

1999-2001 ENGINES

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 the eighth character of the Vehicle Identification Number (VIN) stamped on metal plate located on left side of dash panel. The VIN is also stamped into passenger side of engine compartment bulkhead.

ENGINE IDENTIFICATION CODE

Application	Code
2.0L DOHC	3

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

This engine is equipped with hydraulic lash adjusters. No adjustment is required.

TROUBLE SHOOTING

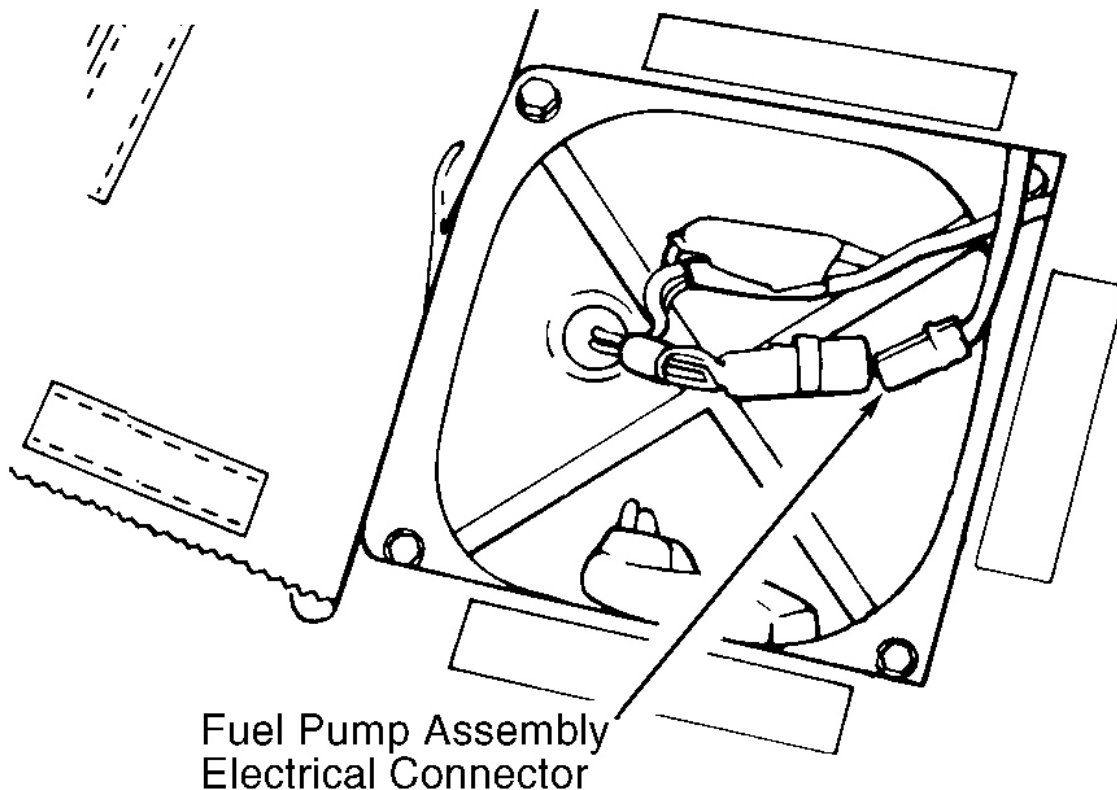
To trouble shoot engine mechanical components, see appropriate table in **TROUBLE SHOOTING** article in **GENERAL INFORMATION**.

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

To release fuel pressure, remove rear seat cushion and fuel pump access plate. Disconnect fuel pump connector. See **Fig. 1**. Start and run engine until it stalls. Turn ignition off. Once repairs have been completed, reconnect fuel pump connector and install access plate and rear seat cushion.



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Fig. 1: Locating Fuel Pump Electrical Connector
Courtesy of KIA MOTORS AMERICA, INC.

ENGINE

Removal & Installation

1. Release fuel pressure. See **FUEL PRESSURE RELEASE** . Remove windshield washer from hood. Remove hood. Disconnect battery cables. Remove battery cover, battery and battery tray. Remove air inlet duct and air cleaner assembly. On A/T models, remove accelerator cable and transmission control cable.
2. On all models, pull back throttle shaft, and disconnect accelerator cable. Remove resonance chamber mounting bolt, chamber bolt and air silencer. Remove IAC air hose, breather hose and vacuum line from air intake tube.
3. Disconnect MAF sensor connector. Loosen air inlet hose clamp from MAF sensor. Remove 3 bolts from air intake tube to throttle body. Remove air intake hose and air intake tube as an assembly.
4. Remove radiator cap. Loosen radiator drain plug, and drain engine coolant. Tighten radiator drain plug. Loosen and remove upper radiator hose clamps, and remove upper radiator hose. Remove 4 thermostated fan nuts.
5. Remove 5 cooling fan shroud bolts. Remove fan and fan shroud as an assembly. Loosen generator mounting bolts. Loosen generator drive belt by loosening adjusting bolt.
6. Remove fan pulley. Remove generator electrical connectors. Remove heater hoses from pipes.

7. Label and disconnect all necessary electrical connectors, wires, hoses and control cables for engine removal. Plug all fuel hoses to avoid leakage. Remove radiator.
8. Raise and support vehicle. Remove undercover mounting bolts and undercover. Loosen A/C idler pulley lock nut, and remove A/C drive belt by loosening adjusting bolt. Remove A/C idler pulley bracket mounting bolts and A/C idler pulley bracket.
9. Remove A/C compressor mounting bolts and A/C compressor. Position A/C compressor away from engine. Loosen power steering pump lock bolt and mounting bolt, and remove power steering drive belt. Remove power steering pump lock bolt and mounting bolt. Position power steering pump away from engine.
10. Remove intake manifold support bracket bolts and bracket. Remove starter bolts. Unbolt starter, and wire aside so there is no tension on wire harness. Remove converter inlet pipe flange lock nuts.
11. Remove front exhaust bracket bolt. On M/T models, remove exhaust bracket-to-clutch housing mounting bolts and bracket. On A/T models, remove converter housing mounting bolts and bracket. On M/T models, remove clutch housing-to-engine mounting bolts. On A/T models, remove converter housing-to-engine mounting bolts.
12. On all models, lower vehicle. On A/T models, remove 6 drive plate-to-torque converter bolts. On all models, support transmission, and connect engine hoist to engine. Remove left side and right side engine mounting bolts.
13. Lift engine up until free of frame, and move forward to clear transmission. Disconnect 3 remaining electrical connectors at back of engine. Check for any other electrical wiring still connected to engine assembly and disconnect, if necessary. Ensure engine is free of any other components. Remove engine from vehicle.

Installation

To install, reverse removal procedure. Tighten all bolts/nuts to specification. See **TORQUE SPECIFICATIONS**. Check fluid levels, and fill as necessary.

INTAKE MANIFOLD

Removal

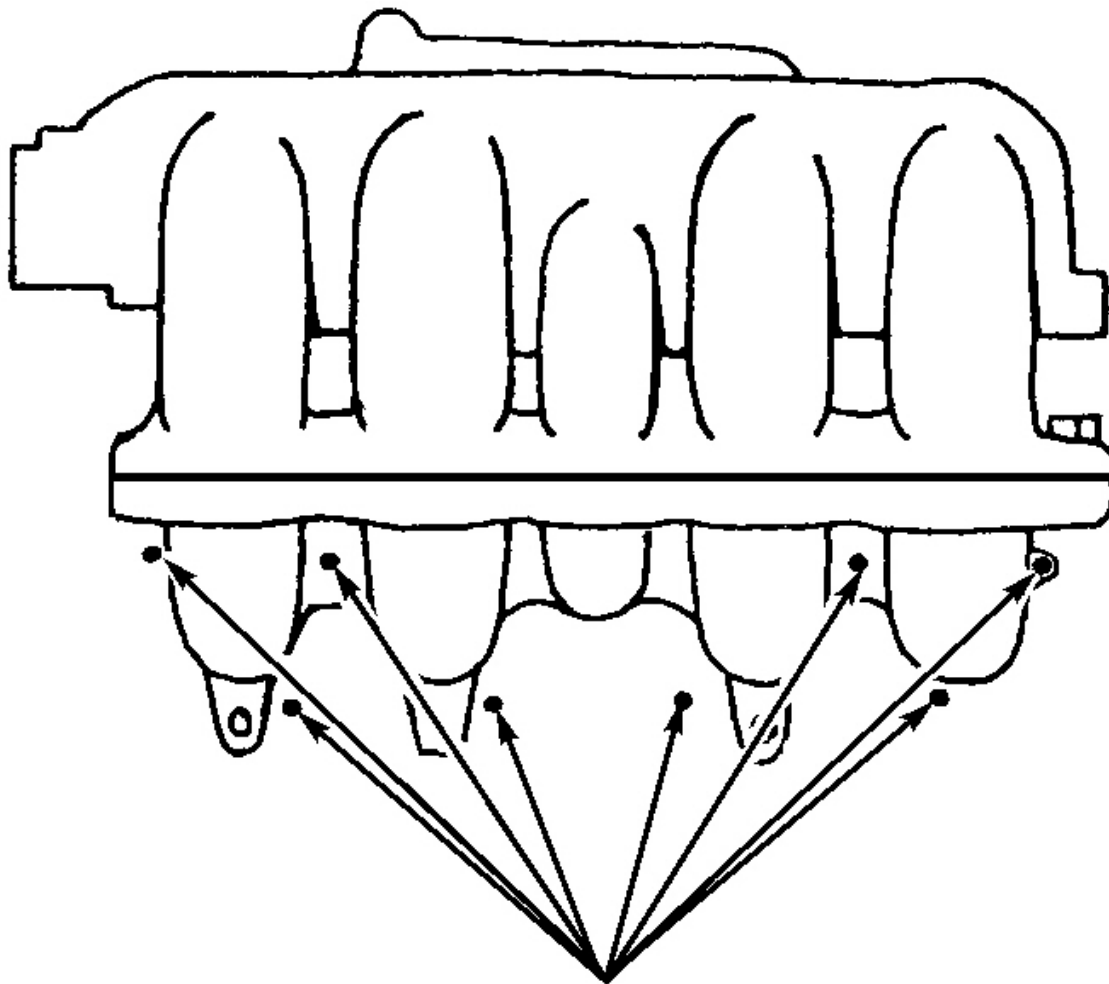
1. Release fuel system pressure. See **FUEL PRESSURE RELEASE**. Disconnect negative battery cable. Remove 2 accelerator cable bracket-to-cylinder head cover bolts. Remove air intake tube-to-cylinder cover bolts. Remove air intake tube-to-throttle body bolts. Loosen clamp from air intake hose to Mass Airflow (MAF) sensor.
2. Remove idler control valve hose, breather hose and vacuum line from air intake tube. Remove air intake tube and air intake hose as an assembly. Remove PCV hose from dynamic chamber. Remove radiator cap. Loosen radiator drain plug, and drain engine coolant. Tighten radiator drain plug.
3. Remove purge solenoid valve vacuum hose from dynamic chamber. Disconnect electrical connector from throttle position sensor. Disconnect electrical connection from idle air control valve. Remove heater hoses from pipes. Remove engine-to-body ground bolt at intake manifold assembly. Remove heater hoses from below throttle body.
4. Remove brake booster vacuum line. Remove vacuum hose from fuel pressure regulator. Remove dynamic chamber support brackets and bolts. Disconnect electrical connectors from fuel injectors by pushing on

wire clips. Release fuel system pressure. See **FUEL PRESSURE RELEASE**.

5. Disconnect fuel line from pressure regulator. Disconnect fuel return line from fuel rail assembly. Remove intake manifold support brackets (side and rear).
6. Using wrench, remove oil filter. Remove bolts and nuts from intake manifold. Remove by-pass pipe from heater hose. Remove intake manifold and gasket.

Installation

Clean gasket mating surfaces. Install intake manifold with NEW gasket. Install by-pass pipe. Install intake manifold bolts and nut, and tighten to specification. See **Fig. 2**. To complete installation, reverse removal procedure. Tighten all bolts and nuts to specification. See **TORQUE SPECIFICATIONS**.



**Intake Manifold
Mounting Bolts**

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Fig. 2: Intake Manifold Mounting Bolt Locations
Courtesy of KIA MOTORS AMERICA, INC.

EXHAUST MANIFOLD

Removal

Disconnect negative battery cable. Loosen air intake hose clamps, and remove air intake hose. Remove exhaust manifold heat shield. Remove 5 converter inlet pipe flange lock nuts. Remove exhaust manifold bolts. Remove exhaust manifold and gasket.

Installation

Ensure gasket mating surfaces are clean and flat. Install NEW gasket to cylinder head. Install manifold. Tighten manifold bolts and nuts evenly to specification, starting from center bolt and alternating outward. Install NEW gasket, and attach converter inlet pipe. To complete installation, reverse removal procedure. See **TORQUE SPECIFICATIONS**.

CYLINDER HEAD

Removal

1. Disconnect negative battery cable. Remove brake booster vacuum hose from dynamic chamber. Remove fuel line from pressure regulator and return line located at rear of dynamic chamber.
2. Remove engine-to-body ground wire from intake manifold and harness bracket. Remove radiator cap. Remove radiator drain plug, and drain engine coolant. Tighten radiator plug.
3. Remove purge solenoid valve vacuum hose from dynamic chamber. Loosen clamps, and disconnect upper radiator hose. Remove intake manifold support bracket bolts and bracket. Remove converter inlet pipe flange lock nuts. Remove timing belt. See **TIMING BELT**.
4. Remove cylinder head cover. Remove cylinder head bolts in sequence. See **Fig. 3**. Disconnect wire harness connectors on back of cylinder head. Lift cylinder head off cylinder block with intake and exhaust manifolds attached, and remove cylinder head assembly from vehicle.

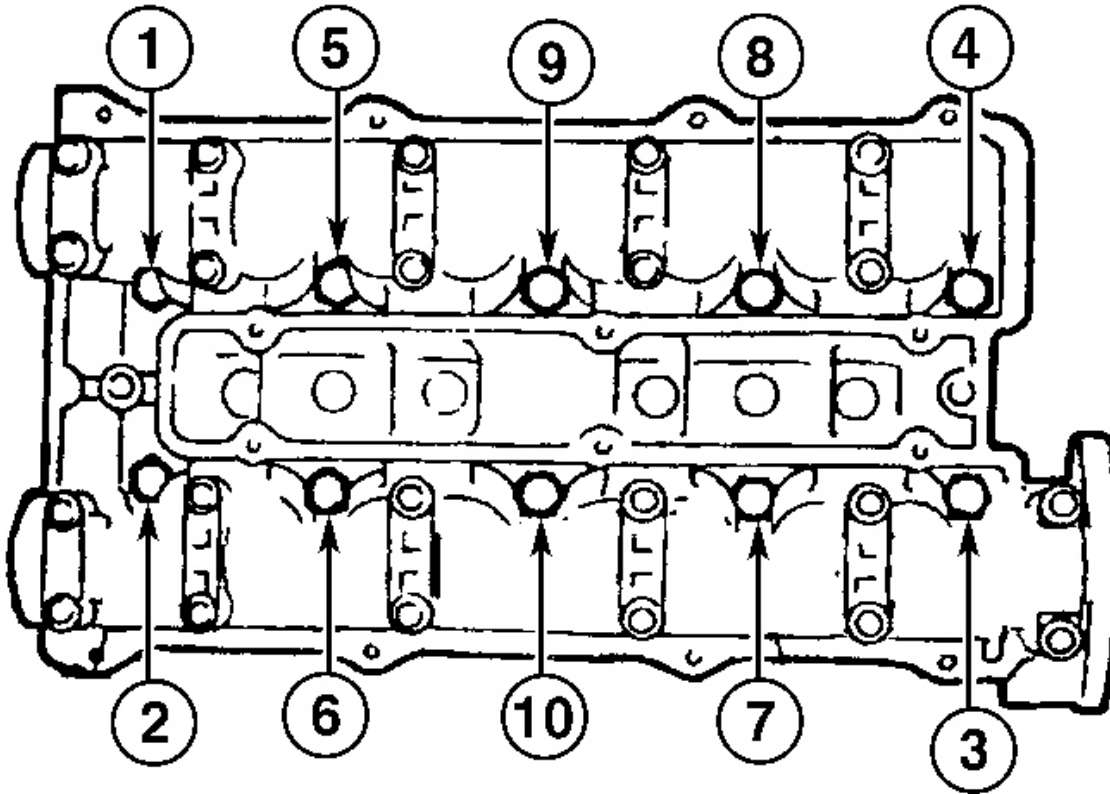
Inspection

Carefully clean carbon and gasket material from all mating surfaces. Clean threads of cylinder head bolts. Use tap to clean threads in engine block. Check cylinder head for warpage and cracks. Resurface or replace head if it is not within specification. Check valve train components. Replace or resurface components if not within specification. See **CYLINDER HEAD** and **VALVES & VALVE SPRINGS** tables under ENGINE SPECIFICATIONS.

Installation

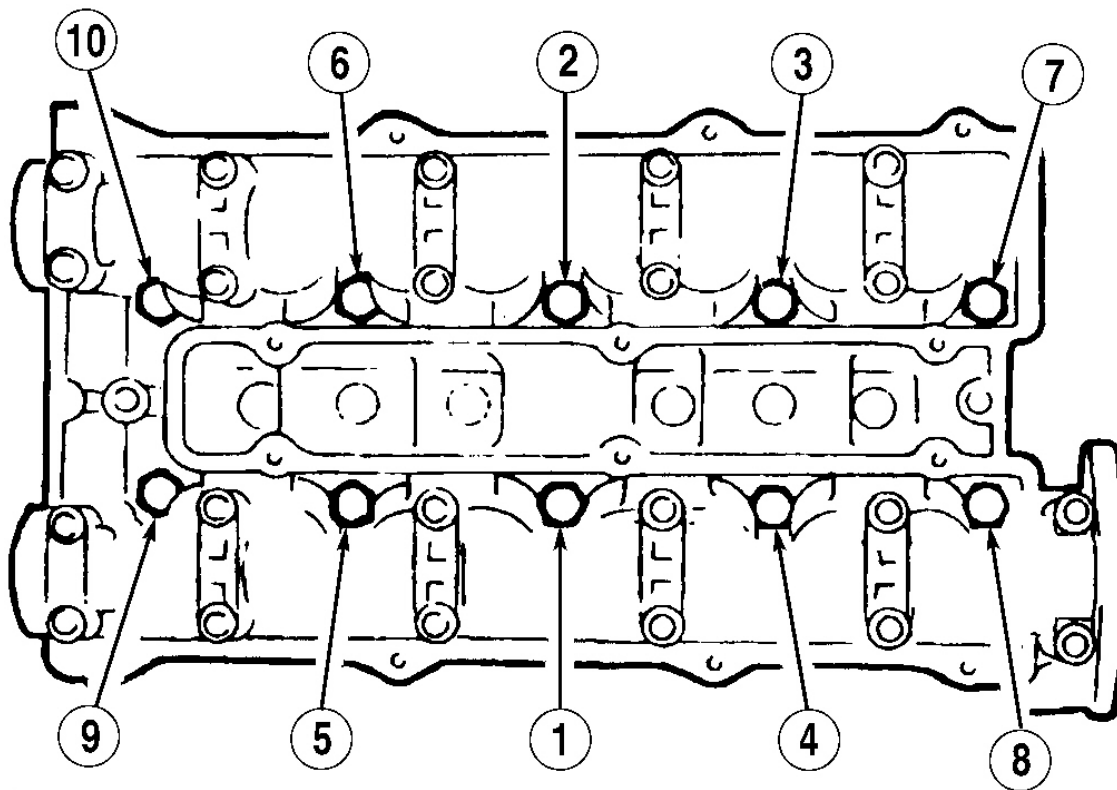
1. Install cylinder head gasket. Place cylinder head with manifolds installed over cylinder block, and attach 3 wire harness connectors to back of head. Install cylinder head assembly and cylinder head bolts. Using 3 equal steps, tighten cylinder head bolts in specified sequence. See **Fig. 4**. See **TORQUE SPECIFICATIONS**.
2. Install timing belt. See **TIMING BELT**. Install converter inlet pipe flange lock nuts, and tighten to specification. See **TORQUE SPECIFICATIONS**.

3. Install upper radiator hose, and tighten clamps. Fill radiator, and install cap. Connect vacuum hose from intake manifold to charcoal canister. Connect purge solenoid vacuum hose to dynamic chamber. Install engine-to-body ground wire and harness bracket to intake manifold.
4. Install fuel line to pressure regulator and return line to fuel rail. Install brake booster vacuum hose to dynamic chamber. Reconnect battery cable. Tighten bolts and nuts to specification. See **TORQUE SPECIFICATIONS**.



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Fig. 3: Cylinder Head Bolt Removal Sequence
Courtesy of KIA MOTORS AMERICA, INC.



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Fig. 4: Cylinder Head Bolt Tightening Sequence
 Courtesy of KIA MOTORS AMERICA, INC.

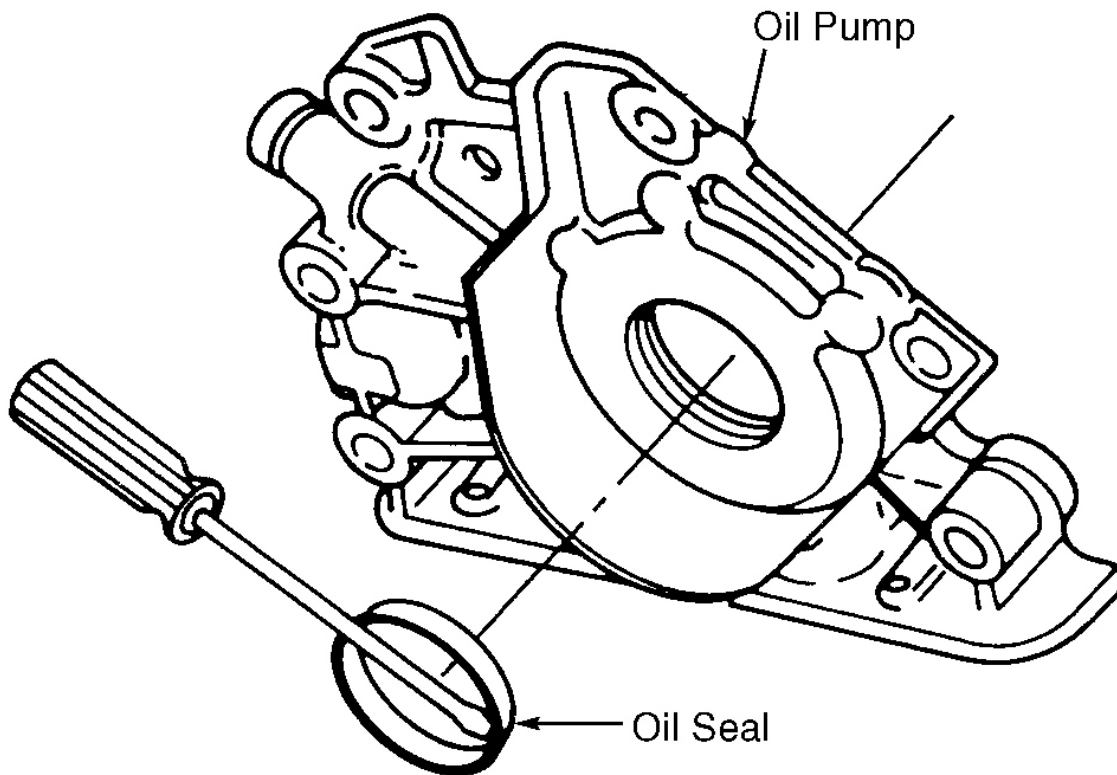
FRONT CRANKSHAFT SEAL

Removal

Disconnect negative battery cable. Remove engine undercover. Remove drive belts and crankshaft pulley. Remove timing belt covers and timing belt. See **TIMING BELT**. Remove crankshaft sprocket pulley lock bolt and pulley. If necessary, remove crankshaft sprocket pulley using steering wheel puller. Remove keyway. Using seal remover, pry oil seal from oil pump housing. See **Fig. 5**.

Installation

1. Apply light coat of oil to lip of seal, and push seal over crankshaft. 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 by tapping lightly using brass hammer.
2. Install keyway with tapered side toward oil pump body. Install crankshaft sprocket lock bolt and tighten crankshaft pulley lock bolt to specification. See **TORQUE SPECIFICATIONS**. Install timing belt. See **TIMING BELT**. Install timing belt covers, pulleys and drive belts. Reconnect negative battery cable. Ensure timing is correct.



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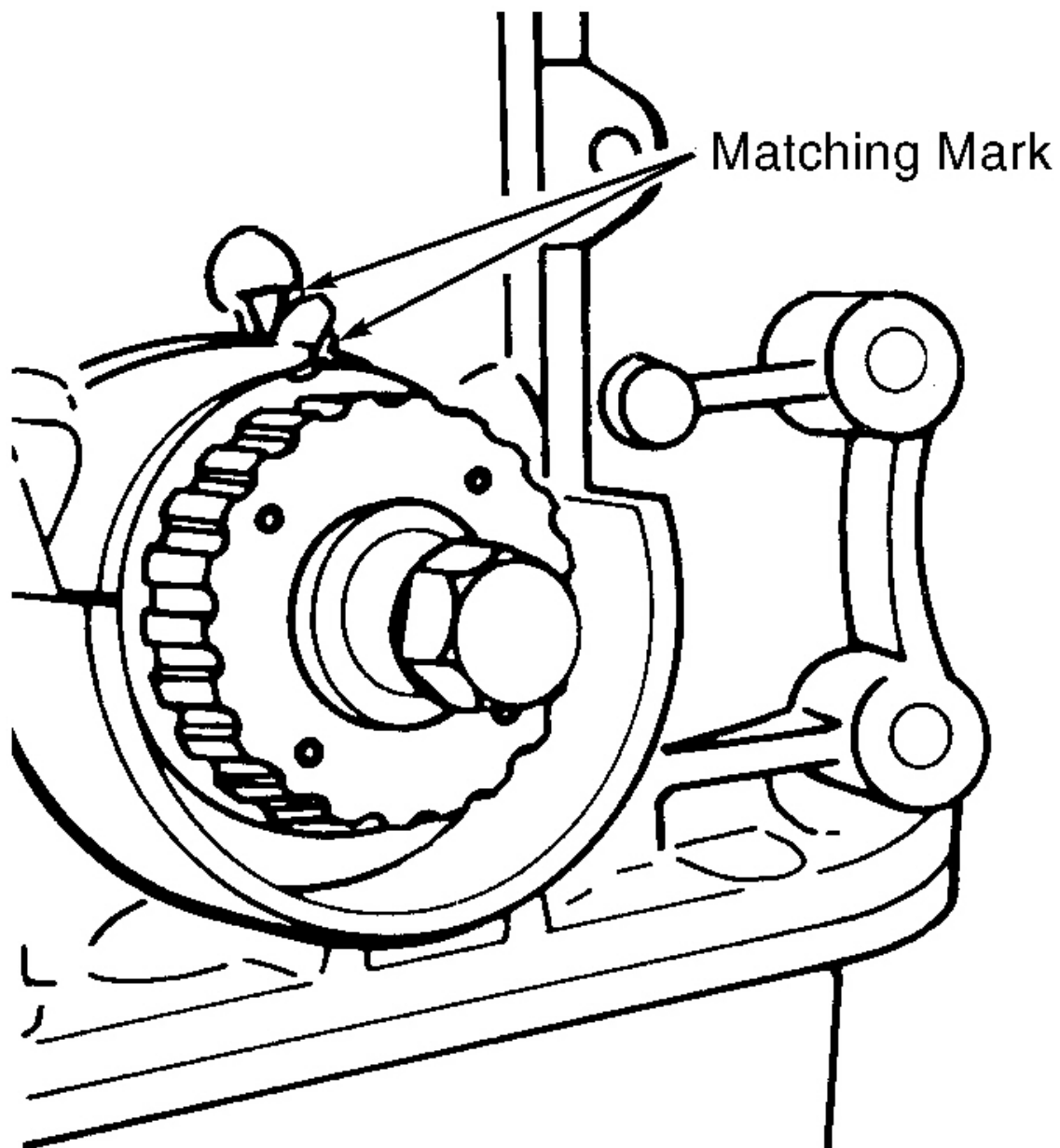
Fig. 5: Removing Front Oil Seal

Courtesy of KIA MOTORS AMERICA, INC.

TIMING BELT

Removal

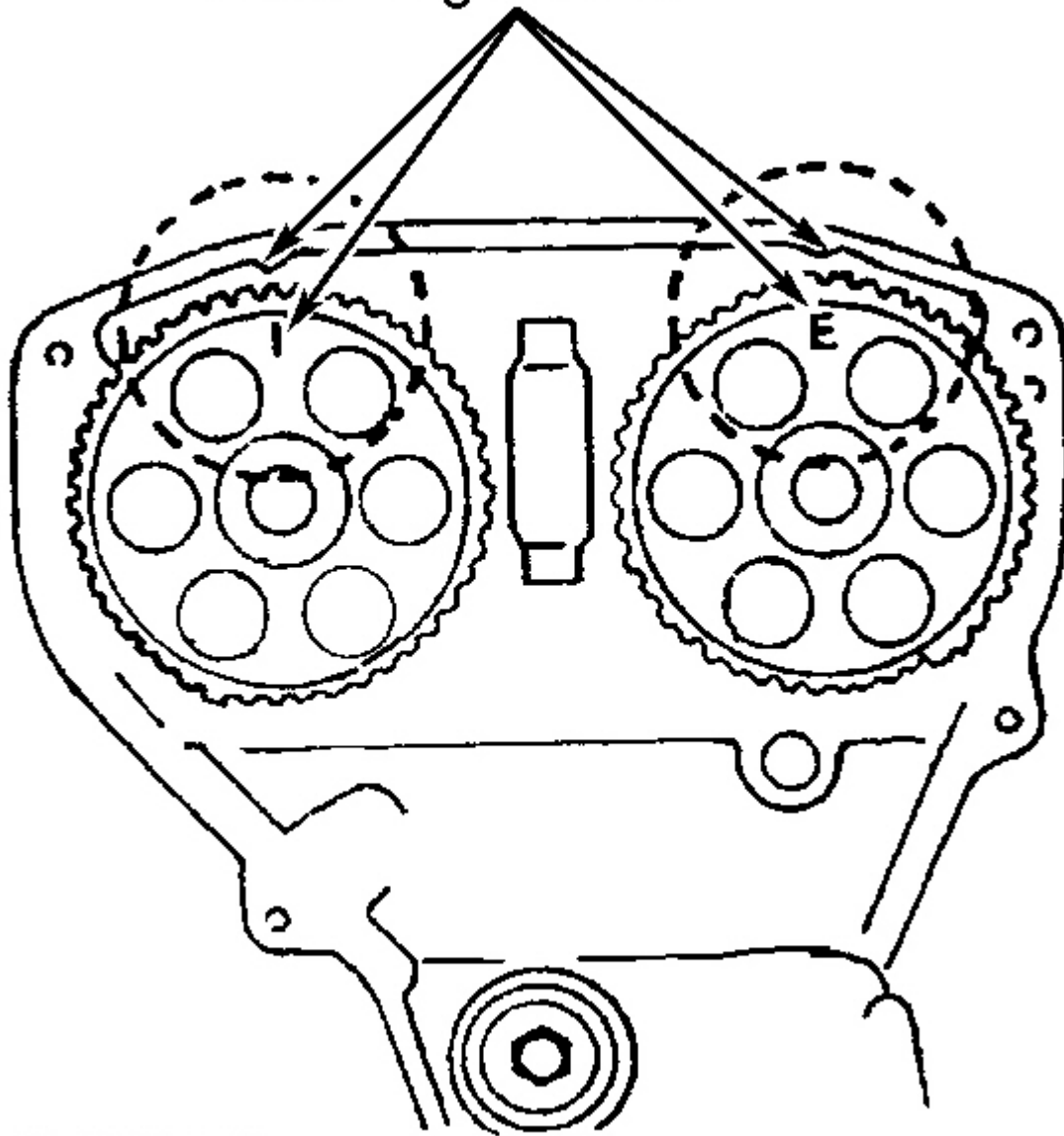
1. Disconnect negative battery cable. Remove air duct mounting bolts at radiator. Loosen air duct clamp at intake housing. Remove hose from resonance chamber. Remove air inlet duct. Remove fan shroud mounting bolts. Remove thermo-modulated nuts. Remove fan and fan shroud together.
2. Loosen generator mounting bolts. Loosen generator drive belt from generator by loosening adjusting bolt, and remove drive belt. Remove fan pulley.
3. Remove splash guard mounting bolts and splash guard. Loosen A/C idler pulley nut. Remove A/C drive belt by loosening adjusting bolt. Loosen power steering pump lock bolt and mounting bolt. Remove power steering belt. Remove bolts and upper timing belt cover. Remove bolts and lower timing belt cover.
4. Ensure camshaft sprocket(s) and crankshaft sprocket timing marks align. See **Fig. 6**. Camshaft sprocket timing marks are an "I" on intake camshaft sprocket, and an "E" on exhaust camshaft sprocket. See **Fig. 7**.
5. If timing belt is to be reused, mark direction of timing belt rotation on belt before removal. Loosen timing belt tensioner lock bolt. Move tensioner away from belt with spring fully extended. Temporarily tighten tensioner lock bolt while tension is released from timing belt. Remove timing belt. See **Fig. 8**.



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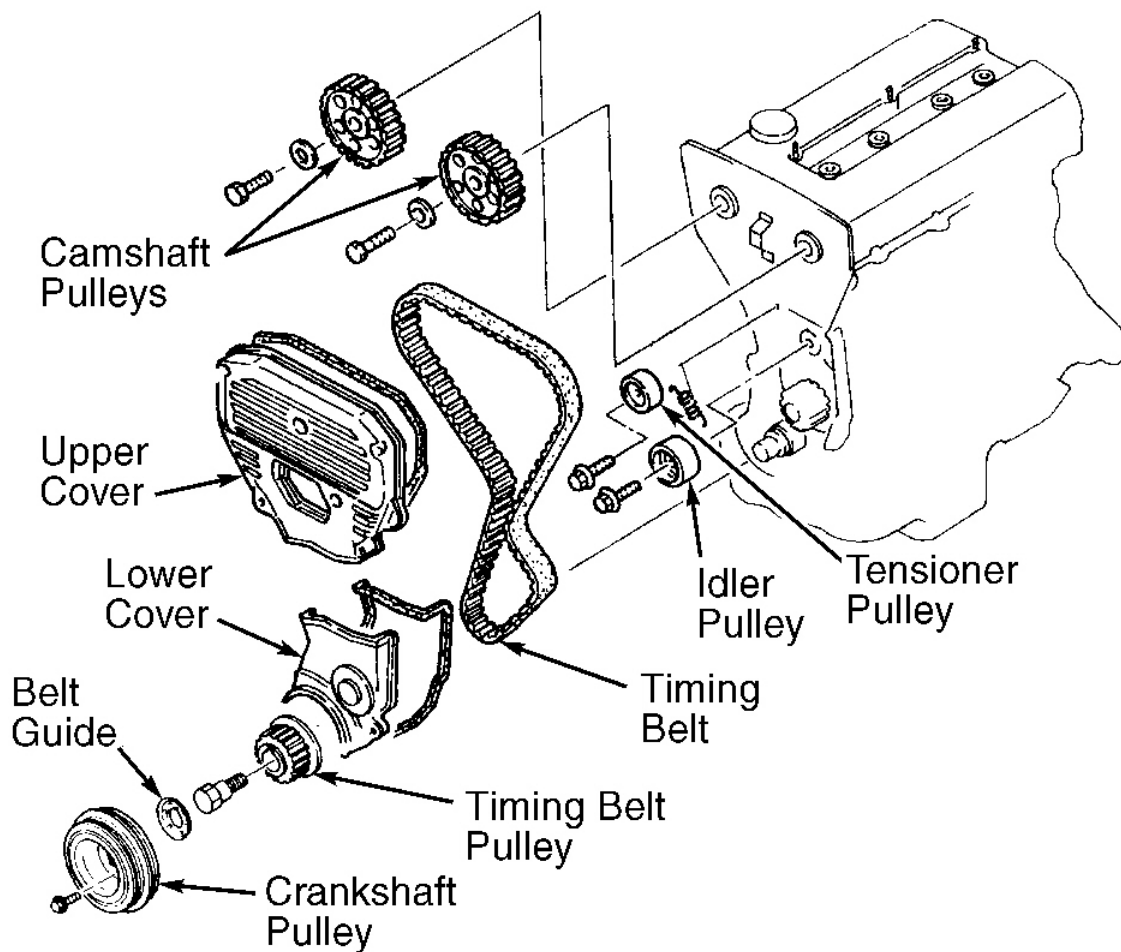
Fig. 6: Aligning Crankshaft Timing Marks
Courtesy of KIA MOTORS AMERICA, INC.

Matching Marks



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Fig. 7: Aligning Camshaft Timing Marks
Courtesy of KIA MOTORS AMERICA, INC.



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Fig. 8: Exploded View Timing Belt & Components
 Courtesy of KIA MOTORS AMERICA, INC.

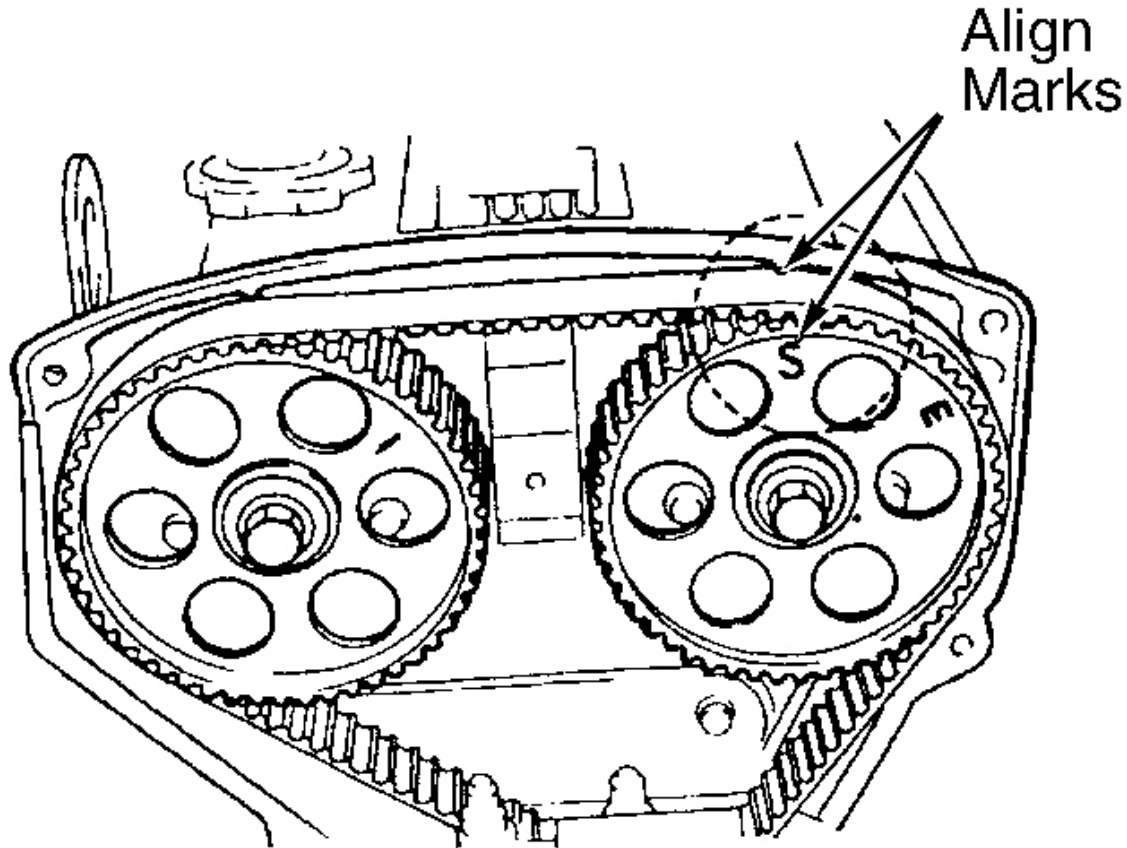
Inspection

Check timing belt for cracks, peeling, abrasion marks or other damage. Check tensioner bearing for looseness or roughness of rotation. Inspect tensioner spring for defects such as warping and rust. Replace parts as necessary.

Installation

1. Ensure camshaft and crankshaft timing marks are still aligned. Install belt around crankshaft sprocket. Keep belt pulled tight on tension side of belt, and route belt around camshaft sprocket(s). Ensure camshaft sprockets do not move while installing timing belt.
2. Loosen timing belt tensioner lock bolt, and allow spring to apply tension on belt. . Rotate crankshaft clockwise 2 complete revolutions. Ensure timing marks are aligned. If timing marks are not aligned, remove belt, realign all timing marks, and repeat procedure. Turn crankshaft to align "S" mark of exhaust camshaft pulley with seal plate mating mark. See **Fig. 9**
3. Check timing belt deflection. Check timing belt deflection with 22 lbs. (10 kg) of pressure applied to belt. Deflection should be .30-.33" (7.6-8.4 mm). If timing belt deflection is not within specification, repeat

steps 2 and 3 and/or replace timing belt tensioner spring. If timing belt deflection is within specification, reverse removal procedure to complete installation.



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Fig. 9: Aligning Camshaft "S" Timing Marks
Courtesy of KIA MOTORS AMERICA, INC.

HYDRAULIC LASH ADJUSTER

Removal

Disconnect negative battery cable. Remove valve cover. Remove timing belt from camshaft sprockets. See **TIMING BELT**. Remove camshaft bearing cap bolts evenly in 2-3 steps. See **Fig. 10**. Remove camshafts from cylinder head. Mark all parts for installation reference. Remove Hydraulic Lash Adjuster (HLA) from bores in cylinder head. Inspect face of HLA for wear or damage, replace as necessary. Remove "O" rings. DO NOT disassemble HLA.

Installation

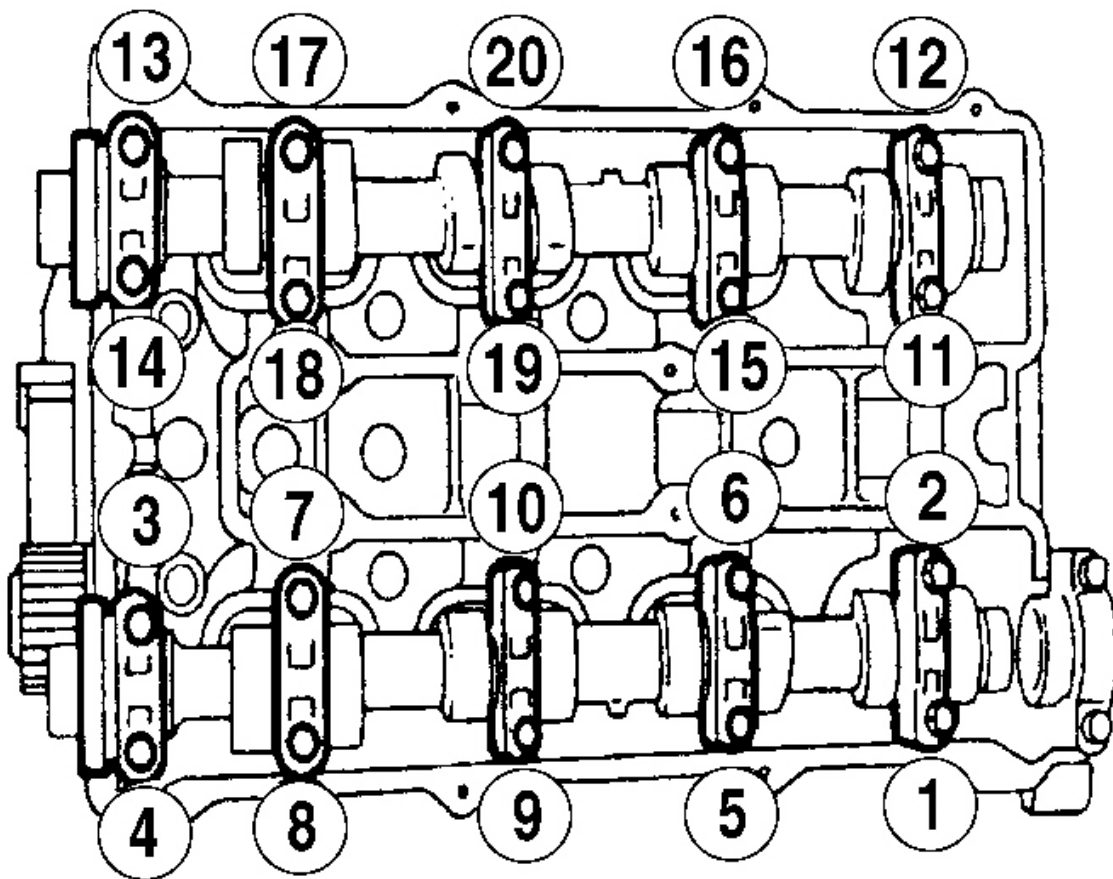
Install NEW "O" rings. Pour clean engine oil into bores of cylinder head. Apply clean engine oil to HLA. Install HLA into bores of cylinder head. DO NOT damage "O" ring oil seal during installation. HLA should move freely in cylinder head bores. Install camshafts to cylinder head. Tighten camshaft cap bolts to specification in

sequence. See **Fig. 11** . See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.

CAMSHAFT

Removal

Disconnect negative battery cable. Remove 5 bolts and upper timing belt cover. Remove timing belt. See **TIMING BELT** . Remove cylinder cover. Remove camshaft pulleys. Remove camshaft sprockets. Remove camshaft cap bolts in sequence. See **Fig. 10** . Remove camshafts from cylinder head. Mark all parts for installation reference.



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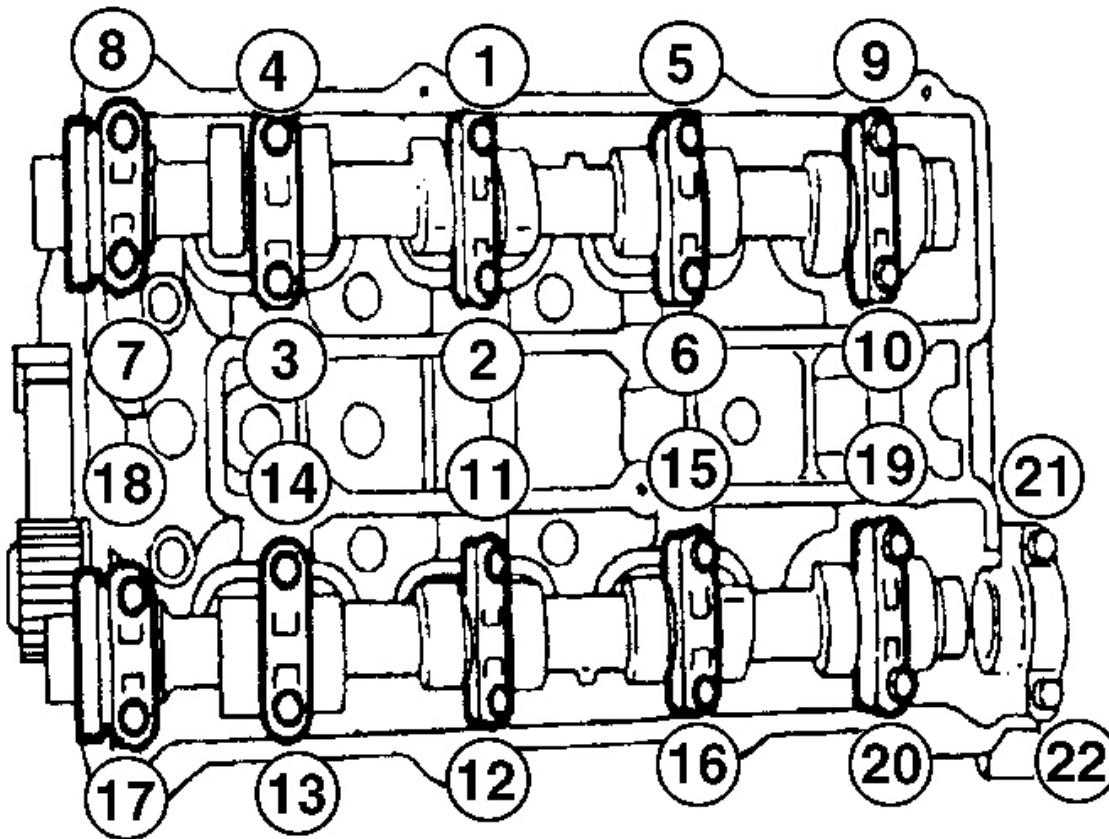
Fig. 10: Camshaft Bearing Cap Bolt Removal Sequence
Courtesy of KIA MOTORS AMERICA, INC.

Inspection

Check camshaft for wear or damage, replace if necessary. Check camshaft runout, lobe height and camshaft oil clearance. Repair or replace as necessary. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.

Installation

Position camshafts in cylinder head. Apply a liberal amount of clean engine oil to journals, bearings and camshaft oil seal. Place camshaft in position with dowel pin facing straight up. Apply sealant to both front camshaft cap surfaces and camshaft position sensor mounting cap. Position camshaft caps according to cap number, with arrows pointing toward front of cylinder head. Install camshaft caps. Tighten camshaft cap bolts to specification in 2 or 3 steps in sequence. See **Fig. 11** . See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.



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Fig. 11: Camshaft Bearing Cap Bolt Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

CRANKSHAFT REAR OIL SEAL

NOTE: Rear crankshaft oil seal can be removed without removing oil pan or crankshaft.

Removal

Disconnect negative battery cable. Raise and support vehicle. Remove transmission. For M/T, see appropriate article in CLUTCHES. For A/T, see AUTOMATIC TRANSMISSION REMOVAL & INSTALLATION article in TRANSMISSION SERVICING. Mark all parts for installation reference. Remove clutch assembly and flywheel. Remove rear cover. Using a seal remover, remove oil seal from rear of cylinder block.

Installation

To install, lubricate seal lip with light coat of engine oil. Tap seal into oil seal holder until it is flush with edge of rear cover. Clean old sealant from crankshaft bolts and bolt holes. Apply new sealant to crankshaft bolts. Install flywheel and clutch assembly. To complete installation, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

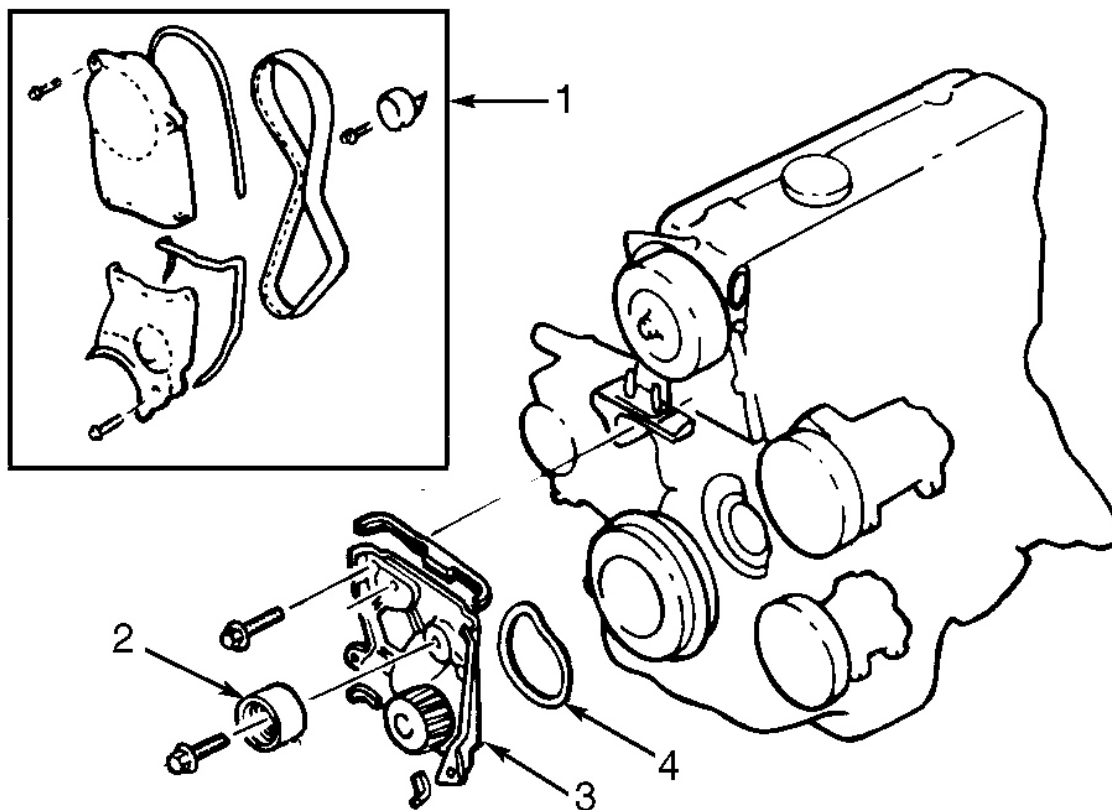
WATER PUMP

Removal

1. Remove undercover. Remove radiator cap. Drain cooling system. Remove upper and lower radiator hoses. Remove coolant reservoir tank hose. Remove air inlet duct. Remove fan and fan shroud together. Loosen generator mounting bolt and adjusting bolt. Remove drive belt.
2. Remove fan pulley. Remove fan bracket assembly. Remove upper and lower timing belt covers. Turn crankshaft so No. 1 cylinder is at TDC. Loosen tensioner lock bolt, and pry tensioner away. Retighten tensioner bolt. If reusing timing belt, mark belt direction of rotation for installation reference. Remove timing belt, and place aside. See **TIMING BELT**. Loosen tensioner bolt, and release tensioner. Remove water pump. **Fig. 12**. Remove 2 tensioners from water pump. Remove gasket and clean gasket mating surface of engine block.

Installation

Ensure all gasket mating surfaces are clean. Install NEW water pump gasket on water pump. Install water pump. To complete installation, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**. Check ignition timing and adjust if necessary.



1. Timing Belt Covers,
Gaskets & Timing Belt
2. Idler Pulley

3. Coolant Pump
4. Gasket

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Fig. 12: Exploded View Of Water Pump & Related Components
Courtesy of KIA MOTORS AMERICA, INC.

OIL PAN & OIL BAFFLE

Removal

1. Disconnect negative battery cable. Remove top 2 bolts on intake manifold bracket. Raise and support vehicle. Drain engine oil, and reinstall drain plug. Remove engine and transmission splash shields. On 4WD models, support front axle housing. Remove front axle housing mounting bolts, and left bushing from axle housing mount. Carefully lower front axle housing.
2. On 2WD models, remove front left bushing from axle housing mount. Carefully lower front axle housing. On all models, remove gusset plate mounting bolts from one side of motor, and remove gusset plate. Remove gusset plate mounting bolts from other side of motor, and remove other gusset plate.
3. Remove transmission undercover bolts, and remove engine undercover. Remove oil pan mounting bolts. Separate oil pan from oil baffle and remove oil pan. Remove oil pan. Remove oil strainer assembly. Remove baffle bolt, and remove oil baffle.

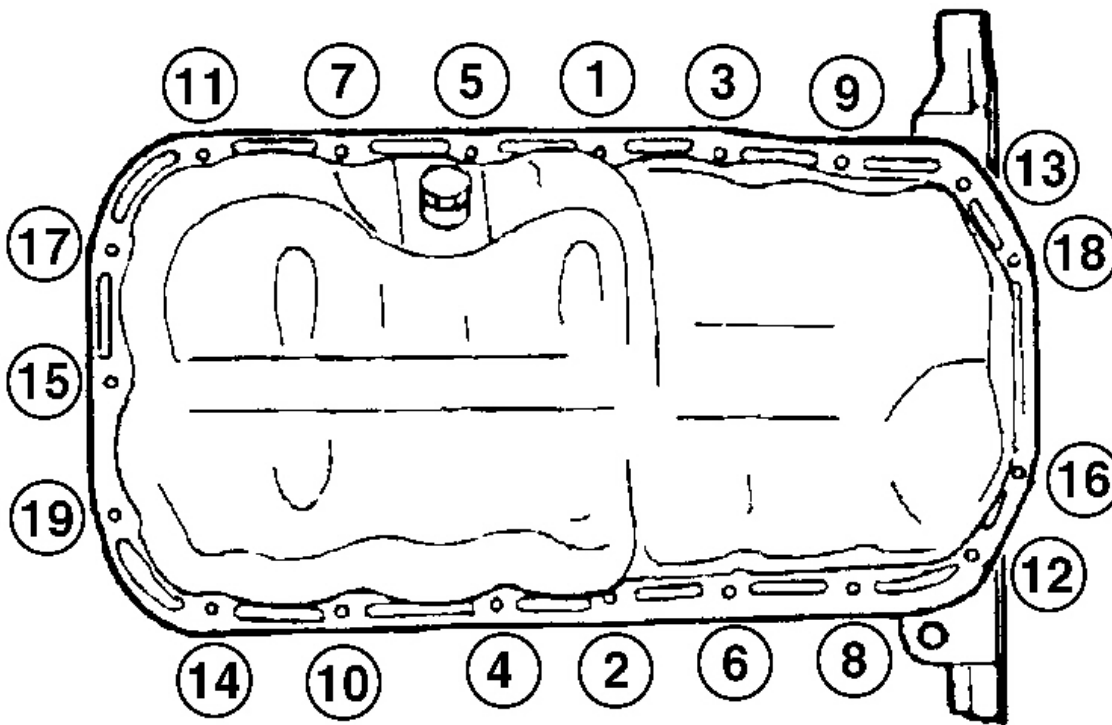
NOTE: DO NOT bend oil pan or oil baffle while separating, removing or cleaning components.

Inspection

Remove oil, dirt and sealant from oil pan mounting bolts, oil pan and oil baffle. Inspect oil pan for cracks, deformation and/or damaged drain plug threads. Check oil baffle for damage or cracks. Repair or replace as necessary.

Installation

Apply a continuous bead of silicone sealant along inside of bolt holes of oil baffle and oil pan. Install oil baffle. Install oil baffle mounting bolt. Install oil strainer assembly. Install oil pan. Install oil pan mounting bolts in sequence. See **Fig. 13** . Tighten bolts to specification. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.



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Fig. 13: Oil Pan Bolt Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

OVERHAUL

CYLINDER HEAD

Cylinder Head

Ensure all mating surfaces are clean. Check cylinder head for warpage. Resurface cylinder head if warpage exceeds specification. Check manifold contact surfaces for warpage. Resurface manifold surfaces or replace cylinder head if warpage exceeds specification. Check cylinder head height. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. If measurements are not as specified, replace cylinder head.

Valve Springs

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

Valves

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

NOTE: Intake and exhaust valve guides come in different shapes and lengths.

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. To replace valve guide, completely disassemble cylinder head. See ENGINE OVERHAUL PROCEDURES article in GENERAL INFORMATION. Heat cylinder head to 194°F (90°C). Working from combustion chamber side of cylinder head, install Valve Guide Remover (OK130-120-006) into valve guide. Drive valve guide out of cylinder head.
3. If necessary, install new circlip on guide. Using proper components of Valve Guide Installer (OK993-120-AAO), adjust installer guide depth to specification using depth micrometer or caliper.
4. Insert guide into pre-adjusted installer. Drive guide into heated cylinder head from camshaft side until guide circlip and/or installer contact cylinder head. Ensure valve guide installed height is within specification. If installed height is not within specification, adjust or replace valve guide or cylinder head as necessary. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.

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. Measure seat contact width on valve, and note that seat contact position should be in center of valve face, and 360 degrees around 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.

Valve Seat Correction Angles

1. Measure seat contact width on valve. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Ensure valve/seat contact position is at center of valve face. If width and position are not within specifications, cut seats as follows.
2. If seat contact position is too high, correct it using 60-degree stone. Finish angle using 45-degree stone

until contact width is corrected.

3. If seat contact position is too low, correct using 35-degree stone (intake) or 15-degree (exhaust). Finish angle using 45-degree stone until contact width is corrected. Seat valve to valve seat using lapping compound.

Valve Stem Installed Height

1. After servicing valves, valve seats and valve guides, measure valve stem installed height. See **VALVE INSTALLED HEIGHT** table. If installed valve stem height is within standard specification, no adjustment is necessary.
2. If installed valve height exceeds standard specification but does not exceed service limit specification, install adjusting shim on spring seat to bring installed height back within standard specification.
3. If valve stem installed height exceeds specification, replace valve. If valve stem installed height still exceeds limit, replace cylinder head. See **VALVE INSTALLED HEIGHT** table.

VALVE INSTALLED HEIGHT

Application	In. (mm)
Intake	
Standard	(1) 1.432-1.467 (36.37-37.27)
Service Limit	(2) 1.495 (37.97)
Exhaust	
Standard	(1) 1.431-1.466 (36.36-37.26)
Service Limit	(2) 1.494 (37.96)
(1) If installed height exceeds standard specification but is less than service limit, adjust with washer on spring seat area of cylinder head.	
(2) If installed height exceeds service limit, replace cylinder head.	

CYLINDER BLOCK

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. Ensure all rods, pistons, and caps are marked for installation reference before removal.
2. Before removing rod from crankshaft, check and record rod bearing oil clearance. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.
3. To install, ensure parts are matched to cylinder. Ensure piston, rod, rings and bearings are properly fitted and in appropriate positions. Install piston and rod assembly into block.

Piston Pin Replacement

1. Match mark piston pin and rod piston for reassembly reference. Using arbor press and piston pin removal/installation set, press piston pin through rod and out of piston.
2. Check piston-to-pin clearance, and rod-to-pin interference fit. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS. Ensure piston mark and rod identification mark are in proper position. Press pin into piston and rod until pin is centered. Piston should pivot freely.

Fitting Pistons

1. Ensure pistons are not scored or damaged. Measure piston diameter on piston skirt at .709" (18.01 mm) below oil ring land. 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, rebore cylinders to fit NEW oversize pistons.
3. Using NEW piston ring, measure piston ring side clearance around entire piston circumference. If clearance is not within specification, replace piston. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.

Piston Rings

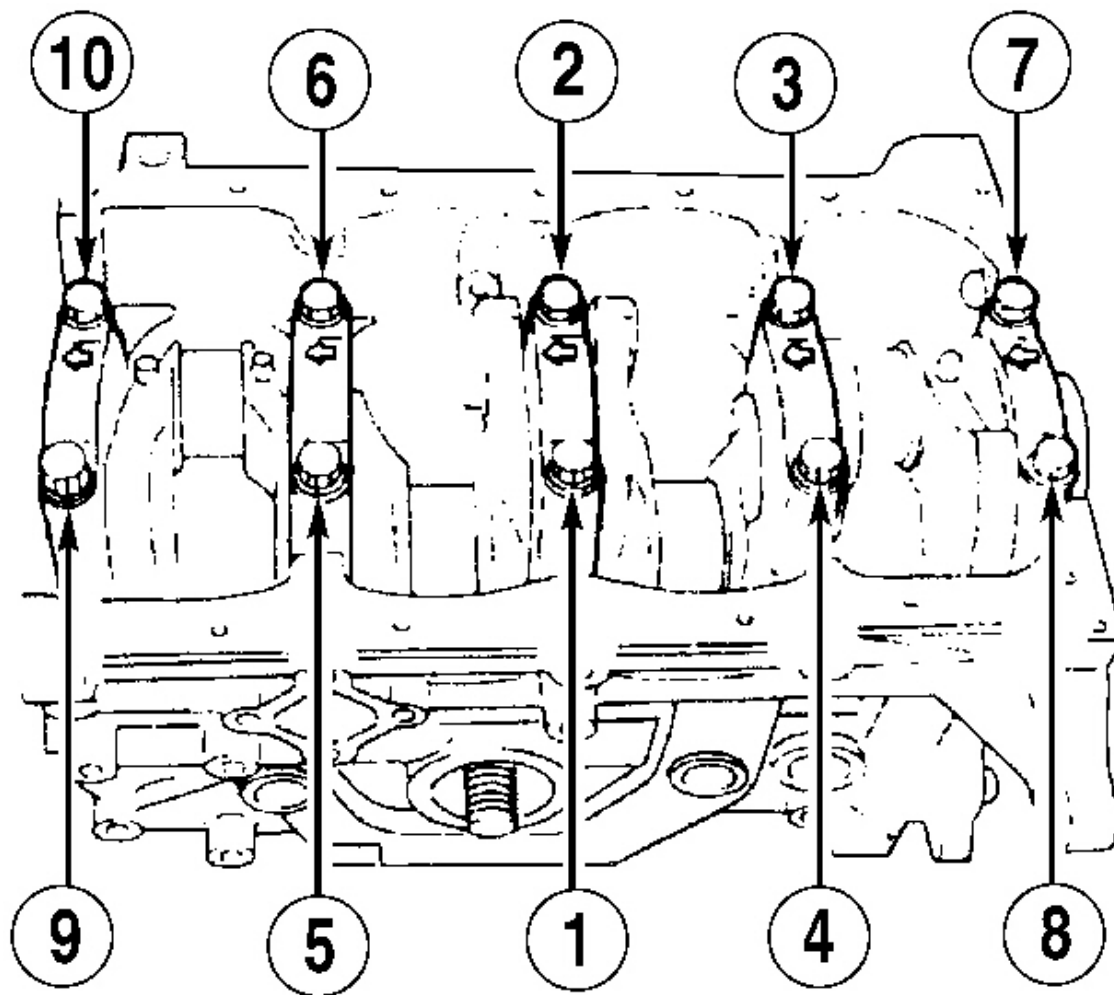
Insert NEW piston ring into cylinder, and measure ring end gap. Grind ring ends to expand ring gap to specification or replace piston ring if ring end gap exceeds specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.

Connecting Rod Bearings

Check crankshaft connecting rod journals for wear, out-of-round, taper and undersize. Machine or replace crankshaft, connecting rod and/or bearings as necessary. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.

Crankshaft & Main Bearings

1. Before removing main caps, measure and record crankshaft end play. Using Plastigage, measure and record main bearing oil clearance. DO NOT rotate crankshaft when measuring oil clearances.
2. Remove crankshaft from engine. Measure and record each main journal diameter in 2 places. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS. Machine or replace crankshaft as necessary. Main bearing upper halves are grooved. Check bearings for wear, replace if necessary.
3. Main bearing caps are marked for installation in original positions. Tighten bearing cap bolts in sequence and to specification. See **TORQUE SPECIFICATIONS** . See **Fig. 14** .



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Fig. 14: Main Bearing Cap Bolt Tightening Sequence
 Courtesy of KIA MOTORS AMERICA, INC.

Thrust Bearings

Check crankshaft end play with crankshaft bearings and caps installed, but without connecting rods attached to crankshaft. Replace thrust bearing if end play is not within specification. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS. Ensure thrust bearings are installed with oil groove facing crankshaft. Oversize thrust bearings are available.

Cylinder Block

Check cylinder bore out-of-round, taper, 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.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Oil pressure is provided by a rotor-type pump. Driven by the crankshaft, pump draws oil from oil pan through oil strainer. From oil pump, oil is sent through oil filter then to cylinder block and up to cylinder head. Oil drains back to oil pan. See **Fig. 15** .

Crankcase Capacity

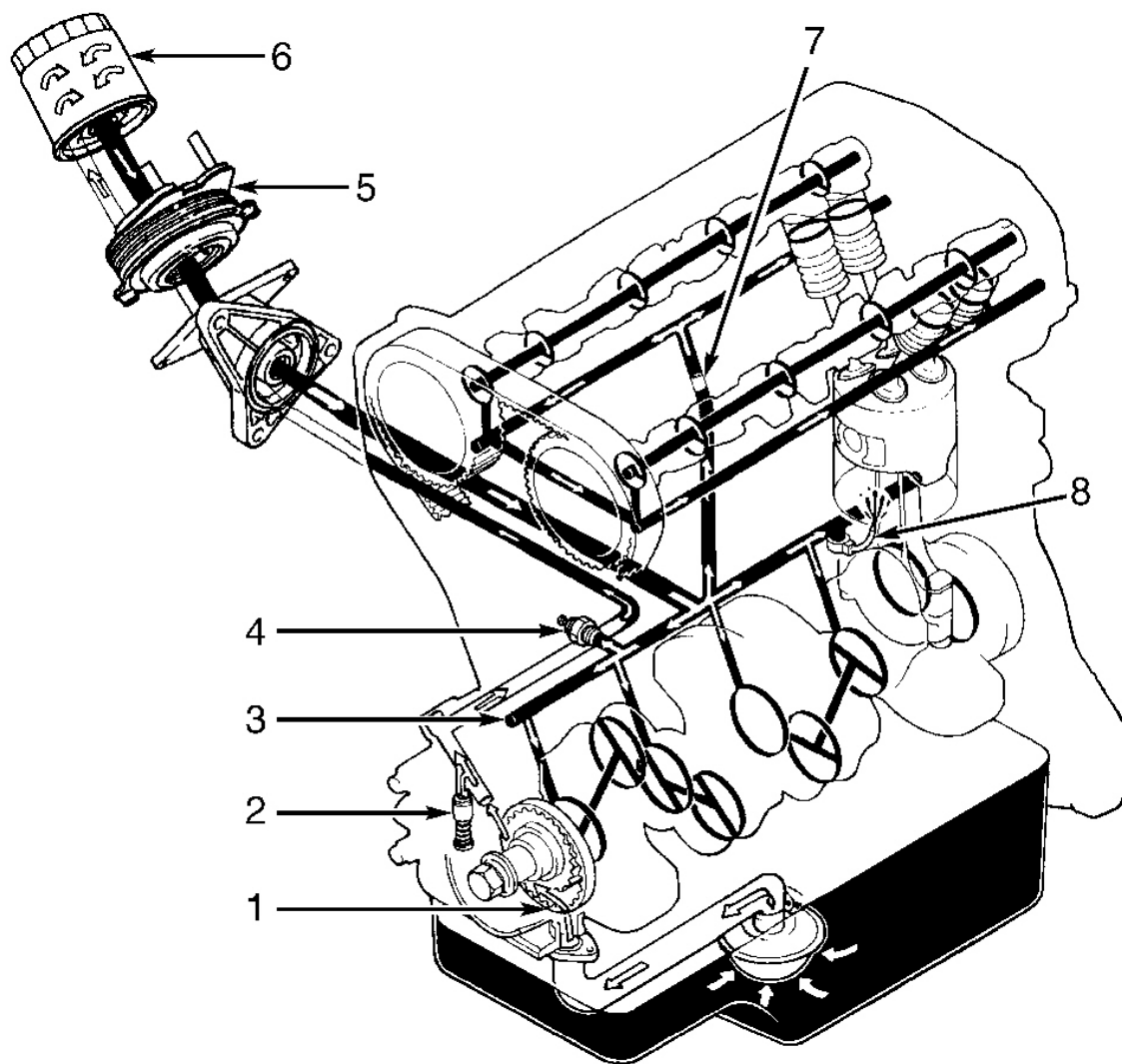
Oil pan capacity is 4.4 qts. (4.16L). Oil filter capacity is .21 qts. (.20L).

Oil Pressure

With engine at operating temperature, oil pressure should be 43-57 psi (3.0-4.0 kg/cm²) at 3000 RPM.

Oil Pressure Relief Valve

Pressure relief valve is located in oil pump body and is not adjustable.



- | | |
|-----------------------------|-----------------------|
| 1. Oil Pump | 5. Oil Cooler |
| 2. Pressure Regulator Valve | 6. Oil Filter |
| 3. Main Gallery | 7. Oil Control Plug |
| 4. Oil Pressure Switch | 8. Piston Cooling Jet |

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Fig. 15: Cross-Sectional View Of Engine Oil Circuit
 Courtesy of KIA MOTORS AMERICA, INC.

OIL PUMP

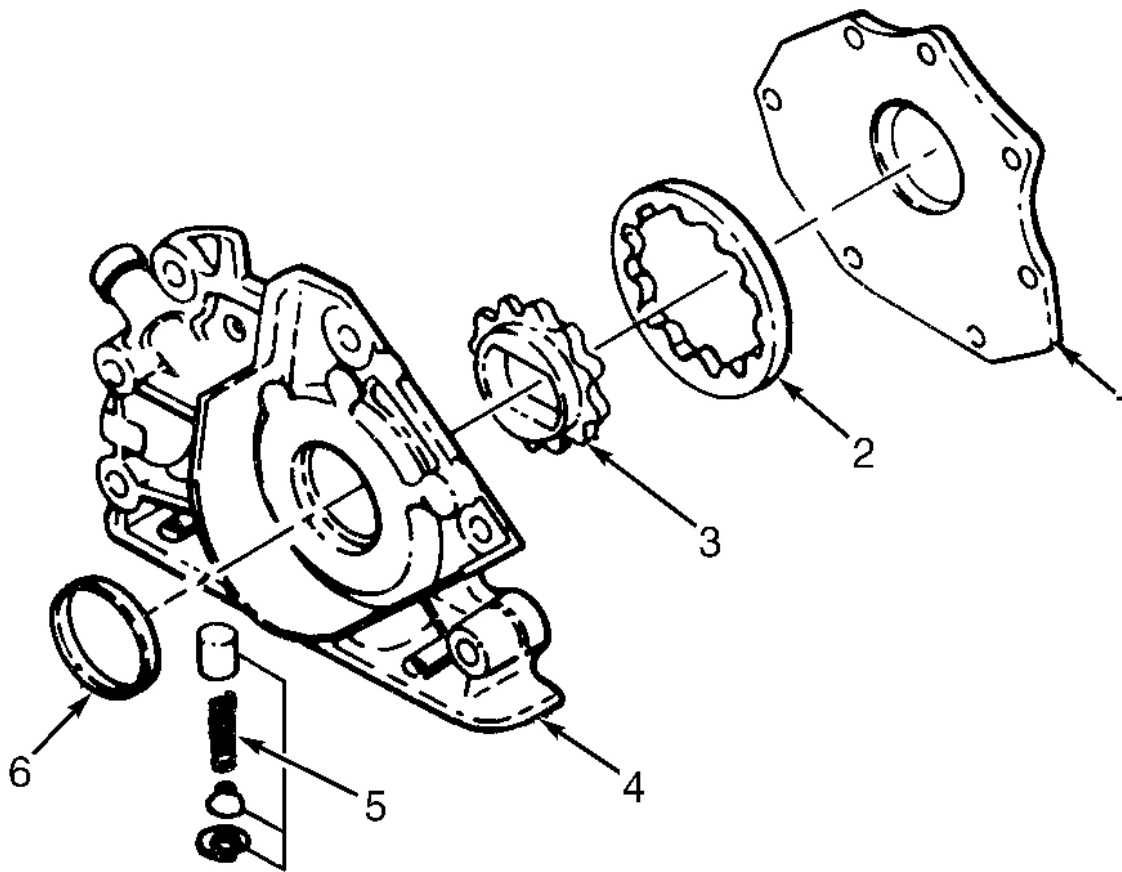
Removal

1. Remove radiator cap, and drain coolant. Disconnect negative battery cable. Remove timing belt. See **TIMING BELT** under REMOVAL & INSTALLATION. Remove oil pan and oil baffle. See **OIL PAN & OIL BAFFLE**.

2. Remove power steering pump bolts. Remove power steering pump bracket bolts. Remove power steering pump bracket. Remove timing belt pulley from crankshaft. Remove remaining oil pump bolts. Remove oil pump. Remove "O" ring from oil pump.
3. 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. See **OIL PUMP SPECIFICATIONS** table. Replace oil pump as necessary. See **Fig. 16** .

Installation

1. Use NEW gasket when installing oil pump. Tighten oil pump bolts to specification. See **TORQUE SPECIFICATIONS** . Apply light oil coat of clean oil to oil seal lip, and tap oil seal into oil pump body until it is flush with edge of pump body. DO NOT bottom seal in pump body.
2. Align keyway slots, and install crankshaft sprocket by tapping lightly using brass hammer. Install crankshaft sprocket lock bolt, and tighten to specification. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.



1. Pump Cover
2. Outer Rotor
3. Inner Rotor

4. Oil Pump Body
5. Pressure Relief Valve
6. Oil Seal

Fig. 16: Exploded View Of Oil Pump
 Courtesy of KIA MOTORS AMERICA, INC.

OIL PUMP SPECIFICATIONS

Application	Maximum Clearance - In. (mm)
Inner Gear Tip-To-Outer Gear Clearance	.007 (.18)
Outer Gear-To-Pump Body Clearance	.008 (.20)
Gear Side-To-Pump Body Clearance	.004 (.10)
Pressure Spring Length	1.791 (45.49)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
A/C Compressor	
Mounting Bolt	18 (24)
Idler Pulley Lock Bolt	24 (32)
Camshaft Cap Bolts ⁽¹⁾	13-20 (18-26)
Camshaft Sprocket Bolt	41 (56)
Coil Mounting Bolt	18 (24)
Connecting Rod Nut	49 (67)
Clutch/Converter Housing Bolt	
6 mm	(2)
10 mm	28 (38)
14 mm	80 (108)
Cooling Fan Assembly Bolt	27 (37)
Crankshaft Sprocket Bolt	119 (162)
Cylinder Head Bolt ⁽³⁾⁽⁴⁾	62 (84)
Dynamic Chamber Bolt/Nut	16 (22)
Dynamic Chamber Support Bracket Bolt	18 (24)
Engine Bracket Bolt	32 (45)
Engine Mount Nut	28 (38)
Engine Support	28 (38)
Exhaust Bracket Bolt	20 (27)
Exhaust Flange Lock Nut	23 (31)
Exhaust Manifold-To-Head Nut	31 (42)
Engine-To-Transmission Support	32 (45)
Front Axle Housing Mounting Bolt	48 (65)
Flywheel/Flex Plate Bolt ⁽⁵⁾	71-76 (96-103)

Generator	
Mounting Bolt	
Top	16 (22)
Bottom	32 (45)
Bracket Bolt	32 (45)
Gusset Plate Bolt	32 (45)
Intake Manifold Bolt ⁽³⁾	16 (22)
Intake Manifold Bracket Bolt	33 (45)
Main Bearing Cap Bolt ⁽³⁾⁽⁶⁾	63 (85)
Oil Cooler Nut	26 (34)
Oil Pump Bolt	
8 mm	16 (22)
10 mm	33 (45)
Power Steering Mounting Bolt	31 (42)
Spark Plug	14-17 (19-23)
Starter Bolt	34 (46)
Timing Belt Tensioner Bolt	33 (45)
Torque Converter Nuts	12-20 (16-27)
Transaxle-To-Engine Mounting Bolt	
M10 Bolts	42-60 (57-81)
M12 Bolts	51-65 (69-88)
Water Pump Bolt	16 (22)
INCH Lbs. (N.m)	
Accelerator Cable Mounting Bolt	62 (7)
Cooling Fan Shroud Bolt	71 (8)
Crankshaft Position Sensor	89 (10)
Oil Baffle Mounting Nuts	89 (10)
Oil Pan Bolt ⁽⁷⁾	89 (10)
Oil Strainer Mounting Bolt	89 (10)
Radiator Mounting Bolt	71 (8)
Rear Cover Bolt	89 (10)
Timing Belt Cover Bolt	89 (10)
Transmission Under Cover Bolt	89 (10)
Undercover Mounting Bolt	71 (8)
Water Pump Pulley Bolt	89 (10)

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

(2) Tighten bolt to 62 inch lbs. (7 N.m).

- (3) Tighten bolts in 2 or 3 steps.
- (4) Tighten bolts in proper sequence. See **Fig. 4** .
- (5) Tighten in a criss-cross pattern.
- (6) Tighten bolts in proper sequence. See **Fig. 14** .
- (7) Tighten bolts in proper sequence. See **Fig. 13** .

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Specification
Displacement	122 Cu. In. (2.0L)
Bore	3.39" (86.1)
Stroke	3.39" (86.1)
Compression Ratio	9.2:1
Compression Pressure	188 psi (13.22 kg/cm ²)
Fuel System	SFI

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0031-.0071 (.079-.180)
Service Limit	.012 (.30)
Maximum Runout	.0012 (.030)
Main Journal Bearings	
Journal Diameter	2.3597-2.3604 (59.936-59.954)
Undersize 1 - .010" (.25 mm)	
No. 1, 2, 4, 5	2.3501-2.3508 (59.693-59.710)
No. 3	2.3499-2.350 (59.687-59.705)
Undersize 2 - .020" (.50 mm)	
No. 1, 2, 4, 5	2.3403-2.3410 (59.444-59.461)
No. 3	2.3400-2.3407 (59.436-59.454)
Undersize 3 - .030" (.75 mm)	
No. 1, 2, 4, 5	2.3304-2.3311 (59.192-59.210)
No. 3	2.3302-2.3309 (59.187-59.205)
Journal Out-Of-Round & Taper	.0002 (.005)
Oil Clearance	
Standard	

No. 1, 2, 4, 5	.0010-.0017 (.025-.043)
No. 3	.0012-.0019 (.030-.048)
Service Limit	.0031- (.080)
Connecting Rod Bearings	
Journal Diameter	2.0055-2.0061 (50.940-50.955)
Journal Out-Of-Round & Taper	.0002 (.005)
Oil Clearance	
Standard	.002-.009 (.05-.23)
Service Limit	.0031 (.080)

CONNECTING RODS

Application	In. (mm)
Bore Diameter	
Connecting Rod Bearing Bore	(1)
Piston Pin Bore	.8657-.8661 (21.989-21.999)
Maximum Bend ⁽²⁾	.0029 (.074)
Maximum Twist ⁽²⁾	.0079 (.201)
Side Play	
Standard	.004.00011(.10-.0028)
Service Limit	.012 (.30)

(1) Information is not available from manufacturer.

(2) Maximum bend or twist per 1.97" (50 mm) of rod length.

PISTONS, PINS & RINGS

Application	In. (mm)
Pistons	
Clearance	
Standard	.0019-.0024 (.048-.061)
Service Limit	.0059 (.15)
Diameter	3.3836-3.3844 (85.943-85.964)
Pins	
Diameter	.8656-.8661 (21.987-21.999)
Piston Fit	.0002-.0004 (.005-.010)
Rod Fit	.0004-.00011 (.010-.025)
Rings	
No. 1	
End Gap	
Standard	.006-.012 (.15-.30)

Service Limit	.039 (1.0)
Side Clearance	
Standard	.001-.003 (.025-.076)
Service Limit	.006 (.15)
No. 2	
End Gap	
Standard	.008-.014 (.20-.36)
Service Limit	.039 (1.0)
Side Clearance	
Standard	.001-.003 (.025-.076)
Service Limit	.006 (.15)
No. 3 (Oil)	
End Gap	
Standard	.008-.028 (.20-.71)
Service Limit	.039 (1.0)

CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore	
Standard Diameter	3.3858-3.3866 (85.999-86.020)
Maximum Taper	.0007 (.018)
Maximum Out-Of-Round	.0007 (.018)
Maximum Deck Warpage	⁽¹⁾ .006 (.15)
(1) Replace block if more than .008" (20 mm) is removed.	

VALVES & VALVE SPRINGS

Application	Specification
Valves	
Face Angle	45°
Head Diameter	(1)
Minimum Margin	
Intake	.033" (.84 mm)
Exhaust	.035" (.89 mm)
Minimum Refinish Length	
Intake	4.0622" (103.18 mm)
Exhaust	4.0921" (103.94 mm)
Installed Height ⁽²⁾	
Valve Seat Contact Width	.047-.063" (1.19-1.60 mm)

Valve Springs	
Free Length	
Inner	1.496" (38.0 mm)
Inner Minimum	1.484" (37.69 mm)
Outer	1.539" (39.09 mm)
Outer Minimum	1.524" (38.71 mm)
Out-Of-Square	
Inner	(1)
Outer	.053" (1.35 mm)
(1) Information is not available from manufacturer.	
(2) Height measured from top of installed valve to spring seat. See VALVE INSTALLED HEIGHT table under CYLINDER HEAD under OVERHAUL.	

CYLINDER HEAD

Application	Specification
Cylinder Head Height	5.274-5.278" (133.96-134.06 mm)
Maximum Warpage (All Machined Surfaces) ⁽¹⁾	.006" (.15 mm)
Valve Seat	
Seat Angle	45°
Margin Thickness Minimum	
Intake	.033" (.84 mm)
Exhaust	.035" (.89 mm)
Seat Contact Width	.047-.063" (1.19-1.60 mm)
Valve Guides	
Valve Guide I.D.	
Intake & Exhaust	.2366-.2374" (6.01-6.03 mm)
Valve Guide Installed Height ⁽²⁾	.449-.469" (11.40-11.91 mm)
Valve Stem-To-Guide Oil Clearance	
Intake	.0010-.0024" (.025-.061 mm)
Exhaust	.0012-.0026" (.030-.066 mm)
Service Limit	.0079" (.201 mm)
(1) DO NOT machine more than .008" (.20 mm) from deck or manifold surfaces.	
(2) Measured from top of installed guide to spring seat.	

CAMSHAFT

Application	In. (mm)
Journal Diameter	1.1787-1.1797 (29.939-29.964)
Maximum Journal Out-Of-Round	.002 (.050)

Maximum Journal Runout	.002 (.050)
Oil Clearance	.0014-.0033 (.036-.084)
Standard Lobe Height	1.7737 (45.052)
Minimum Lobe Height	1.7658 (44.851)