

2010 ENGINE

General Information (Engine Mechanical System-G2.7 DOHC) - Sportage

GENERAL INFORMATION

SPECIFICATIONS

ENGINE MECHANICAL SYSTEM SPECIFICATIONS

Description	Specifications	Limit
General		
Type	V-type, DOHC	
Number of cylinder	6	
Bore	86.7mm (3.4133in.)	
Stroke	75mm (2.9528in.)	
Total displacement	2,656cc	
Compression ratio	10 : 1	
Firing order		
Valve timing	1-2-3-4-5-6	
Intake valve		
Opens (BTDC)	6°	
Closes (ABDC)	46°	
Exhaust valve		
Opens (BBDC)	38°	
Closes (ATDC)	14°	
Camshaft		
Drive mechanism	Cogged type belt	
Cam height		
Intake	43.95 ~ 44.15mm (1.7303 ~ 1.7382in.)	43.45mm (1.7106in.)
Exhaust	43.95 ~ 44.15mm (1.7303 ~ 1.7382in.)	43.45mm (1.7106in.)
Journal diameter	25.964 ~ 25.980mm (1.0222 ~ 1.0228in.)	25.914mm (1.0202in.)
Bearing oil clearance	0.02 ~ 0.061mm (0.0007 ~ 0.0024in.)	0.1mm (0.0039in.)
End play	0.1 ~ 0.15mm (0.0039 ~ 0.0059in.)	
Cylinder head		
Flatness of cylinder head surface	Max. 0.03mm (0.0012in.)	0.05mm (0.0020in.)
Flatness of manifold mounting surface		
Intake	Max. 0.15mm (0.0059in.)	0.15mm (0.0059in.)
Exhaust		

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Valve guides hole diameter	Max. 0.15mm (0.0059in.)	
0.05 (0.002) O.S.	11.05 ~ 11.068mm (0.435 ~ 0.436in.)	
0.25 (0.010) O.S.	11.25 ~ 11.268mm (0.443 ~ 0.444in.)	
0.50 (0.020) O.S.	11.50 ~ 11.518mm (0.453 ~ 0.453in.)	0.15mm (0.0059in.)
Intake valve seat ring hole diameter		
0.3 (0.012) O.S.	33.300 ~ 33.325mm (1.311 ~ 1.312in.)	
Exhaust valve seat ring hole diameter		
0.3 (0.012) O.S.	28.600 ~ 28.621mm (1.126 ~ 1.127in.)	
Valve		
Overall length		
Intake	96.1mm (3.783in.)	
Exhaust	97.15mm (3.825in.)	
Stem diameter		
Intake	5.965 ~ 5.98mm (0.235 ~ 0.2354in.)	
Exhaust	5.95 ~ 5.965mm (0.234 ~ 0.235in.)	
Face angle	45° ~ 45.5°	
Margin		
Intake	1.0mm (0.0394in.)	0.5mm (0.0197in.)
Exhaust		
Clearance (Stem-to-guide)	1.3mm (0.0512in.)	0.8mm (0.0315in.)
Intake	0.02 ~ 0.05mm (0.008 ~ 0.0020in.)	0.10mm (0.0039in.)
Exhaust	0.030 ~ 0.065mm (0.0012 ~ 0.0026in.)	0.13mm (0.0051in.)
Valve spring		
Free length	42.5mm (1.6732in.)	41.5mm (1.6339in.)
Load	21kg/35mm (48.4lb/1.3780in.)	21.9kg/34mm (48.4lb/1.3386in.)
Out of squareness	Max. 1.5°	Max. 3°
Piston		
Diameter (Standard)	86.68 ~ 86.71mm (3.413 ~ 3.414in.)	
Clearance (Piston-to-cylinder)	0.01 ~ 0.03mm (0.0004 ~ 0.0012in.)	
Ring groove width		
No. 1	1.230 ~ 1.250mm (0.0484 ~ 0.0492in.)	

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No. 2	1.220 ~ 1.250mm (0.0480 ~ 0.0488in.)	
Oil	2.515 ~ 2.535mm (0.0990 ~ 0.0998in.)	
Piston for service	0.25mm (0.010in.), 0.50mm (0.020in.)	
Piston ring		
Number of rings per piston	3	
Compression ring	2	
Oil ring	1	
Compression ring type		
No. 1	Inner bevel type	
No. 2	Under cut type	
Oil ring type	3-piece type	
Ring end gap		
No. 1	0.20 ~ 0.35mm (0.0079 ~ 0.0138in.)	0.8mm (0.031in.)
No. 2	0.37 ~ 0.52mm (0.0146 ~ 0.0205in.)	0.8mm (0.031in.)
Oil ring side rail		
Ring side clearance	0.2 ~ 0.7mm (0.0079 ~ 0.0276in.)	1.0mm (0.039in.)
No. 1	0.04 ~ 0.08mm (0.0016 ~ 0.0031in.)	0.1mm (0.004in.)
No. 2	0.03 ~ 0.07mm (0.0012 ~ 0.0028in.)	
Rings for service	0.25mm (0.010in.), 0.50mm (0.020in.)	0.1mm (0.004in.)
Connecting rod		
Piston pin installation force	2,450 ~ 12,225N (250 ~ 1,250kg, 551 ~ 2,755lb)	
Side clearance (big end)	0.10 ~ 0.25mm (0.0039 ~ 0.0098in.)	0.4mm (0.016in.)
Bend	0.05mm or less/100mm (0.0020in. or less/3.937in.)	
Bearing oil clearance	0.018 ~ 0.036mm (0.0007 ~ 0.0014in.)	0.1mm (0.004in.)
Crankshaft		
Journal O.D.	61.982 ~ 62.000mm (2.4402 ~ 2.4409in.)	
Pin O.D.	47.982 ~ 48.000mm (1.8891 ~ 1.8898in.)	
Out-of-round, taper of journal and pin	Max. 0.003mm (0.0012in.)	
Taper of journal and	Max. 0.005mm (0.00020in.)	

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pin		
End play	0.070 ~ 0.250mm (0.0028 ~ 0.0098in.)	0.4mm (0.016in.)
Main bearing of clearance	0.004 ~ 0.022mm (0.0002 ~ 0.0009in.)	0.1mm (0.004in.)
Cylinder block		
Cylinder bore	86.7mm (3.4134in.)	
Flatness of gasket surface	Max. 0.03mm (0.0012in.)	
Out-of-round of cylinder bore	Max. 0.02mm (0.0008in.)	0.05mm (0.002in.)
Engine oil		
Oil quantity		
Total	4.8L (5.07US qt, 4.22imp qt)	When replacing a short engine or a block assembly
Oil pan	4.2L (4.44US qt, 3.70imp qt)	Including oil filter
Drain and refill		If not available, refer to SELECTION OF ENGINE OIL for the recommended API or ILSAC classification and SAE viscosity number.
Oil grade	4.5L (4.76US qt, 3.96imp qt)	Satisfy the requirement of the API or ILSAC classification.
Recommendation	5W-20/GF4&SM	Refer to the " LUBRICATION SYSTEM "
Classification	API SL, SM or above, ILSAC GF3, GF4 or above	
SAE viscosity grade	Recommended SAE viscosity number	Oil temperature in oil pan:
Oil pressure (at 800 RPM)	98kPa (1.0kg/cm ² , 14.2psi) or above	95±5°C (203±41°F)
Oil pump		
Body clearance	0.100 ~ 0.181mm (0.0039 ~ 0.0071in.)	
Side clearance	0.040 ~ 0.095mm (0.0016 ~ 0.0037in.)	
Relief spring		
Free height	43.8mm (1.724in.)	
Load	4.6kg/39.3mm (10lb/1.548in.)	
Oil filter		
Type	Cartridge, full flow	
Engine oil pressure	50kPa (7.3psi) or more [Conditions : Oil temperature is 75 to 90°C (167 to 194°F)]	
Cooling method	Engine coolant cooling, forced circulation with electric fan	
Cooling system quantity	7.0lit (7.4U.S.qts., 6.1imp.qts)	

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Thermostat		
Type	Wax pellet type with jiggle valve	
Normal opening temperature	$82 \pm 2.0^{\circ}\text{C}$ ($179.6 \pm 3.6^{\circ}\text{F}$)	
Opening temperature range	$80 \sim 84^{\circ}\text{C}$ ($176 \sim 183.2^{\circ}\text{F}$)	
Wide open temperature	95°C (203°F)	
Radiator cap		
Main valve opening pressure	$107.9 \pm 14.7\text{kPa}$ ($1.1 \pm 0.15\text{kg/cm}^2$, $15.65 \pm 2.13\text{psi}$)	
Main valve closing pressure	83.4kPa (0.85kg/cm^2 , 12.1psi)	
Vacuum valve opening pressure	-6.86kPa (-0.07kg/cm^2 , -1.00psi)	
Air cleaner		
Type	Dry	
Element	Paper type	
Exhaust pipe		
Muffler	Expansion resonant type	
Suspend system	Rubber hangers	

SERVICE STANDARDS**SERVICE STANDARDS**

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

COOLANT**COOLANT SPECIFICATIONS**

Engine coolant	Ethlylen glycol base for aluminum radiator
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SEALANT**SEALANT SPECIFICATIONS**

Engine coolant temperature sensor	LOCTITE 262 or equivalent, Three bond No. 1324 or equivalent.
Oil pressure switch	3M ATD No. 8660 or Three bond No. 1141E
PCV valve	LOCTITE 242 or equivalent

TIGHTENING TORQUE

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TIGHTENING TORQUE SPECIFICATIONS

Item	N.m	kgf.cm	lb-ft
Camshaft sprocket bolt	90 ~ 110	900 ~ 1,100	65 ~ 85
Cylinder head cover bolt	8 ~ 10	80 ~ 100	5.8 ~ 7.2
Main bearing cap bolt			
M10	27~33 + (90°~94°)	270~300 + (90°~94°)	19.5~24 + (90°~94°)
M8	13~19 + (90°~94°)	130~190 + (90°~94°)	10~14 + (90°~94°)
Connecting rod bolt	16~20 + (90°~94°)	160~200 + (90°~94°)	12~15 + (90°~94°)
Cylinder head bolt (Cold engine)	25 + (58°~62°) + (43° ~47°)	250 + (58°~62°) + (43° ~47°)	18 + (58°~62°) + (43° ~47°)
Oil pan drain plug	35 ~ 45	350 ~ 450	25 ~ 33
Lower oil pan bolt	10 ~ 12	100 ~ 120	7 ~ 9
Upper oil pan bolt			
[10 x 38mm (0.937 x 1.4961in.)]	30 ~ 42	300 ~ 420	22 ~ 30
[8 x 22mm (0.3150 x 0.8661in.)]	19 ~ 28	190 ~ 280	14 ~ 20
[161.5mm (6.3582in.)]	5 ~ 7	50 ~ 70	4 ~ 5
[152.5mm (6.0039in.)]	5 ~ 7	50 ~ 70	4 ~ 5
Oil screen bolt	15 ~ 22	150 ~ 220	11 ~ 16
Oil pump case bolt	12 ~ 15	120 ~ 150	9 ~ 11
Oil relief valve plug	40 ~ 50	400 ~ 500	29 ~ 36
Oil pressure switch	15 ~ 22	150 ~ 220	11 ~ 16
Oil pressure cover screw	8 ~ 12	80 ~ 120	6 ~ 9
Oil filter	12 ~ 16	120 ~ 160	9 ~ 12
Drive plate and adapter	73 ~ 77	730 ~ 770	53 ~ 56
Air cleaner body installation bolt	8 ~ 12	80 ~ 120	6 ~ 9
Surge tank stay	15 ~ 20	150 ~ 200	11 ~ 14
Air intake surge tank to intake manifold (bolt)	15 ~ 20	150 ~ 200	11 ~ 14
Air intake surge tank to intake manifold (nut)	15 ~ 20	150 ~ 200	11 ~ 14
Intake manifold to cylinder head	19 ~ 21	190 ~ 210	14 ~ 15
Heat protector exhaust manifold	12 ~ 15	120 ~ 150	9 ~ 11
Exhaust manifold to cylinder head (Self-locking nut)	30 ~ 35	300 ~ 350	22 ~ 26
Oil level gauge guide to engine	12 ~ 15	120 ~ 150	9 ~ 11
Water outlet fitting bolt	17 ~ 20	170 ~ 200	12 ~ 14
Power steering oil pump bracket to cylinder head	17 ~ 26	170 ~ 260	12 ~ 19
Crank position sensor wheel screw	5 ~ 6	50 ~ 60	3.6 ~ 4.3
Engine mounting insulator bolt	50 ~ 65	500 ~ 650	36 ~ 47

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Engine mounting bracket nut	60 ~ 80	600 ~ 800	43 ~ 58
Engine mounting bracket bolt	60 ~ 80	600 ~ 800	43 ~ 58
Engine support bracket bolt	60 ~ 70	600 ~ 700	43 ~ 51
Front roll stopper bracket sub frame bolt	50 ~ 65	500 ~ 650	36 ~ 47
Front roll stopper insulator bolt and nut	50 ~ 65	500 ~ 650	36 ~ 47
Rear roll stopper bracket to sub frame	50 ~ 65	500 ~ 650	36 ~ 47
Rear roll stopper insulator bolt and nut	50 ~ 65	500 ~ 650	36 ~ 47
Transaxle mounting bracket bolt	50 ~ 65	500 ~ 650	36 ~ 47
Transaxle mounting insulator bolt	90 ~ 110	900 ~ 1,100	65 ~ 80
Fuel hose clamp to rear cylinder head assembly	12 ~ 15	120 ~ 150	9 ~ 11
Transaxle mounting plate	10 ~ 12	100 ~ 120	7 ~ 9
Rear plate	10 ~ 12	100 ~ 120	7 ~ 9
Oil seal case	10 ~ 12	100 ~ 120	7 ~ 9
Crankshaft pulley bolt	180 ~ 190	1,800 ~ 1,900	130 ~ 138
Timing belt cover bolt	10 ~ 12	100 ~ 12	7 ~ 9
Engine hanger bracket to engine	20 ~ 27	200 ~ 270	14 ~ 20
Alternator mounting bracket to engine	20 ~ 30	200 ~ 300	14 ~ 22
Alternator mounting nut (Engine front case side)	20 ~ 30	200 ~ 300	14 ~ 22
Alternator mounting bolt (Alternator mounting bracket side)	20 ~ 30	200 ~ 300	14 ~ 22
Starter to transmission (nut)	20 ~ 30	200 ~ 300	14 ~ 22
Starter to transmission (bolt)	27 ~ 34	270 ~ 340	20 ~ 25
Drive belt pulley bolt	35 ~ 55	350 ~ 550	25 ~ 40
Drive belt tensioner bolt	20 ~ 27	200 ~ 270	14 ~ 20
Engine coolant pump to cylinder block bolt (Head mark "7" mark)	15 ~ 22	150 ~ 200	11 ~ 16
Engine coolant temperature sensor	20 ~ 40	200 ~ 400	14 ~ 29
Engine coolant inlet fitting attaching bolt	17 ~ 20	170 ~ 200	12 ~ 14
Throttle body to surge tank bolt	15 ~ 20	150 ~ 200	11 ~ 14
Oxygen sensor to exhaust manifold	40 ~ 50	400 ~ 500	29 ~ 36
Front exhaust pipe to exhaust manifold nut	30 ~ 40	300 ~ 400	22 ~ 29
Front exhaust pipe to catalytic converter bolt	40 ~ 60	400 ~ 600	29 ~ 43
Catalytic converter to center exhaust pipe nut	40 ~ 60	400 ~ 600	29 ~ 43
Center exhaust pipe to main muffler nut	40 ~ 60	400 ~ 600	29 ~ 43
Main muffler hanger support bracket bolt	10 ~ 15	100 ~ 150	7 ~ 11
Delivery pipe installation bolt	10 ~ 15	100 ~ 150	7 ~ 11
Timing belt tensioner pulley bolt	43 ~ 55	430 ~ 550	31 ~ 40
Timing belt idler pulley bolt	50 ~ 60	500 ~ 600	36 ~ 43

Timing belt tensioner arm fixed bolt	35 ~ 55	350 ~ 550	25 ~ 40
Auto tensioner fixed bolt	20 ~ 27	200 ~ 270	14 ~ 20
Accelerator cable bracket	4 ~ 6	40 ~ 60	3 ~ 4
Spark plug	20 ~ 30	200 ~ 300	14 ~ 22

COMPRESSION

NOTE: If the there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. Warm up and stop engine

Allow the engine to warm up to normal operating temperature.

2. Remove ignition coils. (See **IGNITION**)
3. Remove spark plugs.

Using a 16mm plug wrench, remove the 6 spark plugs.

4. Check cylinder compression pressure
 - A. Insert a compression gauge into the spark plug hole.

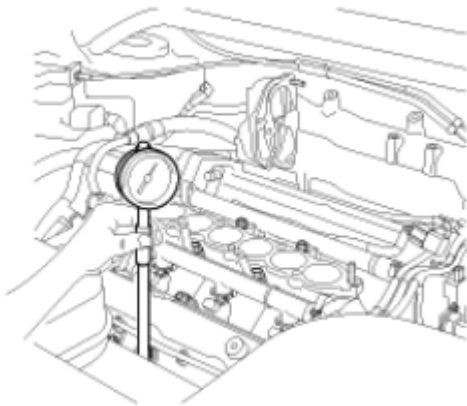


Fig. 1: Checking Cylinder Compression Pressure
Courtesy of KIA MOTORS AMERICA, INC.

- B. While cranking the engine, measure the compression pressure.

NOTE: Always use a fully charged battery to obtain engine speed of 250 RPM or more.

- C. Repeat steps (A) through (B) for each cylinder.

NOTE: This measurement must be done in as short a time as possible.

Compression pressure:

1,420kPa (14.5kgf/cm² , 206 psi)

Minimum pressure:

1,270kPa (13kgf/cm² , 184psi)

Difference between each cylinder:

100kPa (1.0kgf/cm² , 15psi) or less

D. If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (A) through (B) for cylinders with low compression.

- If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
- If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.

5. Reinstall spark plugs. (See **REPLACEMENT**)

6. Install ignition coils. (See **IGNITION**)

TROUBLESHOOTING

TROUBLESHOOTING CHART

Symptom	Suspect area	Remedy (See)
Engine misfire with abnormal internal lower engine noises.	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
	Worn piston rings (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression. Repair or replace as required.
	Worn crankshaft thrust bearings	Replace the crankshaft and bearings as required
Engine misfire with abnormal valve train noise.	Stuck valves. (Carbon buildup on the valve stem)	Repair or replace as required
	Excessive worn or mis-aligned timing chain	Replace the timing chain and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and valve lifters.
Engine misfire with coolant consumption	• Faulty cylinder head gasket and/or cranking or other damage to the cylinder head and engine block cooling system. • Coolant consumption may or may not	• Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket.

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	cause the engine to overheat.	• Repair or replace as required.
Engine misfire with excessive oil consumption	Worn valves, guides and/or valve stem oil seals.	Repair or replace as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire)	• Inspect the cylinder for a loss of compression. • Repair or replace as required.
Engine noise on startup, but only lasting a few seconds.	Incorrect oil viscosity	• Drain the oil. • Install the correct viscosity oil.
	Worn crankshaft thrust bearing.	• Inspect the thrust bearing and crankshaft. • Repair or replace as required.
Upper engine noise, regardless of engine speed.	Low oil pressure	Repair or replace as required.
	Broken valve spring.	Replace the valve spring.
	Worn or dirty valve lifters.	Replace the valve lifters.
	Stretched or broken timing chain and/or damaged sprocket teeth.	Replace the timing chain and sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	• Inspect the camshaft lobes. • Replace the timing camshaft and valve lifters as required.
	Worn valve guides or valve stems.	Inspect the valves and valve guides, then repair as required.
	Stuck valves. (Carbon on the valve stem or valve seat may cause the valve to stay open.	Inspect the valves and valve guides, then repair as required.
Lower engine noise, regardless of engine	Low oil pressure.	Repair or required.
	Loose or damaged flywheel.	Repair or replace the flywheel.
	Damaged oil pan, contacting the oil pump screen.	• Inspect the oil pan. • Inspect the oil pump screen. • Repair or replace as required.
	Oil pump screen loose, damaged or restricted.	• Inspect the oil pump screen. • Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	• Inspect the piston, piston pin and cylinder bore. • Repair as required.
	Excessive piston pin-to-connecting rod clearance	• Inspect the piston, piston pin and the connecting rod. • Repair or replace as required.
		Inspect the following components and repair as required.

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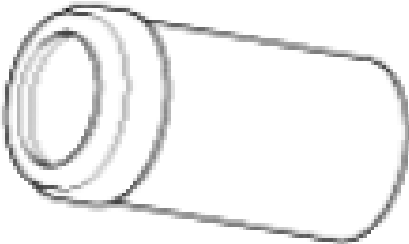
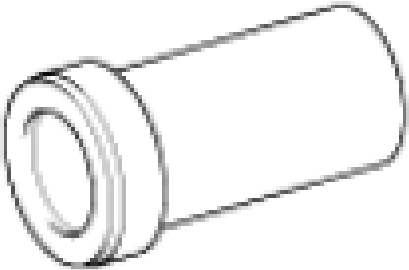
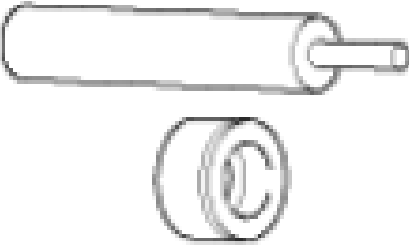
speed	Excessive connecting rod bearing rod clearance	• The connecting rod bearings. • The connecting rods. • The crankshaft. • The crankshaft journal.
	Excessive crankshaft bearing clearance	Inspect the following components, and repair as required. • The crankshaft bearing. • The crankshaft journals.
	Incorrect piston, piston pin and connecting rod installation	• Verify the piston pins and connecting rods are installed correctly. • Repair as required.
Engine noise under load	Low oil pressure	Repair or replace as required.
	Excessive connecting rod bearing clearance	Inspect the following components and repair as required: • The connecting rod bearings. • The connecting rods. • The crankshaft
	Excessive crankshaft bearing clearance	Inspect the following components, and repair as required. • The crankshaft bearings. • The crankshaft journals. • The cylinder block crankshaft
Engine will not crank-crankshaft will not rotate	Hydraulically locked cylinder • Coolant/antifreeze in cylinder. • Oil in cylinder. • Fuel in cylinder	1. Remove spark plugs and check for fluid. 2. Inspect for broken head gasket. 3. Inspect for cracked engine block or cylinder head. 4. Inspect for a sticking fuel injector and/or leaking fuel regulator.
	Broken timing chain and/or timing chain gears.	1. Inspect timing chain and gears. 2. Repair as required.
	Material in cylinder • Broken valve • Piston material • Foreign material	1. Inspect cylinder for damaged components and/or foreign materials. 2. Repair or replace as required.

	Seized crankshaft or connecting rod bearings.	1. Inspect crankshaft and connecting rod bearing. 2. Repair as required.
	Bend or broken connecting rod.	1. Inspect connecting rods. 2. Repair as required.
	Broken crankshaft	1. Inspect crankshaft. 2. Repair as required.

SPECIAL SERVICE TOOLS

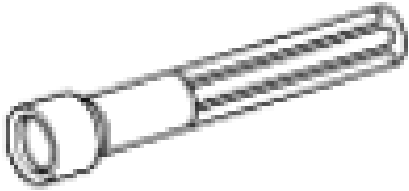
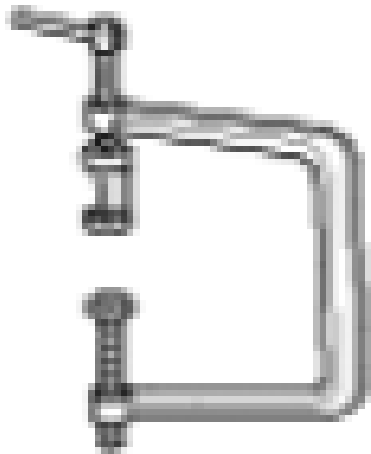
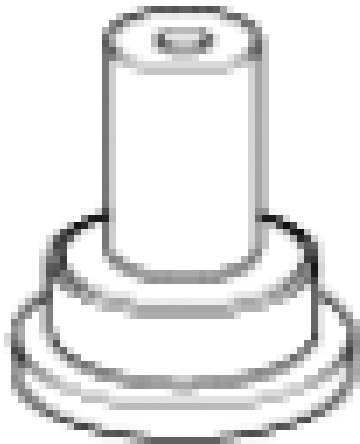
SPECIAL TOOLS

SPECIAL TOOLS REFERENCE CHART

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-33000)		Installation of the front oil seal
Camshaft oil seal installer (09214-21000)		Installation of the camshaft oil seal
Valve guide installer (09221-3F100 A/B)		Remove and installation of the valve guide

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Valve stem oil seal installer (09222-22001)		Installation of the valve stem oil seal
Valve spring compressor & adaptor (09222-28000, 09222-28100)		Removal and installation of the intake or exhaust valve
Crankshaft rear oil seal installer (09231-33000)		1. Installation of the engine rear oil seal 2. Installation of the crankshaft rear oil seal

2010 ENGINE

Cylinder Head Assembly (Engine Mechanical System-G2.7 DOHC) - Sportage

COMPONENTS AND COMPONENTS LOCATION

COMPONENTS

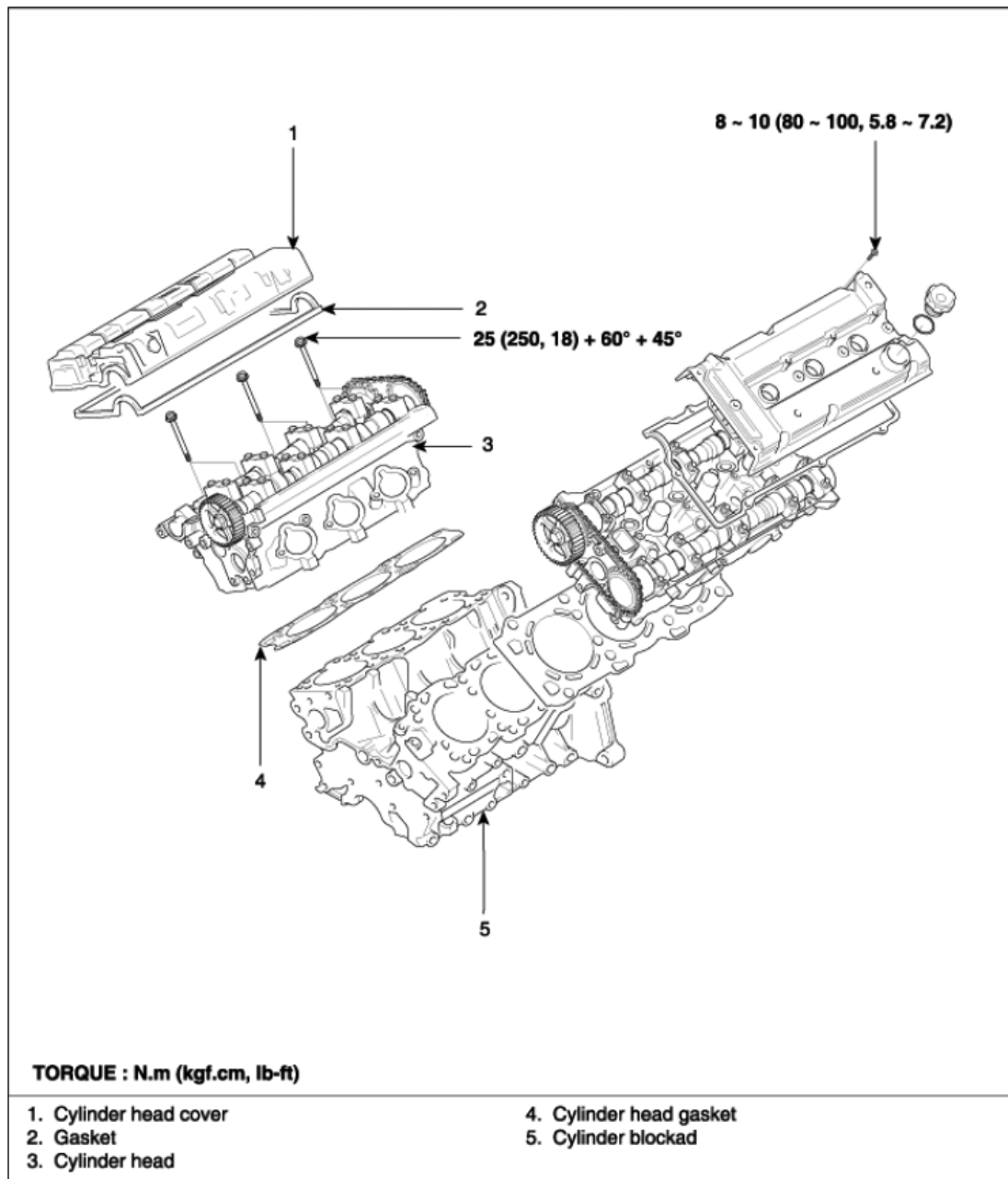


Fig. 1: Identifying Cylinder Head Components With Torque Specifications
Courtesy of KIA MOTORS AMERICA, INC.

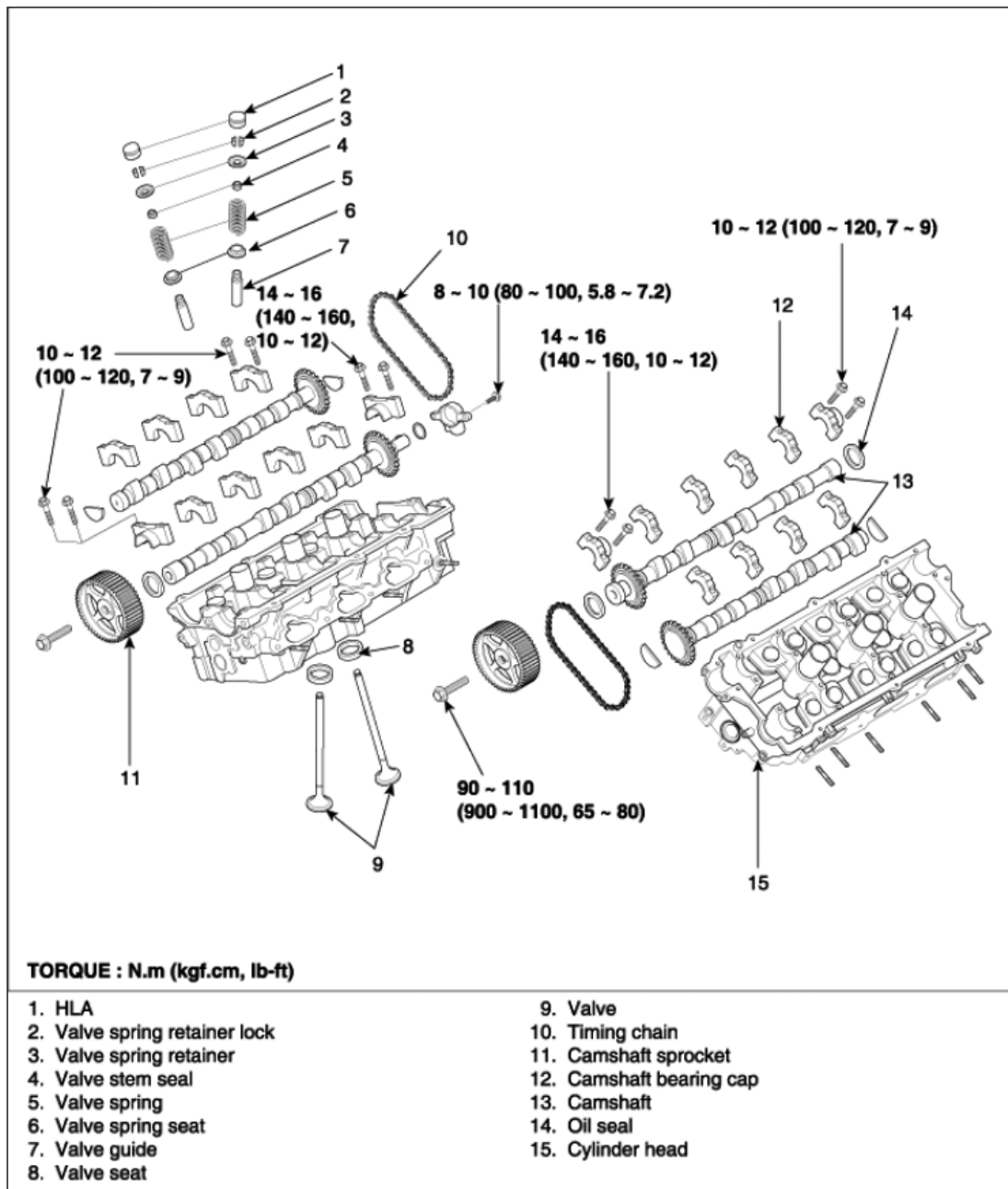


Fig. 2: Identifying Valve And Camshaft Components With Torque Specifications
Courtesy of KIA MOTORS AMERICA, INC.

REPAIR PROCEDURES

REMOVAL

CAUTION:

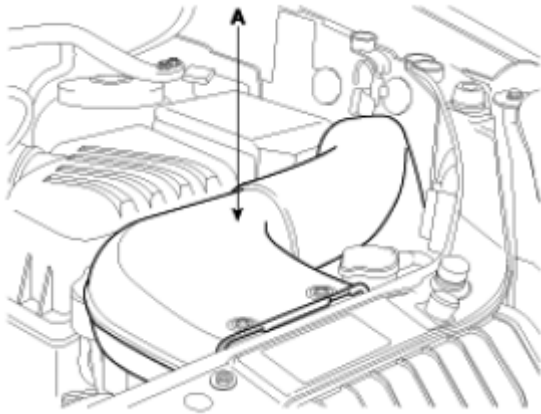
- Use fender covers to avoid damaging painted surfaces.
- To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal temperature before removing it.

- When handling a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

NOTE:

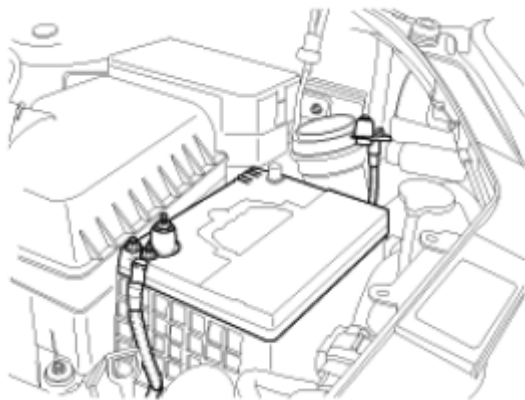
- Mark all wiring and hoses to avoid misconnection.
- Inspect the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center. (See REPAIR PROCEDURES).

1. Remove the air duct (A).

**Fig. 3: Identifying Air Duct**

Courtesy of KIA MOTORS AMERICA, INC.

2. Remove the cowl grill and wiper motor. (Refer to FRONT WIPER MOTOR)
3. Remove the strut bar.
4. Disconnect the negative terminal from the battery.

**Fig. 4: Disconnecting Negative Terminal From Battery**

Courtesy of KIA MOTORS AMERICA, INC.

5. Drain the engine coolant. (See **REMOVAL**)

Remove the radiator cap to speed draining.

6. Remove the engine cover.
7. Remove the intake air hose and air cleaner assembly.
 1. Disconnect the AFS connector (A).
 2. Disconnect the breather hose (B) from air cleaner hose.
 3. Remove the intake air hose and air cleaner assembly (C).

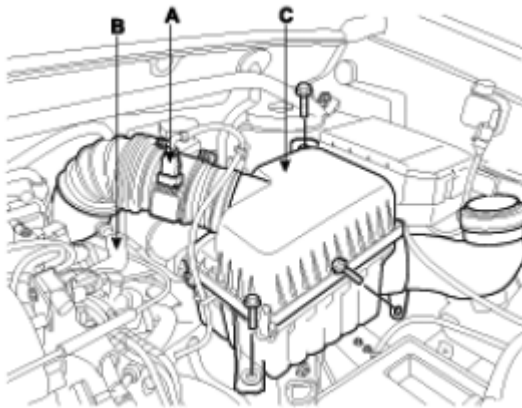


Fig. 5: Identifying AFS Connector, Breather Hose And Air Cleaner Assembly
Courtesy of KIA MOTORS AMERICA, INC.

8. Remove the coolant reservoir tank (A).

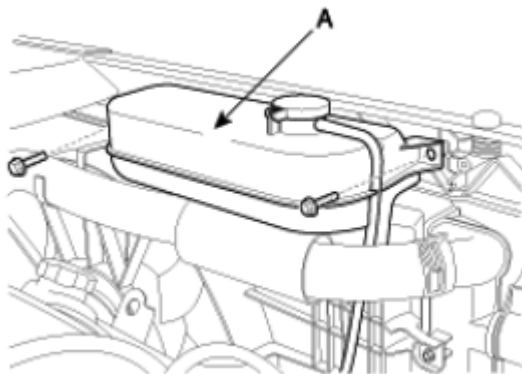


Fig. 6: Identifying Coolant Reservoir Tank
Courtesy of KIA MOTORS AMERICA, INC.

9. Remove the upper radiator hose (A) and lower radiator hose (B).

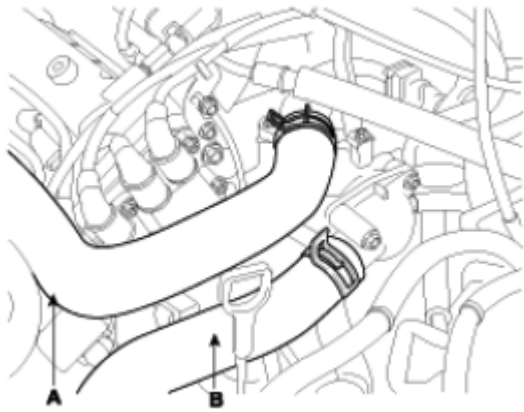


Fig. 7: Identifying Upper And Lower Radiator Hose
Courtesy of KIA MOTORS AMERICA, INC.

10. Remove the heater hoses (A) and throttle body heater hose (B).

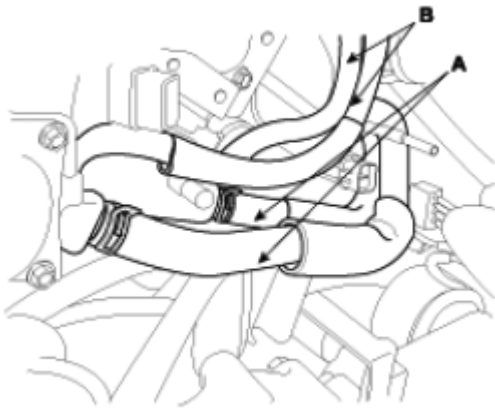


Fig. 8: Identifying Heater Hoses And Throttle Body Heater Hose
Courtesy of KIA MOTORS AMERICA, INC.

11. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.
 1. TPS (Throttle Position Sensor) connector (A).
 2. ISA (Idle Speed Actuator) connector (B).
 3. PCSV (Purge Control Solenoid Valve) connector (C).
 4. VIS actuator connector (D).
 5. Injector connector (E).
 6. Knock sensor connectors (F).
 7. CMP (Camshaft Position Sensor) connector (G).
 8. Oxygen sensor (rear 1st) connector (H).
 9. PCSV (Purge Control Solenoid Valve) hose (I).

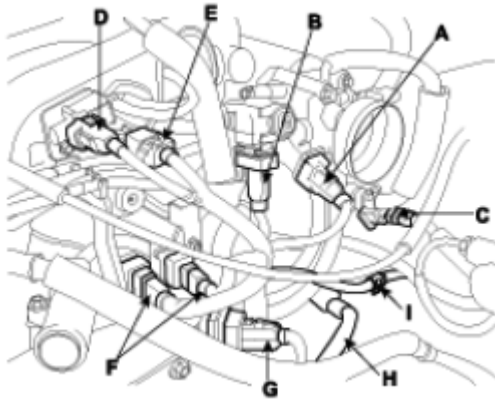


Fig. 9: Identifying TPS (Throttle Position Sensor), ISA (Idle Speed Actuator) And PCSV (Purge Control Solenoid Valve) Connector
Courtesy of KIA MOTORS AMERICA, INC.

10. ECT (Engine Coolant Temperature) sensor connector (A).
11. Ignition coil connector (B).
12. Crankshaft position sensor connector (C).
13. Oxygen sensor (front 2nd) connector (D).
14. Ground cable (E).

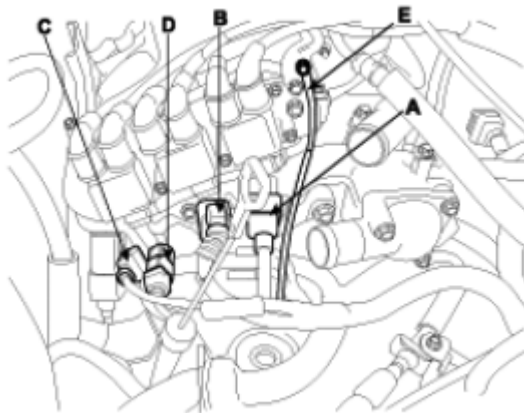


Fig. 10: Identifying ECT (Engine Coolant Temperature) Sensor, Ignition Coil And Crankshaft Position Sensor Connector
Courtesy of KIA MOTORS AMERICA, INC.

15. Three fuel injector connectors (A).

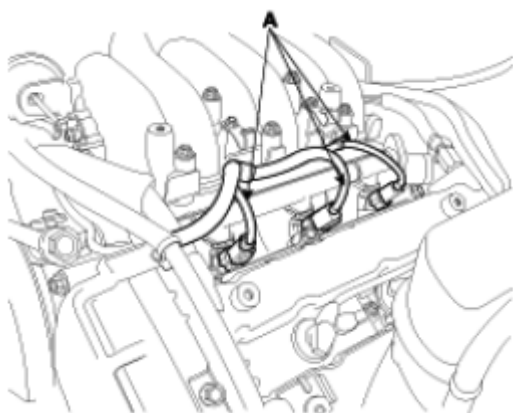


Fig. 11: Identifying Fuel Injector Connectors
Courtesy of KIA MOTORS AMERICA, INC.

16. Disconnect ground cable (A) from the cowl panel.

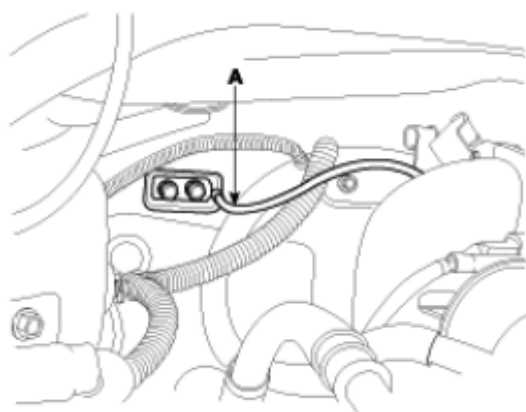


Fig. 12: Identifying Ground Cable
Courtesy of KIA MOTORS AMERICA, INC.

17. IAT (Intake Air Temperature) sensor connector (A).
18. VIS actuator connector (B).
19. Oxygen sensor (rear 2nd) connector (C).
20. Power steering pump switch (D).

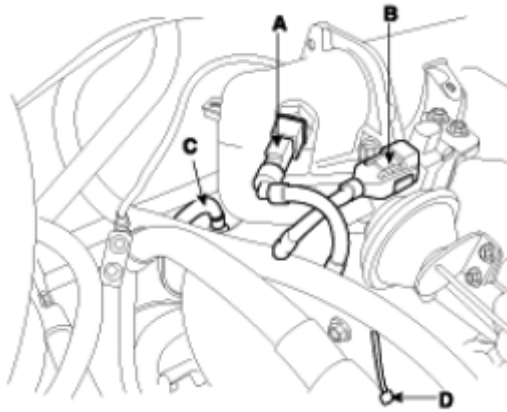


Fig. 13: Identifying IAT (Intake Air Temperature) Sensor, VIS Actuator And Oxygen Sensor (Rear 2nd) Connector

Courtesy of KIA MOTORS AMERICA, INC.

21. Oxygen sensor (front 1st) connector (A).
22. Air conditioner compressor switch connector (B).
23. Oil pressure sensor connector (C).

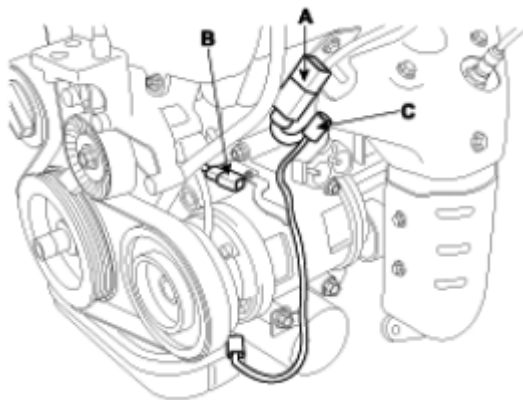


Fig. 14: Identifying Oxygen Sensor (Front 1st), Air Conditioner Compressor Switch And Oil Pressure Sensor Connector

Courtesy of KIA MOTORS AMERICA, INC.

12. Remove the fuel inlet hose (A) from delivery pipe.

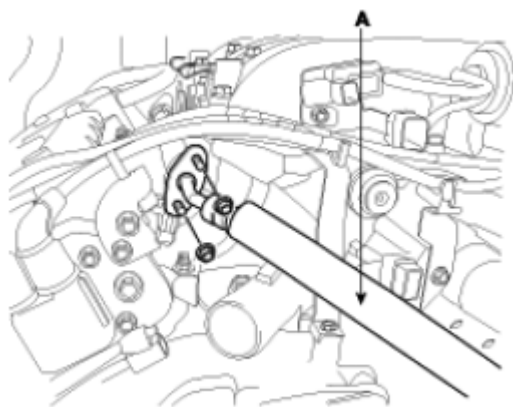


Fig. 15: Identifying Fuel Inlet Hose

Courtesy of KIA MOTORS AMERICA, INC.

13. Remove the brake booster vacuum hose (A).

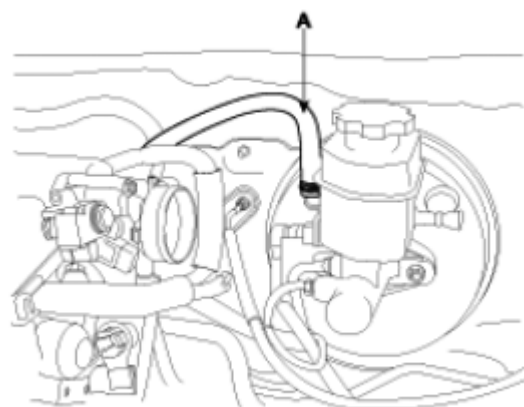


Fig. 16: Identifying Brake Booster Vacuum Hose

Courtesy of KIA MOTORS AMERICA, INC.

14. Remove the accelerator cable by loosening the locknut, then slip the cable end out of the throttle linkage.

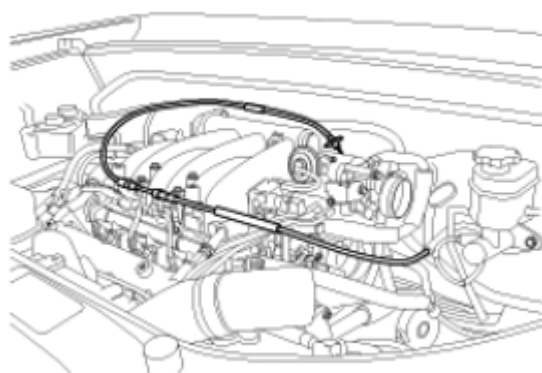


Fig. 17: Identifying Accelerator Cable

Courtesy of KIA MOTORS AMERICA, INC.

15. Remove the PCV hose (A).

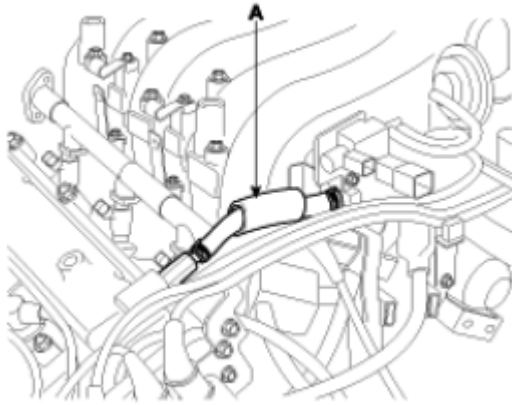


Fig. 18: Identifying PCV Hose

Courtesy of KIA MOTORS AMERICA, INC.

16. Remove the intake manifold. (See **REPAIR PROCEDURES**)
17. Remove the power steering pump. (See **POWER STEERING PUMP**).
18. Remove the exhaust manifold. (See **REPAIR PROCEDURES**)
19. Remove the timing belt. (See **TIMING SYSTEM - 2.7L**)
20. Remove the spark plug cable. (See **IGNITION SYSTEM**)
21. Remove the cylinder head covers (A).

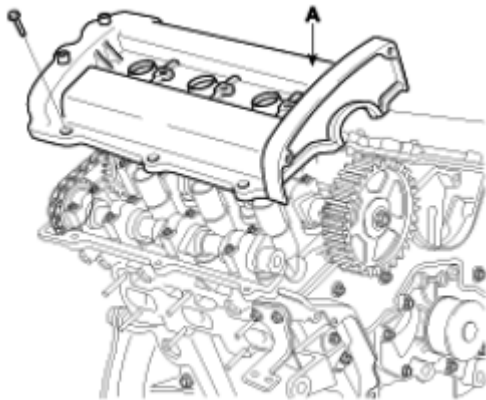


Fig. 19: Identifying Cylinder Head Cover With Mounting Screw

Courtesy of KIA MOTORS AMERICA, INC.

22. Remove the camshaft sprocket.
23. Remove the camshaft bearing caps (A).

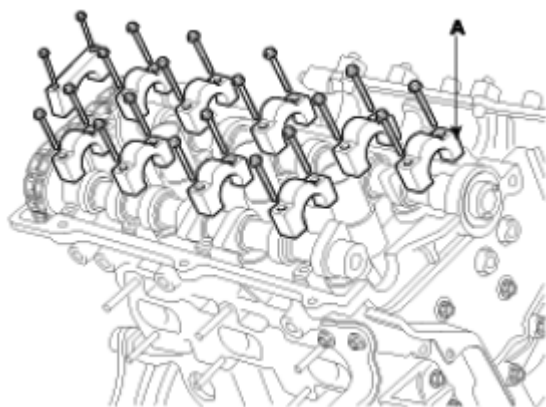


Fig. 20: Identifying Camshaft Bearing Cap With Mounting Bolts (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

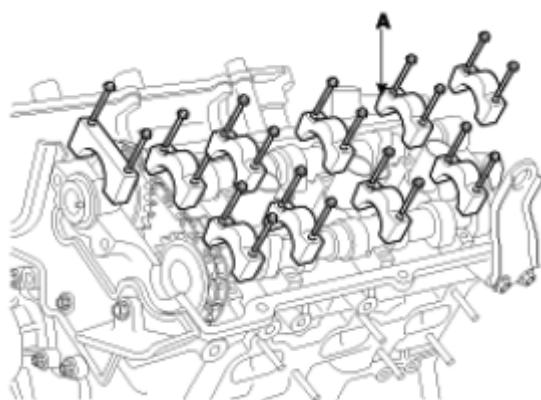


Fig. 21: Identifying Camshaft Bearing Cap With Mounting Bolts (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

24. Remove the camshafts (A).

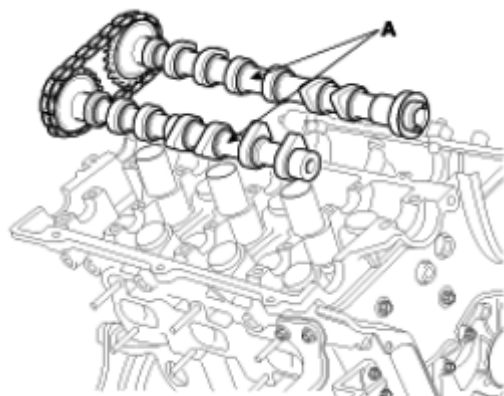


Fig. 22: Identifying Camshafts (1 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

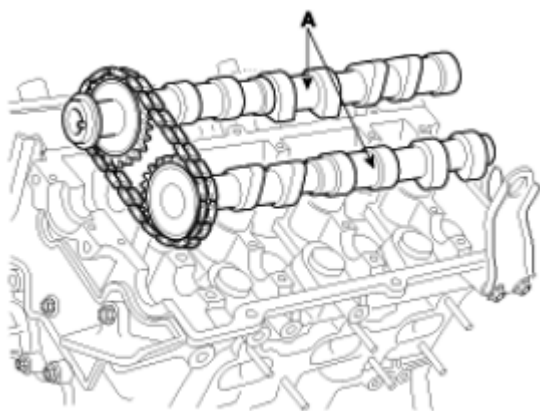


Fig. 23: Identifying Camshafts (2 Of 2)
Courtesy of KIA MOTORS AMERICA, INC.

25. Remove the timing belt rear cover (A).

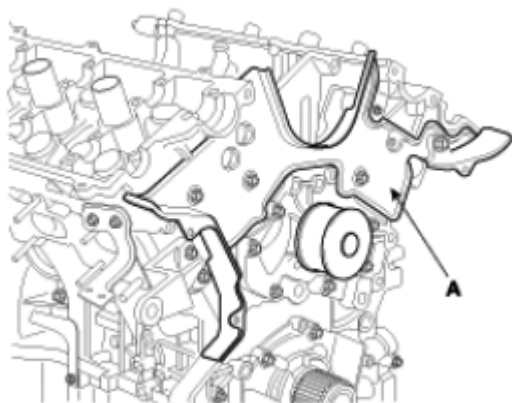


Fig. 24: Identifying Timing Belt Rear Cover
Courtesy of KIA MOTORS AMERICA, INC.

26. Remove the water temperature control assembly (A) and water pipe.

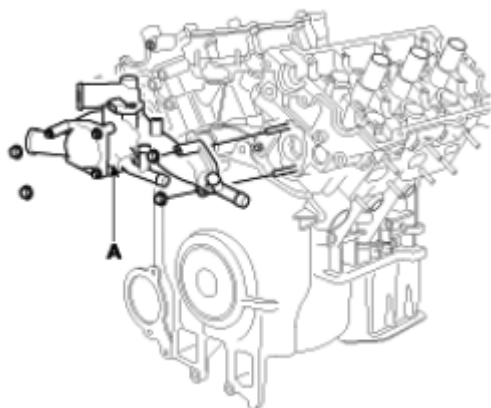


Fig. 25: Identifying Water Temperature Control Assembly
Courtesy of KIA MOTORS AMERICA, INC.

27. Remove the cylinder head bolts, then remove the cylinder heads.
 1. Uniformly loosen and remove the 8 cylinder head bolts on each cylinder head in several passes and in the sequence shown, then repeat for the other side, as shown. Remove the 16 cylinder head bolts and plate washer.

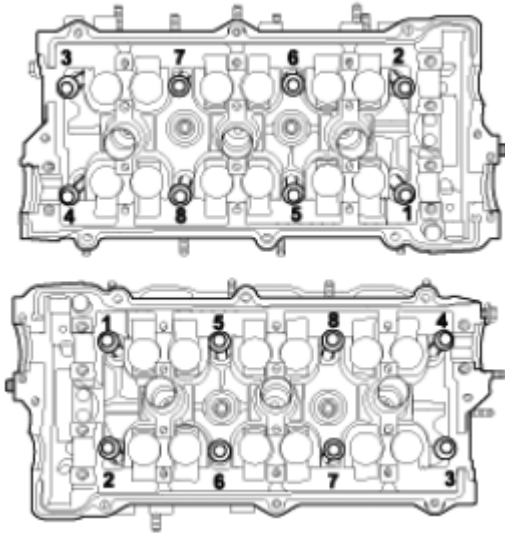


Fig. 26: Cylinder Head Bolts Loosening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

CAUTION: Head warpage or cracking could result from removing bolts in an incorrect order.

2. Lift the cylinder head from the dowels on the cylinder block and place the cylinder head on wooden blocks on a bench.

CAUTION: Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

REPLACEMENT

VALVE GUIDE

1. Using the SST (09221-3F100A), withdraw the old valve guide toward the bottom of cylinder head.

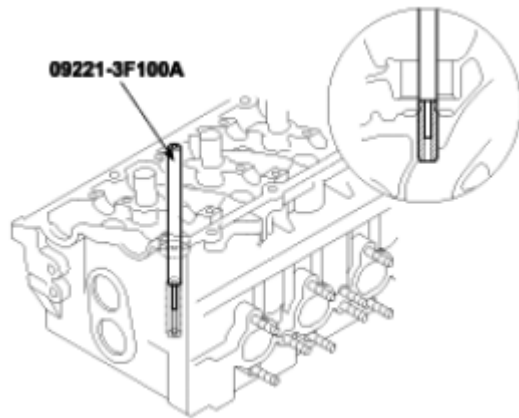


Fig. 27: Removing Valve Guide Using SST (09221-3F100A)
 Courtesy of KIA MOTORS AMERICA, INC.

2. Recondition the valve guide hole so that it can match the newly press-fitted oversize valve guide.
3. Using the SST (09221-3F100A/B), press-fit the valve guide. The valve guide must be press-fitted from the upper side of the cylinder head. Keep in mind that the intake and exhaust valve guides are different in length.

OVERSIZE VALVE GUIDE HOLE SPECIFICATIONS

Over size mm (in.)	Size mark	Oversize valve guide hole size mm (in.)
0.05 (0.002)	5	11.05 ~ 11.068 (0.4350 ~ 0.4357)
0.25 (0.010)	25	11.25 ~ 11.268 (0.4429 ~ 0.4436)
0.50 (0.020)	50	11.50 ~ 11.518 (0.4528 ~ 0.4535)

Valve guide length

Intake : 39mm (1.535in.)

Exhaust : 43mm (1.693in.)

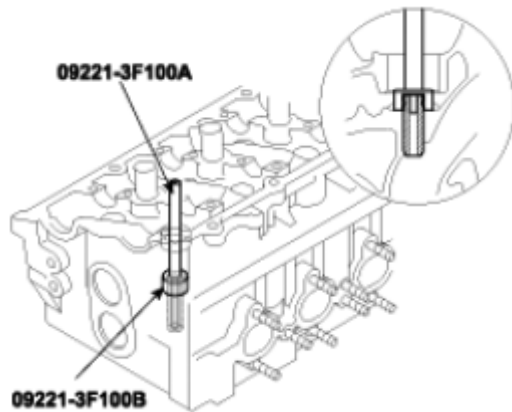


Fig. 28: Installing Valve Guide Using SST (09221-3F100A)

Courtesy of KIA MOTORS AMERICA, INC.

4. After the valve guide is press-fitted, insert a new valve and check for proper stem-to-guide clearance.
5. After the valve guide is replaced, check that the valve is seated properly. Recondition the valve seats as necessary.

DISASSEMBLY

NOTE: Identify HLA (Hydraulic Lash Adjuster), valves, valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove HLAs (A).

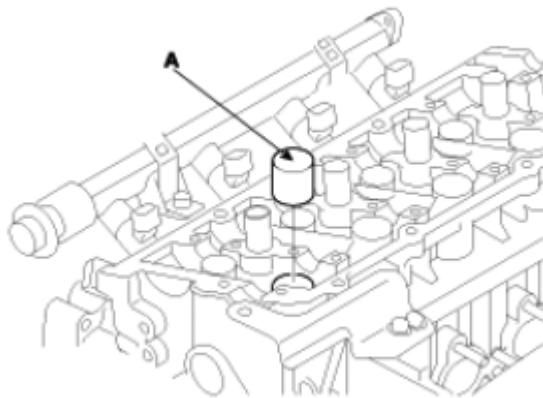


Fig. 29: Identifying HLAs

Courtesy of KIA MOTORS AMERICA, INC.

2. Remove valves.
 1. Using SST (09222-28000, 09222-28100), compress the valve spring and remove retainer lock.

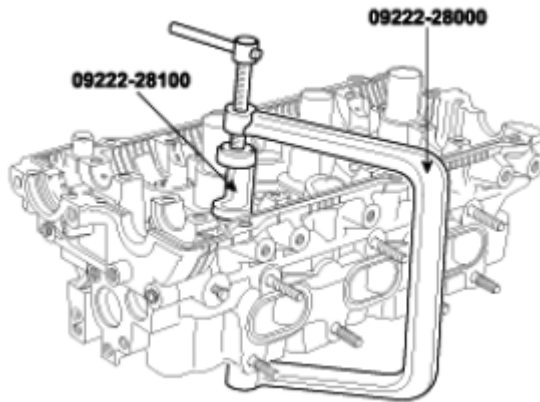


Fig. 30: Removing Valves Using SST (09222-28000, 09222-28100)
Courtesy of KIA MOTORS AMERICA, INC.

2. Remove the spring retainer.
3. Remove the valve spring.
4. Remove the valve.
5. Using needle-nose pliers, remove the oil seal.
6. Using a magnetic finger, remove the spring seat.

INSPECTION

CLEANING

1. Clean top surfaces of pistons and cylinder block.
 1. Turn the crankshaft, and bring each piston to top dead center (TDC).

Using a gasket scraper, remove all the carbon from the piston top surface.

2. Using a gasket scraper, remove all the gasket material from the cylinder block surface.
 3. Using compressed air, blow carbon and oil from the bolt holes.
2. Remove gasket material.

Using a gasket scraper, remove all the gasket material from the cylinder block contact surface.

CAUTION: Be careful not to scratch the cylinder block contact surface.

3. Clean combustion chambers.

Using a wire brush, remove all the carbon from the combustion chambers.

CAUTION: Be careful not to scratch the cylinder block contact surface.

4. Clean cylinder heads.

Using a soft brush and solvent, thoroughly clean the cylinder head.

5. Clean valves.

1. Using a gasket scraper, chip off any carbon from the valve head.
2. Using a wire brush thoroughly clean the valve.

CYLINDER HEAD

1. Inspect for flatness.

Using a precision straight edge and feeler gauge, measure the surface the contacting the cylinder block for warpage.

Flatness of cylinder head gasket surface

Standard : Less than 0.03mm (0.0012 in.)

Limit : 0.05mm (0.0020 in.)

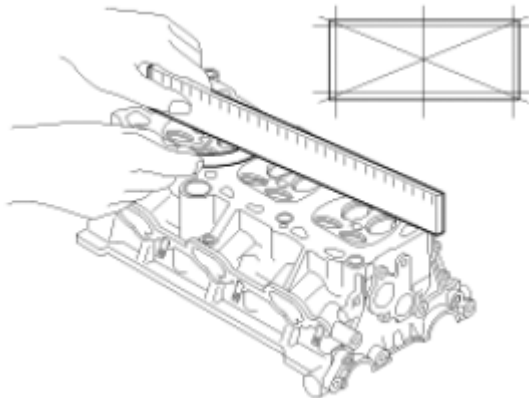


Fig. 31: Measuring Flatness Of Cylinder Head Gasket Surface
Courtesy of KIA MOTORS AMERICA, INC.

2. Inspect for cracks.

Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

VALVE AND VALVE SPRING

1. Inspect valve stems and valve guides.

1. Using a caliper gauge, measure the inside diameter of the valve guide.

Valve guide inside.

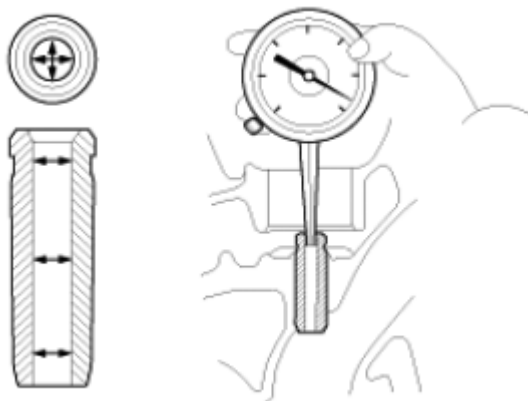


Fig. 32: Measuring Inside Diameter Of Valve Guide
Courtesy of KIA MOTORS AMERICA, INC.

2. Using a micrometer, measure the diameter of the valve stem.

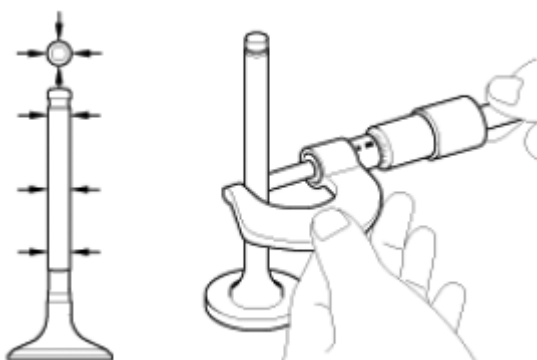


Fig. 33: Measuring Diameter Of Valve Stem
Courtesy of KIA MOTORS AMERICA, INC.

3. Subtract the valve stem diameter measurement from the valve guide inside diameter measurement.

Valve stem-to-guide clearance

[Standard]

Intake : 0.02 ~ 0.05mm (0.0008 ~ 0.0020in.)

Exhaust : 0.030 ~ 0.065mm (0.0012 ~ 0.0026in.)

[Limit]

Intake : 0.1mm (0.0040in.)

Exhaust : 0.13mm (0.0051in.)

If the clearance is greater than maximum, replace the valve and valve guide.

2. Inspect valves.

1. Check the valve is ground to the correct valve face angle.
2. Check that the surface of the valve for wear.

If the valve face is worn, replace the valve.

3. Check the valve head margin thickness.

If the margin thickness is less than minimum, replace the valve.

Margin

[Standard]

Intake : 1.0mm (0.0394in.)

Exhaust : 1.3mm (0.0512in.)

[Limit]

Intake : 0.5mm (0.0197in.)

Exhaust : 0.8mm (0.0315in.)

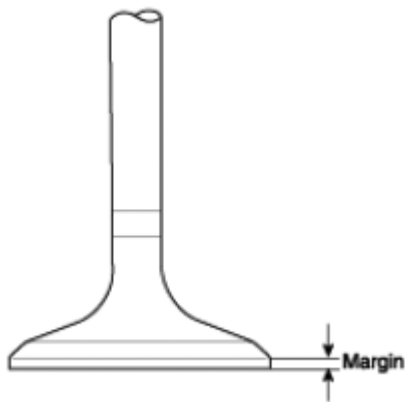


Fig. 34: Identifying Valve Head Margin
Courtesy of KIA MOTORS AMERICA, INC.

4. Check the surface of the valve stem tip for wear.

If the valve stem tip is worn, replace the valve.

3. Inspect valve seats

Check the valve seat for evidence of overheating and improper contact with the valve face.

Replace the seat if necessary.

Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it, 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.

4. Inspect valve springs.

1. Using a steel square, measure the out-of-square of the valve spring.
2. Using a vernier calipers, measure the free length of the valve spring.

Valve spring

[Standard]

Free height : 42.5mm (1.6732in.)

Load : 21kg/35mm (48.4kg/1.378mm)

[Limit]

Free height : -1.0mm (-0.0394 in.)

Out-of-square : 3°

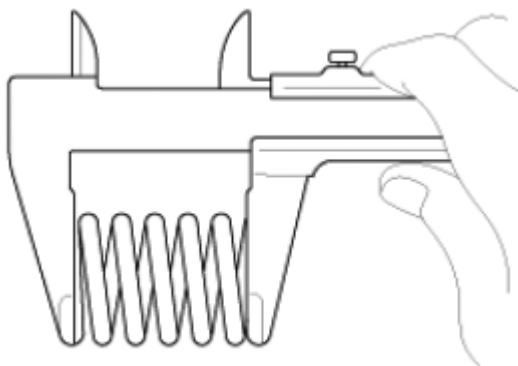


Fig. 35: Measuring Valve Spring Free Length
Courtesy of KIA MOTORS AMERICA, INC.

If the free length is not as specified, replace the valve spring.

CAMSHAFT

1. Inspect cam lobes.

Using a micrometer, measure the cam lobe height.

Cam height

[Standard value]

Intake : 43.95 ~44.15mm (1.7303 ~ 1.7382in.)

Exhaust : 43.95 ~ 44.15mm (1.7303 ~ 1.7382in.)

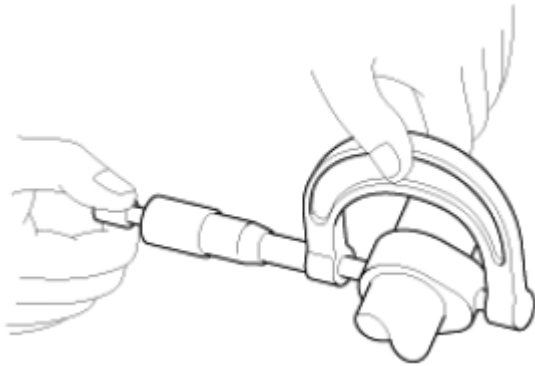


Fig. 36: Measuring Cam Lobe Height
Courtesy of KIA MOTORS AMERICA, INC.

If the cam lobe height is less than minimum, replace the camshaft.

2. Inspect cam journals.

Using a micrometer, measure the journal diameter.

Journal diameter

Standard value

25.964 ~ 25.980mm (1.0222 ~ 1.0228in.)

If the journal diameter is not as specified, check the oil clearance.

3. Inspect camshaft bearings.

Check that bearing for flaking and scoring. If the bearings are damaged, replace the bearing caps and cylinder head as a set.

4. Inspect camshaft journal oil clearance.

1. Clean the bearing caps and camshaft journals.
2. Place the camshafts on the cylinder head.

3. Lay a strip of plastigage across each of the camshaft journal.

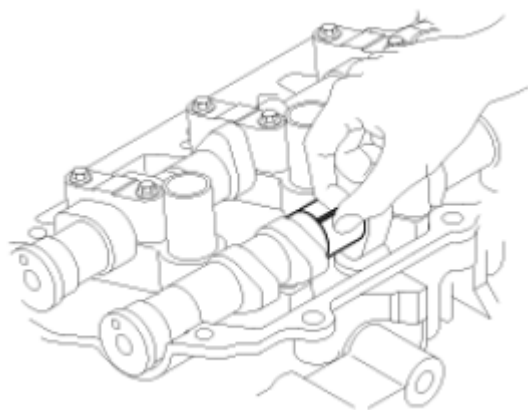


Fig. 37: Inspecting Camshaft Journal Oil Clearance
Courtesy of KIA MOTORS AMERICA, INC.

4. Install the bearing caps. (See 3)

CAUTION: Do not turn the camshaft.

5. Remove the bearing caps.
6. Measure the plastigage at its widest point.

Bearing oil clearance

Standard value : 0.02 ~ 0.061mm (0.0008 ~ 0.0024in.)

Limit : 0.1mm (0.0039in.)

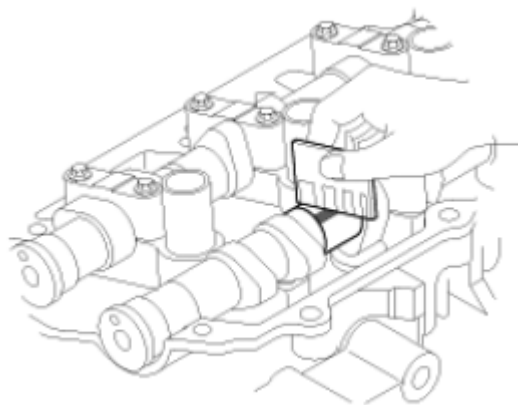


Fig. 38: Measuring Plastigage At Its Widest Point
Courtesy of KIA MOTORS AMERICA, INC.

If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

7. Completely remove the plastigage.
8. Remove the camshafts.
5. Inspect camshaft end play.
 1. Install the camshafts. (See 6).
 2. Using a dial indicator, measure the end play while moving the camshaft back and forth.

Camshaft end play

Standard value : 0.1 ~ 0.15mm (0.004 ~ 0.0059in.)

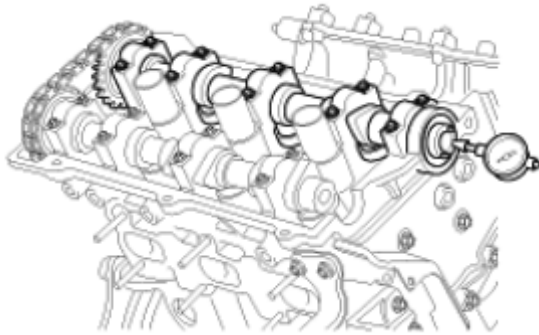


Fig. 39: Measuring Camshaft End Play
Courtesy of KIA MOTORS AMERICA, INC.

If the end play is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

3. Remove the camshafts.

REASSEMBLY

NOTE: Thoroughly clean all parts to be assembled.
Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
Replace oil seals with new ones.

1. Install valves.
 1. Install the spring seats.
 2. Using SST (09222-22001), push in a new oil seal.

NOTE: Do not reuse old valve stem seals.
Incorrect installation of the seal could result in oil leakage past the valve guides.

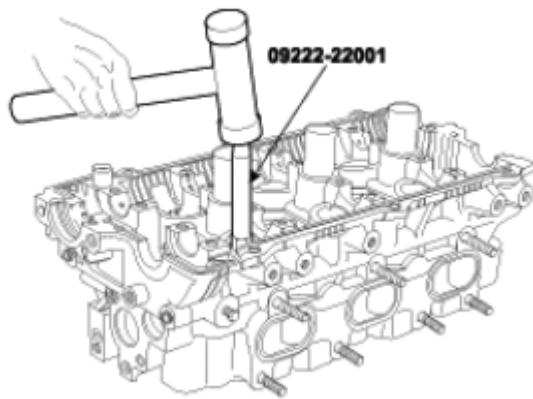


Fig. 40: Installing Oil Seal Using SST (09222-22001)
 Courtesy of KIA MOTORS AMERICA, INC.

3. Install the valve, valve spring and spring retainer.

NOTE: Place valve springs so that the side coated with enamel faces toward the valve spring retainer and then installs the retainer.

4. Using the SST (09222-28000, 09222-28100), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.

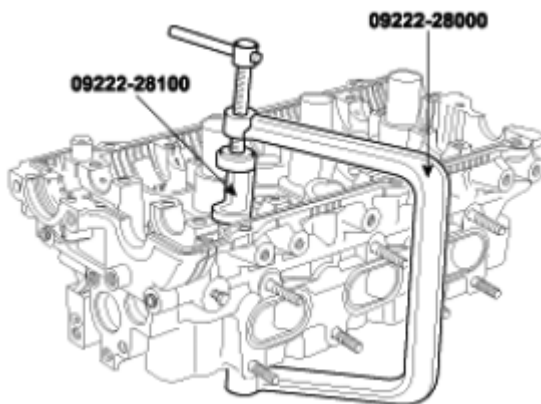


Fig. 41: Compressing Spring Using SST (09222-28000, 09222-28100)
 Courtesy of KIA MOTORS AMERICA, INC.

5. Lightly tap the end of each valve stem two or three times with the wooden handle of a hammer to ensure proper seating of the valve and retainer lock.

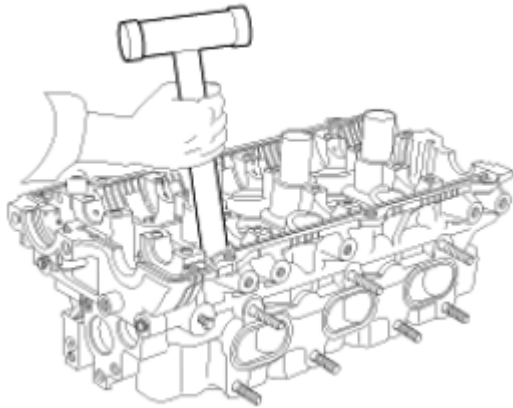


Fig. 42: Checking Proper Seating Of Valve And Retainer Lock
Courtesy of KIA MOTORS AMERICA, INC.

2. Install HLAs.

Check that the HLA rotates smoothly by hand.

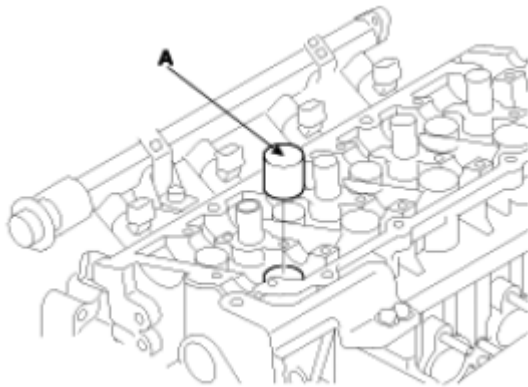


Fig. 43: Identifying HLAs
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

NOTE:

- Thoroughly clean all parts to be assembled.
- Always use a new head and manifold gasket.
- The cylinder head gasket is a metal gasket. Take care not to bend it.
- Rotate the crankshaft, set the No. 1 piston at TDC. (See **REPAIR PROCEDURES**).

1. Install the cylinder head gaskets on the cylinder block.

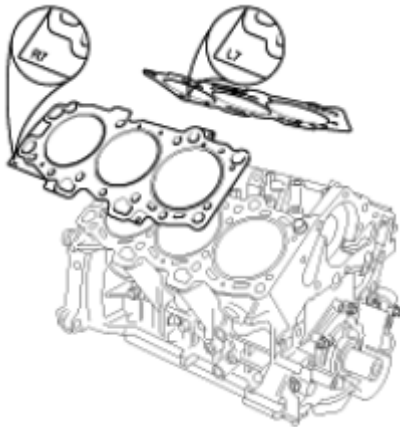


Fig. 44: Cylinder Head Gasket Installation Position
Courtesy of KIA MOTORS AMERICA, INC.

NOTE: Be careful of the installation direction.

2. Place the cylinder head quietly in order not to damage the gasket with the bottom part of the end.
3. Install cylinder head bolts.

Tightening torque

25N.m (250kgf.cm, 18lb-ft) + 60° + 45°

1. Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
2. Install the plate washer to the cylinder head bolt.
3. Install and uniformly tighten the cylinder head bolts on each cylinder head in several passes and in the sequence shown, then repeat for the other side, as shown.

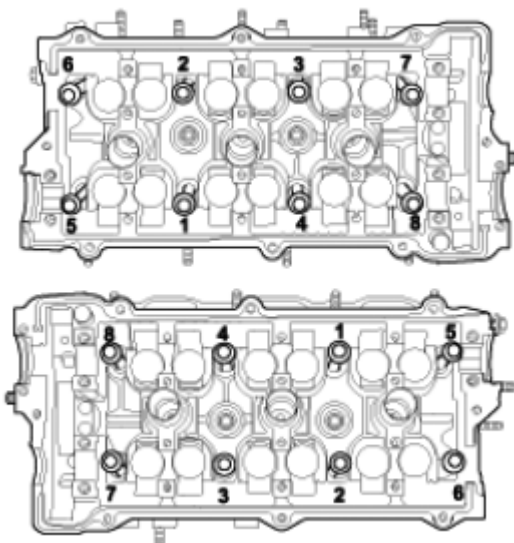


Fig. 45: Cylinder Head Bolts Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

If any of the cylinder head bolts dose not meet the torque specification, repeat the cylinder head bolt torque tightening sequence.

Torque : 25N.m (250kgf.cm, 18lb-ft)

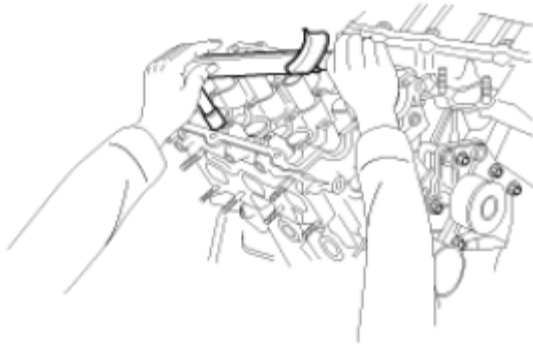


Fig. 46: Tightening Cylinder Head Bolt
Courtesy of KIA MOTORS AMERICA, INC.

4. Retighten the cylinder head bolts by 60° in the numerical order shown.
5. Retighten the cylinder head bolts by 45° in the numerical order shown.
4. Install the water pipe and water temperature control assembly (A).

Tightening torque

Water temperature control

15 ~ 20N.m (150 ~ 200kgf.cm, 11 ~ 14lb-ft)

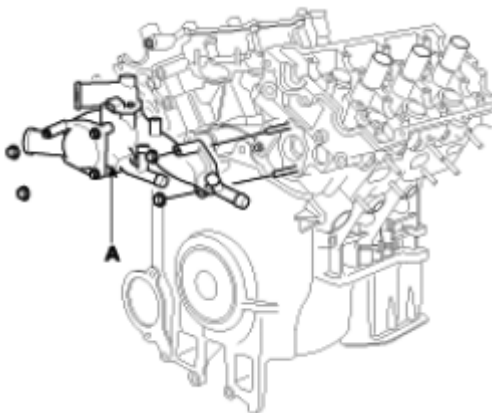


Fig. 47: Identifying Water Pipe And Water Temperature Control Assembly With Mounting Screws
Courtesy of KIA MOTORS AMERICA, INC.

5. Install the timing belt rear cover (A).

Tightening torque

Timing belt rear cover

10 ~ 12N.m (100 ~ 120kgf.cm, 7 ~ 9lb-ft)

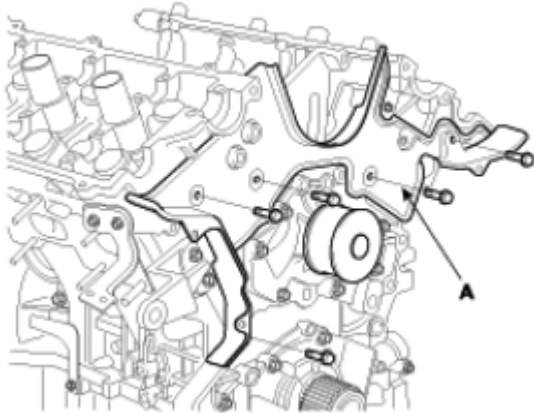


Fig. 48: Identifying Timing Belt Rear Cover With Mounting Bolts
Courtesy of KIA MOTORS AMERICA, INC.

6. Install the camshafts.
 1. Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown.

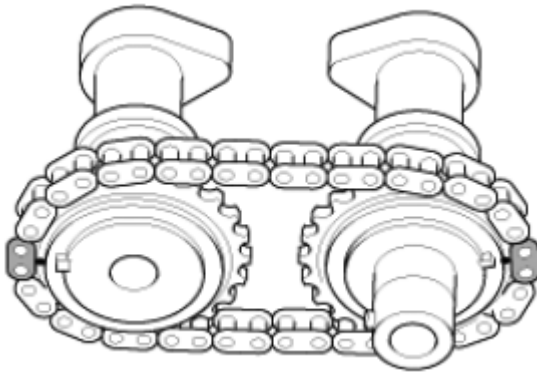
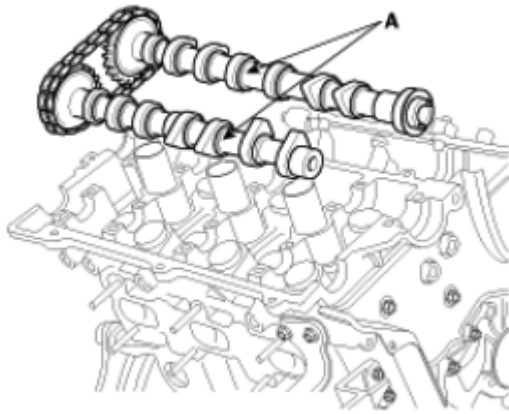


Fig. 49: Identifying Intake And Exhaust Timing Chain Sprocket
Courtesy of KIA MOTORS AMERICA, INC.

2. Install the camshaft (A).

**Fig. 50: Identifying Camshaft**

Courtesy of KIA MOTORS AMERICA, INC.

3. Install the camshaft bearing caps (A).

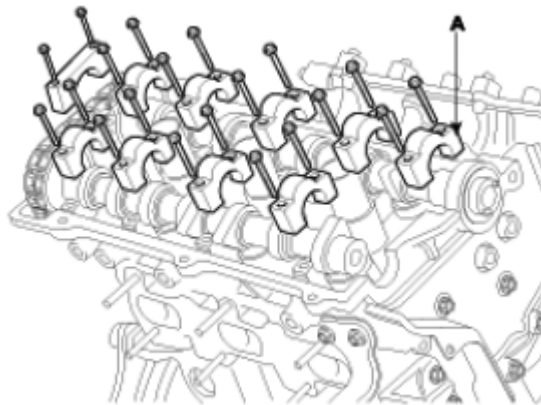
Tightening torque

M6 (38mm):

10 ~ 12N.m (100 ~ 120kgf.cm, 7 ~ 9lb-ft) (Mark7)

M6 (50mm):

14 ~ 16N.m (140 ~ 160kgf.cm, 10 ~ 12lb-ft) (Mark10)

**Fig. 51: Identifying Camshaft Bearing Caps With Mounting Bolts**

Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

- Apply new engine oil to the thrust portion and journal of the camshafts.
- Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

7. Using the SST (09214-21000), install the camshaft bearing oil seal.

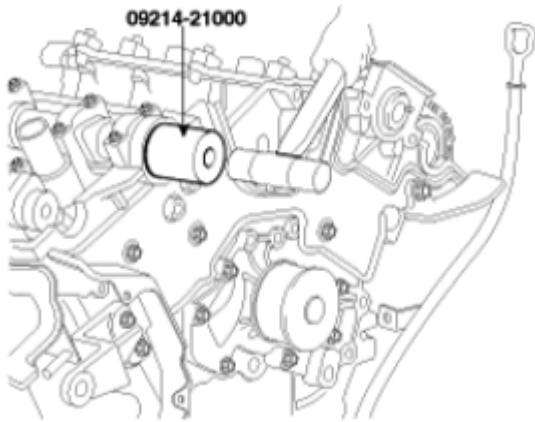


Fig. 52: Installing Camshaft Bearing Oil Seal Using SST (09214-21000)
Courtesy of KIA MOTORS AMERICA, INC.

8. Install the camshaft sprocket.
 1. Temporarily install the camshaft sprocket bolts.
 2. Hold the hexagonal head wrench portion of the camshaft with a wrench, and tighten the camshaft sprocket bolts.

Tightening torque

Camshaft sprocket bolt

90 ~ 110N.m (900 ~ 1100kgf.cm, 65 ~ 80lb-ft)

9. Install semi-circular packing.
10. Install the cylinder head cover.
 1. Install the cylinder head cover gasket (A) in the groove of the cylinder head cover (B).

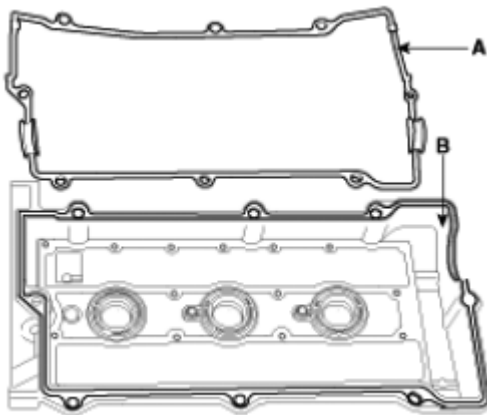


Fig. 53: Identifying Cylinder Head Cover Gasket

Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

- Before installing the head cover gasket, thoroughly clean the head cover gasket and the groove.
- When installing, make sure the head cover gasket is seated securely in the corners of the recesses with no gap.

2. Apply liquid gasket to the head cover gasket at the corners of the recess.

NOTE:

- Use liquid gasket, loctite No. 5699.
- Check that the mating surfaces are clean and dry before applying liquid gasket.
- After assembly, wait at least 30 minutes before filling the engine with oil.

3. Install the cylinder head covers (A) with the 16 bolts. Uniformly tighten the bolts in several passes.

Tightening torque

8 ~ 10N.m (80 ~ 100kgf.cm, 6 ~ 7.4lb-ft)

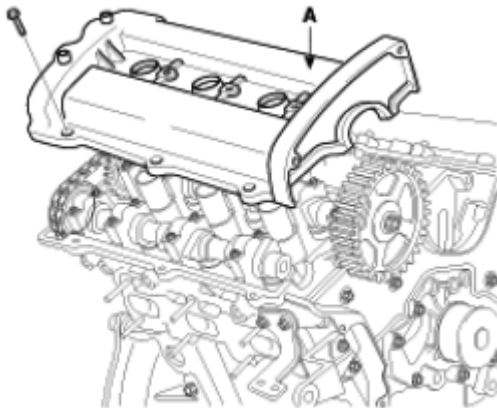


Fig. 54: Identifying Cylinder Head Cover With Mounting Bolt
Courtesy of KIA MOTORS AMERICA, INC.

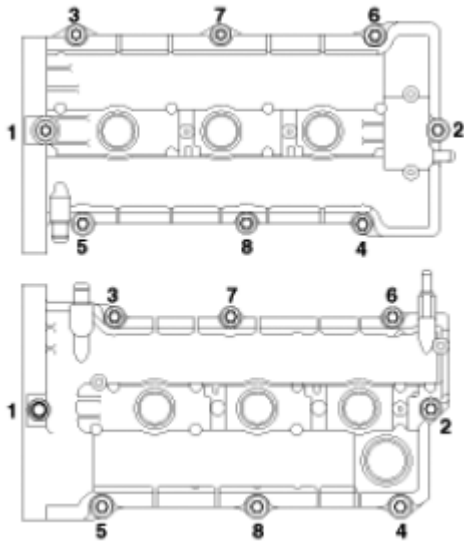


Fig. 55: Cylinder Head Cover Bolts Tightening Pattern
Courtesy of KIA MOTORS AMERICA, INC.

11. Install the spark plug cable. (See **IGNITION SYSTEM**)
12. Install the timing belt. (See **REPAIR PROCEDURES**).
13. Install the exhaust manifold. (See **INSTALLATION**)
14. Install the power steering pump. (See **POWER STEERING PUMP**)
15. Install the intake manifold. (See **INSTALLATION**)
16. Install the PCV hose (A).

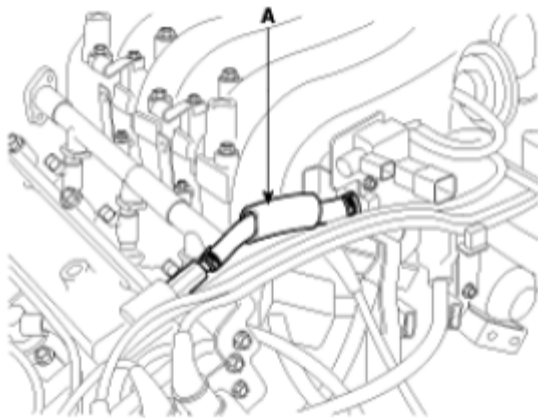


Fig. 56: Identifying PCV Hose
Courtesy of KIA MOTORS AMERICA, INC.

17. Install the accelerator cable.

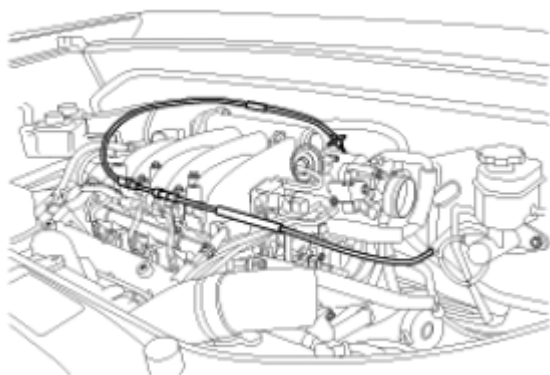


Fig. 57: Identifying Accelerator Cable
Courtesy of KIA MOTORS AMERICA, INC.

18. Install the brake booster vacuum hose (A).

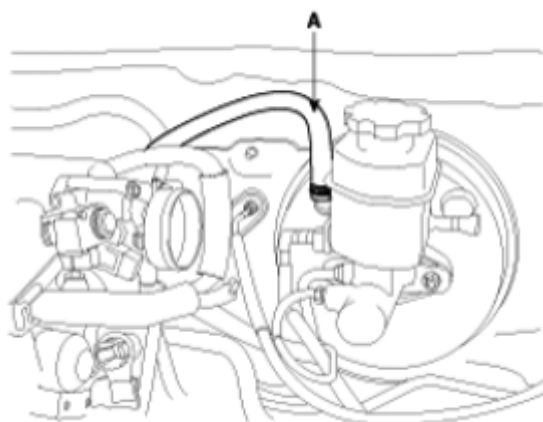


Fig. 58: Identifying Brake Booster Vacuum Hose
Courtesy of KIA MOTORS AMERICA, INC.

19. Install the fuel inlet hose (A).

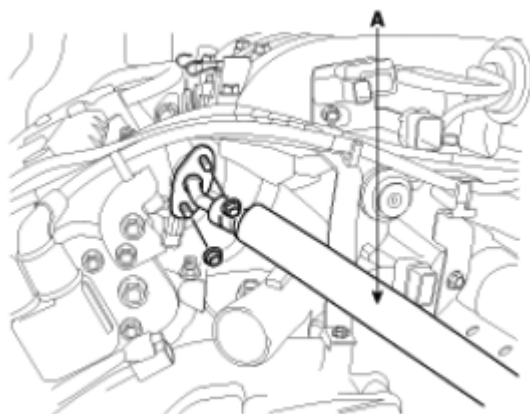


Fig. 59: Identifying Fuel Inlet Hose

Courtesy of KIA MOTORS AMERICA, INC.

20. Install the engine wire harness connectors and wire harness clamps to the cylinder head and the intake manifold.
1. Oil pressure sensor connector (C).
 2. Air conditioner compressor switch connector (B).
 3. Oxygen sensor (front 1st) connector (A).

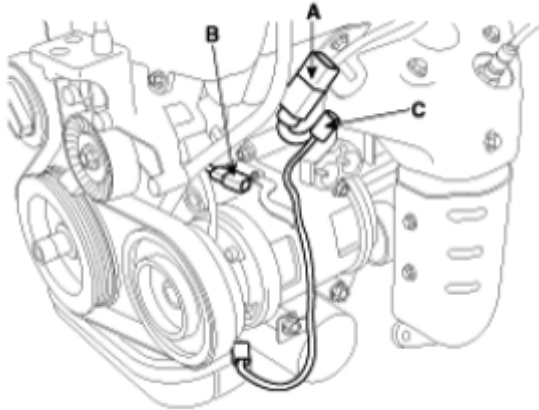


Fig. 60: Identifying Oil Pressure Sensor, Air Conditioner Compressor Switch And Oxygen Sensor (Front 1st) Connector

Courtesy of KIA MOTORS AMERICA, INC.

4. Power steering pump switch (D).
5. Oxygen sensor (rear 2nd) connector (C).
6. VIS actuator connector (B).
7. IAT (Intake Air Temperature) sensor connector (A).

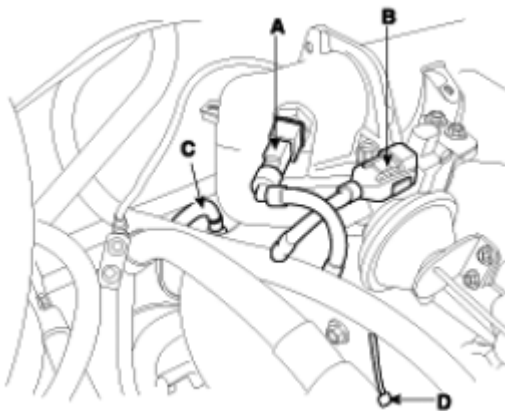


Fig. 61: Identifying Power Steering Pump Switch With Oxygen Sensor (Rear 2nd) And VIS Actuator Connector

Courtesy of KIA MOTORS AMERICA, INC.

8. Connect the ground cable (A) to the cowl panel.

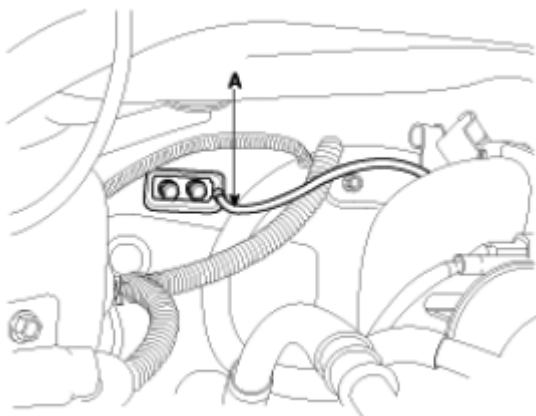


Fig. 62: Identifying Ground Cable
Courtesy of KIA MOTORS AMERICA, INC.

9. Three fuel injector connectors (A).

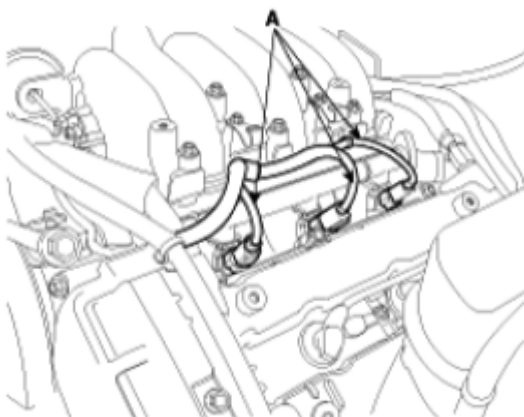


Fig. 63: Identifying Fuel Injector Connectors
Courtesy of KIA MOTORS AMERICA, INC.

10. Ground cable (E).
11. Oxygen sensor connector (D).
12. Crankshaft position sensor connector (C).
13. Ignition coil connector (B).
14. ECT sensor connector (A).

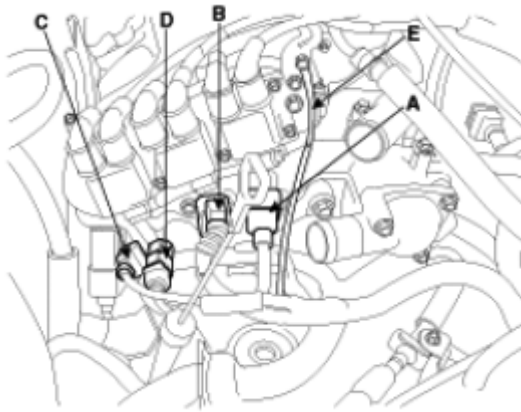


Fig. 64: Identifying ECT Sensor, Ignition Coil And Crankshaft Position Sensor Connector
 Courtesy of KIA MOTORS AMERICA, INC.

15. PCSV (Purge Control Solenoid Valve) hose (I).
16. Oxygen sensor (rear 1st) connector (H).
17. CMP (Camshaft position sensor) connector (G).
18. Knock sensor connector (F).
19. Injector connector (E).
20. VIS actuator connector (D).
21. PCSV (Purge Control Solenoid Valve) connector (C).
22. ISA connector (B).
23. TPS connector (A).

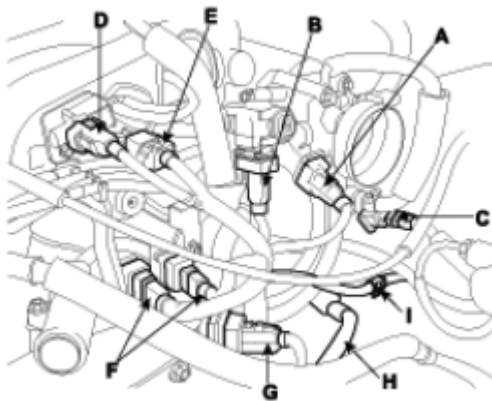


Fig. 65: Identifying ISA, TPS, VIS Actuator And PCSV (Purge Control Solenoid Valve) Connector
 Courtesy of KIA MOTORS AMERICA, INC.

21. Install the heater hoses (A) and throttle body heater hose (B).

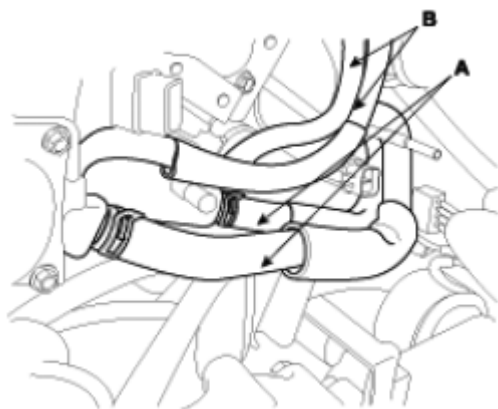


Fig. 66: Identifying Heater Hoses And Throttle Body Heater Hose
Courtesy of KIA MOTORS AMERICA, INC.

22. Install the upper radiator hose (A) and lower radiator hose (B).

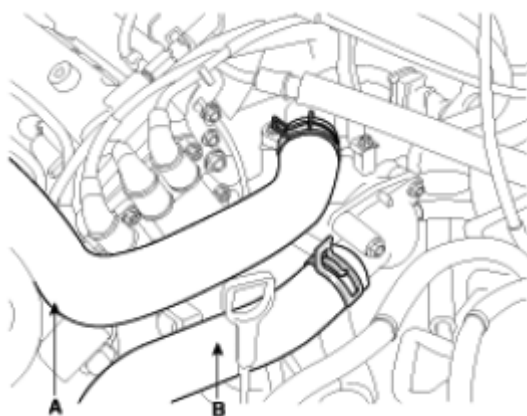


Fig. 67: Identifying Upper And Lower Radiator Hose
Courtesy of KIA MOTORS AMERICA, INC.

23. Install the coolant reservoir tank (A).

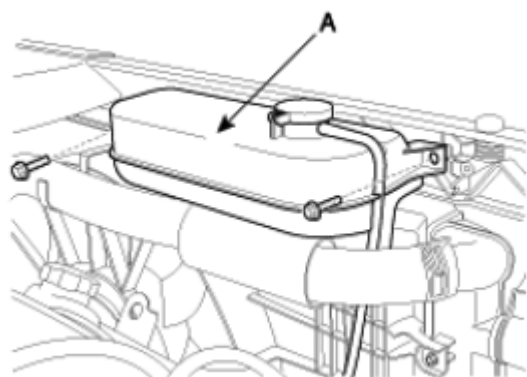


Fig. 68: Identifying Coolant Reservoir Tank

Courtesy of KIA MOTORS AMERICA, INC.

24. Install the intake air hose and air cleaner assembly.
 1. Install the intake air hose and air cleaner assembly (C).
 2. Connect the breather hose (B) from air cleaner hose.
 3. Connect the AFS connector (A).

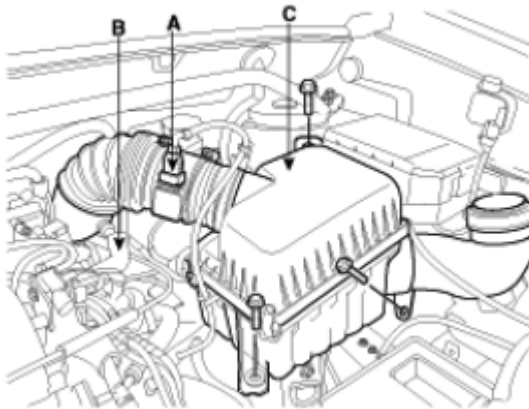


Fig. 69: Identifying AFS Connector, Breather Hose With Intake Air Hose And Air Cleaner Assembly

Courtesy of KIA MOTORS AMERICA, INC.

25. Install the engine cover.
26. Connect the negative terminal to the battery.

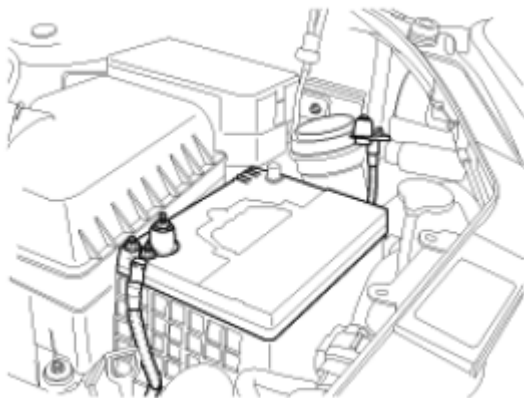


Fig. 70: Connecting Negative Terminal To Battery

Courtesy of KIA MOTORS AMERICA, INC.

27. Install the strut bar.
28. Install the cowl grill and wiper motor. (Refer to **FRONT WIPER MOTOR**)
29. Install the air duct (A).

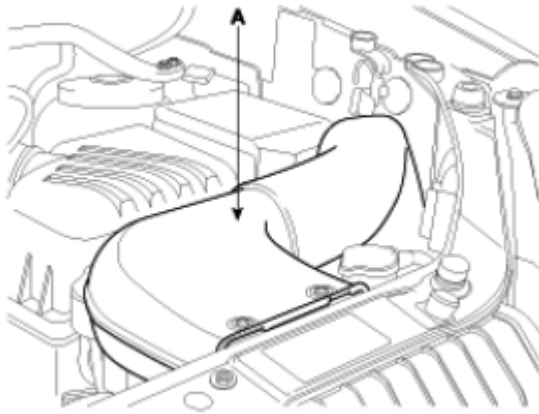


Fig. 71: Identifying Air Duct

Courtesy of KIA MOTORS AMERICA, INC.

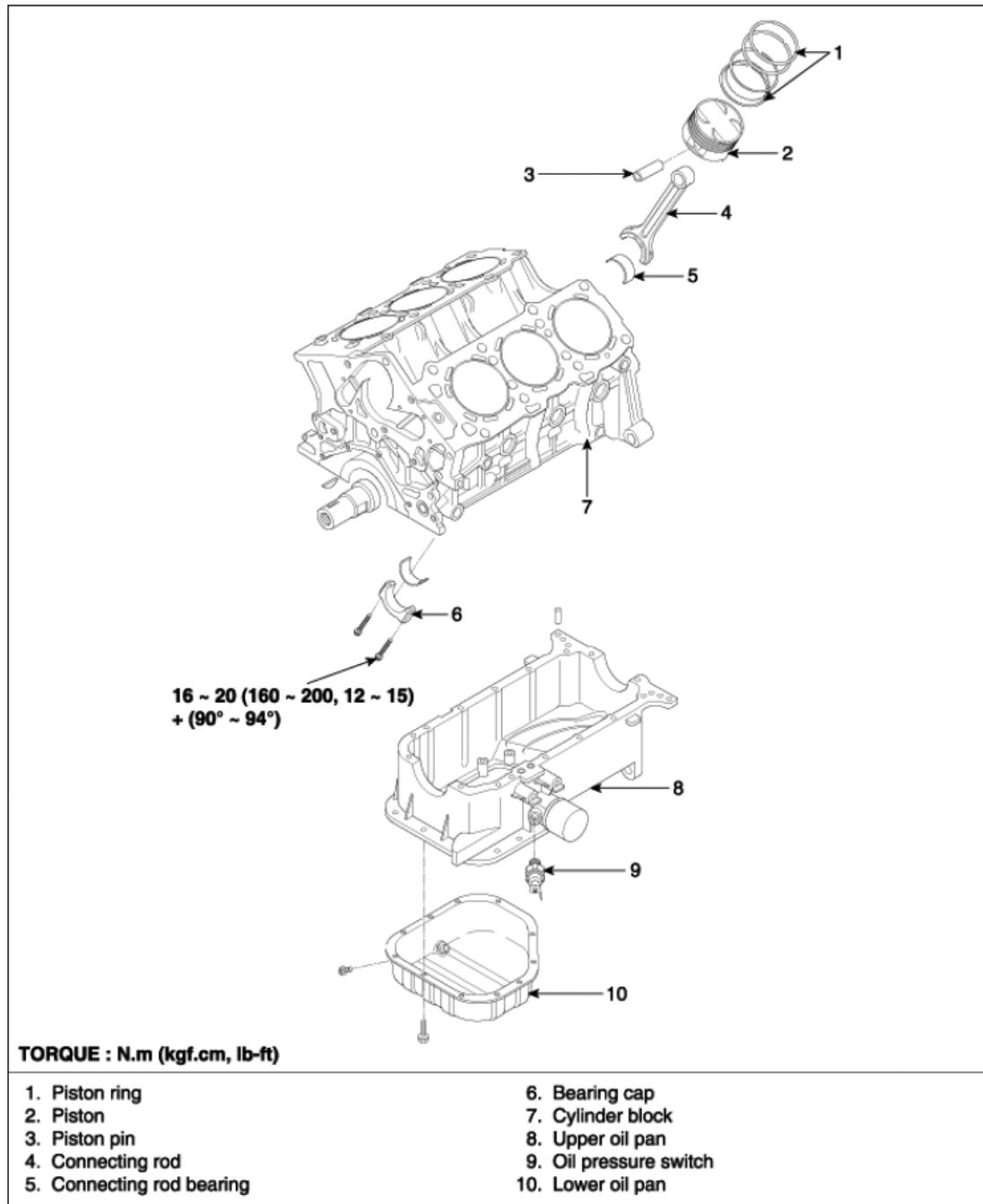
30. Fill with engine coolant.
31. Start the engine and check for leaks.
32. Recheck engine coolant level and oil level.

2010 ENGINE

Cylinder Block (Engine Mechanical System-G2.7 DOHC) - Sportage

COMPONENTS AND COMPONENTS LOCATION

COMPONENT

**Fig. 1: Identifying Cylinder Block Components With Torque Specifications (1 Of 2)**

Courtesy of KIA MOTORS AMERICA, INC.

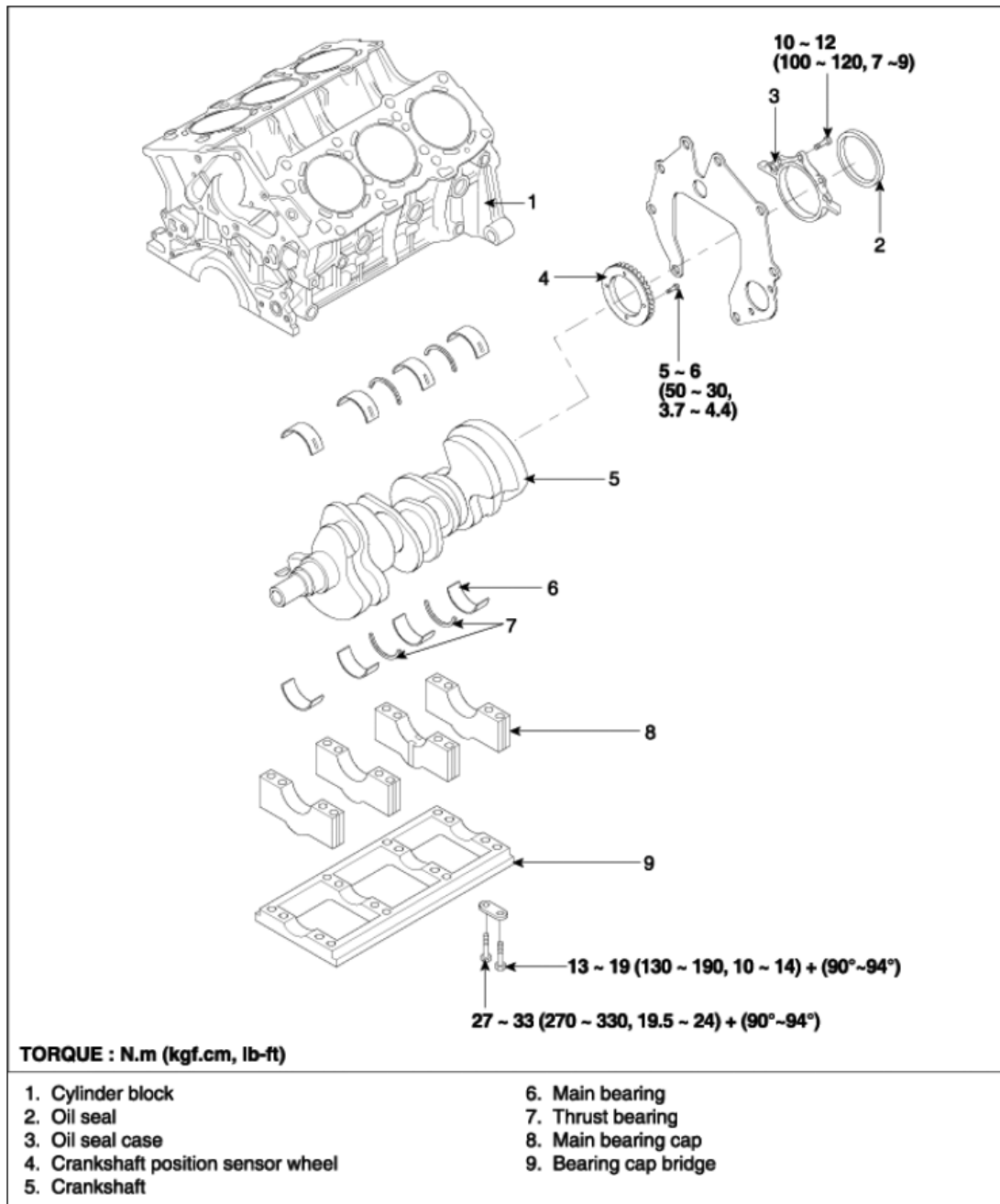


Fig. 2: Identifying Cylinder Block Components With Torque Specifications (2 Of 2)
 Courtesy of KIA MOTORS AMERICA, INC.

REPAIR PROCEDURES

DISASSEMBLY

1. A/T : remove drive plate.

2. Install engine to engine stand for disassembly (A).
3. Remove timing belt. (See **TIMING SYSTEM - 2.7L**).
4. Remove cylinder head. (See **CYLINDER HEAD ASSEMBLY - 2.7L**)
5. Remove oil level gauge assembly.
6. Remove the alternator. (See **ALTERNATOR**).
7. Remove the air compressor. (See **COMPRESSOR**)
8. Remove the power steering pump bracket (A).

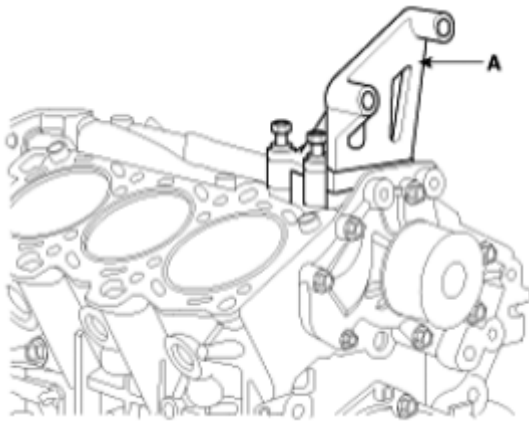


Fig. 3: Locating Power Steering Pump Bracket
Courtesy of KIA MOTORS AMERICA, INC.

9. Remove water pump. (See **REPAIR PROCEDURES**)
10. Remove knock sensors (A).

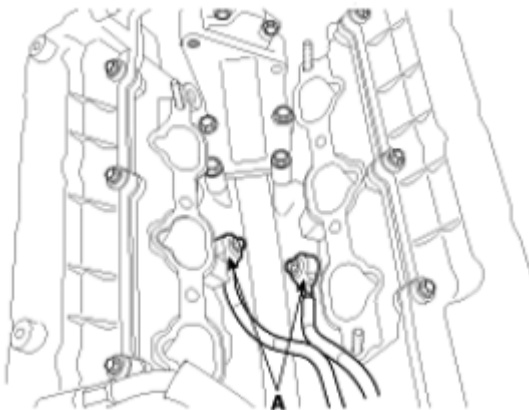
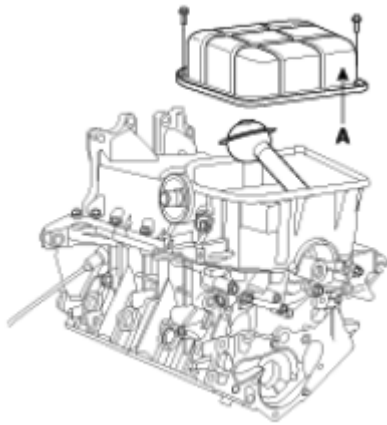


Fig. 4: Locating Knock Sensors
Courtesy of KIA MOTORS AMERICA, INC.

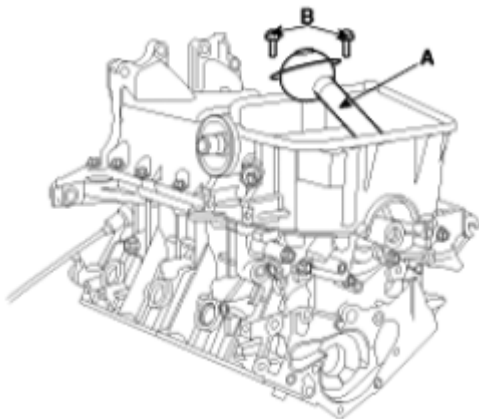
11. Remove the lower oil pan (A).

**Fig. 5: Locating Lower Oil Pan**

Courtesy of KIA MOTORS AMERICA, INC.

12. Remove oil screen.

Remove the 2 bolts (B), oil screen (A) and gasket.

**Fig. 6: Locating Bolts And Oil Screen**

Courtesy of KIA MOTORS AMERICA, INC.

13. Remove the upper oil pan (A).

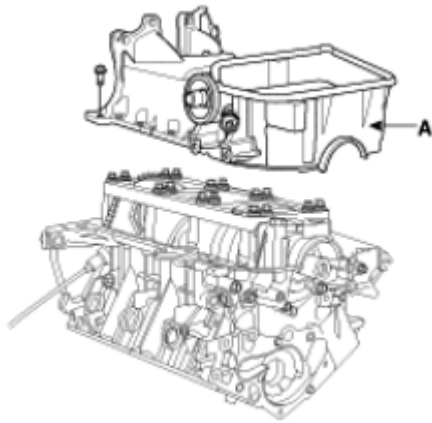


Fig. 7: Locating Upper Oil Pan

Courtesy of KIA MOTORS AMERICA, INC.

14. Check the connecting rod end play. (See CONNECTING ROD AND CRANKSHAFT)
15. Remove the connecting rod caps and check oil clearance. (See CONNECTING ROD AND CRANKSHAFT)
16. Remove piston and connecting rod assemblies.
 1. Using a ridge reamer, remove all the carbon from the top of the cylinder.
 2. Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

NOTE:

- **Keep the bearings, connecting rod and cap together.**
- **Arrange the piston and connecting rod assemblies in the correct order.**

17. Remove front case. (See REPAIR PROCEDURES)
18. Remove oil seal case.

Remove the 3 bolts (B) and oil seal case (A).

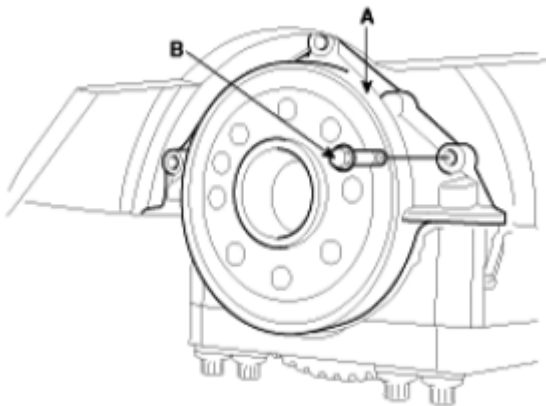


Fig. 8: Locating Bolts And Oil Seal Case

Courtesy of KIA MOTORS AMERICA, INC.

19. Check the crankshaft end play. (See CONNECTING ROD AND CRANKSHAFT)
20. Remove crankshaft bearing cap and check oil clearance. (See CONNECTING ROD AND CRANKSHAFT)

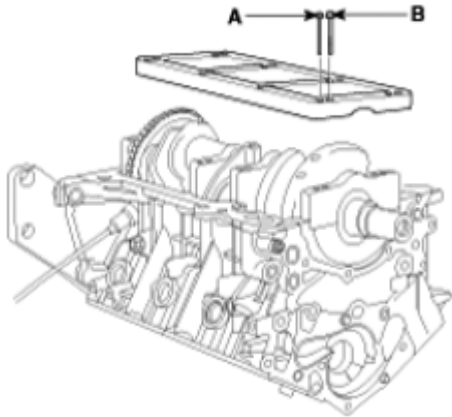


Fig. 9: Removing Crankshaft Bearing Cap
Courtesy of KIA MOTORS AMERICA, INC.

21. Lift the crankshaft (A) out of the engine, being careful not to damage journals.

NOTE: Arrange the main bearings and trust washers in the correct order.

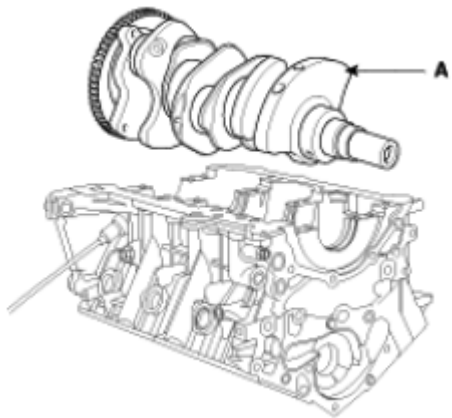


Fig. 10: Locating Crankshaft
Courtesy of KIA MOTORS AMERICA, INC.

22. Check fit between piston and piston pin.

Try to move the piston back and forth on the piston pin. If any movement is felt, replace the piston and pin as a set.

23. Remove piston rings.

1. Using a piston ring expander, remove the 2 compression rings.
2. Remove the 2 side rails and oil ring by hand.

NOTE: **Arrange the piston rings in the correct order only.**

24. Disconnect connecting rod from piston.

DISASSEMBLY

1. A/T : remove drive plate.
2. Install engine to engine stand for disassembly (A).
3. Remove timing belt. (See **TIMING SYSTEM - 2.7L**).
4. Remove cylinder head. (See **CYLINDER HEAD ASSEMBLY - 2.7L**)
5. Remove oil level gauge assembly.
6. Remove the alternator. (See **ALTERNATOR**).
7. Remove the air compressor. (See **COMPRESSOR**)
8. Remove the power steering pump bracket (A).

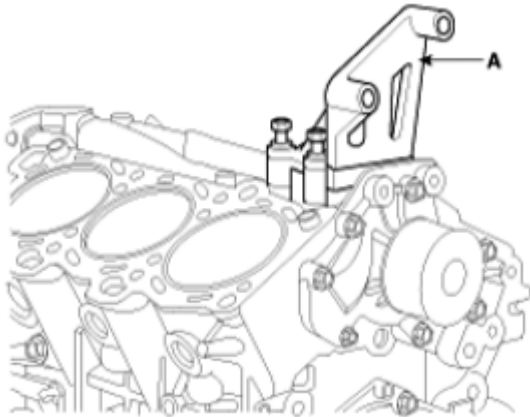


Fig. 11: Locating Power Steering Pump Bracket
Courtesy of KIA MOTORS AMERICA, INC.

9. Remove water pump. (See **REMOVAL**)
10. Remove knock sensors (A).



Fig. 12: Locating Knock Sensors

Courtesy of KIA MOTORS AMERICA, INC.

11. Remove the lower oil pan (A).

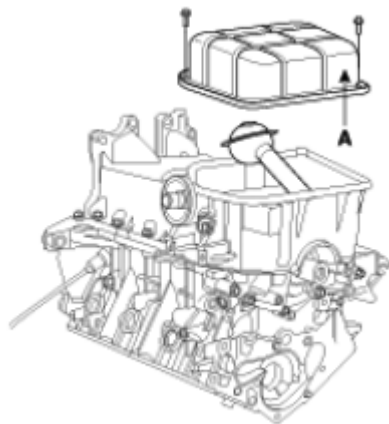


Fig. 13: Locating Lower Oil Pan

Courtesy of KIA MOTORS AMERICA, INC.

12. Remove oil screen.

Remove the 2 bolts (B), oil screen (A) and gasket.

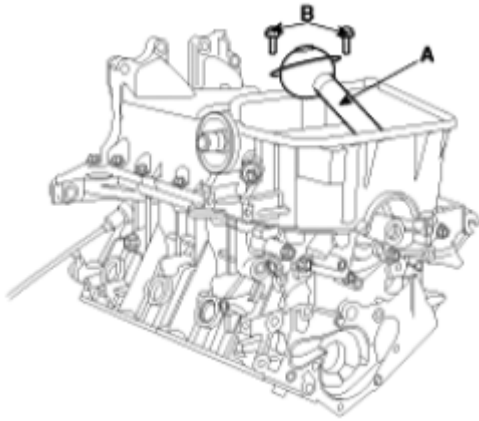


Fig. 14: Locating Bolts, Oil Screen And Gasket
Courtesy of KIA MOTORS AMERICA, INC.

13. Remove the upper oil pan (A).

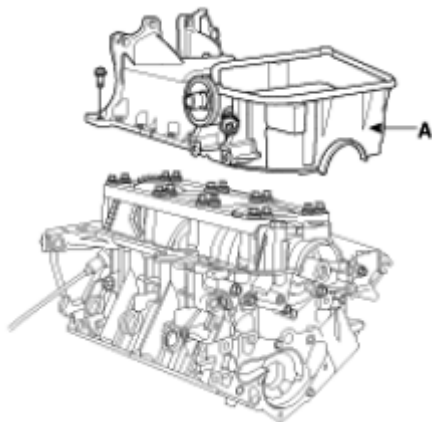


Fig. 15: Locating Upper Oil Pan
Courtesy of KIA MOTORS AMERICA, INC.

14. Check the connecting rod end play. (See CONNECTING ROD AND CRANKSHAFT)
15. Remove the connecting rod caps and check oil clearance. (See CONNECTING ROD AND CRANKSHAFT)
16. Remove piston and connecting rod assemblies.
 1. Using a ridge reamer, remove all the carbon from the top of the cylinder.
 2. Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

NOTE:

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.

17. Remove front case. (See REPAIR PROCEDURES)

18. Remove oil seal case.

Remove the 3 bolts (B) and oil seal case (A).

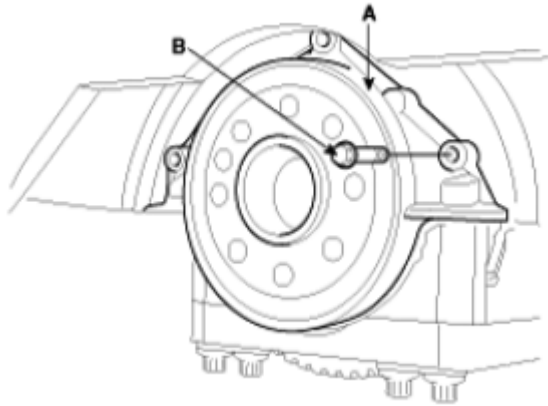


Fig. 16: Locating Bolts And Oil Seal Case
Courtesy of KIA MOTORS AMERICA, INC.

19. Check the crankshaft end play. (See **Place of identification mark (Crankshaft bearing)**)
20. Remove crankshaft bearing cap and check oil clearance. (See **CONNECTING ROD AND CRANKSHAFT**)

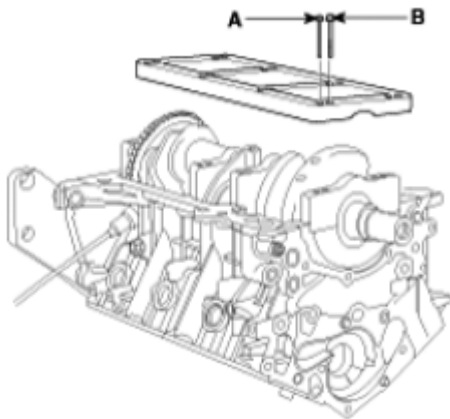


Fig. 17: Checking Oil Clearance
Courtesy of KIA MOTORS AMERICA, INC.

21. Lift the crankshaft (A) out of the engine, being careful not to damage journals.

NOTE: **Arrange the main bearings and trust washers in the correct order.**

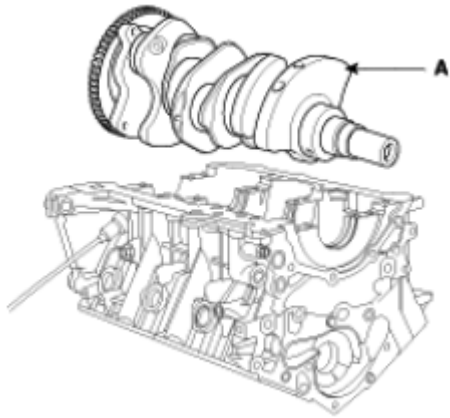


Fig. 18: Locating Crankshaft

Courtesy of KIA MOTORS AMERICA, INC.

22. Check fit between piston and piston pin.

Try to move the piston back and forth on the piston pin. If any movement is felt, replace the piston and pin as a set.

23. Remove piston rings.
1. Using a piston ring expander, remove the 2 compression rings.
 2. Remove the 2 side rails and oil ring by hand.

NOTE: Arrange the piston rings in the correct order only.

24. Disconnect connecting rod from piston.

INSPECTION

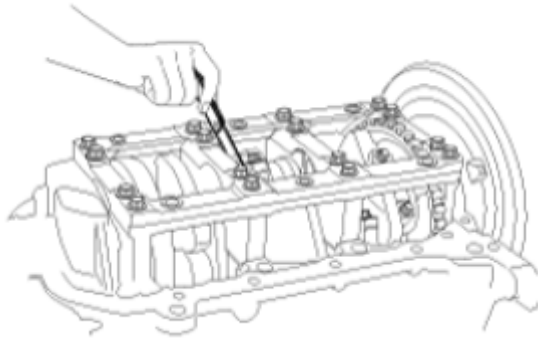
CONNECTING ROD AND CRANKSHAFT

1. Check the connecting rod end play.

Using a dial indicator, measure the end play while moving the connecting rod back and forth.

Standard end play : 0.1~ 0.25mm (0.004 ~ 0.010in.)

Maximum end play : 0.4mm (0.016in.)

**Fig. 19: Measuring End Play**

Courtesy of KIA MOTORS AMERICA, INC.

- A. If out-of-tolerance, replace the connecting rod assembly.
- B. If still out-of-tolerance, replace the crankshaft.
2. Check the connecting rod bearing oil clearance.
 1. Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
 2. Remove the 2 connecting rod cap bolts.
 3. Remove the connecting rod cap and bearing half.
 4. Clean the crank pin and bearing.
 5. Place plastigage across the crank pin.
 6. Reinstall the bearing half and cap, and torque the bolts.

Tightening torque

16 ~ 20N.m (160 ~ 200kgf.cm, 12 ~ 15lb-ft) + 90°

NOTE: **Do not turn the crankshaft.**

7. Remove the 2 bolts, connecting rod cap and bearing half.
8. Measure the plastigage at its widest point.

Standard oil clearance

0.018 ~ 0.036mm (0.0007 ~ 0.0014in.)

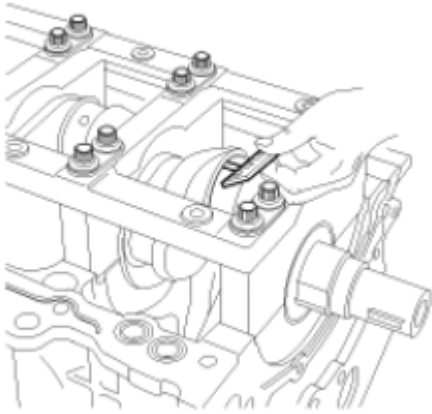


Fig. 20: Measuring Plastigage At Its Widest Point
Courtesy of KIA MOTORS AMERICA, INC.

9. If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

CAUTION: Do not file, shim, or scrape the bearings or the caps to adjust clearance.

10. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

NOTE: If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION: If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

Connecting rod mark location



Fig. 21: Identifying Connecting Rod Mark Location
 Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CONNECTING ROD

CLASS	MARK	INSIDE DIAMETER
0	A	51.000 ~ 51.006mm (2.0079 ~ 2.0081in.)
1	B	51.006 ~ 51.012mm (2.0081 ~ 2.0083in.)
2	C	51.012 ~ 51.018mm (2.0083 ~ 2.0086in.)

Crankshaft pin mark location



Fig. 22: Identifying Crankshaft Pin Mark Location
 Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CRANKSHAFT

CLASS	MARK	OUTSIDE DIAMETER OF PIN
I	A	47.994 ~ 48.000mm (1.8895 ~ 1.8898in.)

2010 Kia Sportage EX

2010 ENGINE Cylinder Block (Engine Mechanical System-G2.7 DOHC) - Sportage

II	B	47.988 ~ 47.994mm (1.8893 ~ 1.8895in.)
III	C	47.982 ~ 47.988mm (1.8890 ~ 1.8893in.)

Place of identification mark (Connecting rod bearing)

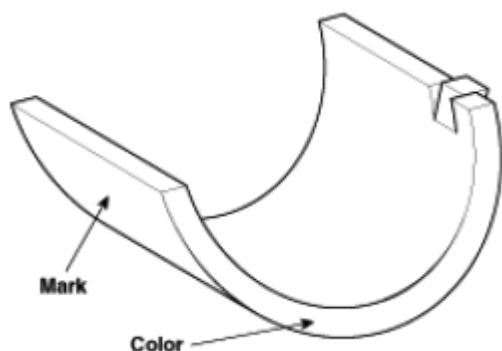


Fig. 23: Identifying Identification Mark (Connecting Rod Bearing)

Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CONNECTING ROD BEARING

CLASS	MARK	THICKNESS OF BEARING
A	BLUE	1.500 ~ 1.503mm (0.0590 ~ 0.0591in.)
B	BLACK	1.497 ~ 1.500mm (0.0589 ~ 0.0590in.)
C	NONE	1.494 ~ 1.497mm (0.0588 ~ 0.0589in.)
D	GREEN	1.491 ~ 1.494mm (0.0587 ~ 0.0588in.)
E	YELLOW	1.488 ~ 1.491mm (0.0586 ~ 0.0587in.)

(11) Selection

CRANKSHAFT IDENTIFICATION MARK REFERENCE CHART

CRANKSHAFT IDENTIFICATION MARK	CONNECTING ROD IDENTIFICATION MARK	ASSEMBLING CLASSIFICATION OF BEARING
I (A)	0 (A)	E (YELLOW)
	1 (B)	D (GREEN)
	2 (C)	C (NONE)
II (B)	0 (A)	D (GREEN)
	1 (B)	C (NONE)

	2 (C)	B (BLACK)
III (C)	0 (A)	C (NONE)
	1 (B)	B (BLACK)
	2 (C)	A (BLUE)

3. Check the crankshaft bearing oil clearance.

1. To check main bearing-to-journal oil clearance, remove the main caps and bearing halves.
2. Clean each main journal and bearing half with a clean shop towel.
3. Place one strip of plastigage across each main journal.
4. Reinstall the bearings and caps, then torque the bolts.

Tightening torque

M8

13 ~ 19N.m (130 ~ 190kgf.cm, 10 ~ 14lb-ft) + 90°

M10

27 ~ 33N.m (270 ~ 330kgf.cm, 19.5 ~ 24lb-ft) + 90°

NOTE: **Do not turn the crankshaft.**

5. Remove the cap and bearing again, and measure the widest part of the plastigage.

Standard oil clearance

0.004 ~ 0.022mm (0.00016 ~ 0.00087in.)

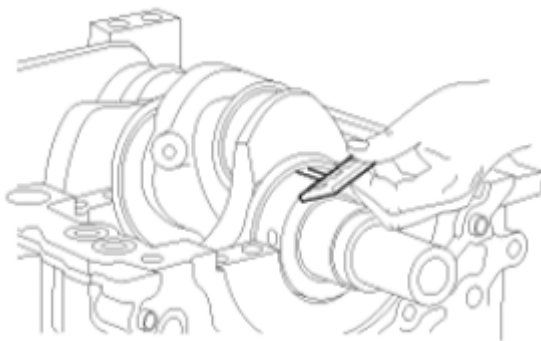


Fig. 24: Measuring Widest Part Of Plastigage
Courtesy of KIA MOTORS AMERICA, INC.

6. If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

CAUTION: Do not file, shim, or scrape the bearings or the caps to adjust clearance.

7. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

NOTE: If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION: If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

Connecting rods

1. When reinstalling, make sure that cylinder numbers put on the connecting rod and 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.
2. Replace the connecting rod if it is damaged on the thrust faces at either end. Also if step wear or a severely rough surface of the inside diameter of the small end is apparent, the rod must be replaced as well.
3. Using a connecting rod aligning tool, check the rod for bend and twist. If the measured value is close to the repair limit, correct the rod by a press. Any connecting rod that has been severely bent or distorted should be replaced.

Allowable bend of connecting rod

0.05mm/100mm (0.0020 in./3.94 in.) or less

Allowable twist of connecting rod

0.1mm/100mm (0.0039 in./3.94 in.) or less

Letters have been stamped on the end of the block as a mark for the size of each of the 4 main journal bores.



Fig. 25: Identifying Letters Stamped On End Of Block
 Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CYLINDER BLOCK

CLASS	MARK	INSIDE DIAMETER
a	A	66.000 ~ 66.006mm (2.5984 ~ 2.5986in.)
b	B	66.006 ~ 66.012mm (2.5986 ~ 2.5989in.)
c	C	66.012 ~ 66.018mm (2.5989 ~ 2.5991in.)

Crankshaft journal mark location

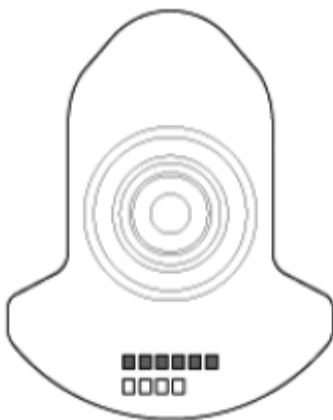


Fig. 26: Identifying Crankshaft Journal Mark Location
 Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CRANKSHAFT

CLASS	MARK	OUTSIDE DIAMETER OF JOURNAL
I	A	61.994 ~ 62.000mm (2.4407 ~ 2.4409in.)

2010 Kia Sportage EX

2010 ENGINE Cylinder Block (Engine Mechanical System-G2.7 DOHC) - Sportage

II	B	61.988 ~ 61.994mm (2.4405 ~ 2.4407in.)
III	C	61.982 ~ 61.988mm (2.4402 ~ 2.4405in.)

Place of identification mark (Crankshaft bearing)

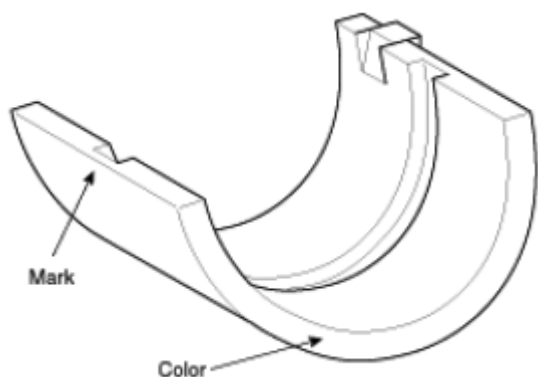


Fig. 27: Identifying Identification Mark (Crankshaft Bearing)

Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CRANKSHAFT BEARING

CLASS	MARK	THICKNESS OF BEARING
A	BLUE	2.007 ~ 2.010mm (0.0790 ~ 0.0791in.)
B	BLACK	2.004 ~ 2.007mm (0.0789 ~ 0.0790in.)
C	NONE	2.001 ~ 2.004mm (0.0788 ~ 0.0789in.)
D	GREEN	1.998 ~ 2.001mm (0.0787 ~ 0.788in.)
E	YELLOW	1.995 ~ 1.998mm (0.0785 ~ 0.0787in.)

CRANKSHAFT BEARING SELECTION CHART

CRANKSHAFT IDENTIFICATION MARK	CRANKSHAFT BORE IDENTIFICATION MARK	ASSEMBLING CLASSIFICATION OF BEARING
I (A)	a (A)	E (YELLOW)
	b (B)	D (GREEN)
	c (C)	C (NONE)
II (B)	a (A)	D (GREEN)
	b (B)	C (NONE)
	c (C)	B (BLACK)
	a (A)	C (NONE)

III (C)	b (B)	B (BLACK)
	c (C)	A (BLUE)

4. Check crankshaft end play.

Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard end play

0.07 ~ 0.25mm (0.0027 ~ 0.0098in.)

Limit : 0.30mm (0.0118in.)

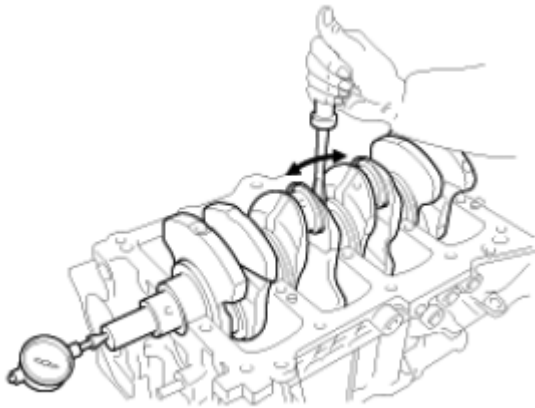


Fig. 28: Checking Crankshaft End Play
Courtesy of KIA MOTORS AMERICA, INC.

If the end play is greater than maximum, replace the thrust bearings as a set.

Thrust bearing thickness

2.05 ~ 2.09mm (0.081 ~ 0.082in.)

Inspect main journals and crank pins

Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter

61.982 ~ 62.000mm (2.4402 ~ 2.4409in.)

Crank pin diameter

47.982 ~ 48.000mm (1.8890 ~ 1.8898in.)

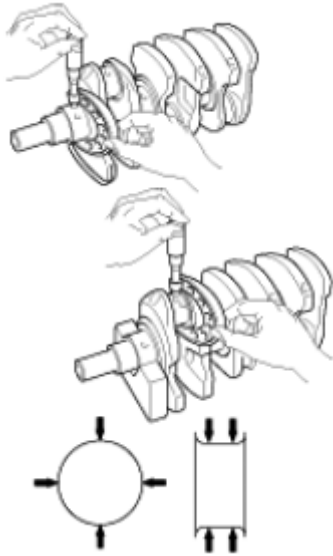


Fig. 29: Measuring Diameter Of Each Main Journal And Crank Pin
Courtesy of KIA MOTORS AMERICA, INC.

CYLINDER BLOCK

1. Remove gasket material.

Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

2. Clean cylinder block

Using a soft brush and solvent, thoroughly clean the cylinder block.

3. Inspect top surface of cylinder block for flatness.

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

Flatness of cylinder block gasket surface

Standard : Less than 0.03mm (0.0012 in.)

Limit : 0.05mm (0.0020 in.)

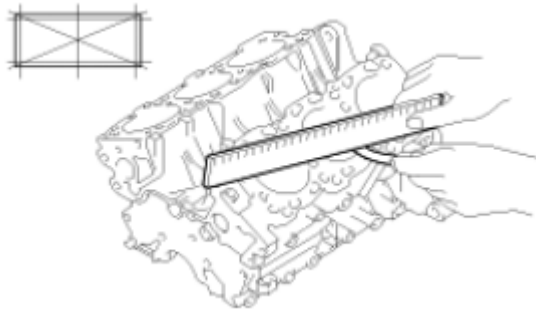


Fig. 30: Measuring Surface Contacting Cylinder Head Gasket For Warpage
Courtesy of KIA MOTORS AMERICA, INC.

4. Inspect cylinder bore diameter

Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder liner.

5. Inspect cylinder bore diameter

Using a cylinder bore gauge, measure the cylinder bore diameter at position A, B and C in the thrust and axial directions.

Standard diameter

86.70 ~ 86.73mm (3.4134 ~ 3.4145in.)

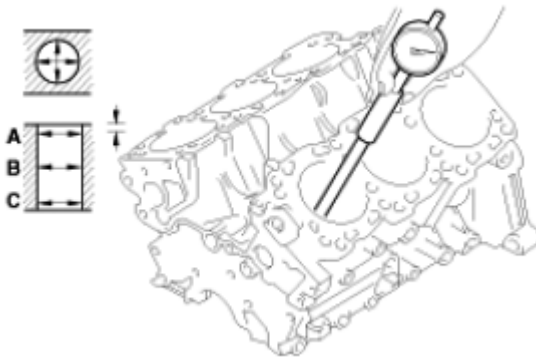


Fig. 31: Measuring Cylinder Bore Diameter At Position A, B And C In Thrust And Axial Directions
Courtesy of KIA MOTORS AMERICA, INC.

6. Check the cylinder bore size code (A) on the cylinder block bottom face.

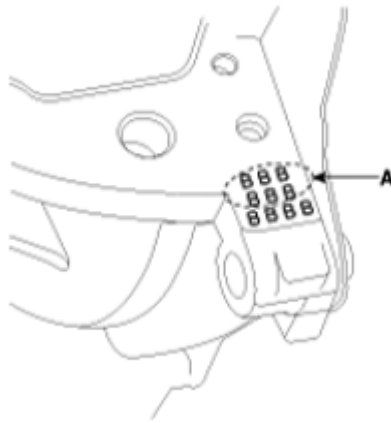


Fig. 32: Checking Cylinder Bore Size Code On Cylinder Block Bottom Face
 Courtesy of KIA MOTORS AMERICA, INC.

CYLINDER BORE SIZE CODE REFERENCE CHART

Class	Cylinder bore inner diameter	Size code
A	86.70 ~ 86.71mm (3.4133 ~ 3.4137in.)	A
B	86.71 ~ 86.72mm (3.4137 ~ 3.4141in.)	B
C	86.72 ~ 86.73mm (3.4141 ~ 3.4145in.)	C

7. Check the piston size code (A) on the piston top face.

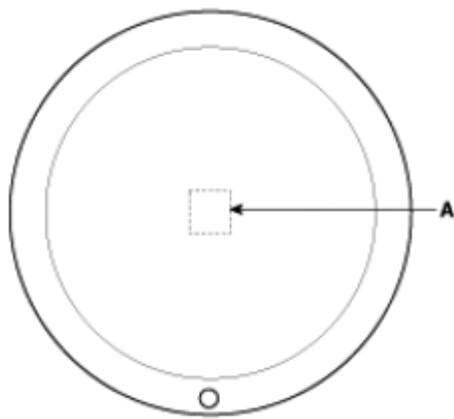


Fig. 33: Checking Piston Size Code On Piston Top Face
 Courtesy of KIA MOTORS AMERICA, INC.

NOTE: Stamp the grade mark of basic diameter with rubber stamp.

PISTON DIAMETER REFERENCE CHART

Class	Piston diameter	Size code
A	86.68 ~ 86.69mm (3.4126 ~ 3.4130in.)	A
B	86.69 ~ 86.70mm (3.4130 ~ 3.4133in.)	None

C	86.70 ~ 86.71mm (3.4133 ~ 3.4137in.)	C
---	--------------------------------------	---

- Select the piston related to cylinder bore class.

Clearance : 0.01 ~ 0.03mm (0.0004 ~ 0.0012in.)

Boring Cylinder

- Oversize pistons should be selected according to the largest bore cylinder.

CYLINDER BORE REFERENCE CHART

Identification	Mark Size
0.25	0.25mm (0.010in.)
0.50	0.50mm (0.0250in.)

NOTE: The size of piston is stamped on top of the piston.

- Measure the outside diameter of the piston to be used.
- According to the measured O.D., calculate the new bore size.

New bore size = Piston O.D + 0.01 to 0.03mm

(0.0004 to 0.0012 in.) (clearance between piston and
cylinder) - 0.01 mm (0.0004 in.) (honing margin.)

- Bore each of the cylinders to the calculated size.

CAUTION: To prevent distortion that may result from temperature rise during honing, bore the cylinder holes in the firing order.

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

Standard : 0.01 ~ 0.03mm (0.0004 ~ 0.0012 in.)

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

PISTON AND RINGS

- Clean piston
 - Using a gasket scraper, remove the carbon from the piston top.
 - Using a groove cleaning tool or broken ring, clean the piston ring grooves.

3. Using solvent and a brush, thoroughly clean the piston.

NOTE: Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 38.5mm (1.516in.) from the top land of the piston.

Standard diameter

86.68 ~ 86.71mm (3.4126 ~ 3.4138in.)

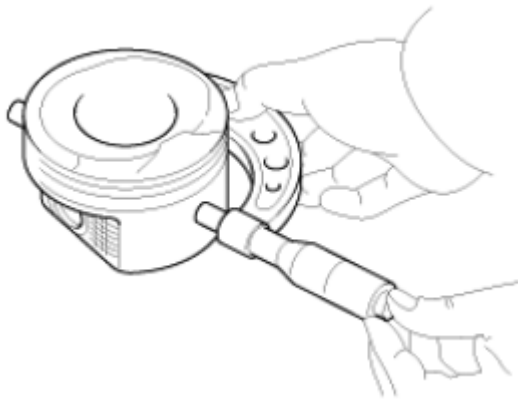


Fig. 34: Measuring Piston Outside Diameter
Courtesy of KIA MOTORS AMERICA, INC.

3. Calculate the difference between the cylinder bore diameter and the piston diameter.

Piston-to-cylinder clearance

0.01 ~ 0.03mm (0.0004 ~ 0.0012in.)

4. Inspect the piston ring side clearance.

Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.

Piston ring side clearance

No. 1 : 0.04 ~ 0.08mm (0.0016 ~ 0.0031 in.)

No. 2 : 0.03 ~ 0.07mm (0.0012 ~ 0.0028 in.)

Limit

No. 1 : 0.1mm (0.004in.)

No. 2 : 0.1mm (0.004in.)

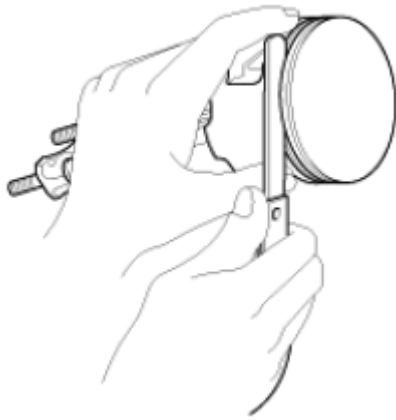


Fig. 35: Measuring Clearance Between New Piston Ring And Wall Of Ring Groove
Courtesy of KIA MOTORS AMERICA, INC.

If the clearance is greater than maximum, replace the piston.

5. Inspect piston ring end gap.

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. If the gap is too large, recheck the cylinder bore diameter against the wear limits, If the bore is over the service limit, the cylinder block must be rebored. (See **Boring Cylinder**).

Piston ring end gap

Standard

No. 1 : 0.20 ~ 0.35mm (0.0079 ~ 0.0138in.)

No. 2 : 0.37 ~ 0.52mm (0.0146 ~ 0.0205in.)

Limit

Oil ring : 0.2 ~ 0.7mm (0.0079 ~ 0.0276in.)

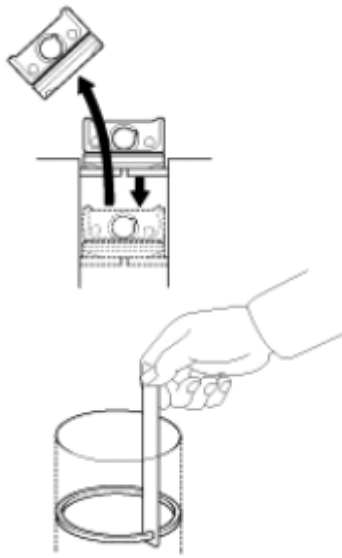


Fig. 36: Inspecting Piston Ring End Gap
Courtesy of KIA MOTORS AMERICA, INC.

PISTON PINS

1. Measure the diameter of the piston pin.

Piston pin diameter

21.001 ~ 21.007mm (0.8268 ~ 0.8270in.)

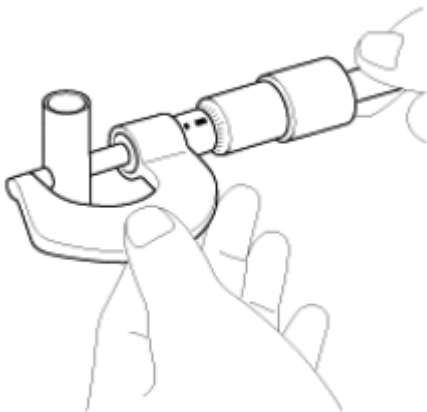


Fig. 37: Measuring Diameter Of Piston Pin
Courtesy of KIA MOTORS AMERICA, INC.

2. Measure the piston pin-to-piston clearance.

Piston pin-to-piston clearance

0.007 ~ 0.022mm (0.00027 ~ 0.00086in.)

3. Check the difference between the piston pin diameter and the connecting rod small end diameter.

Piston pin-to-connecting rod interference

0.016 ~ 0.033mm (0.00063 ~ 0.00130in.)

OIL PRESSURE SWITCH

1. Check the continuity between the terminal and the body with an ohmmeter.

If there is no continuity, replace the oil pressure switch.

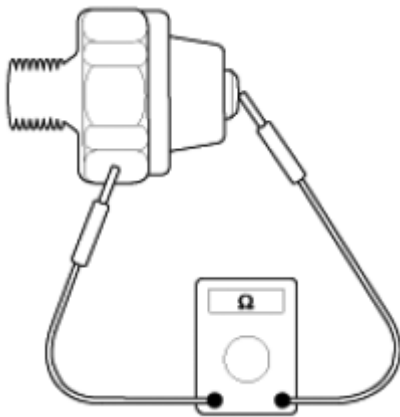


Fig. 38: Checking Continuity Between Terminal And Body With An Ohmmeter
 Courtesy of KIA MOTORS AMERICA, INC.

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 the switch.
3. If there is no continuity when a 50kpa (7psi) vacuum is applied through the oil hole, the switch is operating properly. Check for air leakage. If air leaks, the diaphragm is broken. Replace it.

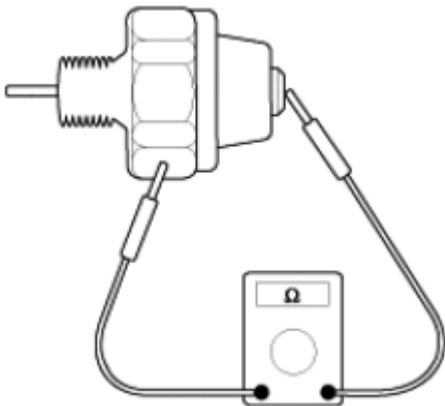


Fig. 39: Checking Continuity Between Terminal And Body With An Ohmmeter
 Courtesy of KIA MOTORS AMERICA, INC.

INSPECTION

CONNECTING ROD AND CRANKSHAFT

1. Check the connecting rod end play.

Using a dial indicator, measure the end play while moving the connecting rod back and forth.

Standard end play : 0.1~ 0.25mm (0.004 ~ 0.010in.)

Maximum end play : 0.4mm (0.016in.)

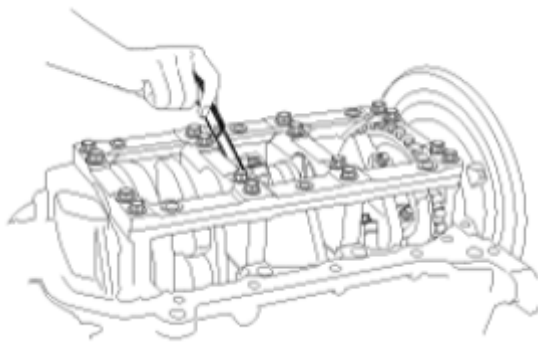


Fig. 40: Measuring End Play While Moving Connecting Rod Back And Forth
Courtesy of KIA MOTORS AMERICA, INC.

- A. If out-of-tolerance, replace the connecting rod assembly.
 - B. If still out-of-tolerance, replace the crankshaft.
2. Check the connecting rod bearing oil clearance.
 1. Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
 2. Remove the 2 connecting rod cap bolts.
 3. Remove the connecting rod cap and bearing half.
 4. Clean the crank pin and bearing.
 5. Place plastigage across the crank pin.
 6. Reinstall the bearing half and cap, and torque the bolts.

Tightening torque

16 ~ 20N.m (160 ~ 200kgf.cm, 12 ~ 15 lbf.ft) + 90°

NOTE: Do not turn the crankshaft.

7. Remove the 2 bolts, connecting rod cap and bearing half.
8. Measure the plastigage at its widest point.

Standard oil clearance

0.018 ~ 0.036mm (0.0007 ~ 0.0014in.)

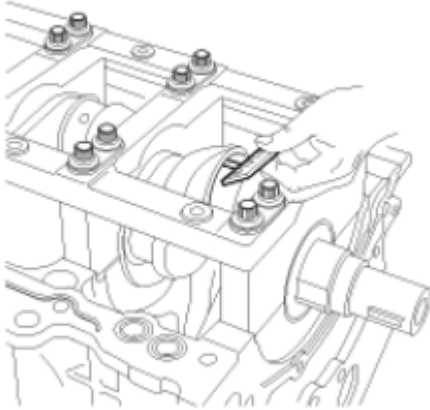


Fig. 41: Measuring Plastigage At Its Widest Point
Courtesy of KIA MOTORS AMERICA, INC.

9. If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

CAUTION: Do not file, shim, or scrape the bearings or the caps to adjust clearance.

10. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

NOTE: If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION: If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

Connecting rod mark location

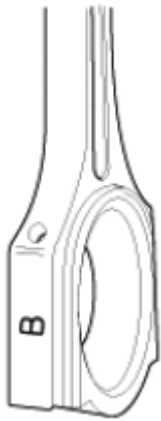


Fig. 42: Identifying Connecting Rod Mark Location
 Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CONNECTING ROD

CLASS	MARK	INSIDE DIAMETER
0	A	51.000 ~ 51.006mm (2.0079 ~ 2.0081in.)
1	B	51.006 ~ 51.012mm (2.0081 ~ 2.0083in.)
2	C	51.012 ~ 51.018mm (2.0083 ~ 2.0086in.)

Crankshaft pin mark location



Fig. 43: Identifying Crankshaft Pin Mark Location
 Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CRANKSHAFT

CLASS	MARK	OUTSIDE DIAMETER OF PIN
I	A	47.994 ~ 48.000mm (1.8895 ~ 1.8898in.)

II	B	47.988 ~ 47.994mm (1.8893 ~ 1.8895in.)
III	C	47.982 ~ 47.988mm (1.8890 ~ 1.8893in.)

Place of identification mark (Connecting rod bearing)

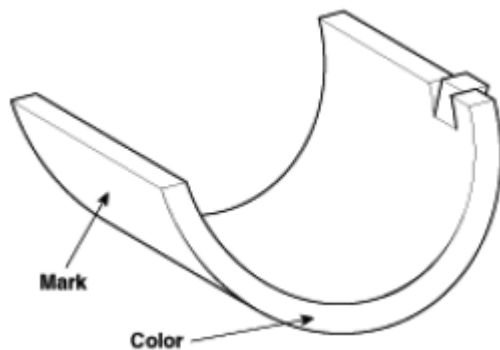


Fig. 44: Identifying Identification Mark (Connecting Rod Bearing)
Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CONNECTING ROD BEARING

CLASS	MARK	THICKNESS OF BEARING
A	BLUE	1.500 ~ 1.503mm (0.0590 ~ 0.0591in.)
B	BLACK	1.497 ~ 1.500mm (0.0589 ~ 0.0590in.)
C	NONE	1.494 ~ 1.497mm (0.0588 ~ 0.0589in.)
D	GREEN	1.491 ~ 1.494mm (0.0587 ~ 0.0588in.)
E	YELLOW	1.488 ~ 1.491mm (0.0586 ~ 0.0587in.)

11. Selection

CRANKSHAFT BEARING SELECTION REFERENCE CHART

CRANKSHAFT IDENTIFICATION MARK	CONNECTING ROD IDENTIFICATION MARK	ASSEMBLING CLASSIFICATION OF BEARING
I (A)	0 (A)	E (YELLOW)
	1 (B)	D (GREEN)
	2 (C)	C (NONE)
II (B)	0 (A)	D (GREEN)
	1 (B)	C (NONE)

III (C)	2 (C)	B (BLACK)
	0 (A)	C (NONE)
	1 (B)	B (BLACK)
	2 (C)	A (BLUE)

3. Check the crankshaft bearing oil clearance.

1. To check main bearing-to-journal oil clearance, remove the main caps and bearing halves.
2. Clean each main journal and bearing half with a clean shop towel.
3. Place one strip of plastigage across each main journal.
4. Reinstall the bearings and caps, then torque the bolts.

Tightening torque

M8

13 ~ 19N.m (130 ~ 190kgf.cm, 10 ~ 14 lbf.ft) + 90°

M10

27 ~ 33N.m (270 ~ 330kgf.cm, 19.5 ~ 24 lbf.ft) + 90°

NOTE: **Do not turn the crankshaft.**

5. Remove the cap and bearing again, and measure the widest part of the plastigage.

Standard oil clearance

0.004 ~ 0.022mm (0.00016 ~ 0.00087in.)

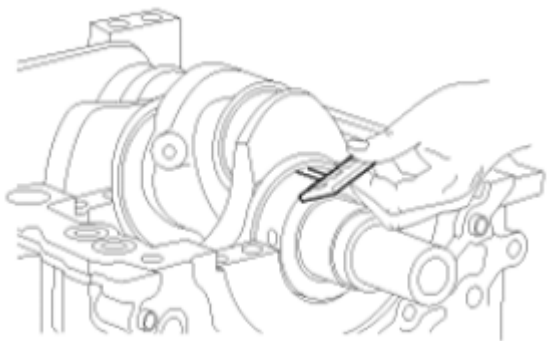


Fig. 45: Measuring Widest Part Of Plastigage
Courtesy of KIA MOTORS AMERICA, INC.

6. If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

CAUTION: Do not file, shim, or scrape the bearings or the caps to adjust clearance.

7. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

NOTE: If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION: If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

Connecting rods

1. When reinstalling, make sure that cylinder numbers put on the connecting rod and 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.
2. Replace the connecting rod if it is damaged on the thrust faces at either end. Also if step wear or a severely rough surface of the inside diameter of the small end is apparent, the rod must be replaced as well.
3. Using a connecting rod aligning tool, check the rod for bend and twist. If the measured value is close to the repair limit, correct the rod by a press. Any connecting rod that has been severely bent or distorted should be replaced.

Allowable bend of connecting rod

0.05mm/100mm (0.0020 in./3.94 in.) or less

Allowable twist of connecting rod

0.1mm/100mm (0.0039 in./3.94 in.) or less

Letters have been stamped on the end of the block as a mark for the size of each of the 4 main journal bores.

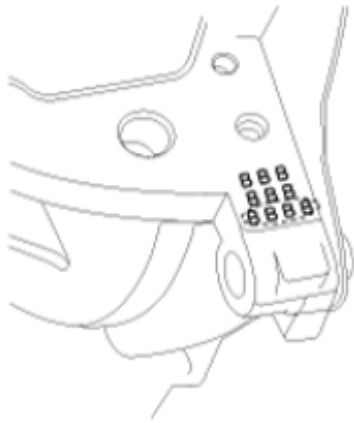


Fig. 46: Identifying Letters Stamped On End Of Block
 Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CYLINDER BLOCK

CLASS	MARK	INSIDE DIAMETER
a	A	66.000 ~ 66.006mm (2.5984 ~ 2.5986in.)
b	B	66.006 ~ 66.012mm (2.5986 ~ 2.5989in.)
c	C	66.012 ~ 66.018mm (2.5989 ~ 2.5991in.)

Crankshaft journal mark location



Fig. 47: Identifying Crankshaft Journal Mark Location
 Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CRANKSHAFT

CLASS	MARK	OUTSIDE DIAMETER OF JOURNAL
I	A	61.994 ~ 62.000mm (2.4407 ~ 2.4409in.)

2010 Kia Sportage EX

2010 ENGINE Cylinder Block (Engine Mechanical System-G2.7 DOHC) - Sportage

II	B	61.988 ~ 61.994mm (2.4405 ~ 2.4407in.)
III	C	61.982 ~ 61.988mm (2.4402 ~ 2.4405in.)

Place of identification mark (Crankshaft bearing)

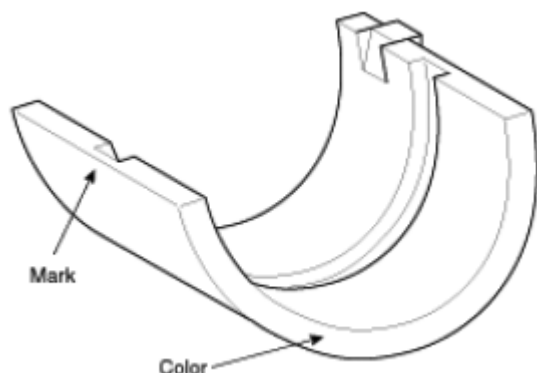


Fig. 48: Identifying Identification Mark (Crankshaft Bearing)
Courtesy of KIA MOTORS AMERICA, INC.

DISCRIMINATION OF CRANKSHAFT BEARING

CLASS	MARK	THICKNESS OF BEARING
A	BLUE	2.007 ~ 2.010mm (0.0790 ~ 0.0791in.)
B	BLACK	2.004 ~ 2.007mm (0.0789 ~ 0.0790in.)
C	NONE	2.001 ~ 2.004mm (0.0788 ~ 0.0789in.)
D	GREEN	1.998 ~ 2.001mm (0.0787 ~ 0.788in.)
E	YELLOW	1.995 ~ 1.998mm (0.0785 ~ 0.0787in.)

CRANKSHAFT BEARING SELECTION CHART

CRANKSHAFT IDENTIFICATION MARK	CRANKSHAFT BORE IDENTIFICATION MARK	ASSEMBLING CLASSIFICATION OF BEARING
I (A)	a (A)	E (YELLOW)
	b (B)	D (GREEN)
	c (C)	C (NONE)
II (B)	a (A)	D (GREEN)
	b (B)	C (NONE)
	c (C)	B (BLACK)

III (C)	a (A)	C (NONE)
	b (B)	B (BLACK)
	c (C)	A (BLUE)

4. Check crankshaft end play.

Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard end play

0.07 ~ 0.25mm (0.0027 ~ 0.0098in.)

Limit : 0.30mm (0.0118in.)

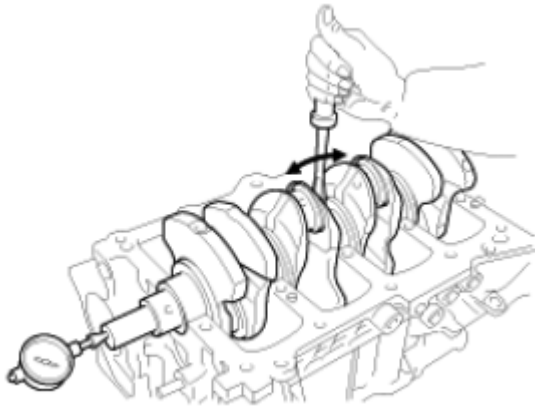


Fig. 49: Measuring Thrust Clearance While Prying Crankshaft Back And Forth With Screwdriver
Courtesy of KIA MOTORS AMERICA, INC.

If the end play is greater than maximum, replace the thrust bearings as a set.

Thrust bearing thickness

2.05 ~ 2.09mm (0.081 ~ 0.082in.)

5. Inspect main journals and crank pins

Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter

61.982 ~ 62.000mm (2.4402 ~ 2.4409in.)

Crank pin diameter

47.982 ~ 48.000mm (1.8890 ~ 1.8898in.)

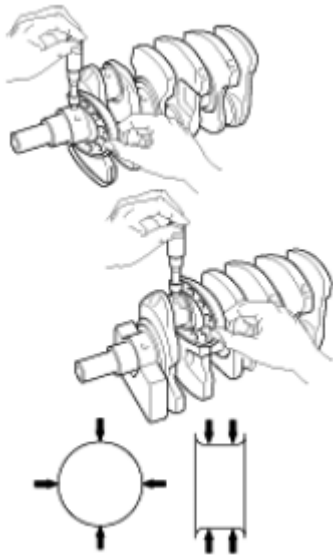


Fig. 50: Measuring Diameter Of Each Main Journal And Crank Pin
Courtesy of KIA MOTORS AMERICA, INC.

CYLINDER BLOCK

1. Remove gasket material.

Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

2. Clean cylinder block

Using a soft brush and solvent, thoroughly clean the cylinder block.

3. Inspect top surface of cylinder block for flatness.

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

Flatness of cylinder block gasket surface

Standard : Less than 0.03mm (0.0012 in.)

Limit : 0.05 mm (0.0020 in.)

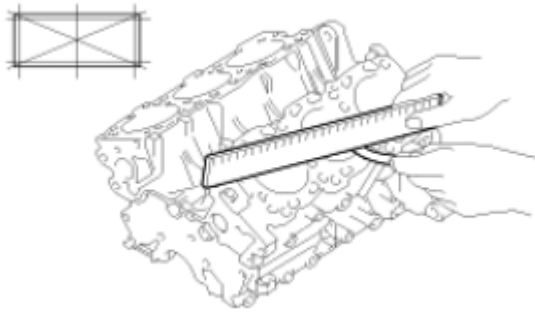


Fig. 51: Measuring Surface Contacting Cylinder Head Gasket For Warpage
Courtesy of KIA MOTORS AMERICA, INC.

4. Inspect cylinder bore diameter

Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder liner.

5. Inspect cylinder bore diameter

Using a cylinder bore gauge, measure the cylinder bore diameter at position A, B and C in the thrust and axial directions.

Standard diameter

86.70 ~ 86.73mm (3.4134 ~ 3.4145in.)

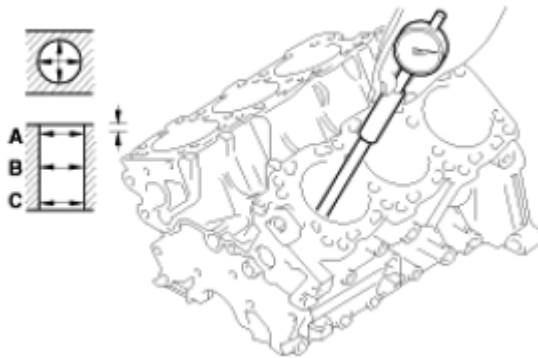


Fig. 52: Measuring Cylinder Bore Diameter At Position A, B And C In Thrust And Axial Directions
Courtesy of KIA MOTORS AMERICA, INC.

6. Check the cylinder bore size code (A) on the cylinder block bottom face.

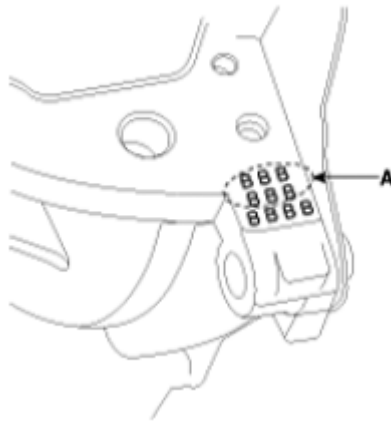


Fig. 53: Checking Cylinder Bore Size Code On Cylinder Block Bottom Face
 Courtesy of KIA MOTORS AMERICA, INC.

CYLINDER BORE INNER DIAMETER REFERENCE CHART

Class	Cylinder bore inner diameter	Size code
A	86.70 ~ 86.71mm (3.4133 ~ 3.4137in.)	A
B	86.71 ~ 86.72mm (3.4137 ~ 3.4141in.)	B
C	86.72 ~ 86.73mm (3.4141 ~ 3.4145in.)	C

7. Check the piston size code (A) on the piston top face.

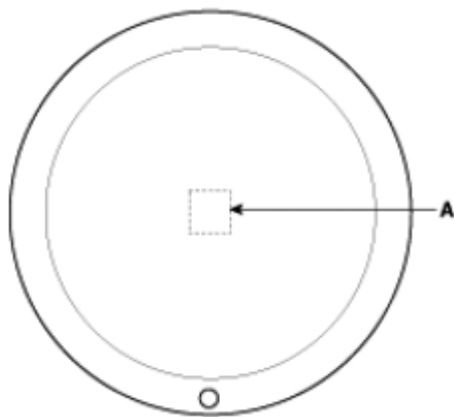


Fig. 54: Checking Piston Size Code On Piston Top Face
 Courtesy of KIA MOTORS AMERICA, INC.

NOTE: Stamp the grade mark of basic diameter with rubber stamp.

PISTON DIAMETER REFERENCE CHART

Class	Piston diameter	Size code
A	86.68 ~ 86.69mm (3.4126 ~ 3.4130in.)	A
B	86.69 ~ 86.70mm (3.4130 ~ 3.4133in.)	None

C	86.70 ~ 86.71mm (3.4133 ~ 3.4137in.)	C
---	--------------------------------------	---

- Select the piston related to cylinder bore class.

Clearance : 0.01 ~ 0.03mm (0.0004 ~ 0.0012in.)

Boring Cylinder

- Oversize pistons should be selected according to the largest bore cylinder.

CYLINDER BORE REFERENCE CHART

Identification Mark	Size
0.25	0.25mm (0.010in.)
0.50	0.50mm (0.0250in.)

NOTE: The size of piston is stamped on top of the piston.

- Measure the outside diameter of the piston to be used.
- According to the measured O.D., calculate the new bore size.

New bore size = Piston O.D + 0.01 to 0.03mm

(0.0004 to 0.0012 in.) (clearance between piston and
cylinder) - 0.01 mm (0.0004 in.) (honing margin.)

- Bore each of the cylinders to the calculated size.

CAUTION: To prevent distortion that may result from temperature rise during honing, bore the cylinder holes in the firing order.

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

Standard : 0.01 ~ 0.03mm (0.0004 ~ 0.0012 in.)

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

PISTON AND RINGS

- Clean piston
 - Using a gasket scraper, remove the carbon from the piston top.
 - Using a groove cleaning tool or broken ring, clean the piston ring grooves.

3. Using solvent and a brush, thoroughly clean the piston.

NOTE: Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 38.5mm (1.516in.) from the top land of the piston.

Standard diameter

86.68 ~ 86.71mm (3.4126 ~ 3.4138in.)

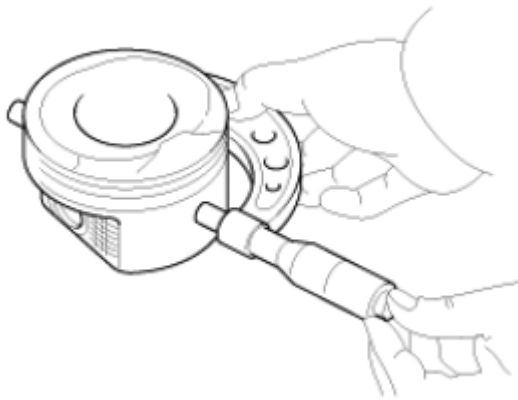


Fig. 55: Measuring Piston Outside Diameter
Courtesy of KIA MOTORS AMERICA, INC.

3. Calculate the difference between the cylinder bore diameter and the piston diameter.

Piston-to-cylinder clearance

0.01 ~ 0.03mm (0.0004 ~ 0.0012in.)

4. Inspect the piston ring side clearance.

Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.

Piston ring side clearance

No. 1 : 0.04 ~ 0.08 mm (0.0016 ~ 0.0031 in.)

No. 2 : 0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in.)

Limit

No. 1 : 0.1mm (0.004in.)

No. 2 : 0.1mm (0.004in.)

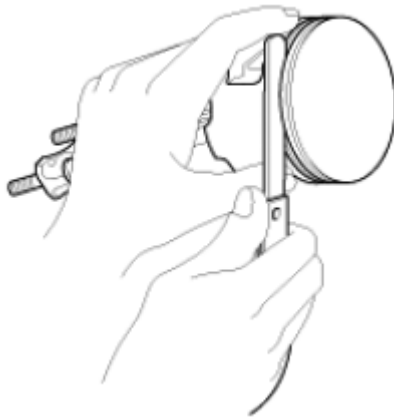


Fig. 56: Measuring Clearance Between New Piston Ring And Wall Of Ring Groove
Courtesy of KIA MOTORS AMERICA, INC.

If the clearance is greater than maximum, replace the piston.

5. Inspect piston ring end gap.

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. If the gap is too large, recheck the cylinder bore diameter against the wear limits, If the bore is over the service limit, the cylinder block must be rebored. (See **Boring Cylinder**).

Piston ring end gap

Standard

No. 1 : 0.20 ~ 0.35mm (0.0079 ~ 0.0138in.)

No. 2 : 0.37 ~ 0.52mm (0.0146 ~ 0.0205in.)

Limit

Oil ring : 0.2 ~ 0.7mm (0.0079 ~ 0.0276in.)

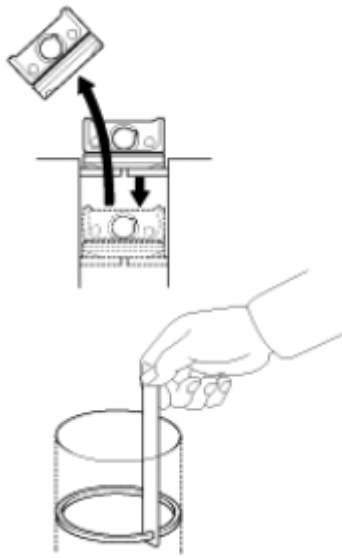


Fig. 57: Inspecting Piston Ring End Gap
Courtesy of KIA MOTORS AMERICA, INC.

PISTON PINS

1. Measure the diameter of the piston pin.

Piston pin diameter

21.001 ~ 21.007mm (0.8268 ~ 0.8270in.)

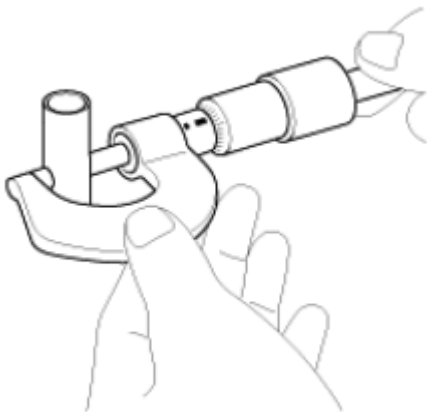


Fig. 58: Measuring Diameter Of Piston Pin
Courtesy of KIA MOTORS AMERICA, INC.

2. Measure the piston pin-to-piston clearance.

Piston pin-to-piston clearance

0.007 ~ 0.022mm (0.00027 ~ 0.00086in.)

3. Check the difference between the piston pin diameter and the connecting rod small end diameter.

Piston pin-to-connecting rod interference

0.016 ~ 0.033mm (0.00063 ~ 0.00130in.)

OIL PRESSURE SWITCH

1. Check the continuity between the terminal and the body with an ohmmeter.

If there is no continuity, replace the oil pressure switch.

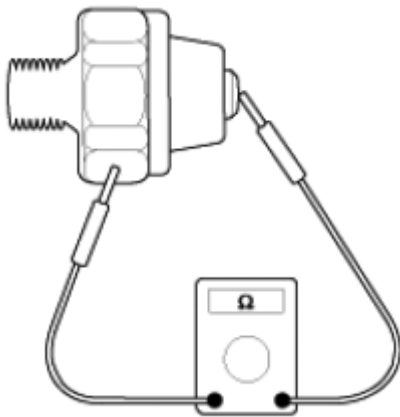


Fig. 59: Checking Continuity Between Terminal And Body With An Ohmmeter
 Courtesy of KIA MOTORS AMERICA, INC.

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 the switch.
3. If there is no continuity when a 50kpa (7psi) is applied through the oil hole, the switch is operating properly.

Check for air leakage. If air leaks, the diaphragm is broken. Replace it.

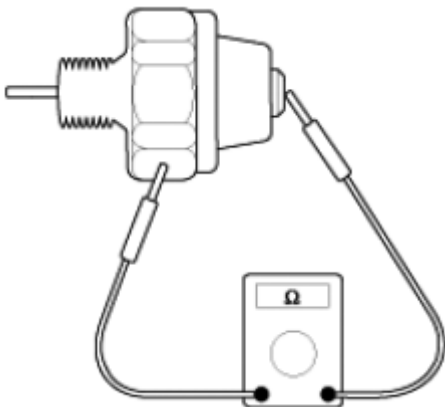


Fig. 60: Checking Continuity Between Terminal And Body With An Ohmmeter
Courtesy of KIA MOTORS AMERICA, INC.

REASSEMBLY**NOTE:**

- Thoroughly clean all parts to assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

1. Assemble piston and connecting rod.
 1. Use a hydraulic press for installation.
 2. The piston front mark (A) and the connecting rod front mark (B) must face the timing belt side of the engine.

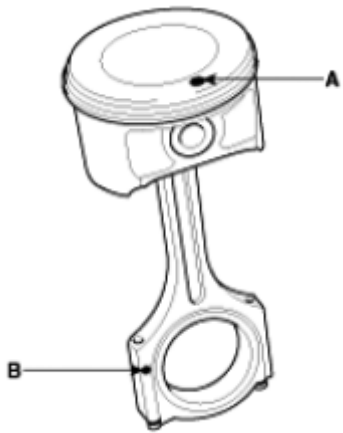


Fig. 61: Locating Piston Front Mark And Connecting Rod Front Mark
Courtesy of KIA MOTORS AMERICA, INC.

2. Install piston rings.
 1. Install the oil ring expander and 2 side rails by hand.
 2. Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
 3. Position the piston rings so that the ring ends are as shown.

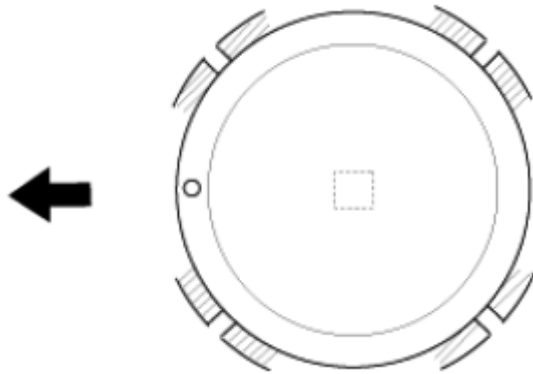


Fig. 62: Identifying Piston Rings End Positions
Courtesy of KIA MOTORS AMERICA, INC.

3. Install connecting rod bearings.
 1. Align the bearing claw with the groove of the connecting rod or connecting rod cap.
 2. Install the bearings in the connecting rod and connecting rod cap.

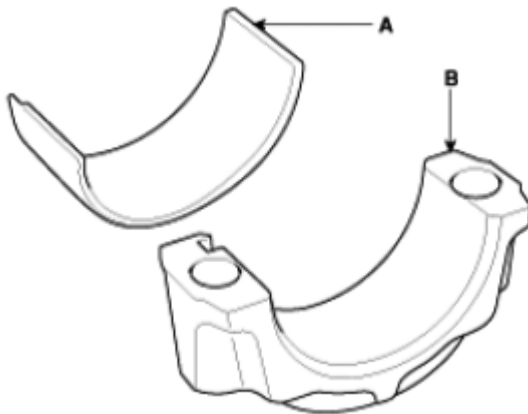


Fig. 63: Locating Bearings And Connecting Rod Cap
Courtesy of KIA MOTORS AMERICA, INC.

4. Install main bearings.

NOTE: Upper 1, 2, 3, 4 bearings have an oil groove of oil holes; Lower bearings do not.

1. Align the bearing claw with the claw groove of the cylinder block, push in the 4 upper bearings (A).

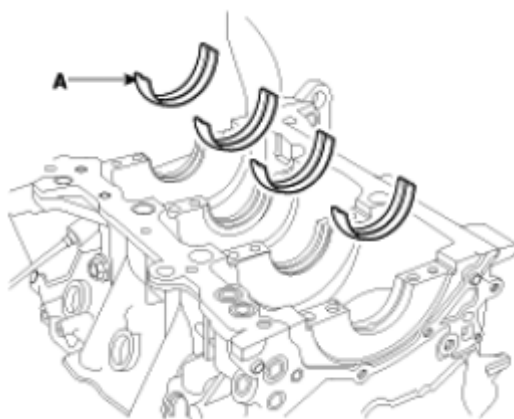


Fig. 64: Locating Upper Bearings
 Courtesy of KIA MOTORS AMERICA, INC.

2. Align the bearing claw with the claw groove of the main bearing cap (A), and push in the 4 lower bearings (B).

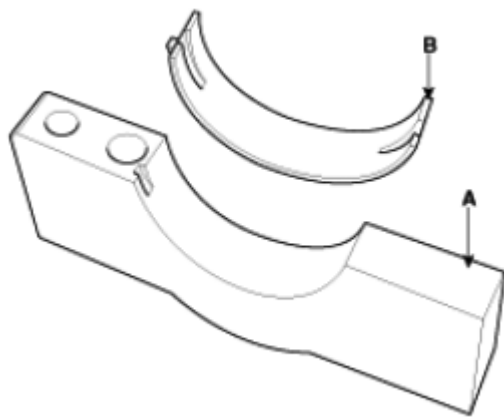


Fig. 65: Locating Main Bearing Cap And Lower Bearings
 Courtesy of KIA MOTORS AMERICA, INC.

5. Install thrust bearings.

Install the 2 thrust bearings (A) under the No. 3 journal position of the cylinder block with the oil grooves facing outward.



Fig. 66: Locating Thrust Bearings

Courtesy of KIA MOTORS AMERICA, INC.

6. Place crankshaft (A) on the cylinder block.

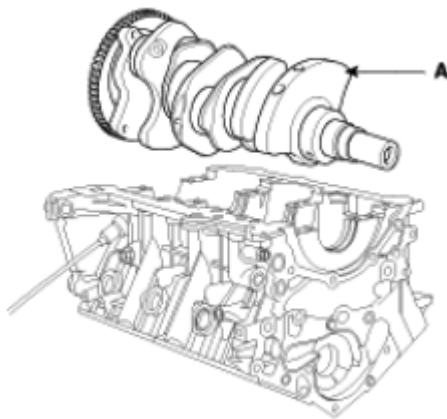


Fig. 67: Locating Crankshaft

Courtesy of KIA MOTORS AMERICA, INC.

7. Place main bearing caps on cylinder block.
8. Install main bearing cap bolts.

NOTE:

- The main bearing cap bolts are tightened in 2 progressive steps.
- If any of the bearing cap bolts is broken or deformed, replace it.

Tightening torque

Main bearing cap bolt

M8 : 13 ~ 19N.m

(130 ~ 190kgf.cm, 10 ~ 14lb-ft) + 90° ~ 94°

M10 : 27 ~ 33N.m

(270 ~ 330kgf.cm, 19.5 ~ 24lb-ft) + 90° ~ 94°

1. Apply a light coat of engine oil on the threads and under the bearing cap bolts.
2. Install and uniformly tighten the 16 bearing cap bolts, in several passes, in the sequence shown.

Tightening torque

M8 (A) : 13 ~ 19N.m (130 ~ 190kgf.cm, 10 ~ 14lb-ft)

M10 (B) : 27 ~ 33N.m (270 ~ 330kgf.cm, 19.5 ~ 24lb-ft)

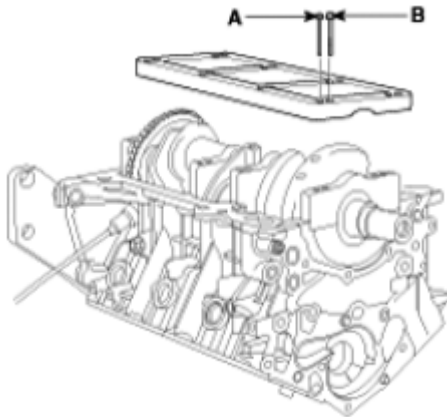


Fig. 68: Locating Bearing Cap Bolts
Courtesy of KIA MOTORS AMERICA, INC.

3. Retighten the bearing cap bolts by 90° ~ 94° in the numerical order shown.

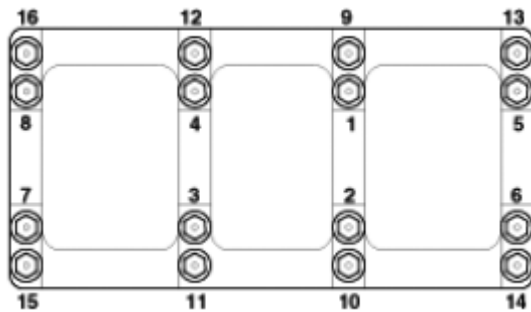


Fig. 69: Identifying Bearing Cap Bolts Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

4. Check that the crankshaft turns smoothly.
9. Check crankshaft end play. (See **Connecting rods**)
10. Install piston and connecting rod assemblies.

NOTE: Before installing the pistons, apply a coat of engine oil to the ring grooves and cylinder bores.

1. Remove the connecting rod caps, and slip short sections of rubber hose over the threaded ends of the connecting rod bolts.
2. Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.
3. Stop after the ring compressor pops free, and check the connecting rod-to-check journal alignment before pushing the piston into place.
4. Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the bolts.

Tightening torque

16 ~ 20N.m (160 ~ 200kgf.cm, 12 ~ 15lb-ft) + 90° ~ 94°

NOTE: Maintain downward force on the ring compressor to prevent the rings from expanding before entering the cylinder bore.

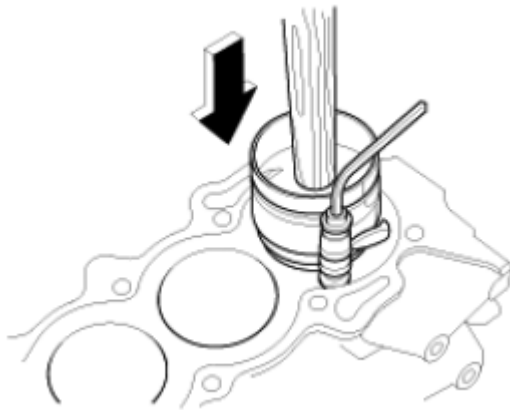


Fig. 70: Installing Piston And Connecting Rod Assemblies
Courtesy of KIA MOTORS AMERICA, INC.

11. Apply liquid gasket to the oil seal case and install the oil seal case (A).

Tightening torque

10 ~ 12N.m (100 ~ 120kgf.cm, 7.3 ~ 8.8lb-ft)

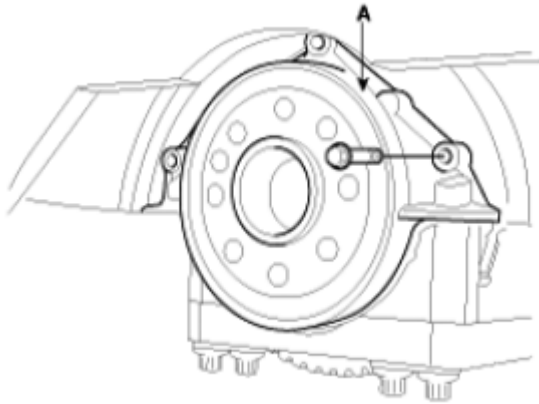


Fig. 71: Locating Oil Seal Case And Bolt
Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

- Use liquid gasket MS721-40A or equivalent
- Check that the mating surfaces are clean and dry.

12. Install rear oil seal.

1. Apply engine oil to a new oil seal lip.
2. Using SST (09231-33000) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

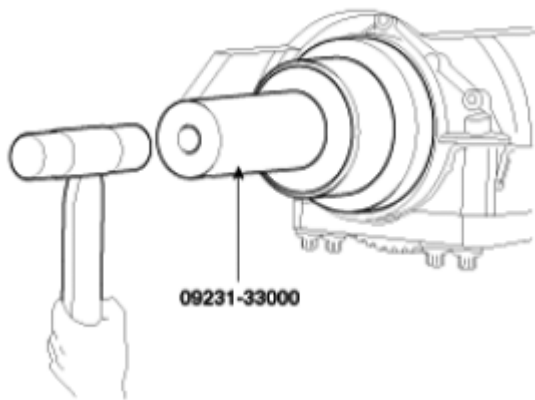


Fig. 72: Installing Oil Seal
Courtesy of KIA MOTORS AMERICA, INC.

13. Install front case. (See **REPAIR PROCEDURES**)

14. Install the upper oil pan.

1. Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

NOTE:

Check that the mating surfaces are clean and dry before applying liquid gasket.

2. Install the oil pan (A) with the 17 bolts.

Uniformly tighten the bolts in several passes.

Tightening torque

19 ~ 28N.m (190 ~ 280kgf.cm, 14 ~ 20lb-ft) : (1 ~ 15)

5 ~ 7N.m (50 ~ 70kgf.cm, 4 ~ 5lb-ft) : (16,17)

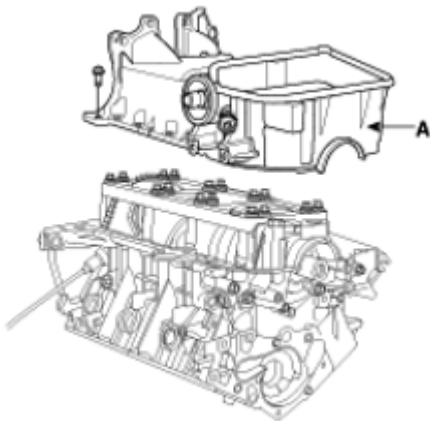


Fig. 73: Locating Oil Pan

Courtesy of KIA MOTORS AMERICA, INC.

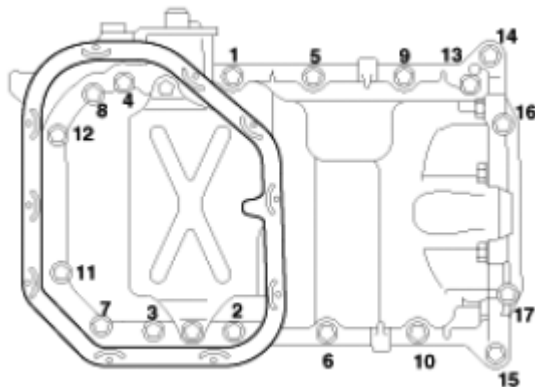


Fig. 74: Locating Oil Pan Bolts Tightening Sequence

Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
- Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.

- After assembly, wait at least 30 minutes before filling the engine with oil.

15. Install oil screen.

Install a new gasket and oil screen (A) with 2 bolts (B).

Tightening torque

15 ~ 22N.m (150 ~ 220kgf.cm, 11 ~ 16lb-ft)

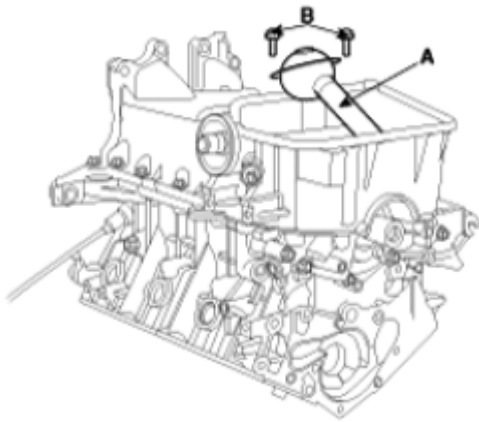


Fig. 75: Locating Oil Screen And Bolts
Courtesy of KIA MOTORS AMERICA, INC.

16. Install the lower oil pan.

1. Apply liquid gasket as an even bead, centered between the edges of the mating surface.

Use liquid gasket MS 721-40A or equivalent.

NOTE:

- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
- Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.
- After assembly, wait at least 30 minutes before filling the engine with oil.

2. Install the lower oil pan 10 bolts.

Uniformly tighten the bolts several passes

Tightening torque

10 ~ 12N.m (100 ~ 120kgf.cm, 7.3 ~ 8.8lb-ft)

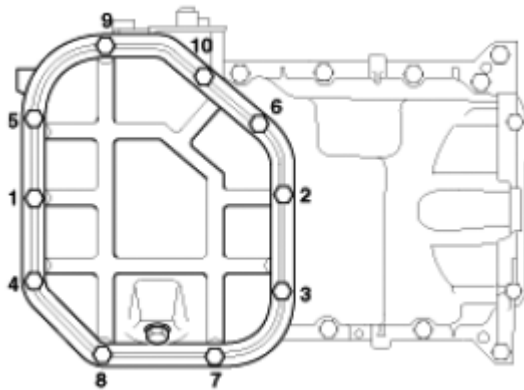


Fig. 76: Locating Lower Oil Pan Bolts Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

17. Install oil pressure sensor.
 1. Apply adhesive to 2 or 3 threads.

Adhesive : THREE BOND TB2403 or equivalent.

2. Install the oil pressure sensor (A).

Tightening torque

15 ~ 22N.m (150 ~ 220kgf.cm, 11 ~ 16lb-ft)



Fig. 77: Locating Oil Pressure Sensor
Courtesy of KIA MOTORS AMERICA, INC.

18. Install knock sensor (A).

Tightening torque

17 ~ 26N.m (170 ~ 260kgf.cm, 12.5 ~ 19lb-ft)

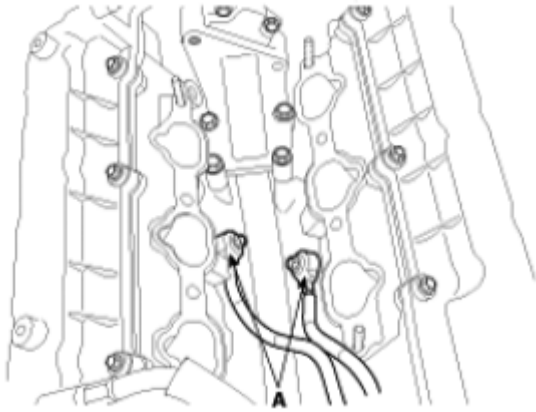


Fig. 78: Locating Knock Sensor
Courtesy of KIA MOTORS AMERICA, INC.

19. Install water pump. (See **REPAIR PROCEDURES**)
20. Install the power steering pump bracket (A).

Tightening torque

35 ~ 55N.m (350 ~ 550kgf.cm, 25.8 ~ 40.6 lb-ft)

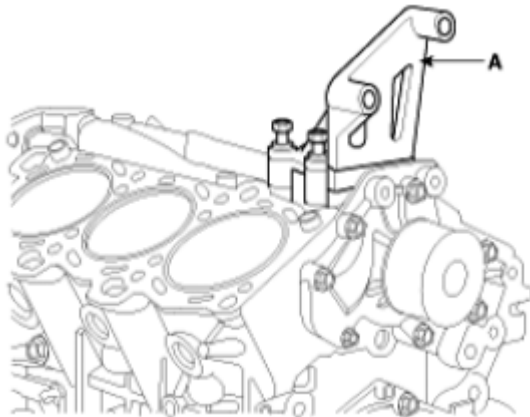


Fig. 79: Locating Power Steering Pump Bracket
Courtesy of KIA MOTORS AMERICA, INC.

21. Install the air compressor. (See **COMPRESSOR**)
22. Install the alternator. (See **ALTERNATOR**)
23. Install oil level gauge assembly.
 1. Install a new O-ring on the oil level gauge.
 2. Apply engine oil on the O-ring.
 3. Install the oil level gauge assembly (A) with the bolt.

Tightening torque

12 ~ 15N.m (120 ~ 150 kgf.cm, 9 ~ 11 lb-ft)

24. Install cylinder head. (See **INSTALLATION**)
25. Install timing belt. (See **INSTALLATION**)
26. Remove engine stand.
27. Install drive plate.

Tightening torque

73 ~ 77N.m (730 ~ 770kgf.cm, 53 ~ 56lb-ft)

REASSEMBLY**NOTE:**

- Thoroughly clean all parts to assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

1. Assemble piston and connecting rod.
 1. Use a hydraulic press for installation.
 2. The piston front mark (A) and the connecting rod front mark (B) must face the timing belt side of the engine.

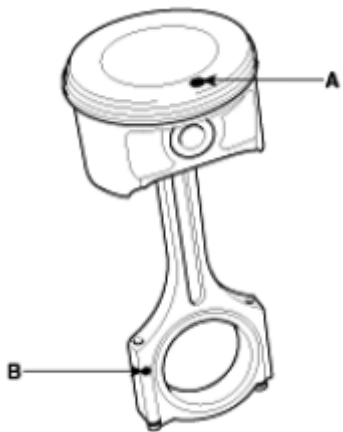


Fig. 80: Locating Piston Front Mark And Connecting Rod Front Mark
Courtesy of KIA MOTORS AMERICA, INC.

2. Install piston rings.
 1. Install the oil ring expander and 2 side rails by hand.
 2. Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

3. Position the piston rings so that the ring ends are as shown.

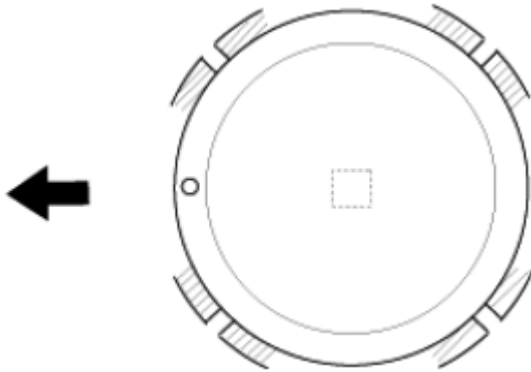


Fig. 81: Identifying Piston Rings End Positions
Courtesy of KIA MOTORS AMERICA, INC.

3. Install connecting rod bearings.
 1. Align the bearing claw with the groove of the connecting rod or connecting rod cap.
 2. Install the bearings in the connecting rod and connecting rod cap.

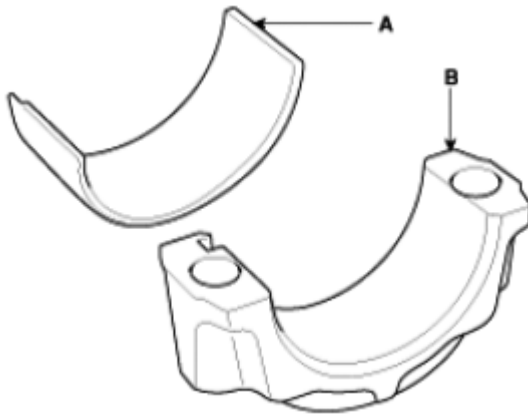


Fig. 82: Locating Bearings And Connecting Rod Cap
Courtesy of KIA MOTORS AMERICA, INC.

4. Install main bearings.

NOTE: Upper 1, 2, 3, 4 bearings have an oil groove of oil holes; Lower bearings do not.

1. Align the bearing claw with the claw groove of the cylinder block, push in the 4 upper bearings (A).

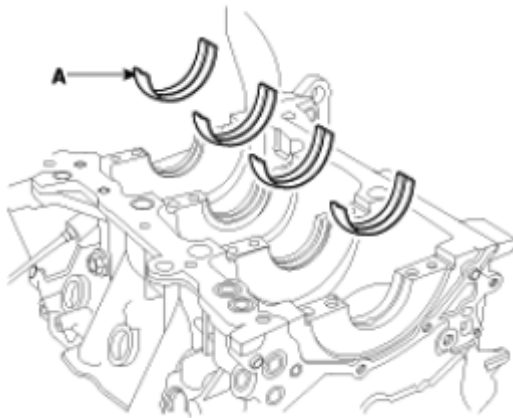


Fig. 83: Locating Upper Bearings
Courtesy of KIA MOTORS AMERICA, INC.

2. Align the bearing claw with the claw groove of the main bearing cap (A), and push in the 4 lower bearings (B).

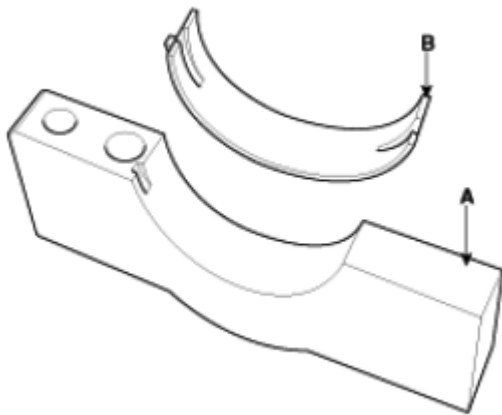


Fig. 84: Locating Main Bearing Cap And Lower Bearings
Courtesy of KIA MOTORS AMERICA, INC.

5. Install thrust bearings.

Install the 2 thrust bearings (A) under the No. 3 journal position of the cylinder block with the oil grooves facing outward.



Fig. 85: Locating Thrust Bearings

Courtesy of KIA MOTORS AMERICA, INC.

6. Place crankshaft (A) on the cylinder block.

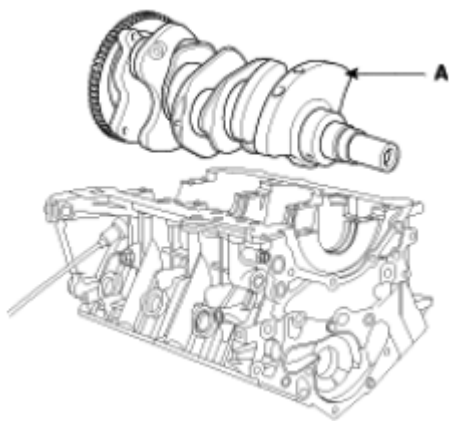


Fig. 86: Locating Crankshaft

Courtesy of KIA MOTORS AMERICA, INC.

7. Place main bearing caps on cylinder block.
8. Install main bearing cap bolts.

NOTE:

- The main bearing cap bolts are tightened in 2 progressive steps.
- If any of the bearing cap bolts is broken or deformed, replace it.

Tightening torque

Main bearing cap bolt

M8

13 ~ 19N.m (130 ~ 190kgf.cm, 10 ~ 14lbf.ft) + 90° ~ 94°

M10

27 ~ 33N.m (270 ~ 330kgf.cm, 19.5 ~ 24lbf.ft) + 90° ~ 94°

1. Apply a light coat of engine oil on the threads and under the bearing cap bolts.
2. Install and uniformly tighten the 16 bearing cap bolts, in several passes, in the sequence shown.

Tightening torque

M8 (A) : 13 ~ 19N.m (130 ~ 190kgf.cm, 10 ~ 14lbf.ft)

M10 (B) : 27 ~ 33N.m (270 ~ 330kgf.cm, 19.5 ~ 24lbf.ft)

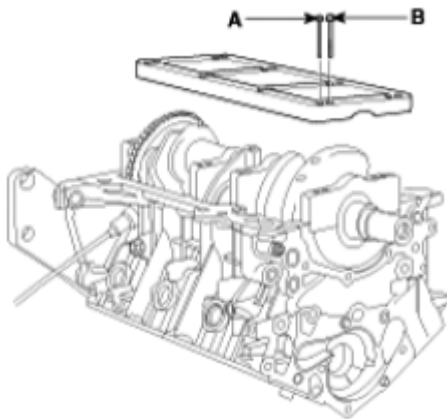


Fig. 87: Identifying Bearing Cap Bolts Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

3. Retighten the bearing cap bolts by 90° ~ 94° in the numerical order shown.

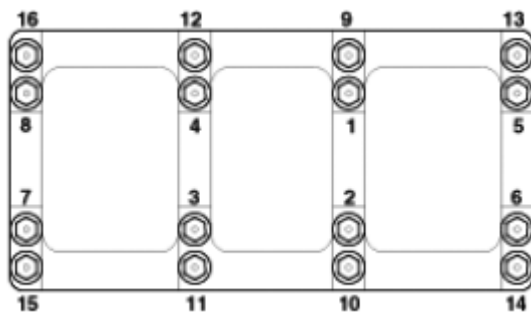


Fig. 88: Identifying Bearing Cap Bolts Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

4. Check that the crankshaft turns smoothly.
9. Check crankshaft end play. (See **Connecting rods**)
10. Install piston and connecting rod assemblies.

NOTE: Before installing the pistons, apply a coat of engine oil to the ring grooves and cylinder bores.

1. Remove the connecting rod caps, and slip short sections of rubber hose over the threaded ends of the connecting rod bolts.
2. Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.
3. Stop after the ring compressor pops free, and check the connecting rod-to-check journal alignment before pushing the piston into place.
4. Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the bolts.

Tightening torque

16 ~ 20N.m (160 ~ 200kgf.cm, 12 ~ 15lbf.ft) + 90° ~ 94°

NOTE: Maintain downward force on the ring compressor to prevent the rings from expanding before entering the cylinder bore.

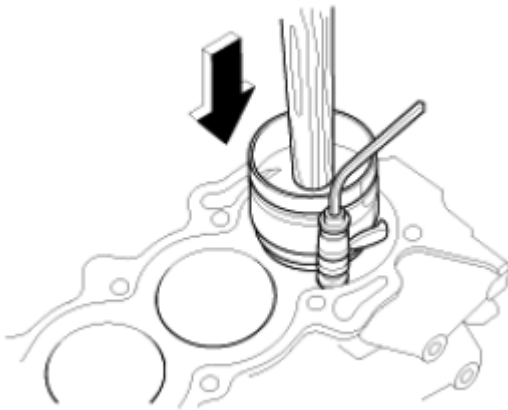


Fig. 89: Installing Piston And Connecting Rod Assemblies
Courtesy of KIA MOTORS AMERICA, INC.

11. Apply liquid gasket to the oil seal case and install the oil seal case (A).

Tightening torque

10 ~ 12N.m (100 ~ 120kgf.cm, 7.3 ~ 8.8lbf.ft)

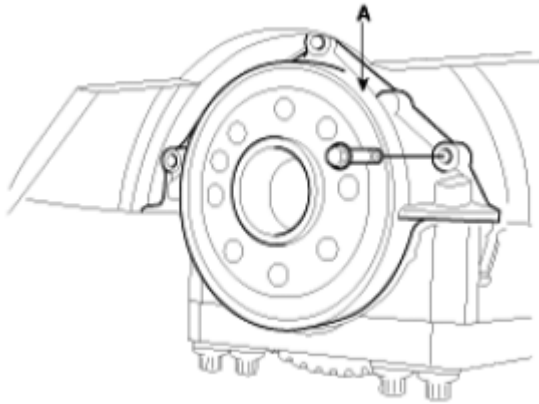


Fig. 90: Locating Oil Seal Case And Bolts
Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

- Use liquid gasket MS721-40A or equivalent
- Check that the mating surfaces are clean and dry.

12. Install rear oil seal.

1. Apply engine oil to a new oil seal lip.
2. Using SST (09231-33000) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

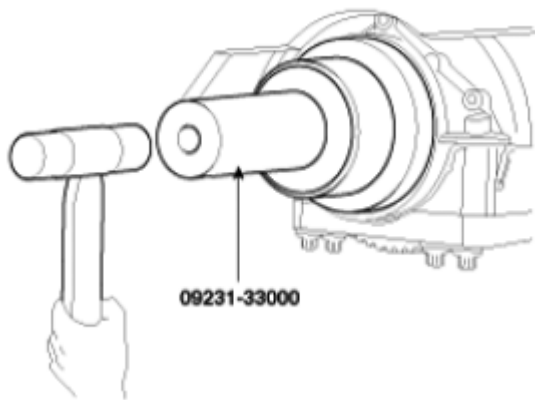


Fig. 91: Installing Oil Seal
Courtesy of KIA MOTORS AMERICA, INC.

13. Install front case. (See **INSTALLATION**)

14. Install the upper oil pan.

1. Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

NOTE:

Check that the mating surfaces are clean and dry before applying liquid gasket.

2. Install the oil pan (A) with the 17 bolts.

Uniformly tighten the bolts in several passes.

Tightening torque

19 ~ 28N.m (190 ~ 280kgf.cm, 14 ~ 20lb.ft) : (1 ~ 15)

5 ~ 7N.m (50 ~ 70kgf.cm, 4 ~ 5lb.ft) : (16,17)

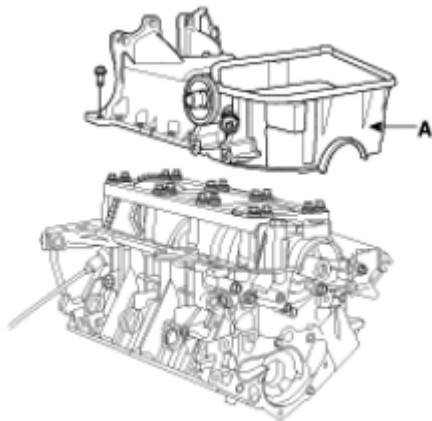


Fig. 92: Locating Oil Pan

Courtesy of KIA MOTORS AMERICA, INC.

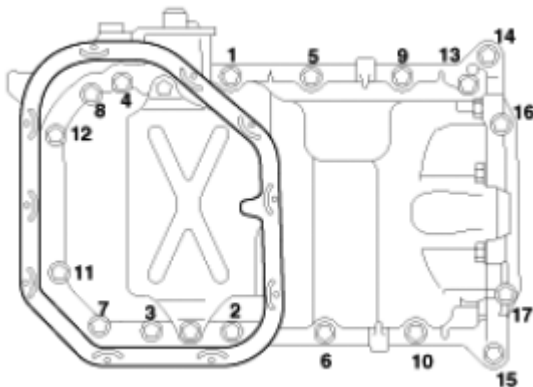


Fig. 93: Identifying Oil Pan Bolts Tightening Sequence

Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
- Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.

- After assembly, wait at least 30 minutes before filling the engine with oil.

15. Install oil screen.

Install a new gasket and oil screen (A) with 2 bolts (B).

Tightening torque

15 ~ 22N.m (150 ~ 220kgf.cm, 11 ~ 16 lbf.ft)

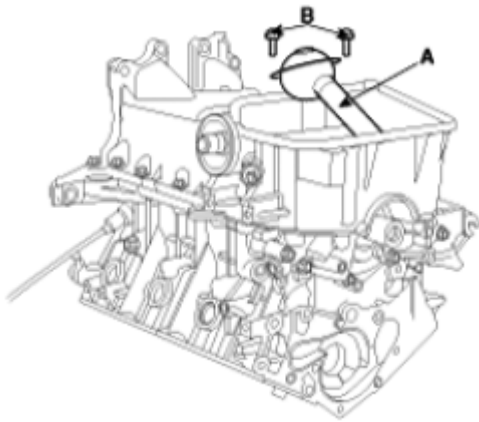


Fig. 94: Locating Oil Screen And Bolts
Courtesy of KIA MOTORS AMERICA, INC.

16. Install the lower oil pan.

1. Apply liquid gasket as an even bead, centered between the edges of the mating surface.

Use liquid gasket MS 721-40A or equivalent.

NOTE:

- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
- Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.
- After assembly, wait at least 30 minutes before filling the engine with oil.

2. Install the lower oil pan 10 bolts.

Uniformly tighten the bolts several passes

Tightening torque

10 ~ 12 N.m (100 ~ 120 kgf.cm, 7.3 ~ 8.8 lbf.ft)

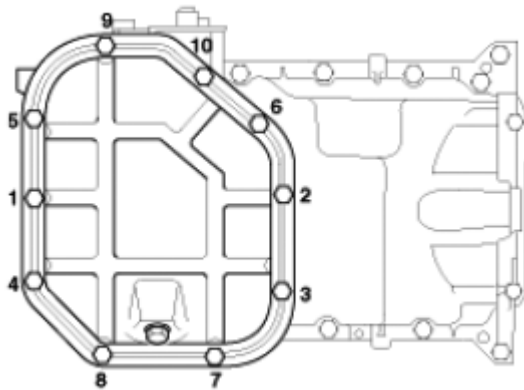


Fig. 95: Identifying Lower Oil Pan Bolts Tightening Sequence
Courtesy of KIA MOTORS AMERICA, INC.

17. Install oil pressure sensor.
 1. Apply adhesive to 2 or 3 threads.

Adhesive : THREE BOND TB2403 or equivalent.

2. Install the oil pressure sensor (A).

Tightening torque

15 ~ 22 N.m (150 ~ 220 kgf.cm, 11 ~ 16 lbf.ft)



Fig. 96: Locating Oil Pressure Sensor
Courtesy of KIA MOTORS AMERICA, INC.

18. Install knock sensor (A).

Tightening torque

17 ~ 26N.m (170 ~ 260kgf.cm, 12.5 ~ 19 lbf.ft)

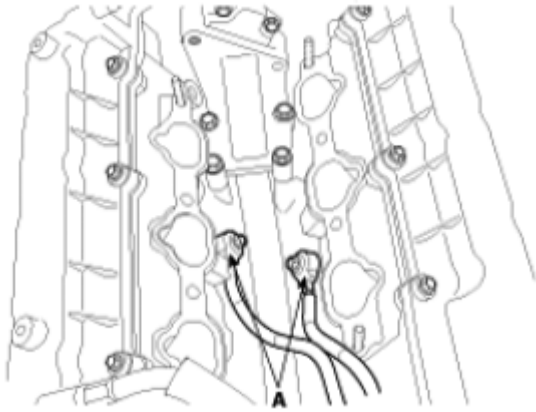


Fig. 97: Locating Knock Sensor

Courtesy of KIA MOTORS AMERICA, INC.

19. Install water pump. (See **INSTALLATION**)
20. Install the power steering pump bracket (A).

Tightening torque

35 ~ 55N.m (350 ~ 550kgf.cm, 25.8 ~ 40.6 lbf.ft)

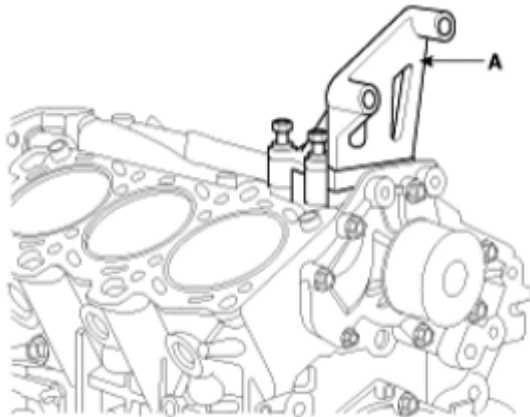


Fig. 98: Locating Power Steering Pump Bracket

Courtesy of KIA MOTORS AMERICA, INC.

21. Install the air compressor. (See **COMPRESSOR**)
22. Install the alternator. (See **ALTERNATOR**)
23. Install oil level gauge assembly.
 1. Install a new O-ring on the oil level gauge.
 2. Apply engine oil on the O-ring.
 3. Install the oil level gauge assembly (A) with the bolt.

Tightening torque

12 ~ 15N.m (120 ~ 150kgf.cm, 9 ~ 11 lbf.ft)

24. Install cylinder head. (See **INSTALLATION**)
25. Install timing belt. (See **INSTALLATION**)
26. Remove engine stand.
27. Install drive plate.

Tightening torque

73 ~ 77N.m (730 ~ 770 kgf.cm, 53 ~ 56 lbf.ft)