

2.0L 4-CYL

1997-98 ENGINES Mazda - 2.0L 4-Cylinder

ENGINE IDENTIFICATION

NOTE: For repair procedures not covered in this article, see **ENGINE OVERHAUL PROCEDURES** article in **GENERAL INFORMATION**.

Engine can be identified by engine model and number. See **ENGINE IDENTIFICATION CODE**. Engine model and number is stamped on left side of cylinder block. See **Fig. 1**.

ENGINE IDENTIFICATION CODE

Engine	Code
2.0L 4-Cylinder	FS

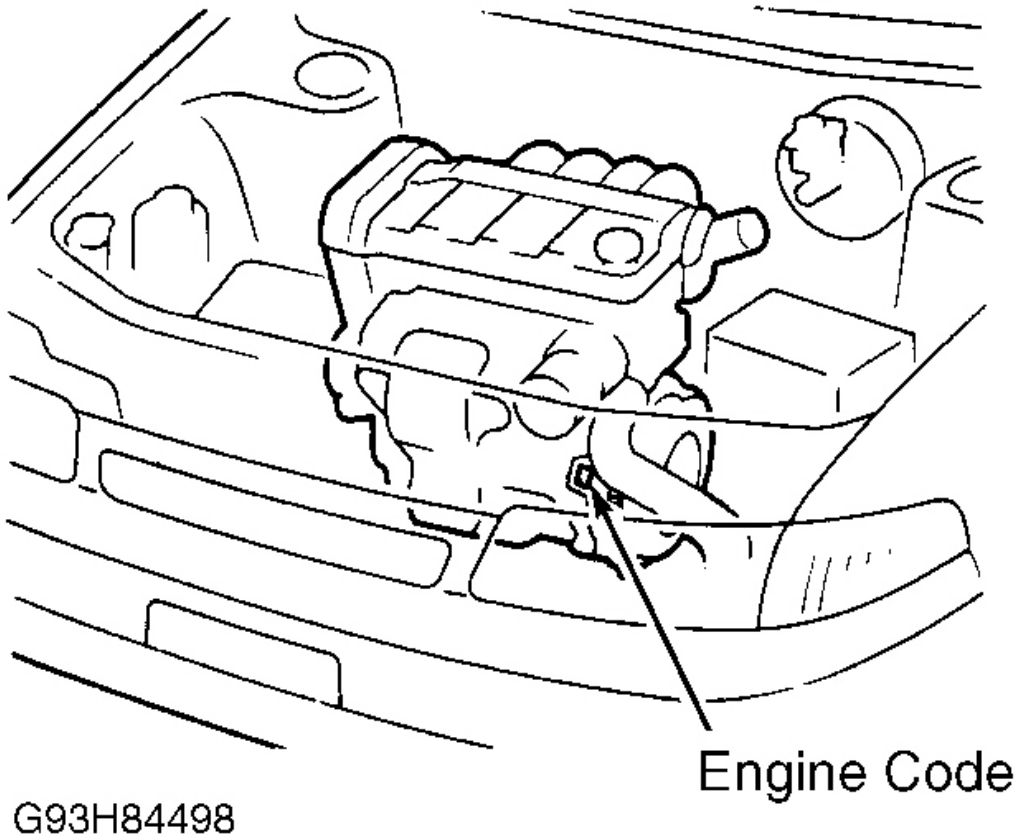


Fig. 1: Locating Engine Code

Courtesy of MAZDA MOTORS CORP.

ADJUSTMENTS**VALVE CLEARANCE ADJUSTMENT****1997 Models**

Valve clearance is not adjustable. Some Hydraulic Lash Adjuster (HLA) noise may occur during engine start-up. Noise should disappear after engine reaches normal operating temperature. If noise persists, run engine at 2000-3000 RPM and noise should stop within 20 minutes. If noise persists, change engine oil. If oil change does not reduce noise, replace HLA. Replace HLA, if HLA to camshaft clearance exceeds .006" (.15 mm).

Checking Valve Clearance (1998 Models)

1. Remove valve cover. Ensure engine is cold. Turn crankshaft clockwise to position No. 1 piston at TDC of compression stroke. Measure and record clearance between camshaft lobe and adjustment shim at specified valves. See **VALVE ADJUSTMENT SEQUENCE**.
2. To measure clearance on remaining valves, rotate crankshaft clockwise 360 degrees (one full turn) until No. 4 piston is at TDC of compression stroke. Measure and record clearance at specified valves. See **VALVE ADJUSTMENT SEQUENCE**. Clearance should be .009-.012" (.23-.30 mm) for all valves. If clearance is not as specified, replace adjustment shim. See ADJUSTING VALVE CLEARANCE (1998 MODELS).

VALVE ADJUSTMENT SEQUENCE

Piston No. At TDC	Check Intake Valves No.	Check Intake Valves No.
1	1 & 2	1 & 3
4	3 & 4	2 & 4

Adjusting Valve Clearance (1998 Models)

1. Turn crankshaft clockwise so that camshaft lobe on valve requiring clearance adjustment is positioned straight up, away from valve. Remove appropriate camshaft cap bolts as necessary. See **Fig. 2**. See **CAMSHAFT BOLT REMOVAL**.

NOTE: For No. 2 and 3 cylinder exhaust valve adjustment shim removal, remove bolt "A" or "C". For No. 2 and 3 cylinder intake valve adjustment shim removal, remove bolt "B" or "D".

CAMSHAFT BOLT REMOVAL

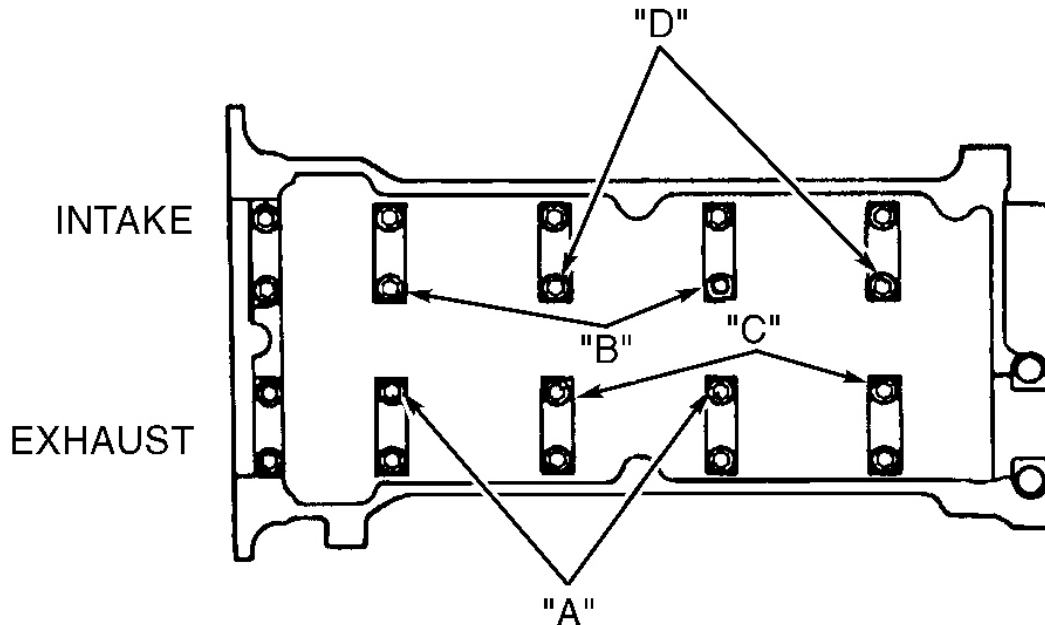
Remove Bolt ⁽¹⁾	Adjust Clearance On Cylinder No. (Valves)
A	1, 2 & 3 (Exhaust)
B	1, 2 & 3 (Intake)
C	2, 3 & 4 (Exhaust)

D	2, 3 & 4 (Intake)
(1) For bolt locations, See Fig. 2 .	

2. Assemble Adjustment Tool Shaft & Clamp (49-T012-002 and 49-T012-003), aligning marks on adjustment tools. See **Fig. 3**. Install shaft and clamp on appropriate camshaft using camshaft cap bolts. Tighten cap bolts to 100-125 INCH Lbs. (11.3-14.1 N.m). See **Fig. 4**. Tighten clamp bolt to secure shaft.
3. Face Body (49-T012-001) toward center of cylinder head. Mount body on shaft at point of adjustment shim to be replaced. See **Fig. 4**. Face notch of tappet so that thin-bladed screwdriver can be inserted. See **Fig. 5**. Set body on tappet by its notch. Tighten short bolt to secure body to shaft.

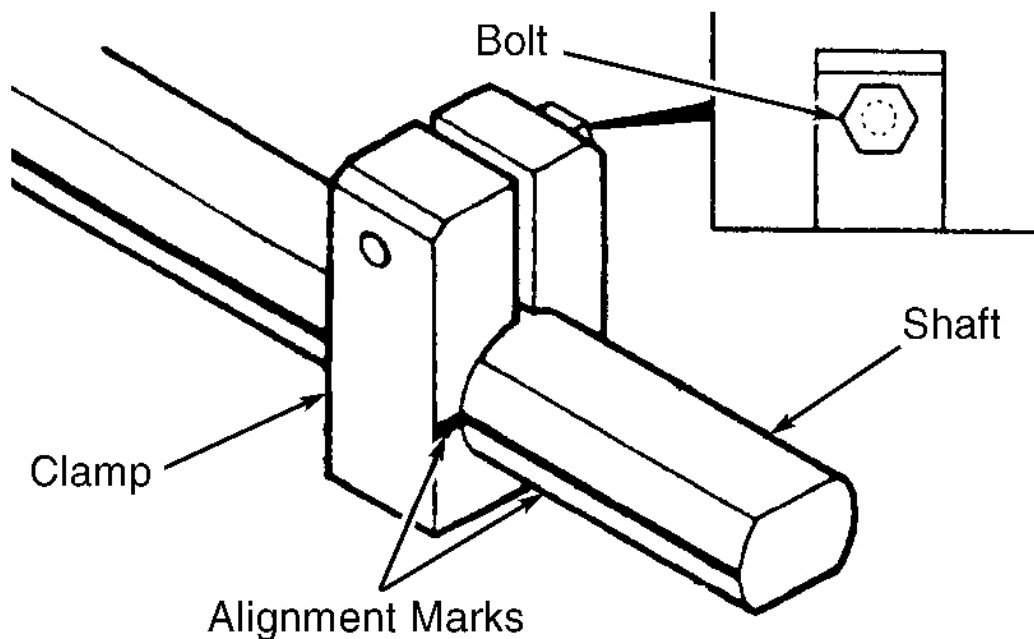
CAUTION: Use caution when depressing tappet. Cylinder head can be damaged by body tip when tappet is depressed.

4. Tighten long bolt on body to depress tappet. Using thin-bladed screwdriver, pry up on adjustment shim through notch on tappet. Using a magnet, remove shim and measure shim thickness. Select proper adjustment shim to obtain clearance of .009-.012" (.23-.30 mm). Push selected shim into tappet. Loosen long bolt to allow tappet to move up. Loosen short bolt and remove body. Remove shaft and clamp. Install camshaft cap bolts and tighten to 100-125 INCH Lbs. (11.3-14.1 N.m). Recheck valve clearance.



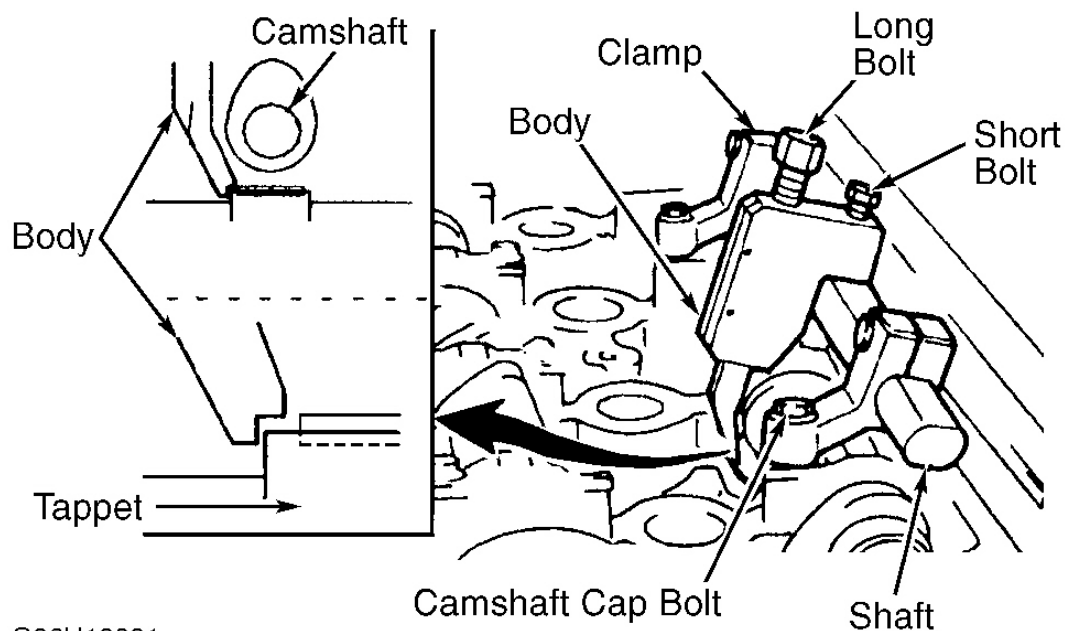
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Fig. 2: Identifying Camshaft Cap Bolts For Valve Adjustment
Courtesy of MAZDA MOTORS CORP.



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Fig. 3: Aligning Adjustment Tool Clamp & Shaft
Courtesy of MAZDA MOTORS CORP.



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Fig. 4: Installing Clamp, Shaft & Body To Cylinder Head
Courtesy of MAZDA MOTORS CORP.

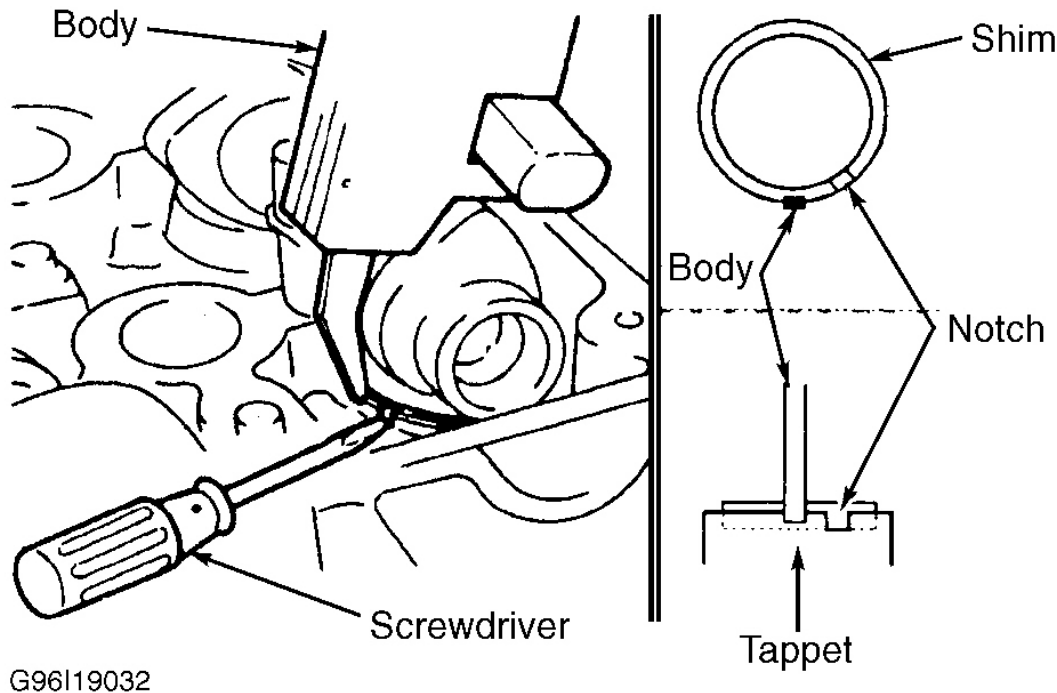


Fig. 5: Removing Adjustment Shim
 Courtesy of MAZDA MOTORS CORP.

REMOVAL & INSTALLATION

NOTE: For reassembly reference, label all electrical connectors, vacuum hoses and fuel lines before removal. Also place mating marks on engine hood and other major assemblies before removal.

FUEL PRESSURE RELEASE & PRIMING

Releasing Pressure

Locate and remove fuel pump relay from fuse/relay block on left front inner fender, in engine compartment. See **Fig. 6** and **Fig. 7**. Start engine and allow to stall. After engine stalls, attempt to restart engine to ensure no residual pressure exists. Turn ignition off and reinstall fuel pump relay. When disconnecting fuel hoses, cover connection with shop rag to catch fuel leakage. To avoid excessive cranking after servicing or to pressurize fuel system to check for fuel leaks, prime fuel system before starting engine.

Priming System (1997 Models)

Ensure fuel system is closed. Connect jumper wire between F/P and GND terminals of data link connector. See **Fig. 8**. Turn ignition on for about 10 seconds and check for fuel leaks. Turn ignition off and disconnect jumper

wire.

Priming System (1998 Models)

Ensure fuel system is closed. Remove fuel pump relay from fuse/relay block. See **Fig. 6** and **Fig. 7**. Connect a jumper wire fuel pump relay connector terminals No. 30 and 87 in fuse/relay block. See **Fig. 9**. Fuel pump will run as long as jumper wire is connected. After about 10 seconds, remove jumper wire from fuel pump relay socket.

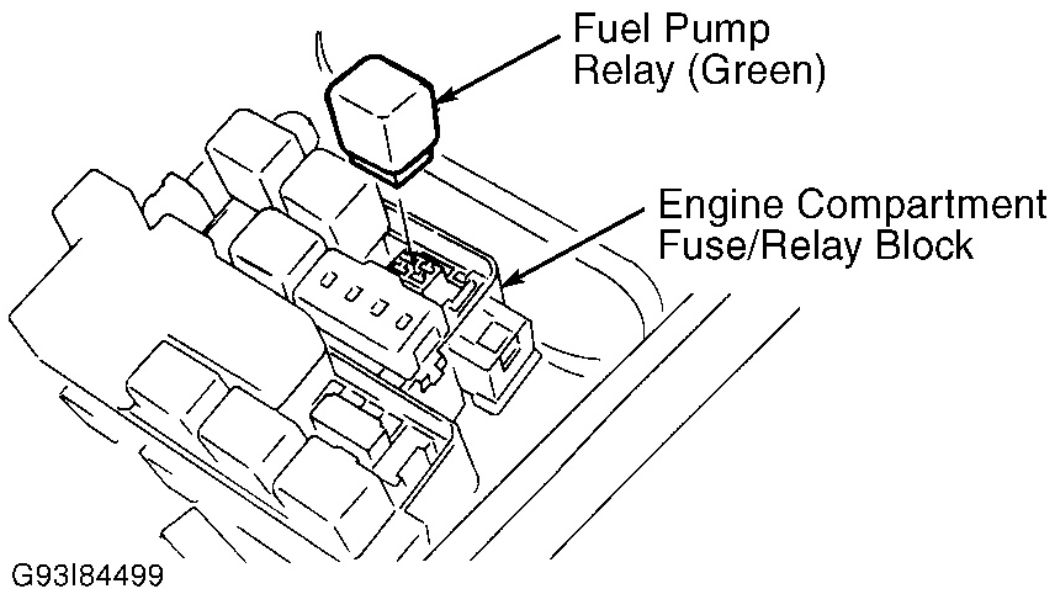
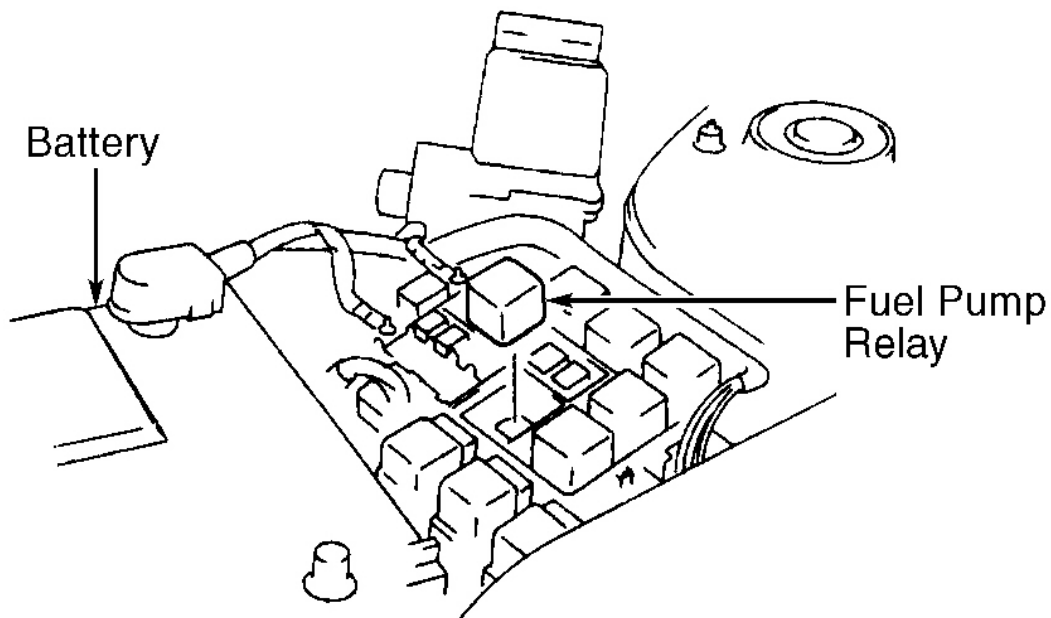
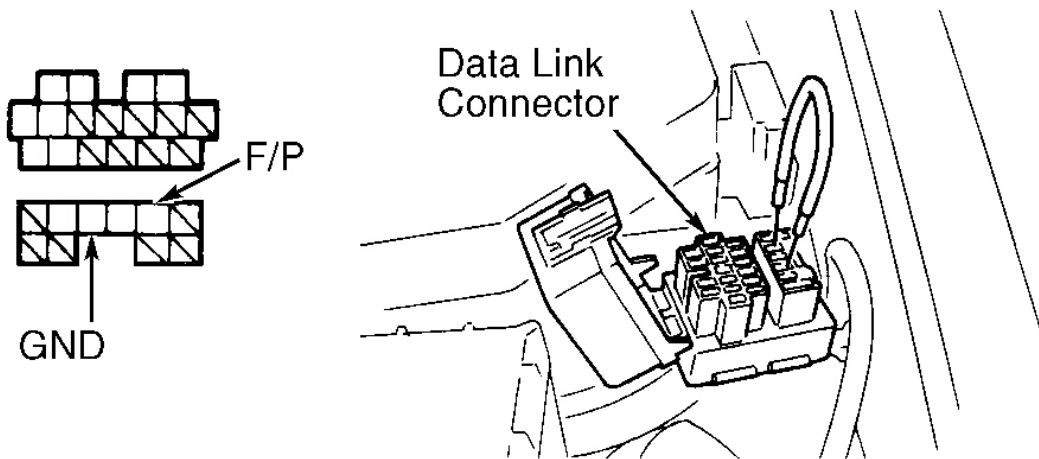


Fig. 6: Locating Fuel Pump Relay 1997 Models
Courtesy of MAZDA MOTORS CORP.



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Fig. 7: Locating Fuel Pump Relay 1998 Models
Courtesy of MAZDA MOTORS CORP.



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Fig. 8: Identifying Data Link Connector Terminals (1997 Models)
Courtesy of MAZDA MOTORS CORP.

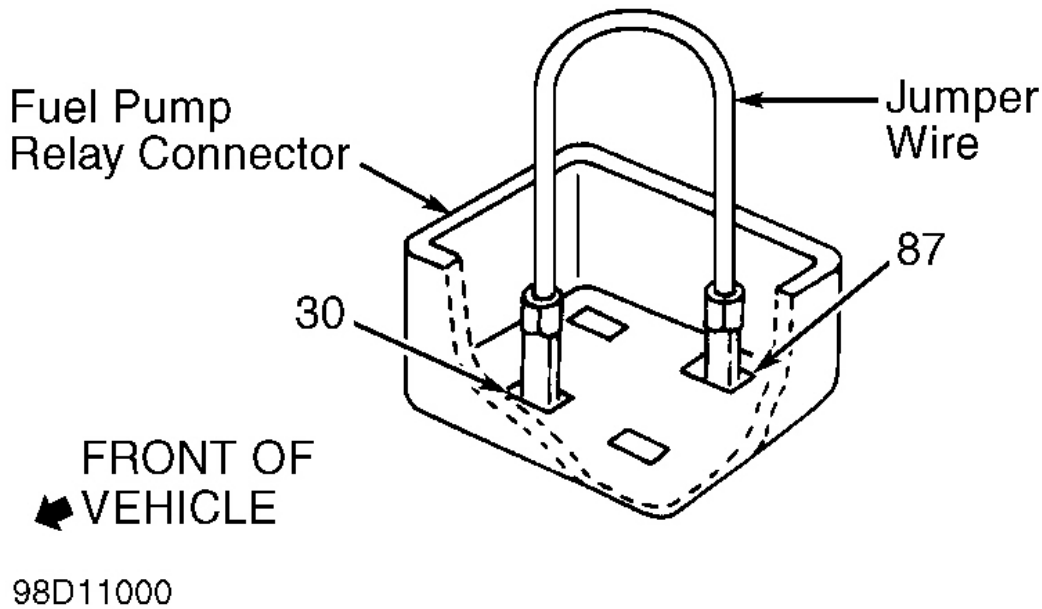


Fig. 9: Activating Fuel Pump (1998 Models)
Courtesy of MAZDA MOTORS CORP.

COOLING SYSTEM BLEEDING

CAUTION: If engine overheats during procedure, system contains excessive air. Stop engine and allow it to cool, then repeat step 1).

1. Slowly pour coolant into radiator at a rate of 1.1 qt. (1.0L) per minute maximum until coolant is level with filler port. Fill coolant reservoir to "F" mark. Securely install radiator cap. Start engine.
2. Operate engine at idle until normal operating temperature is reached. If coolant level warning light illuminates during warm-up, turn engine off and check drain plug and coolant hoses for leaks. Operate engine at 2200-2800 RPM for 5 minutes. Stop engine and allow to cool.
3. Repeat steps 1) and 2). Check coolant level. If engine coolant is not level with filler neck, repeat entire procedure. If engine coolant is level with filler neck, fill reservoir to "F" mark.

ENGINE

NOTE: Remove engine and transaxle as an assembly through top.

Removal

1. Release residual pressure from fuel system. See **FUEL PRESSURE RELEASE & PRIMING**.

Disconnect negative battery cable. Drain cooling system and transaxle. Remove engine undercover. Remove air intake ducting and air cleaner assembly.

2. Remove battery and tray. Disconnect accelerator cable. Remove fuel filter and radiator hoses. Remove radiator and cooling fan assembly. Remove power steering pump and A/C compressor with hoses attached and support aside.
3. Disconnect necessary electrical connectors, hoses and cables. On A/T, disconnect shift cable from transaxle. On M/T, remove clutch release cylinder with hose attached and support aside. On all models, remove transverse member (crossmember) from below engine.
4. Remove nuts securing engine mounts to engine mount member (large support piece that runs from front to rear under flywheel/drive plate end of engine). Support engine from above using hoist. Support engine mount member from below. Remove bolts and nuts securing engine mount member to body. Remove engine mount member.
5. Remove exhaust pipe under engine. On M/T, remove shift control rod and extension (support) bar. On all models, disconnect stabilizer bar and tie rod ends. Separate ball joints from steering knuckles. Remove drive shafts. See FWD AXLE SHAFTS article in DRIVE AXLES.
6. Remove engine mount No. 1 stay bracket. See **Fig. 10**. Remove engine mount No. 3 rubber. Remove engine mount No. 1 bolts. Remove engine mount No. 4 rubber and bracket. Remove engine and transaxle assembly.

Installation

To install, reverse removal procedure. Tighten nuts and bolts to specification. See **TORQUE SPECIFICATIONS**. Use NEW cotter pin on tie rod ends. Fill all fluids to correct level. Prime fuel system before attempting to start engine. See **FUEL PRESSURE RELEASE & PRIMING**. Bleed cooling system. See **COOLING SYSTEM BLEEDING**.

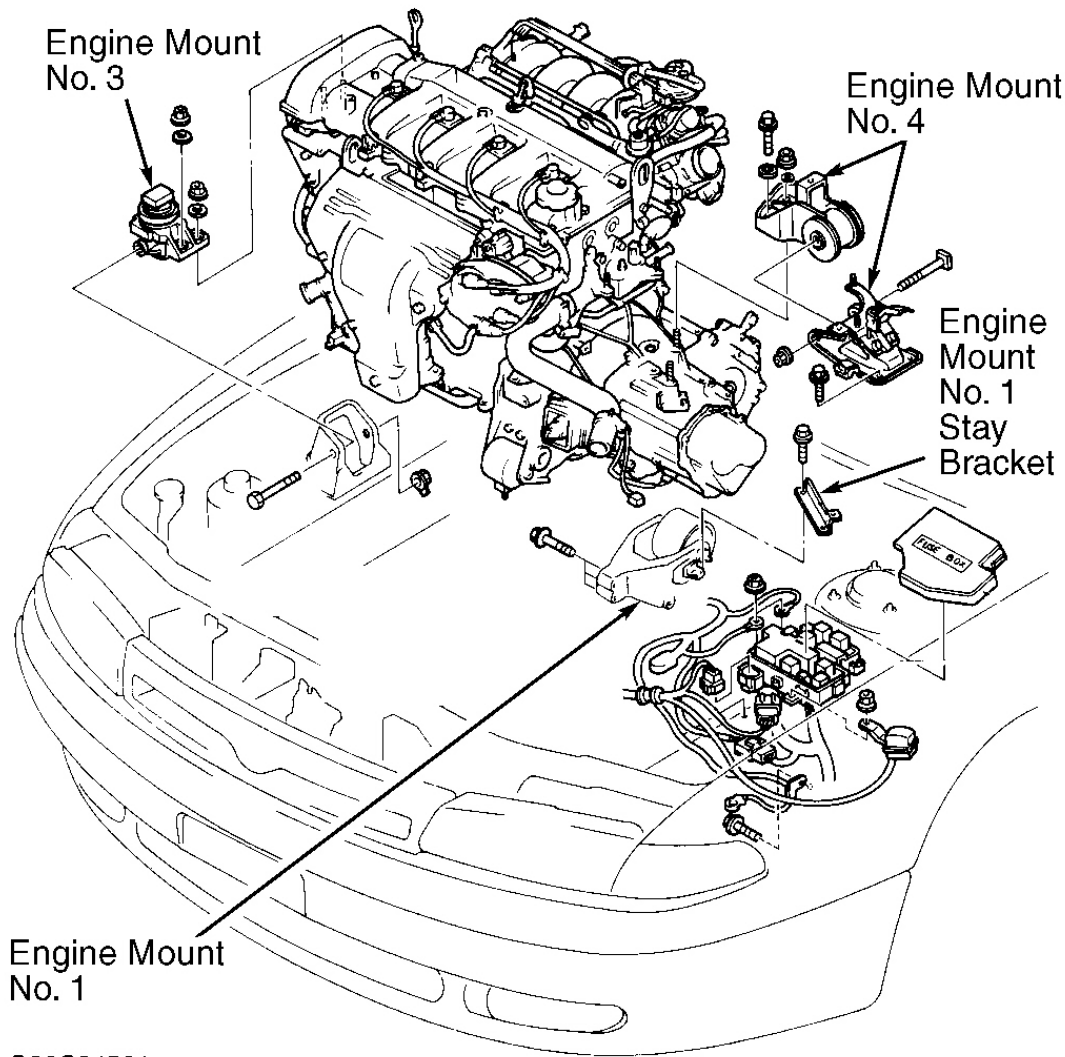


Fig. 10: Exploded View Of Engine Mounts
Courtesy of MAZDA MOTORS CORP.

INTAKE MANIFOLD

Removal

Release residual pressure from fuel system. See **FUEL PRESSURE RELEASE & PRIMING**. Disconnect negative battery cable. Drain cooling system. Remove air intake ducting and air cleaner assembly. Disconnect accelerator cable. Disconnect necessary electrical connectors, hoses and cables. Remove throttle body assembly and fuel rail assembly. Remove intake manifold bracket, bolts and intake manifold.

Installation

To install, reverse removal procedure. Tighten intake manifold bolts to specification. See **TORQUE SPECIFICATIONS**. Prime fuel system before attempting to start engine. See **FUEL PRESSURE RELEASE & PRIMING**. Bleed cooling system. See **COOLING SYSTEM BLEEDING**.

EXHAUST MANIFOLD

Removal & Installation

Disconnect necessary electrical connectors, hoses and cables. Remove exhaust manifold shield. Disconnect exhaust pipe from exhaust manifold. Remove exhaust manifold bolts and nuts. Remove exhaust manifold. To install, reverse removal procedure. Tighten exhaust manifold bolts to specification. See **TORQUE SPECIFICATIONS**.

CYLINDER HEAD

CAUTION: To prevent engine damage, DO NOT rotate crankshaft counterclockwise as viewed from timing belt end of engine.

Removal

1. Release residual pressure from fuel system. See **FUEL PRESSURE RELEASE & PRIMING**. Disconnect negative battery cable. Drain cooling system. Remove engine undercover. Remove air intake ducting and air cleaner assembly. Disconnect necessary electrical connectors, fuel hoses and control cables. Remove ignition coil (1998 models).

CAUTION: To prevent cylinder head warpage or cracking, loosen cylinder head bolts in proper sequence. See Fig. 11 and Fig. 12 .

2. Remove upper radiator, by-pass and heater hoses. Remove timing belt. See **TIMING BELT**. Remove distributor (1997 models). Remove camshafts. See **CAMSHAFTS**. Remove intake manifold bracket. Loosen cylinder head bolts in 2-3 steps, in proper sequence. See **Fig. 11** and **Fig. 12** . Remove cylinder head bolts. Remove cylinder head and gasket.

Inspection

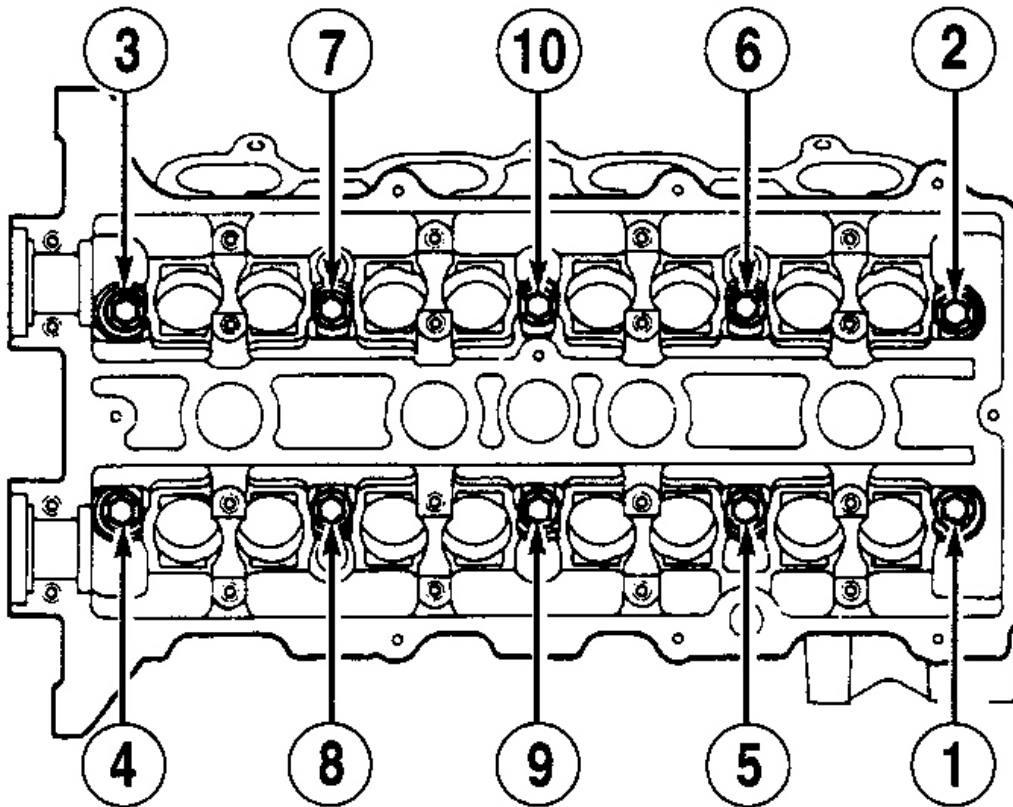
Check cylinder head warpage. If warpage exceeds specification, resurface head, but DO NOT exceed grinding limit. See **CYLINDER HEAD** under ENGINE SPECIFICATIONS. After resurfacing cylinder head, check cylinder head height. Replace cylinder head if height is less than minimum specification. Replace cylinder head bolts if length from bolt head contact surface to tip of bolt shank exceeds 4.154" (105.5 mm).

Installation

1. Install NEW cylinder head gasket. Install cylinder head. Apply oil to bolt threads and bolt seating surface. Tighten cylinder head bolts to specification in 2-3 steps, in proper sequence. See **Fig. 11** and **Fig. 12** . See **TORQUE SPECIFICATIONS**.
2. To install remaining components, reverse removal procedure. Before installing valve cover, apply silicone

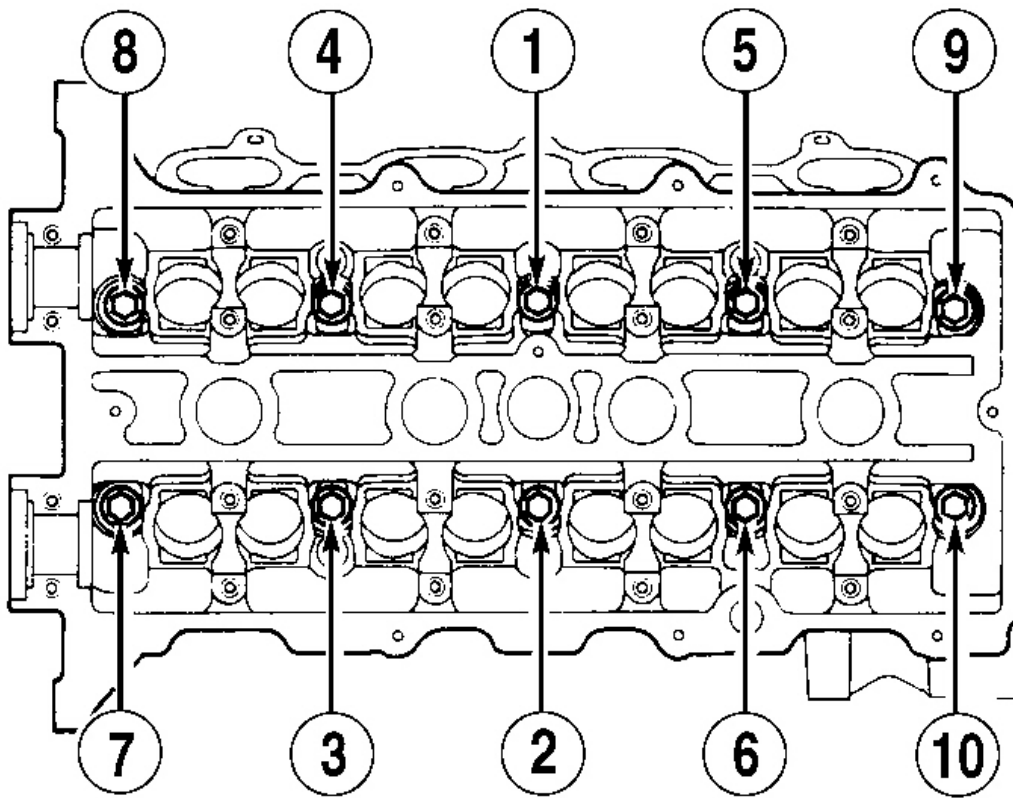
sealant to seams where front camshaft bearing caps contact cylinder head. Install NEW valve cover gasket in valve cover.

3. Tighten valve cover bolts to specification in 5-6 steps, in proper sequence. See **Fig. 13** and **Fig. 14**. See **TORQUE SPECIFICATIONS**. Prime fuel system before attempting to start engine. See **FUEL PRESSURE RELEASE & PRIMING**. Bleed cooling system. See **COOLING SYSTEM BLEEDING**.



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Fig. 11: Cylinder Head Bolt Loosening & Tightening Sequence Loosening
Courtesy of MAZDA MOTORS CORP.



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Fig. 12: Cylinder Head Bolt Loosening & Tightening Sequence Tightening
 Courtesy of MAZDA MOTORS CORP.

FRONT COVER

NOTE: Front cover contains oil pump. For removal and installation procedures, see **OIL PUMP & FRONT COVER** under **ENGINE OILING**.

FRONT COVER OIL SEAL

Removal & Installation

Remove timing belt. See **TIMING BELT**. Remove crankshaft sprocket. Cut oil seal with razor knife. Using screwdriver protected with a rag, pry oil seal from front cover. To install, apply oil to sealing lip of new oil seal. Tap oil seal into bore until seal is even with face of oil pump body. To install remaining components, reverse removal procedure. Tighten nuts and bolts to specification. See **TORQUE SPECIFICATIONS**.

TIMING BELT

CAUTION: To prevent engine damage, **DO NOT** rotate crankshaft if timing belt is not installed. If timing belt is installed, **DO NOT** rotate crankshaft counterclockwise as viewed from timing belt end of engine.

Removal

1. Disconnect negative battery cable. Remove right front wheel and engine undercover. Remove drive belts and pulley shield at power steering pump. Remove power steering pump with hoses attached and support aside. Remove water pump pulley. Remove crankshaft pulley and guide plate (large washer).
2. Remove spark plug wires and spark plugs. Loosen valve cover bolts in 5-6 steps, in proper sequence. See **Fig. 13** and **Fig. 14**. Remove valve cover and gasket. Remove dipstick tube. Remove upper and lower timing belt covers. Support engine from above. Remove engine mount at timing belt end of engine.
3. If reusing timing belt, mark arrow on belt to indicate direction of rotation. Install crankshaft pulley bolt finger-tight to retain crankshaft sprocket. Rotate crankshaft clockwise (as viewed from timing belt end of engine) until cylinder No. 1 piston is at TDC of compression stroke and timing marks are aligned. See **Fig. 15**.
4. Turn tensioner clockwise with an Allen wrench to relieve spring tension, then disconnect spring from hook pin. Remove timing belt. Remove crankshaft sprocket, tensioner and idler pulley (if necessary).

Inspection

Inspect timing belt for drive teeth wear, cracking and oil contamination. Replace belt if damaged or contaminated. Rotate belt tensioner to check for abnormal noise. Replace damaged components.

Installation

1. Install crankshaft sprocket, tensioner, water pump pulley and idler pulley (if removed). Temporarily tighten tensioner with spring fully retracted. Ensure timing marks are aligned. See **Fig. 15**. Install timing belt around crankshaft sprocket, water pump sprocket, idler pulley and camshaft sprockets. Ensure slack does not exist on idler side (tension side) of timing belt.
2. Complete timing belt installation on slack side. Loosen tensioner bolt and allow tensioner to ride against timing belt. Tighten tensioner bolt to specification. See **TORQUE SPECIFICATIONS**. Rotate crankshaft clockwise 2 turns.
3. Before installing valve cover, apply silicone sealant to seams where front camshaft bearing caps contact cylinder head. Install NEW valve cover gasket in valve cover. Tighten valve cover bolts to specification in 5-6 steps, in sequence. See **Fig. 13** and **Fig. 14**. See **TORQUE SPECIFICATIONS**. To install remaining components, reverse removal procedure.

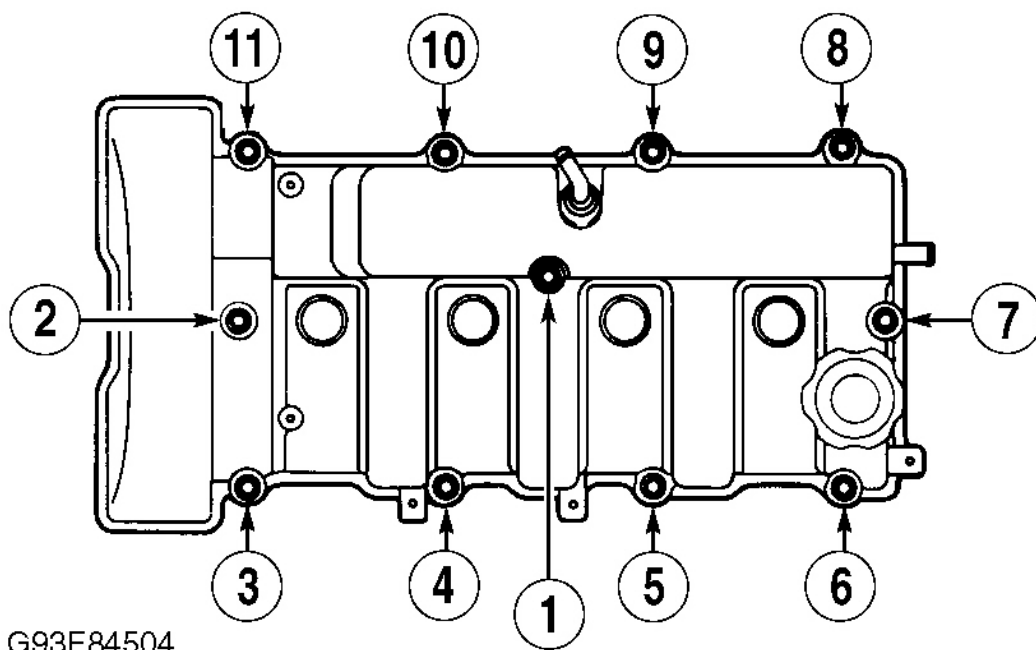
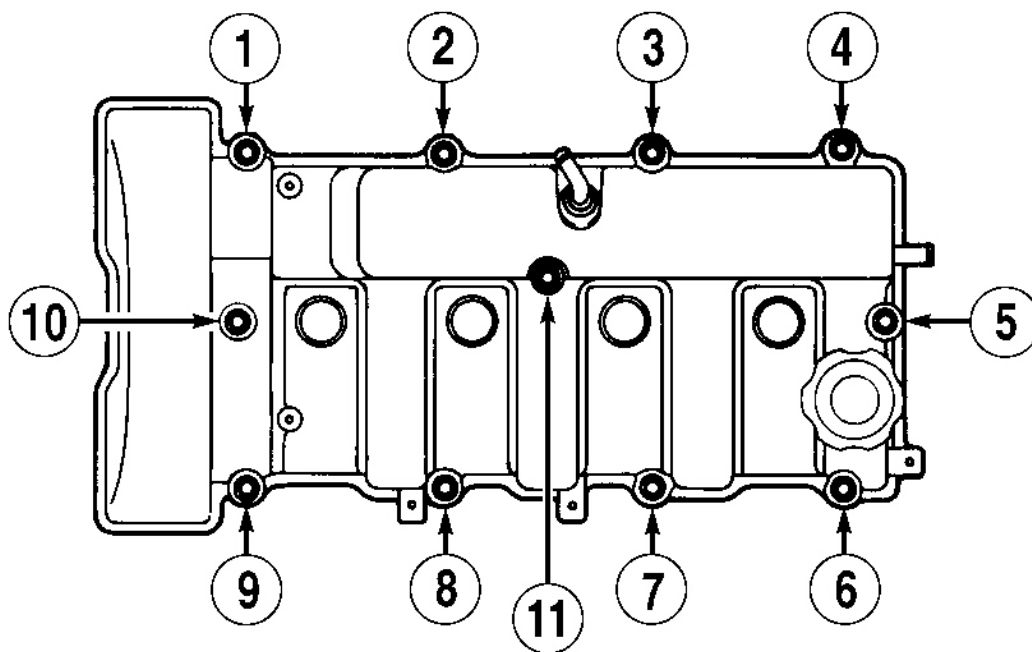


Fig. 13: Valve Cover Bolt Loosening & Tightening Sequence Loosening
Courtesy of MAZDA MOTORS CORP.



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Fig. 14: Valve Cover Bolt Loosening & Tightening Sequence Tightening
 Courtesy of MAZDA MOTORS CORP.

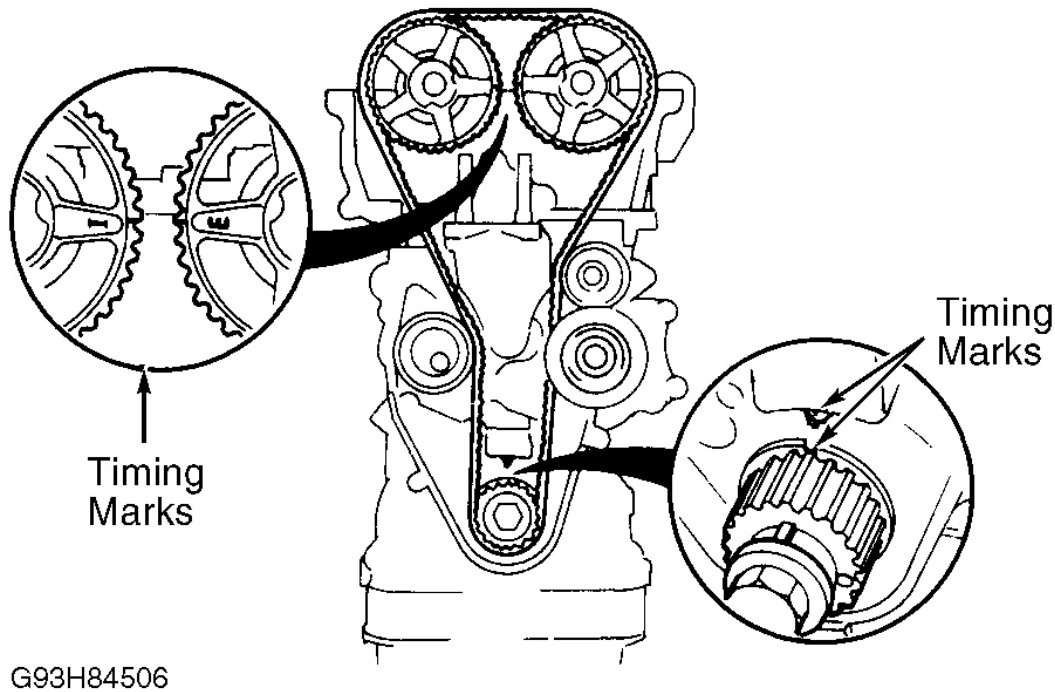


Fig. 15: Aligning Timing Marks
 Courtesy of MAZDA MOTORS CORP.

HYDRAULIC LASH ADJUSTERS

CAUTION: If reusing Hydraulic Lash Adjusters (HLA), always install them to original location. Premature camshaft failure will occur if HLA is not returned to original location.

Removal (1997 Models)

Disconnect negative battery cable. Remove timing belt. See **TIMING BELT**. Remove camshafts. See **CAMSHAFTS**. Mark Hydraulic Lash Adjusters (HLA) for installation to original location. Remove HLA. Store HLA upside-down, submerged in clean engine oil.

Inspection

Replace HLA if friction surfaces are worn or damaged. Hold bucket body and press plunger by hand. If plunger moves, replace HLA.

Installation

Apply oil to friction surfaces. Install HLA in original locations. Ensure each HLA slides freely in bore. To complete installation, reverse removal procedure. Tighten nuts and bolts to specification. See **TORQUE**

SPECIFICATIONS.**CAMSHAFTS****Removal**

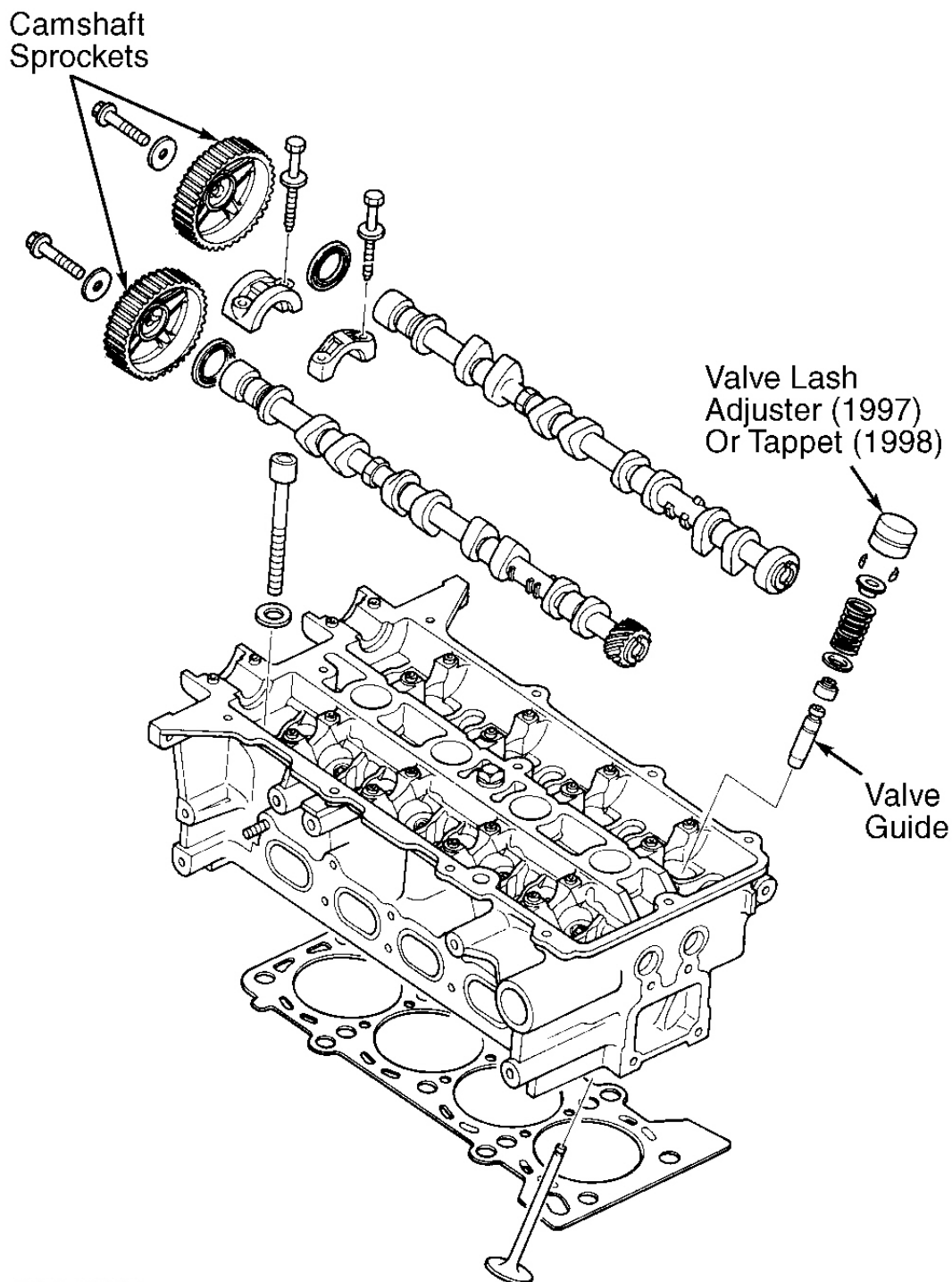
Disconnect negative battery cable. Remove timing belt. See **TIMING BELT**. Remove camshaft sprockets (hold hex portion of camshaft to remove bolt). See **Fig. 16**. Loosen camshaft bearing cap bolts in several steps, starting at ends and working inward. Remove bearing caps and camshafts. Remove camshaft oil seals.

Inspection

Inspect all friction surfaces for scoring or wear. Measure camshaft dimensions. Replace camshaft if dimensions are not within specification. See **CAMSHAFT** under ENGINE SPECIFICATIONS.

Installation

1. Apply oil to camshaft friction surfaces. Install camshafts with dowel pin facing upward. On 1997 models, exhaust camshaft has distributor drive gear on it. On all models, apply silicone sealant to surfaces of cylinder head where camshaft front bearing caps contact cylinder head. DO NOT allow sealant to contact journal surfaces.
2. Intake camshaft bearing caps are numbered 1-5 from front to rear. Exhaust camshaft bearing caps are numbered 6-10 from front to rear. Install camshaft bearing caps, tightening bolts to specification in 5-6 steps, starting at center and working outward. See **TORQUE SPECIFICATIONS**.
3. Apply oil to NEW camshaft oil seals. Install seals until even with face of bearing cap. Install camshaft sprockets, ensuring timing marks are aligned. See **Fig. 15**.



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Fig. 16: Exploded View Of Cylinder Head Assembly
Courtesy of MAZDA MOTORS CORP.

CRANKSHAFT REAR OIL SEAL & REAR COVER**Removal**

Drain engine oil. Remove transmission and flywheel/drive plate. On A/T, see TRANSMISSION REMOVAL & INSTALLATION article in TRANSMISSION SERVICING. On M/T, see appropriate article in CLUTCHES. Remove flywheel or flexplate. On all models, cut oil seal with razor knife. Using screwdriver protected with a rag, pry oil seal from rear cover. Remove rear cover bolts and rear cover (if necessary).

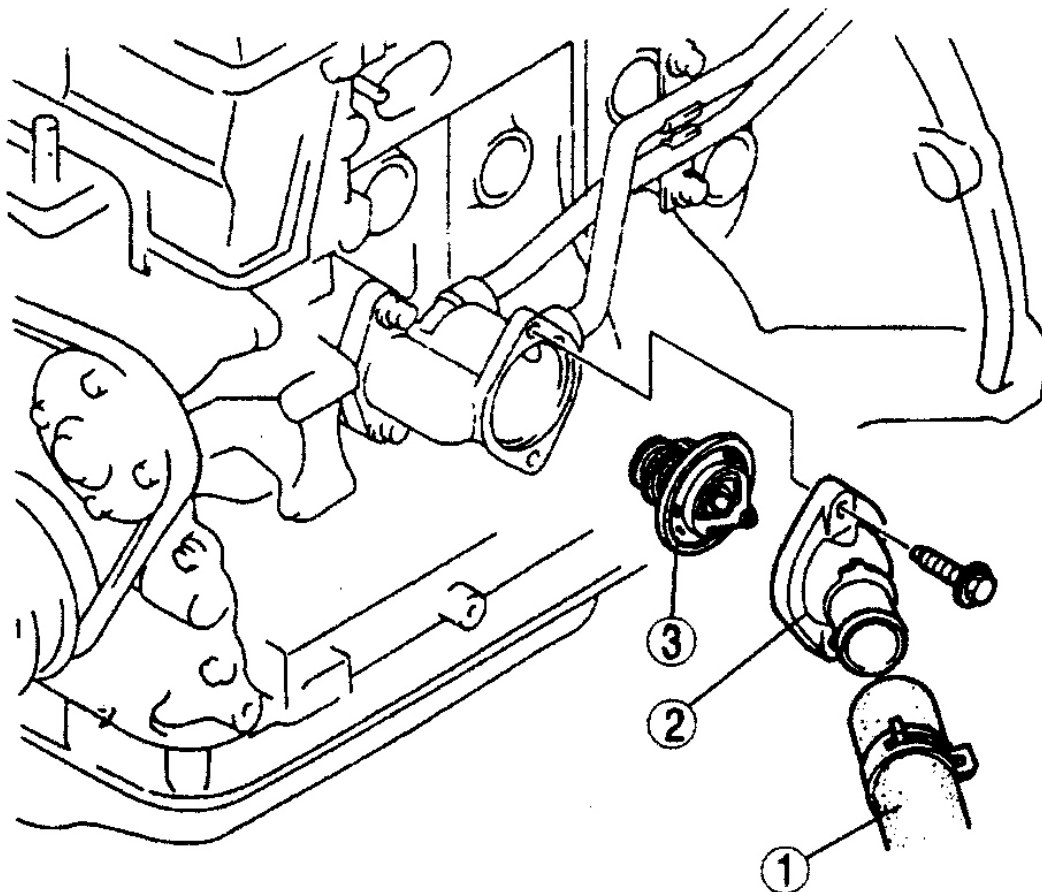
Installation

1. If rear cover was not removed, go to next step. If rear cover was removed, clean old sealant from sealing surfaces of rear cover and cylinder block. Apply continuous bead of silicone sealant to sealing surface of rear cover, running sealant bead inside bolt holes. Install rear cover. Tighten rear cover bolts to specification. See **TORQUE SPECIFICATIONS**.
2. Apply oil to sealing lip of NEW oil seal. Tap oil seal into bore until seal is even with face of rear cover. To install remaining components, reverse removal procedure. Tighten nuts and bolts to specification. See **TORQUE SPECIFICATIONS**.

THERMOSTAT**Removal & Installation**

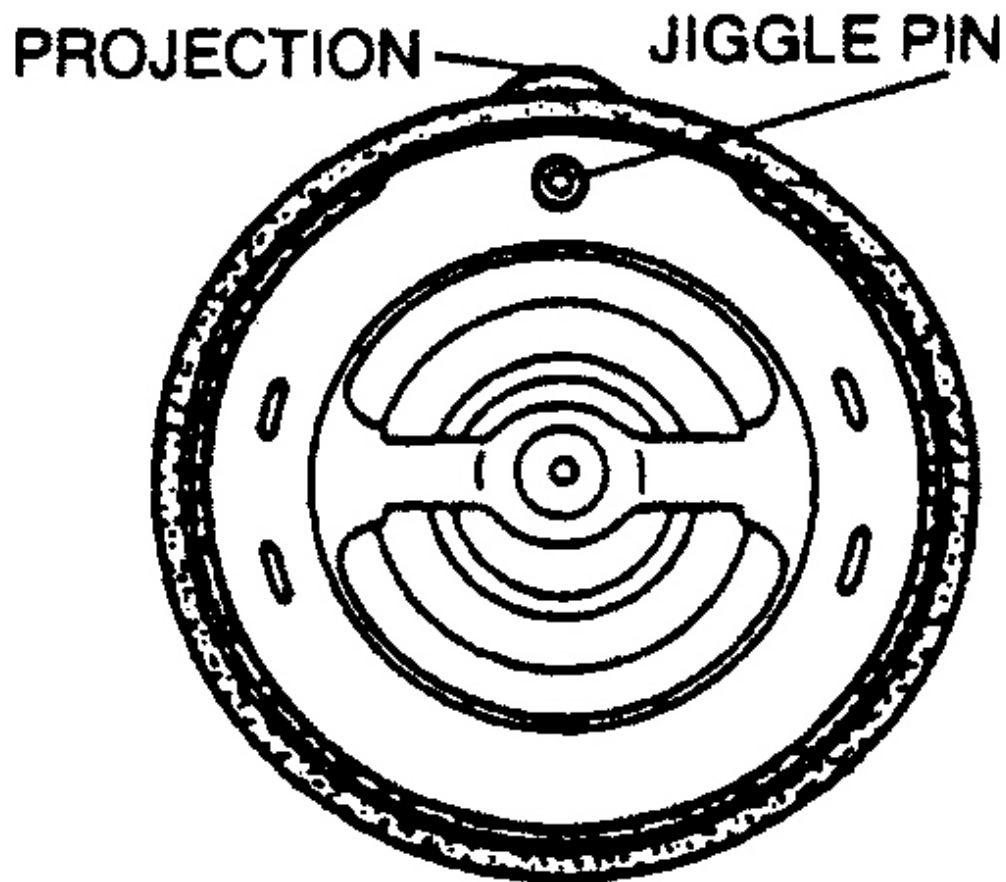
NOTE: **Numbers in parenthesis refer to numbers in illustration.**

1. Disconnect the negative battery cable. Drain the engine coolant. Remove lower radiator hose (1). See **Fig. 17**. Remove thermostat housing (2). Remove thermostat (3).
2. To install, reverse removal procedure. Verify that the jiggle pin is aligned with the projection of the thermostat gasket as shown. See **Fig. 18**. Install the thermostat into the thermostat case, aligning the projection on the gasket to the thermostat case as shown. See **Fig. 19**.
3. Tighten thermostat housing bolts to specification. See **TORQUE SPECIFICATIONS**.



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Fig. 17: Removing Thermostat
Courtesy of MAZDA MOTORS CORP.



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Fig. 18: Verifying Thermostat Jiggle Pin Is Aligned
Courtesy of MAZDA MOTORS CORP.

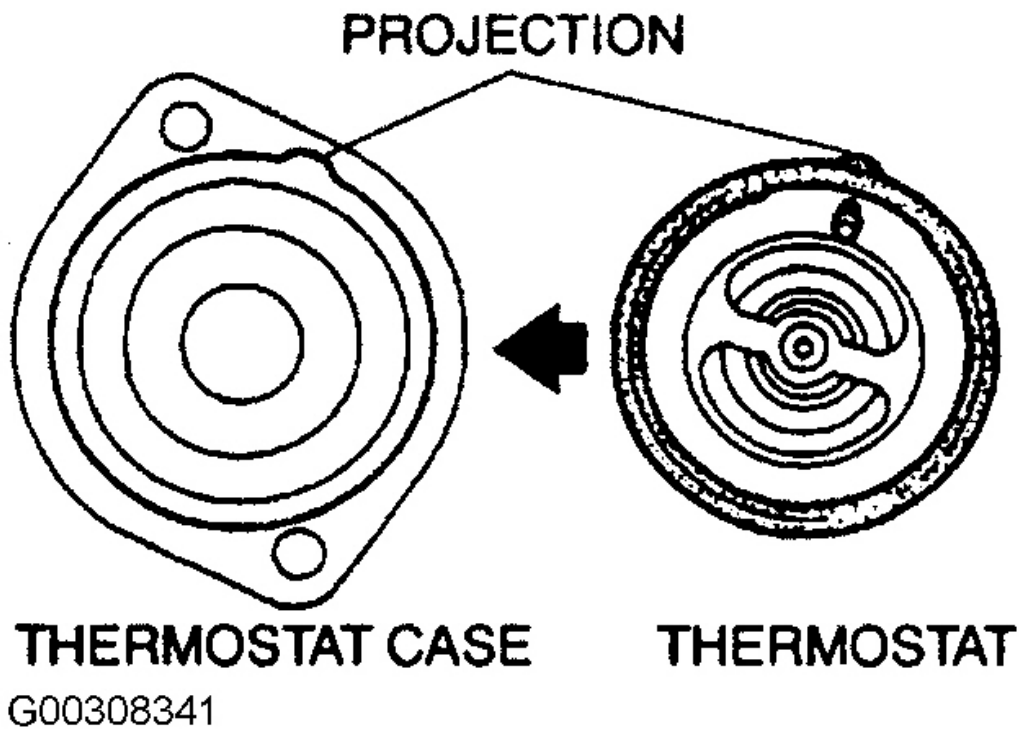


Fig. 19: Installing Thermostat
Courtesy of MAZDA MOTORS CORP.

WATER PUMP

Removal & Installation

Disconnect negative battery cable. Drain coolant. Remove timing belt. See **TIMING BELT**. Remove water pump. To install, reverse removal procedure. Use NEW water pump gasket. Bleed cooling system. See **COOLING SYSTEM BLEEDING**.

OIL PAN

NOTE: If removing oil pan to access crankshaft or other components at bottom of cylinder block, oil pan upper block must also be removed. See **OIL PAN UPPER BLOCK**. See [Fig. 20](#).

Removal

1. Disconnect negative battery cable. Remove engine undercover. Drain engine oil. Disconnect oxygen sensor connector. Remove front exhaust pipe. Remove oil pan bolts.

2. Note weld nut on right flange of oil pan. Screw oil pan bolt into weld nut to create a small gap between oil pan and oil pan upper block. Separate oil pan from oil pan upper block using a screwdriver. DO NOT damage sealing surfaces. Remove oil pan. See **Fig. 20**. Remove oil strainer (if necessary).

CAUTION: If reusing old oil pan bolts, remove old sealant from bolt threads. Failure to remove old sealant may result in cracked oil pan upper block at bolt holes.

Installation

1. Install oil strainer and NEW gasket (if removed). Tighten oil strainer bolts to specification. See **TORQUE SPECIFICATIONS**. If reusing old oil pan bolts, remove old sealant from bolt threads.
2. Clean old sealant from sealing surfaces of oil pan and oil pan upper block. Apply continuous bead of silicone sealant to oil pan flange, running sealant bead inside bolt holes. Install oil pan within 5 minutes of applying sealant. Tighten oil pan bolts to specification. See **TORQUE SPECIFICATIONS**. Fill engine with oil to specification. See **ENGINE LUBRICATION SYSTEM** under ENGINE OILING.

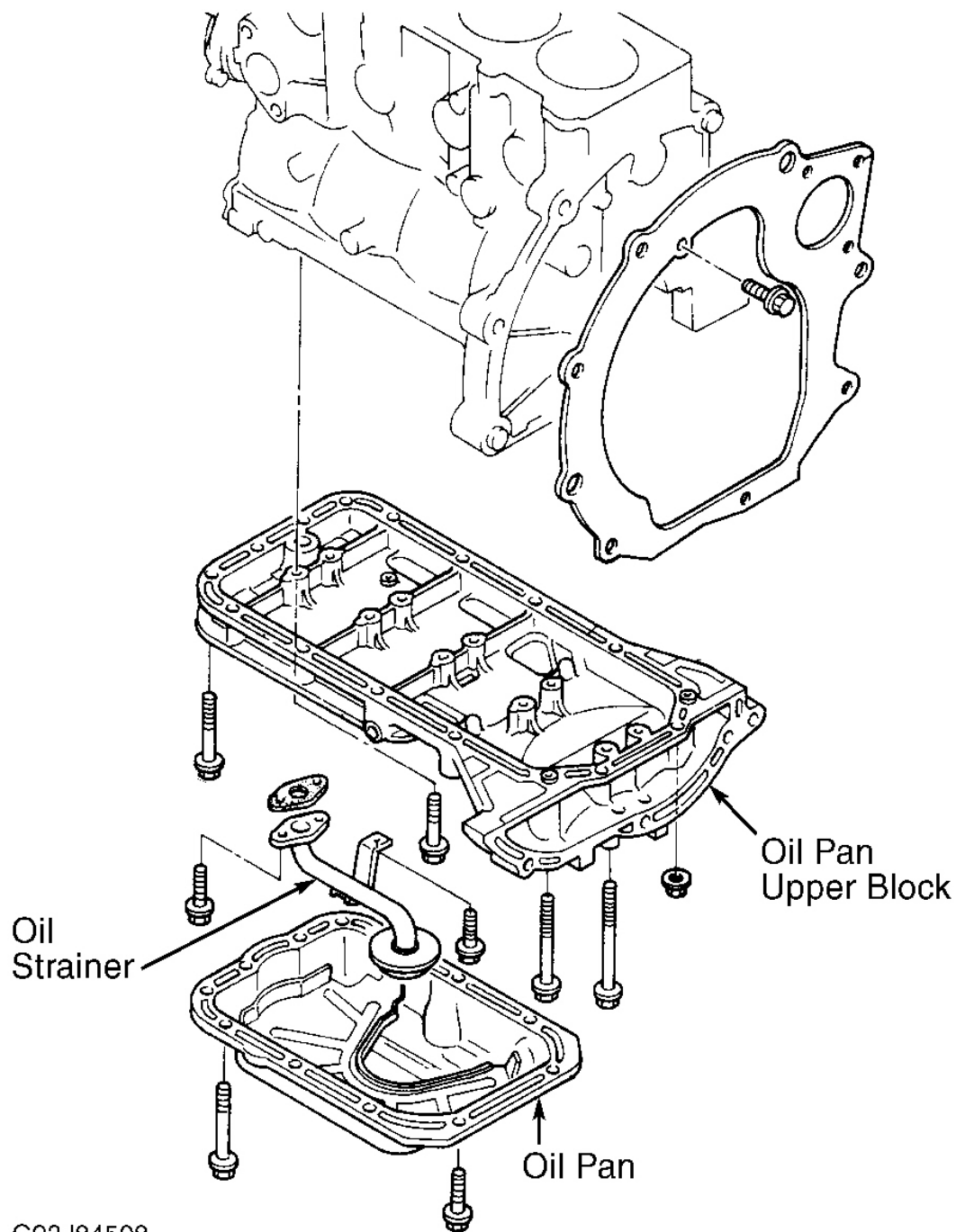
OIL PAN UPPER BLOCK

Removal

Remove oil pan. See OIL PAN. Remove 2 nuts from rear end of cylinder block. See **Fig. 21** and **Fig. 22**. Loosen oil pan upper block bolts in 2-3 steps, in proper sequence. Separate oil pan upper block from cylinder block using screwdriver at rear corner, being careful not to damage sealing surfaces. Remove oil pan upper block.

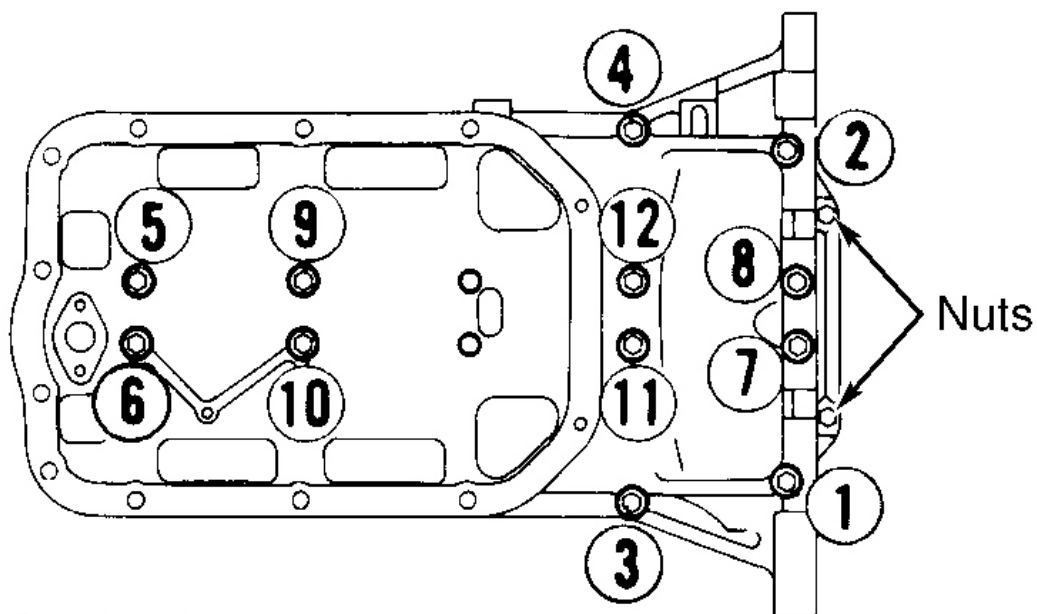
Installation

1. Clean old sealant from sealing surfaces of oil pan upper block and cylinder block. Apply continuous bead of silicone sealant to oil pan upper block, running sealant bead inside bolt holes. Install oil pan upper block within 5 minutes of applying sealant.
2. At rear end of cylinder block, tighten 2 nuts to specification. See **TORQUE SPECIFICATIONS**. See **Fig. 21** and **Fig. 22**. Tighten oil pan upper block bolts to specification in 2-3 steps, in proper sequence. To install remaining components, reverse removal procedure.



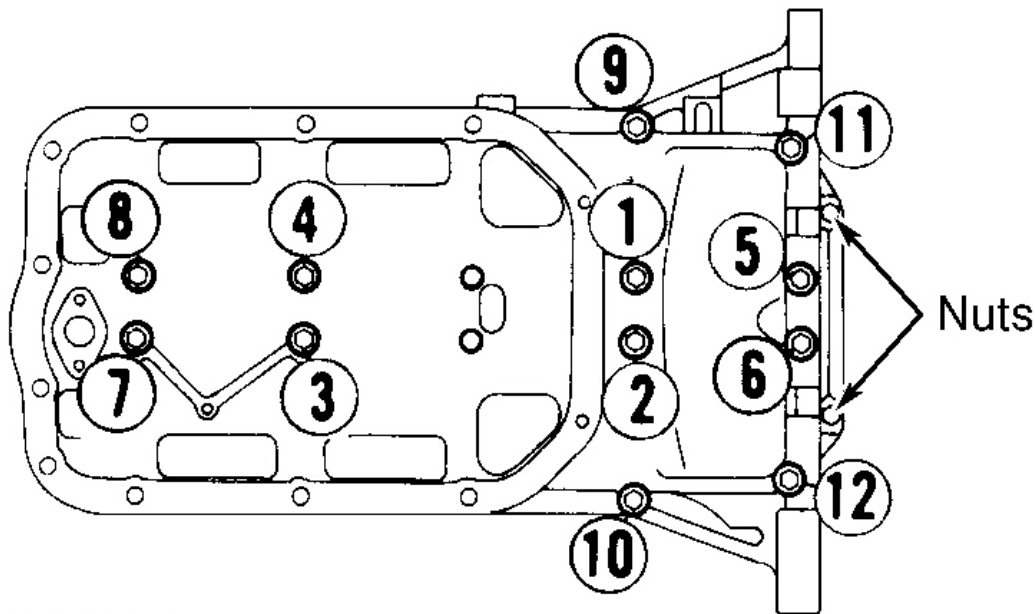
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Fig. 20: Exploded View Of Oil Pan & Oil Pan Upper Block
Courtesy of MAZDA MOTORS CORP.



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Fig. 21: Oil Pan Upper Block Bolt Loosening & Tightening Sequence Loosening
Courtesy of MAZDA MOTORS CORP.



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Fig. 22: Oil Pan Upper Block Bolt Loosening & Tightening Sequence Tightening
 Courtesy of MAZDA MOTORS CORP.

OVERHAUL

CYLINDER HEAD

Cylinder Head

Clean carbon and gasket material from all mating surfaces. Using a tap, clean cylinder head threads. Check cylinder head warpage. If warpage exceeds specification, resurface head, but DO NOT exceed grinding limit. See **CYLINDER HEAD** under ENGINE SPECIFICATIONS. After resurfacing cylinder head, check cylinder head height. Replace cylinder head if height is less than minimum specification.

CAUTION: Install valve spring with tight coil windings toward cylinder head.

Valve Springs

Ensure valve spring free length, out-of-square and compressed length are within specification. See **VALVES & VALVE SPRINGS** under ENGINE SPECIFICATIONS. Replace valve springs if necessary.

NOTE: Intake and exhaust valve stem seals are different. Exhaust seals can be identified by ridges molded into top of seal. Intake seals do not have identifying ridges. Incorrect installation of valve stem seals will cause premature failure.

Valve Stem Oil Seals

Exhaust valve stem oil seal has ridges on top. Use Installer Set (49-L012-0A0) to install valve seals. See **Fig. 23**. Adjust installer dimension "L" to seal depth of .697-.720" (17.7-18.3 mm). Using hand pressure ONLY, install seal until it contacts cylinder head. Lightly oil valve seal lip.

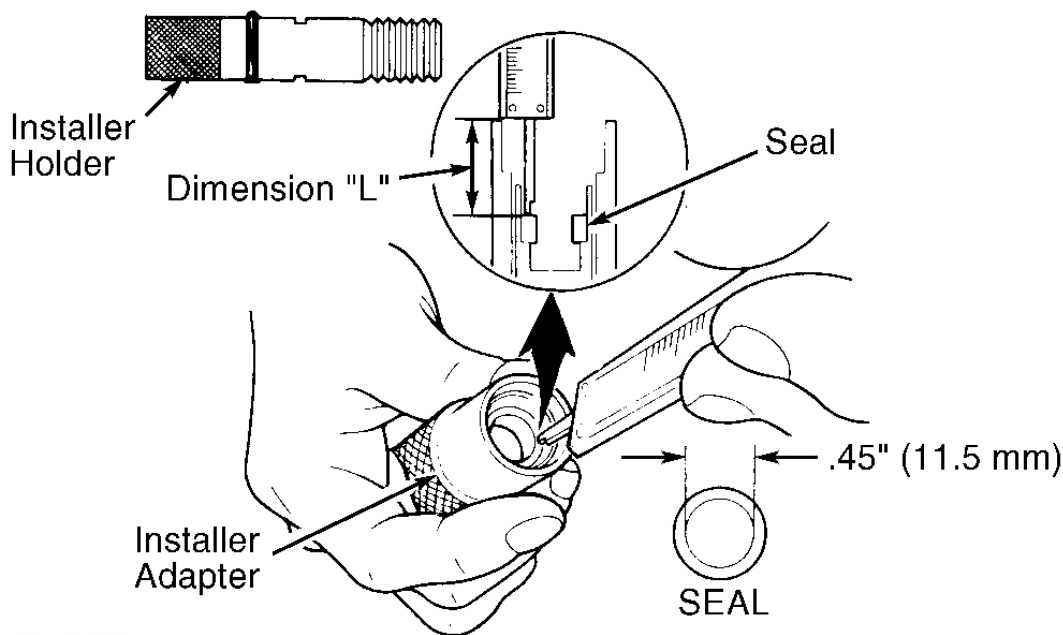


Fig. 23: Installing Valve Guide Seals
Courtesy of MAZDA MOTORS CORP.

Valve Guides

1. Intake and exhaust valve guides are the same. Check valve stem-to-valve guide oil clearance. Ensure valve guide inside diameter is within specification. See **CYLINDER HEAD** under ENGINE SPECIFICATIONS.
2. Using Valve Guide Remover (49-B012-005), drive valve guide out, working from combustion chamber side of cylinder head. If required, install new circlip on guide. Using proper components of Valve Guide Installer (49-L012-002), adjust installer guide depth (dimension "L") to specification using depth micrometer or caliper. See **VALVE GUIDE INSTALLED HEIGHT**. See **Fig. 24**.
3. Insert guide into pre-adjusted installer and drive guide into cylinder head from camshaft side until guide circlip, and/or installer contact cylinder head. Measure dimension "L" (guide installed height). See **Fig.**

24 or **Fig. 25**. If installed height is not within specification, adjust or replace valve guide or cylinder head as necessary. See **VALVE GUIDE INSTALLED HEIGHT**.

VALVE GUIDE INSTALLED HEIGHT

Application	In. (mm)
MX-6 & 626	.531-.555 (13.50-14.10)

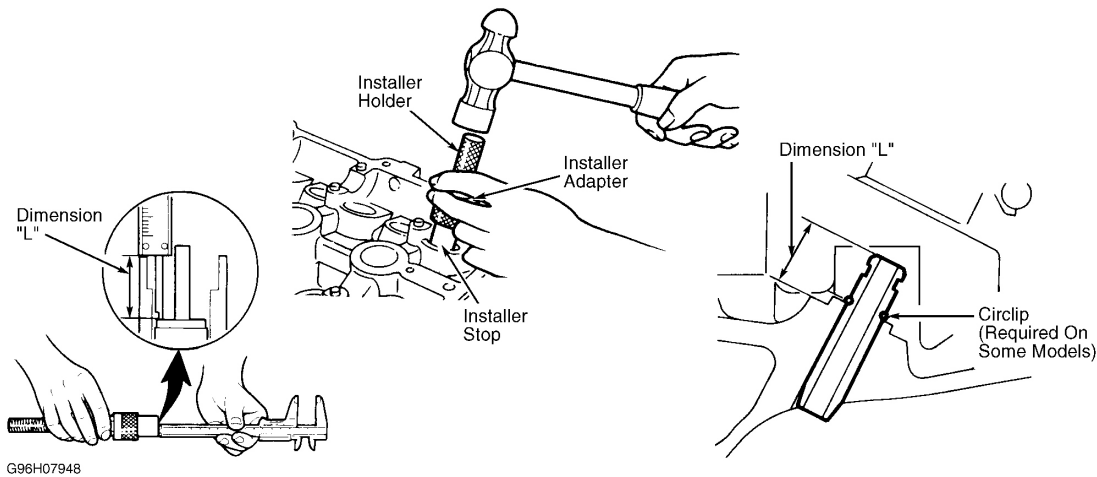


Fig. 24: Adjusting Valve Guide Installer & Installing Guide
Courtesy of MAZDA MOTORS CORP.

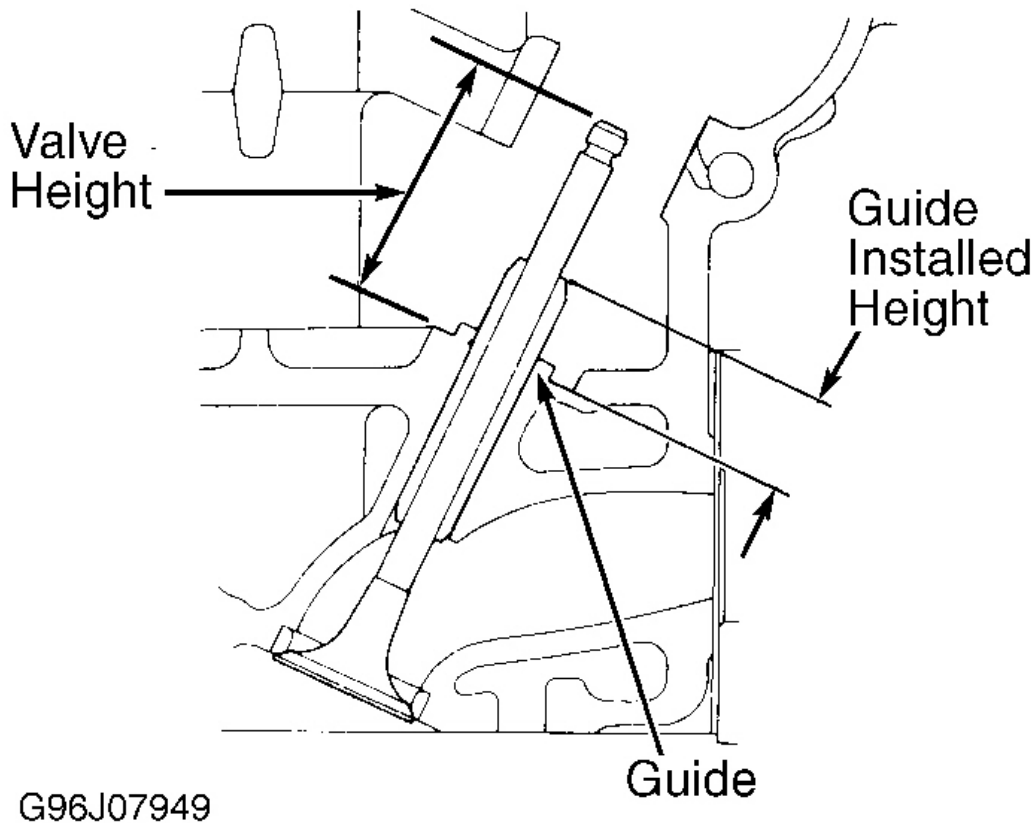


Fig. 25: Measuring Installed Valve & Guide Height
 Courtesy of MAZDA MOTORS CORP.

Valve Seat

1. Service valve guide before valve seat. Valve seat replacement information is not available from manufacturer. Inspect valve seat for roughness and damage. Check valve seat angle and seat width.
2. Measure seat contact width on valve and ensure seat contact position is in center of valve face. Service seat if angle and width are not within specification. See **CYLINDER HEAD** under ENGINE SPECIFICATIONS. Measure valve installed height after servicing valve seat. See **Fig. 25**. See **VALVE INSTALLED HEIGHT**.
3. If valve installed height is within normal range, service proceed with repair. If installed height exceeds normal range, replace cylinder head.

VALVE INSTALLED HEIGHT

In. (mm)	Action
1.536-1.555 (39.0-39.5)	Service Cylinder Head (Normal)
1.556 Or More (39.6 Or More)	Replace Cylinder Head

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2.0L 4-CYL 1997-98 ENGINES Mazda - 2.0L 4-Cylinder

Valves

Check valve face angle, head diameter, margin thickness and stem diameter. Service or replace valves if measurements are not within specifications. See **VALVES & VALVE SPRINGS** under ENGINE SPECIFICATIONS.

Valve Seat Correction Angles

Measure seat contact width on valve. See VALVE SEAT. If seat width is not within specification or if valve face does not contact center of valve seat, correct seat using grinding stone of specified angle. See **VALVE SEAT CORRECTION ANGLES**. After correcting seat, lightly finish seat with 45-degree grinding stone.

VALVE SEAT CORRECTION ANGLES

Application	Angle
Too High ⁽¹⁾	
Intake	65°
Exhaust	75°
Too Low ⁽²⁾	35°
(1) Point of contact on valve face is too close to stem.	
(2) Point of contact on valve face is too close to margin.	

HYDRAULIC LASH ADJUSTERS

Removal (1997 Models)

Remove camshaft cover. Check movement of each Hydraulic Lash Adjuster (HLA) by pushing downward using hand pressure only. If HLA compresses, replace HLA. To remove HLA, remove camshafts. See **CAMSHAFT** under REMOVAL & INSTALLATION. Mark location of HLA before removing from bore. Lift HLA from cylinder head.

NOTE: Store hydraulic lash adjusters in upside-down position submerged in clean engine oil.

Inspection

Inspect HLA friction surfaces for wear and damage. Replace HLA if required. Measure HLA diameter and bore diameter, and determine oil clearance. Ensure oil clearance is within specification. Replace components if oil clearance is not within specification. See **HYDRAULIC LASH ADJUSTERS** under ENGINE SPECIFICATIONS.

Installation

Coat HLA with engine oil and install in original location. Ensure HLA moves smoothly in bore by using small magnet attached to HLA.

CYLINDER BLOCK ASSEMBLY

NOTE: During disassembly, match mark components for reassembly reference.

Piston & Connecting Rod Assembly

1. Before removing rod cap from crankshaft, measure and record rod side play. See **CONNECTING RODS** under ENGINE SPECIFICATIONS. Before removing connecting rods, measure and record connecting rod bearing oil clearance. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** under ENGINE SPECIFICATIONS.
2. Before separating piston from connecting rod, mark piston in relation to connecting rod. Check oscillation movement of piston and rod assembly (hold piston horizontally, lift rod and allow rod to drop by its own weight). If pin binds in pin bore (rod does not drop), replace piston and/or pin as necessary.
3. To separate components, press piston pin out of piston and rod assembly, noting pressure required to remove piston pin. If piston pin can be pressed out with less than 1100 lbs. (500 kg) of pressure, replace piston and/or connecting rod.
4. Ensure piston pin diameter, piston fit and rod fit are within specification. See **PISTONS, PINS & RINGS** under ENGINE SPECIFICATIONS. Using 1100-3300 lbs. (500-1500 kg) of pressure, install piston pin through side of piston that has an "F" mark near pin bore. See **Fig. 26**. Install piston and rod assembly so "F" mark on side of piston is facing front of engine.

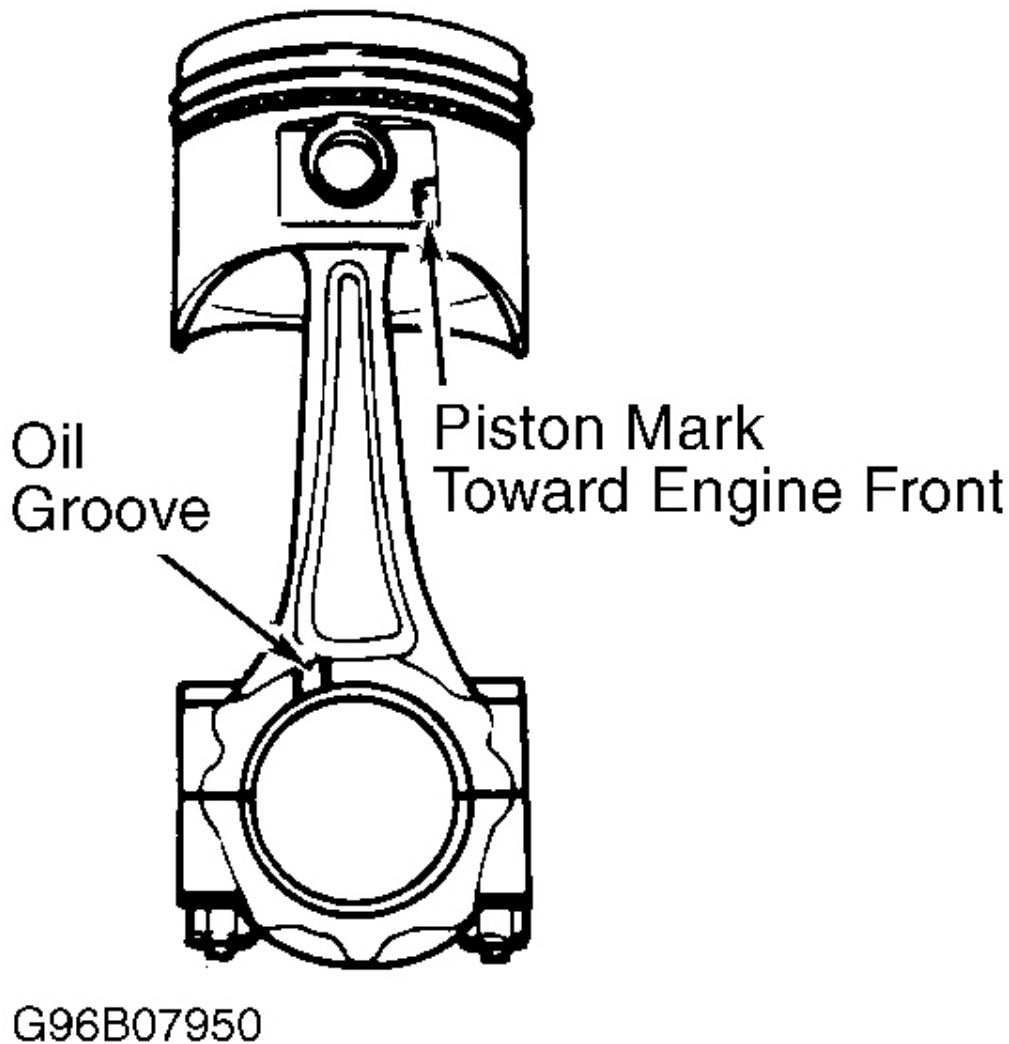


Fig. 26: Installing Piston & Connecting Rod Assembly
Courtesy of MAZDA MOTORS CORP.

Fitting Pistons

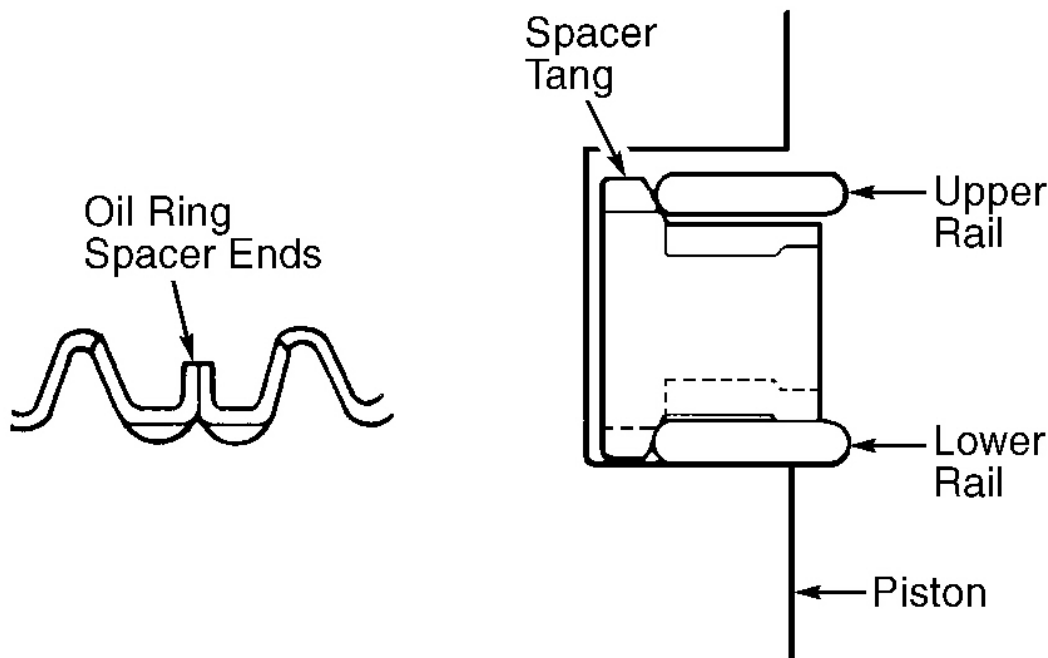
1. Ensure pistons are not scored or damaged. Measure piston diameter on piston skirt at 90-degree angle from piston pin, .65" (16.5 mm) below lowest ring groove. See **PISTONS, PINS & RINGS** under ENGINE SPECIFICATIONS.
2. Check piston-to-cylinder wall clearance in 3 different vertical places of piston travel. If clearance is not within specification, re-bore cylinders to fit oversize pistons. Using NEW piston rings, measure piston ring side clearance around entire piston circumference. If clearance is not within specification, replace

piston. See **PISTONS, PINS & RINGS**.

NOTE: Pistons and rings are available in .010" (.25 mm) and .020" (.50 mm) oversize.

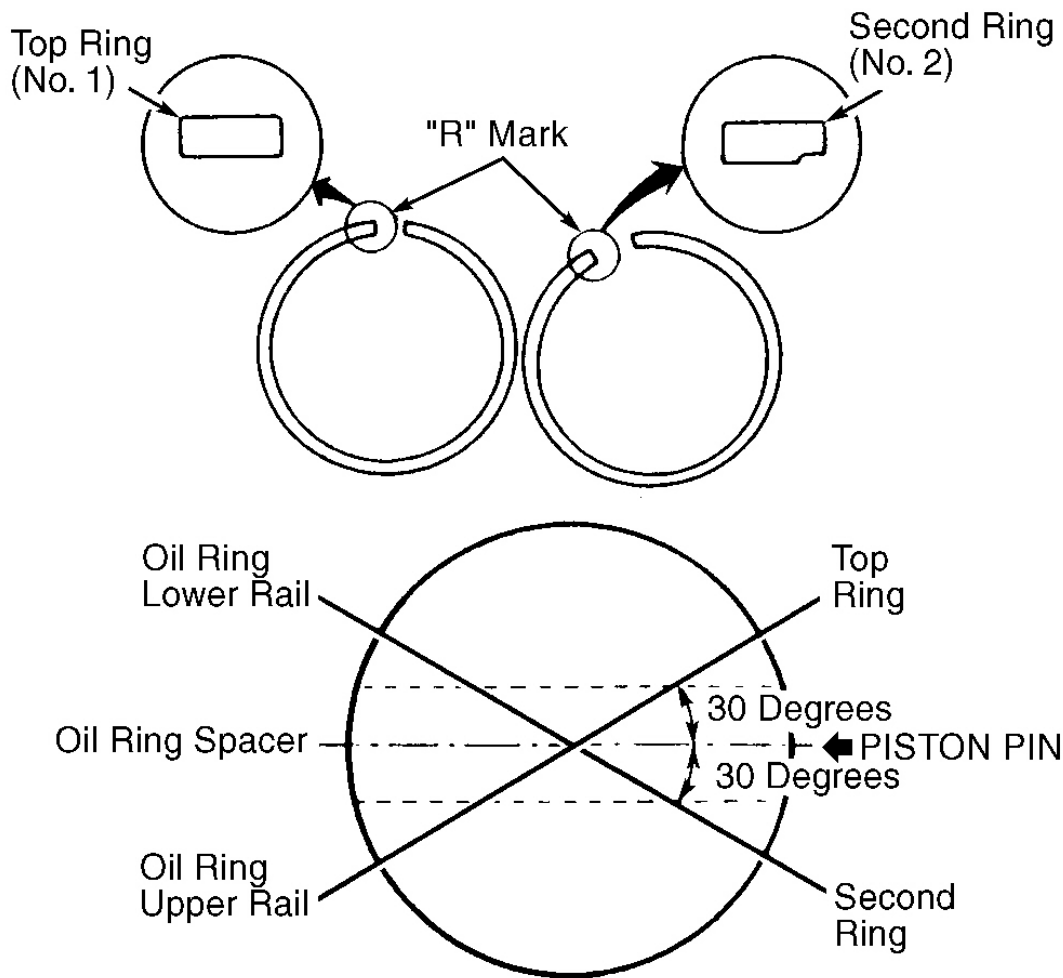
Piston Rings

1. If ring end gap and side clearance are not within specification, replace piston and/or rings as necessary. See **PISTONS, PINS & RINGS** under ENGINE SPECIFICATIONS.
2. Install oil ring spacer. Ensure ends DO NOT overlap. See **Fig. 27**. Upper and lower rails are the same and are interchangeable. Install rails, ensuring rails are expanded by spacer tangs (oil rings when assembled should rotate freely). Install rings No. 2 (second) with scraper face downward. Install No. 1 (top) with chamfer toward top of piston. Ensure ring end gaps are properly positioned around piston. See **Fig. 28**.



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Fig. 27: Identifying Oil Rings
Courtesy of MAZDA MOTORS CORP.



G93F84512

Fig. 28: Identifying Piston Rings & Positioning Ring End Gaps
 Courtesy of MAZDA MOTORS CORP.

Crankshaft & Main Bearings

1. Check crankshaft connecting rod journals for wear, out-of-round, taper and undersize. Machine or replace crankshaft and/or bearings as necessary. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** under ENGINE SPECIFICATIONS.
2. Before removing main cap, measure and record crankshaft end play by prying crankshaft forward, then rearward. Using Plastigage, measure and record main bearing oil clearance. Remove crankshaft. Measure and record each main and connecting rod journal diameter in 2 directions. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** under ENGINE SPECIFICATIONS.
3. Install main bearing caps with square mark facing front of engine. Tighten main bearing cap bolt in 2-3 steps, working outward from center bearing. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

Thrust Bearing

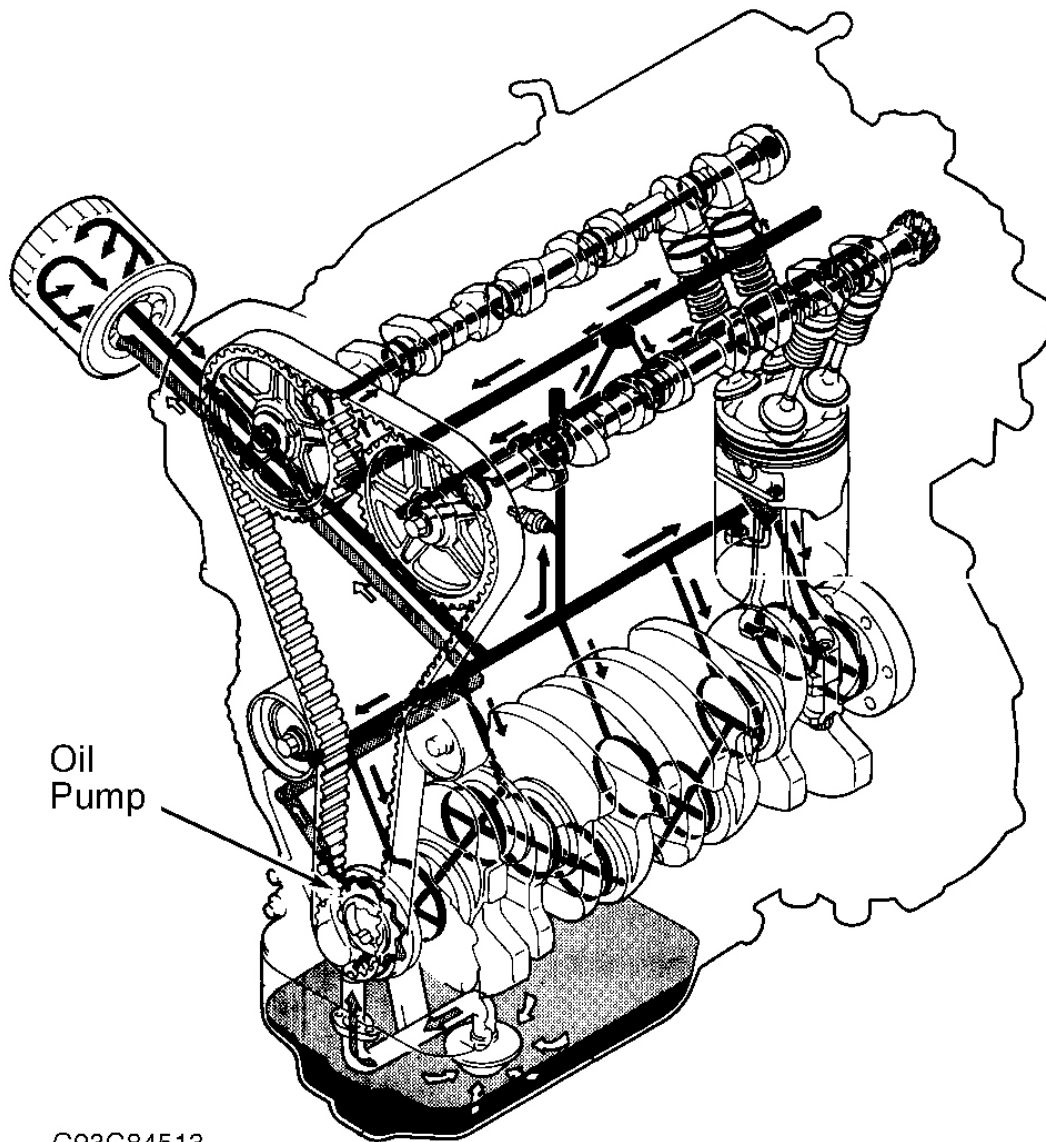
Install thrust bearing before installing crankshaft. Check crankshaft end play with crankshaft bearings and caps installed, but without connecting rods attached to crankshaft. DO NOT turn crankshaft until bearings are lubricated. If crankshaft end play exceeds specification, grind crankshaft and replace thrust bearings with oversize thrust bearings, or replace crankshaft and thrust bearings. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** under ENGINE SPECIFICATIONS.

Cylinder Block

1. Check head gasket surface for warpage. If warpage is not within specification, machine or replace cylinder block as necessary. See **CYLINDER BLOCK** under ENGINE SPECIFICATIONS. Remove, clean and install oil jets for piston oil spraying.
2. Measure cylinder bore diameter just below top of bore, at middle of cylinder bore and just above bottom of cylinder bore. Ensure cylinder bore diameter, taper, out-of-round and piston-to-cylinder bore clearance are within specification. If cylinder bore diameter, taper, out-of-round or piston-to-cylinder bore clearance exceeds specification, bore cylinder to nearest oversize. Cylinder block can be bored for .010" (.25 mm) or .020" (.50 mm) oversize pistons.

ENGINE OILING**ENGINE LUBRICATION SYSTEM**

NOTE: Oil pump is inside of front cover. See cross-sectional view of engine oil circuit. See **Fig. 29**.



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Fig. 29: Cross-Sectional View Of Engine Oil Circuit
Courtesy of MAZDA MOTORS CORP.

Crankcase Capacity

Oil capacity is 3.5 qts. (3.3L) without filter and 3.7 qts. (3.5L) with filter.

Oil Pressure

With engine at operating temperature, oil pressure should be 57-71 psi (4-5 kg/cm (2)) at 3000 RPM.

Oil Pressure Relief Valve

Pressure relief valve opening pressure is 64-78 psi (4.5-5.5 kg/cm²). Pressure relief valve is located in oil pump body and is not adjustable.

OIL PUMP & FRONT COVER**Removal & Disassembly**

1. Disconnect negative battery cable. Remove timing belt and crankshaft sprocket. See **TIMING BELT** under REMOVAL & INSTALLATION. Remove front cover bolts and front cover. Using a screwdriver protected with a rag, drive oil seal out from inside of front cover.
2. Remove pump cover screws (use a manual impact screwdriver, if necessary). See **Fig. 30**. Remove pump cover. Note location of alignment marks on inner and outer rotors. Remove inner and outer rotors. To remove pressure relief valve, remove snap ring, spring seat, pressure spring and control plunger.

Inspection

Replace pressure relief valve spring if length is not as specified. See **OIL PUMP SPECIFICATIONS**. Ensure plunger slides freely in bore. Replace front cover and oil pump assembly if clearances are not as specified. See **OIL PUMP SPECIFICATIONS**.

Reassembly & Installation

1. Apply oil to friction surfaces. Install inner and outer rotors with marks aligned. See **Fig. 31**. Install pressure relief valve components. Apply oil to lip of NEW oil seal. Press oil seal into bore until even with face of front cover. Install pump cover. Tighten screws to 53-78 INCH lbs. (6-9 N.m).
2. Apply silicone sealant to front cover sealing surface, running silicone bead inside bolt holes. Install front cover. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**. To complete installation, reverse removal procedure.

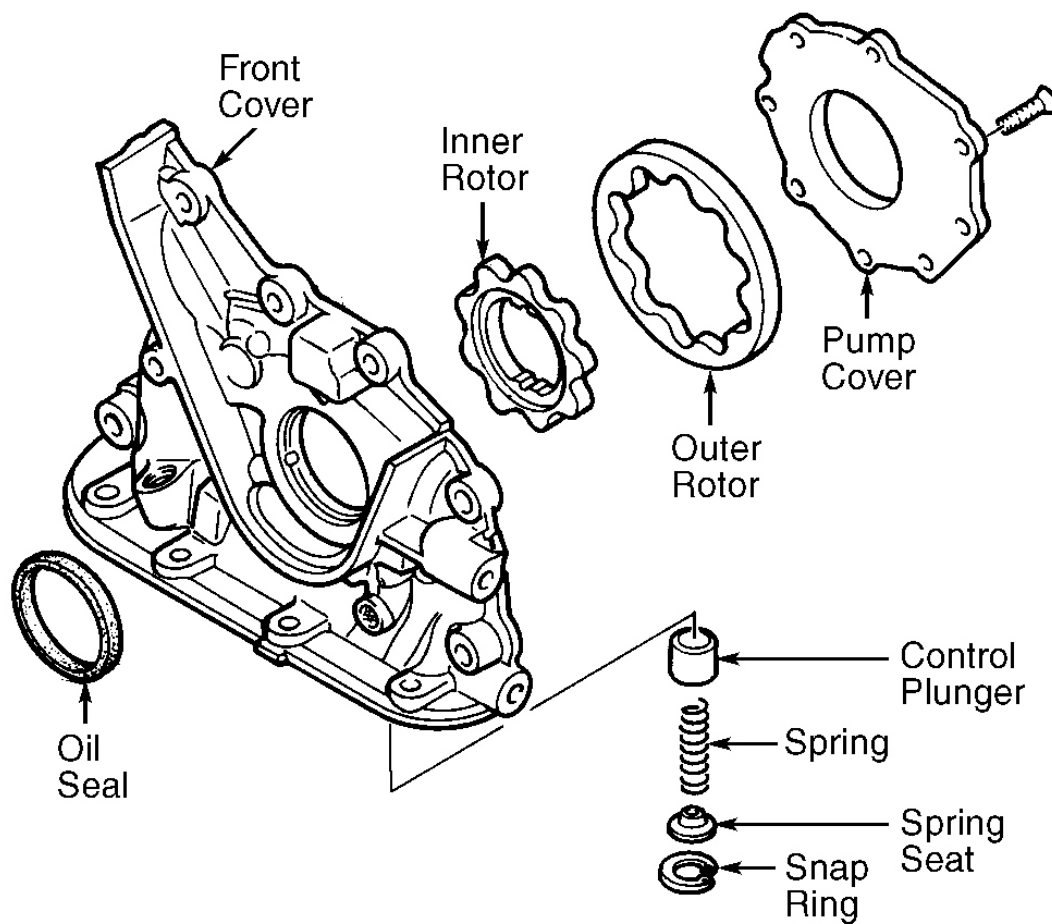
OIL PUMP SPECIFICATIONS

Application	In. (mm)
Maximum Rotor Tip Clearance ⁽¹⁾	.0079 (.20)
Maximum Rotor-To-Pump Body Clearance ⁽²⁾	.0083 (.21)
Maximum Rotor Side Clearance ⁽³⁾	.0047 (.12)
Pressure Relief Spring Free Length	1.842 (46.79)

(1) See **Fig. 31**.

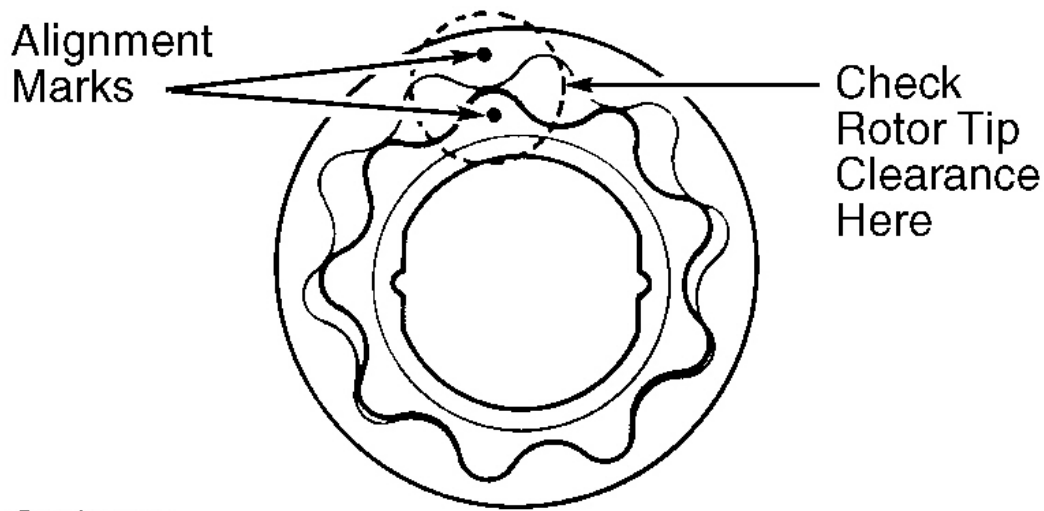
(2) Insert feeler gauge between outer rotor and pump body.

(3) Place straightedge across pump body and check clearance between straightedge and both rotors.



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Fig. 30: Exploded View Of Oil Pump
 Courtesy of MAZDA MOTORS CORP.



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Fig. 31: Aligning Marks On Inner & Outer Rotor
 Courtesy of MAZDA MOTORS CORP.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Sprocket Bolt	37-44 (50-60)
Clutch Pressure Plate Bolt	13-19 (18-26)
Compressor Bracket-To-Compressor	18-26 (24-35)
Connecting Rod Cap Bolt	
Step 1	16-20 (22-27)
Step 2 (Final)	Additional 82.5-97.5 Degrees
Coolant Outlet Bolt	14-18 (19-25)
Crankshaft Sprocket Bolt	116-122 (157-165)
Cylinder Head Bolt ⁽¹⁾	
Step 1	13-16 (18-22)
Step 2	Additional 85-95 Degrees
Step 3 (Final)	Additional 85-95 Degrees
Distributor Bolt (1997 Models)	14-18 (19-25)
Engine Mount-To-Frame Nut	50-68 (67-93)

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Exhaust Header Pipe-To-Exhaust Manifold Nut	28-38 (38-51)
Exhaust Manifold	
Bolt	12-16 (16-22)
Nut	15-20 (20-28)
Flywheel/Drive Plate Bolt	71-76 (97-102)
Front Cover/Oil Pump Bolt	14-18 (19-25)
Generator Top Bolt	28-38 (38-51)
Intake Manifold Bolt/Nut	14-18 (19-25)
Intake Manifold Support Bracket	28-38 (38-51)
Main Bearing Cap Bolt	
Step 1	13-16 (17-22)
Step 2 (Final)	Additional 85-95 Degrees
Motor Mount Bolt	63-86 (86-116)
Motor Mount-To-Engine Bolt/Nut	50-68 (67-93)
Oil Pan Bolt	14-18 (19-25)
Oil Pan Upper Block Bolt/Nut	(2)
Power Steering Pump	
Upper Bolt	32-44 (44-60)
Lower Bolt	24-34 (32-46)
Spark Plug	11-16 (15-22)
Thermostat Housing Bolt	14-18 (19-25)
Timing Belt Idler Pulley Bolt	28-38 (38-51)
Timing Belt Tensioner Lock Bolt	28-38 (38-51)
Water Pump Bolt	14-18 (19-25)
INCH Lbs. (N.m)	
Camshaft Bearing Cap Bolt	100-125 (11-14)
Oil Pressure Switch	105-156 (12-18)
Oil Pump Cover Screws	53-78 (6-9)
Oil Strainer Bolt ⁽³⁾	70-95 (8-11)
Rear Cover Bolt	70-95 (8-11)
Timing Belt Cover Bolt	70-95 (8-11)
Valve Cover Bolt ⁽⁴⁾	53-70 (6-8)
Water Pump Pulley Bolt	70-95 (8-11)

(1) Tighten in sequence. See **Fig. 11** and **Fig. 12** .

(2) Tighten 2 nuts at rear end of cylinder block to 70-95 INCH lbs. (8-11 N.m). Tighten oil pan upper block bolts in 2-3 steps, in proper sequence to 14-18 ft. lbs. (19-25 N.m). See **Fig. 21** and **Fig. 22** .

(3) Tighten flange bolts, then tighten bracket bolt.

(4) Tighten in sequence. See **Fig. 13** and **Fig. 14** .

1997 Mazda MX-6

2.0L 4-CYL 1997-98 ENGINES Mazda - 2.0L 4-Cylinder

ENGINE SPECIFICATIONS**GENERAL SPECIFICATIONS**

Application	Specification
Displacement	121.5 Cu. In. (2.0L)
Bore	3.27" (83.0 mm)
Stroke	3.62" (92.0 mm)
Compression Ratio	9.0:1
Fuel System	MPFI
Horsepower @ RPM	118 @ 5500
Torque Ft. Lbs. @ RPM	127 @ 4500

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS**CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS**

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0032-.0111 (.080-.282)
Maximum	.0118 (.30)
Maximum Runout	.0012 (.03)
Thrust Bearing Width	
Standard	.0984-.1004 (2.500-2.550)
.010" (.25 mm) Oversize	.1033-.1053 (2.625-2.675)
.020" (.50 mm) Oversize	.1083-.1102 (2.750-2.800)
.030" (.75 mm) Oversize	.1132-.1152 (2.875-2.925)
Main Bearings	
Journal Diameter	
Standard Bearings	2.2022-2.2030 (55.937-55.955)
.010" (.25 mm) Undersize	2.1924-2.1931 (55.687-55.705)
Journal Out-Of-Round	.0001 (.003)
Oil Clearance	
Except Journal No. 3	
Standard	.0009-.0020 (.024-.050)
Maximum	.0026 (.067)
Journal No. 3	
Standard	.0012-.0022 (.030-.056)
Maximum	.0026 (.067)
Connecting Rod Bearings	
Journal Diameter	
Standard Bearings	1.8874-1.8880 (47.940-47.955)
.010" (.25 mm) Undersize	1.8776-1.8781 (47.690-47.705)

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2.0L 4-CYL 1997-98 ENGINES Mazda - 2.0L 4-Cylinder

.020" (.50 mm) Undersize	1.8677-1.8683 (47.440-47.455)
Journal Out-Of-Round	.0001 (.003)
Oil Clearance	
Standard	.0010-.0024 (.024-.061)
Maximum	.0026 (.067)

CONNECTING RODS**CONNECTING RODS**

Application	In. (mm)
Bore Diameter	
Crankpin Bore	2.0079-2.0085 (51.000-51.015)
Pin Bore	.7458-.7465 (18.943-18.961)
Center-To-Center Length	5.3209-5.3248 (135.15-135.25)
Maximum Bend	(1)
Side Play	
Standard	.0044-.0103 (.110-.262)
Maximum	.012 (.30)
(1) Bend must not exceed .002" per 1.97" (.05 mm per 50 mm).	

PISTONS, PINS & RINGS**PISTONS, PINS & RINGS**

Application	In. (mm)
Pistons	
Clearance	
Standard	.0016-.0020 (.039-.052)
Maximum	.006 (.15)
Diameter	
Standard Pistons	3.2659-3.2667 (82.954-82.974)
.010" (.25 mm) Oversize	3.2757-3.2765 (83.204-83.224)
.020" (.50 mm) Oversize	3.2856-3.2864 (83.454-83.474)
Pins	
Diameter	.7470-.7472 (18.974-18.980)
Piston Fit	.0003-.0010 (.008-.026)
Rod Fit	Interference .0005-.0015 (.013-.037)
Rings	
No. 1	
End Gap	

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2.0L 4-CYL 1997-98 ENGINES Mazda - 2.0L 4-Cylinder

	Standard	.006-.012 (.15-.30)
	Maximum	.020 (.50)
Side Clearance		
	Standard	.0014-.0026 (.035-.065)
	Maximum	.0033 (.085)
No. 2		
End Gap		
	Standard	.006-.012 (.15-.30)
	Maximum	.020 (.50)
Side Clearance		
	Standard	.0012-.0026 (.030-.065)
	Maximum	.0033 (.085)
No. 3 (Oil)		
End Gap		
	Standard	.008-.028 (.20-.70)
	Maximum	.035 (.90)

CYLINDER BLOCK**CYLINDER BLOCK**

Application	In. (mm)
Cylinder Bore	
Diameter	
Standard	3.2677-3.2685 (83.000-83.019)
.010" (.25 mm) Oversize	3.2776-3.2783 (83.250-83.269)
.020" (.50 mm) Oversize	3.2874-3.2881 (83.500-83.519)
Maximum Taper	.0007 (.019)
Maximum Out-Of-Round	.0008 (.020)
Minimum Deck Height	10.67 (271.0)
Maximum Deck Warpage	.002 (.05)

CYLINDER HEAD**CYLINDER HEAD**

Application	Specification
Cylinder Head	
Height	4.8996-4.9035" (124.45-124.55 mm)
Grinding Limit	.006" (.15 mm)

1997 Mazda MX-6

2.0L 4-CYL 1997-98 ENGINES Mazda - 2.0L 4-Cylinder

Maximum Warpage	.004" (.10 mm)
Valve Seats	
Intake Valve	
Seat Angle	45°
Seat Width	.036-.051" (0.90-1.30 mm)
Exhaust Valve	
Seat Angle	45°
Seat Width	.036-.051" (0.90-1.30 mm)
Valve Guides	
Intake Valve	
Valve Guide I.D.	.2366-.2374" (6.010-6.030 mm)
Valve Guide Installed	
Height	.531-.555" (13.50-14.10 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0010-.0024" (.025-.060 mm)
Maximum	.004" (.10 mm)
Exhaust Valve	
Valve Guide I.D.	.2366-.2374" (6.010-6.030 mm)
Valve Guide Installed	
Height	.531-.555" (13.50-14.10 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0012-.0026" (.030-.065 mm)
Maximum	.004" (.10 mm)

VALVES & VALVE SPRINGS**VALVES & VALVE SPRINGS**

Application	Specification
Intake Valves	
Face Angle	45°
Installed Height	
Normal	1.536-1.555" (39.0-39.5 mm)
Serviceable	1.556-1.597" (39.6-40.5 mm)
Minimum Margin	.043" (1.10 mm)
Refinish Length	
Standard	3.5307" (89.68 mm)
Maximum	3.5150" (89.28 mm)
Stem Diameter	
Standard	.2350-.2356" (5.970-5.985 mm)
Maximum	.2339" (5.940 mm)
Exhaust Valves	

1997 Mazda MX-6

2.0L 4-CYL 1997-98 ENGINES Mazda - 2.0L 4-Cylinder

Face Angle	45°
Installed Height	
Normal	1.536-1.555" (39.0-39.5 mm)
Serviceable	1.556-1.597" (39.6-40.5 mm)
Minimum Margin	.047" (1.20 mm)
Refinish Length	
Standard	3.5346" (89.78 mm)
Maximum	3.5189" (89.38 mm)
Stem Diameter	
Standard	.2348-.2354" (5.965-5.980 mm)
Maximum	.2337" (5.935 mm)
Valve Springs	
Compressed Length	44 Lbs. @ 1.437 In. (20 Kg @ 36.50 mm)
Free Length	1.732" (44.00 mm)
Out-Of-Square	.061" (1.54 mm)

CAMSHAFT**CAMSHAFT**

Application	In. (mm)
End Play	
Standard	.0031-.0079 (.08-.20)
Maximum	.008 (.21)
Journal Diameter	
Standard	1.0213-1.0222 (25.940-25.965)
Minimum	1.0201 (25.910)
Maximum Journal Out-of-Round	.001 (.03)
Maximum Journal Runout	.0012 (.030)
Journal Oil Clearance	
Standard	.0014-.0032 (.035-.081)
Maximum	.006 (.15)
Lobe Height	
Intake	
Standard	1.6919 (42.973)
Minimum	1.6859 (42.823)
Exhaust	
Standard	1.7062 (43.338)
Minimum	1.7003 (43.188)

HYDRAULIC LASH ADJUSTERS (1997 MODELS)

1997 Mazda MX-6

2.0L 4-CYL 1997-98 ENGINES Mazda - 2.0L 4-Cylinder

HYDRAULIC LASH ADJUSTERS (1997 MODELS)

Application	In. (mm)
Bore Diameter	1.1811-1.1821 (30.000-30.025)
Lifter Diameter	1.1795-1.1802 (29.959-29.975)
Oil Clearance	
Standard	.0010-.0026 (.025-.066)
Maximum	.0071 (.180)