A. FRONT OF ENGINE

Figure 14. Cylinder Head Installation



- WASHER 2. 3. ROCKER ARM
- 6. SUPPORT
- ADJUSTMENT 8. SCREW
- Figure 15. Rocker Arm Assembly

Timing Gears Repair

REMOVE

- **1.** Remove timing gear cover.
- **2.** Remove capscrews for thrust plate, idler gear, and hub. Remove parts from engine.
- **3.** Use puller to remove crankshaft timing gear. See Figure 16.



Figure 16. Crankshaft Gear Removal

4. Remove capscrew, washer, and lock plate for camshaft gear. Remove friction gear. See Figure 17. Use puller to remove camshaft timing gear.



Figure 17. Camshaft Timing Gear Removal

5. Remove nut, washer, and friction gear for fuel injection pump. See Figure 18. Use puller to remove timing gear. Remove mounting nuts for fuel injection pump, then remove fuel injection pump.

6. If necessary, timing gear case can be removed from engine block.



Figure 18. Injection Pump Timing Gear Removal

CLEAN AND INSPECT

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

- **1.** Clean all parts in solvent. Make sure all oil passages are clean.
- **2.** Check gears for damaged teeth, burned surfaces, or worn surfaces.
- **3.** Measure the inner diameter of the idler gear and the outer diameter of the idler hub. Standard clearance between parts is 0.034 to 0.084 mm (0.0013 to 0.0033 in.). Maximum clearance is 0.15 mm (0.0059 in.).

If clearance exceeds limits, install new bushing in idler gear. Also use new hub.

INSTALL

- **1.** Install timing gear case on engine block.
- **2.** Install idler gear hub and idler gear. Install thrust plate and capscrews. Tighten capscrews to 23 to 31 N m (17 to 23 lbf ft). See Figure 19.

3. Check clearance between thrust plate and idler gear. Correct clearance is 0.15 to 0.30 mm (0.0059 to 0.0118 in.).



Figure 19. Thrust Plate Clearance Check

- **4.** Align timing marks and install crankshaft timing gear and camshaft timing gear. Install friction gear, lock plate, washer, and capscrew. Tighten capscrew for camshaft gear to 62 to 94 N•m (46 to 69 lbf ft).
- 5. Install fuel injection pump on timing gear case. Align timing marks and install timing gear for the fuel injection pump. Install friction gear, washer, and nut. Tighten nut to 39 to 69 N ⋅ m (29 to 51 lbf ft).
- 6. Make sure all timing marks are aligned. See Figure 20. Use dial indicator to check movement between idler gear and timing gears. See Figure 21.

Standard movement is 0.10 to 0.20 mm (0.0039 to 0.0079 in.). Maximum movement is 0.30 mm (0.0118 in.).

 Install new oil seal in timing gear cover. Install timing gear cover and tighten capscrews to 16 to 24 N•m (12 to 18 lbf ft).



- 1. CAMSHAFT GEAR
- 2. IDLER GEAR
- 3. INJECTION PUMP GEAR
- 4. CRANKSHAFT GEAR

Figure 20. Timing Gears Alignment



Figure 21. Gear Clearance Check

Crankshaft and Main Bearings Repair

REMOVE

- **1.** Remove flywheel. Remove rear oil seal.
- Remove timing gear cover, timing gears, and tim-2. ing gear housing.
- **3.** Remove oil pan and oil pump.
- Remove caps for connecting rods. Put identifica-4. tion mark on each cap so they will be installed in same location.
- 5. Remove main bearing caps. Put identification mark on each cap so they will be installed in same location.
- 6. Put identification mark on each bearing cap. Loosen capscrews for main bearing caps in steps, then remove capscrews and caps. Remove crankshaft and main bearings.

INSPECT AND REPAIR

Crankshaft

- 1. Inspect crankshaft for wear, cracks, or other damage. Install new crankshaft if it has cracks.
- 2. Use micrometer to measure diameter of journals for crankshaft. See Figure 22. Make the measurement at several locations for each journal.

The correct dimensions for the journals are shown in Table 1. If measurements are less than specifications, grind crankshaft and install undersize bearings.

Table 1.	Crankshaft	Journal	Diameters
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Main Journals	Wear Limit	
69.812 to 69.825 mm (2.7485 to 2.7490 in.)	0.05 mm (0.002 in.)	
Rod Journals	Wear Limit	

3. Check crankshaft for straightness. See Figure 22. Put front and rear journals in V-blocks and rotate crankshaft one complete turn.

The maximum amount that the dial indicator can indicate is 0.05 mm (0.002 in.).

4. Check passages for oil in crankshaft. Make sure passages are clean and have no restrictions.



- 1. REAR OIL SEAL
- SURFACE CONNECTING
- 2. **ROD JOURNALS**
- 3. MAIN BEARING JOURNALS
- FRONT OIL SEAL 4. SURFACE

Figure 22. Crankshaft Inspection

Main Bearings

- **1.** Inspect main bearings for wear and damage. Install new bearings as necessary.
- **2.** Measure clearance between main bearings and crankshaft. Use plastic gauge material as shown in Figure 23. Tighten capscrews for main bearing caps to 110 to 117 N•m (80 to 85 lbf ft).

The correct clearance is 0.059 to 0.090 mm (0.0023 to 0.0035 in.). The maximum clearance is 0.12 mm (0.0047 in.). If clearance is greater than specifications, install new main bearings.



1. PLASTIC GAUGE 2. SCALE

Figure 23. Main Bearings Clearance Check

INSTALL

- **1.** Clean main bearings and areas at block for main bearings. Lubricate parts with clean engine oil and install main bearings.
- **2.** Install crankshaft on bearings. Install main bearings in caps and lubricate them with oil.

Use identification marks to install caps in original location. (Make sure arrows on caps are pointing toward front of engine.)

- **3.** Install thrust bearings at center main bearing cap. Tighten capscrews for main bearing caps to 110 to 117 N•m (80 to 85 lbf ft).
- **4.** Check clearance between crankshaft and thrust bearings at center main bearing cap. See Figure 24. Move crankshaft fully forward before making measurement.

The standard clearance is 0.14 to 0.39 mm (0.0055 to 0.0153 in.). Use new thrust bearings if clearance is not correct.



Figure 24. Thrust Bearing Clearance Check

- **5.** Install connecting rods as described in Pistons and Connecting Rods Repair.
- 6. Install oil pump and oil pan.
- 7. Install rear oil seal and flywheel.
- **8.** Install timing gear housing, timing gears, and timing gear cover.

Pistons and Connecting Rods Repair

REMOVE AND DISASSEMBLE

- **1.** Remove cylinder head. Put identification mark on top of each piston.
- **2.** Remove oil pan and oil pump.
- **3.** Clean carbon from top of each cylinder bore.
- **4.** Remove caps and bearings from each connecting rod. Keep caps and bearings with correct piston assemblies.
- 5. Push connecting rod and piston from block.
- **6.** Carefully remove piston rings from pistons. Use tool to push piston pin from connecting rod.

CLEAN

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

Clean all parts in solvent. Make sure all oil passages and grooves are clean. Make sure all machined surfaces are smooth.

INSPECT AND REPAIR

Pistons

- **1.** Inspect pistons for wear and cracks. Install new piston if it has damage.
- **2.** Measure outside diameter of piston as shown in Figure 25.

The correct diameter is 88.872 to 88.898 mm (3.499 to 3.500 in.). The maximum clearance between the piston and the cylinder bore is 0.044 to 0.070 mm (0.0017 to 0.0028 in.).



Figure 25. Piston Measurement

Piston Rings

- **1.** Measure end clearance of each piston ring as shown in Figure 26.
- **2.** Install piston ring into cylinder bore where it will be used. Use thickness gauge to measure end clearance.

The correct dimension for all piston rings is 0.35 to 0.55 mm (0.014 to 0.022 in.). If clearance exceeds 1.5 mm (0.059 in.), piston ring must be replaced.



- 1. PISTON RING END CLEARANCE
 - . PISTON RING GROOVE CLEARANCE

Figure 26. Piston Rings Measurement

3. Measure clearance between piston ring and groove in piston as shown in Figure 26.

The correct dimension for the top piston ring groove is 0.05 to 0.18 mm (0.002 to 0.007 in.). The correct dimension for the second piston ring groove is 0.04 to 0.08 mm (0.002 to 0.003 in.). The correct dimension for the oil piston ring groove is 0.03 to 0.07 mm (0.001 to 0.003 in.). If any clearances exceed 0.3 mm (0.012 in.), piston rings must be replaced.

Connecting Rods and Bearings

1. Use special machine to check connecting rods for straightness.

The maximum amount of distortion per 100 mm (4.0 in.) is 0.05 mm (0.0019 in.). If amount of distortion is greater than specification, use press to straighten connecting rod.

2. Clean rod bearings and crankshaft journals.

- **3.** Check clearance between rod bearings and journals. See Figure 27.
 - **a.** Place plastic gauge material across full width of each bearing as shown.
 - **b.** Install rod caps. Tighten nuts for rod caps to 82 to 90 N•m (60 to 66 lbf ft). Do not allow crankshaft to turn.
 - **c.** Remove rod caps. Plastic gauge material will be flattened and adhering to rod cap or bearing.
 - **d.** Use graduations on measuring device to measure width of plastic gauge material at its widest point. (The number in each graduation indicates thousandths of an inch.)

The correct clearance is 0.037 to 0.076 mm (0.0015 to 0.0030 in.). If clearance is greater than specification, grind crankshaft and use undersize bearings.



Figure 27. Connecting Rod Bearings Clearance Check

4. Check clearance between piston pin and connecting rod. Maximum clearance is 0.05 mm (0.002 in.).

If clearance exceeds specification, install new bushing in connecting rod. Make sure oil hole in bushing is aligned with hole in connecting rod. If necessary, use reamer to finish bushing. Correct clearance for new parts is 0.012 to 0.039 mm (0.0005 to 0.0015 in.).

ASSEMBLE AND INSTALL

1. Use identification marks to align piston with connecting rod. See Figure 28. Lubricate piston pin

and bore in piston with engine oil. Install piston pin and snap rings in piston. After installation, check that piston moves freely on piston pin.



A. FRONT

1. COMBUSTION 2. NOTCH CHAMBER

Figure 28. Connecting Rod and Piston

2. Lubricate piston rings with engine oil. Install rings on pistons. During installation, marks on each piston ring must be toward top of piston. Check that rings rotate freely, then put ends of rings in positions shown in Figure 29.



- A. FRONT
- 1. TOP RING
- 2. SECOND RING
- 3. OIL RING

Figure 29. Piston Rings

OIL RING

EXPANDER

Cylinder Block and Liners Repair

- **3.** Apply clean engine oil to piston assembly. Install bearings for connecting rods. Install piston into correct cylinder, making sure front of piston is toward front of engine. See Figure 30.
- **4.** Apply clean engine oil to bearing, then install cap to correct connecting rod. During installation of caps, be sure to align identification marks that were made during disassembly. Tighten nuts for caps to 82 to 90 N ⋅ m (60 to 66 lbf ft).



1. "F" MARK

Figure 30. Piston Installation

Cylinder Block and Liners Repair

INSPECT AND REPAIR

1. After engine block is cleaned, check its surface for distortion. See Figure 31.

The maximum amount of distortion along lines **A** and **B** is 0.10 mm (0.0039 in.). The maximum amount of distortion along lines **C**, **D**, **E**, and **F** is 0.25 mm (0.0098 in.). If distortion exceeds specifications, have engine block machined or use new one.

2. Check cylinder liners for wear and damage. See Figure 32. Measure each liner at three positions and in two different directions. If difference between maximum measurement and minimum measurement of liner exceeds 0.20 mm (0.0079 in.), use new liner.

The correct dimension for a standard liner is 88.925 to 88.950 mm (3.5010 to 3.5020 in.).



Figure 31. Cylinder Block Inspection



Figure 32. Cylinder Liners Measurement

- 3. Remove and install cylinder liners as follows:
 - **a.** Use press and removal tool to push liners from cylinder block. See Figure 33. If liner is difficult to remove, use boring machine to reduce thickness of liner. Decreasing thickness of liner will reduce tension of liner in block.
 - **b.** After liner is removed, check inner surface of block for damage. Remove any marks with fine abrasive paper. Be careful not to increase size of bore.



1. REMOVAL TOOL 2. PRESS

Figure 33. Cylinder Liners Removal

c. Lubricate the inner surface of the block and the outer surface of the liner with engine oil. Use press and installation tool to install liner in cylinder block. See Figure 34. Pressure required to install a liner is approximately 1000 to 3000 kg (2200 to 6600 lb).

After installation, check that liner is even with or below surface of cylinder block by 0.101 mm (0.004 in.).



1. PRESS 3. LINER 2. INSTALLATION 4. BLOCK TOOL

Figure 34. Cylinder Liners Installation

4. To check clearance between tappet and bore in engine block, measure diameter of tappet and inside diameter of bore. See Figure 35.

The difference between the two measurements must not exceed 0.10 mm (0.0039 in.).



Figure 35. Tappets Measurement

Lubrication System Repair

OIL PUMP

Remove

NOTE: Before removing the oil pump, replace the sending unit with a gauge and run the engine until it is at operating temperature. Check the oil pressure. The minimum oil pressure at 2000 rpm is 250 kPa (36 psi). If the pressure is less than the specification, the oil pump or engine bearings need repair.

- **1.** Remove oil pan. See Figure 36.
- 2. Remove oil pump and oil pipe from engine.

Disassemble

- **1.** Remove oil strainer from pump cover. See Figure 37.
- **2.** Remove screws and pump cover. Remove cover and outer rotor.
- **3.** Use press to remove gear from shaft. Remove rotors from pump housing.
- 4. Remove relief valve from pump cover.

Clean

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

Clean all parts in solvent. Make sure all machined surfaces are smooth.

Inspect

- **1.** Check pump housing and pump cover for wear or damage. Check relief valve spring for damage.
- **2.** Measure clearance between inner and outer rotors. See Figure 38.

Correct clearance is 0.30 mm (0.012 in.). If clearance is more than specification, use new rotors.



- 1. OIL PUMP
- LOWER OIL PAN
 OIL JET
- 2. GASKET
- 3. UPPER OIL PAN

Figure 36. Lubrication System

3. Measure clearance between outer rotor and housing. See Figure 39.

Correct clearance is 0.30 mm (0.012 in.). If clearance is more than specification, use new rotor and/or housing.

4. Use straight edge on housing to measure side clearance of rotors. See Figure 40.

Correct clearance is 0.15 mm (0.006 in.). If clearance exceeds the specification, use new pump.