2008 ENGINE

Engine Mechanical System (G6DA-GSL 3.3) - Santa Fe

GENERAL

SPECIFICATIONS

GENERAL SPECIFICATIONS

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Description			Specifications	Limit
General				
Type			V-type, DOHC	
Number of cylinders			6	
Bore			92 mm (3.6220 in)	
Stroke			83.8 mm (3.2992 in)	
Total displacement			3,342 cc (203.86 cu.in.)	
Compression ratio			10.4	
Firing order			1-2-3-4-5-6	
Valve timing				
Intake	Opens (ATDC)		14°	
	Closes (ABDC)		62°	
Exhaust	Opens (BBDC)		42°	
	Closes (ATDC)		6°	
Cylinder head				
Flatness of gasket surface			Less than 0.05 mm (0.0019 in.) [Less than 0.02 mm (0.0008 in.) / 150 x 150]	
Flatness of manifold mounting	Intake		Less than 0.1 mm (0.0039 in.) [Less than 0.03 mm (0.001 in)/110 x 110]	
	Exhaust		Less than 0.1 mm (0.0039 in.) [Less than 0.03 mm (0.001 in)/110 x 110]	
Camshaft				
Cam height	LH Camshaft	Intake	46.3 mm	
		Exhaust	45.8 mm	
	RH Camshaft	Intake	46.3 mm	

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		Exhaust	45.8 mm	
Journal outer diameter	LH, RH camshaft	Intake	No. 1: 27.964 ~ 27.980 mm (1.1009 ~ 1.1016 in.) No.2,3,4: 23.954 ~ 23.970 mm (0.9430 ~ 0.9437 in.)	
		Exhaust	No. 1: 27.964 ~ 27.980 mm (1.1009 ~ 1.1016 in.) No. 2,3,4: 23.954 - 23.970 mm (0.9430 - 0.9437 in.)	
Bearing oil clearance	LH, RH camshaft	Intake	No. 1: 0.020 ~ 0.057 mm (0.0008 ~ 0.0022 in.) No.2,3,4: 0.030 ~ 0.067 mm (0.0012 ~ 0.0026 in.)	
		Exhaust	No.1: 0.020 ~ 0.057 mm (0.0008 ~ 0.0022 in.) No.2,3,4: 0.030 ~ 0.067 mm (0.0012 ~ 0.0026 in.)	
End play			0.02 ~ 0.18 mm (0.0008 ~ 0.0071 in.)	
Valve				
Valve length	Intake		105.27 mm (4.1445 in.)	
	Exhaust		105.50 mm (4.1535 in.)	
Stem outer diameter	Intake		5.465 ~ 5.480 mm (0.2151 ~ 0.2157 in.)	
	Exhaust		5.458 ~ 5.470 mm (0.2149 ~ 0.2153 in.)	
Face angle			45.25° ~ 45.75°	
Thickness of valvehead (margin)	Intake		1.56 ~ 1.86 mm (0.06142 ~ 0.07323 in.)	
	Exhaust		1.73 ~ 2.03 mm (0.06811 ~ 0.07992 in.)	
Valve stem to valve guide clearance	Intake		0.020 ~ 0.047 mm (0.00078 ~ 0.00185 in.)	0.07 mm (0.00275 in.)
	Exhaust		0.030 ~ 0.054 mm (0.00118 ~ 0.00212 in.)	0.09 mm (0.00354 in.)
Valve guide				
Inner diameter	Intake		5.500 ~ 5.512 mm	

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		(0.2165 ~ 0.2170 in.)	
	Exhaust	5.500 ~ 5.512 mm (0.2165 ~ 0.2170 in.)	
Length	Intake	41.8 ~ 42.2 mm (1.6457 ~ 1.6614 in.)	
	Exhaust	41.8 ~ 42.2 mm (1.6457 ~ 1.6614 in.)	
Valve seat			
Width of seat contact	Intake	1.15 ~ 1.45 mm (0.05118 ~ 0.05709 in.)	
	Exhaust	1.35 ~ 1.65 mm (0.05315 ~ 0.06496 in.)	
Seat angle	Intake	44.75° ~ 45.20°	
	Exhaust	44.75° ~ 45.20°	
Valve spring			
Free length		43.86 mm (1.7267 in.)	
Load		19.3 ± 0.8 kg/34.0 mm (42.7 ± 1.8 lb/1.3386 in)	
		42.3 ± 1.3kg/24.2 mm (93.3 ± 2.9 lb/0.9527 in)	
Out of squareness		Less than 1.5°	
MLA			
MLA outer diameter	Intake	34.964 ~ 34.980 mm (1.3765 ~ 1.3772 in.)	
	Exhaust	34.964 ~ 34.980 mm (1.3765 ~ 1.3772 in.)	
Cylinder head tappet bore inner diameter	Intake	35.000 ~ 35.025 mm (1.3779 ~ 1.3789 in.)	
	Exhaust	35.000 ~ 35.025 mm (1.3779 ~ 1.3789 in.)	
MLA to tappet bore clearance	Intake	0.020 ~ 0.061 mm (0.0008 ~ 0.0024 in.)	0.07 mm (0.0027 in.)
	Exhaust	0.020 ~ 0.061 mm (0.0008 ~ 0.0024 in.)	0.07mm (0.0027in.)
Valve clearance			
Intake		0.17 ~ 0.23 mm (0.0067 ~ 0.0090 in.)	0.10 ~ 0.30 mm (0.0039-0.0118 in.)
Exhaust		0.27 ~ 0.33 mm (0.0106 ~ 0.0129 in,)	0.20 ~ 0.40 mm (0.0078-0.0157 in.)
Cylinder block			
Cylinder bore		92.00 ~ 92.03 mm (3.6220 ~ 3.6232 in.)	

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Flatness of gasket surface		Less than 0.05 mm (0.0019 in.) [Less than 0.02 mm (0.0008 in.) / 150 x 150]	
Piston			
Piston outer diameter		91.97 ~ 92.00 mm (3.6209 ~ 3.6220 in.)	
Piston to cylinder clearance		0.02 ~ 0.04 mm (0.0008 ~ 0.0016 in.)	
Ring groove width	No. 1 ring groove	1.23 ~ 1.25 mm (0.0484 ~ 0.0492 in.)	1.26 mm (0.0496 in.)
	No. 2 ring groove	1.22 ~ 1.24 mm (0.0480 ~ 0.0488 in.)	1.26 mm (0.0496 in.)
	Oil ring groove	2.01 ~ 2.03 mm (0.0791 ~ 0.0799 in.)	2.05 mm (0.0807 in.)
Piston ring			
Side clearance	No. 1 ring	0.04 ~ 0.078 mm (0.0016 ~ 0.0031 in.)	0.1 mm (0.004 in.)
	No. 2 ring	0.03 ~ 0.07 mm (0.0012 ~ 0.0027 in.)	0.1 mm (0.004 in.)
	Oil ring	0.06 ~ 0.15 mm (0.0024 ~ 0.0059 in.)	0.2mm (0.008 in.)
End gap	No. 1 ring	0.17 ~ 0.32 mm (0.0067 ~ 0.0126 in.)	0.6 mm (0.0236 in.)
	No. 2 ring	0.32 ~ 0.47 mm (0.0126 ~ 0.0185 in.)	0.7 mm (0.0275 in.)
	Oil ring	0.20 ~ 0.70 mm (0.0078 ~ 0.0275 in.)	0.8 mm (0.0315 in.)
Piston pin			
Piston pin outer diameter		23.002 ~ 23.006 mm (0.9056 ~ 0.9057 in.)	
Piston pin hole inner diameter		23.015 ~ 23.019 mm (0.9061 ~ 0.9063 in.)	
Piston pin hole clearance		0.009 ~ 0.017 mm (0.0004 ~ 0.0007 in.)	
Connecting rod small end inner diameter		22.974 ~ 22.985 mm (0.9045 ~ 0.9049 in.)	
Connecting rod small end hole clearance		-0.032 ~ -0.017 mm (-0.0013 ~ -0.0007 in.)	
Connecting rod			
Connecting rod big end innerdiameter		58.000 ~ 58.018 mm (2.2834 ~ 2.2842 in.)	
Connecting rod bearing oil clearance		0.038 ~ 0.056 mm	

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		(0.0015 ~ 0.0022 in.)	
Side clearance		0.1 ~ 0.25 mm (0.0039 ~ 0.0098 in.)	
Crankshaft			
Main journal outer diameter		68.942 ~ 68.960 mm (2.7142 ~ 2.7149 in.)	
Pin journal outer diameter		54.954 ~ 54.972 mm (2.1635 ~ 2.1642 in.)	
Main bearing oil clearance		0.022 ~ 0.040 mm (0.0008 ~ 0.0016 in.)	
End play		0.10 ~ 0.28 mm (0.0039 ~ 0.0110 in.)	
Oil pump			
Relief valve opening pressure		450 ~ 550 kPa (4.59 ~ 5.61 kgf/cm^2 , 65.28 ~ 79.79 psi)	
Engine oil			
Oil quantity (Total)		6.4L (6.76 U.S.qts, 5.63 lmp.qts)	
Oil quantity (Oil pan)		5.5L (5.81 U.S.qts, 4.84 lmp.qts)	
Oil quantity (Oil filter)		0.4L (0.42 U.S.qts, 0.35 lmp.qts)	
Oil quantity (Drain and refill)		5.2L (5.49 U.S.qts, 4.58 lmp.qts)	
Oil quality		Above SJ or SL	
Oil pressure		130 kPa (1.32 kgf/cm^2 , 18.77 psi) [at 1000 rpm,110°C (230°F)]	
Cooling system			
Cooling method		Forced circulation with electrical fan	
Coolant quantity		9.0L (9.40 U.S.qts, 7.83 lmp.qts)	
Thermostat	Type	Wax pellet type	
	Opening temperature	82 ± 2°C (179.6 ± 35.6°F)	
	Fully opened temperature	95°C (203°F)	
	Full lift	More than 10 mm (0.3937 in.)	
Radiator cap	Main valve opening pressure	93.16 ~ 122.58 kpa (0.95 ~ 1.25 kg/cm^2 ,	

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		13.51 ~ 17.78 psi)	
	Vacuum valve opening pressure	0.98 ~ 4.90 kpa (0.01 ~ 0.05 kg/cm^2 , 0.14 ~ 0.71 psi)	
Water temperature sensor			
Type		Thermister type	
Resistance	20°C (68°F)	2.31 ~ 2.59 Kohms	
	80°C (176°F)	0.3222 Kohms	

TIGHTENING TORQUE SPECIFICATIONS

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Item	Quantity	Nm	kgf.m	lb-ft
Crankshaft pulley bolt	1	284.2 ~ 303.8	29.0 ~ 31.0	209.76 ~ 224.22
Timing chain cover bolt B	17	18.62 ~ 21.56	1.9 ~ 2.2	13.74 ~ 15.91
Timing chain cover bolt C	4	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain cover bolt D	1	58.80 ~ 68.80	6.0 ~ 7.0	43.40 ~ 50.63
Timing chain cover bolt E	1	58.80 ~ 68.80	6.0 ~ 7.0	43.40 ~ 50.63
Timing chain cover bolt F	2	24.50 ~ 26.46	2.5 ~ 2.7	18.08 ~ 19.53
Timing chain cover bolt G	4	21.56 ~ 23.52	2.2 ~ 2.4	15.91 ~ 17.36
Timing chain cover bolt H	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain cover bolt 1	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain cover bolt J	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Cam to cam guide bolt	4	9.80~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain auto tensioner bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain auto tensioner nut	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain tensioner arm bolt	2	18.62 ~ 21.56	1.9 ~ 2.2	13.74 ~ 15.91
Timing chain guide bolt	4	19.60 ~ 24.50	2.0 ~ 2.5	14.17 ~ 18.08
Oil pump chain cover bolt	3	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil pump chain tensioner bolt	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil pump chain guide bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil pump chain sprocket bolt	1	18.62 ~ 21.56	1.9 ~ 2.2	13.74 ~ 15.91
Lower oil pan bolt	13	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Drive belt auto tensioner bolt (M12)	1	96.04 ~ 99.96	9.8 ~ 10.2	70.88 ~ 73.78
Drive belt auto tensioner bolt (M8)	1	17.64 ~ 21.56	1.8 ~ 2.2	13.02 ~ 15.91
Drive belt idler bolt	1	53.90 ~ 57.82	5.5 ~ 5.9	39.78 ~ 42.67
OCV (oil control valve) bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Cylinder head bolt	16	39.2 ± 120° ± 90°	4.0 ± 120° ± 90°	28.93 ± 120° ± 90°
Cylinder head bolt	1	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
CVVT & exhaust cam sprocket bolt	4	64.68 ~ 76.44	6.6 ~ 7.8	47.74 ~ 56.42
Camshaft bearing cap bolt	32	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68

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Cylinder head cover bolt		38	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Connecting rod bearing bolt		12	19.60 ± 90°	2.0 ± 90°	14.46 ± 90°
Main bearing cap inner bolt (M11)		8	49.00 ± 90°	5.0 ± 90°	36.16 ± 90°
Main bearing cap outer bolt (M8)		8	19.60 ± 120°	2.0 ± 120°	14.46 ± 120°
Main bearing cap side bolt (M8)		6	29.40 ~ 31.36	3.0 ~ 3.2	21.70 ~ 23.14
Oil drain cover bolt		6	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Rear oil seal case bolt		6	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Baffle plate bolt		12	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Upper oil pan bolt		16	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Knock sensor bolt		2	15.68 ~ 23.52	1.6 ~ 2.4	11.57 ~ 17.36
Drive plate bolt		8	71.54 ~ 75.46	7.3 ~ 7.7	52.80 ~ 55.69
Oil filter cap		1	24.50	2.5	18.08
Oil drain bolt		1	34.30 ~ 44.10	3.5 ~ 4.5	25.31 ~ 32.55
Oil pump bolt		3	19.60 ~ 23.52	2.0 ~ 2.4	14.47 ~ 17.36
Oil filter body bolt		10	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil filter body cover bolt		11	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Water vent hose bolt		2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Water pump bolt (Timing chain cover bolt L)		1	21.56 ~ 26.46	2.2 ~ 2.7	15.91 ~ 19.53
Water pump bolt (Timing chain cover bolt K)		4	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Water pump pulley bolt		4	7.84 ~ 9.80	0.8 ~ 1.0	5.78 ~ 7.23
Water temp, control nut		4	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
Water temp, control bolt		2	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
Water inlet fitting bolt		3	16.66 ~ 19.60	1.7 ~ 2.0	12.30 ~ 14.47
Air vent pipe bolt		2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Intake manifold bolt (M8)		6	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
Intake manifold nut (M8)		2	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
Surge tank bolt	(M8)	3	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
	(M6)	1	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Surge tank nut (M8)		2	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Breather pipe bolt		2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Surge tank bracket bolt (M10)		2	27.44 ~ 31.36	2.8 ~ 3.2	20.25 ~ 23.14
Surge tank bracket bolt (M8)		2	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Exhaust manifold nut		16	39.20 ~ 44.10	4.0 ~ 4.5	28.93 ~ 32.55
Heat protector bolt		8	16.66 ~ 21.56	1.7 ~ 2.2	12.30 ~ 15.91
Front muffler		2	39.20 ~ 58.80	4.0 ~ 6.0	28.93 ~ 43.40

INSPECTION

COMPRESSION PRESSURE INSPECTION

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NOTE: If 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 SYSTEM (ENGINE ELECTRICAL SYSTEM (G6DA-GSL 3.3)) -- SANTA FE**)
3. Remove spark plugs.

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

4. Check cylinder compression pressure.
   a. Insert a compression gauge into the spark plug hole.
   b. Fully open the throttle.
   c. After 7 times of cranking the engine, measure the compression pressure.

      NOTE: Always use a fully charged battery to obtain engine speed of 200 RPM or more.

   d. Repeat steps (a) through (c) for each cylinder.

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

      Compression pressure: 1,225 kPa (12.5 kgf/cm^2 , 177 psi) ~ 200 ~ 250 RPM

      Minimum pressure: 1,078 kPa (11.0 kgf/cm^2 156 psi)

   e. 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 (c) 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.
6. Install ignition coils. (See **IGNITION SYSTEM (ENGINE ELECTRICAL SYSTEM (G6DA-GSL 3.3)) -- SANTA FE**)

VALVE CLEARANCE INSPECTION AND ADJUSTMENT

NOTE: Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature : 20° C) and cylinder head is installed on the cylinder block.

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1. Remove the engine cover.
2. Remove air cleaner assembly.
3. Remove the surge tank.
4. Remove the cylinder head cover.
    a. Disconnect the ignition coil connector and remove the ignition coil.
    b. Disconnect the breather hose (A) from the cylinder head cover.

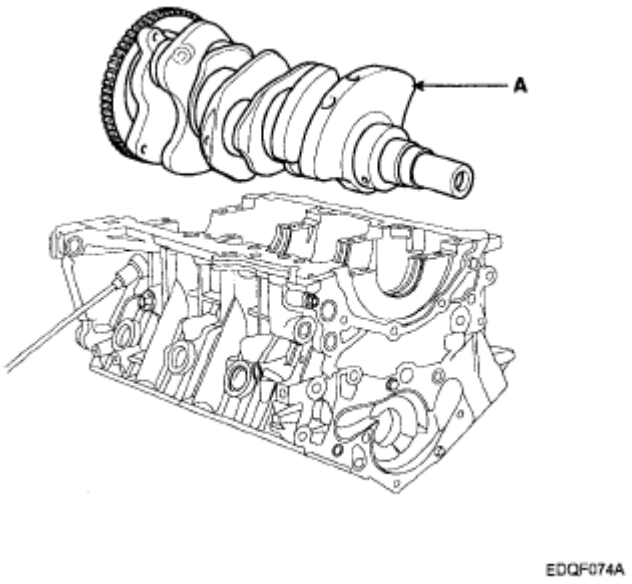


Fig. 1: Identifying Breather Pipe Assembly
Courtesy of HYUNDAI MOTOR CO.

    c. Loosen the cylinder head cover bolts and then remove the cover (A) and gasket.

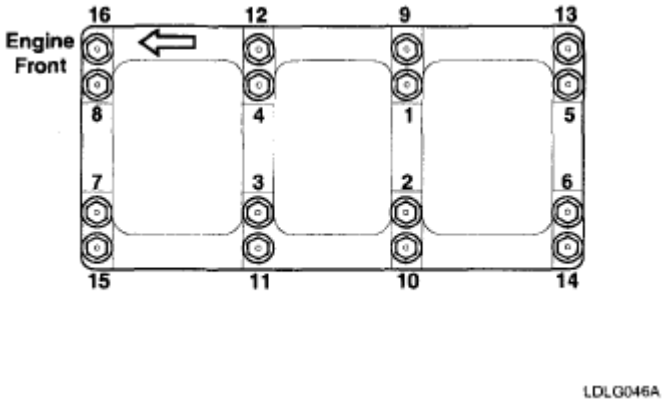
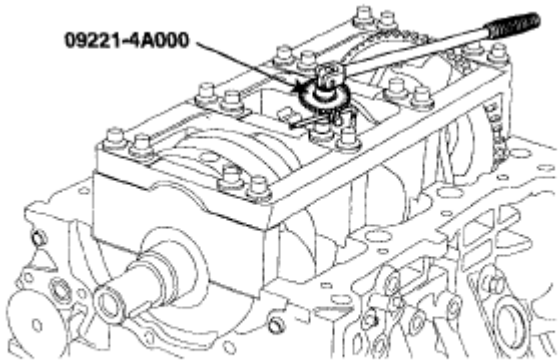


Fig. 2: Identifying Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

5. Set No. 1 cylinder to TDC/compression.

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a. Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing chain cover.



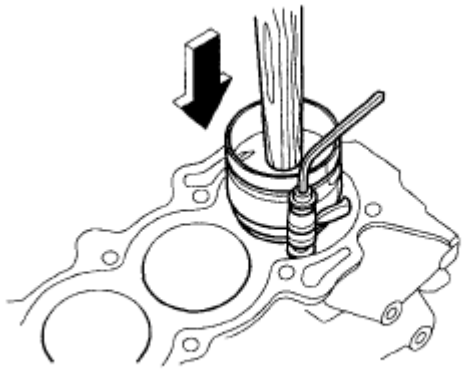
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Fig. 3: Aligning Groove With Timing Mark "T" Of Lower Timing Chain Cover
Courtesy of HYUNDAI MOTOR CO.

b. Check that the mark (A) of the camshaft timing sprockets are in straight line on the cylinder head surface as shown in the illustration.

If not, turn the crankshaft one revolution (360°)

NOTE: Do not rotate engine counterclockwise



ECKD001F

Fig. 4: Aligning Mark Of Camshaft Timing Sprockets On Cylinder Head Surface
Courtesy of HYUNDAI MOTOR CO.

6. Inspect the valve clearance.
   a. Check only the valve indicated as shown in the illustration. [No. 1 cylinder: TDC/Compression] measure the valve clearance.

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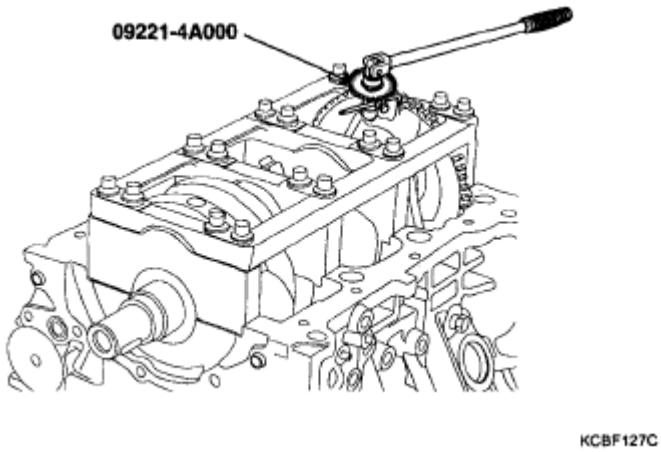


Fig. 5: Inspecting Valve Clearance
Courtesy of HYUNDAI MOTOR CO.

- Using a thickness gauge, measure the clearance between the tappet and the base circle of camshaft.
- Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting tappet.

Valve clearance

Specification

Engine coolant temperature: 20°C [68°F]

Limit

Intake: 0.10 ~ 0.30 mm (0.0039 ~ 0.0118 in.)

Exhaust: 0.20 ~ 0.40 mm (0.0079 ~ 0.0157 in.)

b. Turn the crankshaft pulley one revolution (360°) and align the groove with timing mark "T" of the lower timing chain cover.

NOTE: Do not rotate engine counterclockwise

c. Check only valves indicated as shown in the illustration. [NO. 4 cylinder: TDC/compression]. Measure the valve clearance.

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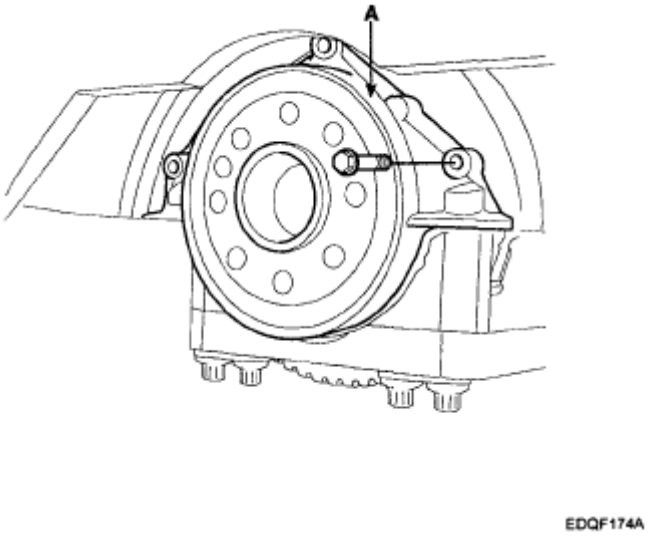


Fig. 6: Inspecting Valve Clearance
Courtesy of HYUNDAI MOTOR CO.

7. Adjust the intake and exhaust valve clearance.
   a. Set the No. 1 cylinder to the TDC/compression.
   b. Remove the timing chain.

NOTE: Before removing the timing chain, mark the RH/LH timing chain with an identification based on the location of the sprocket because the identification mark on the chain for TDC (Top Dead Center) can be erased.

   c. Remove the camshaft bearing caps (A).

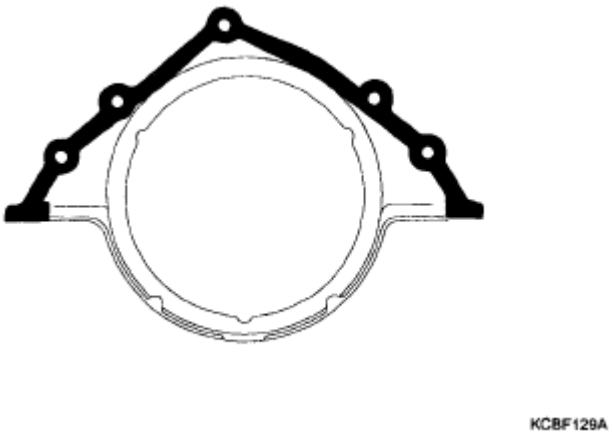
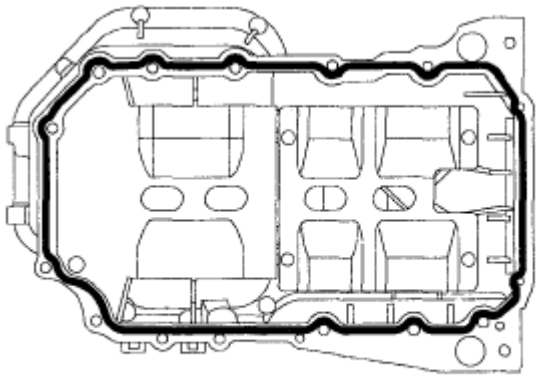


Fig. 7: Identifying Camshaft Bearing Caps
Courtesy of HYUNDAI MOTOR CO.

   d. Remove the camshaft assembly (A).

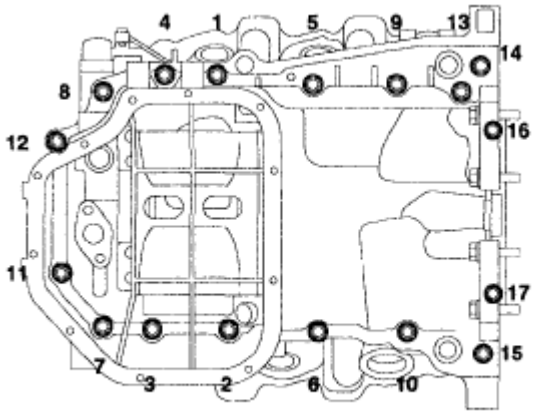
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Fig. 8: Locating Camshaft Assembly
Courtesy of HYUNDAI MOTOR CO.

e. Remove MLAs.
f. Measure the thickness of the removed tappet using a micrometer.



KCBF131A

Fig. 9: Measuring Thickness Of Tappet Using Micrometer
Courtesy of HYUNDAI MOTOR CO.

g. Calculate the thickness of a new tappet so that the valve clearance comes within the specified value.

Valve clearance (Engine coolant temperature: 20°C [68°F])

T: Thickness of removed tappet

A: Measured valve clearance

N: Thickness of new tappet

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Intake: N = T + [A ~ 0.20 mm (0.0079 in.)]

Exhaust: N = T + [A ~ 0.30 mm (0.0118 in.)]

h. Select a new tappet with a thickness as close as possible to the calculated value.

NOTE: Shims are available in 41 size increments of 0.015 mm (0.0006 in.) from 3.00 mm (0.118 in.) to 3.600 mm (0.1417 in.)

i. Place a new tappet on the cylinder head.

NOTE: Applying engine oil at the selected tappet on the periphery and top surface.

j. Install the intake and exhaust camshaft.
k. Install the bearing caps.
l. Install the timing chain.
m. Turn the crankshaft two turns in the operating direction (clockwise) and realign crankshaft sprocket and camshaft sprocket timing marks.
n. Recheck the valve clearance.

Valve clearance (Engine coolant temperature: 20°C [68°F])

[Specification]

Intake: 0.17 ~ 0.23 mm (0.0067 ~ 0.0090 in.)

Exhaust: 0.27 ~ 0.33 mm (0.0106 ~ 0.0129 in.)

ENGINE TROUBLESHOOTING

ENGINE TROUBLESHOOTING CHART

Symptom	Suspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Worn crankshaft bearings. Loose or improperly engine drive plate.	Replace the crankshaft and bearings as required. Repair or replace the drive plate 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	Stuck valves. (Carbon buildup on the valve stem)	Repair or replace as required.
	Excessive worn or mis-aligned timing	Replace the timing chain and

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abnormal valve train noise.	chain.	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 cause the engine to overheat.	• Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket. • 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 start-up, 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.
	Worn drive belt, idler, tensioner and bearing.	Replace as required.
	Low oil pressure.	Repair or required.
	Loose or damaged drive plate.	Repair or replace the drive plate.
	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	• Inspect the oil pump screen.

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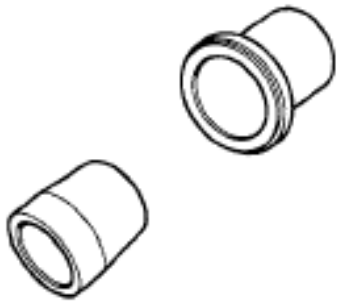
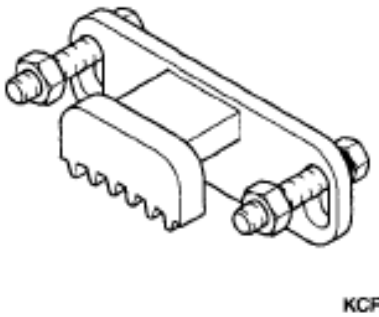
Lower engine noise, regardless of engine speed.	restricted.	• Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	• Inspect the piston, piston pin and cylinder bore. • Repair as required.
	Excessive piston pin-to-piston clearance.	• Inspect the piston, piston pin and the connecting rod. • 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 pin journals.
	Excessive crankshaft bearing clearance.	Inspect the following components, and repair as required. • The crankshaft bearings. • The crankshaft main journals. • The cylinder block.
	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 main journals. • The cylinder block.
	Hydraulically locked cylinder. • Coolant/antifreeze in cylinder. • Oil 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.

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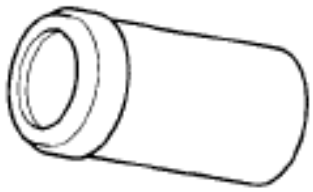
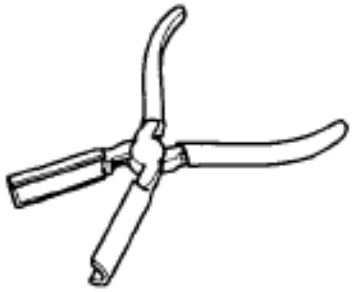
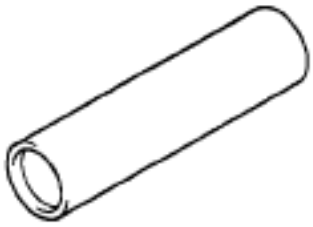
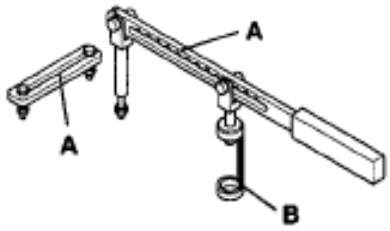
Engine will not crank-crankshaft will not rotate.	• Fuel in cylinder.	4. Inspect for a sticking fuel injector and/or leaking fuel regulator.
	Broken timing chain and/or timing chain and/or timing chain gears.	1. Inspect timing chain and gears. 2. Repair as required.
	Material in cylinder. • Broken valve • 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.
	Bent or broken connecting rod.	1. Inspect connecting rods. 2. Repair as required.
	Broken crankshaft.	1. Inspect crankshaft. 2. Repair as required.

SPECIAL TOOLS

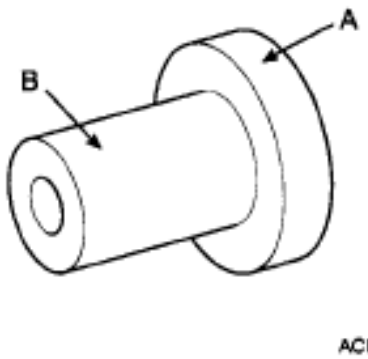
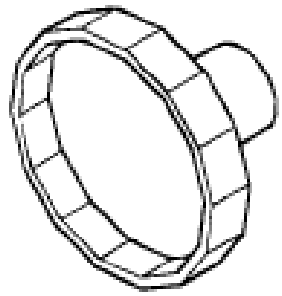
SPECIAL TOOLS CHART

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09231-3C100)		Installation of the front oil seal
Flywheel stopper (09231-3C300)		Removal and installation of the flywheel and crankshaft pulley.

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Torque angle adapter (09221-4A000)	 EDKA010A	Installation of bolts & nuts needing an angular method
Valve stem seal remover (09222-29000)	 KDRF232A	Remover of the valve stem seal
Valve stem seal remover (09222-3C100)	 LCAC030D	Installation of the valve stem seal
Valve spring compressor & holder (09222-3K000) (09222-3C300)	 ECRF003A	Removal and installation of the intake or exhaust valve A. A : 09222-3K000 B. B : 09222-3C300 (holder)
Crankshaft rear oil seal installer (09231-3C200)		Installation of the crankshaft rear oil seal A. A : 09231-3C200

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(09231-H1100)		B. B : 09231-H1100
Oil pan remover (09215-3C000)		Removal of oil pan
Oil filter wrench (09263-3C100)		Removal and installation of the oil filter

ENGINE AND TRANSAXLE ASSEMBLY

REMOVAL

CAUTION:
- **Use fender covers to avoid damaging painted surfaces.**
- **To avoid damage, unplug the wiring connectors carefully while holding the connector portion.**

NOTE:
- **Mark all wiring and hoses to avoid misconnection.**
- **Turn the crankshaft pulley so that the No. 1 piston is at top dead center.**

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1. Remove the engine cover (A).

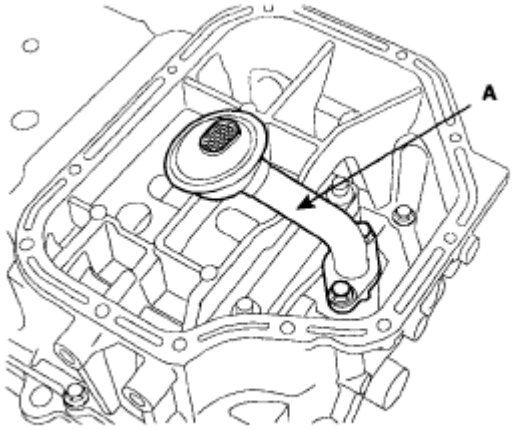


Fig. 10: Locating Engine Cover
Courtesy of HYUNDAI MOTOR CO.

2. Recover refrigerant by opening the high & low pressure pipe caps and connecting the refrigerant station (Refer to **HEATING, VENTILATION & AIR CONDITIONING -- SANTA FE**).
3. Disconnect the negative terminal from the battery and remove the battery (A).

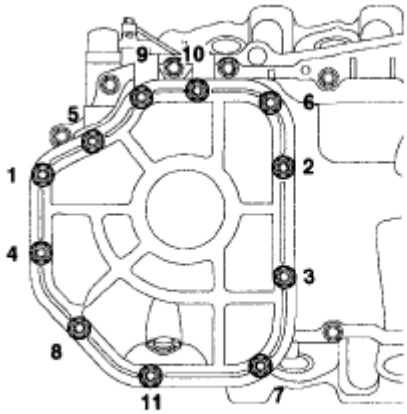


Fig. 11: Locating Battery Terminals
Courtesy of HYUNDAI MOTOR CO.

4. Remove the intake air hose and air cleaner assembly.
    1. Disconnect the MAF connector (A).
    2. Disconnect the breather hose (B) from air cleaner hose.
    3. Remove the intake air hose and air cleaner assembly (C).
    4. Disconnect the PCM connectors (D).

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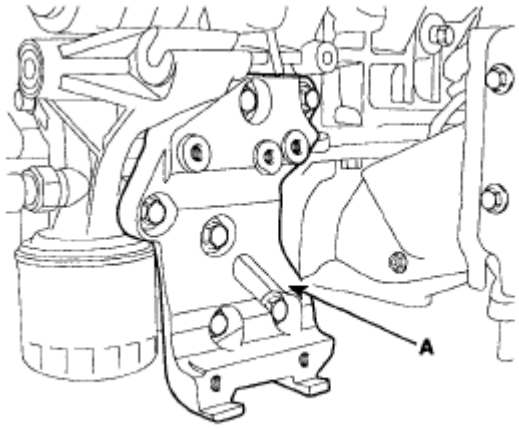


Fig. 12: Locating PCM Connectors (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

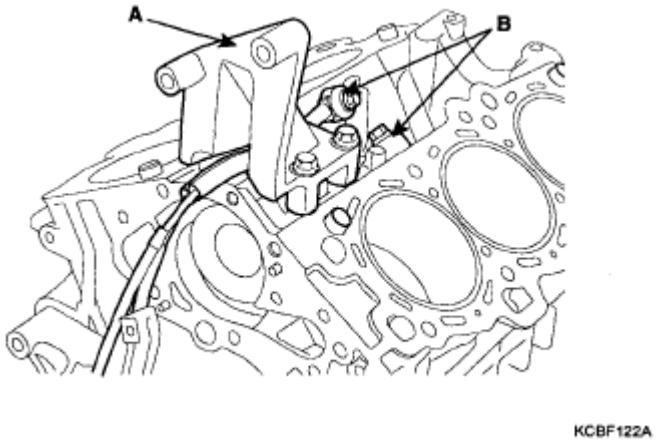
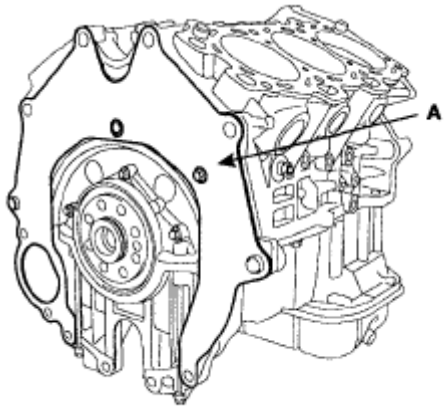


Fig. 13: Locating PCM Connectors (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

5. Remove the battery tray (A) while recovering refrigerant.



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Fig. 14: Locating Battery Tray
Courtesy of HYUNDAI MOTOR CO.

6. Disconnect the high and low pressure pipes from the radiator or the compressor.
7. Disconnect the engine wiring harness connectors.
    1. Disconnect RH oxygen sensor connector (A).

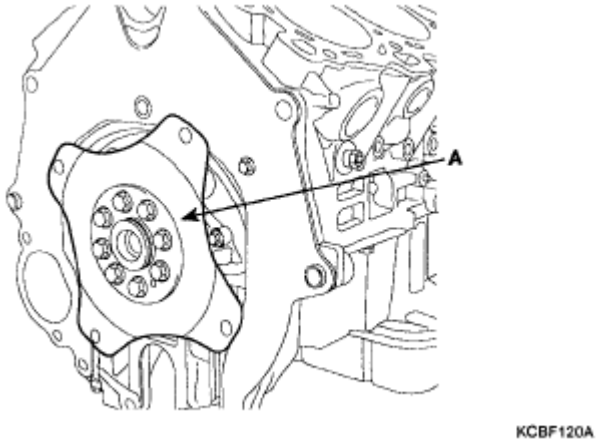
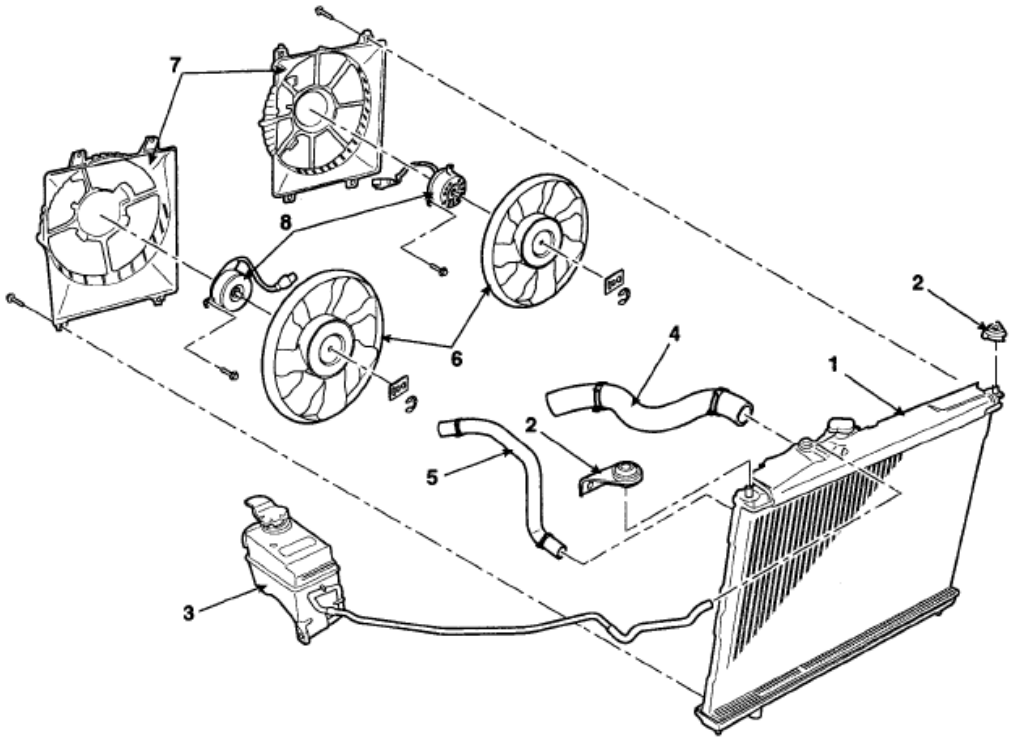


Fig. 15: Locating RH Oxygen Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

    2. Disconnect power steering oil pressure sensor connector. (Refer to **STEERING COLUMN AND SHAFT -- SANTA FE**).
    3. Disconnect RH injector connector (A) and ignition coil connector (B).

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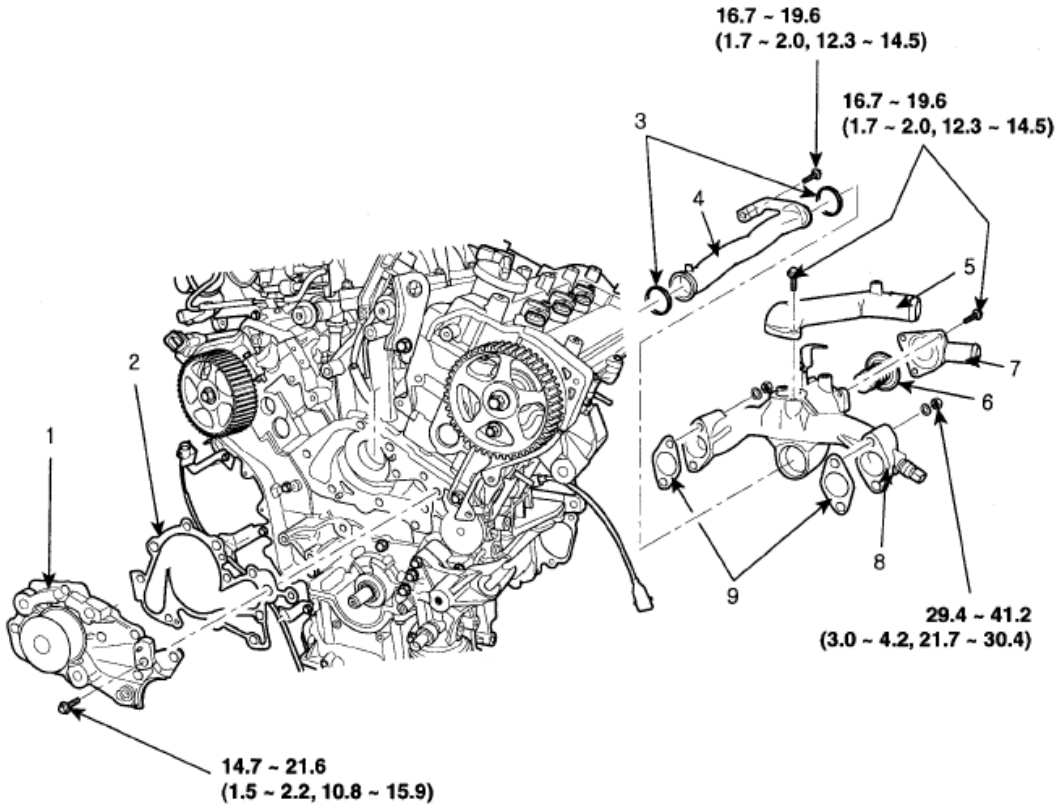


1. Radiator
2. Radiator bracket
3. Coolant reservoir tank
4. Radiator upper hose
5. Radiator lower hose
6. Radiator fan
7. Shroud
8. Motor assembly

Fig. 16: Locating RH Injector Connector And Ignition Coil Connector
Courtesy of HYUNDAI MOTOR CO.

4. Disconnect OCV connector (A) and knock sensor connector (B).

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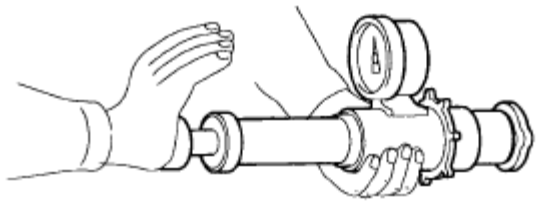
TORQUE : N.m (kgf.m, lb-ft)

1. Water pump
2. Water pump gasket
3. Water pipe O-ring
4. Water inlet pipe
5. Water outlet fitting
6. Thermostat
7. Water inlet fitting
8. Water temp. control assembly
9. Thermostat Housing gasket

SCMEM6301D

Fig. 17: Locating OCV Connector And Knock Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

5. Disconnect LH front oxygen sensor connector (A).



ECKD501X

Fig. 18: Locating LH Front Oxygen Sensor Connector

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Courtesy of HYUNDAI MOTOR CO.

6. Disconnect alternator connector (A).

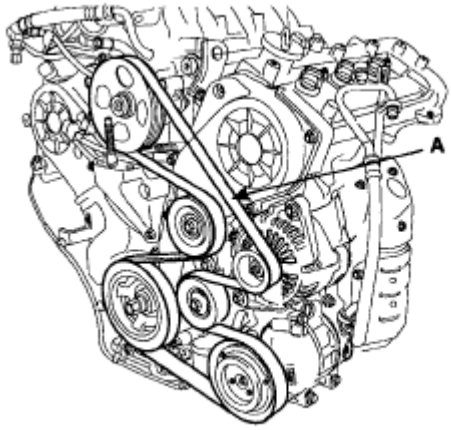


Fig. 19: Locating Alternator Connector
Courtesy of HYUNDAI MOTOR CO.

7. Disconnect LH ignition coil connector (A), injector connector (B), condenser connector (C) and ground (D), and remove wiring harness protector (E).

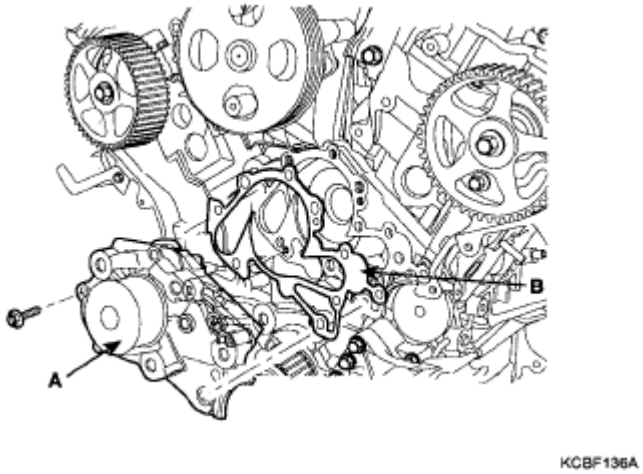


Fig. 20: Locating Ignition Coil Connector, Injector Connector And Condenser Connector
Courtesy of HYUNDAI MOTOR CO.

8. Disconnect LH CMPS (A) and oil pressure switch connector (B).

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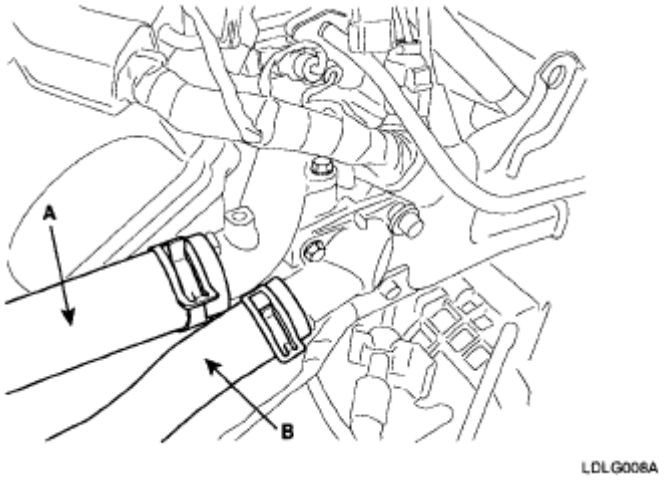


Fig. 21: Locating LH CMPS And Oil Pressure Switch Connector
Courtesy of HYUNDAI MOTOR CO.

9. Disconnect PCSV connector (A) and MAP sensor connector (B).

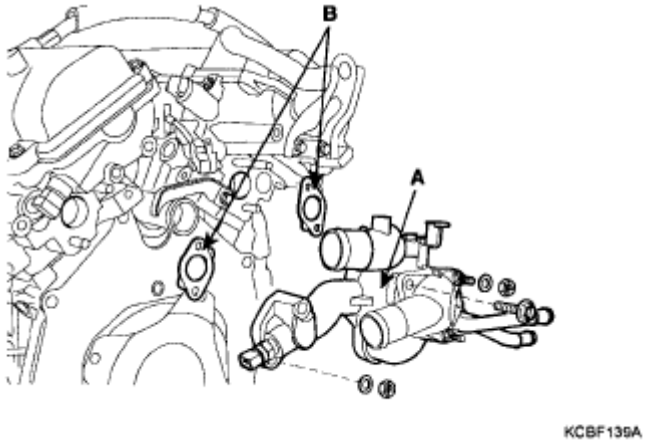


Fig. 22: Locating PCSV Connector And MAP Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

10. Disconnect RH CMPS (A) and OTS connector (B).

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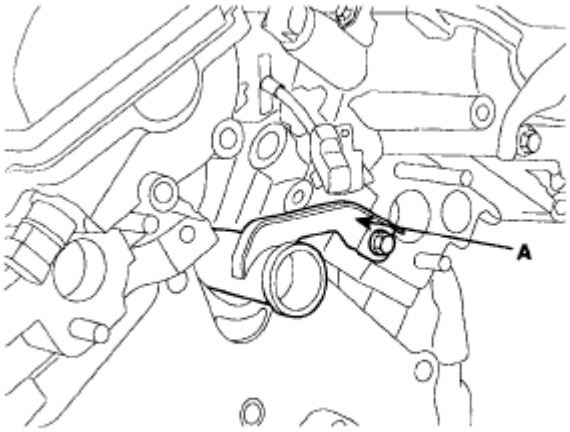


Fig. 23: Locating RH CMPS And OTS Connector
Courtesy of HYUNDAI MOTOR CO.

11. Disconnect ETC connector (A) and knock sensor connector (B).

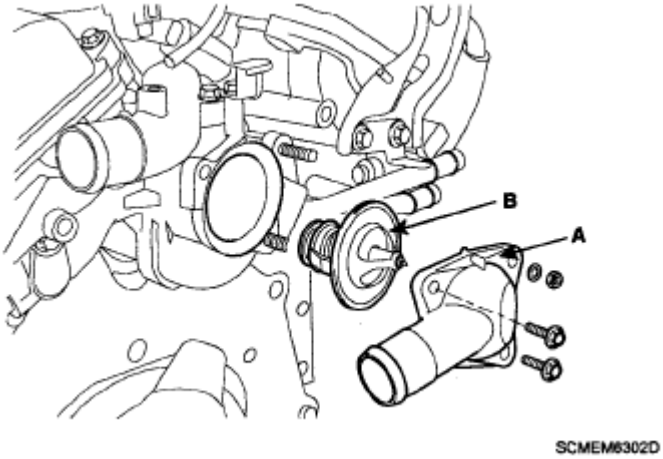


Fig. 24: Locating ETC Connector And Knock Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

12. Disconnect WTS connector (A).

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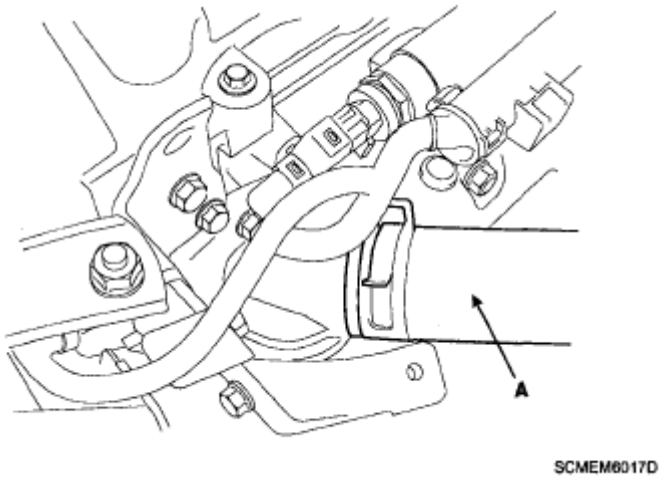


Fig. 25: Locating WTS Connector
Courtesy of HYUNDAI MOTOR CO.

13. Disconnect LH rear oxygen sensor connector (A) and CPS connector (B).

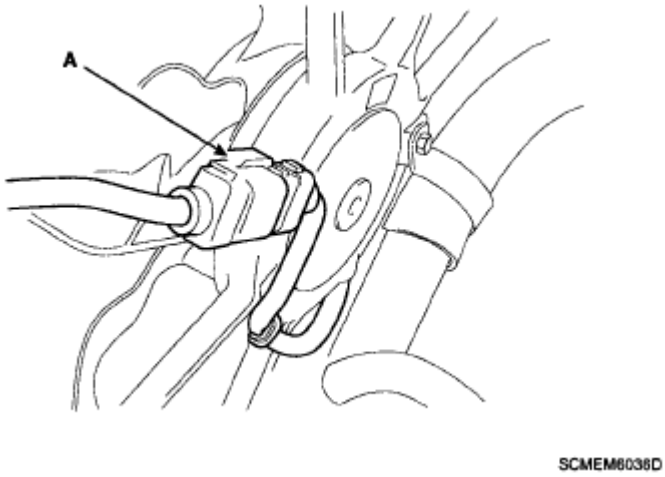


Fig. 26: Locating LH Rear Oxygen Sensor Connector And CPS Connector
Courtesy of HYUNDAI MOTOR CO.

8. Disconnect the transaxle wire harness connector and remove the transaxle control cable. (Refer to **AUTOMATIC TRANSAXLE (A5HF1) -- SANTA FE** or **AUTOMATIC TRANSAXLE (F4A51-3) -- SANTA FE**)
9. Disconnect the fuel hose tube (A).

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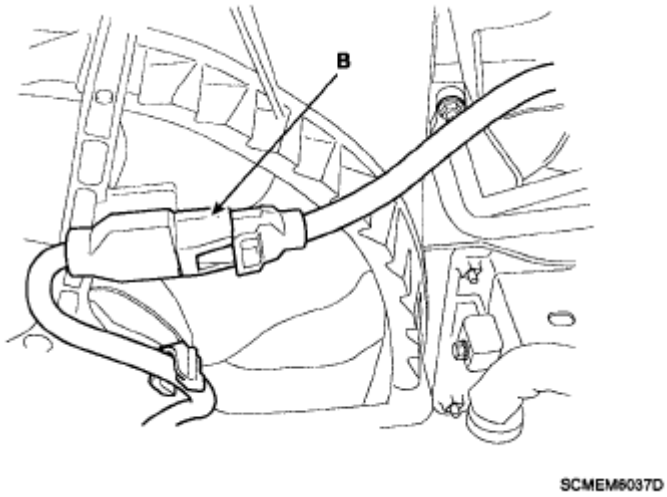


Fig. 27: Locating Fuel Hose Tube
Courtesy of HYUNDAI MOTOR CO.

10. Remove the under cover (A).

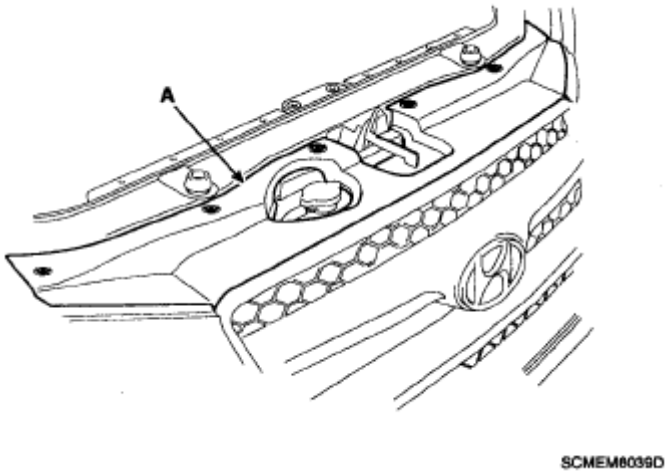


Fig. 28: Locating Under Cover
Courtesy of HYUNDAI MOTOR CO.

11. Drain engine oil.
12. Drain coolant by loosening the plug (A).

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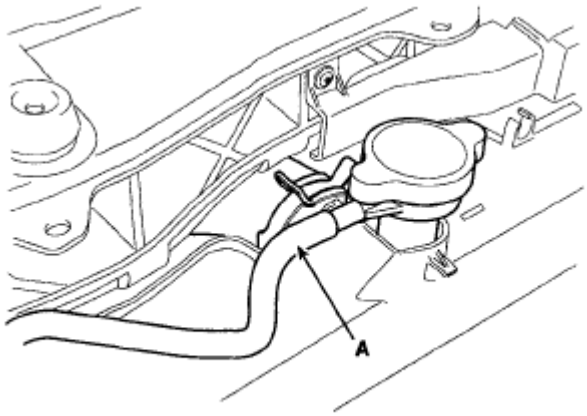


Fig. 29: Locating Plug
Courtesy of HYUNDAI MOTOR CO.

13. Remove the front exhaust muffler (A).

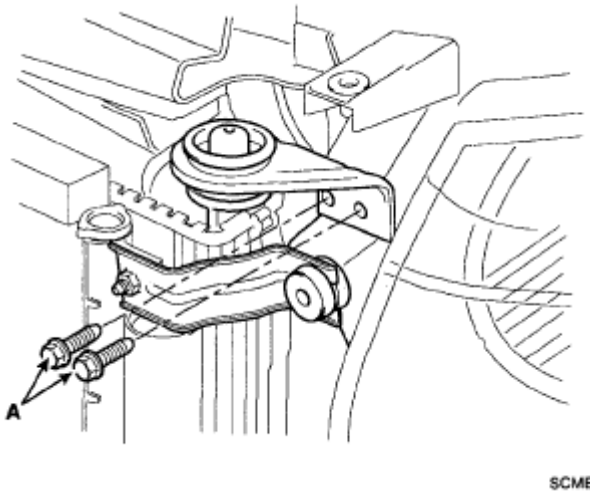
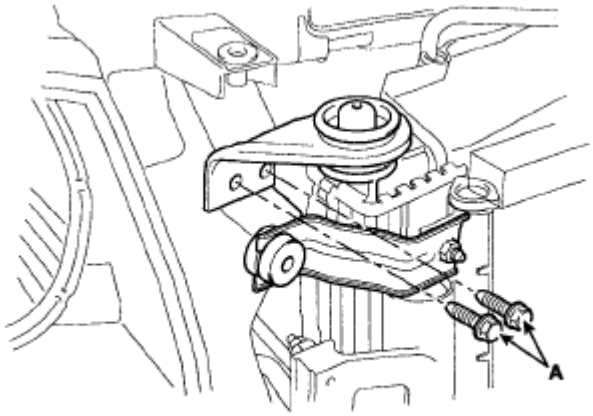


Fig. 30: Locating Front Exhaust Muffler
Courtesy of HYUNDAI MOTOR CO.

14. Disconnect the ECM (Electronic Controlled Mounting) solenoid connector (A).

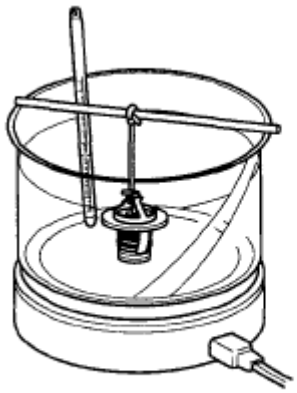
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SCMEM6042D

Fig. 31: Locating ECM (Electronic Controlled Mounting) Solenoid Connector
Courtesy of HYUNDAI MOTOR CO.

15. Remove the steering column bolt. (Refer to **STEERING COLUMN AND SHAFT -- SANTA FE**).
16. Remove the engine transaxle assembly under mounting bolts. (Refer to **MANUAL TRANSAXLE (M5GF2) -- SANTA FE** , **AUTOMATIC TRANSAXLE (A5HF1) -- SANTA FE** or **AUTOMATIC TRANSAXLE (F4A51-3) -- SANTA FE**).
17. Remove the front wheels and tires. (Refer to **DRIVESHAFT -- SANTA FE**).
18. Remove the stabilizer bar link nuts, the lower arm mounting bolts and tie rod end mounting nuts. (Refer to **DRIVESHAFT -- SANTA FE** , **FRONT SUSPENSION SYSTEM -- SANTA FE** or **REAR SUSPENSION SYSTEM -- SANTA FE**).
19. Remove heater hose (A).

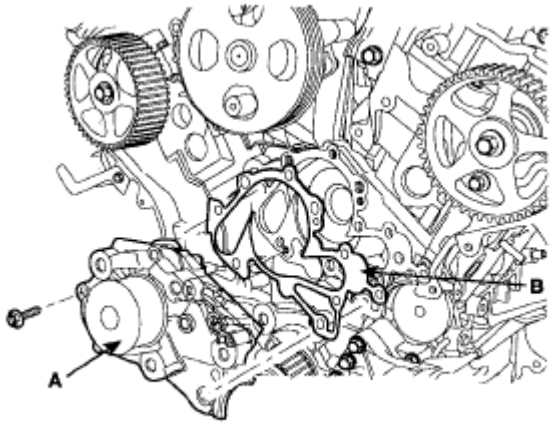


ECKD503B

Fig. 32: Locating Heater Hose
Courtesy of HYUNDAI MOTOR CO.

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

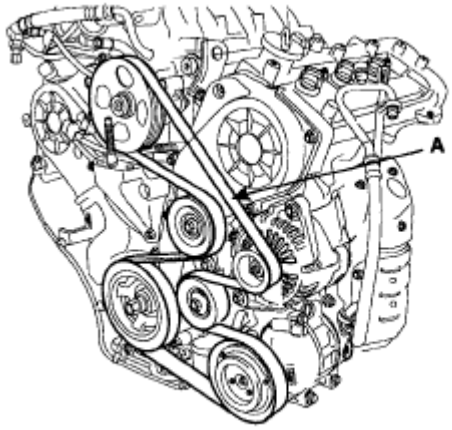
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KCBF136A

Fig. 33: Locating Upper Radiator Hose And Lower Radiator Hoses
Courtesy of HYUNDAI MOTOR CO.

21. Disconnect the brake vacuum hose (A).



KCBF105A

Fig. 34: Locating Brake Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

22. Disconnect the automatic trestles fluid cooler hoses. (Refer to **AUTOMATIC TRANSAXLE (A5HF1) -- SANTA FE** or **AUTOMATIC TRANSAXLE (F4A51-3) -- SANTA FE**).
23. After draining or gathering power steering fluid, disconnect the power steering feeding and return hoses. (Refer to **STEERING COLUMN AND SHAFT -- SANTA FE**).
24. Remove the subframe mounting bolts.

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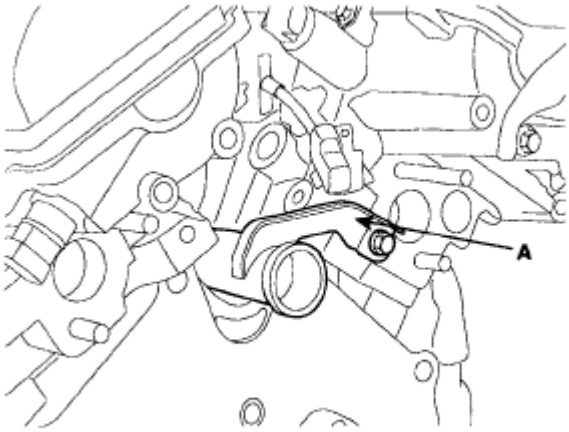


Fig. 35: Identifying Subframe Mounting Bolts (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

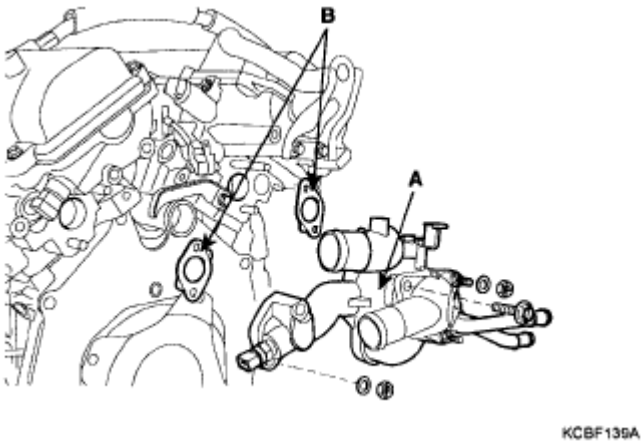


Fig. 36: Identifying Subframe Mounting Bolts (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

25. Install a jack for supporting the engine and transaxle assembly with the subframe.
26. Remove the engine mounting bracket (A).

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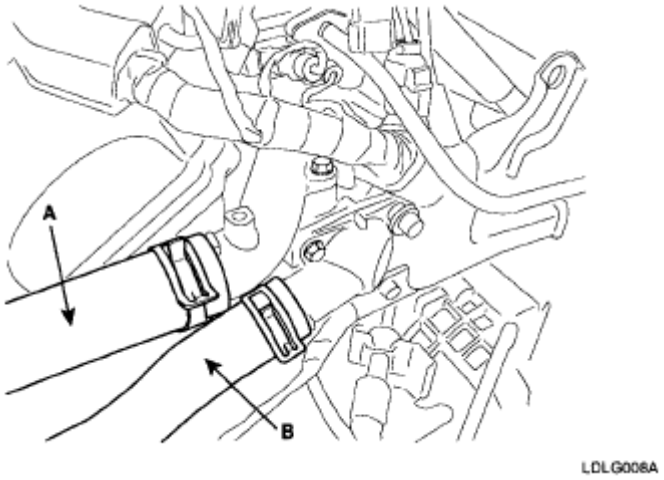


Fig. 37: Locating Engine Mounting Bracket
Courtesy of HYUNDAI MOTOR CO.

27. Remove the transaxle mounting bracket (A).

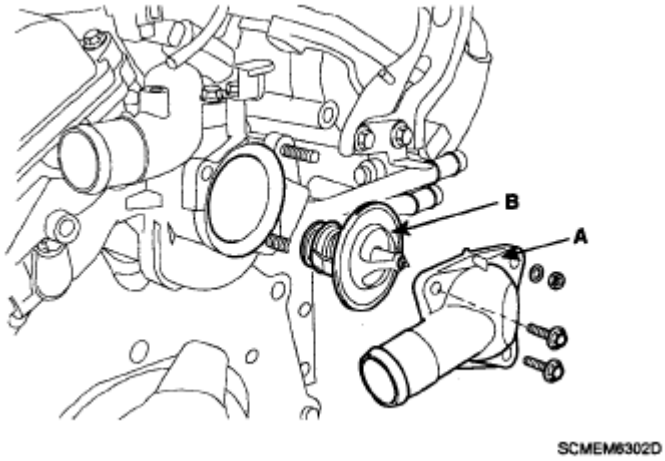


Fig. 38: Locating Transaxle Mounting Bracket
Courtesy of HYUNDAI MOTOR CO.

NOTE: When the transaxle mounting bracket is removed, the two mounting nuts should be removed from the front left wheel housing.

28. Jack up the vehicle body in order to remove the engine and transaxle assembly.

INSTALLATION

Installation is in the reverse order of removal.

Perform the following :

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- Adjust the shift cable.
- Refill the engine with engine oil.
- Refill the transaxle with fluid.
- Refill the radiator with engine coolant.
- Bleed air from the cooling system with the heater valve open.
- Clean the battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
- Inspect for fuel leakage.

  After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.

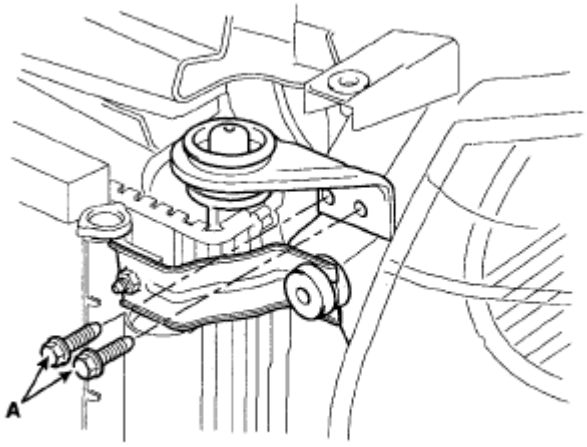
  Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.

TIMING SYSTEM

TIMING CHAIN

Components and Components Location

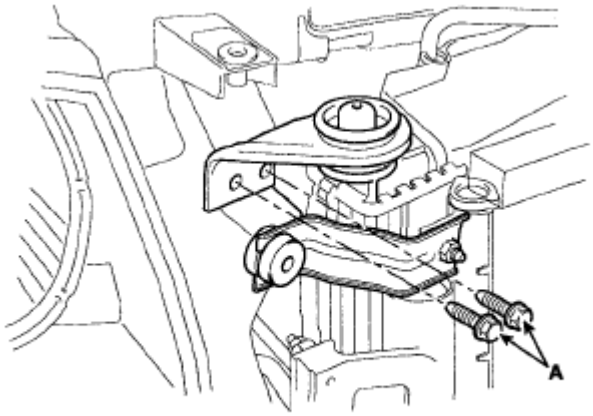
Components



SCMEM6041D

Fig. 39: Exploded View Of Timing Chain System With Torque Specification (1 Of 2)

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SCMEM6042D

Fig. 40: Exploded View Of Timing Chain System With Torque Specification (2 Of 2)

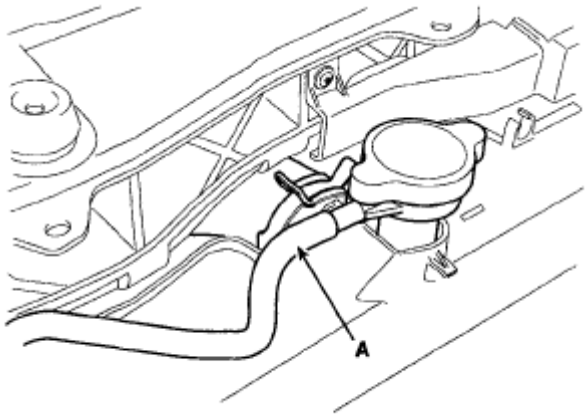
Repair procedures

Removal

CAUTION:
- **Use fender covers to avoid damaging painted surfaces.**
- **To avoid damage, unplug the wiring connectors carefully while holding the connector portion.**

NOTE:
- **Mark all wiring and hoses to avoid misconnection.**
- **Turn the crankshaft pulley so that the No. 1 piston is at top dead center.**

1. Disconnect the battery negative cable (A).



SCMEM6040D

Fig. 41: Identifying Battery Negative Cable

2. Remove the engine cover (A).

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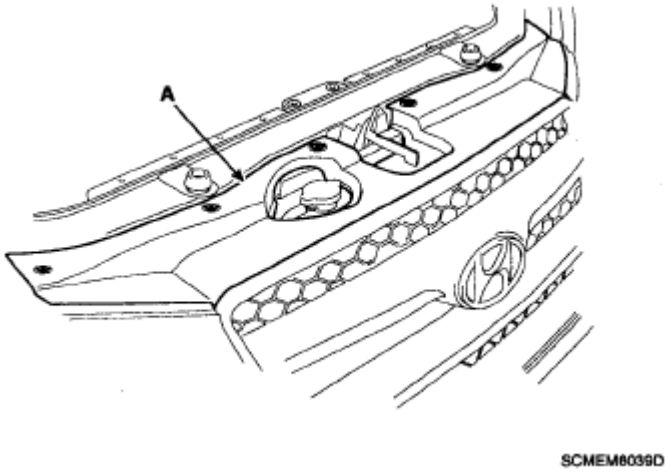


Fig. 42: Identifying Engine Cover

3. Remove the intake air hose and air cleaner assembly.
    1. Disconnect the MAF connector (A).
    2. Disconnect the breather hose (B) from air cleaner hose.
    3. Remove the intake air hose(C) and air cleaner body (D).

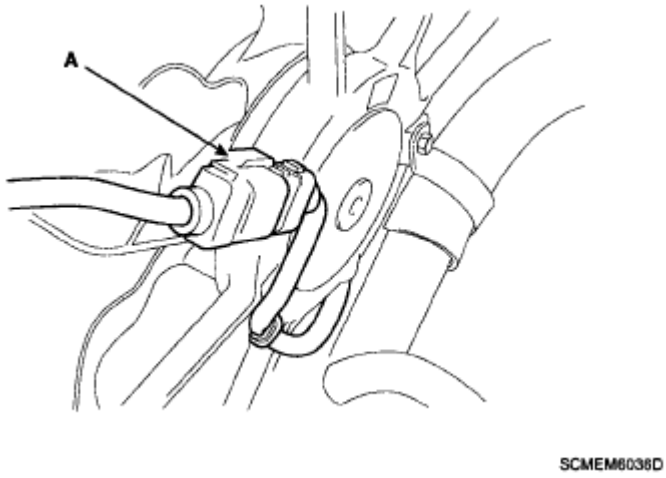


Fig. 43: Identifying MAF Connector, Breather Hose, Intake Air Hose And Air Cleaner Body

4. Remove the RH front wheel.
5. Remove the under cover (A).

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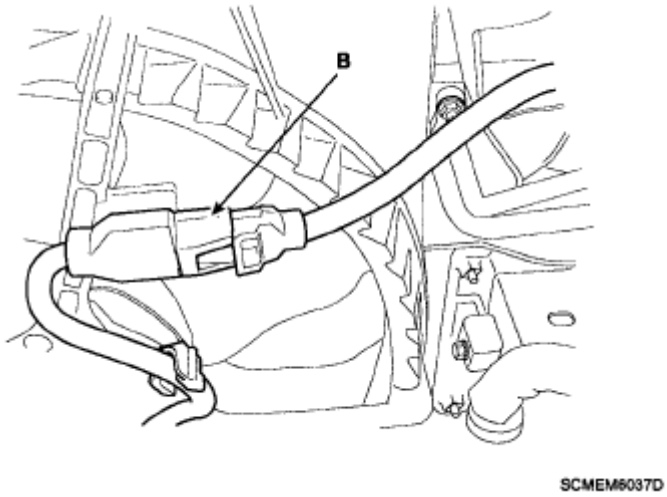


Fig. 44: Identifying Under Cover

6. Remove the side cover.
7. Loosen the drain plug(A) and drain the engine coolant.

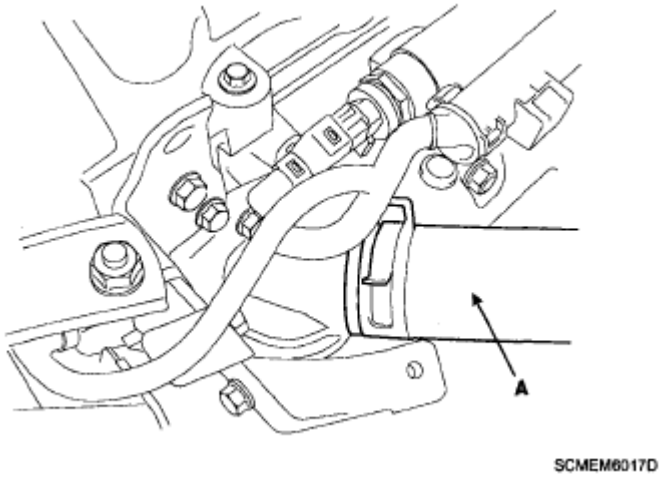
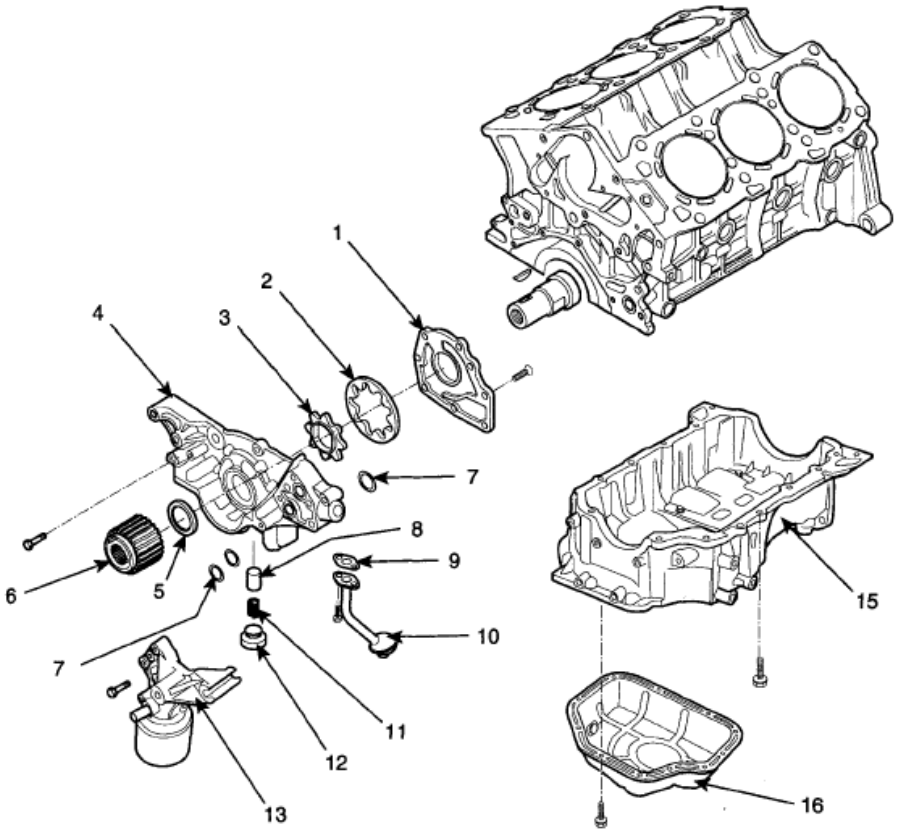


Fig. 45: Identifying Drain Plug

8. Drain the engine oil.
9. Remove the surge tank.
    1. Disconnect the RH oxygen sensor connector (A).

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1. Oil pump cover
2. Oil pump outer rotor
3. Oil pump inner rotor
4. Oil pump case
5. Oil seal
6. Crankshaft sprocket
7. O-ring
8. Relief plunger
9. Oil screen gasket
10. Oil screen
11. Relief spring
12. Plug
13. Oil filter bracket
15. Upper oil pan
16. Lower oil pan

SCMEM6303D

Fig. 46: Identifying RH Oxygen Sensor Connector

2. Disconnect the RH injector connector (A), ignition coil connector (B) and VIS connector (C).

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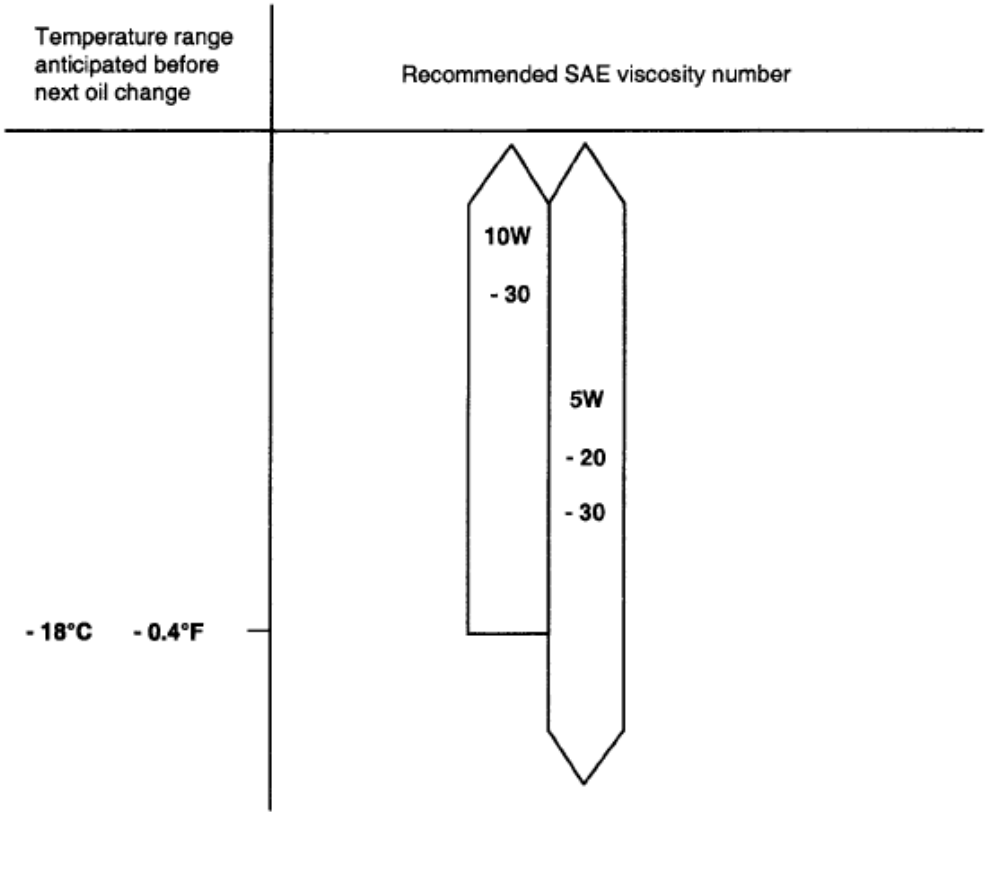


Fig. 47: Identifying RH Injector Connector, Ignition Coil Connector And VIS Connector

3. Disconnect the PCSV connector (A), MAP sensor connector (B), PCSV hose and the ECM vacuum hose.

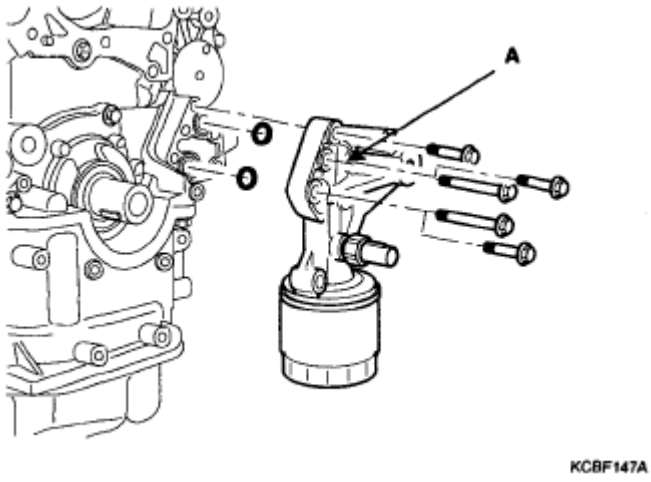


Fig. 48: Identifying PCSV Connector And Map Sensor Connector

4. Disconnect the ETC connector (A) and knock sensor connector (B).

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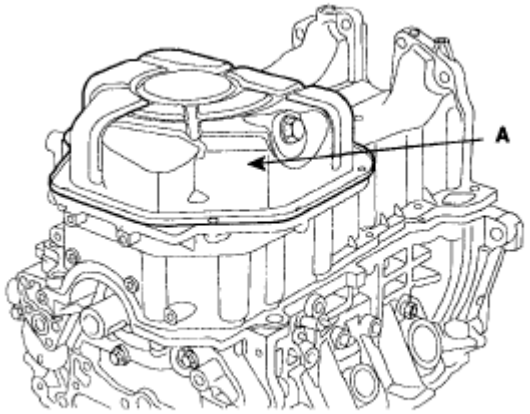


Fig. 49: Identifying ETC Connector And Knock Sensor Connector

5. Disconnect the OCV connector (A) and knock sensor connector (B).

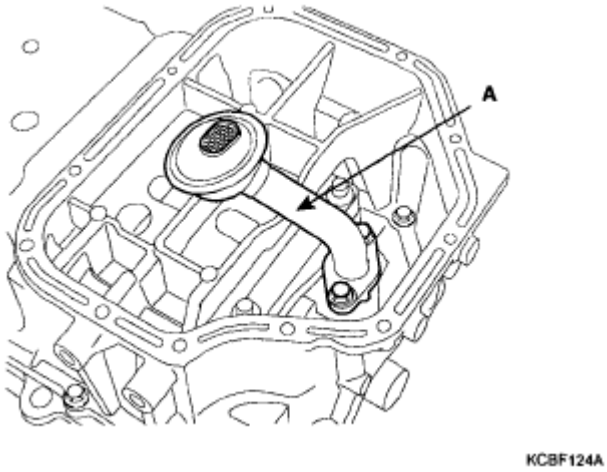
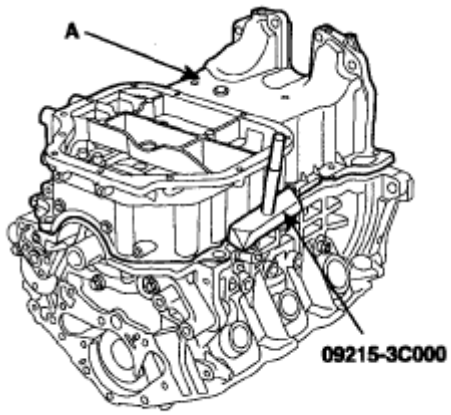


Fig. 50: Identifying OCV Connector And Knock Sensor Connector

6. Disconnect the LH front oxygen sensor connector (A).

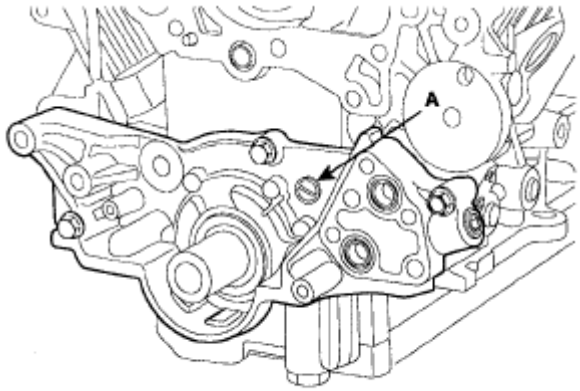
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KCBF125B

Fig. 51: Identifying LH Front Oxygen Sensor Connector

7. Disconnect the LH ignition coil connector (A), injector connector (B), condenser connector (C) and ground (D), and remove the wiring harness protector (E).



KCBF163A

Fig. 52: Identifying LH Ignition Coil Connector, Injector Connector, Condenser Connector, Ground And Wiring Harness Protector

8. Disconnect the LH CMPS (A) and oil pressure switch connector (B).

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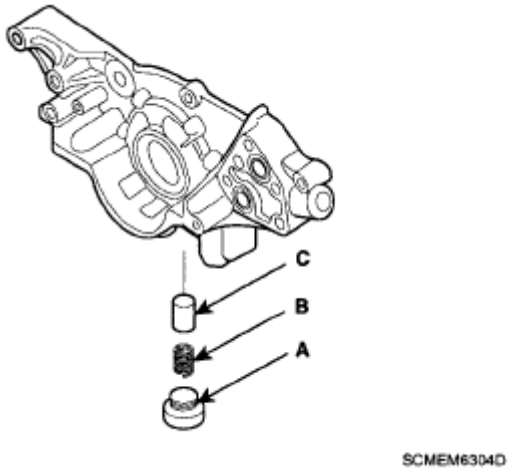


Fig. 53: Identifying LH CMPS And Oil Pressure Switch Connector

9. Disconnect the RH CMPS connector (A).

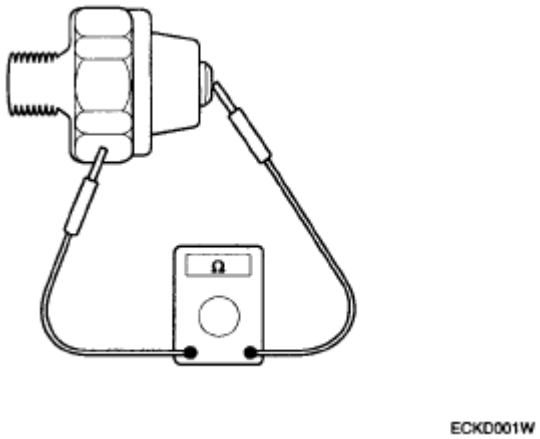


Fig. 54: Identifying RH CMPS Connector

10. Remove the ETC bracket.
11. Disconnect the water hoses from ETC.
12. Disconnect the PCV hose.
13. Disconnect the brake vacuum hose.
14. Remove the surge tank stay (A).

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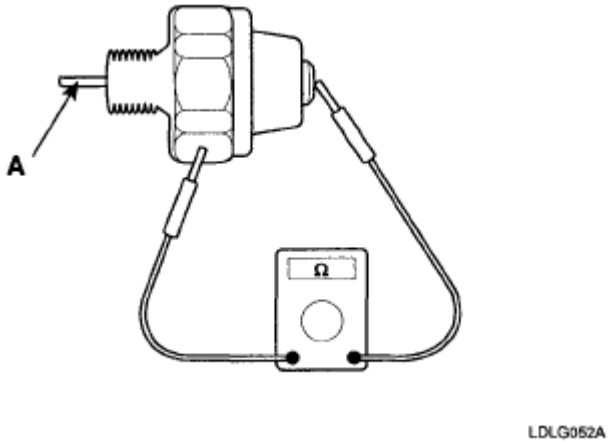


Fig. 55: Identifying Surge Tank Stay With Mounting Bolts

15. Remove the connector bracket (A) from surge tank.

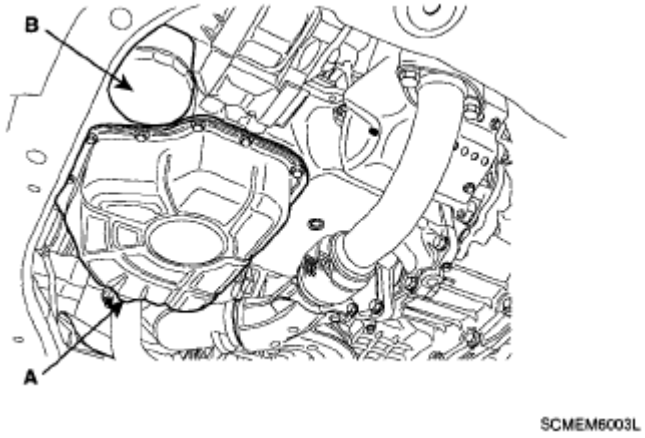


Fig. 56: Identifying Surge Tank Connector Bracket

16. Remove the surge tank (A).

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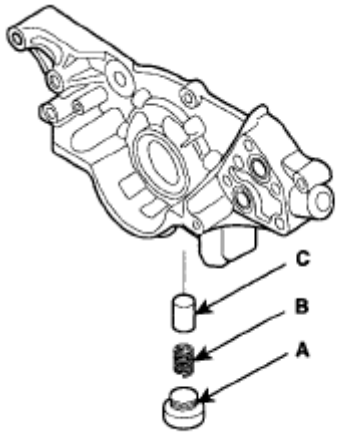


Fig. 57: Identifying Surge Tank With Mounting Bolts

NOTE: Cover the inlet of intake manifold with a clean woven stuff or vinyl cover to prevent foreign materials from entering.

10. Remove the cylinder head cover.
    1. Remove the connector bracket (A) from LH cylinder head cover.

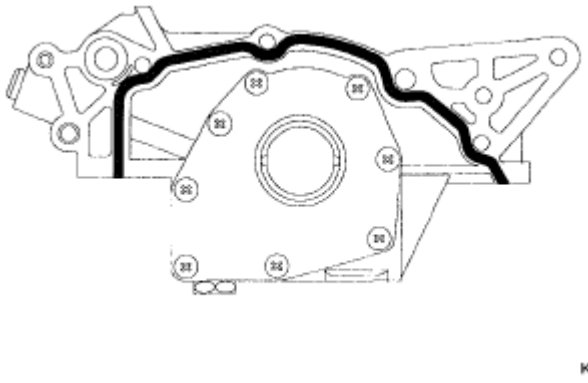
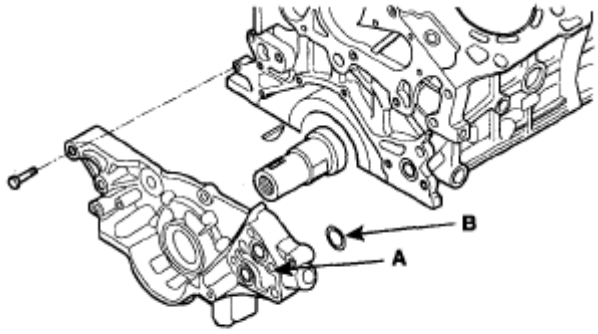


Fig. 58: Identifying LH Cylinder Head Cover Connector Bracket

    2. Disconnect the RH ignition coil connector (A), condenser connector (B) and remove the wiring bracket (C).

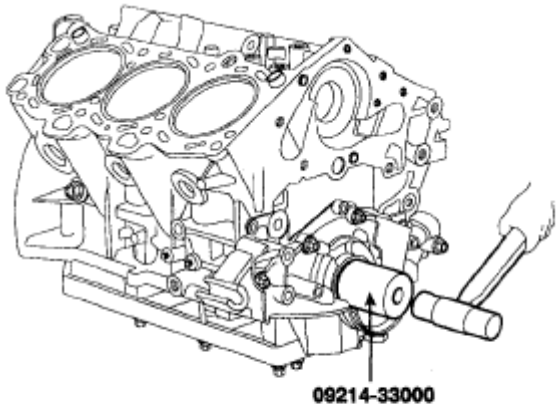
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LDLG070A

Fig. 59: Identifying RH Ignition Coil Connector, Condenser Connector And Wiring Bracket

3. Remove the LH, RH ignition coil.
4. Remove the LH, RH cylinder head cover (A).

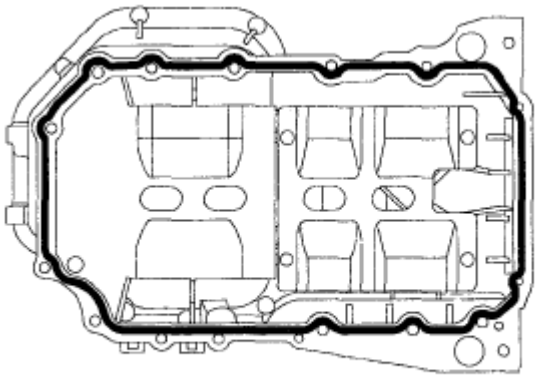


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Fig. 60: Identifying LH And RH Cylinder Head Cover

11. Using SST (09215-3C000) remove lower oil pan (A).

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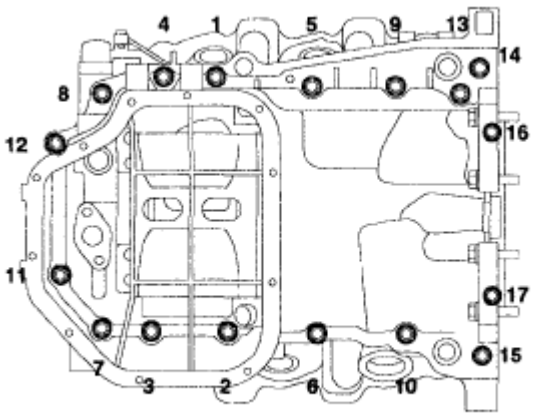


KCBF130A

Fig. 61: Removing Lower Oil Pan Using SST (09215-3C000)

NOTE: Be careful not to damage the contact surfaces of upper oil pan and lower oil pan.

12. Set a jack to the upper oil pan.



KCBF131A

Fig. 62: Locating Upper Oil Pan

13. Just loosen the transaxle mounting bracket bolts without removing the transaxle mounting bracket.

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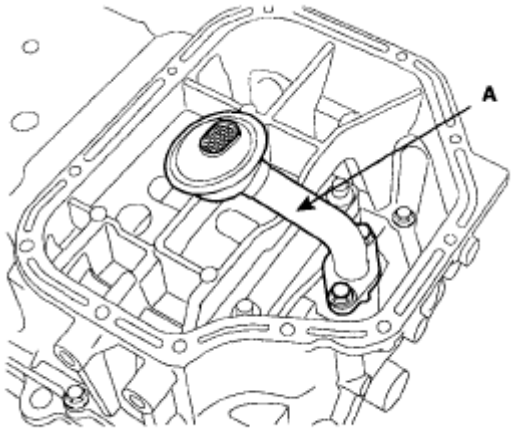


Fig. 63: Identifying Transaxle Mounting Bracket Bolts

14. Remove the engine mounting bracket (A).

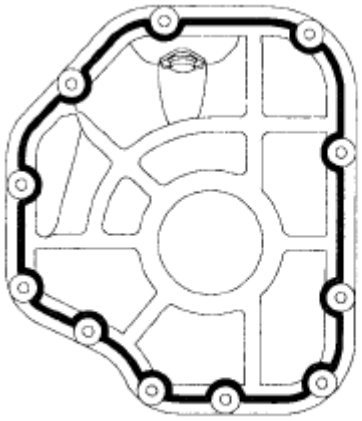
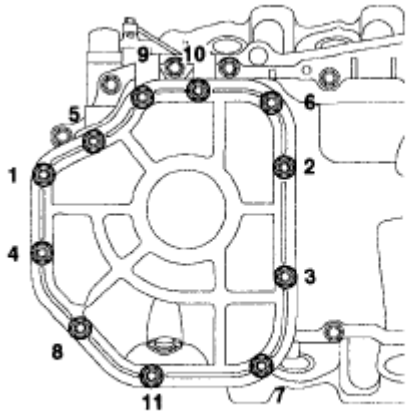


Fig. 64: Identifying Engine Mounting Bracket

15. Set No. 1 cylinder to TDC/compression.
    1. Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing chain cover.

NOTE: Do not rotate engine counterclockwise.

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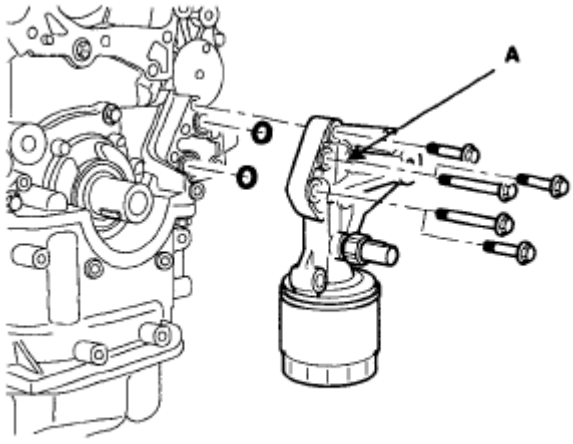


KCBF133A

Fig. 65: Identifying Timing Mark On Lower Timing Chain Cover

2. Check that the mark (A) of the camshaft timing sprockets are in straight line on the cylinder head surface as shown in the illustration.

   If not, turn the crankshaft one revolution (360°).



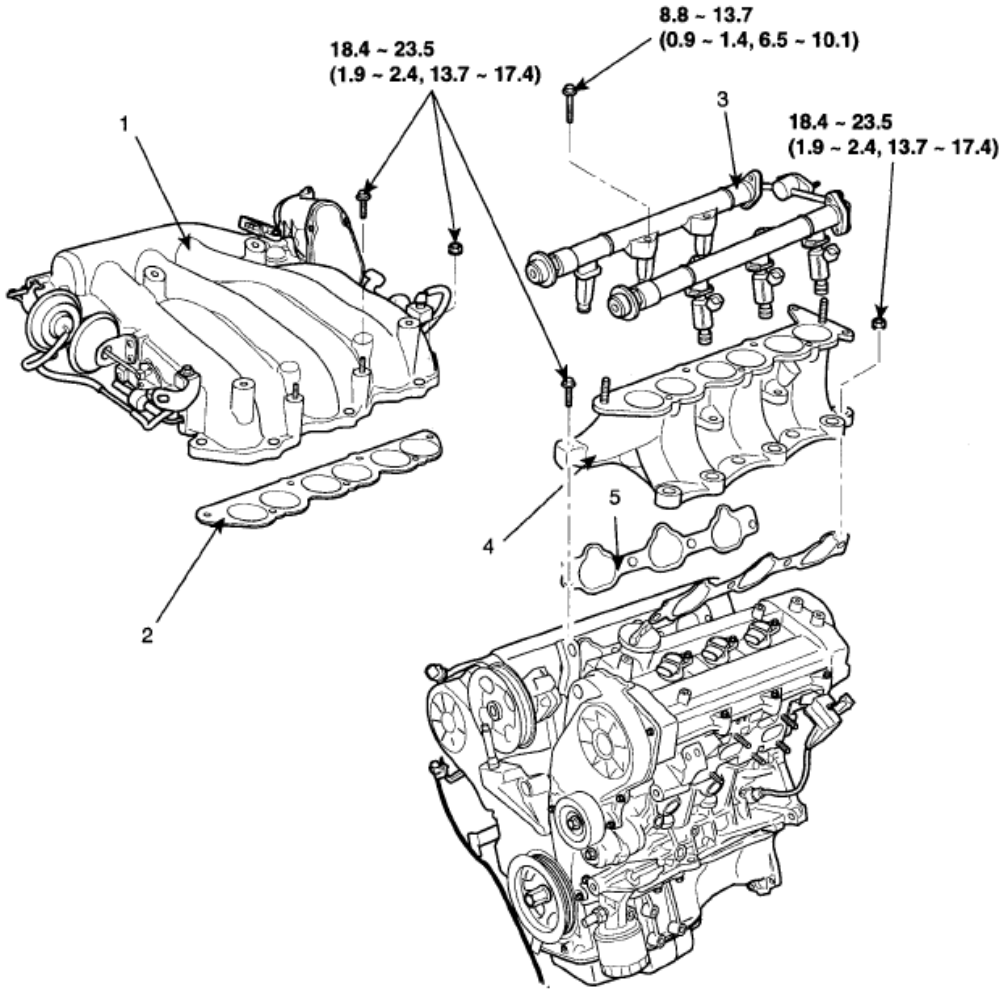
KCBF147A

Fig. 66: Identifying Mark On Camshaft Timing Sprockets

NOTE: Do not rotate engine counterclockwise.

16. Remove the drive belt (A).

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TORQUE : N.m (kgf.m, lb-ft)

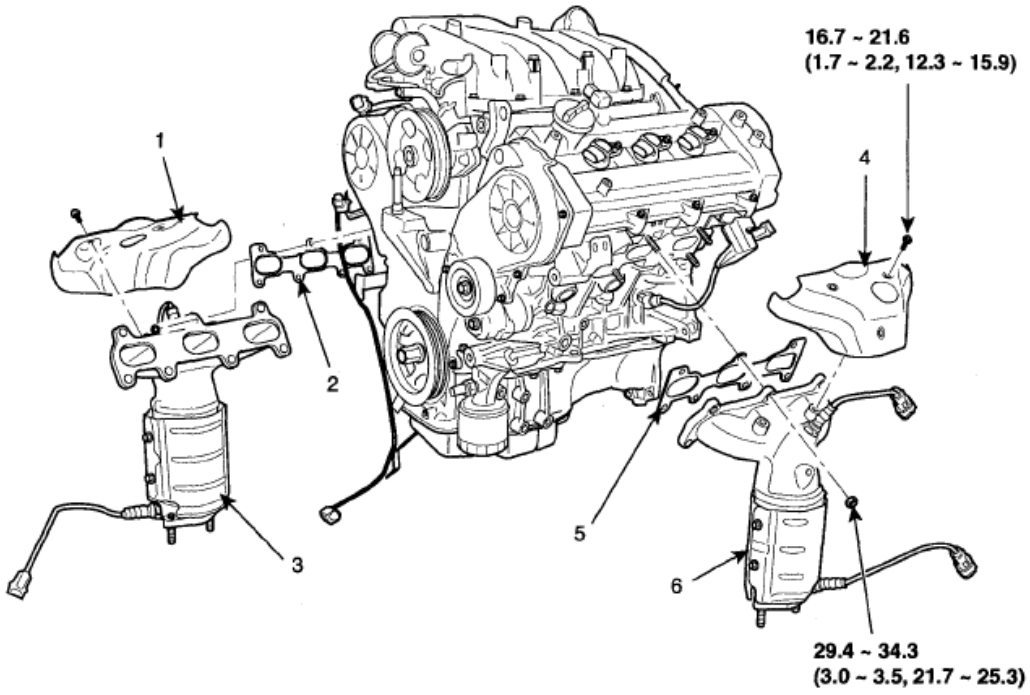
1. Surge tank
2. Surge tank gasket
3. Delivery pipe
4. Intake manifold
5. Intake manifold gasket

LDLG053A

Fig. 67: Identifying Drive Belt

17. Remove the crankshaft damper pulley (A).

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TORQUE : N.m (kgf.m, lb-ft)

1. Bank 1 heat protector
2. Bank 1 exhaust manifold
3. Bank 1 exhaust gasket
4. Bank 2 protector
5. Bank 2 exhaust manifold gasket
6. Bank 2 exhaust manifold

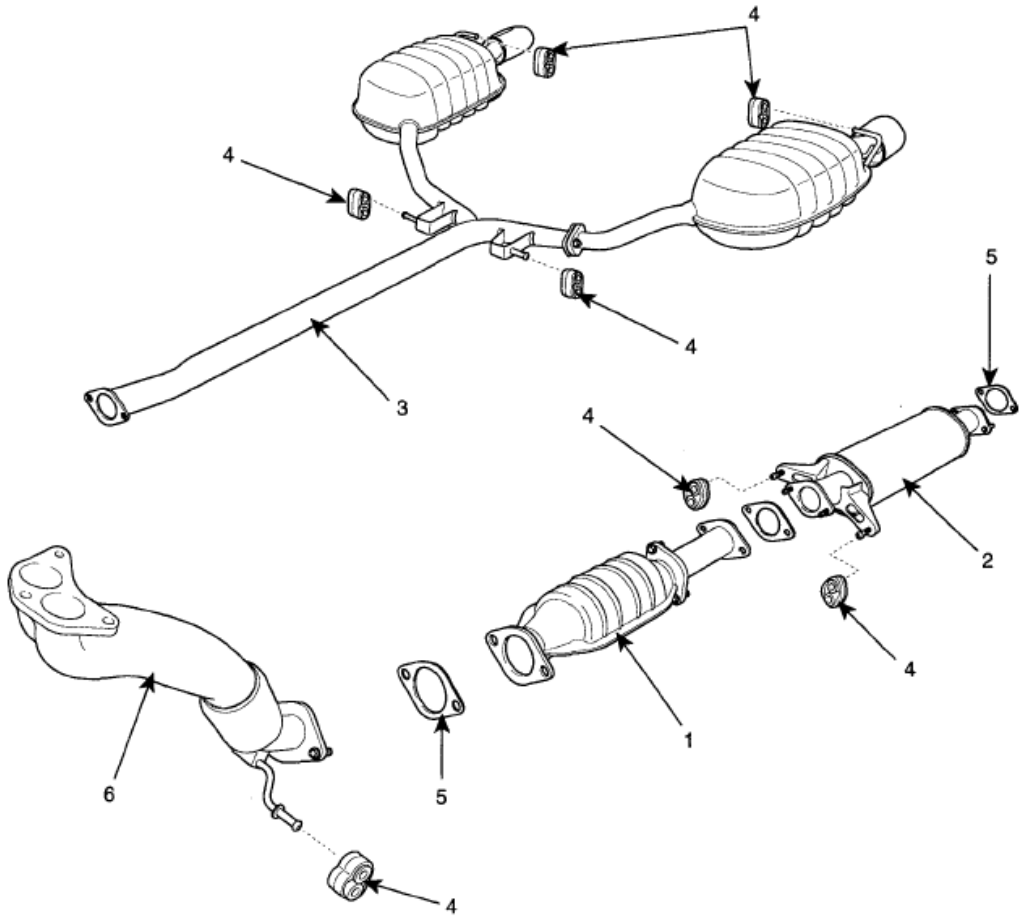
LDLG054A

Fig. 68: Identifying Crankshaft Damper Pulley

NOTE: There are two methods to hold the ring gear when installing or removing the crankshaft damper pulley.

- Install the SST (09231-3C300) to hold the ring gear after removing the starter.

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1. Catalytic convert
2. Center muffler
3. Main muffler
4. Lever hanger
5. Gasket
6. Front muffler

Fig. 69: Installing Crankshaft Damper Pulley Using SST (09231-3C300)

- Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.
  1. Remove the front muffler. (Refer to Intake And Exhaust system)
  2. Remove the dust cover (A) on the bottom of the upper oil pan and unfasten the two transaxle mounting bolts (B).

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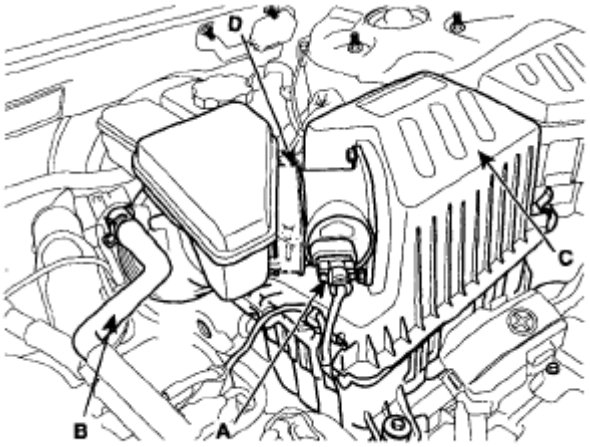


Fig. 70: Identifying Dust Cover And Transaxle Mounting Bolts

3. Adjust the length of the holder nuts (A) so that the front plate of the holder (B) puts in the ring gear (C) teeth.
4. Fasten the two transaxle mounting bolts in the original mounted holes.

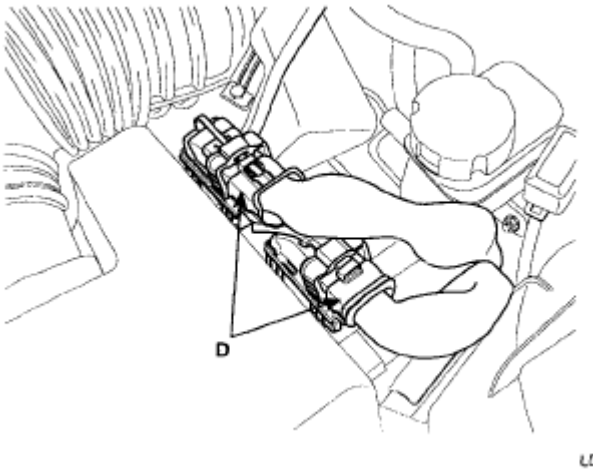


Fig. 71: Identifying Holder Nuts, Holder And Ring Gear With Transaxle Mounting Bolts

5. Install the SST (09231-3D100) using the two mounting bolts. Tighten the bolts and nuts of the holder securely.

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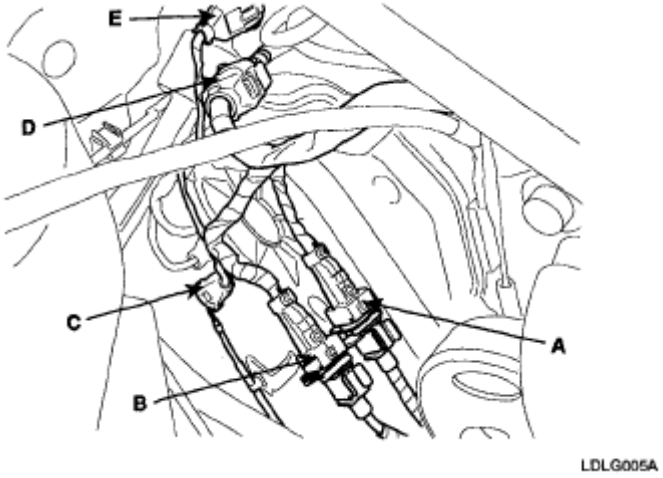


Fig. 72: Installing SST (09231-3D100) Using Mounting Bolts

18. Lift up the engine assembly to using the jack.
19. Remove the drive belt idler (A).

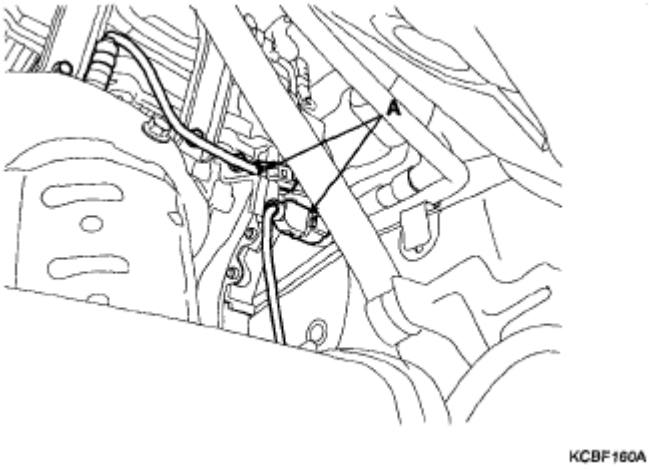


Fig. 73: Identifying Drive Belt Idler

20. Remove the drive belt auto tensioner (A).

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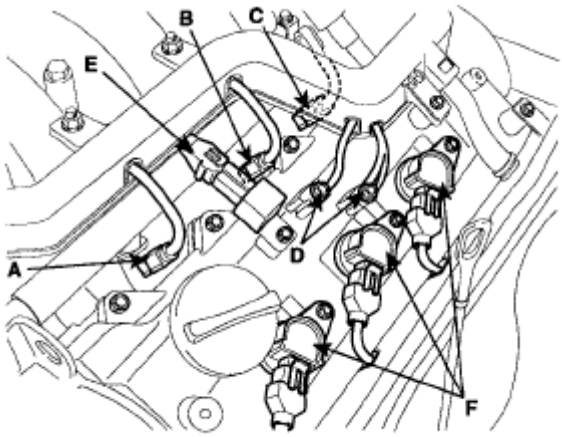


Fig. 74: Identifying Drive Belt Auto Tensioner With Mounting Bolts

21. Remove the water pump pulley (A).

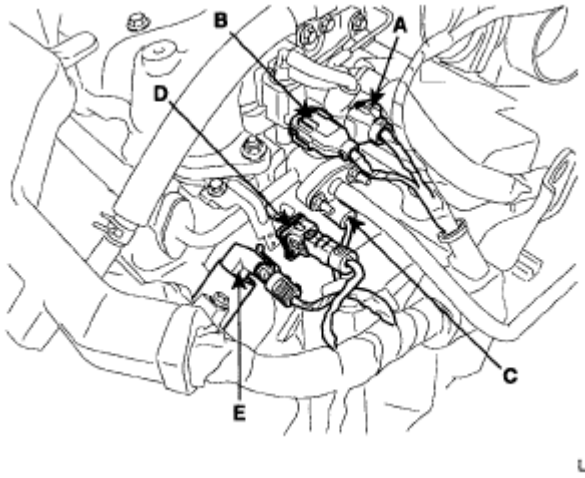


Fig. 75: Identifying Water Pump Pulley

22. Remove the timing chain cover (A). If necessary remove the water pump (B) first.

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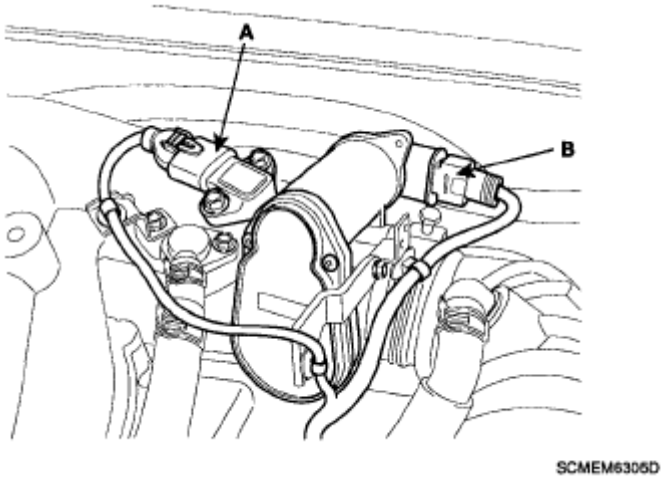


Fig. 76: Identifying Timing Chain Cover

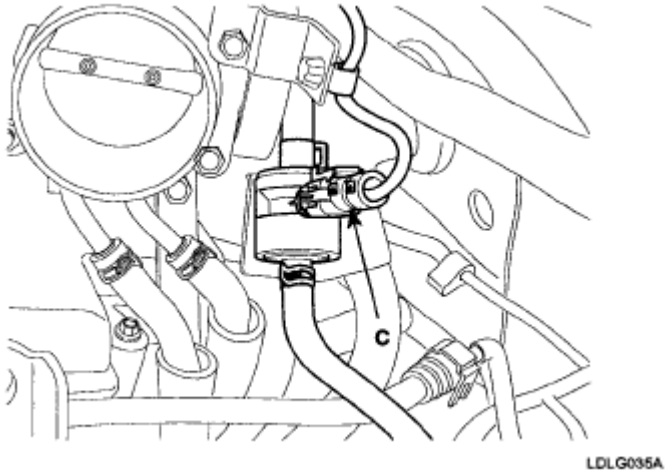


Fig. 77: Identifying Water Pump With Mounting Bolts

NOTE: Be careful not to damage the contact surfaces of cylinder block, cylinder head and timing chain cover. Before removing the timing chain, mark the RH/LH timing chain with an identification based on the location of the sprocket because the identification mark on the chain for TDC (Top Dead Center) can be erased.

23. Install a set pin after compressing the timing chain tensioner.

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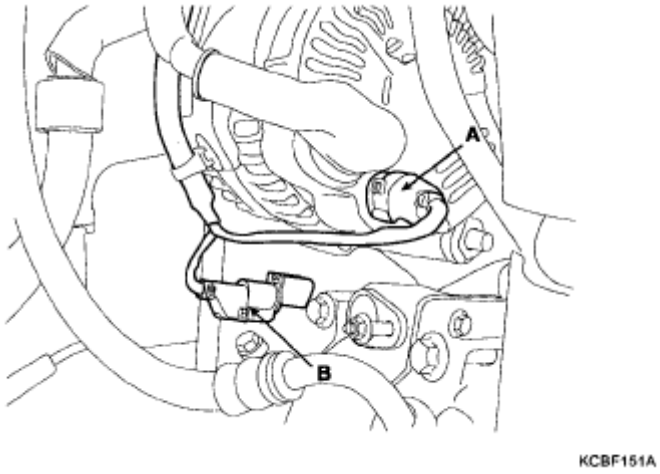


Fig. 78: Installing Set Pin

24. Remove the RH cam-to-cam guide (A).

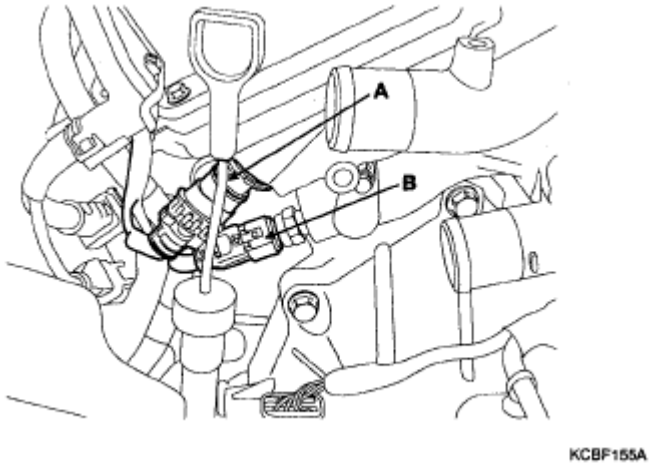


Fig. 79: Identifying RH Cam-To-Cam Guide

25. Remove the RH timing chain auto tensioner (A) and RH timing chain tensioner arm (B).

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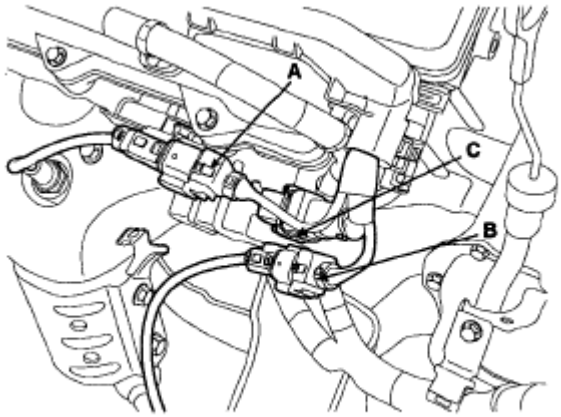


Fig. 80: Identifying RH Timing Chain Auto Tensioner And RH Timing Chain Tensioner Arm

26. Remove the RH timing chain.
27. Remove the RH timing chain guide (A).

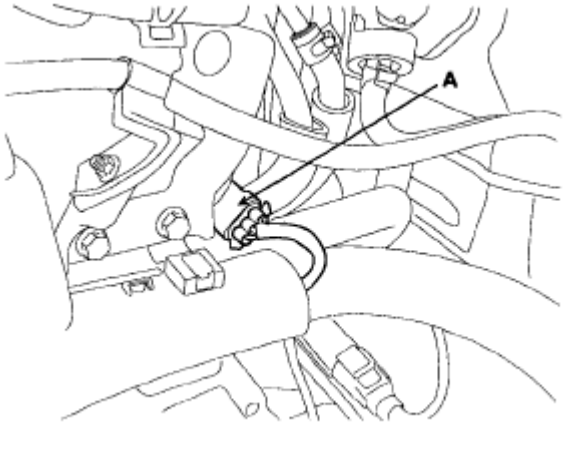


Fig. 81: Identifying RH Timing Chain Guide

28. Remove the oil pump chain cover (A).

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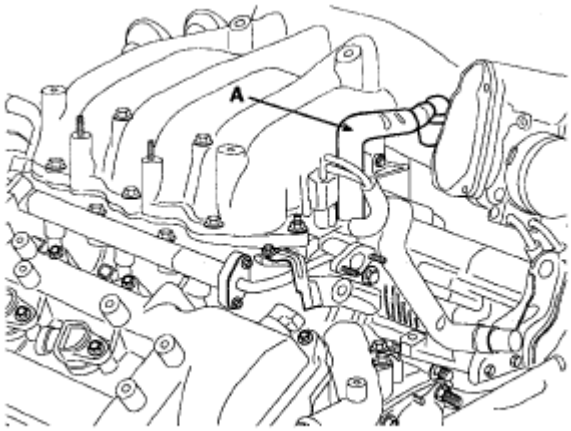


Fig. 82: Identifying Oil Pump Chain Cover With Mounting Bolts

29. Remove the oil pump chain tensioner assembly (A).

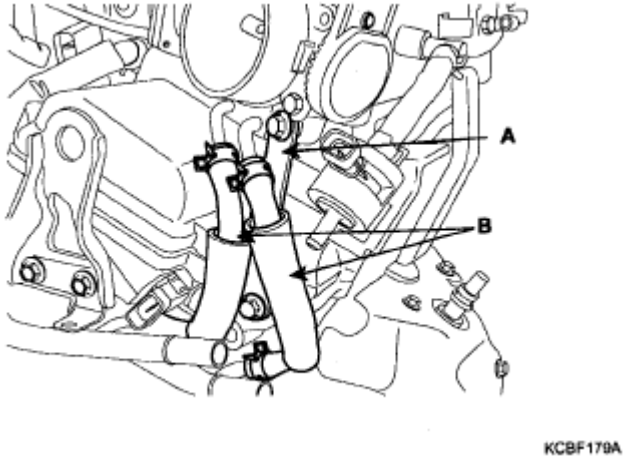


Fig. 83: Identifying Oil Pump Chain Tensioner Assembly

30. Remove the oil pump chain guide (A).

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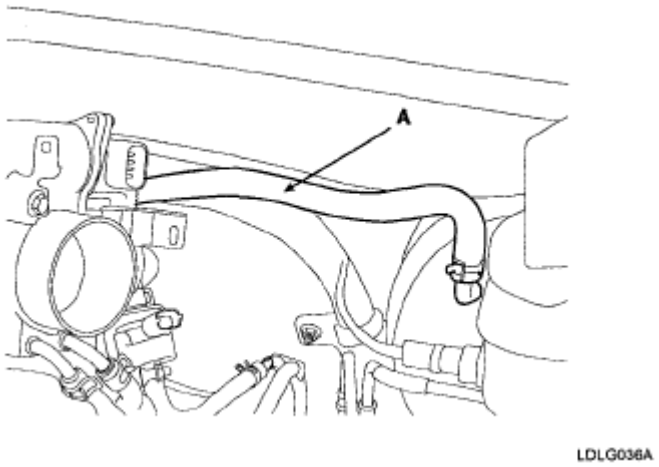


Fig. 84: Identifying Oil Pump Chain Guide

31. Remove the oil pump chain sprocket (A) and oil pump chain (B).

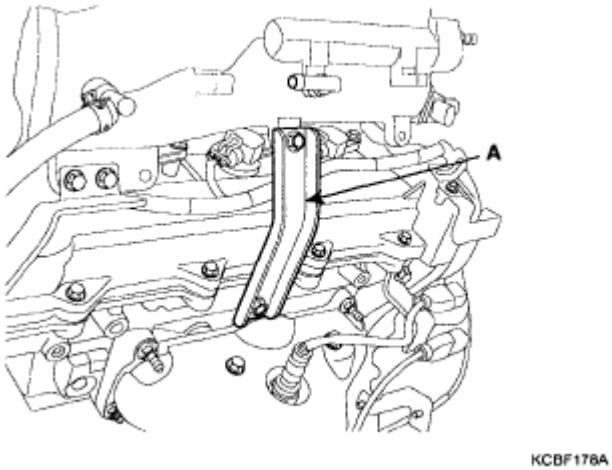
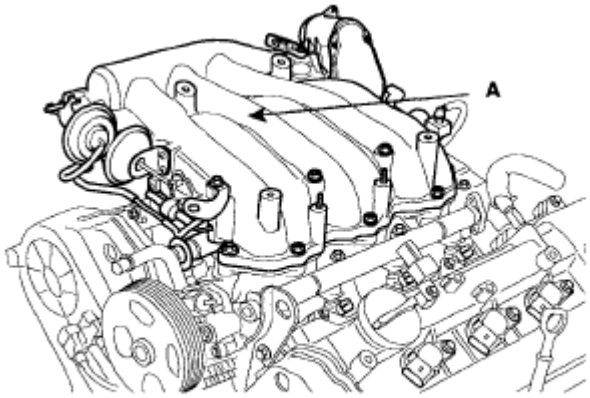


Fig. 85: Identifying Oil Pump Chain Sprocket And Oil Pump Chain With Mounting Bolt

32. Remove the crankshaft sprocket (A) (Oil pump & RH camshaft drive).

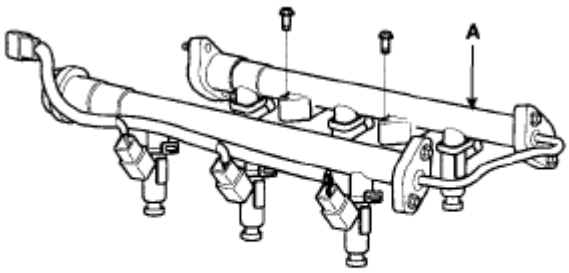
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KCBF181A

Fig. 86: Identifying Crankshaft Sprocket (Oil Pump & RH Camshaft Drive)

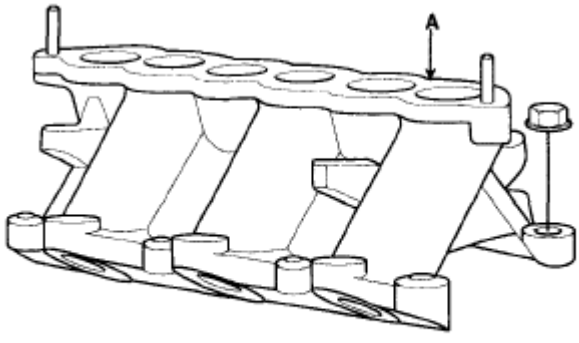
33. Install a set pin after compressing the LH timing chain tensioner.



SMGM16030N

Fig. 87: Installing Set Pin

34. Remove the LH cam-to-cam guide (A).



SMGM16020N

Fig. 88: Identifying LH Cam-To-Cam Guide

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35. Remove the LH timing chain auto tensioner (A) and LH timing chain tensioner arm (B).

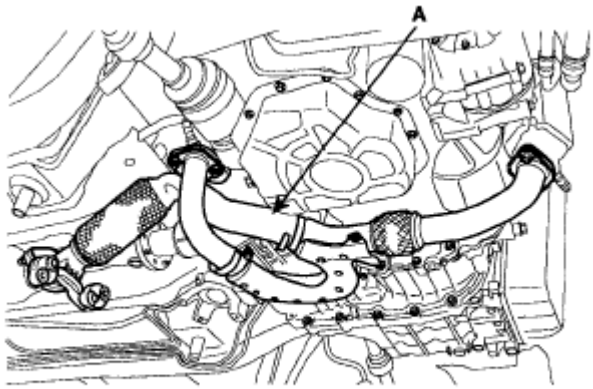


Fig. 89: Identifying LH Timing Chain Auto Tensioner And LH Timing Chain Tensioner Arm

36. Remove the LH timing chain.
37. Remove the LH timing chain guide (A).

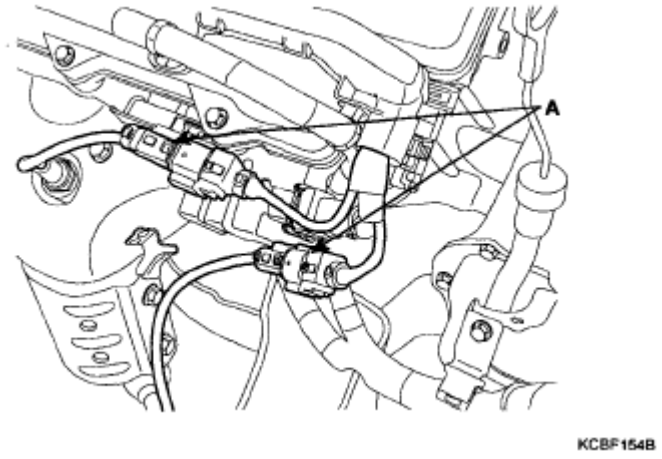


Fig. 90: Identifying LH Timing Chain Guide

38. Remove the crankshaft sprocket (A) (LH camshaft drive).

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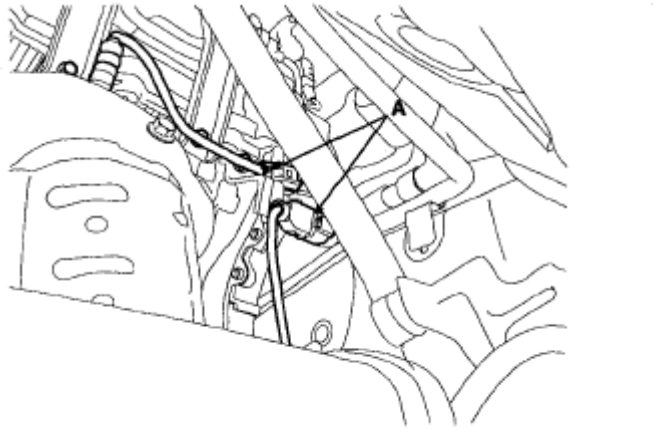


Fig. 91: Identifying Crankshaft Sprocket (LH Camshaft Drive)

39. Remove the tensioner adapter assembly (A).

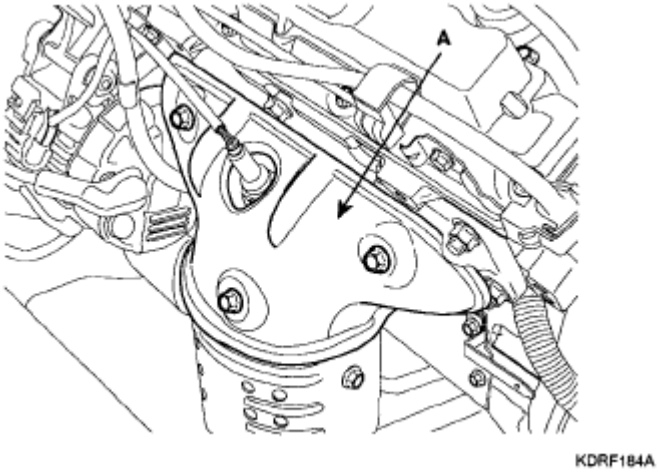


Fig. 92: Identifying Tensioner Adapter Assembly

Inspection

Sprockets, Chain Tensioner, Chain Guide, Chain Tensioner Arm

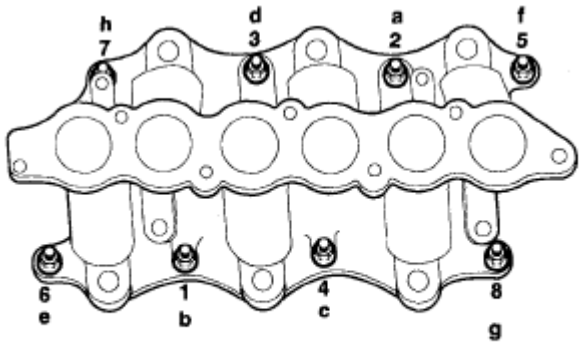
1. Check the camshaft sprocket and crankshaft sprocket for abnormal wear, cracks, or damage. Replace as necessary.
2. Inspect the tensioner arm and chain guide for abnormal wear, cracks, or damage. Replace as necessary.
3. Check that the tensioner piston moves smoothly when the ratchet pawl is released with thin rod.

Installation

1. Install the jack to the upper oil pan.
2. The key (A) of crankshaft should be aligned with the timing mark (B) of timing chain cover. As a result

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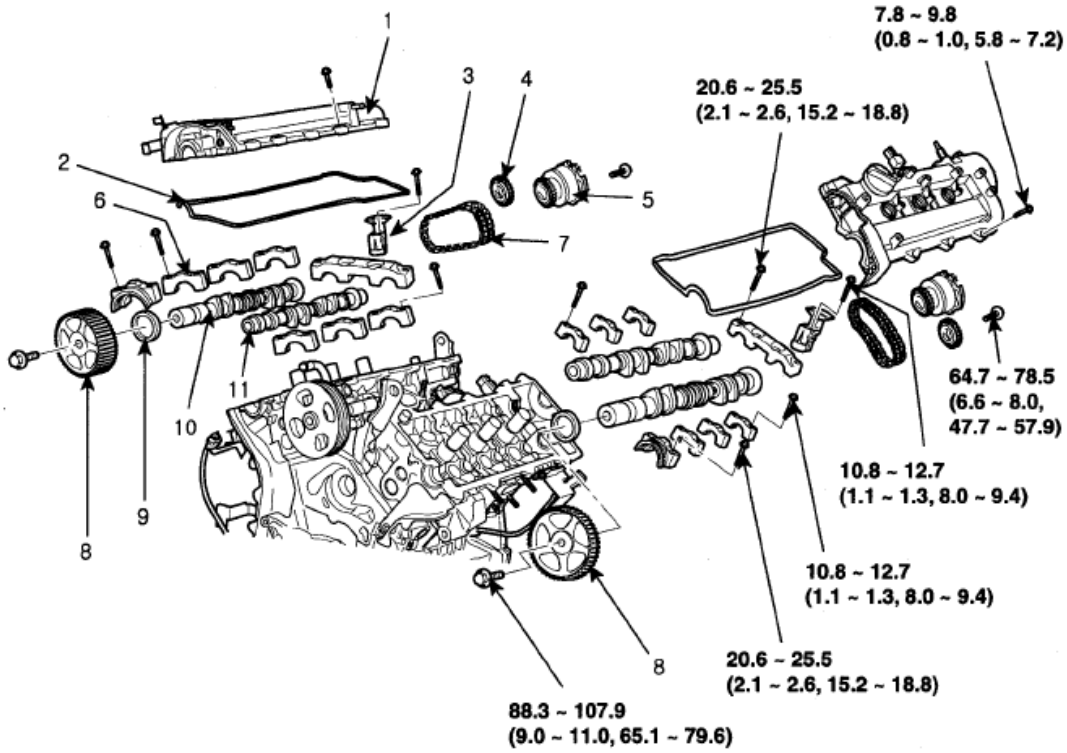
of this, the piston of No. 1 cylinder is placed at the top dead center on compression stroke.



SCMEM6307D

Fig. 93: Identifying Key And Timing Mark On Timing Chain Cover

3. Install the tensioner adapter assembly (A).



TORQUE : N.m (kgf.m, lb-ft)

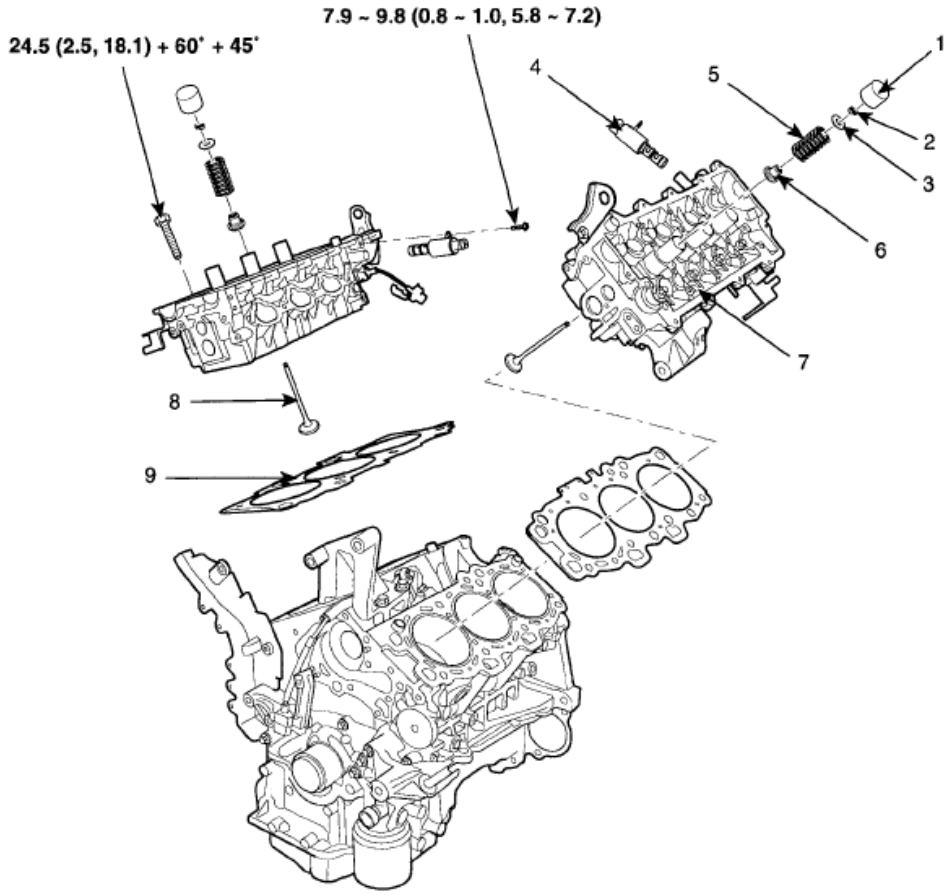
1. Cylinder head cover
2. Cylinder head cover gasket
3. Timing chain auto tensioner
4. Exhaust camshaft chain sprocket
5. CVVT assembly
6. Camshaft bearing cap
7. Timing chain
8. Exhaust camshaft sprocket
9. Camshaft oil seal
10. Exhaust camshaft
11. Intake camshaft

LDLG040A

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Fig. 94: Identifying Tensioner Adapter Assembly

4. Install the crankshaft sprocket (A) (LH camshaft drive).



TORQUE : N.m (kgf.m, lb-ft)

1. MLA(Mechanical Lash Adjuster)
2. Retainer lock
3. Retainer
4. OCV(Oil Control Valve)
5. Valve spring
6. Valve stem seal
7. Cylinder head
8. Valve
9. Cylinder head gasket

SCMEM6317D

Fig. 95: Identifying Crankshaft Sprocket (LH Camshaft Drive)

5. Install the LH timing chain guide (A).

Tightening torque:

19.60 ~ 24.50 N.m (2.0 ~ 2.5 kgf.m, 14.17 ~ 18.08 lb-ft)

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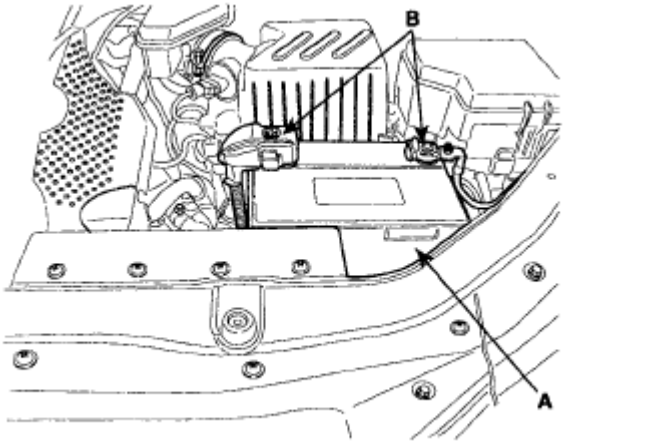


Fig. 96: Identifying LH Timing Chain Guide

6. Install LH timing chain.

   To install the timing chain with no slack between each shaft (cam, crank), follow the procedure below. Crankshaft sprocket --> Timing chain guide --> Exhaust camshaft sprocket(C) --> Intake camshaft sprocket(D).

   The timing mark of each sprocket should be matched with timing mark (color link) of timing chain at installing timing chain.

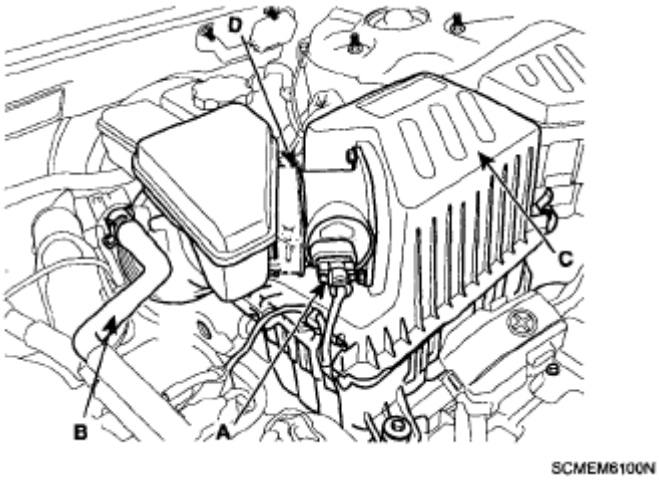


Fig. 97: Identifying Timing Mark On Exhaust Camshaft Sprocket And Intake Camshaft Sprocket

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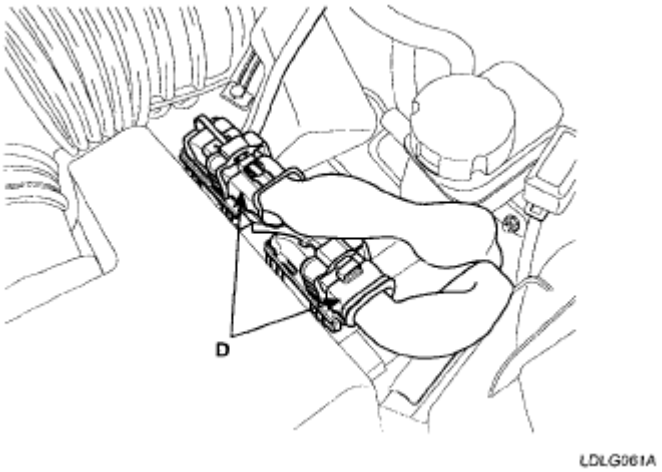


Fig. 98: Identifying LH Timing Chain

7. Install the LH timing chain tensioner arm(B).

   Tightening torque:

   18.62 ~ 21.56 N.m (1.9 ~ 2.2 kgf.m, 13.74 ~ 15.91 lb-ft)

8. Install the LH chain tensioner (A).

   Tightening torque:

   9.80 ~ 11.76 N.m(1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

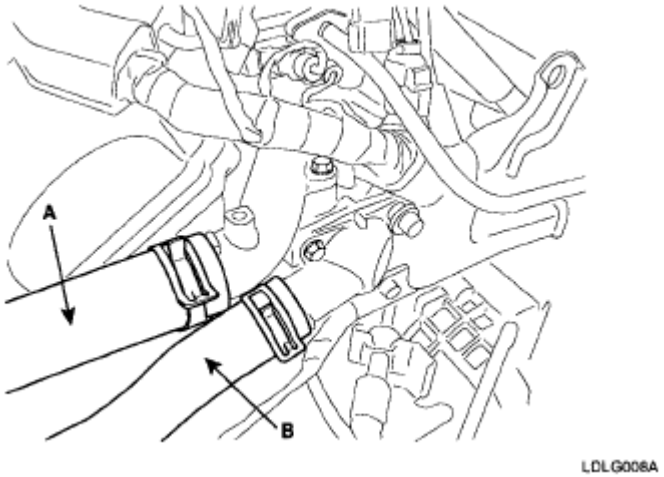


Fig. 99: Identifying LH Timing Chain Tensioner Arm And LH Chain Tensioner

9. Install the LH cam-to-cam guide (A).

   Tightening torque:

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9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

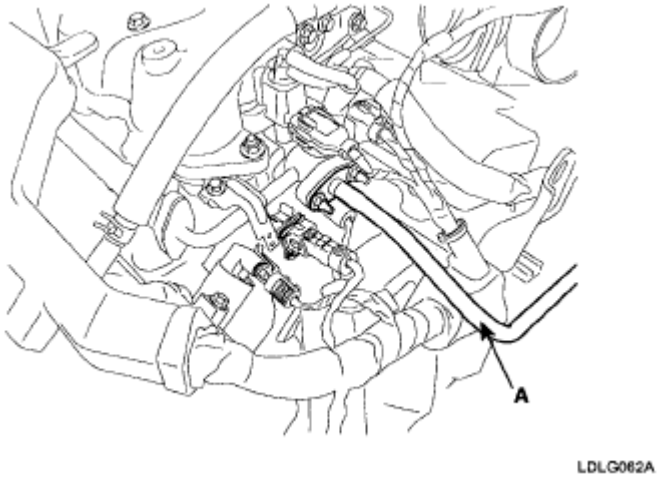


Fig. 100: Identifying LH Cam-To-Cam Guide

10. Install the crankshaft sprocket (A) (Oil pump & RH camshaft drive).

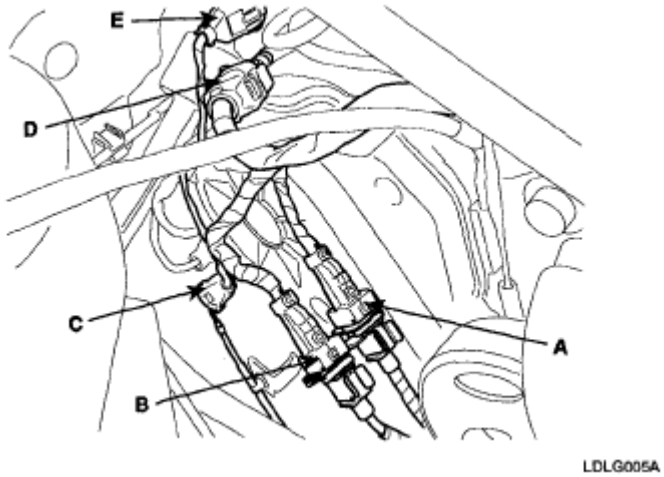


Fig. 101: Identifying Crankshaft Sprocket (Oil Pump & RH Camshaft Drive)

11. Install the oil pump chain (B) and oil pump sprocket (A).

Tightening torque:

18.62 ~ 21.56 N.m (1.9 ~ 2.2 kgf.m, 13.74 ~ 15.91 lb-ft)

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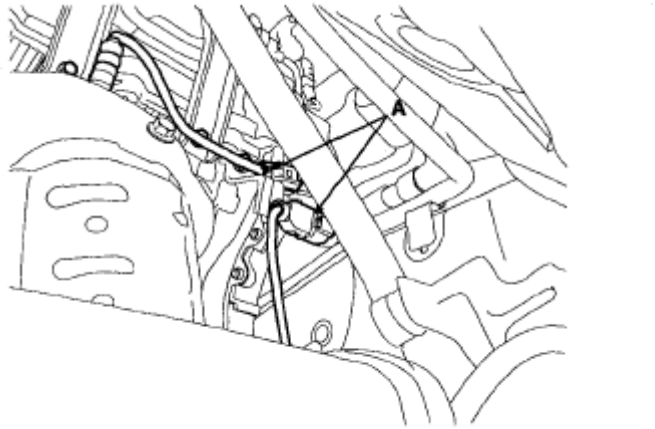


Fig. 102: Identifying Oil Pump Chain And Oil Pump Sprocket With Mounting Bolt

12. Install the RH timing chain guide (A).

    Tightening torque:

    19.60 ~ 24.50 N.m (2.0 ~ 2.5 kgf.m, 14.17 ~ 18.08 lb-ft)

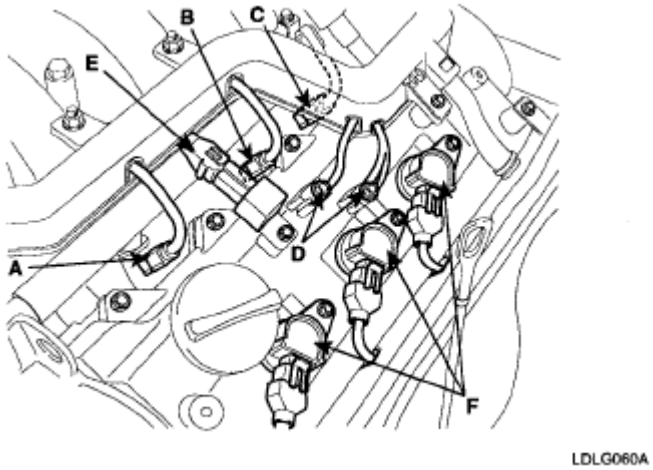


Fig. 103: Identifying RH Timing Chain Guide

13. Install the RH timing chain.

    To install the timing chain with no slack between each shaft (cam, crank), follow the procedure below.

    Crankshaft sprocket (A) --> Intake camshaft sprocket (B) --> Exhaust camshaft sprocket (C).

    The timing mark of each sprocket should be matched with timing mark (color link) of timing chain at installing timing chain.

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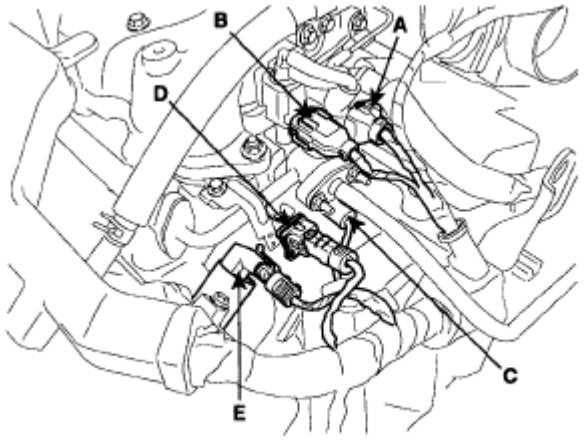


Fig. 104: Identifying Timing Mark On Crankshaft Sprocket

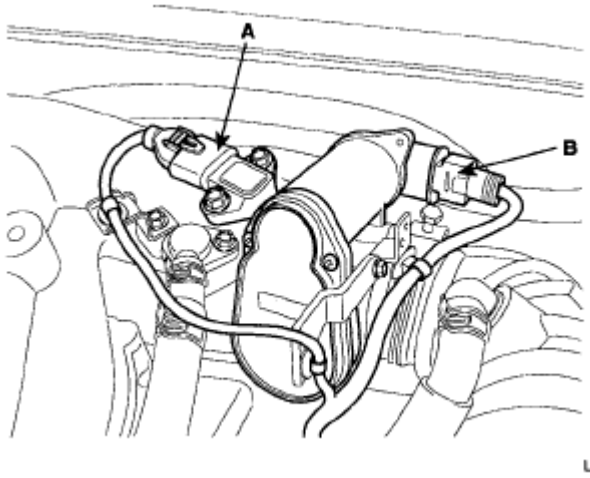


Fig. 105: Identifying Timing Mark On Intake Camshaft Sprocket And Exhaust Camshaft Sprocket

14. Install the RH timing chain tensioner arm (B).

    Tightening torque:

    18.62 ~ 21.56 N.m (1.9 ~ 2.2 kgf.m, 13.74 ~ 15.91 lb-ft)

15. Install the RH timing chain auto tensioner (A).

    Tightening torque:

    9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

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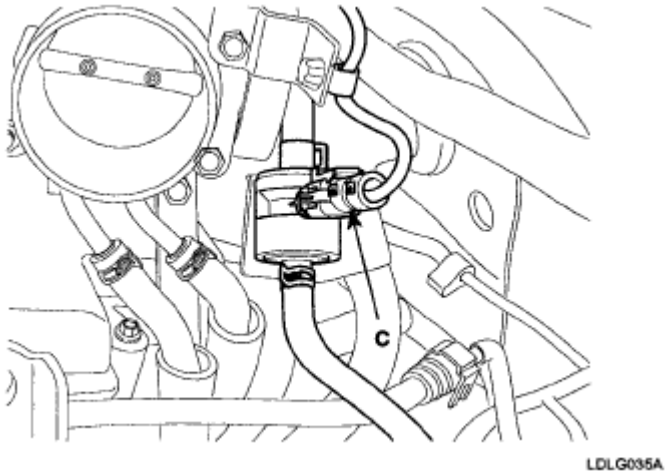


Fig. 106: Identifying RH Timing Chain Tensioner Arm And RH Timing Chain Auto Tensioner

16. Install the RH cam-to-cam guide (A).

    Tightening torque:

    9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

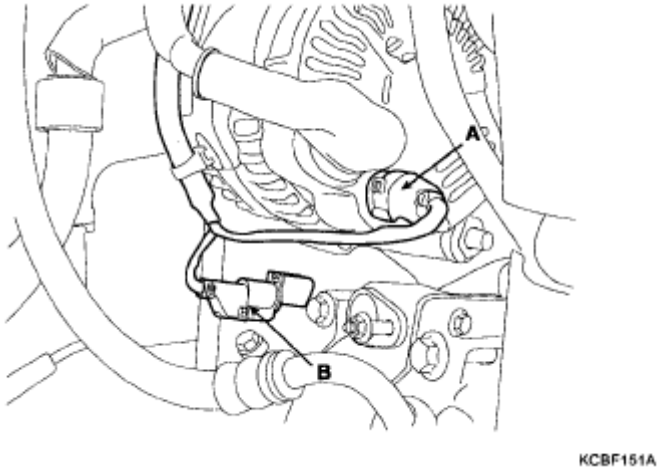


Fig. 107: Identifying RH Cam-To-Cam Guide

17. Install the oil pump chain guide (A).

    Tightening torque:

    9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

18. Install the oil pump chain tensioner assembly (A).

    Tightening torque:

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9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

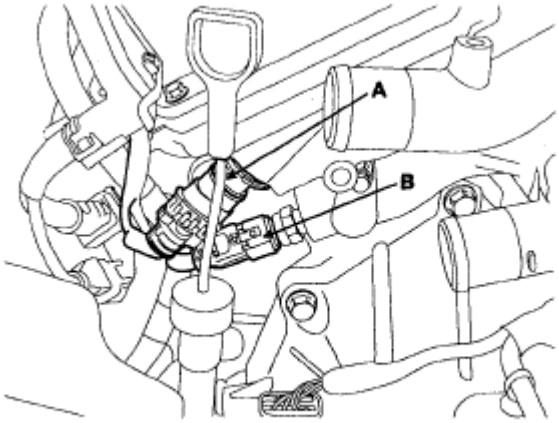


Fig. 108: Identifying Oil Pump Chain Tensioner Assembly

19. Pull out the pins of hydraulic tensioners (LH & RH).

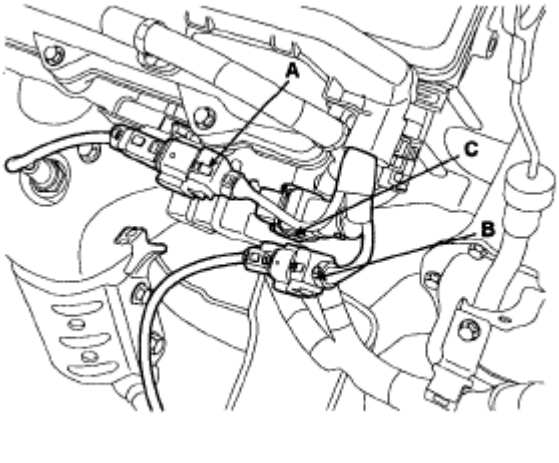


Fig. 109: Pulling Out Pins Of Hydraulic Tensioners (LH)

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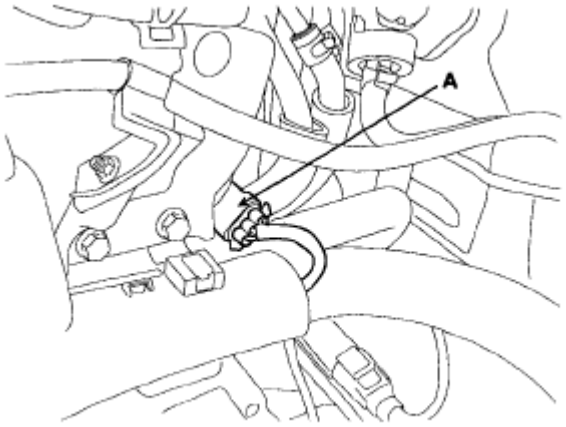


Fig. 110: Pulling Out Pins Of Hydraulic Tensioners (RH)

20. Install the oil pump chain cover (A).

    Tightening torque:

    9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

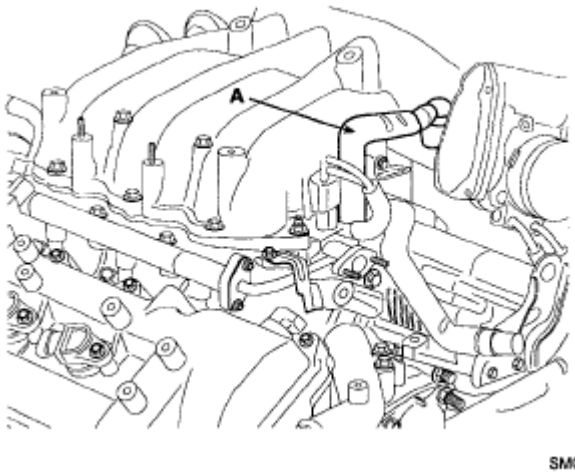


Fig. 111: Identifying Oil Pump Chain Cover With Mounting Bolts

21. After rotating crankshaft 2 revolutions in regular direction (clockwise viewed from front), confirm the timing mark.

    NOTE: Always turn the crankshaft clockwise.

22. Install the timing chain cover.
    1. The sealant locations on chain cover and on counter parts (cylinder head, cylinder block, and lower oil pan) must be free of engine oil and ETC.

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2. Before assembling the timing chain cover, the liquid sealant TB1217H should be applied on the gap between cylinder head and cylinder block

   The part must be assembled within 5 minutes after sealant was applied.

   Bead width: 2.5 mm (0.1 in.)

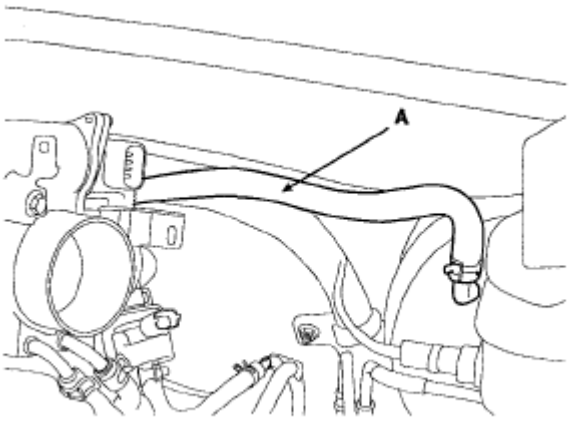


Fig. 112: Identifying Timing Chain Cover

3. After applying liquid sealant TB1217H on the timing chain cover.

   The part must be assembled within 5 minutes after sealant was applied.

   Sealant should be applied without discontinuity.

   Bead width: 2.5 mm (0.1 in.)

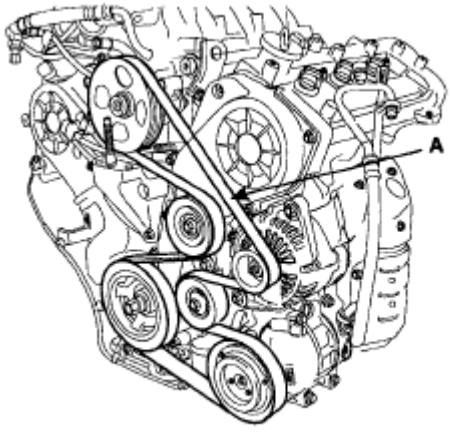
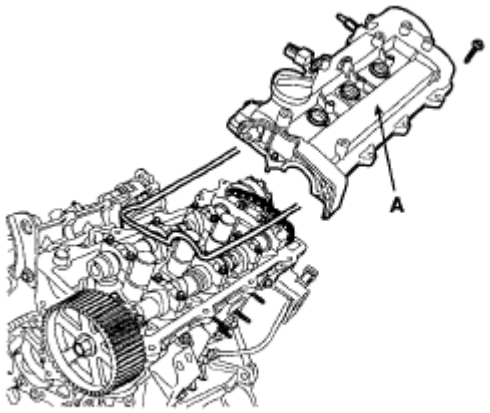


Fig. 113: Identifying Timing Chain Cover Liquid Sealant TB1217H Applying Dimensions

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4. Install the new gasket (A) to the timing chain cover.



KCBF177A

Fig. 114: Identifying Timing Chain Cover Gasket

NOTE: During timing cover installation, care not to take off applied sealant on the timing cover by contact with other parts.

5. The dowel pins on the cylinder block and holes on the timing chain cover should be used as a reference in order to assemble the timing chain cover to be in exact position.

Tightening torque:

B(17):

18.62 ~ 21.56 N.m (1.9 ~ 2.2 kgf.m, 13.74 ~ 15.91 lb-ft)

C(4):

9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

D(1):

58.80 ~ 68.80 N.m (6.0 ~ 7.0 kgf.m, 43.40 ~ 50.63 lb-ft)

E(1):

58.80 ~ 68.80 N.m (6.0 ~ 7.0 kgf.m, 43.40 ~ 50.63 lb-ft)

F(2):

24.50 ~ 26.46 N.m (2.5 ~ 2.7 kgf.m, 18.08 ~ 19.53 lb-ft)

G(4):

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21.56 ~ 23.52 N.m (2.2 ~ 2.4 kgf.m, 15.91 ~ 17.36 lb-ft)

H(1):

9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

I(1):

9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

J(1):

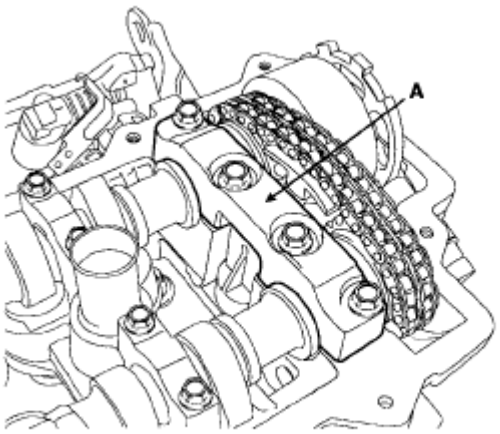
9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

K(4):

9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

L(1):

21.56 ~ 26.46 N.m (2.2 ~ 2.7 kgf.m, 15.91 ~ 19.53 lb-ft) - New bolt



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Fig. 115: Identifying Cylinder Block Mounting Dowel Pins Tightening Sequence

6. The firing and/or blow out test should not be performed within 30 minutes after the timing chain cover was assembled.

23. Install the water pump pulley (A).

Tightening torque:

7.84 ~ 9.80 N.m(0.8 ~ 1.0 kgf.m, 5.78 ~ 7.23 lb-ft)

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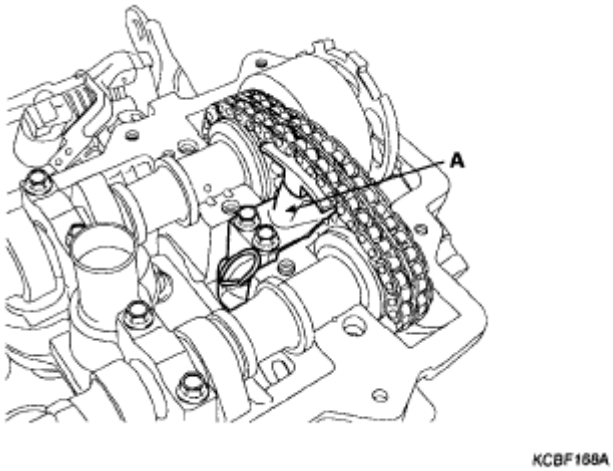


Fig. 116: Identifying Water Pump Pulley

24. Install the drive belt auto tensioner (A).

    Tightening torque:

    Bolt(B):

    81.39 ~ 85.32 N.m (8.3 ~ 8.7 kgf.m, 60.03 ~ 62.93 lb-ft)

    Bolt(C):

    17.64 ~ 21.56 N.m (1.8 ~ 2.2 kgf.m, 13.02 ~ 15.91 lb-ft)

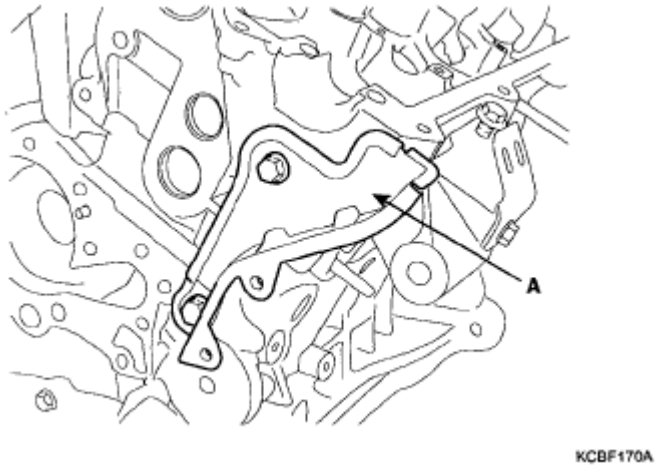


Fig. 117: Identifying Drive Belt Auto Tensioner With Mounting Bolts

25. Install the drive belt idler (A).

    Tightening torque:

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52.92 ~ 57.82 N.m (5.4 ~ 5.9 kgf.m, 39.06 ~ 42.67 lb-ft)

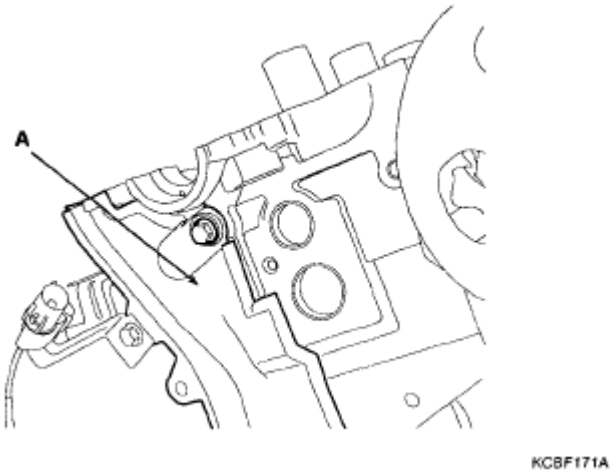


Fig. 118: Identifying Drive Belt Idler

26. Lower the engine assembly by using the jack.
27. Using SST (09231-3C100), install timing chain cover oil seal.

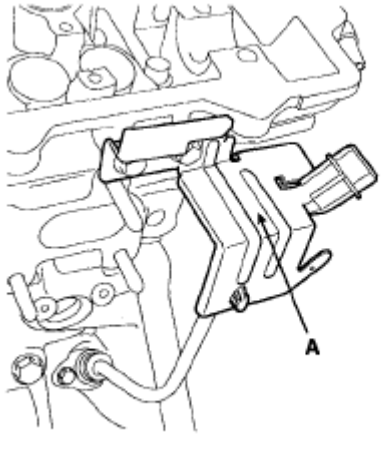


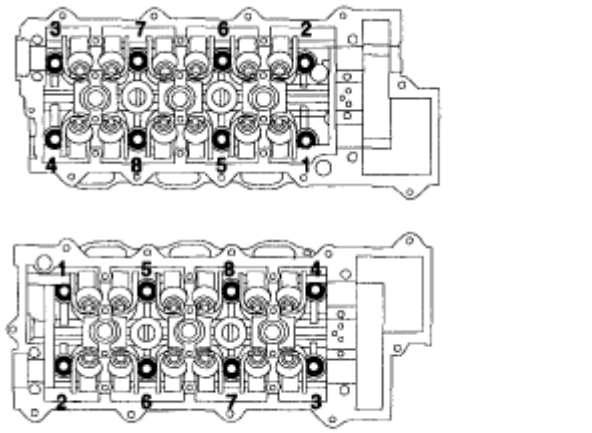
Fig. 119: Installing Timing Chain Cover Oil Seal Using SST (09231-3C100)

28. Install the crankshaft damper pulley (A).

Tightening torque:

284.2~303.8 N.m (29.0~31.0 kgf.m, 209.76~224.22 lb-ft)

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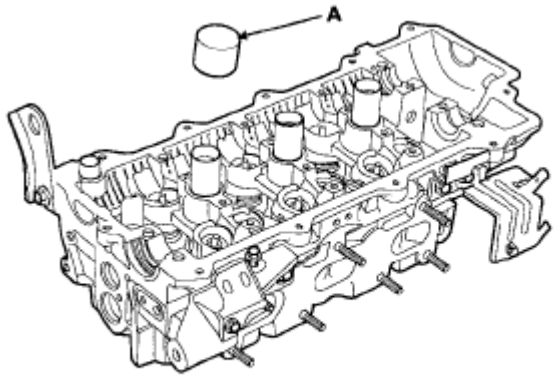


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Fig. 120: Identifying Crankshaft Damper Pulley

NOTE: There are two methods to hold the ring gear when installing or removing the crankshaft damper pulley.

- Install the SST (09231-3C300) to hold the ring gear after removing the starter.



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Fig. 121: Installing Crankshaft Damper Pulley Using SST (09231-3C300)

- Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.
  1. Remove the front muffler. ((Refer to Intake And Exhaust system))
  2. Remove the dust cover (A) on the bottom of the upper oil pan and unfasten the two transaxle mounting bolts (B).

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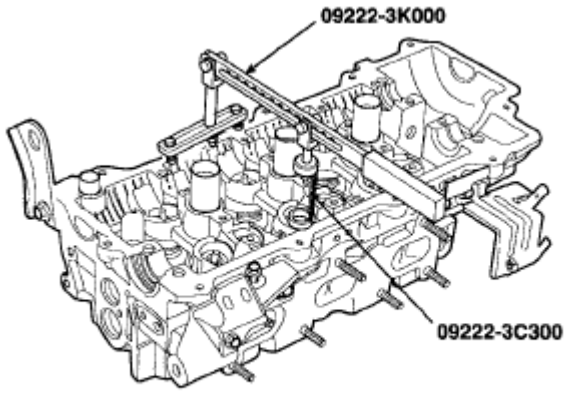


Fig. 122: Identifying Dust Cover And Transaxle Mounting Bolts

3. Adjust the length of the holder nuts (A) so that the front plate of the holder (B) puts in the ring gear (C) teeth.
4. Fasten the two transaxle mounting bolts in the original mounted holes.

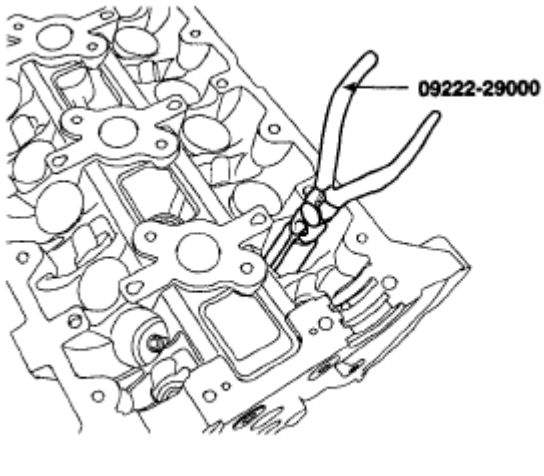


Fig. 123: Identifying Holder Nuts, Holder And Ring Gear With Transaxle Mounting Bolts

5. Install the SST (09231-3D100) using the two mounting bolts. Tighten the bolts and nuts of the holder securely.

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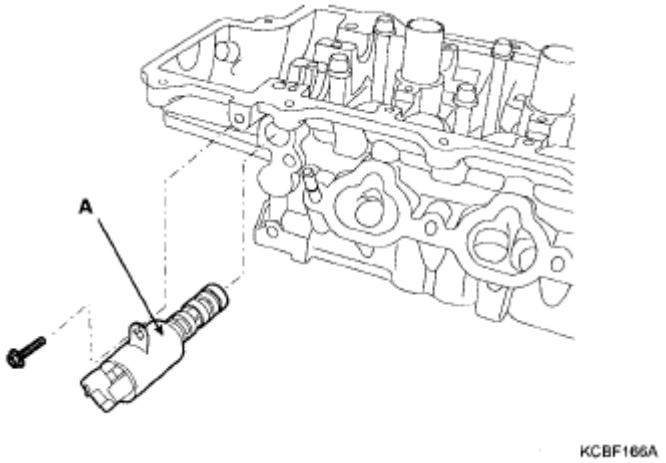


Fig. 124: Installing SST (09231-3D100) Using Mounting Bolts

29. Install the drive belt (A).

    Crankshaft pulley --> A/C pulley --> idler pulley --> alternator pulley --> water pump pulley --> P/S pump pulley --> tensioner pulley.

    Rotate auto tensioner arm in the counterclockwise moving auto tensioner pulley bolt with wrench.

    After putting belt on auto tensioner pulley, release the auto tensioner pulley slowly.

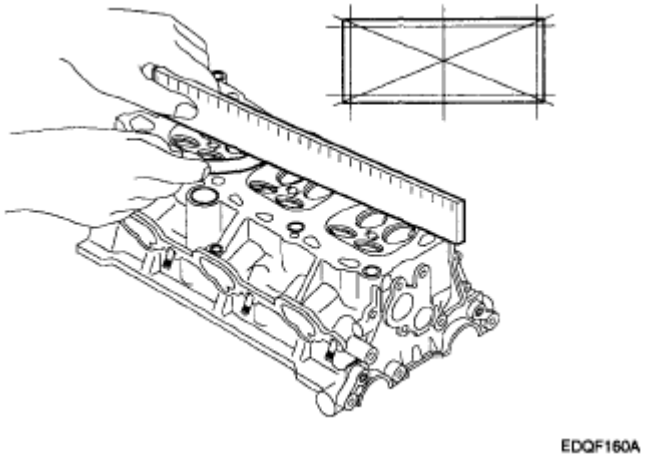


Fig. 125: Identifying Drive Belt

30. Install the cylinder head cover.
    1. The hardening sealant located on the upper area between timing chain cover and cylinder head should be removed before assembling cylinder head cover.
    2. After applying sealant (TB1217H), it should be assembled within 5 minutes.

       Bead width: 2.5 mm (0.1 in.)

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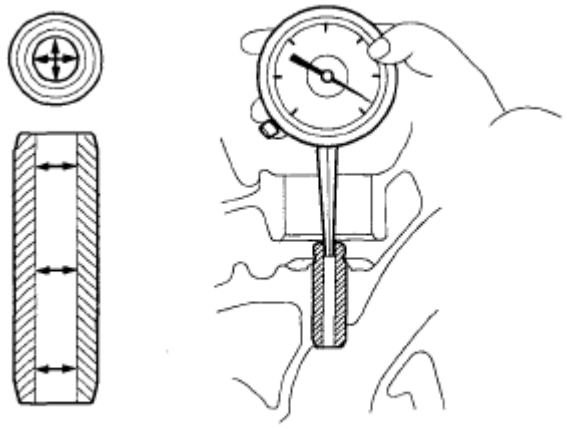


Fig. 126: Identifying Cylinder Head Cover Sealant Applying Area

3. The firing and/or blow out test should not be performed within 30 minutes after the cylinder head cover was assembled.
4. Install the cylinder head cover bolts as following method.

Tightening torque:

9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

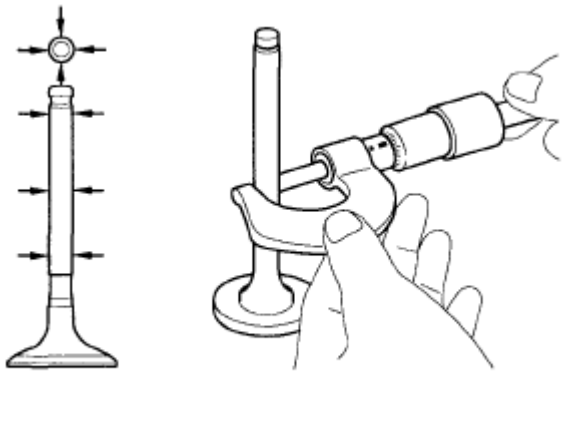


Fig. 127: Identifying Cylinder Head Cover Bolts Tightening Sequence

CAUTION: Do not reuse cylinder head cover gasket.

5. Install the ignition coil.
6. Connect the RH ignition coil connector (A), the condenser connector (B) and install the wiring bracket (C).

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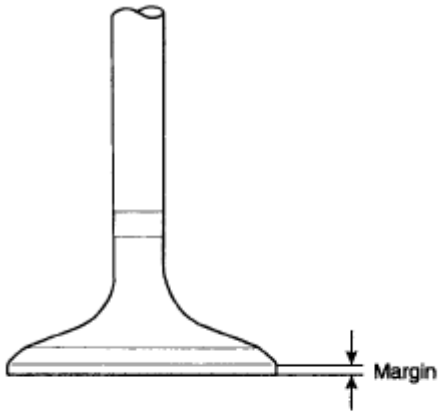


Fig. 128: Identifying RH Ignition Coil Connector, Condenser Connector And Wiring Bracket

7. Install the connector bracket (A) to the LH cylinder head cover.

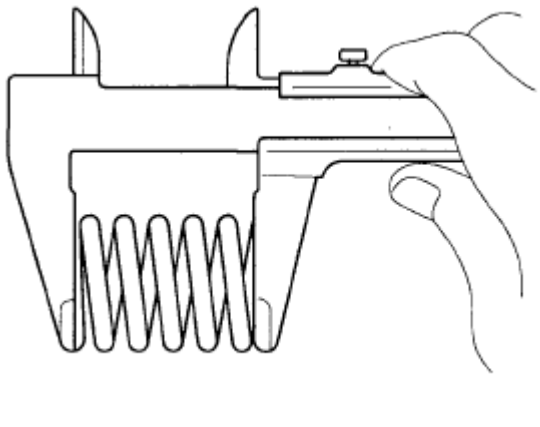


Fig. 129: Identifying LH Cylinder Head Cover Connector Bracket

31. Install the surge tank and wiring connectors.
    1. Install the surge tank (A).

       Tightening torque:

       9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

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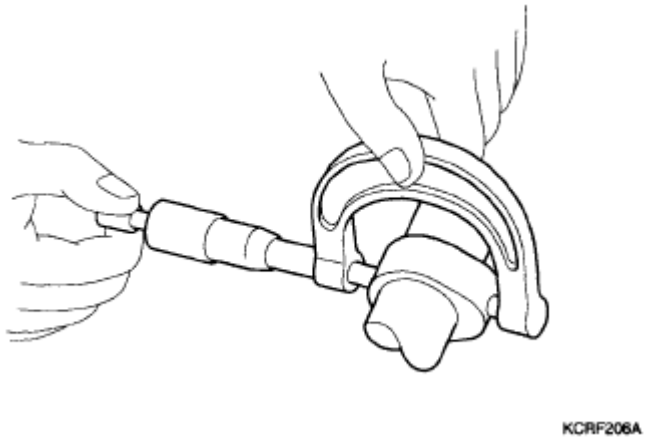


Fig. 130: Identifying Surge Tank With Mounting Bolts

2. Install the connector bracket (A) to the surge tank.

   Tightening torque:

   6.86 ~ 10.78 N.m (0.7 ~ 1.1 kgf.m, 5.06 ~ 7.96 lb-ft)

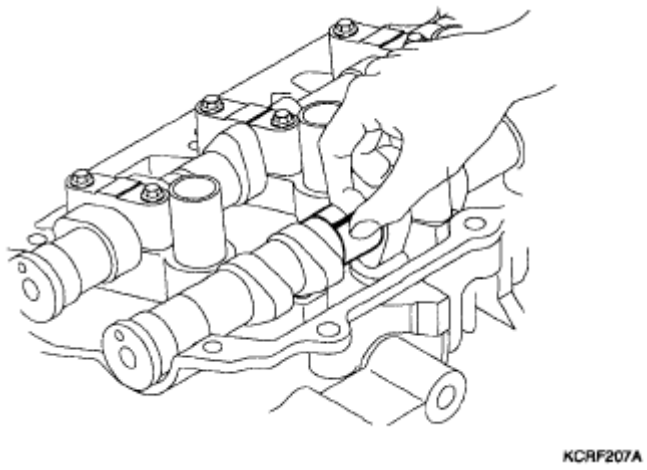


Fig. 131: Identifying Surge Tank Connector Bracket

3. Install the surge tank stay (A).

   Tightening torque:

   27.44 ~ 31.36 N.m (2.8 ~ 3.2 kgf.m, 20.25 ~ 23.14 lb-ft)

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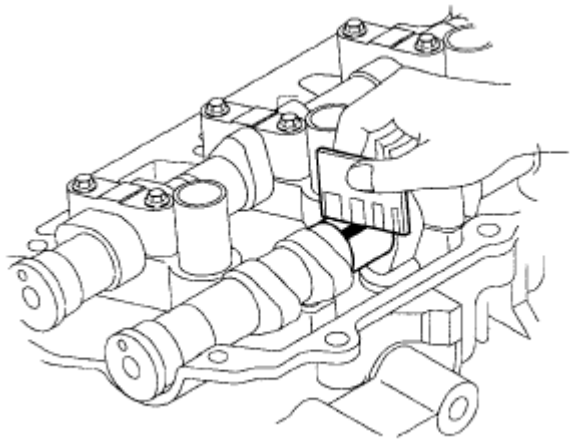


Fig. 132: Identifying Surge Tank Stay With Mounting Bolts

4. Connect the brake vacuum hose.
5. Connect the PCV hose.
6. Connect the water hoses to the ETC.
7. Install the ETC bracket.
8. Connect the RH CMPS connector (A).

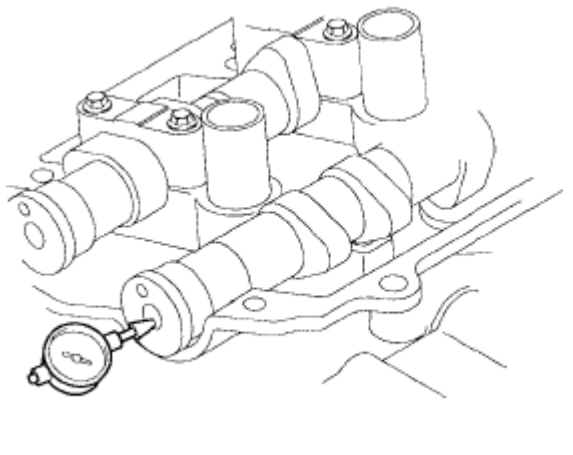
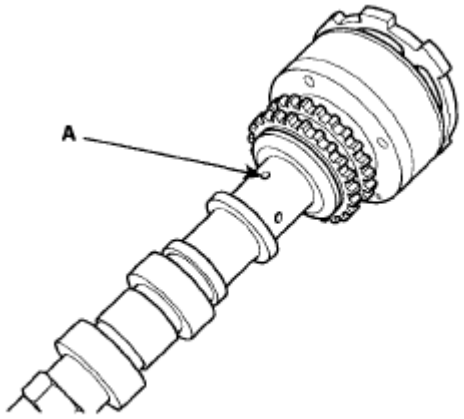


Fig. 133: Identifying RH CMPS Connector

9. Connect the LH CMPS connector (A) and oil pressure switch connector(B).

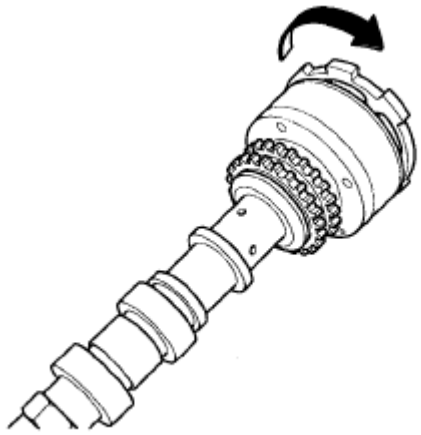
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Fig. 134: Identifying LH CMPS Connector And Oil Pressure Switch Connector

10. Install the wiring harness protector (E) and connect the LH ignition coil connector(A), injector connector (B), condenser connector (C) and ground (D).

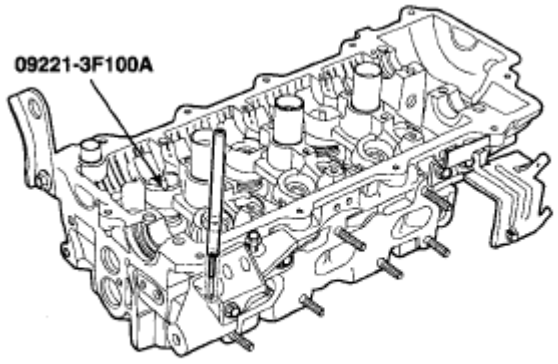


KCBF166B

Fig. 135: Identifying LH Ignition Coil Connector, Injector Connector, Condenser Connector, Ground And Wiring Harness Protector

11. Connect the LH front oxygen sensor connector (A).

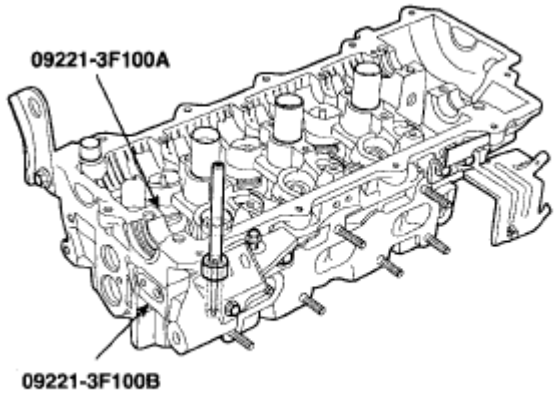
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SCMEM6103N

Fig. 136: Identifying LH Front Oxygen Sensor Connector

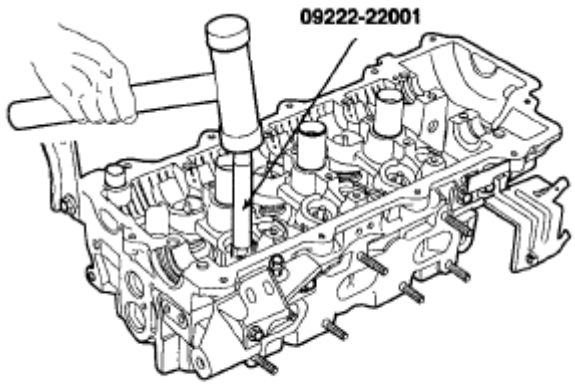
12. Connect the OCV connector (A) and knock sensor connector (B).



SCMEM6104N

Fig. 137: Identifying OCV Connector And Knock Sensor Connector

13. Connect the ETC connector (A) and knock sensor connector (B).

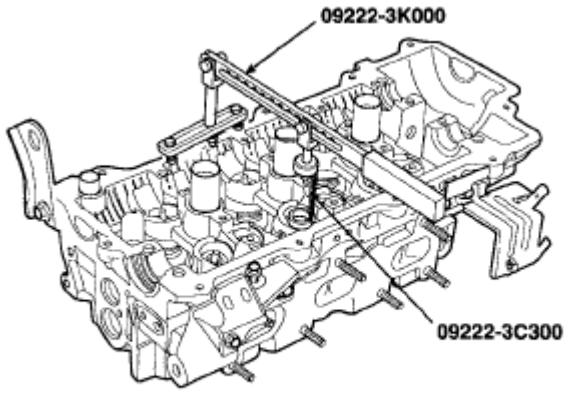


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Fig. 138: Identifying ETC Connector And Knock Sensor Connector

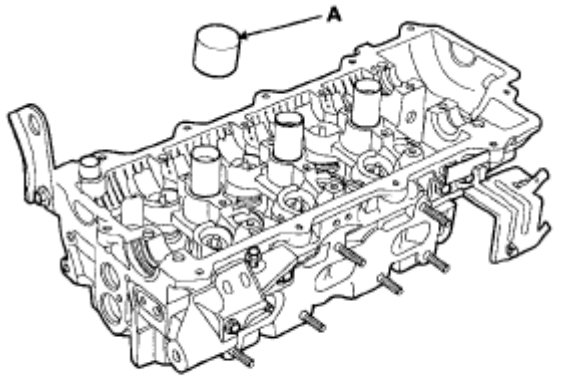
14. Connect the PCSV connector (A), MAP sensor connector (B), PCSV hose and ECM vacuum hose.



KCBF173C

Fig. 139: Identifying PCSV Connector And Map Sensor Connector

15. Connect the RH injector connector (A), ignition coil connector (B) and VIS connector (C).



KCBF173D

Fig. 140: Identifying RH Injector Connector, Ignition Coil Connector And VIS Connector

16. Connect the RH oxygen sensor connector (A).

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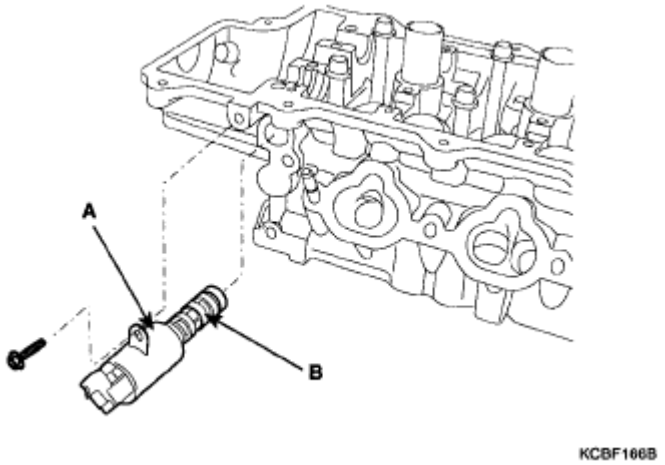


Fig. 141: Identifying RH Oxygen Sensor Connector

32. Install the engine mounting bracket (A).

    Tightening torque:

    B: 78.5 ~ 98.0 N.m (8.0 ~ 10.0 kgf.m, 57.9 ~ 72.3 lb-ft)

    C: 63.7 ~ 83.4 N.m (6.5 ~ 8.5 kgf.m, 47.0 ~ 61.5 lb-ft)

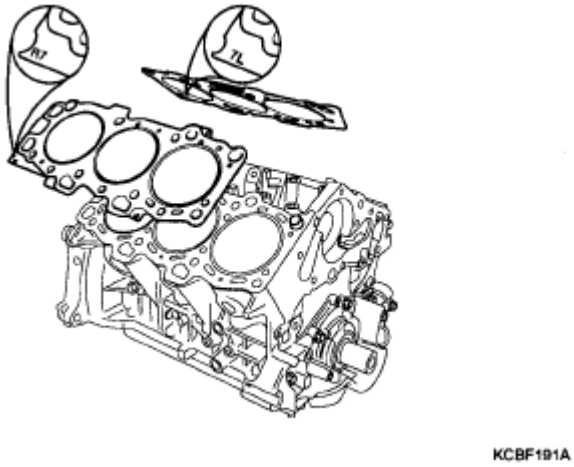


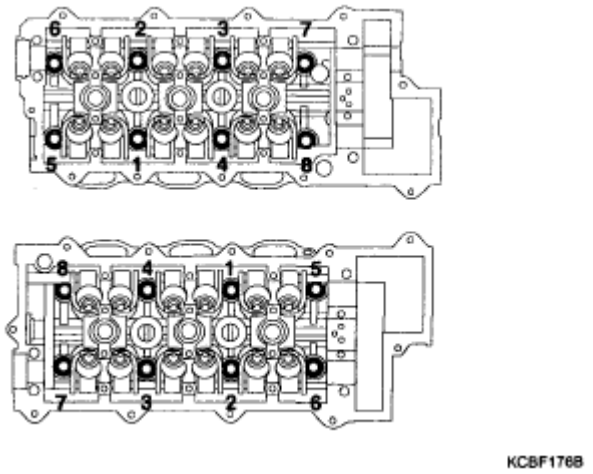
Fig. 142: Identifying Engine Mounting Bracket With Nuts And Bolts

33. Install the transaxle mounting bracket bolts.

    Tightening torque:

    63.7 ~ 83.4 N.m (6.5 ~ 8.5 kgf.m, 47.0 ~ 61.5 lb-ft)

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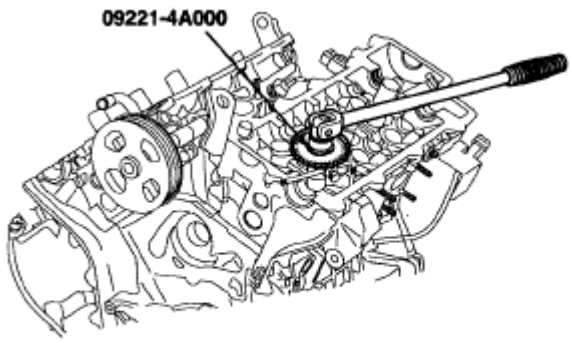
Fig. 143: Identifying Transaxle Mounting Bracket Bolts

34. Remove the jack from the upper oil pan.
35. Install the lower oil pan.
    1. Using a gasket scraper, remove all the old packing material from the gasket surfaces.
    2. Before assembling the oil pan, the liquid sealant TB1217H should be applied on oil pan.

       The part must be assembled within 5 minutes after the sealant was applied.

       Bead width: 2.5 mm (0.1 in.).

       But marked area (*) to be 5.0 mm (0.2 in.)



LDLG063A

Fig. 144: Identifying Lower Oil Pan Sealant Applying Area

CAUTION:
1. **Make clean the sealing face before assembling two parts.**
2. **Remove harmful foreign matters on the sealing face before applying sealant.**
3. **When applying sealant gasket, sealant must not be**

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protruded into the inside of oil pan.

4. **To prevent leakage of oil, apply sealant gasket to the inner threads of the bolt holes.**

3. Install the lower oil pan (A).

   Tightening torque:

   9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

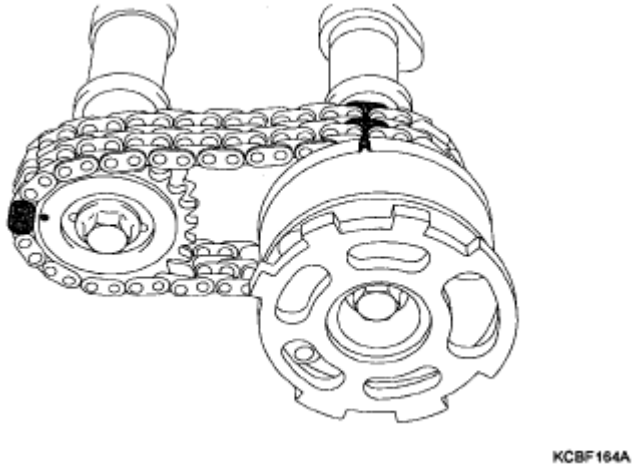


Fig. 145: Identifying Lower Oil Pan

36. Install the side cover.

    Tightening torque:

    8.8 ~ 10.8 N.m (0.9 ~ 1.1 kgf.m, 6.5 ~ 7.9 lb-ft)

37. Install the under cover (A).

    Tightening torque:

    8.8 ~ 10.8 N.m (0.9 ~ 1.1 kgf.m, 6.5 ~ 7.9 lb-ft)

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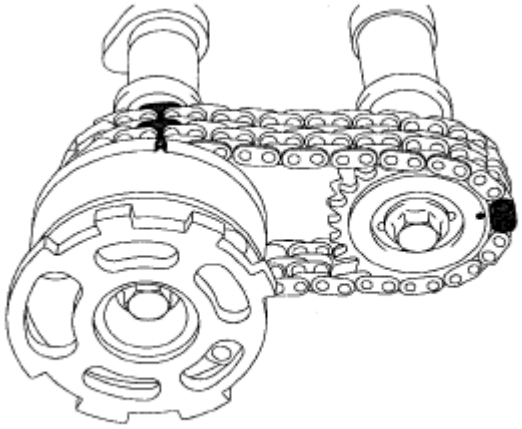


Fig. 146: Identifying Under Cover

38. Install the RH front wheel.

    Tightening torque:

    88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)

39. Install the intake air hose and air cleaner assembly.
    1. Install the intake air hose(C) and air cleaner body (D).
    2. Connect the breather hose (B) to the air cleaner hose.
    3. Connect the MAF connector (A).

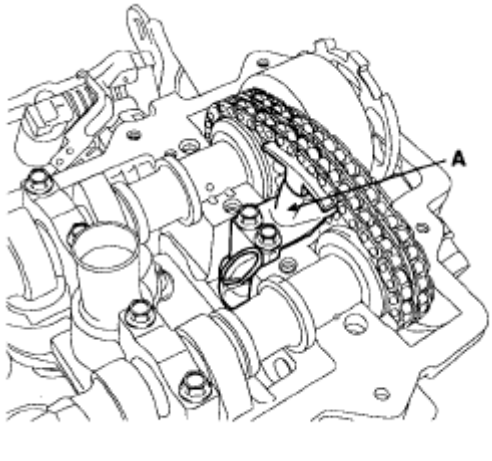


Fig. 147: Identifying MAF Connector, Breather Hose, Intake Air Hose And Air Cleaner Body

40. Install the engine cover (A).

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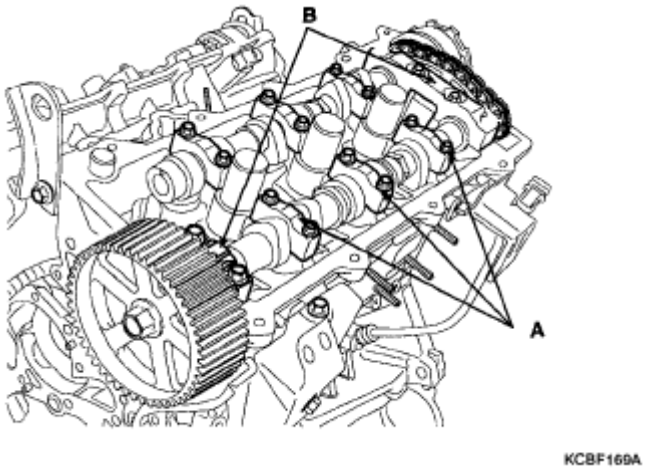


Fig. 148: Identifying Engine Cover

41. Connect the battery negative cable (A).

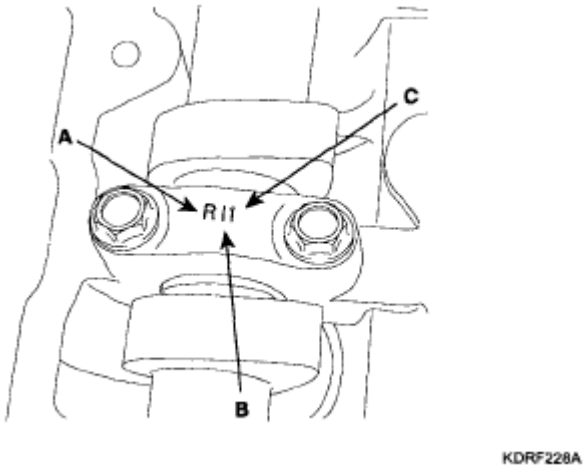


Fig. 149: Identifying Battery Negative Cable

NOTE:

- **Refill engine with engine oil.**
- **Refill radiator and reservoir tank with engine coolant.**
- **Bleed air from the cooling system.**
  - **Start engine and let it run until it warms up. (until the radiator fan operates 3 or 4 times.)**
  - **Turn Off the engine. Check the level in the radiator, add coolant if needed. This will allow trapped air to be removed from the cooling system.**
  - **Put radiator cap on tightly, then run the engine again and check for leaks.**

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ACCESSORY DRIVE BELT

INSPECTION

BELT, IDLER, BELT TENSIONER, PULLEY INSPECTION

1. Check the belt for oil or dust deposits. Replace, if necessary.

   Small deposits should be wiped away with a dry cloth or paper. Do not clean with solvent.

2. When the engine is overhauled or belt tension adjusted, check the belt carefully. If any of the following flaws are evident, replace the belt.

   NOTE:
   - **Do not bend, twist or turn the timing belt inside out.**
   - **Do not allow the timing belt to come into contact with oil, water and steam.**

3. Inspect the idler for easy and smooth rotation and check for play or noise.

INSTALLATION

1. Install drive belt auto tensioner (A).

   Tightening torque

   96.04 ~ 99.96 Nm (9.8 ~ 10.2 kgf.m, 70.85 ~ 73.74 lb-ft)

   17.64 ~ 21.56 Nm (1.8 ~ 2.2 kgf.m, 13.02 ~ 15.91 lb-ft)

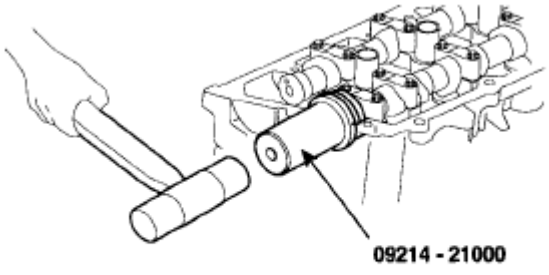


Fig. 150: Locating Drive Belt Auto Tensioner
Courtesy of HYUNDAI MOTOR CO.

2. Install drive belt idler (A).

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Tightening torque

52.92 ~ 57.82 Nm (5.4 ~ 5.9 kgf.m, 39.06 ~ 42.67 lb-ft)

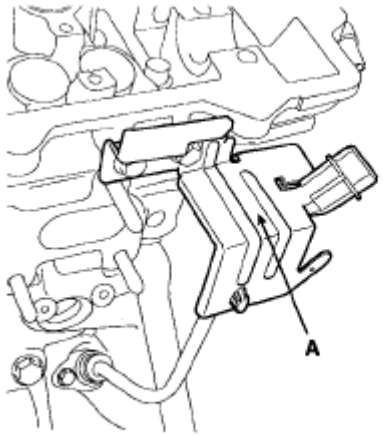


Fig. 151: Locating Drive Belt Idler
Courtesy of HYUNDAI MOTOR CO.

3. Install drive belt (A).

   Crankshaft pulley --> A/C pulley --> idler pulley --> alternator pulley --> water pump pulley --> P/S pump pulley --> tensioner pulley.

   Rotate auto tensioner arm in the counter ~ clockwise moving auto tensioner pulley bolt with wrench. After putting belt on auto tensioner pulley, release the auto tensioner pulley slowly.

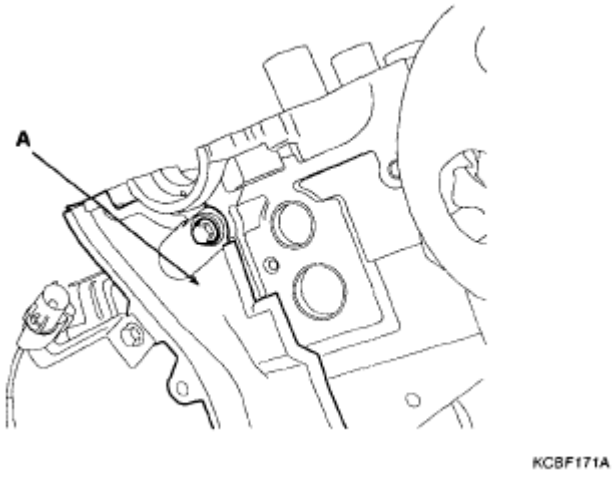
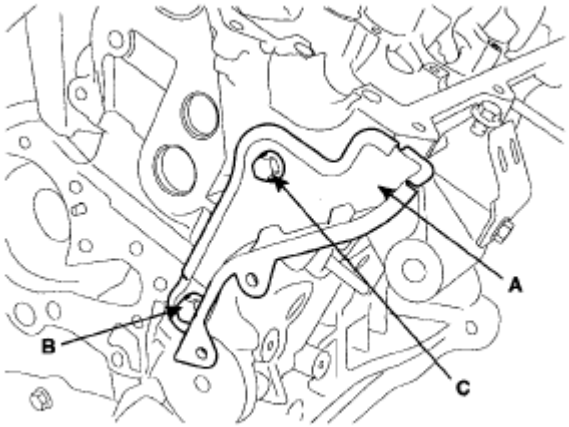


Fig. 152: Identifying Drive Belt Routing
Courtesy of KIA MOTORS AMERICA, INC.

CYLINDER HEAD ASSEMBLY

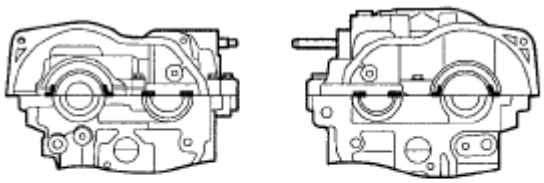
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COMPONENTS



KCBF170B

Fig. 153: Identifying Cylinder Head Assembly Components And Torque Specifications (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



SCMEM6101N

Fig. 154: Identifying Cylinder Head Assembly Components And Torque Specifications (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

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.**
- **Turn the crankshaft pulley so that the No. 1 piston is at top dead center.**

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Engine removal is required for this procedure.

1. Remove exhaust manifold.
2. Remove intake manifold.
3. Remove timing chain.
4. Remove water temperature control assembly.
5. Remove camshaft bearing cap (A).

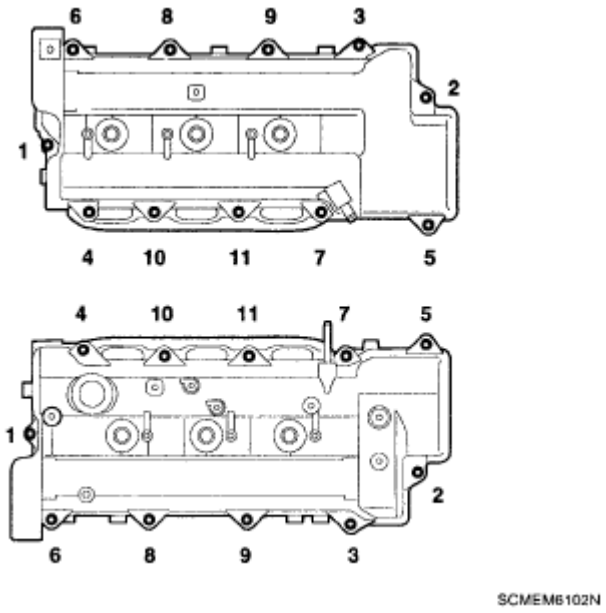


Fig. 155: Locating Camshaft Bearing Caps
Courtesy of HYUNDAI MOTOR CO.

6. Remove camshaft assembly (A).

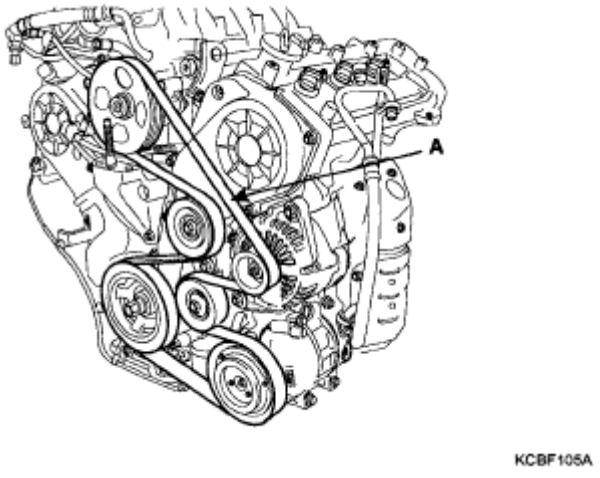


Fig. 156: Locating Camshaft Assembly
Courtesy of HYUNDAI MOTOR CO.

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7. Remove cylinder head bolts, then remove cylinder head.
    1. Uniformly loosen and remove the 17 cylinder head bolts, in several passes, in the sequence shown in the illustration. Remove the 17 cylinder head bolts and plate washers.

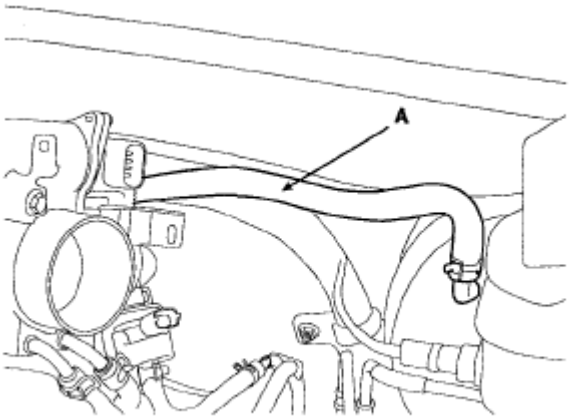


Fig. 157: Removing Cylinder Head Bolts In Sequence
Courtesy of HYUNDAI MOTOR CO.

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.

DISASSEMBLY

NOTE: Identify MLA, valves and valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove MLAs (A).

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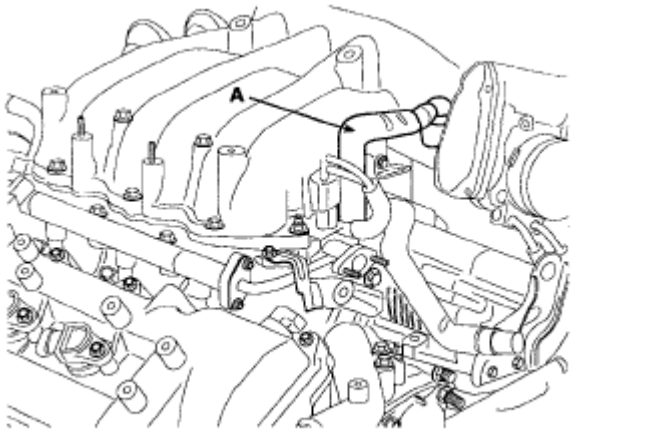


Fig. 158: Locating MLAs
Courtesy of HYUNDAI MOTOR CO.

2. Remove valves.
    1. Using SST (09222-3K000, 09222-3C300), compress the valve spring and remove retainer lock.

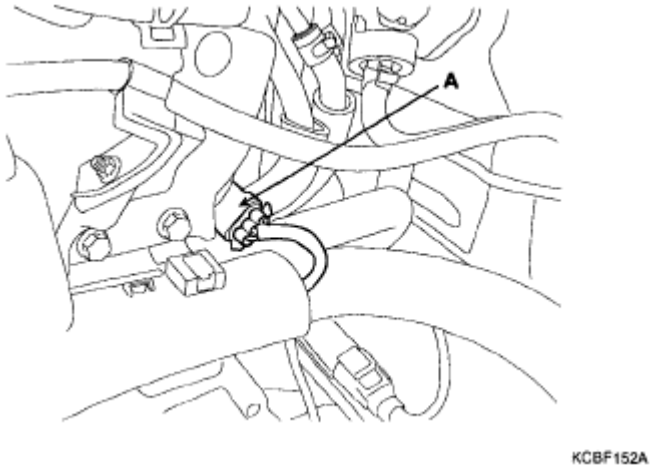


Fig. 159: Compressing Valve Spring Using SST
Courtesy of HYUNDAI MOTOR CO.

    2. Remove the spring retainer.
    3. Remove the valve spring.
    4. Remove the valve.
    5. Using SST (09222-29000), remove the valve stem seal.

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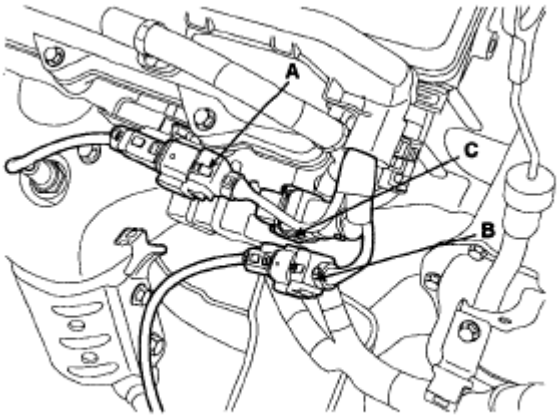


Fig. 160: Removing Valve Stem Seal Using SST(09222-29000)
Courtesy of HYUNDAI MOTOR CO.

NOTE: Do not reuse old valve stem seals.

3. Remove OCV (A).

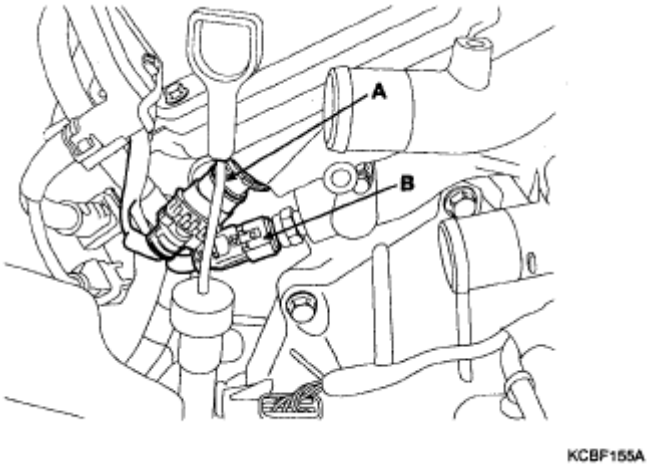


Fig. 161: Locating OCV
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

CYLINDER HEAD INSPECTION

1. Inspect for flatness.

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

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Flatness of cylinder head gasket surface

Standard: Less than 0.05 mm (0.002 in.) [Less than 0.02 mm (0.0008 in.)/150 x 150]

Flatness of manifold gasket surface

Standard: Less than 0.03 mm (0.001 in)/110 x 110

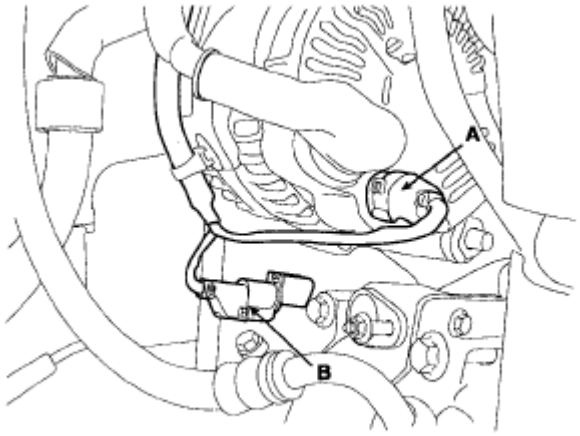


Fig. 162: Measuring Surface Contacting Cylinder Block And Manifolds
Courtesy of HYUNDAI MOTOR CO.

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 INSPECTION

1. Inspect valve stems and valve guides.
   1. Using a caliper gauge, measure the inside diameter of the valve guide.

      Valve guide I.D.

      Intake / Exhaust: 5.500 ~ 5.512 mm (0.216 ~ 0.217 in.)

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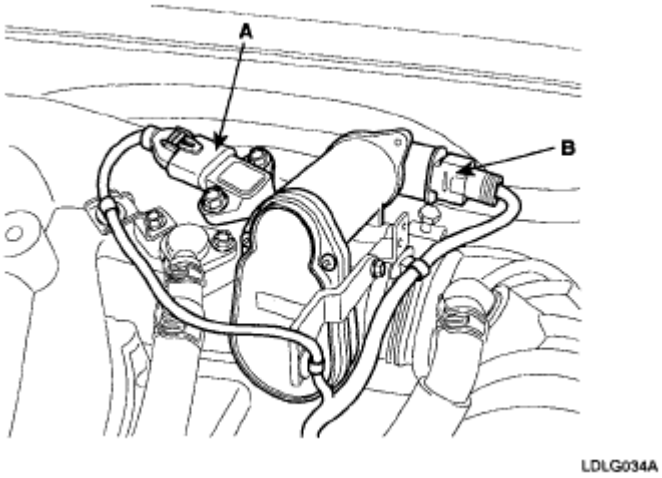


Fig. 163: Measuring Inside Diameter Of Valve Guide
Courtesy of HYUNDAI MOTOR CO.

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

   Valve stem O.D.

   Intake: 5.465 ~ 5.480 mm (0.2151 ~ 0.2157 in.)

   Exhaust: 5.458 ~ 5.470 mm (0.2149 ~ 0.2153 in.)

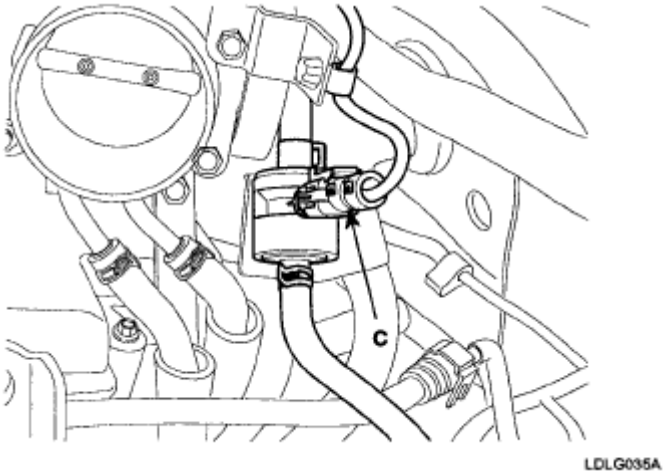


Fig. 164: Measuring Diameter Of Valve Stem
Courtesy of HYUNDAI MOTOR CO.

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

   Valve stem-to-guide clearance

   [Standard]

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Intake: 0.020 ~ 0.047 mm (0.0008 ~ 0.0018 in.)

Exhaust: 0.030 ~ 0.054 mm (0.0012 ~ 0.0021 in.)

[Limit]

Intake: 0.07 mm (0.0027 in.)

Exhaust: 0.09 mm (0.0035 in.)

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: 1.56 ~ 1.86 mm (0.06142 ~ 0.07323 in.)

    Exhaust: 1.73 ~ 2.03 mm (0.06811 ~ 0.07992 in.)

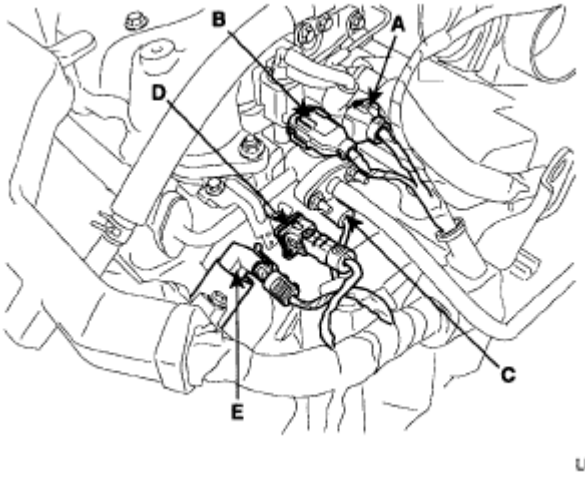


Fig. 165: Locating Valve Head Margin Thickness
Courtesy of HYUNDAI MOTOR CO.

    4. Check the valve length.

    Length

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Intake: 105.27 mm (4.1445 in)

Exhaust: 105.50 mm (4.1535 in)

5. 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. If the valve seat is worn, replace cylinder head. Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace cylinder head. 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: 43.8 6mm (1.7267 in.)

Out-of-square: 1.5°

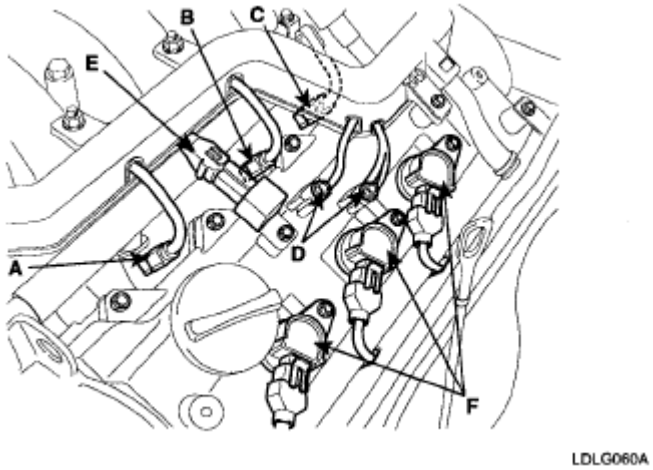


Fig. 166: Measuring Free Length Of Valve Spring
Courtesy of HYUNDAI MOTOR CO.

MLA INSPECTION

1. Inspect MLA.

Using a micrometer, measure the MLA outside diameter.

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MLA O.D.

Intake/Exhaust: 34.964 ~ 34.980 mm (1.3765 ~ 1.3771 in.)

2. Using a caliper gauge, measure MLA tappet bore inner diameter of cylinder head.

Tappet bore I.D.

Intake/Exhaust: 35.000 ~ 35.025 mm (1.3779 ~ 1.3789 in.)

3. Subtract MLA outside diameter measurement from tappet bore inside diameter measurement.

MLA to tappet bore clearance

[Standard]

Intake/Exhaust: 0.020 ~ 0.061 mm (0.0008 ~ 0.0024 in.)

[Limit]

Intake/Exhaust: 0.07 mm (0.0027 in.)

CAMSHAFT INSPECTION

1. Inspect cam lobes.

Using a micrometer, measure the cam lobe height.

Cam height

[Standard value]

Intake: 46.3 mm (1.8228 in.)

Exhaust: 45.8 mm (1.8031 in.)

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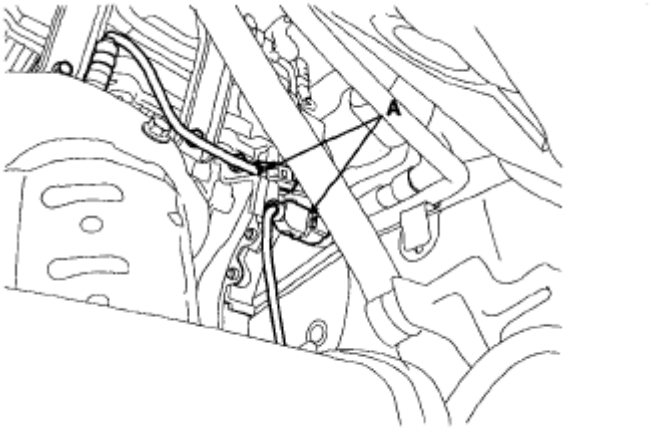


Fig. 167: Measuring Cam Lobe Height
Courtesy of HYUNDAI MOTOR CO.

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

2. Inspect camshaft journal 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.

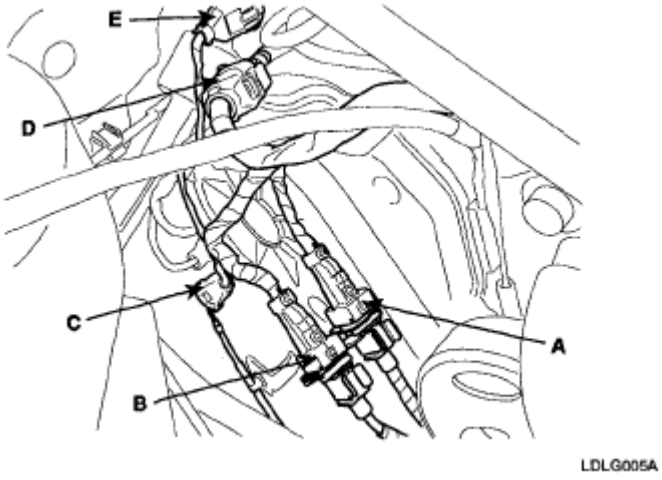


Fig. 168: Laying Strip Of Plastigage Across Each Of Camshaft Journal
Courtesy of HYUNDAI MOTOR CO.

4. Install the bearing caps.

CAUTION: Do not turn the camshaft.

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

Bearing oil clearance

[Standard value]

Intake No.1 journal: 0.020 ~ 0.057 mm (0.0008 ~ 0.0022 in.)

No. 2,3,4 journal: 0.030 ~ 0.067 mm (0.0012 ~ 0.0026 in.)

Exhaust No. 1 journal: 0.020 ~ 0.057 mm (0.0008 ~ 0.0022 in.)

No.2,3,4 journal: 0.030 ~ 0.067 mm (0.0012 ~ 0.0026 in.)

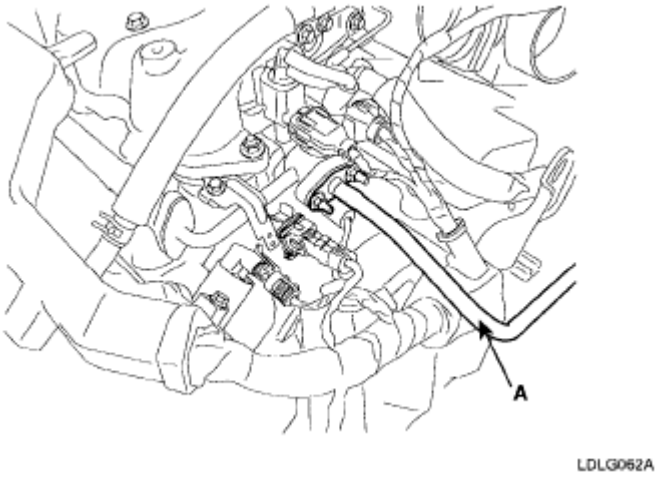


Fig. 169: Measuring Plastigage At Widest Point
Courtesy of HYUNDAI MOTOR CO.

If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

7. Completely remove the plastigage.
8. Remove the camshafts.

3. Inspect camshaft end play.
    1. Install the camshafts.
    2. Using a dial indicator, measure the end play while moving the camshaft back and forth.

Camshaft end play

[Standard value]: 0.056 ~ 0.064 mm (0.0022 ~ 0.0025 in.)

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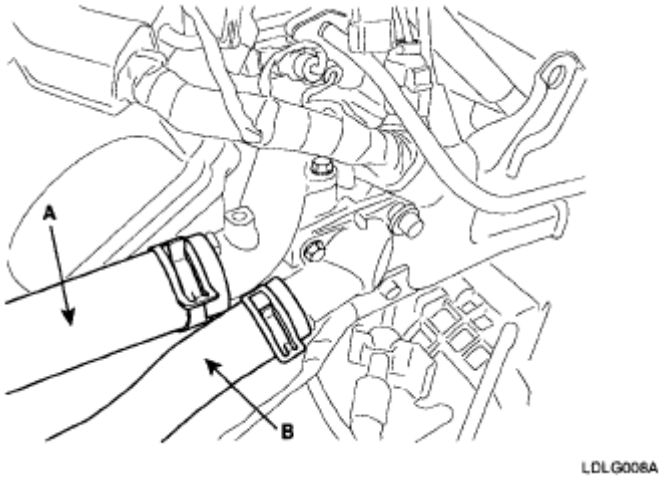


Fig. 170: Checking Camshaft End Play
Courtesy of HYUNDAI MOTOR CO.

If the end play is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

3. Remove the camshafts.

CVVT ASSEMBLY INSPECTION

1. Inspect CVVT assembly.
    1. Check that the CVVT assembly will not turn.
    2. Apply vinyl tape to the retard hole except the one indicated by the arrow in the illustration.

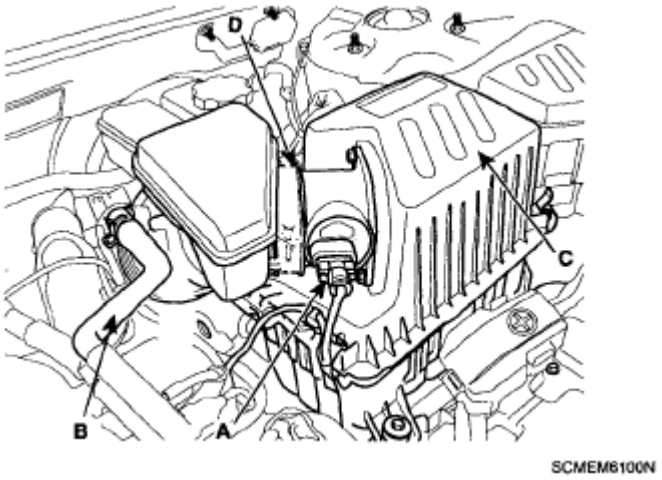


Fig. 171: Locating Retard Hole
Courtesy of HYUNDAI MOTOR CO.

3. Wind tape around the tip of the air gun and apply air of approx. 150 kpa (1.5 kgf/cm^2 21 psi) to the port of the camshaft.

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(Perform this order to release the lock pin for the maximum delay angle locking.)

NOTE: When the oil splashes, wipe it off with a shop rag.

4. Under the condition of (3), turn the CVVT assembly to the advance angle side (the arrow marked direction in the illustration) with your hand. Depending on the air pressure, the CVVT assembly will turn to the advance side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.

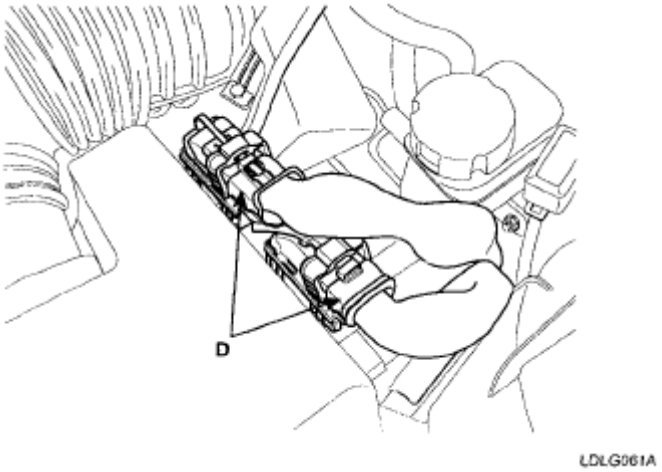


Fig. 172: Identifying Retard And Advance Position Of CVVT Assembly
Courtesy of HYUNDAI MOTOR CO.

5. Except the position where the lock pin meets at the maximum delay angle, let the CVVT assembly turn back and forth and check the movable range and that there is no disturbance.

   Standard: Movable smoothly in the range about 22.5°

6. Turn the CVVT assembly with your hand and lock it at the maximum delay angle position (counter clockwise).

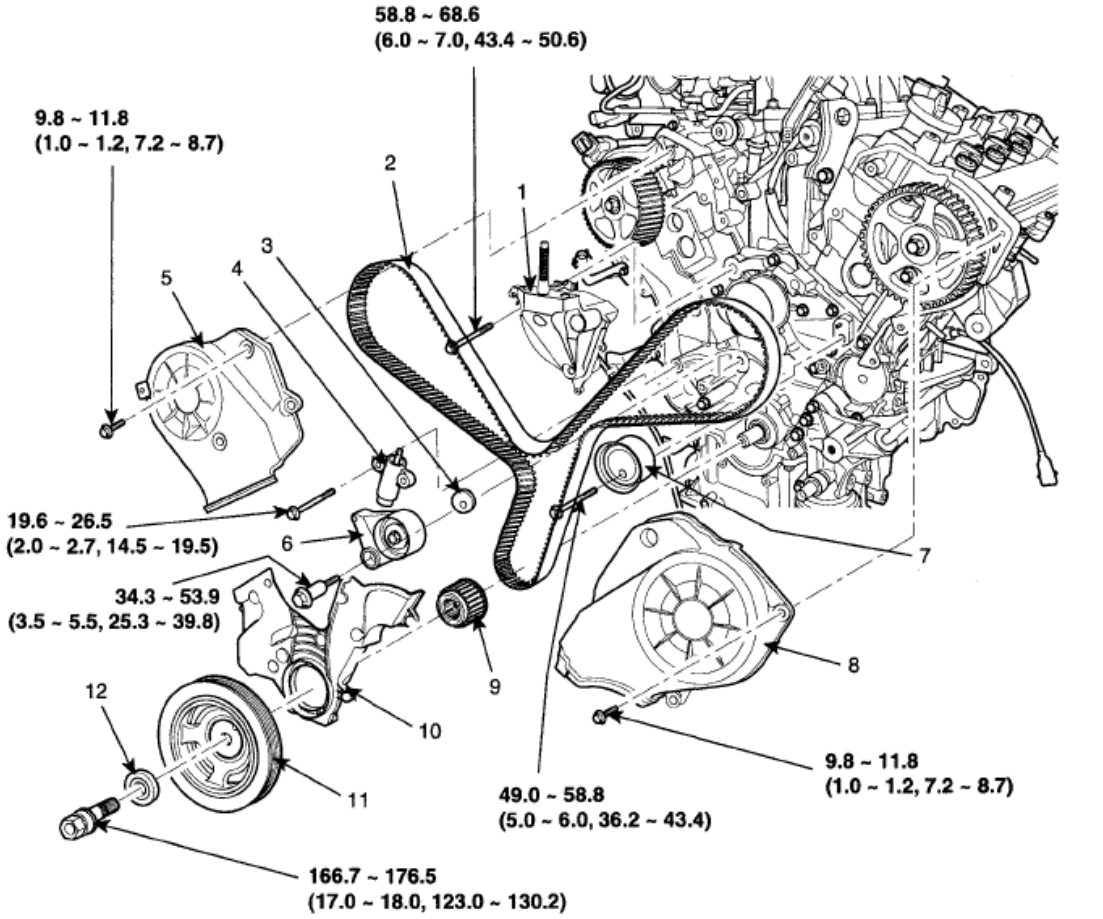
REASSEMBLY

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. Using SST (09222~3C100), 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.

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TORQUE : N.m (kgf.m, lb-ft)

1. Engine support bracket
2. Timing belt
3. Tensioner arm assembly washer
4. Timing belt auto tensioner
5. Bank 1 timing belt upper cover
6. Timing belt tensioner arm assembly
7. Idler pulley
8. Bank 2 timing belt upper cover
9. Crankshaft sprocket
10. Timing belt lower cover
11. Damper pulley
12. Special washer

LDLG039A

Fig. 173: Installing Oil Seal
Courtesy of HYUNDAI MOTOR CO.

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

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

3. Using the SST (09222 ~ 3K000, 09222~3C300), 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.

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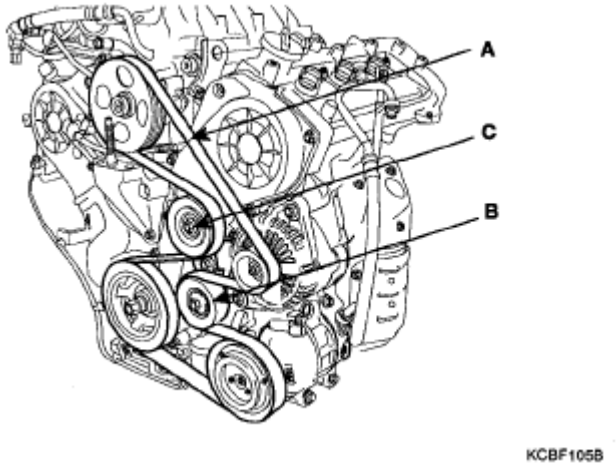


Fig. 174: Compressing Spring
Courtesy of HYUNDAI MOTOR CO.

4. 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.

2. Install MLAs.

Check that the MLA rotates smoothly by hand.

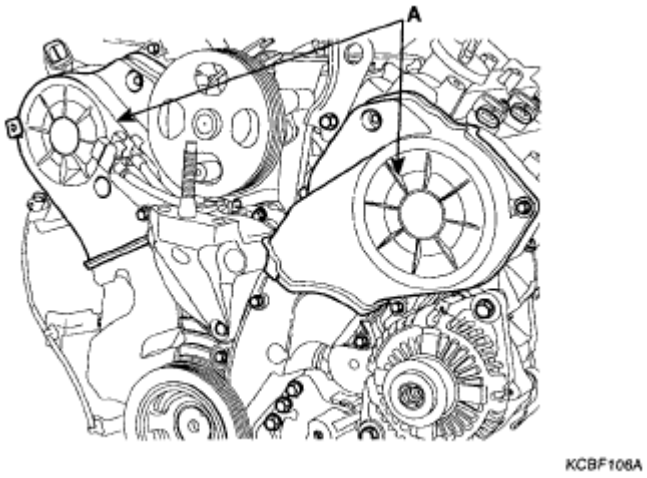


Fig. 175: Locating MLA
Courtesy of HYUNDAI MOTOR CO.

NOTE: MLA can be reinstalled in its original position.

3. Install OCV (A).

Tightening torque

9.80 ~ 11.76 Nm (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

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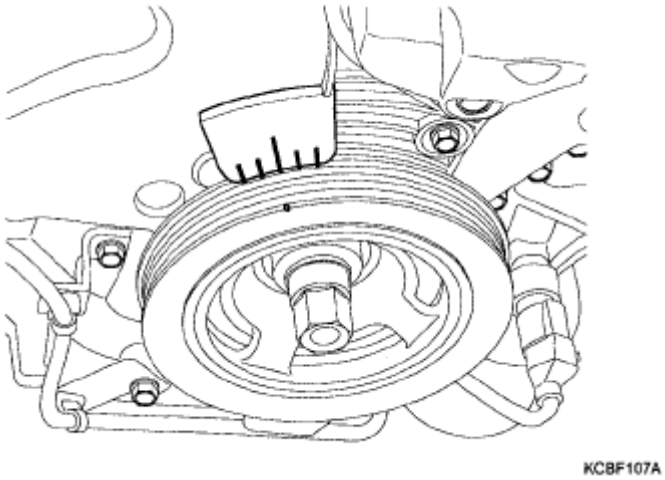


Fig. 176: Locating OCV
Courtesy of HYUNDAI MOTOR CO.

NOTE:
- **To install OCV with gray colored connector into RH bank.**
- **To install OCV with black colored connector into LH bank.**

CAUTION:
- **Do not reuse the OCV when dropped.**
- **Keep clean the OCV.**
- **Do not hold the OCV sleeve during servicing.**
- **When the OCV is installed on the engine, do not move the engine with holding the OCV yoke.**

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.**

1. Install the cylinder head.
   a. The sealant locations on cylinder head and cylinder block must be free of engine oil and ETC.
   b. Apply sealant on cylinder block top face before assembling cylinder head gaskets.

      The part must be assembled within 5 minutes after sealant was applied.

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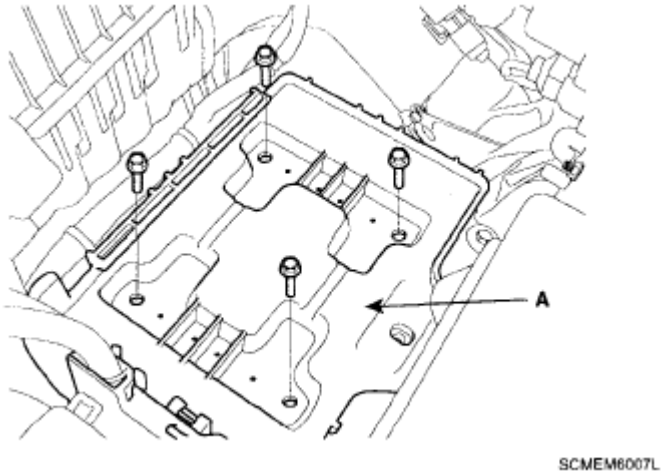


Fig. 177: Locating Sealant Locations
Courtesy of HYUNDAI MOTOR CO.

NOTE: Refer to below illustration to apply the sealant.

Bead width: 2.0~3.0 mm

Sealant locations: 1.0~1.5 mm from block surface

Recommended sealant: Liquid sealant TB1217H

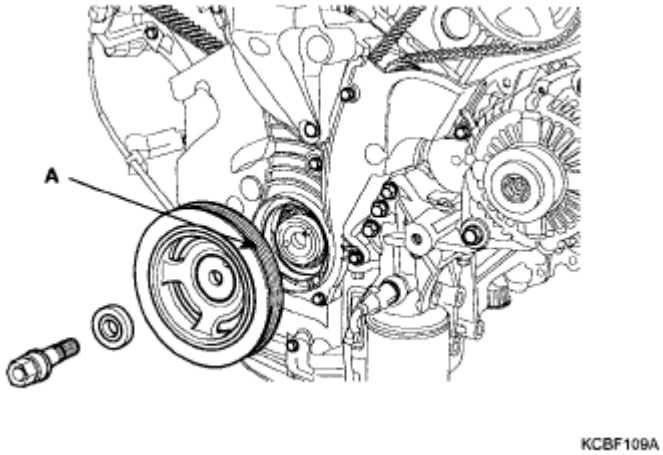


Fig. 178: Identifying Sealant Area
Courtesy of HYUNDAI MOTOR CO.

c. Apply sealant on cylinder head gaskets after assembling cylinder head gaskets on cylinder block. The part must be assembled within 5 minutes after sealant was applied.

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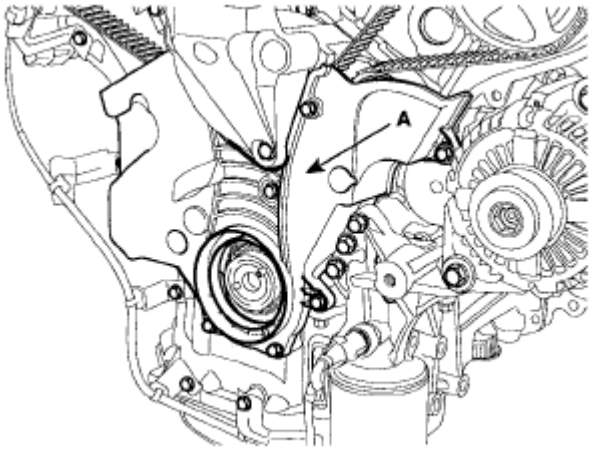


Fig. 179: Applying Sealant On Cylinder Head Gaskets
Courtesy of HYUNDAI MOTOR CO.

NOTE: Be careful of the installation direction.

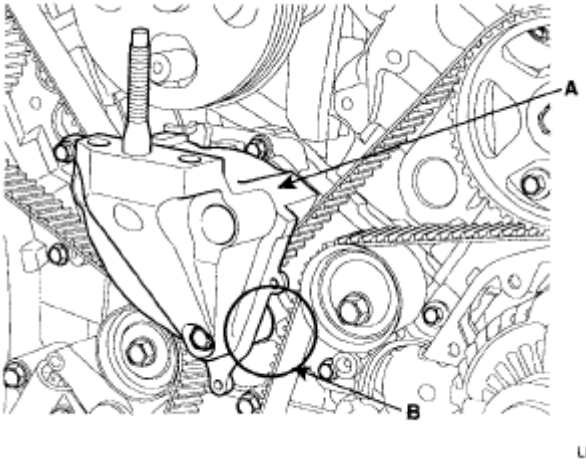


Fig. 180: Locating 3R Mark
Courtesy of HYUNDAI MOTOR CO.

d. Install the cylinder head.

NOTE: Remove the extruded sealant after assembling cylinder heads.

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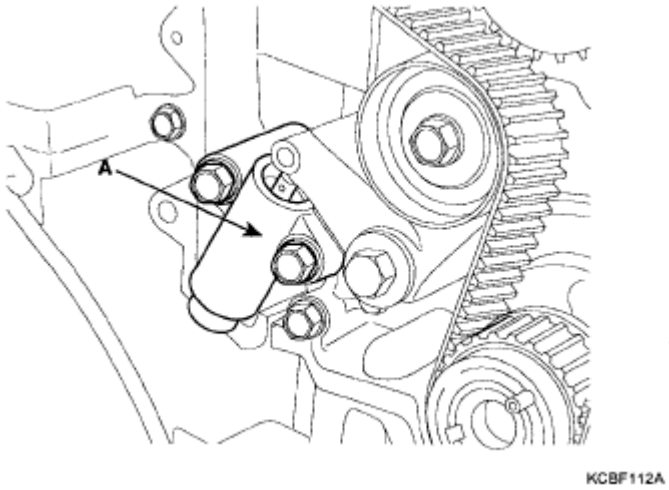


Fig. 181: Identifying Cylinder Head
Courtesy of HYUNDAI MOTOR CO.

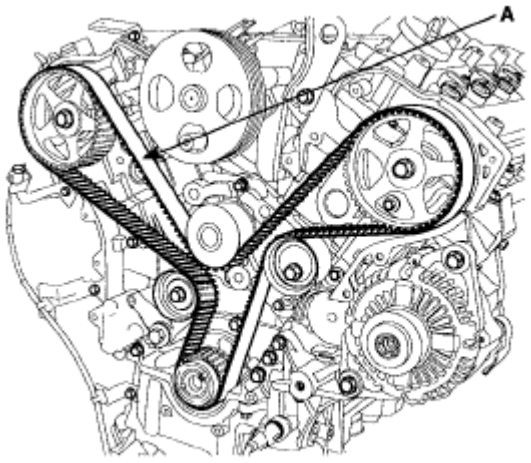
2. Place the cylinder head carefully in order not to damage the gasket with the bottom part of the end.
3. Install cylinder head bolts.
    1. Do not apply engine oil on the threads and under the heads of the cylinder head bolts.
    2. Using SST (09221~4A000), install and tighten the cylinder head bolts and plate washers, in several passes, in the sequence shown in the illustration.

    Tightening torque

    39.2 Nm (4.0 kgf.m, 28.93 lb-ft) ± 120° ± 90°

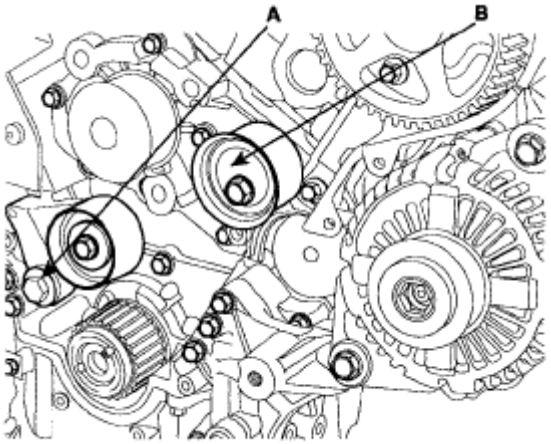
    18.62 ~ 23.52 Nm (1.9 ~ 2.4 kgf.m, 13.74 ~ 17.36 lb-ft) (A)

    NOTE: Always use new cylinder head bolt.



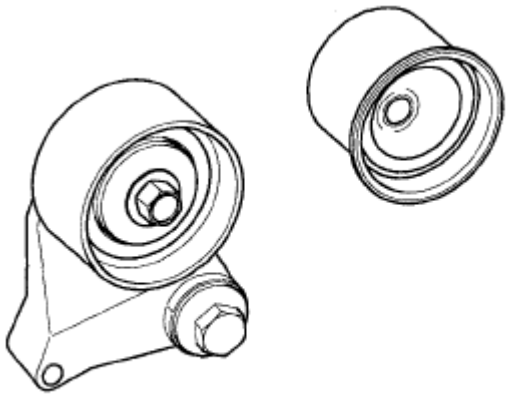
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Fig. 182: Tightening Cylinder Head Bolt In Sequence
Courtesy of HYUNDAI MOTOR CO.



KCBF114A

Fig. 183: Locating Cylinder Head Bolt
Courtesy of HYUNDAI MOTOR CO.



KCBF116A

Fig. 184: Tightening Cylinder Head Bolt
Courtesy of HYUNDAI MOTOR CO.

4. Install the CVVT and camshaft sprocket.

   Tightening torque

   64.68 ~ 76.44 Nm (6.6 ~ 7.8 kgf.m, 47.74 ~ 56.4 lb-ft)

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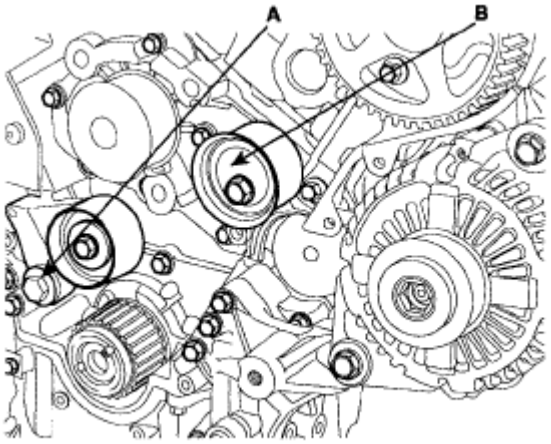


Fig. 185: Identifying CVVT And Camshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

NOTE:

- **Install camshaft-inlet to dowel pin of CVVT assembly.**

  At this time, attend not to be installed to oil hole of camshaft-inlet.

- **Hold the hexagonal head wrench portion of the camshaft with a vise, and install the bolt and CVVT assembly.**
- **Do not rotate CVVT assembly when camshaft is installed to dowel pin of CVVT assembly.**

5. Install camshafts (A).

NOTE:

- **Apply a light coat of engine oil on camshaft journals.**
- **Assemble the key groove of camshaft rear side to the same level of head top surface.**
- **Be careful the right, left bank, intake, exhaust side before assembling.**

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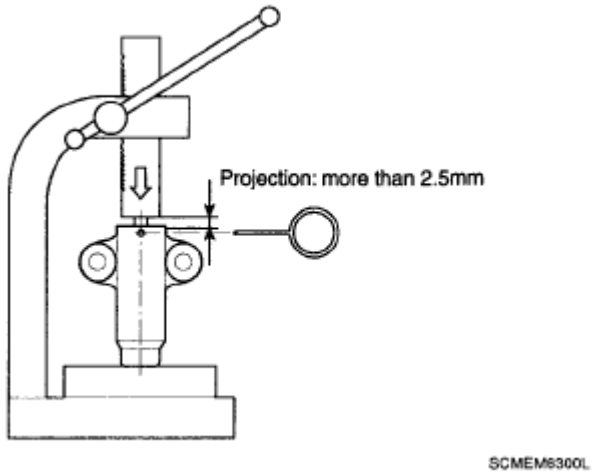


Fig. 186: Identifying Camshafts
Courtesy of HYUNDAI MOTOR CO.

INTAKE CAMSHAFT

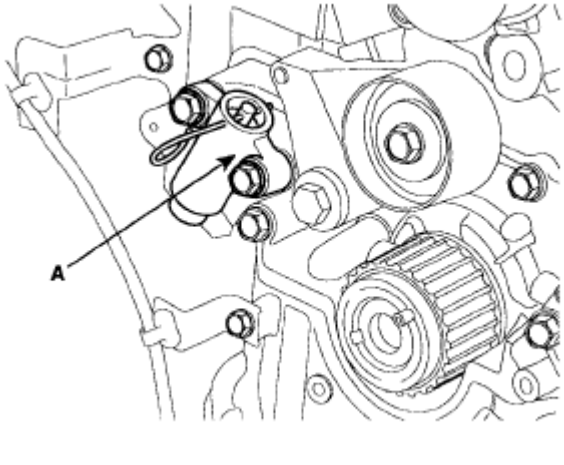


Fig. 187: Identifying Intake Camshaft
Courtesy of HYUNDAI MOTOR CO.

INTAKE CAMSHAFT REFERENCE

	LH	RH
3.3L	A : 027 mm (1.0630 in.) B: 027 mm (1.0630 in.)	A: 030 mm (1.1811 in.) B: 030 mm (1.1811 in.)

EXHAUST CAMSHAFT

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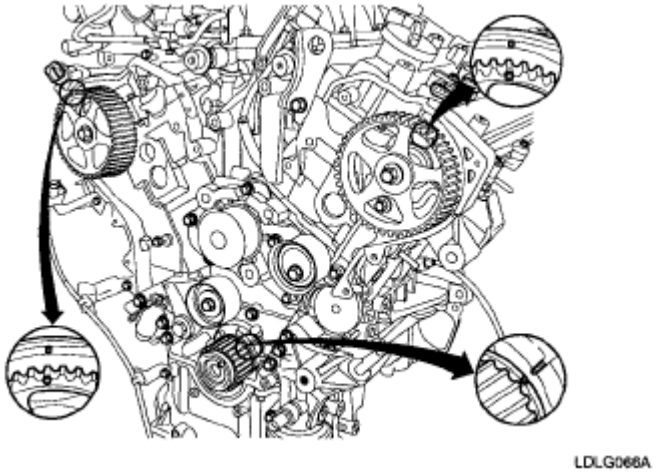


Fig. 188: Identifying Exhaust Camshaft
Courtesy of HYUNDAI MOTOR CO.

EXHAUST CAMSHAFT REFERENCE

	LH	RH
3.3L	A: 027 mm (1.0630 in.)	A: 030 mm (1.1811 in.)

6. Install camshaft bearing caps.

   Assemble camshaft bearing caps as the order below.

   Tightening torque

   5.9 Nm (0.6 kgf.m, 4.3 lb-ft) ~ 1st step

   9.80 ~ 11.76 Nm (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft) ~ 2nd step

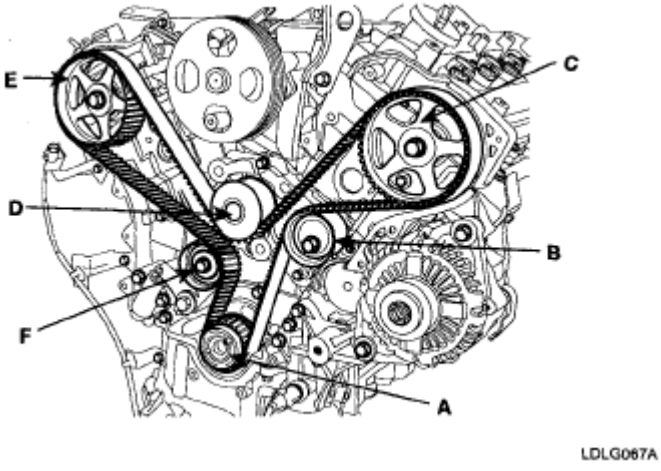


Fig. 189: Locating Camshaft Bearing Caps

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Courtesy of HYUNDAI MOTOR CO.

NOTE: Be careful the right, left bank, intake, exhaust side before assembling.

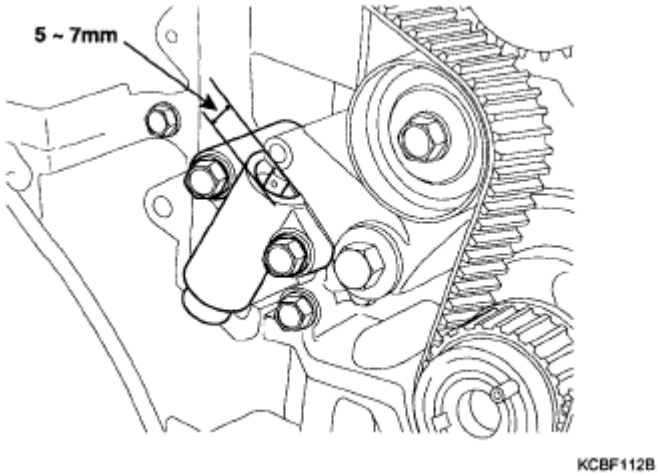


Fig. 190: Identifying Camshaft Bearing Cap Mark
Courtesy of HYUNDAI MOTOR CO.

CAUTION: Rotate the crankshaft not to contact the valves to the pistons by making the pistons below 10mm (0.3937in.) from the top of cylinder block.

7. Install water temperature control assembly.
8. Install timing chain.
9. Check and adjust valve clearance.
10. Install the exhaust manifold.
11. Install the intake manifold.

ENGINE MOUNTS

DESCRIPTION

Semi-active mounting (it can also be called 'Electronic Controlled Mounting (ECM)'), unlike hydraulic mountings before, is a controllable hydraulic mounting which gives a high damping value in driving and also reduce vibration with a low damping value and a spring coefficient at idle. This system is composed of a power control module (PCM), solenoid valve and a diaphragm for ON/OFF in it.

At idle, the power control module (PCM) receives a RPM signal and give it to the solenoid valve. As the valve opens or closes, vacuum pressure in the intake system goes to the diaphragm for opening the orifice. By opening the orifice, the mounting has a low damping value and a low spring coefficient for reducing vibration.

OPERATION

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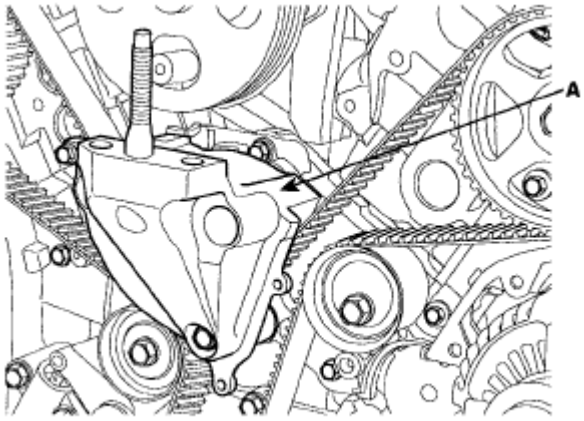


Fig. 191: Electronic Controlled Mounting (ECM) - System Diagram
Courtesy of HYUNDAI MOTOR CO.

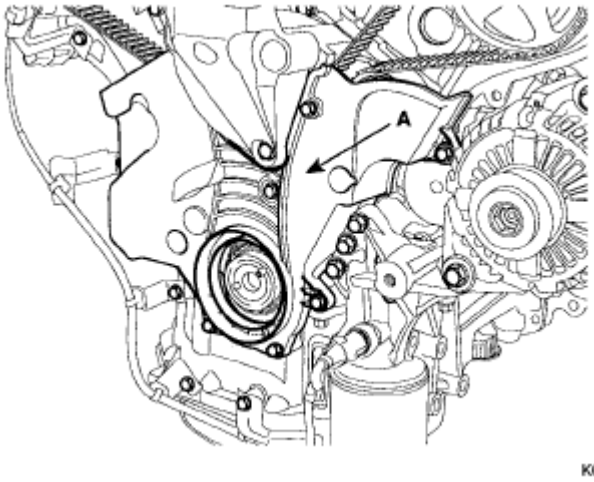


Fig. 192: Electronic Controlled Mounting (ECM) - Circuit Diagram
Courtesy of HYUNDAI MOTOR CO.

ECM: Electronic Controlled Mounting

ECM SPECIFICATIONS

SYSTEM	CONDITION		SOLENOID VALVE RELAY	VOLTAGE
Semi-active engine mount or Electronic Controlled Mounting (ECM)	After ignition switch is ON	~ 810 RPM	ON (idle)	9V ~
		810~910 RPM	Hold the previous state.	2~9V
		910 RPM ~	OFF (driving)	~ 2V
	Ignition switch is OFF		OFF	

TROUBLESHOOTING

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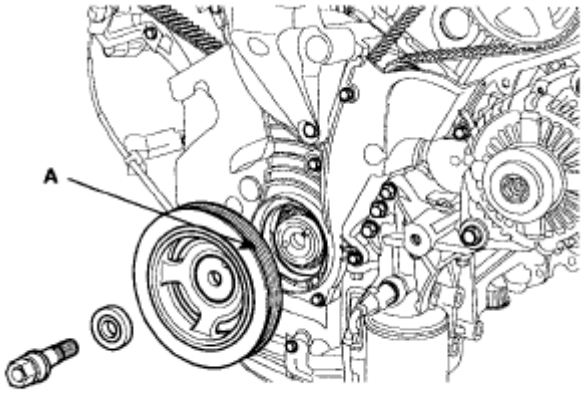


Fig. 193: Troubleshooting Flow Chart (1 Of 3)
Courtesy of HYUNDAI MOTOR CO.

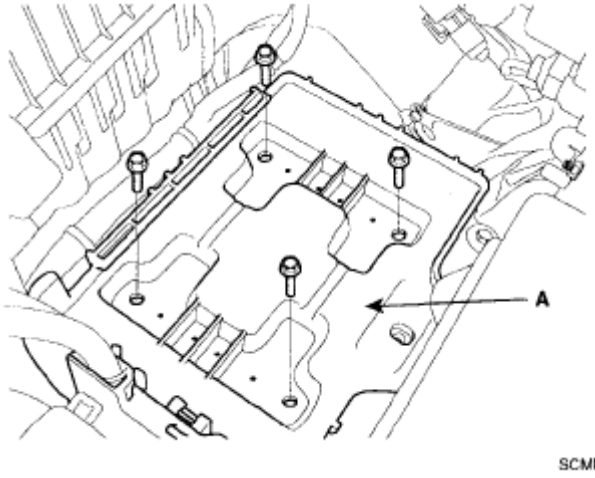
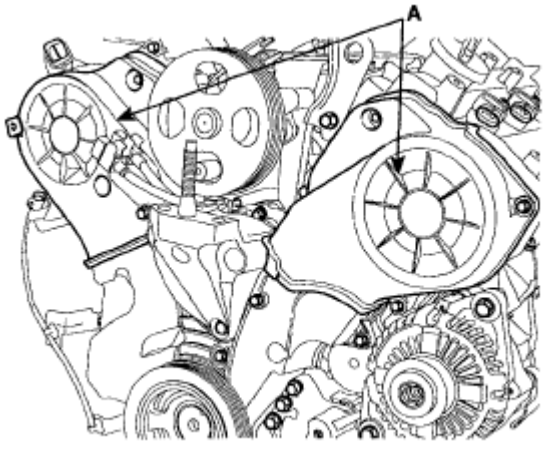


Fig. 194: Troubleshooting Flow Chart (2 Of 3)
Courtesy of HYUNDAI MOTOR CO.



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Fig. 195: Troubleshooting Flow Chart (3 Of 3)
Courtesy of HYUNDAI MOTOR CO.

ENGINE BLOCK

COMPONENTS

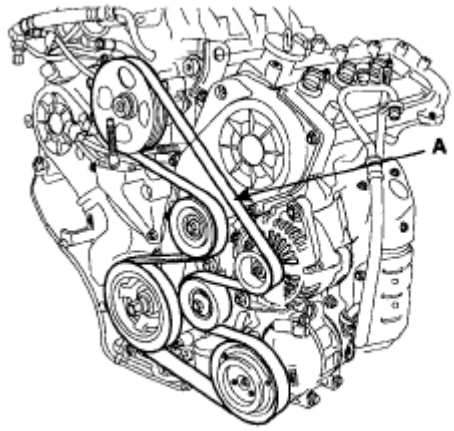


Fig. 196: Identifying Engine Block Components And Torque Specifications (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

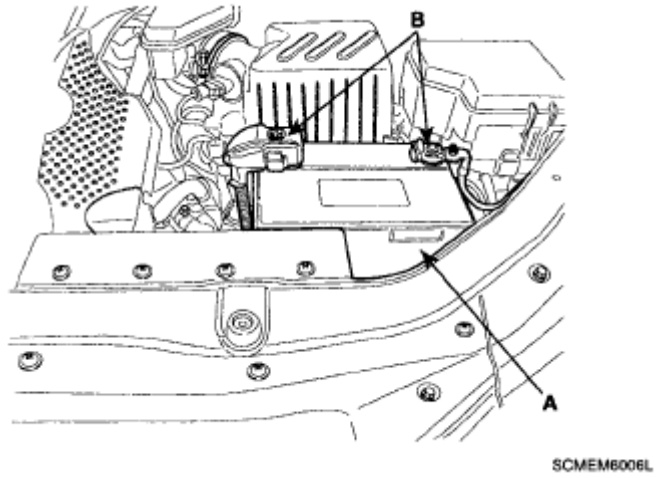


Fig. 197: Identifying Engine Block Components And Torque Specifications (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

CAUTION:
- **Use fender covers to avoid damaging painted surfaces.**
- **To avoid damage, unplug the wiring connectors carefully while holding the connector portion.**

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NOTE:

- **Mark all wiring and hoses to avoid misconnection.**
- **Inspection the timing belt before removing the cylinder head.**
- **Turn the crankshaft pulley so that the No. 1 piston is at top dead center.**

1. Remove exhaust manifold.
2. Remove intake manifold.
3. Remove timing chain.
4. Remove water temperature control assembly.
5. Remove cylinder head.
6. Remove oil pump.
7. Remove oil filter assembly.
8. Remove A/C compressor (A) from engine.

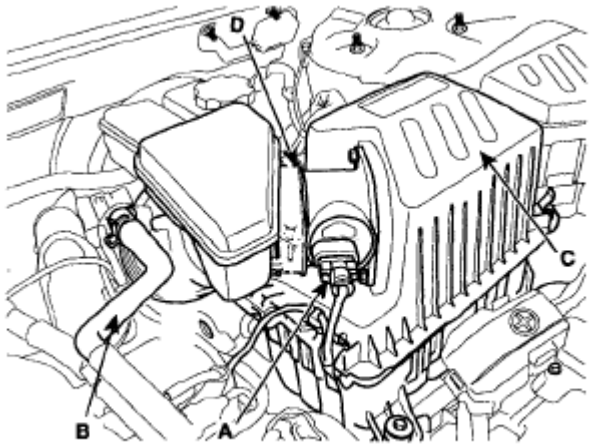


Fig. 198: Locating A/C Compressor
Courtesy of HYUNDAI MOTOR CO.

9. Remove alternator (A) from engine.

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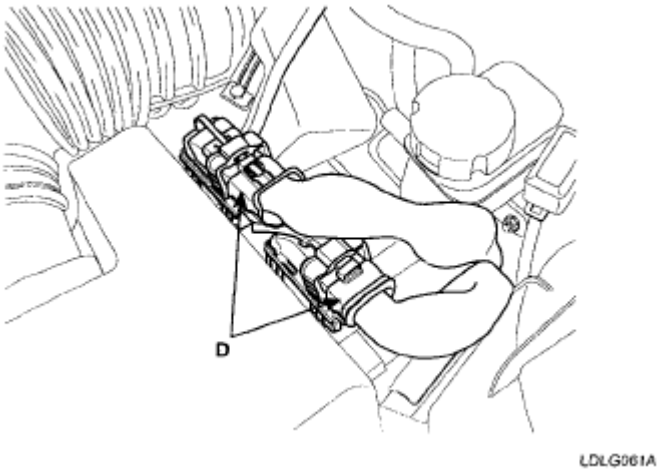


Fig. 199: Locating Alternator
Courtesy of HYUNDAI MOTOR CO.

10. Remove power steering pump (A) from engine.

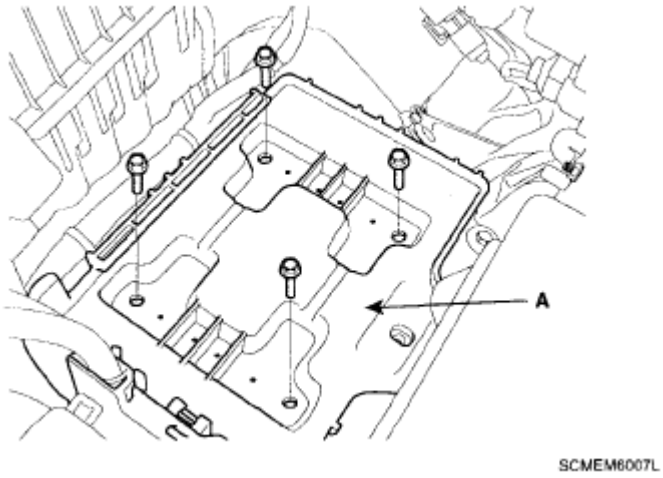


Fig. 200: Locating Power Steering Pump
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. Remove drive plate.
2. Remove knock sensor (A).

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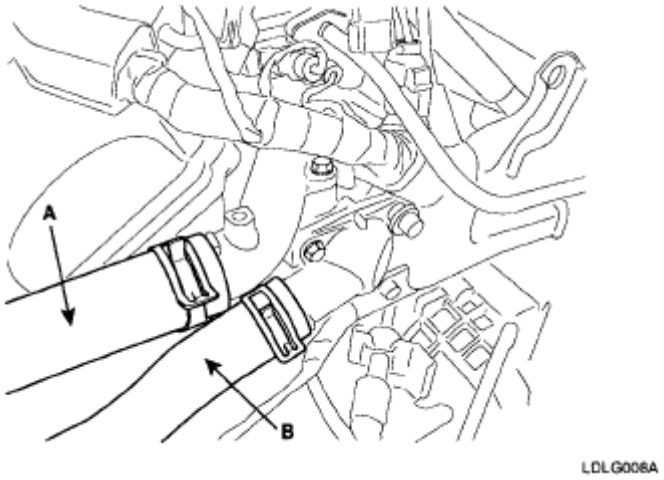


Fig. 201: Locating Knock Sensor
Courtesy of HYUNDAI MOTOR CO.

3. Remove upper oil pan (A).

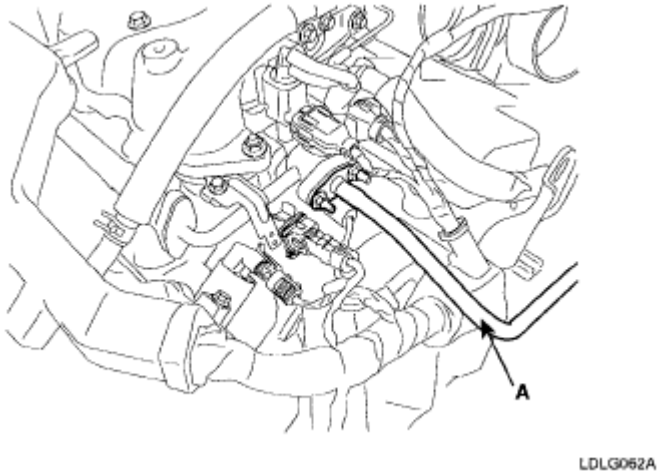


Fig. 202: Locating Upper Oil Pan
Courtesy of HYUNDAI MOTOR CO.

4. Remove baffle plate (A).

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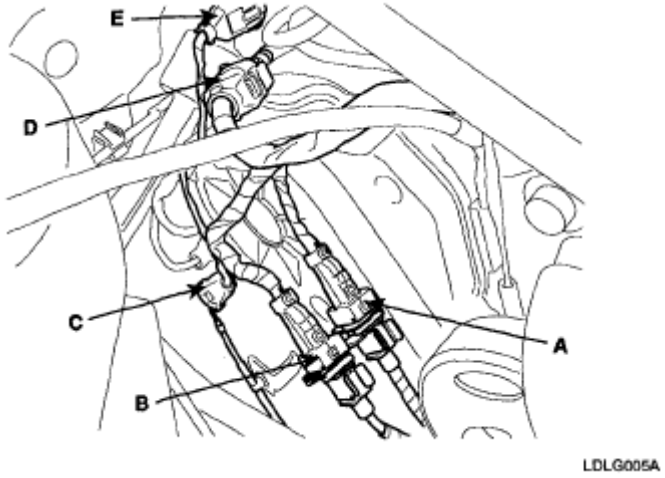


Fig. 203: Locating Baffle Plate
Courtesy of HYUNDAI MOTOR CO.

5. Remove rear oil seal case (A).



Fig. 204: Locating Rear Oil Seal Case
Courtesy of HYUNDAI MOTOR CO.

6. Remove oil drain cover (A).

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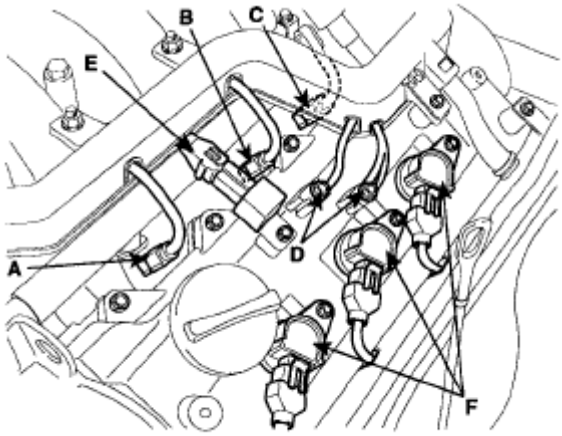


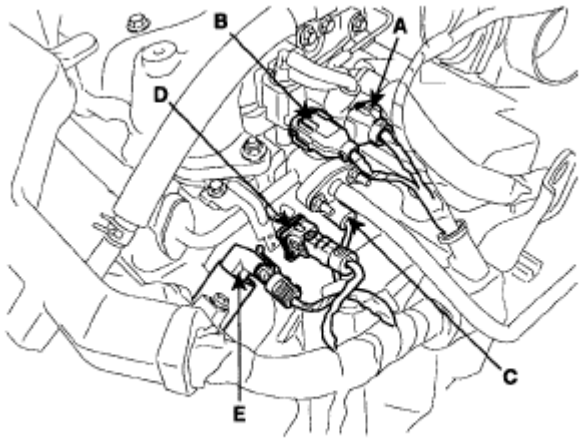
Fig. 205: Locating Oil Drain Cover
Courtesy of HYUNDAI MOTOR CO.

7. Check the connecting rod end play.
8. Check the connecting rod oil clearance.
9. 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.**

10. Remove crankshaft main bearing cap and check oil clearance.
11. Check the crankshaft end play.
12. Lift the crankshaft (A) out of engine, being careful not to damage journals.



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Fig. 206: Locating Crankshaft
Courtesy of HYUNDAI MOTOR CO.

NOTE: Arrange the main bearings and thrust bearings in the correct order.

13. 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 piston and piston pin as a set.

14. Remove piston rings.
    1. Using a piston ring expender, remove the 2 compression rings.
    2. Remove 2 side rails and the spacer by hand.

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

15. Disconnect connecting rod from piston.

INSPECTION

CONNECTING ROD AND CRANKSHAFT INSPECTION

1. Check the connecting rod end play.

   Using a feeler gauge, measure the end play while moving the connecting rod back and forth.

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

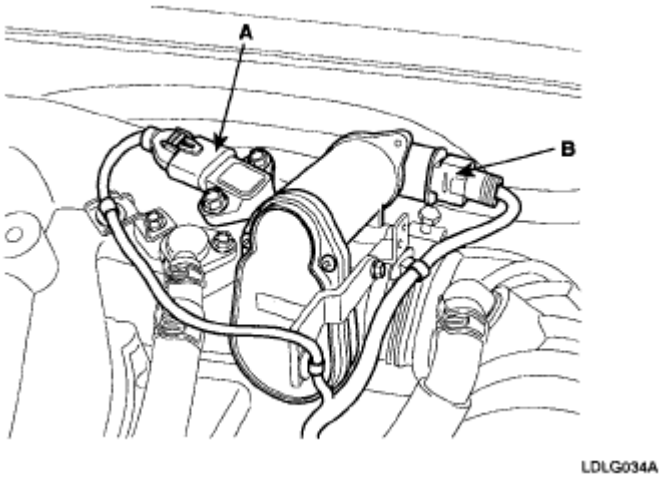


Fig. 207: Checking Connecting Rod End Play
Courtesy of HYUNDAI MOTOR CO.

- If out-of-tolerance, install a new connecting rod.

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- 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 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

    19.6 Nm (2.0 kgf.m, 14.46 lbf.ft) + 90°

    NOTE: Do not turn the crankshaft.

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

    Standard oil clearance

    0.030 ~ 0.048 mm (0.0012 ~ 0.0019 in.)

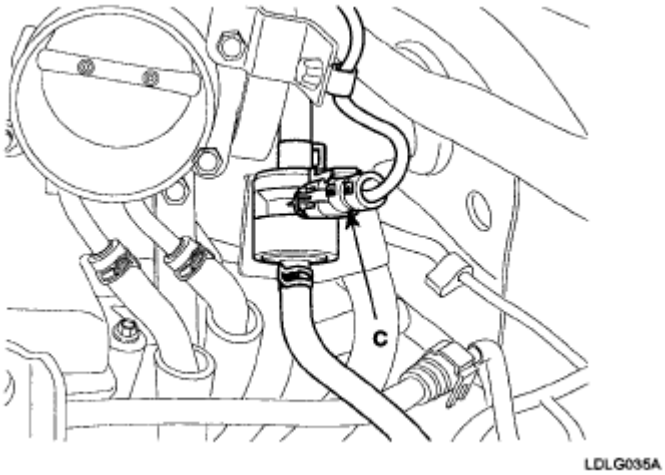


Fig. 208: Measuring Plastigage At Widest Point
Courtesy of HYUNDAI MOTOR CO.

    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 **DISCRIMINATION OF CONNECTING ROD BEARING** table), and recheck the clearance.

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

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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

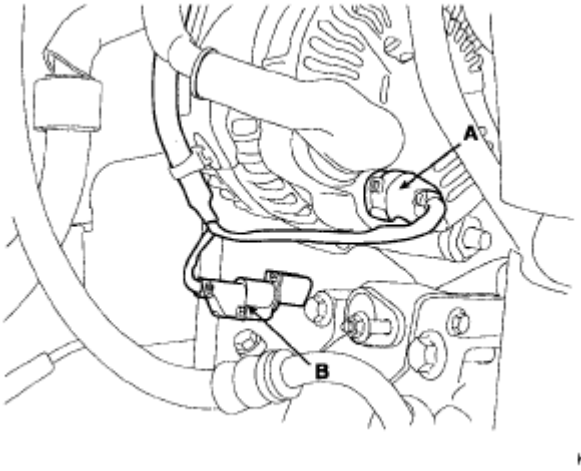


Fig. 209: Identifying Connecting Rod Mark Location
Courtesy of HYUNDAI MOTOR CO.

DISCRIMINATION OF CONNECTING ROD

DISCRIMINATION OF CONNECTING ROD

CLASS	MARK	INSIDE DIAMETER
0	a	58.000~58.006 mm (2.2834 ~ 2.2837 in.)
1	b	58.006~58.012 mm (2.2837 ~ 2.2839 in.)
2	c	58.012~58.018 mm (2.2839 ~ 2.2842 in.)

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CRANKSHAFT PIN MARK LOCATION

DISCRIMINATION OF CRANKSHAFT

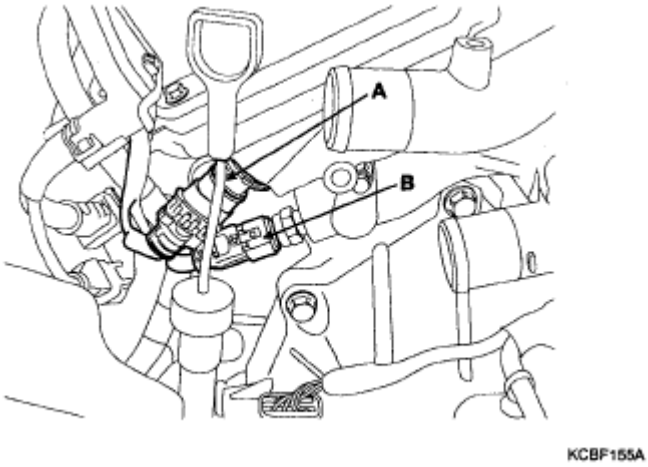


Fig. 210: Identifying Crankshaft Pin Mark Location
Courtesy of HYUNDAI MOTOR CO.

DISCRIMINATION OF CRANKSHAFT

DISCRIMINATION OF CRANKSHAFT

CLASS	MARK	OUTSIDE DIAMETER OF PIN
I	1 or A	54.966 ~ 54.972 mm (2.1640 ~ 2.1642 in.)
II	2 or B	54.960 ~ 54.966 mm (2.1638 ~ 2.1640 in.)
III	3 or C	54.954 ~ 54.960 mm (2.1635 ~ 2.1638 in.)

PLACE OF IDENTIFICATION MARK (CONNECTING ROD BEARING)

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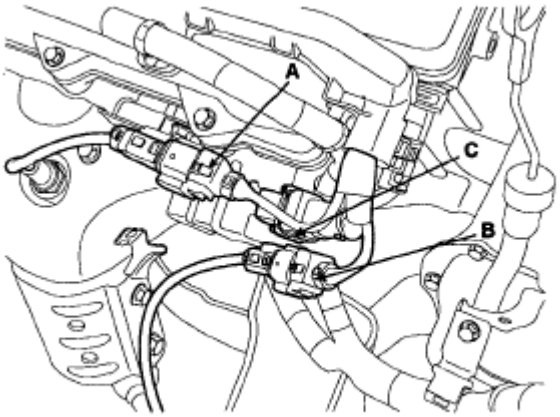


Fig. 211: Identifying Identification Mark (Connecting Rod Bearing)
Courtesy of HYUNDAI MOTOR CO.

DISCRIMINATION OF CONNECTING ROD BEARING

DISCRIMINATION OF CONNECTING ROD BEARING

CLASS	MARK	THICKNESS OF BEARING
E	BLUE	1.514 ~ 1.517 mm (0.0596 ~ 0.0597 in.)
D	BLACK	1.511 ~ 1.514 mm (0.0595 ~ 0.0596 in.)
C	BROWN	1.508 ~ 1.511 mm (0.0594 ~ 0.0595 in.)
B	GREEN	1.505~ 1.508 mm (0.0593 ~ 0.0594 in.)
A	YELLOW	1.502 ~ 1.505 mm (0.0591 ~ 0.0593 in)

11. Selection

SELECTION CHART

		CONNECTING ROD IDENTIFICATION MARK		
		0 (a)	1 (b)	2 (c)
CRANKSHAFT IDENTIFICATION	1 or A	A (YELLOW)	B (GREEN)	C (BROWN)
	2 or			

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MARK	B	B (GREEN)	C (BROWN)	D (BLACK)
	3 or C	C (BROWN)	D (BLACK)	E (BLUE)

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

       Tightening torque

       49.00 Nm (5.0 kgf.m, 36.16 lb-ft) + 90°

       19.60 Nm (2.0 kgf.m, 14.46lb-ft) + 120°

       29.40 ~ 31.36 Nm (3.0 ~ 3.2 kgf.m, 21.70 ~ 23.14 lb-ft)

       NOTE: Do not turn the crankshaft.

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

       Standard oil clearance

       0.022 ~ 0.040 mm (0.0009 ~ 0.0016 in.)

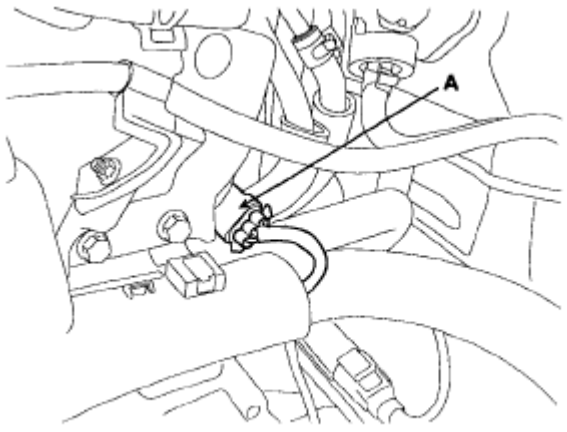


Fig. 212: Measuring Widest Part Of Plastigage
Courtesy of HYUNDAI MOTOR CO.

    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 **DISCRIMINATION OF CONNECTING ROD BEARING** table), and recheck the clearance.

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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.

Crankshaft bore mark location

Letters have been stamped on the block as a mark for the size of each of the 5 main journal bores.

Use them, and the numbers or bar stamped on the crank (marks for main journal size), to choose the correct bearings.

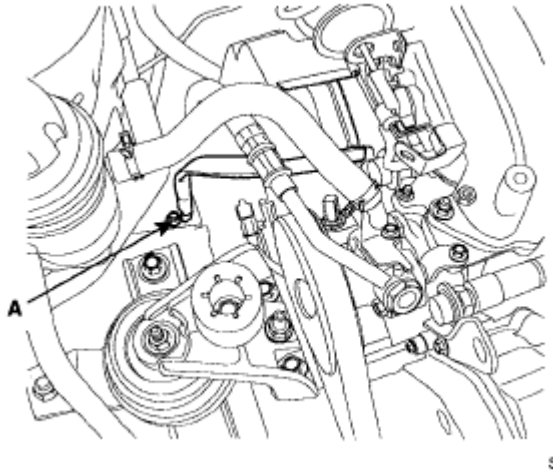


Fig. 213: Identifying Crankshaft Bore Mark Location
Courtesy of HYUNDAI MOTOR CO.

DISCRIMINATION OF CYLINDER BLOCK

DISCRIMINATION OF CYLINDER BLOCK

CLASS	MARK	INSIDE DIAMETER
a	A	73.500 ~ 73.506 mm (2.8937 ~ 2.8939

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		in.)
b	B	73.506 ~ 73.512 mm (2.8939 ~ 2.8942 in.)
c	C	73.512 ~ 73.518 mm (2.8942 ~ 2.8944 in.)

CRANKSHAFT JOURNAL MARK LOCATION

DISCRIMINATION OF CRANKSHAFT

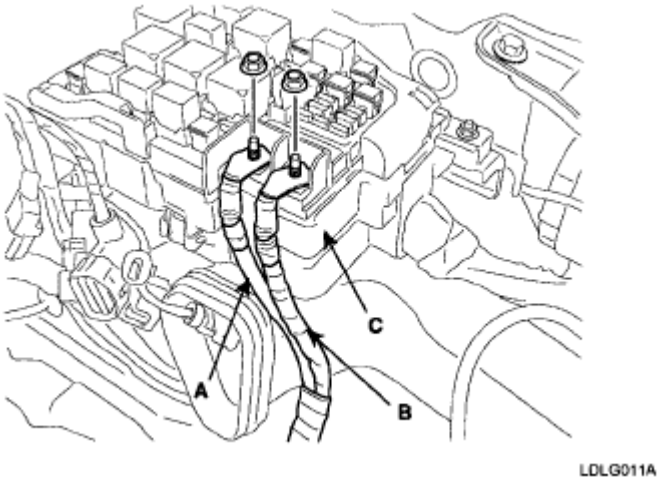


Fig. 214: Identifying Crankshaft Journal Mark Location
Courtesy of HYUNDAI MOTOR CO.

DISCRIMINATION OF CRANKSHAFT

DISCRIMINATION OF CRANKSHAFT

CLASS	MARK	OUTSIDE DIAMETER OF JOURNAL
I	1 or A	68.954 ~ 68.960 mm (2.7147 ~ 2.7150 in.)
II	2 or B	68.948 ~ 68.954 mm (2.7145 ~ 2.7147 in.)
III	3 or C	68.942 ~ 68.948

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		mm (2.7142 ~ 2.7145 in.)

PLACE OF IDENTIFICATION MARK (CRANKSHAFT BEARING)

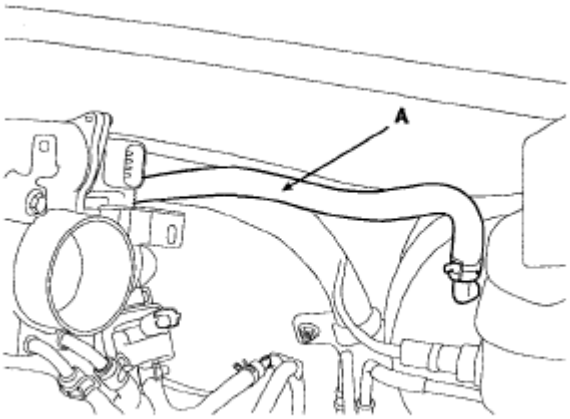


Fig. 215: Identifying Identification Mark (Crankshaft Bearing)
Courtesy of HYUNDAI MOTOR CO.

DISCRIMINATION OF CRANKSHAFT BEARING

DISCRIMINATION OF CRANKSHAFT BEARING

CLASS	MARK	THICKNESS OF BEARING
E	BLUE	2.277 ~ 2.280 mm (0.0896 ~ 0.0897 in.)
D	BLACK	2.274 ~ 2.277 mm (0.0895 ~ 0.0896 in.)
C	BROWN	2.271 ~ 2.274 mm (0.0894 ~ 0.0895 in.)
B	GREEN	2.268~2.271 mm (0.0893 ~ 0.0894 in.)
A	YELLOW	2.265 ~ 2.268 mm (0.0892 ~ 0.0893 in.)

SELECTION

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SELECTION CHART

		CRANKSHAFT BORE IDENTIFICATION MARK		
		a (A)	b (B)	c (C)
CRANKSHAFT IDENTIFICATION MARK	1 or A	A (YELLOW)	B (GREEN)	C (BROWN)
	2 or B	B (GREEN)	C (BROWN)	D (BLACK)
	3 or C	C (BROWN)	D (BLACK)	E (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 0.10 ~ 0.28 mm (0.0039 ~ 0.0110 in.)

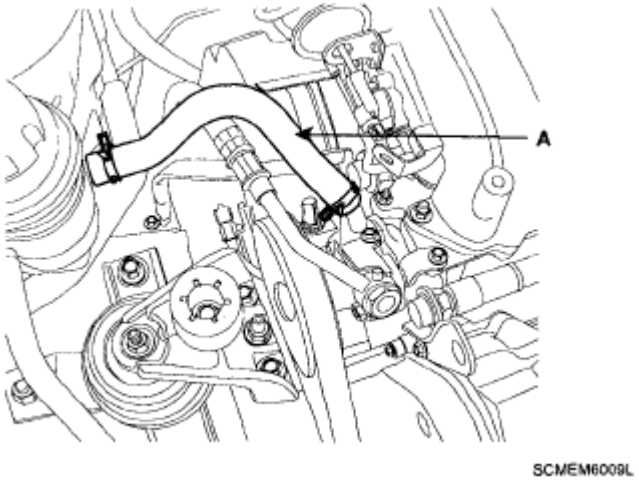


Fig. 216: Checking Crankshaft End Play
Courtesy of HYUNDAI MOTOR CO.

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

   Thrust bearing thickness 2.41 ~ 2.45 mm (0.0949 ~ 0.0964 in.)

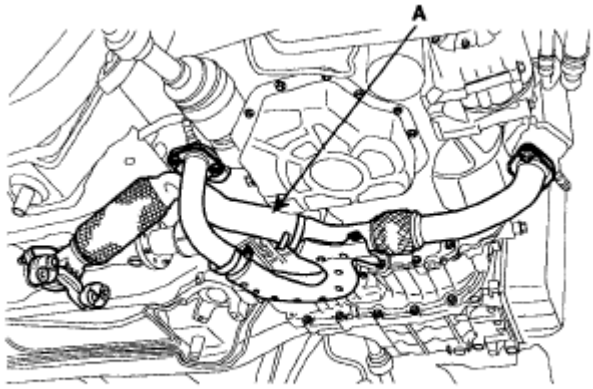
5. Inspect main journals and crank pins

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

   Main journal diameter: 68.942 ~ 68.960 mm (2.7142 ~ 2.7149 in.)

   Crank pin diameter: 54.954 ~ 54.972 mm (2.1635 ~ 2.1642 in.)

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SCMEM6005L

Fig. 217: Measuring Diameter Of Main Journal And Crank Pin
Courtesy of HYUNDAI MOTOR CO.

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

   Allowable twist of connecting rod: 0.1 mm / 100 mm (0.0039 in./3.94 in.) or less

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

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Standard: Less than 0.05 mm (0.0020 in.), Less than 0.02 mm (0.0008 in.) / 150 x 150

4. Inspect cylinder bore diameter

   Visually check the cylinder for vertical scratches.

   If deep scratches are present, replace the cylinder block.

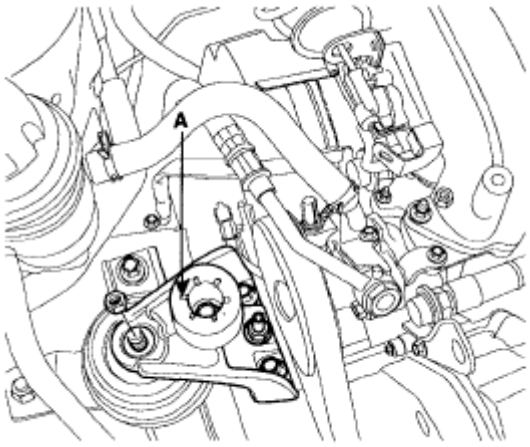


Fig. 218: Checking Top Surface Of Cylinder Block For Flatness
Courtesy of HYUNDAI MOTOR CO.

5. Inspect cylinder bore diameter

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

   Standard diameter 92.00 ~ 92.03 mm (3.6220 ~ 3.6232 in.)

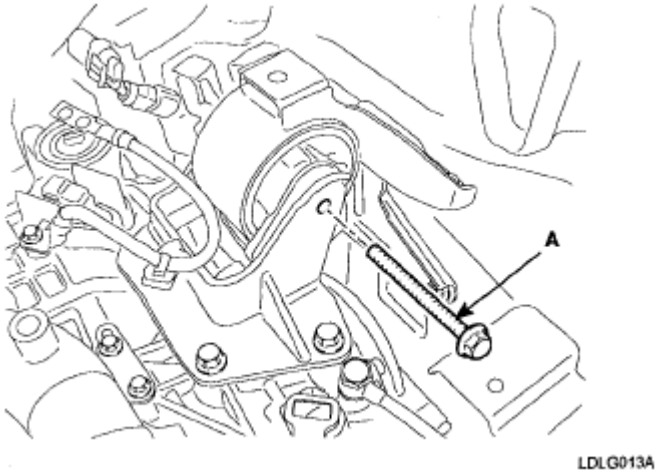
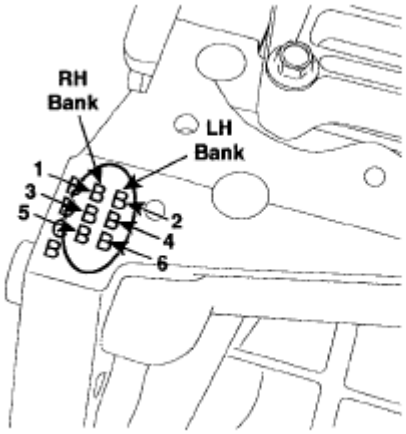


Fig. 219: Checking Cylinder Bore Diameter

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Courtesy of HYUNDAI MOTOR CO.

6. Check the cylinder bore size code on the cylinder block.



ECBF002A

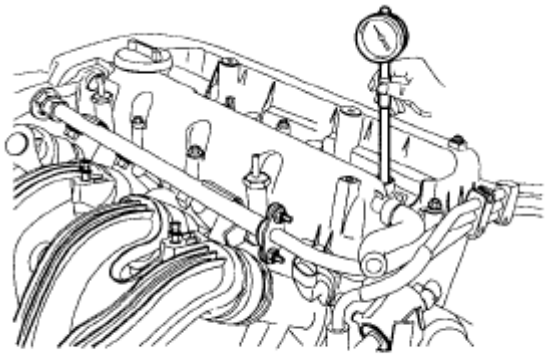
Fig. 220: Identifying Cylinder Bore Size Code On Cylinder Block
Courtesy of HYUNDAI MOTOR CO.

CYLINDER BORE SIZE CODE CHART

Class	Size code	Cylinder bore inner diameter
A	A	92.00 ~ 92.01 mm (3.6220 ~ 3.6224 in.)
B	B	92.01 ~ 92.02 mm (3.6224 ~ 3.6228 in.)
C	C	92.02 ~ 92.03 mm (3.6228 ~ 3.6232 in.)

7. Check the piston size code on the piston top face.

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KCRF134B

Fig. 221: Identifying Piston Size Code On Piston Top Face
Courtesy of HYUNDAI MOTOR CO.

PISTON SIZE CODE CHART

Class	Size code	Piston outer diameter
A	A	91.97 ~ 91.98 mm (3.6209 ~ 3.6212 in.)
B	B	91.98 ~ 91.99 mm (3.6212 ~ 3.6216 in.)
C	C	91.99 ~ 92.00 mm (3.6216 ~ 3.6220 in.)

8. Select the piston related to cylinder bore class.

   Clearance: 0.02 ~ 0.04 mm (0.0008 ~ 0.0016 in.)

PISTON AND RINGS

1. Clean piston
   1. Using a gasket scraper, remove the carbon from the piston top.
   2. Using a groove cleaning tool or broken ring, clean the piston ring grooves.
   3. Using solvent and a brush, thoroughly clean the piston.

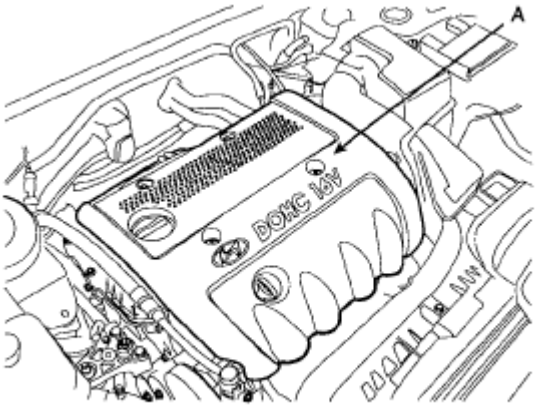
   NOTE: Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 14 mm (0.5512 in.) from the bottom of the piston.

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Standard diameter

91.97 ~ 92.00 mm (3.6209 ~ 3.6220 in.)



KCRF146A

Fig. 222: Measuring Piston Outside Diameter
Courtesy of HYUNDAI MOTOR CO.

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

   Piston-to-cylinder clearance

   0.02 ~ 0.04 mm (0.0008 ~ 0.0016 in.)

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

   Standard

   No. 1: 0.04 ~ 0.078 mm (0.0016 ~ 0.0031 in.)

   No. 2: 0.03 ~ 0.07 mm (0.0012 ~ 0.0027 in.)

   Oil ring: 0.06 ~ 0.15 mm (0.0024 ~ 0.0059 in.)

   Limit

   No. 1: 0.1 mm (0.004 in.)

   No. 2: 0.1 mm (0.004 in.)

   Oil ring: 0.2 mm (0.008 in.)

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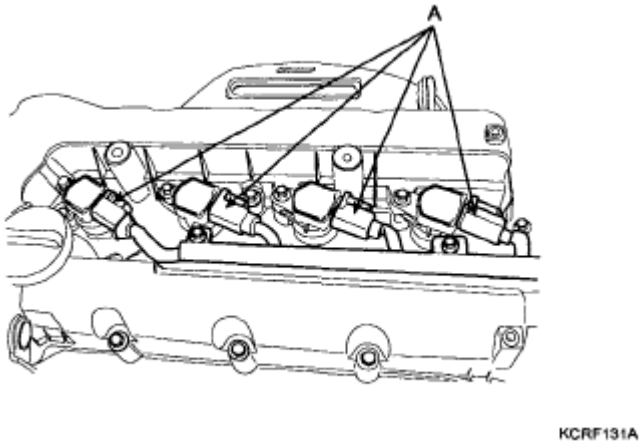


Fig. 223: Checking Piston Ring Side Clearance
Courtesy of HYUNDAI MOTOR CO.

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 replaced.

   Piston ring end gap

   Standard

   No. 1: 0.17 ~ 0.32 mm (0.0067 ~ 0.0126 in.)

   No. 2: 0.32 ~ 0.47 mm (0.0126 ~ 0.0185 in.)

   Oil ring: 0.20 ~ 0.70 mm (0.0079 ~ 0.0275 in.)

   Limit

   No. 1: 0.6 mm (0.0236 in.)

   No. 2: 0.7 mm (0.0275 in.)

   Oil ring: 0.8 mm (0.0315 in.)

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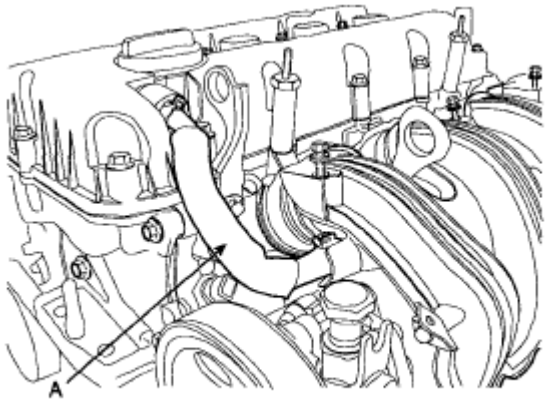


Fig. 224: Checking Piston Ring End Gap
Courtesy of HYUNDAI MOTOR CO.

PISTON PINS

1. Measure the diameter of the piston pin.

   Piston pin diameter

   23.002 ~ 23.006 mm (0.9056 ~ 0.9057 in.)

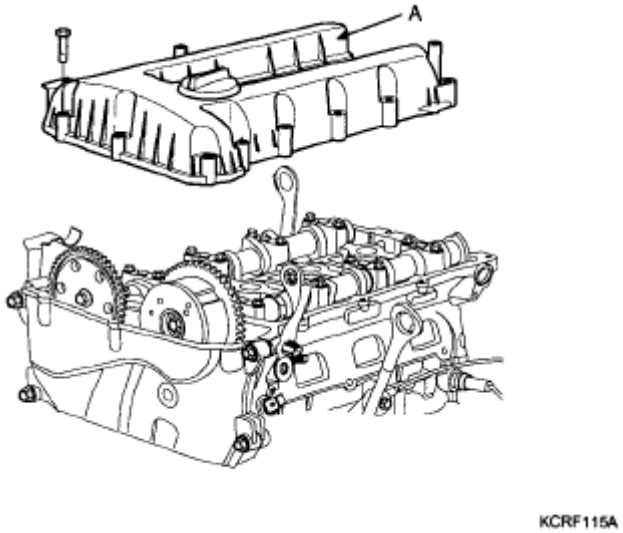


Fig. 225: Measuring Diameter Of Piston Pin
Courtesy of HYUNDAI MOTOR CO.

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

   Piston pin-to-piston clearance

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0.009 ~ 0.017 mm (0.0004 ~ 0.0007 in.)

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

   Piston pin-to-connecting rod interference

   -0.032 ~ -0.017 mm (-0.0013 ~ -0.0007 in.)

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 and the connecting rod front mark must face the timing belt side of the engine.

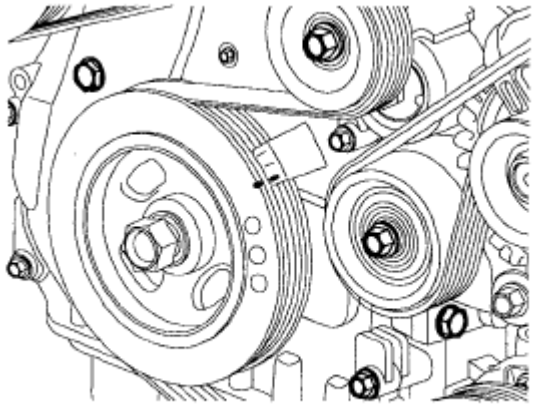


Fig. 226: Locating Piston Front Mark And Connecting Rod Front Mark
Courtesy of HYUNDAI MOTOR CO.

2. Install piston rings.
   1. Install the oil ring spacer 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 in the illustration.

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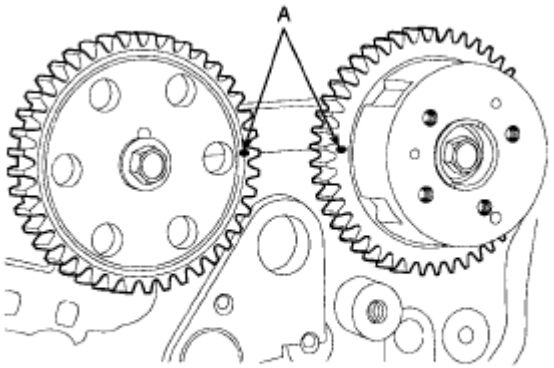


Fig. 227: Identifying Piston Rings Gap Direction
Courtesy of HYUNDAI MOTOR CO.

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 (A) in the connecting rod and connecting rod cap (B).

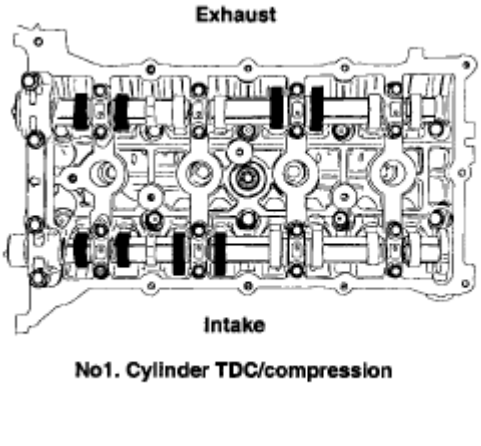


Fig. 228: Locating Bearings And Connecting Rod Cap
Courtesy of HYUNDAI MOTOR CO.

4. Install main bearings.

    Upper 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).

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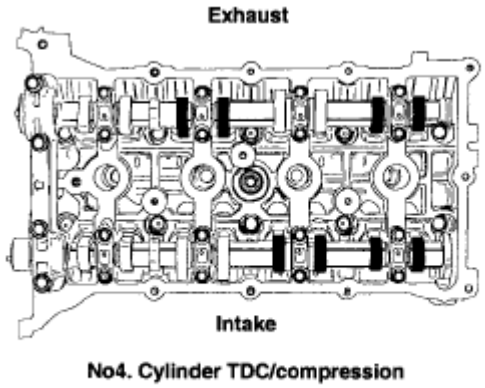


Fig. 229: Locating Upper Bearings
Courtesy of HYUNDAI MOTOR CO.

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

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.

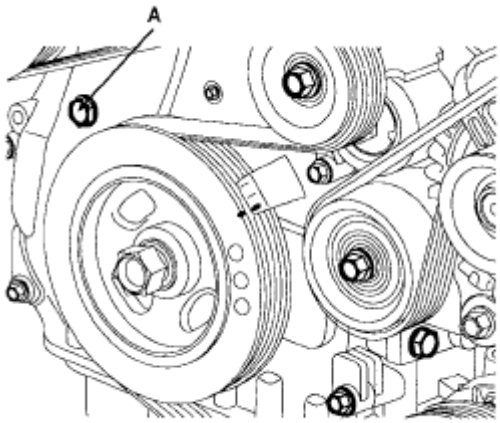


Fig. 230: Locating Thrust Bearings
Courtesy of HYUNDAI MOTOR CO.

6. Place crankshaft on the cylinder block.

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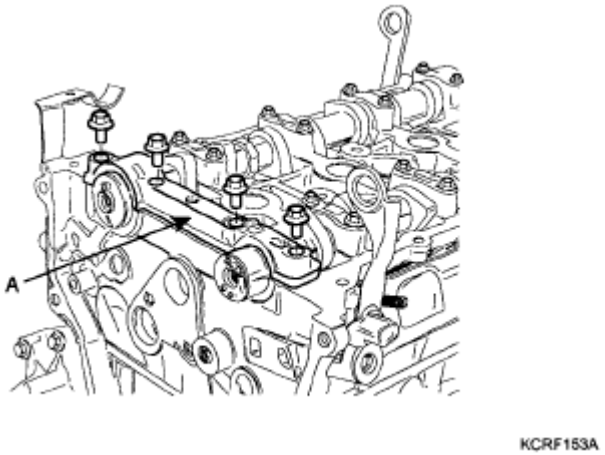


Fig. 231: Locating Crankshaft
Courtesy of HYUNDAI MOTOR CO.

7. Place main bearing caps on cylinder block.
8. Install main bearing cap bolts.
    1. Install and uniformly tighten the bearing cap bolts, in several passes, in the sequence shown in the illustration.

       Tightening torque

       Main bearing cap bolt

       49.00 Nm (5.0 kgf.m, 36.16 lb-ft) + 90° (1 ~ 8)

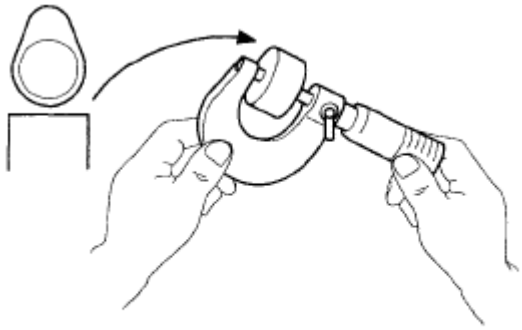
       19.60 Nm (2.0 kgf.m, 14.46 lb-ft) + 120° (9 ~ 16)

       29.40 ~ 31.36 Nm (3.0 ~ 3.2 kgf.m, 21.70 ~ 23.14 lb-ft) (17 ~ 22)

       NOTE:

       - **Always use new main bearing cap bolt.**
       - **If any of the bearing cap bolts in broken or deformed, replace it.**

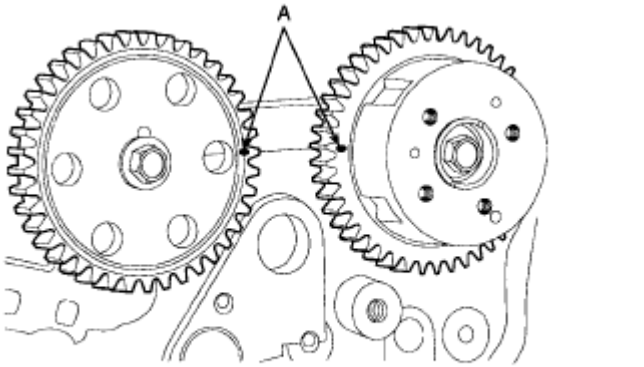
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EDKE869D

Fig. 232: Removing Main Bearing Cap Bolt In Sequence
Courtesy of HYUNDAI MOTOR CO.

Use SST (09221-4A000), install main bearing cap bolts.



ACRF007A

Fig. 233: Tightening Main Bearing Cap Bolts
Courtesy of HYUNDAI MOTOR CO.

2. Check that the crankshaft turns smoothly.

9. Check crankshaft end play.
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.

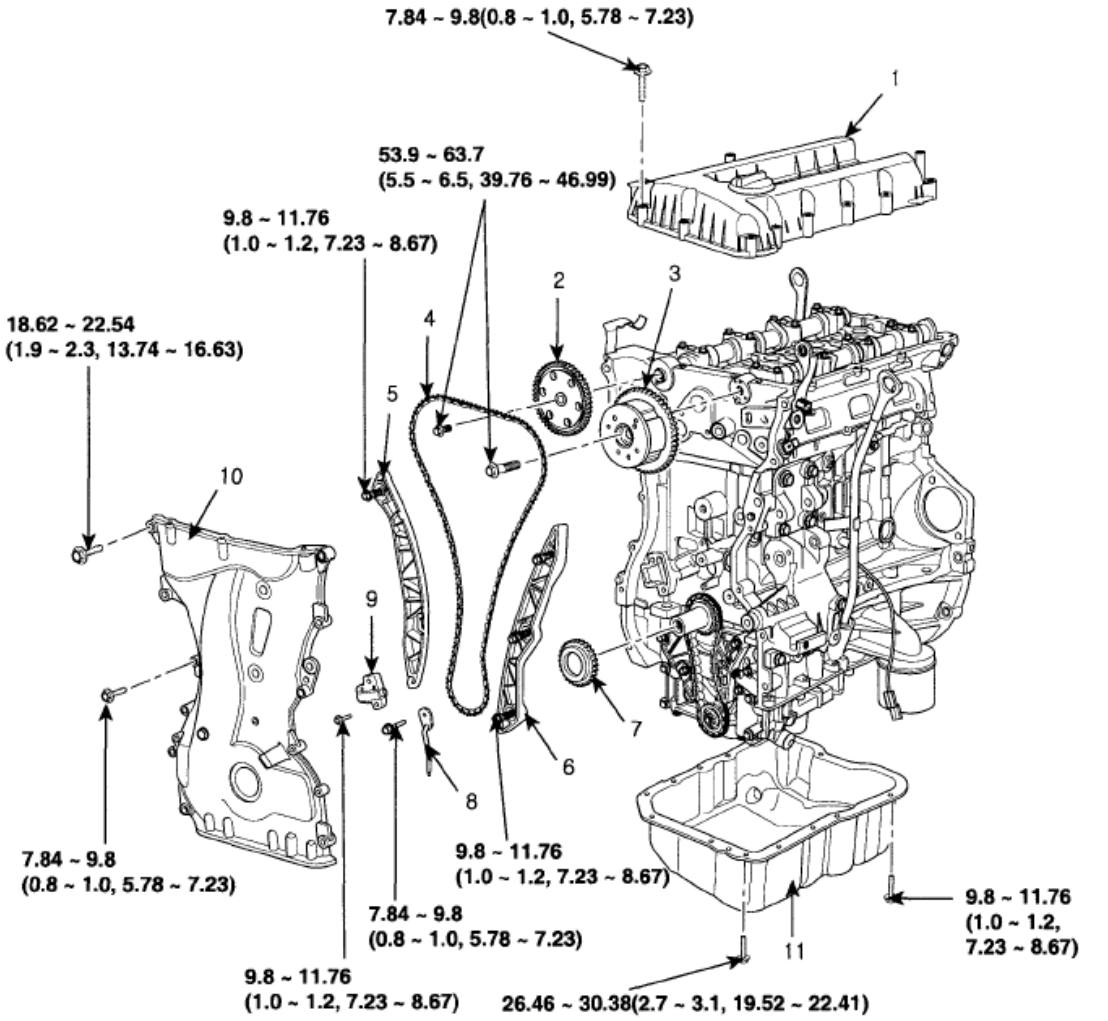
1. Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.
2. Stop after the ring compressor pops free, and check the connecting rod-to-check journal alignment before pushing the piston into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

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Tightening torque

19.6 Nm (2.0 kgf.m, 14.46 lb-ft) + 90°

Use SST (09221-4A000), install connecting rod bearing cap bolts.



TORQUE : N.m (kgf.m, lbf.ft)

1. Cylinder head cover
2. Exhaust camshaft sprocket
3. CVVT assembly
4. Timing chain
5. Timing chain tensioner arm
6. Timing chain guide
7. Crankshafe sprocket
8. Oil jet
9. Timing chain tensioner
10. Timing chain cover
11. Oil pan

ECRF004A

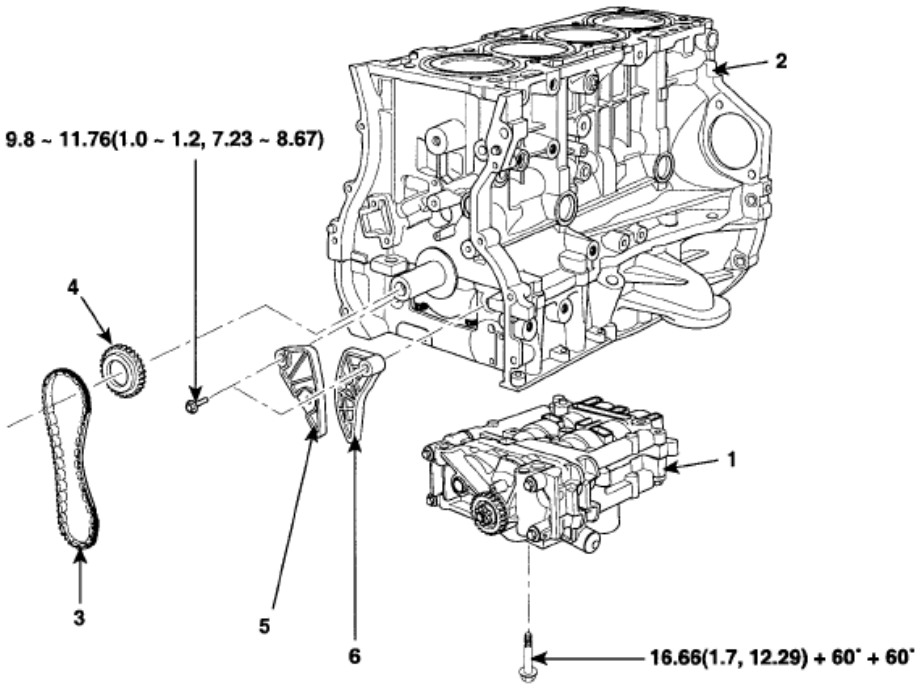
Fig. 234: Tightening Connecting Rod Bearing Cap Bolts
Courtesy of HYUNDAI MOTOR CO.

NOTE:

- **Always use new connecting rod bearing cap bolt.**
- **Maintain downward force on the ring compressor to prevent the rings**

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from expanding before entering the cylinder bore.



TORQUE : N.m (kgf.m, lbf.ft)

1. Balance shaft module
2. Cylinder block
3. Balance shaft chain
4. Balance shaft chain sprocket
5. Balance shaft chain guide
6. Balance shaft chain tensioner arm

ECRI

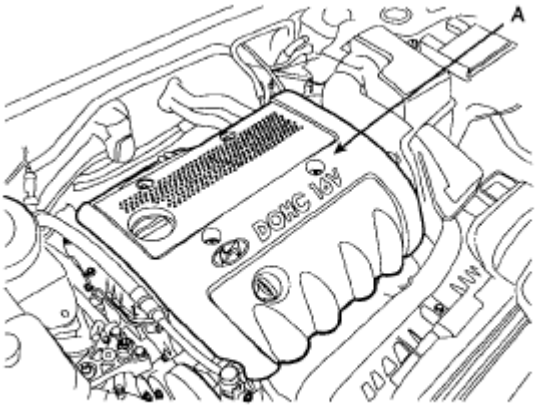
Fig. 235: Inserting Piston In Cylinder Bore
Courtesy of HYUNDAI MOTOR CO.

11. Check the connecting rod end play.
12. Install oil drain cover.

Tightening torque

9.80 ~ 11.76 Nm (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.67 lb-ft)

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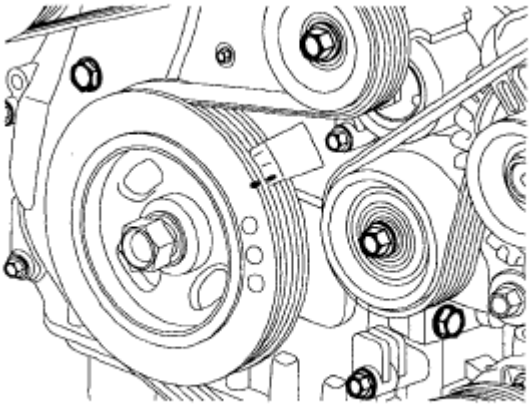


KCRF146A

Fig. 236: Locating Oil Drain Cover
Courtesy of HYUNDAI MOTOR CO.

NOTE:

- **Make clean the sealing face before assembling two parts.**
- **Remove harmful foreign matters on the sealing face before applying sealant**
- **Be assembling oil drain cover, the liquid sealant TB1217H should be applied oil drain cover.**
- **The part must be assembled within 5 minutes after sealant was applied.**
- **Apply sealant to the inner threads of the bolt holes.**



KCRF107A

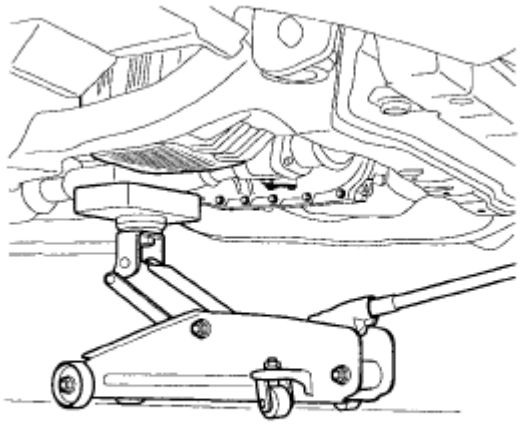
Fig. 237: Applying Sealant To Inner Threads Of Bolt Holes
Courtesy of HYUNDAI MOTOR CO.

13. Install rear oil seal case.

Tightening torque

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9.80 ~ 11.76 Nm (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.67 lb-ft)

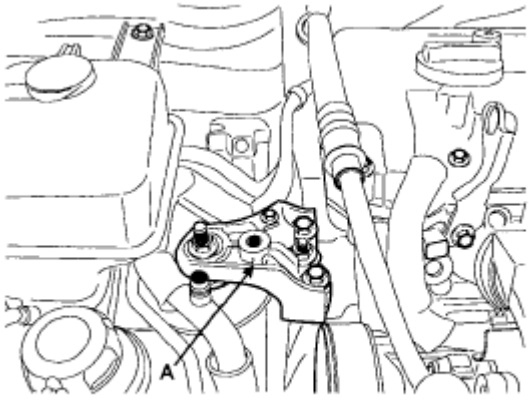


ECKD102A

Fig. 238: Locating Rear Oil Seal Case
Courtesy of HYUNDAI MOTOR CO.

NOTE:

- **Make clean the sealing face before assembling two parts.**
- **Remove harmful foreign matters on the sealing face before applying sealant**
- **Be assembling rear oil seal case, the liquid sealant TB1217H should be applied rear oil seal case.**
- **The part must be assembled within 5 minutes after sealant was applied.**
- **Apply sealant to the inner threads of the bolt holes.**



KCRF137A

Fig. 239: Applying Sealant To Inner Threads Of Bolt Holes
Courtesy of HYUNDAI MOTOR CO.

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14. Using SST (09231~3C200, 09231~H1100), install rear oil seal.

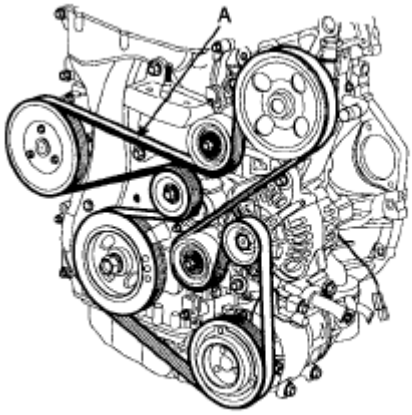


Fig. 240: Installing Rear Oil Seal
Courtesy of HYUNDAI MOTOR CO.

15. Install baffle plate.

    Install and uniformly tighten the baffle plate bolts, in several passes, in the sequence shown in the illustration.

    Tightening torque

    9.80 ~ 11.76 Nm (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

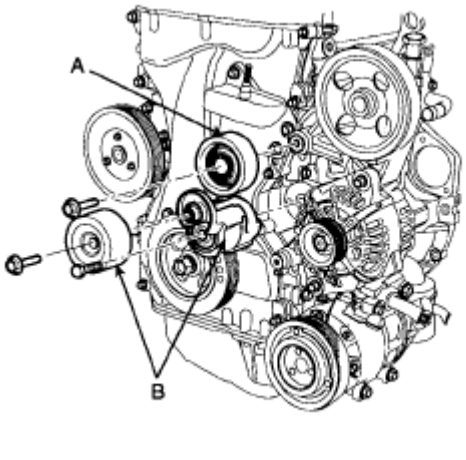


Fig. 241: Tightening Baffle Plate Bolts In Sequence
Courtesy of HYUNDAI MOTOR CO.

16. Install upper oil pan.
    a. Using a gasket scraper, remove all the old packing material from the gasket surfaces.

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b. Before assembling the oil pan, the liquid sealant TB1217H should be applied on upper oil pan. The part must be assembled within 5 minutes after the sealant was applied.

Bead width: 2.5 mm (0.1 in.)

CAUTION:

- **Make clean the sealing face before assembling two parts.**
- **Remove harmful foreign matters on the sealing face before applying sealant**
- **When applying sealant gasket, sealant must not be protruded into the inside of oil pan.**
- **To prevent leakage of oil, apply sealant gasket of the inner threads of the bolt holes.**

c. Install oil pan.

Uniformly tighten the bolts in several passes.

Tightening torque

9.80 ~ 11.76 Nm (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

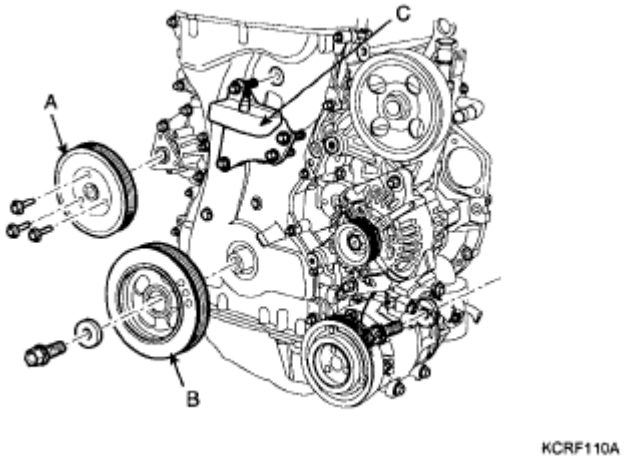


Fig. 242: Tightening Oil Pan Bolts In Sequence
Courtesy of HYUNDAI MOTOR CO.

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

17. Install knock sensor.

Tightening torque

15.68 ~ 23.52 Nm (1.6 ~ 2.4 kgf.m, 11.57 ~ 17.36 lb-ft)

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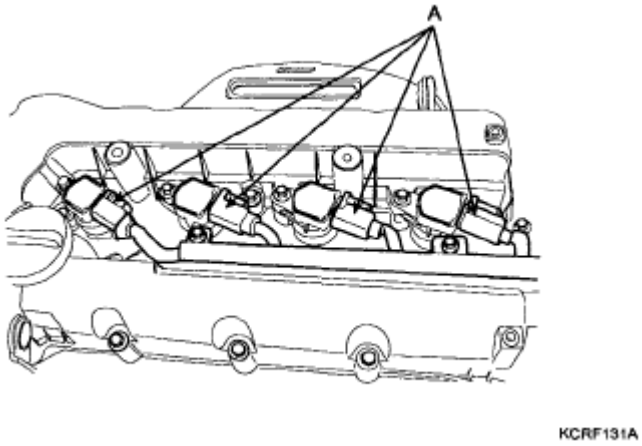


Fig. 243: Locating Knock Sensor
Courtesy of HYUNDAI MOTOR CO.

18. Install drive plate.

    Tightening torque

    71.54 ~ 75.46 Nm (7.3 ~ 7.7 kgf.m, 52.80 ~ 55.69 lb-ft)

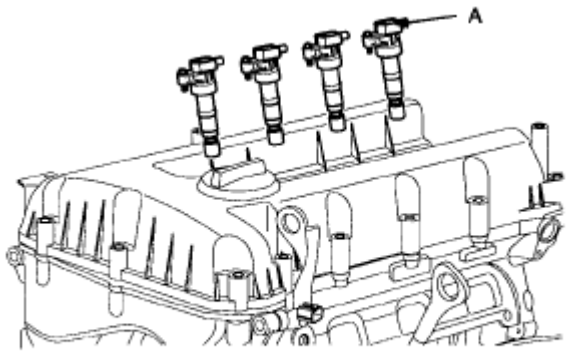
INSTALLATION

1. Install power steering pump.
2. Install alternator.
3. Install air compressor
4. Install oil filter assembly.
5. Install oil pump.
6. Install cylinder head.
7. Install water temperature control assembly.
8. Install timing chain.
9. Install intake manifold.
10. Install exhaust manifold.

COOLING SYSTEM

COMPONENTS

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KCRF111A

Fig. 244: Identifying Cooling System Components And Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

ENGINE COOLANT REFILLING AND BLEEDING

WARNING: Never remove the radiator cap when the engine is hot. Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

CAUTION: When pouring engine coolant, be sure to shut the relay box lid and not to let coolant spill on the electrical parts or the paint. If any coolant spills, rinse it off immediately.

1. Make sure the engine and radiator are cool to the touch.
2. Remove radiator cap.
3. Loosen the drain plug, and drain the coolant.
4. Tighten the radiator drain plug securely.
5. Remove, drain and reinstall the reservoir. Fill the tank halfway to the MAX mark with water, then up to the MAX mark with antifreeze.
6. Fill fluid mixture with coolant and water (4 : 6) slowly through the radiator cap. Push the upper/lower hoses of the radiator so as bleed air easily.

NOTE:

- **Use only genuine antifreeze/coolant.**
- **For best corrosion protection, the coolant concentration must be maintained year-round at 50% minimum.**

  Coolant concentrations less than 50% may not provide sufficient protection against corrosion or freezing.

- **Coolant concentrations greater then 60% will impair cooling**

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efficiency and are not recommended.

CAUTION:
- **Do not mix different brands of antifreeze/coolants.**
- **Do not use additional rust inhibitors or antirust products; they may not be compatible with the coolant.**

7. Start the engine and run coolant circulates.

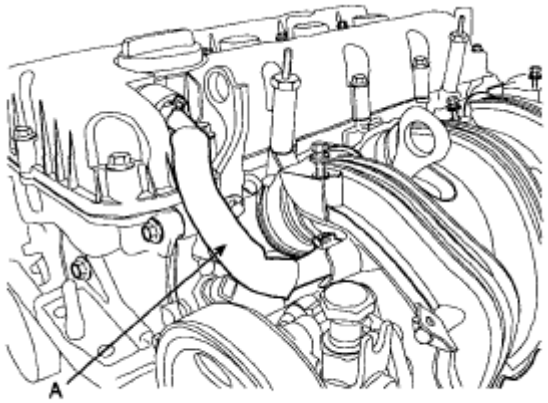
   When the cooling fan operates and coolant circulates, refill coolant through the radiator cap.

8. Repeat 7 until the cooling fan 3 ~ 5 times and bleed air sufficiently out of the cooling system.
9. Install the radiator cap and fill the reservoir tank to the "MAX" line with coolant.
10. Run the vehicle under idle until the cooling fan operates 2~3 times.
11. Stop the engine and wait coolant gets cool.
12. Repeat 6 to 11 until the coolant level doesn't fall any more, bleed air out of the cooling system.

NOTE: **As it is to bleed air out to the cooling system and refill coolant when coolant gets cool completely, recheck the coolant level in the reservoir tank for 2 ~ 3 days after replacing coolant.**

CAP TESTING

1. Remove the radiator cap, wet its seal with engine coolant, then install it no pressure tester.



KCRF141E

Fig. 245: Checking Radiator Cap
Courtesy of HYUNDAI MOTOR CO.

2. Apply a pressure of 93 ~ 123 kPa (0.95 ~ 1.25 kgf/cm^2 14 ~ 19 psi)
3. Check for a drop in pressure.
4. If the pressure drops, replace the cap.

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TESTING

1. Wait until engine is cool, then carefully remove the radiator cap and fill the radiator with engine coolant, then install it on the pressure tester.

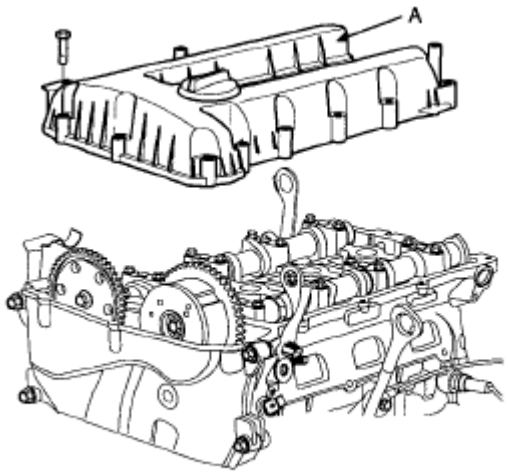


Fig. 246: Identifying Radiator Cap
Courtesy of HYUNDAI MOTOR CO.

2. Apply a pressure tester to the radiator and apply a pressure of 93 ~ 123 kPa (0.95 ~ 1.25 kgf/cm^2 14 ~ 18 psi).
3. Inspect for engine coolant leaks and a drop in pressure.
4. Remove the tester and reinstall the radiator cap.

NOTE: Check for engine oil in the coolant and/or coolant in the engine oil.

REMOVAL

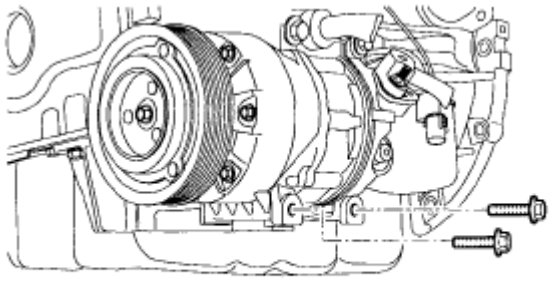
WATER PUMP

1. Drain the engine coolant.

WARNING: System is under high pressure when the engine is hot. To avoid danger of releasing scalding engine coolant, remove the cap only when the engine is cool.

2. Remove drive belt (A).

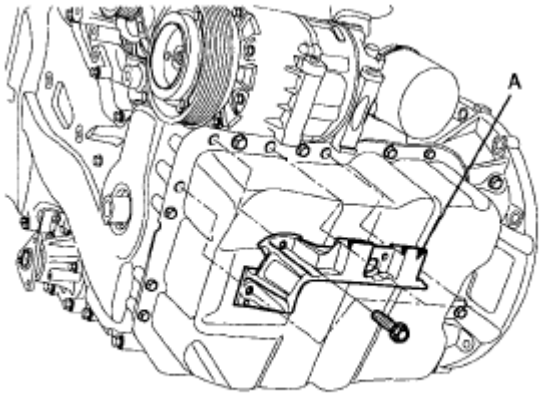
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KCRF112A

Fig. 247: Identifying Drive Belt Routing
Courtesy of KIA MOTORS AMERICA, INC.

3. Remove the 4 bolts and pump pulley (A).



KCRF113A

Fig. 248: Locating Bolts And Pump Pulley
Courtesy of HYUNDAI MOTOR CO.

4. Remove the water pump (A) and gasket.

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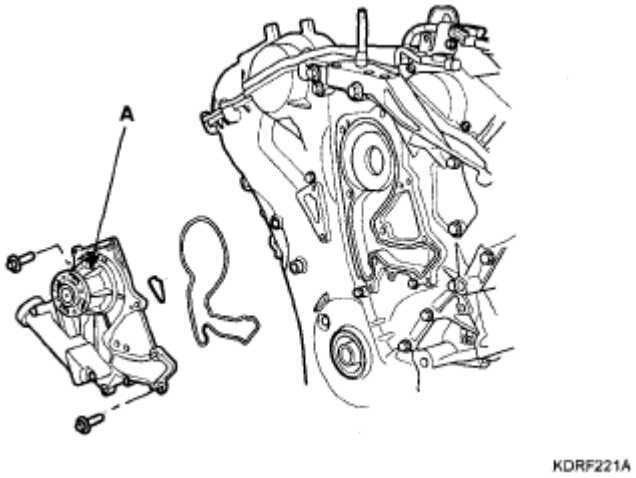


Fig. 249: Locating Water Pump
Courtesy of HYUNDAI MOTOR CO.

WATER TEMPERATURE CONTROL ASSEMBLY

1. Drain the engine coolant.
2. Remove air cleaner assembly.
3. Disconnect radiator upper and lower hose (A, B).

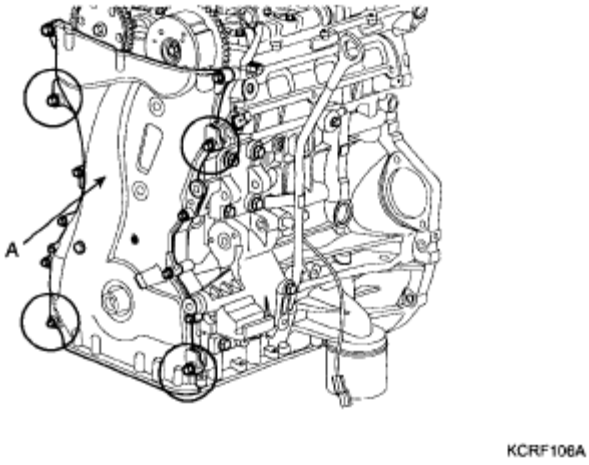
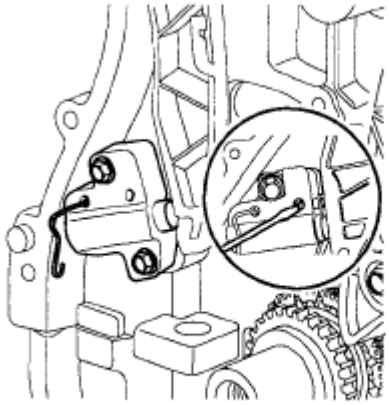


Fig. 250: Locating Radiator Upper And Lower Hose
Courtesy of HYUNDAI MOTOR CO.

4. Disconnect WTS connector.
5. Disconnect heater hose, water vent hose and water hose from water temperature control assembly.
6. Remove wiring protector.
7. Remove water temperature control assembly (A).

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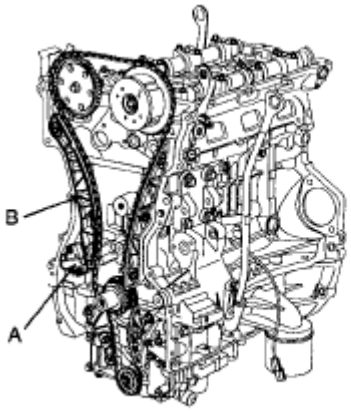
KCRF105A

Fig. 251: Locating Water Temperature Control Assembly
Courtesy of HYUNDAI MOTOR CO.

THERMOSTAT

NOTE: Removal of the thermostat would have an adverse effect, causing a lowering of cooling efficiency. Do not remove the thermostat, even if the engine tends to overheat.

1. Drain engine coolant so its level is below thermostat.
2. Remove water inlet (A) and thermostat (B).



KCRF104A

Fig. 252: Locating Water Inlet And Thermostat
Courtesy of HYUNDAI MOTOR CO.

RADIATOR

1. Drain the engine coolant. Remove the radiator cap to speed coolant draining.
2. Remove the air duct.

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

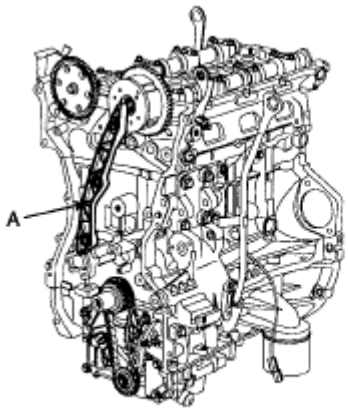


Fig. 253: Locating Radiator Upper And Lower Hoses
Courtesy of HYUNDAI MOTOR CO.

4. Disconnect the radiator fan connector. (A,B)

LH

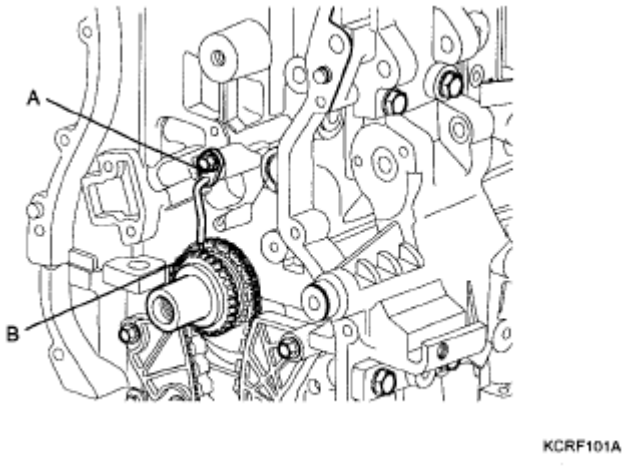


Fig. 254: Identifying Radiator Fan Connector (LH)
Courtesy of HYUNDAI MOTOR CO.

RH

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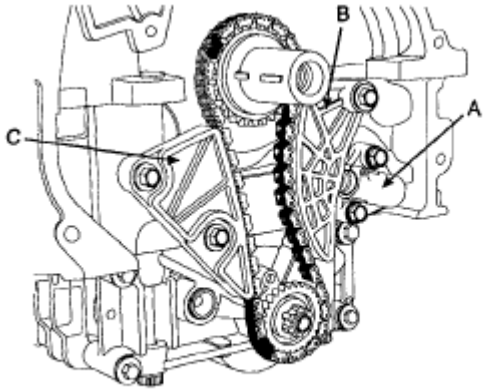


Fig. 255: Identifying Radiator Fan Connector (RH)
Courtesy of HYUNDAI MOTOR CO.

5. Remove the radiator grill upper cover. (A)

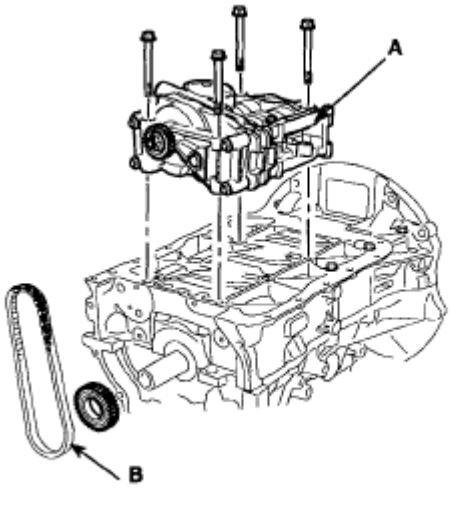


Fig. 256: Identifying Upper Radiator Grill cover
Courtesy of HYUNDAI MOTOR CO.

6. Remove the head lamp washer nozzle cover and front bumper. (refer to **FRONT BUMPER**
7. Remove the radiator cap hose (A).

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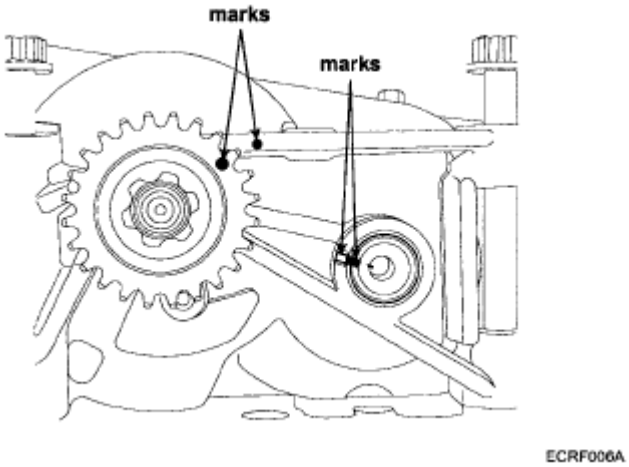


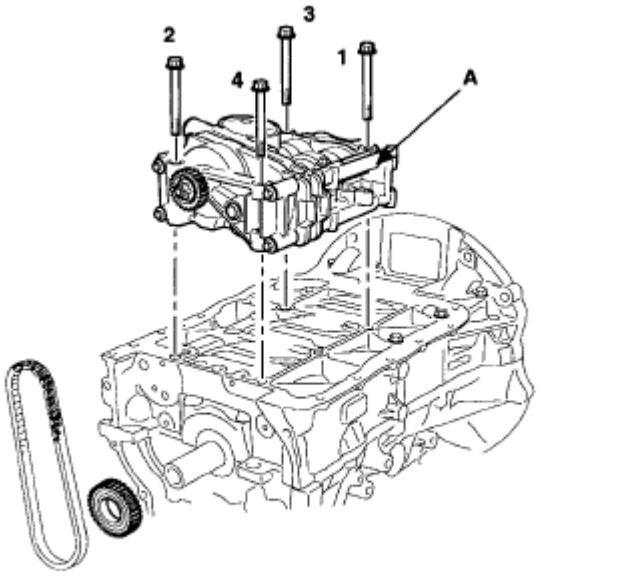
Fig. 257: Identifying Radiator Cap Hose
Courtesy of HYUNDAI MOTOR CO.

8. First, remove the cooling fan. (First, separate LH side)

NOTE: Remove the bracket bolt of radiator lower hose.

9. Recover refrigerant by opening the high & low pressure pipe caps and connecting the refrigerant station. (Refer to **AIR CONDITIONING SYSTEM**)
10. Remove the air conditioner condenser.
11. Remove the radiator bracket bolt of the radiator upper side (A).

LH



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Fig. 258: Identifying Radiator Bracket Bolt (LH)
Courtesy of HYUNDAI MOTOR CO.

RH

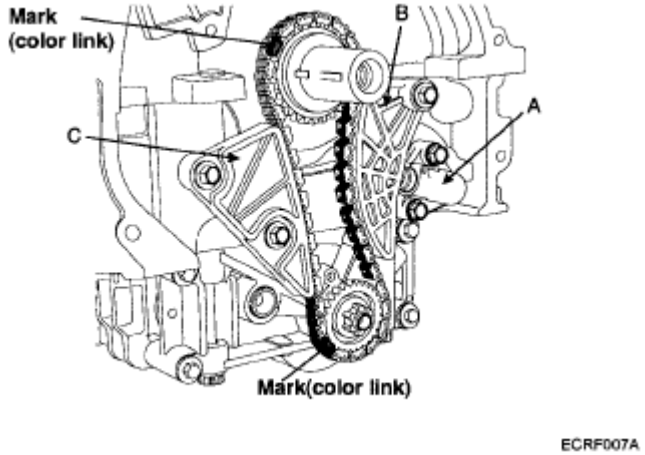


Fig. 259: Identifying Radiator Bracket Bolt (RH)
Courtesy of HYUNDAI MOTOR CO.

12. Remove the radiator assembly from the engine.

INSPECTION

WATER PUMP

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

NOTE: A small amount of "weeping" from the bleed hole is normal.

THERMOSTAT

1. Immerse the thermostat in water and gradually heat the water.

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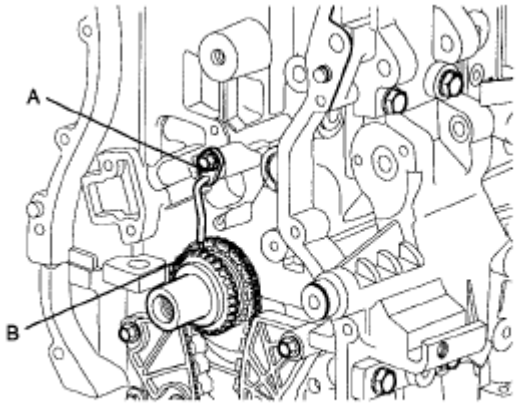


Fig. 260: Checking Thermostat Opening Temperature
Courtesy of HYUNDAI MOTOR CO.

2. Check the valve opening temperature.

   Valve opening temperature: 82°C (177°F)

   Full opening temperature: 95°C (205°F)

   If the valve opening temperature is not as specified, replace the thermostat.

3. Check the valve lift.

   Valve lift: Min. 10 mm (0.4 in.) at 95°C (205°F)

   If the valve lift is not as specified, replace the thermostat.

INSTALLATION

WATER PUMP

1. Install the water pump (A) and a new gasket (B) with 12 bolts. Apply sealant on C.

   Tightening torque

   21.56 ~ 23.52 Nm (2.2 ~ 2.4 kgf.m, 15.91 ~ 17.36 lb-ft)

   9.80 ~ 11.76 Nm (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

   Sealant : Three bond 13868 or 13860

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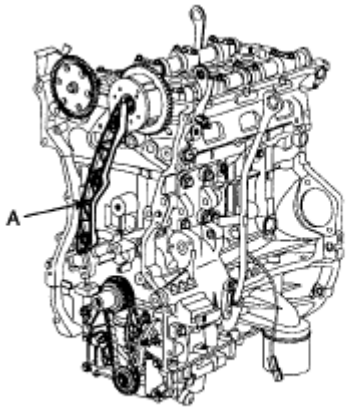


Fig. 261: Locating Water Pump And Gasket
Courtesy of HYUNDAI MOTOR CO.

NOTE: Make clean the contact face before assembly.

2. Install the 4 bolts and pump pulley (A).

Tightening torque

7.84 ~ 9.80 Nm (0.8 ~ 1.0 kgf.m, 5.78 ~ 7.23 lb-ft)

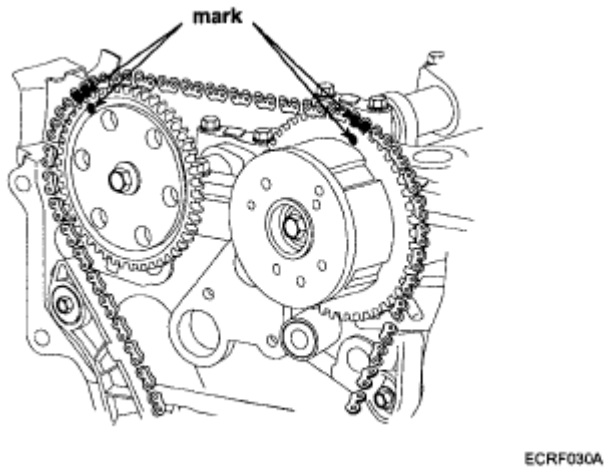


Fig. 262: Locating Bolts And Pump Pulley
Courtesy of HYUNDAI MOTOR CO.

3. Install drive belt (A).

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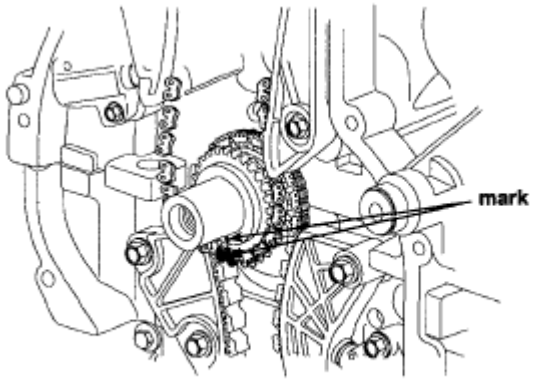


Fig. 263: Identifying Drive Belt Routing
Courtesy of KIA MOTORS AMERICA, INC.

4. Fill with engine coolant.
5. Start engine and check for leaks.
6. Recheck engine coolant level.

WATER TEMPERATURE CONTROL ASSEMBLY

NOTE: Make clean the contact face before assembly.

1. Install water temperature control assembly (B) and new gasket (A).

   Tightening torque

   18.62 ~ 23.52 Nm (1.9 ~ 2.4 kgf.m, 13.74 ~ 17.36 lb-ft)

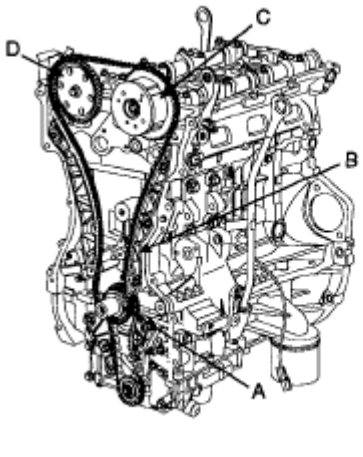


Fig. 264: Locating Water Temperature Control Assembly And Gasket
Courtesy of HYUNDAI MOTOR CO.

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NOTE: Use new O-rings (C) when reassembling.

2. Connect water hoses to the water temperature control assembly.
3. Install wiring protector.
4. Connect WTS connector.
5. Connect radiator upper and lower hose (A, B).

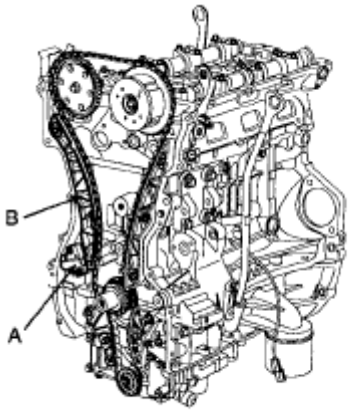


Fig. 265: Locating Radiator Upper And Lower Hose
Courtesy of HYUNDAI MOTOR CO.

6. Install air cleaner assembly.
7. Fill with engine coolant.
8. Start engine and check for leaks.
9. Recheck engine coolant level.

THERMOSTAT

1. Place thermostat in thermostat housing.
    1. Install the thermostat with the jiggle valve upward.
    2. Install a new thermostat (B).

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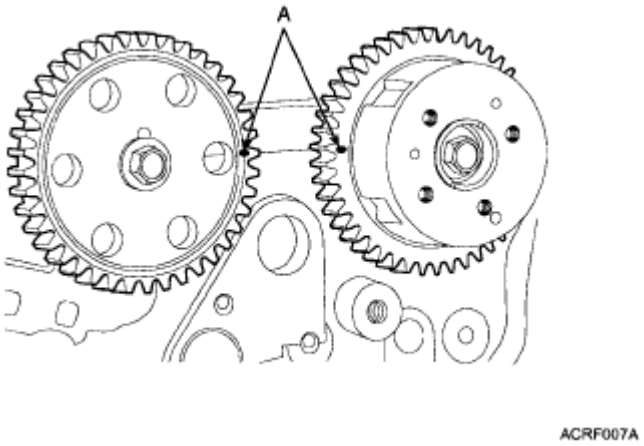


Fig. 266: Locating Water Inlet And Thermostat
Courtesy of HYUNDAI MOTOR CO.

2. Install water inlet (A).

   Tightening torque

   16.66 ~ 19.60 Nm (1.7 ~ 2.0 kgf.m, 12.30 ~ 14.47 lb-ft)

3. Fill with engine coolant.
4. Start engine and check for leaks.

RADIATOR

1. Install the engine from radiator assembly.
2. Install the radiator bracket bolt. (A)

   LH

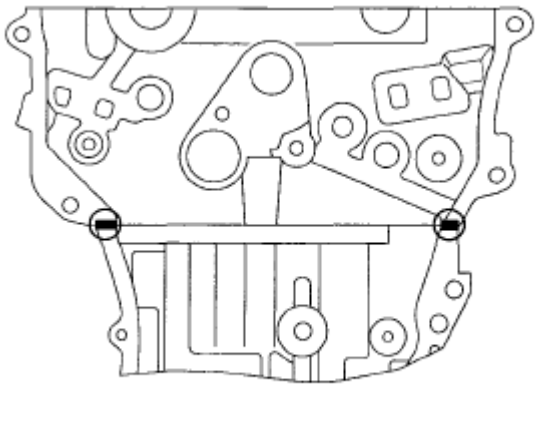


Fig. 267: Identifying Radiator Bracket Bolt (LH)

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Courtesy of HYUNDAI MOTOR CO.

RH

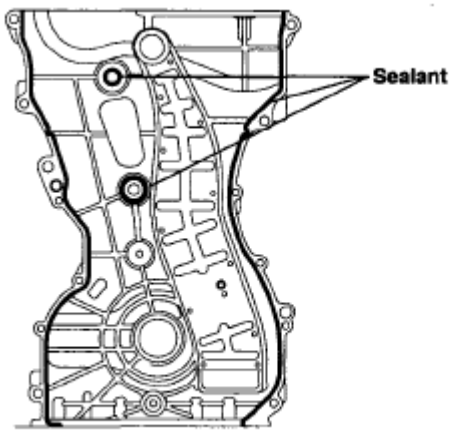


Fig. 268: Identifying Radiator Bracket Bolt (RH)
Courtesy of HYUNDAI MOTOR CO.

3. Install the air conditioner condenser. (Refer to **HEATING, VENTILATION & AIR CONDITIONING**)
4. Install the cooling fan
5. Install the radiator cap hose. (A)

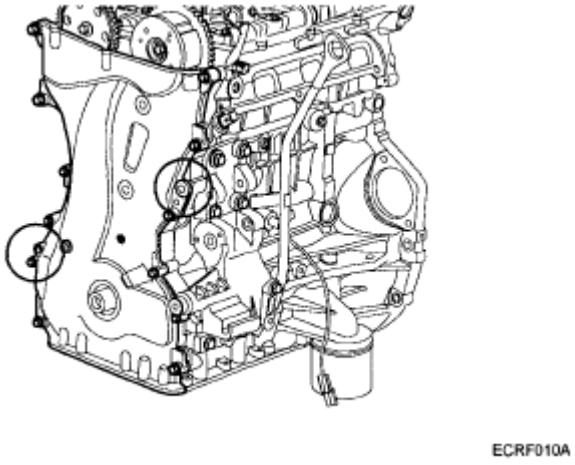
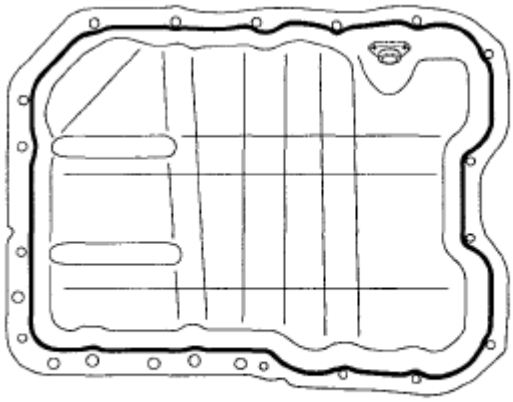


Fig. 269: Identifying Radiator Cap Hose
Courtesy of HYUNDAI MOTOR CO.

6. Install the front bumper and head lamp washer nozzle cover. (Refer to **FRONT BUMPER**)
7. Install the radiator grill upper cover. (A)

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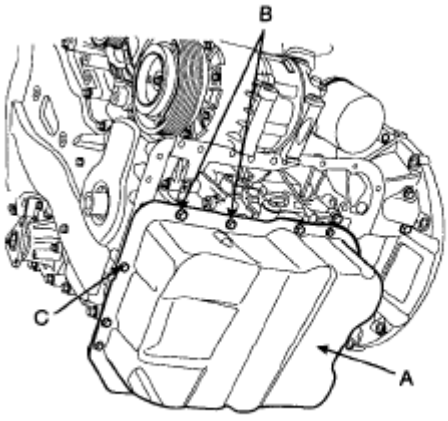


KCRF179A

Fig. 270: Identifying Upper Radiator Grill cover
Courtesy of HYUNDAI MOTOR CO.

8. Connect the radiator fan connector. (A, B)

LH



KCRF114B

Fig. 271: Identifying Radiator Fan Connector (LH)
Courtesy of HYUNDAI MOTOR CO.

RH

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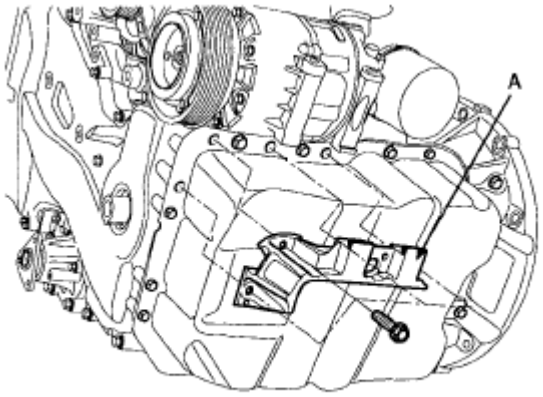


Fig. 272: Identifying Radiator Fan Connector (RH)
Courtesy of HYUNDAI MOTOR CO.

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

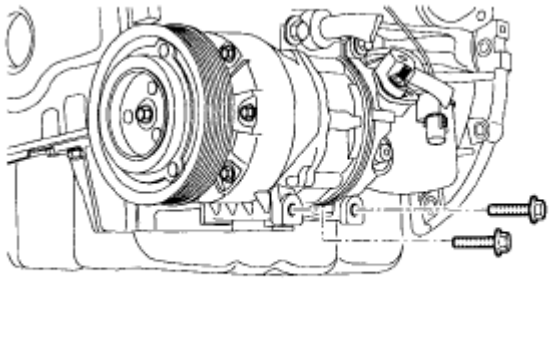


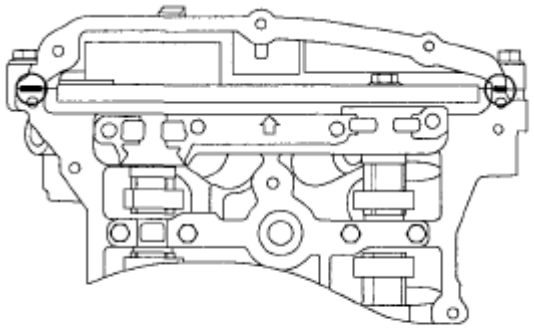
Fig. 273: Locating Radiator Upper And Lower Hoses
Courtesy of HYUNDAI MOTOR CO.

10. Install the air duct.
11. Refill with engine coolant

LUBRICATION SYSTEM

COMPONENTS

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Fig. 274: Identifying Lubrication System Components And Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

OIL AND FILTER

CAUTION:

- **Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.**
- **Exercise caution in order to minimize the length and frequency of contact of your skin to used oil. Wear protective clothing and gloves. Wash your skin thoroughly with soap and water, or use water-less hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.**
- **In order to preserve the environment, used oil and used oil filter must be disposed of only at designated disposal sites.**

1. Park the car on level ground. Start the engine and let it warm up.
2. Turn the engine off and open the hood. Remove the engine cover.
3. Wait for 5 minutes after loosening the oil filter cap by turning it counterclockwise with SST (09263~3C100) to drain well the oil in the oil filter.

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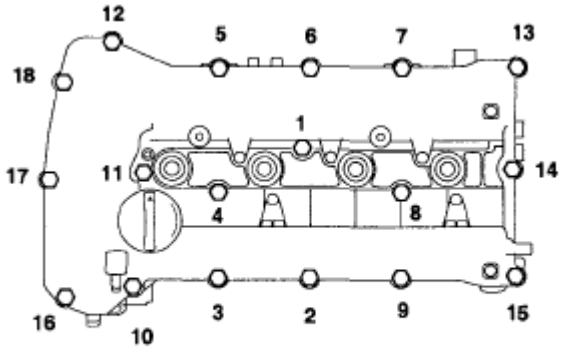


Fig. 275: Loosening Oil Filter Cap By Turning
Courtesy of HYUNDAI MOTOR CO.

4. Drain the engine oil.
   a. Remove the oil filler cap.
   b. After lifting the car, remove the oil drain plug and drain the oil into a container.
5. Replace oil filter.
   a. Disconnect the oil filter cap from oil filter body.
   b. Remove the oil filter element.
   c. Check and clean the oil filter installation surface.
   d. Check the part number of the new oil filter is as same as old one.
   e. Install new oil filter element (A) and two new

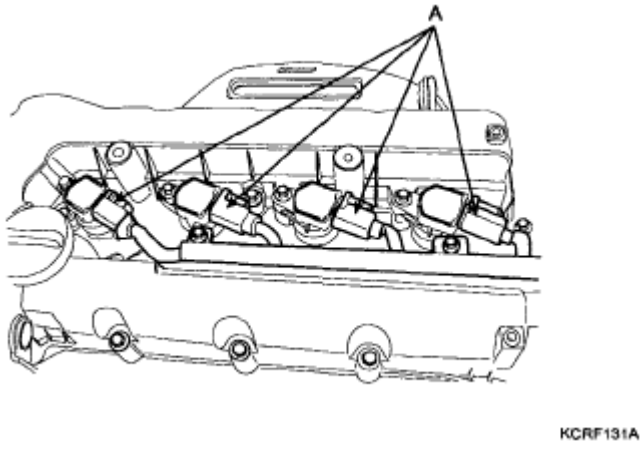


Fig. 276: Locating Oil Filter Element And O-Rings
Courtesy of HYUNDAI MOTOR CO.

   f. Apply clean engine oil to the new O-rings. Lightly screw the oil filter cap into place, and tighten it until the O-ring contacts the seat.
   g. Finally tighten it again by specified tightening torque.

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Tightening torque

24.50 Nm (2.5 kgf.m, 18.08 lb-ft)

6. Refill with engine oil.
   a. Install the oil drain plug with a new gasket.

      Tightening torque

      34.3 ~ 44.1 Nm (3.5 ~ 4.5 kgf.m, 25.3 ~ 32.5 lb-ft)

   b. Fill with fresh engine oil, after remove the engine oil level gauge.

      Capacity

      Total: 6.0L (6.34 U.S.qts, 5.28 lmp.qts)

      Oil pan: 5.5L (5.81 U.S.qts, 4.84 lmp.qts)

      Drain and refill including oil filter: 5.2L (5.49 U.S.qts, 4.58 lmp.qts)

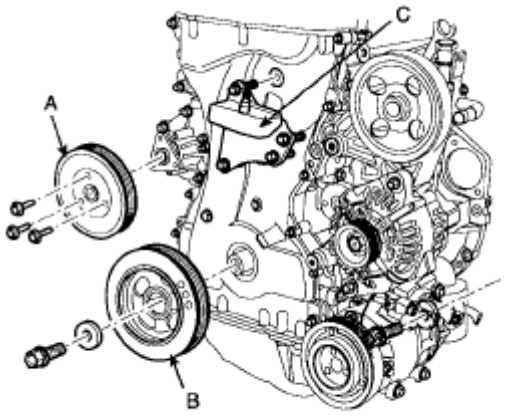
      Oil quality: Above API SJ/ SL or SAE 5W-20

   c. Install the oil filler cap and oil level gauge.
7. Start the engine and check to be sure no oil is leaking from the drain plug or oil filter.

REMOVAL

OIL PUMP

1. Drain engine oil.
2. Using SST (09215~3C000) remove lower oil pan (A).



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Fig. 277: Locating Lower Oil Pan
Courtesy of HYUNDAI MOTOR CO.

CAUTION: Be careful not to damage the contact surfaces of upper oil pan and lower oil pan.

3. Remove oil pump chain cover (A).

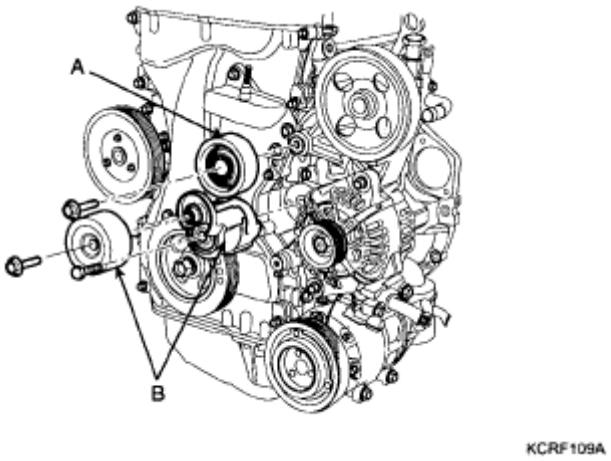


Fig. 278: Locating Oil Pump Chain Cover
Courtesy of HYUNDAI MOTOR CO.

4. Remove oil pump chain sprocket (A).

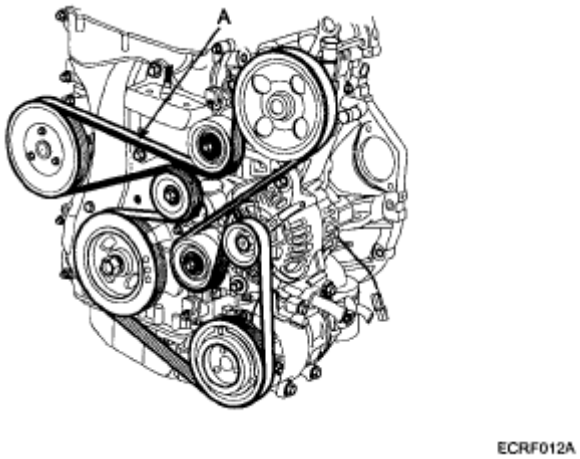
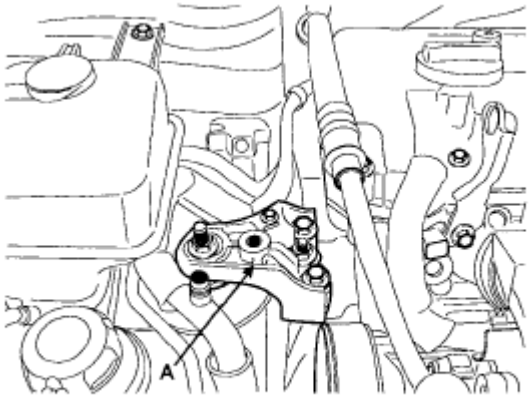


Fig. 279: Locating Oil Pump Chain Sprocket
Courtesy of HYUNDAI MOTOR CO.

5. Remove oil pump (A).

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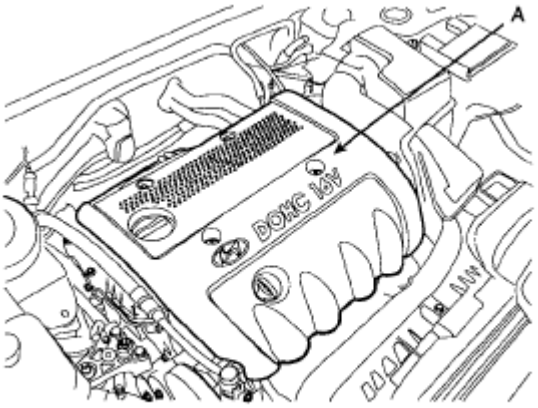


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Fig. 280: Locating Oil Pump
Courtesy of HYUNDAI MOTOR CO.

OIL FILTER ASSEMBLY

1. Loosen the oil filter cap by turning it counterclockwise to drain well the oil in the oil filter.
2. Remove surge tank and intake manifold.
3. Disconnect oil pressure switch connector.
4. Drain the engine coolant.
5. Disconnect water hoses from ETC.
6. Remove water temperature control assembly.
7. Disconnect water vent hose (A).
8. Remove oil filter body cover (B).



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Fig. 281: Locating Water Vent Hose And Oil Filter Body Cover
Courtesy of HYUNDAI MOTOR CO.

9. Remove oil filter body.

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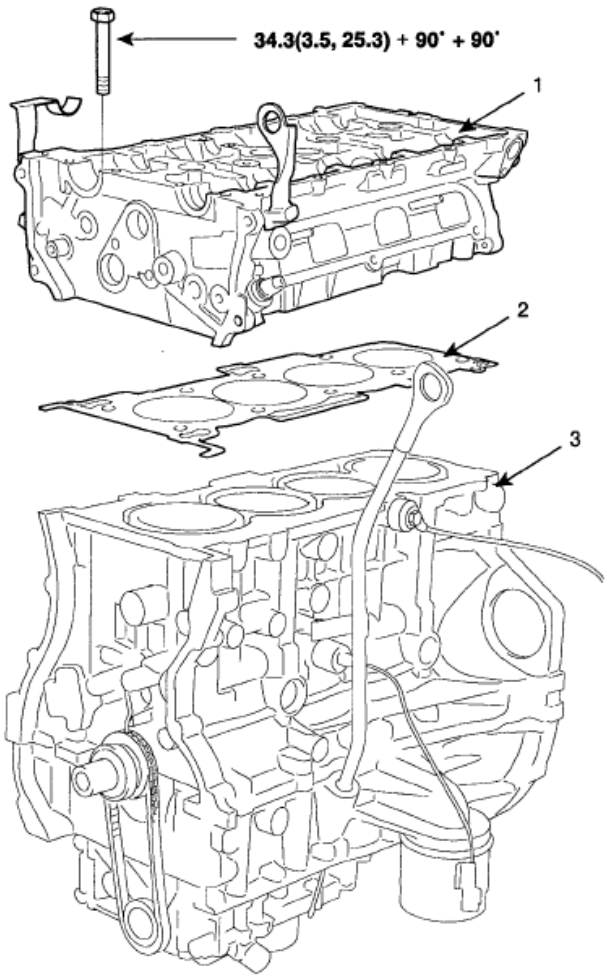
NOTE: Be careful of the knock sensor connector.

INSPECTION

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.



TORQUE : N.m (kgf.m, lbf.ft)

1. Cylinder head
2. Cylinder head gasket
3. Cylinder block

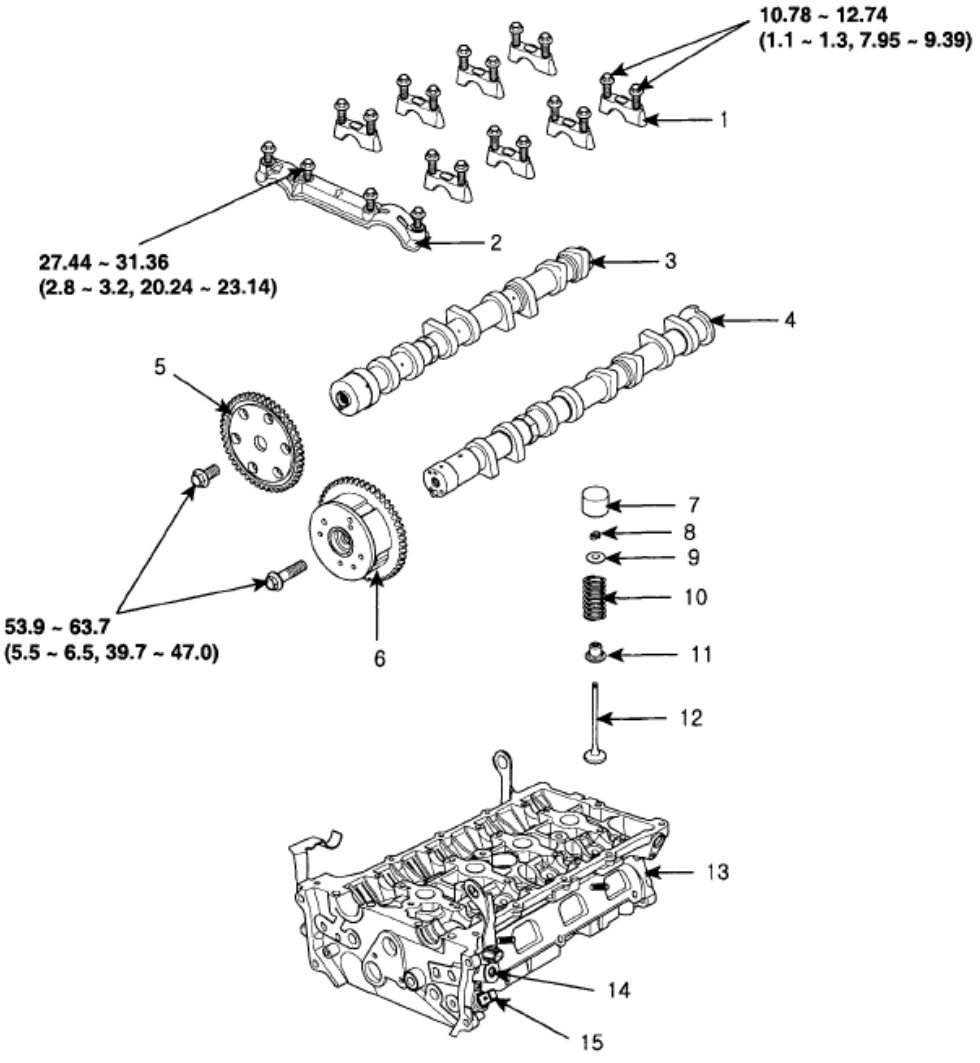
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Fig. 282: Checking Continuity Between Terminal And Body
Courtesy of HYUNDAI MOTOR CO.

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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 50 kpa (7 psi) 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.



TORQUE : N.m (kgf.m, lbf.ft)

1. Camshaft bearing cap
2. Camshaft front bearing cap
3. Exhaust camshaft
4. Intake camshaft
5. Exhaust camshaft sprocket
6. CVVT assembly
7. MLA
8. Retainer lock
9. Retainer
10. Valve spring
11. Valve stem seal
12. Valve
13. Cylinder head
14. OCV
15. OTS

ECRF014A

Fig. 283: Checking Continuity Between Terminal And Body
Courtesy of HYUNDAI MOTOR CO.

ENGINE OIL

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1. Check engine oil quality.

   Check the oil for deterioration, entry of water, discoloring or thinning.

   If the quality is visibly poor, replace the oil.

2. Check engine oil level.

   After warming up the engine and then 5 minutes after the engine stop, oil level should be between the "L" and "F" marks on the dipstick.

   If low, check for leakage and add oil up to the "F" mark.

NOTE: Do not fill with engine oil above the "F" mark.

SELECTION OF ENGINE OIL

Recommended API classification: Above SJ or SL

Recommended SAE viscosity grades: 5W-20

If 5W-20 engine oil is not available, 5W-30 or secondary recommended engine oil for corresponding temperature range can be used.

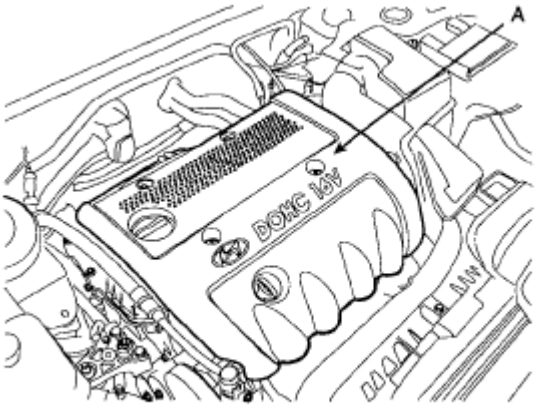


Fig. 284: SAE Viscosity Grades Chart
Courtesy of HYUNDAI MOTOR CO.

NOTE: For best performance and maximum protection of all types of operation, select only those lubricants which:

- **Satisfy the requirement of the API classification.**
- **Have proper SAE grade number for expected ambient temperature range.**

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Lubricants that do not have both an SAE grade number and API service classification on the container should not be used.

INSTALLATION

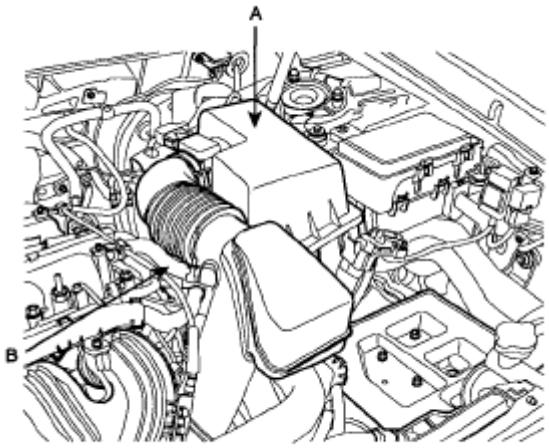
OIL PUMP

1. Install oil pump (A).

   Tightening torque

   19.60 ~ 23.52 Nm (2.0 ~ 2.4 kgf.m, 14.47 ~ 17.36 lb-ft)

   NOTE: Always use a new O-ring.



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Fig. 285: Locating Oil Pump
Courtesy of HYUNDAI MOTOR CO.

2. Install oil pump sprocket (A)and oil pump chain on the oil pump.

   Tightening torque

   18.62 ~ 21.56 Nm (1.9 ~ 2.2 kgf.m, 13.74 ~ 15.91 lb-ft)

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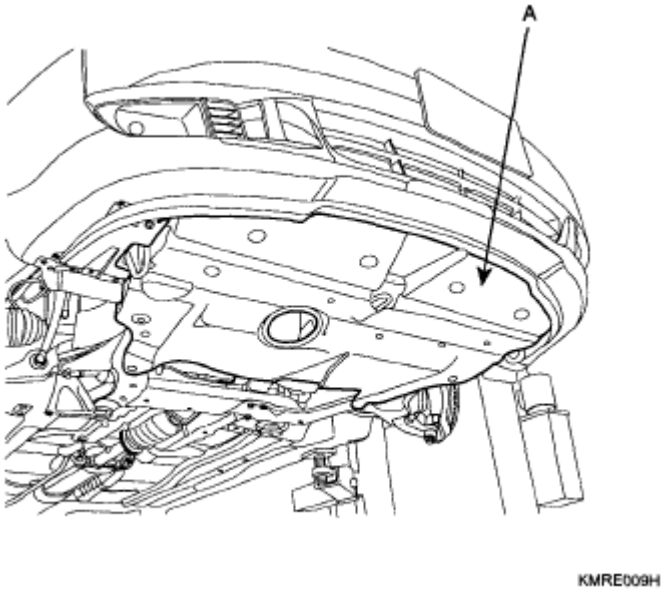


Fig. 286: Locating Oil Pump Sprocket
Courtesy of HYUNDAI MOTOR CO.

3. Install oil pump chain cover (A).

   Tightening torque

   9.80 ~ 11.76 Nm (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

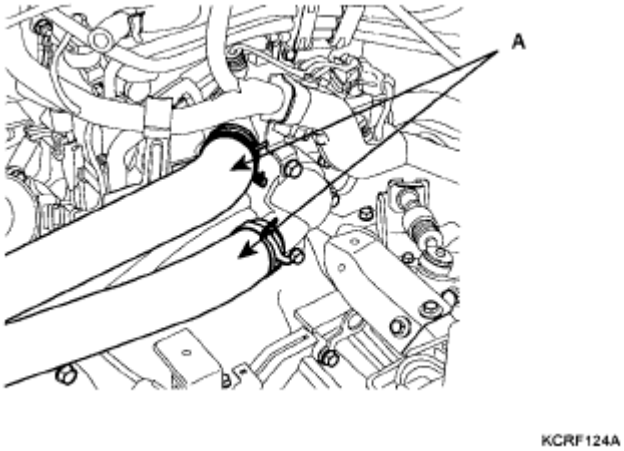


Fig. 287: Locating Oil Pump Chain Cover
Courtesy of HYUNDAI MOTOR CO.

4. Install upper oil pan.
   a. Using a gasket scraper, remove all the old packing material from the gasket surfaces.
   b. Before assembling the oil pan, the liquid sealant TB1217H should be applied on upper oil pan. The part must be assembled within 5 minutes after the sealant was applied.

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Bead width: 2.5 mm (0.1 in.)

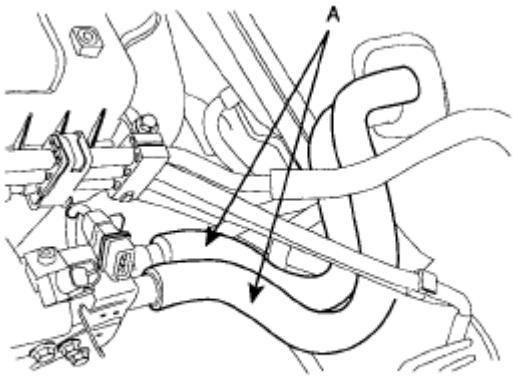


Fig. 288: Applying Liquid Sealant On Oil Pan
Courtesy of HYUNDAI MOTOR CO.

CAUTION:
- **Make clean the sealing face before assembling two parts.**
- **Remove harmful foreign matters on the sealing face before applying sealant**
- **When applying sealant gasket, sealant must not be protruded into the inside of oil pan.**
- **To prevent leakage of oil, apply sealant gasket of the inner threads of the bolt holes.**

e. Install upper oil pan.

Uniformly tighten the bolts in several passes.

Tightening torque

9.80 ~ 11.76 Nm (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

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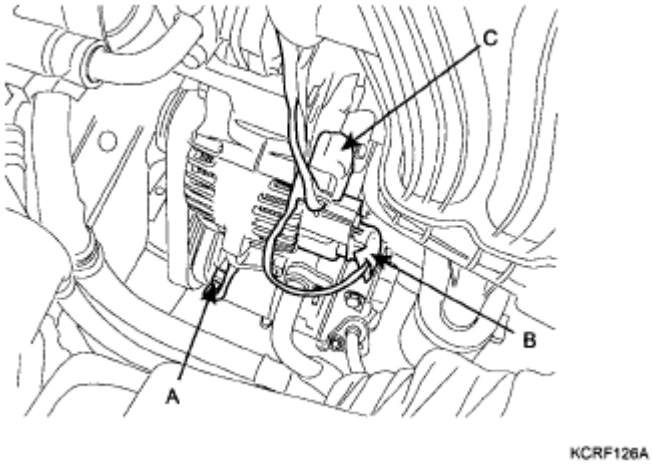


Fig. 289: Tightening Bolt In Sequence
Courtesy of HYUNDAI MOTOR CO.

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

OIL FILTER ASSEMBLY

1. Install oil filter body and new O-rings.

   Tightening torque

   9.80 ~ 11.76 Nm (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

   NOTE:
   - **All rubber gasket must be no damaged by assembling parts.**
   - **Be careful of the knock sensor connector.**
   - **Always use a new O-ring**

2. Install oil filter body cover (B) and new gasket on the oil filter body.

   Tightening torque

   9.80 ~ 11.76 Nm (1.0~1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

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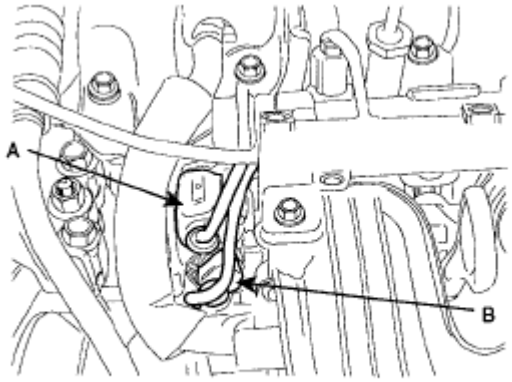


Fig. 290: Locating Oil Filter Body Cover And Water Vent Hose
Courtesy of HYUNDAI MOTOR CO.

3. Connect water vent hose (A).

   Tightening torque

   9.80 ~ 11.76 Nm (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

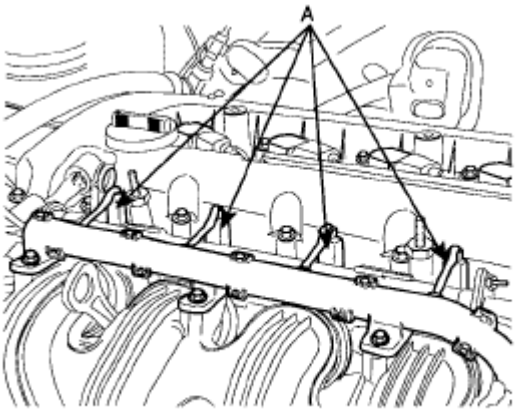
4. Install water temperature control assembly.
5. Connect water hoses on the ETC.
6. Connect oil pressure switch connector.
7. Install intake manifold and surge tank.
8. Fill with engine coolant.
9. Start engine and check for leaks.
10. Recheck engine coolant level.

INTAKE SYSTEM AND EXHAUST SYSTEM

INTAKE MANIFOLD

COMPONENTS

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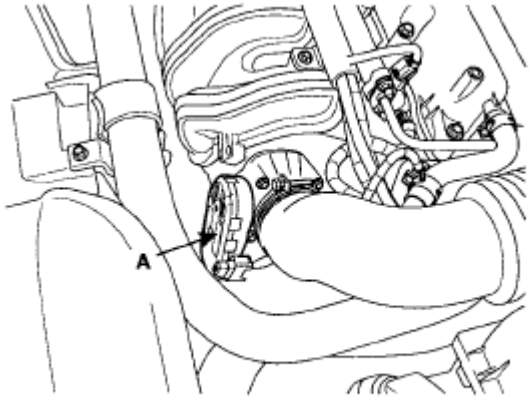


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Fig. 291: Identifying Intake Manifold Components And Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

1. Disconnect AFS (A) and breather hose (B).
2. Remove air cleaner upper cover (D) and intake hose (C).
3. Remove the wire protector.



ECRF032A

Fig. 292: Locating Air Cleaner Upper Cover And Intake Hose
Courtesy of HYUNDAI MOTOR CO.

4. Disconnect RH oxygen sensor connector.
5. Disconnect RH injector connector, ignition coil connector and the VIS solenoid valve connector.
6. Disconnect ETC connector (A) and knock sensor connector (B).

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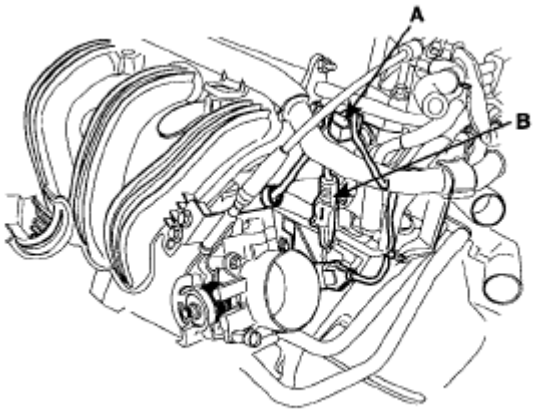


Fig. 293: Locating ETC Connector And Knock Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

7. Disconnect PCSV connector (A), MAP sensor connector (B), PCSV hose and the ECM vacuum hose.

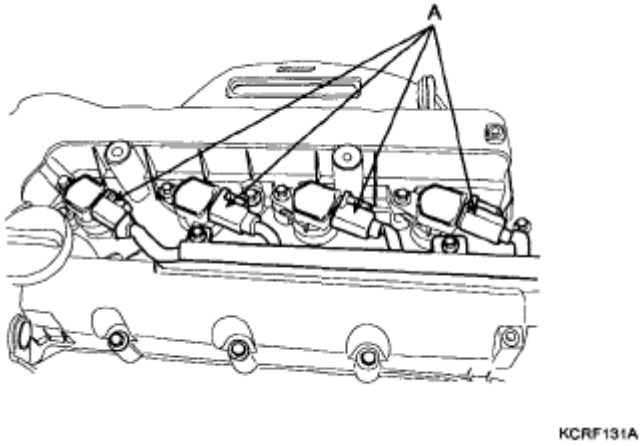


Fig. 294: Locating PCSV Connector, MAP Sensor Connector, PCSV Hose And ECM Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

8. Remove the surge tank stay.
9. Disconnect water hoses from ETC.
10. Disconnect PCV hose.
11. Disconnect brake vacuum hose.
12. Remove surge tank stay (A).

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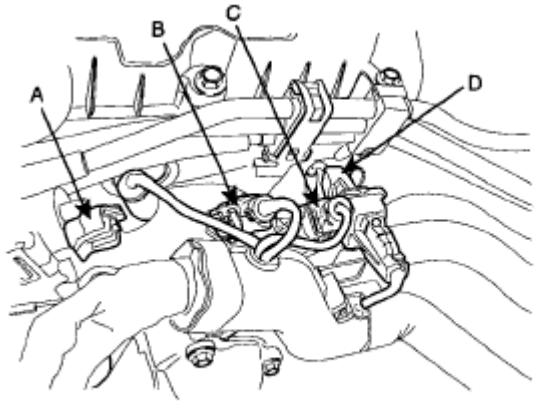


Fig. 295: Locating Surge Tank Stay
Courtesy of HYUNDAI MOTOR CO.

13. Remove connector bracket from surge tank.
14. Remove surge tank (B).

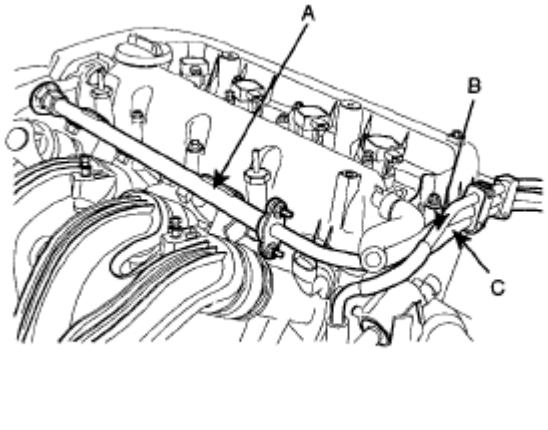


Fig. 296: Locating Surge Tank
Courtesy of HYUNDAI MOTOR CO.

15. Disconnect breather hose (A).

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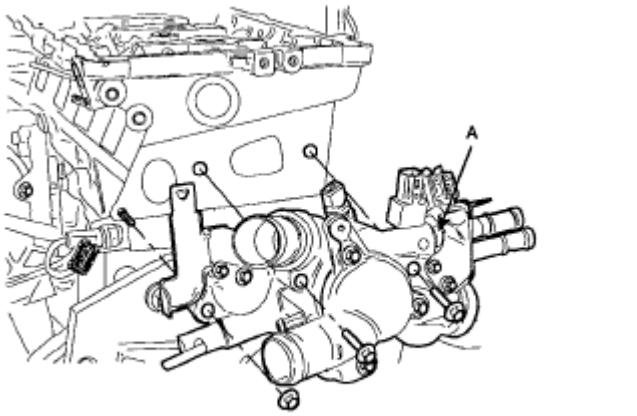


Fig. 297: Locating Breather Hose
Courtesy of HYUNDAI MOTOR CO.

16. Disconnect LH injector connector.
17. Remove the surge tank gasket.
18. Remove the intake manifold module assembly.
19. Remove the intake manifold gasket.

INSTALLATION

1. Install intake manifold and new gasket on the cylinder head.

   Tightening torque

   1st: 3.9 ~ 5.9 Nm (0.4 ~ 0.6 kgf.m, 2.9 ~ 4.3 lb-ft)

   2st: 18.62 ~ 23.52 Nm (1.9 ~ 2.4 kgf.m, 13.74 ~ 17.36 lb-ft)

   3st: Repeat 2nd step twice or more.

   NOTE: Be careful of the installation direction.
   a ~ h: 1st step order
   1 ~ 8: 2nd step order

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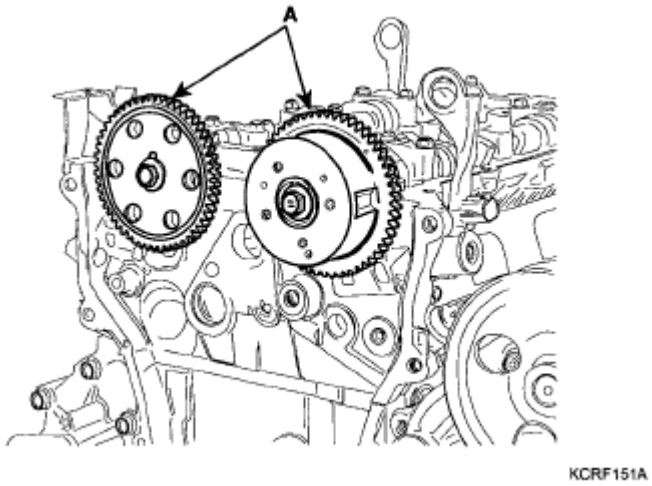


Fig. 298: Tightening Intake Manifold Bolts In Sequence
Courtesy of HYUNDAI MOTOR CO.

2. Install delivery pipe (Refer to **FUEL SYSTEM (G6DA-GSL 3.3) -- SANTA FE**).
3. Connect LH injector connector.
4. Connect breather hose.

   Tightening torque

   9.80 ~ 11.76 Nm (1.0~1.2 kgf.m, 7.23 ~ 8.68 lb-ft) ~ M6

   18.6 ~ 23.5 Nm (1.9 ~ 2.4 kgf.m, 13.7 ~ 17.4 lb-ft) ~ M8

5. Install surge tank and a new surge tank gasket.

   Tightening torque

   9.80 ~ 11.76 Nm (1.0~1.2 kgf.m, 7.23 ~ 8.68 lb-ft) ~ M6

   18.6 ~ 23.5 Nm (1.9 ~ 2.4 kgf.m, 13.7 ~ 17.4 lb-ft) ~ M8

6. Install connector bracket on the surge tank.

   Tightening torque

   6.86 ~ 10.78 Nm (0.7 ~ 1.1 kgf.m, 5.06 ~ 7.96 lb-ft)

7. Install surge tank stay.

   Tightening torque

   27.44 ~ 31.36 Nm (2.8 ~ 3.2 kgf.m, 20.25 ~ 23.14 lb-ft) ~ M10

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18.6 ~ 23.5 Nm (1.9 ~ 2.4 kgf.m, 13.7 ~ 17.4 lb-ft) ~ M8

8. Connect brake vacuum hose.
9. Connect PCV hose.
10. Connect water hoses to ETC.
11. Connect ETC connector and knock sensor connector.
12. Connect PCSV connector, MAP sensor connector and PCSV hoe.
13. Connect RH injector connector and ignition coil connector.
14. Connect RH oxygen sensor connector.
15. Install air cleaner upper cover and in take hose.
16. Connect AFS (A) and breather hose.

EXHAUST MANIFOLD

COMPONENTS

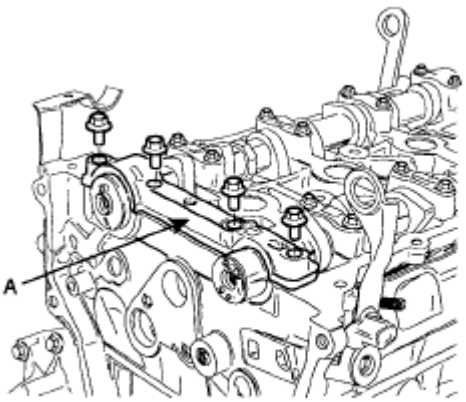


Fig. 299: Identifying Exhaust Manifold Components And Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

1. Remove under cover (A).

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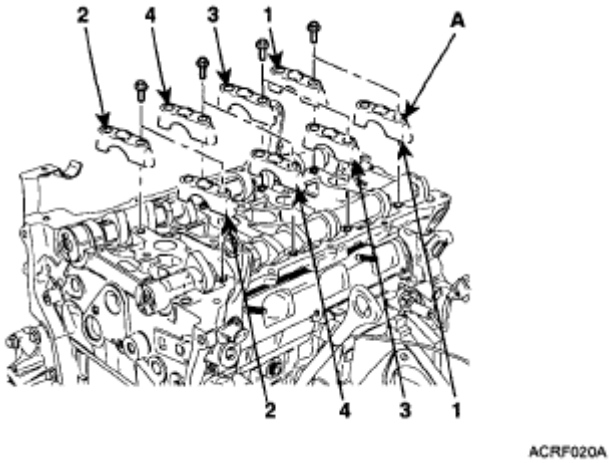


Fig. 300: Locating Under Cover
Courtesy of HYUNDAI MOTOR CO.

2. Disconnect LH, RH rear oxygen sensor connector from bracket.
3. Remove front muffler (A).

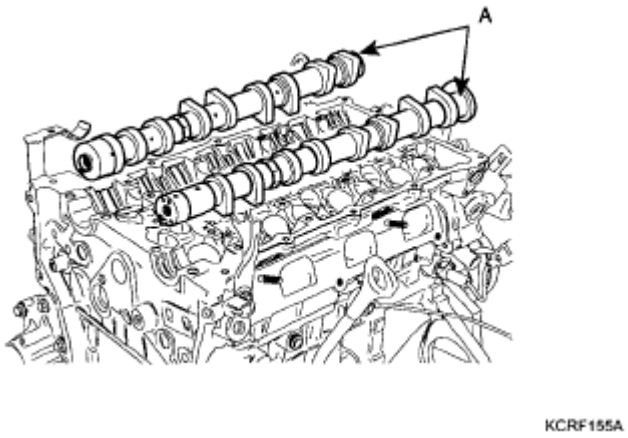
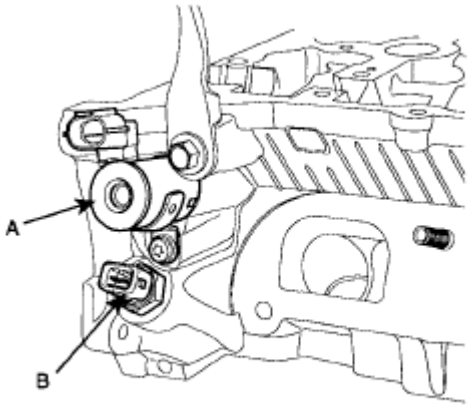


Fig. 301: Locating Front Muffler
Courtesy of HYUNDAI MOTOR CO.

4. Remove oil level gauge (A).
5. Disconnect LH front oxygen sensor connector (B) from bracket.

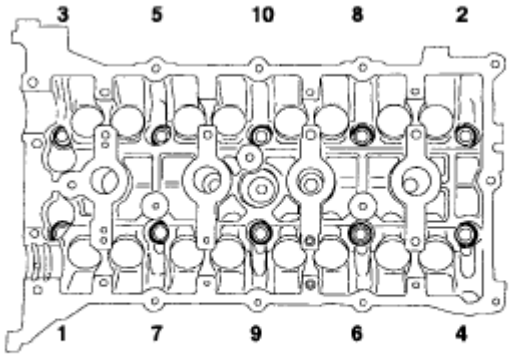
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KCRF119A

Fig. 302: Locating Oil Level Gauge And LH Front Oxygen Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

6. Remove LH heat protector.



KCRF162A

Fig. 303: Locating LH Heat Protector
Courtesy of HYUNDAI MOTOR CO.

7. Remove LH exhaust manifold.
8. Disconnect RH front oxygen sensor connector from bracket.

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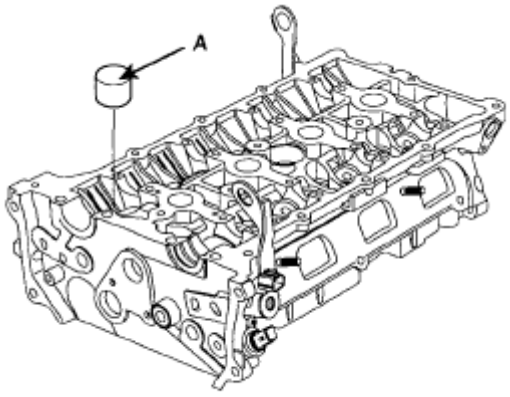


Fig. 304: Locating RH Front Oxygen Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

9. Remove RH heat protector.
10. Remove RH exhaust manifold.

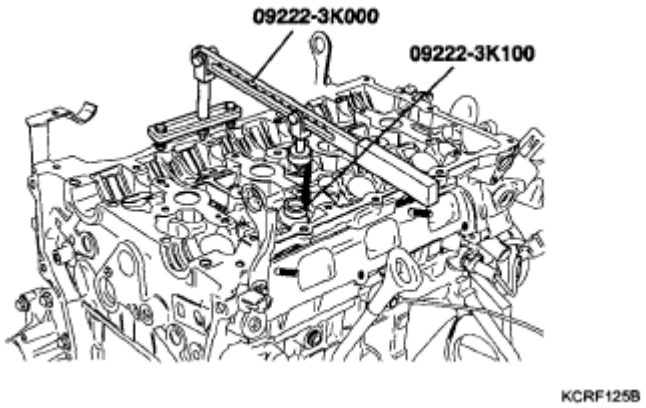


Fig. 305: Locating RH Heat Protector
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

1. Install new gasket and exhaust manifold.

   Tightening torque

   39.2 ~ 44.1 Nm (4.0 ~ 4.5 kgf.m, 28.92 ~ 32.53 lb-ft)

2. Install heat protector.

   Tightening torque

   16.66 ~ 21.56 Nm (1.7 ~ 2.2 kgf.m, 12.30 ~ 15.91 lb-ft)

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3. Install front muffler.

   Tightening torque

   39.2 ~ 58.8 N.m (4.0 ~ 6.0 kgf.m, 28.92 ~ 43.37 lb-ft)

4. Connect oxygen sensor connector.
5. Install under cover.

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