

MAZDA ENGINE

F2-2.0G AND F2-2.2G

2.0 LPG (2-3[t])

2.2 LPG (2-3[t])

2.0 LPG (1-2[t])

2.0 Gas (2-3[t])

2.2 Gas (2-3[t])

2.0 Gas (1-2[t])

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This section is for the following models:

2.0 LPG (2-3[t])
 2.2 LPG (2-3[t])
 2.0 LPG (1-2[t])
 2.0 Gas (2-3[t])
 2.2 Gas (2-3[t])
 2.0 Gas (1-2[t])

General

This section has the instructions for removal, disassembly, repair, assembly, installation, checks, adjustments and troubleshooting for the Mazda M4-2.0G and M4-2.2G engines. The engine specifications are given at the end of the section.

Additional information on engine components can be found in the sections for **Gasoline Fuel System**, **LPG Fuel System** and **Electrical System**.

Description

⚠WARNING

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

- 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 a DANGEROUS FIBERS warning label on the container. Discard dangerous fiber material safely.
- Do not place hands, tools, parts or other objects in the engine compartment while the engine is running as it could result in injury. Be careful when performing work in the engine compartment when the engine is running.

⚠CAUTION

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 of the wire is made 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 Mazda M4-2.0G and M4-2.2G engines have four cylinders. The displacement of the M4-2.0G is 1998 cm³ (121.9 in.³). The displacement of the M4-2.2G is 2184 cm³ (133.2 in.³). The firing order is 1–3–4–2. They are both available with either a gasoline or LPG fuel system. The No. 1 cylinder is toward the end of the engine with the cooling fan.

The overhead camshaft is driven by a cog belt. The camshaft operates the rocker arms that actuate the valves.

The crankshaft has five main bearings. The main bearing in the center of the crankshaft is also the thrust bearing.

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.

Engine Removal and Installation

The removal and installation procedures for the engine are not included in this section.

Engine Mounting and Dismounting

MOUNTING

1. Install special tool (arms and attachment) to cylinder block holes, and hand-tighten special tool (bolts). See Fig. 1.

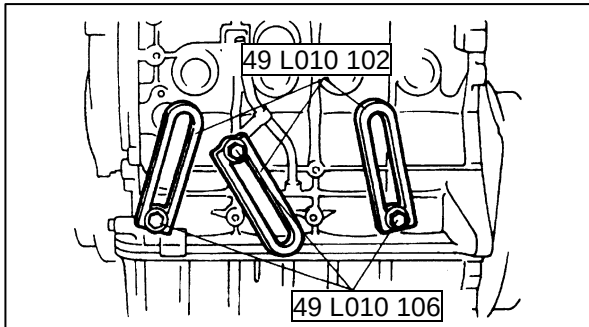


Fig. 1 Arms Installation

2. Assemble special tool (bolts, nuts and plate) to specified positions. See Fig. 2.

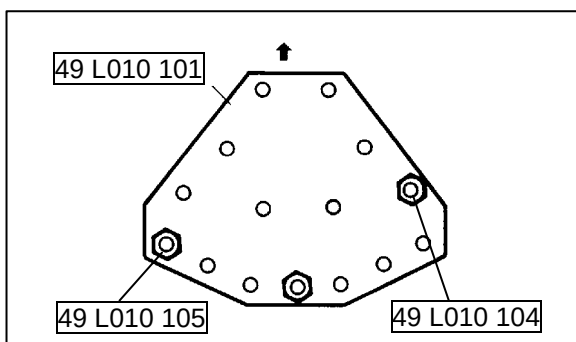
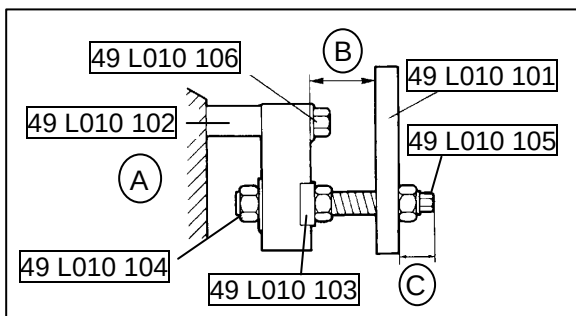


Fig. 2 Plate Installation

3. Adjust special tool (bolts) so that less than 20 mm (0.79 in.) of thread is exposed. Make special tool (plate and arms) parallel by adjusting special tool (bolts and nuts). See Fig. 3.



- A. ENGINE B. PARALLEL
C. LESS THAN 20 mm (0.79 in.)

Fig. 3 Arm and Plate Installation

4. Tighten special tool (bolts and nuts) to affix special tool firmly.

⚠ WARNING

- Self-locking brake system of the engine stand may not be effective when engine is held in an unbalanced position. This could lead to sudden, rapid movement of engine and mounting stand handle and cause serious injury. Never keep engine in an unbalanced position, and always hold rotation handle firmly when turning engine.

5. Mount engine on special tool (engine stand). See Fig. 4.

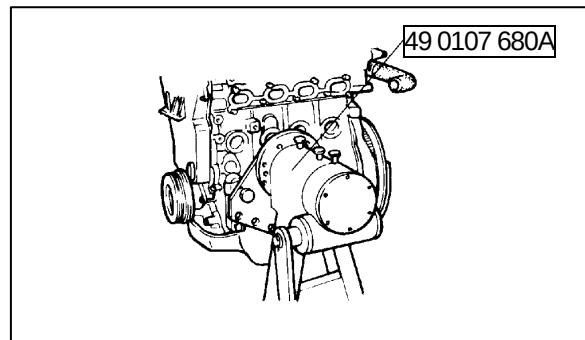


Fig. 4 Engine Mounting

6. Drain engine oil.
7. Install oil drain plug and tighten oil drain plug to 30 to 41 N·m (22 to 30 ft·lbf).

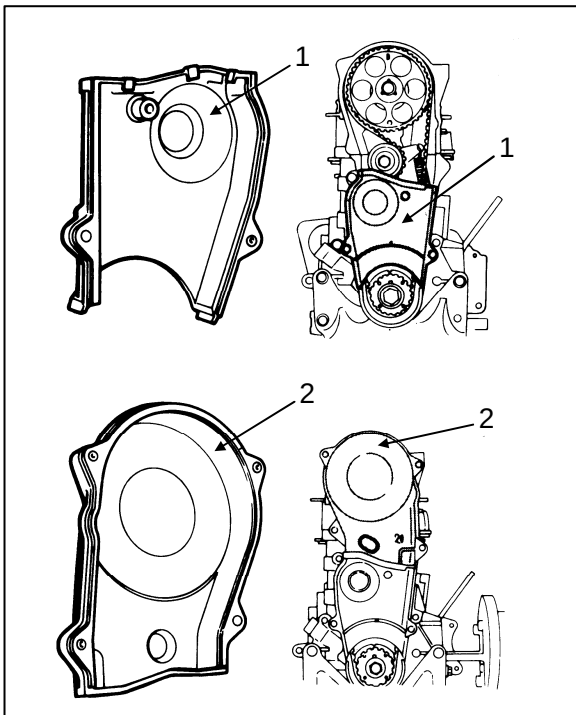
DISMOUNTING

1. Dismount in reverse order of mounting.

Cylinder Head, Camshaft and Valve Mechanism Repair

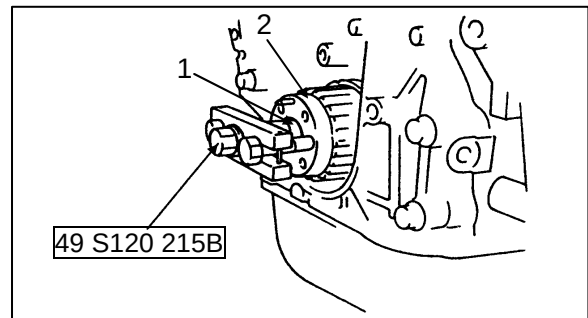
REMOVE

1. Disconnect connections at battery.
2. Drain cooling system.
3. Remove air cleaner, fuel system linkage, inlet and exhaust manifolds.
4. Remove coolant hoses.
5. Remove bracket for cooling fan.
6. Remove six capscrews and drive plate from crankshaft pulley (For 2.0 LPG (1-2[t])).
7. Remove six capscrews that hold crankshaft pulley to timing pulley.
8. Remove upper and lower timing belt covers. See Fig. 5.
9. Remove spark plugs from cylinder head.
10. Loosen capscrews and timing belt tensioner and remove spring. Remove capscrew and timing belt tensioner.
11. Remove capscrew and washer from timing pulley. Install special tool on spacer to remove timing pulley. Bring a suitable washer or pipe into contact with end of center bolt of special tool. Rotate tool until it touches front of crankshaft. Hit tool with hammer to loosen timing pulley. Remove timing pulley, dowel pin, tapered ring and spacer. Remove tool. (For 2.0 LPG (1-2[t])) See Fig. 6.



1. LOWER TIMING BELT COVER
2. UPPER TIMING BELT COVER

Fig. 5 Timing Belt Covers



1. SUITABLE WASHER OR PIPE
2. SPACER

Fig. 6 Timing Pulley Removal

12. Use chalk to mark direction of timing belt rotation. See Fig. 7. Remove timing belt.

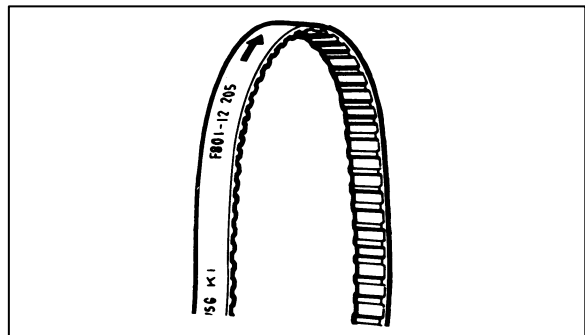


Fig. 7 Timing Belt

13. Put labels on wires to aid in correct installation. Disconnect wires at distributor. Remove capscrew for distributor mount and pull distributor from front housing.
14. Remove camshaft pulley. Keep pulley from rotating and loosen capscrew. Remove capscrew and pulley. See Fig. 8.

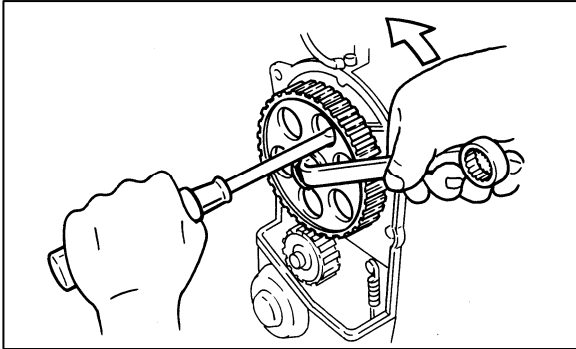
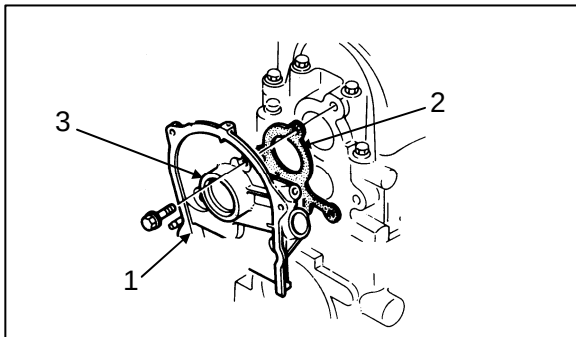


Fig. 8 Camshaft Pulley Removal

15. Remove nuts and capscrews for front housing. Then remove housing. See Fig. 9.



1. FRONT HOUSING 3. OIL SEAL
2. GASKET

Fig. 9 Front Housing

16. Remove rocker cover.
17. Loosen capscrews for rocker shaft supports in proper sequence. See Fig. 10. Remove rocker shaft assembly and camshaft.

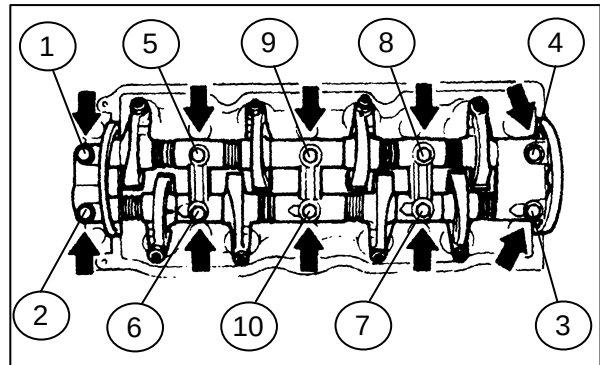


Fig. 10 Rocker Assembly Removal Sequence

18. Remove capscrews for cylinder head in proper sequence. See Fig. 11.

19. Lift cylinder head from the block.

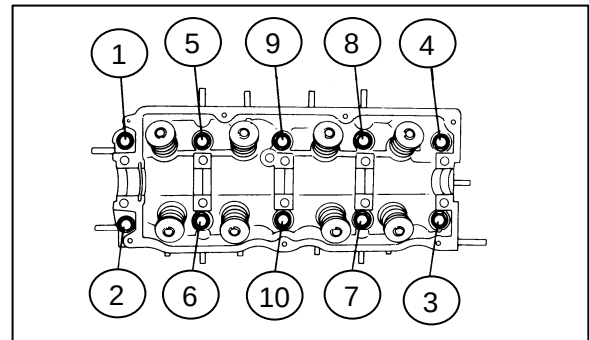


Fig. 11 Cylinder Head Removal Sequence

20. Use special tool to remove valve retainers, springs and valves from head. See Fig. 12.

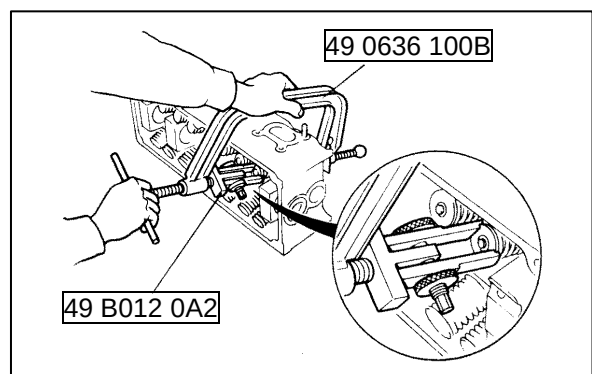


Fig. 12 Valve Removal

CLEAN

⚠WARNING

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 with solvent. Make sure all oil passages are clean and all machined surfaces are smooth.

INSPECT AND REPAIR

Cylinder Head

1. Use straight edge and thickness gauge to check bottom surface of cylinder head for distortion. Do the measurements at the positions shown in Fig. 13.

Maximum amount of distortion is 0.15 mm (0.006 in.). If grinding of cylinder head is necessary, maximum amount of correction is 0.2 mm (0.008 in.).

2. For the manifold mounting surfaces, use the same inspection procedures and correct it if there are any faults.

Maximum amount of distortion is 0.15 mm (0.006 in.). If grinding of cylinder head is necessary, maximum amount of correction is 0.2 mm (0.008 in.).

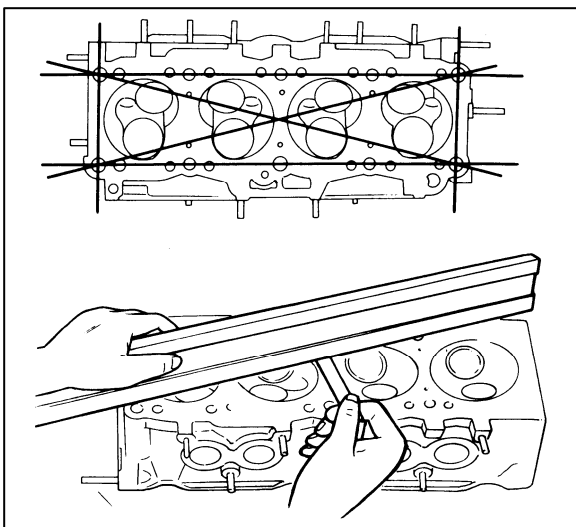


Fig. 13 Cylinder Head Inspection

Rocker Shaft Assembly

1. Disassemble rocker shaft assembly. Put marks on rocker arms so they can be installed on correct shafts.
2. Clean oil passages in rocker shafts and rocker arms.
3. Check clearance between rocker arms and rocker shafts. Maximum clearance is 0.10 mm (0.004 in.).

Correct dimension for inside diameter of rocker arm is 16.000 to 16.027 mm (0.6299 to 0.6310 in.).

Correct dimension for outside diameter of rocker shaft is 15.966 to 15.984 mm (0.6286 to 0.6293 in.). If components do not meet specifications, replace rocker arm(s) or rocker shaft(s) as necessary.

Camshaft

1. Check camshaft for cracks or damage.
2. Use dial indicator on end of camshaft to check movement of camshaft in cylinder head. See Fig. 14. Maximum movement is 0.20 mm (0.008 in.).

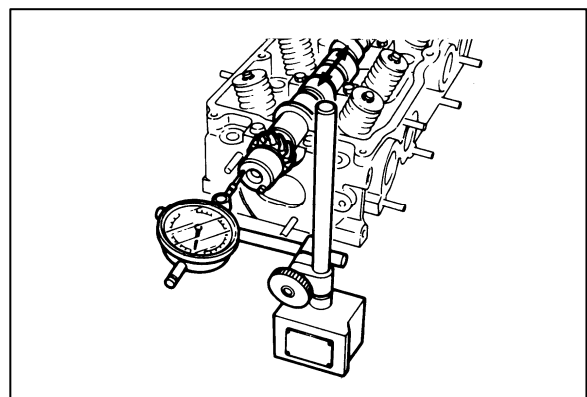


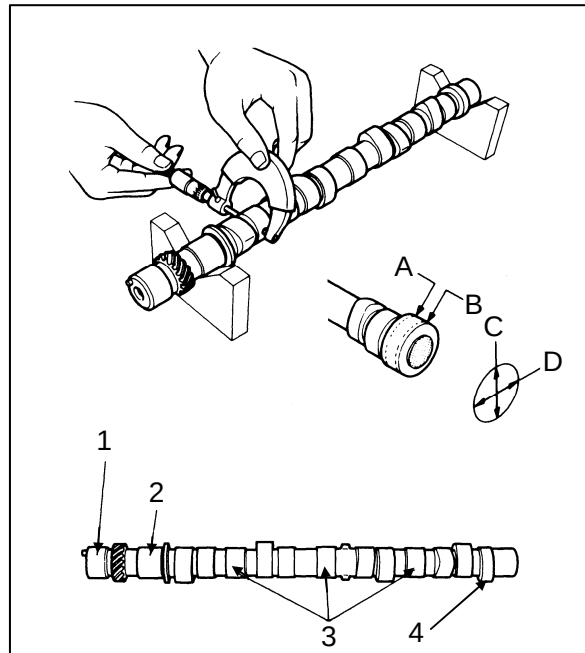
Fig. 14 Camshaft Check

3. Measure height of camshaft lobes. See Fig. 15.
Minimum height of intake and exhaust lobes is 37.170 mm (1.4634 in.).
4. Measure camshaft journals at four points (A-D) as shown in Fig. 15. Minimum dimensions for the journals are as follows:
Front and Rear Journals (No. 1 and 5) - 31.940 to 31.965 mm (1.2575 to 1.2585 in.)
Center Journals (No. 2, 3 and 4) - 31.910 to 31.935 mm (1.2563 to 1.2573 in.)
Front Oil Seal Surface - 33.961 to 34.000 mm (1.3371 to 1.3386 in.)
5. Check camshaft for straightness. Put front and rear journals in V blocks and rotate camshaft one complete turn. See Fig. 16. Maximum amount that the dial indicator should indicate is 0.03 mm (0.0012 in.).
6. Measure clearance between camshaft and bore in cylinder head as follows:
 - a. Install camshaft in cylinder head.
 - b. Put plastic gauge material between each camshaft journal and cap. Do not allow camshaft to rotate.
 - c. Tighten capscrews for caps to 18 to 27 N·m (13 to 20 ft·lbf). See Fig. 17.

Correct clearance for journals No. 1 and 5 is 0.035 to 0.085 mm (0.0014 to 0.0033 in.).
Correct clearance for journals No. 2, 3 and 4 is 0.065 to 0.115 mm (0.0026 to 0.0045 in.).

If any clearances are greater than 0.15 mm (0.006 in.), replace cylinder head assembly.

7. Replace camshaft if there is any damage or if it does not meet specifications.



1. FRONT OIL SEAL SURFACE
2. FRONT JOURNAL (NO. 1)
3. CENTER JOURNALS (NO. 2, 3 AND 4)
4. REAR JOURNAL (NO. 5)

Fig. 15 Camshaft Inspection

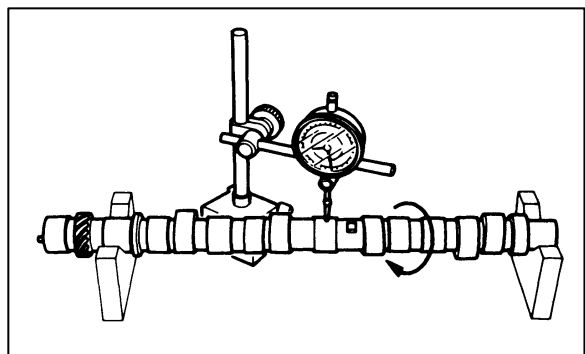
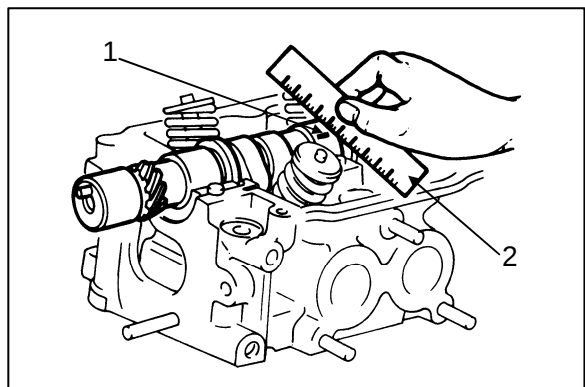


Fig. 16 Camshaft Check



1. PLASTIC GAUGE 2. SCALE

Fig. 17 Camshaft Clearance Measurement

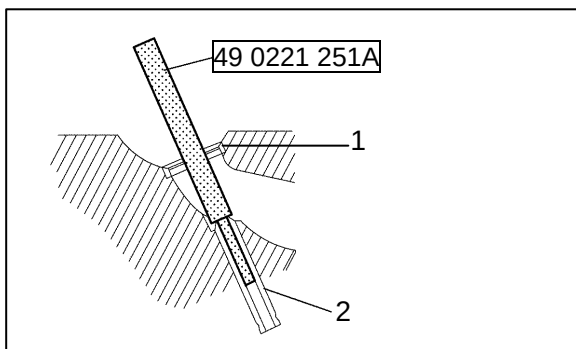
Valve Guides

1. Measure clearance between valve stems and valve guides. Normal clearance for intake valve guide is 0.025 to 0.060 mm (0.0010 to 0.0024 in.). Normal clearance for exhaust valve guide is 0.030 to 0.065 mm (0.0012 to 0.0026 in.).

If clearance is more than 0.10 mm (0.004 in.), replace valve or valve guide.

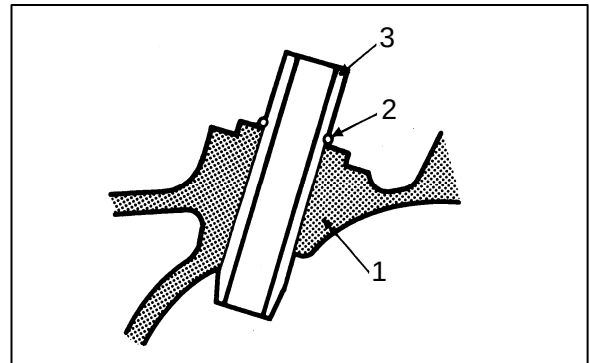
2. If replacement is necessary, remove seal from valve guide(s). Then use special tool to remove valve guide(s) from combustion chamber side. See Fig. 18.
3. To install valve guide, install retaining ring on valve guide. Use special tool to install valve guide so that retaining ring contacts cylinder head. See Fig. 19.

Correct height of valve guide above valve spring seat is 19.1 to 19.6 mm (0.752 to 0.771 in.).



1. VALVE SEAT 2. VALVE GUIDE

Fig. 18 Valve Guide Removal

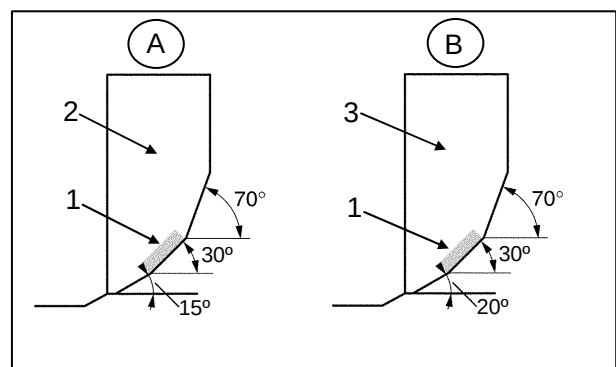


1. CYLINDER HEAD 3. VALVE GUIDE
2. RETAINING RING

Fig. 19 Valve Guide Inspection

Valve Seats

1. Inspect condition of valve seats. If valve seats have cracks, 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 Fig. 20. Use valve compound to make sure valves fit seats.



- A. EXHAUST B. INTAKE

1. VALVE SEAT WIDTH
2. EXHAUST VALVE SEAT
3. INTAKE VALVE SEAT

Fig. 20 Valve Seat Specifications

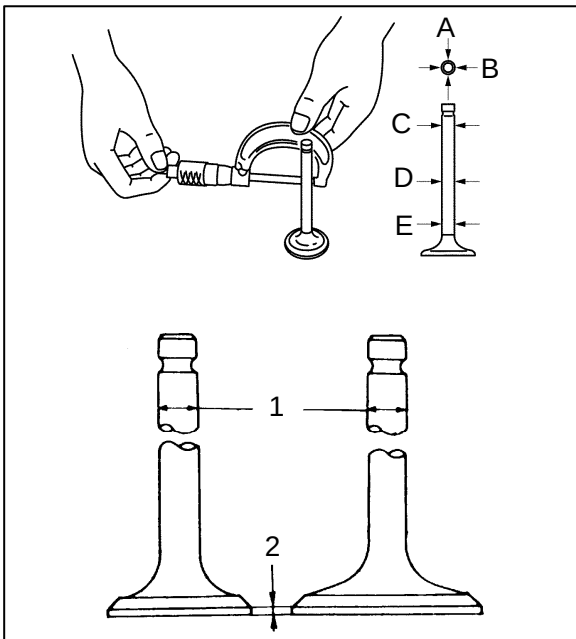
Valves

1. Measure length of each valve. Minimum length for intake valve is 111.19 mm (4.378 in.). Minimum length for exhaust valve is 110.99 mm (4.370 in.).
2. Inspect stem of each valve for wear. Use micrometer to measure outside diameter of stem at six points (A-E) as shown in Fig. 21.

Minimum dimension for intake valve is 7.980 mm (0.3142 in.). Minimum dimension for exhaust valve is 7.975 mm (0.3140 in.).

3. Inspect valves for cracks, burned faces and distortion. Inspect seat face of valves for wear and damage.
4. Measure thickness of valve head. Minimum thickness for intake valve is 0.5 mm (0.020 in.). Minimum thickness for exhaust valve is 1.0 mm (0.040 in.).

If valves need grinding, correct surface angle is 30° for both intake and exhaust valves.



1. VALVE STEM
2. THICKNESS, VALVE HEAD

Fig. 21 Valve Inspection

Valve Springs

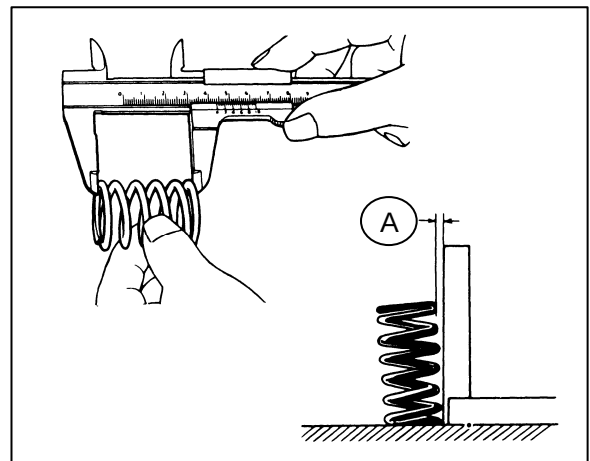
1. Check valve springs for damage.
2. Measure free length of valve springs. See Fig. 22.

Minimum length of inner valve spring is 46.3 mm (1.823 in.). Minimum length of outer valve spring is 50.6 mm (1.992 in.).

3. Check valve springs for squareness. See Fig. 16.

Correct squareness of inner valve spring is 1.66 mm (0.065 in.). Correct squareness of outer valve spring is 1.82 mm (0.072 in.).

If measurement is more than specification, replace valve spring(s).



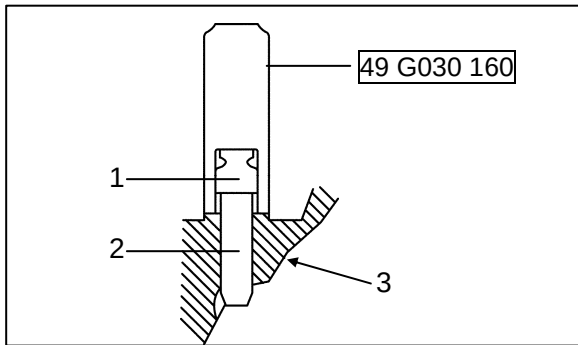
A. MEASURE HERE

Fig. 22 Valve Springs Inspection

INSTALL

1. Clean surface of cylinder head and surface of engine block.
2. Use special tool to insert valve seals into valve guides. See Fig. 23.

Cylinder Head, Camshaft and Valve Mechanism Repair



1. VALVE SEAL 3. CYLINDER HEAD
2. VALVE GUIDE

Fig. 23 Valve Seals Installation

3. Use special tool to install valve retainers, springs and valve. See Fig. 24.

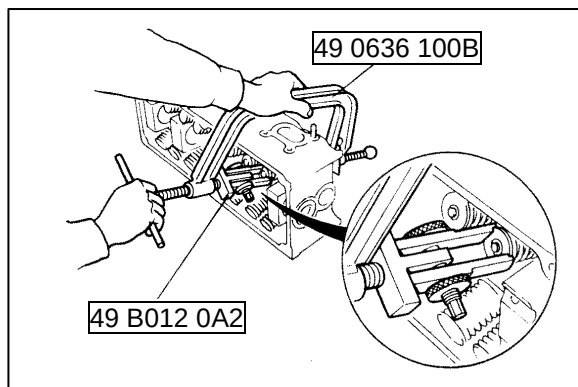


Fig. 24 Valve Installation

4. Install new gasket and cylinder head on engine block.
5. Install capscrews and washers for cylinder head. Tighten capscrews to 81 to 88 N·m (60 to 65 ft·lbf) in proper sequence. See Fig. 25.
6. Apply gasket sealer to areas shown by arrows. Lubricate camshaft with clean engine oil. Then install camshaft. Make sure dowel pin is at top of camshaft. See Fig. 26.

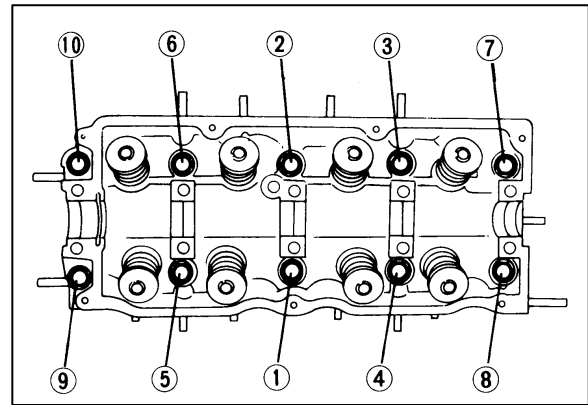
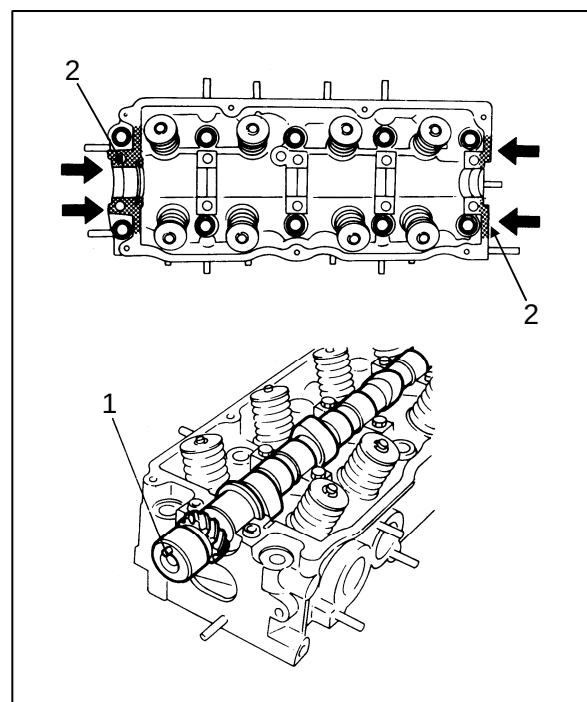


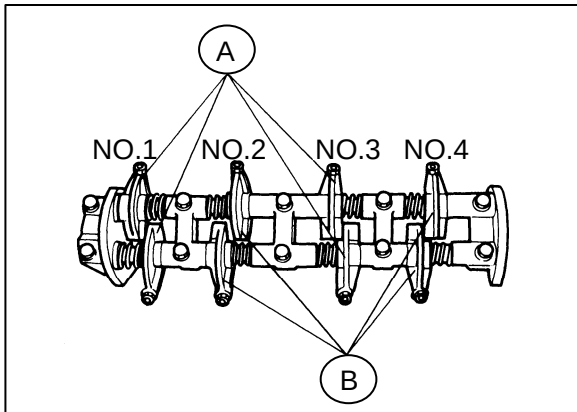
Fig. 25 Cylinder Head Installation



1. DOWEL PIN 2. APPLY SEALANT HERE

Fig. 26 Camshaft Installation

7. Assemble rocker shaft assembly. See Fig. 27. Lubricate rocker arms and shafts with clean engine oil. Put capscrews in rocker shaft supports. Then install assembly on cylinder head.



- A. NO. 1 AND NO. 3 ARE THE SAME
B. NO. 2 AND NO. 4 ARE THE SAME

Fig. 27 Rocker Shaft Assembly

8. Tighten capscrews for rocker shaft supports to 18 to 27 N·m (13 to 20 ft·lbf) in proper sequence. See Fig. 28.

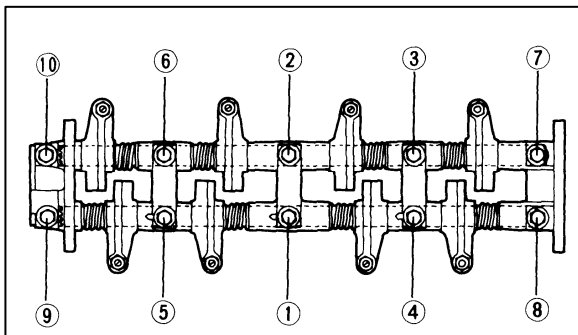
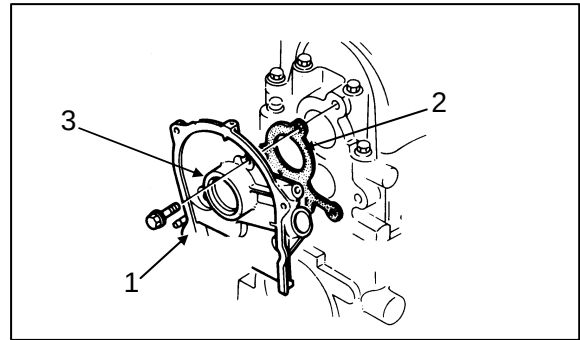


Fig. 28 Rocker Shaft Assembly Installation

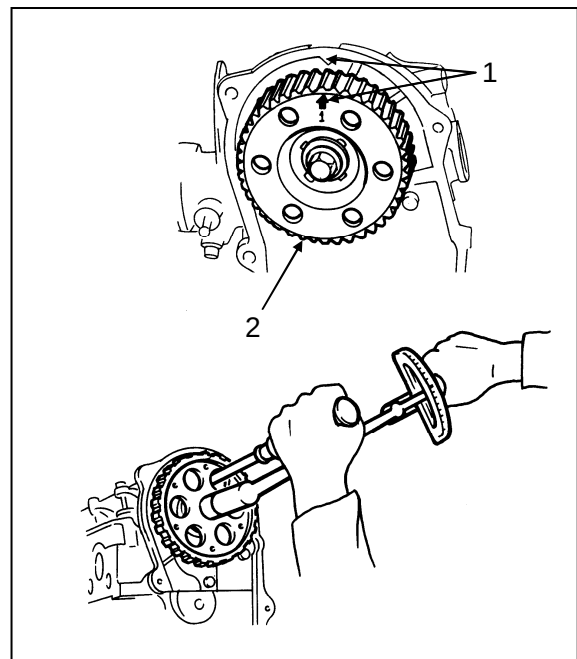
9. Lubricate surface of new oil seal with clean engine oil. Use press to install oil seal in front housing. See Fig. 29.
10. Use new gasket and install front housing on cylinder head. Tighten nuts and capscrews for front housing to 19 to 26 N·m (14 to 19 ft·lbf).
11. Install camshaft pulley with dowel pin at top of camshaft.
For FE-2.0L engine (LPG and EGI), check that "1" on pulley is aligned with timing mark on front housing.
For FE-2.2L engine (LPG and EGI), check that "1" on pulley is positioned approximately 2.5° in the retard direction.

12. Install capscrew and washer for camshaft pulley. See Fig. 30. Keep pulley from turning and tighten capscrew to 48 to 66 N·m (35 to 49 ft·lbf).



1. FRONT HOUSING 3. OIL SEAL
2. GASKET

Fig. 29 Front Housing

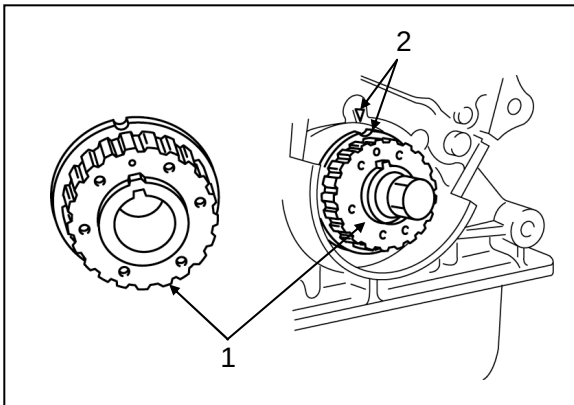


1. TIMING MARKS 2. CAMSHAFT PULLEY

Fig. 30 Camshaft Pulley Installation

Cylinder Head, Camshaft and Valve Mechanism Repair

13. Align timing marks for timing pulley. See Fig. 31. Install timing pulley, dowel pin, tapered ring, spacer, washer and capscrew. For 2.0 LPG (1-2[t]) engine, tighten capscrew to 157 to 167 N·m (115 to 123 ft·lbf). For gasoline, 2.0 LPG (2-3[t]) and 2.2 LPG (2-3[t]) engines, tighten capscrew to 157 to 167 N·m (116 to 123 ft·lbf).

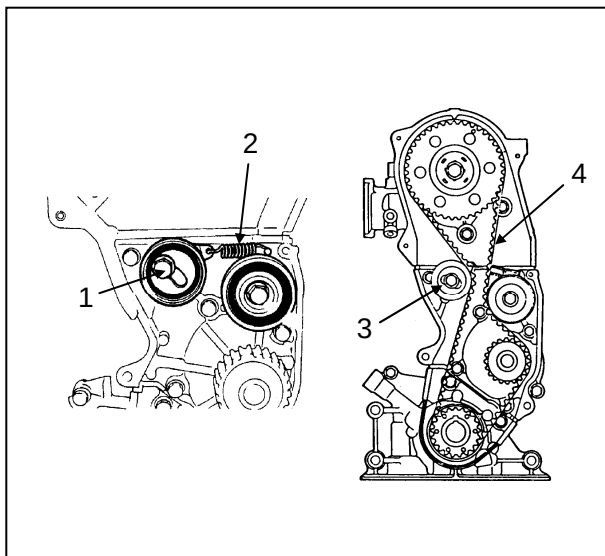


1. TIMING PULLEY 2. TIMING MARK

Fig. 31 Timing Belt Installation

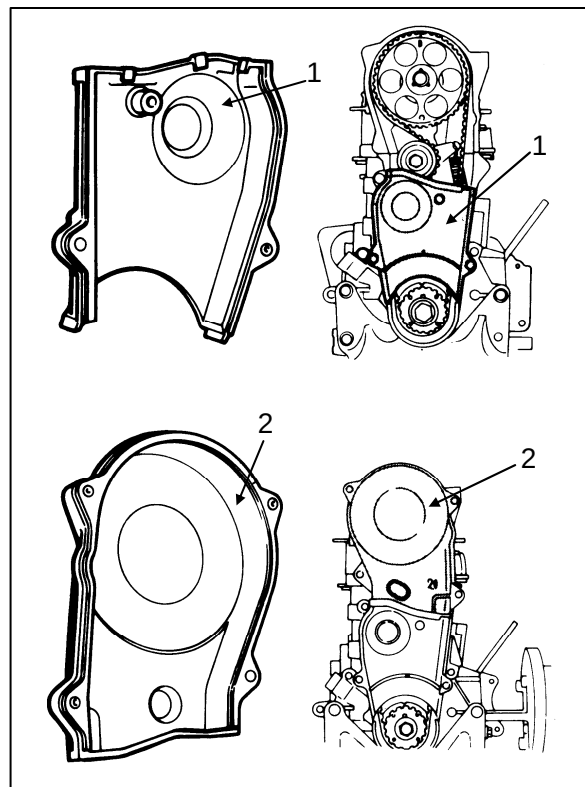
14. Install timing belt tensioner and spring. Move tensioner fully toward intake side of engine and temporarily tighten lock bolt.
15. Clean any oil or grease from pulleys. Install timing belt so that it goes in same direction as mark made during removal.
16. Loosen lock bolt and apply spring tension on belt. Rotate crankshaft pulley clockwise two complete turns and check timing marks.
17. Install lower timing belt cover and new gasket. Tighten capscrews to 7 to 10 N·m (62 to 89 in·lbf). Install upper timing belt cover and new gasket. Tighten capscrews to 7 to 10 N·m (62 to 89 in·lbf). See Fig. 33.
18. Install crankshaft pulley. Tighten capscrews to 12 to 17 N·m (9 to 13 ft·lbf).
19. Install drive plate to crankshaft pulley. Tighten capscrews to 12 to 17 N·m (9 to 13 ft·lbf). (For 2.0 LPG (1-2[t])).
20. Apply gasket sealer to areas shown by arrows. Install new gasket and rocker cover on cylinder head. See Fig. 34.
21. Install capscrews for rocker cover. Tighten capscrews to 6 to 8 N·m (52 to 70 in·lbf).
22. Install spark plugs on cylinder head. Tighten spark plugs to 15 to 23 N·m (11 to 16 ft·lbf).
23. Install distributor. See Distributor Repair for procedures.

If timing marks are correct, tighten lock bolt for tensioner to 38 to 53 N·m (28 to 39 ft·lbf). Be sure tensioner does not move together with lock bolt rotation. Check movement on tension side of timing belt. If tension is correct, belt will move 12 to 14 mm (0.47 to 0.55 in.) with 10 kg (22 lb) of force. (For 2.0 LPG engine) If tension is correct, belt will move 9 to 10 mm (0.36 to 0.39 in.) with 10 kg (20 lb) of force. (For gasoline and 2.2 LPG engines) See Fig. 32.



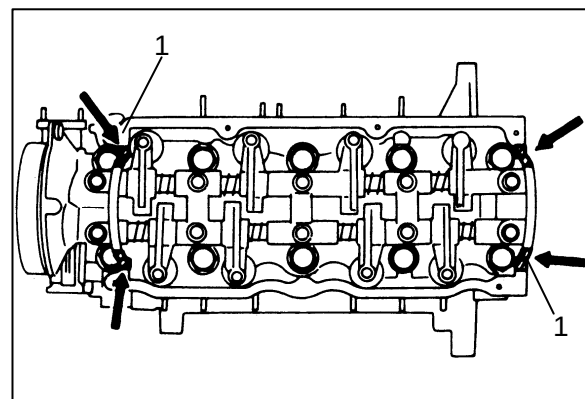
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|--------------|-----------------|
| 1. TENSIONER | 3. LOCK BOLT |
| 2. SPRING | 4. TENSION SIDE |

Fig. 32 Timing Belt Installation



- | |
|----------------------------|
| 1. LOWER TIMING BELT COVER |
| 2. UPPER TIMING BELT COVER |

Fig. 33 Timing Belt Covers



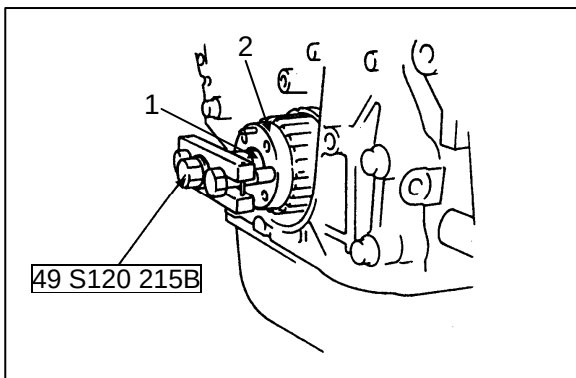
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|-----------------------|
| 1. APPLY SEALANT HERE |
|-----------------------|

Fig. 34 Rocker Cover Installation

Crankshaft and Main Bearings Repair

REMOVE

1. Remove bracket for cooling fan.
2. Remove six capscrews that hold crankshaft pulley to timing pulley.
3. Remove capscrew and washer from timing pulley. Install special tool on spacer to remove timing pulley. Bring a suitable washer or pipe into contact with end of center bolt of special tool. Rotate tool until it touches front of crankshaft. Hit tool with hammer to loosen timing pulley. Remove timing pulley, dowel pin, tapered ring and spacer. Remove tool. (For 2.0 LPG (1-2[t])) See Fig. 35.

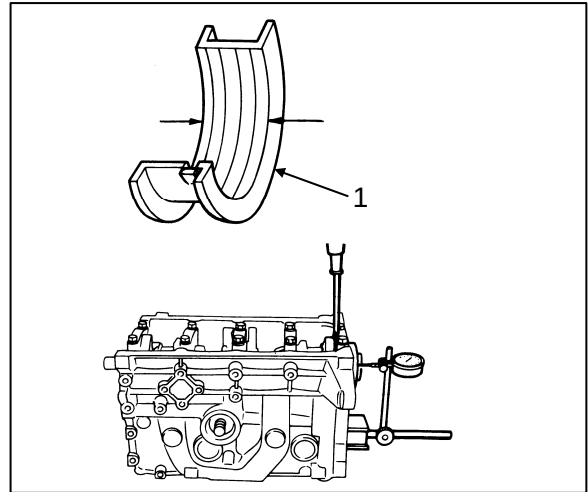


1. SUITABLE WASHER OR PIPE 2. SPASER

Fig. 35 Timing Pulley Removal

4. Remove oil pan and oil strainer.
5. Remove baffle plate. (For M4-2.2G)
6. Remove rear cover and oil pump.
7. Remove caps for connecting rods. Put identification mark on each cap so they will be installed in correct location.
8. Before removing crankshaft, measure clearance between crankshaft and flange of center main bearing. See Fig. 36. Push crankshaft fully forward before making measurement.

Maximum clearance is 0.30 mm (0.012 in.). If clearance is greater than specification, replace center main bearing or grind crankshaft and install undersize center main bearing.



1. CENTER MAIN BEARING

Fig. 36 Crankshaft Clearance Measurement

9. Put identification marks on bearing caps. Loosen capscrews for main bearing caps in steps. Then remove capscrews, caps and crankshaft.

INSPECT AND REPAIR

Crankshaft

1. Inspect crankshaft for wear, cracks or other damage. Replace crankshaft if it has cracks.
2. Use micrometer to measure diameter of journals for crankshaft. See Fig. 37. Make measurement at several locations for each journal. Correct dimensions for journals are as follows:

Main Journal Diameter - 59.937 to 59.995 mm (2.3598 to 2.3604 in.)

Connecting Rod Journals - 50.940 to 50.955 mm (2.0055 to 2.0061 in.)

Rear Oil Seal Surface - 89.946 to 90.000 mm (3.5412 to 3.5433 in.)

Front Oil Seal Surface - 33.961 to 34.000 mm (1.3371 to 1.3386 in.)

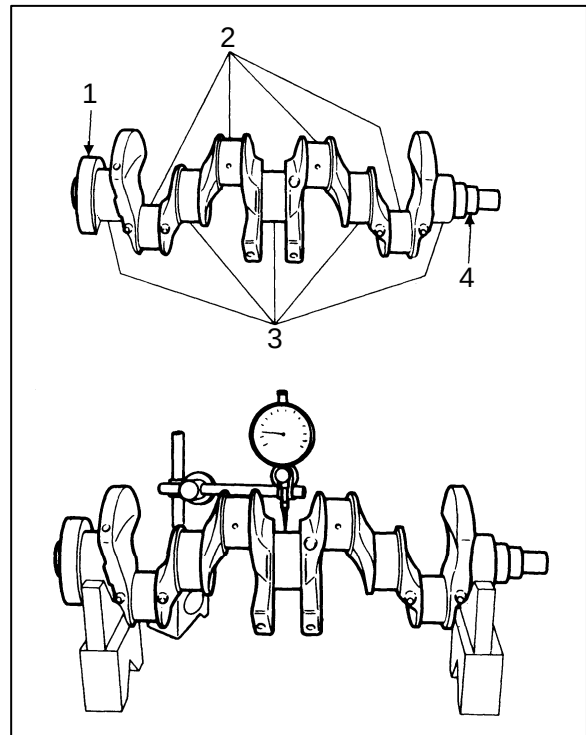
If measurements are less than specifications, grind crankshaft and install undersize bearings.

3. Check crankshaft for straightness. See Fig. 37. Put front and rear journals in V blocks and rotate crankshaft one complete turn. Maximum amount that dial indicator should indicate is 0.03 mm (0.0012 in.).
4. Check oil passages of crankshaft. Make sure passages are clean and have no restrictions.

Main Bearings

NOTE: Do not clean main bearings. If any bearings are too dirty, replace all main bearings.

1. Inspect main bearings for damage. If any main bearing is damaged, all main bearings must be replaced.
 2. To inspect main bearings for wear, measure clearance between main bearings and crankshaft. See Fig. 38.
- a. Install crankshaft in cylinder block.



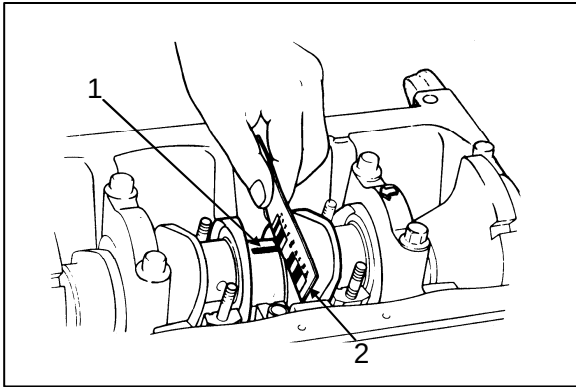
- | | |
|----------------------------|---------------------------|
| 1. REAR OIL SEAL SURFACE | 3. MAIN BEARING JOURNALS |
| 2. CONNECTING ROD JOURNALS | 4. FRONT OIL SEAL SURFACE |

Fig. 37 Crankshaft Inspection

- b. Put plastic gauge material on journals and install main bearing caps. Tighten capscrews for bearing caps to 84 to 90 N·m (62 to 66 ft·lbf).
- c. Remove bearing caps. Plastic gauge material will adhere to journals or bearing caps.
- d. Use graduations on scale to measure width of plastic gauge material at its widest point.

Correct clearance for journals No. 1, 2, 4 and 5 is 0.025 to 0.043 mm (0.00099 to 0.00169 in.). Correct clearance for journal No.3 is 0.031 to 0.049 mm (0.00123 to 0.00192 in). If any clearance is greater than specification, replace all main bearings.

Crankshaft and Main Bearings Repair



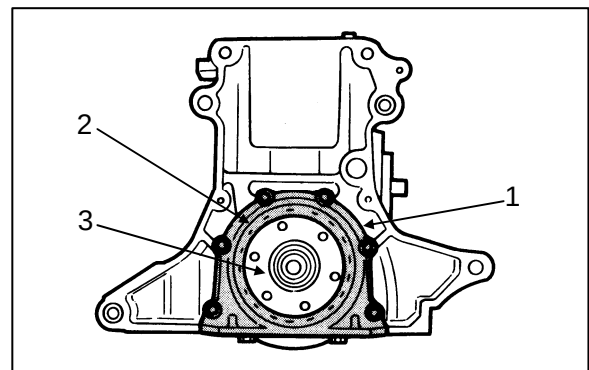
1. PLASTIC GAUGE MATERIAL 2. SCALE

Fig. 38 Main Bearings Clearance Check

INSTALL

1. Clean areas of cylinder block around main bearings. Carefully install bottom half of new main bearings if necessary. Lubricate bearings with clean engine oil.
2. Install crankshaft.
3. Install top half of main bearings in caps and lubricate with clean engine oil. Use identification marks to install main bearing caps in correct locations. Tighten capscrews for main bearing caps to 84 to 90 N·m (62 to 66 ft·lbf).
4. Install pistons and connecting rods as described in Pistons and Connecting Rods Repair.
5. Make sure new O-ring is in oil pump housing. Lubricate new oil seal with engine oil. Use adhesive sealant to install housing to cylinder block. Make sure there is no sealant in oil port. Tighten M10 capscrews to 38 to 53 N·m (28 to 39 ft·lbf). Tighten M8 capscrews to 19 to 26 N·m (14 to 19 ft·lbf).
6. Lubricate surfaces of new oil seal with engine oil. Use press to install oil seal in rear cover. Install alignment pin in cylinder block.

7. Install new gasket and rear cover. See Fig. 39. Make sure dowel pin is installed. Tighten capscrews to 8 to 12 N·m (70 to 95 in·lbf). Cut off part of gasket that extends past bottom of cylinder block.
8. Use adhesive sealant to install baffle plate to cylinder block. Tighten capscrews to 8 to 12 N·m (70 to 95 in·lbf). (For M4-2. 2G)
9. Install new gasket and oil strainer. Tighten capscrews to 8 to 12 N·m (70 to 95 in·lbf).
10. Use adhesive sealant to install oil pan to cylinder block.
11. Install new gasket and oil pan. Tighten capscrews to 8 to 12 N·m (70 to 95 in·lbf).



1. REAR COVER 3. CRANKSHAFT
2. OIL SEAL

Fig. 39 Rear Cover

Pistons and Connecting Rods Repair

REMOVE AND DISASSEMBLE

1. Remove cylinder head as described in Cylinder Head, Camshaft and Valve Mechanism Repair.
2. Remove oil pan and oil strainer.
3. Remove baffle plate. (For M4-2.2G)
4. Put identification mark on top of each piston.
5. Clean carbon from top of each cylinder bore.
6. Remove caps and bearings from each connecting rod. Keep caps and bearings with correct piston assemblies.
7. Push connecting rod and piston from cylinder block.
8. Carefully remove piston rings from pistons.
9. Assemble special tool as shown. See Fig. 40.

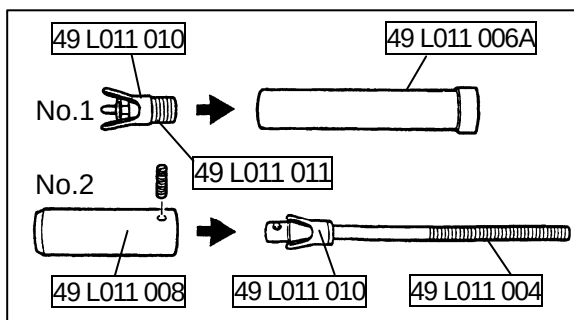


Fig. 40 Special Tool Assemble

10. Insert special tool No.2 into the piston pin as shown and fully screw in special tool No.1. See Fig. 41.

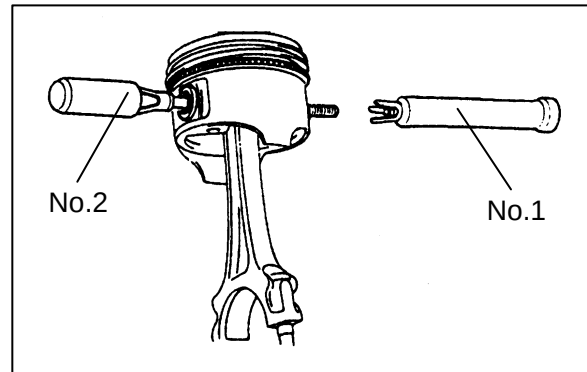


Fig. 41 Special Tool Installation

11. Set the piston and connecting rod on special tool as shown. See Fig. 42.

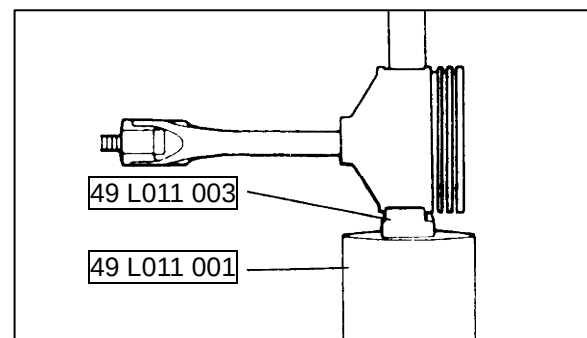


Fig. 42 Special Tool Installation

12. Press out piston pin.

CLEAN

⚠ WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow 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. Replace any piston that is damaged.
2. Measure outside diameter of piston. See Fig. 43. Correct dimension is 85.943 to 85.965 mm (3.3836 to 3.3844 in.). Maximum clearance between piston and cylinder bore is 0.15 mm (0.0059 in.).

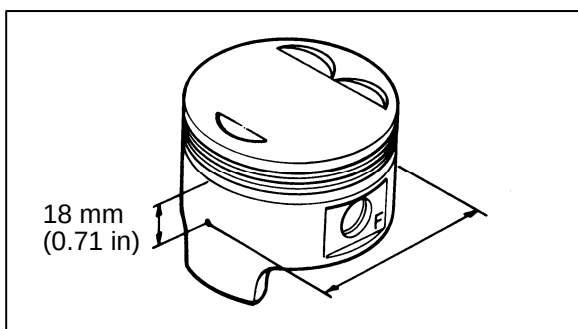
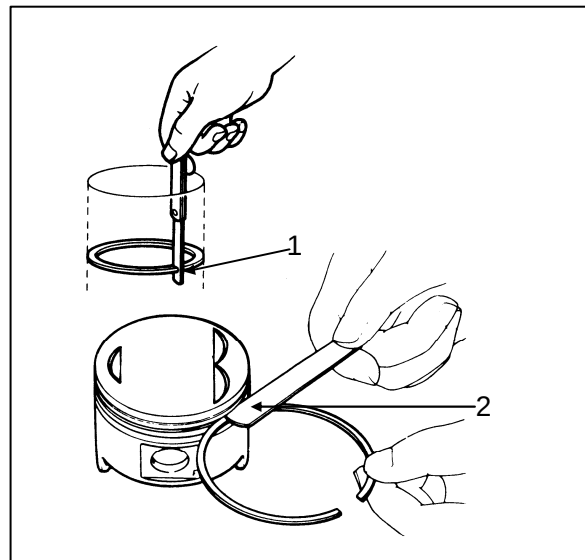


Fig. 43 Piston Measurement

Piston Rings

1. Install piston ring into cylinder bore where it will be used. Use thickness gauge to measure amount of end clearance of each piston ring. See Fig. 44. Correct dimensions are as follows:
 - Top Piston Ring - 0.20 to 0.35 mm (0.008 to 0.014 in.)
 - 2nd Piston Ring - 0.15 to 0.30 mm (0.006 to 0.012 in.)
 - Oil Ring - 0.20 to 0.70 mm (0.008 to 0.027 in.)
 - Maximum clearance is 1.0 mm (0.039 in.)
2. Measure clearance between piston ring and groove in piston. See Fig. 31. Correct dimensions are as follows:
 - Top and second Ring - 0.03 to 0.07 mm (0.0012 to 0.0028 in.)
 - Maximum clearance is 0.15 mm (0.0059 in.)



1. PISTON RING END CLEARANCE
2. PISTON RING GROOVE CLEARANCE

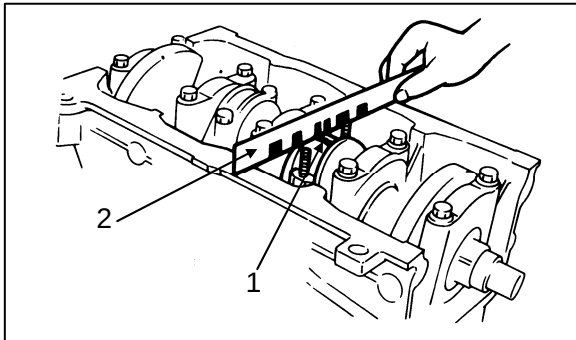
Fig. 44 Piston Rings Measurement

Connecting Rods and Bearings

1. Use alignment tool to check connecting rods for straightness. Maximum amount of distortion per 50 mm (1.97 in.) is 0.18 mm (0.007 in.). Maximum amount of bending per 50 mm (1.97 in.) is 0.075 mm (0.003 in.).

If amount of distortion and bending are greater than specification, install new rod.
2. Clean rod bearings and crankshaft journals. To check bearings for wear, measure clearance between rod bearings and journals. See Fig. 45.
 - a. Put plastic gauge material on crankshaft journals and install rod caps. Tighten capscrews for rod caps to 66 to 70 N·m (49 to 52 ft·lbf). Do not rotate connecting rod.
 - b. Remove rod caps. Plastic gauge material will adhere to journals or rod caps.
 - c. Use graduations on scale to measure width of plastic gauge material at its widest point.

Correct clearance is 0.027 to 0.067 mm (0.0011 to 0.0026 in.). If any clearance is greater than specification, replace all rod bearings.

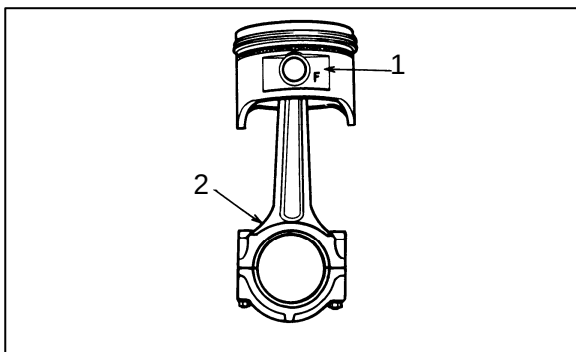


1. PLASTIC GAUGE MATERIAL 2. SCALE

Fig. 45 Connecting Rod Bearings Clearance Check

ASSEMBLE AND INSTALL

1. Align oil port on large end of connecting rod with F mark on piston. See Fig. 46. Lubricate piston pin and bore in piston with clean engine oil.



1. F MARK 2. OIL PORT

Fig. 46 Connecting Rod and Piston

2. Assemble special tool as shown. See Fig. 47.

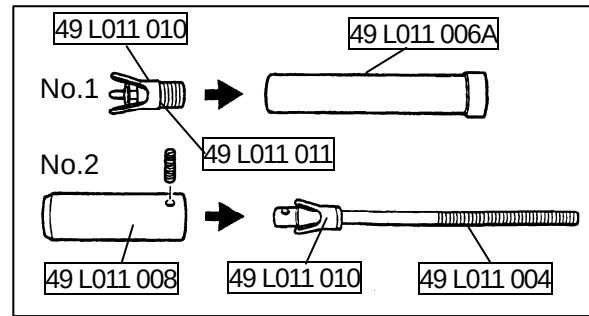


Fig. 47 Special Tool Assemble

3. Insert special tool No.2 into piston pin as shown and fully screw in special tool No.1. See Fig. 48.

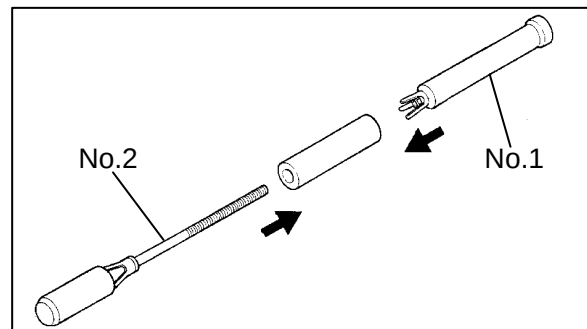
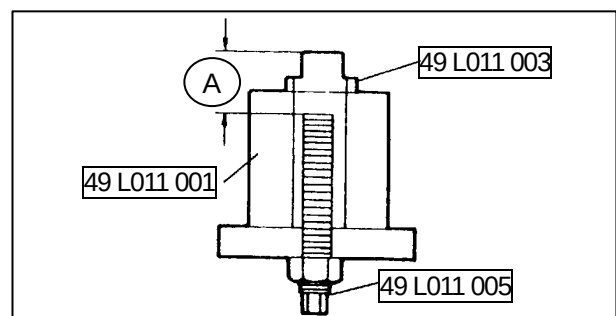


Fig. 48 Special Tool Installation

4. Set special tool (stopper bolt) so that dimension L is as specified. See Fig. 49.

Dimension L
60.0 mm (2.36 in.)

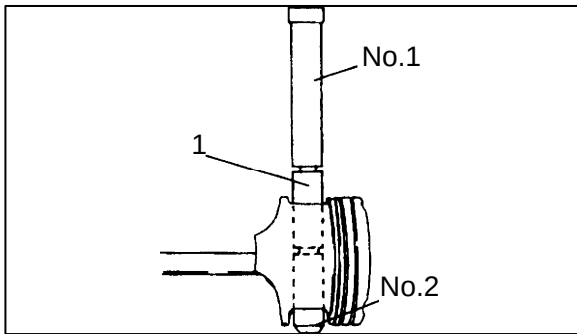


A. DIMENSION L

Fig. 49 Special Tool Installation

Pistons and Connecting Rods Repair

5. Apply clean engine oil to piston pin.
6. Insert piston pin and special tool assembled in step 3 into piston and connecting rod. See Fig. 50.

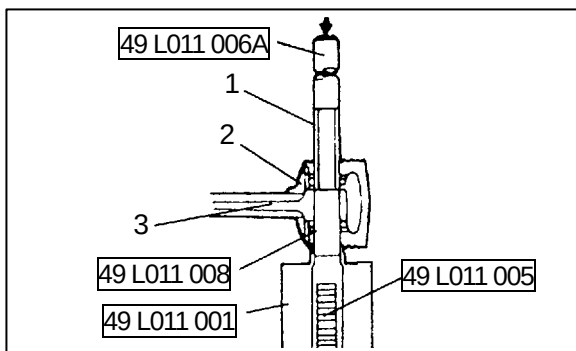


1. PISTON PIN

Fig. 50 Special Tool Installation

7. Press piston pin into piston and connecting rod until special tool (guide) contacts special tool (stopper bolt). See Fig. 51.
8. While inserting piston pin, check pressure force.
If it is less than specification, replace piston pin or connecting rod.

Pressure force
500 to 1,500 kg (1,102 to 3,306 lb)



1. PISTON PIN
2. PISTON
3. CONNECTING ROD

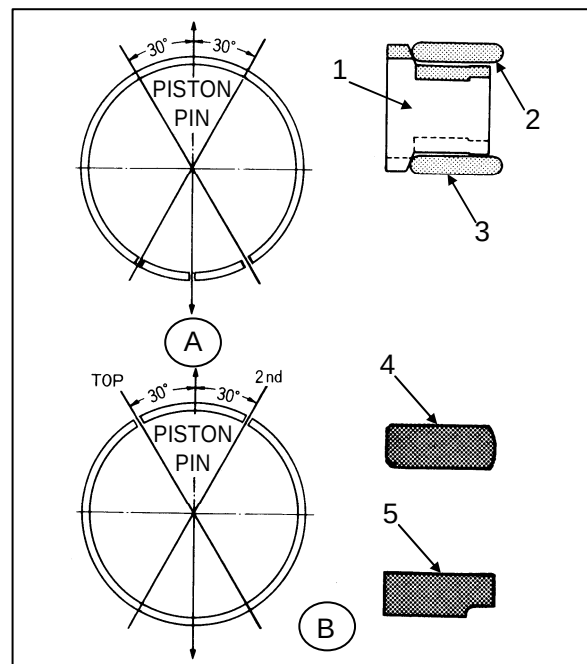
Fig. 51 Piston Pin Installation

9. After installation, check that piston moves freely on piston pin.

10. Install piston rings on pistons. During installation, writing on each piston ring must be toward top of piston. Check that rings rotate freely. Then put ends of rings in positions shown in Fig. 52. Make sure ends of upper and lower oil control rings are each 30° from piston pin. Also make sure that top and second rings are each 30° from piston pin. Lubricate rings with clean engine oil.

11. Apply clean engine oil to piston assembly. Install bearings for connecting rods. Install piston into correct cylinder, making sure F is toward front (timing belt end) of engine. See Fig. 53.

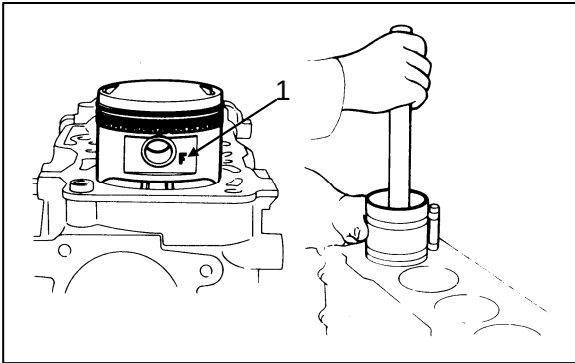
12. Apply clean engine oil to bearing. Then install each cap to correct connecting rod. During installation of caps, make sure to align identification marks that were made during disassembly. Tighten nuts for caps to 66 to 70 N·m (49 to 52 ft·lbf).



- A. OIL CONTROL RING
- B. TOP AND SECOND RINGS

1. EXPANDER RING
2. OIL RING (UPPER)
3. OIL RING (LOWER)
4. TOP RING
5. SECOND RING

Fig. 52 Piston Rings



1. F MARK

Fig. 53 Piston Installation

Cylinder Block Repair

1. After cylinder block is cleaned, check its surface for distortion. See Fig. 54.

If amount of distortion is greater than 0.15 mm (0.0059 in.), grind surface of cylinder block. Maximum amount of correction permitted is 0.20 mm (0.008 in.).

2. Check cylinder bores for wear and damage. Measure each bore. Correct dimension is 86.000 to 86.019 mm (3.3858 to 3.3866 in.). Wear limit above this dimension is 0.15 mm (0.0059 in.).

Repair cylinder block or use bigger pistons as necessary.

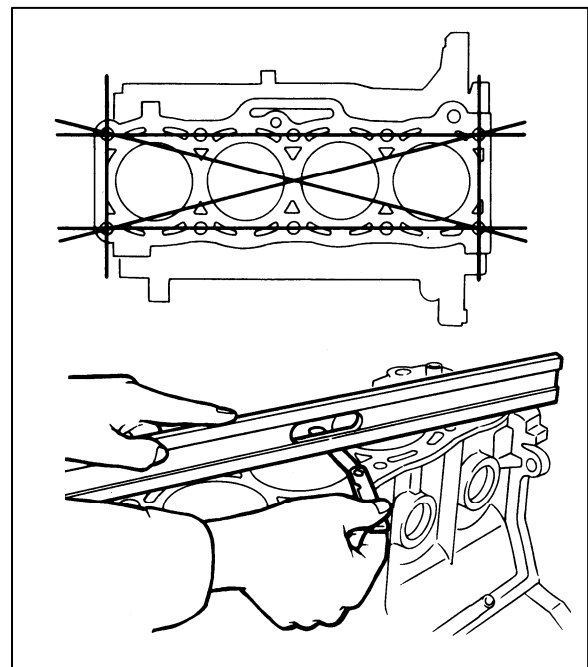


Fig. 54 Cylinder Block Inspection

Oil Pump Repair

Before removing oil pump, remove oil pressure switch and connect special tool. Run engine and check oil pressure. See Fig. 55. Minimum oil pressure at governed rpm is approx. 275 kPa (40 psi). If pressure is less than specification, oil pump or engine bearings need repair.

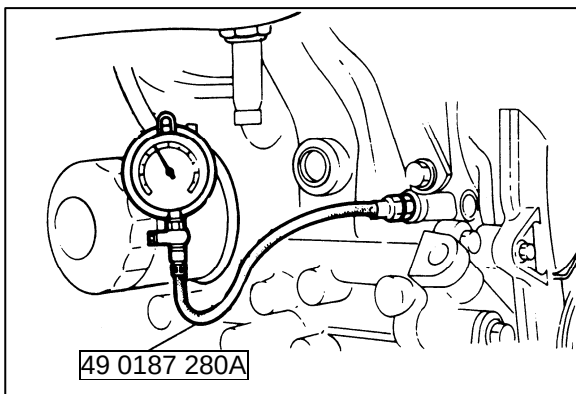


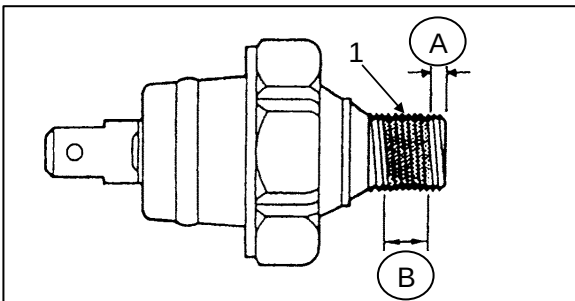
Fig. 55 Oil Pressure Inspection

⚠ CAUTION

Any sealant stuck at end of oil pressure switch can cause operation malfunction of oil pressure switch.

Be sure there is no sealant at end 1.0 to 2.0mm (0.04 to 0.07 in.) of oil pressure switch.

Remove special tool. Apply sealant to oil pressure switch threads. See Fig. 56. Install oil pressure switch. Tighten oil pressure switch to 12 to 17 N·m (9 to 13 ft·lbf).



- | | |
|--|--|
| A. 1.0 to 2.0 mm
(0.04 to 0.07 in.) | B. 4.0 to 6.0 mm
(0.16 to 0.23 in.) |
|--|--|

1. APPLY SEALANT HERE

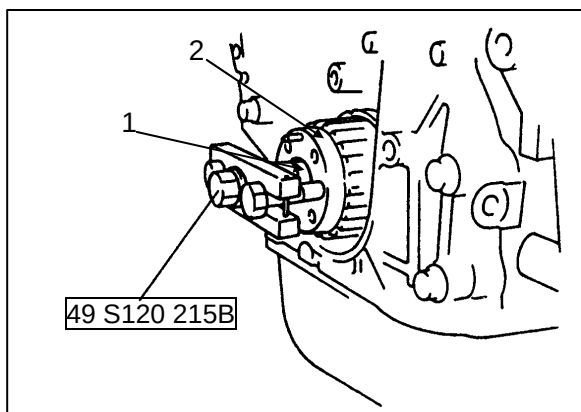
Fig. 56 Oil Pressure Switch Installation

REMOVE

1. Remove bracket for cooling fan.
2. Remove upper and lower timing belt covers. See Fig. 5.
3. Loosen capscrews for timing belt tensioner and remove spring. Remove capscrews and timing belt tensioner.
4. Use chalk to mark direction of rotation of timing belt. See Fig. 7. Remove timing belt.
5. Remove six capscrews and drive plate from crankshaft pulley. (For 2.0 LPG (1-2[t]))
6. Remove six capscrews that hold crankshaft pulley to timing pulley.
7. Remove capscrew and washer from timing pulley. Install special tool on spacer to remove timing pulley. Bring a suitable washer or pipe into contact with end of center bolt of special tool.

Rotate tool until it touches front of crankshaft. Hit tool with hammer to loosen timing pulley.

Remove timing pulley, dowel pin, tapered ring and spacer. Remove tool. (For 2.0 LPG (1-2[t])) See Fig. 57.



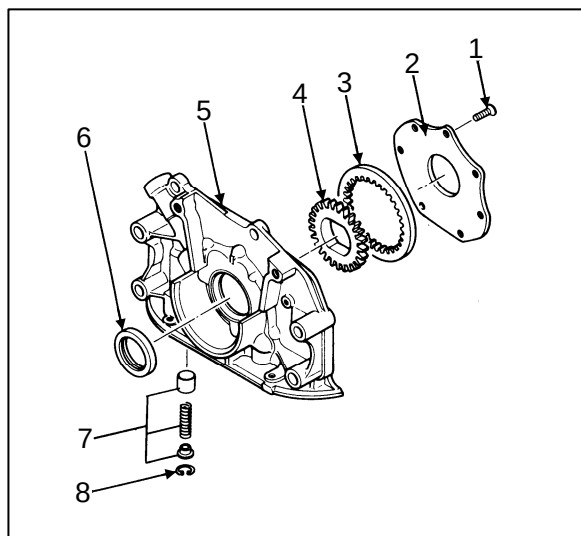
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| 1. SUITABLE WASHER
OR PIPE | 2. SPACER |
|-------------------------------|-----------|

Fig. 57 Timing Pulley Removal

8. Remove capscrews that hold oil pan to cylinder block. Remove oil pan.
9. Remove capscrews that hold oil strainer to oil pump. Remove oil strainer.
10. Remove capscrews that hold baffle plate to cylinder block. Remove baffle plate. (For M4-2.2G)
11. Remove capscrews that hold oil pump to cylinder block. Remove oil pump assembly.

DISASSEMBLE

1. Remove screws and pump cover. See Fig. 58.



- | | |
|---------------|-----------------------------|
| 1. SCREW | 5. FRONT COVER
(HOUSING) |
| 2. COVER | 6. OIL SEAL |
| 3. OUTER GEAR | 7. PLUNGER |
| 4. INNER GEAR | 8. SNAP RING |

Fig. 58 Oil Pump

2. Remove outer gear and inner gear from pump body.
3. Remove snap ring and plunger assembly from housing.

CLEAN

⚠ WARNING

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 with solvent. Make sure all machined surfaces are smooth.

INSPECT

1. Check front cover (pump housing) and pump cover for wear or damage. Check plunger spring for damage.
2. Measure parts of oil pump.

For 2.0 LPG (1-2[t]), see Fig. 59.

- a. Measure clearance between inner gear and crescent. Correct clearance is 0.267 to 0.380 mm (0.0105 to 0.0150 in.). If clearance is more than 0.40 mm (0.0157 in.), repair as necessary.
- b. Measure clearance between crescent and outer gear. Correct clearance is 0.20 to 0.32 mm (0.008 to 0.013 in.). If clearance is more than 0.35 mm (0.014 in.), repair as necessary.
- c. Use straight edge to measure side clearance of gears. Correct clearance is 0.030 to 0.063 mm (0.0012 to 0.0025 in.). If clearance is more than 0.10 mm (0.004 in.), repair as necessary.

Oil Pump Repair

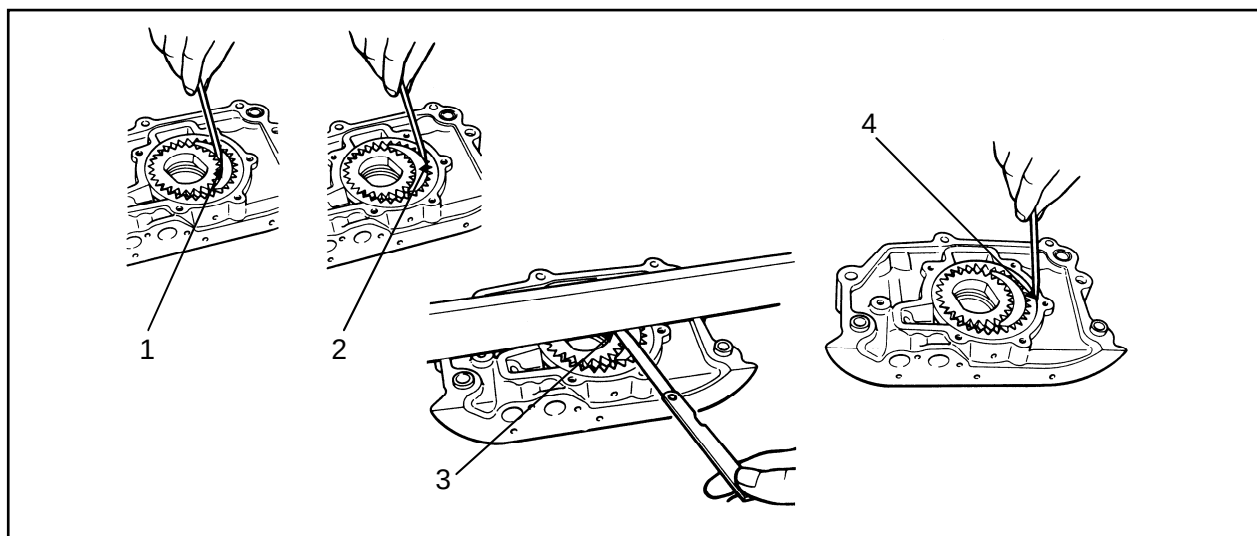
- d. Measure clearance between housing and outer gear. Correct clearance is 0.030 to 0.063 mm (0.0012 to 0.0025 in.). If clearance is more than 0.10 mm (0.004 in.), repair as necessary.

- b. Measure clearance between housing and outer rotor. Correct clearance is 0.090 to 0.176 mm (0.0036 to 0.0069 in.). If clearance is more than 0.20 mm (0.008 in.), repair as necessary.

Except for 2.0 LPG (1-2[t]), see Fig. 60.

- a. Measure clearance between inner rotor tip and outer rotor. Maximum clearance is 0.18 mm (0.007 in.). If clearance is more than 0.18 mm (0.007 in.), repair as necessary.

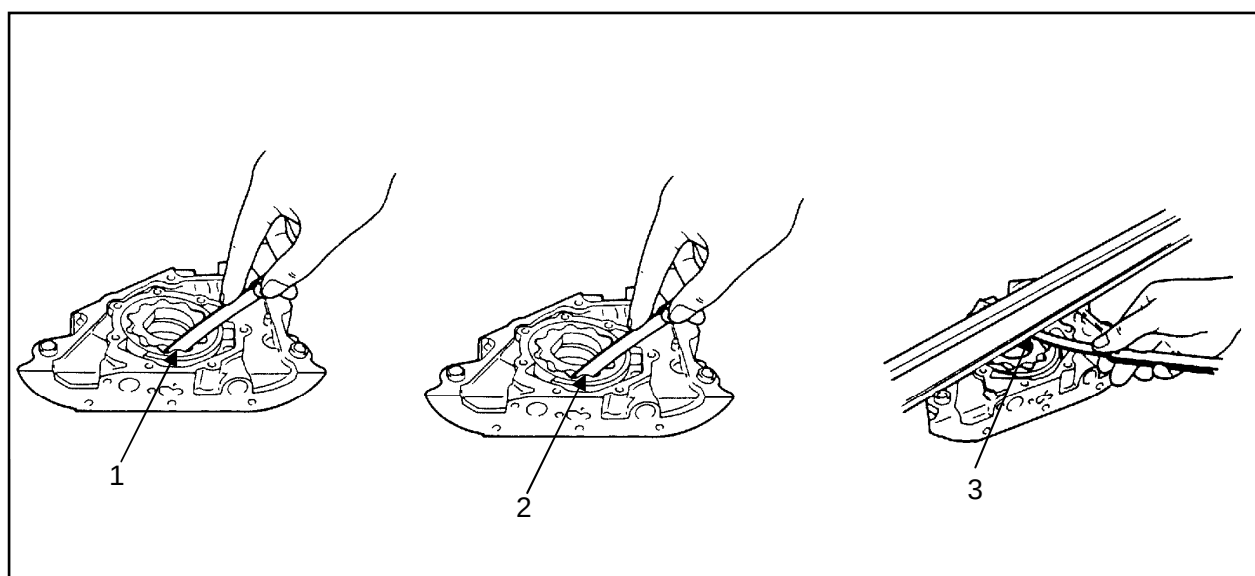
- c. Use straight edge to measure side clearance of rotors. Correct clearance is 0.03 to 0.09 mm (0.0012 to 0.0035 in.). If clearance is more than 0.10 mm (0.004 in.), repair as necessary.



- 1. CLEARANCE BETWEEN CRESCENT AND INNER GEAR
- 2. CLEARANCE BETWEEN CRESCENT AND OUTER GEAR

- 3. SIDE CLEARANCE OF GEARS IN HOUSING
- 4. CLEARANCE BETWEEN HOUSING AND OUTER GEAR

Fig. 59 Oil Pump Measurement (For 2.0 LPG (1-2[t]))



1. CLEARANCE BETWEEN INNER ROTOR TOOTH TIP AND OUTER ROTOR
2. CLEARANCE BETWEEN HOUSING AND OUTER ROTOR
3. SIDE CLEARANCE OF ROTORS IN HOUSING

Fig. 60 Oil Pump Measurement (Except for 2.0 LPG (1-2[t]))

ASSEMBLE

1. Install new oil seal in oil pump housing. Make sure front edge of oil seal is even with outer edge of housing. See Fig. 58.
2. Lubricate gears with clean engine oil. Then install gears in housing.
3. Install pump cover. Apply thread-locking compound on screws for pump cover. Then install screws.
4. Install plunger assembly and snap ring.
5. Use adhesive sealant to install oil pump housing on cylinder block. Make sure there is no sealant in oil port. Tighten M10 capscrews to 38 to 53 N·m (28 to 39 ft·lbf). Tighten M8 capscrews to 19 to 26 N·m (14 to 19 ft·lbf).
6. Install suction tube assembly.
7. Use adhesive sealant to install baffle plate to cylinder block. Tighten capscrews to 8 to 12 N·m (70 to 106 in·lbf). (For M4-2.2G)
8. Install new gasket and oil strainer. Tighten capscrews to 8 to 12 N·m (70 to 106 in·lbf).

INSTALL

1. Install new O-ring on oil pump housing. Use grease to hold O-ring in position. Lubricate oil seal with engine oil. See Fig. 61.
2. Use adhesive sealant to install oil pan to cylinder block.
3. Install new gasket and oil pan. Tighten screws to 8 to 12 N·m (70 to 106 in·lbf).

Oil Pump Repair

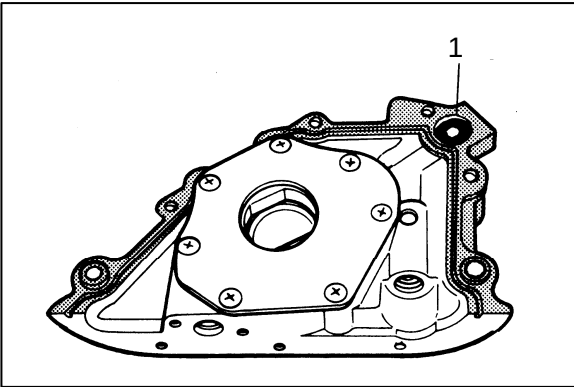


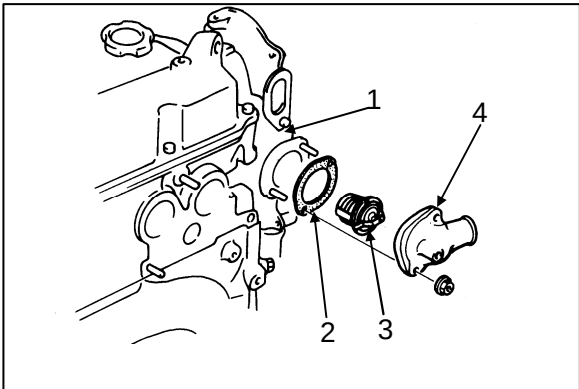
Fig. 61 Oil Pump

Cooling System Repair

THERMOSTAT

Replace

- 1. Drain cooling system to level of thermostat.
- 2. Disconnect hose and remove thermostat housing. Remove thermostat. See Fig. 62.



- 1. CYLINDER HEAD
- 2. GASKET
- 3. THERMOSTAT
- 4. HOUSING

Fig. 62 Thermostat

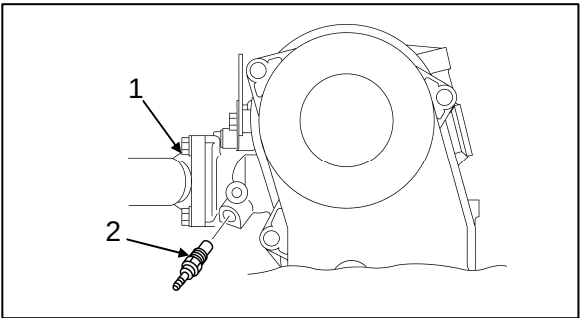
- 3. Test operation of thermostat.

Thermostat must begin to open at 82±1.5°C(180±3° F). Thermostat must be completely open at 95°C (203° F).
- 4. Install thermostat and new gasket. Make sure print side of gasket is toward thermostat.
- 5. Install thermostat housing and tighten capscrews to 19 to 26 N•m (14 to 19 ft•lbf).
- 6. Connect hose and fill cooling system. Start engine and check for leaks.

HEAT GAUGE UNIT

Replace

- 1. Disconnect heat gauge unit connector.
- 2. Remove heat gauge unit. See Fig. 63.



- 1. THERMOSTAT HOUSING
- 2. HEAT GAUGE

Fig. 63 Heat Gauge

- 3. Test operation of thermostat.
Place heat gauge unit in a container with water.
Heat water gradually.
Using an ohmmeter, measure and verify that resistance between terminal of heat gauge unit and heat gauge unit body. See Fig. 64.
If not as specified, replace heat gauge unit.

Model	Water Temperature °C (°F)	Resistance Ω
2-3[t]	79.8 to 80.2 (175.7 to 176.3)	49.3 to 57.7
1-2[t]	49.8 to 50.2 (121.7 to 122.3)	189.4 to 259.6

Cooling System Repair

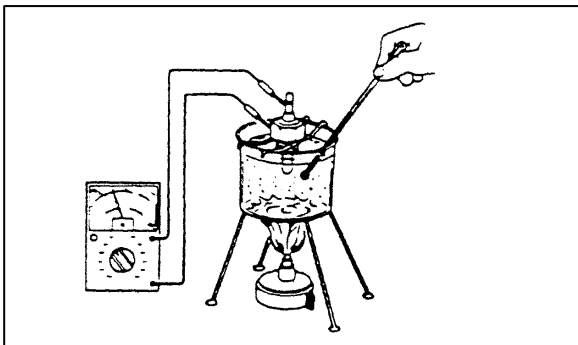
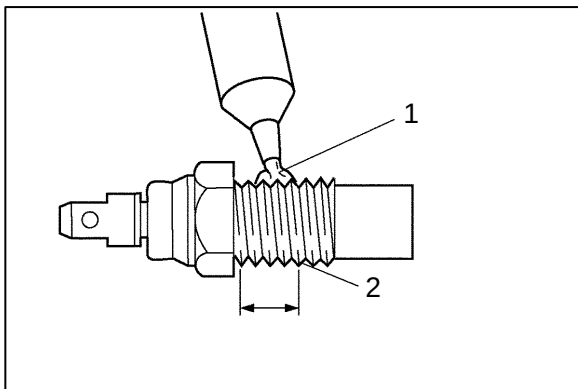


Fig. 64 Heat Gauge

4. Apply sealant from third thread to top thread. See Fig. 65.



A. 6-8 mm (0.24-0.31 in.)

1. SEALANT
2. THIRD THREAD

Fig. 65 Heat Gauge Installation

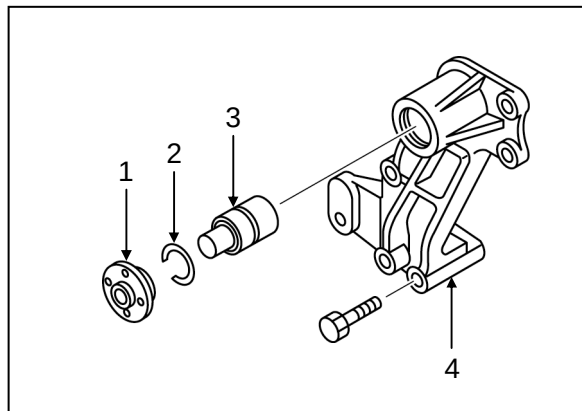
5. Install heat gauge and tighten heat gauge to 11.8 to 17.6 N·m (105 to 156 in·lbf).
6. Connect heat gauge unit connector.

FAN ASSEMBLY

Remove and Disassemble

1. Loosen alternator and remove fan belt.
2. Remove capscrews for fan. Remove fan and pulley from hub.
3. Remove capscrews that hold fan bracket to engine. Remove fan bracket.

4. Disassemble fan assembly.
Except for 2.0 LPG: See Fig. 66.



1. PULLEY HUB
2. SNAP RING
3. BEARING
4. BRACKET

Fig. 66 Fan Assembly

- (a) Press pulley boss off with a press. Secure cooling fan bearing assembly with special tool. See Fig. 67.

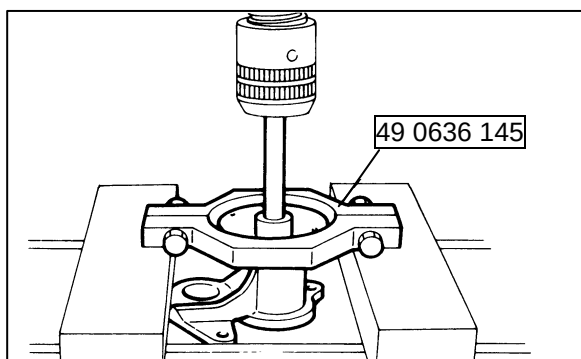


Fig. 67 Water Pump Pulley Boss Removal

- (b) Remove snap ring.
- (c) Press bearing off using a press as shown in figure. See Fig. 68.

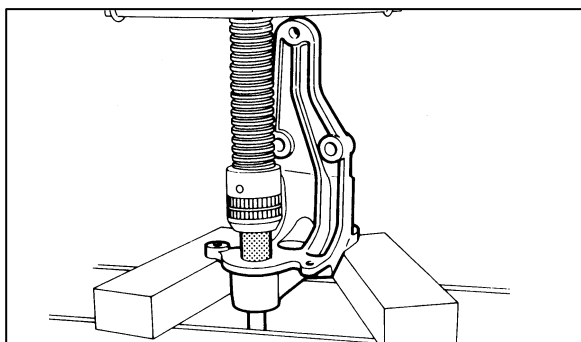


Fig. 68 Bearing Removal

Assemble and Install

1. Assemble fan assembly.
 - (a) Set bracket, as shown in figure, so that bearing surface is level. See Fig. 69.
 - (b) Press bearing in using a press.

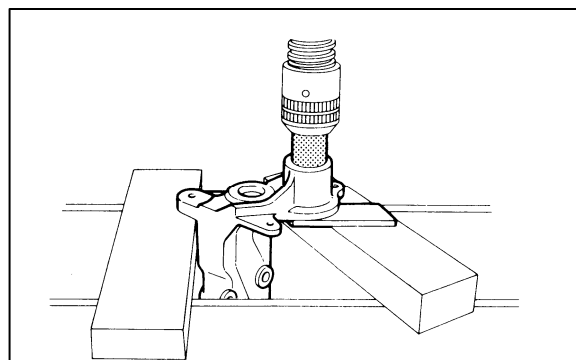
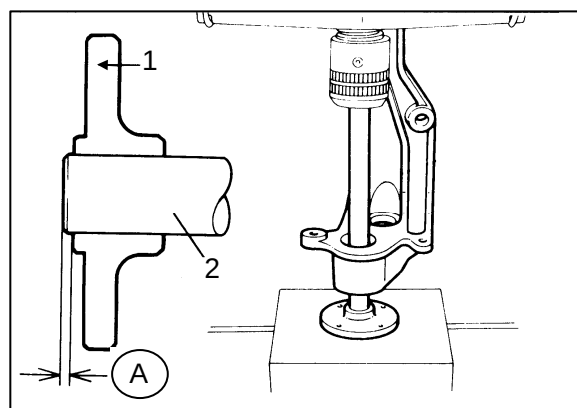


Fig. 69 Bearing Installation

⚠ CAUTION

Press bearing unit in until it contacts bracket.

- (c) Install snap ring.
- (d) Set bracket and pulley boss and, press as shown in figure. See Fig. 70.
- (e) Press upward to position shown in figure. See Fig. 70.



A. For 2.0 LPG : 0 mm (0 in.)
Except for 2.0 LPG : 1.5 mm (0.059 in.)

1. PULLEY BOSS 2. SHAFT

Fig. 70 Pulley Boss Installation

Cooling System Repair

2. Install bracket assembly on cylinder block. Tighten M8 capscrews to 32 to 47 N·m (24 to 35 ft·lbf). Tighten M10/M12 capscrews to 38 to 64 N·m (28 to 47 ft·lbf).
3. Install pulley and fan on hub. Tighten capscrews to 8 to 11 N·m (6 to 8 ft·lbf).
4. Install fan belt. Adjust tension of the fan belt. Check movement of fan belt between fan and alternator.

Tension for fan belt is correct when it moves 17 to 19 mm (0.67 to 0.75 in.) with 10 kg (22 lb) of force. Tighten alternator when tension is correct.

WATER PUMP

Remove and Disassemble

NOTE: If either the shaft or impeller is damaged, the complete water pump must be replaced.

1. Drain cooling system.
2. Loosen alternator and remove fan belt.
3. Remove capscrews for the fan. Remove fan and pulley from the hub.
4. Remove capscrews that hold fan bracket to engine. Remove fan bracket.
5. Remove upper and lower timing belt covers. See Fig. 5.
6. Loosen capscrews for timing belt tensioner and remove spring. Remove capscrews and timing belt tensioner.

⚠CAUTION

Do not rotate the camshaft gear or the crankshaft gear while the timing belt is removed. If either of the gears is moved, it will be necessary to align the timing marks.

7. Use chalk to mark direction of rotation of timing belt. See Fig. 7. Align timing marks. Then remove timing belt.

8. Disconnect hose at water pump. (For 2.0 LPG)
9. Remove capscrews for water pump. Then remove water pump from cylinder block.
10. Disassemble water pump.
Except for 2.0 LPG: See Fig. 77.
 - (a) Remove pump pulley using special tool as shown in the figure. See Fig. 71.

⚠CAUTION

Inspect pump pulley and replace it with a new one if there is any damage to timing belt grooves.

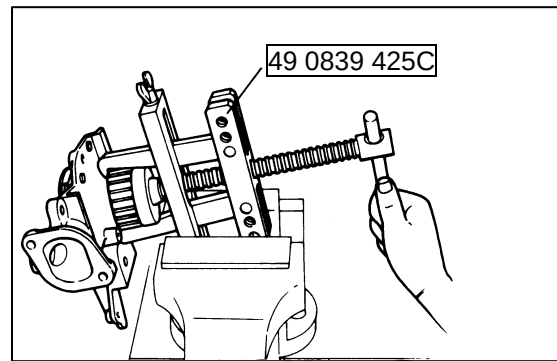


Fig. 71 Water Pump Pulley Removal

- (b) Set pulley with special tool. Press impeller off using a press and an iron rod between press and shaft. See Fig. 72.
- (c) Press shaft and bearing assy off using press with an iron rod set between the assy and press.

⚠CAUTION

Replace shaft and bearing assy as a unit.

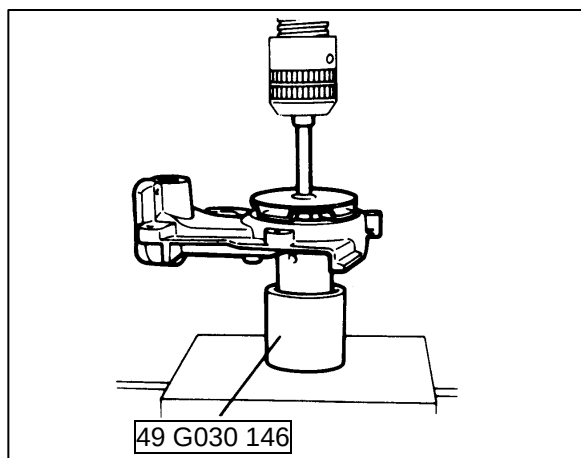


Fig. 72 Shaft and Bearing Removal

- (d) Use a pipe shown in the figure to remove water seal. See Fig. 73.

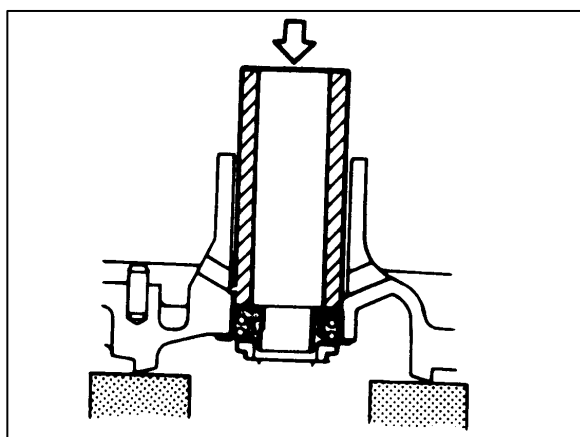


Fig. 73 Water Seal Removal

Assemble and Install

1. Assemble water pump.
Except for 2.0 LPG: See Fig. 77.

- (a) Install water seal by tapping as shown in figure. See Fig. 74.

⚠CAUTION

- Make sure that seal is not cocked or crooked.
Do not damage seal surface.
- Coat water seal lip with Long Life Coolant.

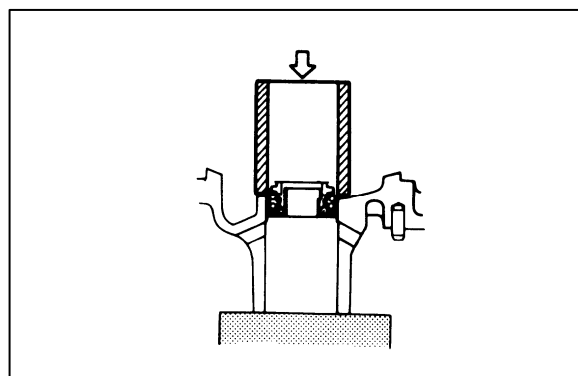


Fig. 74 Water Seal Installation

- (b) Use a press to push shaft and bearing assy in as shown in figure. See Fig. 75.

⚠CAUTION

- Place pipe on the outer race of the bearing.
- Make sure that bearing turns smoothly.

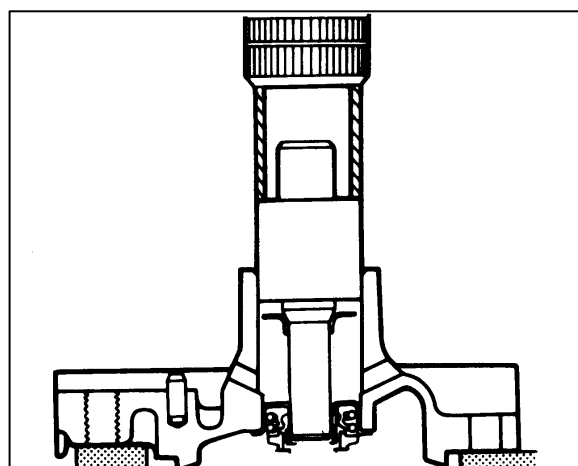


Fig. 75 Shaft and Bearing Installation

- (c) Push pump pulley in using press.
- (d) Press impeller in so that it is flush with end of shaft, as shown in Fig. See Fig. 76.

Cooling System Repair

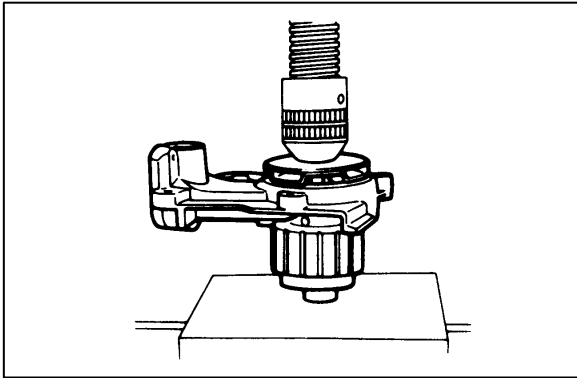
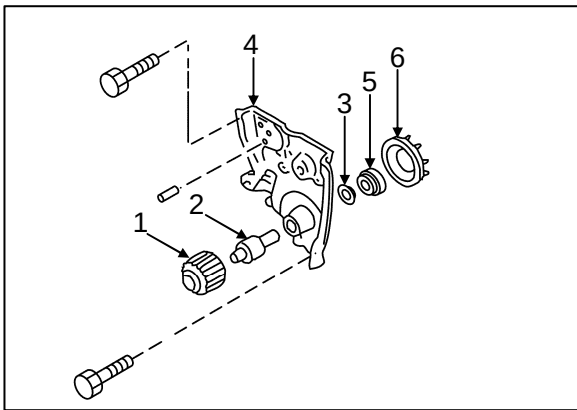


Fig. 76 Impeller Installation



- | | |
|-------------------------------|-------------|
| 1. PULLEY | 3. WASHER |
| 2. SHAFT AND BEARING ASSEMBLY | 4. HOUSING |
| | 5. SEAL |
| | 6. IMPELLER |

Fig. 77 Water Pump (Except for 2.0 LPG)

2. Install water pump with a new gasket. Tighten capscrews to 19 to 26 N·m (14 to 19 ft·lbf).
3. Clean any oil or grease from pulleys. Install timing belt so that it goes in same direction as mark made during removal.
4. Loosen lock bolt and apply spring tension on belt. Rotate crankshaft pulley clockwise two complete turns and check timing marks.

If timing marks are correct, tighten lock bolt for tensioner to 38 to 53 N·m (28 to 39 ft·lbf). Check movement on tension side of timing belt. If tension is correct, belt will move 12 to 14 mm (0.47 to 0.55 in.)

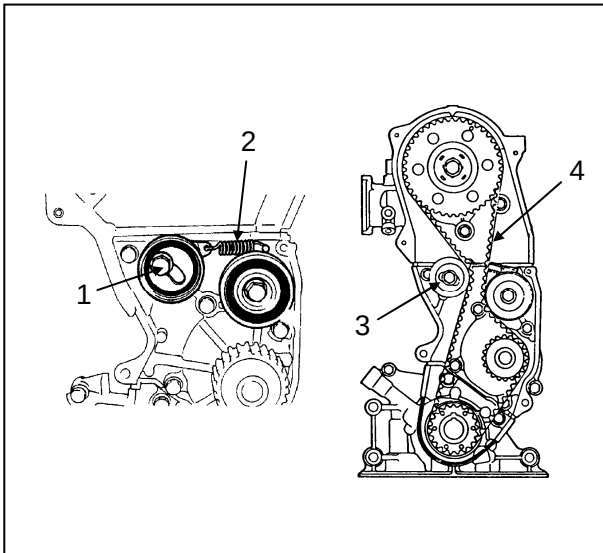
with 10 kg (22 lb) of force. (For 2.0 LPG engine) If tension is correct, belt will move 9 to 10 mm (0.36 to 0.39 in.) with 10 kg (22 lb) of force. (For gasoline and 2.2 LPG engines) See Fig. 78.

5. Install lower timing belt cover and new gasket. Tighten capscrews to 7 to 10 N·m (62 to 89 in·lbf). Install upper timing belt cover and new gasket. Tighten capscrews to 7 to 10 N·m (62 to 89 in·lbf). See Fig. 33.
6. Install fan assembly as described in the procedure for Assemble and Install, Fan Assembly.
7. Install coolant hoses. (For 2.0 LPG)
8. Fill cooling system with coolant.
9. Start engine and check cooling system for leaks.

⚠ WARNING

DO NOT remove the radiator cap from the radiator when the engine is hot. When the radiator cap is removed, the pressure is released from the system. If the system is hot, the steam and boiling coolant can cause burns. DO NOT remove the cover for the radiator when the engine is running.

10. After engine has been operated, stop engine. If coolant is hot, give engine time to cool. Check coolant level and add coolant if necessary.



- | | |
|--------------|-----------------|
| 1. TENSIONER | 3. LOCK BOLT |
| 2. SPRING | 4. TENSION SIDE |

Fig. 78 Timing Belt Installation

Distributor Repair

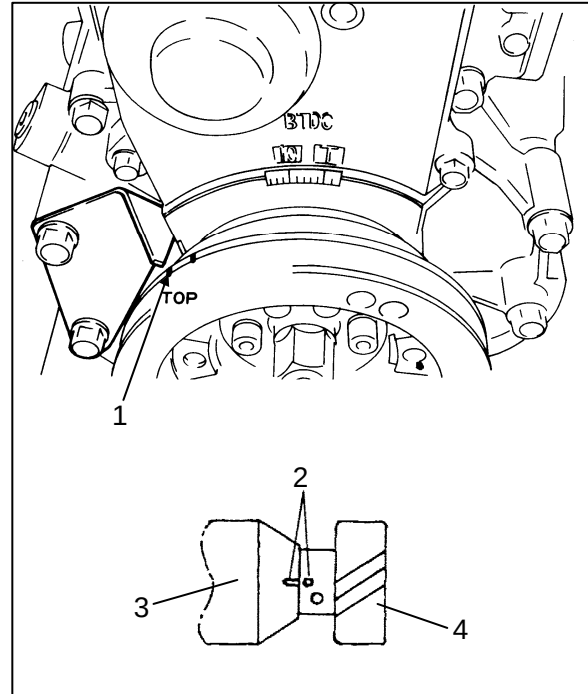
NOTE: This section only has the removal and installation procedures for the distributor. Service procedures for the ignition system are found in the Electrical System section.

REMOVE

1. Rotate crankshaft until No.1 piston is at TDC on compression stroke. Make note of position of distributor rotor. See Fig. 79.
2. Disconnect wires at spark plugs.
3. Remove capscrew from flange of distributor shaft housing. Lift distributor assembly from engine.

INSTALL

1. Rotate crankshaft until No. 1 piston is at TDC on compression stroke. Put rotor in correct position. See Fig. 79.
2. Lubricate new O-ring and gear on distributor with engine oil. Install distributor, making sure to align matching marks on distributor housing, distributor gear and engine.
3. Connect wires at spark plugs.



1. MARKING FOR ALL ENGINES IS ORANGE
2. MATCHING MARKS
3. DISTRIBUTOR HOUSING
4. DISTRIBUTOR GEAR

Fig. 79 Distributor Replacement

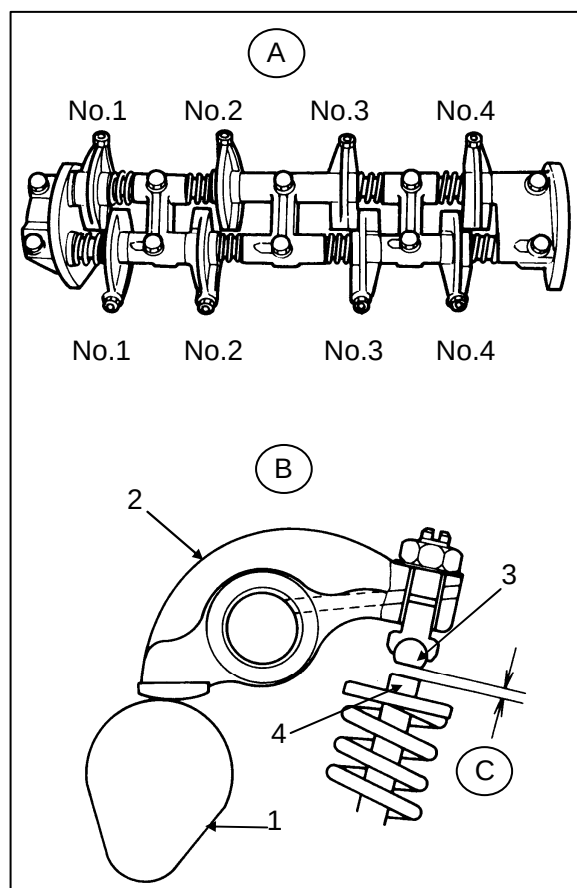
Valve Adjustment

1. Rotate crankshaft until No. 1 piston is at TDC on compression stroke (intake and exhaust valves closed).
2. Adjust clearance of intake valves for No. 1 and No. 2 cylinders and exhaust valves for the No. 1 and No. 3 cylinders. See Fig. 80. Correct clearance for intake valves when engine is cold is 0.15 ± 0.05 mm (0.006 ± 0.002 in.). Correct clearance for exhaust valves when engine is cold is 0.35 ± 0.05 mm (0.014 ± 0.002 in.).

To adjust clearance, loosen lock nut and turn adjustment screw. Tighten lock nut to 16 to 21 N·m (12 to 15 ft·lbf).

NOTE: During adjustment of valves, check position of balls in ends of rocker arms. Flat surface of ball must be in contact with stem of valve.

3. Rotate crankshaft clockwise one complete turn. Adjust remaining valves.



A. INTAKE VALVES B. EXHAUST VALVES
C. VALVE CLEARANCE

1. CAMSHAFT 3. BALL
2. ROCKER ARM 4. VALVE STEM

Fig. 80 Valve Adjustment

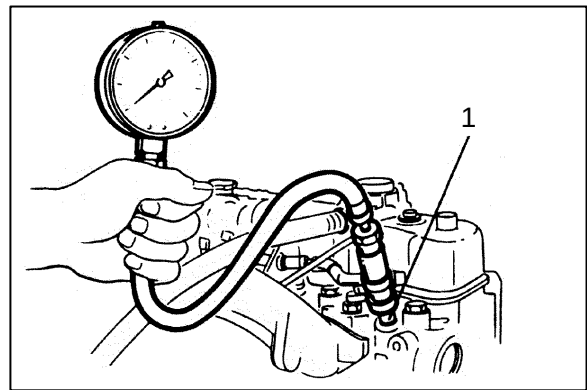
Compression Pressure Check

1. Remove spark plugs from cylinder head. Disconnect high tension wire at ignition coil.
2. Install compression gauge in No. 1 cylinder. Make sure gauge has minimum range of 1725 kPa (250 psi). See Fig. 81.
3. Use starter to crank engine at least six revolutions. Check pressure reading and release pressure. Repeat test again and make note of highest pressure. Do this test for each cylinder.

Standard pressure reading is 1128 kPa (164 psi) at 270 rpm.
Minimum reading is 794 kPa (115 psi) at 270 rpm.

4. If the readings are lower than minimum reading, there is a problem with the valves, piston rings or cylinder head gasket. Do the following tests to find the problem:
 - a. Add approx. 30 ml (1.0 oz) of engine oil to each cylinder at spark plug hole.
 - b. Crank engine approx. 10 revolutions to distribute oil.
 - c. Install compression gauge and do same tests as described in Step 3.

- If pressure reading increases to normal reading, low pressure was caused by worn or damaged piston rings. Cylinder bore may also be damaged.
- If pressure reading does not increase, low pressure was caused by worn valves, valve seats or valve guides.
- If low pressure readings are in two cylinders next to each other, cylinder head may be leaking.



1. ADAPTER

Fig. 81 Compression Pressure Check

Engine Timing Adjustment

See Ignition System Check and Adjustment in the section Mazda M4-2.0G and M4-2.2G Gasoline/LPG Engines for the adjustment procedure for engine timing.

6±1° BTDC at 800±25 rpm (orange mark)

Engine Specifications

ENGINE DATA

Engine Type	In-line 4 cylinders
Bore × Stroke (M4-2.0G).....	86 mm (3.39 in.) × 86 mm (3.39 in.)
Bore × Stroke (M4-2.2G).....	86 mm (3.39 in.) × 94 mm (3.70 in.)
Displacement (M4-2.0G).....	1998 cm ³ (121.9 in. ³)
Displacement (M4-2.2G).....	2184 cm ³ (133.2 in. ³)
Firing Order	1 - 3 - 4 - 2
Compression Ratio.....	8.6 : 1
Valve Clearance (Cold Engine) (Intake)	0.15 ± 0.05 mm (0.006 ± 0.002 in.)
Valve Clearance (Cold Engine) (Exhaust).....	0.35 ± 0.05 mm (0.014 ± 0.002 in.)
Compression Pressure	1128 kPa (164 psi) at 270 rpm
– Service Limit	794 kPa (115 psi) at 270 rpm
– Maximum Difference between Cylinders	196 kPa (28 psi)
Engine Timing (No. 1 Cylinder):	
– Gasoline	6 ± 1° BTDC
– LPG.....	6 ± 1° BTDC
When in IG set mode	
Engine Speed, Gasoline Engine:	
– Idle Speed	800 ± 25 rpm
– Governed Speed (1-2t).....	2400 ± 25 rpm
(2-3t).....	2700 ± 25 rpm
Engine Speed, LPG Engine:	
– Idle Speed	800 ± 25 rpm
– Governed Speed (1-2t).....	2400 ± 25 rpm
(2-3t).....	2700 ± 25 rpm

HEAT GAUGE UNIT (MC-Distributed part)

Resistance	
– Gasoline	79.8 to 80.2 °C (175.7 to 176.3°F)/ 49.3 to 57.7 Ω
– LPG	49.8 to 50.2 °C (121.7 to 122.3°F)/ 189.4 to 259.6 Ω

THERMOSTAT

Starts to Open	82±1.5°C (180±3°F)
Fully Open	95°C (203°F)
Fully Open Lift.....	8.5 mm (0.33 in.) min.

CYLINDER HEAD

Height	91.95 to 92.05 mm (3.621 to 3.624 in.)
Distortion Limit.....	0.15 mm (0.006 in.)
Grinding Limit.....	0.20 mm (0.008 in.)

VALVE MECHANISM

Valve Guide	
Inside Diameter	8.07 to 8.09 mm (0.3177 to 0.3185 in.)
Guide Clearance	
(Exhaust)	0.030 to 0.065 mm (0.0012 to 0.0026 in.)
Guide Clearance	
(Intake)	0.025 to 0.060 mm (0.0010 to 0.0024 in.)
– Service Limit (Intake and Exhaust).....	0.10 mm (0.004 in.)
Valve Length	
(Intake)	111.49 to 112.29 mm (4.390 to 4.420 in.)
– Service Limit	111.19 mm (4.378 in.)

Engine Specifications

Valve Length (Exhaust).....	111.29 to 112.09 mm (4.382 to 4.412 in.)
– Service Limit	110.99 mm (4.370 in.)
Valve Stem Diameter (Intake)	8.030 to 8.045 mm (0.3161 to 0.3167 in.)
– Service Limit	7.980 mm (0.3142 in.)
Valve Stem Diameter (Exhaust).....	8.025 to 8.040 mm (0.3159 to 0.3165 in.)
– Service Limit	7.975 mm (0.3140 in.)
Valve Head Thickness (Intake)	0.5 mm (0.020 in.)
Valve Head Thickness (Exhaust).....	1.0 mm (0.040 in.)
Valve Face Angle (Intake and Exhaust).....	30°
Spring Free Length – Outer	52.2 mm (2.055 in.)
– Service Limit	50.6 mm (1.992 in.)
Spring Free Length – Inner.....	47.7 mm (1.878 in.)
– Service Limit	46.3 mm (1.823 in.)
Spring out of Square – Outer	More than 1.82 mm (0.072 in.)
– Inner.....	More than 1.66 mm (0.065 in.)
Rocker Arm Shaft Diameter	15.966 to 15.984 mm (0.6286 to 0.6293 in.)
Rocker Arm Bore Diameter	16.000 to 16.027 mm (0.6299 to 0.6310 in.)
Clearance Between Rocker Arm and Shaft.....	0.016 to 0.061 mm (0.0006 to 0.0024 in.)
– Service Limit	0.10 mm (0.004 in.)

CAMSHAFT

Runout	Less than 0.03 mm (0.0012 in.)
Cam Lobes Height.....	37.370 mm (1.4713 in.)
Cam Lobes to Service Limit	37.170 mm (1.4634 in.)
Bearing Journals (No. 1 and 5).....	31.940 to 31.965 mm (1.2575 to 1.2585 in.)
Bearing Journals (No. 2, 3 and 4).....	31.910 to 31.935 mm (1.2563 to 1.2573 in.)
Bearing Journal Wear Limit	0.03 mm (0.0012 in.)
Clearance Between Journals and Bore (No. 1 and 5).....	0.035 to 0.085 mm (0.0014 to 0.0033 in.)
Clearance Between Journals and Bore (No. 2, 3 and 4).....	0.065 to 0.115 mm (0.0026 to 0.0045 in.)
– Service Limit	0.15 mm (0.006 in.)
End Clearance.....	0.08 to 0.16 mm (0.003 to 0.006 in.)
– Service Limit	0.20 mm (0.008 in.)

CRANKSHAFT

Runout	Less than 0.03 mm (0.0012 in.)
Main Bearing Journal Diameter – Standard (No. 1, 2, 4 and 5).....	59.937 to 59.955 mm (2.3598 to 2.3604 in.)
(No. 3)	59.937 to 59.955 mm (2.3598 to 2.3604 in.)
– 0.25 mm (0.01 in.) Undersize (No. 1, 2, 4 and 5).....	59.679 to 59.736 mm (2.3496 to 2.3518 in.)
(No. 3)	59.673 to 59.730 mm (2.3494 to 2.3515 in.)

- 0.50 mm (0.02 in.) Undersize
(No. 1, 2, 4 and 5)..... 59.429 to 59.486 mm
(2.3398 to 2.3419 in.)
(No. 3)..... 59.423 to 59.480 mm
(2.3395 to 2.3417 in.)
- 0.75 mm (0.03 in.) Undersize
(No. 1, 2, 4 and 5)..... 59.179 to 59.236 mm
(2.3299 to 2.3321 in.)
(No. 3)..... 59.173 to 59.230 mm
(2.3297 to 2.3318 in.)

- Service Limit 0.05 mm (0.002 in.)
- Grinding Limit 0.75 mm (0.03 in.)

Clearance Between Journals and Main Bearings

- (No. 1, 2, 4 and 5)..... 0.025 to 0.043 mm
(0.00099 to 0.00169 in.)
- (No. 3)..... 0.031 to 0.049 mm
(0.00123 to 0.00192 in.)

- Service Limit 0.08 mm (0.003 in.)

Connecting Rod Journal Diameter

- Standard 50.940 to 50.955 mm
(2.0055 to 2.0061 in.)
- 0.25 mm (0.01 in.) Undersize 50.690 to 50.705 mm
(1.9957 to 1.9962 in.)
- 0.50 mm (0.02 in.) Undersize 50.440 to 50.455 mm
(1.9859 to 1.9864 in.)
- 0.75 mm (0.03 in.) Undersize 50.190 to 50.205 mm
(1.9760 to 1.9765 in.)

- Service Limit 0.05 mm (0.002 in.)
- Grinding Limit 0.75 mm (0.03 in.)

Thrust Bearing

Clearance 0.08 to 0.18 mm
(0.003 to 0.007 in.)

- Service Limit 0.30 mm (0.012 in.)

Thrust Bearing

Thickness

- Standard 27.94 to 27.99 mm
(1.1000 to 1.1019 in.)

- 0.25 mm (0.01 in.) Undersize 28.04 to 28.09 mm
(1.1040 to 1.1060 in.)
- 0.50 mm (0.02 in.) Undersize 28.12 to 28.17 mm
(1.1071 to 1.1090 in.)
- 0.75 mm (0.03 in.) Undersize 28.20 to 28.25 mm
(1.1103 to 1.1122 in.)

CONNECTING RODS

Distortion Limit 0.18 mm (0.007 in.)/50 mm
(1.97 in.)

Bending Limit 0.075 mm (0.003 in.)/50 mm
(1.97 in.)

Small End Bore 21.943 to 21.961 mm
(0.8639 to 0.8646 in.)

Clearance Between Piston Pin and Bore

..... -0.037 to -0.013 mm
(-0.0014 to -0.0006 in.)

Clearance Between Crankshaft Journals and Rod Bearings

..... 0.027 to 0.067 mm
(0.0011 to 0.0026 in.)

- Service Limit 0.10 mm (0.004 in.)

CYLINDER BLOCK

Top Surface Distortion 0.15 mm (0.0059 in.)

Grinding Limit 0.20 mm (0.008 in.)

Bore Diameter 86.000 to 86.019 mm
(3.3858 to 3.3866 in.)

- Wear Limit 0.15 mm (0.0059 in.)

Engine Specifications

PISTONS

Diameter	
Standard.....	85.943 to 85.965 mm (3.3836 to 3.3844 in.)
0.25 mm (0.01 in.)	
Oversize.....	86.193 to 86.215 mm (3.3934 to 3.3943 in.)
0.50 mm (0.02 in.)	
Oversize.....	86.443 to 86.465 mm (3.4033 to 3.4041 in.)

Clearance Between Piston and Bore.....	0.035 to 0.076 mm (0.0014 to 0.0030 in.)
---	---

– Service Limit 0.15 mm (0.0059 in.)

Piston Pin Diameter	21.988 to 21.998 mm (0.8657 to 0.8660 in.)
---------------------------	---

Piston Rings Groove Width :	
Top and Second.....	1.520 to 1.540 mm (0.0598 to 0.0606 in.)

Groove Width :	
Oil Ring	4.020 to 4.040 mm (0.1583 to 0.1591 in.)

Piston Ring Groove Clearance (Top and Second Ring)	0.03 to 0.07 mm (0.0012 to 0.0028 in.)
---	---

– Service Limit 0.15 mm (0.0059 in.)

Piston Ring End Clearance:	
– Top Ring	0.20 to 0.35 mm (0.008 to 0.014 in.)
– Second Ring.....	0.15 to 0.30 mm (0.006 to 0.012 in.)
– Oil Control Ring.....	0.20 to 0.70 mm (0.008 to 0.027 in.)

– Service Limit
(All Rings).....1.0 mm (0.039 in.)

OIL PUMP

Clearance Between Inner Rotor Tip and Outer Rotor	
– Service Limit	0.18 mm (0.007 in.)

Clearance Between Housing and Outer Rotor.....	0.090 to 0.176 mm (0.0036 to 0.0069 in.)
---	---

– Service Limit 0.20 mm (0.008 in.)

Side Clearance Between Rotors and Housing	0.03 to 0.09 mm (0.0012 to 0.0035 in.)
--	---

– Service Limit 0.10 mm (0.004 in.)

ENGINE OIL**Recommended Engine Oil**

Item	Specifications
Grade	API SG, SH, SJ, SL
Viscosity (SAE)	5W-20, 5W-30, 10W-30

Oil Capacity (Approx. Quantity)

L (US qt, Imp qt)

Item	Specifications	
	M4-2.0G	M4-2.2G
Oil replacement	3.6 (3.8, 3.2)	3.9 (4.1, 3.4)
Oil and oil filter replacement	3.9 (4.1, 3.4)	4.2 (4.4, 3.7)
Total (dry engine)	4.5 (4.8, 3.96)	4.6 (4.9, 4.0)

ENGINE COOLANT**Engine Coolant Notes**

1. Using of genuine Mazda engine coolant is recommended.
2. Do not use engine coolant containing silicates, borates, nitrosamine or triethanolamine because these elements may cause sedimentation and corrosion inside the cooling system.

Torque Specifications

Camshaft Pulley Lock Bolt

48 to 66 N•m (35 to 49 ft•lbf)

Cooling Fan

8 to 11 N•m (71 to 97 in•lbf)

Connecting Rod Cap

66 to 70 N•m (49 to 52 ft•lbf)

Crankshaft Pulley

12 to 17 N•m (9 to 13 ft•lbf)

Camshaft Cap

18 to 27 N•m (13 to 20 ft•lbf)

Front Housing

19 to 26 N•m (14 to 19 ft•lbf)

Timing Pulley Lock Bolt

For 2.0 LPG (1-2[t])

177 to 196 N•m (131 to 144 ft•lbf)

Except for 2.0 LPG (1-2[t])

157 to 167 N•m (116 to 123 ft•lbf)

Cylinder Head

81 to 88 N•m (60 to 65 ft•lbf)

Exhaust Manifold

22 to 29 N•m (16 to 21 ft•lbf)

Intake Manifold

19 to 31 N•m (14 to 23 ft•lbf)

Main Bearing Cap

84 to 90 N•m (62 to 66 ft•lbf)

Oil Pan

8 to 12 N•m (70 to 106 in•lbf)

Oil Drain Plug (Oil Pan)

30 to 41 N•m (22 to 30 ft•lbf)

Oil Pump

M8 Capscrews 19 to 26 N•m (14 to 19 ft•lbf)

M10 Capscrews 38 to 53 N•m (28 to 39 ft•lbf)

Rear Cover

8 to 12 N•m (70 to 95 in•lbf)

Oil Strainer

8 to 12 N•m (70 to 95 in•lbf)

Rocker Cover

6 to 8 N•m (52 to 70 in•lbf)

Rocker Shaft Assembly

18 to 27 N•m (13 to 20 ft•lbf)

Spark Plugs

15 to 22 N•m (11 to 16 ft•lbf)

Thermostat Cover

19 to 26 N•m (14 to 19 ft•lbf)

Timing Belt Cover

7 to 10 N•m (62 to 89 in•lbf)

Timing Belt Tension Lock Bolt

38 to 53 N•m (28 to 39 ft•lbf)

Water Pump

19 to 26 N•m (14 to 19 ft•lbf)

Oil Pressure Switch

12 to 17 N•m (9 to 13 ft•lbf)

Heat Gauge Unit

11.8 to 17.6 N•m (105 to 156 in•lbf)

Troubleshooting

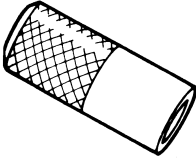
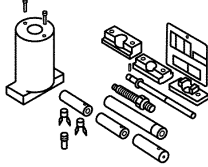
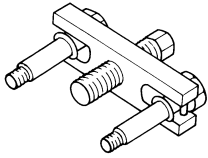
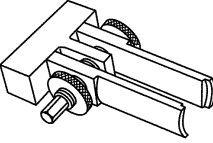
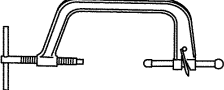
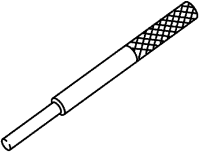
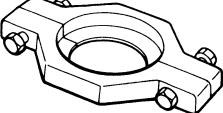
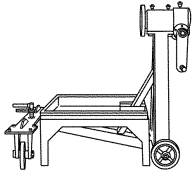
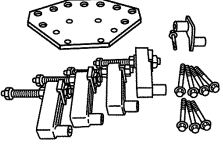
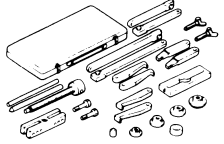
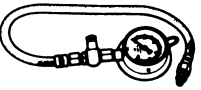
PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
The engine will not start.	The fuel tank is empty.	Fill fuel tank.
	The battery is not fully charged.	Charge battery.
	The connections at the battery are loose or they have corrosion.	Check and tighten battery connections.
	The starter system has a problem.	Check electrical circuit for starter.
	There are damaged parts in the engine.	Repair engine.
	The valves are worn or damaged.	Install new valves.
	The piston rings are worn or damaged.	Install new piston rings.
	The fuel system has a problem.	Check and repair fuel system.
	Ignition timing is not correct.	Adjust timing.
	Fuel line has a restriction.	Clean or use new fuel lines.
	Fuel filter has a restriction.	Install new fuel filter.
	Ignition system does not operate correctly.	Check and repair ignition system.
The engine does not run smoothly.	The valve mechanism does not operate correctly.	Check and repair valve mechanism.
	The cylinder head has cracks.	Install new cylinder head.
	The head gasket has a leak.	Install new gasket.
	There is a leak in the intake system.	Check and repair intake system.
	Engine is too hot.	Check cooling system.
	Fuel lines or fuel filter has a restriction.	Clean or use new fuel lines.
	The ignition timing is not correct.	Adjust timing.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
The engine does not have enough power.	The fuel is used the wrong type.	Fill tank with correct fuel.
	The air filter is dirty.	Install new air filter.
	The ignition timing is not correct.	Adjust timing.
	The valve mechanism does not work correctly.	Check and repair valve mechanism.
	The piston assemblies are worn or damaged.	Install new pistons.
	The exhaust system has restrictions.	Clean parts or install new muffler or pipes.
	Fuel lines or fuel filter has a restriction.	Clean or use new fuel lines and filter.
	Engine is too hot or too cold.	Check cooling system.
	Cylinder head gasket leaks.	Install new gasket.
There is noise inside the engine.	The main bearings are worn or damaged.	Install new main bearings.
	Engine is too hot.	Check and repair cooling system.
	Valves are not adjusted correctly.	Adjust valves.
	The bearings for the connecting rods are worn or damaged.	Install new bearings.
	The pistons are worn or damaged.	Install new pistons.
	Valve spring is broken.	Install new valve springs.
	There is not enough oil in the engine.	Fill engine with correct oil.
	The flywheel is loose.	Tighten capscrews for flywheel.
	A connecting rod is bent.	Repair engine.
	There is a leak in the exhaust system.	Repair exhaust system.
	The valve mechanism does not operate correctly.	Check and repair valve mechanism.
	Spark plugs are dirty.	Install new spark plugs.

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
The engine gets too hot.	There is not enough coolant in the cooling system.	Fill cooling system.
	The air filter has a restriction.	Install new air filter.
	The water pump has damage.	Install new water pump.
	The radiator is dirty.	Clean or repair the radiator.
	The cooling system has restrictions.	Check radiator and hoses.
	The belt for the cooling fan is worn or not adjusted correctly.	Check and adjust the belt.
	The thermostat has damage.	Install new thermostat.
	The exhaust system has restrictions.	Check and repair exhaust system.
	Ignition timing is not correct.	Adjust timing.
	Cylinder head gasket leaks.	Install new head gasket.
	Engine compression is not correct.	Check and repair engine.

Special Tools

49 G030 160 Valve seal pusher 	49 L011 0A0C Piston pin setting set 	49 S120 215B Pulley puller 
49 B012 0A2 Pivot 	49 0636 100B Valve spring lifter arm 	49 0221 251A Valve guide installer 
49 0636 145 Water pump pulley boss puller 	49 0107 680A Engine stand 	49 L010 1A0 Engine hanger set 
49 G030 146 Support block (Water pump) 	49 0839 425C Bearing puller set 	49 0187 280A Oil pressure gauge 

Periodic Inspection

Inspect the engine periodically to obtain the optimum performance from the engine and related parts. Adjust, clean or replace parts when necessary. Carry out periodic inspection in accordance with the table below.

Item	8 h/1 Day	300 h /7 weeks	600 h/ 3.5 months	1000 h/ 6 months	2000 h/1 year	3500 h/ 3.5 years	5000 h/ 7 years	TBD	Procedure or Quantity	Specification	Note
Engine oil Mazda M4-2.0G Mazda M4-2.2G	X CIL CIL	C							4.5 L (4.8 US qt, 3.96 Imp qt) 4.6 L (4.9 US qt, 4.0 Imp qt)	Replace it at first 250 h.	
Engine oil filter		C (1st:)	C						Quantity: 1 See NOTE 1.		NOTE 1: Change filters on NEW life trucks at first 250 h as indicated on hour meter.
Air cleaner element	CIL								Cleaning or replacement See NOTE 1 and 2.		NOTE 1: Clean and check it every day under very dirty condition. NOTE 2: Check it at more frequent intervals if used it under bad environment or at high temperature.
Spark plug				C					Quantity: 4	See maintenance manual. Plug gap: 0.8 mm (0.031 in.)	
Fuel injector (Gasoline)							X		Quantity: 1	See maintenance manual. Check and clean it as required.	
Fuel injector (LPG)							X		Quantity: 1	See maintenance manual. Check and clean it as required.	Check and change it as required.
Valve clearance adjustment				X					Adjust it as required.	Cold: Intake: 0.15±0.05 mm (0.006±0.002 in.) Cold: Exhaust: 0.35±0.05 mm (0.014±0.002 in.)	
V-belt and timing belt			X			C			Adjustment or replacement See NOTE 5.		NOTE 5: Replace timing belt of Mazda engine every 3500 h. Use it at hourly intervals only.

X: Check

C: Change

L: Lubricate

CIL: Check Indicator Light

Periodic Inspection

Item	8 h/1 Day	300 h /7 weeks	600 h/ 3.5 months	1000 h/ 6 months	2000 h/1 year	3500 h/ 3.5 years	5000 h/7 years	TBD	Procedure or Quantity	Specification	Note
Ignition timing					X				Adjust it as required.	6±1° BTDC	
Fuel filter					C				Quantity: 1	See maintenance manual.	
Regulator (LPG)			X						Drain tar.		
Regulator/diaphragm and O-ring (LPG)				X	C					Check and adjust per part as required. Replace it as required.	
Air intake system (Gasoline)					X				Drain oil.	Remove drain plug attached to air intake system and drain oil.	
Solenoid valve (LPG)					X				Check and clean it as required.		
Fuel filter (Regulator) (LPG)					C				Quantity: 1	See maintenance manual.	
Slow fuel filter (LPG)				C					Quantity: 1	See maintenance manual.	
Emission control system	CIL										

X: Check

C: Change

L: Lubricate

CIL: Check Indicator Light

Periodic Inspection

Inspection Items	Initial Opera- tion or every day	Every 50 h	Every 100 h	Every 300 h or 1 month	Every 400 h or 2 months	Every 600 h or 3 months	Every 1200 h or 6 months
Head bolt torque inspection		⊗					
Fan belt tension adjustment		⊗		○			
Cooling water inspection (in reserve tank)	○						
Cooling water replacement and radiator	Once every 2 years when replacing the Long Life Coolant (LLC)						
Fuel tank drain and clean	Once every year						
Battery fluid specific gravity measurement						○	
Battery fluid level and terminal inspection	○						

Note: It is necessary to carry out the procedure marked with ⊗ for a new engine or during first maintenance after overhauling. The mark * indicates when truck is used in a high dust area.