

3.0L V6

Article Text

1993 Mazda 929

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ARTICLE BEGINNING

1992-93 MAZDA ENGINES
3.0L V6

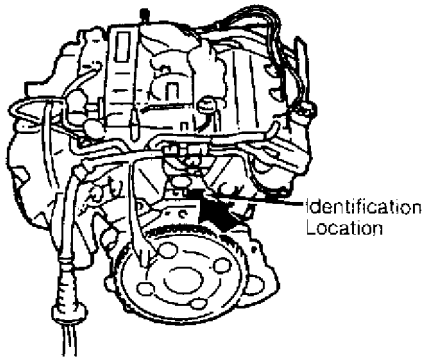
929

* PLEASE READ THIS FIRST *

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

ENGINE IDENTIFICATION

Engine code and number are stamped on rear of cylinder block, above flywheel. See Fig. 1. Engine identification code information is not available from manufacturer.



93B84369

Fig. 1: Identifying Engine Code & Number Location
Courtesy of Mazda Motors Corp.

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

1) No valve clearance adjustment is required, as Hydraulic Lash Adjusters (HLA) are used. If noise exists when engine is started, operate engine at 2000-3000 RPM for 10 minutes.

2) If noise stops, valve lash adjuster is operating correctly. If noise still exists, check engine oil level and oil pressure. Oil pressure should be within specification. See ENGINE LUBRICATION SYSTEM under ENGINE OILING. If oil pressure is not within specification, check for defective engine components.

3) If oil pressure is okay, remove valve cover. Push downward on valve lash adjuster. If valve lash adjuster pushes downward,

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replace valve lash adjuster. See VALVE LASH ADJUSTER under REMOVAL & INSTALLATION. If valve lash adjuster does not push downward, check for worn or damaged camshaft and components.

NOTE: DO NOT remove HLA unless necessary, as "O" ring may be damaged during removal. Before installing valve cover, apply sealant on cylinder head at designated areas. See Fig. 10.

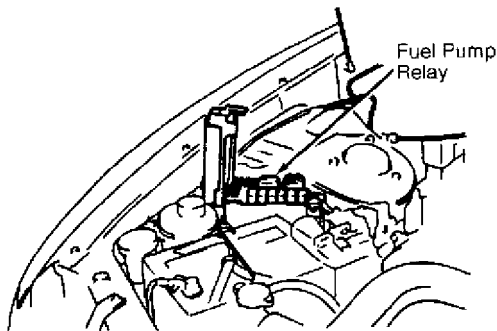
REMOVAL & INSTALLATION

NOTE: For installation 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.

CAUTION: When battery is disconnected, radio will go into anti-theft protection mode. Obtain radio anti-theft protection code from owner and deactivate radio anti-theft function prior to disconnecting battery.

FUEL PRESSURE RELEASE

Start engine and disconnect fuel pump relay, located on right side of engine compartment, near battery. See Fig. 2. After engine dies, turn ignition off and reconnect fuel pump relay.



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Fig. 2: Locating Fuel Pump Relay
Courtesy of Mazda Motors Corp.

ENGINE

Removal

1) Release fuel pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION. Disconnect battery cables and remove battery and battery tray. Remove hood. Raise and support vehicle. Remove undercover. Drain engine oil. Disconnect exhaust pipes from exhaust manifolds.

2) Disconnect and plug automatic transmission cooling lines from radiator. Lower vehicle and drain engine coolant. Remove fresh

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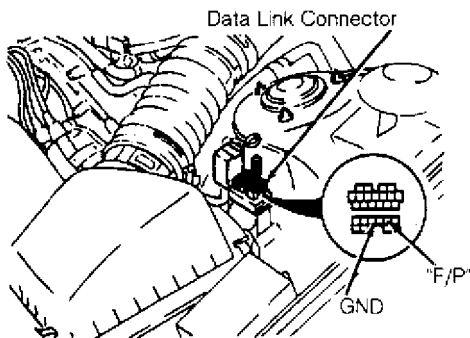
air duct, air cleaner and air intake tube. Disconnect accelerator cable.

3) Remove cooling fan and fan shroud. Remove radiator hoses and all drive belts. Remove spark plug cables and spark plugs. Remove canister and power brake vacuum hoses. Cover fuel hose fitting with rag to prevent fuel spray during removal. Remove fuel hoses as necessary. Plug disconnected hoses to prevent fuel leakage. Remove appropriate wiring and hoses and remove upper intake manifold.

4) Disconnect heater hoses from engine. Disconnect engine wiring harness. Remove radiator wiring harness and radiator. Remove alternator and adjusting bracket. Remove A/C compressor and power steering pump, and tie them aside with hoses still connected. Support transmission and remove engine-to-transmission bolts. Remove engine mount nuts and remove engine.

Installation

To install, reverse removal procedure. Adjust tension of all drive belts. Restore all fluids to proper level. Prime fuel system by connecting jumper wire between data link connector terminals F/P and GND in engine compartment. See Fig. 3. Turn ignition switch to ON position for 10 seconds. Check for fuel leaks. Turn ignition switch to OFF position. Remove jumper wire.



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Fig. 3: Identifying Data Link Connector Terminals
Courtesy of Mazda Motors Corp.

INTAKE MANIFOLD

Removal

1) Apply parking brake, and block rear wheels. Release fuel pressure. See FUEL PRESSURE RELEASE. Disconnect negative battery cable. Remove fresh air duct, air cleaner and air intake tube. Disconnect accelerator cable. Remove canister and power brake vacuum hoses.

2) Cover fuel hose fitting with rag to prevent fuel spray during removal. Remove fuel hoses as necessary. Plug disconnected hoses to prevent fuel leakage.

3) Remove automatic transmission vacuum hose. Disconnect engine wiring harness connectors and grounds. Remove distributor.

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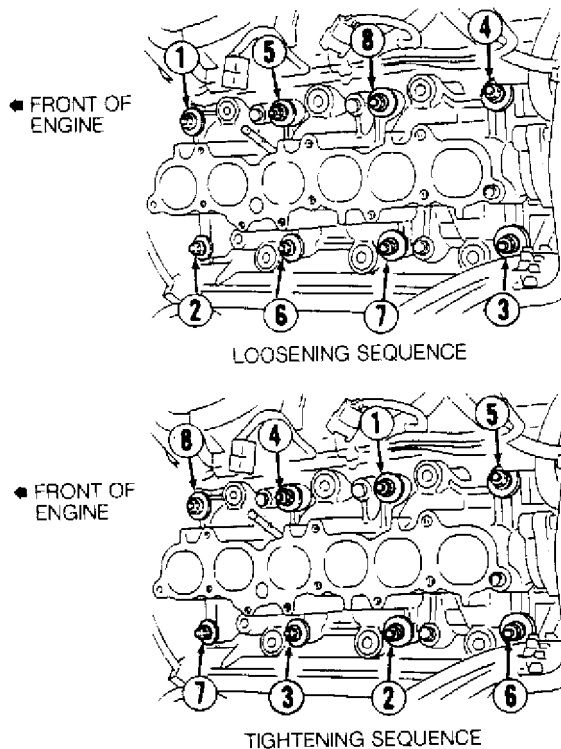
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Remove upper intake manifold bolts and upper intake manifold. Loosen intake manifold bolts in 2 steps and in sequence. See Fig. 4. Remove intake manifold.

Installation

Using NEW gaskets and "O" rings, install intake manifold. Tighten bolts in 2 steps to specification and in proper sequence. See Fig. 4. See TORQUE SPECIFICATIONS TABLE at the end of this article. Ensure all electrical and vacuum lines are properly connected. To complete installation, reverse removal procedure.



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Fig. 4: Intake Manifold Loosening & Tightening Sequence
Courtesy of Mazda Motors Corp.

EXHAUST MANIFOLDS

Removal & Installation

Remove exhaust manifold nuts at exhaust pipe. Remove exhaust manifold heat shields and exhaust manifolds. To install, reverse removal procedure. Install NEW gaskets. Tighten fasteners to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

CYLINDER HEAD

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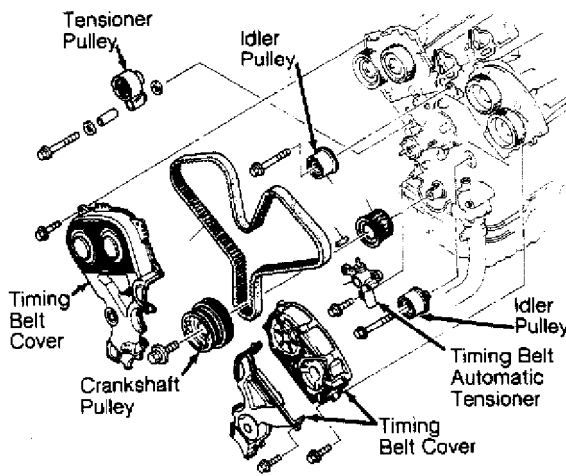
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Removal

1) Apply parking brake, and block rear wheels. Release fuel pressure. See FUEL PRESSURE RELEASE. Disconnect negative battery cable. Drain engine coolant. Remove air intake hose. Disconnect accelerator cable from throttle body. Remove spark plug cables and spark plugs.

2) Remove cooling fan and fan shroud. Remove all drive belts. Remove A/C idler pulley. Remove crankshaft pulley and sensor rotor. DO NOT damage sensor rotor. Remove coolant by-pass and upper radiator hose.

3) Remove timing belt cover and gasket. See Fig. 5. Turn crankshaft to align match marks of pulleys. See Fig. 6. Remove timing belt upper idler pulley. Remove timing belt and timing belt automatic tensioner. Mark timing belt rotation direction if belt is to be reused.



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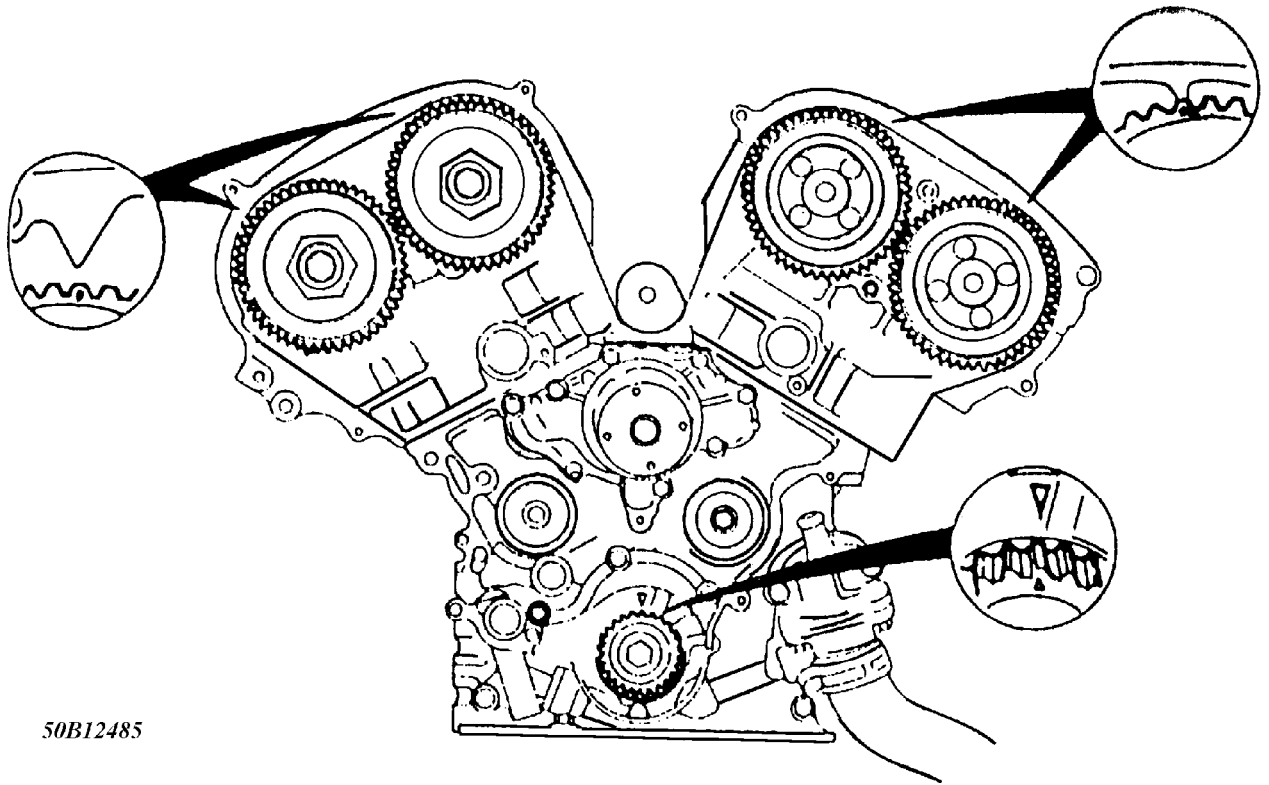
Fig. 5: Exploded View Of Timing Belt Components
Courtesy of Mazda Motors Corp.

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Fig. 6: Aligning Timing Belt Match Marks
Courtesy of Mazda Motors Corp.

4) Remove canister and power brake vacuum hoses. Remove fuel hoses as necessary, covering hose fitting with rag to prevent fuel spray during removal. Plug disconnected hoses to prevent fuel leakage.

5) Remove automatic transmission vacuum hose. Disconnect engine wiring harness connectors and grounds. Remove distributor. Remove upper intake manifold bolts and upper intake manifold. Loosen intake manifold bolts in sequence, in 2-3 steps. See Fig. 4. Remove intake manifold.

6) Remove valve covers. Remove exhaust manifold nuts at exhaust pipe. Remove exhaust manifold heat shields and exhaust manifolds. Hold camshaft at cast hexagon and remove camshaft pulley bolts and pulleys. Loosen camshaft bearing cap bolts in sequence in 2-3 steps. See Fig. 7.

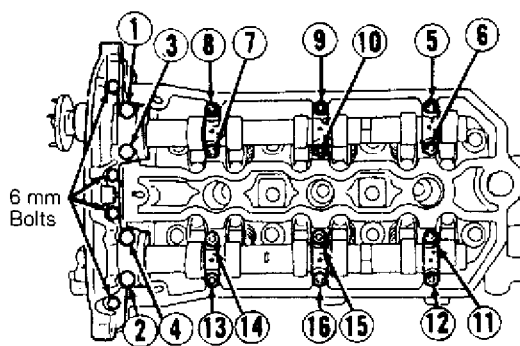
7) Remove camshaft bearing caps, camshafts and rocker arms. Remove camshaft oil seals from camshaft. Loosen cylinder head bolts in sequence, in 2-3 steps. See Fig. 8. Remove cylinder head.

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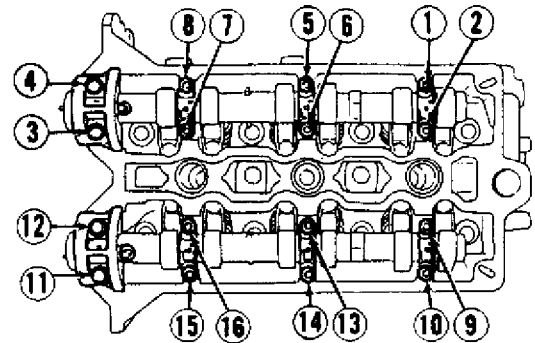
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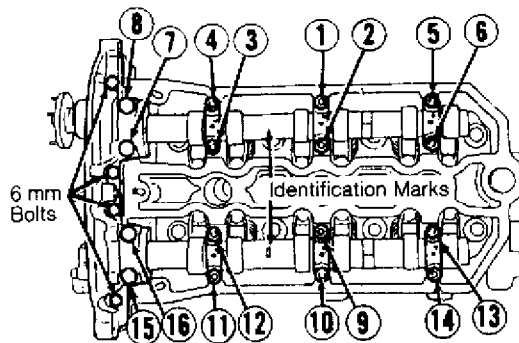
LOOSENING SEQUENCE

LEFT CYLINDER HEAD

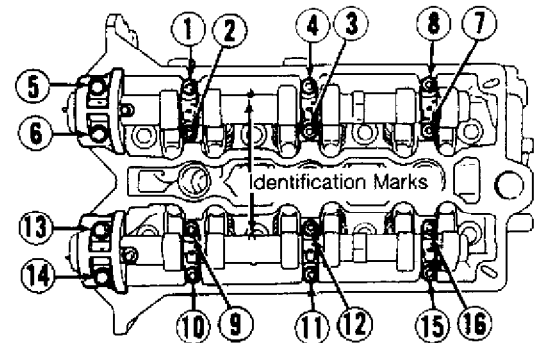


LOOSENING SEQUENCE

RIGHT CYLINDER HEAD



TIGHTENING SEQUENCE



TIGHTENING SEQUENCE

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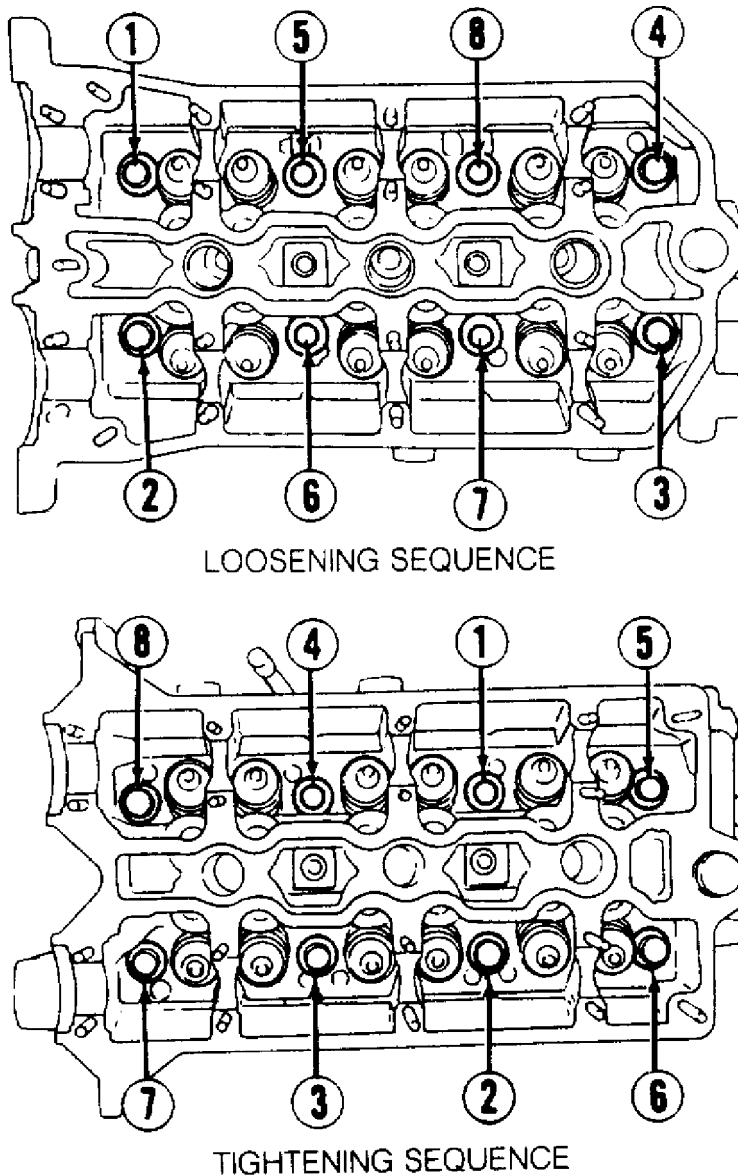
Fig. 7: Camshaft Bearing Cap Bolt Loosening & Tightening Sequence
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Fig. 8: Cylinder Head Bolt Loosening & Tightening Sequence
Courtesy of Mazda Motors Corp.

Inspection

Check for cracks, damage and coolant leakage. Remove scale, sealing compound and carbon deposits. Clean oil passages and ensure they are cleared with compressed air. Inspect cylinder head for warpage at deck surface. Resurface cylinder head if warpage exceeds specification. See appropriate CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Installation

- 1) Ensure all mating surfaces are clean. Check cylinder block

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and cylinder head surfaces for warp. See CYLINDER BLOCK and appropriate CYLINDER HEAD tables under ENGINE SPECIFICATIONS. Resurface or replace as required.

2) Ensure cylinder head oil control plugs are installed in block. Measure oil control plug projection from cylinder block. Projection should be .21-.22" (5.3-5.7 mm). See Fig. 9. Apply engine oil to NEW "O" rings, and install them on oil control plugs.

3) Install cylinder heads, with NEW gaskets, to block. New head gaskets are marked "L" for left bank and "R" for right bank. If reusing cylinder head bolts, measure each bolt. Intake-side bolts should measure 4.25-4.29" (108-109 mm) and exhaust-side bolts should measure 5.43-5.47" (138-139 mm). If bolts exceed maximum length, replace bolts.

4) Install and tighten cylinder head bolts as follows. First, tighten bolts in sequence to 14 ft. lbs. (19 N.m). See Fig. 8. Next, tighten bolts in sequence an additional 90 degrees. Finally, tighten bolts another 90 degrees in sequence.

5) Install camshafts, camshaft bearing caps, pulleys and bolts. Tighten camshaft bearing cap bolts in sequence and to specification. See Fig. 7. See TORQUE SPECIFICATIONS TABLE at the end of this article. Tighten 4 camshaft bearing cap front bolts (6-mm) on left cylinder head to 71-97 INCH lbs. (8-11 N.m). Tighten camshaft pulley bolts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

6) To prevent oil leakage, apply sealant to cylinder head surface at inner and outer front edge of each cam. See Fig. 10. To complete installation, reverse removal procedure.

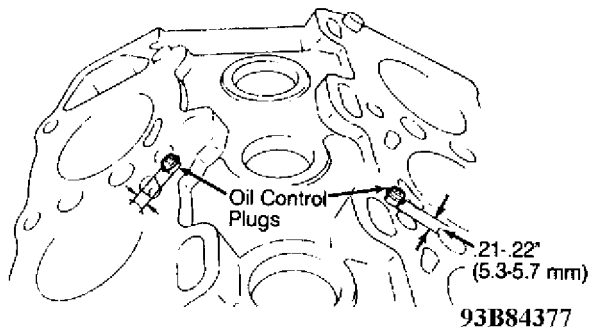


Fig. 9: Measuring Oil Control Plug Projection
Courtesy of Mazda Motors Corp.

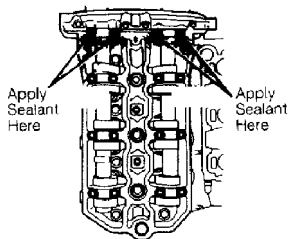


Fig. 10: Installing Sealant To Cylinder Head
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FRONT COVER OIL SEAL

See OIL PUMP under ENGINE OILING.

TIMING BELT

Removal

1) Disconnect negative battery cable. Drain engine coolant. Remove spark plug cables and spark plugs. Remove air intake hose. Remove cooling fan and fan shroud.

2) Remove drive belts. Remove A/C and P/S idler pulleys (if equipped). Remove crankshaft pulley and sensor rotor. DO NOT damage sensor rotor. Remove coolant by-pass and upper radiator hoses.

3) Remove distributor. Remove timing belt covers and gasket. See Fig. 5. Turn crankshaft to align pulley match marks. See Fig. 6. Remove timing belt upper idler pulley. If reusing timing belt, mark rotation direction. Remove timing belt and timing belt automatic tensioner.

Inspection

Check automatic tensioner rod projection. Rod should project .47-.55" (12-14 mm) from tensioner body. Replace tensioner if projection is not within specification.

Installation

1) Using flat washer to prevent damage to tensioner body plug, place automatic tensioner in vise or arbor press. Compress tensioner rod until a pin can be inserted into tensioner rod through hole in tensioner body. Install tensioner with pin installed.

CAUTION: DO NOT exceed 2200 lbs. (1000 kg) pressure on tensioner rod.

2) Ensure match marks on pulleys align with marks on heads. See Fig. 6. With upper idler pulley removed, install timing belt on pulleys. Keep slack toward automatic tensioner side. Install upper idler pulley.

3) Rotate crankshaft twice in direction of rotation, and ensure match marks still align. Remove automatic tensioner pin, and repeat steps to confirm match marks are still in alignment.

4) Check timing belt deflection between right cam pulley and lower idler. Deflection should be .20-.28" (5-7 mm) at 22 lbs. (10 kg). If deflection is not correct, repeat installation procedure. If deflection is still not correct, check for faulty automatic tensioner or stretched timing belt. To complete installation, reverse removal procedure. Tighten fasteners to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

ROCKER ARM & VALVE LASH ADJUSTER

Removal

1) Release fuel pressure. See FUEL PRESSURE RELEASE.

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Disconnect negative battery cable. Remove timing belt cover and timing belt. Remove accelerator cable. Remove upper intake manifold. Disconnect electrical connectors and remove top engine wiring harness. Disconnect and plug fuel lines. Remove spark plug cables and valve covers.

2) Hold camshaft at cast hexagon while removing camshaft pulley bolts. Remove camshaft pulley. Remove camshaft bearing cap bolts in sequence. See Fig. 7. Remove camshafts, oil seals and rocker arms. Protect Hydraulic Lash Adjuster (HLA) with rag while grasping with pliers. Remove HLA from cylinder head, and place in container filled with engine oil.

Installation

1) Bleed air from HLA by inserting pin into hole on end of adjuster, and depressing plunger slightly until it cannot be collapsed. Remove any remaining oil from hydraulic lash adjuster socket in cylinder head, and install adjuster.

2) Install camshafts according to identification marks. See CAMSHAFT IDENTIFICATION MARKS table. Ensure camshafts are in correct positions. Install camshaft bearing caps. Tighten camshaft bearing cap bolts to specification in sequence. See Fig. 7. See TORQUE SPECIFICATIONS TABLE at the end of this article. Tighten 4 camshaft bearing cap front bolts (6-mm) on left cylinder head to 71-97 INCH lbs. (8-11 N.m). To complete installation, reverse removal procedure.

CAMSHAFT IDENTIFICATION MARKS TABLE

AA

Application (1) Identification Mark

Exhaust Camshaft

Left	451
Right	441

Intake Camshaft

Left	431
Right	421

(1) - See Fig. 7 for identification mark locations.

AA

CAMSHAFTS & OIL SEALS

Removal

See ROCKER ARM & VALVE LASH ADJUSTER under REMOVAL & INSTALLATION.

Inspection

1) Inspect camshaft, journals and cam surface for wear or damage. Using dial indicator, check runout with camshaft in "V" blocks. Maximum runout limit is .001" (.03 mm). See CAMSHAFT table under ENGINE SPECIFICATIONS.

2) Check camshaft lobe height. Replace camshaft if it is worn beyond minimum limit. With bearing caps installed, measure end play

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with dial indicator. If end play exceeds maximum specification, replace camshaft or cylinder head.

Installation

See ROCKER ARM & VALVE LASH ADJUSTER under REMOVAL & INSTALLATION.

REAR CRANKSHAFT OIL SEAL

Removal & Installation

Disconnect negative battery cable. Drain engine oil. Remove transmission and flywheel. See appropriate information in TRANSMISSION REMOVAL & INSTALLATION - A/T article in TRANSMISSION SERVICING (vehicles with A/T). Pry rear oil seal from rear cover. To install, coat NEW seal lip with engine oil, and drive seal into rear cover. To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

WATER PUMP

Removal & Installation

Remove timing belt. See TIMING BELT under REMOVAL & INSTALLATION. Remove water pump and gasket. To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

OIL PAN

Removal & Installation

Disconnect negative battery cable. Raise and support vehicle. Drain engine oil. Remove undercover. Remove oil pan mounting bolts and oil pan. Insert a wide-face gasket scraper between oil pan and oil pan block assembly to separate them. Remove oil pan. Clean oil pan block assembly-to-oil pan gasket mounting surface. To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.

OVERHAUL

CYLINDER HEAD

CAUTION: When removing valve keepers, separate intake valve keepers from exhaust valve keepers. Intake and exhaust valve keepers are of different design.

Cylinder Head

Check for cracks, damage and coolant leakage. Remove scale, sealing compound and carbon deposits. Clean oil passages, and blow compressed air through passages to ensure they are not clogged. Inspect cylinder head for warpage at deck surface. Resurface cylinder head if warpage exceeds specification. See appropriate CYLINDER HEAD

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table under ENGINE SPECIFICATIONS.

Valve Springs

Inspect valve spring free length, tension and installed height. Installed spring height is measured from spring seat to valve spring retainer. Using a square, check out-of-square of each spring. Replace valve spring if measurements are not within specification. See appropriate VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS.

NOTE: Outer valve spring has an uneven pitch. Install spring with narrow pitch toward cylinder head.

Valve Stem Oil Seals

Install NEW valve seal by hand. After installation, set seal protrusion to .881" (22.4 mm). Protrusion is measured from inner spring seat to spring on seal.

Valve Guides

1) Measure clearance between valve stem and guide. If guide wear is greater than specification, replace guide. See appropriate CYLINDER HEAD table under ENGINE SPECIFICATIONS. Using guide remover and hammer, tap guide from cylinder head from combustion chamber side.

2) Install NEW guide from cam side of cylinder head. Measure valve guide installed height from outer spring seat surface of cylinder head. Ensure installed height is within specification. See appropriate CYLINDER HEAD table under ENGINE SPECIFICATIONS. Regrind valve seat after installing valve guide.

NOTE: Although intake and exhaust valve guides are shaped differently, use exhaust valve guide for replacement of either side.

Valve Seat

Inspect contact surface of valve seat for roughness, cracking or other damage. Resurface valve seat using a 45-degree cutter or stone. Manufacturer does not provide valve seat replacement information.

Valves

Inspect valves for roughness or damage to stems, stem tips or face. If thickness is less than specification, replace valve. See appropriate VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS. Valve stem end surface grinding limit is .020" (.50 mm). Inspect valve stem keeper grooves for excessive wear. Replace valves as necessary.

Valve Seat Correction Angles

Valve seat contact width should be .047-.063" (1.2-1.6 mm). If valve seat contact position on valve face is too high, correct with a 75-degree cutter or stone. If valve seat contact position on valve face is too low, correct with a 35-degree (intake) or 15-degree (exhaust) cutter or stone. Seat valve to valve seat with lapping compound.

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Valve Seat Depth

Measure protruding length of each valve stem from spring seat to tip of valve stem. See VALVE STEM INSTALLED HEIGHT table. If length is within service limit, use valve spring shims to bring measurement within acceptable limit. If length is greater than service limit, replace valve or cylinder head.

VALVE STEM INSTALLED HEIGHT TABLE

AA

Application In. (mm)

Intake & Exhaust

Acceptable 2.005-2.025 (50.93-51.43)

Service Limit 2.025-2.064 (51.43-52.43)

AA

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1) Using press and adapters, remove pin from piston and rod. Check pin and bores for signs of sticking, excessive wear or damage. Measure pin bore diameter in piston. Standard pin bore is .9048-.9057" (22.982-23.006 mm). Measure outside diameter of pin. Standard pin diameter is .9045-.9047" (22.974-22.980 mm).

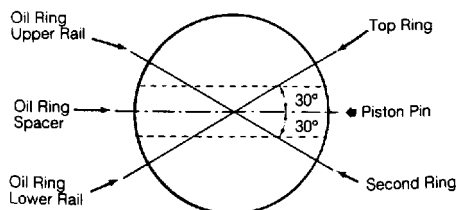
2) Determine pin-to-piston clearance. Standard clearance is .0003-.0010" (.008-.026 mm). If wear exceeds specification, replace piston and/or pin. Pin must fit into piston with light pressure at room temperature.

3) Piston pin is press-fit in rod. Align connecting rod cap mating mark with single valve recess side of piston. Standard interference fit of piston pin-to-rod is .0005-.0015" (.013-.037 mm).

Installation

1) Lubricate piston, rings and cylinder bore with engine oil. Install piston rings and properly space ring end gaps on piston. See Fig. 11. Install piston and rod into cylinder bore.

2) Ensure "L" (left bank) and "R" (right bank) marks on pistons face timing belt side of engine. Install and tighten rod cap nuts to specification in 2 steps. See TORQUE SPECIFICATIONS TABLE at the end of this article.



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Fig. 11: Installing & Spacing Piston Rings
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Fitting Pistons

1) Measure cylinder bore at 3 places for out-of-round and taper. If out-of-round or taper exceeds .0007" (.019 mm), rebore cylinder for oversize pistons. See CYLINDER BORE DIAMETERS table.

2) Insert piston in cylinder. Using a feeler gauge, determine piston-to-cylinder bore clearance. Clearance should be .0009-.0020" (.023-.051 mm). Maximum clearance is .006" (.15 mm). If clearance exceeds maximum specification, rebore cylinder, and install oversize piston. See PISTON DIAMETERS table.

CYLINDER BORE DIAMETERS TABLE (1)

AA

Application	In. (mm)
Standard (New)	3.5433-3.5442 (90.000-90.022)
.010 (.25 mm) O/S	3.5531-3.5540 (90.250-90.272)
.020 (.50 mm) O/S	3.5630-3.5639 (90.500-90.522)

(1) - Cylinder bore taper and out-of-round must not exceed .0007" (.019 mm).

AA

PISTON DIAMETERS TABLE (1)

AA

Application	In. (mm)
Standard (New)	3.5416-3.5429 (89.958-89.990)
.010 (.25 mm) O/S	3.5515-3.5527 (90.208-90.240)
.020 (.50 mm) O/S	3.5613-3.5639 (90.458-90.522)

(1) - Measured at .87" (22 mm) from bottom of oil ring land.

AA

Piston Rings

1) Measure piston ring end gap. Use head of piston to push ring squarely into bore. Leave ring at bottom of ring travel. Using a feeler gauge, measure piston ring end gap. Compare measurement with specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

2) Install rings on piston with "R" facing upward. Note 2nd compression ring outer edge is slightly chamfered. Using a feeler gauge, measure ring side clearance between ring and ring land. If ring lands are excessively worn, replace piston. Properly space ring end gaps on piston. See Fig. 11. Ensure end gaps do not align with piston pin or thrust face of piston.

Main & Rod Bearings

1) Remove main bearing cap bolts in sequence. See Fig. 12. Remove main bearing caps and main bearings. Remove connecting rod caps and rod bearings. Clean connecting rod journal and bearing halves with a clean shop towel. Check connecting rod bearing oil clearance using Plastigage method.

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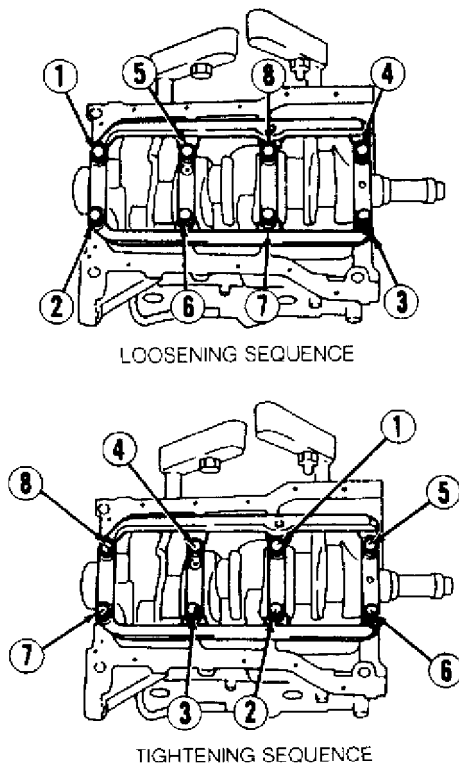
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2) Standard connecting rod bearing oil clearance is .0009-.0017" (.023-.043 mm). Maximum connecting rod bearing oil clearance is .004" (.10 mm). If oil clearance exceeds maximum limit, grind crankshaft, and use oversize bearings.

3) Use Plastigage method to determine main bearing oil clearance. Standard main bearing clearance is .0010-.0014" (.025-.035 mm). Maximum main bearing clearance is .0031" (.080 mm). If oil clearance exceeds specification, grind crankshaft, and use oversize main bearings.

4) Install main bearing halves into engine block. Ensure bearings are on correct journal and oil feed holes are clear. Journal No. 4 requires thrust bearing. Upper bearing halves have oil grooves and are not interchangeable with lower bearing halves. Apply oil to main bearing surface. Install crankshaft.

5) Install main bearing caps, and tighten bolts to specification in 3 steps. Start at center bearing and work outward. See Fig. 12. See TORQUE SPECIFICATIONS TABLE at the end of this article. To complete installation, reverse removal procedure.



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Fig. 12: Main Bearing Cap Bolt Loosening & Tightening Sequence
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Thrust Bearing

Check crankshaft end play with dial indicator. End play limit

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is .012" (.30 mm). If end play exceeds specification, grind crankshaft, and install oversize thrust bearing. See THRUST BEARING SPECIFICATIONS table.

THRUST BEARING SPECIFICATIONS TABLE

Application		In. (mm)
Standard (New)	.0787-.0807	(2.000-2.050)
.010 (.25 mm) O/S	.0837-.0856	(2.125-2.175)
.020 (.50 mm) O/S	.0886-.0906	(2.250-2.300)

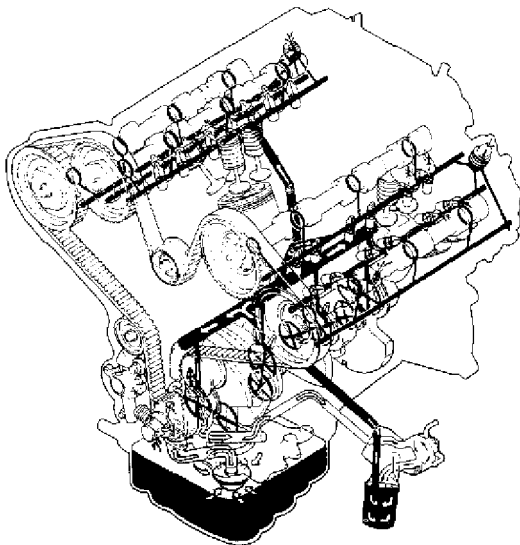
Cylinder Block

Visually inspect cylinder block for scores, rust and corrosion. Check for cracks or any other defects. Repair or replace block if defective. Measure cylinder bore in 3 areas from top to bottom of bore, checking for taper and out-of-round.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

A crankshaft-driven, trochoid-type oil pump draws oil from oil pan, and delivers it under pressure to main and connecting rod bearings. An oil hole in each connecting rod lubricates thrust side of piston and cylinder wall. An oil passage carries oil to camshafts and rocker arms. Oil spray lubricates valve stems. See Fig. 13.



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Fig. 13: Cross-Sectional View Of Engine Oil Circuit
Courtesy of Mazda Motors Corp.

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Crankcase Capacity

Oil capacity is 4.8 qts. (4.5L) without oil filter replacement and 5.0 qts. (4.7L) with filter replacement. Capacity is 5.7 qts. (5.4L) after engine overhaul.

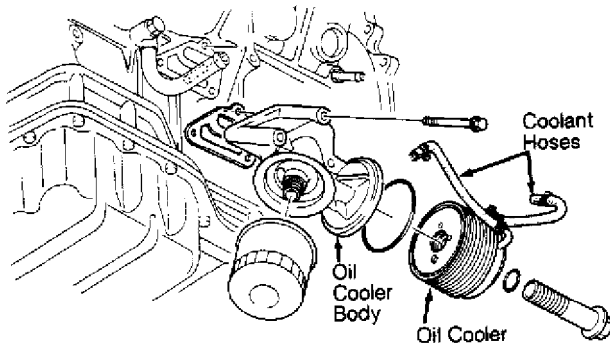
Oil Pressure

Oil pressure is 10-37 psi (0.7-2.6 kg/cm²) at 1000 RPM and 46-71 psi (3.2-5.0 kg/cm²) at 3000 RPM.

OIL COOLER

Removal & Installation

Disconnect negative battery cable and drain engine coolant. Raise and support vehicle. Drain engine oil. Remove oil filter and coolant hoses. Remove oil cooler bolt, oil cooler and oil cooler body. See Fig. 14. To install, reverse removal procedure. Replace oil cooler "O" rings. Install engine oil and coolant. Start engine and check for leaks.



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Fig. 14: Exploded View Of Oil Cooler Assembly
Courtesy of Mazda Motors Corp.

OIL PUMP

Removal

1) Disconnect negative battery cable. Drain engine oil and coolant. Remove timing belt cover and gasket. Turn crankshaft to align pulley match marks. See Fig. 6.

2) Remove timing belt upper idler pulley. Remove timing belt and timing belt automatic tensioner. Mark timing belt rotation direction if belt is to be reused. Remove crankshaft pulley and timing belt drive pulley. Remove thermostat housing. Remove oil pan, oil screen and oil pan block assembly. Remove oil pump assembly. Remove pump cover screws and cover. Remove oil seal from oil pump. See Fig. 15.

Inspection

Check oil pump body, plunger and plunger spring for damage or distortion. Check side clearance. Side clearance should be .0014-.

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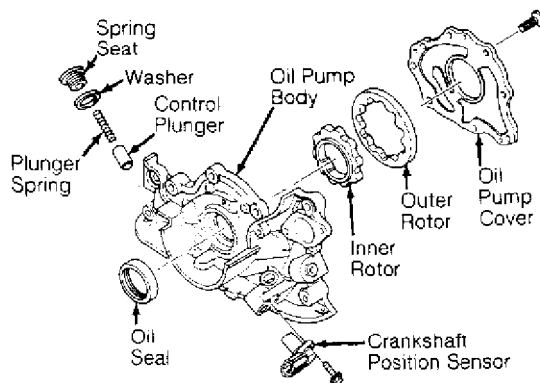
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0038" (.035-.096 mm) with a maximum limit of .0051" (.13 mm). Check tooth tip clearance. Clearance should be .0016-.0079" (.04-.20 mm) with a maximum limit of .0094" (.24 mm). Check outer rotor-to-pump body clearance. Clearance should be .0039-.0077" (.100-.196 mm) with a maximum limit of .0091" (.23 mm).

Installation

Apply engine oil to pump body and outside of oil seal before installing NEW seal. Replace coolant inlet pipe gasket. To install, reverse removal procedure. Tighten oil pump bolts to specification. See TORQUE SPECIFICATIONS TABLE at the end of this article.



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Fig. 15: Exploded View Of Oil Pump
Courtesy of Mazda Motors Corp.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

AA

Application	Ft. Lbs. (N.m)
A/C Compressor-To-Bracket Bolt	21-29 (29-39)
Alternator-To-Bracket Bolt	27-38 (37-52)
Camshaft Bearing Cap Bolt (1)	21-24 (29-32)
Camshaft Pulley Bolt	
Left Head	14-18 (19-25)
Right Head	52-59 (71-80)
Connecting Rod Cap Nut	
First Step	21 (29)
Second Step	90 Degrees
Crankshaft Pulley Bolt	116-123 (157-167)
Cylinder Head Bolt (2)	
First Step	14 (19)
Second Step	90 Degrees
Third Step	90 Degrees
Distributor Mount Bolt	14-18 (19-25)
Drive Shaft Bolt	37-43 (50-58)
Drive Shaft Center Support Bolt	27-38 (37-52)

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Engine Block-To-Transmission

Mounting Bolt	27-38 (37-52)
Engine Mount Nut	25-36 (34-49)
Exhaust Manifold Nut	16-21 (22-29)
Exhaust Pipe Flange Nut	28-38 (38-52)
Exhaust Heat Shield Bolt	14-18 (19-25)
Flywheel (Flexplate) Bolt	76-81 (103-110)
Intake Manifold	
Upper & Lower Intake Manifold Bolt (3)	14-18 (19-25)
Main Bearing Cap Bolt (4)	
First Step	14 (19)
Second Step	90 Degrees
Third Step	45 Degrees
Oil Cooler Bolt	18-25 (25-34)
Oil Cooler Body Bolt	14-18 (19-25)
Oil Pan Drain Plug	22-30 (30-41)
Oil Pump Bolt	14-18 (19-25)
Power Steering	
Idler Bolt	14-18 (19-25)
Pulley Nut	29-43 (39-58)
Pump Mount Bolt	23-34 (31-46)
Radiator Bolt	14-18 (19-25)
Spark Plug	10-13 (14-17)
Thermostat Housing Bolt	14-18 (19-25)
Timing Belt Lower Idler Bolt	32-45 (43-61)
Timing Belt Tensioner Bolt	14-18 (19-25)
Timing Belt Upper Idler Bolt	27-38 (37-52)
Torque Converter Bolt	25-36 (34-49)
Transmission Crossmember-To-Frame Nut	32-44 (44-60)
Transmission Mount-To-Crossmember Bolt	40-56 (54-76)
Water Pump Bolt	14-18 (19-25)

INCH Lbs. (N.m)

Camshaft Bearing Cap Front Bolt (5)

6-mm	71-97 (8-11)
Crankshaft Position Sensor Bolt	71-97 (8-11)
Oil Baffle Bolt	71-97 (8-11)
Oil Pan Block Assembly Bolt	71-97 (8-11)
Oil Pan Bolt	71-97 (8-11)
Oil Pump Housing Screw	53-80 (6-9)
Oil Pump Screen Bolt	71-97 (8-11)
Rear Crankshaft Seal Bolt	71-97 (8-11)
Timing Belt Cover Bolt (6)	71-97 (8-11)
Valve Cover Bolt	30-39 (3.4-4.4)

(1) - Tighten in sequence. See Fig. 7.

(2) - Tighten in sequence. See Fig. 8.

(3) - Tighten in sequence. See Fig. 4.

(4) - Tighten in sequence. See Fig. 12.

(5) - Four bolts on left cylinder head. See Fig. 7.

(6) - Except 3 top bolts on right side cover: 14-18 ft. lbs.

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GENERAL ENGINE SPECIFICATIONS

[illegible][illegible][illegible]

Application	In. (mm)
Crankshaft	
End Play0031-.0111 (.080-.282)
Runout0008 (.02)
Main Bearings	
Journal Diameter	2.4385-2.4392 (61.937-61.955)
Journal Taper & Out-Of-Round002 (.05)
Oil Clearance0010-.0015 (.025-.037)
Connecting Rod Bearings	
Journal Diameter	2.0842-2.0848 (52.940-52.955)
Journal Out-Of-Round002 (.05)
Oil Clearance0009-.0017 (.023-.043)

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PISTONS, PINS & RINGS SPECIFICATIONS

PISTONS, PINS & RINGS SPECIFICATIONS TABLE

AA

Application In. (mm)

Pistons

Clearance0009-.0020 (.023-.051)

Diameter 3.5416-3.5429 (89.958-89.990)

Pins

Diameter9045-.9047 (22.974-22.980)

Piston Fit (Clearance)0003-.0010 (.008-.026)

Rod Fit (Interference) (1)0005-.0015 (.013-.037)

Rings

No. 1

End Gap008-.014 (.20-.35)

Side Clearance001-.003 (.03-.08)

No. 2

End Gap006-.012 (.15-.30)

Side Clearance001-.003 (.03-.08)

No. 3 (Oil)

End Gap008-.028 (.20-.70)

(1) - Press fit in rod using 1100-3300 lb. (500-1500 kg.)

AA

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK SPECIFICATIONS TABLE

AA

Application In. (mm)

Cylinder Bore

Standard Diameter 3.5433-3.5442 (90.000-90.022)

Maximum Taper & Out-Of-Round0007 (.019)

Minimum Deck Height 8.66 (220.05)

Maximum Deck Warpage006 (.15)

AA

VALVES & VALVE SPRINGS SPECIFICATIONS

VALVES & VALVE SPRINGS SPECIFICATIONS TABLE

AA

Application Specification

Intake Valves

Face Angle 45°

Minimum Margin054" (1.38 mm)

Minimum Refinish Length 4.516" (114.72 mm)

Stem Diameter2350-.2356" (5.970-5.985 mm)

Exhaust Valves

Face Angle 45°

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Minimum Margin053" (1.35 mm)
Minimum Refinish Length 4.730" (120.14 mm)
Stem Diameter2348-.2354" (5.965-5.980 mm)
Valve Springs
Free Length 1.720" (43.68 mm)
Out-Of-Square060" (1.53 mm)

Pressure Lbs. @ In. (kg @ mm)

Valve Closed 47-48 @ 1.398 (21.4-21.7 @ 35.5)
AA

CYLINDER HEAD SPECIFICATIONS

CYLINDER HEAD SPECIFICATIONS TABLE

AA

Application Specification

Cylinder Head Height 5.707-5.711" (144.95-145.05 mm)
Maximum Refinish Removal006" (.16 mm)
Maximum Warpage004" (.10 mm)
Valve Seats
Seat Angle 45°
Seat Width047-.063" (1.2-1.6 mm)
Valve Guides
Valve Guide I.D.2366-.2374" (6.01-6.03 mm)
Valve Guide Installed
Height717-.740" (18.20-18.80 mm)
Valve Stem-To-Guide Oil Clearance
Intake0010-.0024" (.025-.060 mm)
Exhaust0012-.0026" (.030-.065 mm)
AA

CAMSHAFT SPECIFICATIONS

CAMSHAFT SPECIFICATIONS TABLE

AA

Application In. (mm)

End Play001-.006 (.03-.15)
Journal Diameter
No. 1 & No. 4 1.1787-1.1797 (29.940-29.965)
No. 2 & No. 3 1.1776-1.1785 (29.910-29.935)
Journal Runout001 (.03)
Lobe Height
Intake
Standard 1.5874 (40.320)
Minimum 1.5795 (40.120)
Exhaust
Standard 1.5873 (40.318)
Minimum 1.5794 (40.118)
Oil Clearance

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No. 1 & No. 40016-.0032 (.040-.081)
No. 2 & No. 30028-.0044 (.070-.111)
AA

END OF ARTICLE