1994 ENGINES

1.8L 4-Cylinder

ENGINE IDENTIFICATION

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

Engineering codes can identify basic engine type. See **ENGINE IDENTIFICATION CODE** table. Engines can be further identified by engine number.

On Miata, engine number is stamped on flange, at upper right rear of cylinder block deck as viewed from flywheel.

ENGINE IDENTIFICATION CODE

Application	Code
Miata DOHC	BP

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: 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, change engine oil. If oil change does not reduce noise, check with manufacturer for modified HLA.

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

Disconnect fuel pump relay, located behind dash, left of steering column. Start engine and allow to idle until it stalls. Turn ignition off. Disconnect negative battery cable, and reconnect circuit opening relay. When disconnecting fuel hoses, cover connection with shop rag to catch fuel spray.

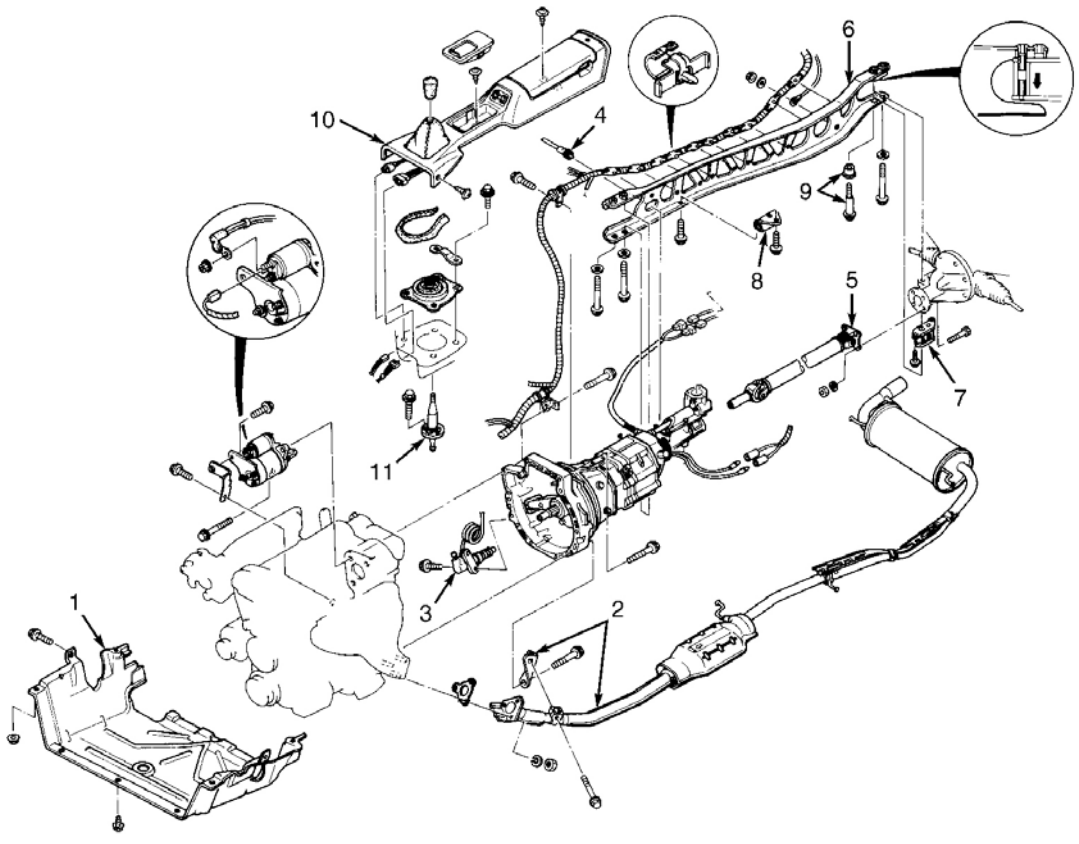
ENGINE

NOTE: On models with audio anti-theft system, radio will not operate if power to radio

is cut. Obtain code from customer to reactivate radio. To reactivate radio after reconnecting power supply, turn ignition switch to ACC position. press and hold FF and REW buttons until "cod e" is displayed. Again press and hold FF and REW buttons until bars (--- -) are displayed. Use preset button No. 1 to enter first number, No. 2 to enter second number, 3 for third number, etc. Press FF and REW buttons for about 2 seconds until a beep is heard. After 5 seconds, flashing "cod e" will go away and radio will operate.

Removal

1. Relieve fuel pressure. See **FUEL PRESSURE RELEASE** . Disconnect negative battery cable from trunk-mounted battery. Reference mark hood and remove. Raise vehicle, and remove engine undercover. See **Fig. 1** . Drain engine oil, transmission oil and cooling system.
2. Remove transmission. For automatic or manual transmission removal procedure, see appropriate TRANSMISSION REMOVAL & INSTALLATION article in the TRANSMISSION/TRANSAXLE section.
3. Remove all cooling system hoses and A/T oil cooler lines at radiator (if equipped). Remove radiator and cooling fans as an assembly. Remove all drive belts. DO NOT disconnect power steering hoses or A/C compressor hoses. Remove power steering pump and A/C compressor from engine, and secure units away from engine.
4. Remove air cleaner assembly and throttle body intake duct assembly. See **Fig. 2** . Remove throttle cable. Note locations and disconnect all necessary electrical connectors, ground wires, vacuum hoses, fuel hoses, coolant hoses and control cables for engine removal. Plug all fuel hoses to prevent leakage.



1. Undercover
2. Exhaust Downpipe & Bracket
3. Clutch Release Cylinder
4. Speedometer Cable
5. Drive Shaft
6. Power Plant Frame (PPF)
7. PPF/Differential Mounting Spacer
8. Transmission-To-PPF Bracket
9. Reamer Bolt & Spacer
10. Console
11. Shift Lever

G91E01836

Fig. 1: Removing & Installing Drive Train Components
Courtesy of MAZDA MOTORS CORP.

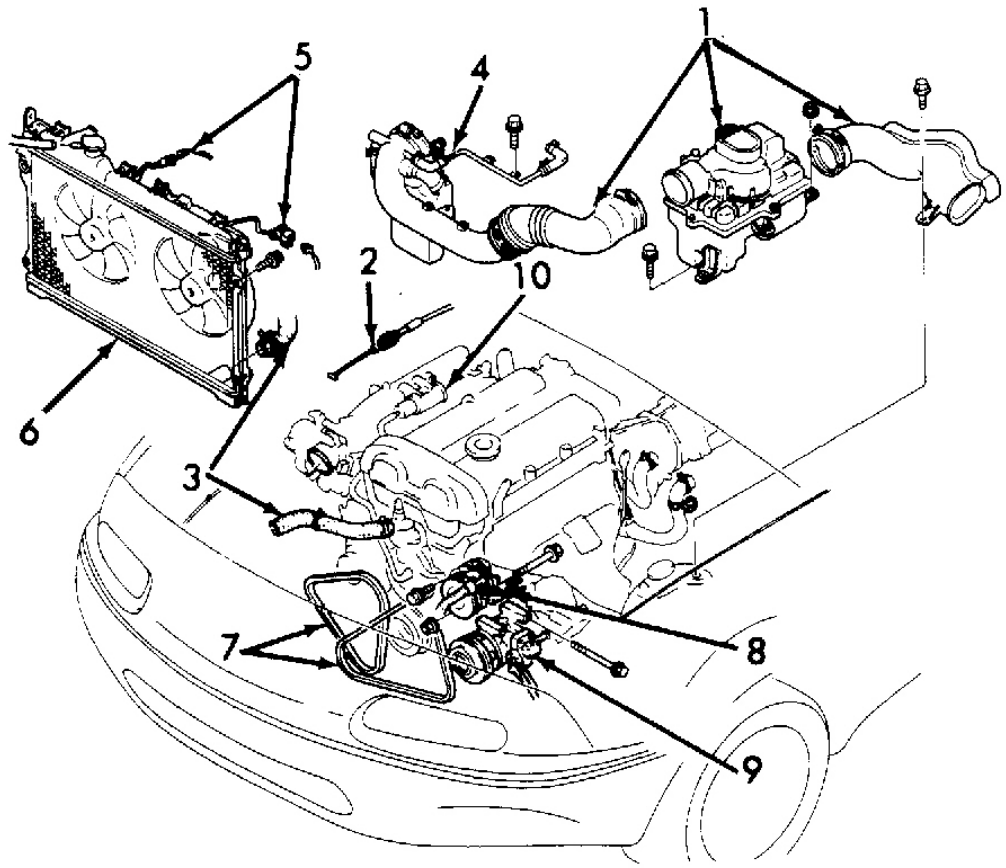


Fig. 2: Removing Engine Components
Courtesy of MAZDA MOTORS CORP.

NOTE: Proper installation of PPF is critical for aligning drive shaft and eliminating harmonic vibrations.

Installation

1. To install, reverse removal procedure. After installing engine mount nuts, mount PPF to transmission, and tighten long bolts by hand. Ensure bolt sleeve and PPF/differential mounting spacer are installed to differential housing block.

2. Tighten PPF/differential mounting spacer bolts to 27-38 ft. lbs. (37-52 N.m). See **Fig. 3** . Install PPF to differential. Hand-tighten long bolts. Ensure PPF-to-differential large shank reamer bolt and spacer are properly installed.

NOTE: Reamer bolt is the front long bolt attaching PPF to differential. This bolt aligns PPF with drive train.

3. When PPF is properly aligned between transmission and differential, tighten all long mounting bolts to specification. Install rear transmission-to-PPF bracket, and tighten to specification. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure. Before installing M/T shift lever, add gear oil to transmission through shifter hole. Fill all fluids to correct level.

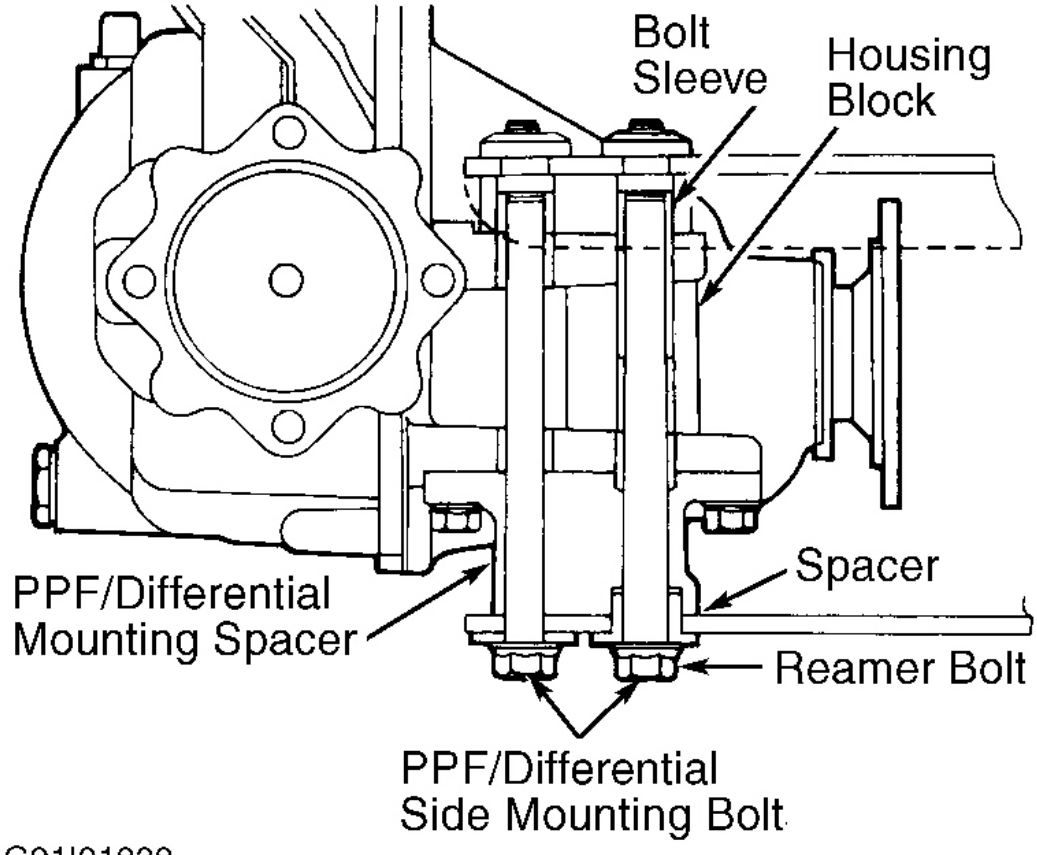


Fig. 3: Locating PPF-To-Differential Reamer Bolt, Sleeve & Spacer
Courtesy of MAZDA MOTORS CORP.

INTAKE MANIFOLD

Removal

1. Relieve fuel pressure. See **FUEL PRESSURE RELEASE** . Disconnect negative battery cable. Drain cooling system. Remove air cleaner assembly and ducting. See **Fig. 2** . Mark and disconnect coolant hoses, vacuum hoses and electrical connectors from intake manifolds.
2. Disconnect throttle cable. Remove fuel lines from fuel rail and pressure regulator. Remove throttle body intake duct housing and throttle body. Remove air valve.
3. Remove intake manifold support bracket from underneath manifold. Disconnect injector harness connectors, and remove injectors/fuel rail assembly. Remove intake manifold and gasket.

Installation

1. Ensure all gasket surfaces are clean and flat. Install new gasket and intake manifold to cylinder head. Tighten manifold bolts/nuts evenly to specification, starting from center bolt and alternating outward. See **TORQUE SPECIFICATIONS** . Install support bracket underneath intake manifold.
2. Install gasket and upper intake manifold (if equipped). Tighten bolts/nuts evenly to specification, alternating from top to bottom.
3. To complete installation, reverse removal procedure. Ensure throttle cable has .04-.12" (1-3 mm) free play. Ensure injectors twist freely and are not cocked in insulator "O" rings. Refill engine with coolant.

EXHAUST MANIFOLD

Removal & Installation

1. Disconnect oxygen sensor. Remove heat shields. Disconnect downpipe from exhaust manifold. Remove exhaust manifold.
2. To install, reverse removal procedure. Ensure all mating surfaces are clean and flat. Install new gasket to cylinder head. Tighten manifold bolts evenly to specification, starting from center bolt and alternating outward. See **TORQUE SPECIFICATIONS** .

CYLINDER HEAD

Removal

1. Drain engine coolant. Release fuel pressure. See **FUEL PRESSURE RELEASE** . Note locations and disconnect all necessary electrical connectors, ground wires, vacuum hoses, fuel hoses, coolant hoses and control cables for cylinder head removal. Plug all fuel hoses to avoid leakage.
2. Remove spark plug wires from spark plugs. Remove all drive belts. Remove water pump pulley. Remove timing belt. See **TIMING BELT** . Remove camshaft/rocker cover.
3. Remove front exhaust pipe. Remove intake manifold support bracket. Loosen all cylinder head bolts evenly, in 3 steps, in reverse of tightening sequence. See **Fig. 4** . Remove bolts and cylinder head assembly.

Inspection

Carefully clean carbon and gasket material from all mating surfaces. Clean threads of cylinder head bolts. Use a

tap to clean threads in engine block. Check cylinder head for warpage. Resurface or replace head if it is not within specification. Check valve train components. Replace or resurface components if they are not within specification. See **CYLINDER HEAD** and **VALVES & VALVE SPRINGS** tables under ENGINE SPECIFICATIONS.

Installation

Install cylinder head gasket, cylinder head assembly and bolts. Tighten cylinder head bolts in 2 steps and in sequence to specification. See **Fig. 4** . See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.

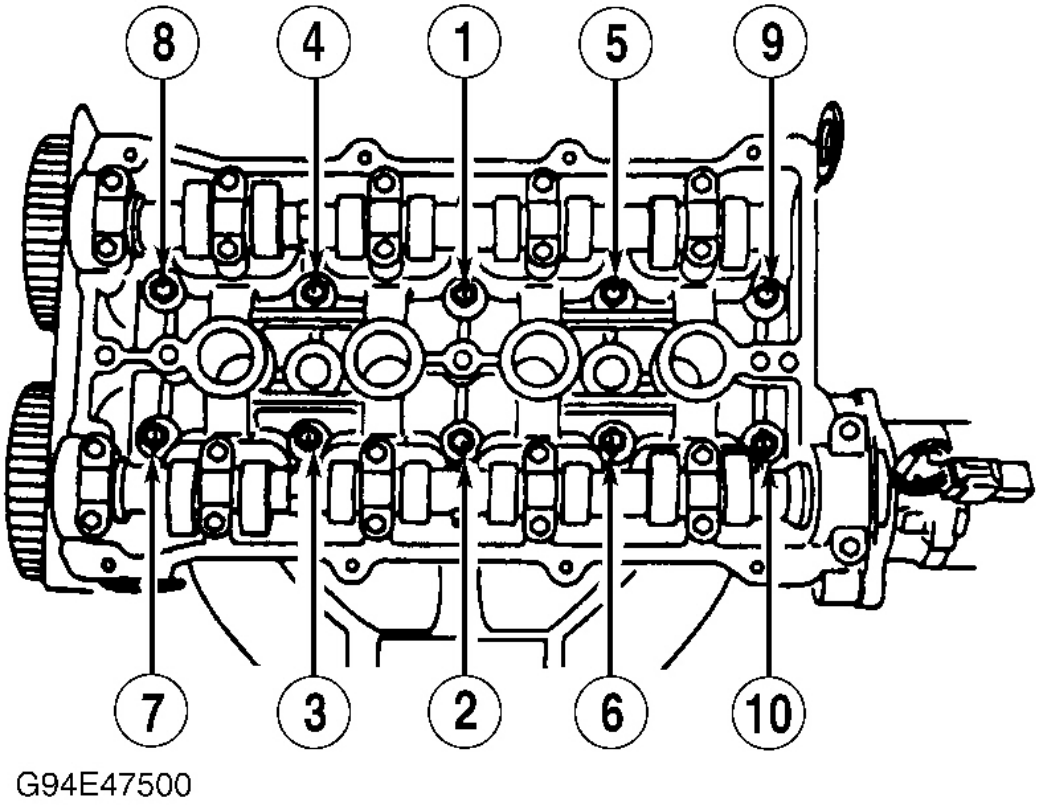


Fig. 4: Cylinder Head Bolt Tightening Sequence
Courtesy of MAZDA MOTORS CORP.

CRANKSHAFT FRONT SEAL

Removal

Disconnect negative battery cable. Remove drive belts and crankshaft pulley. Remove water pump pulley,

timing belt covers and timing belt. See **TIMING BELT** . Use Crankshaft Lock Tools (49-S120-710 and 49-B011-102) to lock crankshaft sprocket into position. Remove crankshaft sprocket bolt. Remove crankshaft sprocket using steering wheel puller. Pry out seal.

Installation

1. Apply light oil coat to seal lip. Using a hammer and seal installer, tap seal into oil pump body until it is flush with edge of pump body. DO NOT bottom seal in pump body. Align keyway slots, and install crankshaft sprocket and Woodruff key with tapered side toward oil pump body. Install crankshaft sprocket bolt.
2. Using Crankshaft Lock Tools (49-S120-710 and 49-B011-102), lock crankshaft sprocket into position. Tighten lock bolt to specification. See **TORQUE SPECIFICATIONS** .
3. Install timing belt. See **TIMING BELT** under REMOVAL & INSTALLATION. Install timing belt covers, pulleys and drive belts. Reconnect negative battery cable, and ensure timing is correct.

TIMING BELT

NOTE: For 1994 vehicles, the manufacturer recommends the belt be replaced at 60,000 mile intervals for vehicles sold outside of California. For vehicles sold in California, inspect timing belt at 60,000 and 90,000 miles, and replace timing belt at 105,000 miles. For removal and installation procedure, see TIMING BELT REPLACEMENT - 1.8L - DOHC, BP ENG .

HYDRAULIC LASH ADJUSTER (HLA)

NOTE: If hydraulic lash adjusters are persistently noisy, check with manufacturer for availability of modified adjusters.

Removal

Disconnect negative battery cable. Remove camshaft. See **CAMSHAFT** . Mark location of each HLA for reassembly reference. Remove HLA from cylinder head.

Inspection

Place HLA in palm of hand. Attempt to compress HLA plunger with thumb. If plunger compresses, replace HLA.

Installation

Insert HLA in original location. To complete installation, reverse removal procedure. Tighten camshaft caps evenly in sequence to specification. See **Fig. 5** . See **TORQUE SPECIFICATIONS** .

CAMSHAFT

NOTE: Intake camshaft has slot for crank angle sensor drive. Match mark camshafts

and sprockets for installation reference.

Removal

Remove cylinder head cover. Remove timing belt. See **TIMING BELT** . Remove distributor/crank angle sensor. Reference mark camshafts, caps and sprockets, and remove sprockets. Loosen camshaft cap bolts evenly in 2-3 steps, in sequence. See **Fig. 5** . Remove camshafts.

Inspection

Check camshaft end play. Check camshaft journal diameters and bearing clearances. Check camshaft lobes for wear. See **CAMSHAFT** table under ENGINE SPECIFICATIONS. If any measurement is not within specification, replace camshaft and/or cylinder head.

Installation

To install, reverse removal procedure. On both camshafts, apply small amount of silicone sealant to contact area of cylinder head/camshaft seal cover cap. Tighten camshaft caps evenly in sequence to specification. See **Fig. 5** . See **TORQUE SPECIFICATIONS** .

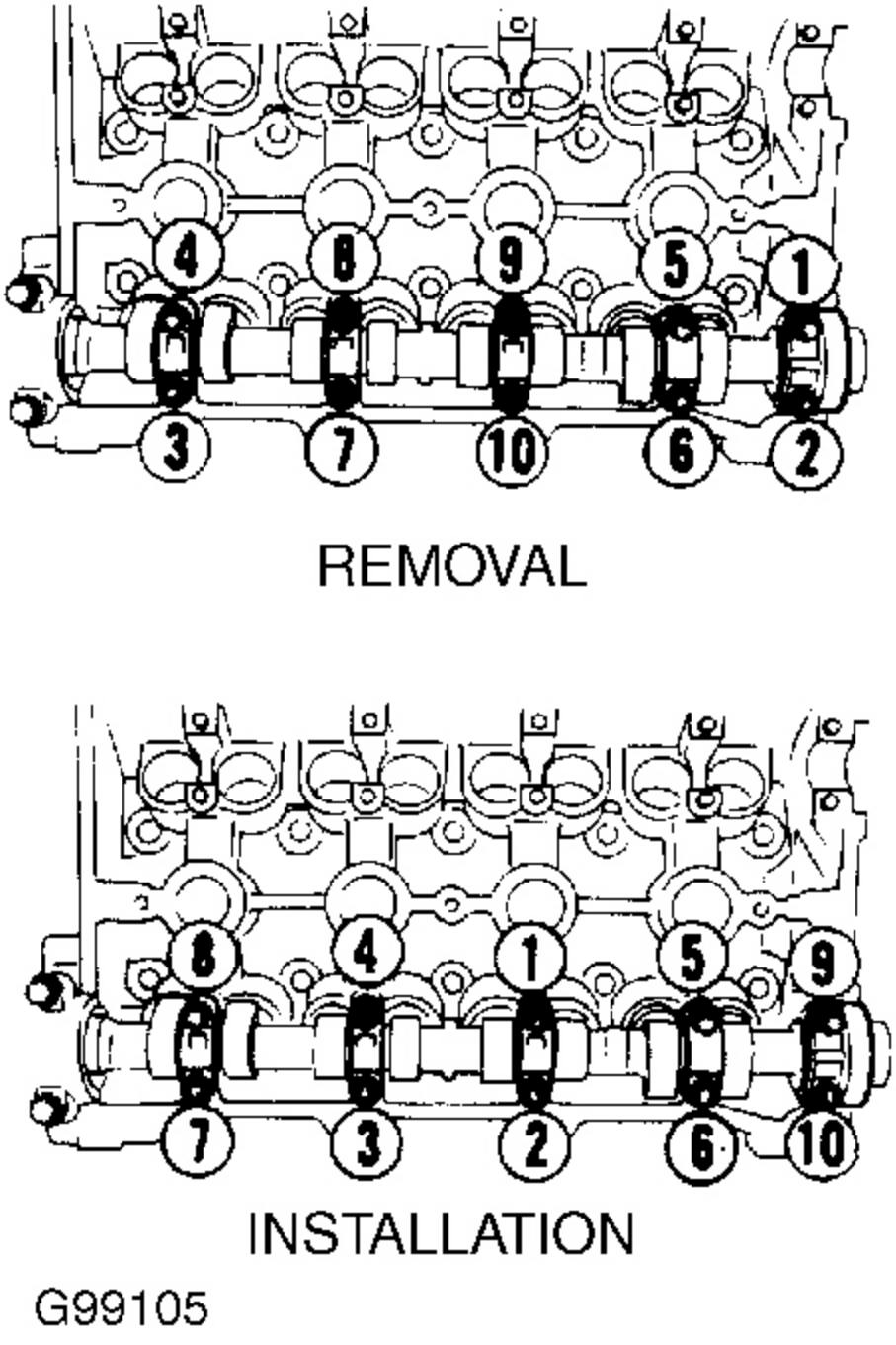


Fig. 5: Camshaft Cap Bolt Removal & Installation Sequence

Courtesy of MAZDA MOTORS CORP.

CRANKSHAFT REAR OIL SEAL

Removal & Installation

1. Disconnect negative battery cable. Remove transmission/transaxle and flywheel. For automatic or manual transmission removal procedure, see appropriate TRANSMISSION REMOVAL & INSTALLATION article in the TRANSMISSION/TRANSAXLE section. Pry out rear oil seal.
2. To install, apply light coat of oil to seal lip and push seal over crankshaft. Tap seal into rear cover until it is flush with edge of rear cover. DO NOT bottom seal in cover.
3. Completely remove used sealant from flywheel bolts. Apply lock-type sealant to bolts, and install flywheel to crankshaft. Tighten bolts to 71-76 ft. lbs. (96-103 N.m) in a star-pattern sequence. Install clutch assembly (if equipped), and tighten cover bolts to 13-20 ft. lbs. (18-26 N.m) in a star-pattern sequence. Install transmission. For automatic or manual transmission removal procedure, see appropriate TRANSMISSION REMOVAL & INSTALLATION article in the TRANSMISSION/TRANSAXLE section (See above).

WATER PUMP

Removal & Installation

1. Drain engine coolant. Disconnect battery cable. Position No. 1 cylinder at TDC of compression stroke.
2. Remove air cleaner intake duct between throttle body and air cleaner/filter assembly. Remove upper radiator hose and by-pass hoses from thermostat housing.
3. Remove drive belts and water pump pulley. Remove power steering pump with hoses attached, and secure pump away from engine (if necessary). Remove timing belt, tensioner and idler. See **TIMING BELT** .
4. Unbolt water inlet pipe from water pump. Water pump inlet pipe has lower radiator hose and by-pass pipe attached to it. Remove bolts from water pump. To install, reverse removal procedure. Tighten bolt to specification. See **TORQUE SPECIFICATIONS** .

NOTE: For further information on cooling systems, see COOLING SYSTEM SPECIFICATIONS & DRIVE BELT ROUTING article and/or ENGINE COOLING FAN article.

OIL PAN

NOTE: Engine must be supported in order to remove oil pan.

Removal & Installation

1. Disconnect negative battery cable. Remove dipstick, tube and "O" ring. Raise vehicle on hoist. Remove engine undercover. Drain engine oil. Disconnect steering column shaft at steering rack coupling. Remove engine mount nuts. See **Fig. 6** . Lift and support engine using jack.

2. Support crossmember using transmission jack, and remove crossmember bolts. Slowly and carefully lower crossmember until clearance between oil pan and steering rack is about 4 inches. Remove oil pan bolts from engine block and transmission.
3. DO NOT damage sealant contact surfaces. Remove oil pan by prying between oil pan and transmission support. Remove oil pan baffle by prying it from engine. See **Fig. 6** . DO NOT deform oil pan baffle. Replace oil pan baffle if deformed. Clean sealant from oil pan, bolts, engine block and both sides of oil pan baffle.
4. To install, apply oil resistant sealant to engine block and oil pan. Install oil pan baffle and oil pan. To complete installation, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** . Fill engine with oil to specification. See **ENGINE LUBRICATION SYSTEM** under ENGINE OILING.

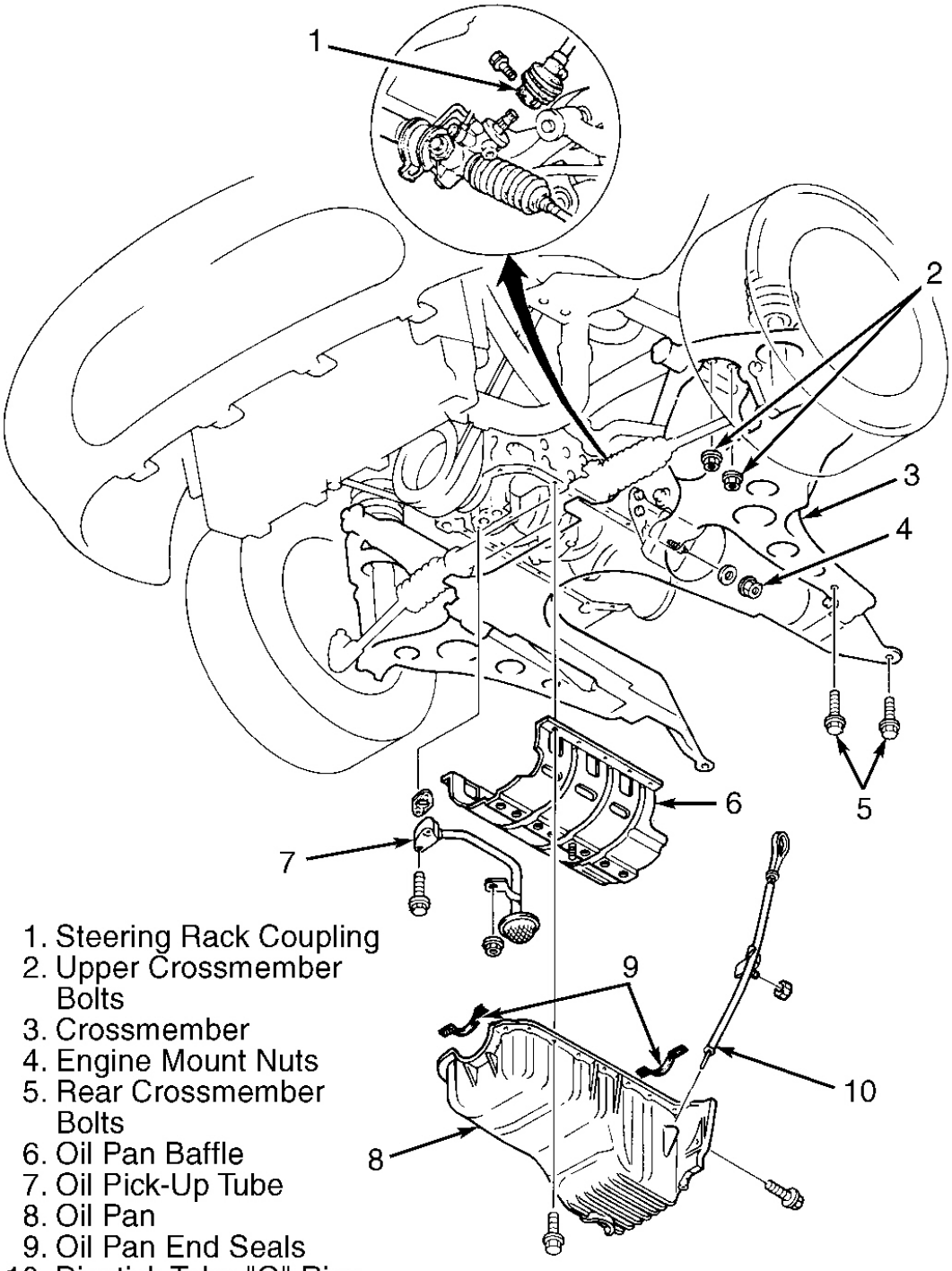


Fig. 6: Removing Crossmember & Oil Pan

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 for warpage, and resurface or replace if warpage exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.

Valve Springs

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

Use Installer Set (49-L012-0A0) to install valve seals. See **Fig. 7** . Adjust installer dimension "L" to seal depth of .720-.744" (18.3-18.9 mm). Using hand pressure ONLY, install seal until it contacts cylinder head. Lightly oil valve seal lip.

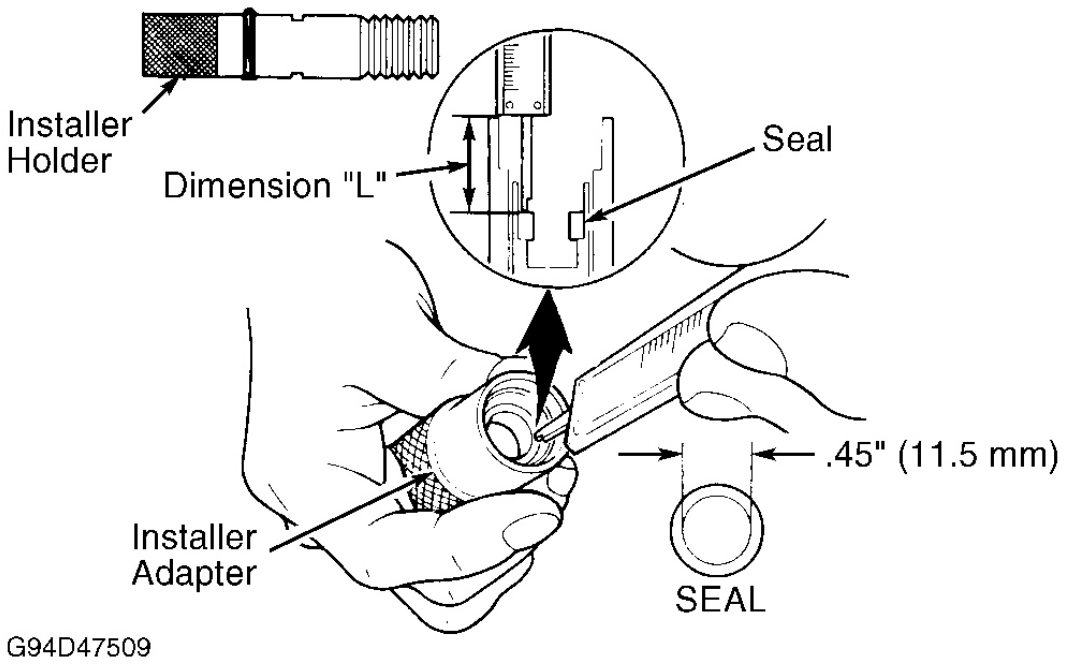


Fig. 7: Installing Valve Guide Seals
Courtesy of MAZDA MOTORS CORP.

NOTE: Use only new exhaust valve guides to replace intake or exhaust valve guides.

Valve Guides

1. Check valve stem-to-valve guide oil clearance. Ensure valve guide inside diameter is within specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.
2. Completely disassemble cylinder head. Gradually heat cylinder head in water to 194°F (94°C). Using Valve Guide Remover (49-B002-005), drive valve guide out, working from combustion chamber side of cylinder head. Repeat procedure if required, keeping cylinder head hot so aluminum head will not warp.
3. If required, install new circlip on guide. Using proper components of Valve Guide Installer (49-L012-0A0), adjust installer guide depth (dimension "L") to specification using depth micrometer or caliper. See **VALVE GUIDE INSTALLED HEIGHT** table. See **Fig. 8** .
4. 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. 8** or **Fig. 9** . If installed height is not within specification, adjust or replace valve guide or cylinder head as necessary.

VALVE GUIDE INSTALLED HEIGHT

Application	In. (mm)
Miata	.720-.744 (18.30-18.90)

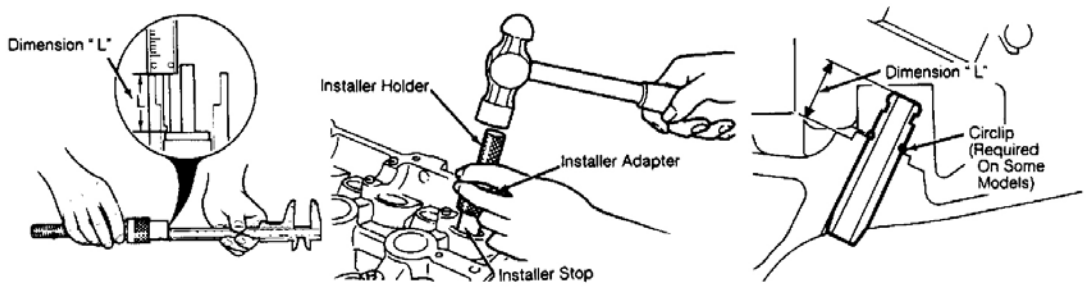


Fig. 8: Adjusting Valve Guide Installer & Installing Guide
Courtesy of MAZDA MOTORS CORP.

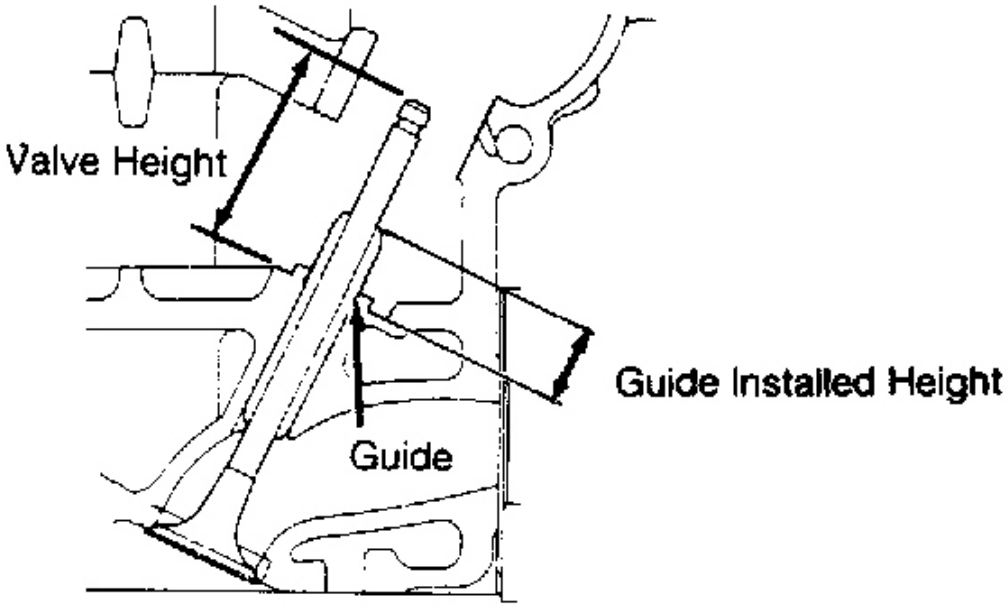


Fig. 9: Measuring Installed Valve & Guide Height
Courtesy of MAZDA MOTORS CORP.

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** table under ENGINE SPECIFICATIONS. Measure valve installed height after servicing valve seat. See **Fig. 9** . See **VALVE INSTALLED HEIGHT** table.

3. If valve installed height is within serviceable range, install adjusting shim on spring seat. If installed height exceeds serviceable range, replace cylinder head.

VALVE INSTALLED HEIGHT

Application	In. (mm)
Normal	1.772-1.791 (45.00-45.50)
Serviceable	1.733-1.772 (45.60-46.50)

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** table under ENGINE SPECIFICATIONS.

Valve Seat Correction Angles

Measure seat contact width on valve. See **VALVE SEAT** . Ensure valve/seat contact position is at center of valve face. If seat contact is too wide or too high, correct it using a 70-degree cutter.

VALVE TRAIN

Hydraulic Lash Adjusters

1. 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 it from bore. Lift HLA from cylinder head.

NOTE: If hydraulic lash adjusters are persistently noisy, check with manufacturer for availability of modified adjusters.

2. Inspect HLA friction surfaces for wear and damage. Replace HLA if required. Coat HLA with engine oil, and install it 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** table under ENGINE SPECIFICATIONS.

2. Remove rod cap from crankshaft. Install short pieces of rubber hose over rod bolts. Push piston and rod assembly out of block.
3. To install, ensure parts are matched to cylinder. Ensure piston, rod, rings and bearings are properly fitted and in related positions. See **Fig. 10** . Install piston and rod assembly into block.

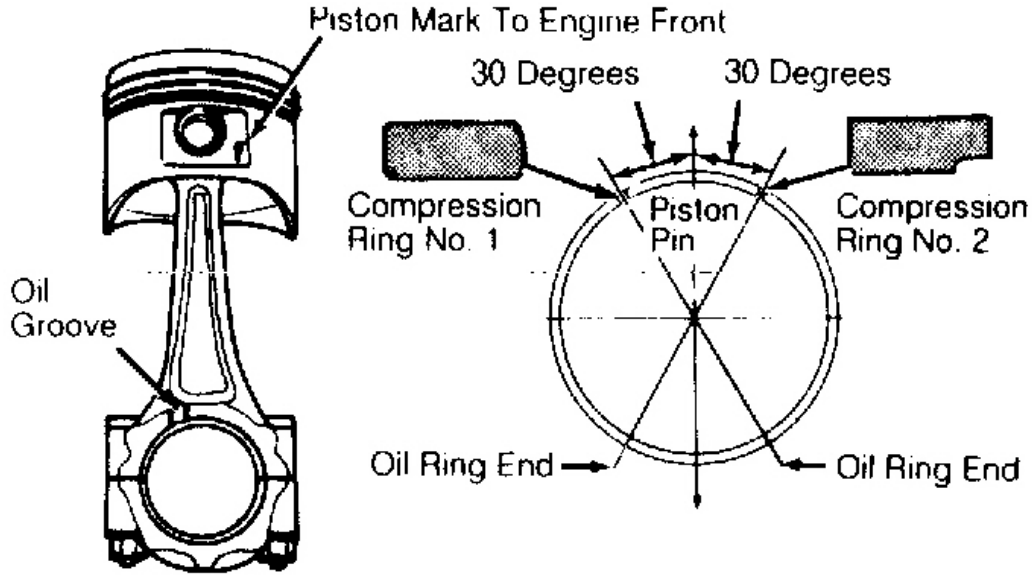


Fig. 10: Assembling Piston, Rod & Rings
Courtesy of MAZDA MOTORS CORP.

Piston Pin Replacement

Match mark piston-to-pin and rod-to-piston positions for proper reassembly. Remove piston pin retaining clip. Drive piston pin out of piston and rod assembly. To install, insert one piston pin retaining clip into groove in piston. Ensure piston is positioned properly on connecting rod. See **Fig. 10** . Tap piston pin into piston and through rod. Install second retaining clip. Piston should pivot freely.

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** table 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.

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

Piston Rings

Insert NEW piston ring into cylinder, and measure ring end gap. Grind ring ends or replace piston ring if ring end gap is not within specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.

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** table under ENGINE SPECIFICATIONS.
2. Before removing main cap, measure and record crankshaft end play by prying crankshaft forward then rearward. Using Plastigage method, measure and record main bearing oil clearance. Remove crankshaft. Measure and record each main journal diameter in 2 places.
3. Main bearing caps are marked and must be installed in original position. Tighten bearing caps evenly 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. Replace thrust bearing if end play is not within specification. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS. Oversize thrust bearings are available.

Cylinder Block

Check cylinder bore out-of-round, taper, ridge and piston-to-cylinder bore clearance. Check head gasket surface for warpage. If warpage is not within specification, machine or replace cylinder block as necessary. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS. Remove, clean and install oil jets for piston oil spraying.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

NOTE: For cross-sectional view of engine oil circuit, See Fig. 11 .

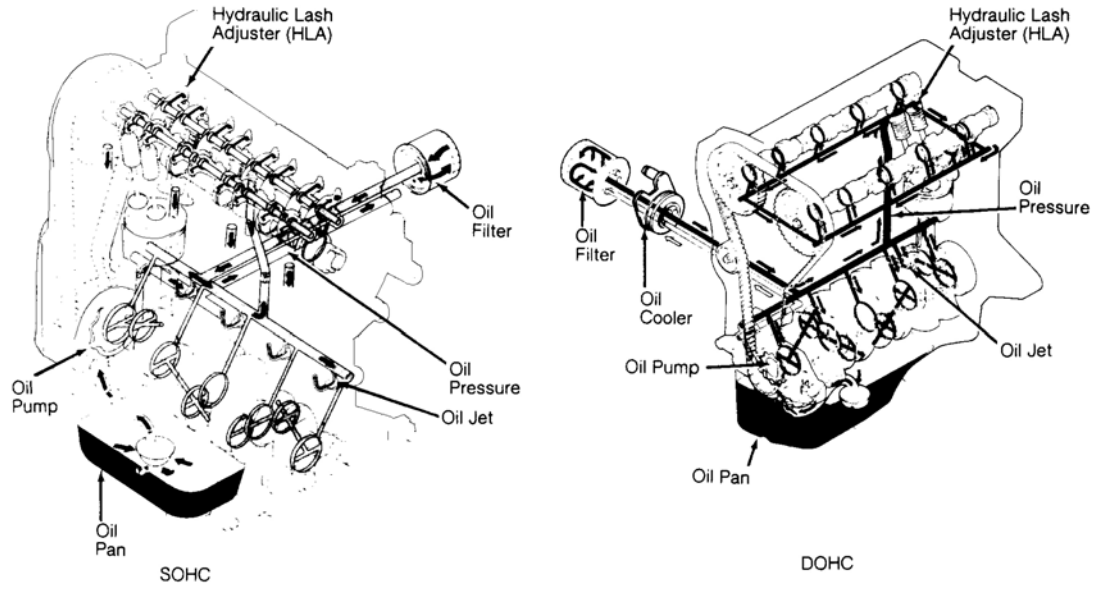


Fig. 11: Cross-Sectional View Of Engine Oil Circuit
Courtesy of MAZDA MOTORS CORP.

Crankcase Capacity

See **ENGINE OIL CRANKCASE CAPACITY** table.

Oil Pressure

With engine at operating temperature, oil pressure should be 28-43 psi (2.0-3.0 kg/cm^2) at 1000 RPM, and 43-57 psi(3.0-4.0 kg/cm^2) at 3000 RPM.

Oil Pressure Relief Valve

Pressure relief valve opening pressure is 50-64 psi (3.5-4.5 kg/cm^2). Pressure relief valve is located in oil pump body and is not adjustable.

ENGINE OIL CRANKCASE CAPACITY

Application	Qts. (L)
Without Filter	3.8 (3.8)
With Filter	4.0 (3.8)

OIL PUMP

Removal & Installation

1. Disconnect negative battery cable. Remove dipstick, tube and "O" ring. Drain engine oil and coolant. Remove drive belts, crankshaft and water pump pulleys. Remove alternator, A/C compressor and mounting bracket. Without disconnecting A/C hoses, secure A/C compressor away from engine. Remove timing belt and related components. See **TIMING BELT** under REMOVAL & INSTALLATION.
2. Hold crankshaft sprocket in place, and remove crankshaft sprocket bolt. Remove crankshaft sprocket using steering wheel puller. Leave crankshaft Woodruff key in place.
3. Remove oil pan and oil pump pick-up tube. See **OIL PAN** under REMOVAL & INSTALLATION. Remove oil pump housing assembly. See **Fig. 12** . Carefully clean all gaskets and sealant from mating surfaces without damaging sealing/mating surfaces. Remove all sealant from components and bolts. Check oil pump clearances. Repair or replace pump if necessary. See **OIL PUMP SPECIFICATIONS** table.
4. To install, reverse removal procedure. Tighten all bolts to specifications. See **TORQUE SPECIFICATIONS** .

OIL PUMP SPECIFICATIONS

Application	Maximum Clearance In. (mm)
Inner Gear Tip-To-Outer Gear Clearance	.0079 (.201)
Outer Gear-To-Pump Body Clearance	.0079 (.201)
Gear End Play-To-Pump Body Clearance	.0055 (.140)
Pressure Spring Length	1.809 (45.94)

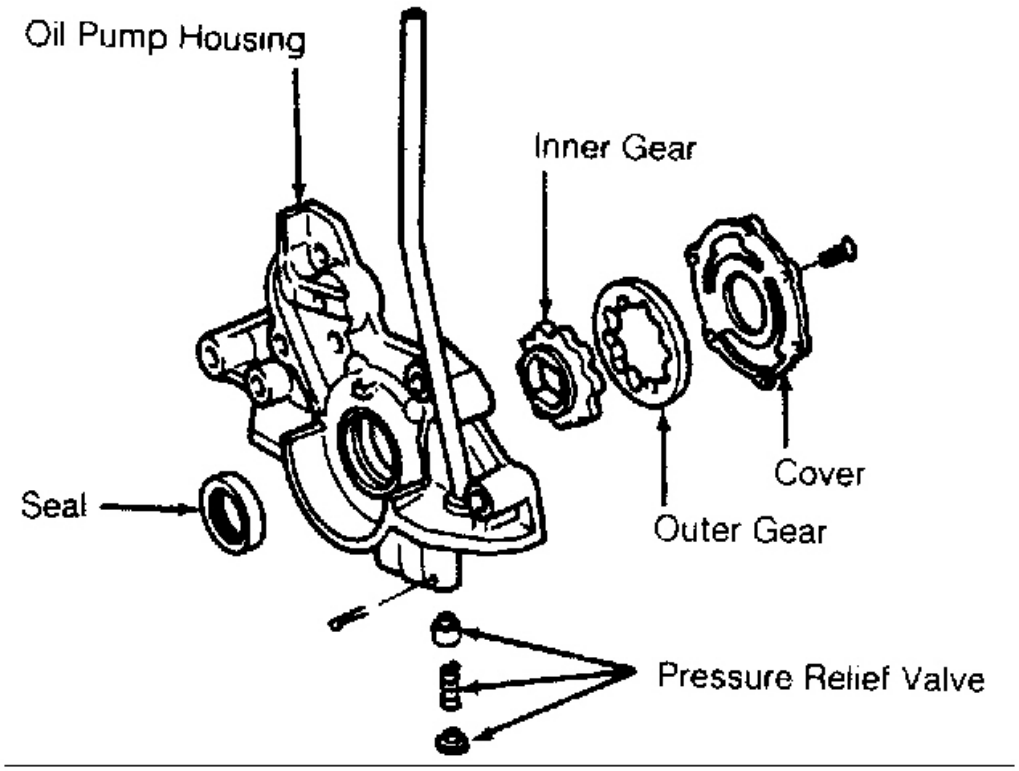


Fig. 12: Exploded View Of Oil Pump
Courtesy of MAZDA MOTORS CORP.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Alternator Top Bolt	27-38 (37-52)
Camshaft Sprocket Bolt	36-45 (49-61)
Compressor Bracket-To-Engine Bolt	28-38 (38-51)
Connecting Rod Cap Nut	35-37 (48-50)
Crankshaft Pulley Attaching Bolts	9-13 (12-18)
Crankshaft/Timing Belt Sprocket Bolt	116-123 (157-167)
Crossmember-To-Frame Bolt	47-66 (63-89)
Cylinder Head Bolt (2)	
Step 1	35-40 (47-54)

Step 2 (Final)	56-60 (76-81)
Distributor Bolt	14-19 (19-26)
Drive Shaft Bolts	20-22 (27-30)
Engine Mount-To-Frame Nut	42-57 (57-77)
Exhaust Header Pipe-To-Exhaust Manifold Nut	23-34 (31-46)
Exhaust Manifold Nut	(1) 28-34 (38-46)
Flywheel Bolt	71-76 (96-103)
Fuel Rail Bolt	14-19 (19-26)
Intake Manifold Bolt/Nut	(1) 14-19 (19-26)
Intake Manifold Support Bracket	14-19 (19-26)
Main Bearing Cap Bolt	
Step 1	(1) 22-27 (30-37)
Step 2 (Final)	(1) 40-43 (54-58)
Motor Mount Nut	42-58 (57-79)
Motor Mount-To-Engine Bolt	27-40 (37-54)
Oil Pan Support-To-Transaxle	28-38 (38-52)
Oil Pump-To-Block Bolt	14-19 (19-26)
PPF/Differential Spacer Mounting Bolt (2)	27-38 (37-52)
PPF-To-Differential Long Mounting Bolt (2)	77-91 (104-123)
PPF-To-Transmission Side Mounting Bolt (2)	77-91 (104-123)
PPF/Transmission Rear Bracket Mounting Bolt	27-40 (37-54)
Spark Plug	11-17 (15-23)
Timing Belt Tensioner Bolt	27-38 (37-52)
Water Pump Bolt	14-19 (19-26)
	INCH Lbs. (N.m)
Camshaft Cap Bolt	(3) 100-125 (11.3-14.1)
Camshaft/Rocker Cover Bolt	43-78 (5-9)
Crankshaft Pulley Bolts	109-152 (12-17)
Oil Jet	104-156 (12-18)
Oil Pan Bolt	69-95 (8-11)
Oil Strainer Bolt	69-95 (8-11)
Water Pump Pulley Bolt	69-95 (8-11)

(1) Tighten evenly to specification in alternating sequence.

(2) Tighten in sequence. See **Fig. 4** .

(3) Tighten in sequence. See **Fig. 5** .

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Specification In. (mm)
Displacement	112.2 Cu. In.
Bore	3.27" (83.0)
Stroke	3.35" (85.0)
Compression Ratio	9.0:1
Fuel System	PFI
Horsepower @ RPM	128 @ 6500
Torque Ft. Lbs. @ RPM	110 @ 5000

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0031-.0111 (.079-.282)
Maximum	.012 (.30)
Maximum Runout	.0016 (.040)
Main Journals	
Diameter	1.9660-1.9668 (49.938-49.956)
Out-Of-Round & Taper	.002 (.05)
Oil Clearance	
Standard	.0007-.0014 (.018-.036)
Maximum Wear Limit	.0039 (.100)
Crankpin Journal	
Diameter	1.7693-1.7699 (44.940-44.956)
Out-Of-Round & Taper	.002 (.05)
Oil Clearance	
Standard	.0008-.0027 (.017-.068)
Maximum Wear Limit	.0039 (.100)

CONNECTING RODS

Application	In. (mm)
Bore Diameter	
Crankpin Bore	1.8898-1.8904 (48.000-48.016)
Pin Bushing Bore	.7875-.7880 (20.003-20.014)
Center-To-Center Length	5.230-5.234 (132.85-132.95)
Maximum Bend	.003 (.08)
Side Play	
Standard	.0043-.0103 (.110-.262)
Wear Limit	.012 (.30)

PISTONS, PINS & RINGS

Application	In. (mm)
Pistons	
Clearance	
Standard	.0013-.0023 (.032-.059)
Maximum	.006 (.15)
Diameter	
Standard	3.2659-3.2667 (82.954-82.974)
Pins	
Diameter	.7869-.7871 (19.987-19.993)
Piston Fit	-.0002-.0005 (-.005-.013)
Rings	
End Gap	
No. 1	
Standard	.006-.012 (.15-.30)
Wear Limit	.039 (1.0)
No. 2	
Standard	.006-.012 (.15-.30)
Wear Limit	.039 (1.0)
Oil Ring	
Standard	.008-.028 (.20-.71)
Wear Limit	.039 (1.0)
Side Clearance	
Standard	.0012-.0026 (.030-.065)
Wear Limit	Wear Limit

CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore	
Standard Diameter	3.2677-3.2684 (83.000-83.019)
Maximum Taper & Out-Of-Round	.0007 (.019)
Deck Height	
Standard	8.720 (221.5)
Minimum	8.712 (221.3)
Maximum Deck Warpage	.006 (.15)

CYLINDER HEAD

Application	In. (mm)
Cylinder Head Height	5.268-5.276 (133.81-134.01)
Maximum Warpage	.004 (.10)

Valve Seat Contact Angle	45°
Valve Guides	
Valve Guide I.D.	.2366-.2374 (6.009-6.029)
Valve Guide Installed Height (1)	.720-.744 (18.28-18.89)
Valve Stem-To-Guide Oil Clearance	
Intake	.0010-.0024 (.025-.060)
Exhaust	.0012-.0026 (.030-.065)
Maximum Wear Limit	.008 (.20)
Cylinder Head-To-HLA Clearance	.0010-.0071 (.025-.180)
(1) Valve guide installed height is measured from top of installed guide to spring seat. See **Fig. 6** .	

VALVES & VALVE SPRINGS

Application	**Specification In. (mm)**
Valves	
Face Angle	45°
Contact Width	.031-.055" (.79-1.40)
Installed Height (1)	
Normal	1.772-1.791" (45.00-45.50)
Serviceable	1.733-1.772" (45.60-46.50)
Minimum Margin	
Intake	.035" (0.9)
Exhaust	.039" (1.0)
Minimum Refinish Length	
Intake	3.952" (100.39)
Exhaust	3.956" (100.49)
Stem Diameter	
Intake	
Standard	.2350-.2356" (5.970-5.985)
Minimum	.2331" (5.920)
Exhaust	
Standard	.2348-.2354" (5.965-5.980)
Minimum	.2329" (5.952)
Valve Springs	
Free Length	1.821" (46.26)
Maximum Out-Of-Square	.064" (1.62)
Compressed Length (Minimum)	
1.8L DOHC (1)	1.555" (39.50)
(1) Valve height is measured from top of installed valve to spring seat. See **VALVE INSTALLED HEIGHTS** table under OVERHAUL. See **Fig. 7** .	

CAMSHAFT

Application	In. (mm)
End Play	.0032-.0120 (.081-.305)
Journal Diameter	1.0213-1.0222 (25.940-25.965)
Maximum Journal Out-Of-Round	.0015 (.038)
Maximum Journal Runout	.0012 (.030)
Journal Oil Clearance	.0014-.0032 (.035-.081)
Maximum Wear Limit	.006 (.15)
Lobe Height	
Standard	
Intake	1.7360 (44.094)
Exhaust	1.7560 (44.600)
Minimum	
Intake	1.7281 (43.894)
Exhaust	1.7480 (44.400)