

2004-05 ENGINES

2.4L 4 Cylinder - Optima & Magentis (Canadian)

GENERAL

SPECIFICATIONS

NOTE:

- O.D. = Outer Diameter
- I.D. = Inner Diameter
- O.S. = Oversize Diameter
- U.S. = Undersize Diameter

Engine Specifications

Description	Specification	Limit
General		
Type	In-line, Double Overhead Camshaft	
Number of cylinders	4	
Bore	86.5 mm (3.41 in.)	
Stroke	100 mm (3.94 in.)	
Total displacement	2351 cc (143.5 cu. in.)	
Compression ratio	10	
Firing order	1-3-4-2	
Idle R.P.M	800 ± 100 rpm	
Ignition timing at idling speed	BTDC 5° ± 2°	
Valve timing		
Intake valve		
Opens (BTDC)	12°	
Closes (ABDC)	56°	
Exhaust valve		
Opens (BBDC)	54°	
Closes (ATDC)	14°	
Cylinder head		
Flatness of gasket surface	Max. 0.03 mm (0.0012 in.)	0.2 mm (0.008 in.)
Flatness of manifold mounting surface	0.15 mm (0.0059 in.)	0.3 mm (0.012 in.)
Dimensions for reworking oversize valve seat hole		
Intake	0.3 mm (0.012 in.) O.S.	35.300-35.325 mm (1.3898-1.3907 in.)
	0.6 mm (0.024 in.) O.S.	35.600-35.625 mm (1.4016-1.4026 in.)
Exhaust	0.3 mm (0.012 in.) O.S.	33.300-33.325 mm (1.3110-1.3120 in.)
	0.6 mm (0.024 in.) O.S.	33.600-33.625 mm (1.3228-1.3238 in.)
Dimensions for reworking oversize valve se; at hole (both intake and exhaust)		
0.05 mm (0.002 in.) O.S.		12.050-12.068 mm (0.4744-0.4751 in.)

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0.25 mm (0.010 in.) O.S.		12.250-12.268 mm (0.4823-0.4830 in.)	
0.50 mm (0.020 in.) O.S.		12.500-12.518 mm (0.4921-0.4928 in.)	
Camshaft			
Cam height			
Intake		35.493 mm (1.3974 in.)	34.993 mm (1.3777 in.)
Exhaust		35.317 mm (1.3904 in.)	34.817 mm (1.3707 in.)
Journal O.D.		26 mm (1.02 in.)	
	Bearing oil clearance	0.040-0.076 mm (0.0020-0.0029 in.)	
	End play	0.1-0.2 mm (0.004-0.008 in.)	
Valve			
Valve length			
	Intake	109.5 mm (4.311 in.)	
	Exhaust	109.7 mm (4.319 in.)	
Stem O.D.			
	Intake	6.565-6.580 mm (0.2585-0.2591 in.)	
	Exhaust	6.530-6.550 mm (0.2571-0.2579 in.)	
	Face angle	45-45.5°	
Thickness of valve head (margin)			
	Intake	1.0 mm (0.040 in.)	0.7 mm (0.028 in.)
	Exhaust	1.5 mm (0.059 in.)	1.0 mm (0.040 in.)
Valve stem to valve guide clearance			
	Intake	0.020-0.047 mm (0.0008- 0.10 mm (0.0040 in.) 0.0019 in.)	
	Exhaust	0.050-0.085 mm (0.0020- 0.15 mm (0.0059 in.) 0.0033 in.)	
Valve guide			
Length			
	Intake	45.5 mm (1.791 in.)	
	Exhaust	50.5 mm (1.988 in.)	
	Service size	0.05, 0.25, 0.50 mm (0.002, 0.010, 0.020 in.) oversize	
Valve seat			
	Width of seat contact	0.9-1.3 mm (0.035-0.051 in.)	
	Seat angle	44-44.5	
	Service size	0.3 mm (0.012 in.), 0.6 mm (0.024 in.) oversize	
Valve spring			
	Free length	45.82 mm (1.804 in.)	44.82 mm (1.765 in.)
	Load	248 N (55 lb) at installed height	
	Out of squareness	Less than 1.5°	4°
Cylinder block			
	Cylinder bore	86.5-86.53 mm (3.4055-3.4067 in.)	
	Out-of-roundness and taper of cylinder bore	Less than 0.01 mm (0.0004 in.)	

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Flatness of gasket surface		Less than 0.05 mm (0.0020 in.)	0.1 mm (0.0040 in.)
Piston			
	O.D.	84.97-85.00 mm (3.3453-3.3465 in.)	
	Piston-to-cylinder clearance	0.02-0.04 mm (0.0008-0.0012 in.)	
Ring groove width			
	No. 1	1.21-1.23 mm (0.0476-0.0484 in.)	
	No. 2	1.51-1.53 mm (0.0595-0.0602 in.)	
	Oil	2.81-2.83 mm (0.1106-0.1114 in.)	
Piston ring			
Side clearance			
	No. 1	0.03-0.07 mm (0.0012-0.0028 in.)	0.1 mm (0.004 in.)
	No. 2	0.02-0.06 mm (0.0008-0.0024 in.)	0.1 mm (0.004 in.)
End gap			
	No. 1	0.25-0.35 mm (0.0098-0.0138 in.)	0.8 mm (0.031 in.)
	No. 2	0.40-0.55 mm (0.0157-0.0216 in.)	0.8 mm (0.031 in.)
	Oil ring side rail	0.10-0.40 mm (0.0039-0.0157 in.)	1.0 mm (0.040 in.)
Connecting rod			
	Bend	0.05 mm (0.0020 in.) or less per 100 mm (3.937 in.)	
	Twist	0.1 mm (0.004 in.) or less per 100 mm (3.937 in.)	
	Connecting rod big end to crankshaft side clearance	0.10-0.25 mm (0.0040-0.0098 in.)	0.4 mm (0.0157 in.)
	Piston pin press-in load	7,500-17,500 N (1,653-3,858 lb)	
Connecting rod bearing			
	Oil clearance	0.015-0.048 mm (0.0008-0.0020 in.)	0.1 mm (0.004 in.)
Crankshaft main bearing			
	Oil clearance	No. 1, 2, 4, 5:0.018-0.036 mm (0.0007-0.0014 in.) No. 3 :0.024-0.042 mm (0.0009-0.0016 in.)	0.1 mm (0.004 in.)
Crankshaft			
	Pin O.D.	44.980-45.000 mm (1.7709-1.7717 in.)	
	Journal O.D.	56.982-57.000 mm (2.2434-2.2442 in.)	
	Out-of-roundness of journal and pin	Less than 0.015 mm (0.0006 in.)	
	Taper of journal and pin	Less than 0.005 mm (0.0002 in.)	
	End play	0.05-0.25 mm (0.0020-	0.25 mm (0.0098 in.)

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		0.0098 in.)
Flywheel		
Runout		0.13 mm (0.0051 in.)
	Oil pressure at curb idle speed	80 kPa (11.4 psi) or more
[Oil temperature is 75 to 90°C 167 to 194°F]		
Oil pump		
Tip clearance		
	Drive gear	0.160-0.205 mm (0.0063- 0.25 mm (0.0098 in.) 0.0081 in.)
	Driven gear	0.180-0.205 mm (0.0071- 0.25 mm (0.0098 in.) 0.0081 in.)
Side clearance		
	Drive gear	0.08-0.14 mm (0.0031- 0.25 mm (0.0098 in.) 0.0055 in.)
	Driven gear	0.06-0.12 mm (0.0024- 0.25 mm (0.0098 in.) 0.0047 in.)
Relief spring		
	Free length	46.6 mm (1.835 in.)
	Load [61 N (13.5 lb)]	40.1 mm (1.579 in.)
Right silent shaft		
	Front journal diameter	41.959-41.975 mm (1.6519-1.6526 in.)
	Rear journal diameter	40.951-40.967 mm (1.6122-1.6129 in.)
Oil clearance		
	Front	0.020-0.0061 mm (0.0008-0.0024 in.)
	Rear	0.050-0.091 mm (0.0020-0.0036 in.)
Left silent shaft		
	Front journal diameter	18.467-18.480 mm (0.7270-0.7276 in.)
	Rear journal diameter	40.959-40.975 mm (1.6126-1.6132 in.)
Oil clearance		
	Front	0.020-0.054 mm (0.0008-0.0021 in.)
	Rear	0.042-0.083 mm (0.0017-0.0033 in.)
Cooling system	Cooling method	Engine coolant cooling, forced circulation with water pump (Driven belt)
Thermostat	Quantity	6.5 lit (6.9 U.S.qts., 5.7 Imp.qts.) [For DOHC]
	Type	Wax pellet type with jiggle valve
	Normal opening temperature	82°C (179.6°F)
	Opening temperature range	80.5°C -83.5°C (176.9-182.3°F)
	Wide open temperature	95°C (203°F)
Radiator cap		

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	Main valve opening pressure	86.1-124.5 kPa (0.98-1.27 kg/cm ² , 13.94-18.06 psi)
	Main valve closing pressure	83.4 kPa (0.85 kg/cm ² , 12.1 psi)
	Vacuum valve opening pressure	-6.86 kPa (-0.07 kg/cm ² -1.00 psi)
Air cleaner	Type	Dry type
	Element	Unwoven cloth type
Exhaust pipe	Muffler	Expansion resonance type
	Suspension system	Rubber hangers

SERVICE STANDARD

Standard value	
Coolant concentration	
Tropical area	40%
Other area	50%

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Fig. 1: Coolant Concentration Service Standard Specifications
Courtesy of KIA MOTORS AMERICA, INC.

LUBRICANT

Engine coolant	Ethylene glycol base for aluminum radiator
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Fig. 2: Identifying Lubricant Specifications
Courtesy of KIA MOTORS AMERICA, INC.

SEALANT

Engine coolant temperature sender	Three bond No.2310 or equivalent
Engine coolant temperature sensor	LOCTITE 962T or equivalent

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Fig. 3: Identifying Sealant Specifications
Courtesy of KIA MOTORS AMERICA, INC.

TORQUE SPECIFICATIONS

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TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Air Conditioner Compressor-To-Bracket Bolt	17-20 (23-27)
Auto Tensioner Bolt	14-20 (19-27)
Camshaft Bearing Cap Bolt ⁽¹⁾	14-15 (19-21)
Camshaft Position Sensing Cylinder Bolt	11-16 (15-22)
Camshaft Sprocket Bolt	59-74 (80-100)
Center Exhaust Pipe-To-Catalytic Converter Nuts	22-30 (30-40)
Center Exhaust Pipe-To-Main Muffler Bolts	22-30 (30-40)
Connecting Rod Cap Nut	
Step 1	13-16 (18-22)
Step 2	(2)
Crankshaft Main Bearing Cap Bolt ⁽³⁾	
Step 1	18 (25)
Step 2	(2)
Crankshaft Pulley-To-Crankshaft Sprocket Bolt	14-22 (19-30)
Crankshaft Sprocket Bolt	81-96 (110-130)
Cylinder Head Bolts	INSTALLATION
Drive Plate\Flywheel Bolt	96-103 (130-140)
Driven Gear Bolt	25-30 (34-40)
EGR Valve Bolts	13-19 (17-26)
Engine Coolant Pump-To-Cylinder Block Bolt	11-15 (15-20)
Engine Coolant Temperature Sensor	15-30 (20-40)
Engine Hanger Bolt	
M8	18-22 (25-30)
M10	25-41 (34-55)
Engine Mounting Bracket Bolts	44-59 (60-80)
Engine Mounting Bracket Nuts	44-59 (60-80)
Engine Mounting Insulator Bolt	66-81 (90-110)
Exhaust Manifold-To-Engine Nuts	
M8	18-22 (25-30)
M10	25-41 (34-55)
Front Exhaust Pipe Clamp Bolt	14-22 (19-30)
Front Exhaust Pipe-To-Manifold Nut	22-30 (30-40)
Front Roll Stopper Bracket-To-Sub Frame Bolts	37-48 (50-65)
Front Roll Stopper Bracket-To-Transaxle Bolts	44-59 (60-80)
Front Roll Stopper Insulator Bolt & Nut	37-48 (50-65)
Generator Brace Bolt	
4T	9-11 (12-15)
5T	14-20 (19-27)
Generator Support Bolt	14-18 (19-25)

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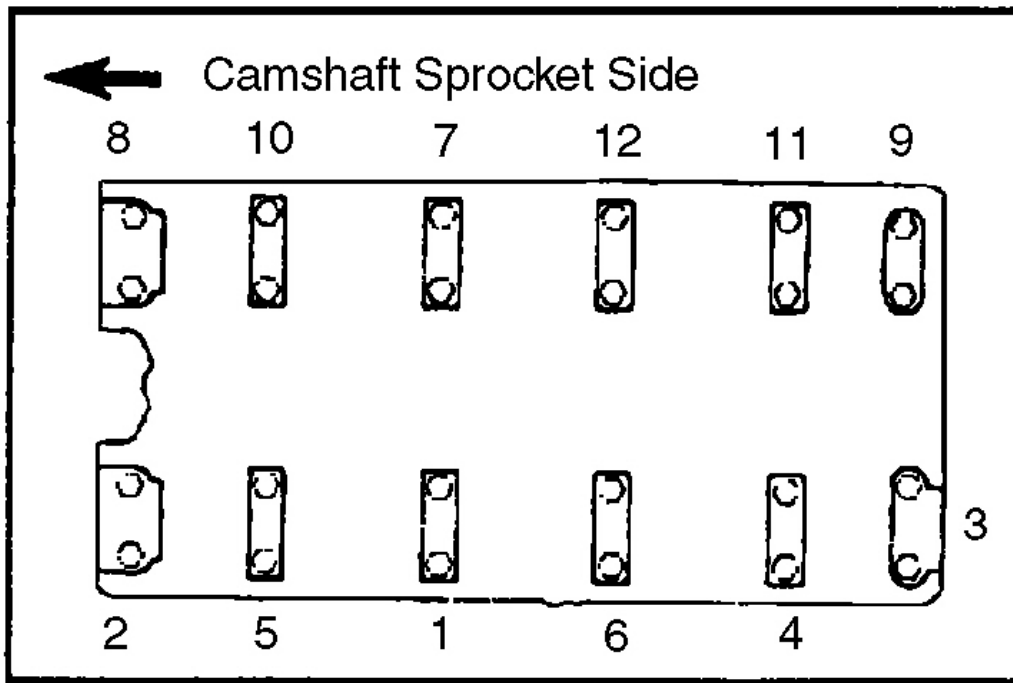
Hanger-To-Body Bolt	
M8	18-22 (25-30)
M10	26-41 (35-55)
Idler Pulley Bolt	33-41 (45-55)
Intake Manifold Mounting Bolt	
M8	11-14 (15-19)
M10	13-18 (18-25)
Intake Manifold Mounting Nut	22-31 (30-42)
Intake Manifold Stay Bolts	13-16 (18-22)
Oil Filter Bracket Bolt	14-20 (19-27)
Oil Pan Drain Plug	26-33 (35-45)
Oil Pump Case Bolt (M8)	14-20 (19-27)
Oil Pump Cover Bolt	11-13 (15-18)
Oil Pump Sprocket Nut	37-44 (50-60)
Oil Screen Bolt	11-16 (15-22)
Oxygen Sensor	30-37 (40-50)
Plug Cap	14-20 (19-27)
Power Steering Oil Pump-To-Bracket Bolt	26-33 (35-45)
Rear Roll Stopper Bracket-To-Sub Frame Bolts	37-48 (50-65)
Rear Roll Stopper Bracket-To-Transaxle Bolts	44-59 (60-80)
Rear Roll Stopper Insulator Bolt & Nut	37-48 (50-65)
Relief Plug	30-37 (40-50)
Tensioner Pulley Bolt	32-41 (43-55)
Tensioner Pulley Bracket Bolt	17-20 (23-27)
Tension Rod Bracket Bolt-To-Tension Rod	26-41 (35-55)
Throttle Body Stay Bolt	11-16 (15-22)
Throttle Body-To-Intake Manifold Bolt	11-16 (15-22)
Timing Belt Left Rear Cover (Lower) Bolt	22-31 (30-42)
Transaxle Mounting Bracket Bolts	44-59 (60-80)
Transaxle Mounting Insulator Bolt	66-81 (90-110)
Transaxle Mounting Sub Bracket Nut	44-59 (60-80)
INCH Lbs. (N.m)	
Accelerator Cable-To-Intake Manifold Bolts	35-53 (4-6)
Air Cleaner Body Installation Bolt	71-89 (8-10)
Air Cleaner Mounting Bolts	71-89 (8-10)
Center Cover Bolt	35-44 (4-5)
Center Exhaust Pipe-To-Bracket Bolt	89-133 (10-15)
Crankshaft Position Sensor Bolt	89-115 (10-13)
EGR Temperature Sensor (California)	89-106 (10-12)
Engine Coolant Outlet Fitting Attaching Bolt	89-133 (10-15)
Engine Coolant Pump Pulley Bolt	71-89 (8-10)
Engine Coolant Temperature Gauge Unit	

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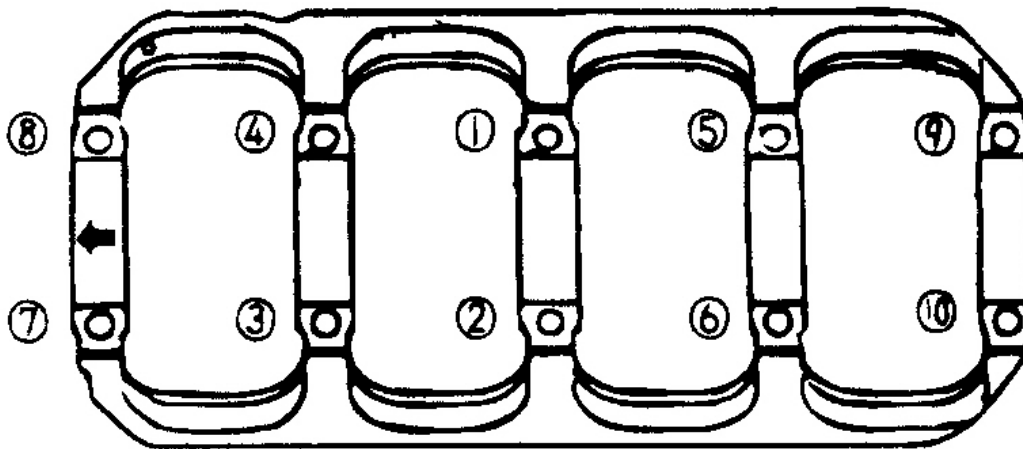
	89-106 (10-12)
Hanger-To-Muffler Bolt	89-133 (10-15)
Heat Protector-To-Exhaust Manifold Bolt	106-133 (12-15)
Ignition Coil Bolts	71-106 (8-12)
Oil Pan Bolt	89-106 (10-12)
Oil Pressure Switch	71-106 (8-12)
Oil Seal Case Bolt	89-106 (10-12)
Power Transistor Bolts	89-106 (10-12)
Resonator Mounting Bolt	71-89 (8-10)
Resonator Mounting Nut	35-53 (4-6)
Rocker Cover Bolt	71-89 (8-10)
Timing Belt Lower Cover Bolt ⁽⁶⁾	71-89 (8-10)
Timing Belt Left Rear Cover (Upper) Bolt	89-106 (10-12)
Timing Belt Right Rear Cover Bolt	89-106 (10-12)
Timing Belt Upper Cover Bolt	71-89 (8-10)

- (1) Tighten in sequence. See **Fig. 4**.
- (2) Tighten an additional 90-94 degrees.
- (3) Tighten in sequence. See **Fig. 5**.
- (4) With new bolts tighten to 47 ft. lbs. (64 N.m) in sequence. Loosen bolts and follow standard tightening procedure. Tighten in sequence. See **Fig. 6**.
- (5) Tighten an additional 90 degrees.
- (6) Tighten in sequence. See **Fig. 7**.



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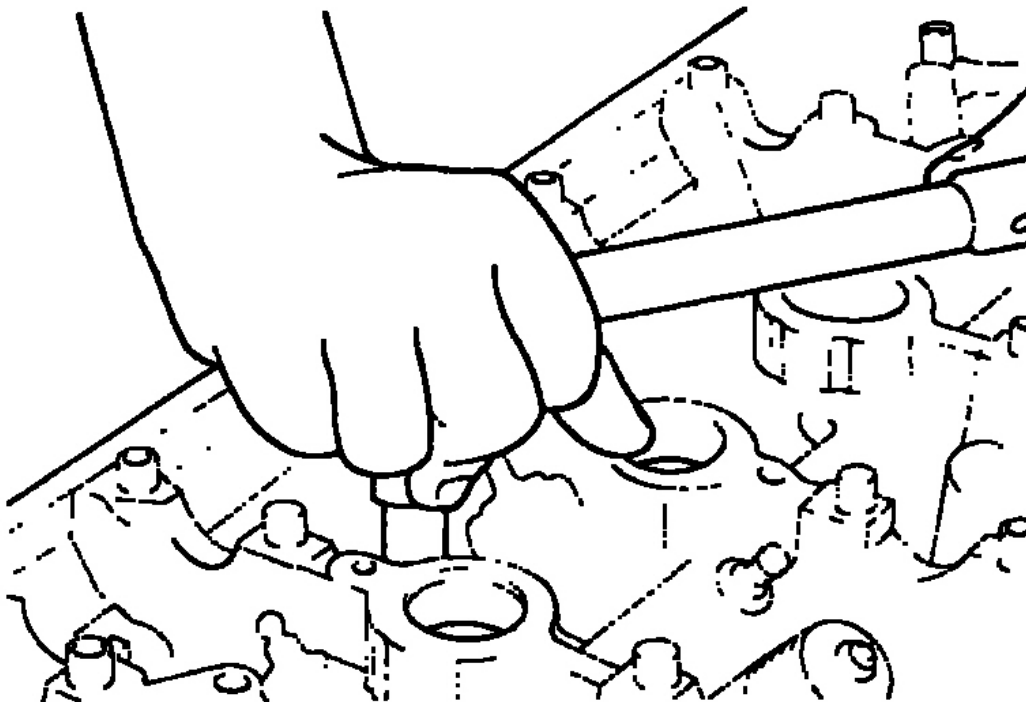
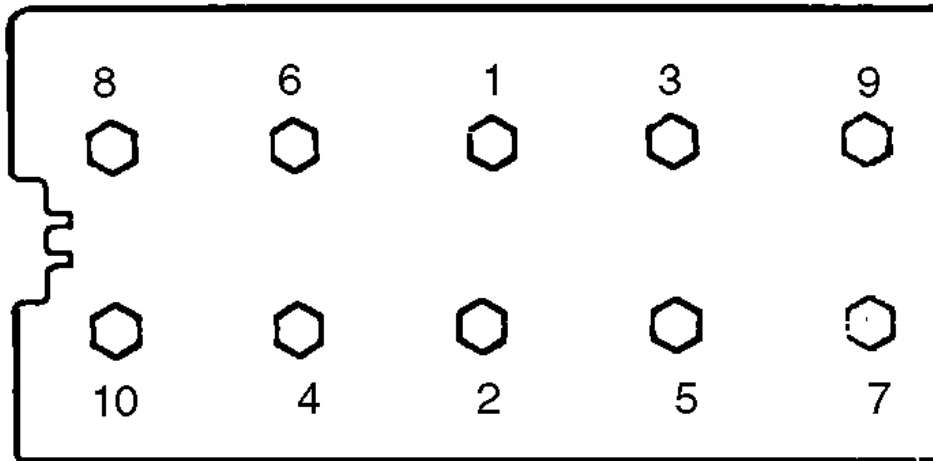
Fig. 4: Camshaft Bearing Cap Bolt Tightening Sequence
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Fig. 5: Crankshaft Main Bearing Cap Bolt Tightening Sequence
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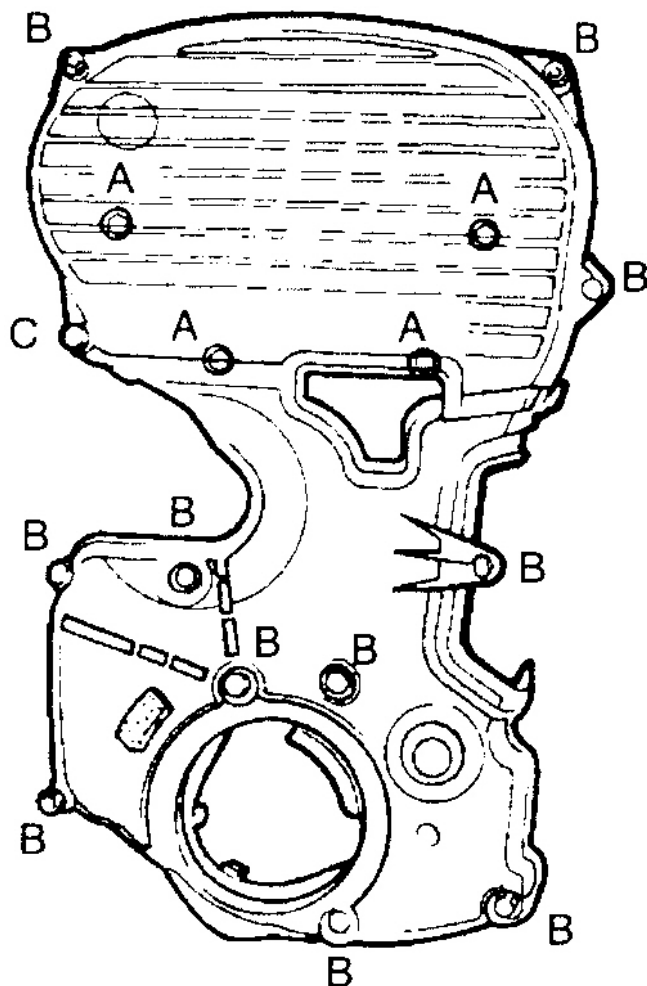
← Camshaft Sprocket Side



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Fig. 6: Cylinder Head Bolt Tightening Sequence

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Tread diameter x
thread length mm (in.)

A : 6 x 10 (100-120 kgf. cm)

B : 6 x 25 (80-100 kgf. cm)

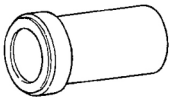
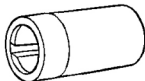
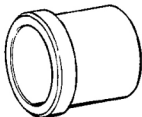
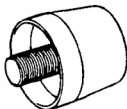
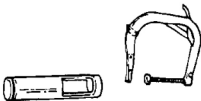
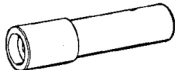
C : 6 x 28 (100-120 kgf. cm)

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Fig. 7: Timing Belt Lower Cover Bolt Tightening Sequence

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SPECIAL SERVICE TOOLS

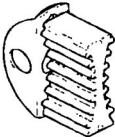
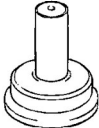
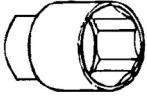
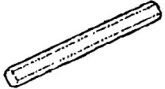
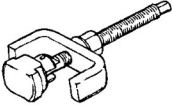
Tool Number and name	Illustration	Use
09214-32000 / 09214-M2001 Crankshaft front oil seal installer		Installation of the crankshaft front oil seal (use with 09214-32100/09214-M2100)
09214-32100 / 09214-M2100 Crankshaft front oil seal guide		Installation of the crankshaft front oil seal (use with 09214-32000/09214-M001)
09221-21000 / 09221-M2000 Camshaft oil seal installer		Installation of the camshaft oil seal (use with 09221-21100/09211-M2100)
09221-21100 / 09221-M2100 Camshaft oil seal guide		Used as a guide when pressing in the camshaft oil seal
09222-28000 / 0K993 120 001 Valve spring compressor		Removal and installation of the inlet or exhaust (use with 09222-28100/0K993 120 004)
09222-21100 Valve stem oil seal installer		Installation of the valve stem oil seal

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Fig. 8: Identifying Special Service Tools (1 Of 3)
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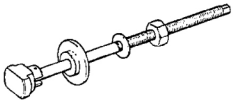
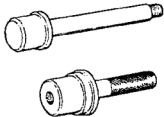
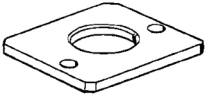
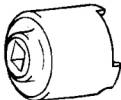
Tool Number and name	Illustration	Use
09222-21200 A/B / 09222-M2200 A/B Valve guide installer		Removal and installation of the valve guide
09231-38000 Camshaft locking tool		Fixing the camshaft when replacing the timing belt
09231-21000 / 09231-M2000 Crankshaft rear oil seal installer		1. Installation of the engine rear oil seal 2. Installation of the crankshaft rear oil seal
09260-32000 Oil pressure switch wrench		Removal and installation of oil pressure switch
09221-32001 / 09221-M2001 Cylinder head bolt wrench		Removal and installation of the cylinder head bolt
09212-32000 / 09212-M2000 Counter balance shaft bearing puller		Removal of front bearing of counter balance shaft

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Fig. 9: Identifying Special Service Tools (2 Of 3)
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Tool Number and name	Illustration	Use
09212-32100 / 09212-M2100 Counter balance shaft bearing puller		Removal of rear bearing of counter balance shaft (use with 09212-32300)
09212-32200 Counter balance shaft bearing installer		Installation of counter balance shaft bearing front and rear (use with 09212-32300)
09212-32300 Guide plate		Removal and installation of counter balance shaft rear bearing (use with 09212-32100 / 09212-M2100, 09212-32200)
09213-33000 Plug cap wrench		Removal and installation of front case cap plug

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Fig. 10: Identifying Special Service Tools (3 Of 3)
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TROUBLESHOOTING

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Symptom	Probable cause	Remedy
Low compression	Blown cylinder head gasket	Replace gasket
	Worn or damaged piston rings	Replace rings
	Worn piston or cylinder	Repair or replace piston and/or cylinder block
	Worn or damaged valve seat	Repair or replace valve and/or seat ring
Oil pressure drop	Low engine oil level	Check engine oil level
	Faulty oil pressure switch	Replace
	Clogged oil filter	Replace
	Worn oil pump gears or cover	Replace
	Thin or diluted engine oil	Change and find out cause
	Oil relief valve stuck (open)	Repair
	Excessive bearing clearance	Replace
High oil pressure	Oil relief valve stuck (closed)	Repair
Excessive engine rolling and vibration	Loose engine roll stopper (front, rear)	Re-tighten
	Loose transaxle mount bracket	Re-tighten
	Loose engine mount bracket	Re-tighten
	Loose center member	Re-tighten
	Broken transaxle mount insulator	Replace
	Broken engine mount insulator	Replace
	Broken engine roll stopper insulator	Replace
Noisy valves	Thin or diluted engine oil (low oil pressure)	Change
	Worn or damaged valve stem or valve guide	Replace
Connecting rod and/main bearing noise	Insufficient oil supply	Check engine oil level
	Thin or diluted engine oil	Change and find out cause
	Excessive bearing clearance	Replace
Timing belt noise	Incorrect belt tension (Auto tensioner)	Adjust belt tension or Replace auto tensioner.
Low coolant level	Leakage of coolant	
	Damaged radiator core joint	Replace
	Corroded or cracked hoses (Radiator hose, heater hose, etc)	Replace
	Faulty radiator cap valve or setting of spring	Replace
	Faulty thermostat	Replace
	Faulty Engine coolant pump	Replace

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Fig. 11: Engine Mechanical System Troubleshooting Chart (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

Symptom	Probable cause	Remedy
Clogged radiator	Foreign material in coolant	Replace
Abnormally high coolant temperature	Faulty thermostat	Replace
	Faulty radiator cap	Replace
	Restriction of flow in cooling system	Replace
	Loose or missing drive belt	Adjust or replace
	Faulty Engine coolant pump	Replace
	Faulty temperature gauge or wiring	Repair or replace
	Faulty electric fan	Repair or replace
	Faulty thermo-sensor on radiator	Replace
	Insufficient coolant	Refill coolant
Abnormally low coolant temperature	Faulty thermostat	Replace
	Faulty temperature gauge or wiring	Repair or replace
Leakage from oil cooling system	Loose hose and pipe connection	Retighten
	Blocked or collapsed hose and pipe	Replace
Inoperative electrical cooling fan	Damaged	Replace or repair
Exhaust gas leakage	Loose connections	Retighten
	Broken pipe or muffler	Repair or replace
Abnormal noise	Detached baffle plate in muffler	Replace
	Broken rubber hanger	Replace
	Pipe or muffler contacting vehicle body	Correct
	Broken pipe or muffler	Repair or replace

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Fig. 12: Engine Mechanical System Troubleshooting Chart (2 Of 2)

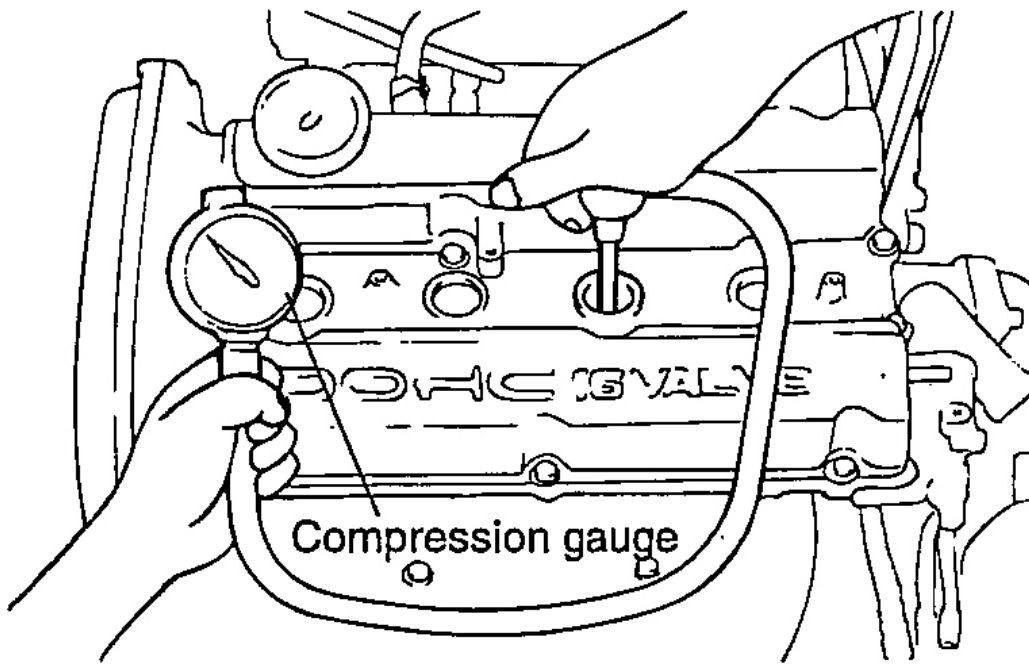
Courtesy of KIA MOTORS AMERICA, INC.

CHECKING COMPRESSION PRESSURE

- Before checking compression pressure, check the engine oil level. Make sure that the starter motor and battery are in normal operating condition.
- Start the engine and wait until engine coolant temperature reaches 80-95°C (176-205°F).
- Stop the engine and disconnect the spark plug cables.
- Remove the spark plugs.
- Crank the engine to remove any foreign material in the cylinders.
- Attach the compression gauge to the spark plug hole.
- Depress the accelerator pedal to fully open the throttle.
- Crank the engine and read the gauge.

Limit :

12.5 kg/ cm² (1.23 MPa, 178 psi) [250-400 rpm]



G00326718

Fig. 13: Checking Engine Compression

Courtesy of KIA MOTORS AMERICA, INC.

9. Repeat steps from 6 to 8 over all cylinders, making sure that the pressure differential for each of the cylinders is within the specified limit.

Limit: Max :

1.0 kg/cm² (100 kpa, 14 psi) between cylinders

10. If a cylinder's compression or pressure differential is below the specification, add a small amount of oil through the spark plug hole and repeat steps from 6 to 9.
 1. If the addition of oil brings the compression up, it is possible that there is wear between the piston ring and cylinder wall.
 2. If compression remains the same, valve seizure, poor valve seating or a compression leak from the cylinder head gasket are all possible causes.

Tightening torque

Spark plug : 20-30 Nm (200-300 kg.cm, 15-21 lb.ft)

ENGINE OIL

CHECKING ENGINE OIL

1. Position a vehicle on a level surface.
2. Stop the engine.

NOTE: In the case of a vehicle that has been out of service for a prolonged period, run the engine for several minutes. Stop the engine and wait 5 minutes at least, and then check the oil level.

3. Check that the engine oil level is within the level range indicated on the oil dipstick. If the oil level is found to have fallen to the lower limit (the "MIN" mark), refill to the "MAX" mark.

NOTE: When refilling, use the same type of engine oil as the one currently being used.

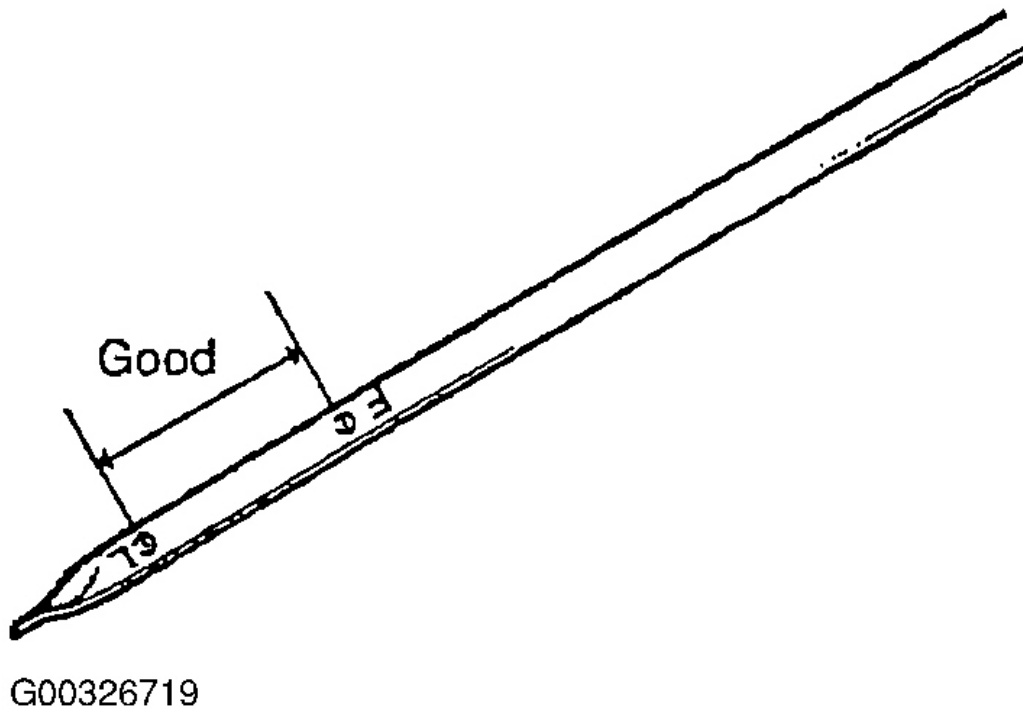


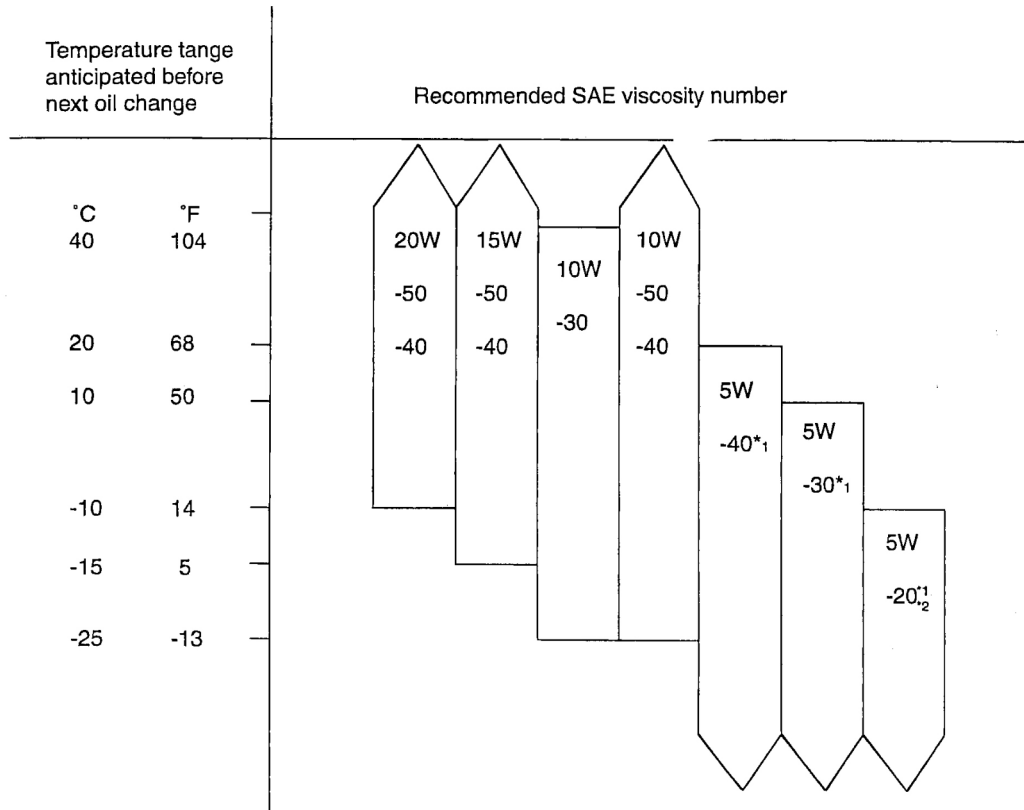
Fig. 14: Checking Engine Oil
Courtesy of KIA MOTORS AMERICA, INC.

4. Check that the oil is not dirty or mixed with coolant or gasoline and it has the proper viscosity.

SELECTION OF ENGINE OIL

Recommended API classification: SG OR SG/CD, SH OR SH/CD

RECOMMENDED SAE VISCOSITY GRADES:



*1. Restricted by driving and climate condition.

*2. Not recommended for sustained high speed vehicle operation.

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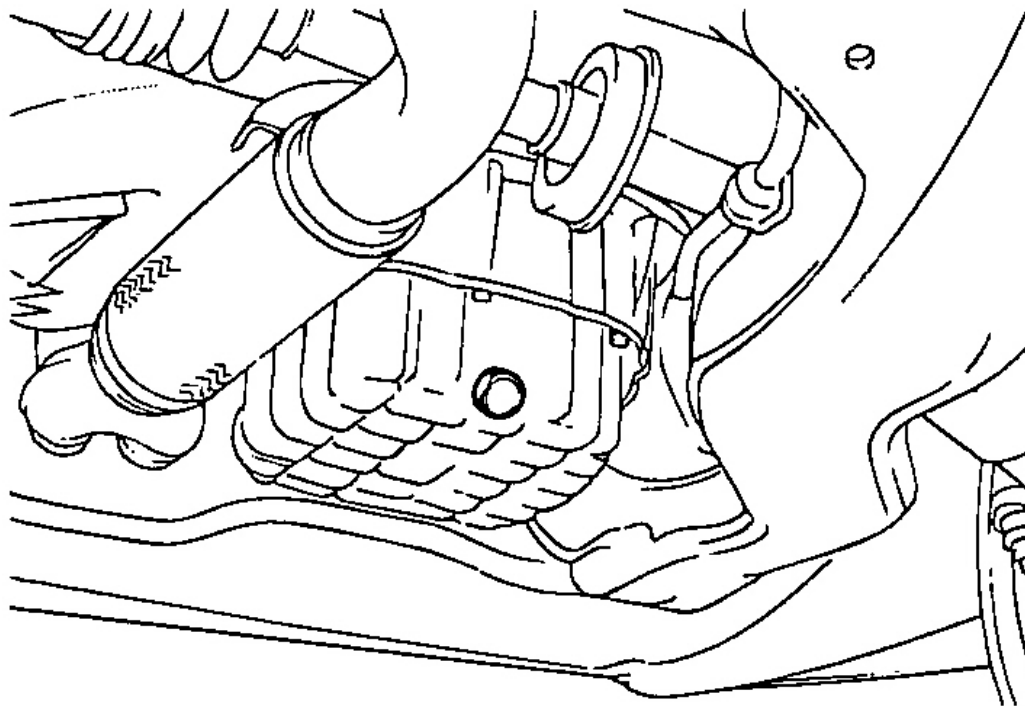
Fig. 15: Identifying Society Of Automotive Engineers (SAE) Viscosity Grades
Courtesy of KIA MOTORS AMERICA, INC.

NOTE: For best performance and for maximum protection for all types of operation, select only those lubricants that are the following:

1. Confirm the requirements of the API classification.
2. Have proper SAE grade number for expected ambient temperature range. Lubricant which do not have both a SAE grade number and an API service classification on the container should not be used.

CHANGING ENGINE OIL

1. Run the engine until it reaches normal operating temperature.
2. Stop the engine.
3. Remove the oil filler cap (on rocker cover) and the drain plug (on the oil pan). Drain the engine oil.



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Fig. 16: Locating Engine Oil Drain Plug
Courtesy of KIA MOTORS AMERICA, INC.

4. Re-install and tighten the drain plug to the specified torque.

Tightening torque

Drain plug : 35-45 Nm (350-450 kg.cm, 25-33 lb.ft)

5. Fill the crankcase with new engine oil through the oil filler cap opening.

Capacity (drain and refill):

- Without oil filter: 4.0 lit (4.23 U.S.qts., 3.51 Imp.qts.)

- With oil filter: 4.3 lit (4.5 U.S.qts., 3.8 Imp.qts)

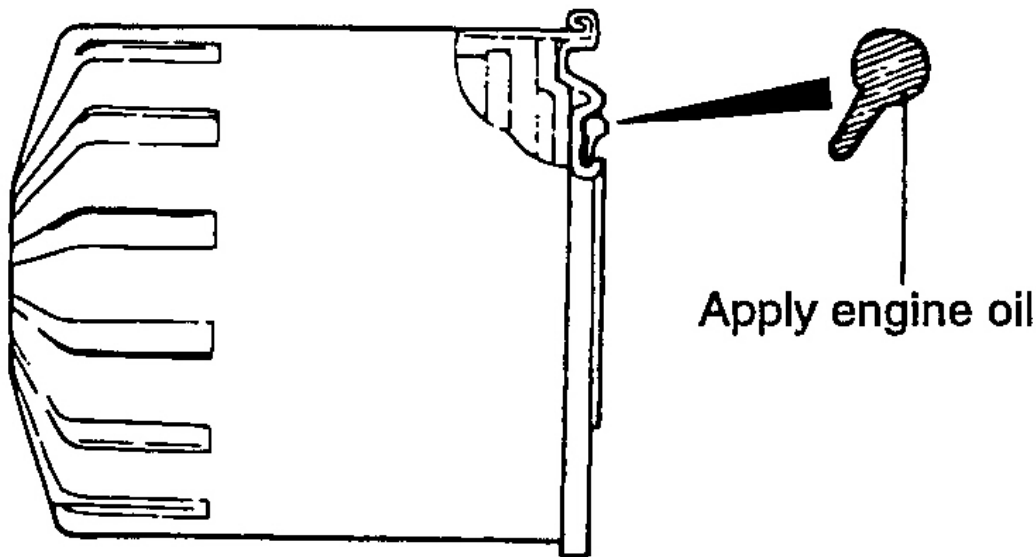
CAUTION: Do not overfill the crankcase. This will cause oil aeration and loss of oil pressure.

6. Install the oil filler cap.
7. Start and run the engine.
8. Stop the engine and then check the oil level. Add oil if necessary.

REPLACING THE OIL FILTER

All Kia engines are equipped with a high quality, throw-away oil filter. This filter is recommended as a replacement filter on all vehicles. The quality of replacement filters vary considerably. High quality replacement filters should be used to assure the most efficient service. Make sure that the rubber gasket from the old oil filter is completely removed from the contact surface on the engine block before installing the new filter.

1. Use a filter wrench to remove the oil filter
2. Before installing the new oil filter on the engine, apply clean engine oil to the surface of the rubber gasket.



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Fig. 17: Installing Oil Filter
Courtesy of KIA MOTORS AMERICA, INC.

3. Tighten the oil filter to the specified torque.

Oil filter: 17-25 Nm (170-250 kg.cm, 12-28 lb.ft)

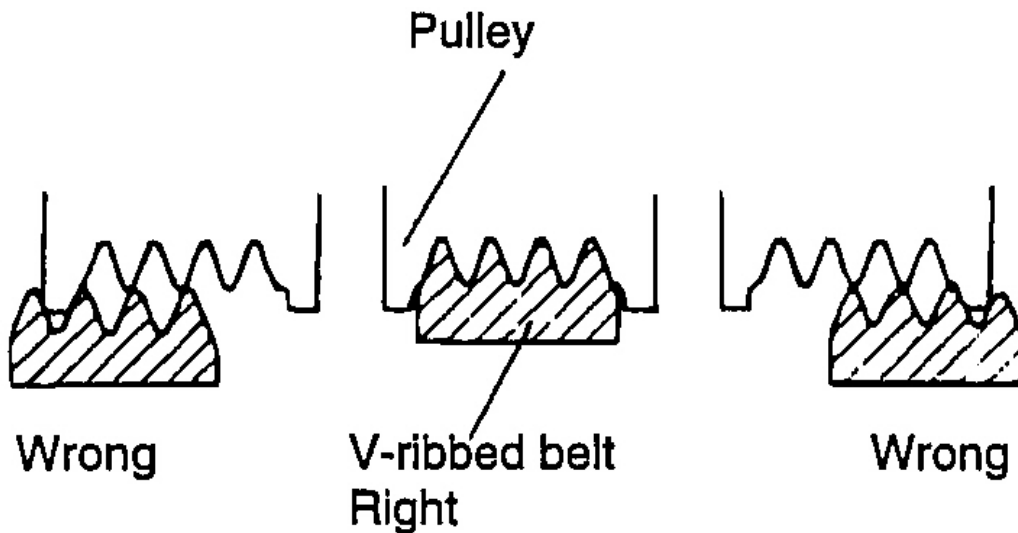
4. Start and run the engine and check for engine oil leak.
5. After stopping the engine, check the oil level and add oil as necessary.

ADJUSTING DRIVE BELTS TENSION

1. Check that the belts are not damaged and are properly fit into the pulley grooves.

CAUTION:

- When installing the V-ribbed belt, check that the V-ribs are properly in alignment.
- If noise or slippage is detected, check the belt for wear, damage, or breakage on the pulley contact surface, and check the pulley for scoring. Also check the degree that the belt is deflected.



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Fig. 18: Installing Drive Belts

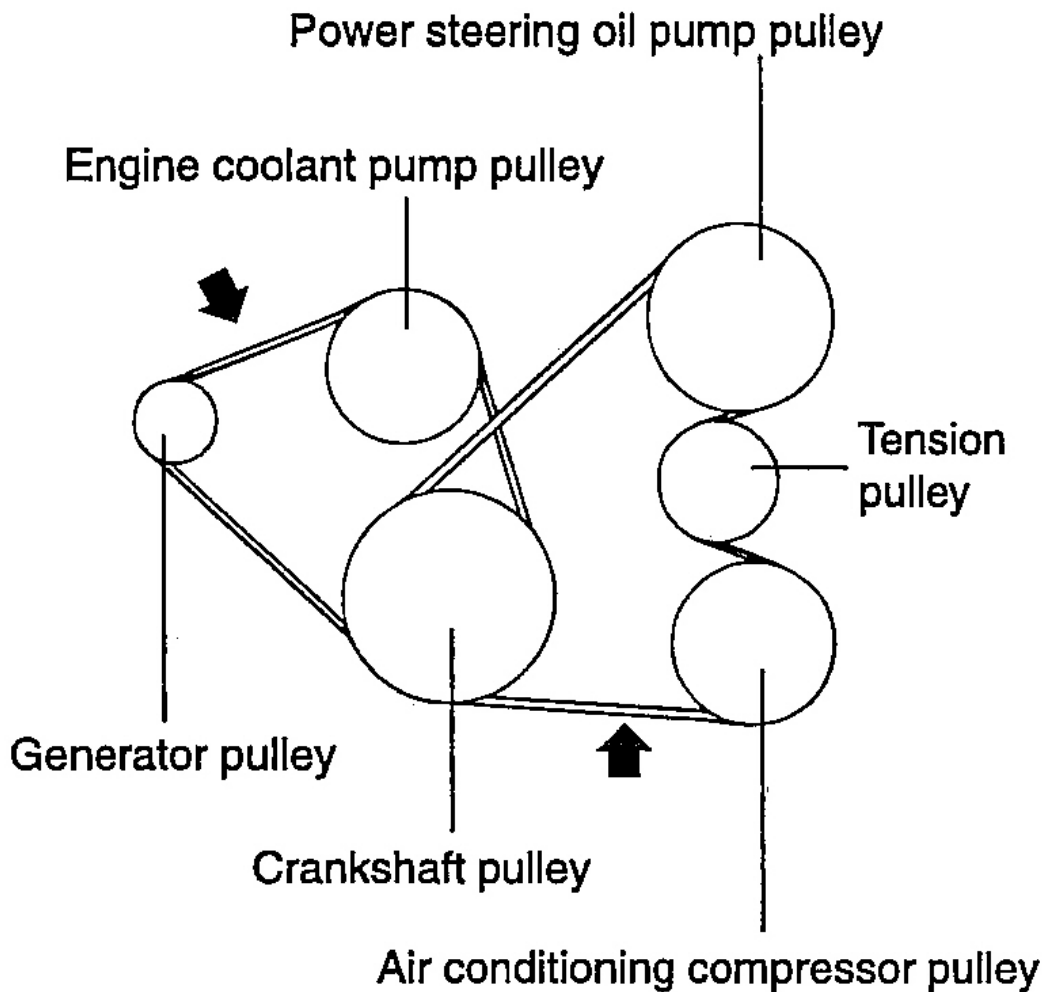
Courtesy of KIA MOTORS AMERICA, INC.

2. Apply 100 N (22 lbs.) force to the belt back midway between the pulleys as shown in the illustration. Measure the amount of deflection with a tension gauge.

Items		Inspection	Adjustment	
			New	Used
For generator	Deflection mm(in.)	7.7-12.3 (0.303-0.484)	6.3-7.3 (0.248-0.287)	8.4-10.6 (0.330-0.417)
	Tension N (lb)	300-500 (66-110)	550-650 (121-143)	350-450 (77-99)
For air conditioner compressor and power steering oil pump	Deflection mm(in.)	11.7-15.3 (0.46-0.6)	8.8-11.0 (0.35-0.43)	12.5-14.3 (0.5-0.56)

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Fig. 19: Identifying Drive Belt Tension Table
 Courtesy of KIA MOTORS AMERICA, INC.



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Fig. 20: Identifying Drive Belt Routing
Courtesy of KIA MOTORS AMERICA, INC.

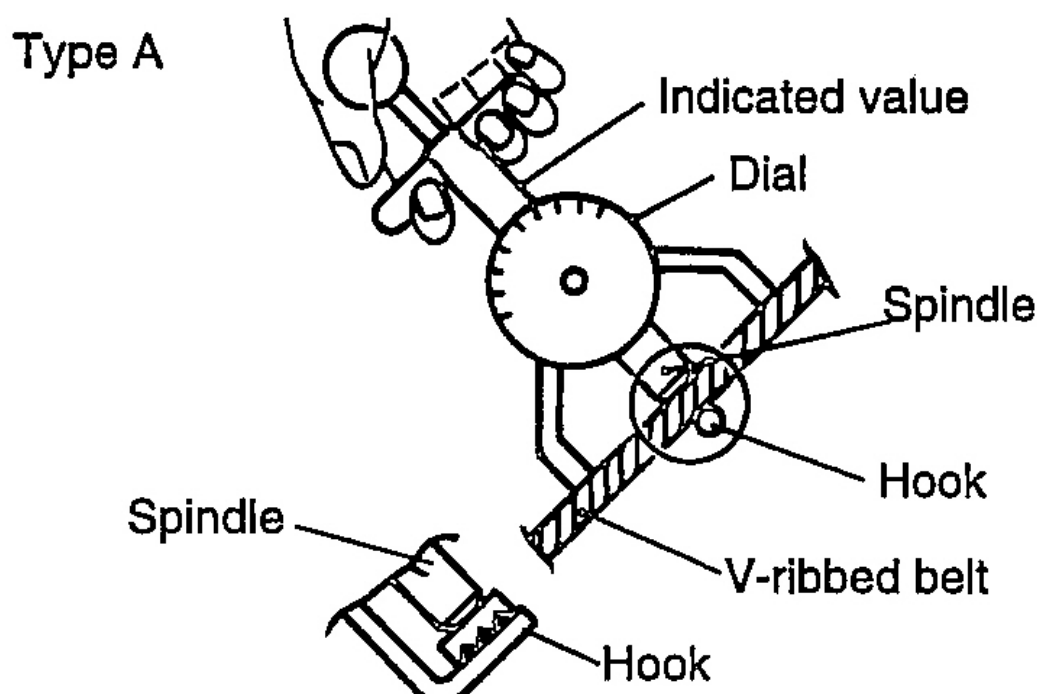
NOTE:

- The belt tension must be measured between the specified pulleys.
- When a new belt is installed, adjust the tension to the central value of the standard range indicated under "New". See [Fig. 19](#). And then let the engine idle for 5 minutes or more, and check the standard value indicated under "Inspection". See [Fig. 19](#).
- When adjusting a belt which has been used or a belt newly installed after 5 minutes or more of operation, refer to the standard value indicated under "Used" in the above table. See [Fig. 19](#).

- Refer to the standard value indicated under "Inspection" for periodic inspections. See Fig. 19.

Type A Tension Gauge

Do not let the dial section of the tension gauge contact other objects during measurement.

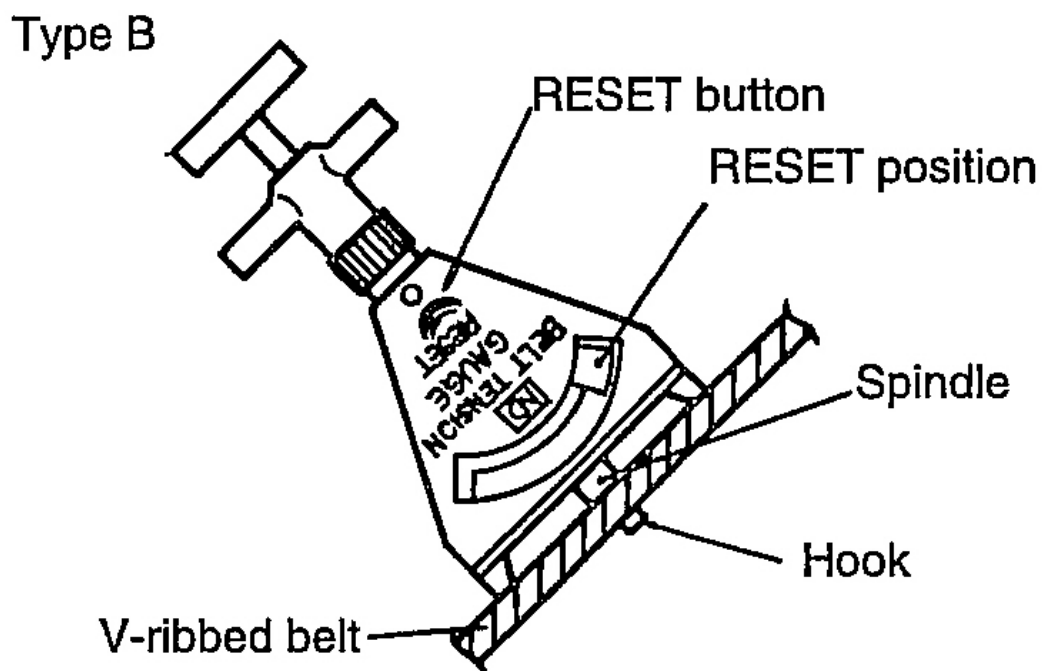


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Fig. 21: Identifying Type A Tension Gauge
Courtesy of KIA MOTORS AMERICA, INC.

Type B Tension Gauge

1. When measuring, be sure to turn reset button in the arrow direction to set the gauge needle to the RESET position.
2. If the tension gauge is removed from the belt, the needle will still indicate the tension. Read the tension value after removing the gauge.



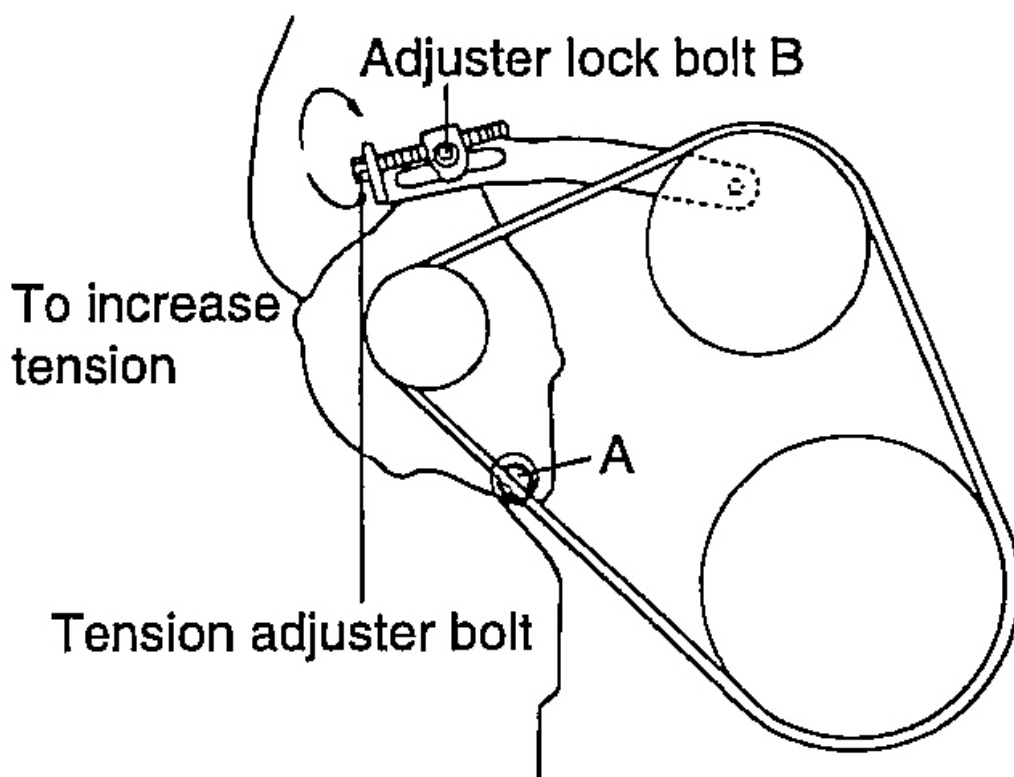
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Fig. 22: Identifying Type B Tension Gauge
Courtesy of KIA MOTORS AMERICA, INC.

Adjusting The Generator Belt

CAUTION: If the belt is too loose, this will cause noise or sudden wear. If the belt is too tight, the engine coolant pump bearing or the generator will get damaged.

1. Loosen the generator nut "A" and the tension adjuster lock bolt "B".



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Fig. 23: Adjusting Generator Drive Belt
Courtesy of KIA MOTORS AMERICA, INC.

2. Using the tension adjuster bolt, adjust the belt tension to the specification.
3. Tighten the adjuster lock bolt "B".
4. Tighten the generator nut "A".
5. Check the tension or the deflection of belt, readjust if necessary.

Generator Belt Adjustment

Tightening torque

Generator nut A :

34-54 Nm (340-540 kg.cm, 25-39 lb.ft)

Adjuster lock bolt B :

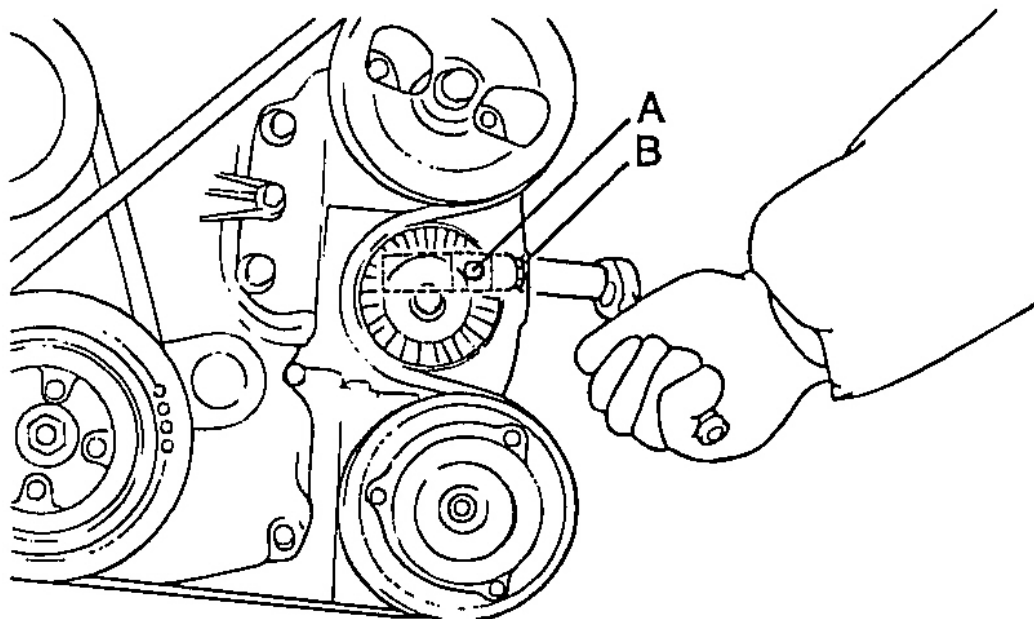
20-25 Nm (200-250 kg.cm, 14-18 lb.ft)

Tension adjuster bolt :

8-12 Nm (80-120 kg.cm, 6-8 lb.ft)

Adjusting The Power Steering And Air Conditioner Belt

1. Loosen the tension pulley adjustment bolt A.



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Fig. 24: Adjusting Power Steering & Air Conditioner Belt
Courtesy of KIA MOTORS AMERICA, INC.

2. Adjust the belt deflection with adjustment bolt B.
3. Tighten the fixing bolt A.
4. Re-check the belt deflection and re-adjust, if necessary.

NOTE: Before re-checking, crank the engine one or more revolutions.

CHECKING LASH ADJUSTERS

If an abnormal noise is heard from the lash adjusters (tappets), check as follows;

1. While installed to the cylinder head, press the part where the rocker arm contacts the lash adjuster at the very top. If the adjuster is normal, the part pressed will feel very hard.
2. If it always moves easily downward when pressed, there is a malfunction of the lash adjuster and it should be replaced with a new one.
3. If it feels spongy or elastic, probably oil mixed with air has entered the lash adjuster, so perform the following steps:
 - Check whether the amount of oil is too much or is not enough.
 - Check whether the reason why air is mixed with oil is a damaged oil screen or oil screen gasket. After repairing the cause of the air leak, warm up the engine and then drive the vehicle at low speed for a while. Stop the engine and leave it off for a few minutes; then restart the engine and drive at low speed. Repeat this procedure several times during the course of about one hour so as to remove the air from the oil.

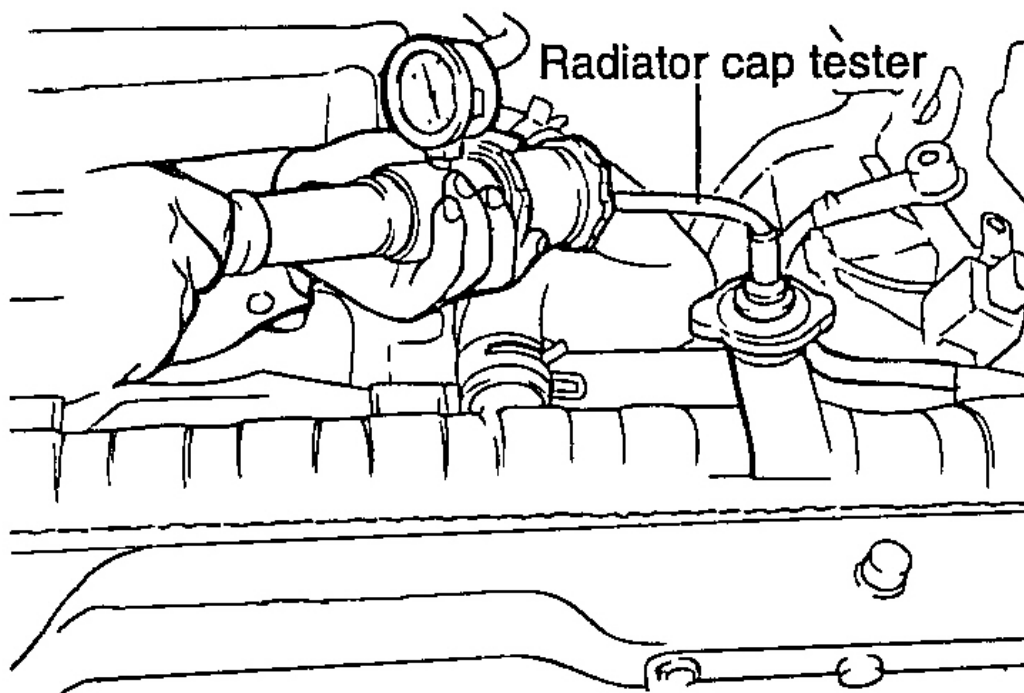
COOLING SYSTEM

CHECKING COOLING SYSTEM FOR LEAKS

WARNING:

- **Radiator coolant may be extremely hot. Do not open the system because hot, or scalding Engine coolant could spray out causing severe burns and blindness. Allow the vehicle to cool to ambient air temperature before servicing this system.**
- **Be sure to completely clean away any moisture from the places checked.**
- **When the tester is removed, be careful not to spill any coolant from it.**
- **Be careful, when installing and removing the tester and when testing, not to deform the filler neck of the radiator.**

1. Loosen the radiator cap.
2. Confirm that the coolant level is up to the filler neck.
3. Install a radiator cap tester in the radiator filler neck and apply 150 kPa (21 psi, 1.53 kg/cm²) pressure. Hold it for two minutes in that condition, while checking for leakage from the radiator, hose or connections.



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Fig. 25: Checking Cooling System For Leaks
Courtesy of KIA MOTORS AMERICA, INC.

4. If there is leakage, repair or replace the appropriate part.

RADIATOR CAP PRESSURE TEST

NOTE: Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an improper indication.

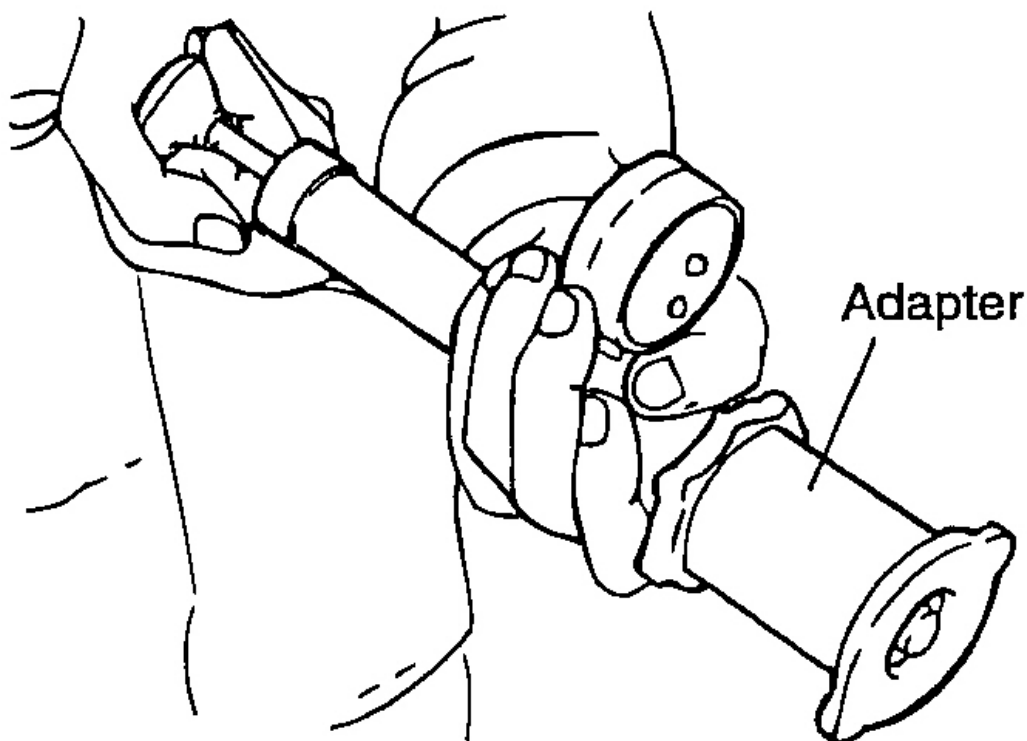
1. Use an adapter to attach the cap to the tester.
2. Increase the pressure until the indicator of the gauge stops moving.

Main valve opening pressure :

96.1-124.5 kPa (0.98-1.27 kg/m² , 13.94-18.06 psi)

Main valve closing pressure :

83.4kPa (0.85 kg/cm² , 12.1 psi)



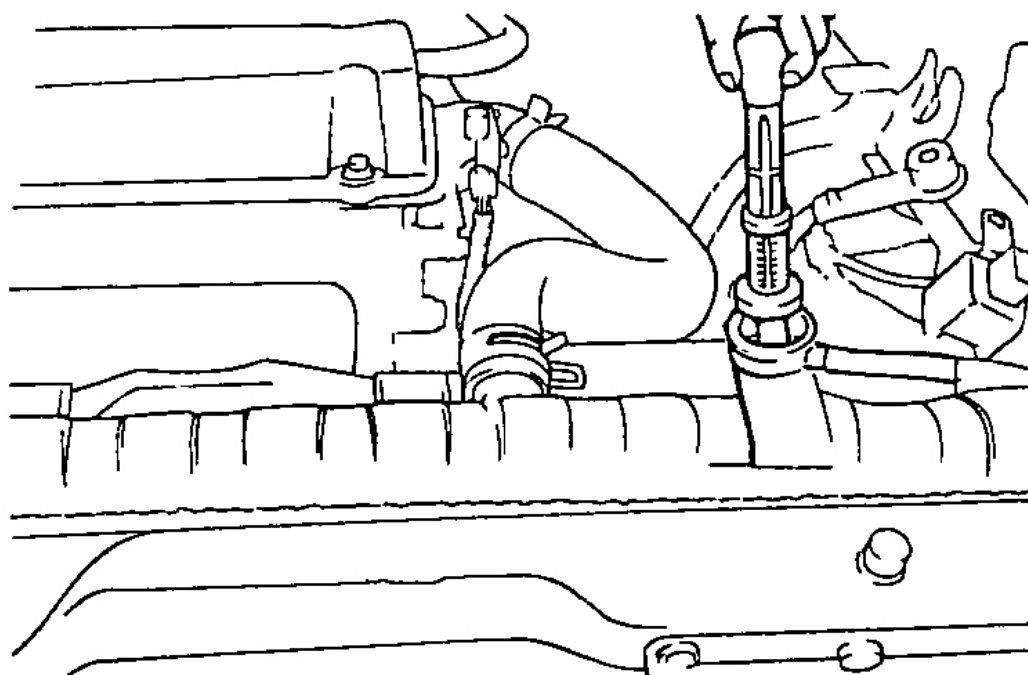
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Fig. 26: Pressure Testing Radiator Cap
Courtesy of KIA MOTORS AMERICA, INC.

3. Check that the pressure level is maintained at or above the limit.
4. Replace the radiator cap if the reading does not remain at or above the limit.

SPECIFIC GRAVITY TEST

1. Measure the specific gravity of the coolant with a hydrometer.
2. Measure the coolant temperature, and calculate the concentration from the relation between the specific gravity and temperature, using the following illustration for reference.



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Fig. 27: Measuring Specific Gravity Of Coolant
Courtesy of KIA MOTORS AMERICA, INC.

RELATION BETWEEN COOLANT CONCENTRATION AND SPECIFIC GRAVITY

Coolant temperature °C (°F) and specific gravity					Freezing temperature °C (°F)	Safe operating temperature °C (°F)	Coolant concentration (Specific volume)
10 (50)	20 (68)	30 (86)	40 (104)	50 (122)			
1.054	1.050	1.046	1.042	1.036	-16 (3.2)	-11 (12.2)	30%
1.063	1.058	1.054	1.049	1.044	-20 (-4)	-15 (5)	35%
1.071	1.067	1.062	1.057	1.052	-25 (-13)	-20 (-4)	40%
1.079	1.074	1.069	1.064	1.058	-30 (-22)	-25 (-13)	45%
1.087	1.082	1.076	1.070	1.064	-36 (-32.8)	-31 (-23.8)	50%
1.095	1.090	1.084	1.077	1.070	-42 (-44)	-37 (-35)	55%
1.103	1.098	1.092	1.084	1.076	-50 (-58)	-45 (-49)	60%

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Fig. 28: Identifying Coolant Concentration & Specific Gravity Chart
Courtesy of KIA MOTORS AMERICA, INC.

2004 Kia Optima EX

2004-05 ENGINES 2.4L 4 Cylinder - Optima & Magentis (Canadian)

Example:

The safe operating temperature is -15°C (5°F) when the measured specific gravity is 1.058 at coolant temperature of 20°C (68°F).

CAUTION: If the concentration of the coolant is below 30%, the anti-corrosion property will be adversely affected. In addition, if the concentration is above 60%, both the anti-freeze and engine cooling properties will decrease, affecting the engine adversely. For these reasons, be sure to maintain the concentration level within the specified range. Do not use together with another brand's product.

RECOMMENDED COOLANT

Antifreeze	Mixture ratio of anti-freeze in coolant
ETHYLENE GLYCOL	50% [Except tropical areas]
BASE FOR ALUMINUM	40% [Tropical areas]

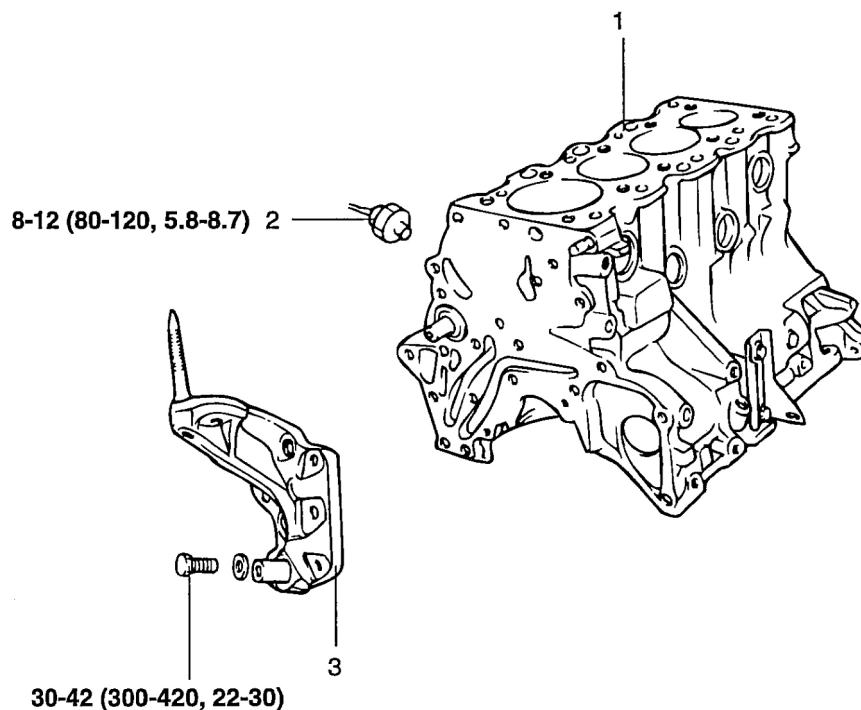
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Fig. 29: Identifying Engine Coolant Type
Courtesy of KIA MOTORS AMERICA, INC.

ENGINE BLOCK

ENGINE BLOCK

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

1. Cylinder block
2. Oil pressure switch

3. Engine support bracket, left

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Fig. 30: Identifying Engine Block Components
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

Remove the cylinder head, timing belt train, front case, flywheel, piston and crankshaft. For further details, refer to the respective headings.

INSPECTION

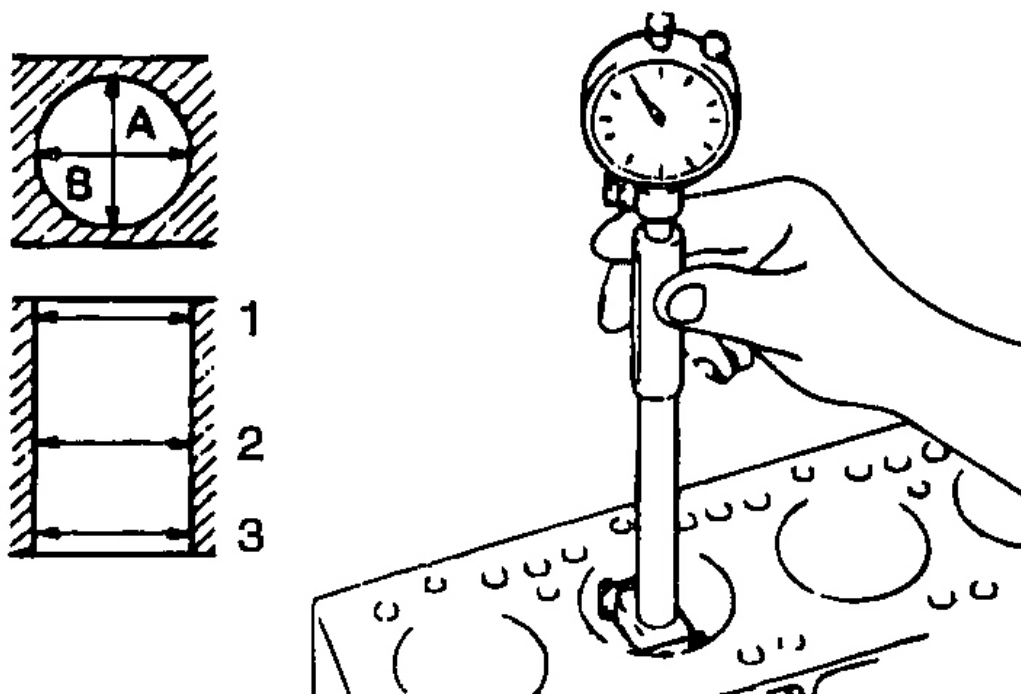
Cylinder Block

1. Visually check the cylinder block for scores, rust and corrosion. Also check for cracks or any other defects. Correct or replace the block if defective.
2. Measure cylinder bore with a cylinder gauge at three levels in directions of A and B shown in illustration.

Level 1 : No.1 piston ring position with piston at TDC

Level 2 : Center of cylinder

Level 3 : Bottom of cylinder



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Fig. 31: Measuring Cylinder Bore
Courtesy of KIA MOTORS AMERICA, INC.

3. If cylinder bores show more the specified out-of-round or taper, or if the cylinder walls are badly scuffed or scored, the cylinder block should be re-bored and honed and fitted with oversize pistons and rings.

Standard value

Cylinder bore: 85.00-85.03 mm (3.3465-3.3476 in.)

Out-of-roundness and taper of cylinder bore:

Max. 0.01 mm (0.0004 in.)

4. If cylinder top ridge is worn in stages, cut away with ridge reamer.
5. Oversize piston is available in one size.

Piston service size and mark mm (in.): 0.25 (0.010) O.S: 0.25

6. To rebore the cylinder to oversize, keep the specified clearance between the oversize piston and the bore, and make sure that all pistons used are of the same oversize. The standard measurement of the piston outside diameter is taken at a level 2 mm (0.08 in.) above the bottom of the piston skirt and across the thrust faces.

Piston-to-cylinder wall clearance: 0.02-0.04 mm (0.0008-0.0012 in.)

7. Check for damage and cracks.
8. Check top surface for flatness. If excessive flatness is evident, grind to minimum limit or replace.

Standard value

Flatness of gasket surface : Max. 0.05 mm (0.0020 in.)

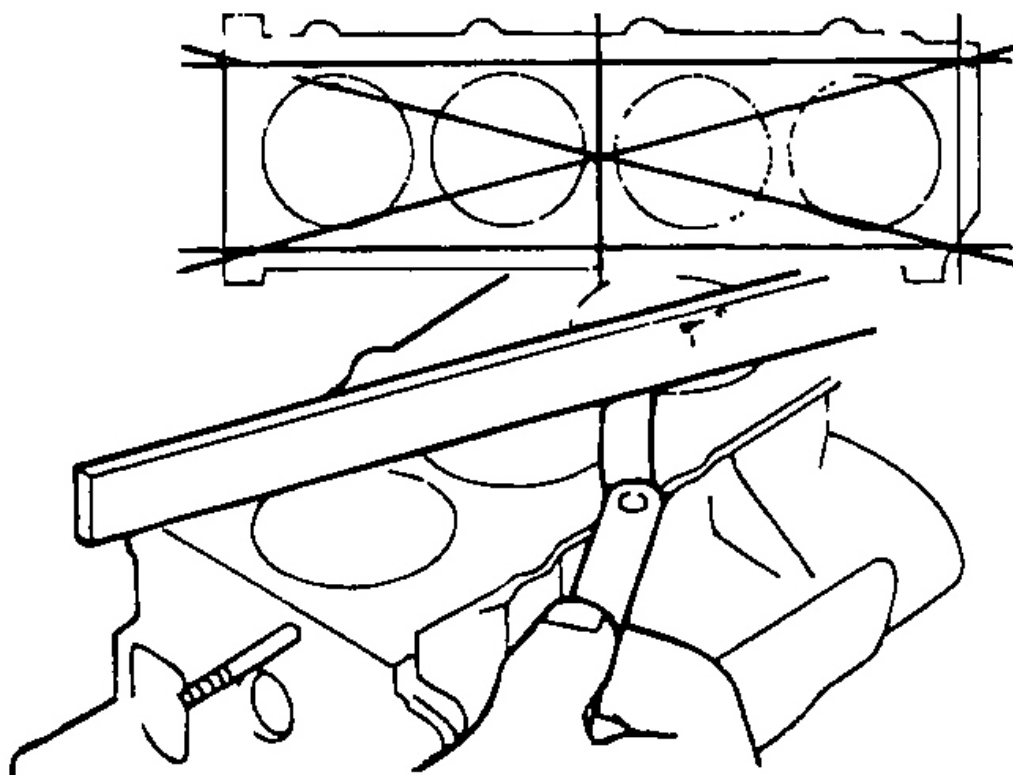
Cylinder block (New) height : 284 mm (11.18 in.)

Service limit

Flatness of gasket surface : 0.1 mm (0.0039 in.)

Overall height : -0.2 mm (-0.0079 in.)

NOTE: **The cylinder block gasket surface should be ground within -0.2 mm (-0.0079 in.) including the ground surface of cylinder head gasket surface.**



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Fig. 32: Checking Flatness Of Engine Block Top Surface
Courtesy of KIA MOTORS AMERICA, INC.

Boring Cylinder

1. Oversize pistons to be used should be determined on the base of the largest bore cylinder.

Size	Identification mark
0.25 mm (0.010 in.) O.S	0.25

G00326739

Fig. 33: Identifying Piston Bore Identification Mark
Courtesy of KIA MOTORS AMERICA, INC.

NOTE: Size mark is stamped on top of piston.

2. Measure outside diameter of piston to be used.
3. On the base of measured piston O.D., calculate boring finish dimension. Boring finish dimension = Piston O.D + 0.02-0.04 mm (0.0008-0.0016 in.) (clearance between O.D and cylinder)-0.02 mm (0.008 in.) (honing margin.)

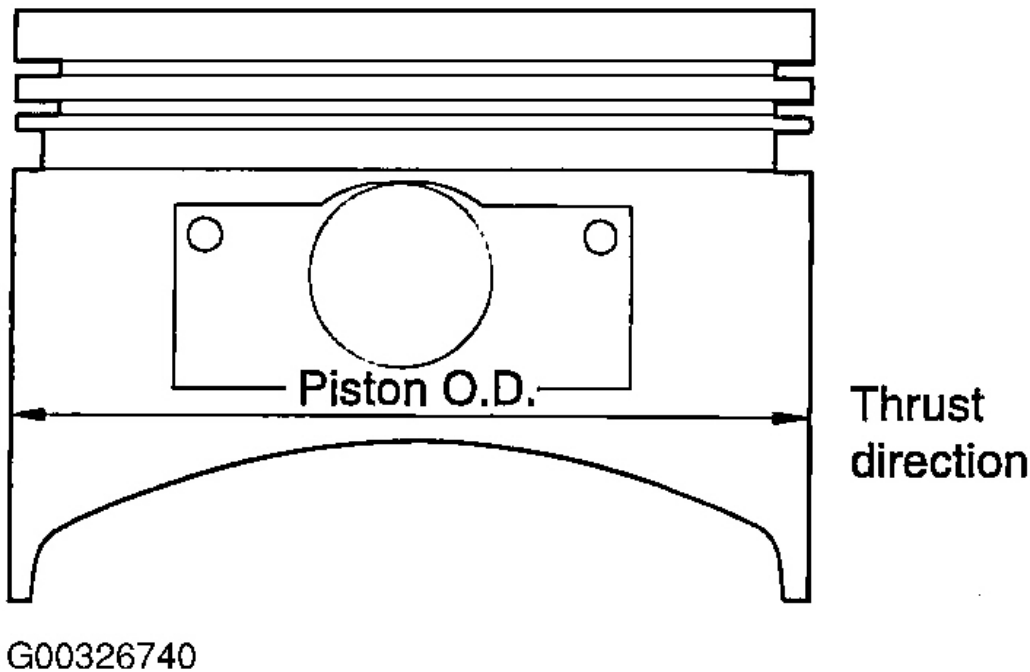


Fig. 34: Locating Piston Outside Diameter Identification Mark
Courtesy of KIA MOTORS AMERICA, INC.

4. Bore each of the cylinders to the calculated size.

NOTE: To prevent distortion that may result from temperature rise during honing, bore cylinders, working from No. 2 to No. 4 to No. 1 to No. 3.

5. Hone the cylinders, finishing them to the proper dimension (piston outside diameter + gap with cylinder).
6. Check clearance between piston and cylinder.

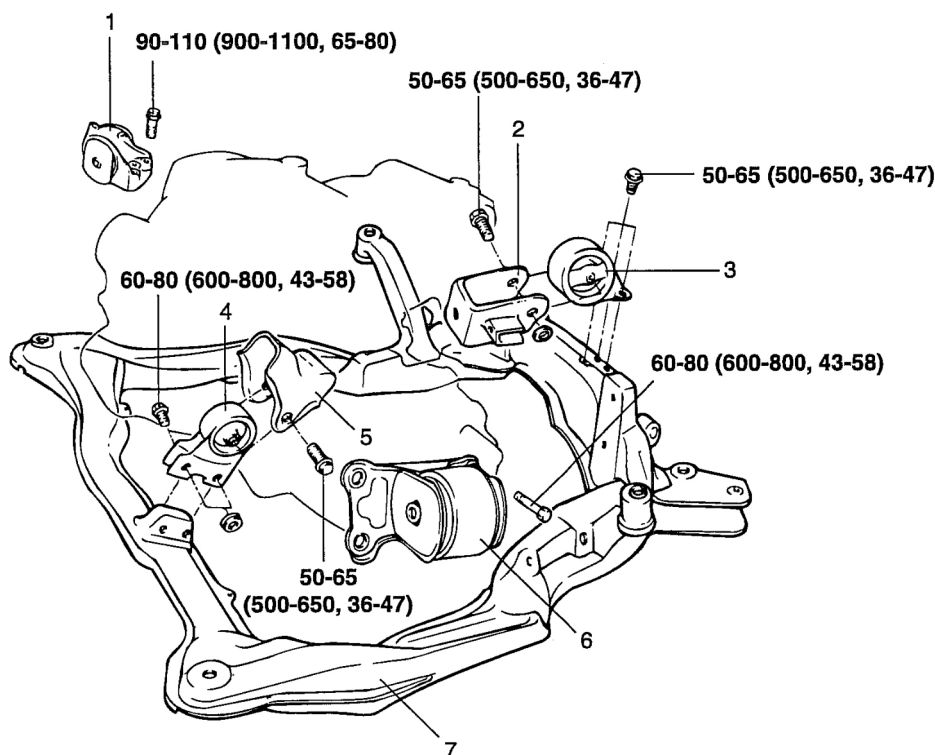
NOTE: When boring cylinders, finish all of four cylinders to the same oversize. Do not bore only one cylinder to an oversize.

REASSEMBLY

Install the following parts by referring to the respective procedures.

1. Crankshaft. See **CRANK SHAFT**.
2. Flywheel. See **FLY WHEEL**.
3. Piston. See **PISTON**.
4. Cylinder head. See **CYLINDER HEAD**.
5. Timing belt train. See **TIMING BELT**.
6. Front case. See **FRONT CASE**.

ENGINE MOUNTS**COMPONENTS**



TORQUE : Nm (kg.cm, lb.ft)

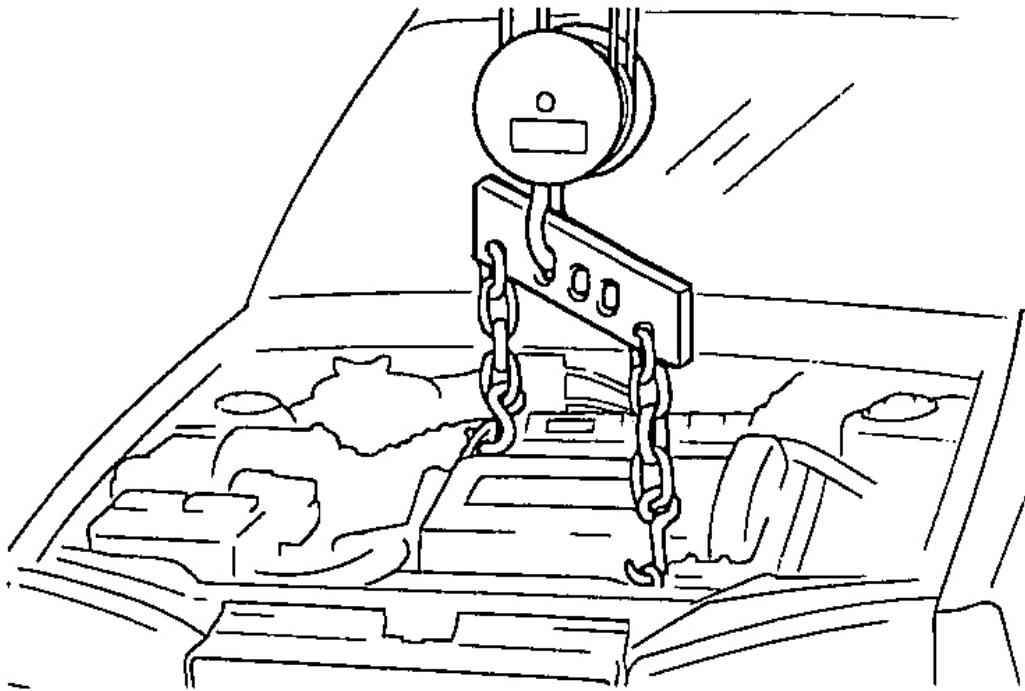
- | | |
|------------------------------|-------------------------------|
| 1. Engine mounting bracket | 5. Front roll stopper bracket |
| 2. Rear roll stopper bracket | 6. Transaxle mounting bracket |
| 3. Rear roll stopper | 7. Sub-frame |
| 4. Front roll stopper | |

G00326741

Fig. 35: Exploded View Of Engine Mounts
 Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

Attach an engine hoist to the engine hooks, and raise just enough so that there is no pressure on the insulators.



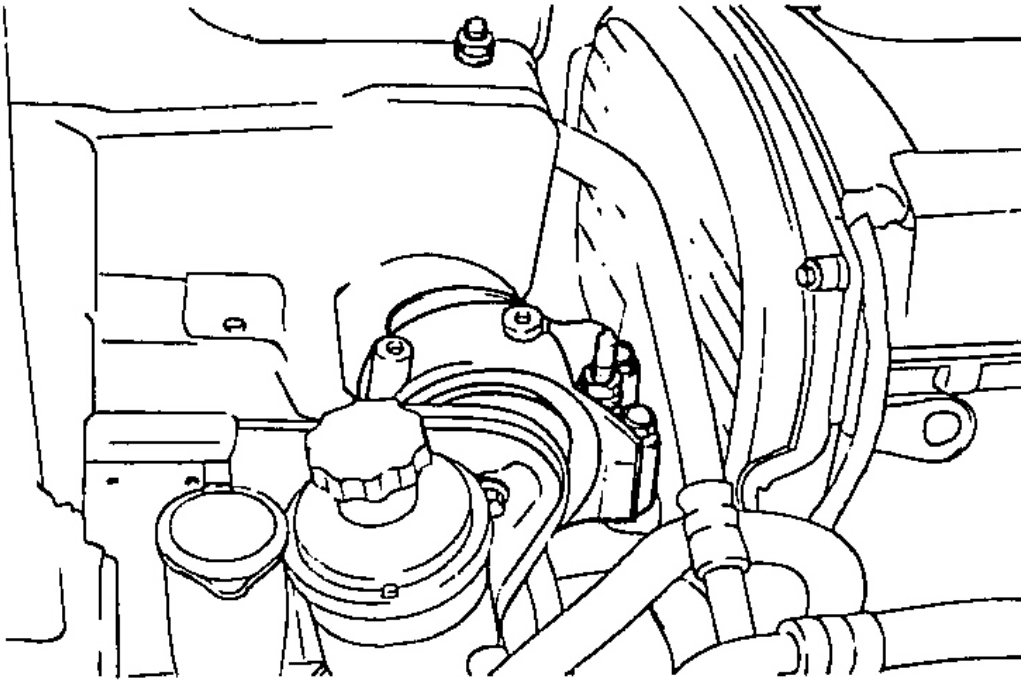
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Fig. 36: Installing Engine Hoist

Courtesy of KIA MOTORS AMERICA, INC.

Engine Mounting

1. Remove the engine mount insulator bolts.
2. Remove the engine mount bracket from the engine.

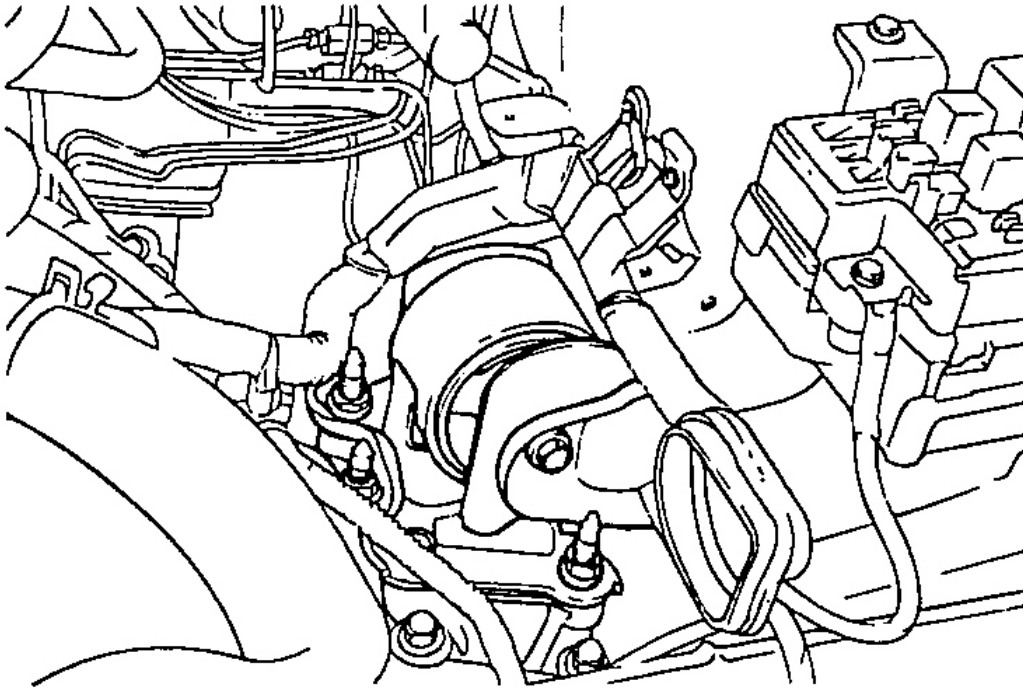


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Fig. 37: Removing Engine Mounting Bracket
Courtesy of KIA MOTORS AMERICA, INC.

Transaxle Mounting

1. Remove the transaxle mount insulator bolts.
2. Remove the transaxle mounting bracket from the transaxle.

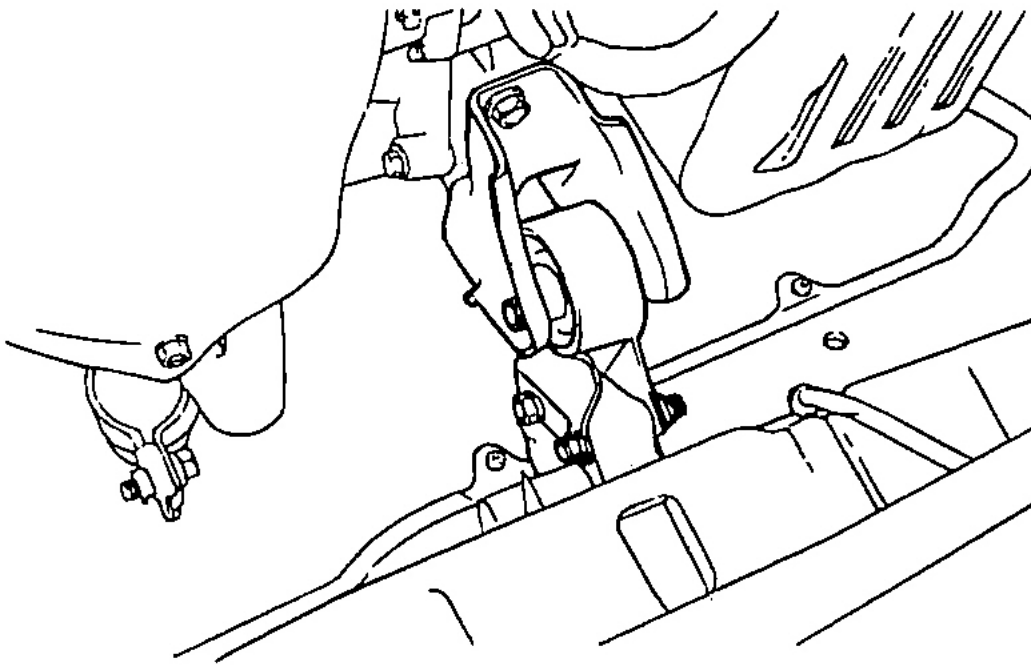


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Fig. 38: Removing Transaxle Mounting Bracket
Courtesy of KIA MOTORS AMERICA, INC.

Front Roll Stopper

Remove the front roll stopper bracket from the sub-frame.

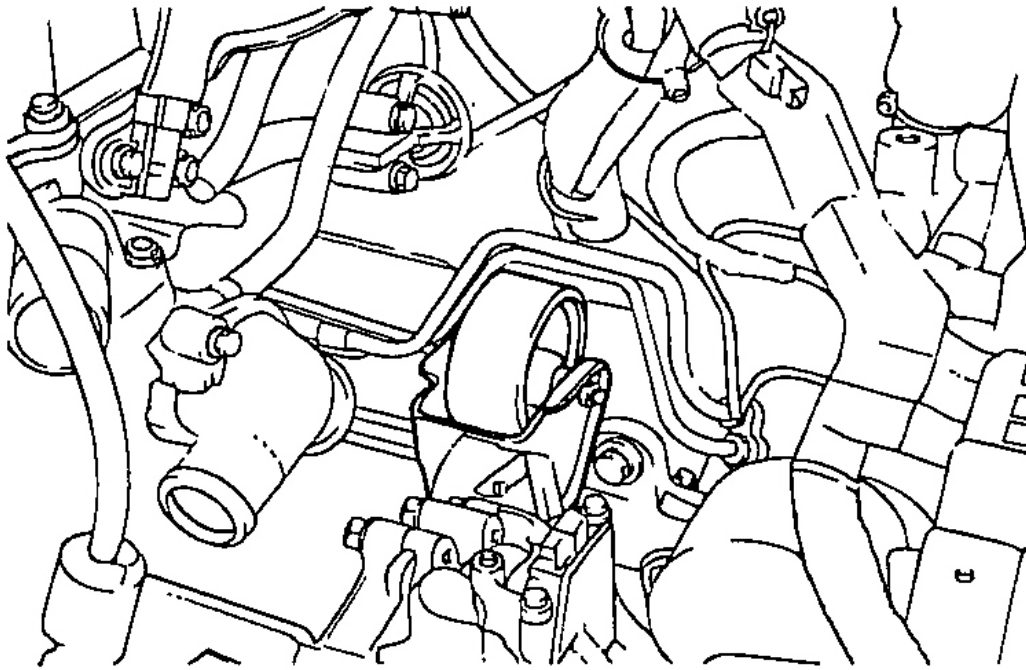


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Fig. 39: Removing Front Roll Stopper From Subframe
Courtesy of KIA MOTORS AMERICA, INC.

Rear Roll Stopper

1. Remove the bolt from the rear roll stopper.
2. Remove the rear roll stopper from the subframe.

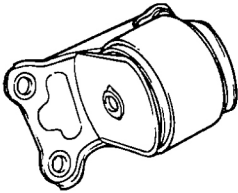


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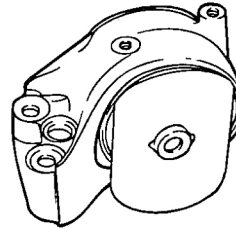
Fig. 40: Removing Rear Roll Stopper From Subframe
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION ITEMS

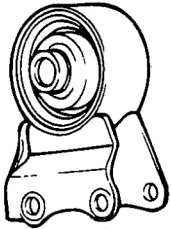
Transaxle mounting



Engine mounting



Front roll stopper assembly



G00326747

Rear roll stopper assembly

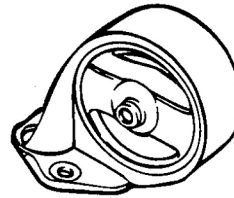
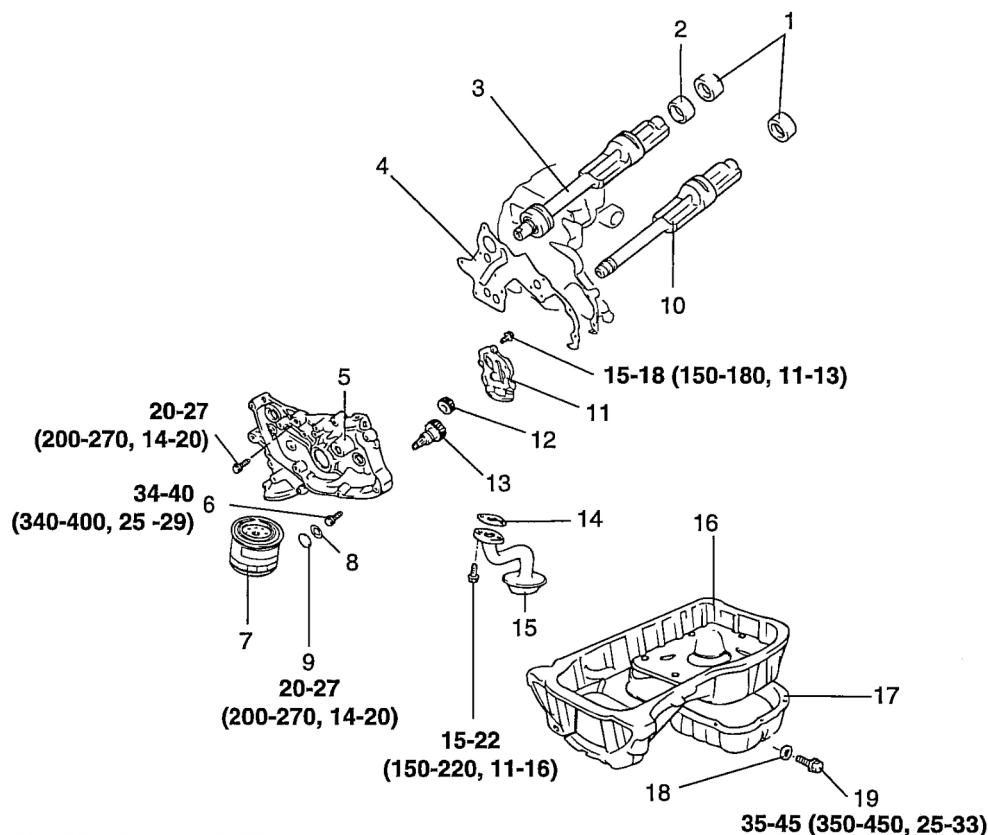


Fig. 41: Identifying Engine Mounts
Courtesy of KIA MOTORS AMERICA, INC.

FRONT CASE

COMPONENTS



TORQUE : Nm (kg.cm, lb.ft)

- | | |
|--------------------------------|--------------------|
| 1. Rear bearing | 11. Oil pump cover |
| 2. Front bearing | 12. Driven gear |
| 3. Right counter balance shaft | 13. Drive gear |
| 4. Gasket | 14. Gasket |
| 5. Oil pump case | 15. Oil screen |
| 6. Driven gear bolt | 16. Upper oil pan |
| 7. Oil filter | 17. Lower oil pan |
| 8. O-ring | 18. Gasket |
| 9. Plug cap | 19. Drain plug |
| 10. Left counter balance shaft | |

G00326748

Fig. 42: Exploded View Of Front Case
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Remove the timing belt. Refer to **TIMING BELT**.
2. Remove all the oil pan bolts.
3. Remove the oil pan.
4. Remove the oil screen and gasket.
5. Remove the relief plunger and gasket, and then take off the relief spring and relief valve from the oil filter bracket.

6. Remove the oil pressure switch.

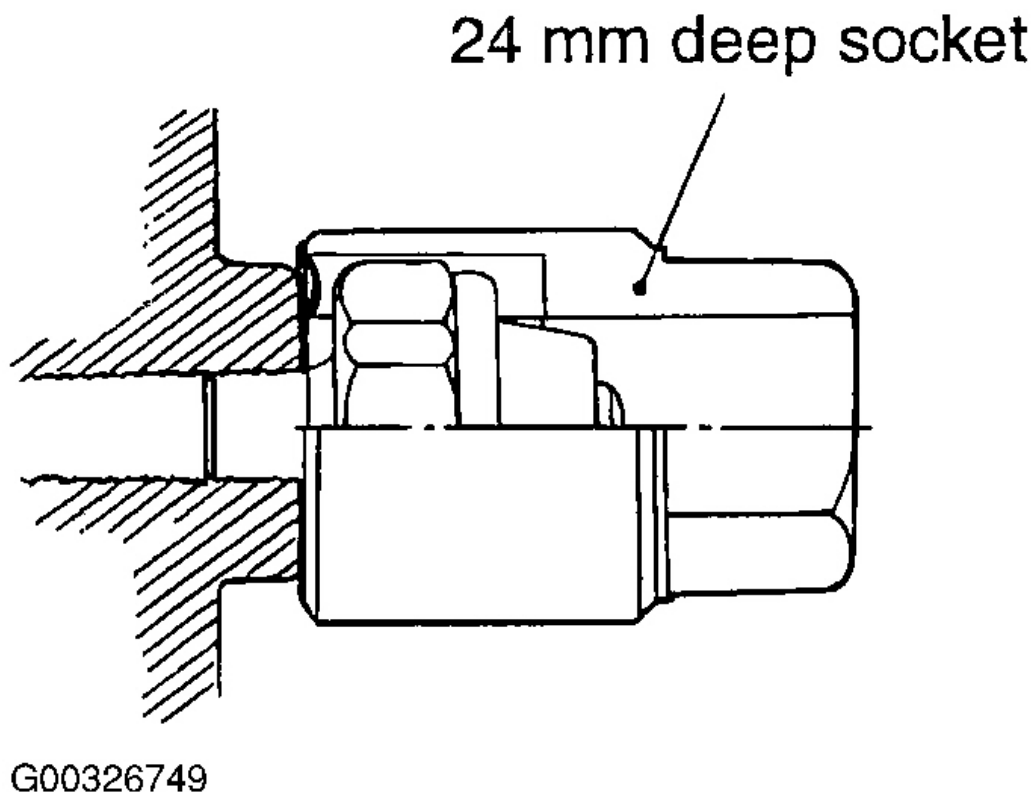
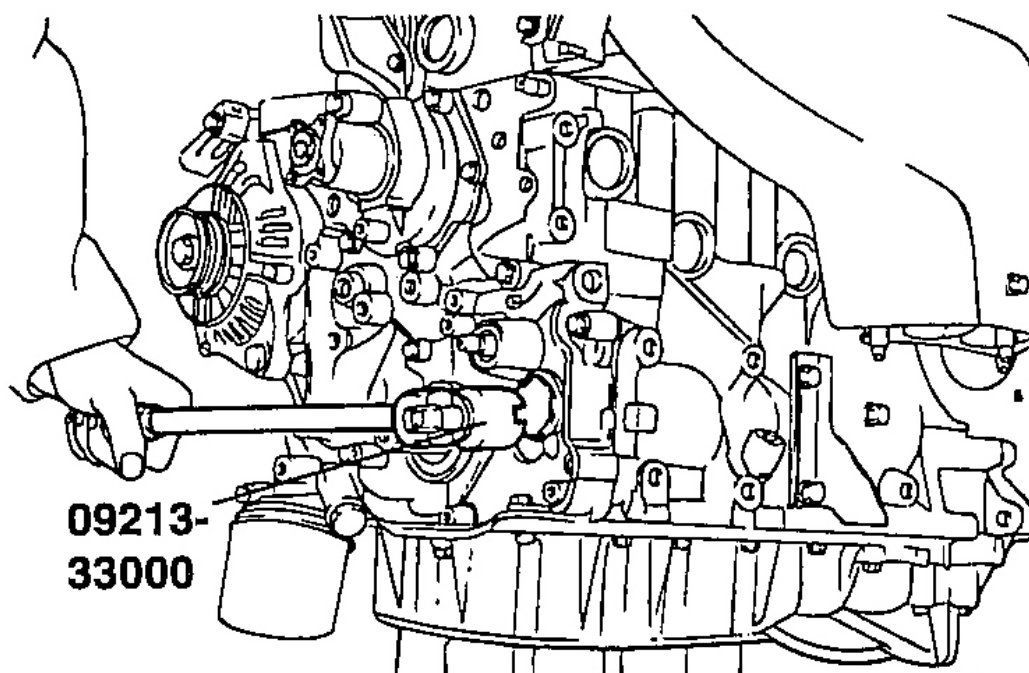


Fig. 43: Removing Oil Pressure Switch
Courtesy of KIA MOTORS AMERICA, INC.

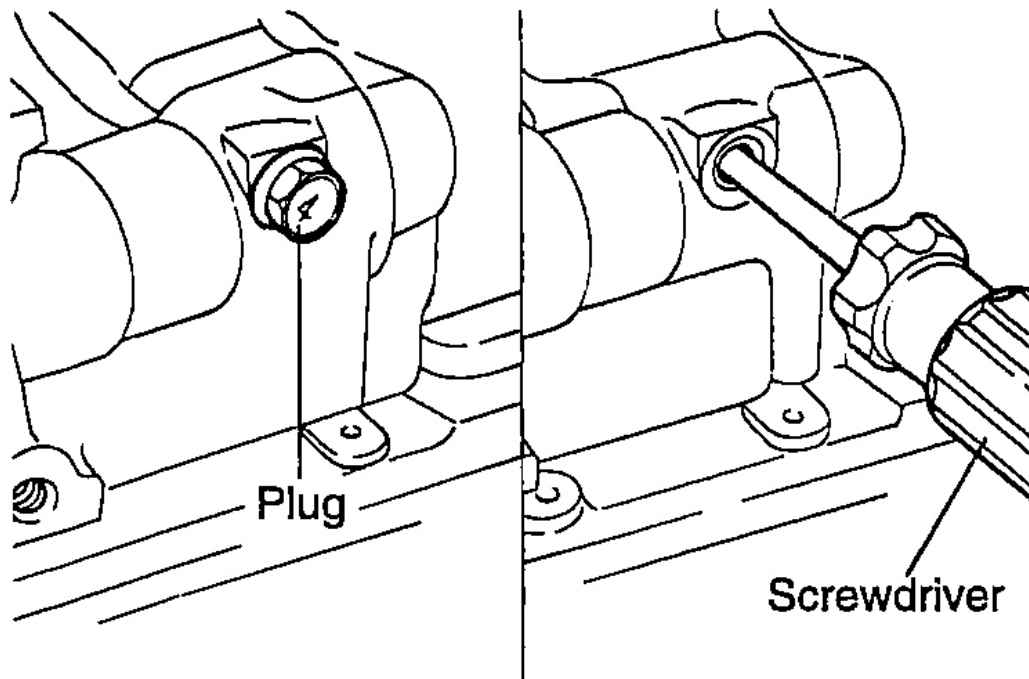
7. Remove the oil filter bracket and gasket.
8. Using the special tool, remove the plug cap from the oil pump portion of front case.



G00326750

Fig. 44: Removing Plug Cap From The Oil Pump Portion Of Front Case
Courtesy of KIA MOTORS AMERICA, INC.

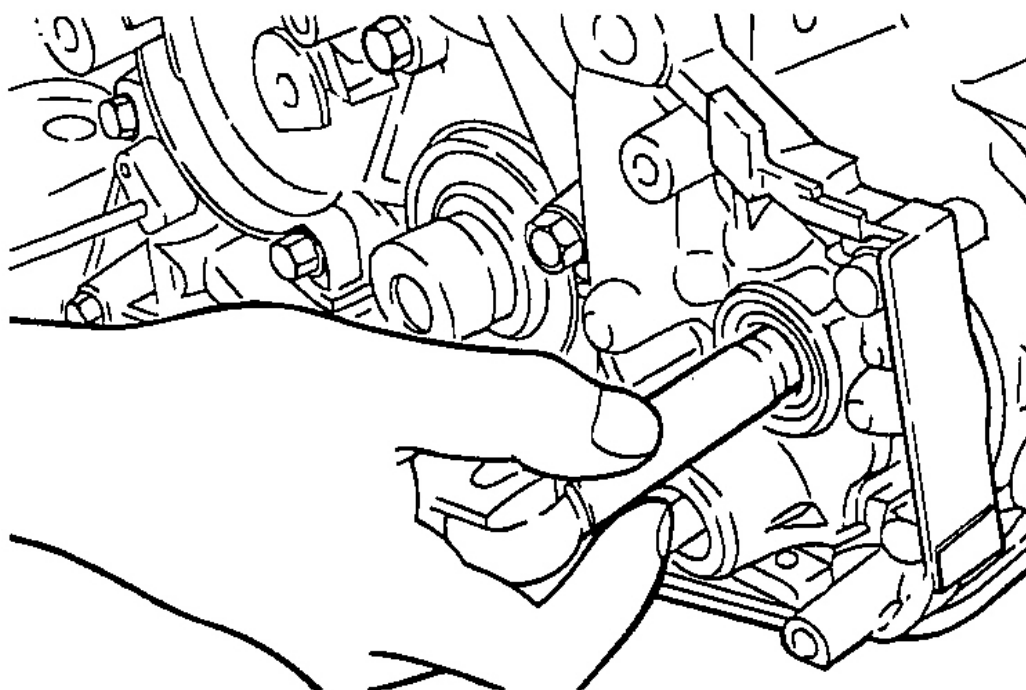
9. Remove the left side of cylinder block plug and insert a screwdriver with an 8 mm (0.32 in.) diameter shaft into plug hole. The screwdriver shaft must be inserted more than 60 mm (2.4 in.).



G00326751

Fig. 45: Removing Left Side Of Cylinder Block Plug & Inserting Screwdriver
Courtesy of KIA MOTORS AMERICA, INC.

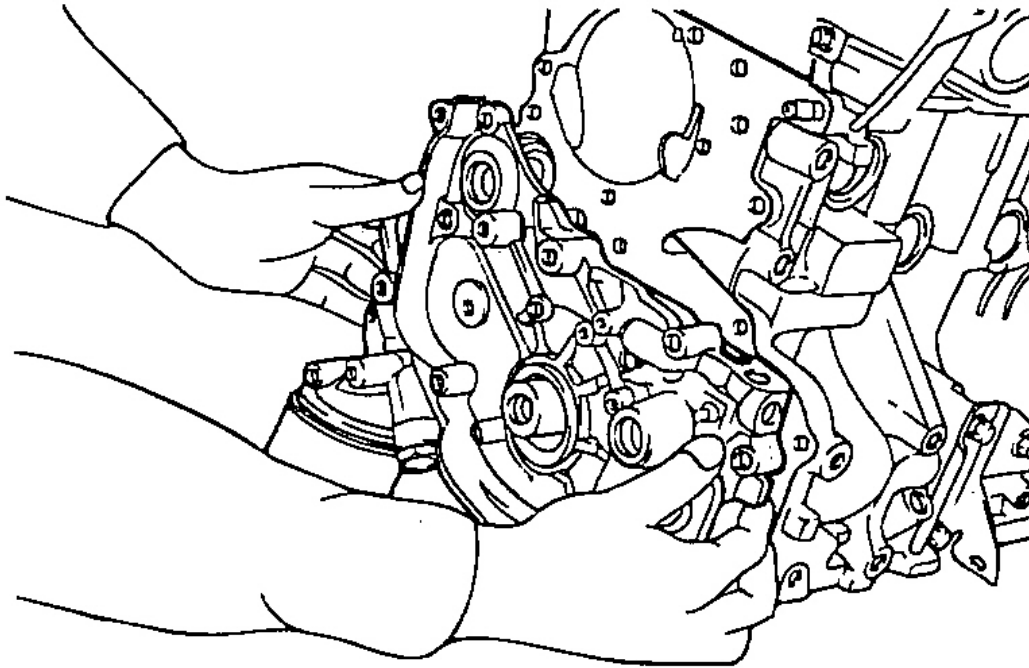
10. Remove the oil pump driven gear and the counter balance shaft retaining bolt.



G00326752

Fig. 46: Removing Counter Balance Shaft Retaining Bolt
Courtesy of KIA MOTORS AMERICA, INC.

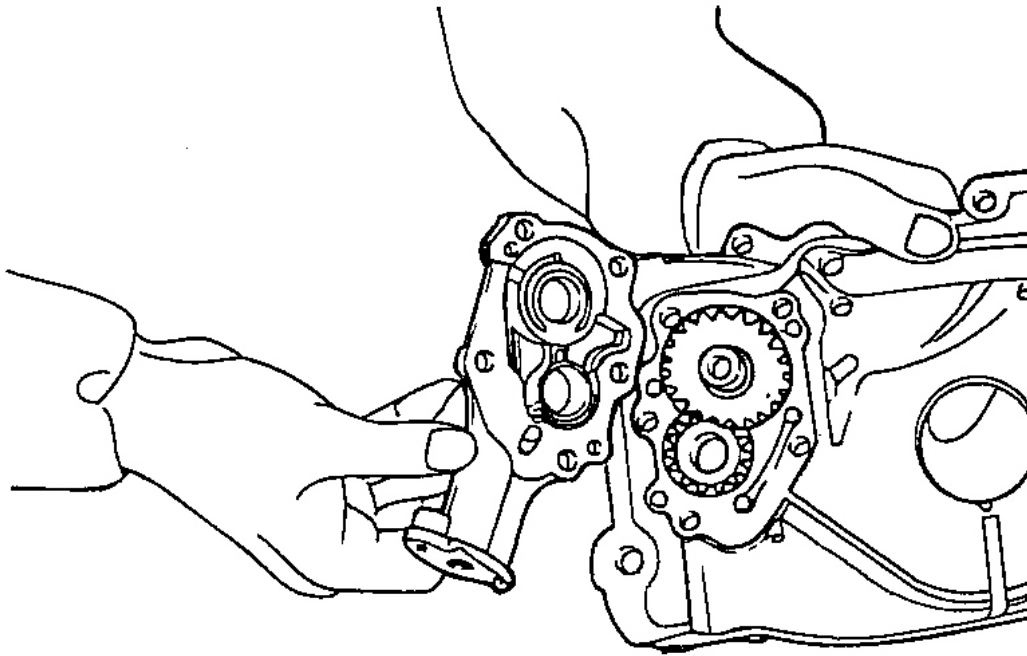
11. Remove the front case mounting bolts and remove the front case assembly and gasket. Remove the two counter balance shafts from the cylinder block.



G00326753

Fig. 47: Removing Front Case
Courtesy of KIA MOTORS AMERICA, INC.

12. Remove the oil pump cover from the front case.
13. Remove the oil pump gears from the front case.



G00326754

Fig. 48: Removing Oil Pump Gears

Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION**FRONT CASE**

1. Check oil holes for clogging and clean if necessary.
2. Check the counter balance shaft front bearing section for wear, damage and seizure. If there is anything wrong with the section, replace the front case.
3. Check the front case for cracks and other damage. Replace the cracked or damaged front case.

OIL SEAL

1. Check the oil seal lip for wear and damage. Replace the oil seal if necessary.
2. Check the oil seal lip for deterioration. Replace the oil seal if necessary.

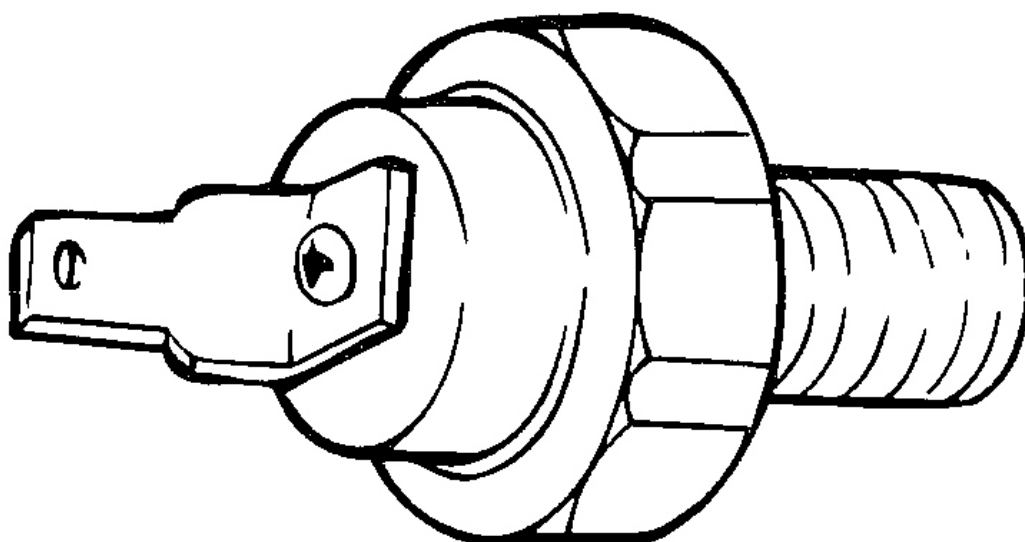
OIL PRESSURE SWITCH

1. If the "OIL PRESSURE" indicating lamp lights up when the ignition switch is "ON" and goes out when engine is started and runs at idle, everything is in order. If "OIL PRESSURE" lamp does not light when ignition switch is "ON". Check switch, lamp and wiring.

2. If there is current flow when ignition switch is "ON" and if there is no current flow when engine is running at idle, the switch is good. If the switch is good, check the lamp and wiring.

Oil pressure switch operation pressure :

14.71-29.42 kPa (0.15-0.3 kg/cm² ,2.1-4.3 psi)



G00326755

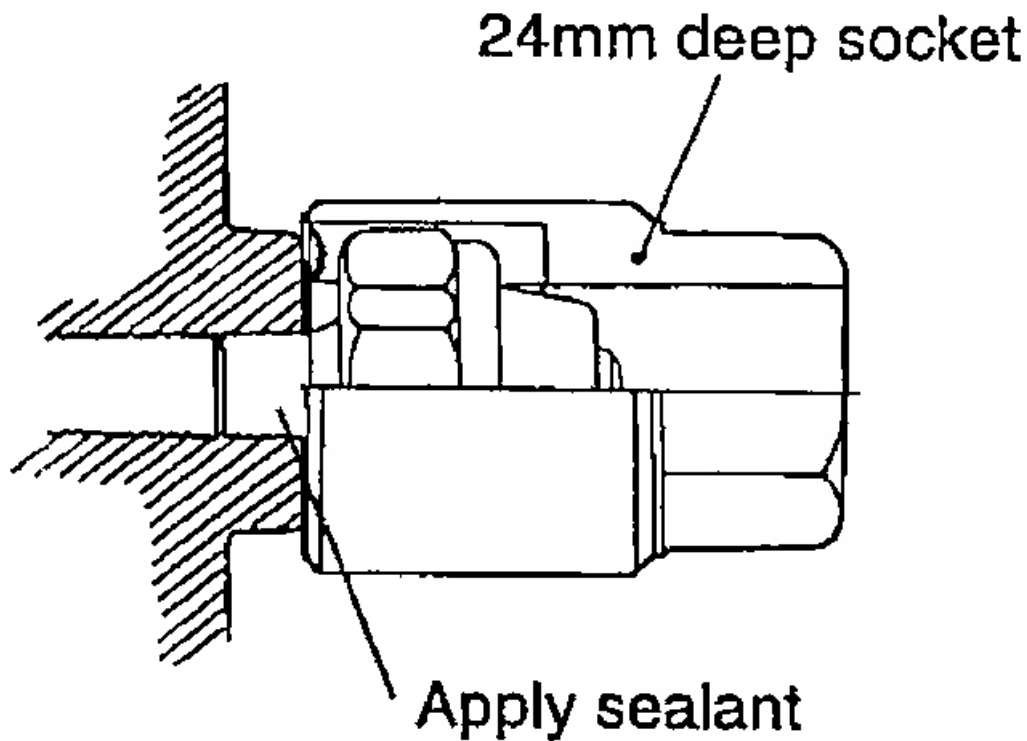
Fig. 49: Identifying Oil Pressure Switch
Courtesy of KIA MOTORS AMERICA, INC.

3. Using 24 mm deep socket, tighten the switch to the specified torque.

Tightening torque

Oil pressure switch and sensor assembly:

8-12 N.m (80-120 kg-cm, 5.8-8.7 lb.ft)

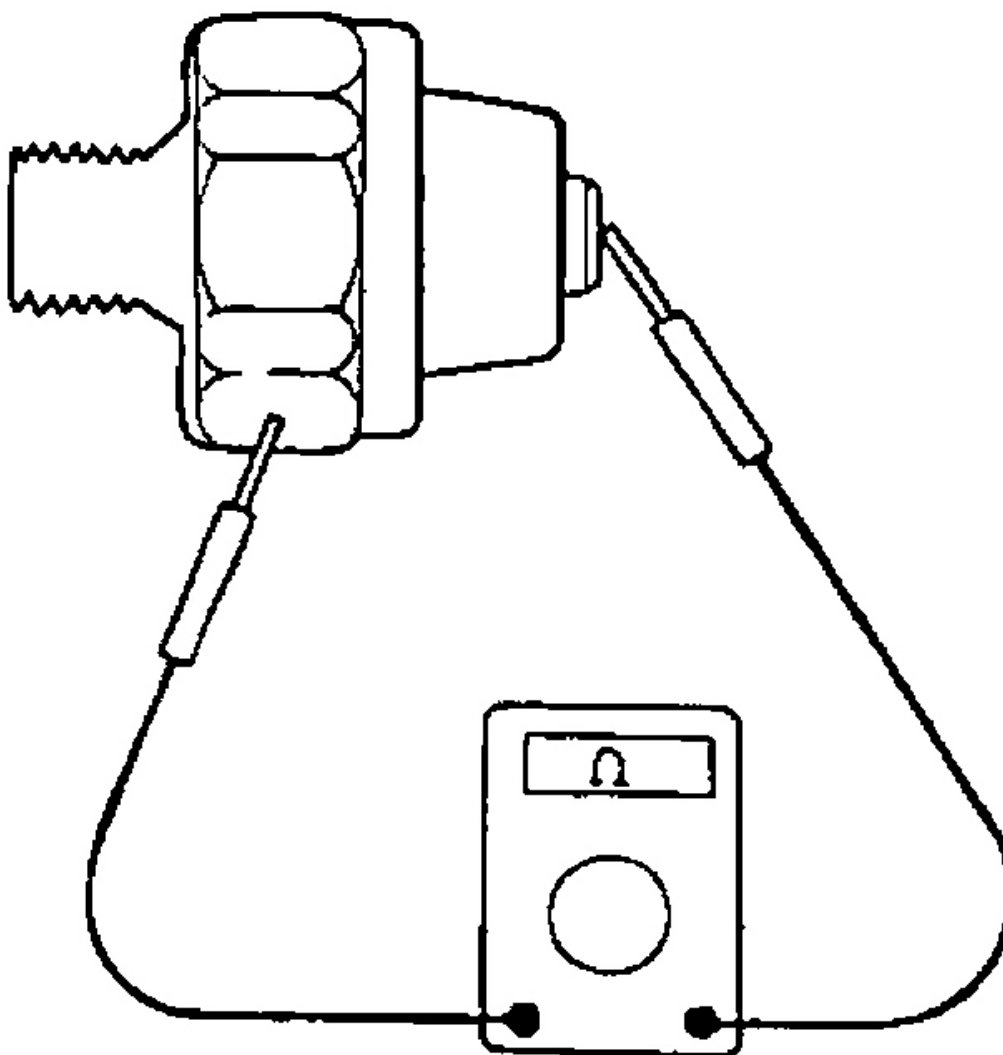


G00326756

Fig. 50: Installing Oil Pressure Switch
Courtesy of KIA MOTORS AMERICA, INC.

OIL PRESSURE SENSOR ASSEMBLY

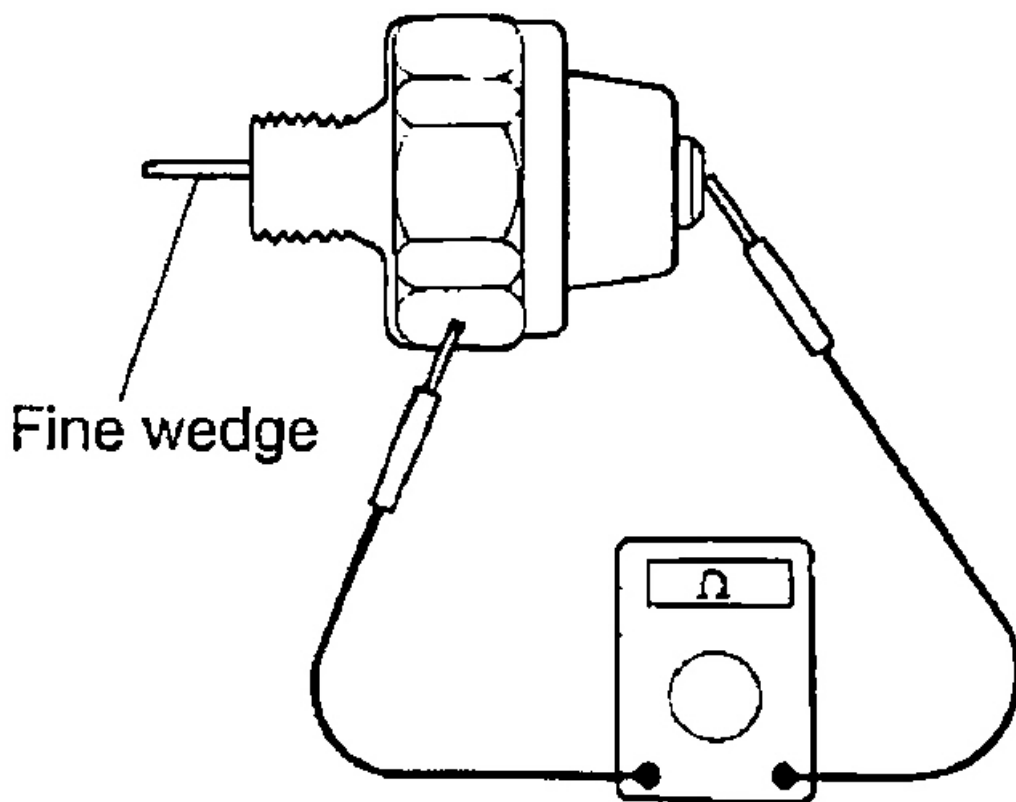
1. Check the continuity between the terminal and the body with an ohmmeter. If there is no continuity, replace the oil pressure switch.



G00326757

Fig. 51: Testing Oil Pressure Sensor Assembly (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace sensor.



G00326758

Fig. 52: Testing Oil Pressure Sensor Assembly (2 Of 2)

Courtesy of KIA MOTORS AMERICA, INC.

3. Or, if there is no continuity when a 50 kPa (7 psi) vacuum is applied through the oil hole, the switch is operating properly.

Check that air doesn't leak. If air leaks, the diaphragm is broken. Replace the sensor.

INSTALLATION

1. Apply engine oil to the gear and align the two timing marks.

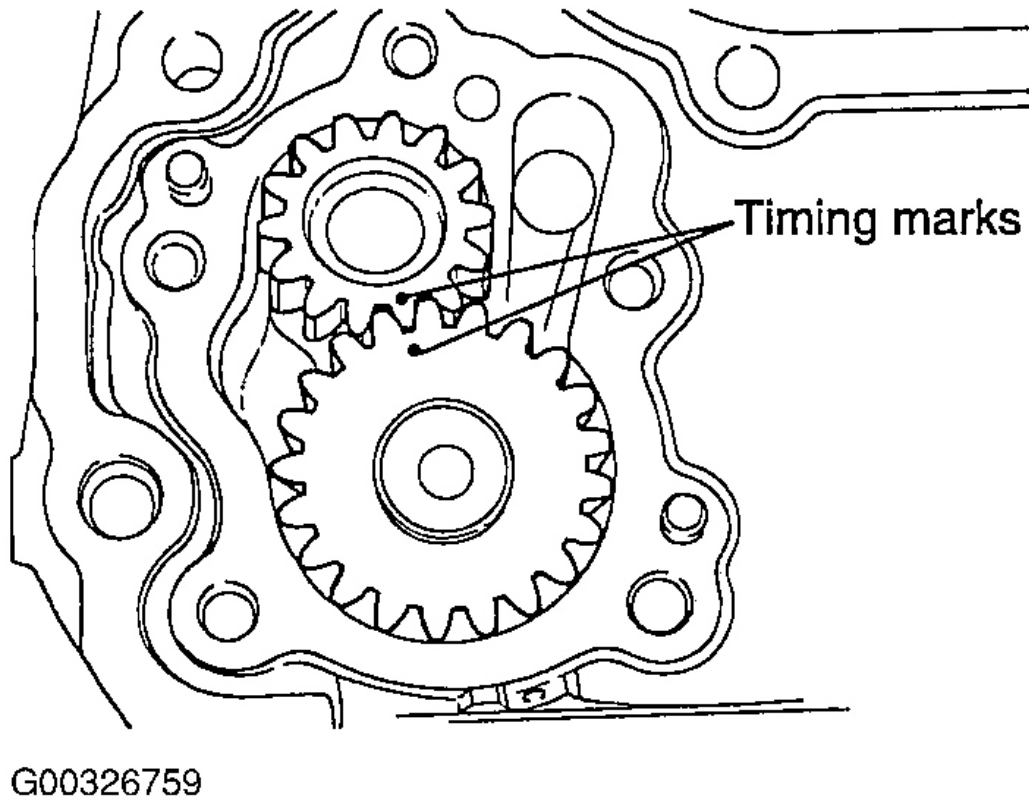


Fig. 53: Installing Oil Pump Gears
Courtesy of KIA MOTORS AMERICA, INC.

2. Using the special tool, Crankshaft Front Oil Seal Installer (09214-32000), install the crankshaft front oil seal into the front case.

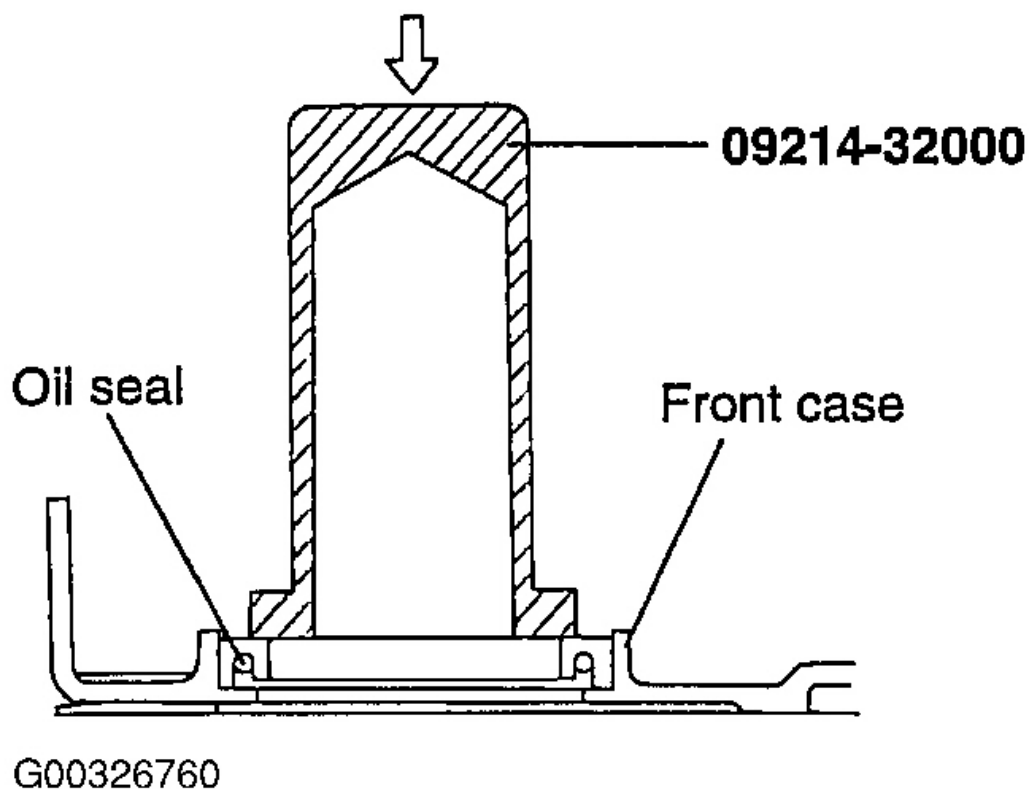
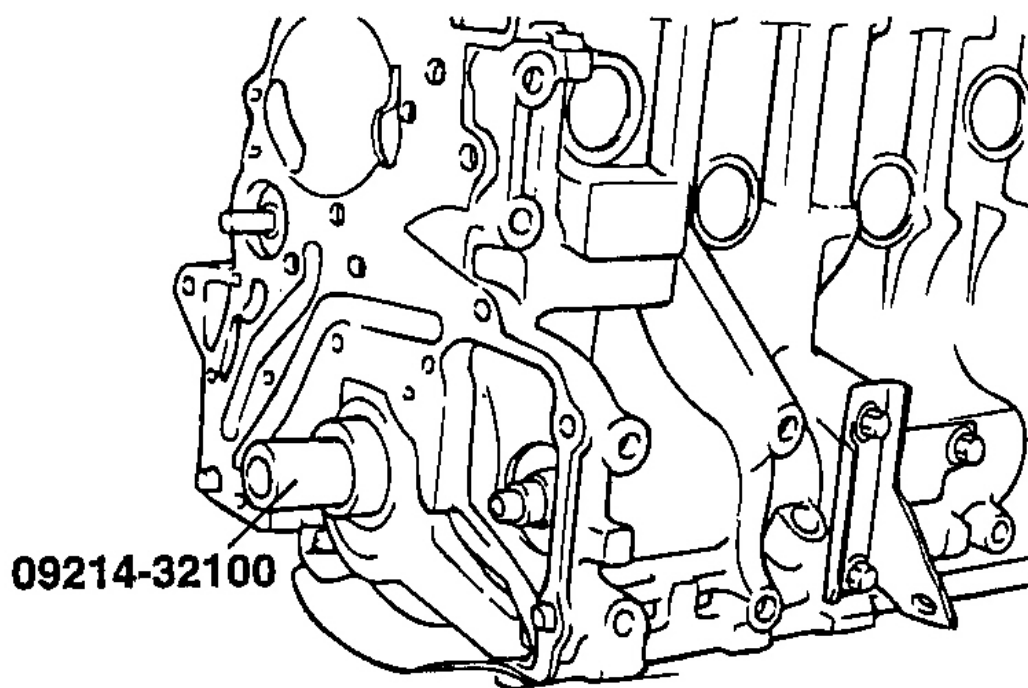


Fig. 54: Identifying Crankshaft Front Oil Seal Installer (09214-32100)
Courtesy of KIA MOTORS AMERICA, INC.

3. Set the special tool (09214-32100) on the front end of crankshaft and apply a thin coat of engine oil to the outer circumference of the special tool to install the front case.

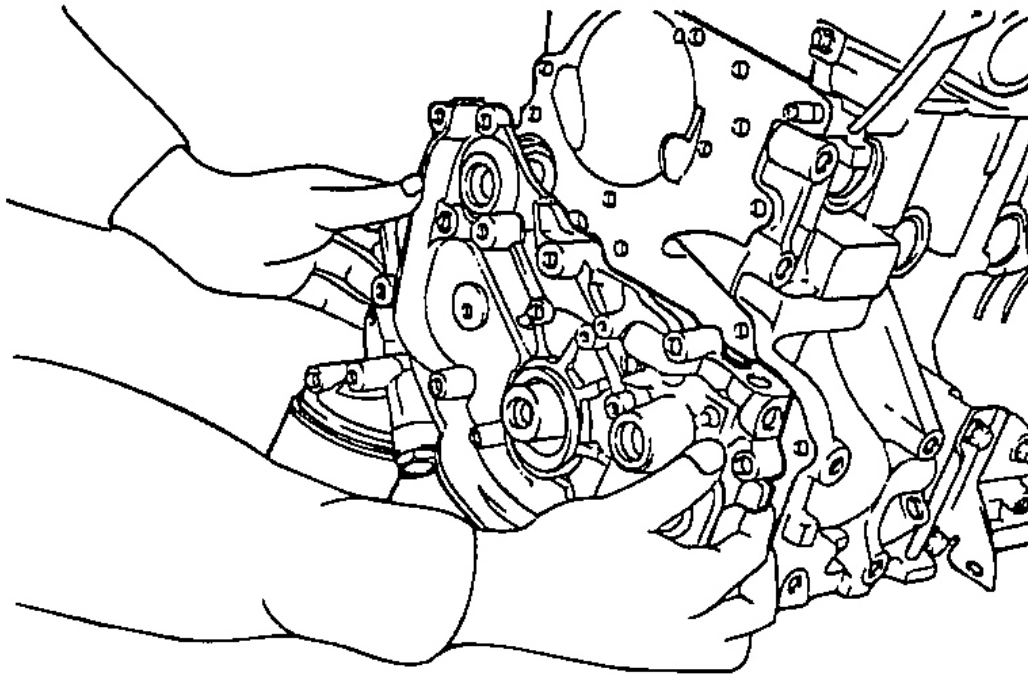


G00326761

Fig. 55: Identifying Crankshaft Front Oil Seal Guide (09214-32100)

Courtesy of KIA MOTORS AMERICA, INC.

4. Install the front case assembly through a new front case gasket and temporarily tighten the flange bolts (other than those for tightening the filter bracket).



G00326762

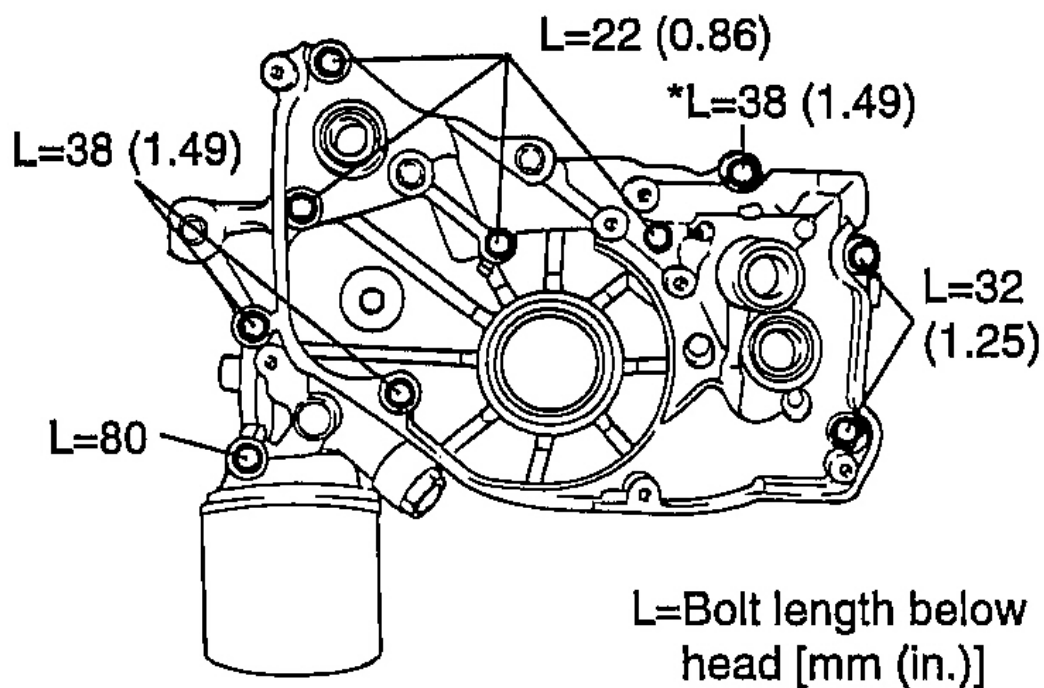
Fig. 56: Installing Front Case
Courtesy of KIA MOTORS AMERICA, INC.

5. Install the front case assembly with a new gasket, and tighten the bolts to the specified torque.

Front case assembly

Tightening torque

All except : 20-27 Nm (200-270 kg.cm, 14-20 lb.ft)

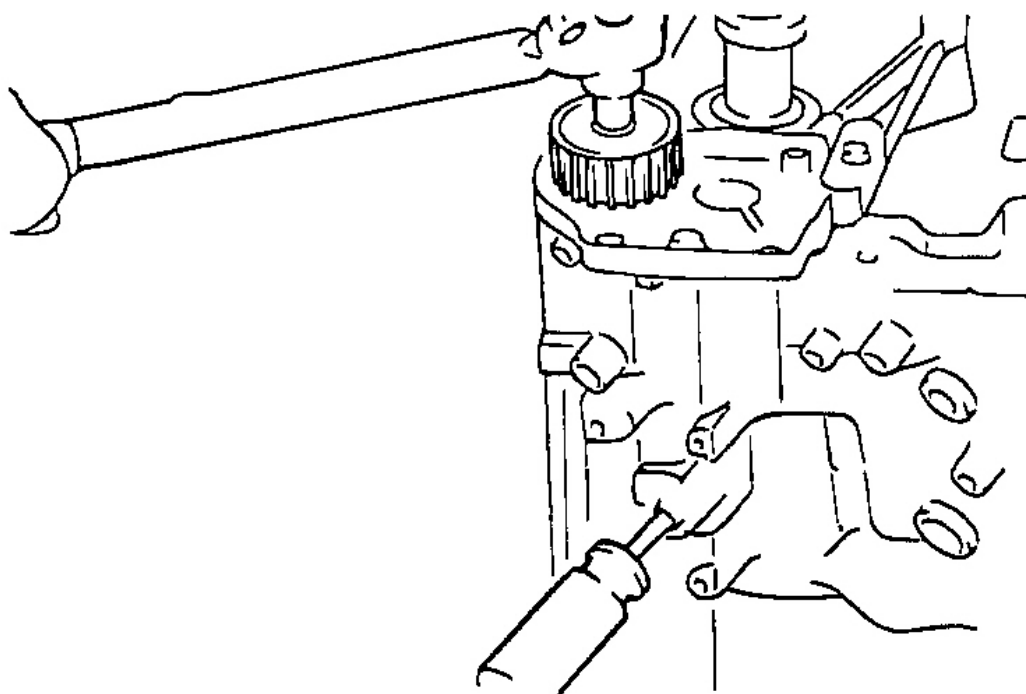


G00326763

Fig. 57: Identifying Front Case Bolts

Courtesy of KIA MOTORS AMERICA, INC.

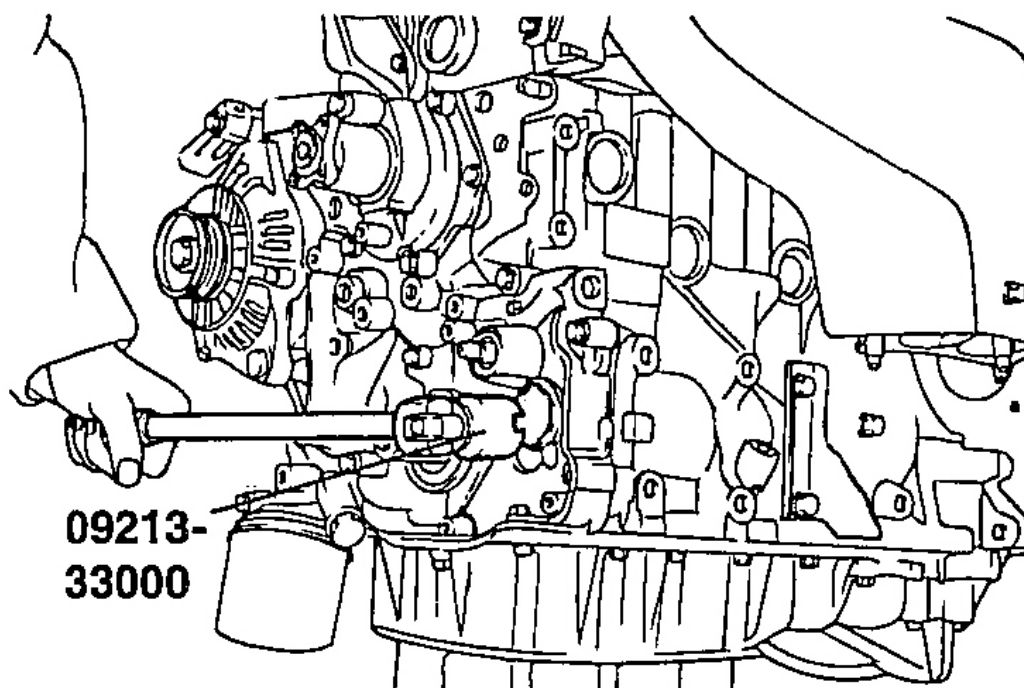
6. Insert a screwdriver through plug hole in left side of cylinder block. Checking that the shaft is in position and tighten.



G00326764

Fig. 58: Installing Shaft In Left Side Of Cylinder Block
Courtesy of KIA MOTORS AMERICA, INC.

7. Install a new O-ring to the groove of front case.
8. Using a special tool, install the plug case and tighten to the specified torque.



G00326765

Fig. 59: Identifying Plug Cap Wrench (09213-33000)

Courtesy of KIA MOTORS AMERICA, INC.

9. Apply sealant into the groove of the pan flange as shown in illustration.

NOTE:

- Apply sealant about 4 mm (0.16 in.) in thickness.
- After application of sealant, do not exceed 15 minutes before installing the oil pan.

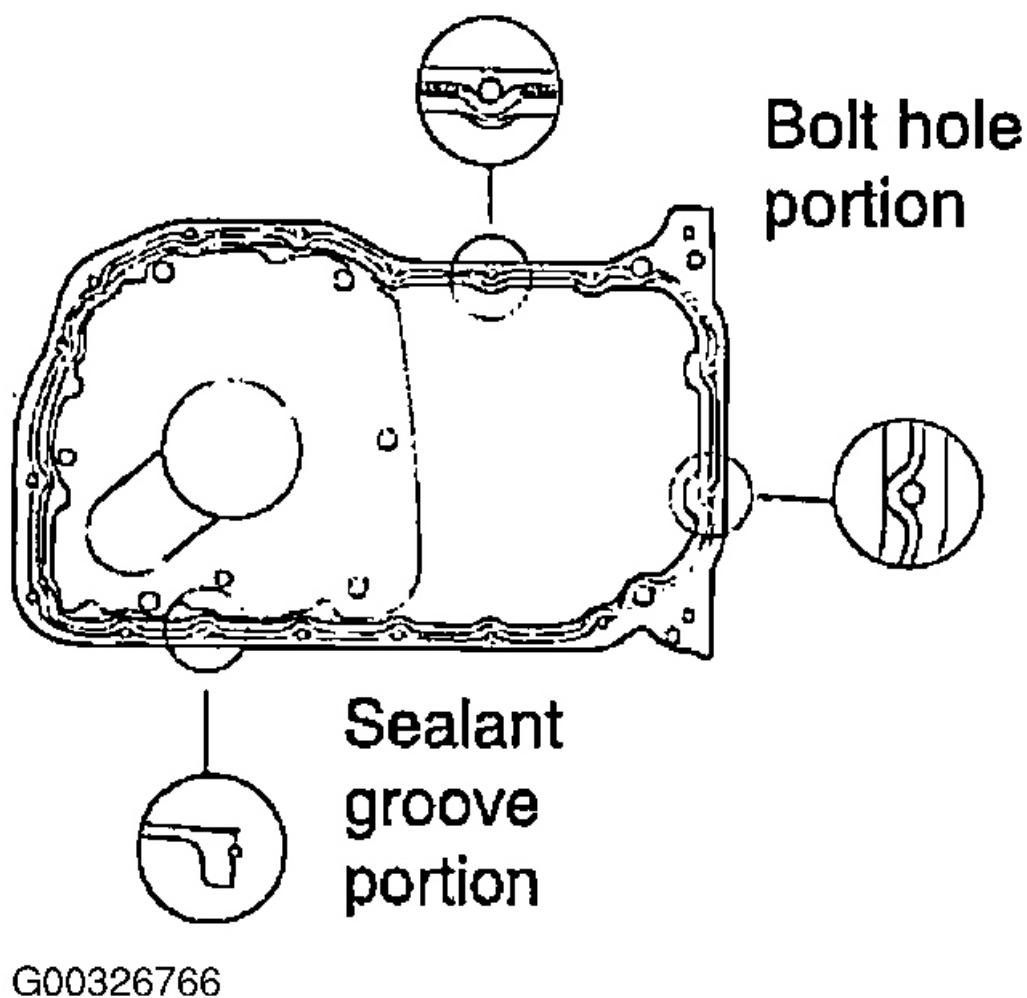
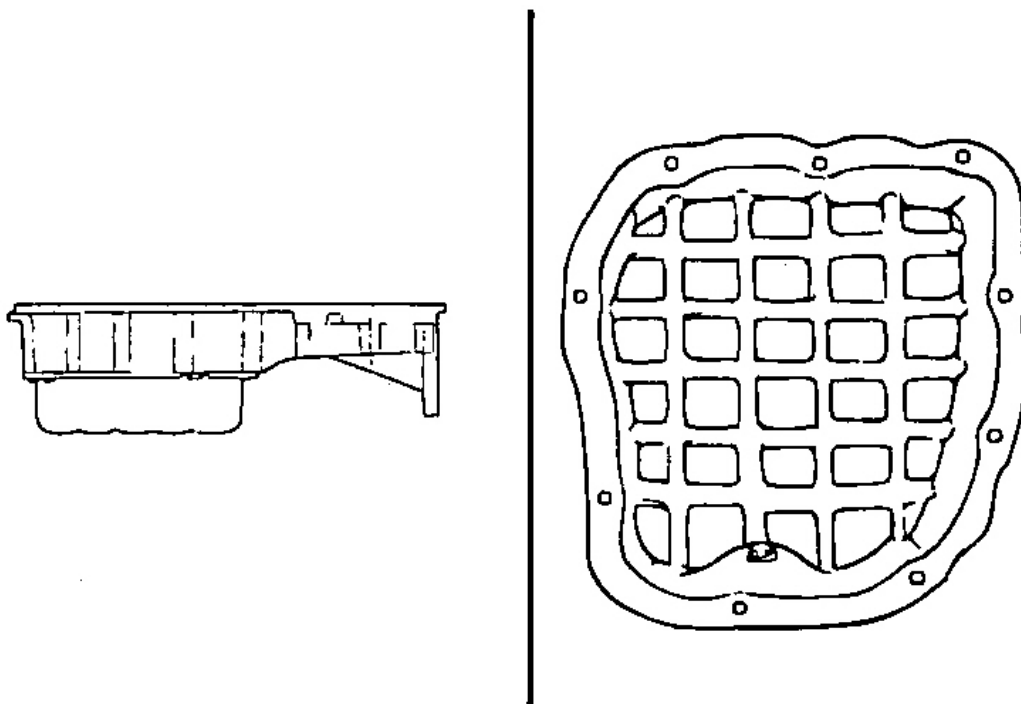


Fig. 60: Installing Oil Pan Bolts (1 Of 2)

Courtesy of KIA MOTORS AMERICA, INC.

10. Note the difference in bolt lengths at the location shown in illustration. Install the oil pan and tighten the bolts to the specified torque.

Oil pan bolt tightening torque: 10-12 Nm (100-120 kg.cm, 7-9 lb.ft)



G00326767

Fig. 61: Installing Oil Pan Bolts (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

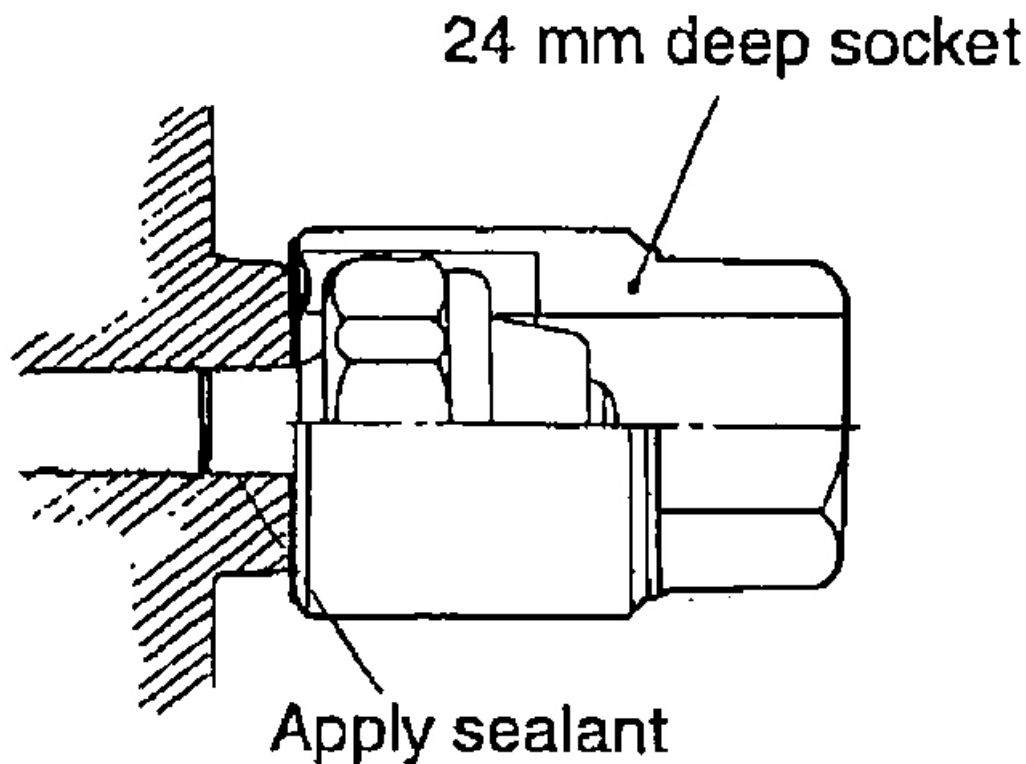
11. Using the special tool, install the oil pressure switch after applying sealant to the threaded area.

Sealant : Threebond 1104 or equivalent

NOTE: Do not torque the oil pressure switch excessively.

Tightening torque

Oil pressure switch: 8-12 Nm (80-120 kg.cm, 6-8 lb.ft)



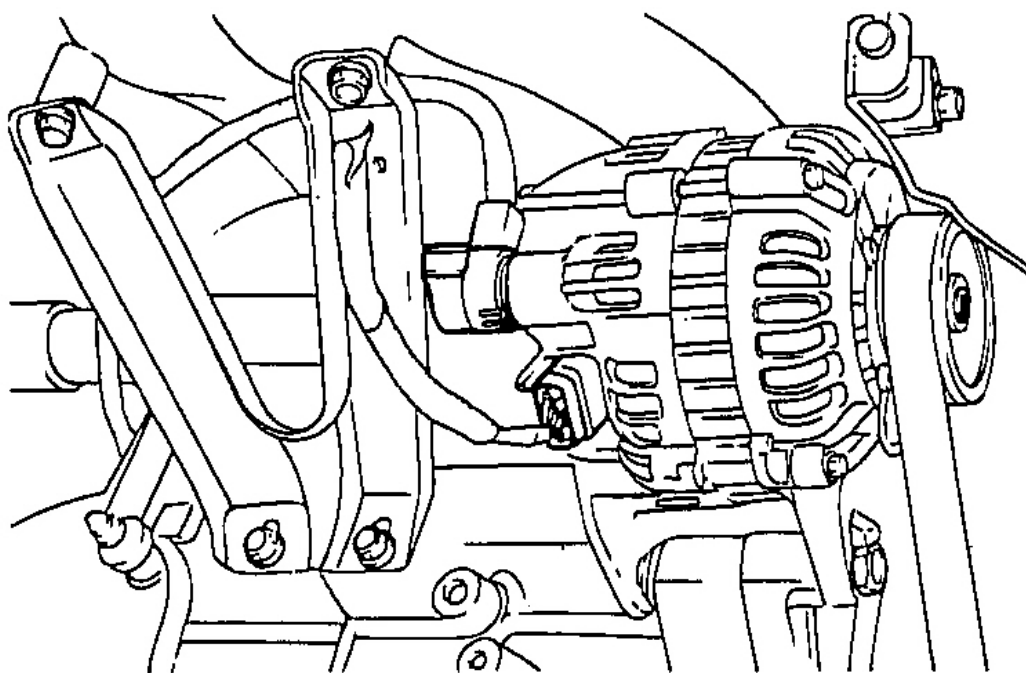
G00326768

Fig. 62: Installing Oil Pressure Switch
Courtesy of KIA MOTORS AMERICA, INC.

ENGINE & TRANSAXLE ASSEMBLY

REMOVAL

1. Remove the battery.
2. Detach the air cleaner.
3. Disconnect the connectors for the backup lamp and engine harness.
4. For a vehicle with a 5-speed manual transaxle, disconnect the select control valve connector.
5. On all vehicles, disconnect the connectors for the generator harness and the oil pressure gauge wiring.



G00326769

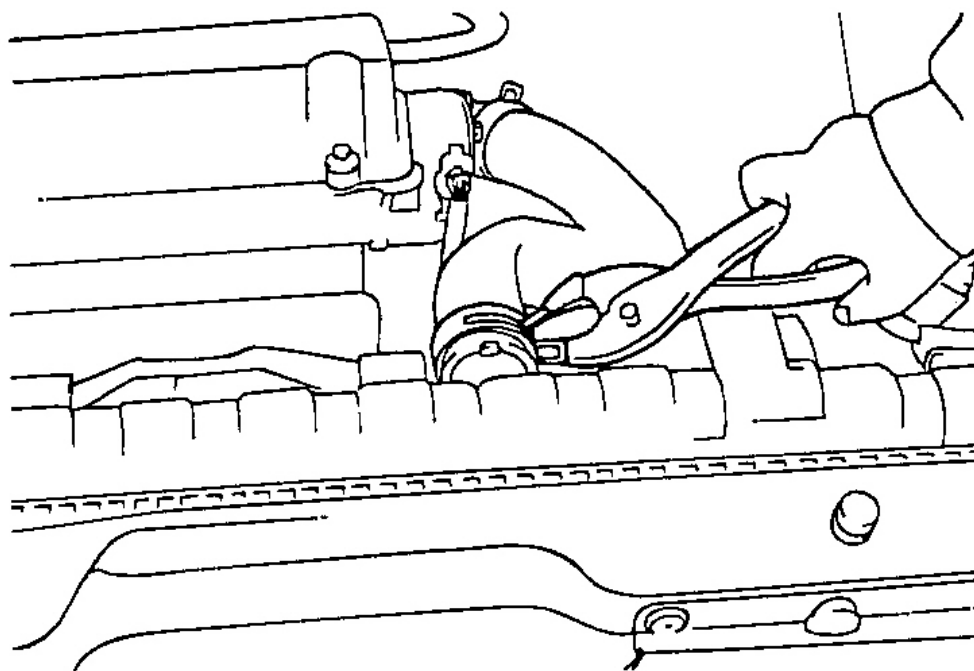
Fig. 63: Locating Generator & Oil Pressure Gauge Wiring
Courtesy of KIA MOTORS AMERICA, INC.

6. Drain the engine coolant.
7. For vehicles with an automatic transaxle, disconnect the transaxle oil cooler hoses.

NOTE: When disconnecting the hoses, make identification marks to avoid making any mistakes in reconnecting them.

CAUTION: Be careful not to spill oil or fluid out of the hoses, and plug the openings to prevent the entrance of foreign material.

8. On all vehicles, disconnect the radiator upper and lower hoses on the engine side.



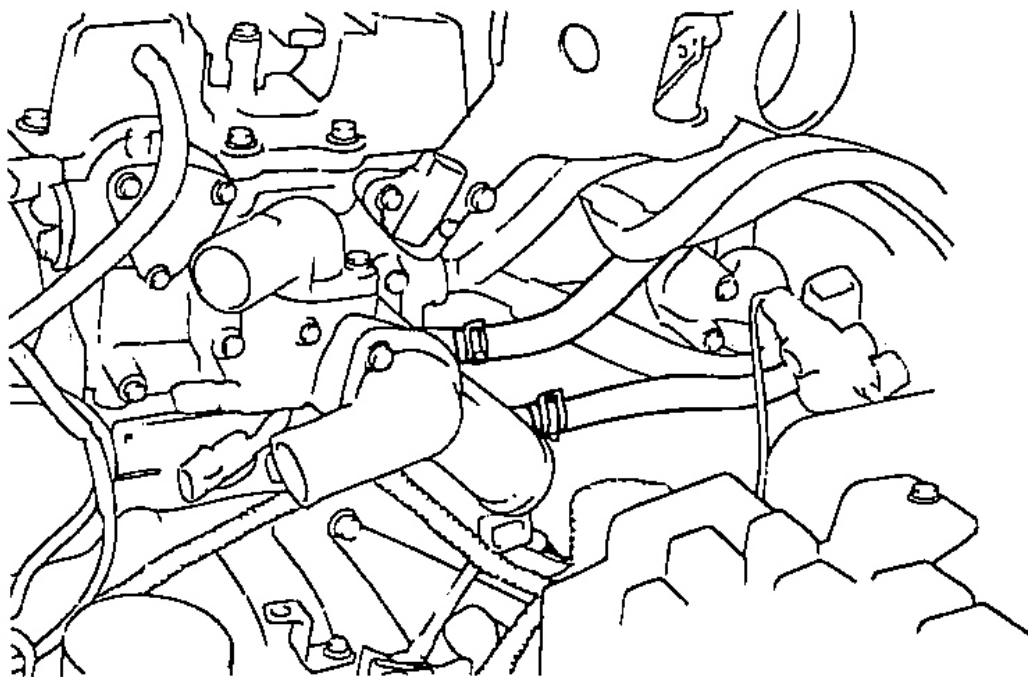
G00326770

Fig. 64: Disconnecting Radiator Hoses
Courtesy of KIA MOTORS AMERICA, INC.

9. Disconnect the engine ground.
10. Disconnect the brake booster vacuum hose.
11. Remove the main fuel line, and the return and vapor hoses from the engine side.

CAUTION: To reduce the residual pressure in the hoses, refer to FUEL FILTER .

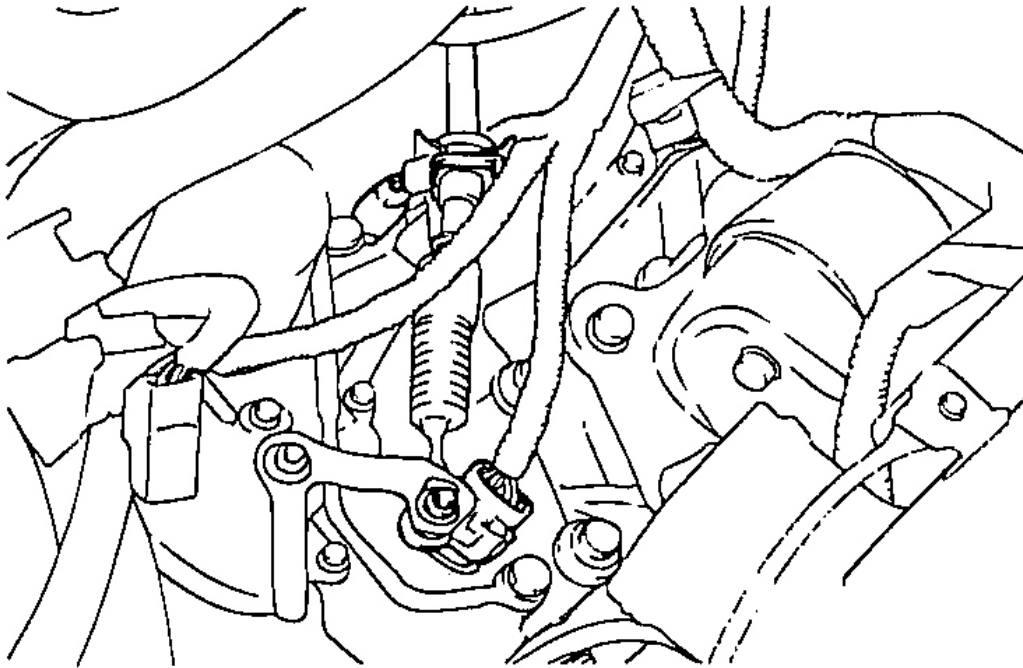
12. Disconnect the heater hoses (inlet and outlet) on the engine side.



G00326771

Fig. 65: Disconnecting Heater Hoses
Courtesy of KIA MOTORS AMERICA, INC.

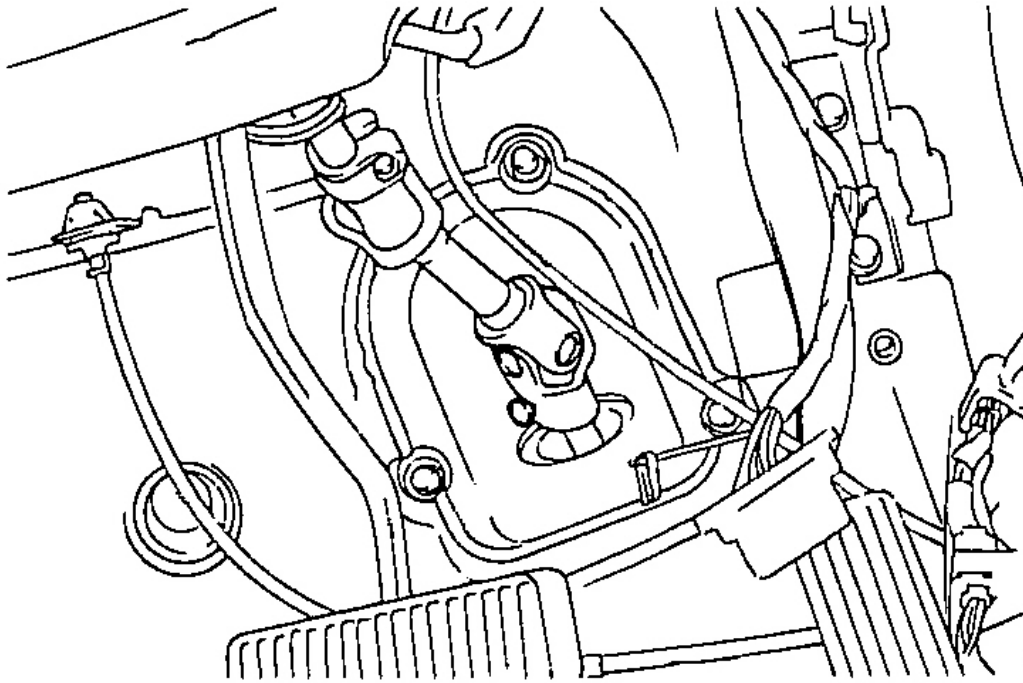
13. Disconnect the accelerator cable at the engine side.
14. For vehicles with a manual transaxle, remove the clutch cable from the transaxle.
15. For vehicles with an automatic transaxle, remove the control cable from the transaxle.
16. For vehicles with manual transaxle, remove the shift control rod and extension rod.
17. On all vehicles, disconnect the connector of the vehicle speed sensor from the transaxle.



G00326772

Fig. 66: Locating Vehicle Speed Sensor Connector
Courtesy of KIA MOTORS AMERICA, INC.

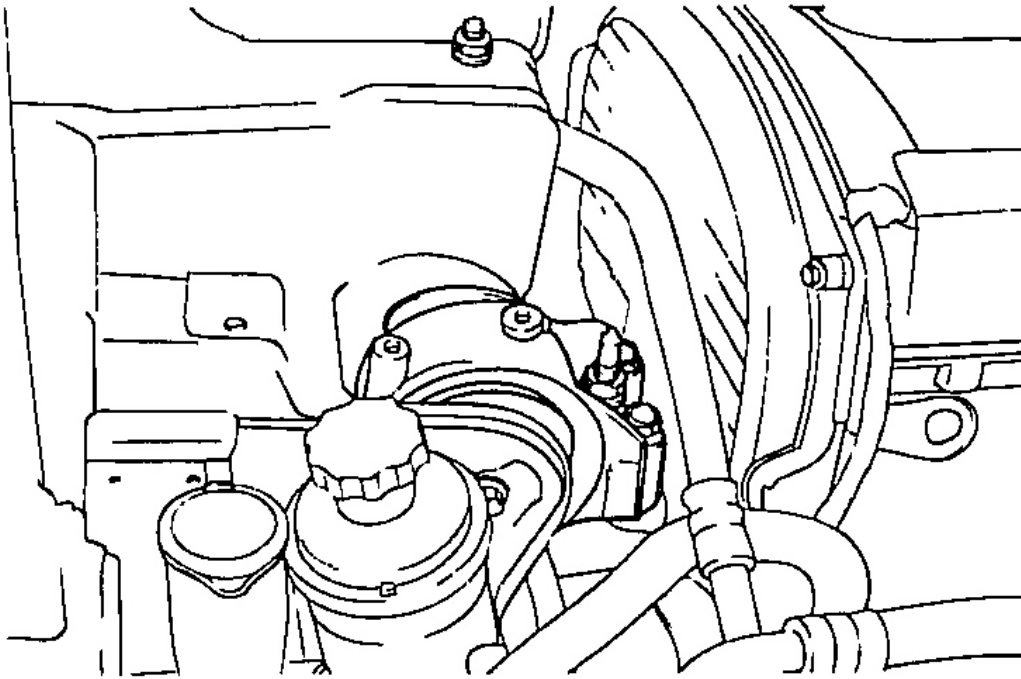
18. Separate the column shaft from the steering gear box.



G00326773

Fig. 67: Separating Column Shaft From Steering Gear Box
Courtesy of KIA MOTORS AMERICA, INC.

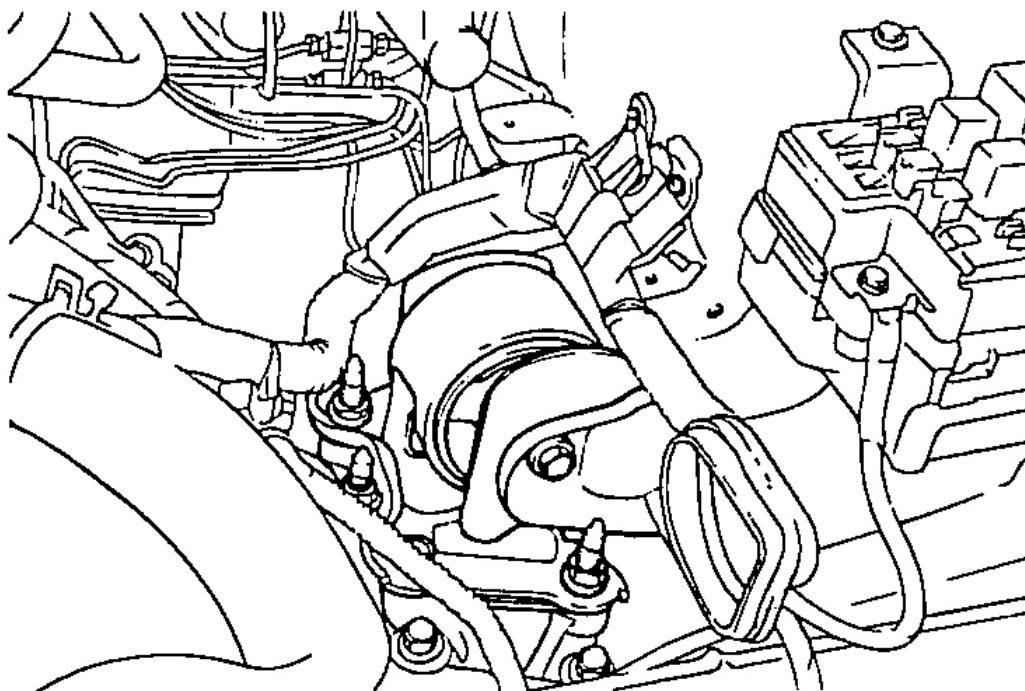
19. Remove the engine mounting insulator.



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Fig. 68: Removing Engine Mounting Insulator
Courtesy of KIA MOTORS AMERICA, INC.

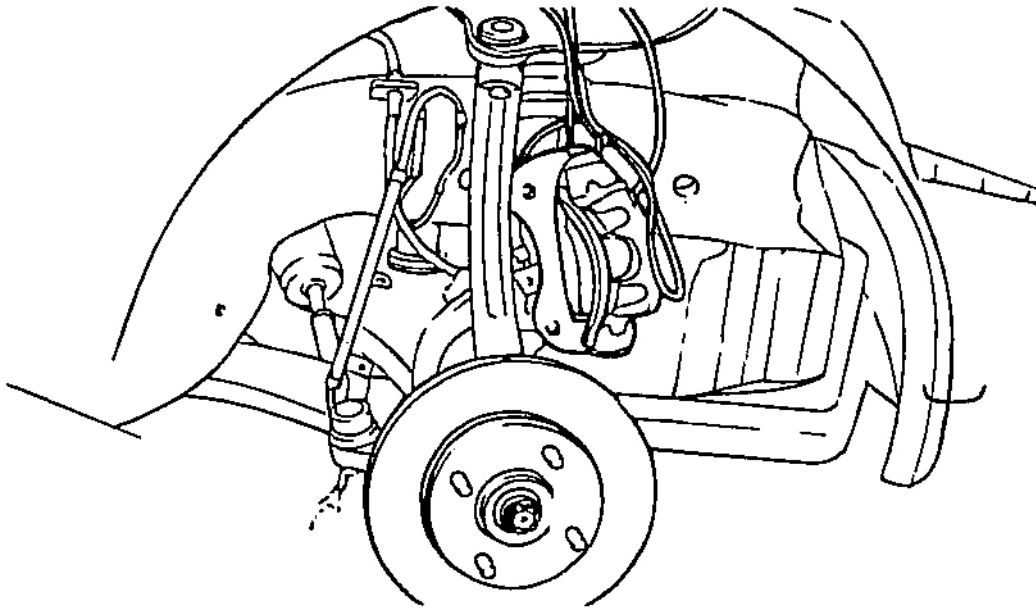
20. Remove the transaxle mounting insulator.



G00326775

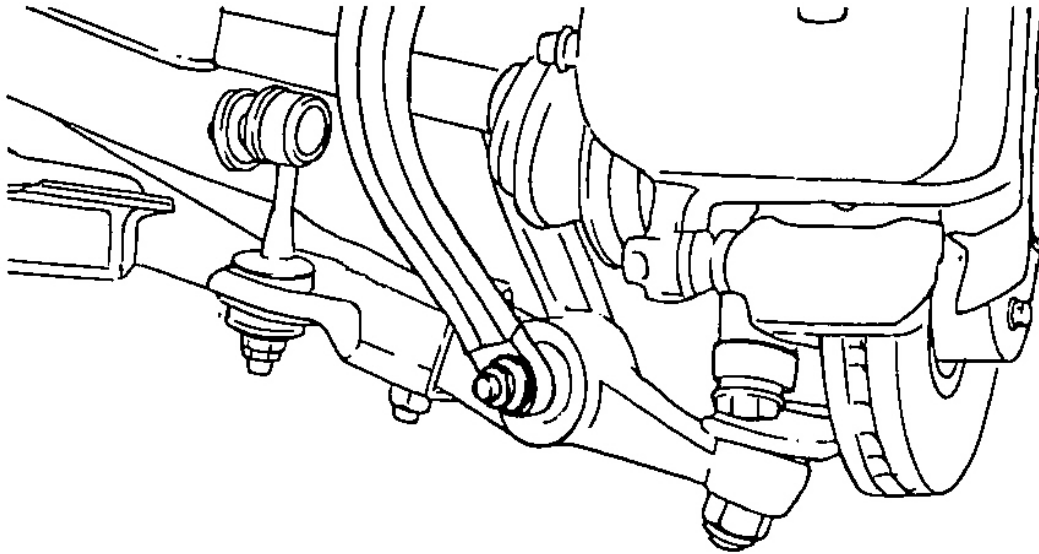
Fig. 69: Removing Transaxle Mounting Insulator
Courtesy of KIA MOTORS AMERICA, INC.

21. After removing the wheel and attaching the wheel speed sensor and caliper to the body, disconnect the lower arm and the fork, and then separate the upper arm and knuckle.



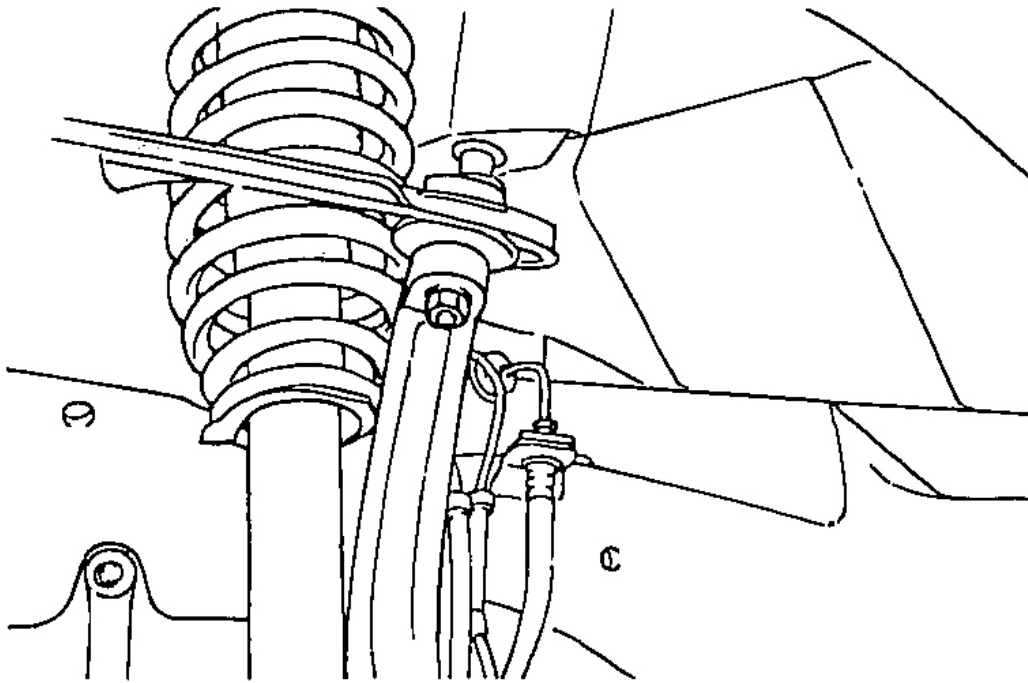
G00326776

Fig. 70: Removing Caliper & Attaching Caliper To Body
Courtesy of KIA MOTORS AMERICA, INC.



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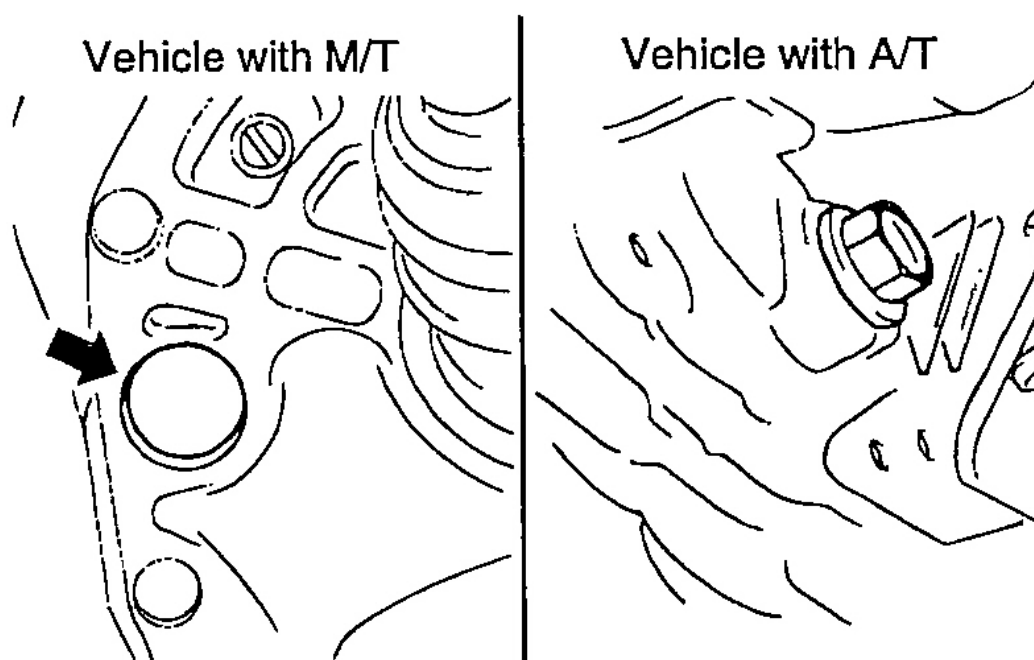
Fig. 71: Disconnecting Lower Arm From Fork
Courtesy of KIA MOTORS AMERICA, INC.



G00326778

Fig. 72: Disconnecting Upper Arm From Knuckle
Courtesy of KIA MOTORS AMERICA, INC.

22. Jack up the vehicle.
23. Drain the transaxle oil (or fluid).



G00326779

Fig. 73: Draining Transaxle Oil

Courtesy of KIA MOTORS AMERICA, INC.

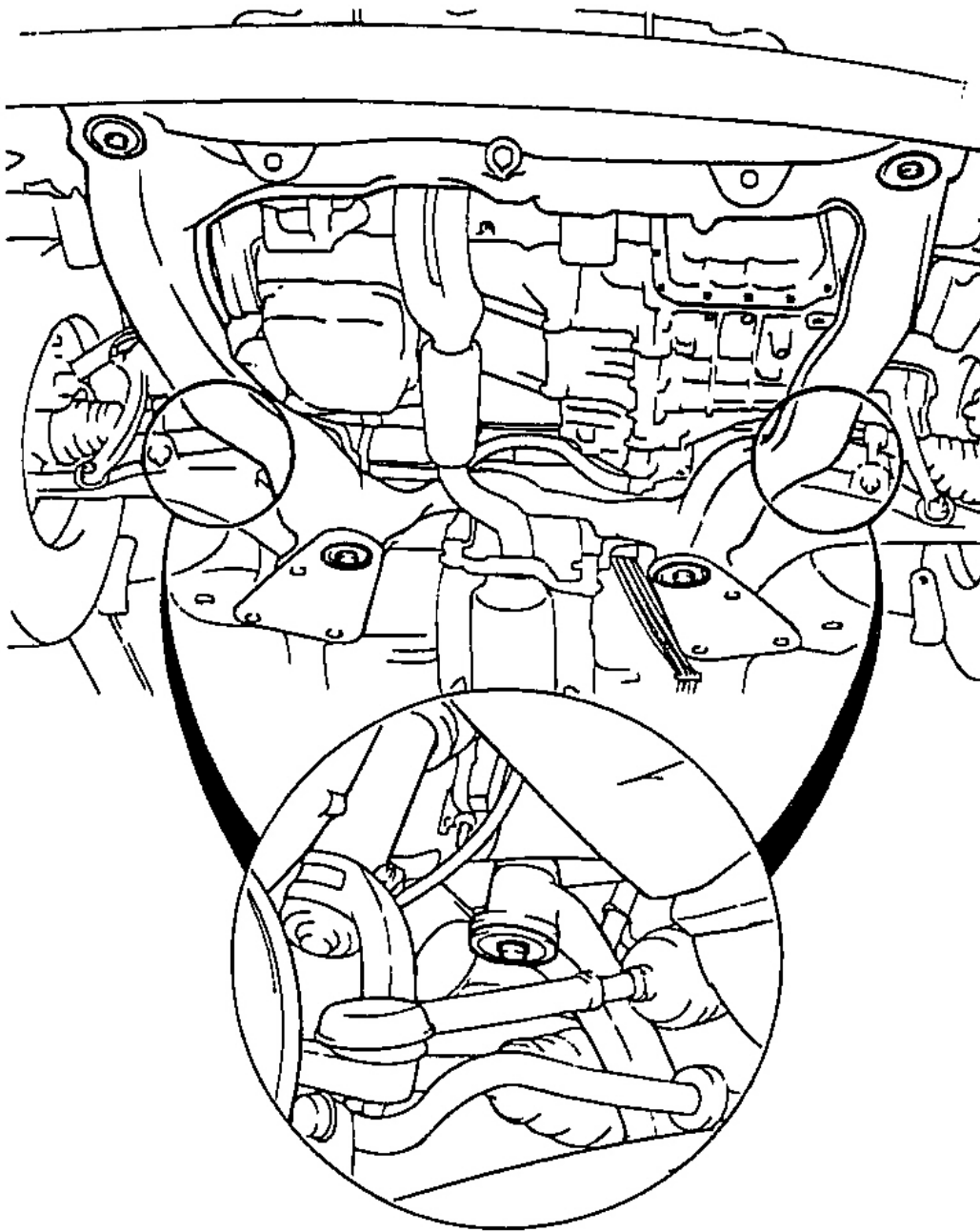
24. Disconnect the front exhaust pipe from the manifold.

NOTE: Use wire to suspend the exhaust pipe from the bottom of the vehicle.

25. Place the supporter under the sub-frame.

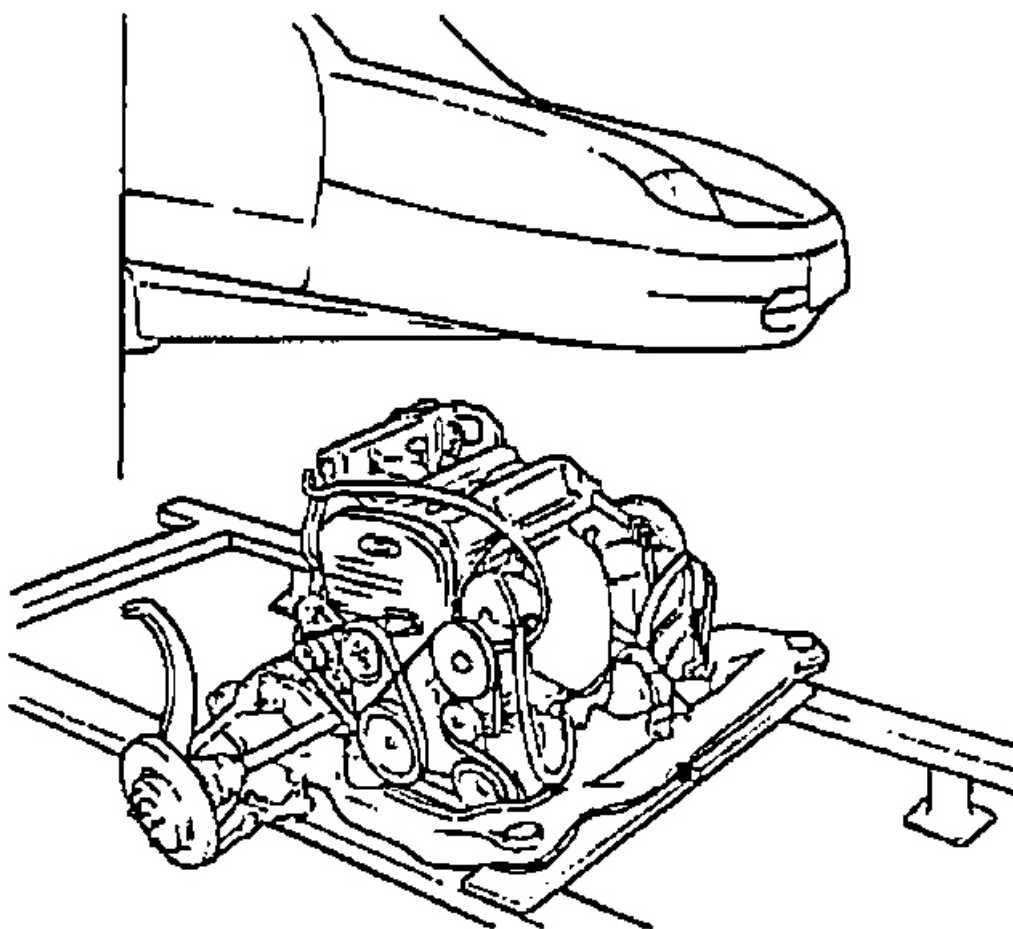
CAUTION: Check that all of the cables, hoses, harnesses, connectors etc. are disconnected from the engine.

26. In order to remove the sub-frame, engine, transaxle, steering gear box and drive shaft all together, loosen the sub-frame bolts (6ea) slowly and lift the vehicle with lifter.



G00326780

Fig. 74: Removing Sub-Frame
Courtesy of KIA MOTORS AMERICA, INC.



G00326781

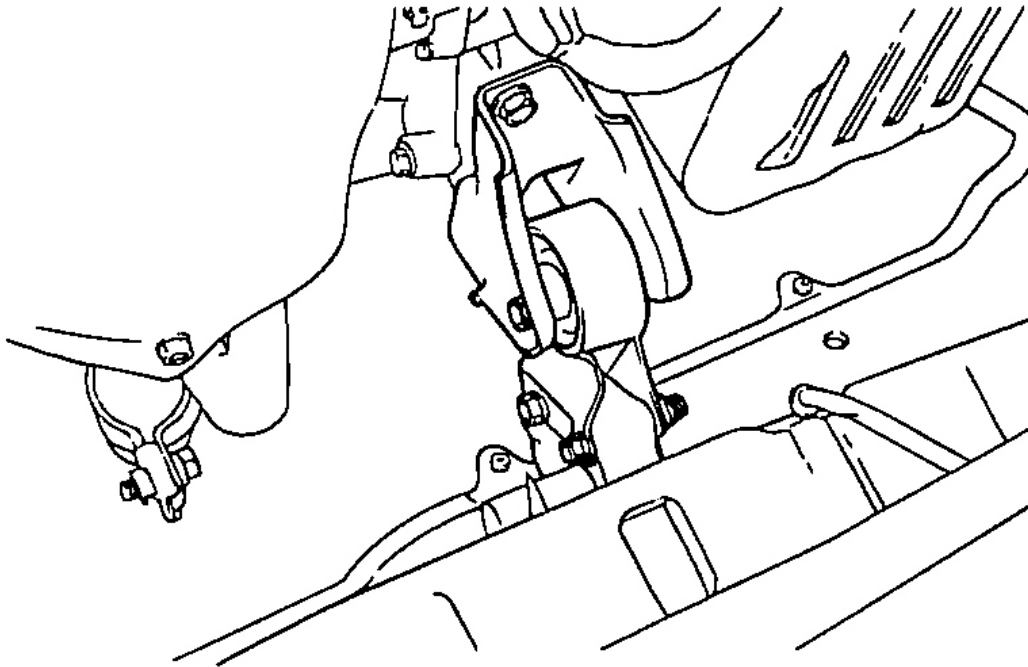
Fig. 75: Removing Engine, Transaxle, Steering Box & Drive Shaft
Courtesy of KIA MOTORS AMERICA, INC.

27. Remove the driveshaft and hang the engine and transaxle at the hoist, then separate engine and transaxle from the sub-frame. To separate the engine and transaxle from the sub-frame, remove the engine mounting bracket and transaxle mounting bracket, and then lift up the hoist.

INSTALLATION

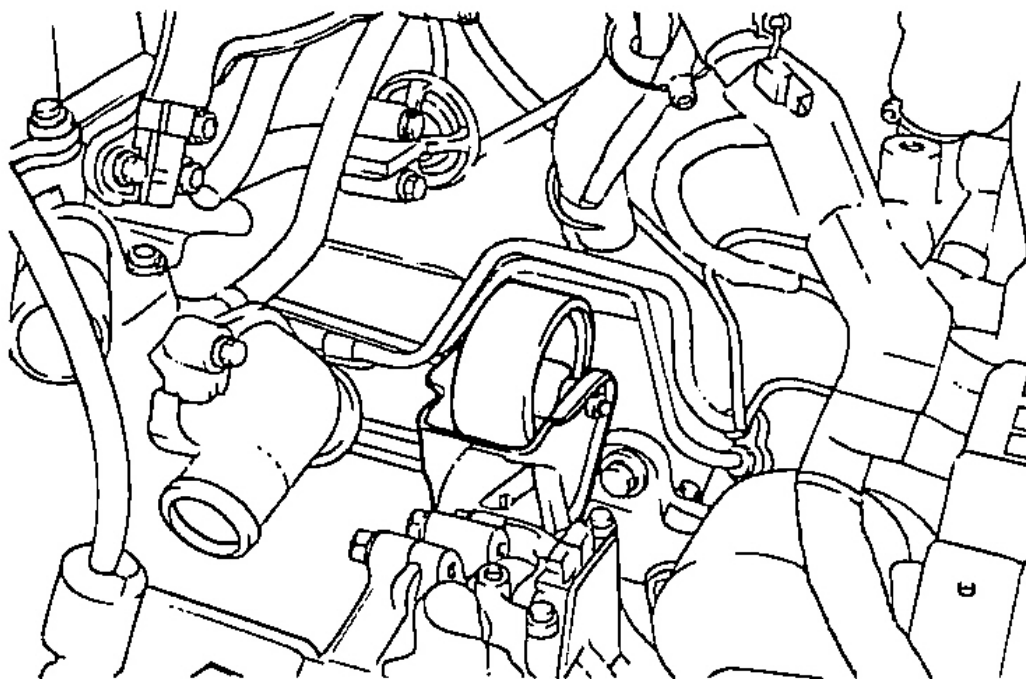
1. While checking the connections of the harnesses, pipes, hoses, etc., make sure that none of them is being caught, damaged, etc.
2. To place the engine and transaxle assembly on the sub-frame, install the front roll stopper and rear roll stopper between the sub-frame and engine and transaxle assembly.

NOTE: Especially when installing front roll stopper mounting bracket, be careful not to crush the insulator. If crushed, idle vibration is high.



G00326783

Fig. 76: Installing Front Roll Stopper
Courtesy of KIA MOTORS AMERICA, INC.



G00326784

Fig. 77: Installing Rear Roll Stopper

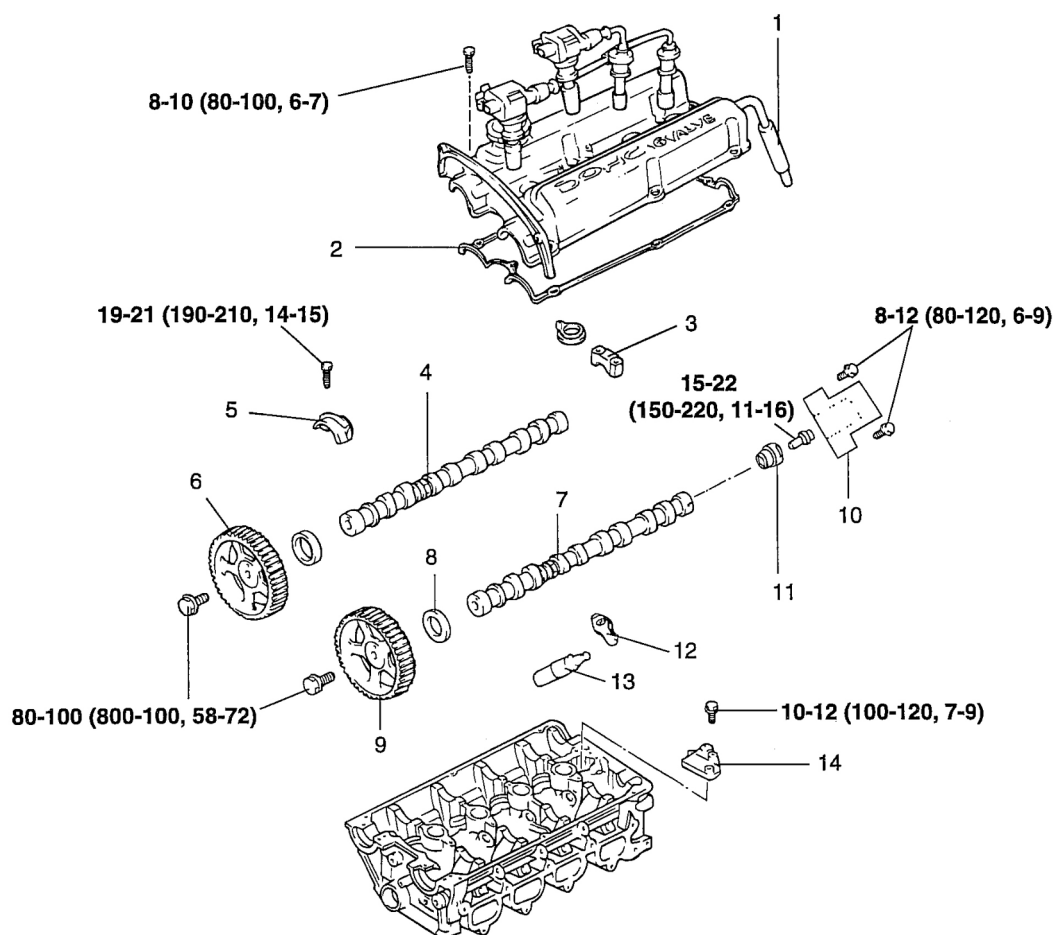
Courtesy of KIA MOTORS AMERICA, INC.

3. To install the engine transaxle and sub-frame, follow the removal procedures in the reverse order.
4. Refill the coolant and check for leak.
5. Refill the transaxle fluid, test its operation, and check for leak.
6. Check for the operation of the transaxle control cable and accelerator cable. Adjust as necessary.
7. Check for proper operation of each of the various gauges.

MAIN MOVING SYSTEM

CAMSHAFT

COMPONENTS



TORQUE: Nm (kg.cm, lb.ft)

- | | |
|------------------------|----------------------------------|
| 1. Breather hose | 8. Camshaft oil seal |
| 2. Gasket | 9. Camshaft sprocket |
| 3. Bearing cap (Rear) | 10. Support assembly |
| 4. Intake camshaft | 11. Camposition sensing cylinder |
| 5. Bearing cap (front) | 12. Rocker arm |
| 6. Camshaft sprocket | 13. Lash adjuster |
| 7. Exhaust camshaft | 14. Oil delivery body |

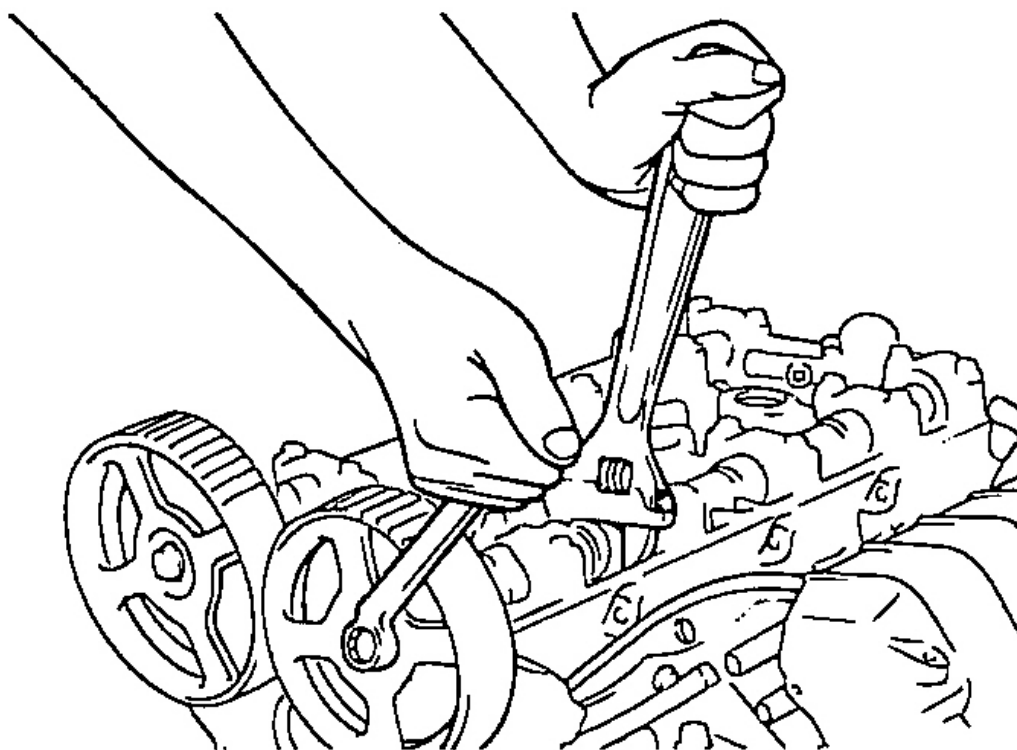
G00326785

Fig. 78: Exploded View Of Main Moving System
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Disconnect the negative terminal from battery.
2. Drain the engine coolant.
3. Remove the breather hose between the air cleaner and the rocker cover.
4. Remove the air cleaner.

5. Remove the timing belt cover.
6. Remove the rocker cover, crankshaft position sensor.
7. Loosen the camshaft sprocket bolts and remove the camshaft sprockets.



G00326786

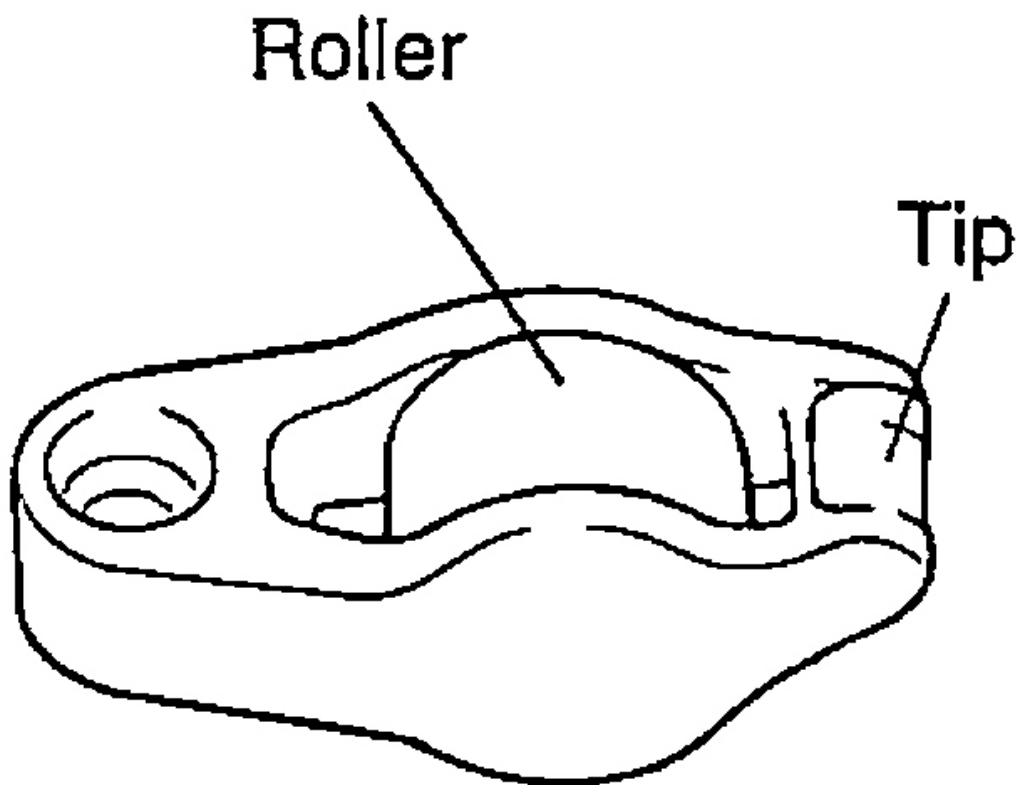
Fig. 79: Removing Camshaft Sprockets
Courtesy of KIA MOTORS AMERICA, INC.

8. Loosen the bearing cap bolts and remove the bearing caps, camshafts, rocker arms and lash adjusters.

INSPECTION

Rocker Arms

1. Check rotation of the roller. If it does not rotate smoothly or if looseness is evident, replace it.



G00326787

Fig. 80: Checking Rocker Arms

Courtesy of KIA MOTORS AMERICA, INC.

2. Check the roller and replace if there are any dents, damage or signs of bearing seizure.
3. Check the valve contact surface for possible damage or seizure and replace as necessary.

Camshafts

1. Check the camshaft journals for wear. If the journals are badly worn, replace the camshaft.
2. Check the cam lobes for damage. If the lobe is damaged or worn excessively, replace the camshaft.

Cam height

[Standard]

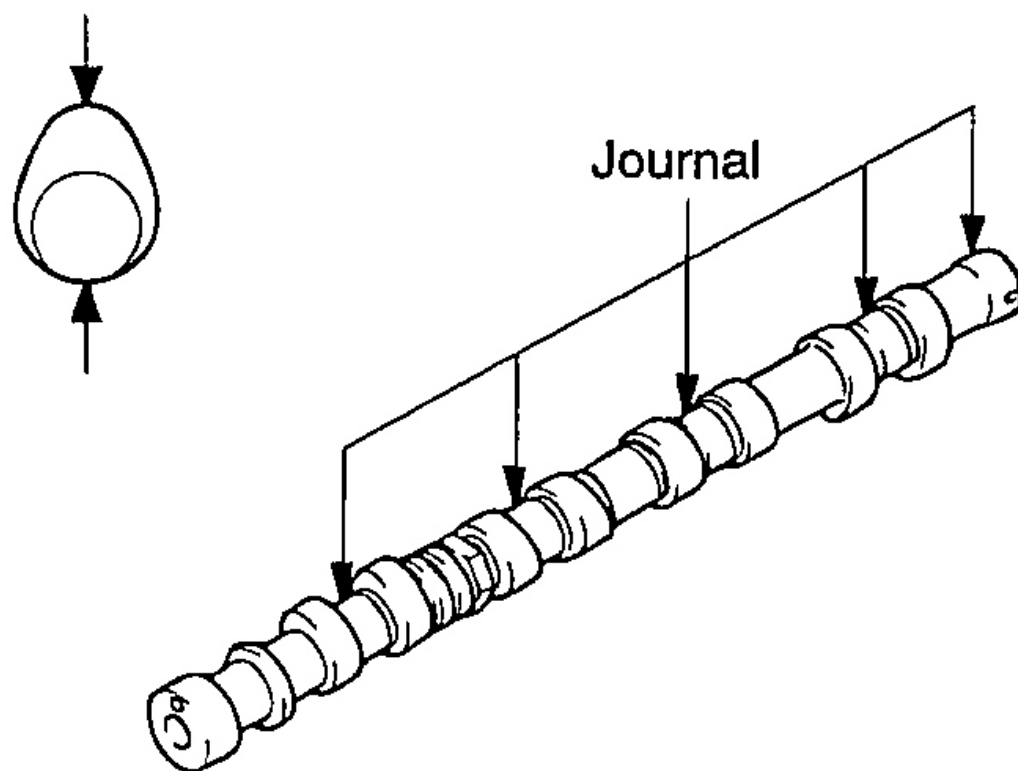
Intake: 35.493 mm (1.3974 in.)

Exhaust: 35.317 mm (1.3904 in.)

[Limit]

Intake: 34.993 mm (1.3777 in.)

Exhaust: 34.817 mm (1.3707 in.)



G00326788

Fig. 81: Checking Camshafts

Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Install the camshafts on the cylinder head.

NOTE:

- Apply engine oil to journals and cams of the cam shafts.
- The intake camshaft has a slit on its rear end for driving the

crankshaft position sensor.

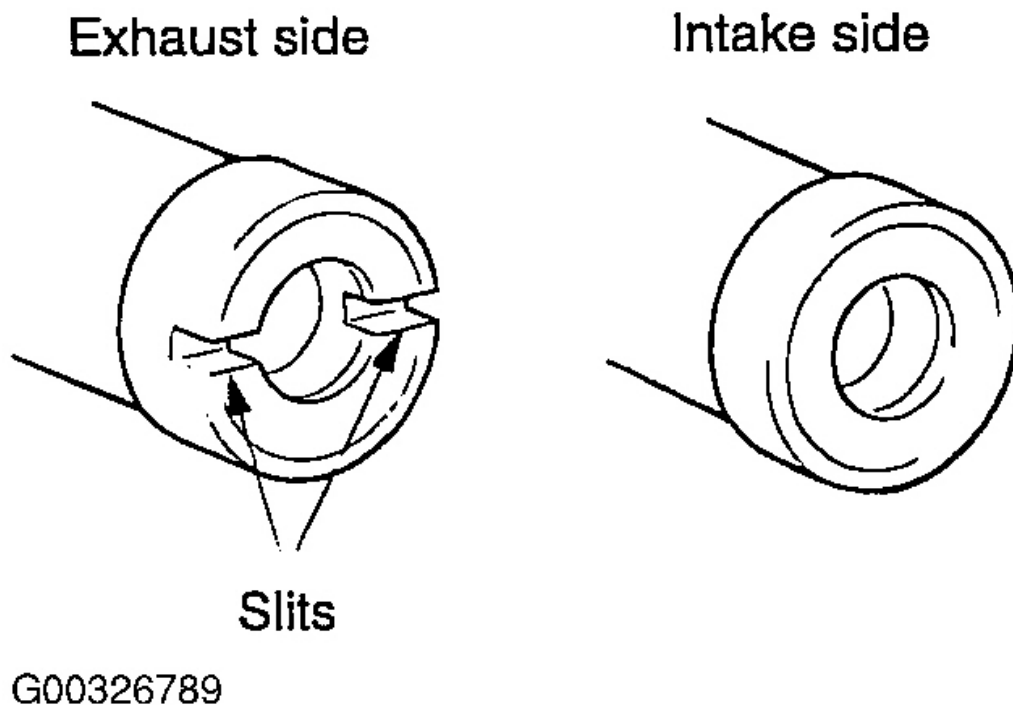
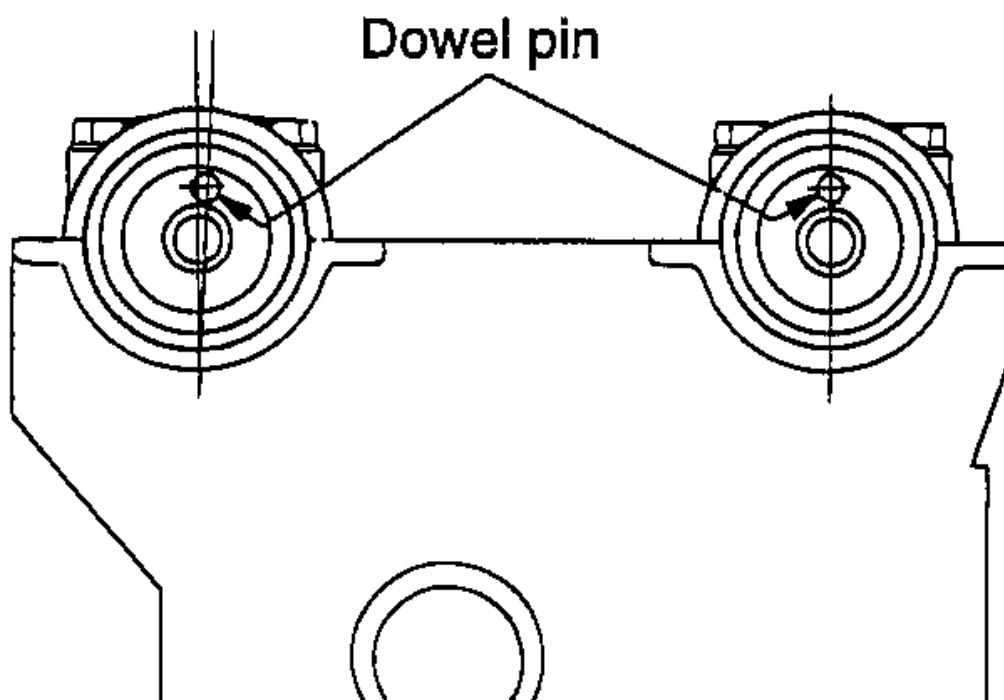


Fig. 82: Installing Camshafts (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the bearing caps. Check the markings on the caps for intake/exhaust identification symbol.

R : Intake camshaft

L : Exhaust camshaft
3. Check that the camshaft can be easily turned by hand. After checking, remove the bearing caps and the camshafts, and then install the rocker arms.
4. Make sure that the dowel pins on the camshaft sprocket end are located on the top.



G00326791

Fig. 83: Installing Camshafts (2 Of 2)

Courtesy of KIA MOTORS AMERICA, INC.

5. Tighten the bearing caps to the specified torque in two or three steps as shown in illustration.

NOTE: **Tighten the rocker arms uniformly.**

Tightening torque

Rocker arm bolts :

19-21 Nm (190-210 kg.cm, 14-15 lb.ft)

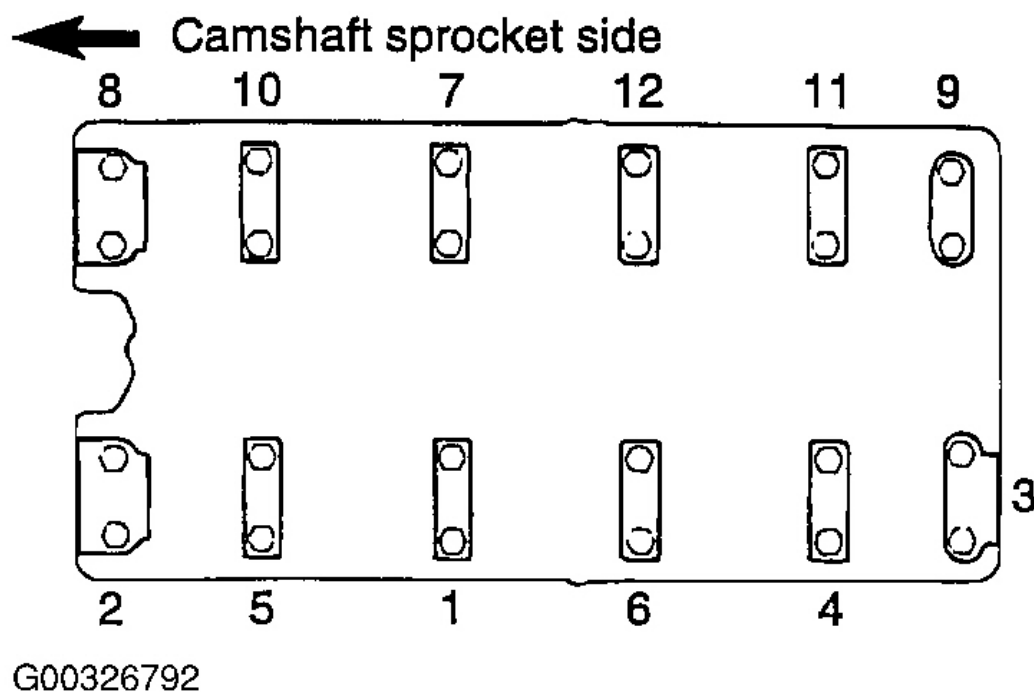
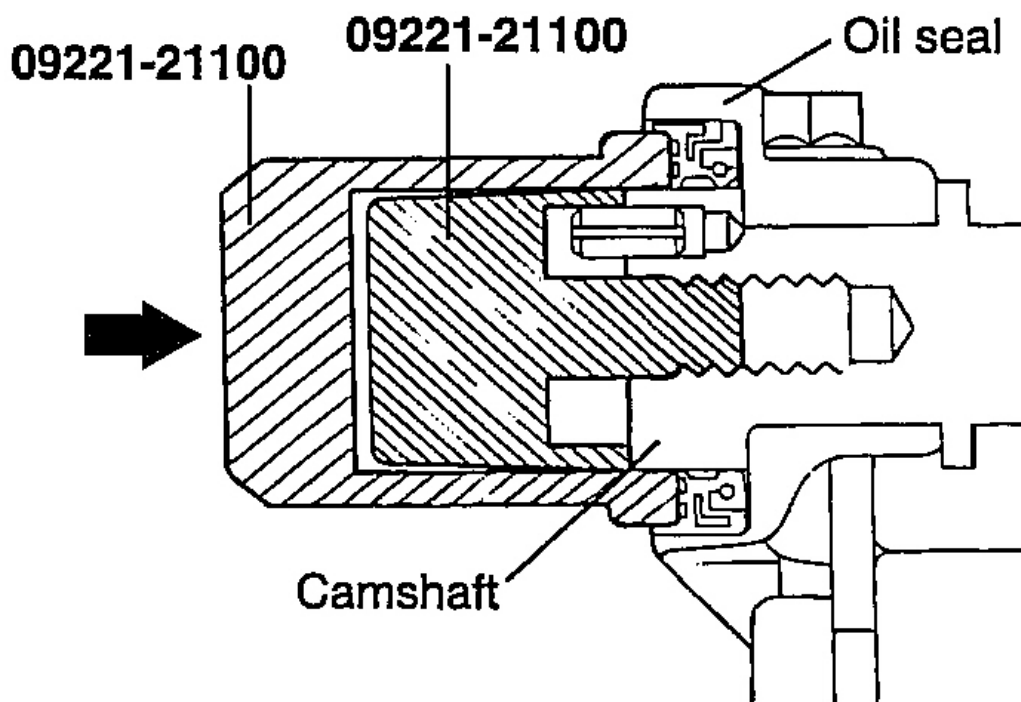


Fig. 84: Identifying Bearing Cap Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

- Using special tools, Camshaft Oil Seal Installer and guide (09221-21000, 09221-21100), press fit the camshaft oil seal. Be sure to apply engine oil to the external surface of the oil seal. Insert the oil seal along the camshaft front end and install by driving the installer with a hammer until the oil seal is fully seated.



G00326793

Fig. 85: Identifying Camshaft Oil Seal Installer (09221-21000) & Camshaft Oil Seal Guide (09221-21100)

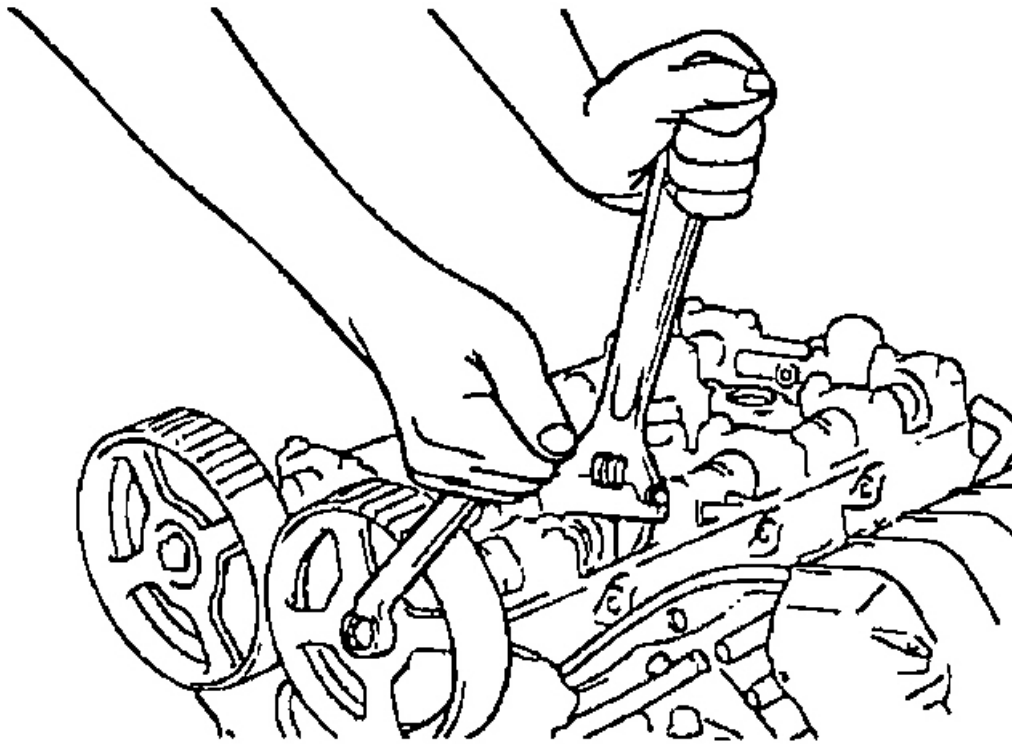
Courtesy of KIA MOTORS AMERICA, INC.

7. Install the camshaft sprockets to the specified torque.

Tightening torque

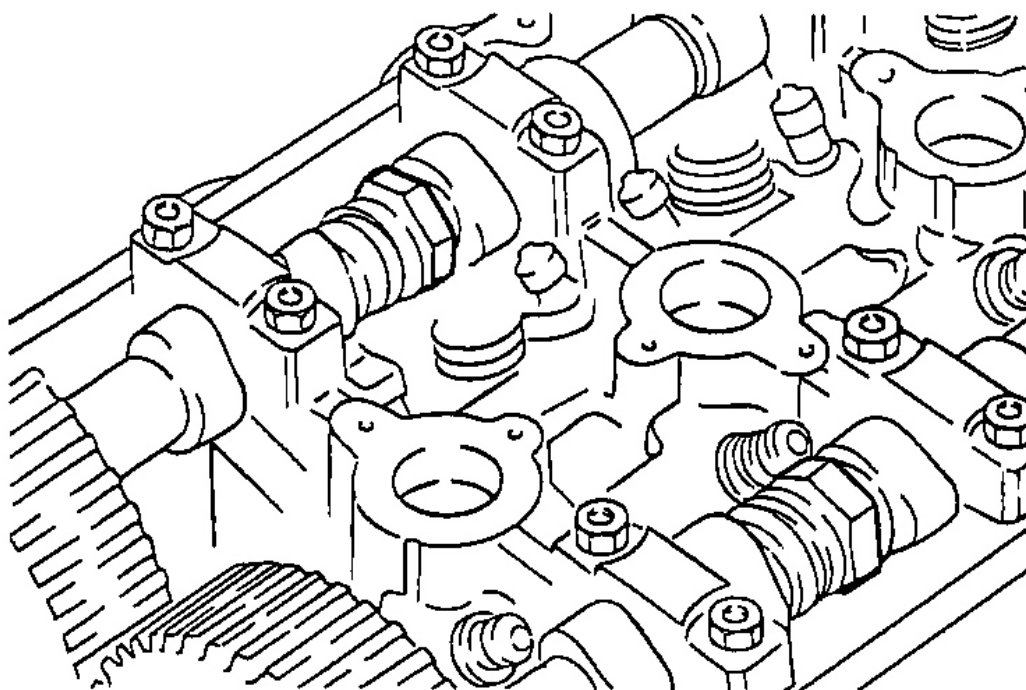
Camshaft sprocket bolts :

80-100 Nm (800-1000 kg.cm, 58-72 lb.ft)



G00326794

Fig. 86: Installing Camshaft Sprockets (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.



G00326795

Fig. 87: Installing Camshaft Sprockets (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

8. Install the rocker cover. Apply sealant as shown in illustration.

Tightening torque

Rocker cover bolts : 8-10 Nm (80-100 kg.cm, 6-7 lb.ft)

Center cover bolts : 4-5 Nm (40-50 kg.cm, 3-3.6 lb.ft)

Sealant

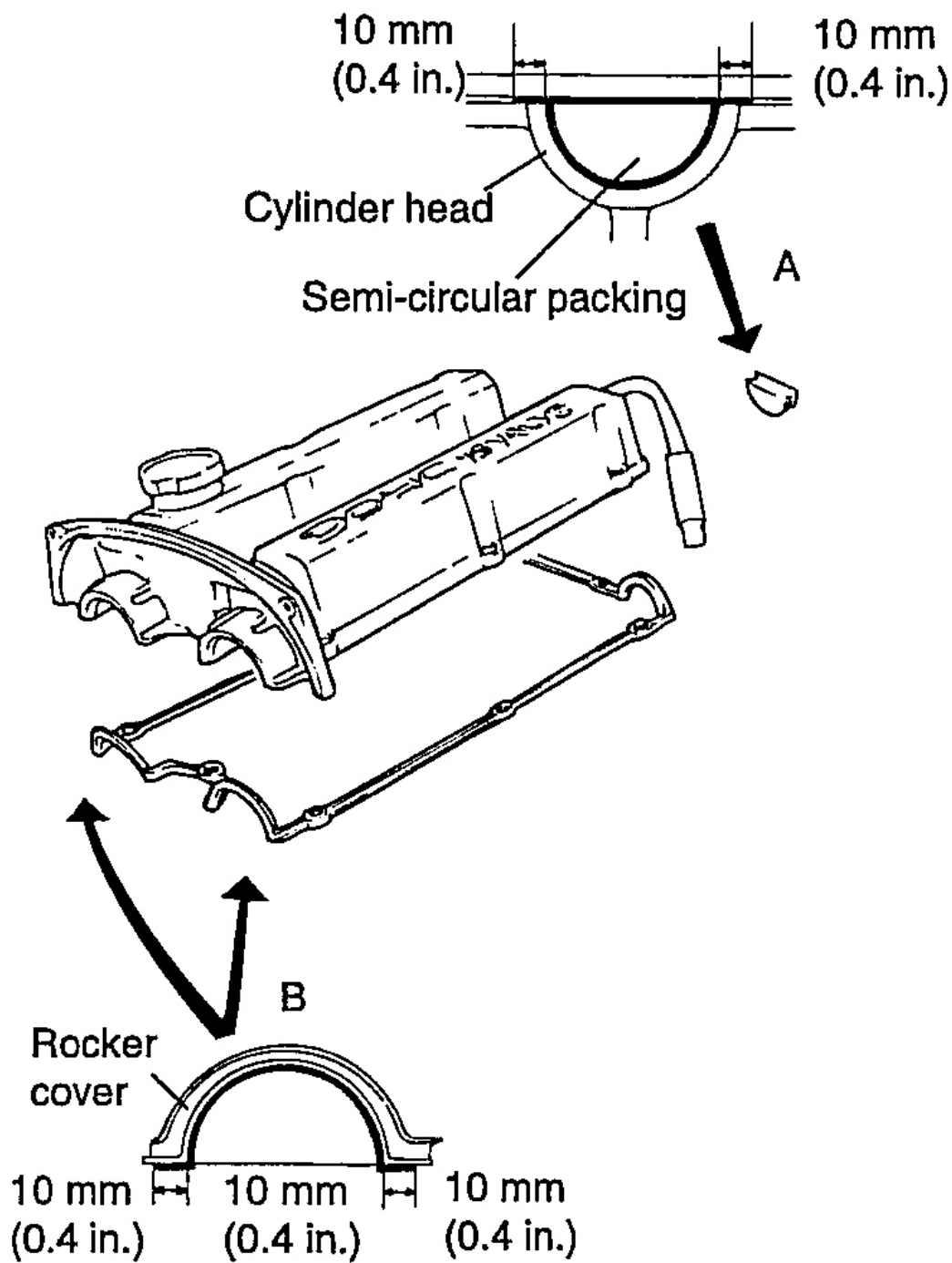
A Portion : Threebond No. 1212D or equivalent

B Portion : Threebond No. 1212D or equivalent

Bolt length x Diameter

Center cover bolt : 16 mm x 6 mm

Rocker cover bolt : special bolt

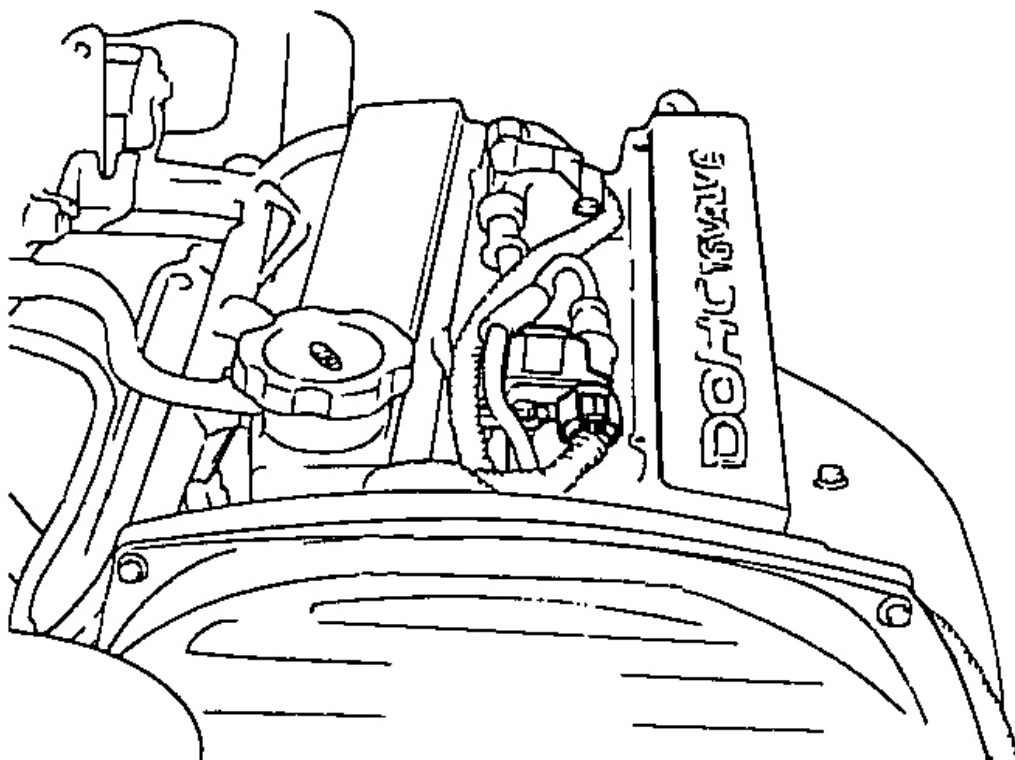


G00326796

Fig. 88: Installing Rocker Cover

Courtesy of KIA MOTORS AMERICA, INC.

9. Install the spark plugs, ignition coil, connect the connector and then install the center cover.

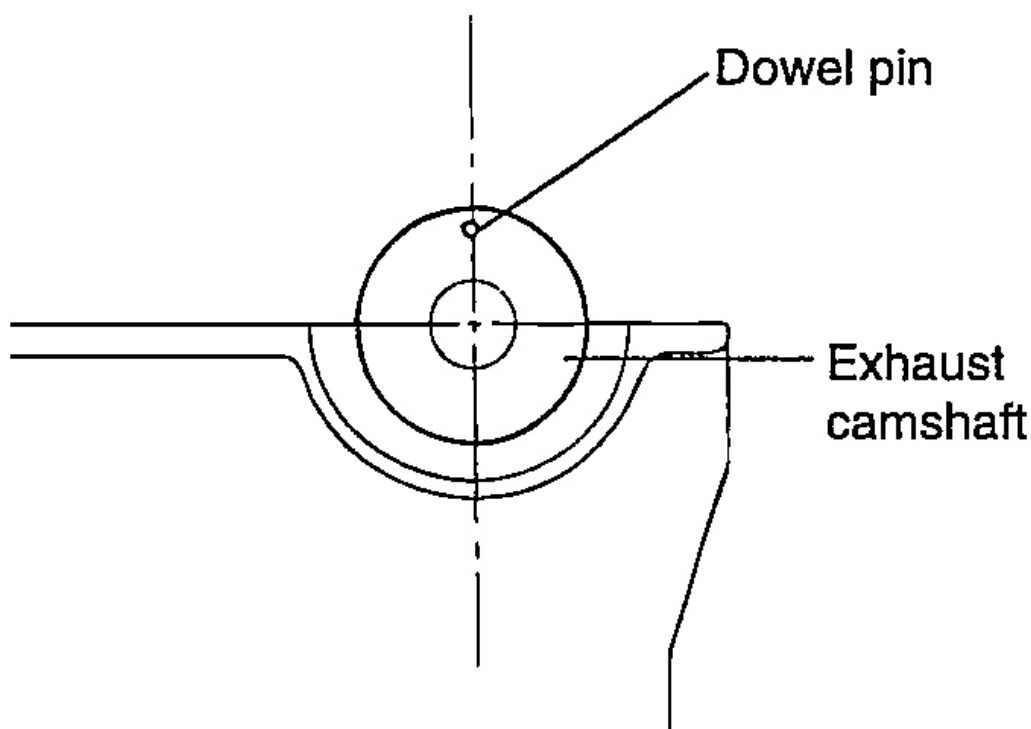


G00326797

Fig. 89: Installing Spark Plugs & Ignition Coil

Courtesy of KIA MOTORS AMERICA, INC.

10. Locate the dowel pin on the sprocket side of the exhaust camshaft.



G00326798

Fig. 90: Locating Dowel Pin

Courtesy of KIA MOTORS AMERICA, INC.

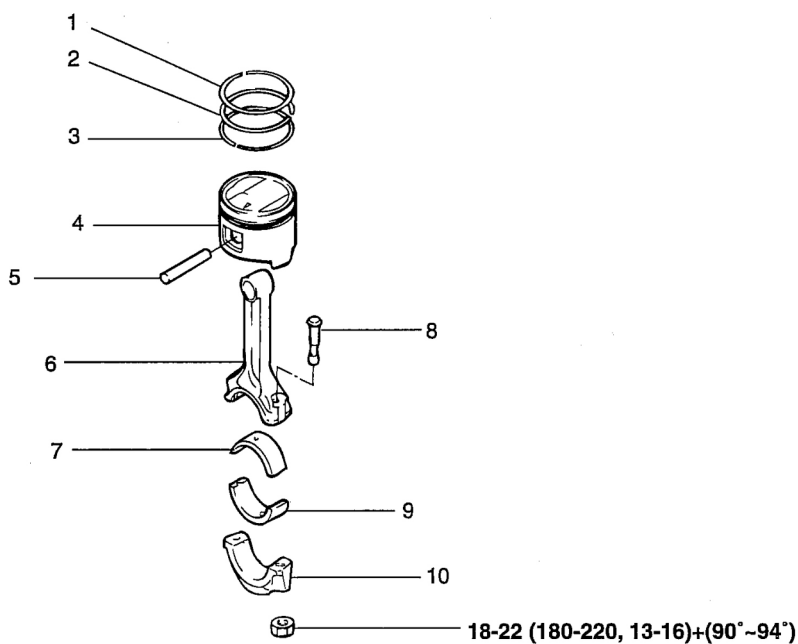
11. Align the notch of the camshaft sensor to the hole in camshaft (intake manifold side) and tighten the bolts.

NOTE: The camshaft position sensor can be installed even when the punch mark is positioned opposite the notch; however, the position results in incorrect fuel injection and ignition timings.

12. Install the camshaft position sensor on the cylinder head.

CONNECTING ROD

COMPONENTS



TORQUE : Nm (kg-cm, lb-ft)

- | | |
|---------------------|--------------------------------|
| 1. No.1 piston ring | 6. Connecting rod |
| 2. No.2 piston ring | 7. Upper bearing |
| 3. Oil ring | 8. Bolt |
| 4. Piston | 9. Lower bearing |
| 5. Piston pin | 10. Connecting rod bearing cap |

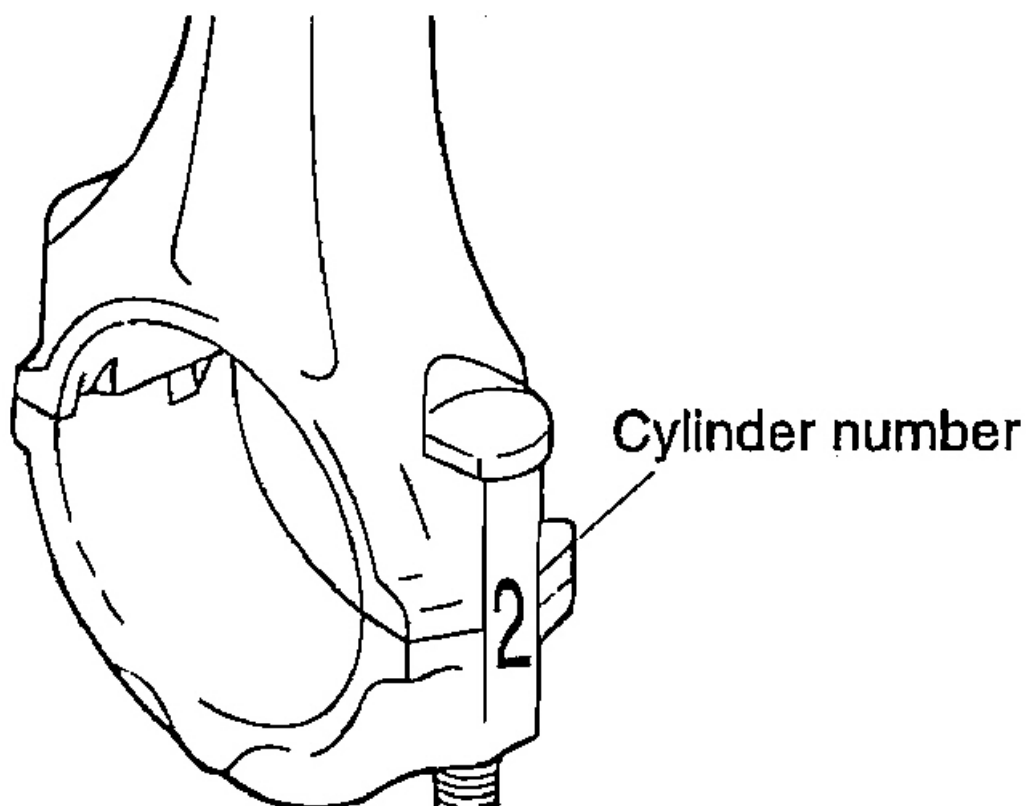
G00326799

Fig. 91: Exploded View Of Connecting Rod
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

Connecting Rod Cap

NOTE: Keep the bearings in order with their corresponding connecting rods (according to cylinder numbers) for proper reassembly.



G00326800

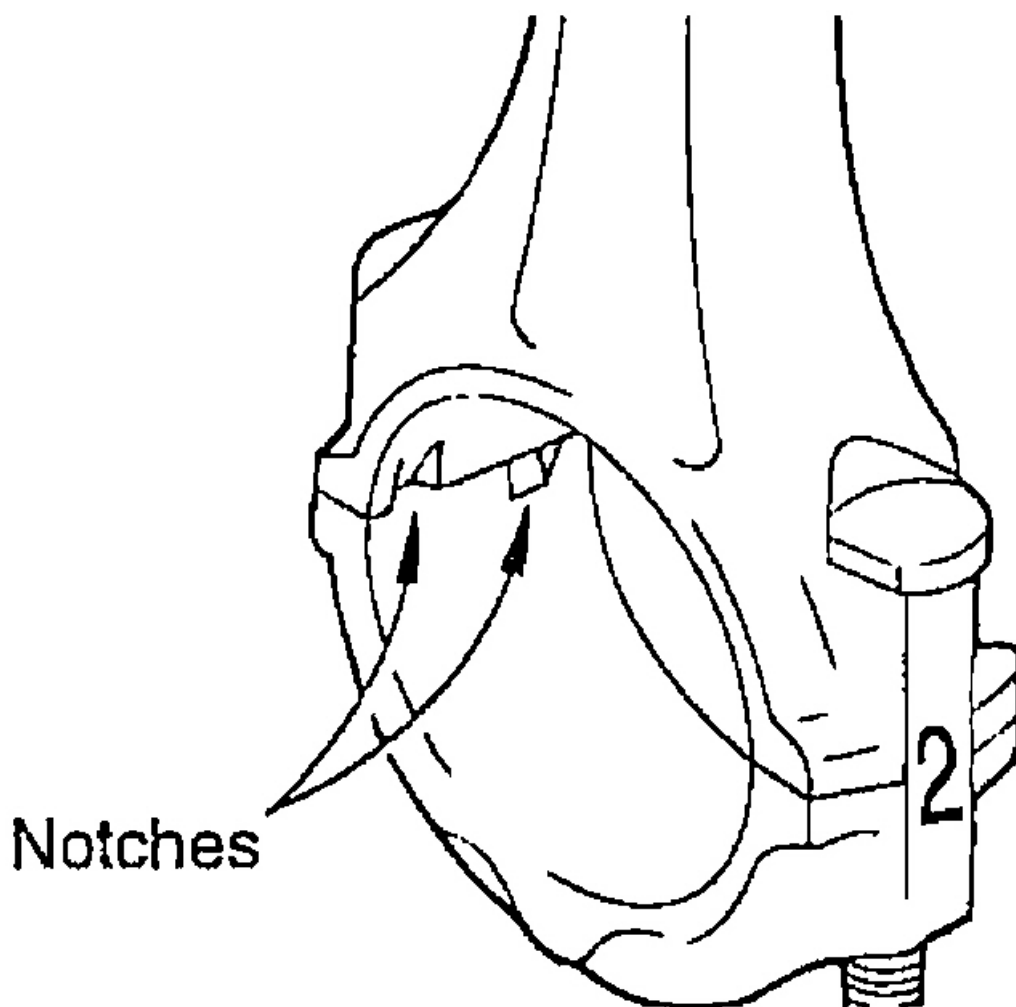
Fig. 92: Identifying Connecting Rod Cap Identification Numbers
Courtesy of KIA MOTORS AMERICA, INC.

1. Remove the connecting rod cap nuts and then remove the caps and the big end lower bearing.
2. Push each piston-connecting rod assembly toward the top of the cylinder.

INSPECTION

1. When the connecting rod cap is installed, make sure that cylinder numbers put on the rod end cap at disassembly match.

When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.



G00326801

Fig. 93: Identifying Connecting Rod Notches
Courtesy of KIA MOTORS AMERICA, INC.

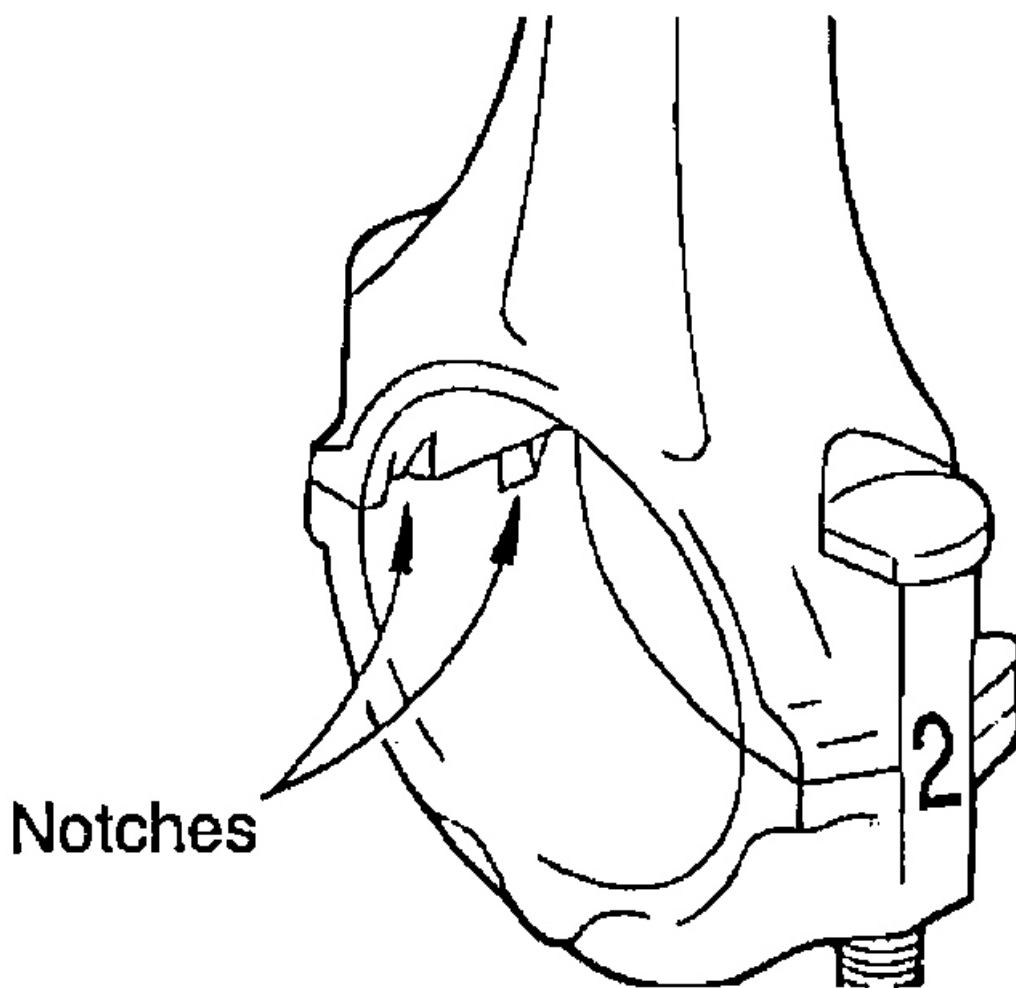
2. Replace the connecting rod if it is damaged on the thrust faces at either end, and also if it has step wear in, or a severely rough surface on the inside diameter of the small end.

INSTALLATION

1. Make sure that the front mark of piston and front mark (identification mark) of connecting rod are directed toward front of engine.
2. When connecting rod cap is installed, make sure that cylinder numbers put on rod and cap at disassembly

match.

3. When new connecting rod is installed, make sure that notches for holding bearing in place are on same side.



G00326802

Fig. 94: Identifying Connecting Rod Notches
Courtesy of KIA MOTORS AMERICA, INC.

4. Tighten the connecting rod cap nuts.

Tightening torque

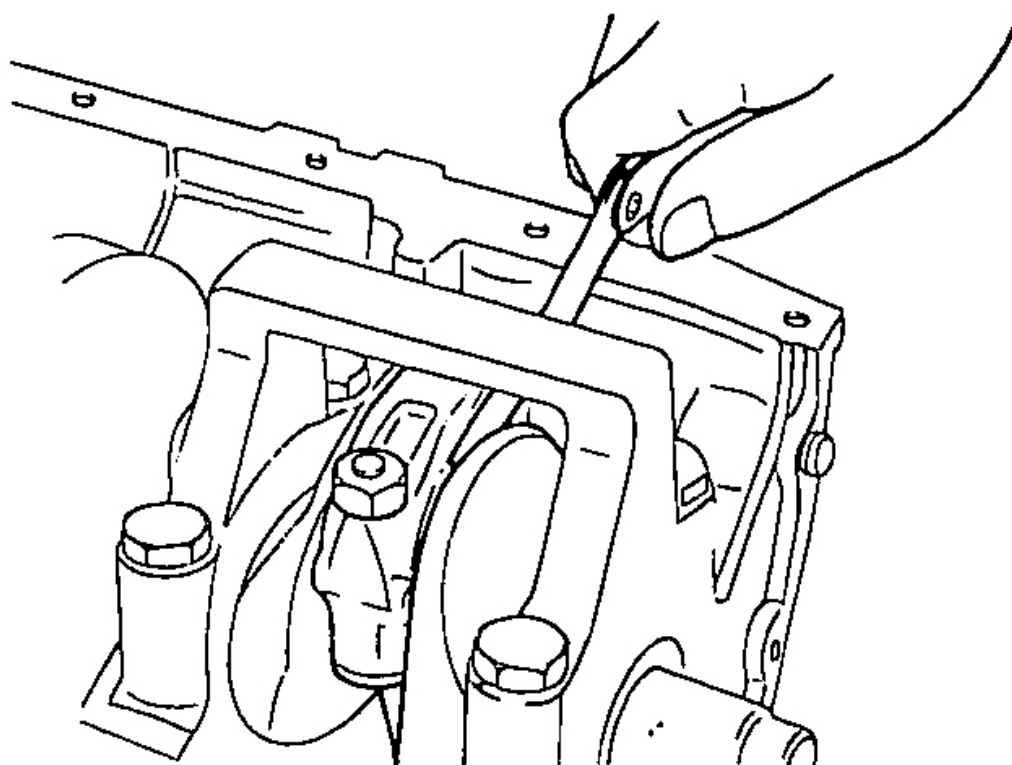
Connecting rod cap nuts :

18-22 Nm (180-220 kg.cm, 13-16 lb.ft) + (90°~94°)

5. Check connecting rod side clearance.

Side clearance : 0.10-0.25 mm (0.004-0.0098 in.)

Limit : 0.4 mm (0.0157 in.)

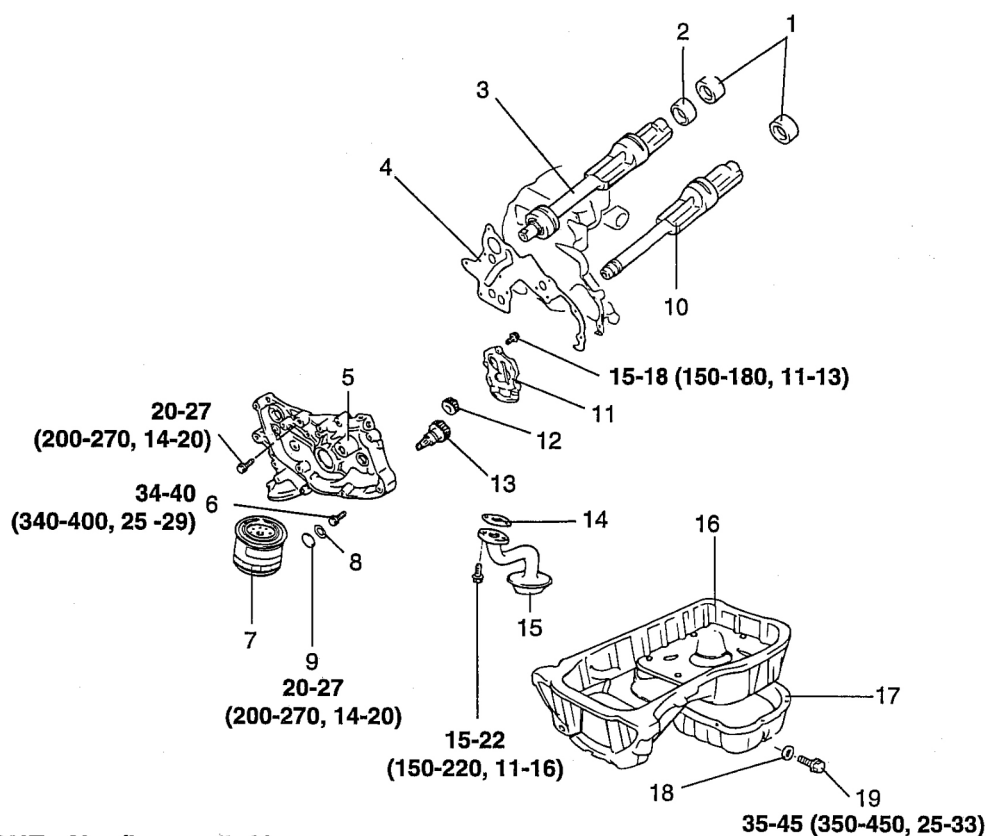


G00326803

Fig. 95: Checking Connecting Rod Side Clearance
Courtesy of KIA MOTORS AMERICA, INC.

COUNTER BALANCE SHAFT

COMPONENTS



TORQUE : Nm (kg.cm, lb.ft)

- | | |
|--------------------------------|--------------------|
| 1. Rear bearing | 11. Oil pump cover |
| 2. Front bearing | 12. Driven gear |
| 3. Right counter balance shaft | 13. Drive gear |
| 4. Gasket | 14. Gasket |
| 5. Oil pump case | 15. Oil screen |
| 6. Driven gear bolt | 16. Upper oil pan |
| 7. Oil filter | 17. Lower oil pan |
| 8. O-ring | 18. Gasket |
| 9. Plug cap | 19. Drain plug |
| 10. Left counter balance shaft | |

G00326804

Fig. 96: Exploded View Of Counter Balance Shaft

Courtesy of KIA MOTORS AMERICA, INC.

REPLACEMENT

COUNTER BALANCE SHAFT BEARING

1. Using a special tool, remove the right counter balance shaft front bearing from the cylinder block.

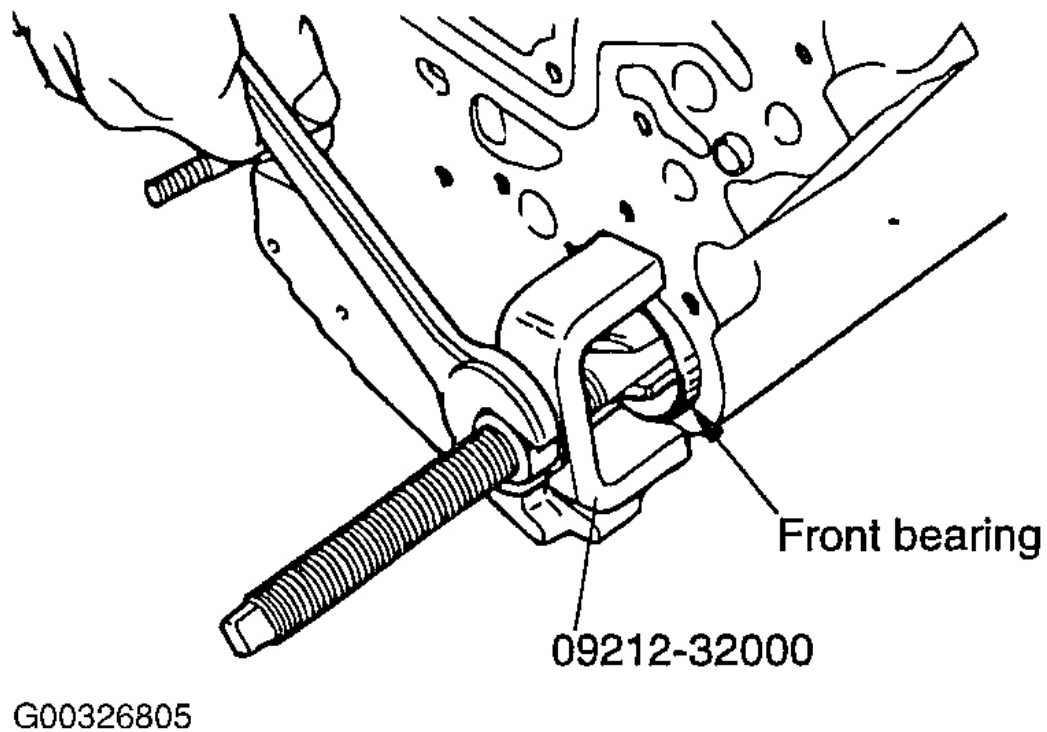
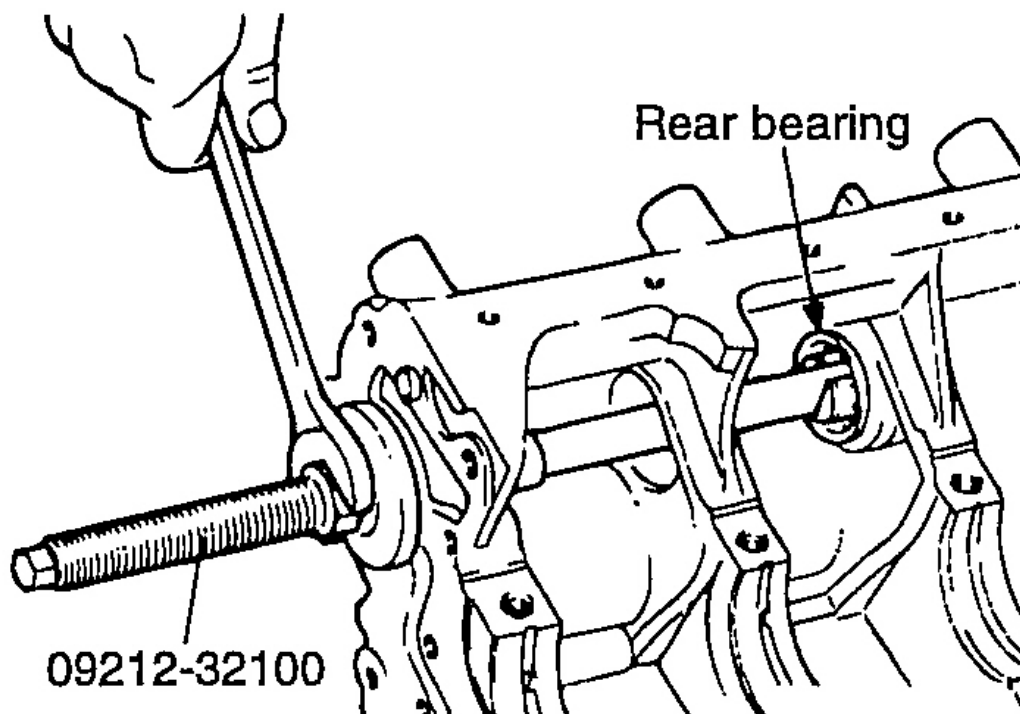


Fig. 97: Removing Right Counter Balance Shaft Front Bearing
Courtesy of KIA MOTORS AMERICA, INC.

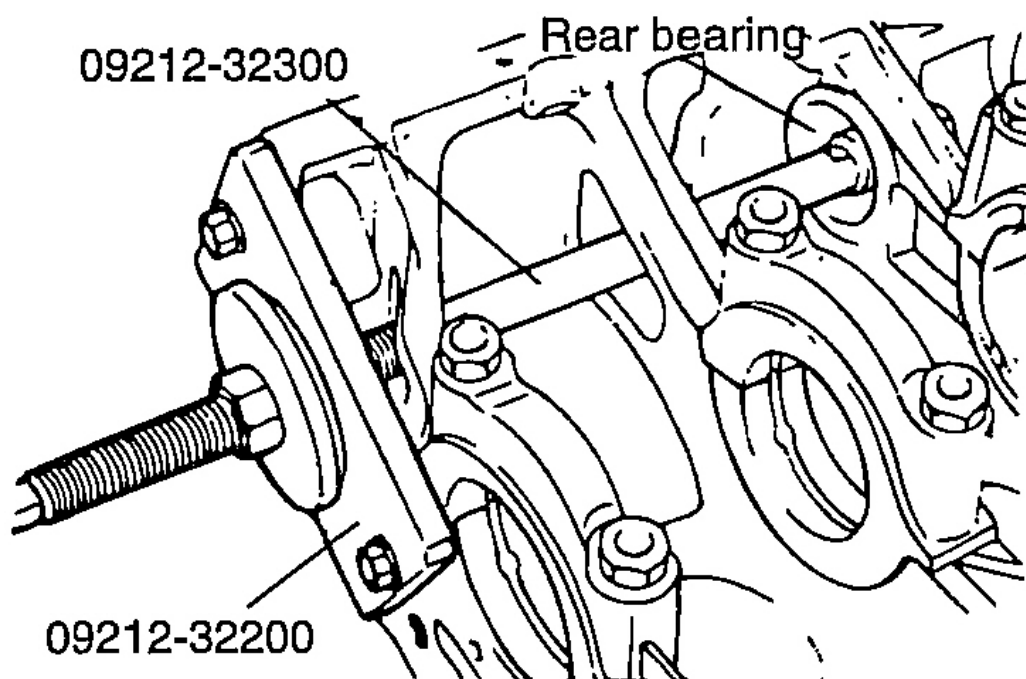
2. Using a special tool, remove the right counter balance shaft rear bearing from the cylinder block.



G00326806

Fig. 98: Removing Right Counter Balance Shaft Rear Bearing
Courtesy of KIA MOTORS AMERICA, INC.

3. Using a special tool, remove the left counter balance shaft rear bearing from cylinder block. At this time, install special tool on the front surface of cylinder block to hold the bearing puller.



G00326807

Fig. 99: Removing Left Counter Balance Shaft Rear Bearing
Courtesy of KIA MOTORS AMERICA, INC.

4. Using a special tool, install the left counter balance shaft rear bearing to the cylinder block.

NOTE:

- Apply engine oil to the rear bearing outer circumference and bearing hole in cylinder block.
- The left rear bearing has no oil holes.

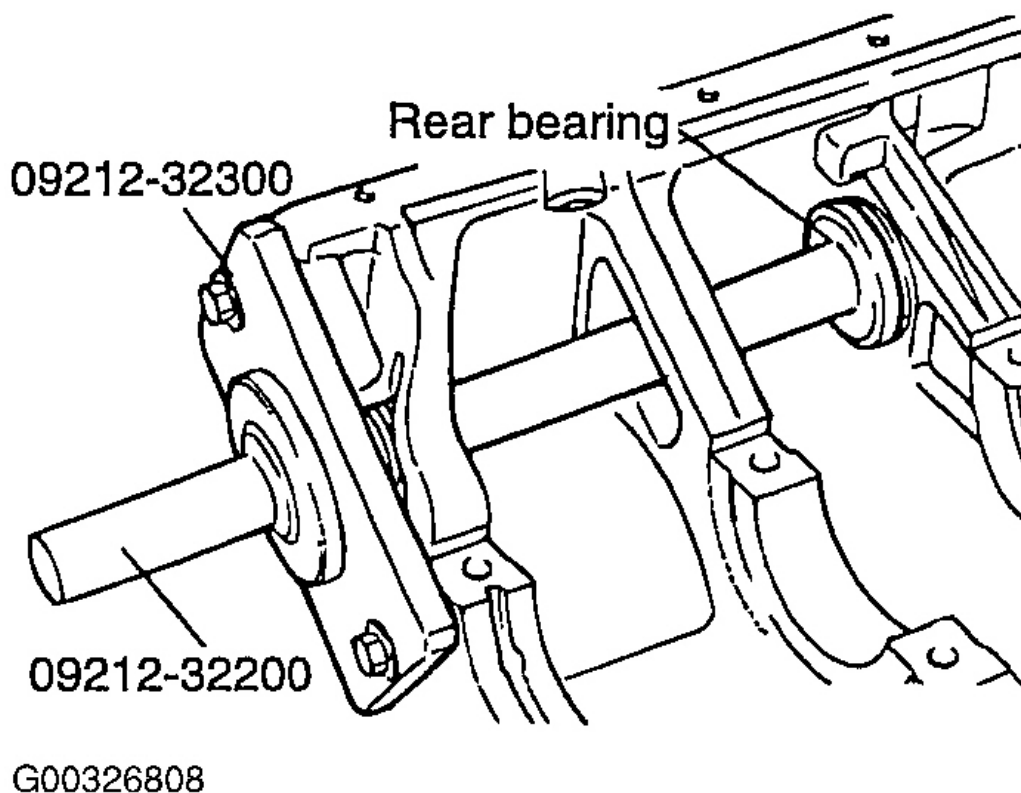


Fig. 100: Installing Left Counter Balance Shaft Rear Bearing
Courtesy of KIA MOTORS AMERICA, INC.

5. Using a special tool, install the right counter balance shaft rear bearing to the cylinder block.

NOTE:

- Apply engine oil to the outer surface of bearing.
- Make sure that the bearing oil hole is aligned with the oil hole of cylinder block.

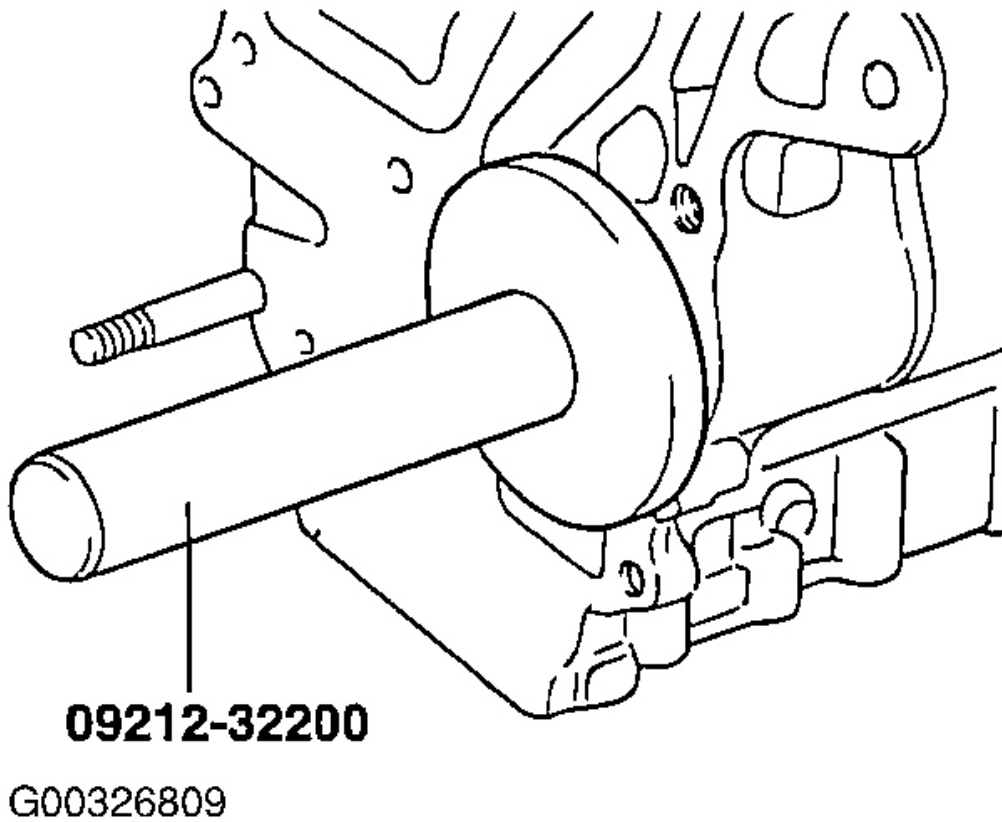
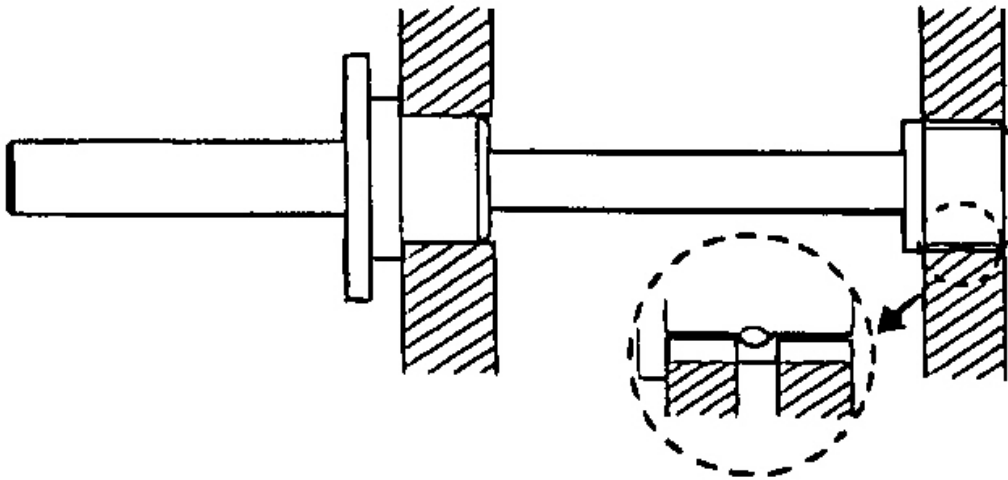


Fig. 101: Installing Right Counter Balance Shaft Rear Bearing (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.



G00326810

Fig. 102: Installing Right Counter Balance Shaft Rear Bearing (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

6. Using a special tool, install the right counter balance shaft front bearing to the cylinder block.

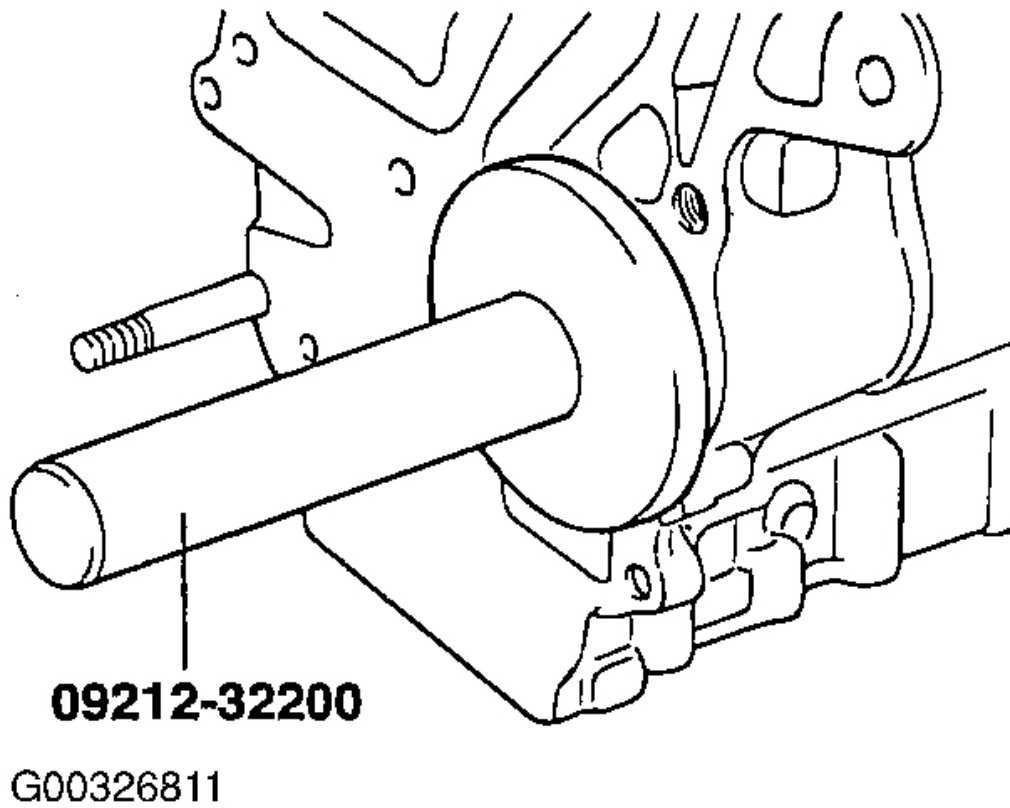
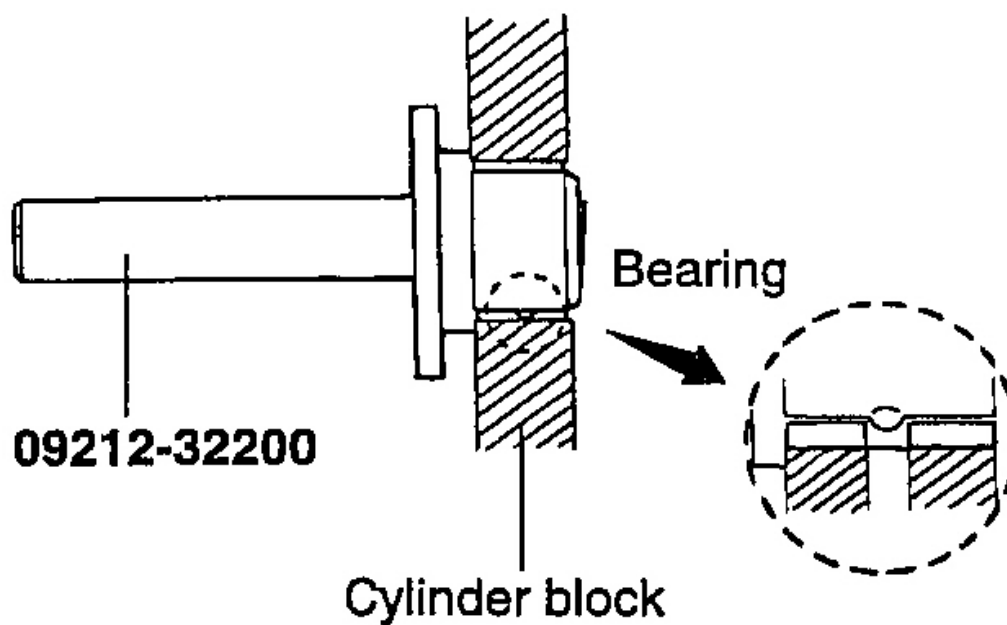


Fig. 103: Installing Right Counter Balance Shaft Front Bearing (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

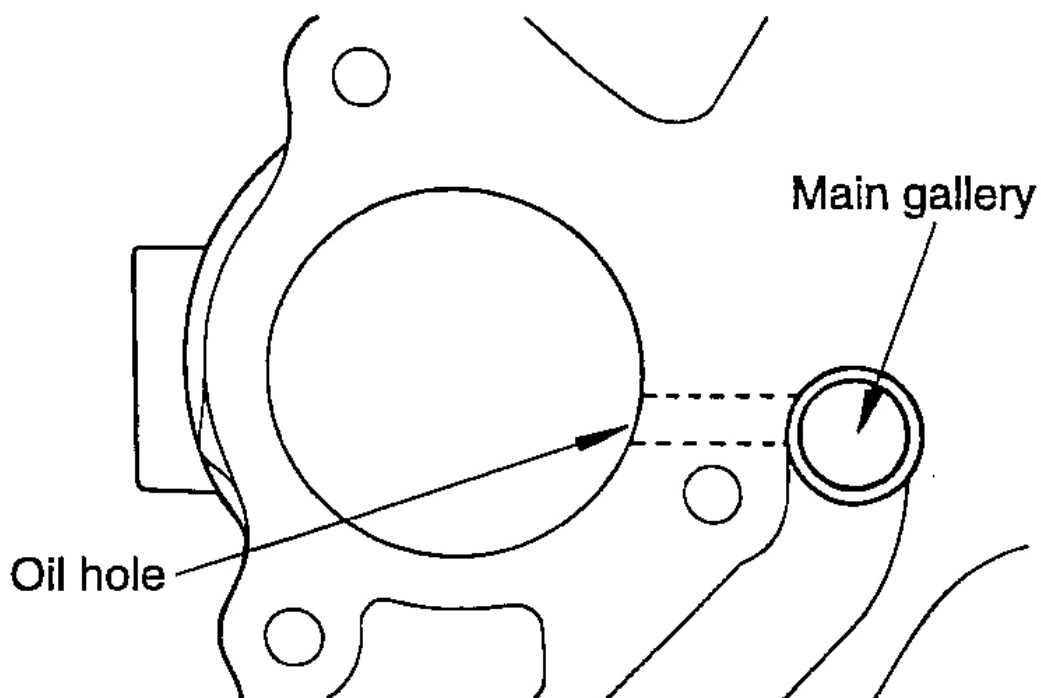


G00326812

Fig. 104: Installing Right Counter Balance Shaft Front Bearing (2 Of 2)

Courtesy of KIA MOTORS AMERICA, INC.

NOTE: Make sure that the bearing oil hole is aligned with the oil hole of cylinder block.

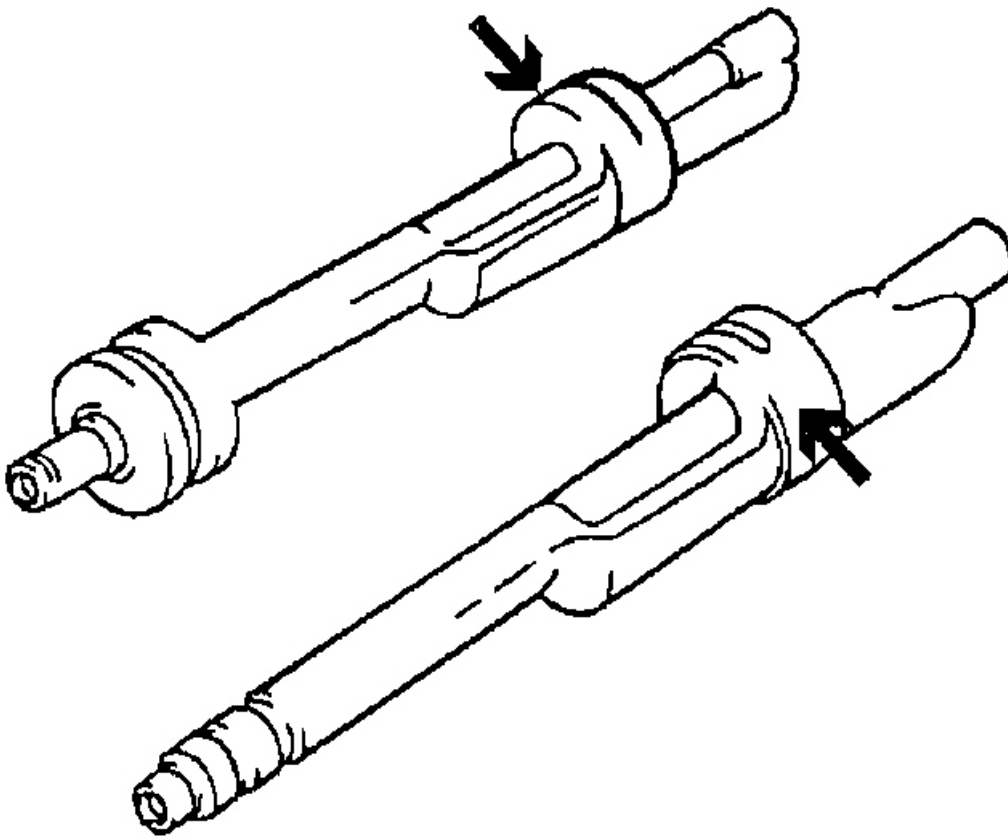


G00326813

Fig. 105: Identifying Bearing & Cylinder Block Oil Hole Alignment
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

Check journals for wear or seizure. If excessive wear or seizure is evident, check the bearing carefully. If necessary, replace the counter balance shaft bearings.

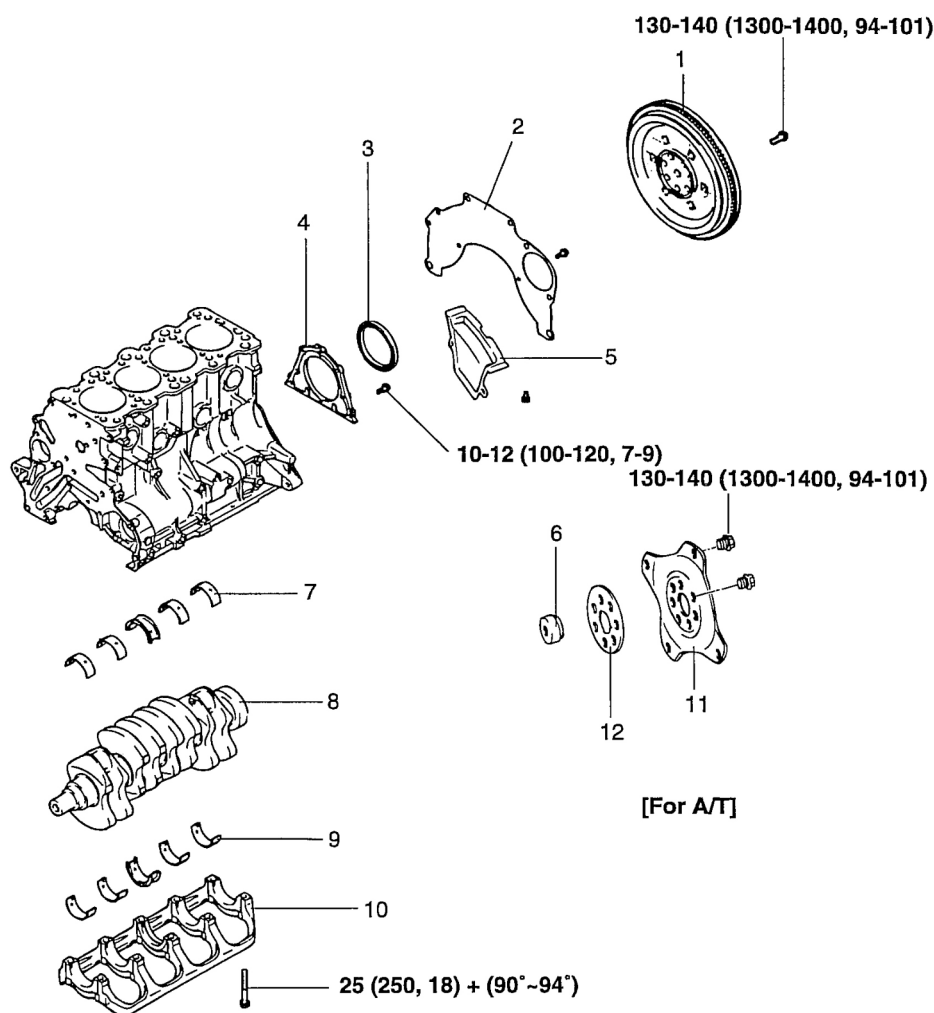


G00326814

Fig. 106: Checking Counter Balance Shaft Journals For Wear
Courtesy of KIA MOTORS AMERICA, INC.

CRANKSHAFT

COMPONENTS



TORQUE : Nm (kg-cm, lb-ft)

- | | |
|-----------------------|-------------------|
| 1. Flywheel | 7. Upper bearing |
| 2. Rear plate | 8. Crankshaft |
| 3. Oil seal | 9. Lower bearing |
| 4. Oil seal case | 10. Bearing cap |
| 5. Bell housing cover | 11. Drive plate |
| 6. Crankshaft bushing | 12. Adapter plate |

G00326815

Fig. 107: Exploded View Of Crankshaft
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Remove the timing belt train, front case, flywheel cylinder head assembly and oil pan. For details, refer to respective procedures.
2. Remove the rear plate and the rear oil seal.

3. Remove the connecting rod caps.

NOTE: **Mark the main bearing caps to be reassembled in the original position and direction.**

4. Remove the main bearing caps and remove the crankshaft. Keep the bearings in order according to the cap number.

INSPECTION

Crankshaft

1. Check the crankshaft journals and pins for damage, uneven wear and cracks. Also check oil holes for clogging. Correct or replace any defective part.
2. Inspect out-of-roundness and taper of crankshaft journal and pin.

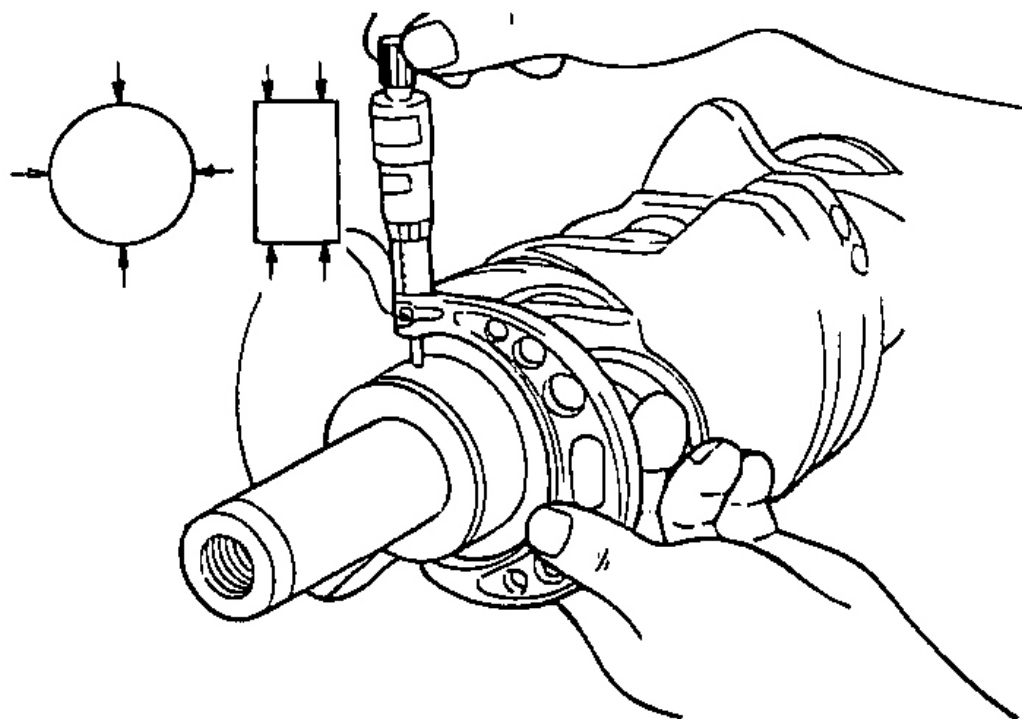
Standard value

Crankshaft journal O.D :

56.982-57.000 mm (2.2434-2.2442 in.)

Crankshaft pin O.D :

44.980-45.000 mm (1.7709-1.7717 in.)



G00326816

Fig. 108: Checking Crankshaft Journals & Pins
Courtesy of KIA MOTORS AMERICA, INC.

Main Bearings and Connecting Rod Bearings

Visually inspect each bearing for peeling, melt, seizure and improper contact. Replace the defective bearings.

Measuring Oil Clearance

To check the oil clearance, measure the outside diameter of the crankshaft journal and the crank pin and the inside diameter of the bearing. The clearance can be obtained by calculating the difference between the measured outside and inside diameters.

Standard value

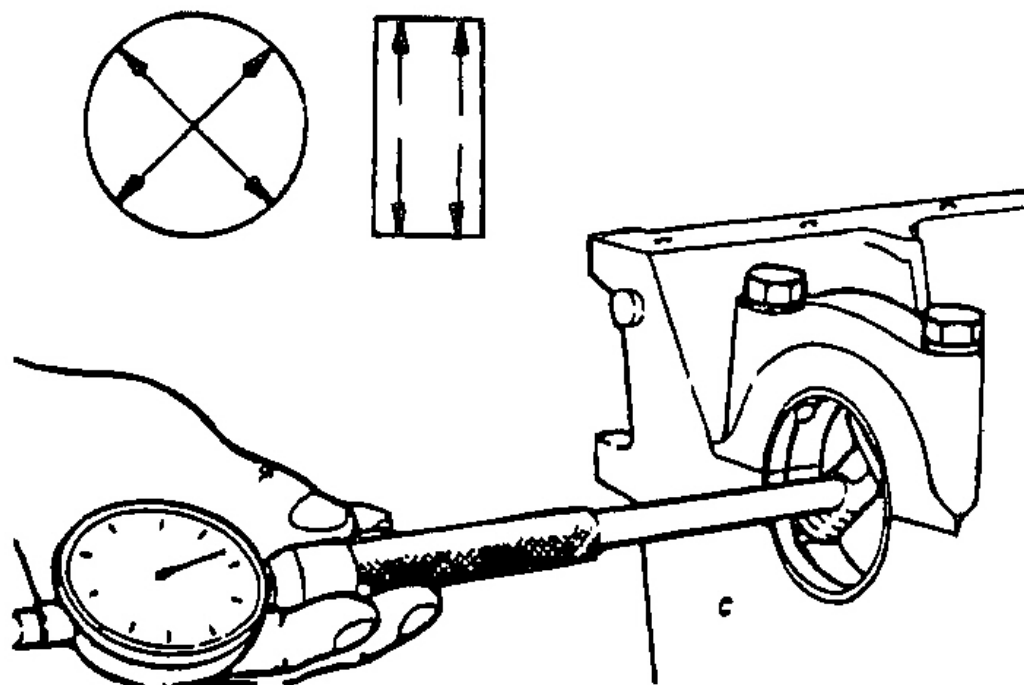
Oil clearance

Crankshaft main bearing :

No. 1, 2, 4, 5 : 0.018-0.036 (0.0007 - 0.0014)

No. 3 : 0.024 - 0.042 (0.0009 - 0.0016)

Connecting rod bearing : 0.015-0.048 mm



G00326817

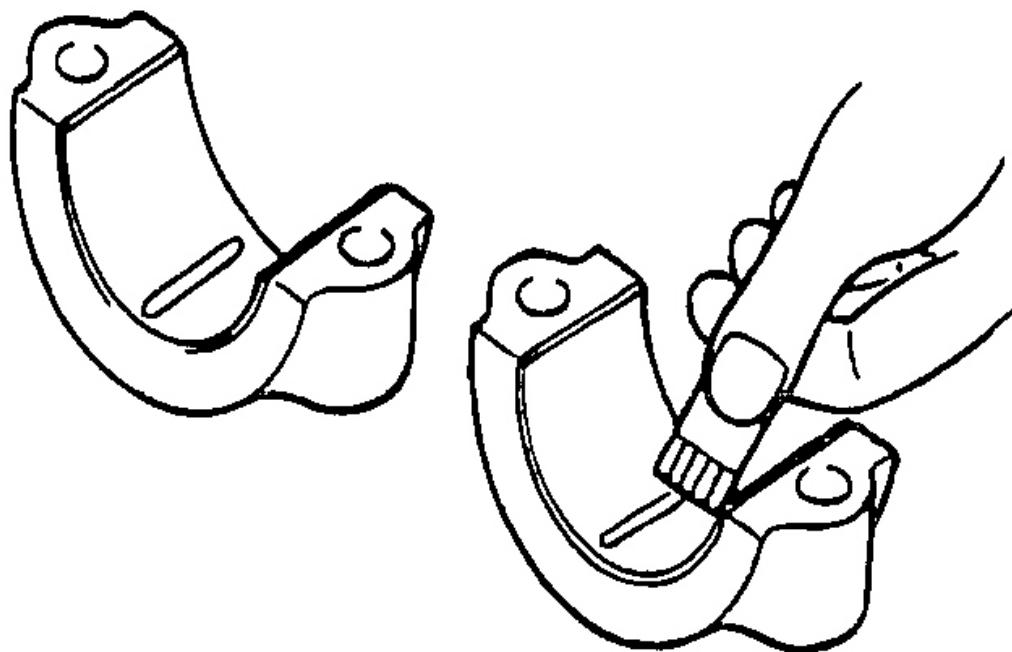
Fig. 109: Checking Oil Clearance

Courtesy of KIA MOTORS AMERICA, INC.

How to Use Plastic Gauge

Plastic gauge may be used to measure the clearance.

1. Remove oil and grease and any other dirt from bearings and journals.
2. Cut plastic gauge to the same length as the width of the bearing and place it in parallel with the journal, off oil holes.
3. Install the crankshaft, bearings and caps and tighten them to the specified torques. During this operation, do not turn the crank shaft. Remove the caps. Measure the width of the plastic gauge at the widest part by using a scale printed on the gauge package. If the clearance exceeds the service limit, the bearing should be replaced. When installing a new crankshaft, be sure to use standard size of bearings. If the clearance exceeds the service limit, the bearing should be replaced. When installing a new crankshaft, be sure to use standard size of bearing.



G00326818

Fig. 110: Identifying Plastic Gauge
Courtesy of KIA MOTORS AMERICA, INC.

Oil Seal

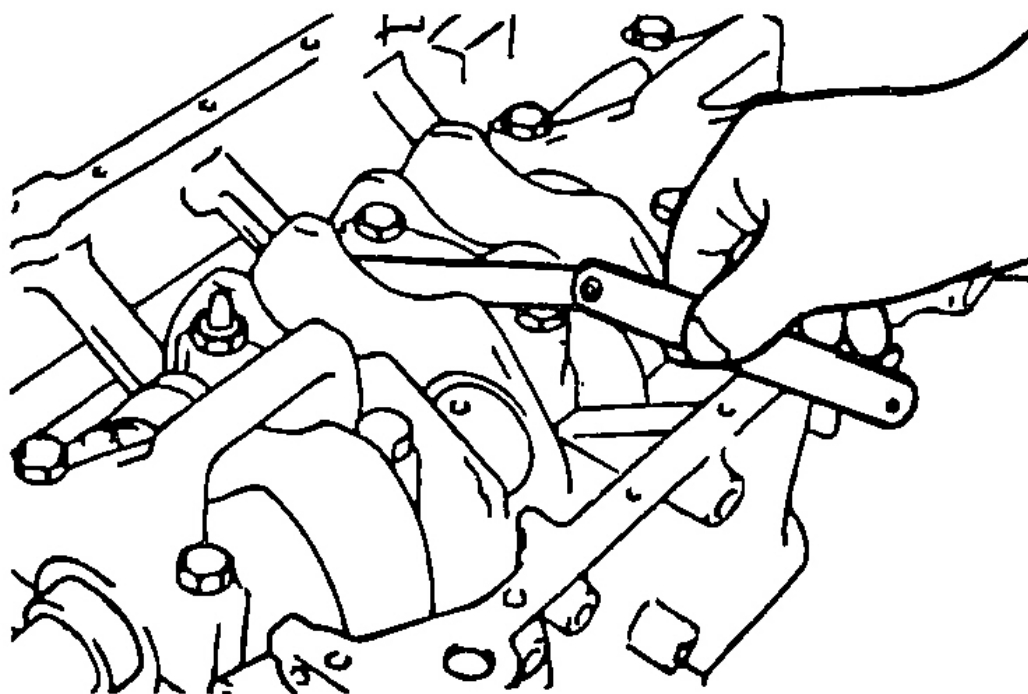
Check front and rear oil seals for damage or worn lips. Replace any seal that is defective.

Bearing Caps

After installing the bearing caps, make sure that the crankshaft turns smoothly and the end play is correct. If the end play exceeds the limit, replace crankshaft bearings.

Standard value : 0.05-0.25 mm (0.0020-0.0098 in.)

Limit : 0.25 mm (0.0098 in.)



G00326819

Fig. 111: Checking End Play

Courtesy of KIA MOTORS AMERICA, INC.

Drive Plate

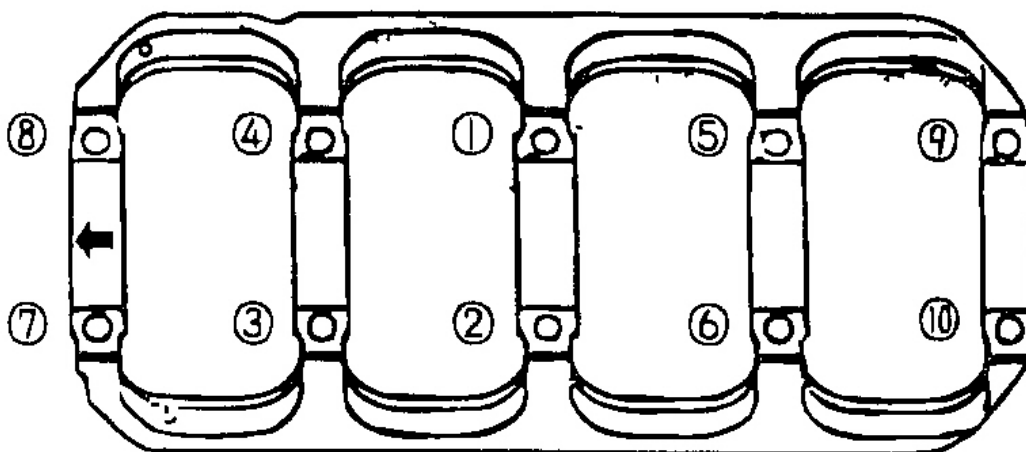
Replace deformed, damaged, or cracked drive plate.

INSTALLATION

1. Install grooved main bearing (upper bearing) and thrust bearing on cylinder block side.
2. Install grooveless main bearing (lower bearing) on main bearing cap side.
3. Install crankshaft. Apply engine oil to journal and pin.
4. Caps should be installed with arrow mark directed toward front of engine.
5. Tighten cap bolts to specified torque in sequence.

Tightening torque

Main bearing cap bolts : 25 Nm (250, 18 lb.ft) + (90°~94°)



G00326820

Fig. 112: Identifying Main Bearing Cap Bolt Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

6. Cap bolts should be tightened evenly in from 4 to 5 stages before they are tightened to specified torque.
7. Make certain that crankshaft turns freely and has proper end play.
8. Using a special tool, install oil seal in oil seal case.

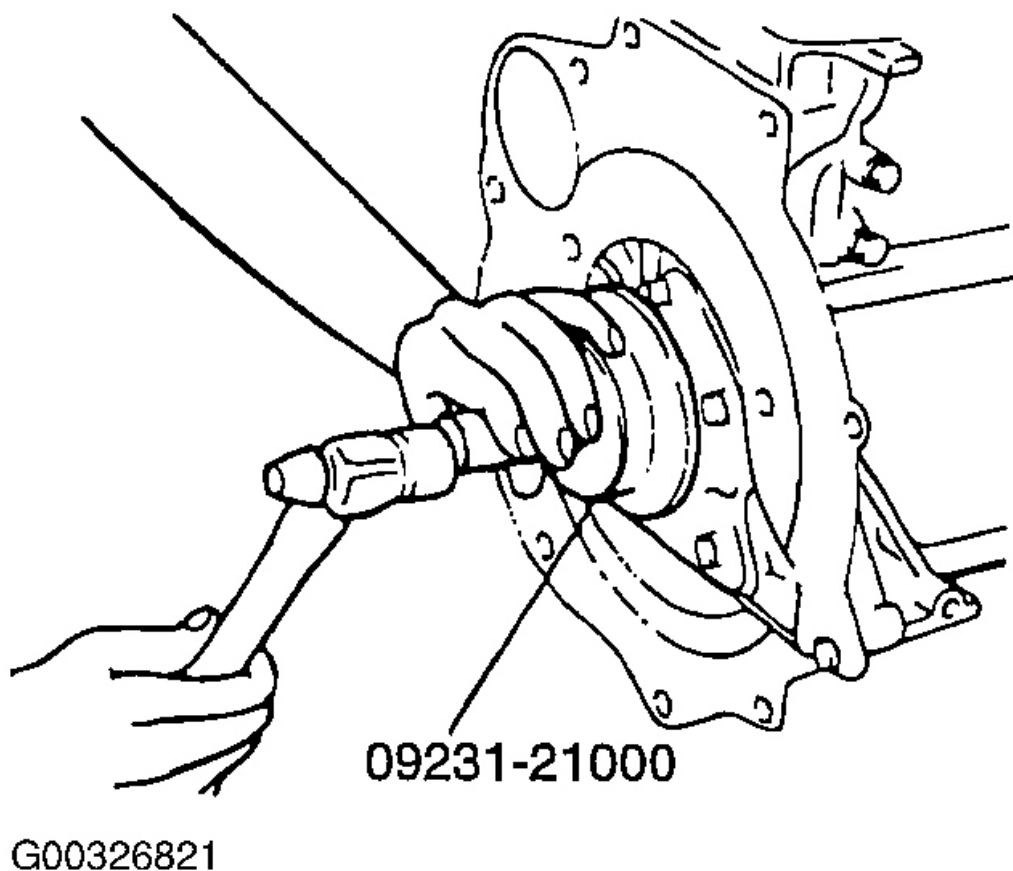
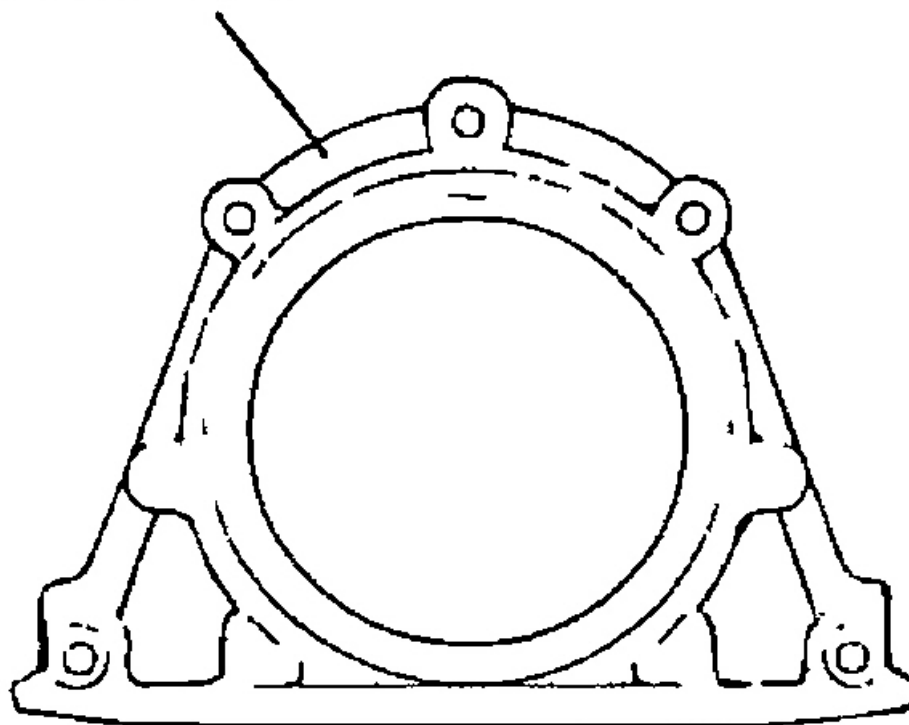


Fig. 113: Identifying Crankshaft Rear Oil Seal Installer (09231-21000)

Courtesy of KIA MOTORS AMERICA, INC.

9. Install the oil seal into the oil seal case so that the oil hole in the separator is directed downward (arrow shown in illustration).
10. Install the new oil seal case gasket and oil seal case assembly.

Oil seal case



Oil pan mounting surface

G00326822

Fig. 114: Installing Oil Seal Case Assembly
Courtesy of KIA MOTORS AMERICA, INC.

11. Install the rear plate to the cylinder block.
12. Install the flywheel assembly and tighten the bolts to the specified torque.

Tightening torque

Flywheel bolt :

130-140 Nm (1,300-1,400 kg.cm, 94-101 lb.ft)

FLY WHEEL

INSPECTION

1. Check the clutch disc contacting surface of the flywheel for damage and wear. Replace the flywheel if excessively damaged or worn.
2. Check the clutch disc contacting surface of the flywheel for runout.

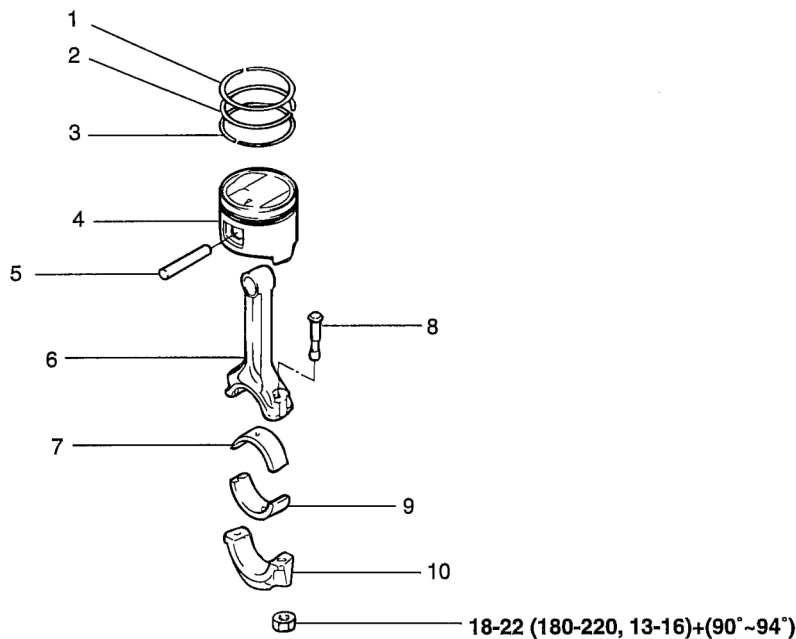
Limit

Flywheel run-out : 0.13 mm (0.0051 in.)

3. Check the ring gear for damage, cracks and wear, and replace if necessary.

PISTON

COMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

1. No.1 piston ring
2. No.2 piston ring
3. Oil ring
4. Piston
5. Piston pin

6. Connecting rod
7. Upper bearing
8. Bolt
9. Lower bearing
10. Connecting rod bearing cap

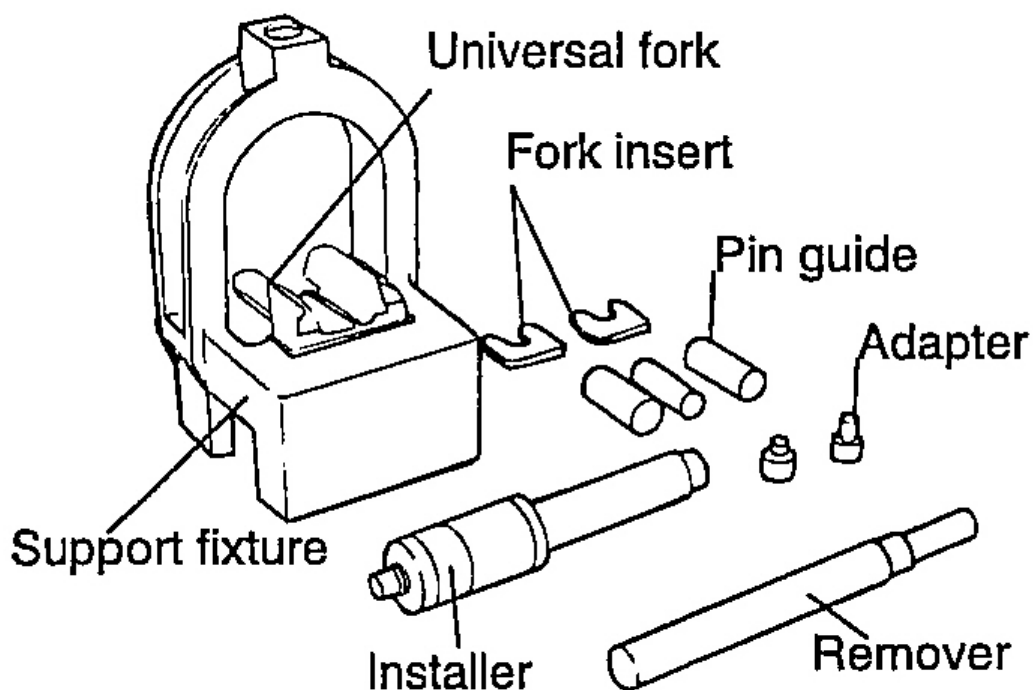
G00326823

Fig. 115: Exploded View Of Piston
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

PISTON PIN

1. Use the special tools (09234-33001), to disassemble and reassemble the piston and connecting rod.



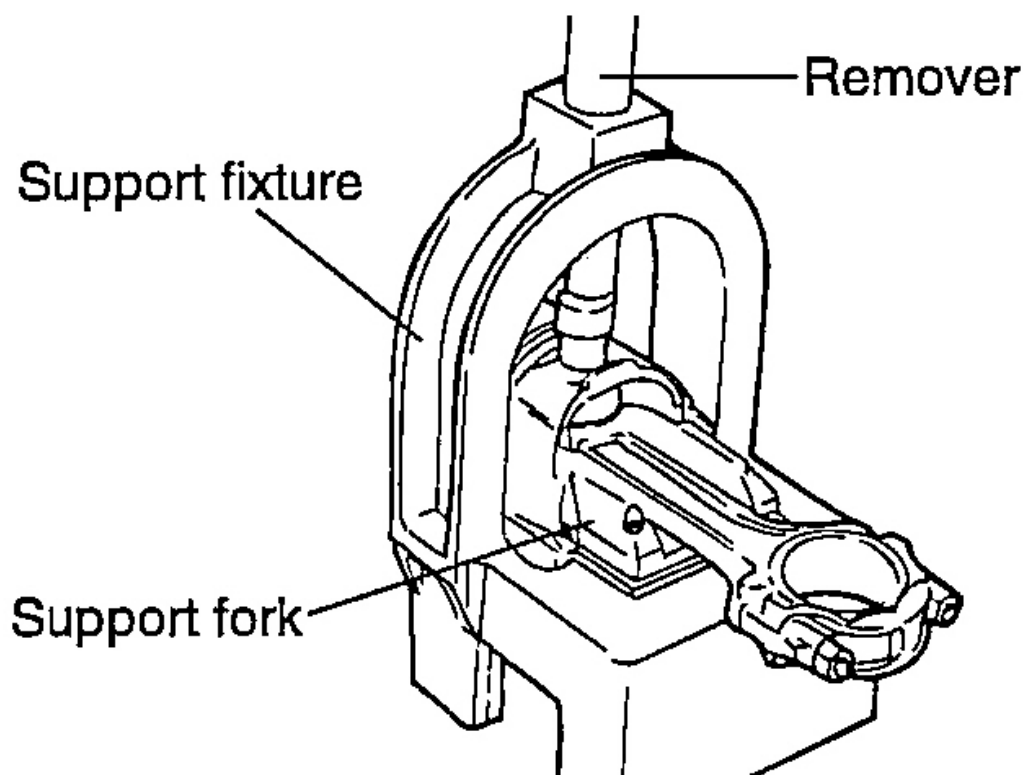
G00326824

Fig. 116: Identifying Special Tools (09234-33001)

Courtesy of KIA MOTORS AMERICA, INC.

2. Place the proper insert in the fork of the tool. Position the insert between the connecting rod and the piston.
3. Insert the proper tool for removal through the hole in the arch of the tool.

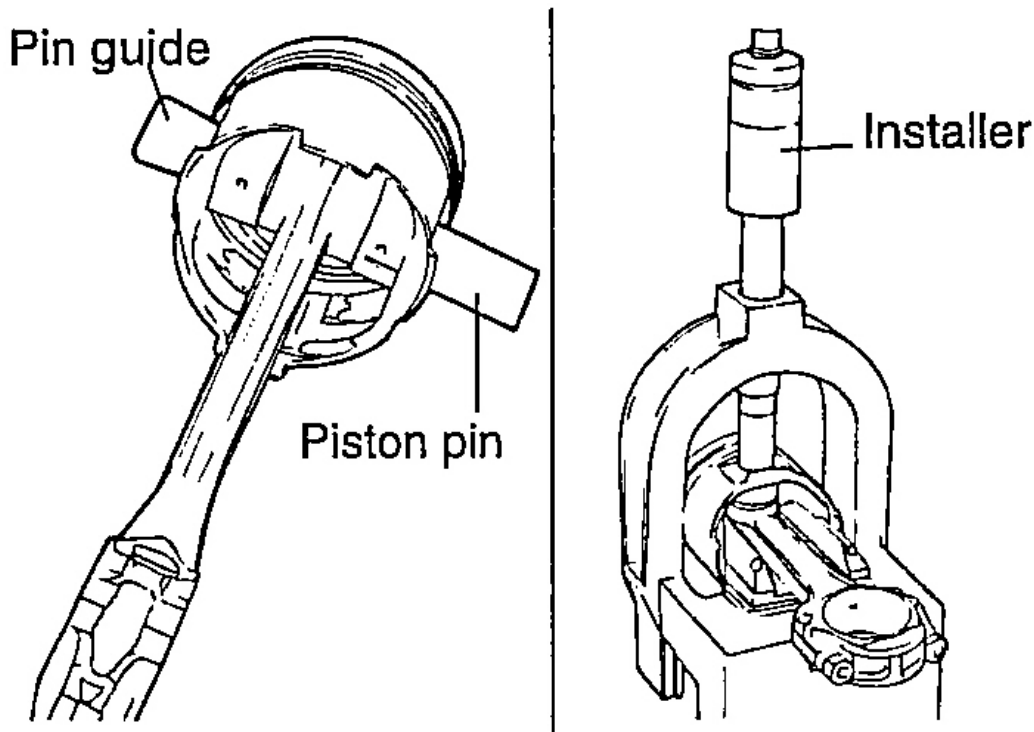
NOTE: Center the piston, rod and pin assembly with the removal arbor.



G00326825

Fig. 117: Centering Piston, Rod & Pin Assembly Using Removal Arbor
Courtesy of KIA MOTORS AMERICA, INC.

4. Press the piston pin out of the connecting rod.
5. Install proper pin guide (as shown in illustration) through piston and into connecting rod. Hand tap pin guide into piston for proper retention. Drop piston pin into the other side of the piston.



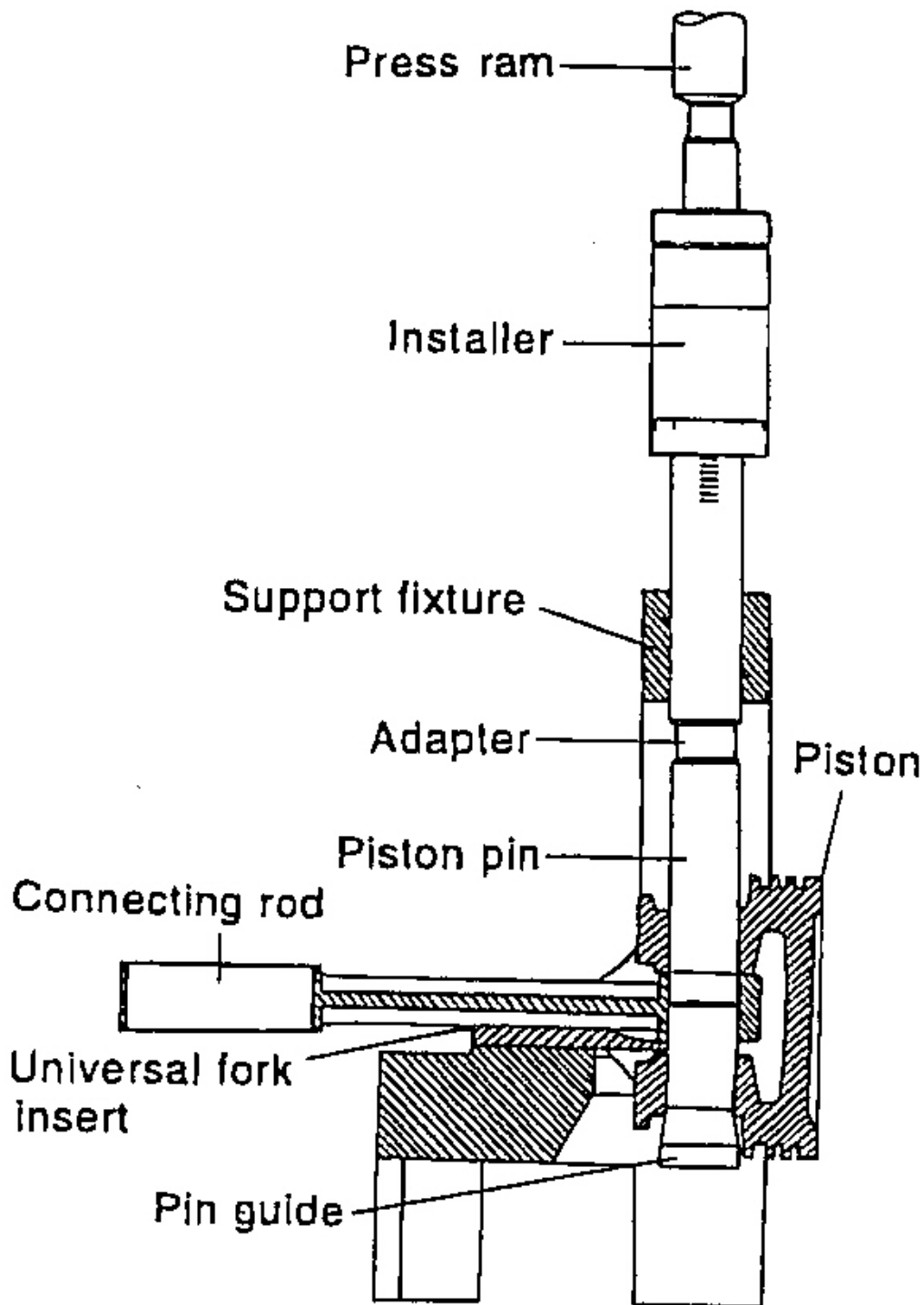
G00326826

Fig. 118: Installing Piston Pin (1 Of 2)

Courtesy of KIA MOTORS AMERICA, INC.

NOTE: The pin guide centers the connecting rod in the piston. When the piston, connecting rod, piston pin and pin guide assembly are positioned on the fork of the tool, the pin guide will also center this assembly in the tool. If a pin guide that is too small is used, the piston assembly will not be located centrally in the tool, and damage may occur to the fork and/or the insert of the tool.

6. Install the piston assembly onto the fork assembly of tool. The tool will support connecting rod at the piston pin. Be sure the piston assembly is slid onto the fork until the pin guide contacts the fork insert.



G00326827

Fig. 119: Installing Piston Pin (2 Of 2)**Courtesy of KIA MOTORS AMERICA, INC.**

7. Adjust the installing arbor to the proper length by turning the numbered sleeve on the lettered shaft until the specified alpha numeric setting from the application chart shown in illustration is obtained. Turn knurled nut to lock numbered sleeve on shaft.
8. Insert the installing arbor through the hole in the arch of the tool. Press the piston pin into the connecting rod until the sleeve on the installing arbor contacts the top of the tool arch. The pin guide will fall out of the connecting rod as the piston pin is pressed in.

CAUTION: Do not exceed 5000 pounds of force when stopping the installing arbor sleeve against the arch.

INSPECTION**PISTON AND PISTON PINS**

1. Check each piston for scuffing, scoring, wear and other defects. Replace any piston that is defective.
2. Check each piston ring for breakage, damage and abnormal wear. Replace the defective rings. When the piston requires replacement, its rings should also be replaced.
3. Check the piston pin fits in the piston pin hole. Replace any piston and pin assembly that is defective. The piston pin must be smoothly pressed by hand into the pin hole at room temperature.

PISTON RINGS

1. Measure the piston ring side clearance. If the measured value exceeds the service limit, insert a new ring in a ring groove to measure the side clearance. If the clearance still exceeds the service limit, replace the piston and rings together. If it is less than the service limit, replace the piston rings only.

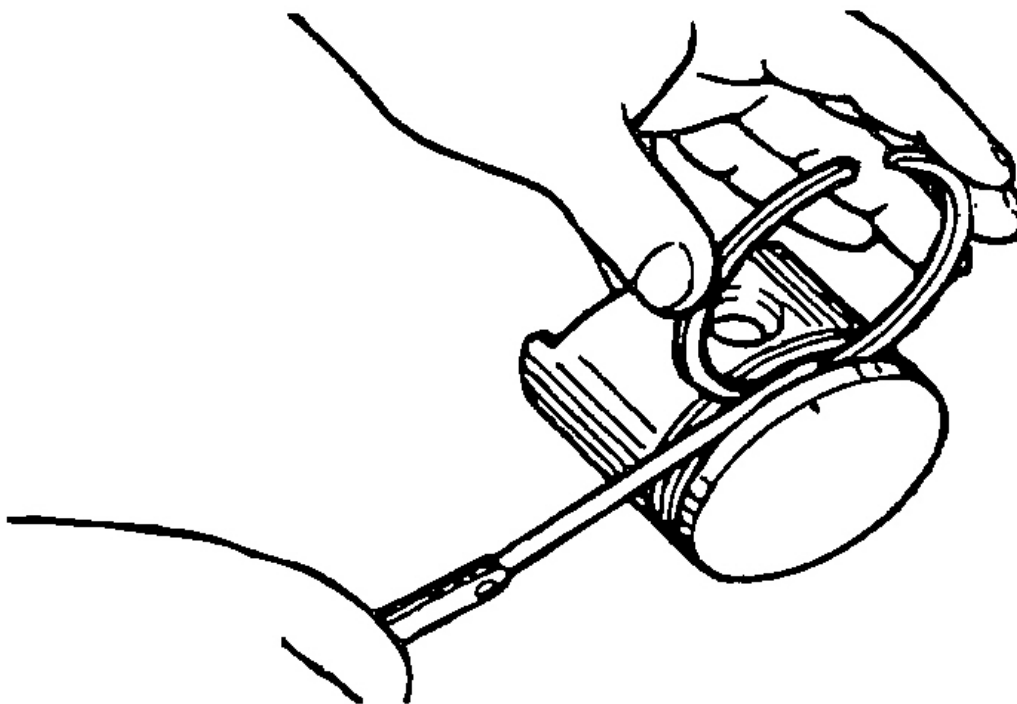
[Standard value]

Piston ring side clearance :

No.1 : 0.03-0.07mm (0.0012-0.0028 in.)

No.2 : 0.02-0.06 mm (0.0008-0.0024 in.)

[Limit] : 0.1 mm (0.004 in.)



G00326828

Fig. 120: Checking Piston Ring Side Clearance
Courtesy of KIA MOTORS AMERICA, INC.

2. To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles to the cylinder wall by gently pressing it down with a piston. Measure the gap with a feeler gauge. If the gap exceeds the service limit, replace the piston ring.

Piston ring end gap

[Standard dimension]

No. 1 : 0.25-0.35 mm (0.0098-0.0138 in.)

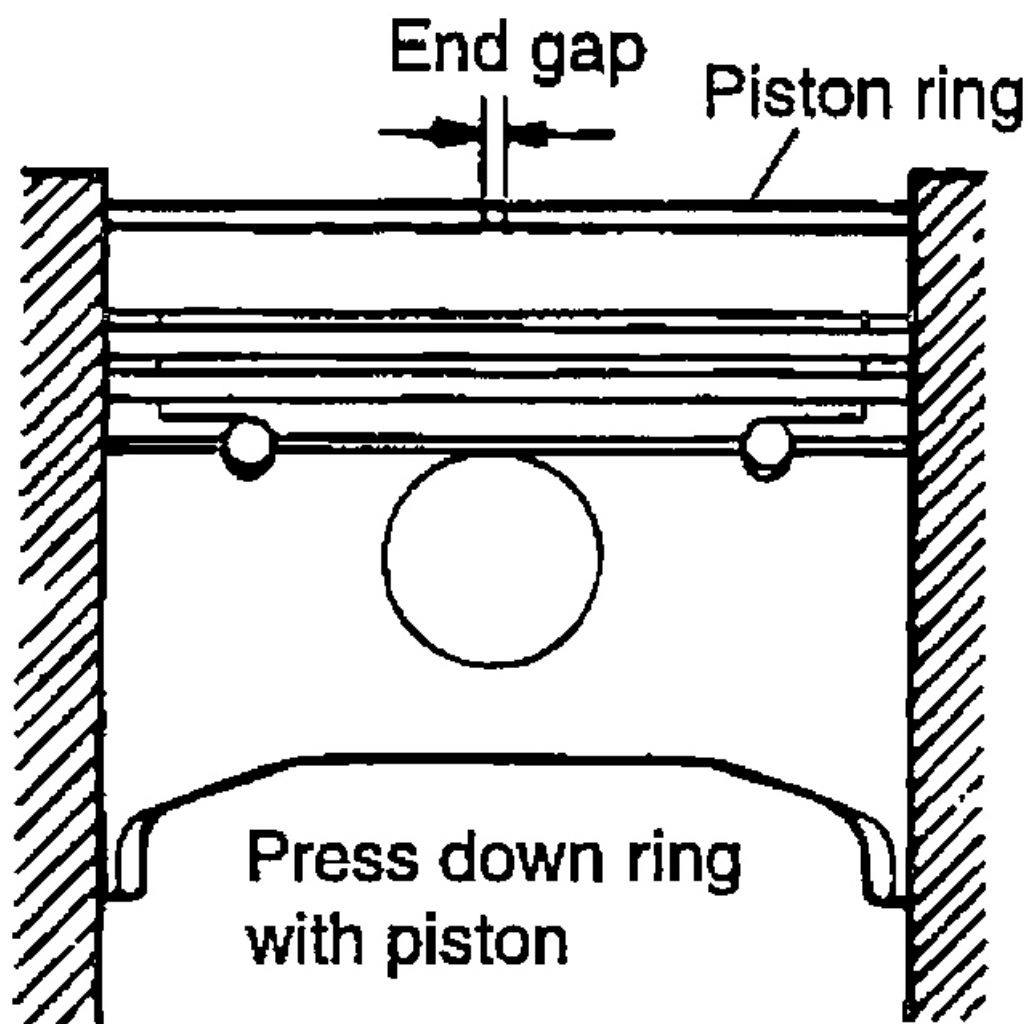
No. 2 : 0.40-0.55 mm (0.0157-0.0216 in.)

Oil ring side rail : 0.10-0.40 mm (0.0039-0.0157 in.)

[Limit]

No. 1, No. 2 : 0.8 mm (0.031 in.)

Oil ring side rail : 1.0 mm (0.039 in.)

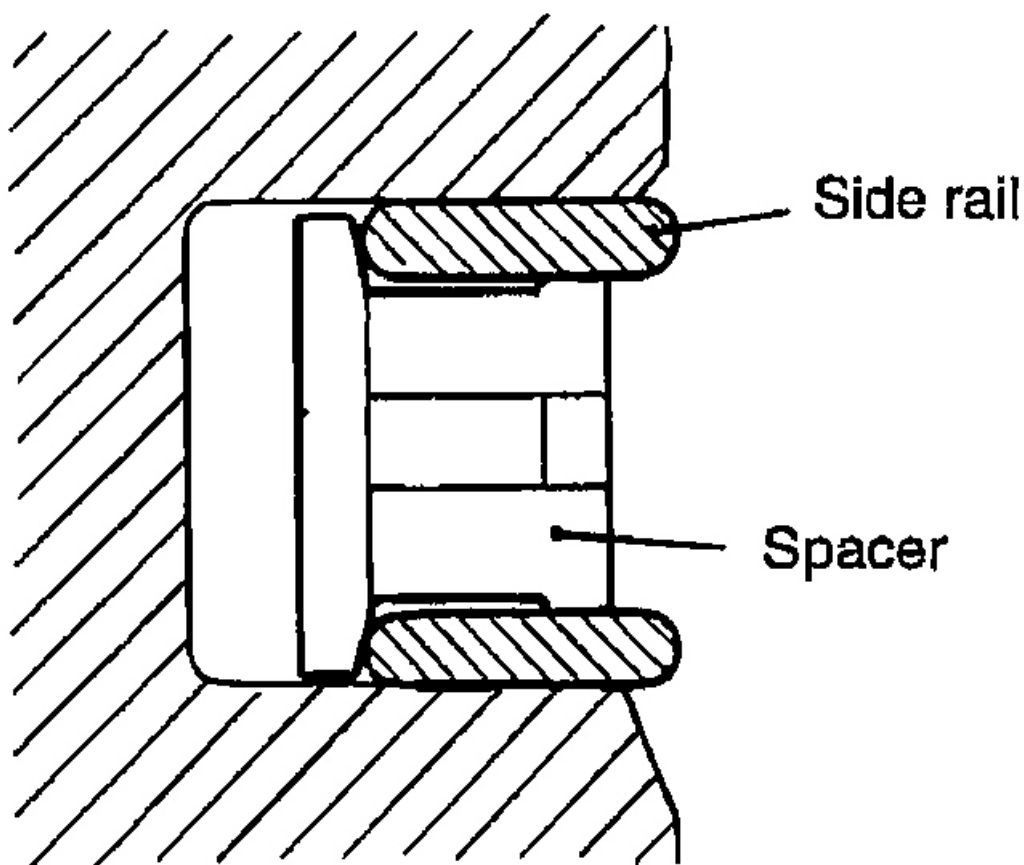


G00326829

Fig. 121: Checking Piston Ring End Gap
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Install the spacer.



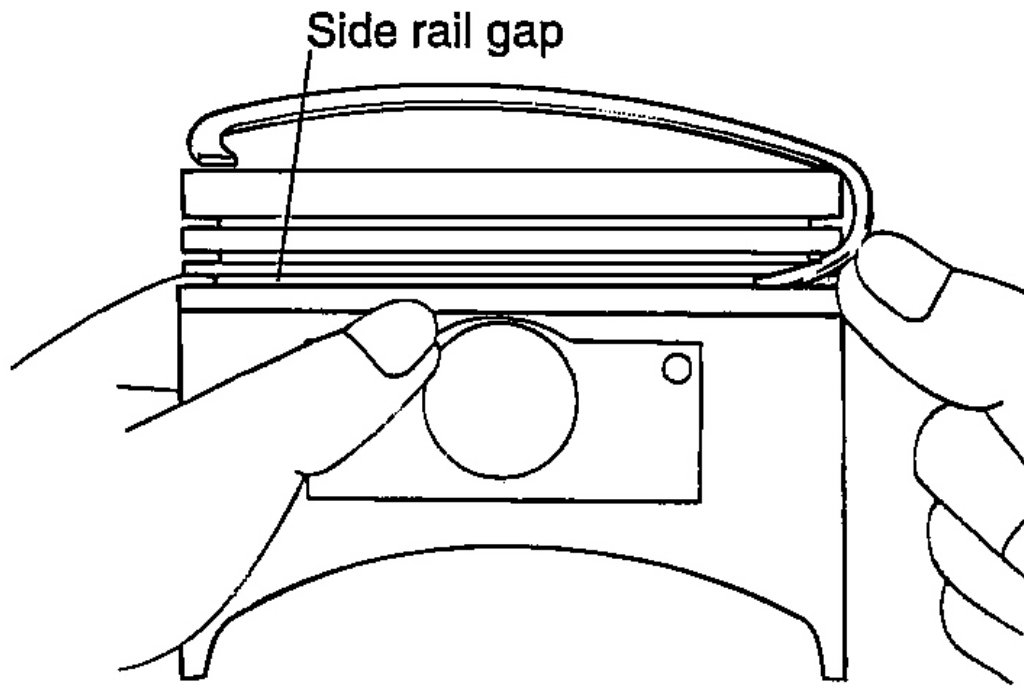
G00326830

Fig. 122: Installing Spacer

Courtesy of KIA MOTORS AMERICA, INC.

2. Install the upper side rail. To install the side rail, first put one end of the side rail between piston ring groove and spacer, hold it down firmly, and then press down the portion which is to be inserted into groove with a finger as shown in illustration.

NOTE: Do not use piston ring expander when installing the side rail.

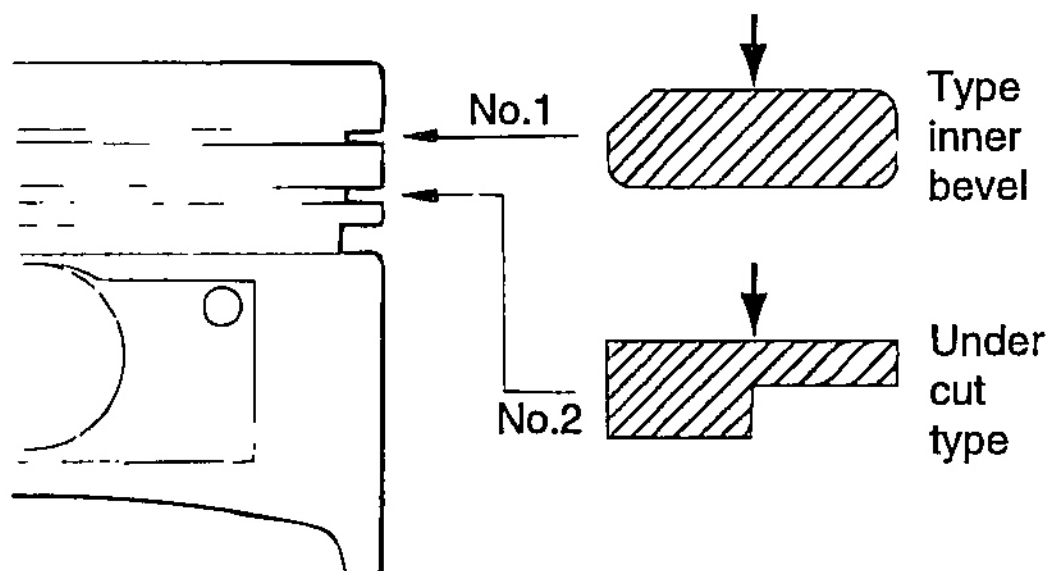


G00326831

Fig. 123: Installing Side Rail

Courtesy of KIA MOTORS AMERICA, INC.

3. Install the lower side rail by same procedure as Step 2.
4. Using piston ring expander, install No. 2 piston ring.



G00326832

Fig. 124: Installing Piston Rings

Courtesy of KIA MOTORS AMERICA, INC.

5. Install No. 1 piston ring.
6. Apply engine oil around piston and piston rings.
7. Position each piston ring end gap as far apart from neighboring gaps as possible. Make sure that gaps are not positioned in thrust and pin directions.

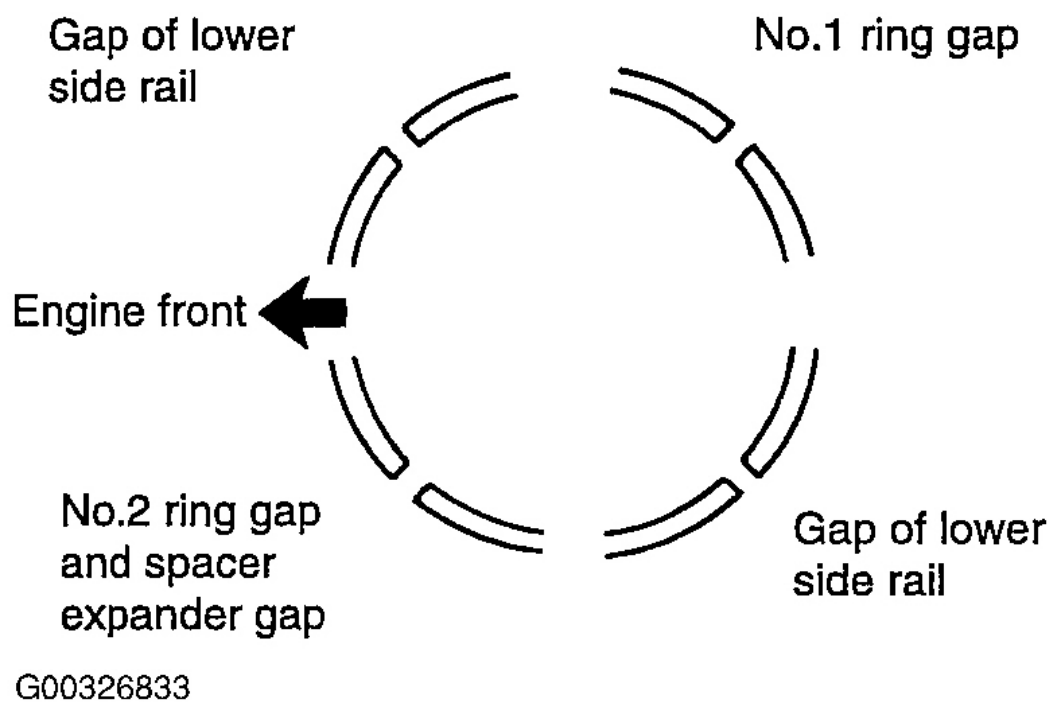


Fig. 125: Identifying Piston Ring Gap Installed Position

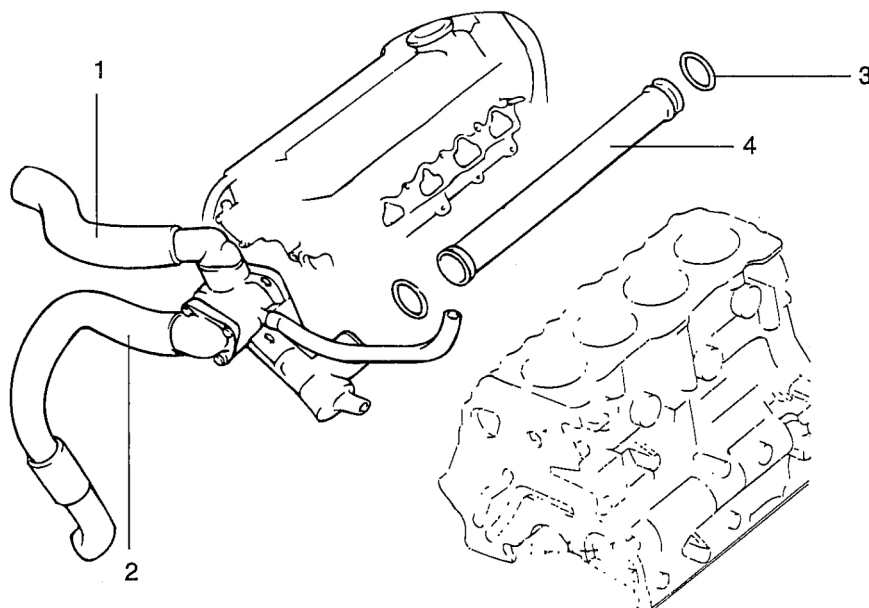
Courtesy of KIA MOTORS AMERICA, INC.

8. Hold piston rings firmly in a piston ring compressor as they are inserted into cylinder.

COOLING SYSTEM

ENGINE COOLANT HOSE/PIPES

COMPONENTS

[DOHC ENGINE]

- 1. Radiator upper hose
- 2. Radiator lower hose

- 3. O-ring
- 4. Engine coolant inlet pipe

G00326834

Fig. 126: Identifying Engine Coolant Hose & Pipe Routing
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

Check the engine coolant pipe and hoses for cracks, damage, and restrictions. Replace if necessary.

INSTALLATION

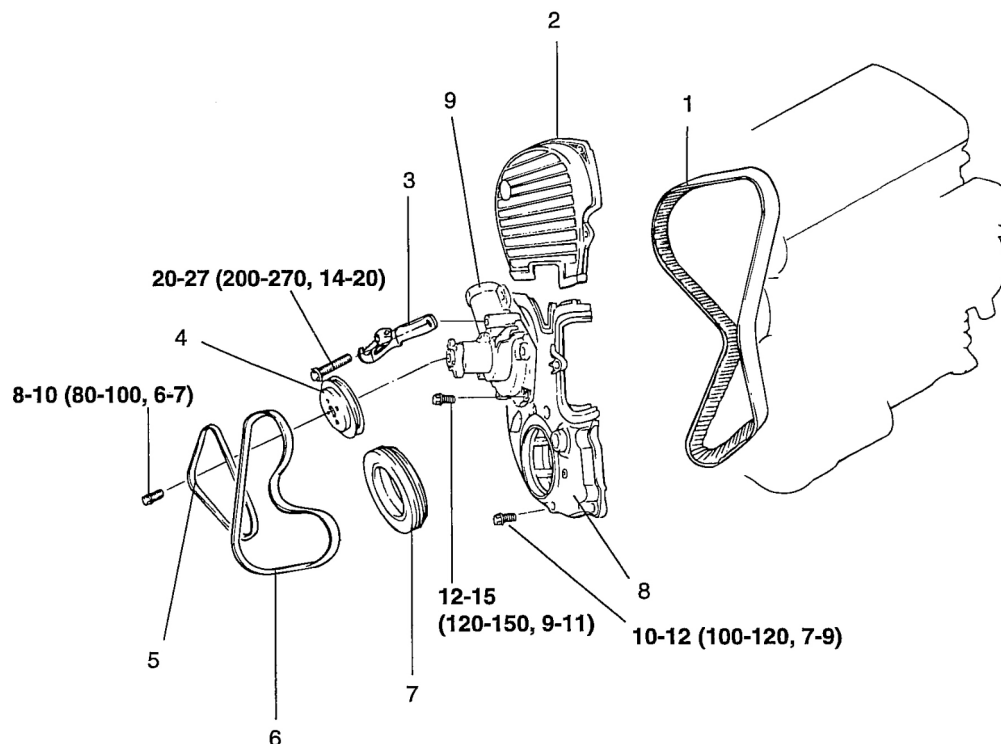
Fit O-ring in the groove provided at engine coolant inlet pipe end, wet the periphery of O-ring and insert engine coolant inlet pipe.

NOTE:

- Do not apply oils or greases to engine coolant pipe O-ring.
- Keep the engine coolant pipe connections free of sand, dust, etc.
- Insert engine coolant pipe to its end bottoms.
- While installing the engine coolant inlet pipe, always replace the O-ring with a new one.

ENGINE COOLANT PUMP

COMPONENTS



TORQUE : Nm (kg-cm, lb-ft)

- | | |
|-------------------------------|----------------------------------|
| 1. Timing belt | 6. Drive belt (Power steering) |
| 2. Timing belt upper cover | 7. Crankshaft pulley |
| 3. Generator brace | 8. Timing belt front lower cover |
| 4. Engine coolant pump pulley | 9. Engine coolant pump |
| 5. Drive belt (Alternator) | |

G00326835

Fig. 127: Removing & Installing Engine Coolant Pump

Courtesy of KIA MOTORS AMERICA, INC.

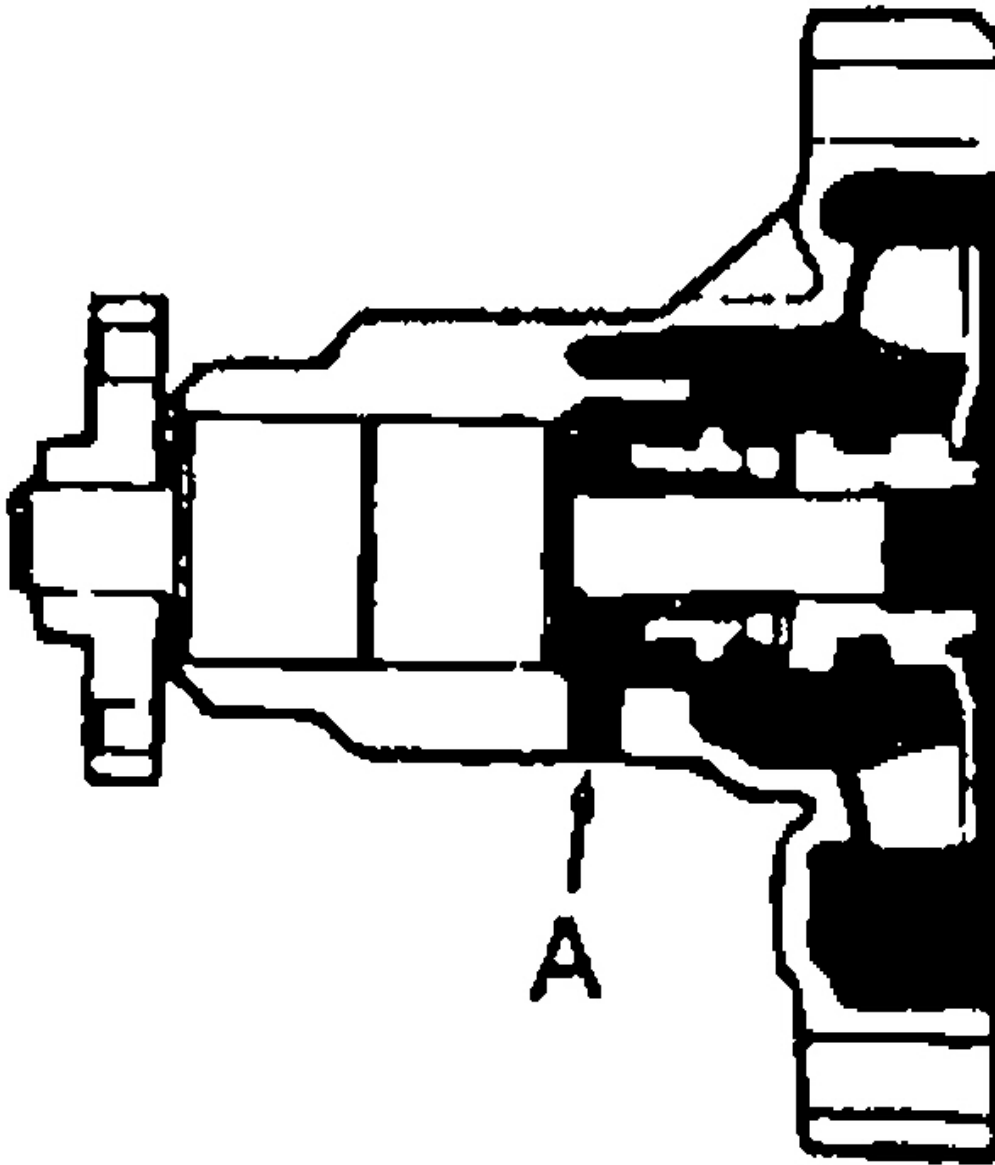
REMOVAL

1. Drain the coolant and disconnect the radiator outlet hose and engine coolant by-pass hose from the engine coolant pump.
2. Remove the drive belt and engine coolant pump pulley.
3. Remove the timing belt covers and the timing belt tensioner.
4. Remove the engine coolant pump mounting bolts and then remove the alternator brace.

5. Remove the engine coolant pump assembly from the cylinder block.

INSPECTION

1. Check the engine coolant pump for cracks, damage or wear, and replace the engine coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation, and replace the engine coolant pump assembly if necessary.
3. Check the seal unit for leaks, and replace the engine coolant pump assembly if necessary.
4. Check for engine coolant leakage. If the engine coolant leaks from hole "A" seal unit is defective. Replace engine coolant pump assembly.



G00326836

Fig. 128: Checking Engine Coolant Pump
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Clean the gasket surfaces of the engine coolant pump body and the cylinder block.

2. Install the new O-ring onto the groove on the front end of the engine coolant pipe, then wet the O-ring with engine coolant.

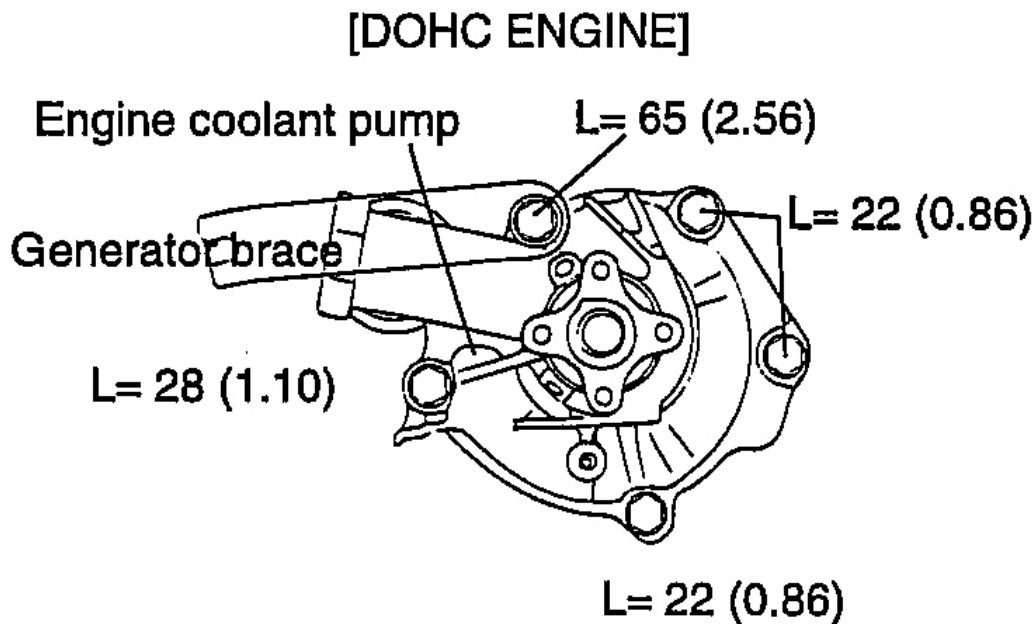
NOTE: Do not apply oil or grease.

3. Install new Engine coolant pump gasket and Engine coolant pump assembly. Tighten the bolts to specified torque.

Tightening torque

Engine coolant pump bolt:

20-27 Nm (200-270 kg.cm, 14-20 lb.ft)



L=Length of bolt mm (in.)

G00326837

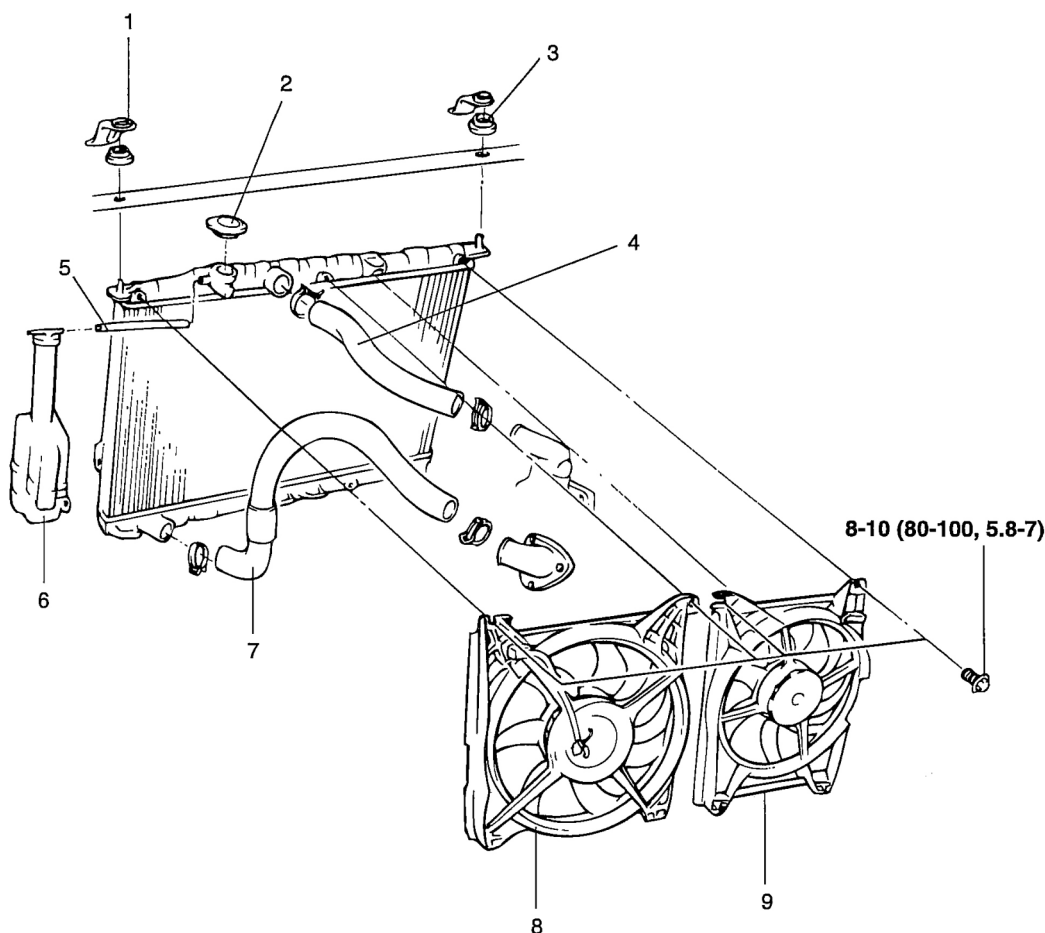
Fig. 129: Installing Engine Coolant Pump
Courtesy of KIA MOTORS AMERICA, INC.

4. Install the timing belt tensioner and timing belt. Adjust the timing belt tension, and then install the timing belt covers.
5. Install the engine coolant pump pulley and drive belt, and then adjust the belt tension.

6. Refill the coolant.
7. Run the engine and check for leaks.

RADIATOR

COMPONENTS



TORQUE : Nm (kg-cm, lb-ft)

- | | |
|------------------------|---------------------------------|
| 1. Upper insulator | 6. Reservoir tank |
| 2. Radiator cap | 7. Radiator lower hose |
| 3. Upper insulator | 8. Radiator fan motor assembly |
| 4. Radiator upper hose | 9. Condenser fan motor assembly |
| 5. Overflow tube | |

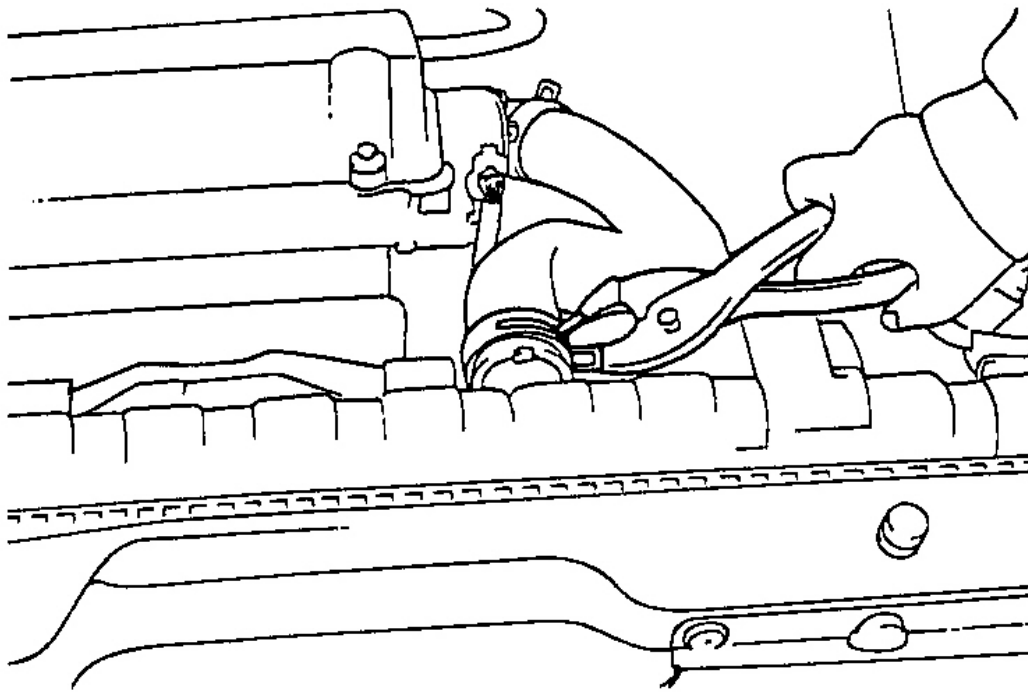
G00326838

Fig. 130: Removing & Installing Radiator
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

WARNING: Never open or disassemble any portion of the cooling system until the engine temperature has dropped to ambient air temperature. Engine coolant escaping under heat and resulting pressure can cause severe burns and blindness.

1. Disconnect the ground cable from the battery terminal.
2. Disconnect the fan motor connector.
3. Loosen the radiator drain plug to drain the coolant.
4. Disconnect the upper and lower hoses and overflow tube after making marks on the radiator hose and the hose clamp.



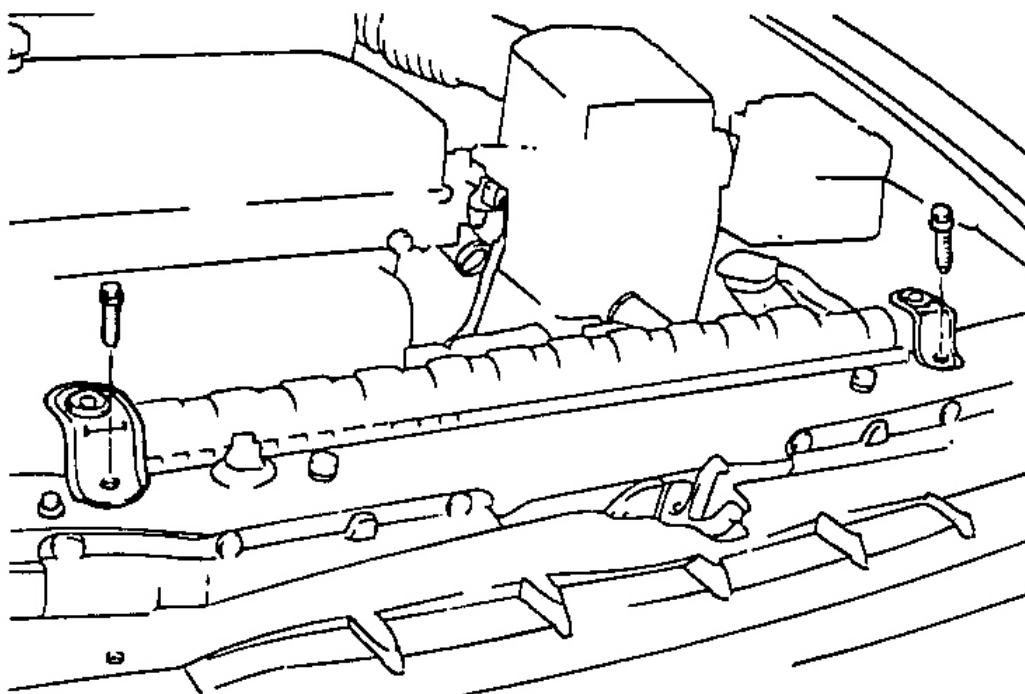
G00326839

Fig. 131: Removing Upper & Lower Radiator Hoses
Courtesy of KIA MOTORS AMERICA, INC.

5. For vehicles with automatic transaxle, disconnect the oil cooler hoses from the automatic transaxle.

CAUTION: Cover or plug the hose and nipple part of the radiator so that dust, foreign materials, etc. do not enter after the hose has been disconnected from the radiator.

6. On all vehicles, remove the radiator mounting bolt.



G00326840

Fig. 132: Removing Radiator Mounting Bolts
Courtesy of KIA MOTORS AMERICA, INC.

7. Remove the radiator together with the fan motor.
8. Remove the radiator fan motor and condenser fan motor from the radiator.

INSPECTION

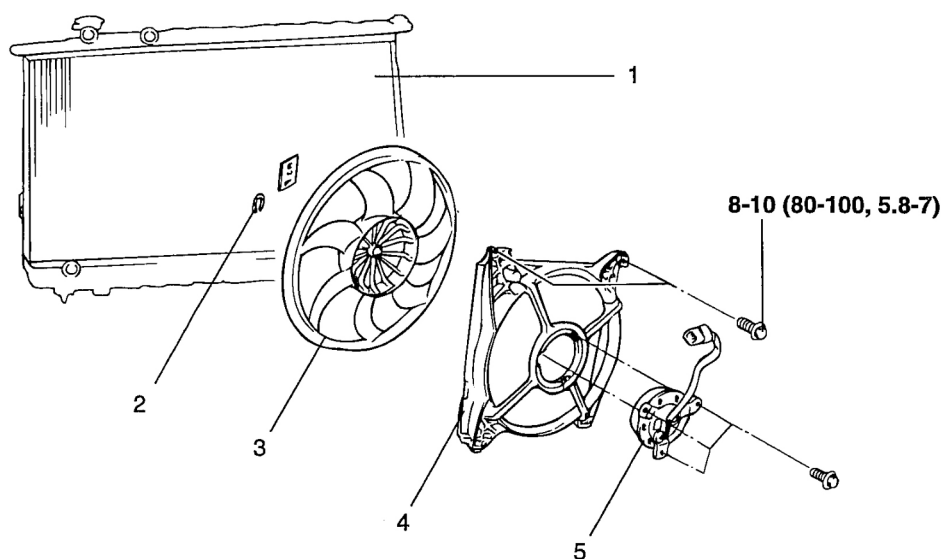
1. To install, reverse removal procedure.
2. Check for foreign material between radiator fins.
3. Check the radiator fins for damage and straighten if necessary.
4. Check the radiator for corrosion, damage, rust or scale.
5. Check the radiator hoses for cracks, damage or deterioration.
6. Check the reserve tank for damage.
7. Check the automatic transaxle oil cooler hoses for cracking, damage or deterioration.

INSTALLATION

1. Fill the radiator and reservoir tank with clean coolant mixture.
2. Run the engine until the coolant has warmed up enough so that the thermostat valve opens, and then stop the engine.
3. Remove the radiator cap and pour the coolant to the filler neck of the radiator. Fill the reservoir tank with the coolant to the upper level.
4. Check that there is no leakage from the radiator, hoses or connections.

RADIATOR FAN MOTOR

COMPONENTS



TORQUE : Nm (kg·cm, lb· ft)

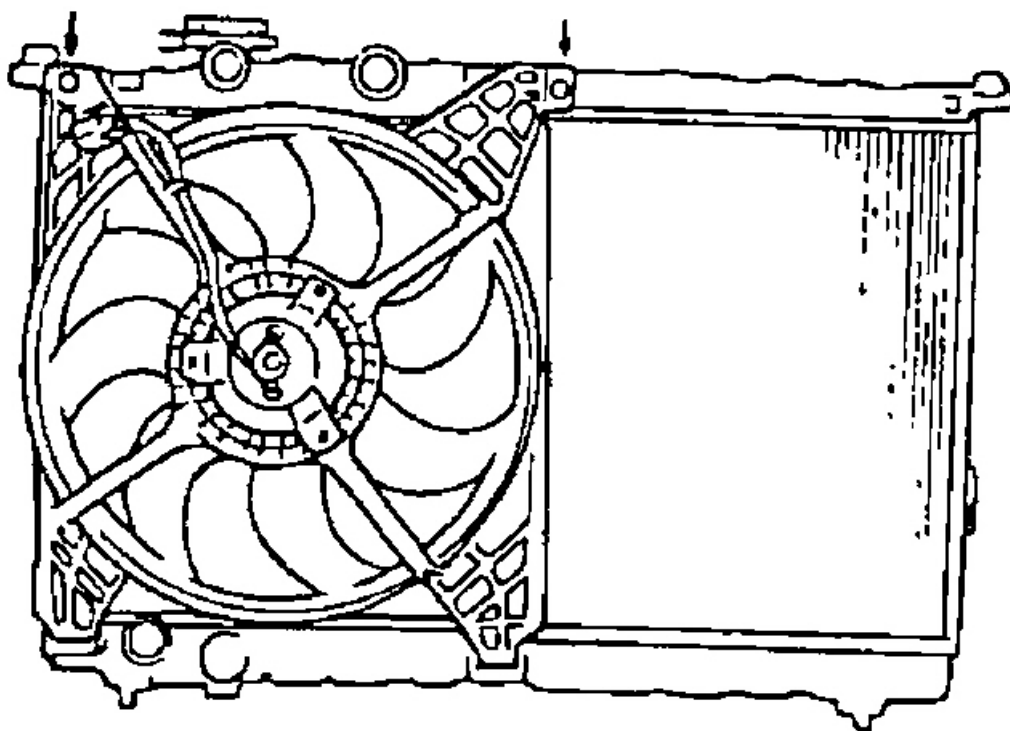
- | | |
|----------------------|-----------------------|
| 1. Radiator | 4. Shroud |
| 2. Fan mounting clip | 5. Radiator fan motor |
| 3. Fan | |

G00326841

Fig. 133: Removing & Installing Radiator Fan Motor
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Disconnect the ground cable from battery cable.
2. Disconnect the connectors from the fan motor and the harness from shroud.
3. For vehicles with automatic transaxle, remove the oil cooler hose from the shroud.
4. On all vehicles, remove the shroud mounting four bolts.



G00326842

Fig. 134: Removing Radiator Fan Shroud Mounting Bolts
Courtesy of KIA MOTORS AMERICA, INC.

5. Remove the shroud with the fan motor.
6. Remove the fan mounting clip and detach the fan from fan motor.
7. Remove the three screws and detach the fan motor.

INSPECTION

RADIATOR FAN MOTOR AND CONDENSER FAN MOTOR

1. Check that the radiator fan rotates when battery voltage is applied between the terminals (as shown in illustrations).
2. Check that abnormal noises are not produced while the motor is turning.

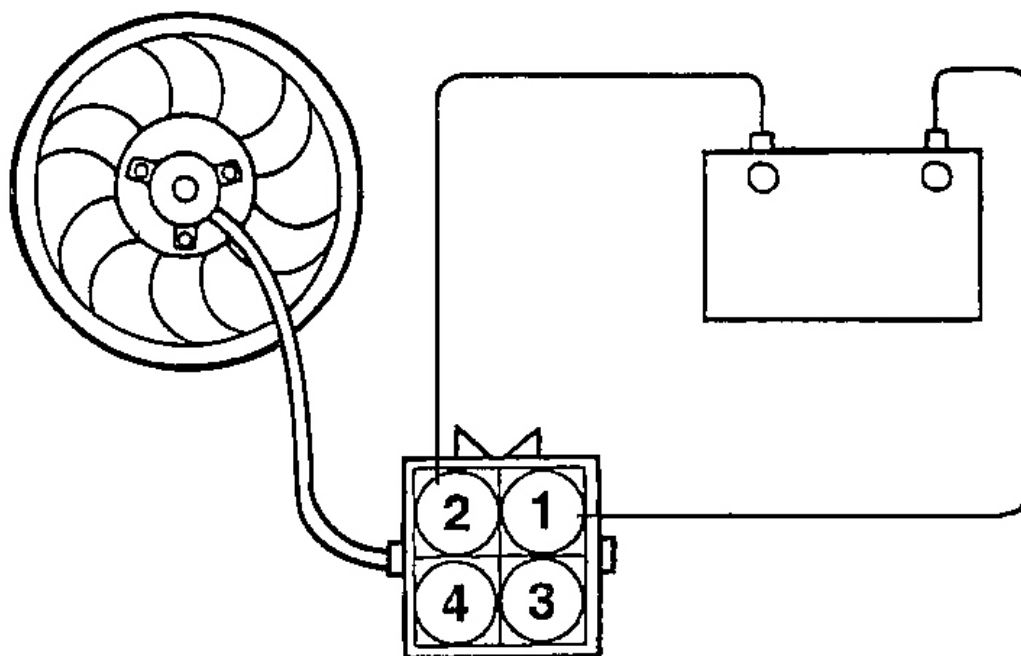
2004 Kia Optima EX

2004-05 ENGINES 2.4L 4 Cylinder - Optima & Magentis (Canadian)

Terminal Item	1	2	3	4	MOTOR SPEED
RADIATOR FAN MOTOR	⊕		⊖		LOW
	⊕	⊕		⊖	MIDDLE
	⊕	⊕	⊖	⊖	HIGH
CONDENSER FAN MOTOR		⊕	⊖		LOW
	⊕	⊕		⊖	MIDDLE
	⊕	⊕	⊖	⊖	HIGH

G00326843

Fig. 135: Testing Radiator Fan Motor & Condenser Fan Motor (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

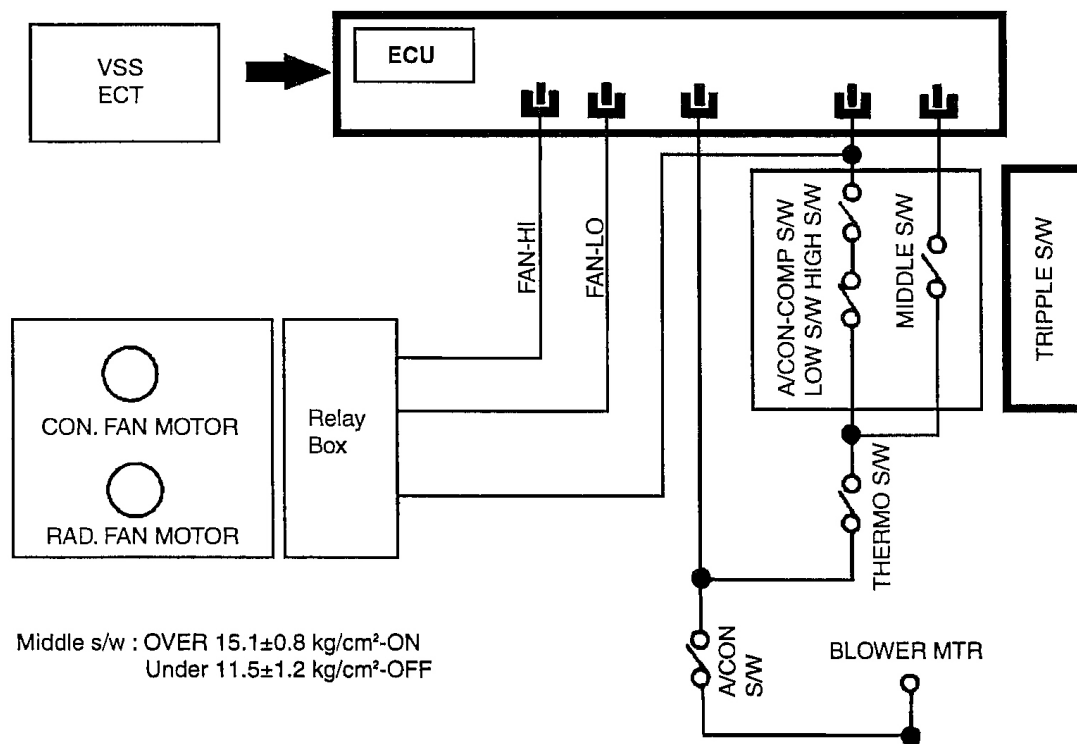


G00326844

Fig. 136: Testing Radiator Fan Motor & Condenser Fan Motor (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

COOLING FAN CONTROL SYSTEM

ECM controls the cooling fan in 3 steps (LO/MIDDLE/HI) according to the vehicle speed, the air-conditioning load and engine coolant temperature.



G00326845

Fig. 137: Cooling Fan Control System Circuit Diagram
Courtesy of KIA MOTORS AMERICA, INC.

ECM CONTROL LOGIC

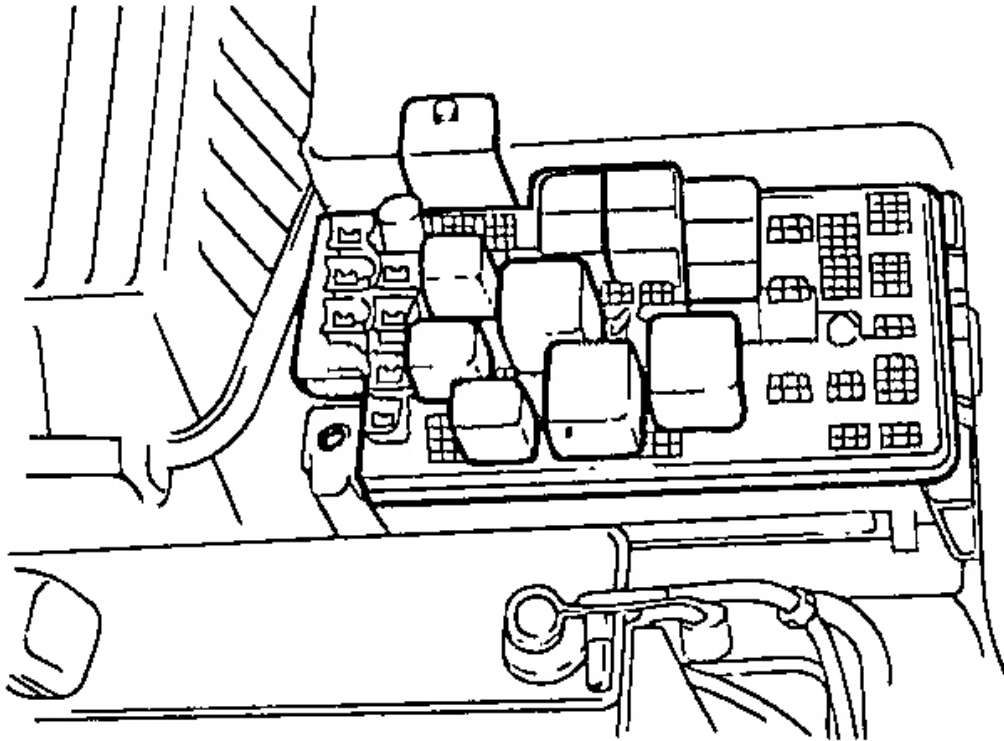
ECM		A/C	FAN	
LOW	HIGH		RADIA-TOR	CON-DEN-SOR
OFF	OFF	ON/OFF	OFF	OFF
ON	OFF	OFF	LOW	OFF
ON	OFF	ON	LOW	LOW
OFF	ON	ON/OFF	MID	MID
ON	ON	OFF	HIGH	MID
ON	ON	ON	HIGH	HIGH

G00326846

Fig. 138: Identifying ECM Control Logic For Cooling System
 Courtesy of KIA MOTORS AMERICA, INC.

RADIATOR FAN MOTOR RELAY

1. Remove the radiator fan motor relay (High and Low) from the relay box in engine room.



G00326847

Fig. 139: Identifying Engine Compartment Relay Box
Courtesy of KIA MOTORS AMERICA, INC.

2. Check the continuity of the terminals "86" and "85" with an ohmmeter.

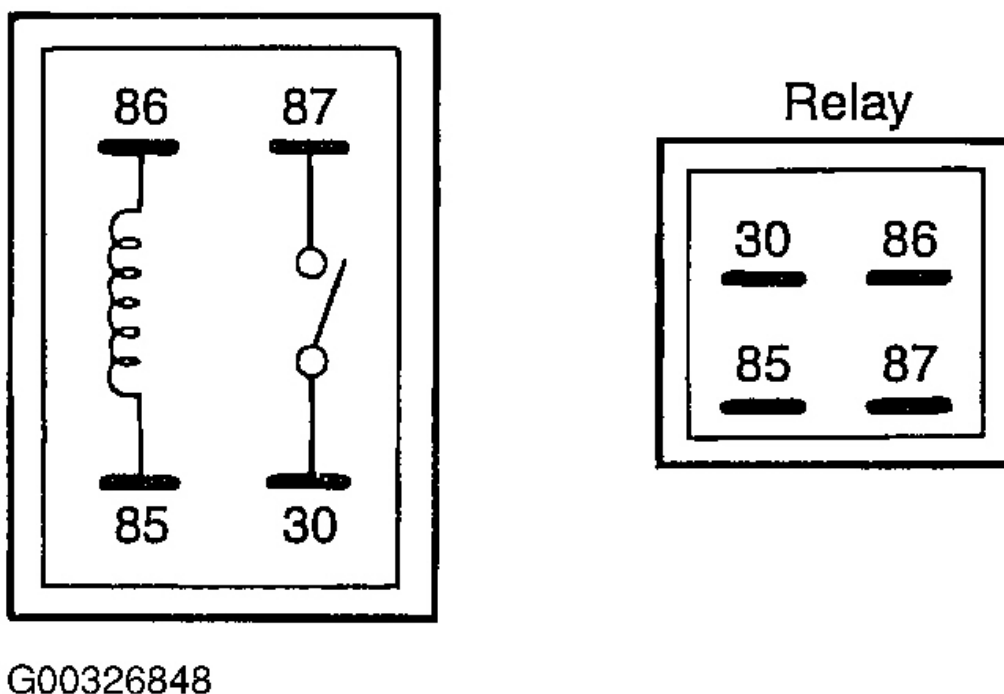


Fig. 140: Testing Radiator Fan Motor Relay
Courtesy of KIA MOTORS AMERICA, INC.

3. Apply DC 12 V to the terminals "86" and ground the terminal "85".
4. Check the continuity between the terminals "87" and "30".

INSTALLATION

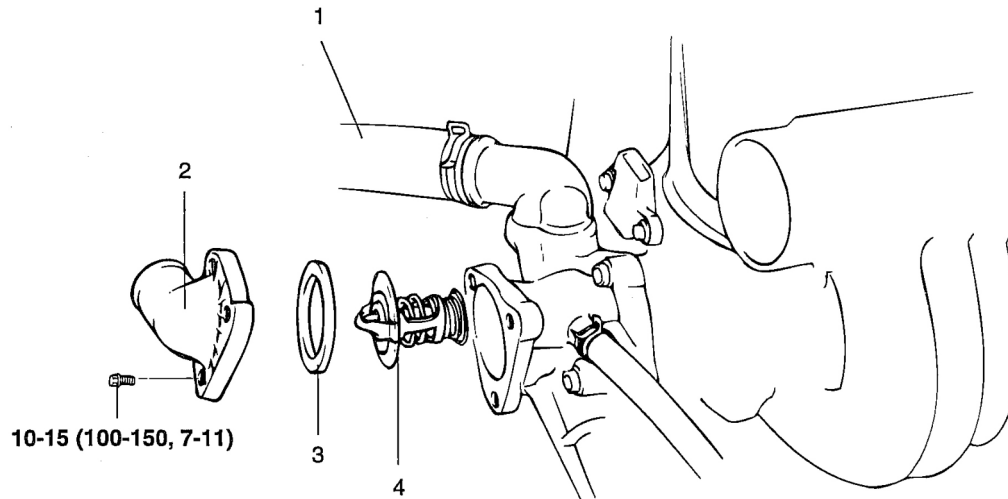
Installation is the reverse order of removal procedures.

CAUTION:

- Make sure the cooling fan does not come into contact with the shroud when installed.
- After installation, make sure there is no unusual noise or vibration when fan is rotated.

THERMOSTAT

COMPONENTS



TOR QUE : Nm (kg-cm, lb-ft)

- | | |
|---|---------------|
| 1. Radiator upper hose
(Engine side) | 3. Gasket |
| 2. Coolant inlet fitting | 4. Thermostat |

G00326850

Fig. 141: Removing & Installing Thermostat
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Drain the coolant to the thermostat level or below.
2. Remove the Engine coolant outlet fitting and gasket.
3. Remove the thermostat.

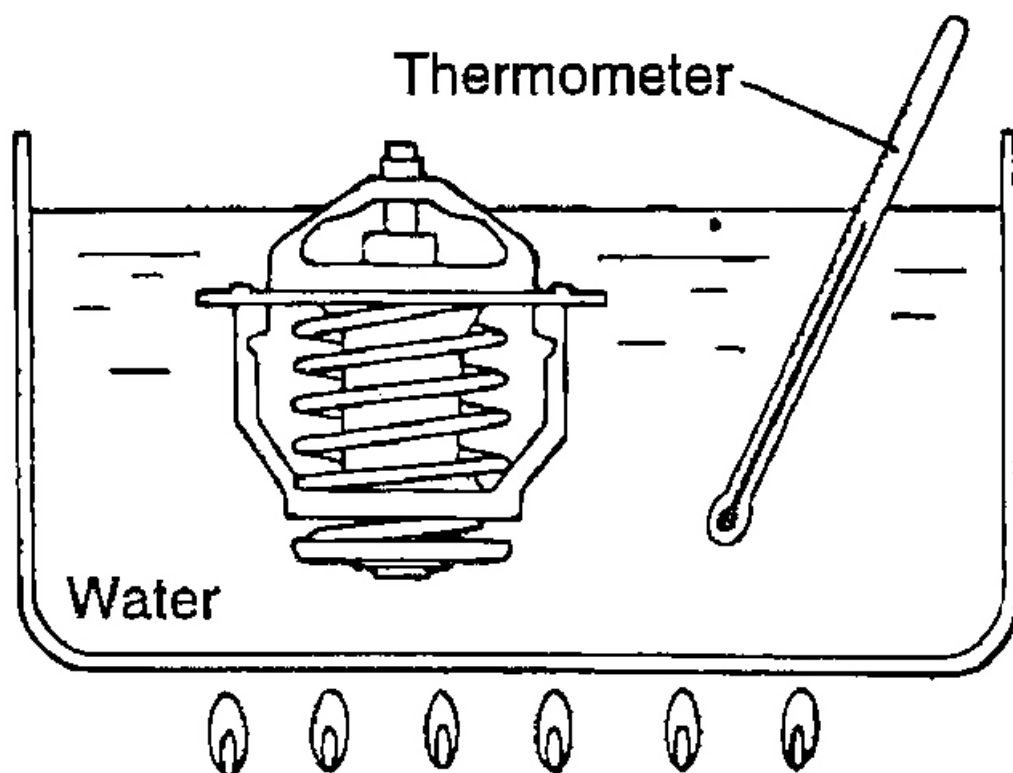
INSPECTION

1. Heat the thermostat as shown in the illustration.
2. Check that the valve operates properly.
3. Check to determine the temperature at which the valve begins to open.

Valve opening temperature :

80.5-83.5°C (176.9-182.3°F)

Full opening temperature : 95°C (203°F)



G00326851

Fig. 142: Testing Thermostat

Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Check to ensure that the flange of the thermostat is correctly seated in the socket of the thermostat housing. If the thermostat is installed in the wrong direction, the bottom of the thermostat will touch the rib inside the intake manifold, making it impossible to seat flange in position.
2. Install a new gasket and engine coolant outlet fitting.

Tightening torque

Engine coolant outlet fitting bolt :

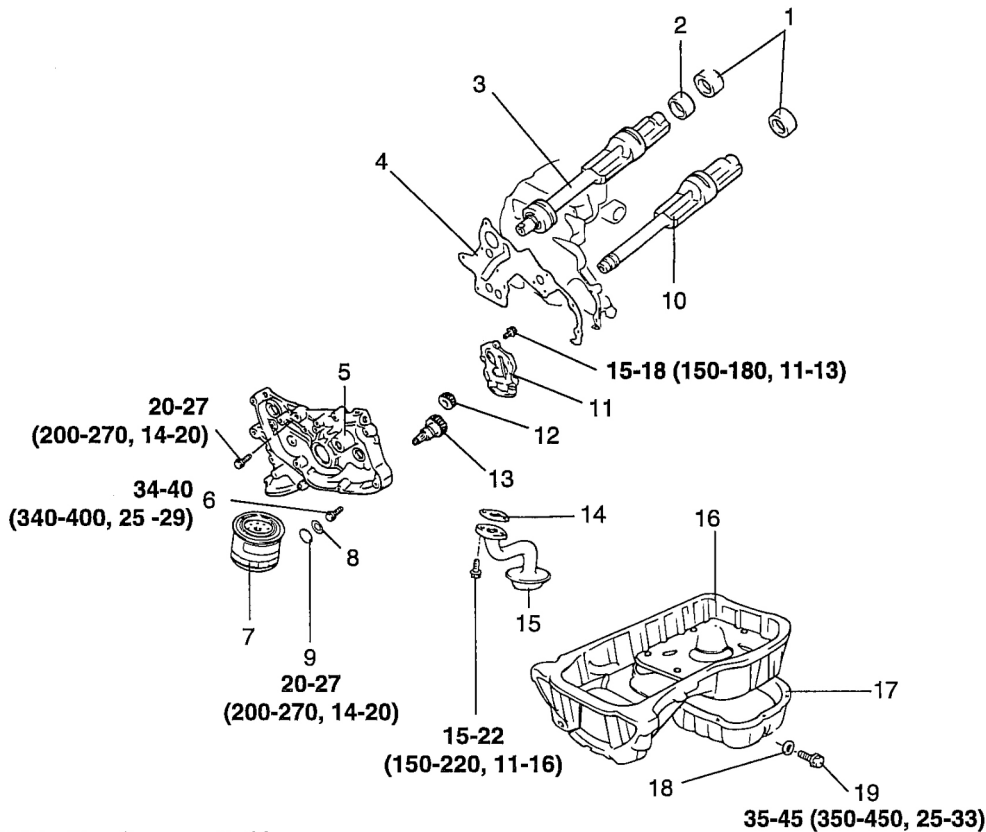
10-15 Nm (100-150 kg.cm, 7-11 lb.ft)

3. Refill the coolant.

LUBRICATION SYSTEM

LUBRICATION SYSTEM

COMPONENTS



TORQUE : Nm (kg.cm, lb.ft)

- | | |
|--------------------------------|--------------------|
| 1. Rear bearing | 11. Oil pump cover |
| 2. Front bearing | 12. Driven gear |
| 3. Right counter balance shaft | 13. Drive gear |
| 4. Gasket | 14. Gasket |
| 5. Oil pump case | 15. Oil screen |
| 6. Driven gear bolt | 16. Upper oil pan |
| 7. Oil filter | 17. Lower oil pan |
| 8. O-ring | 18. Gasket |
| 9. Plug cap | 19. Drain plug |
| 10. Left counter balance shaft | |

G00326852

Fig. 143: Removing & Installing Lubrication System Components
 Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Remove the timing belt. Refer to **TIMING BELT**.

2. Remove all the oil pan bolts.
3. Remove the oil pan.
4. Remove the oil screen and gasket.
5. Remove the relief plunger and gasket, and then take off the relief spring and relief valve from the oil filter bracket.
6. Remove the oil pressure switch.

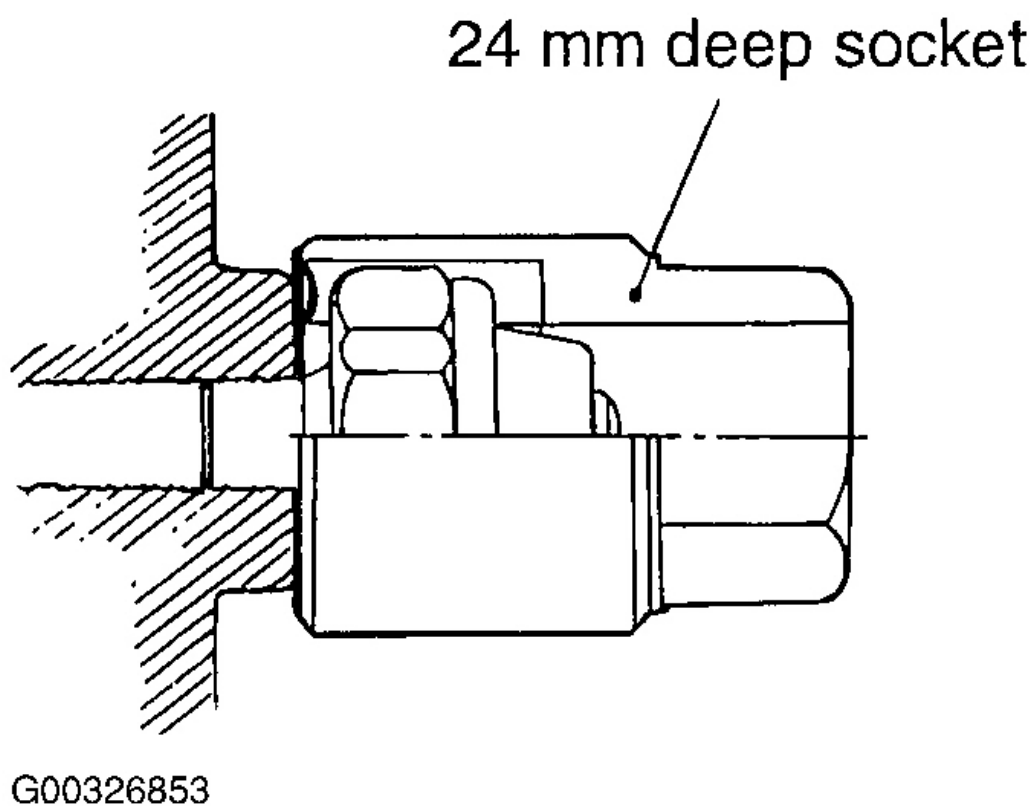
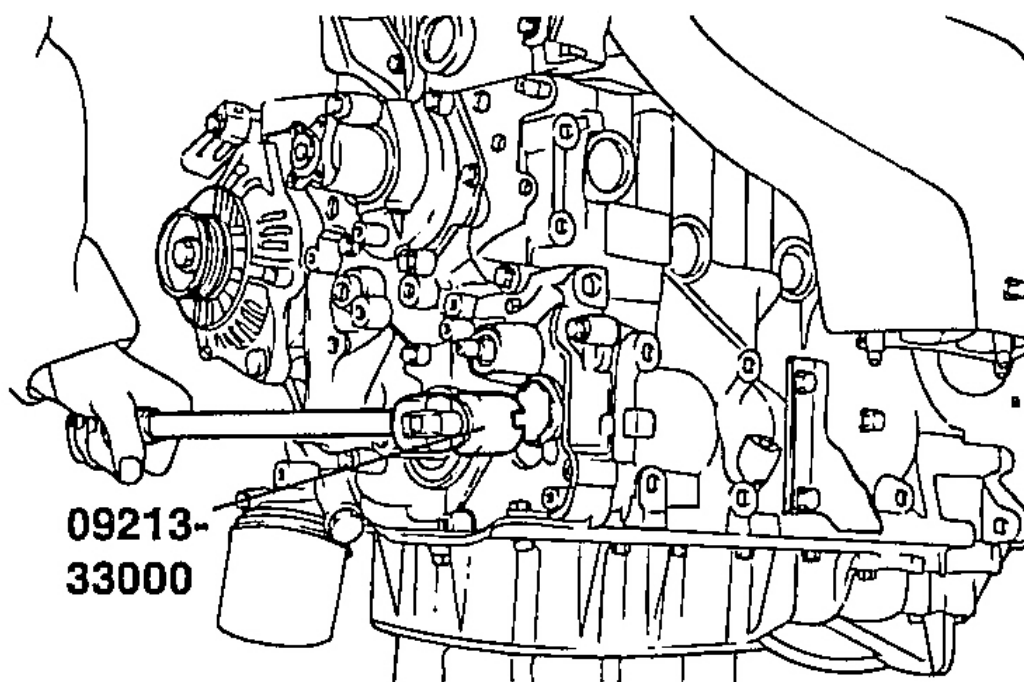


Fig. 144: Removing Oil Pressure Switch
Courtesy of KIA MOTORS AMERICA, INC.

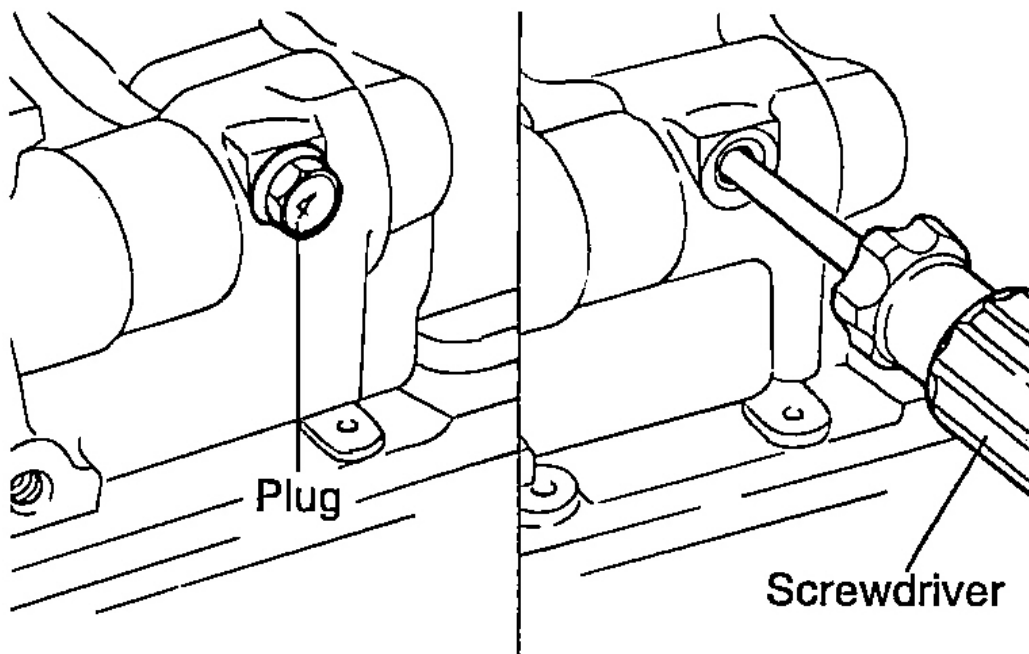
7. Remove the oil filter bracket and gasket.
8. Using the special tool, remove the plug cap from the oil pump portion of front case.



G00326854

Fig. 145: Removing Plug Cap From Oil Pump Portion Of Front Case
Courtesy of KIA MOTORS AMERICA, INC.

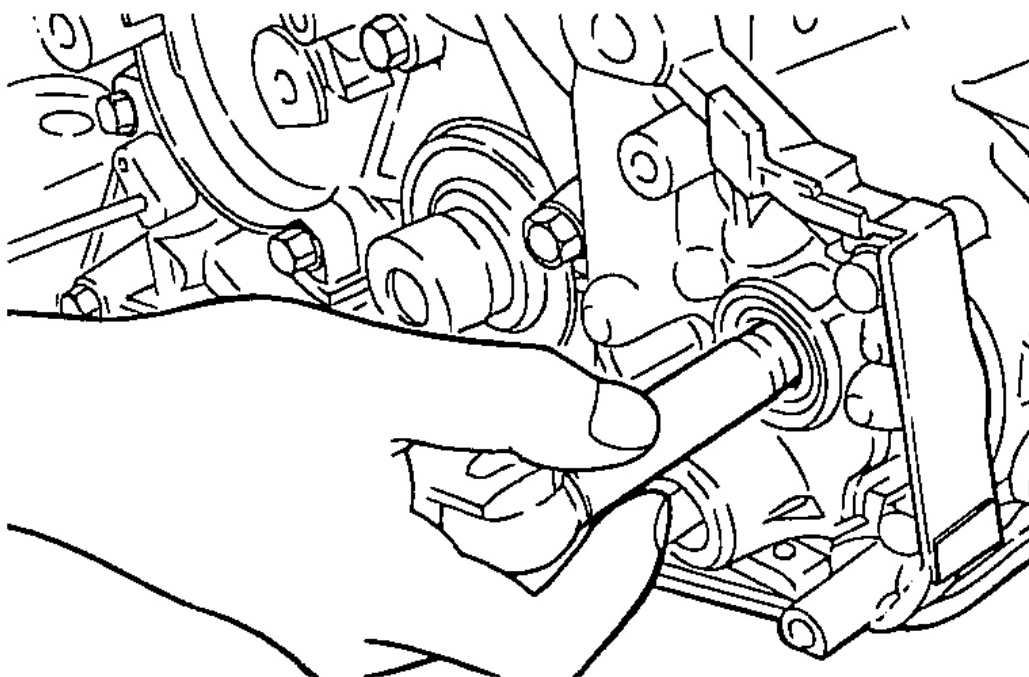
9. Remove the left side of cylinder block plug and insert a screwdriver with an 8 mm (0.32 in.) diameter shaft into plug hole. The screwdriver shaft must be inserted more than 60 mm (2.4 in.)



G00326855

Fig. 146: Removing Cylinder Block Plug (Left Side)
Courtesy of KIA MOTORS AMERICA, INC.

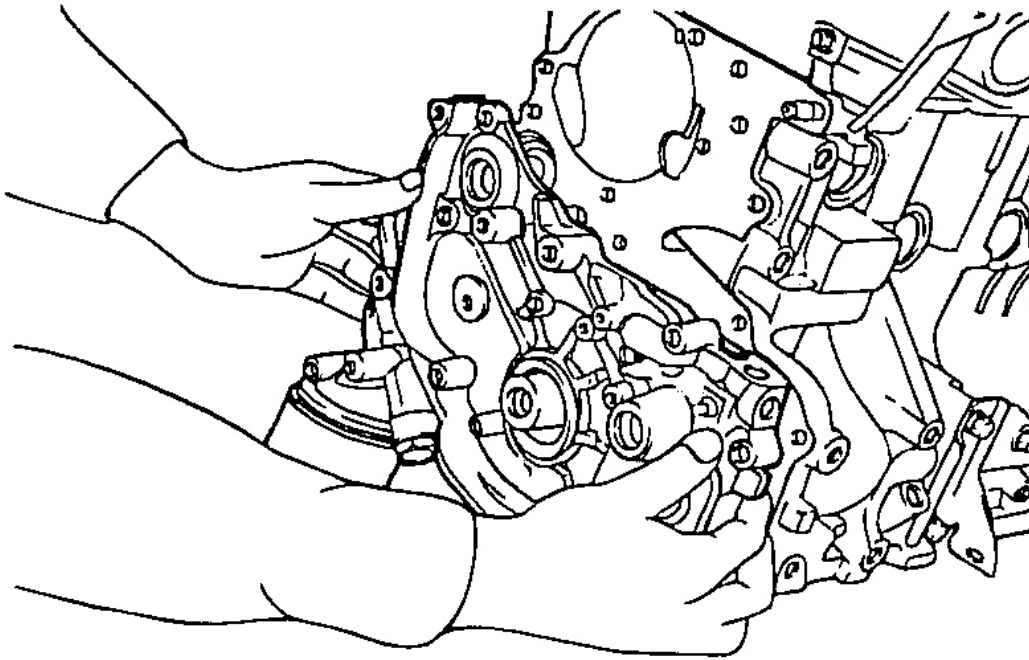
10. Remove the oil pump driven gear and left counter balance shaft retaining bolt.



G00326856

Fig. 147: Removing Oil Pump Driven Gear & Left Counter Balance Shaft Retaining Bolt
Courtesy of KIA MOTORS AMERICA, INC.

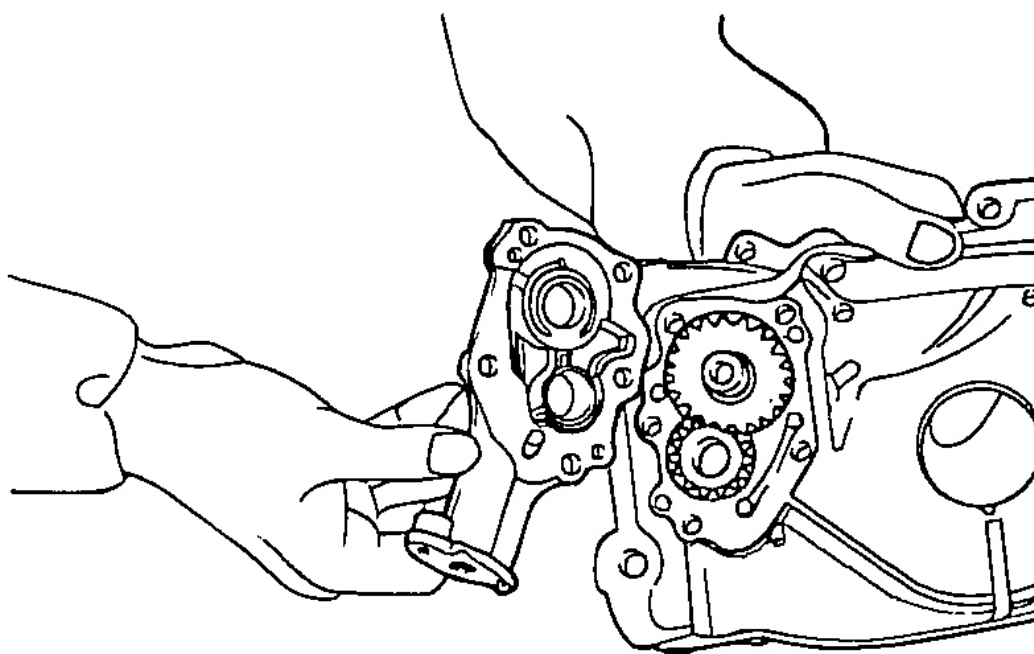
11. Remove the front case mounting bolts and remove the front case assembly and gasket. Remove the two counter balance shafts from the cylinder block.



G00326857

Fig. 148: Removing Front Case
Courtesy of KIA MOTORS AMERICA, INC.

12. Remove the oil pump cover from the front case.
13. Remove the oil pump gears from the front case.



G00326858

Fig. 149: Removing Oil Pump Gears
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

1. Assemble the oil pump gear to the front case and rotate it to ensure smooth rotation with no looseness.
2. Ensure that there is no ridge wear on the contact surface between the front case and gear surface of the oil pump cover.
3. With the drive and driven gears installed into the front case, measure the tip clearance of the gears.

[Standard value]

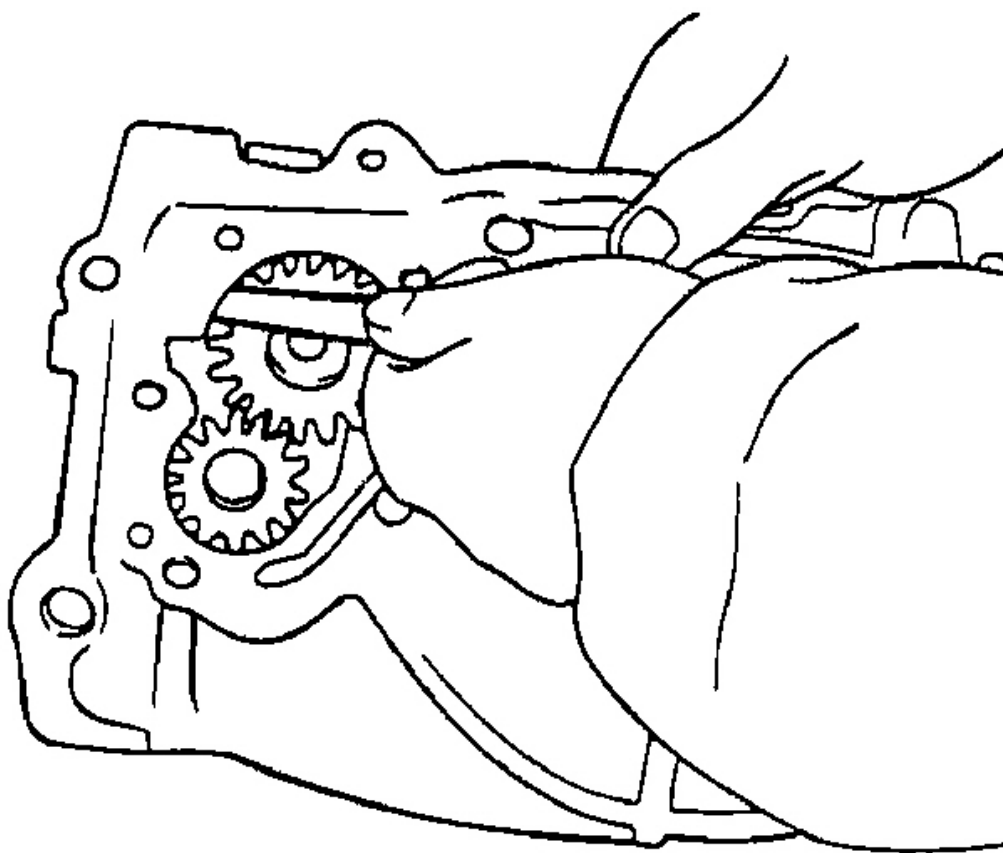
Drive gear: 0.160-0.205 mm (0.0063-0.0081 in.)

Driven gear: 0.180-0.205 mm (0.0071-0.0081 in.)

[Limit]

Drive gear : 0.25 mm (0.0098 in.)

Driven gear : 0.25 mm (0.0098 in.)



G00326859

Fig. 150: Checking Oil Pump Gear Tip Clearance
Courtesy of KIA MOTORS AMERICA, INC.

4. Check the side clearance.

[Standard value]

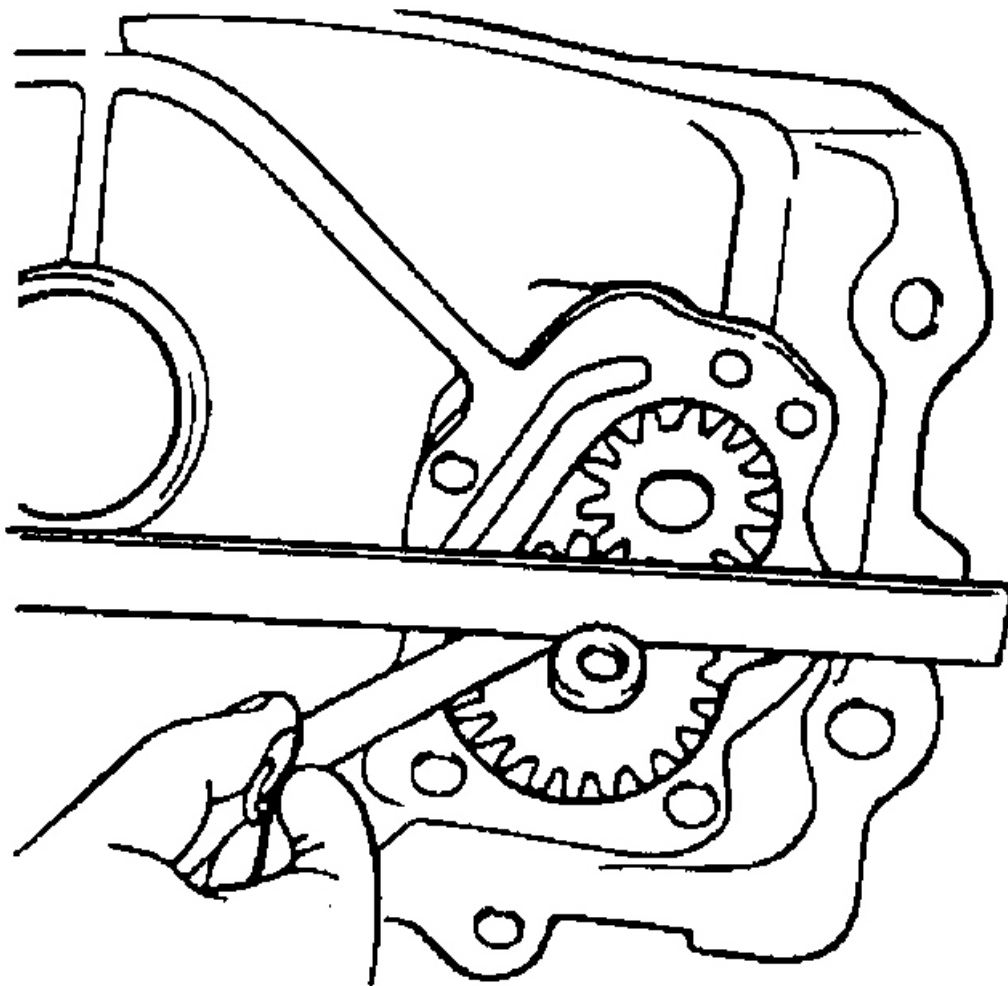
Drive gear: 0.08-0.14 mm (0.0031-0.0055 in.)

Driven gear: 0.06-0.12 mm (0.0024-0.0047 in.)

[Limit]

Drive gear: 0.25 mm (0.0098 in.)

Driven gear : 0.25 mm (0.0098 in.)

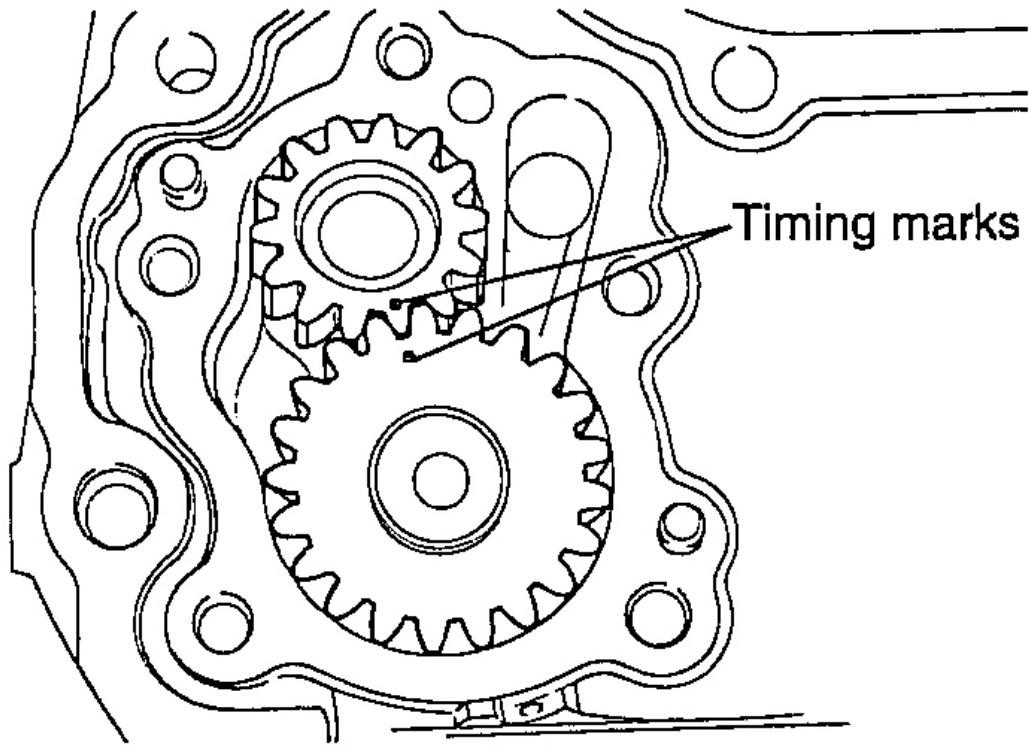


G00326860

Fig. 151: Checking Oil Pump Gear Side Clearance
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Apply engine oil to the gears and align the two timing marks.



G00326861

Fig. 152: Installing Oil Pump Gears
Courtesy of KIA MOTORS AMERICA, INC.

2. Using the special tool, Crankshaft Front Oil Seal Installer (09214-32000), install the crankshaft front oil seal into the front case.

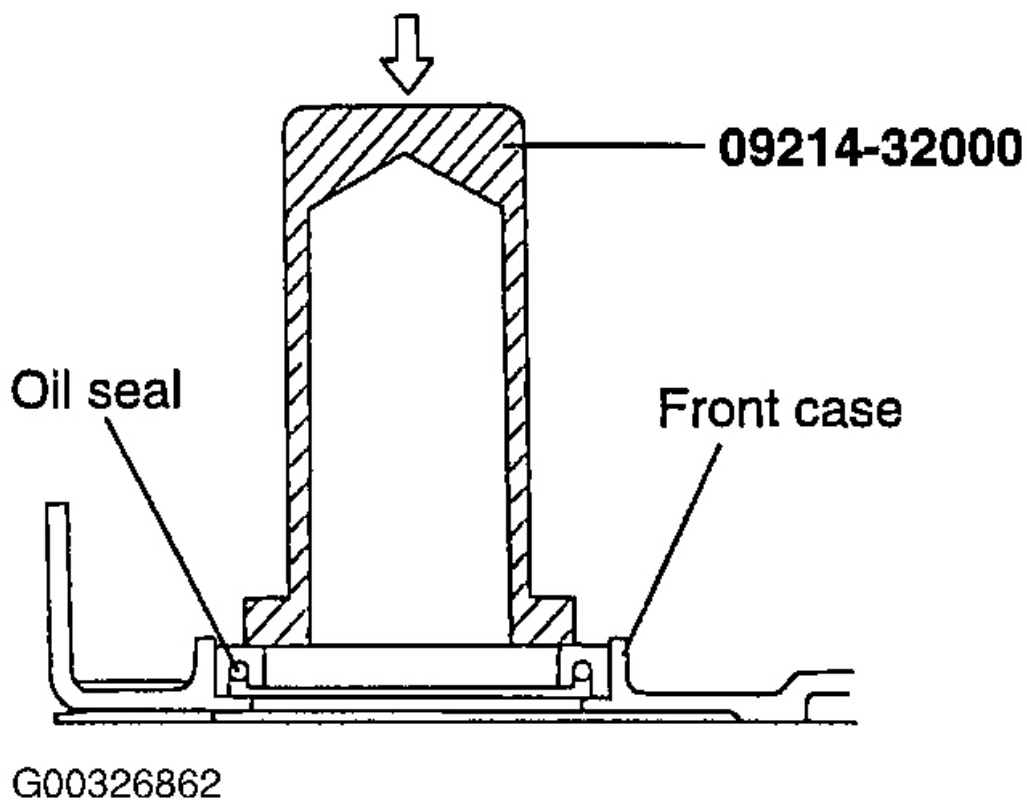
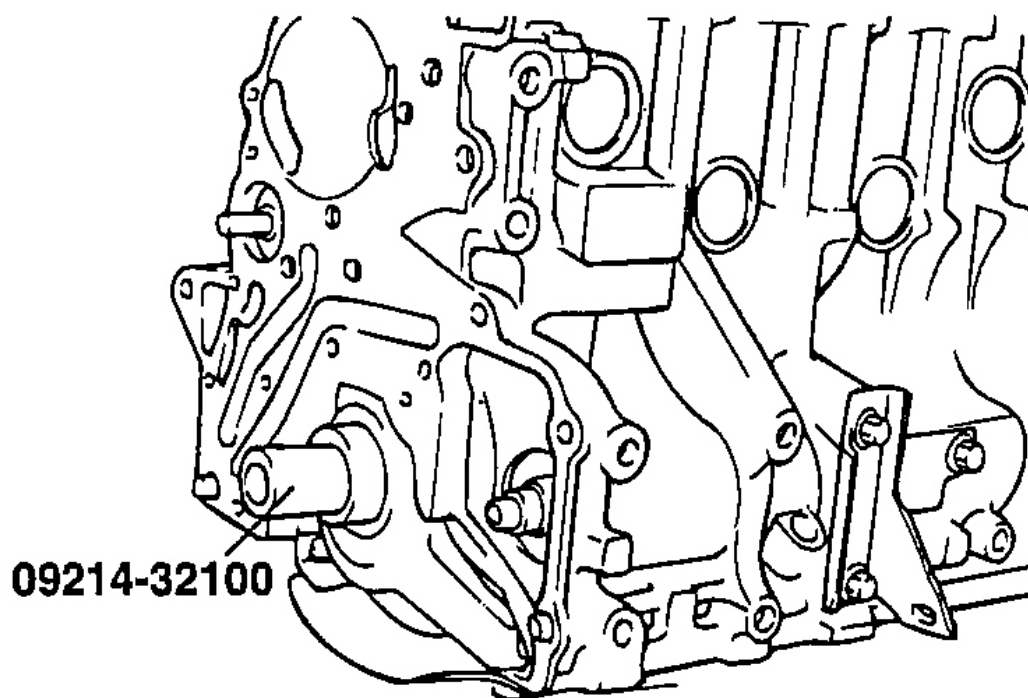


Fig. 153: Identifying Crankshaft Front Oil Seal Installer (09214-32000)
Courtesy of KIA MOTORS AMERICA, INC.

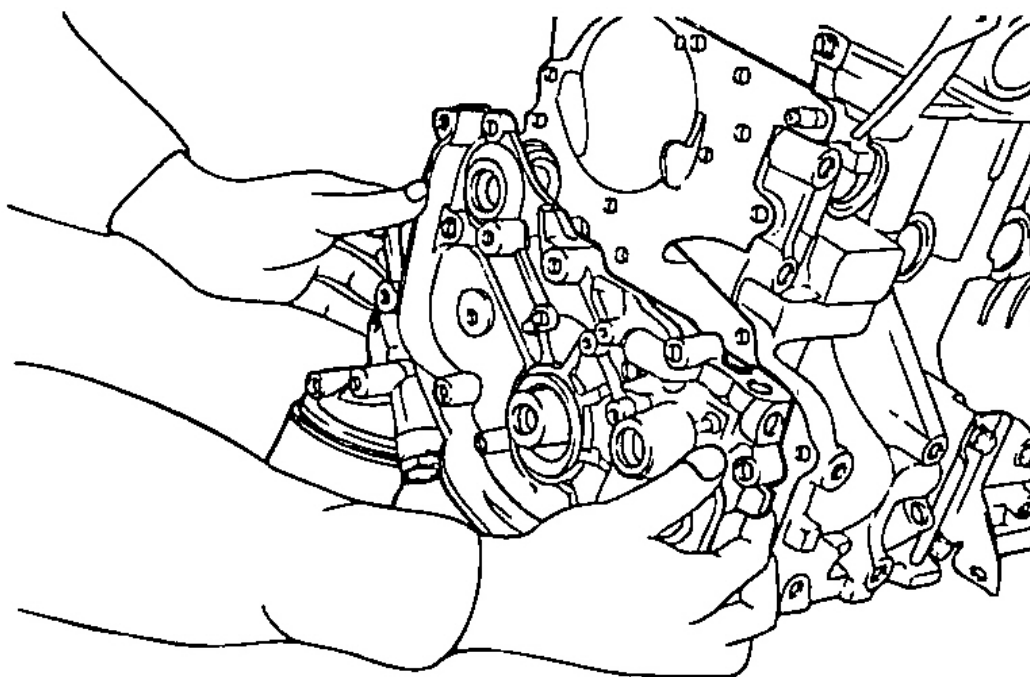
3. Set the special tool (09214-32100) on the front end of crankshaft and apply a thin coat of engine oil to the outer circumference of the special tool to install the front case.



G00326863

Fig. 154: Identifying Crankshaft Front Oil Seal Guide (09214-32100)
Courtesy of KIA MOTORS AMERICA, INC.

4. Install the front case assembly through a new front case gasket and temporarily tighten the flange bolts (other than those for tightening the filter bracket).



G00326864

Fig. 155: Installing Front Case (1 Of 2)

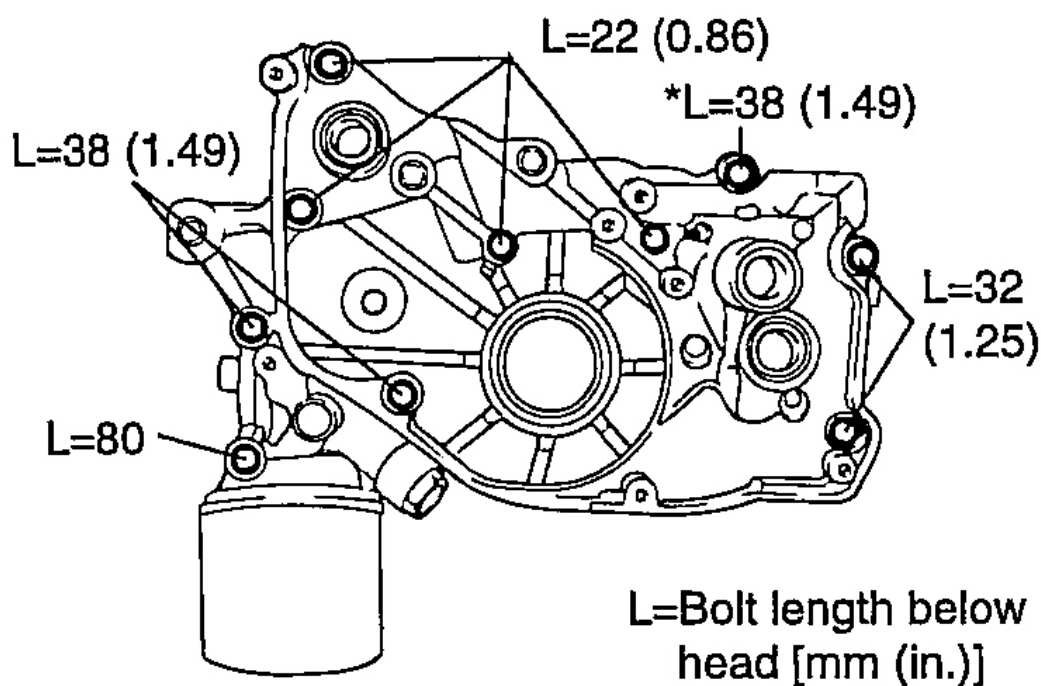
Courtesy of KIA MOTORS AMERICA, INC.

5. Install the front case assembly with a new gasket, and tighten the bolts to the specified torque.

Front case assembly

Tightening torque

All except: 20-27 Nm (200-270 kg.cm, 14-20 lb.ft)

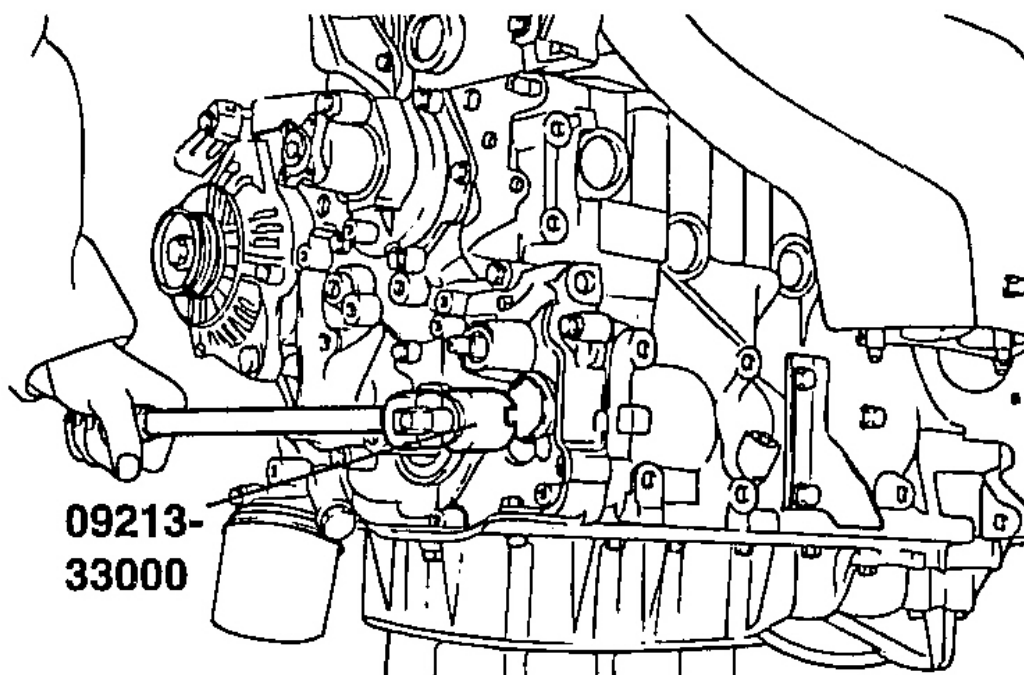


G00326865

Fig. 156: Installing Front Case (2 Of 2)

Courtesy of KIA MOTORS AMERICA, INC.

6. Insert a screwdriver through plug hole in left side of cylinder block. After checking that the shaft is in position, tighten.
7. Install a new O-ring to the groove of front case.
8. Using a special tool, install the case plug and tighten to the specified torque.



G00326867

Fig. 157: Installing Case Plug

Courtesy of KIA MOTORS AMERICA, INC.

9. Apply sealant into the groove of the oil pan flange as shown in illustration.

NOTE:

- Apply sealant about 4 mm (0.16 in.) in thickness.
- After application of sealant, do not exceed 15 minutes before installing the oil pan.

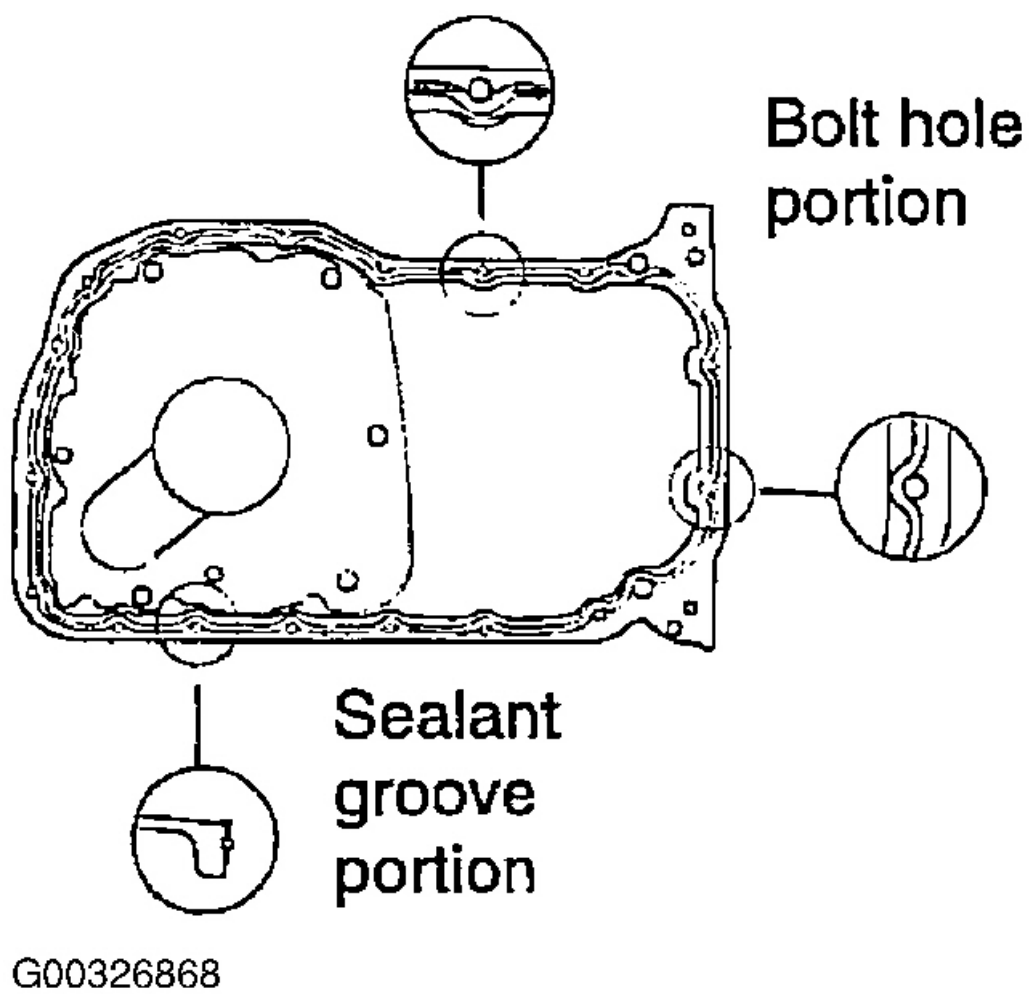
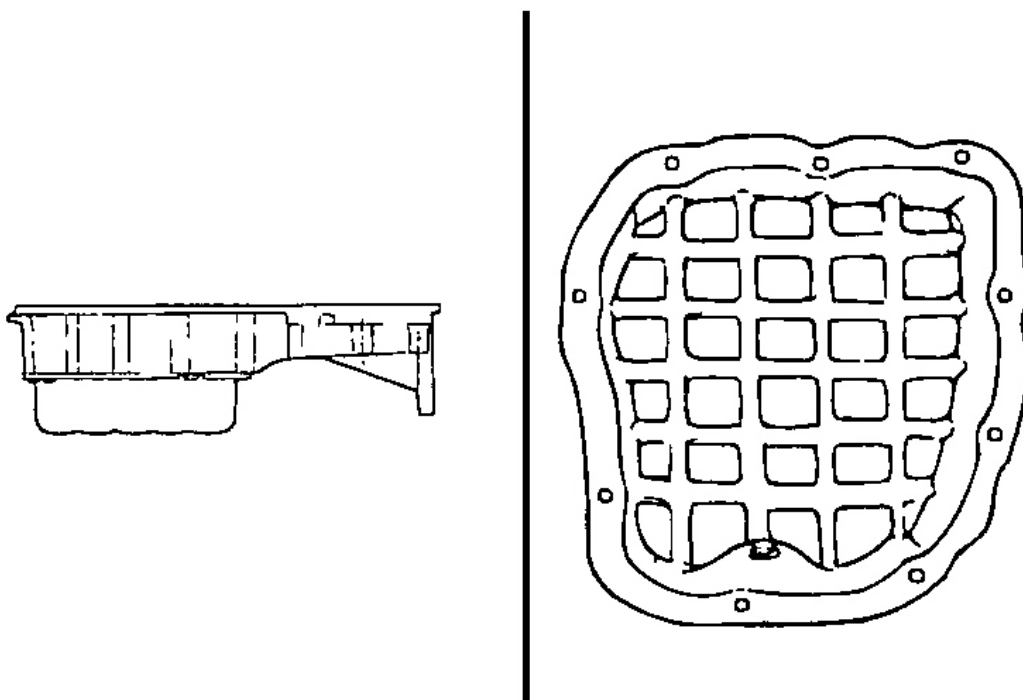


Fig. 158: Installing Oil Pan Flange
Courtesy of KIA MOTORS AMERICA, INC.

10. Note the difference in bolt lengths at the location shown in illustration. Install the oil pan and tighten the bolts to the specified torque.

Tightening torque

Oil pan bolt: 10-12 Nm (100-120 kg.cm, 7-9 lb.ft)



G00326869

Fig. 159: Installing Oil Pan

Courtesy of KIA MOTORS AMERICA, INC.

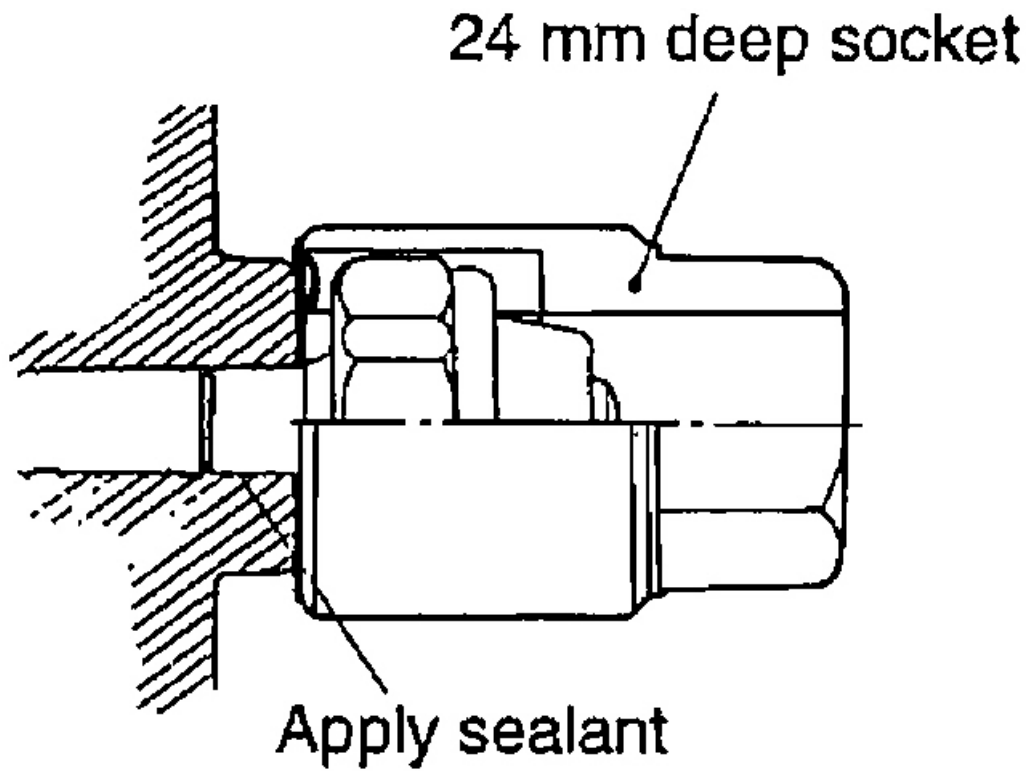
11. Using the special tool, install the oil pressure switch after applying sealant to the threaded area.

Sealant: Threebond 1104 or equivalent

NOTE: Do not torque the oil pressure switch excessively.

Tightening torque

Oil pressure switch : 8-12 Nm (80-120 kg.cm, 6-8 lb.ft)



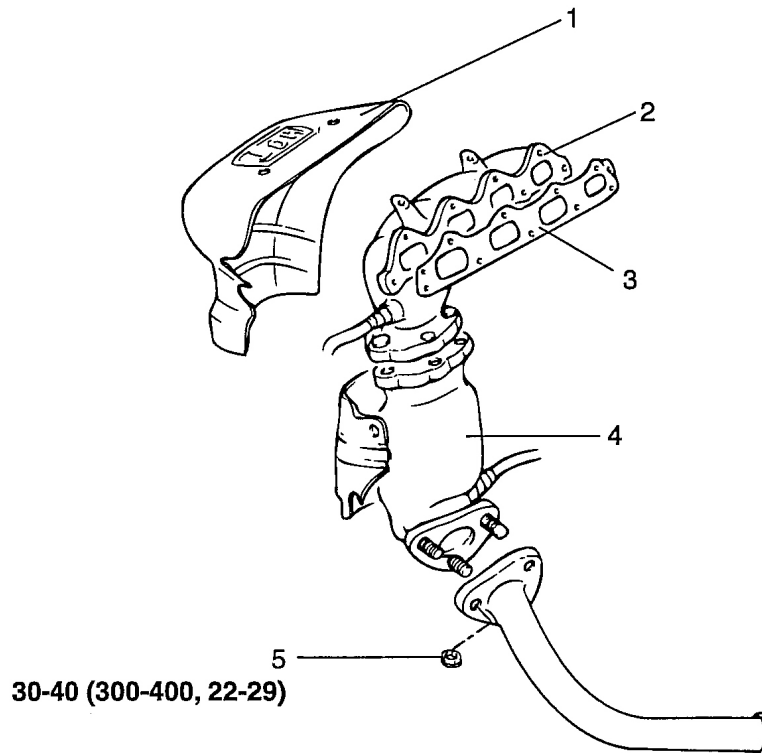
G00326870

Fig. 160: Installing Oil Pressure Switch
Courtesy of KIA MOTORS AMERICA, INC.

INTAKE & EXHAUST SYSTEM

EXHAUST MANIFOLD

COMPONENTS



TORQUE : Nm (kg.cm, lb.ft)

- 1. Heat protector
- 2. Exhaust manifold
- 3. Exhaust manifold gasket

- 4. Front catalytic converter
- 5. Self-locking nut

G00326871

Fig. 161: Removing & Installing Exhaust Manifold
Courtesy of KIA MOTORS AMERICA, INC.

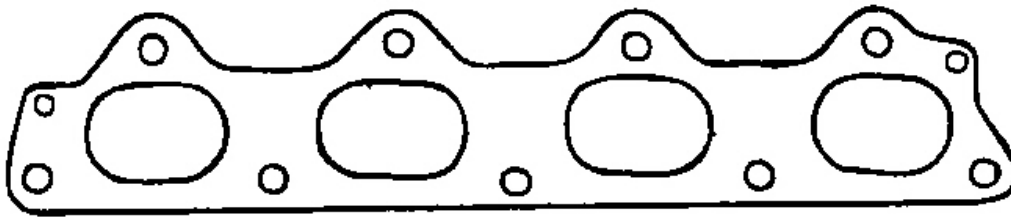
INSPECTION

Exhaust Manifold

Check for damage or cracking of any part.

Exhaust Manifold Gasket

Check for flaking damage of the gasket.

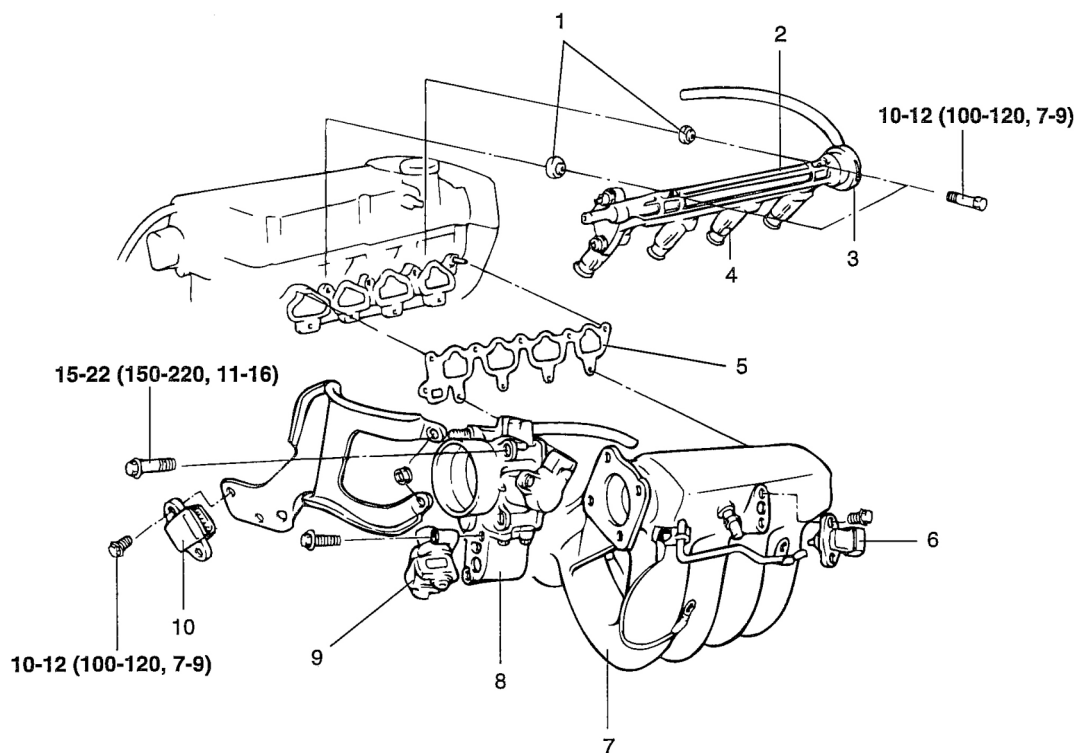


G00326872

Fig. 162: Identifying Exhaust Manifold Gasket
Courtesy of KIA MOTORS AMERICA, INC.

INTAKE MANIFOLD

COMPONENTS



TORQUE : Nm (kg-cm, lb-ft)

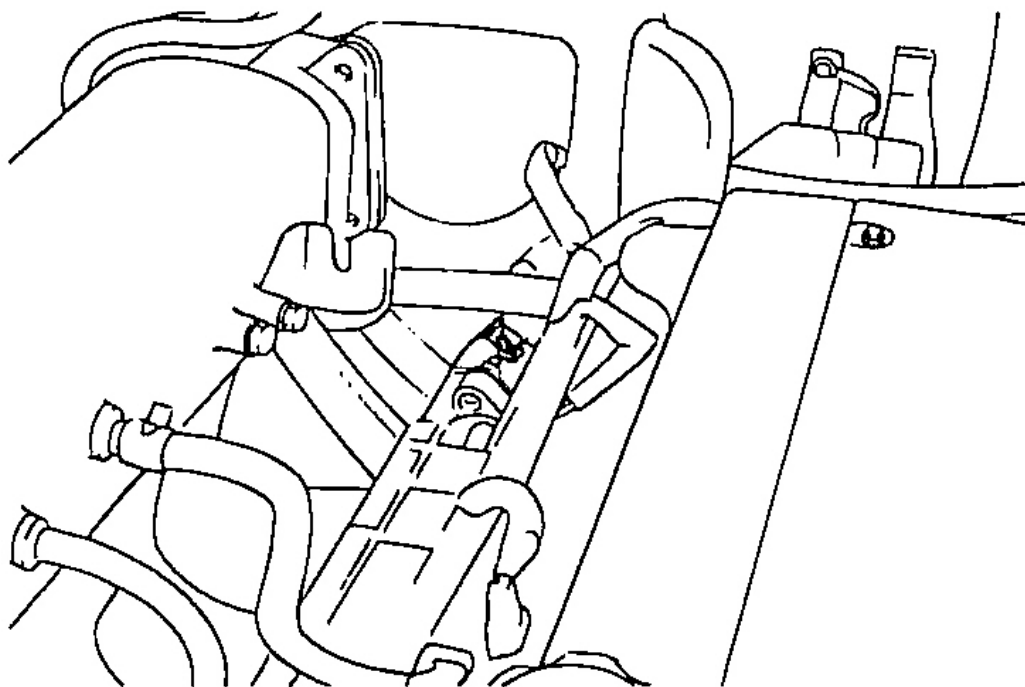
- | | |
|----------------------------|----------------------|
| 1. Insulator | 6. MAP & ATS Sensor |
| 2. Delivery pipe | 7. Intake manifold |
| 3. Fuel pressure regulator | 8. Throttle body |
| 4. Injector | 9. ISA |
| 5. Gasket | 10. Power transistor |

G00326873

Fig. 163: Removing & Installing Intake Manifold
 Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Disconnect the high pressure fuel hose connection after draining pressure in the fuel pipe line to prevent overflow of fuel. Refer to **FUEL FILTER**.

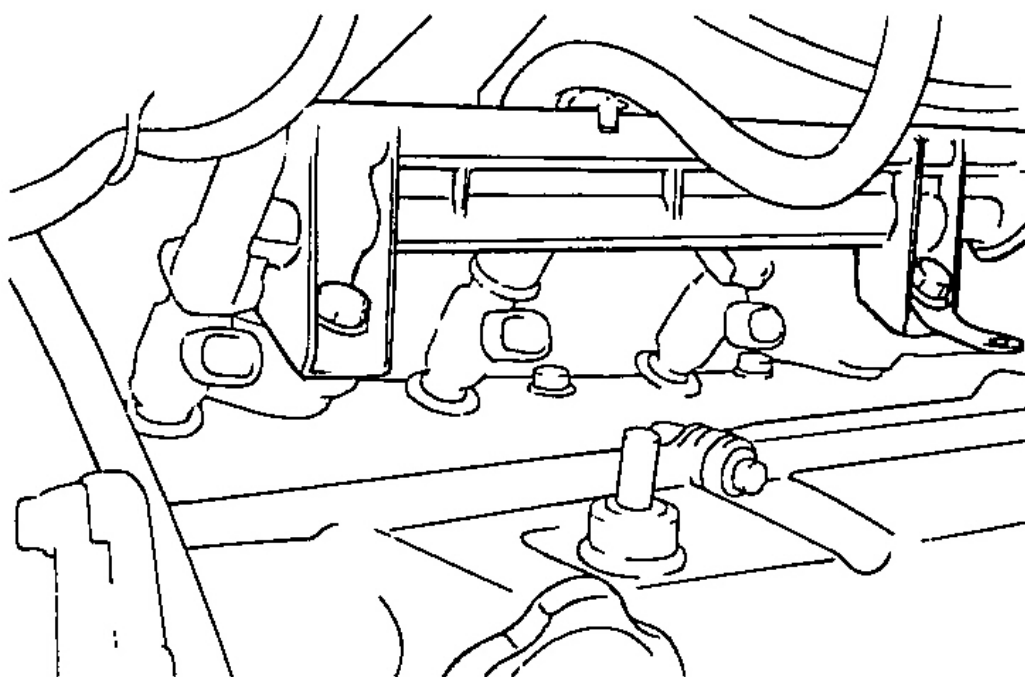


G00326874

Fig. 164: Disconnecting High Pressure Fuel Hose
Courtesy of KIA MOTORS AMERICA, INC.

2. Remove the delivery pipe with the fuel injectors and pressure regulator attached.

CAUTION: Be careful not to drop the injectors when removing the delivery pipe.



G00326875

Fig. 165: Removing Delivery Pipe With The Fuel Injectors & Pressure Regulator
Courtesy of KIA MOTORS AMERICA, INC.

3. Remove intake manifold. See **Fig. 163**.

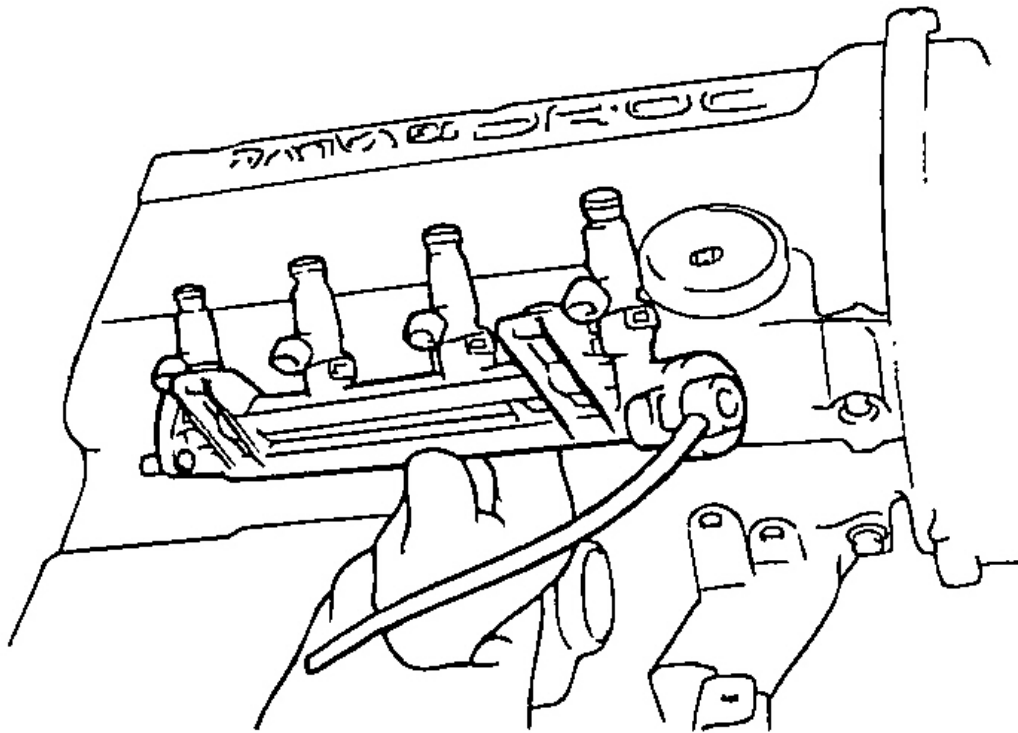
INSPECTION

INTAKE MANIFOLD

1. Check for damage or cracking of any part.
2. Check for obstructions in the vacuum outlet port and the gas passage.

INSTALLATION

1. To install, reverse removal procedure.
2. Make sure that the injector is not dropped, when installing the delivery pipe.

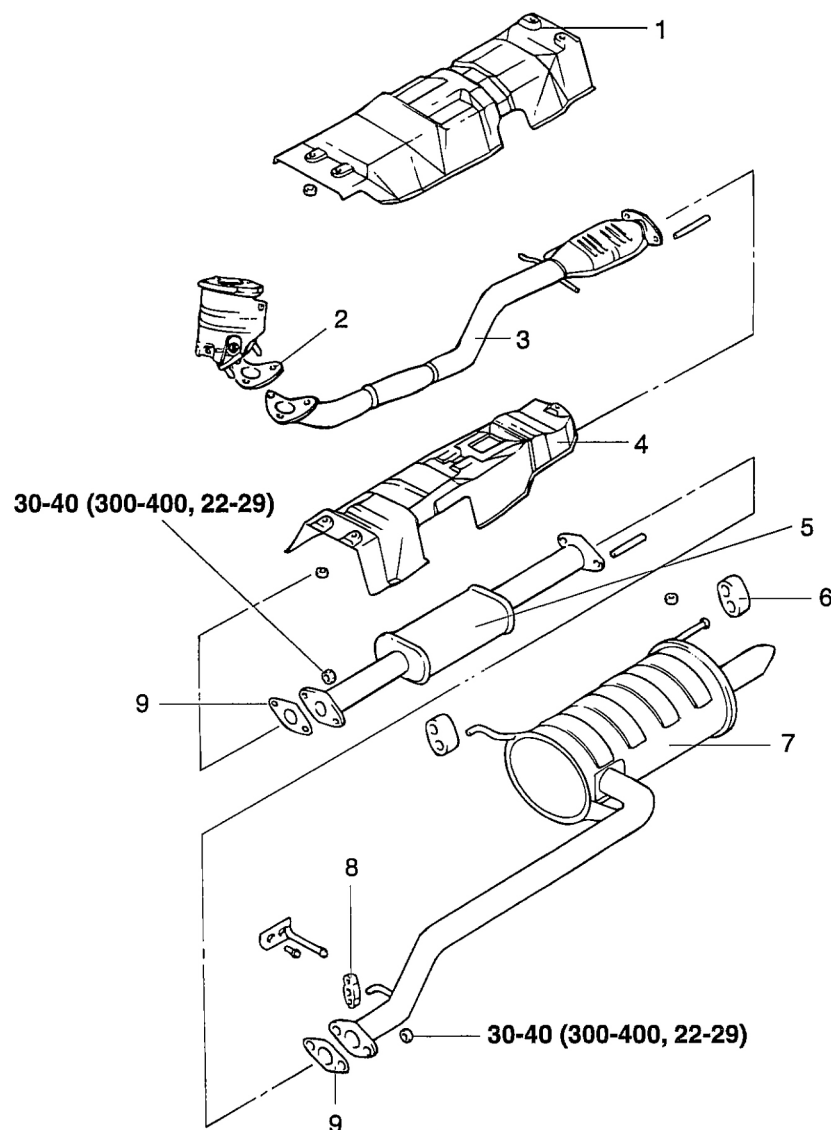


G00326876

Fig. 166: Installing Delivery Pipe
Courtesy of KIA MOTORS AMERICA, INC.

MUFFLER

COMPONENTS



TORQUE : Nm (kg.cm, lb.ft)

- | | |
|-------------------------------|-------------------|
| 1. Front floor heat protector | 6. Rubber hangers |
| 2. Gasket | 7. Main muffler |
| 3. Front exhaust pipe | 8. Rubber hangers |
| 4. Rear floor heat protector | 9. Gasket |
| 5. Center exhaust pipe | |

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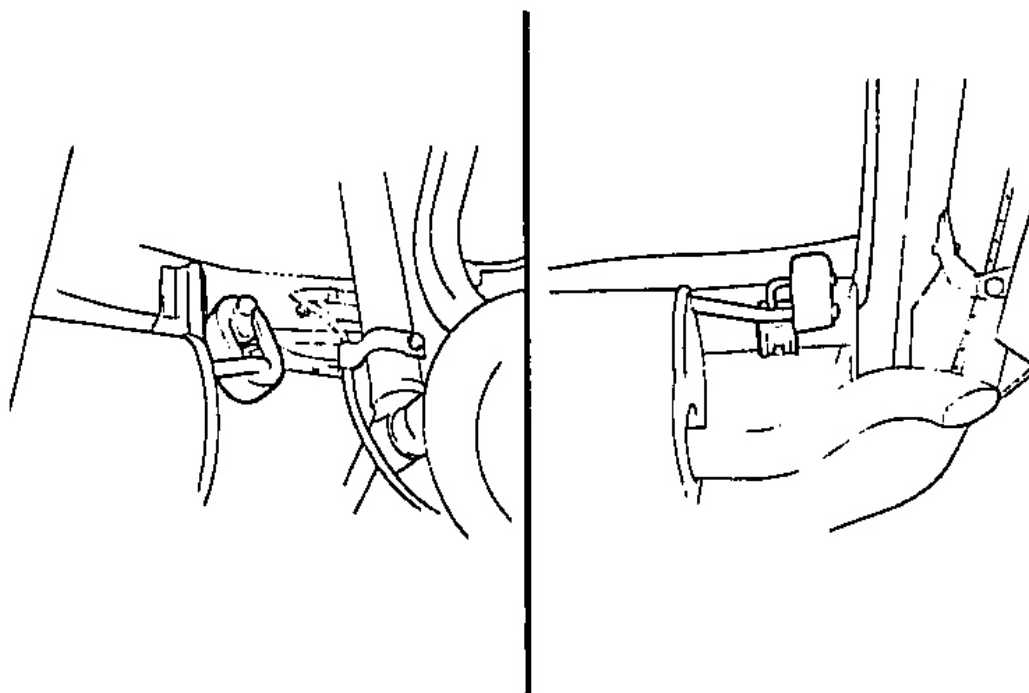
Fig. 167: Removing & Installing Muffler
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

MAIN MUFFLER

CAUTION: Before removing or inspecting the exhaust system, ensure that the exhaust system is cool enough.

1. Disconnect the main muffler from the center exhaust pipe.
2. Remove the rubber hangers and take out the main muffler.



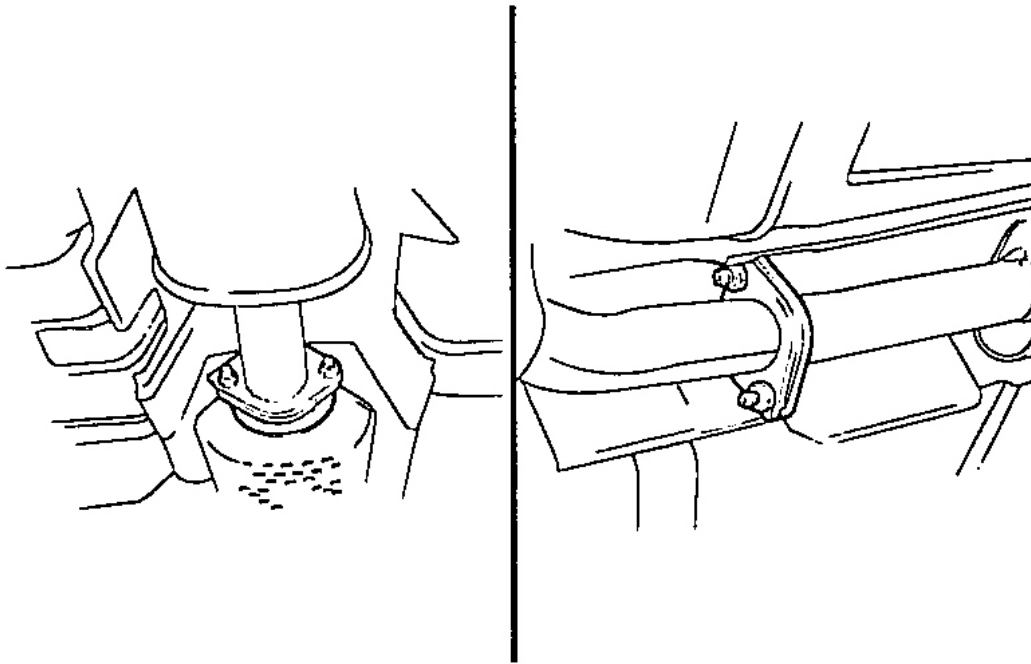
G00326878

Fig. 168: Removing Main Muffler

Courtesy of KIA MOTORS AMERICA, INC.

CENTER EXHAUST PIPE

1. Disconnect the center exhaust pipe from the main muffler.
2. After disconnecting from the front exhaust pipe, remove the center exhaust pipe.

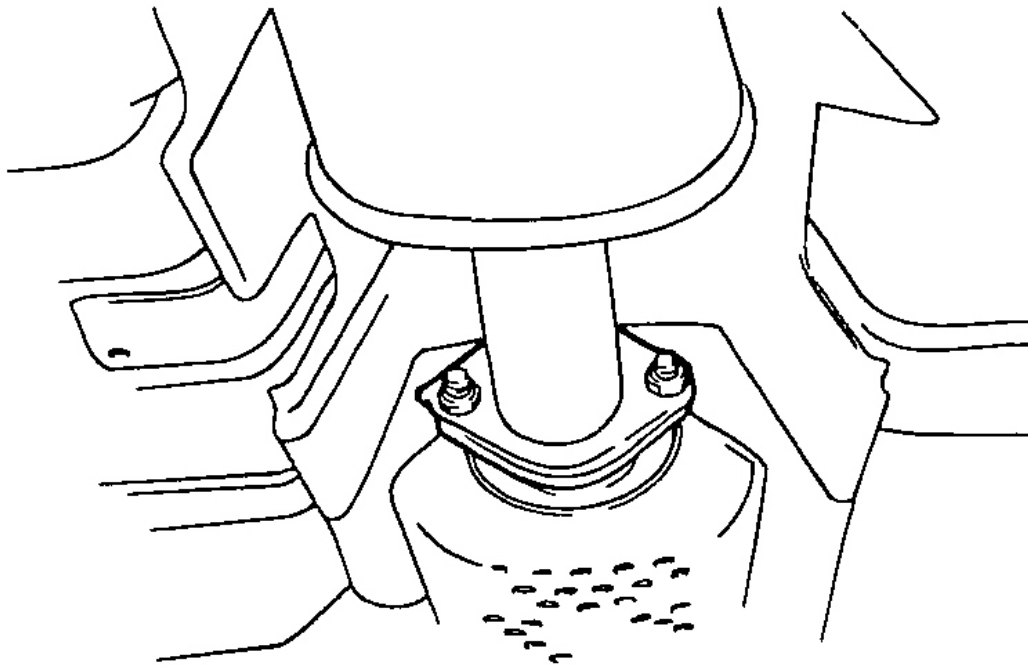


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Fig. 169: Removing Center Exhaust Pipe
Courtesy of KIA MOTORS AMERICA, INC.

FRONT EXHAUST PIPE (INCLUDING REAR CATALYTIC CONVERTER)

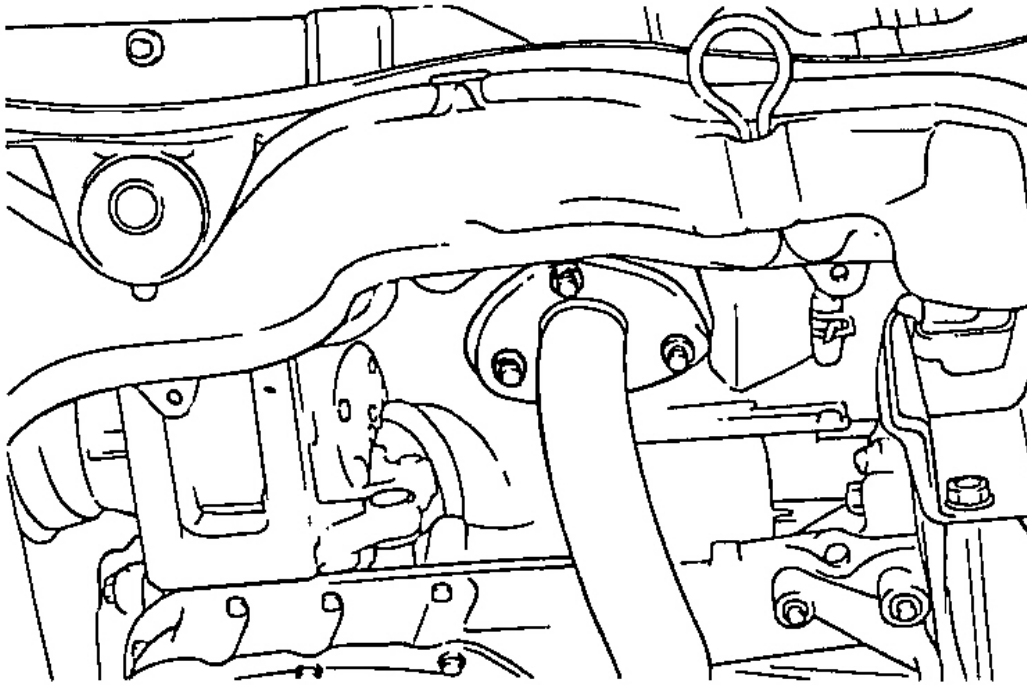
1. Remove the front exhaust pipe from the center exhaust pipe.



G00326880

Fig. 170: Removing Front Exhaust Pipe (1 Of 3)
Courtesy of KIA MOTORS AMERICA, INC.

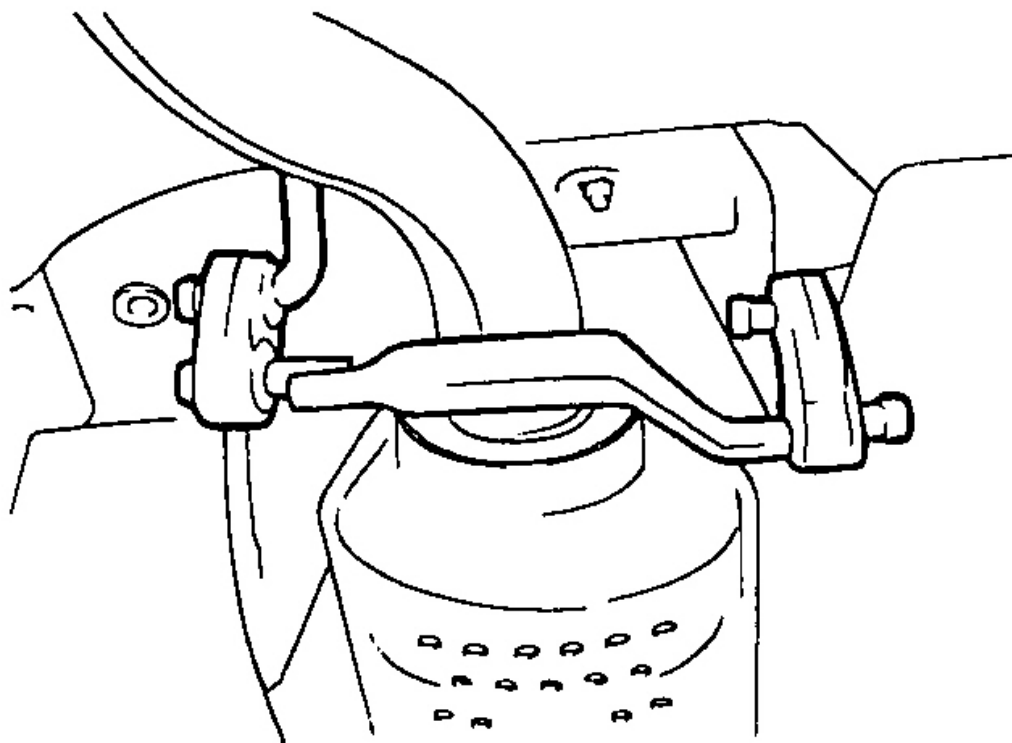
2. Remove the front exhaust pipe from the exhaust manifold (including front catalytic converter).



G00326881

Fig. 171: Removing Front Exhaust Pipe (2 Of 3)
Courtesy of KIA MOTORS AMERICA, INC.

3. Remove the front exhaust pipe from the rubber hanger.



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Fig. 172: Removing Front Exhaust Pipe (3 Of 3)
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

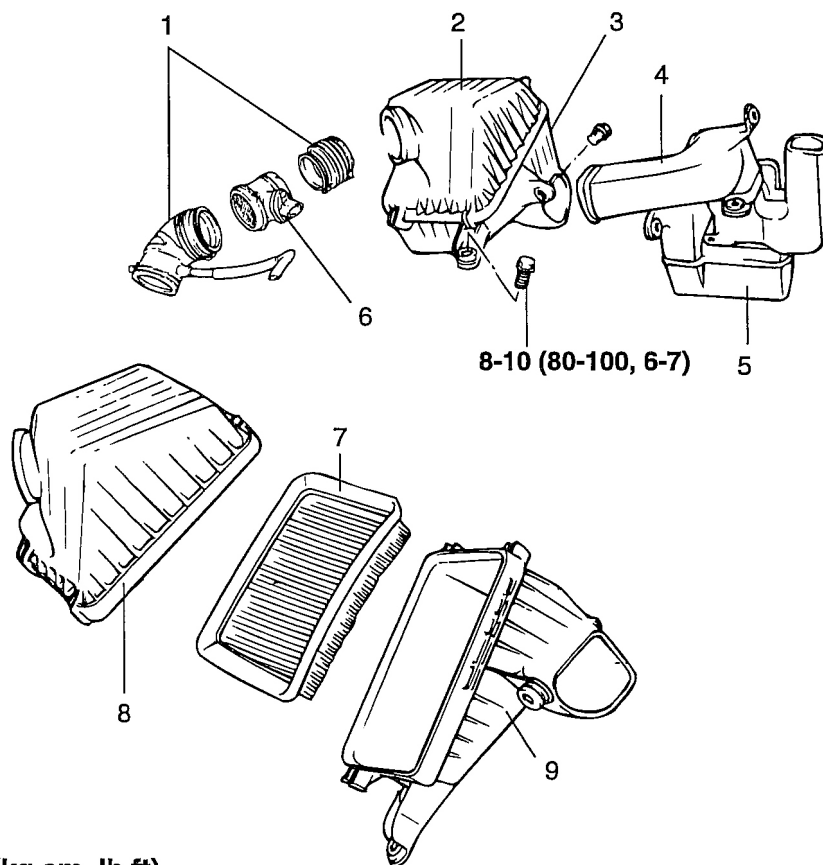
1. Check the mufflers and pipes for corrosion and damage.
2. Check the rubber hanger and hangers for deterioration and cracks.

INSTALLATION

1. Temporarily install the front exhaust pipe (rear catalytic converter assembly), the center exhaust pipe, and the main muffler, in order.
2. Install the rubber hangers so that they are identical (left and right) in length.
3. Tighten the parts securely, and then confirm that there is no interference with any body components.

AIR CLEANER (ACL)

COMPONENTS



TORQUE : Nm (kg-cm, lb-ft)

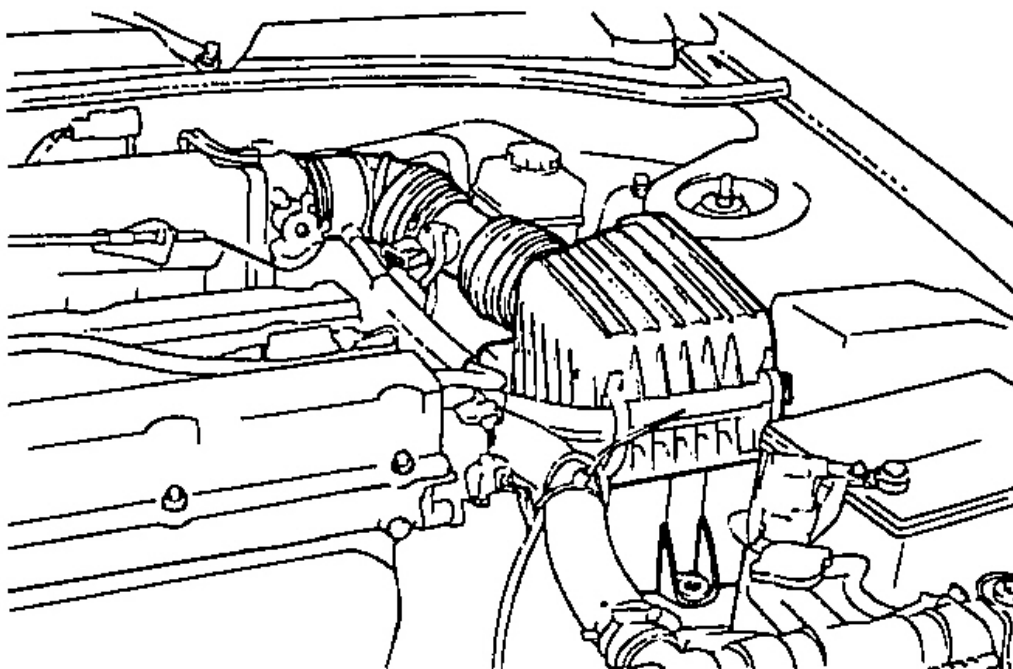
- | | |
|---------------------|------------------------|
| 1. Air intake hose | 6. Air flow sensor |
| 2. Air cleaner | 7. Air cleaner element |
| 3. Air cleaner body | 8. Air cleaner cover |
| 4. Air duct | 9. Air cleaner body |
| 5. Air duct | |

G00326883

Fig. 173: Exploded View Of Air Cleaner Components
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Remove the air intake hose and air duct connected to the air cleaner, and the resonator.



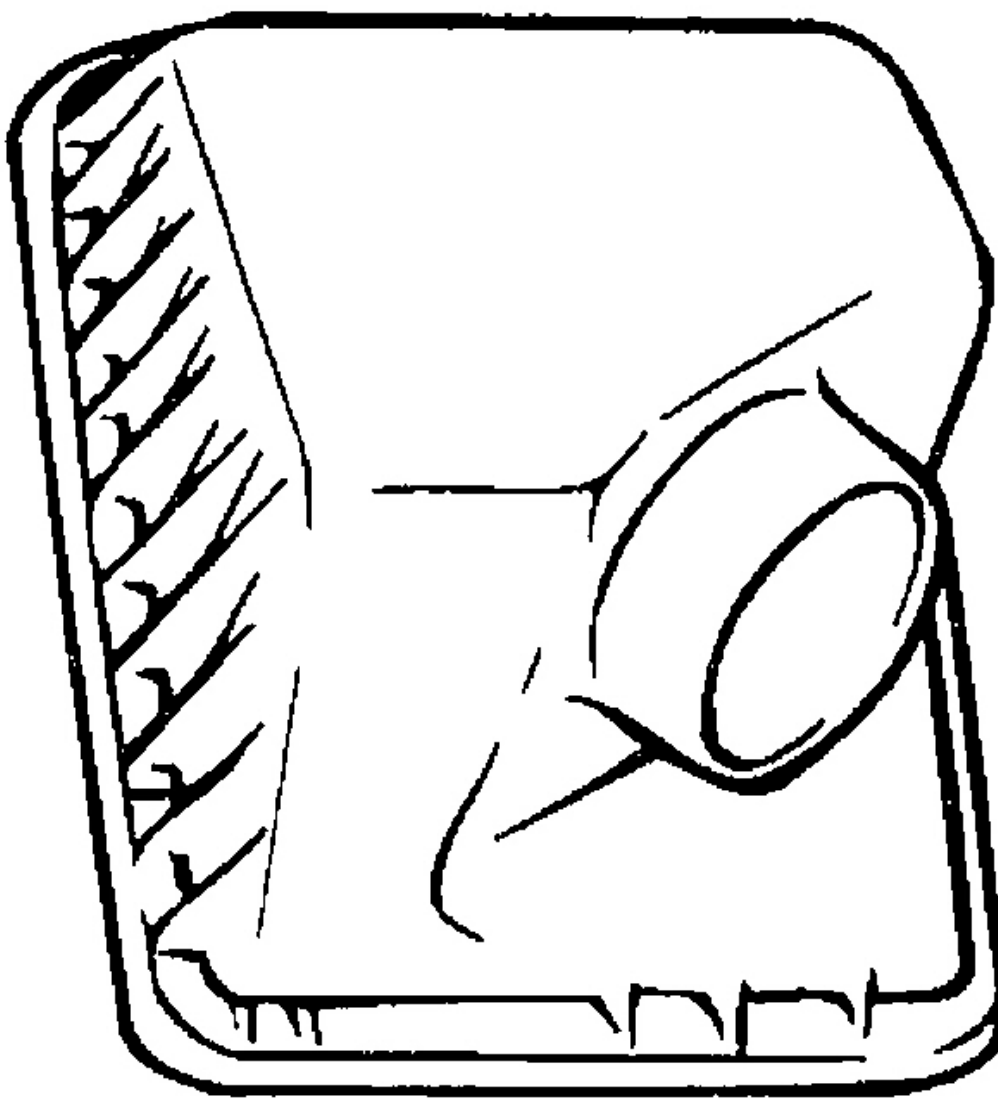
G00326884

Fig. 174: Removing Air Cleaner
Courtesy of KIA MOTORS AMERICA, INC.

2. Remove the three bolts attaching the air cleaner mounting brackets.
3. Detach the air cleaner.

INSPECTION

1. Check the air cleaner body, cover, or packing for distortion, corrosion or damage.

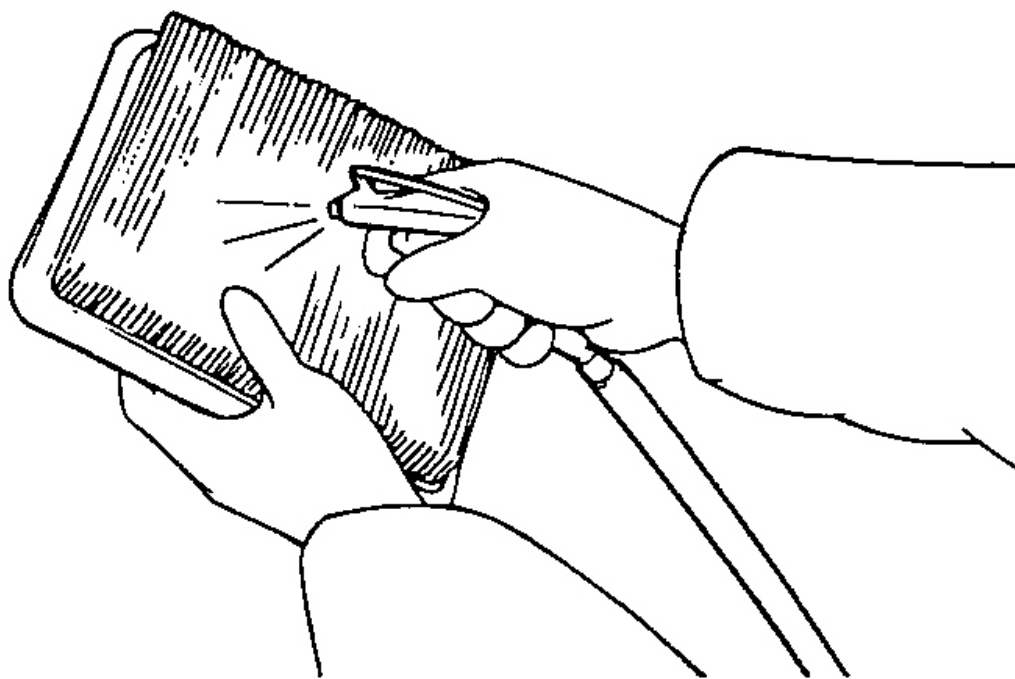


G00326885

Fig. 175: Checking Air Cleaner Body
Courtesy of KIA MOTORS AMERICA, INC.

2. Check the air duct for damage.
3. Check the air cleaner element for restriction, contamination or damage.

If the element is slightly restricted, remove the dust and other contaminants by blowing to the inside through the element.



G00326886

Fig. 176: Cleaning Air Cleaner Element
Courtesy of KIA MOTORS AMERICA, INC.

4. Check the air cleaner housing for restriction, contamination or damage.
5. Check the resonator for damage.

INSTALLATION

Install the air cleaner according to the reverse order of removal.

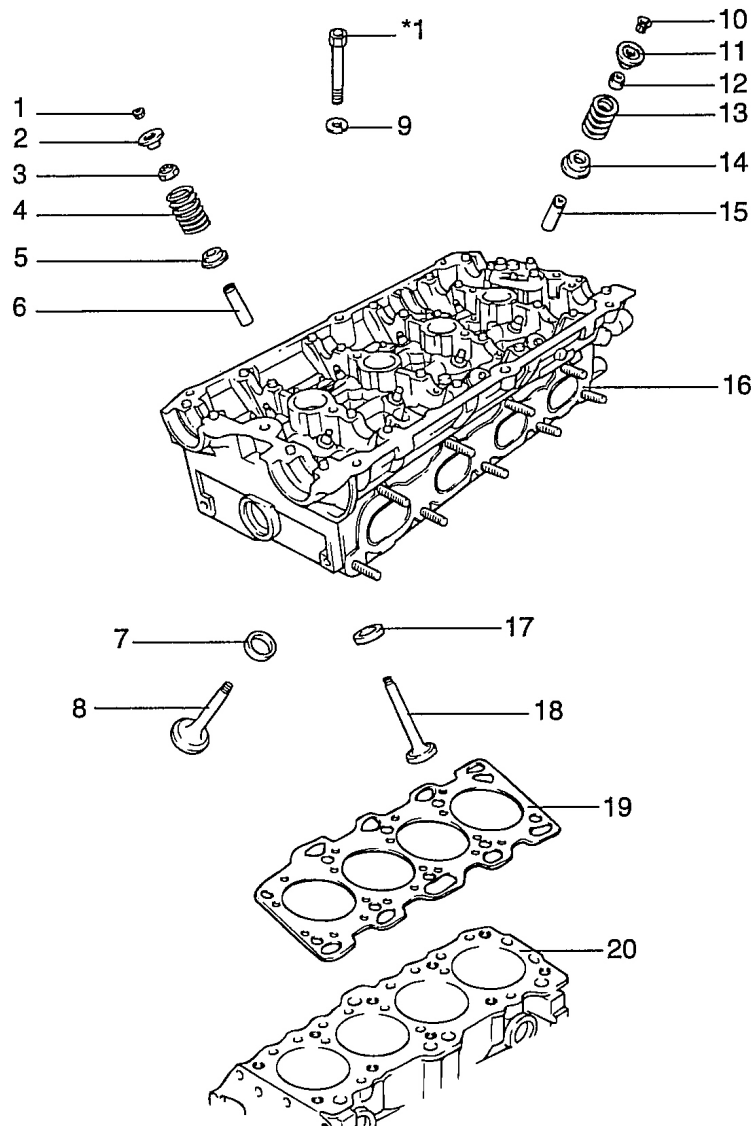
CYLINDER HEAD ASSEMBLY

CYLINDER HEAD

COMPONENTS

2004 Kia Optima EX

2004-05 ENGINES 2.4L 4 Cylinder - Optima & Magentis (Canadian)



*1: Cylinder head bolt

With changing parts: 20 (200, 14) + Release all bolts + 20 (200, 14) + 90° + 90°

Without changing parts : 20 (200, 14) + 90° + 90°

1. Retainer lock
2. Valve spring retainer
3. Valve stem seal
4. Valve spring
5. Valve spring seat
6. Intake valve guide
7. Exhaust valve seat
8. Exhaust valve
9. Washer
10. Retainer lock

11. Valve spring retainer
12. Valve stem seal
13. Valve spring
14. Valve spring seat
15. Exhaust valve guide
16. Cylinder head
17. Intake valve seat
18. Intake valve
19. Cylinder head gasket
20. Cylinder block

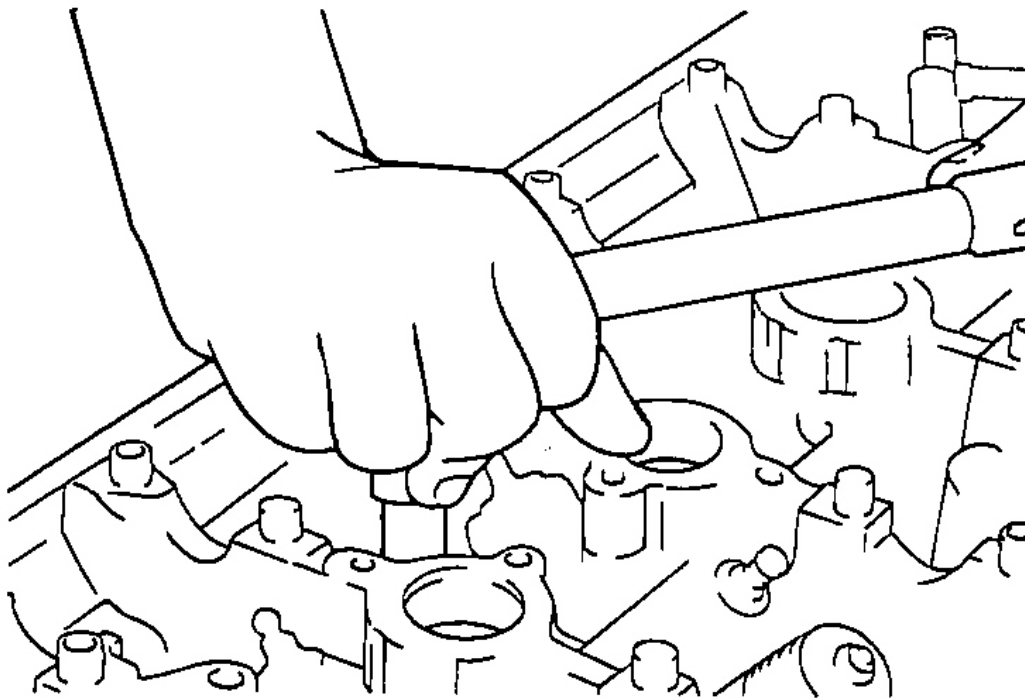
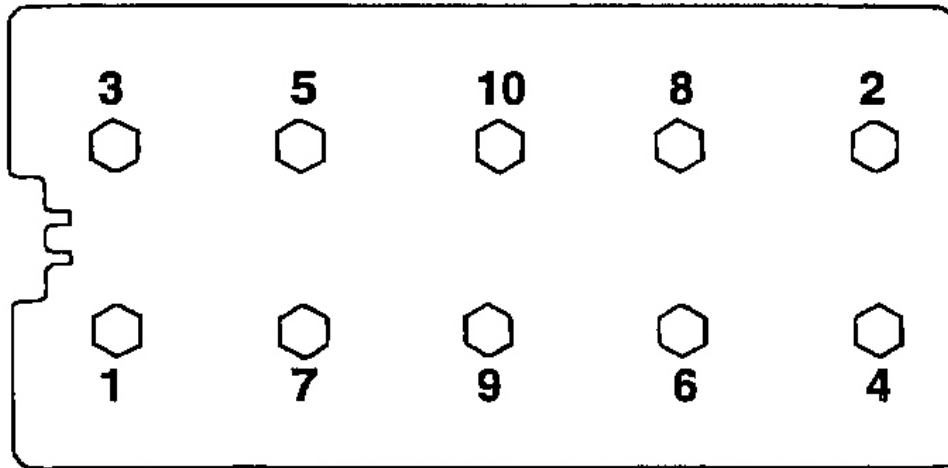
G00326887

Fig. 177: Exploded View Of Cylinder Head
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Remove the cylinder head bolts as shown in the illustration.

← Camshaft sprocket side



G00326888

Fig. 178: Removing Cylinder Head Bolts

Courtesy of KIA MOTORS AMERICA, INC.

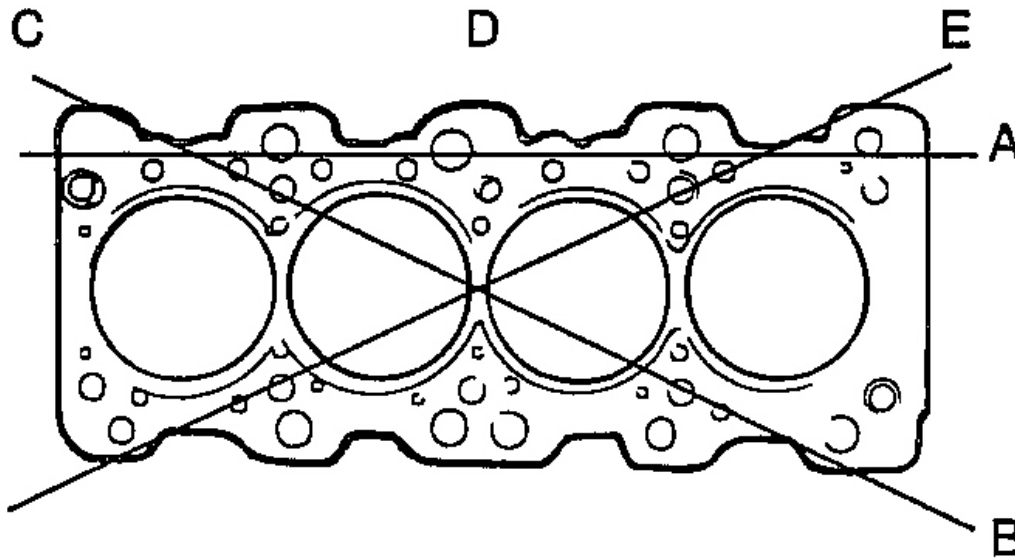
INSPECTION

1. Check the cylinder head for cracks, damage and coolant leakage. If cracked, replace the cylinder head.
2. Remove scale, sealing compound and carbon deposits completely. After cleaning oil passages, apply compressed air to them to make certain that the passages are not clogged.
3. Check the cylinder head gasket surface for flatness by using a straight edge in the direction of A, B, etc. as shown in illustration. If flatness exceeds service limit in any direction, either replace the cylinder head, or lightly machine the cylinder head gasket surface.

Flatness of cylinder head gasket surface

[Standard dimension]: Less than 0.05 mm (0.002 in.)

[Limit] : 0.2 mm (0.008 in.)



G00326889

Fig. 179: Checking Flatness Of Cylinder Head Gasket Surface
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

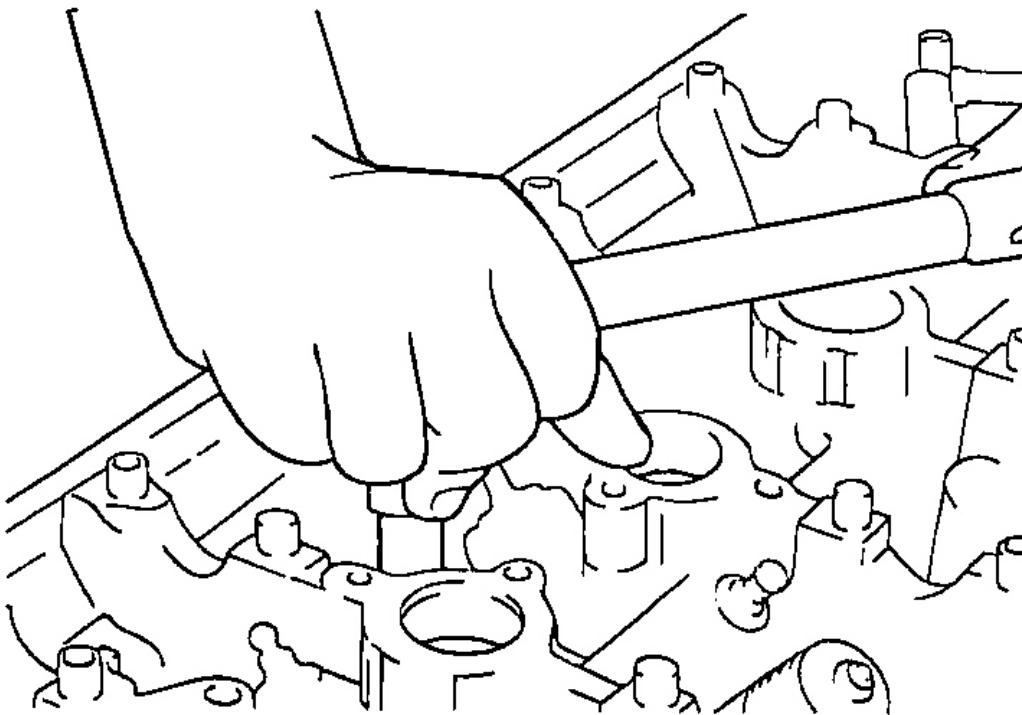
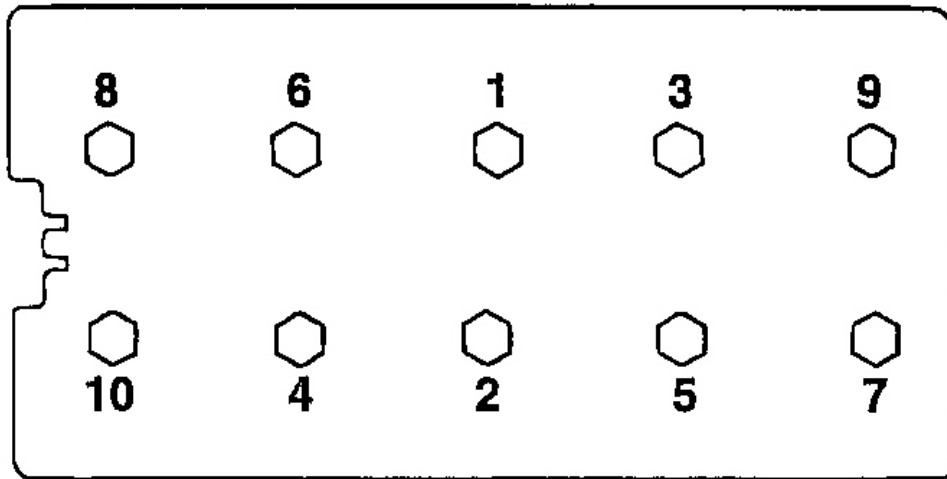
1. Install the cylinder head bolts as shown in the illustration.

2004 Kia Optima EX

2004-05 ENGINES 2.4L 4 Cylinder - Optima & Magentis (Canadian)

NOTE: Check and measure the length of bolt. Maximum length : 99.4 +/- 0.35 mm (3.9 in.)

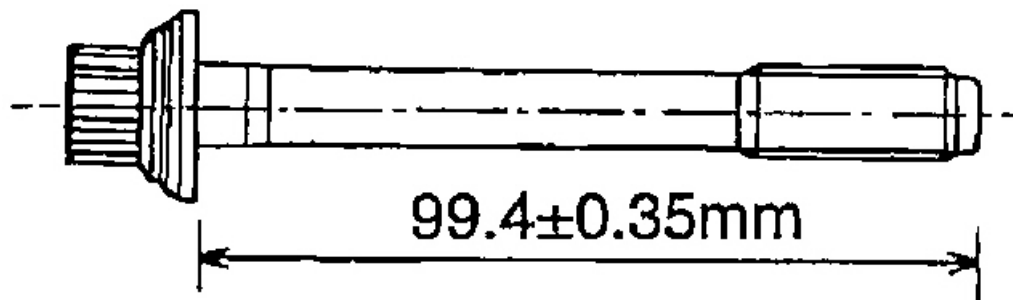
← Camshaft sprocket side



G00326890

Fig. 180: Identifying Cylinder Head Bolt Installation Sequence

Courtesy of KIA MOTORS AMERICA, INC.



G00326892

Fig. 181: Identifying Cylinder Head Bolt Maximum Length

Courtesy of KIA MOTORS AMERICA, INC.

2. Tighten the bolts according to the following procedure shown in illustration.

Step	Operation	Remarks
1	Tighten to 20Nm (200kg·cm, 14lb·ft)	Carry out as shown in the illustration
2	Tighten 90° of a turn	As shown in the illustration. Mark the head of the cylinder head bolt and cylinder head by paint.
3	Fully loosen	Carry out as the reverse order of the illustration.
4	Tighten to 20Nm (200kg·cm, 14lb·ft)	Carry out as shown in the illustration
5	Tighten 90° of a turn	As shown in the illustration. Mark the head of the cylinder head bolt and cylinder head by paint.
6	Tighten 90° of a turn	As shown in the illustration. Check that the painted mark of the head bolt is lined up with that of the cylinder head.

G00326891

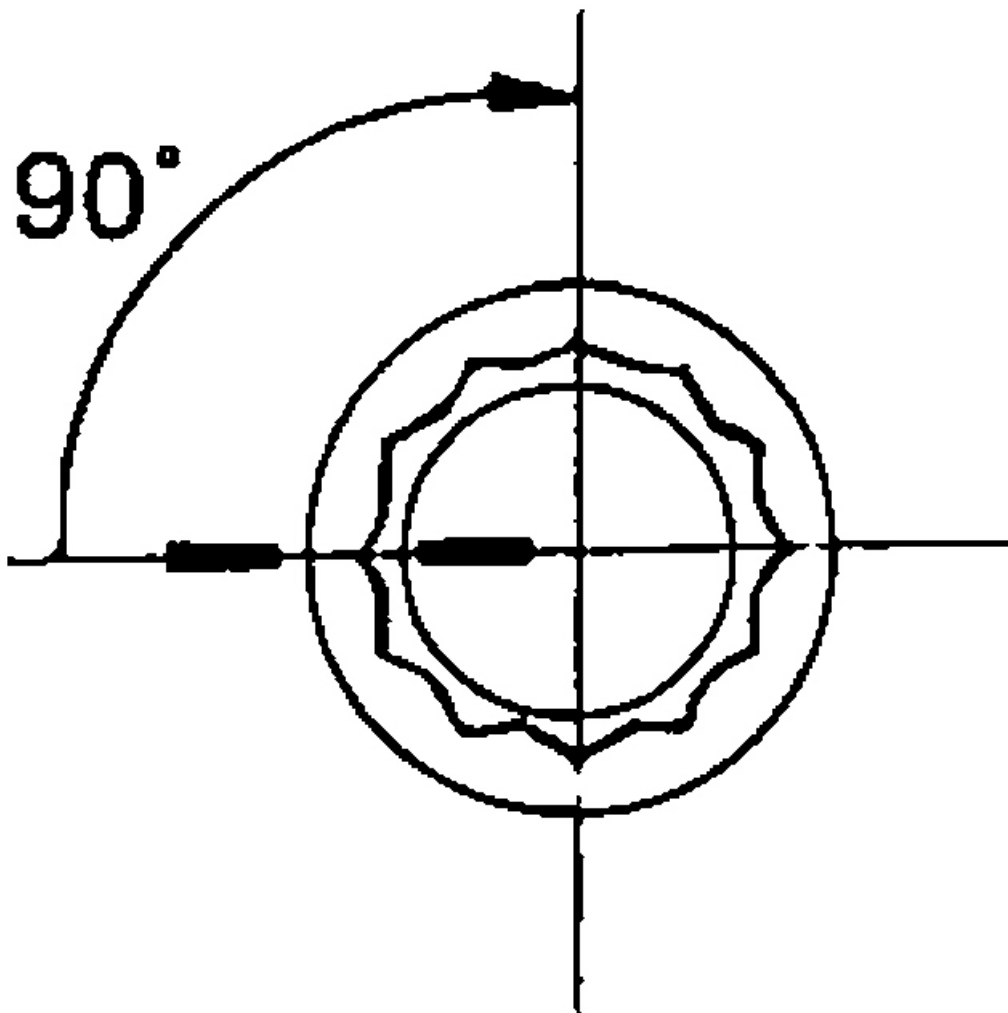
Fig. 182: Installing Cylinder Head (With Replacing Head Bolts)

Courtesy of KIA MOTORS AMERICA, INC.

Step	Operation	Remarks
1	Tighten to 2Nm (20kg·m,0.14lb·ft)	Carry out as shown in the illustration
2	Tighten 90° of a turn	As shown in the illustration. Mark the head of the cylinder head bolt and cylinder head by paint.
3	Tighten 90° of a turn	As shown in the illustration. Check that the painted mark of the head bolt is lined up with that of the cylinder head.

G00326895

Fig. 183: Installing Cylinder Head (Without Replacing Head Bolts)
 Courtesy of KIA MOTORS AMERICA, INC.



G00326893

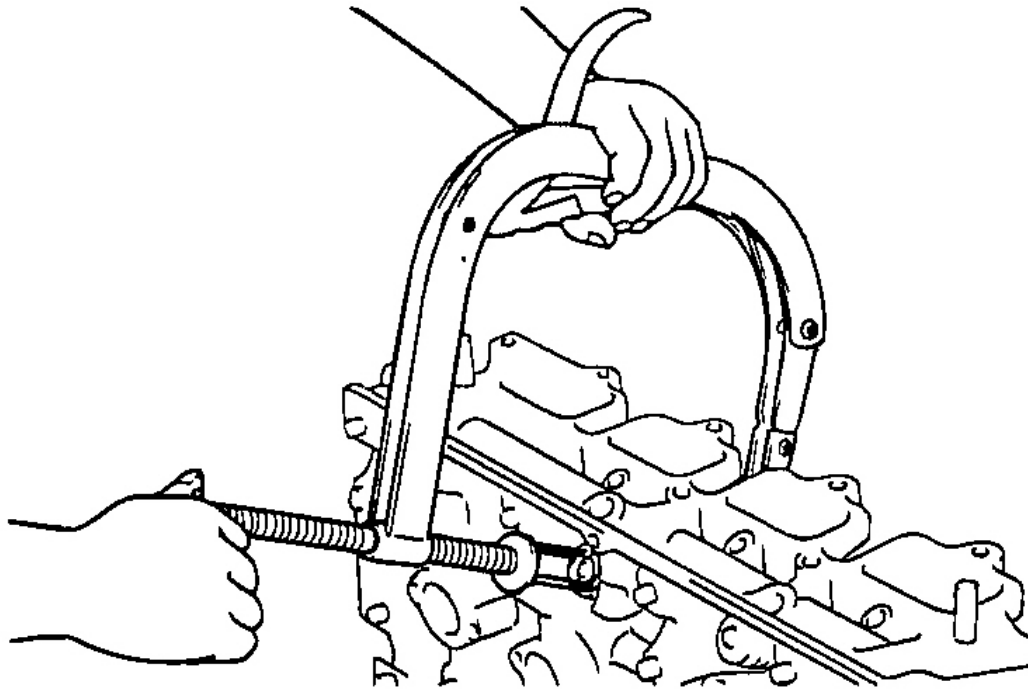
Fig. 184: Identifying 90° Additional Torque
Courtesy of KIA MOTORS AMERICA, INC.

VALVES

REMOVAL

1. Using 12 mm socket, remove the retainer lock. Next, remove the spring retainer, valve spring, spring seat and valve.

NOTE: Keep these parts so that they can be reinstalled in their original positions.

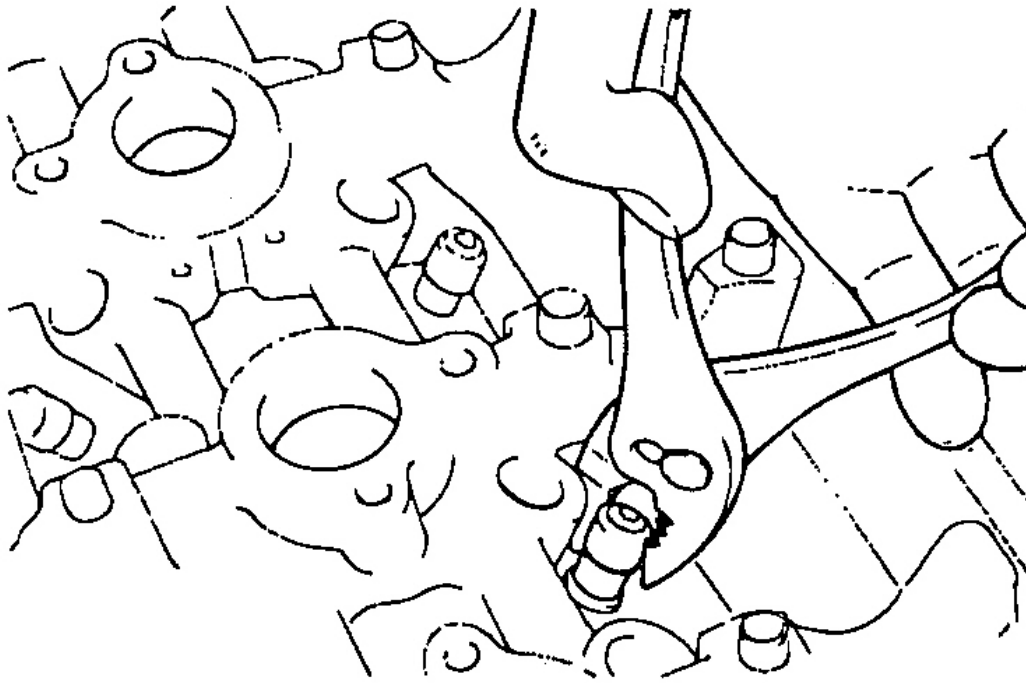


G00326898

Fig. 185: Removing Retainer Lock
Courtesy of KIA MOTORS AMERICA, INC.

2. Remove the valve stem seals with pliers, and discard.

NOTE: Do not reuse the valve stem seals.



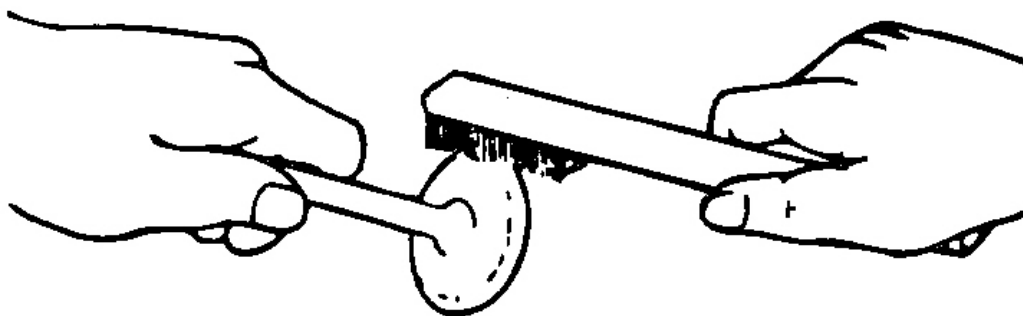
G00326899

Fig. 186: Removing Valve Stem Seals
Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

Valves

1. Using a wire brush, clean the valve thoroughly.



G00326900

Fig. 187: Cleaning Valves

Courtesy of KIA MOTORS AMERICA, INC.

2. Check each valve for wear, damage and distortion of head and stem at location B. Repair or correct if necessary. If stem end A is pitted or worn, resurface as necessary. This correction must be limited to a minimum. Also resurface the valve face. Replace the valve if the margin has decreased to less than the service limit.

Margin

[Standard dimension]

Intake : 1.0 mm (0.040 in.)

Exhaust : 1.5 mm (0.059 in.)

[Limit]

Intake : 0.7 mm (0.028 in.)

Exhaust : 1.0 mm (0.040 in.)

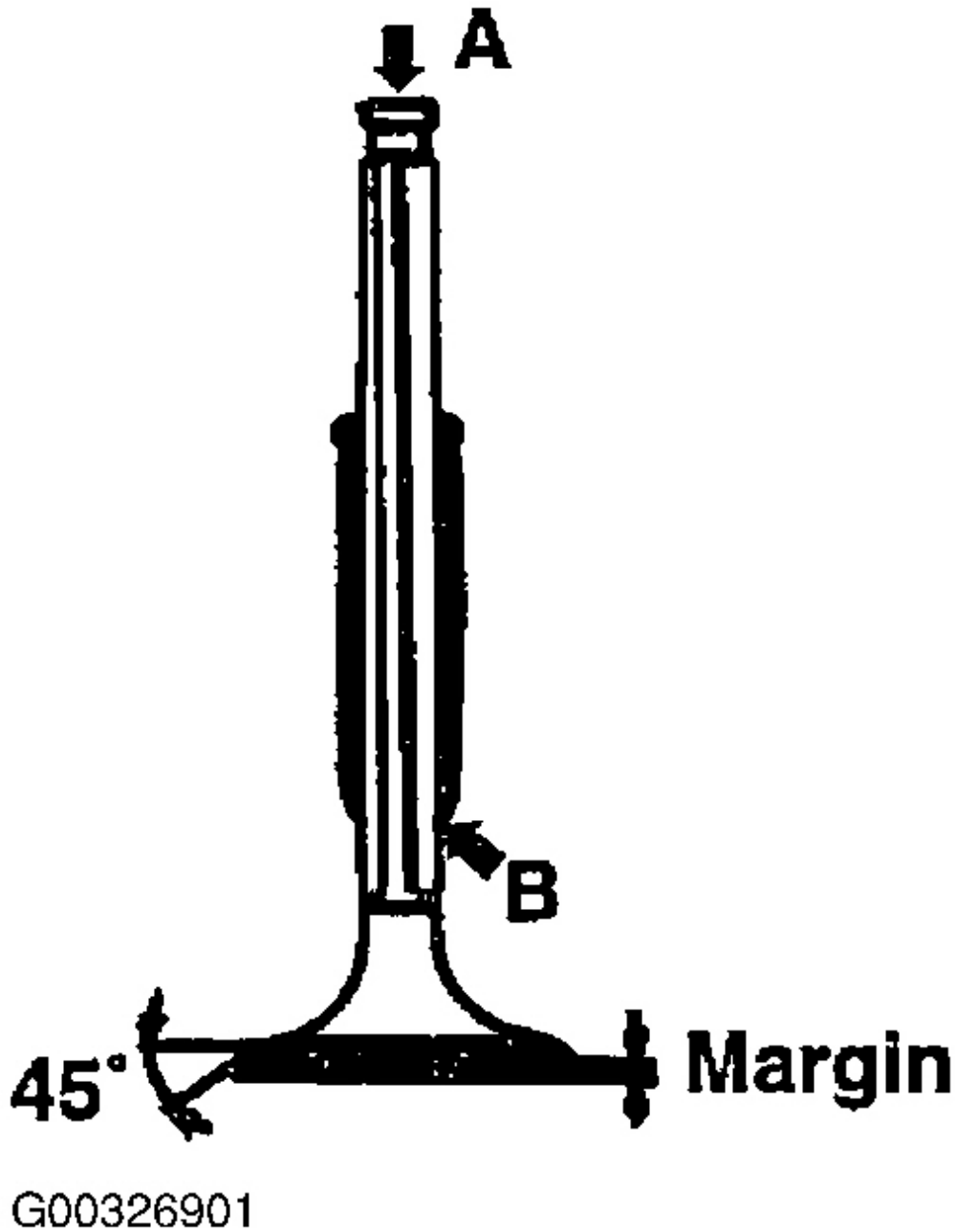


Fig. 188: Checking Valve Dimensions
Courtesy of KIA MOTORS AMERICA, INC.

Valve Springs

2004 Kia Optima EX

2004-05 ENGINES 2.4L 4 Cylinder - Optima & Magentis (Canadian)

1. Check free length and tension of the valve spring. If they exceed the service limit, replace the spring.
2. Using a square, test the squareness of each spring. If the spring is excessively out of square, replace it.

Valve spring

[Standard Value]

Free height : 45.82 mm (1.804 in.)

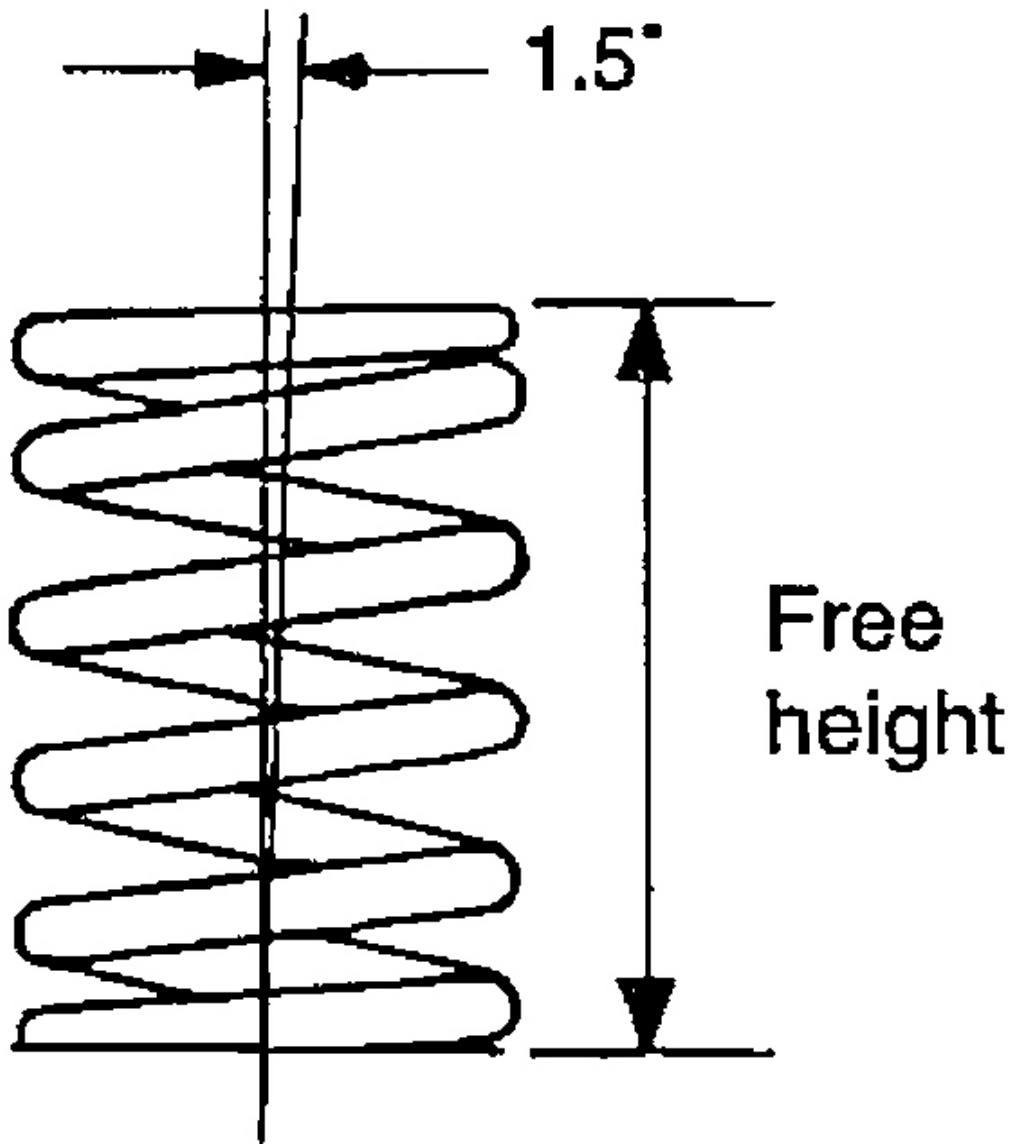
Load : 248 N (55 lb.) at installed height

Out of square : 1.5° or less

[Limit]

Free height : -1.0 mm (-0.039 in.)

Out of square : 4°



G00326902

Fig. 189: Checking Valve Springs

Courtesy of KIA MOTORS AMERICA, INC.

Valve Guides

Check the valve stem-to-guide clearance. If the clearance exceeds the service limit, replace the valve guide with

the next oversize part.

Valve stem-to-guide clearance

[Standard dimension]

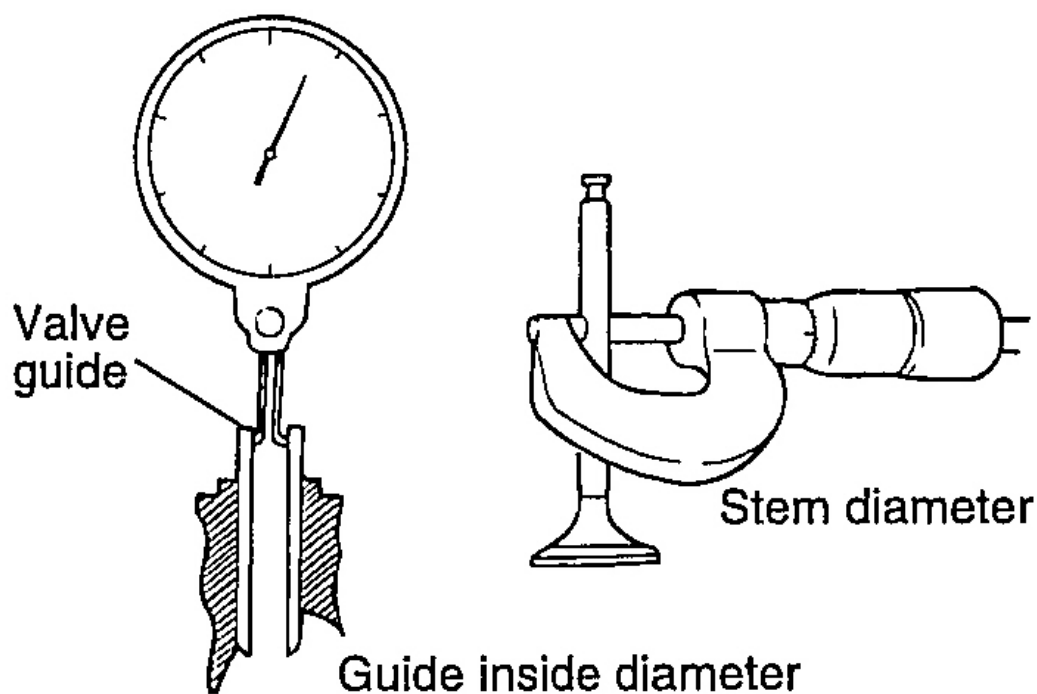
Intake : 0.020-0.047 mm (0.0008-0.0019 in.)

Exhaust: 0.050-0.085 mm (0.0020-0.0033 in.)

[Limit]

Intake : 0.1 mm (0.0040 in.)

Exhaust : 0.15 mm (0.0059 in.)



G00326903

Fig. 190: Checking Valve Guides

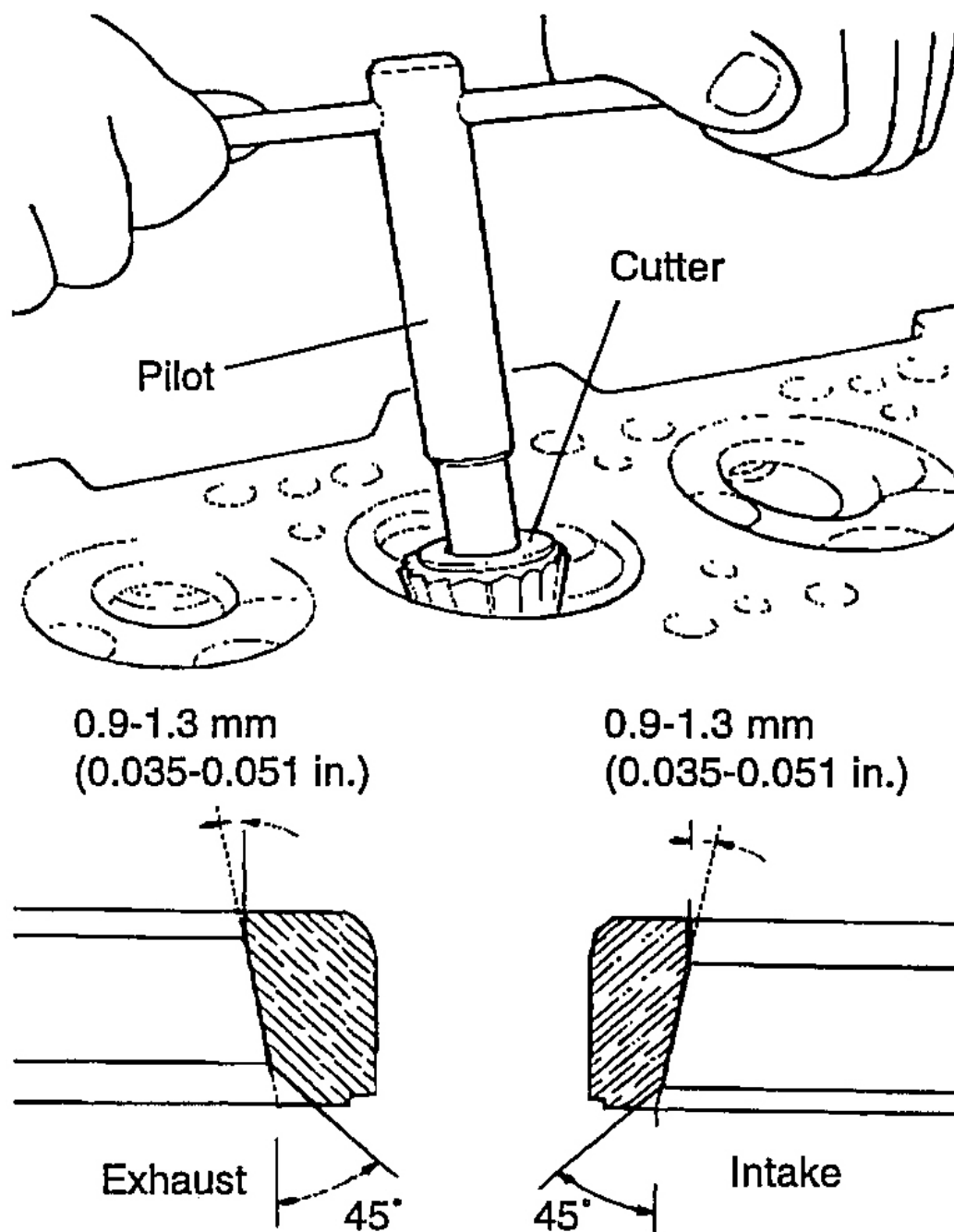
Courtesy of KIA MOTORS AMERICA, INC.

Valve Seat Insert

2004 Kia Optima EX

2004-05 ENGINES 2.4L 4 Cylinder - Optima & Magentis (Canadian)

Check the valve seat for overheating and improper contact with the valve face. Recondition or replace the seat if necessary. Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it, and then recondition the seat. Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specifications and centered on the valve face.

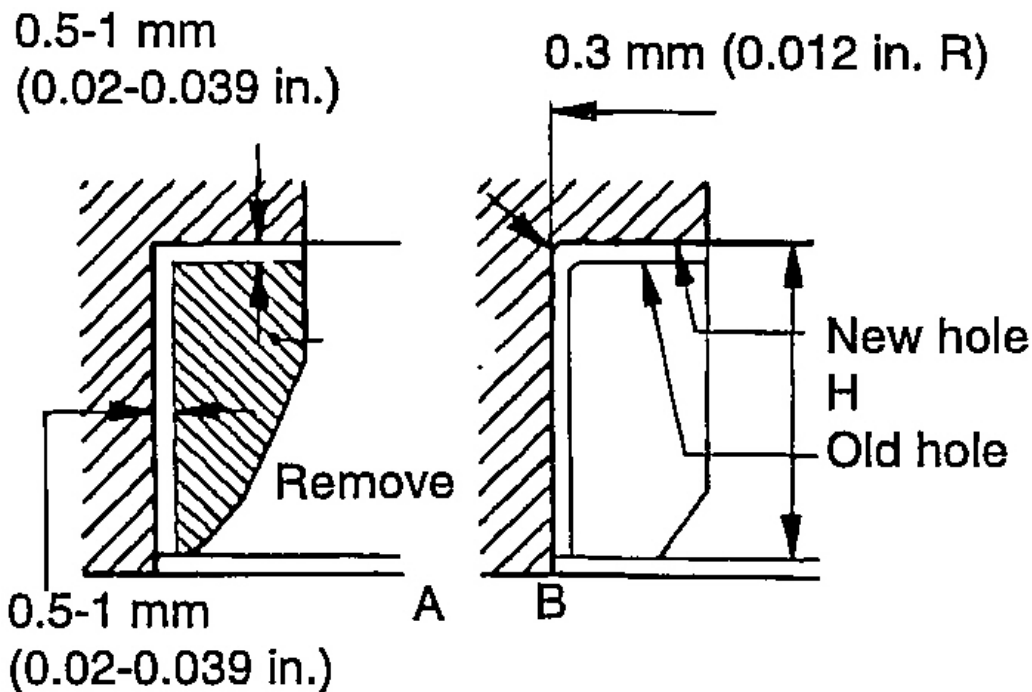


G00326904

Fig. 191: Cleaning & Checking Valve Seat Insert
 Courtesy of KIA MOTORS AMERICA, INC.

Procedures for Replacing Valve Seat Insert

1. Any valve seat insert that has been worn over the service limit should be removed at normal temperature after cutting away most of the insert wall using valve seat cutters as shown in illustration.



G00326905

Fig. 192: Replacing Valve Seat Insert
Courtesy of KIA MOTORS AMERICA, INC.

2. After removing the seat insert, machine the seat insert bore using a reamer or a cutter. Cut to the size shown in illustration.
3. Heat the cylinder head to about 250°C (480°F) and press in the oversize seat insert. The oversize seat insert should be at normal room temperature for installation. After installing a new valve seat insert, resurface the valve seat using the same procedure as in paragraph 1. in Valve Seat Insert. See **Valve Seat Insert**.

Valve Seat Insert Oversizes

2004 Kia Optima EX

2004-05 ENGINES 2.4L 4 Cylinder - Optima & Magentis (Canadian)

Description	Size mm (in.)	Size mark	Seat insert height H mm (in.)	Cylinder head I.D. mm (in.)
Intake valve seat insert	0.3 (0.012) O.S.	30	8.4-8.6 (0.330-0.338)	35.300-35.325 (1.3898-1.3907)
	0.6 (0.024) O.S.	60	8.7-8.9 (0.342-0.350)	35.600-35.625 (1.4016-1.4026)
Exhaust valve seat insert	0.3 (0.012) O.S.	30	8.0-8.2 (0.314-0.322)	33.300-33.325 (1.3110-1.3120)
	0.6 (0.024) O.S.	60	8.3-8.5 (0.326-0.334)	33.600-33.625 (1.3228-1.3238)

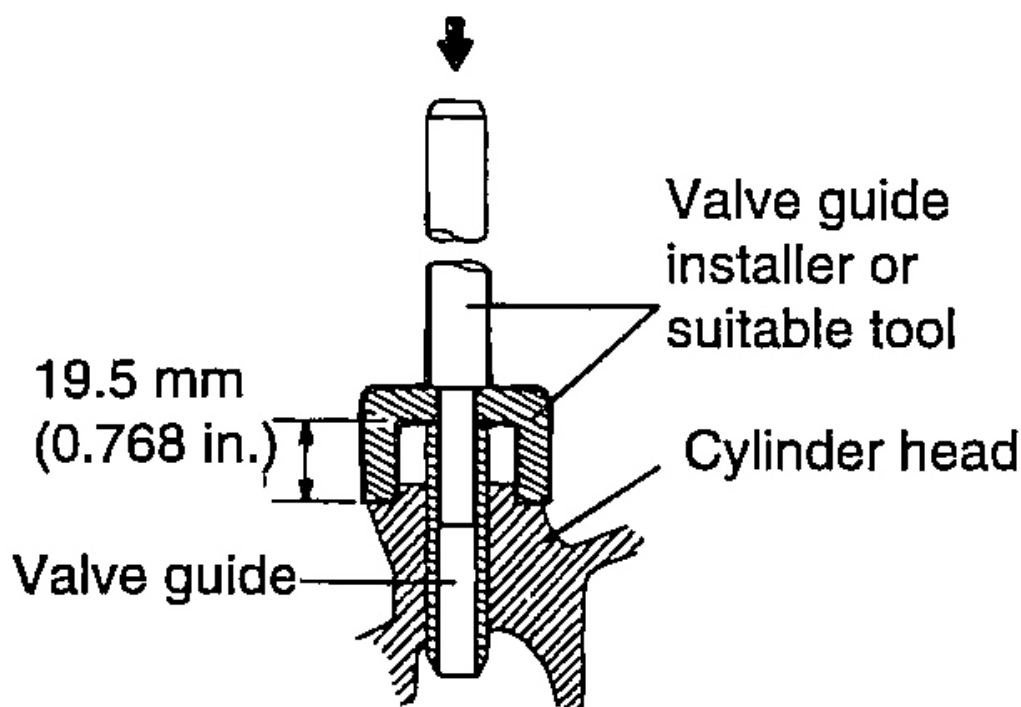
G00326906

Fig. 193: Identifying Valve Seat Insert Oversizes
Courtesy of KIA MOTORS AMERICA, INC.

Procedures for Replacing Valve Guide

The valve guide is installed by using a press fit. Using a Valve Guide Installer (09222-21200 A/B and 09222-28400) or suitable tool, replace the valve guide according to the following procedure.

1. Using the push rod of the Valve Guide Installer, push the valve guide out toward the cylinder block with a press.



G00326907

Fig. 194: Replacing Valve Guide (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

2. Machine the valve guide insert hole in the cylinder head to the specified oversize of the new valve guide.
3. Using the Valve Guide Installer or suitable tool, press fit the valve guide. The use of the valve guide installer makes it possible to press fit the valve guide to a predetermined height. The valve guide should be installed from the top of the cylinder head. Note that intake and exhaust valve guides are different in length [45.5 mm (1.791 in.) for intake and 50.5 mm (1.988 in.) for exhaust.]

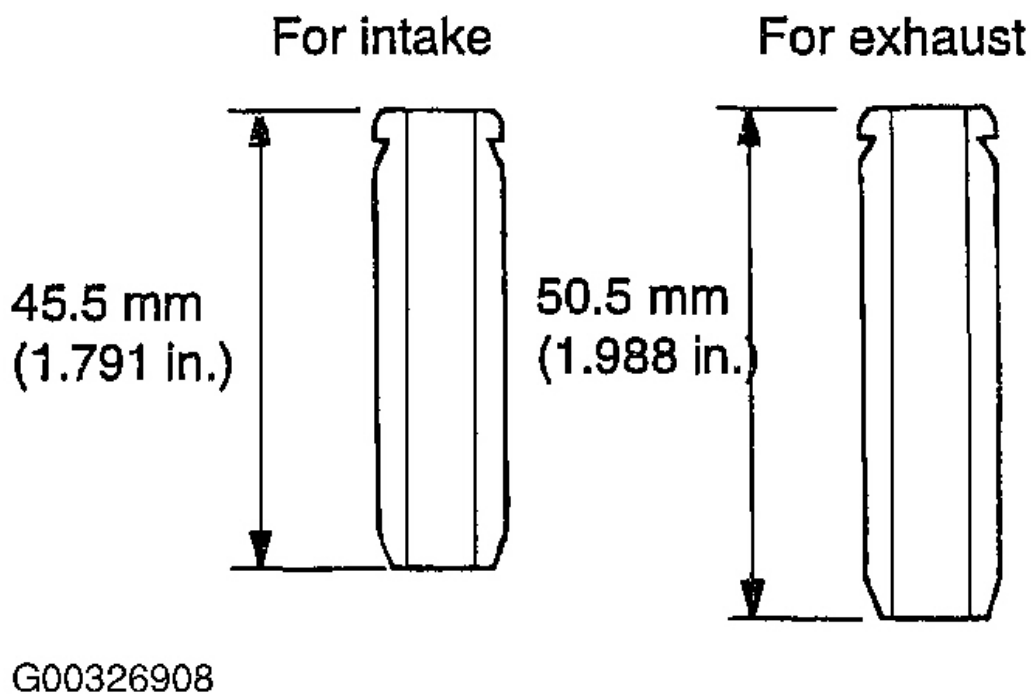


Fig. 195: Replacing Valve Guide (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

4. After the valve guides have been installed, insert new valves and check the clearance.
5. Whenever valve guides are replaced, check that the valve is seated properly and recondition the valve seats as necessary.

Valve Guide Oversizes

Size mm (in.)	Size mark	Cylinder head hole size mm (in.)
0.05 (0.002) O.S.	5	12.050-12.068 (0.4744-0.4751)
0.25 (0.010) O.S.	25	12.250-12.268 (0.4823-0.4830)
0.50 (0.020) O.S.	50	12.500-12.518 (0.4921-0.4928)

G00326909

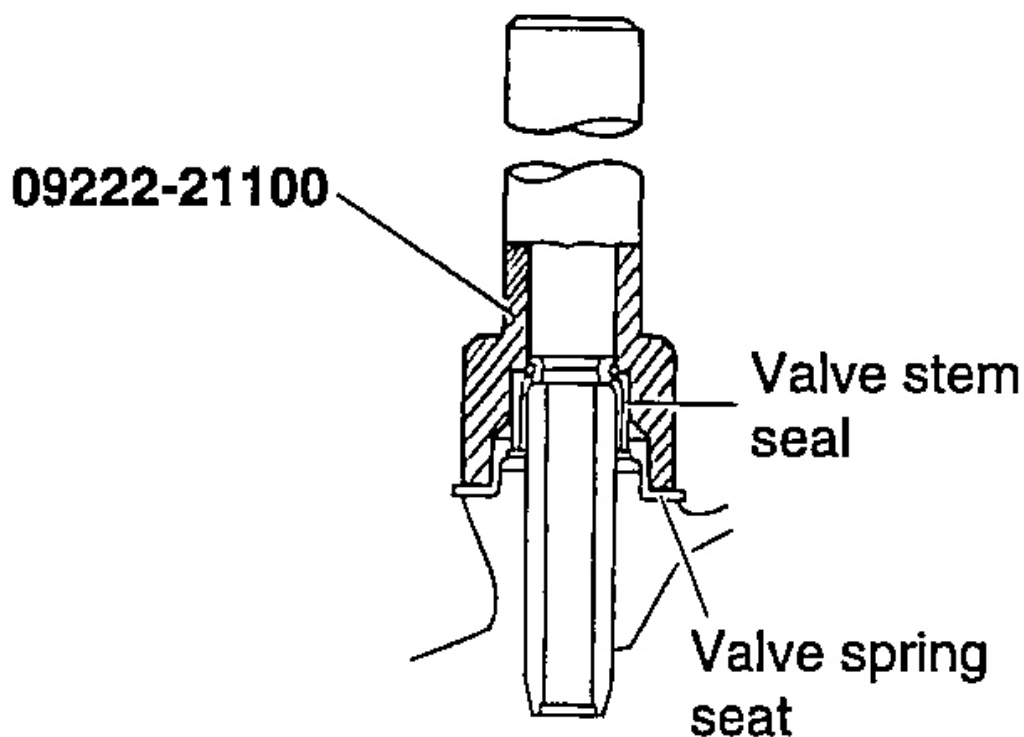
Fig. 196: Identifying Valve Guide Oversizes
 Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

NOTE:

- Clean each part before assembly.
- Apply engine oil to sliding and rotating parts.

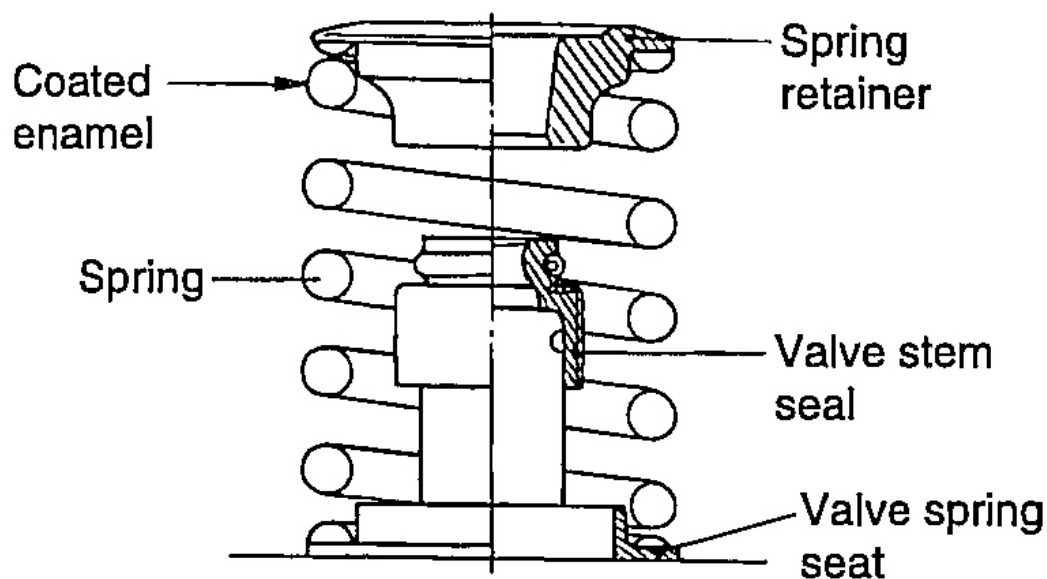
1. After installing the spring seat, fit the stem seal onto the valve guide. Fit the seal in by lightly tapping the Special Tool, Valve Stem Oil Seal Installer. The seal is installed in the specified position by means of the special tool. Incorrect installation of the seal will adversely affect the lip I.D. and eccentricity, resulting in oil leakage down the valve guides. When installing, therefore, be careful not to twist the seal. Do not reuse old stem seals.



G00326910

Fig. 197: Installing Valve Stem Seal
Courtesy of KIA MOTORS AMERICA, INC.

2. Apply engine oil to each valve. Insert the valves into the valve guides. Avoid inserting the valve into the seal by force. After inserting, check that the valve moves smoothly.
3. Install springs and spring retainers. Valve springs should be installed with the enamel coated side toward the valve spring retainer.



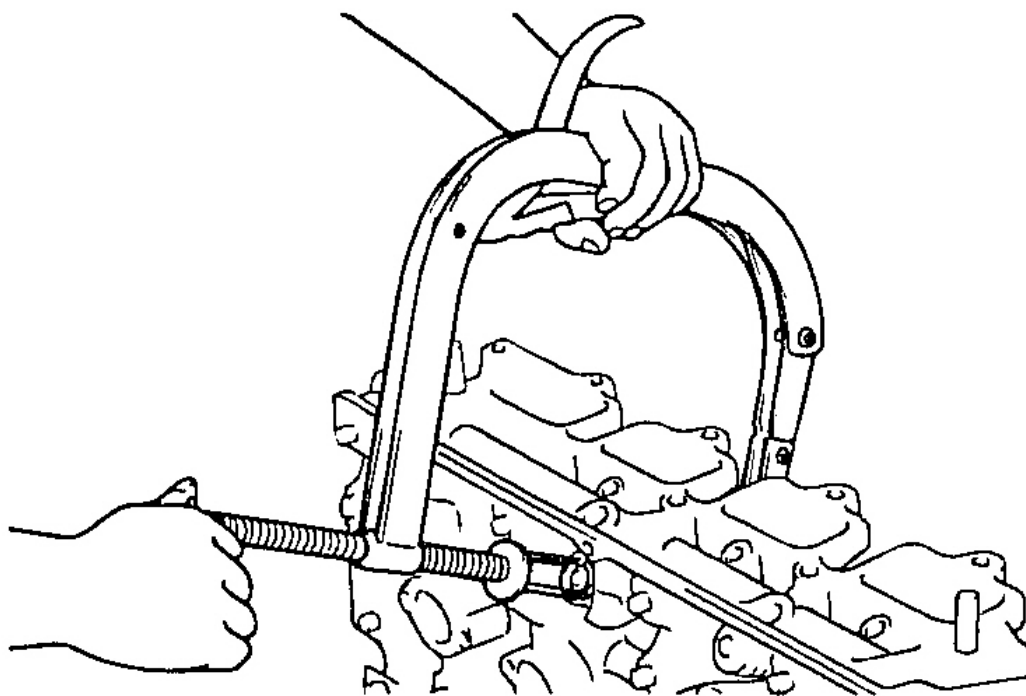
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Fig. 198: Install Valve Springs

Courtesy of KIA MOTORS AMERICA, INC.

4. Using the special tool, Valve Spring Compressor (09221-29100), remove the retainer lock. Next, remove the spring retainer, valve spring, spring seat and valve.

NOTE: Keep these parts so that they can be reinstalled in their original positions.



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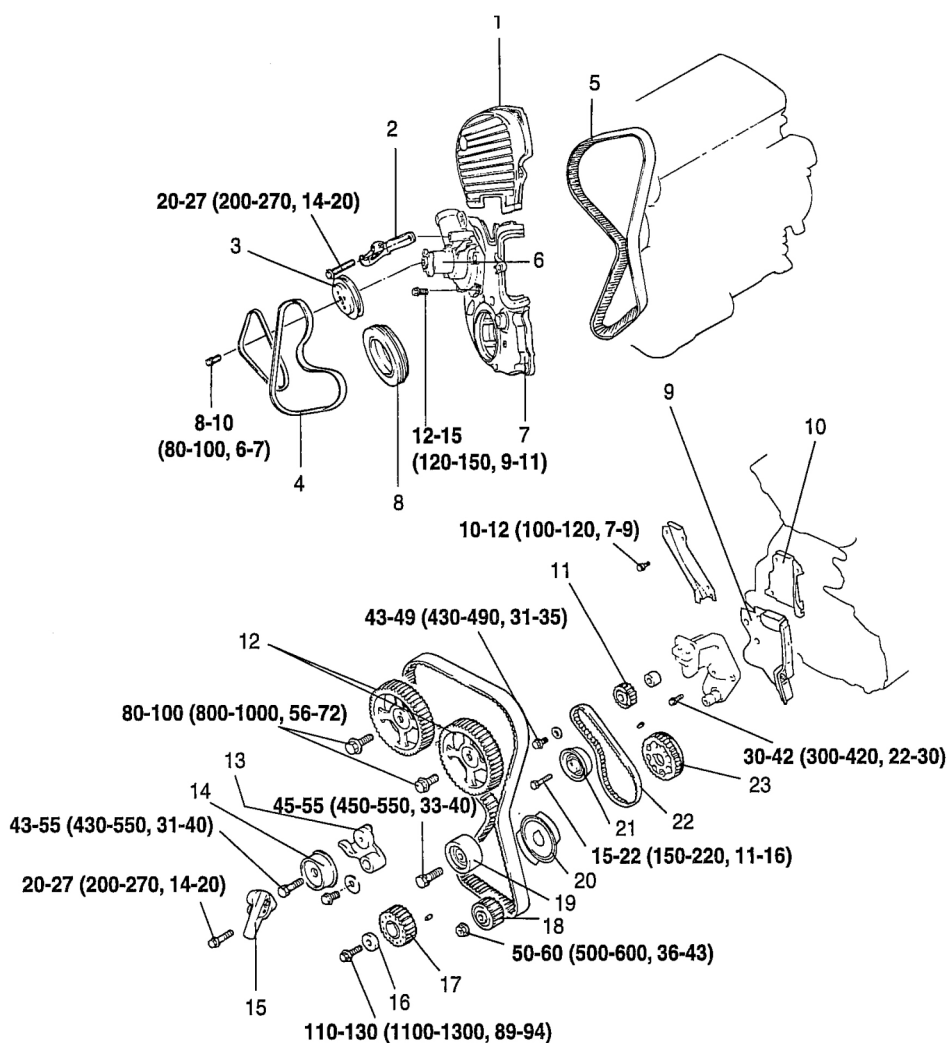
Fig. 199: Removing Retainer Lock
Courtesy of KIA MOTORS AMERICA, INC.

5. Clean all gasket surfaces of the cylinder block and cylinder head.
6. Install a new cylinder head gasket onto the cylinder head assembly. Do not apply sealant to the gasket and do not reuse the old cylinder head gasket.

TIMING SYSTEM

TIMING BELT

COMPONENTS



TORQUE : Nm (kg-cm, lb-ft)

- | | | |
|-------------------------------|---|-----------------------------|
| 1. Timing belt upper cover | 9. Timing belt rear left cover (lower) | 17. Crankshaft sprocket |
| 2. Generator brace | 10. Timing belt rear left cover (upper) | 18. Oil pump sprocket |
| 3. Engine coolant pump pulley | 11. Counter shaft sprocket | 19. Idler pulley |
| 4. Drive belt (A/C, P/S) | 12. Camshaft sprocket | 20. Sensing blade |
| 5. Timing belt | 13. Tensioner arm | 21. Tensioner "B" |
| 6. Engine coolant pump | 14. Tensioner pulley | 22. Timing belt "B" |
| 7. Timing belt lower cover | 15. Auto tensioner | 23. Crankshaft sprocket "B" |
| 8. Crankshaft pulley | 16. Special washer | |

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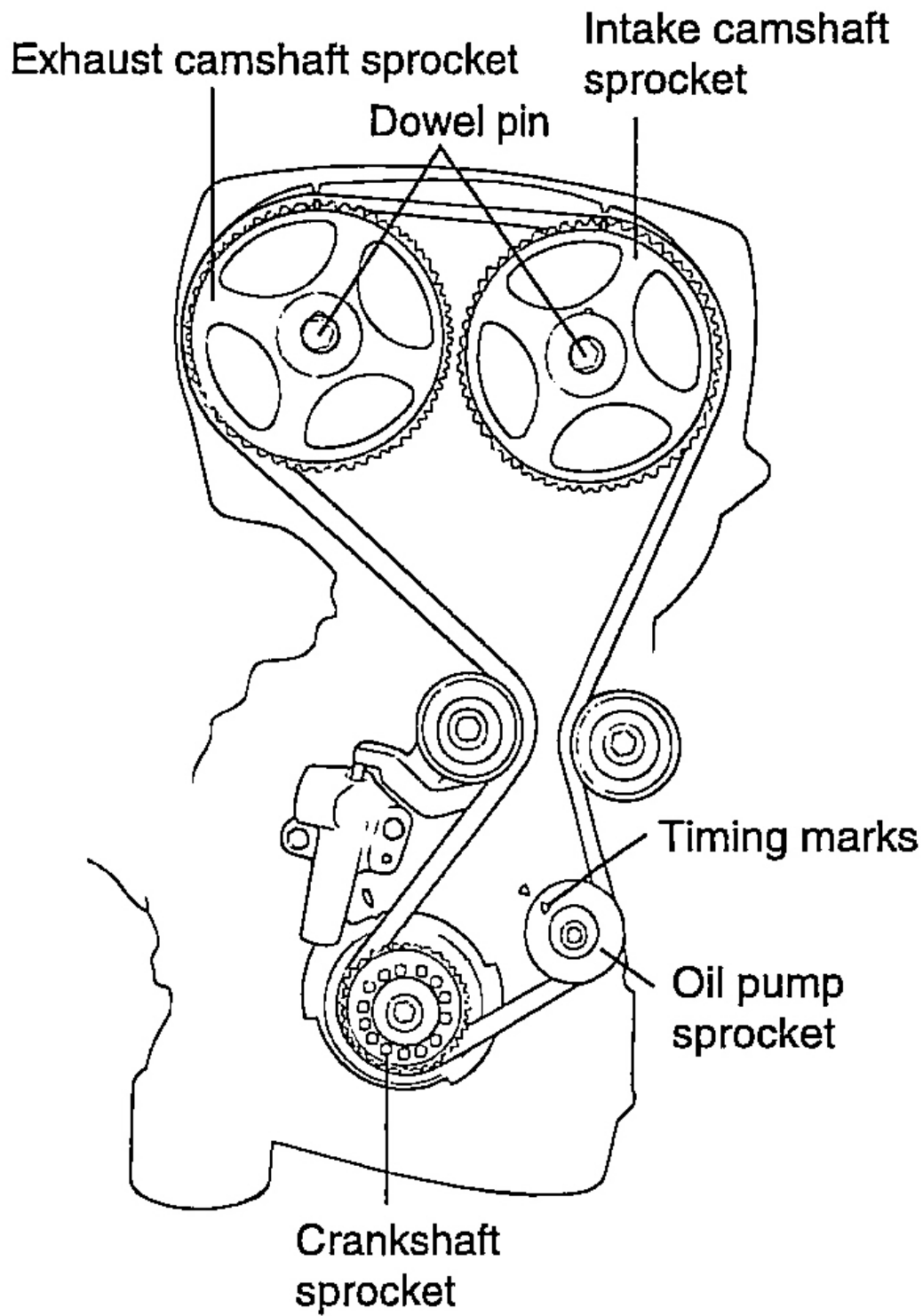
Fig. 200: Exploded View Of Timing Belt
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

1. Remove the crankshaft pulley, engine coolant pump pulley and drive belt.
2. Remove the timing belt cover.
3. Turn the crankshaft clockwise and align the timing marks so as to bring the No. 1 cylinder to compression

top-dead-center position. At this time the timing marks of the camshaft sprocket and the timing marks of the rocker cover should coincide, and the dowel pin of the camshaft sprocket should be at the upper side. Remove the auto tensioner.

CAUTION: Rotate the crankshaft clockwise.



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Fig. 201: Locating Timing Marks

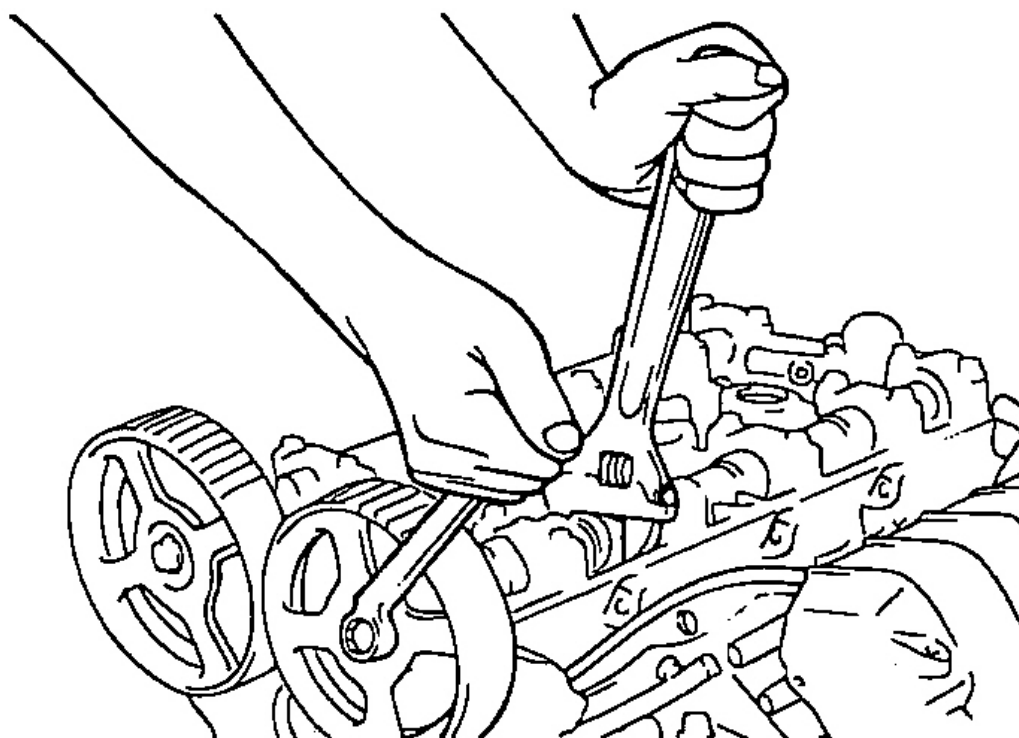
Courtesy of KIA MOTORS AMERICA, INC.

4. Remove the timing belt.

NOTE: If the timing belt is reused, make an arrow mark indicating the turning direction (of the front of the engine) to make sure that the belt is reinstalled in the same direction as before.

5. Remove the camshaft sprockets.

NOTE: Be careful not to damage the cylinder head with the wrench.



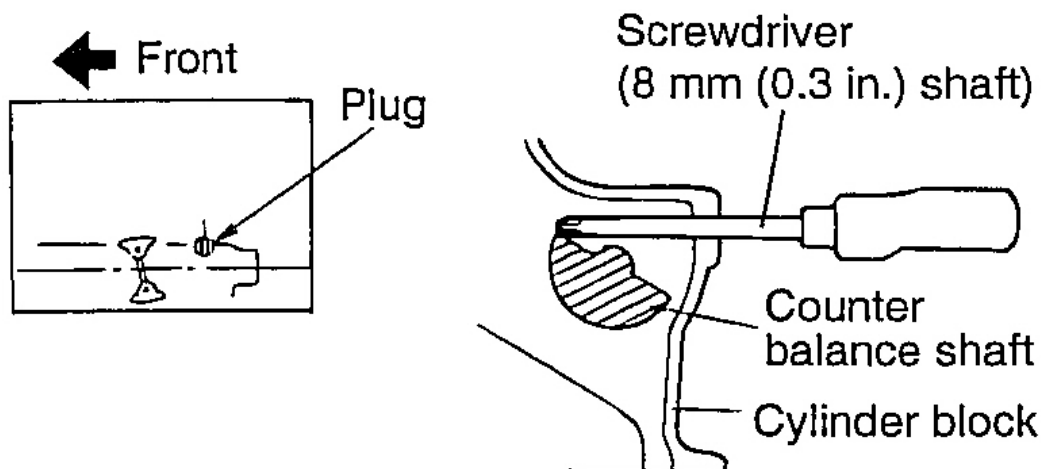
G00326916

Fig. 202: Removing Camshaft Sprockets

Courtesy of KIA MOTORS AMERICA, INC.

6. When the oil pump sprocket nut is removed, first remove the plug at left side of the cylinder block and insert a screwdriver to check the left counter balance shaft in position. Screwdriver used for this purpose

should have a shaft 8 mm (0.3 in.) in diameter which can be inserted more than 60 mm (2.36 in.)

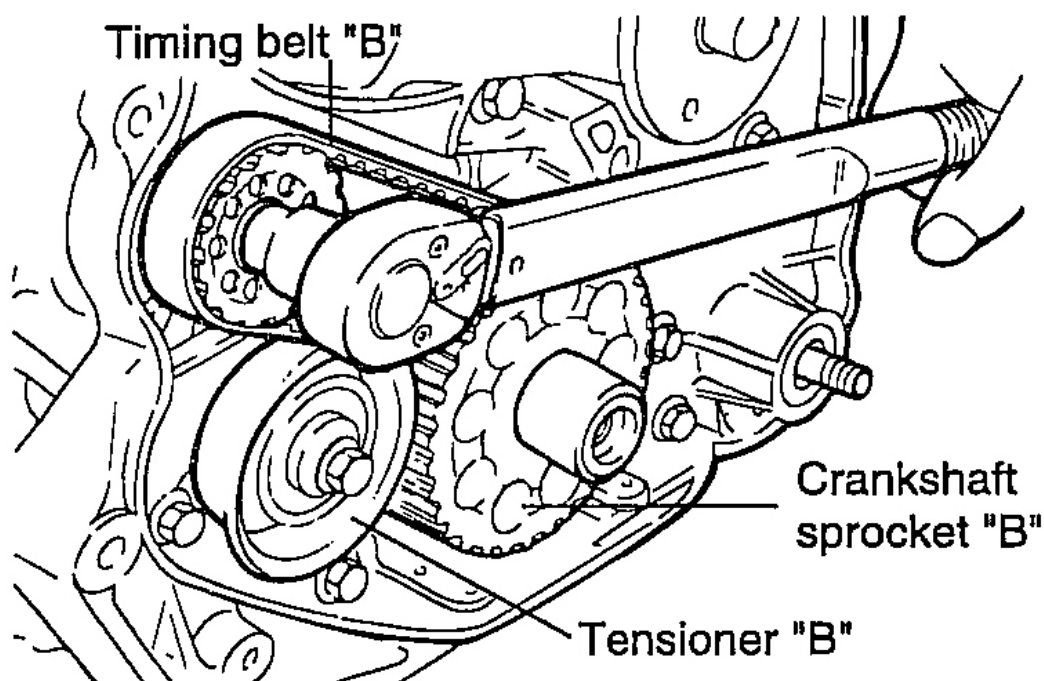


G00326917

Fig. 203: Holding Left Counter Balance Shaft
Courtesy of KIA MOTORS AMERICA, INC.

7. Remove the oil pump sprocket retaining nut and remove the oil pump sprocket.
8. Loosen the right counter balance shaft sprocket mounting bolt until it can be loosened by hand.
9. Next, remove tensioner "B" and remove timing belt "B".

CAUTION: After timing belt "B" has been removed, do not attempt to loosen bolt while holding sprocket with pliers, etc.



G00326918

Fig. 204: Removing Tensioner "B", Timing Belt "B" & Crankshaft Sprocket "B"
Courtesy of KIA MOTORS AMERICA, INC.

10. Remove the crankshaft sprocket "B" from crankshaft.

INSPECTION

Sprockets, Tensioner Pulley, & Idler Pulley

1. Check the camshaft sprocket, crankshaft sprocket, tensioner pulley, and idler pulley for abnormal wear, cracks, or damage. Replace as necessary.
2. Inspect the tensioner pulley and the idler pulley for easy and smooth pulley rotation and check for play or noise. Replace as necessary.

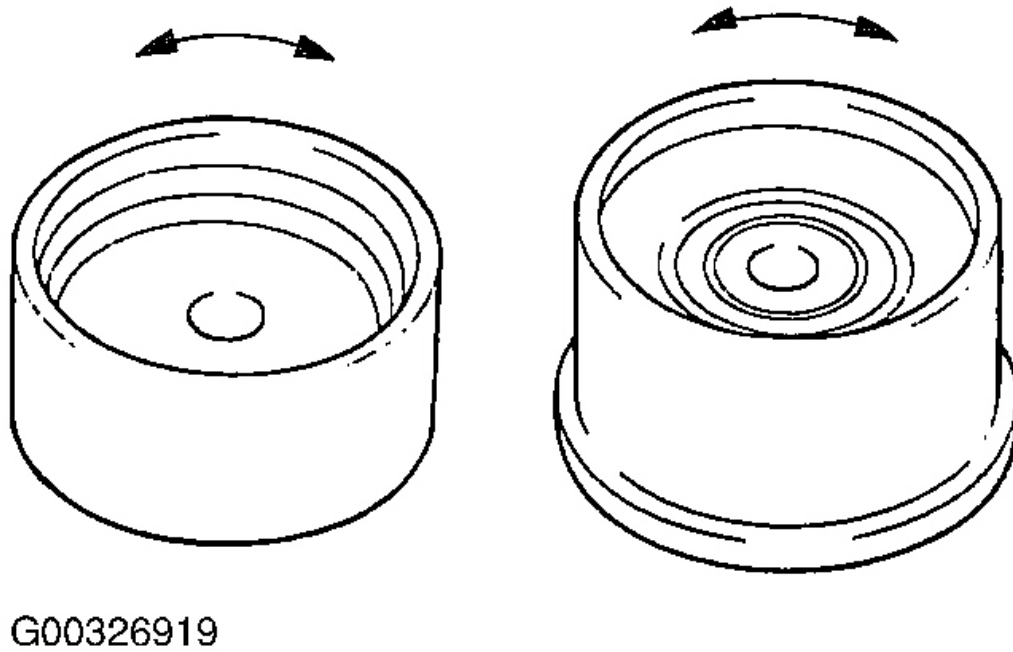
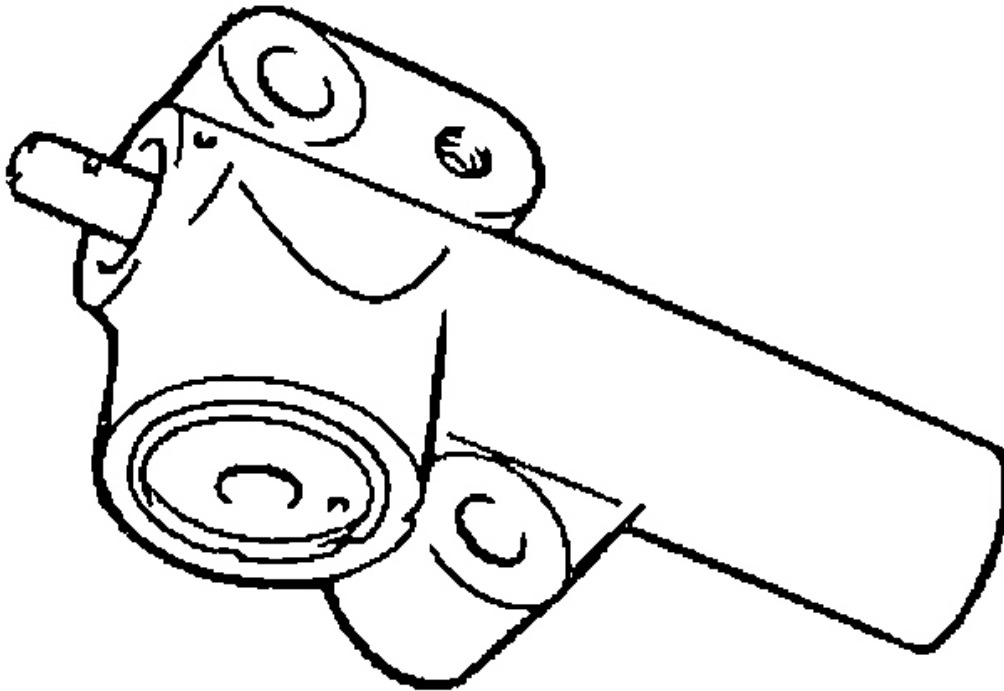


Fig. 205: Checking Tensioner Pulley & Idler Pulley
Courtesy of KIA MOTORS AMERICA, INC.

Auto Tensioner

1. Check the auto tensioner for leak and replace as necessary.
2. Check the rod end for wear or damage and replace as necessary.

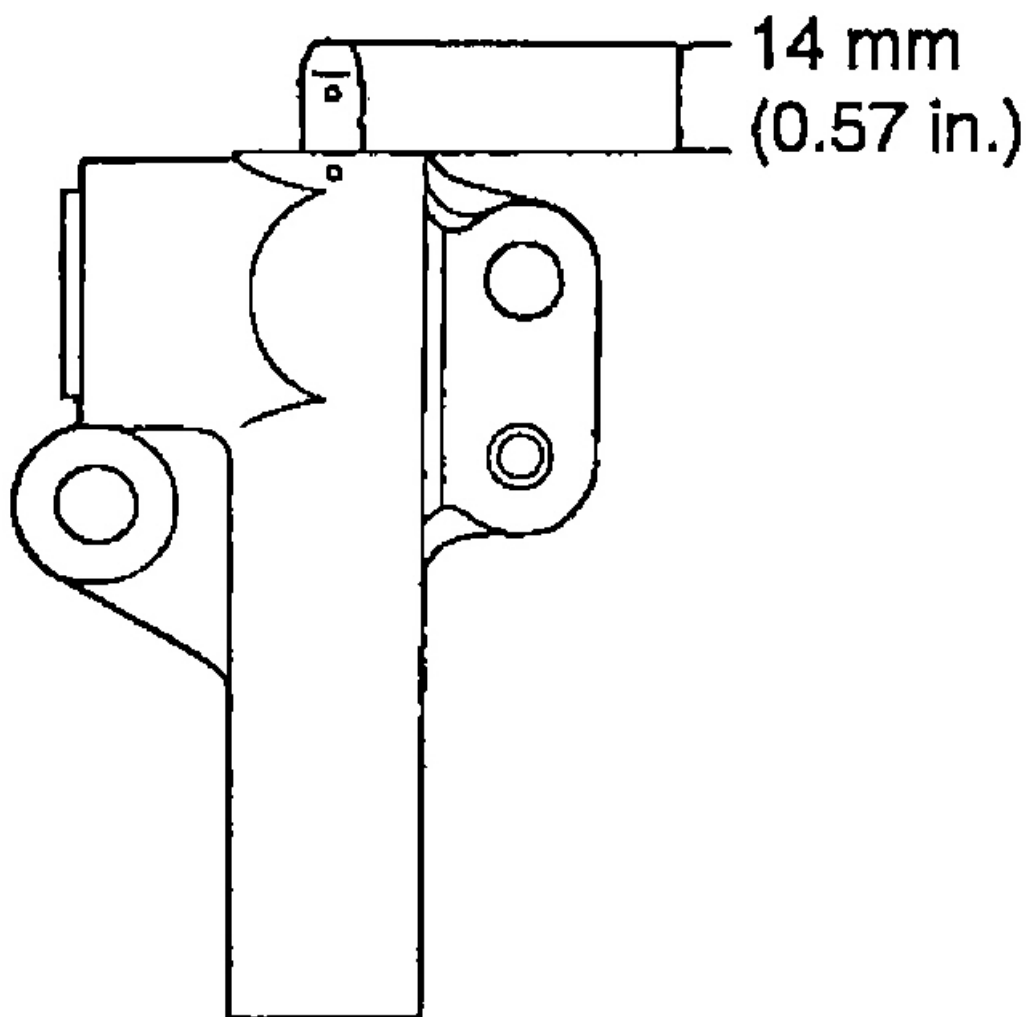


G00326920

Fig. 206: Checking Auto Tensioner (1 Of 3)
Courtesy of KIA MOTORS AMERICA, INC.

3. Measure the rod protrusion. If it is out of specification, replace the auto tensioner.

Standard value : 14.5 mm (0.57 in.)

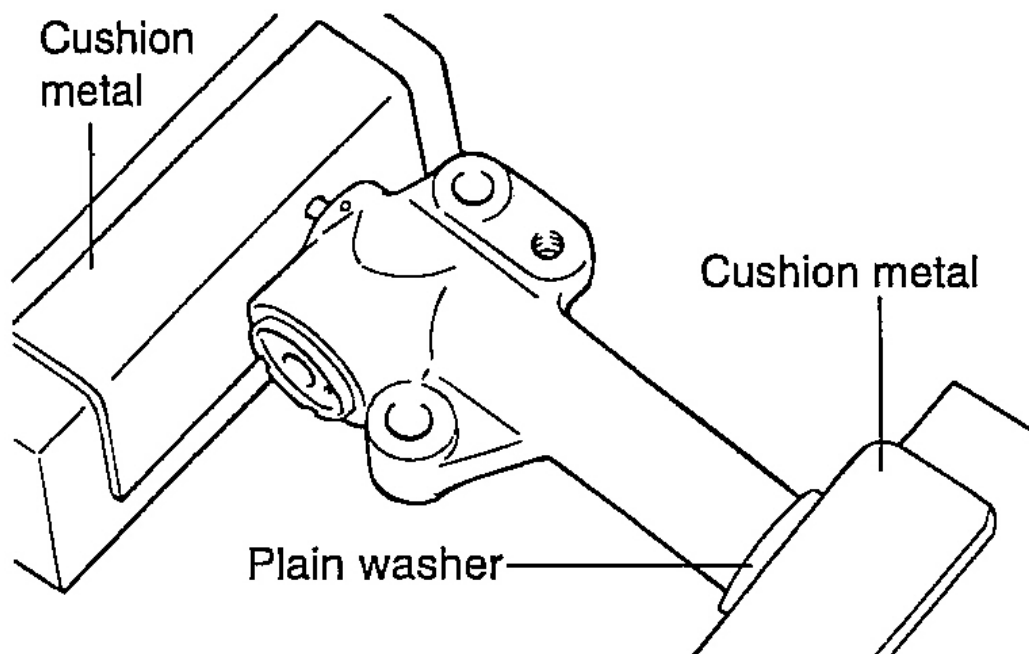


G00326921

Fig. 207: Checking Auto Tensioner (2 Of 3)
Courtesy of KIA MOTORS AMERICA, INC.

4. Using a soft-jawed vise push in the auto tensioner rod. If the rod can be easily retracted, replace the auto tensioner. You should feel a great deal of resistance when pushing the rod in.

CAUTION: Clamp the auto tensioner in the vise so that it can be level. Use soft jaws in the vise to avoid damaging the auto tensioner.



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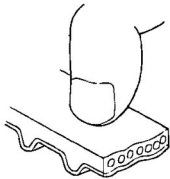
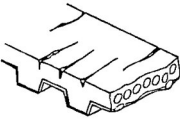
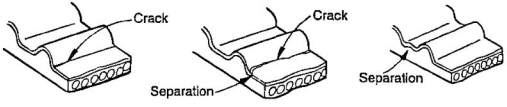
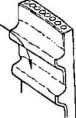
Fig. 208: Checking Auto Tensioner (3 Of 3)
Courtesy of KIA MOTORS AMERICA, INC.

TIMING BELT

1. Check the belt for oil or dust deposits. Replace if necessary. Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.
2. When the engine is overhauled or belt tension adjusted, check the belt in detail. If the following flaws are evident, replace the belt with a new one.

2004 Kia Optima EX

2004-05 ENGINES 2.4L 4 Cylinder - Optima & Magentis (Canadian)

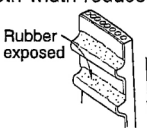
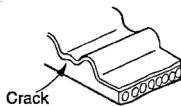
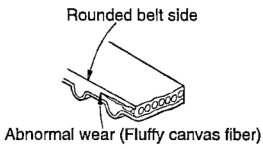
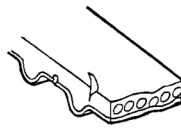
Description	Flaw conditions
Hardened back surface rubber	Back surface glossy. Non-elastic and so hard that when a finger nail is forced into it, no mark is produced. 
Cracked back surface rubber	
Cracked or separating canvas	
Badly worn teeth (initial stage)	Canvas on load side tooth flank worn (Fluffy canvas fibers, rubber gone and color changed to white, and unclear canvas texture) Flak worn (On load side) 

G00326924

Fig. 209: Timing Belt Inspection Chart (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

2004 Kia Optima EX

2004-05 ENGINES 2.4L 4 Cylinder - Optima & Magentis (Canadian)

Description	Flaw conditions
Badly worn teeth (last stage)	Canvas on load side tooth flank worn down and rubber exposed (tooth width reduced) 
Cracked tooth bottom	
Missing tooth	Tooth missing and canvas fiber exposed 
Side of belt badly worn	NOTE Normal belt should have precisely cut sides as if produced by a sharp knife. 
Side of belt cracked	

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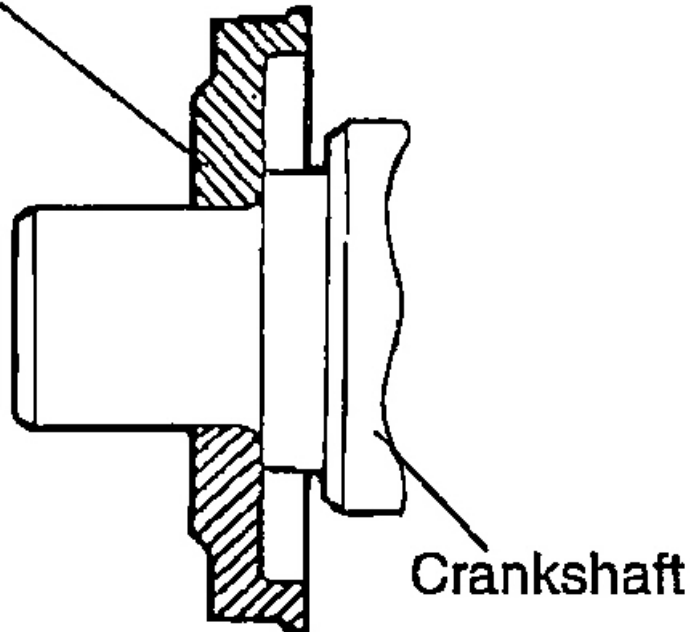
Fig. 210: Timing Belt Inspection Chart (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Install crankshaft sprocket "B" into crankshaft.

CAUTION: Pay special attention to the direction of the flange. If it is installed in the wrong direction, a broken belt could result.

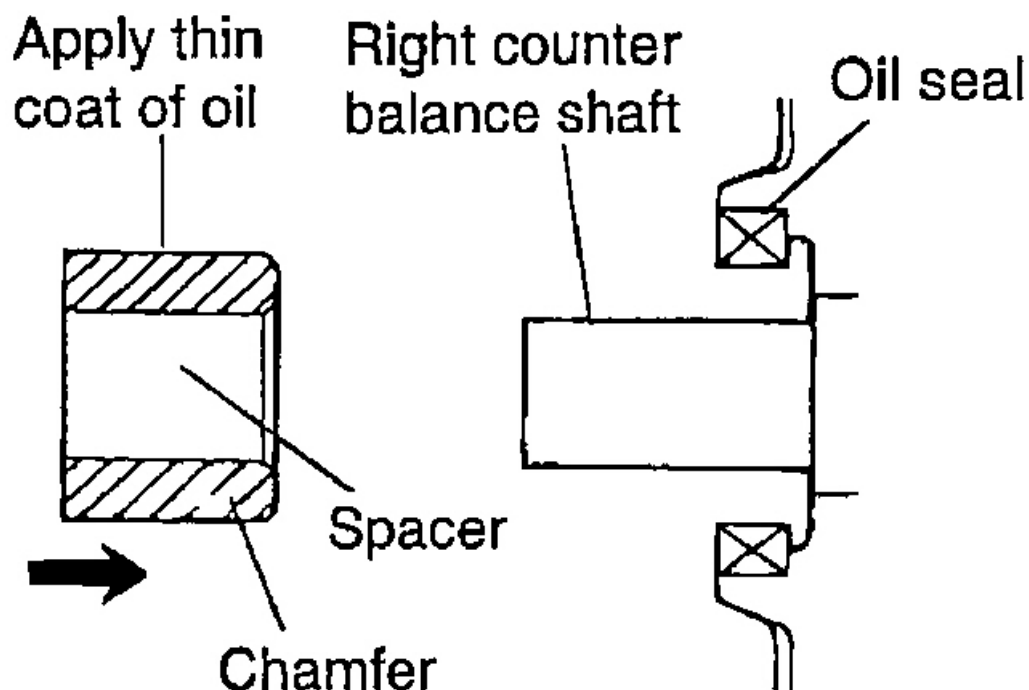
Crankshaft sprocket "B"



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Fig. 211: Installing Crankshaft Sprocket "B"
Courtesy of KIA MOTORS AMERICA, INC.

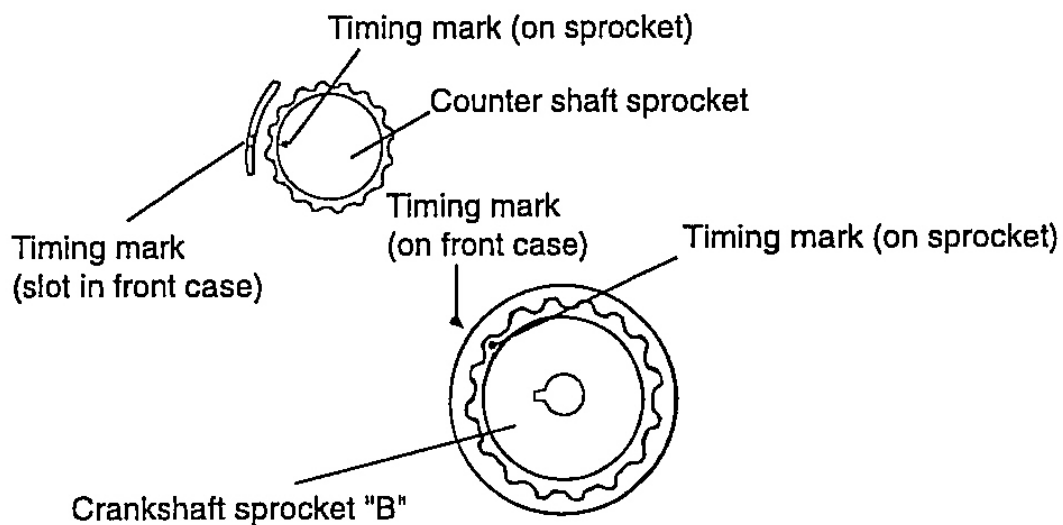
2. Lightly apply engine oil to the outer surface of spacer, and then install the spacer to the right counter balance shaft. Be sure to install in the direction as shown in illustration.



G00326927

Fig. 212: Installing Spacer To Right Counter Balance Shaft
Courtesy of KIA MOTORS AMERICA, INC.

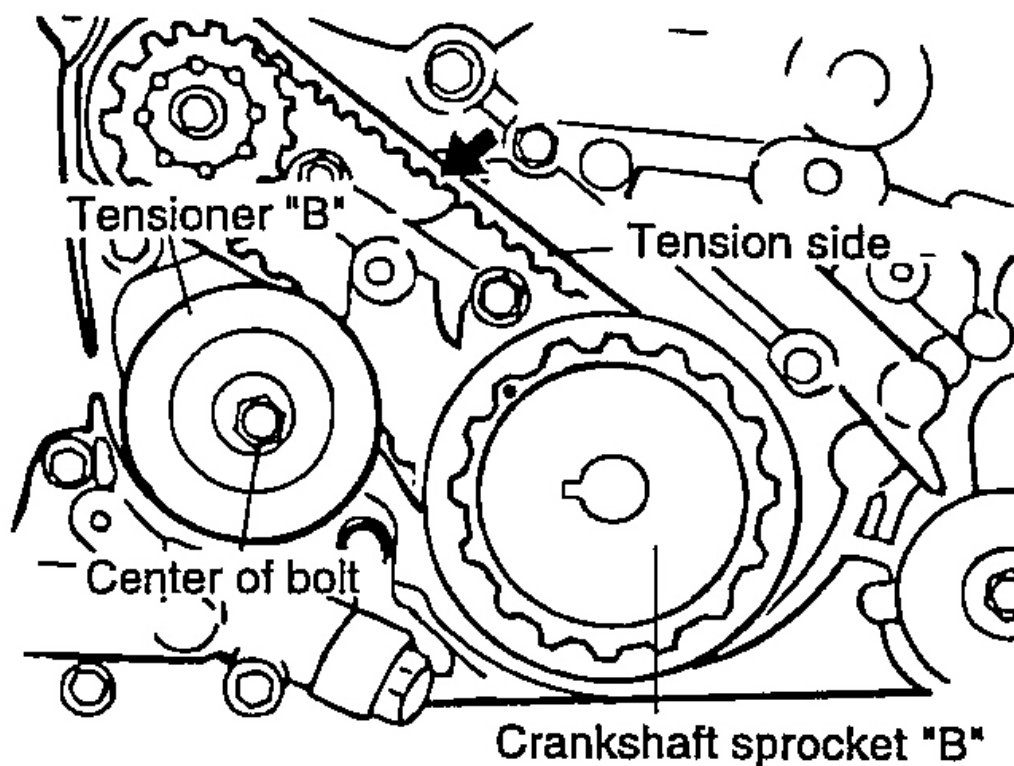
3. Install the counter balance shaft sprocket onto the right counter balance shaft, and then tighten flange bolt finger tight.
4. Align the timing mark on each sprocket with the corresponding timing mark on the front case.



G00326928

Fig. 213: Locating Timing Marks Of Timing Belt
Courtesy of KIA MOTORS AMERICA, INC.

5. When the timing belt "B" is installed, make certain that tension side has no slack. Install tensioner "B" with center of pulley located on the left side of mounting bolt.

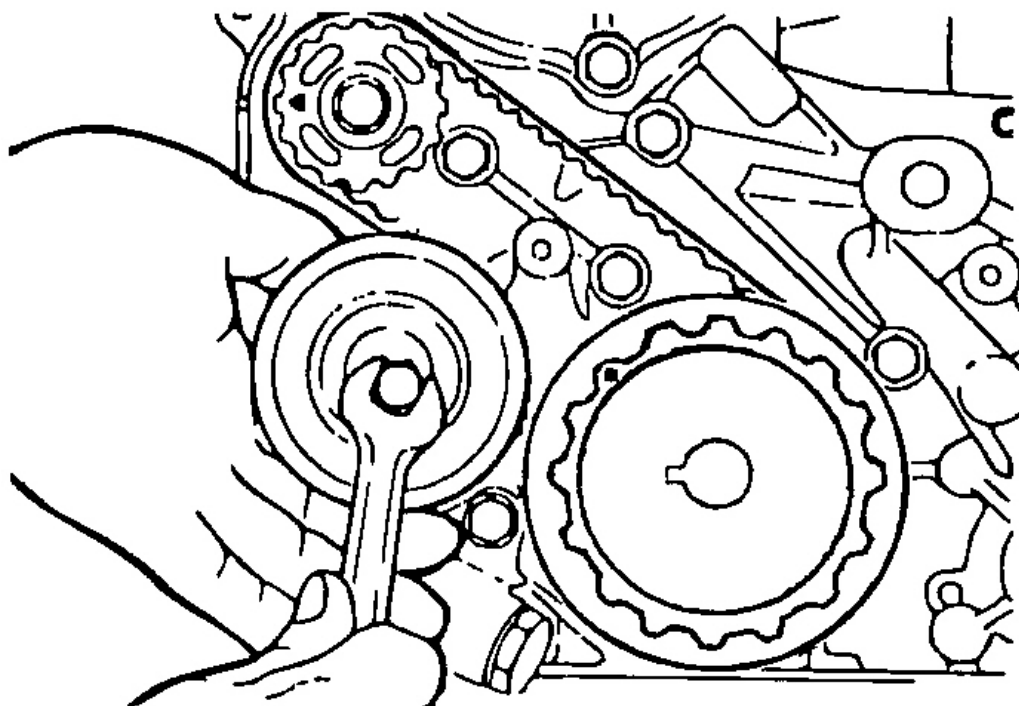


G00326929

Fig. 214: Checking & Adjusting Tension Of Timing Belt (1 Of 2)

Courtesy of KIA MOTORS AMERICA, INC.

6. Lift tensioner "B" to tighten the timing belt "B" so that its tension side will be pulled tight. In this condition, tighten a bolt to secure tensioner "B". When a bolt is tightened, be careful to prevent from turning shaft. If the shaft is turned together, the belt will be overtightened.

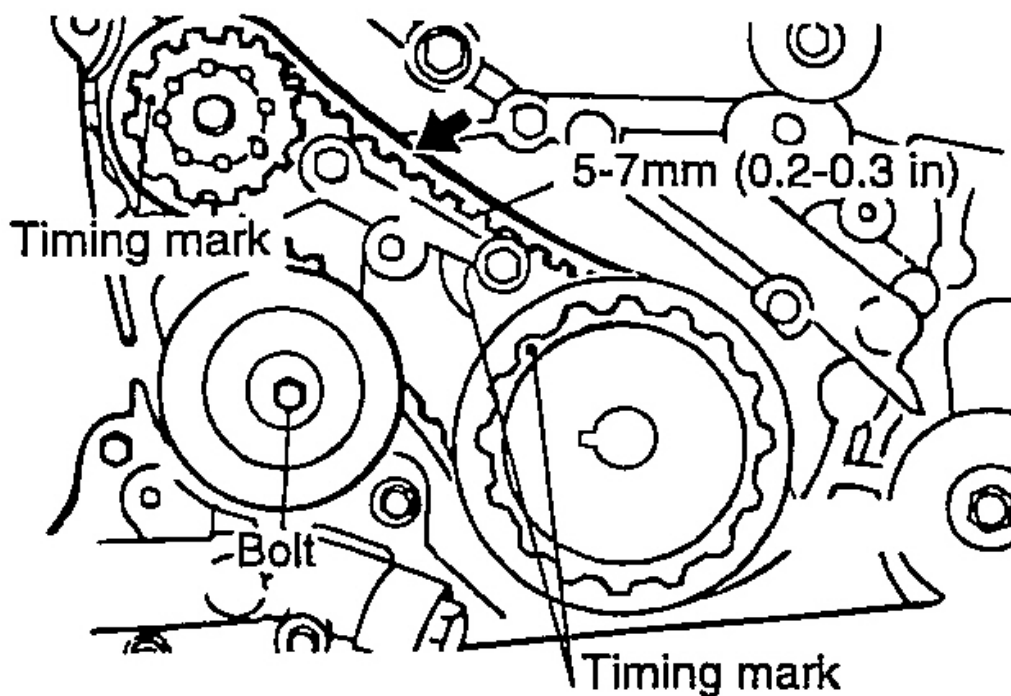


G00326930

Fig. 215: Checking & Adjusting Tension Of Timing Belt (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

7. Check to ensure that timing marks are in alignment.
8. Check to ensure that when the center of span on the tension side is depressed with index finger in direction of arrow, deflection of belt is within specification.

Belt deflection: 5-7 mm (0.2-0.3 in.)

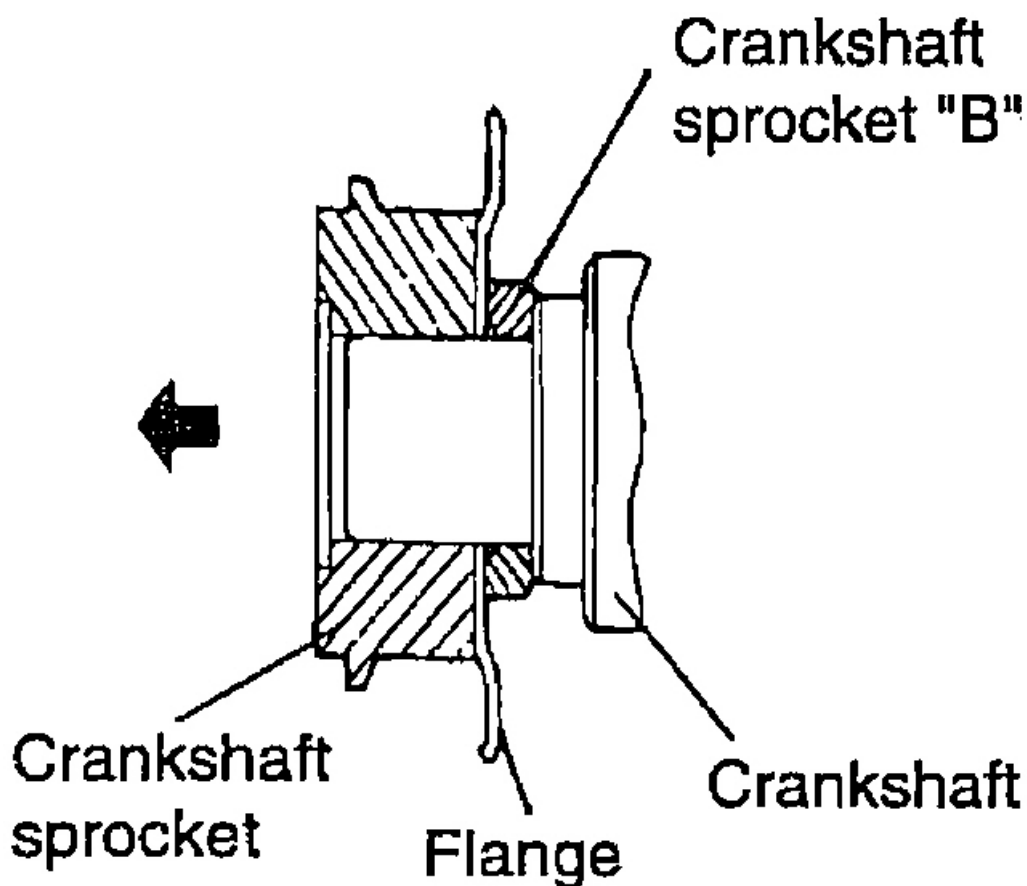


G00326931

Fig. 216: Checking Timing Belt Tension "B" Deflection
Courtesy of KIA MOTORS AMERICA, INC.

9. Install sensing blade and crankshaft sprocket onto crankshaft. Be sure to install in the direction as shown in illustration.

CAUTION: Pay attention to direction of flange. If it is installed in wrong direction, a broken belt could result.



G00326932

Fig. 217: Installing Crankshaft Sprocket
Courtesy of KIA MOTORS AMERICA, INC.

10. Install the special washer and sprocket bolt to crankshaft, and then tighten the sprocket bolt.

Tightening torque

Crankshaft sprocket bolt :

110-130 Nm (1100-1300 kg.cm, 80-94 lb.ft)

11. Insert a screwdriver through the plug hole in left side of cylinder block to keep shaft in position.

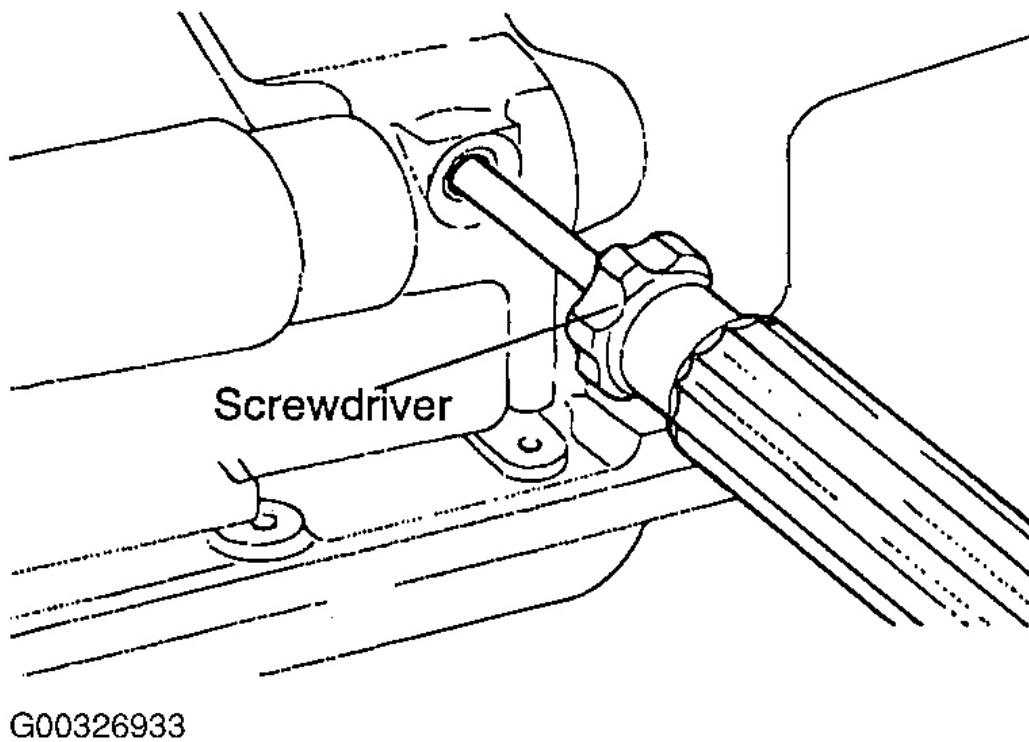
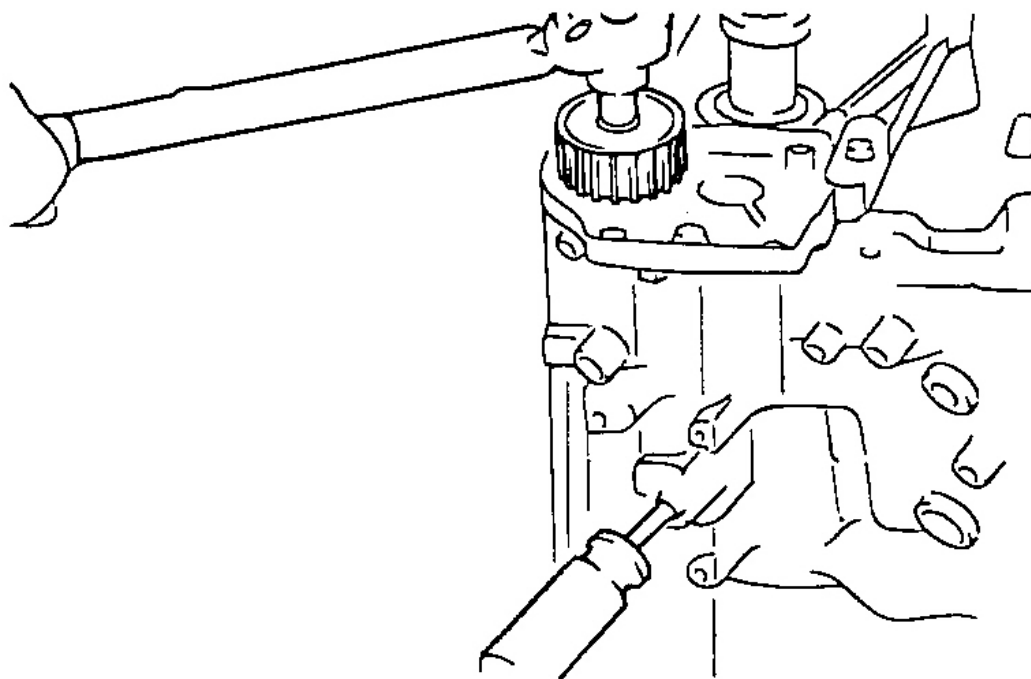


Fig. 218: Installing Screwdriver In Plug Hole To Hold Shaft In Position
Courtesy of KIA MOTORS AMERICA, INC.

12. Install the oil pump sprocket, and tighten the nut to the specified torque.



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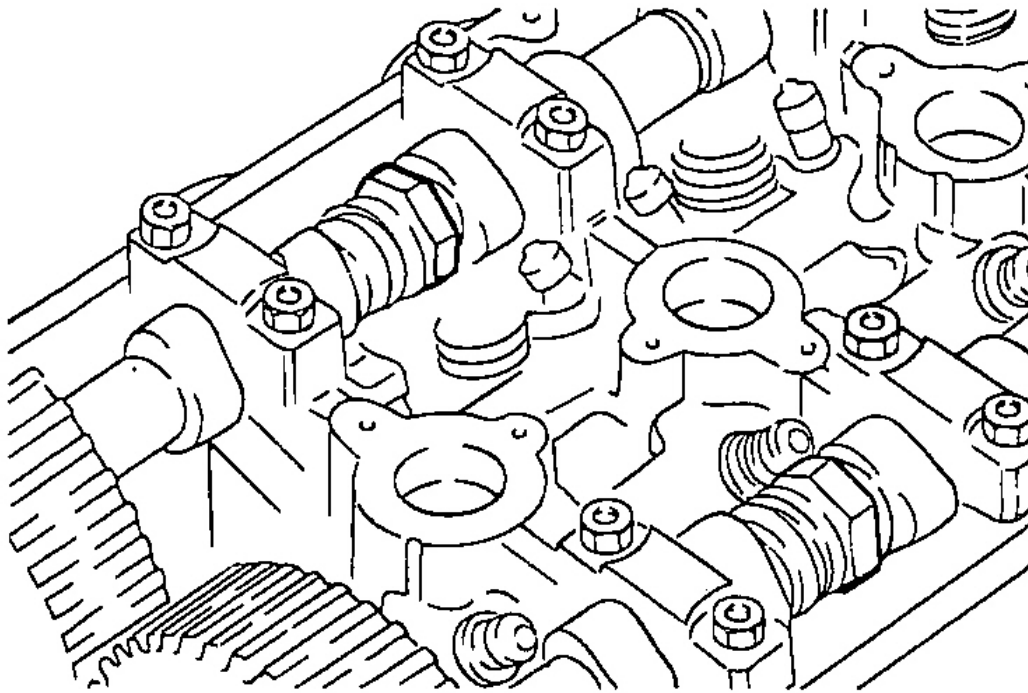
Fig. 219: Installing Oil Pump Sprocket
Courtesy of KIA MOTORS AMERICA, INC.

13. Install the camshaft sprocket and tighten the bolt to the specified torque.

Tightening torque

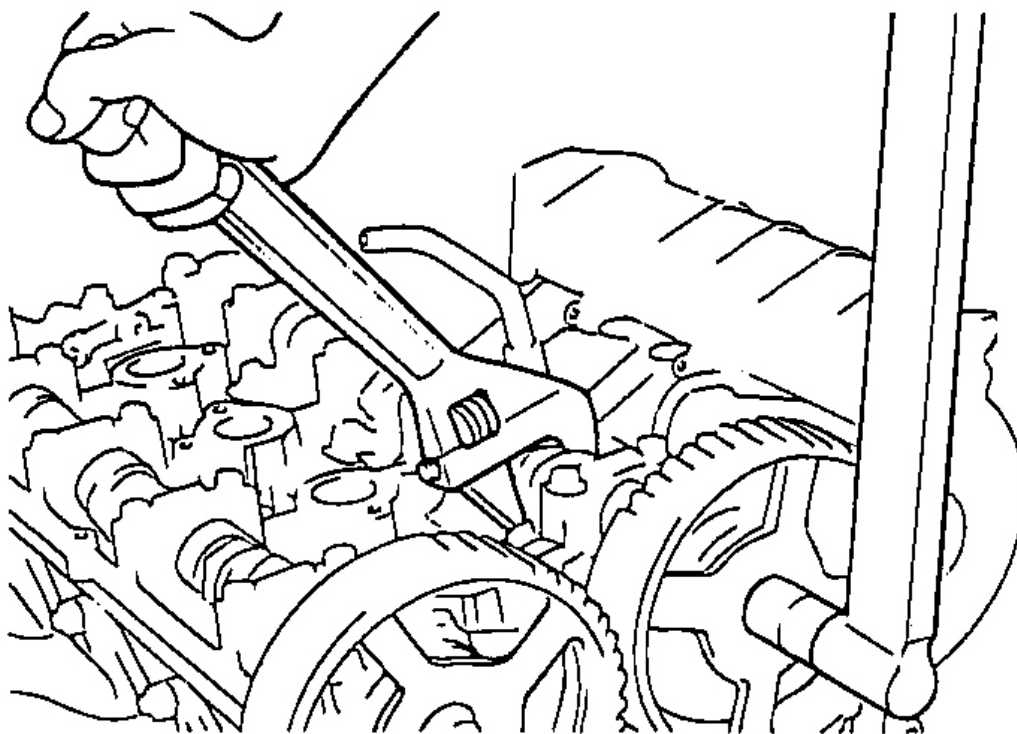
Camshaft sprocket bolt :

80-100 Nm (800-1000 kg.cm, 56-72 lb.ft)



G00326935

Fig. 220: Installing Camshaft Sprocket (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.



G00326936

Fig. 221: Installing Camshaft Sprocket (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

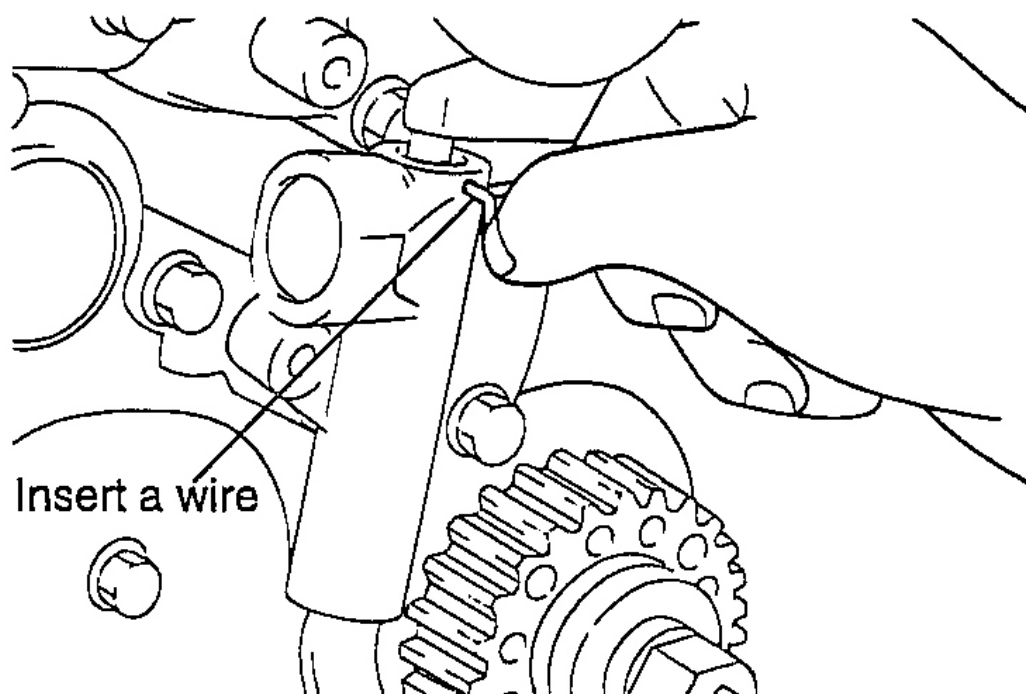
14. Install the auto tensioner.

CAUTION: Leave the set pin installed in the auto tensioner

Tightening torque

Auto tensioner bolt :

19.6-26.5 Nm (2.0-2.7 kg.cm, 145-19.5 lb.ft)



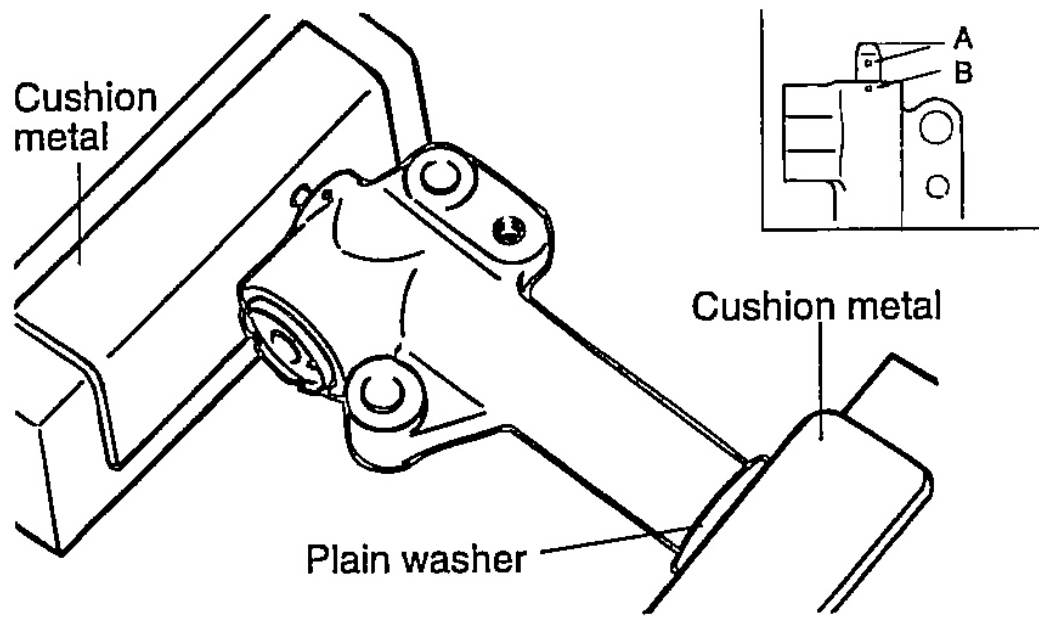
G00326937

Fig. 222: Installing Auto Tensioner

Courtesy of KIA MOTORS AMERICA, INC.

NOTE: If the auto tensioner rod is in its fully extended position, reset it as follows.

- Clamp it in the vise with soft jaws in a level position. Apply a plain washer if there is a plug at the bottom of the auto tensioner.
- Push in the rod slowly with the vise until the set hole A in the rod is aligned with the set hole B in the cylinder.
- Insert a wire to the set hole A and B.



G00326938

Fig. 223: Resetting Auto Tensioner For Installation
Courtesy of KIA MOTORS AMERICA, INC.

15. Install the tensioner pulley onto the tensioner arm.

CAUTION: Leave the wire installed in the auto tensioner.

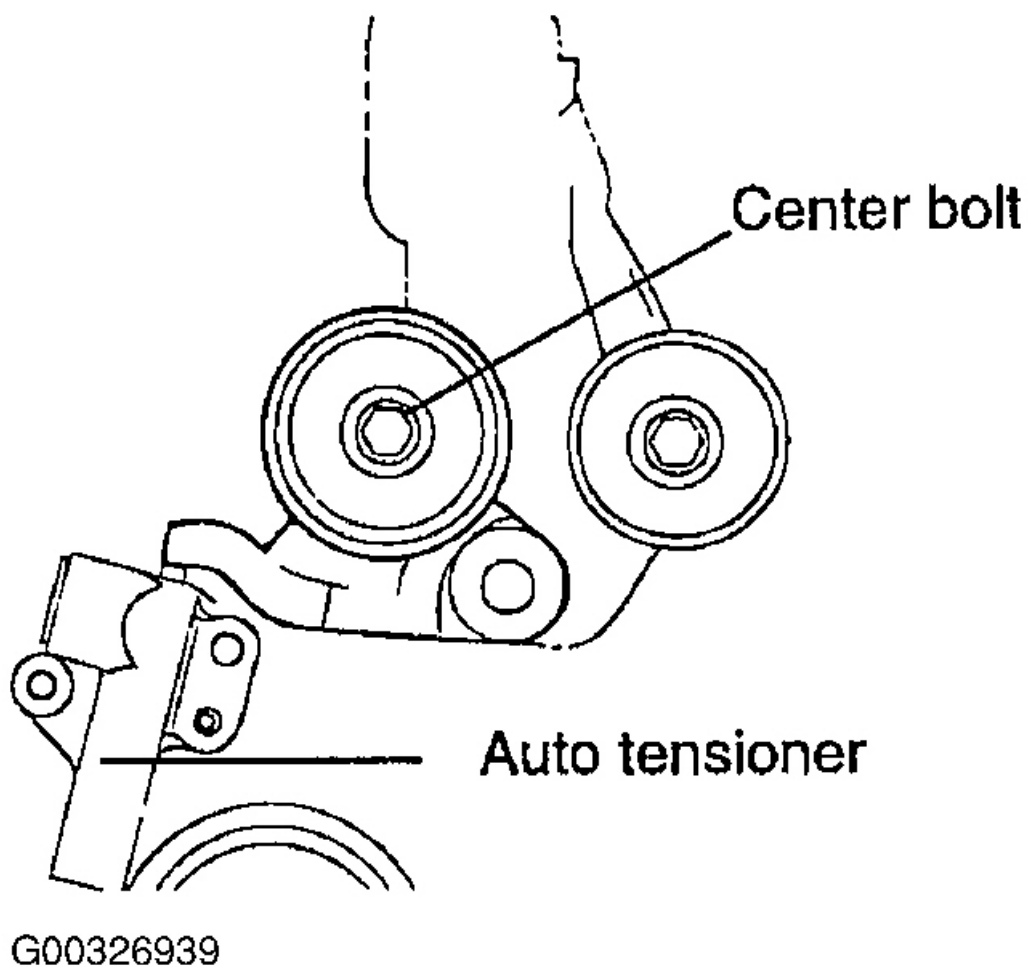
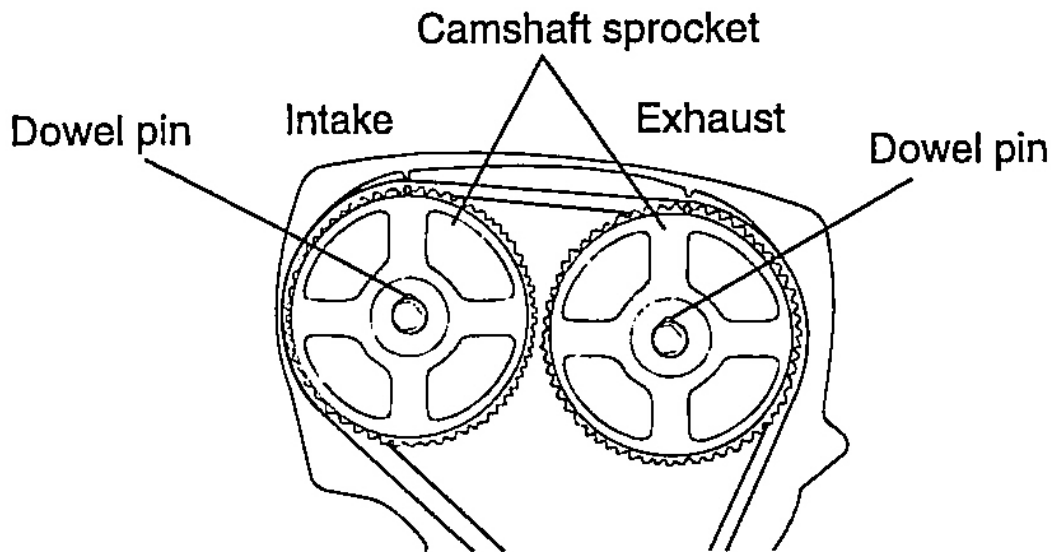


Fig. 224: Installing Tensioner Pulley

Courtesy of KIA MOTORS AMERICA, INC.

16. Align the timing marks of the camshaft sprocket to the timing marks of the rocker cover. The dowel pin of the camshaft sprocket should be at the upper side.

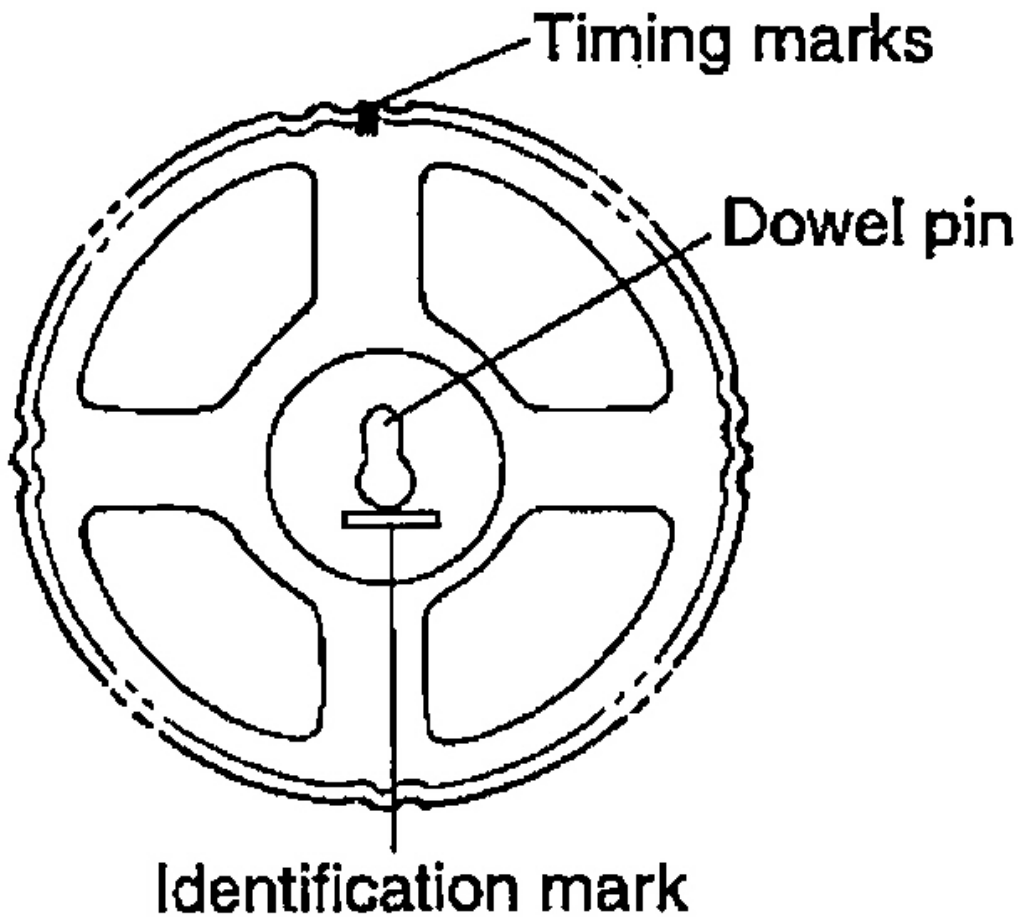


G00326940

Fig. 225: Identifying Camshaft Timing Marks (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

- The identification mark is on the camshaft sprocket.
- Before installing timing belt, if the timing marks of camshaft sprocket and rocker cover do not coincide, do not rotate the camshaft sprocket more than 2 teeth of sprocket in any direction. Rotating sprocket more than 2 teeth allows valve and piston to touch each other.
- In case of rotating the camshaft sprocket in avoidably more than 2 teeth, rotate the camshaft sprocket after rotating crankshaft sprocket counter clockwise on basis of timing mark.



G00326941

Fig. 226: Identifying Camshaft Timing Marks (2 Of 2)

Courtesy of KIA MOTORS AMERICA, INC.

17. Align the timing marks of each sprocket and install the timing belt in this order. Crankshaft sprocket-Oil pump sprocket-Idler pulley-Exhaust camshaft sprocket-Intake camshaft sprocket-Tensioner pulley.

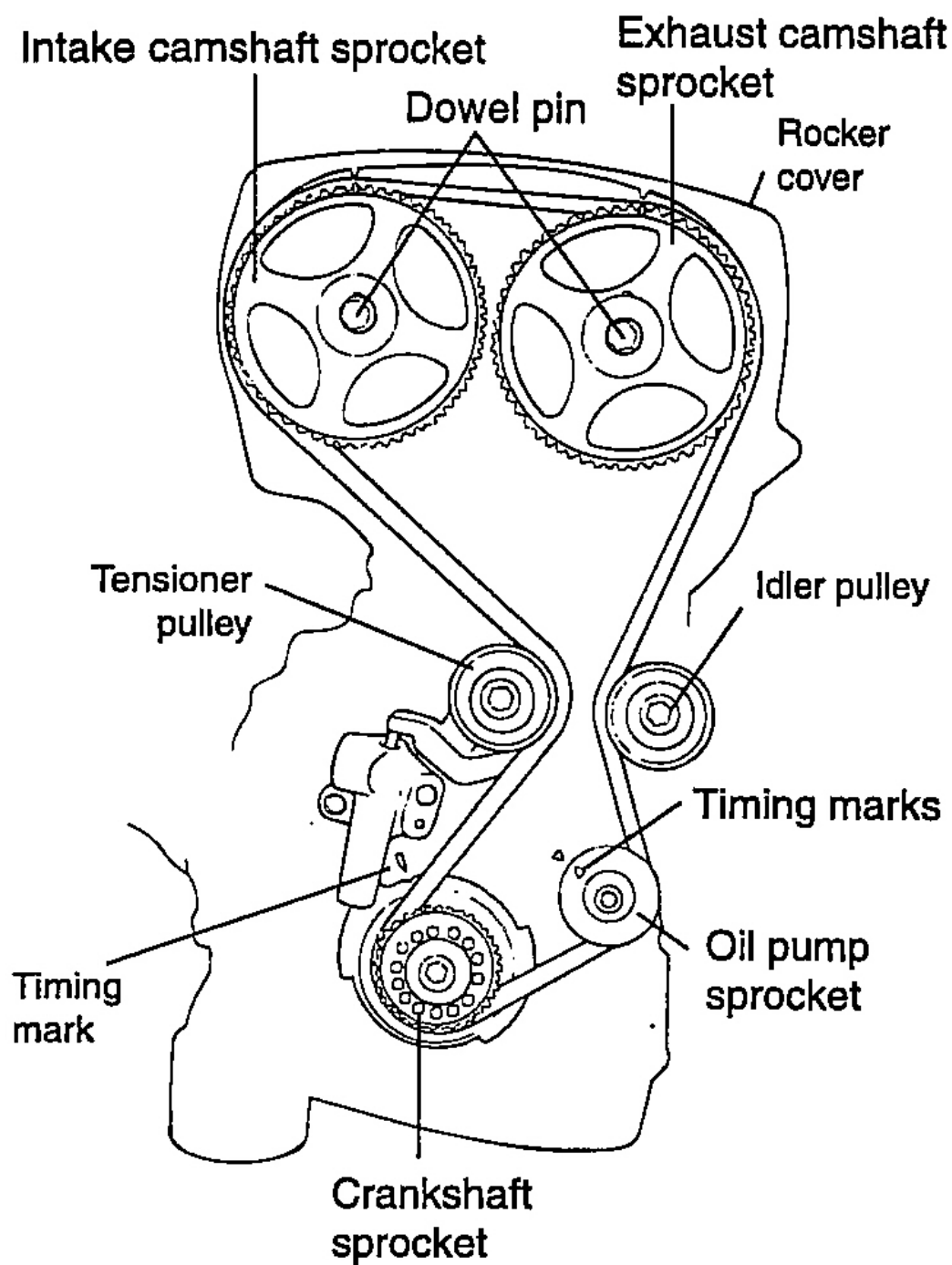
NOTE:

- In this step, No. 1 is in TDC (Compression stroke).
- When the timing mark of oil pump sprocket is aligned, first remove the plug at left side of the cylinder block and insert a screwdriver to check the left counter balance shaft in position. Screwdriver used for this purpose should have a shaft 8 mm (0.3 in) in diameter which can be inserted more than 60 mm (2.36 in).

2004 Kia Optima EX

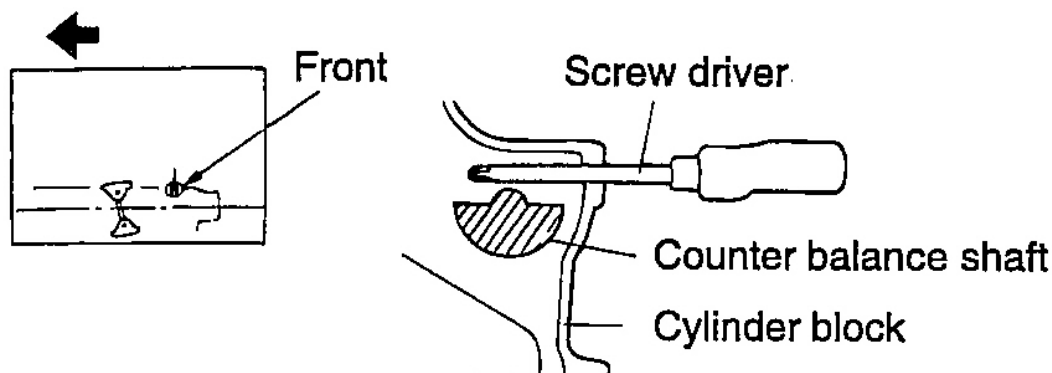
2004-05 ENGINES 2.4L 4 Cylinder - Optima & Magentis (Canadian)

- **Install the plug at left side of the cylinder block after check timing.**



G00326942

Fig. 227: Aligning Timing Marks
 Courtesy of KIA MOTORS AMERICA, INC.



G00326943

Fig. 228: Holding Counter Balance Shaft With Screwdriver

Courtesy of KIA MOTORS AMERICA, INC.

18. Remove the wire from the auto tensioner.
19. Rotate the crankshaft two complete turns clockwise and leave it as is for about 5 minutes. Then, measure the auto tensioner protrusion "A" (distance between the tensioner arm and auto tensioner body) to ensure that it is up to specification. If the protrusion exceeds specification, repeat step 14-18

Standard value : 5.5-9.0 mm (0.22-0.35 in.)

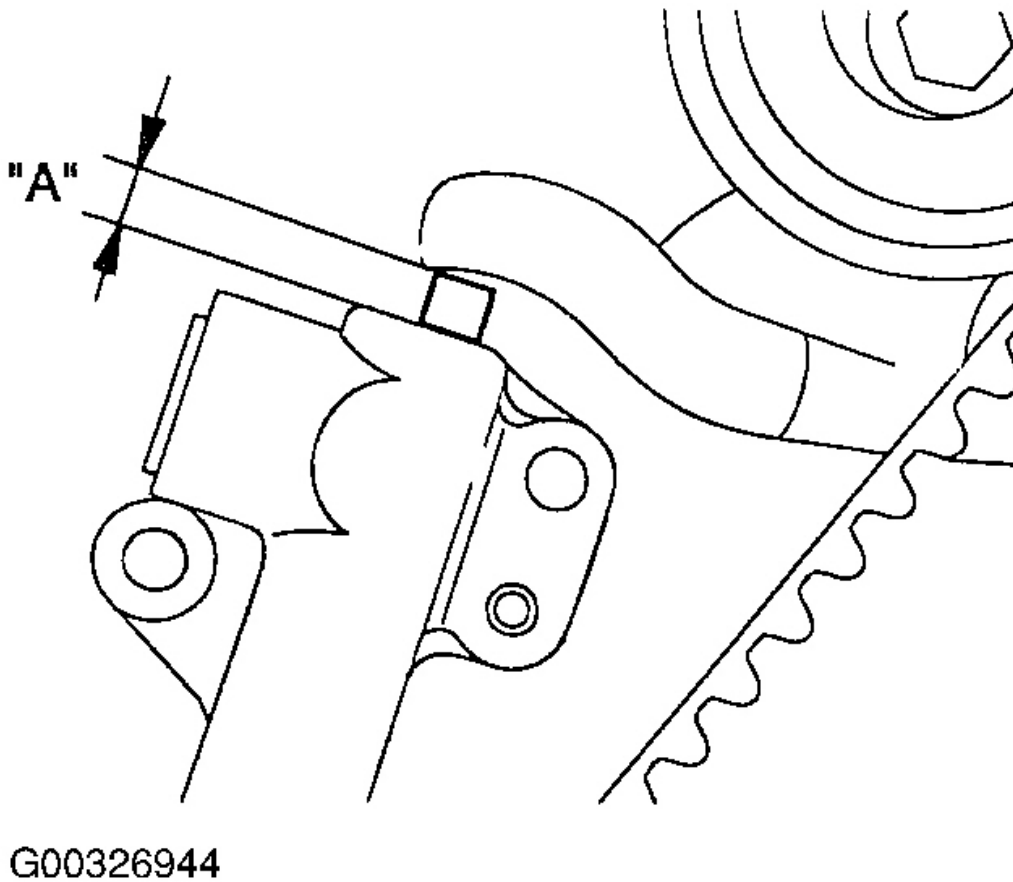
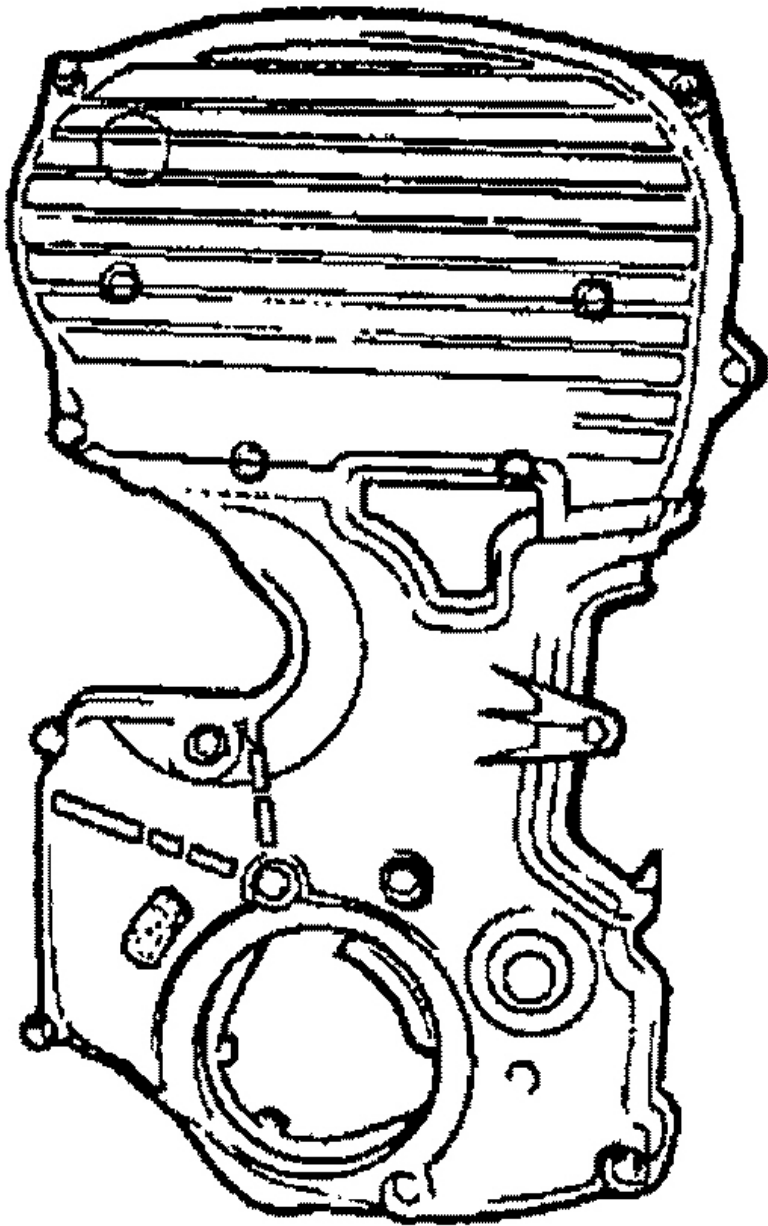


Fig. 229: Checking Auto Tensioner Protrusion
Courtesy of KIA MOTORS AMERICA, INC.

20. Install the timing belt lower cover and the timing belt upper cover.



G00326945

Fig. 230: Installing Timing Belt Upper & Lower Cover
Courtesy of KIA MOTORS AMERICA, INC.