

2007 ENGINE

Engine (G6DA - GSL 3.8) - Veracruz

GENERAL

SPECIFICATIONS

GENERAL SPECIFICATIONS

Description			Specifications	Limit
			3.8L	
General				
Type			V-type, DOHC	
Number of cylinders			6	
Bore			96 mm (3.7795 in)	
Stroke			87.0 mm (3.4252 in)	
Total displacement			3,778 cc (230.55 cu.in.)	
Compression ratio			10.4	
Firing order			1-2-3-4-5-6	
Idle RPM			710 RPM	
Valve timing				
Intake	Opens (ATDC)		10°	
	Closes (ABDC)		62°	
Exhaust	Opens (BBDC)		42°	
	Closes (ATDC)		6°	
Cylinder head				
Flatness of gasket surface			Less than 0.05 mm (0.00 19 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	46.8 mm (1.8425 in.)	
		Exhaust	45.8 mm (1.8031 in.)	
	RH Camshaft	Intake	46.8 mm (1.8425 in.)	
		Exhaust	45.8 mm (1.8031 in.)	
Journal outer	LH, RH Camshaft	Intake	No. 1: 27.964-27.978 mm	

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diameter			(1.1009 ~ 1.1015 in.) No. 2, 3, 4: 23.954 ~ 23.970 mm (0.9430 ~ 0.9437 in.)	
		Exhaust	No.1: 27.964 ~ 27.978 mm (1.1009 ~ 1.1015 in.) No. 2, 3, 4: 23.954 ~ 23.970 mm (0.9430 ~ 0.9437 in.)	
Bearing oil clearance	LH, RH camshaft	Intake	No. 1: 0.027 ~ 0.057 mm (0.0011 ~ 0.0022 in.) No. 2, 3, 4: 0.030 ~ 0.067 mm (0.0012 ~ 0.0026 in.)	
		Exhaust	No.1: 0.027 ~ 0.057 mm (0.0011 ~ 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 valve head (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 (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	Intake		1.15 ~ 1.45 mm (0.05118 ~	

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contact		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 ± 1.3 kg/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.)	0.07 mm (0.0027 in.)
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		96.00 ~ 96.03 mm (3.7795 ~ 3.7807 in.)	
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		95.96 ~ 95.99 mm (3.7779 ~ 3.7791 in.)	
Piston to cylinder clearance		0.03 ~ 0.05 mm (0.0012 ~ 0.0020 in.)	

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Ring groove width	No. 1 ring groove	1.22 ~ 1.24 mm (0.0480 ~ 0.0488 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	0.03 ~ 0.07 mm (0.0012 ~ 0.0027 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.)	0.2 mm (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		23.001 ~ 23.006 mm (0.9055 ~ 0.9057 in.)	
Piston pin hole inner diameter		23.016 ~ 23.021 mm (0.9061 ~ 0.9063 in.)	
Piston pin hole clearance		0.01 ~ 0.02 mm (0.0004 ~ 0.0008 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 ~ -0.016 mm (-0.0012 ~ 0.0006 in.)	
Connecting rod			
Connecting rod big end inner diameter		58.000 ~ 58.018 mm (2.2834 ~ 2.2842 in.)	
Connecting rod bearing oil clearance		0.038 ~ 0.056 mm (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.)	

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End play		0.10 ~ 0.28mm (0.0039 ~ 0.0110in.)	
Oil pump			
Relief valve opening pressure		450 ~ 550kPa (4.59 ~ 5.61kgf/cm ² , 65.28 ~ 79.79psi)	
Engine oil			
Oil quantity (Total)		6.0L (6.34U.S.qts, 5.28Imp.qts)	When replacing a short engine or a block assembly.
Oil quantity (Oil pan)		5.5L (5.81 U.S.qts, 4.84Imp.qts)	When replacing an oil pan only.
Oil quantity (Drain and refill)		5.2L (5.49U.S.qts, 4.58Imp.qts)	
Oil quality		Above SJ or SL	
Oil pressure		130kPa (1.32kgf/cm ² , 18.77psi) [at 1000rpm, 110°C (230°F)]	
Cooling system			
Cooling method		Forced circulation with electrical fan	
Coolant quantity		8.5~10.5L (8.98~11.10U.S.qts, 7.48-9.24Imp.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	10mm (0.3937in.) MIN	
Radiator cap	Main valve opening pressure	93.16 ~ 122.58kpa (0.95 ~ 1.25kg/cm ² , 13.51 ~ 17.78psi)	
	Vacuum valve opening pressure	0.98 ~ 4.90 kpa (0.01 ~ 0.05kg/cm ² , 0.14 ~ 0.71 psi)	
Water temperature sensor			
Type		Thermistor type	
Resistance	20°C (68°F)	2.31 ~ 2.59 Kohms	
	80°C (176°F)	0.3222 Kohms	

TIGHTENING TORQUE

TIGHTENING TORQUE SPECIFICATIONS

Item	Quantity	Nm	kgf.m	lb-ft
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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 I	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 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	81.4 ~ 85.3	8.3 ~ 8.7	60.0 ~ 62.9
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
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 cap	8	71.54 ~ 75.46	7.3 ~ 7.7	52.80 ~ 55.69
Oil filter cap		24.50	2.5	18.08
Oil drain bolt cap	1	34.30 ~ 44.10	3.5 ~ 4.5	25.31 ~ 32.55

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Oil pump bolt	3	20.6 ~ 22.6	2.1 ~ 2.3	15.2 ~ 16.6
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 (Timing chain cover bolt L)	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Water pump bolt (Timing chain cover bolt K)	1	21.56 ~ 26.46	2.2 ~ 2.7	15.91 ~ 19.53
Water pump bolt	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	19.6 ~ 23.52	2.0 ~ 2.4	14.5 ~ 17.36
Water temp, control bolt	2	19.6 ~ 23.52	2.0 ~ 2.4	14.5 ~ 17.36
Water inlet pipe 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	6	26.5 ~ 31.4	2.7 ~ 3.2	19.5 ~ 23.1
Intake manifold nut	2	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
Surge tank bolt (M8 x 25)	3	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
Surge tank bolt (M6 x 106)	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Surge tank nut	1	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
Breather pipe bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Surge tank bracket bolt rear (M10 x 18)	2	27.44 ~ 31.36	2.8 ~ 3.2	20.25 ~ 23.14
Surge tank bracket bolt front (M8 x 16)	2	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
ETC bracket bolt	2	15.68 ~ 25.48	1.6 ~ 2.6	11.57 ~ 18.80
Exhaust manifold nut	16	39.20 ~ 44.10	4.0 ~ 4.5	28.93 ~ 32.55
Heat proctor 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

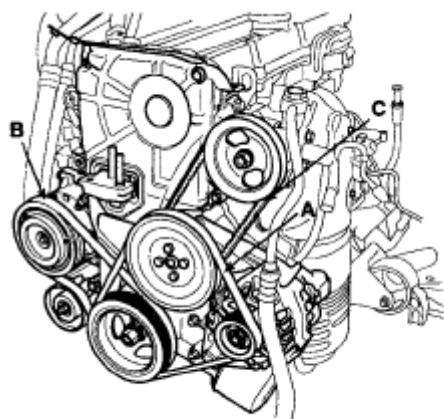
INSPECTION**COMPRESSION PRESSURE**

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 the surge tank.
3. Remove the ignition coil connectors (A) and ignition coils (B).



ACJF002A

Fig. 1: Identifying Ignition Coil Connectors And Ignition Coils
Courtesy of HYUNDAI MOTOR CO.

4. Remove the spark plugs.

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

5. Check cylinder compression pressure.
 1. Insert a compression gauge into the spark plug hole.
 2. Fully open the throttle.
 3. After 7 times of cranking the engine, measure the compression pressure.

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

4. Repeat steps 1) through 3) for each cylinder.

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

Compression pressure

1,225kPa (12.5 kgf/cm² , 177 psi)

Minimum pressure:

1,078kPa (11.0 kgf/cm² , 156 psi)

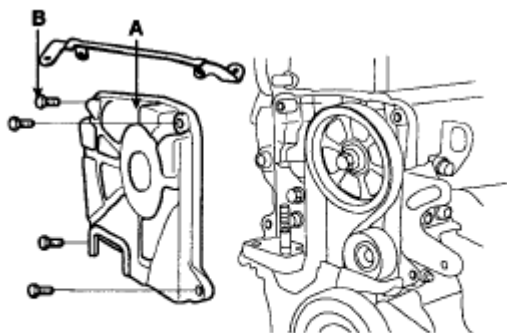
5. If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps 1 through 3 for cylinders with low compression.
 - If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore 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.
6. Reinstall the spark plugs.
 7. Install the ignition coil and ignition coil connectors.
 8. Install the surge tank.

VALVE CLEARANCE INSPECTION AND ADJUSTMENT

NOTE: Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature: 2°C) and cylinder head is installed on the cylinder block.

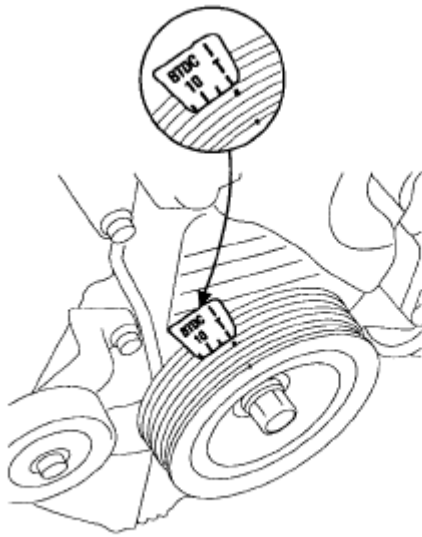
1. Remove the engine cover.
2. Remove air cleaner assembly.
3. Remove the surge tank.
4. Remove the cylinder head cover.
 1. Disconnect the ignition coil connector and remove the ignition coil.
 2. Disconnect the breather pipe assembly (A) from the intake manifold.



ADGE023A

Fig. 2: Identifying Breather Pipe Assembly
Courtesy of HYUNDAI MOTOR CO.

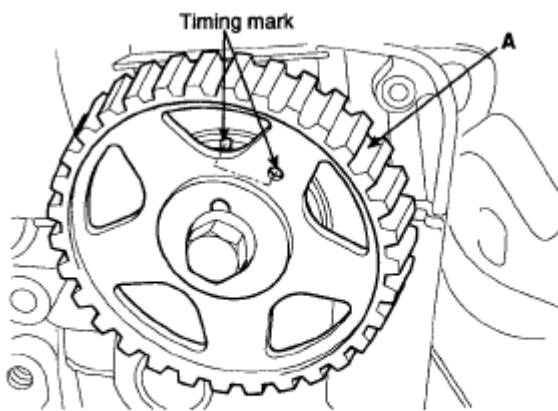
3. Loosen the cylinder head cover bolts and then remove the cover (A) and gasket.



ECKD106A

Fig. 3: Identifying Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

5. 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.



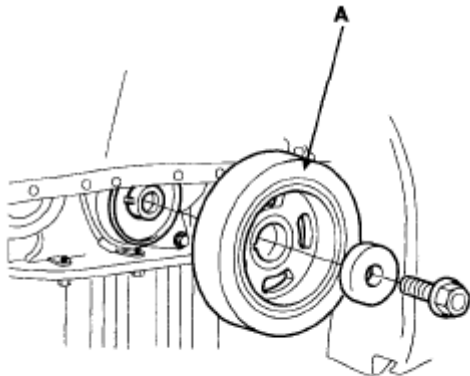
ECDD008F

Fig. 4: Aligning Groove With Timing Mark
Courtesy of HYUNDAI MOTOR CO.

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°)

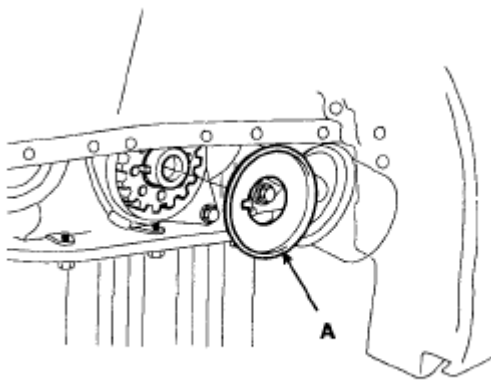
NOTE: Do not rotate engine counterclockwise



ADGE074A

Fig. 5: Identifying Camshaft Timing Mark Location
Courtesy of HYUNDAI MOTOR CO.

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



ECKD108A

Fig. 6: Identifying Intake And Exhaust Valve Clearance
Courtesy of HYUNDAI MOTOR CO.

Measurement method.

- 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

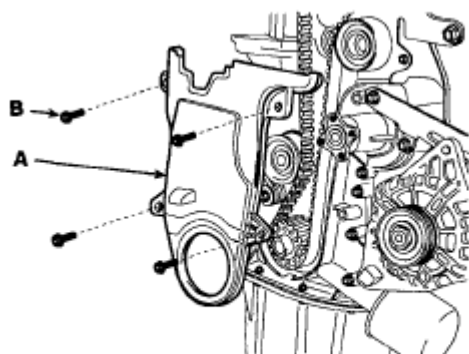
Intake : 0.17 ~ 0.23 mm (0.0067 ~ 0.0090 in.)

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

2. 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

3. Check only valves indicated as shown. [NO. 4 cylinder: TDC/compression]. Measure the valve clearance. (Refer to procedure step 1)



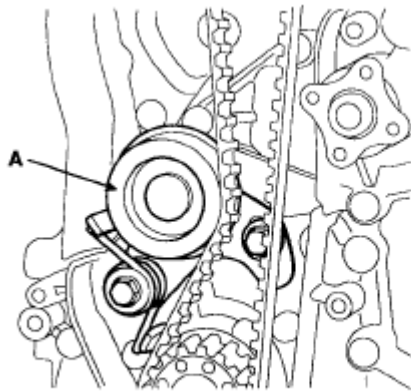
ADGE024A

Fig. 7: Identifying Intake And Exhaust Valve Clearance
Courtesy of HYUNDAI MOTOR CO.

7. Adjust the intake and exhaust valve clearance.
 1. Set the No. 1 cylinder to the TDC/compression.
 2. 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.

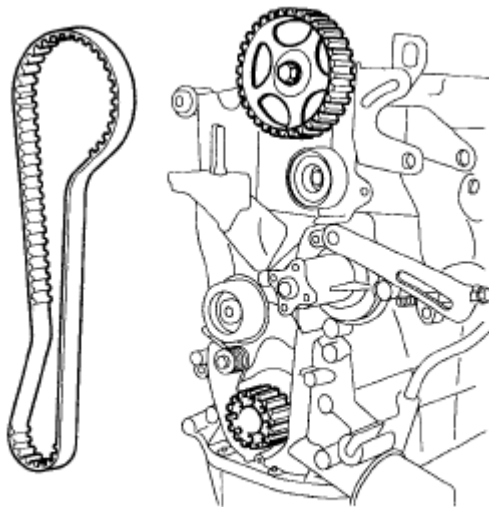
3. Remove the camshaft bearing caps (A).



EDKD102B

Fig. 8: Identifying Camshaft Bearing Caps
Courtesy of HYUNDAI MOTOR CO.

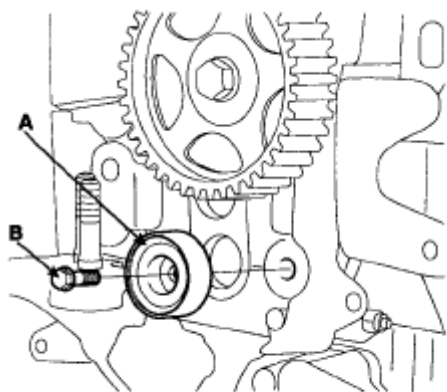
4. Remove the camshaft assembly (A).



EDKD102A

Fig. 9: Identifying Camshaft Assembly
Courtesy of HYUNDAI MOTOR CO.

5. Remove MLAs.
6. Measure the thickness of the removed tappet using a micrometer.



EDKD103A

Fig. 10: Measuring Thickness Of Tappet Using Micrometer
Courtesy of HYUNDAI MOTOR CO.

7. 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

Intake: $N = T + [A - 0.20 \text{ mm (0.0079 in.)}]$

Exhaust: $N = T + [A - 0.30 \text{ mm (0.0118 in.)}]$

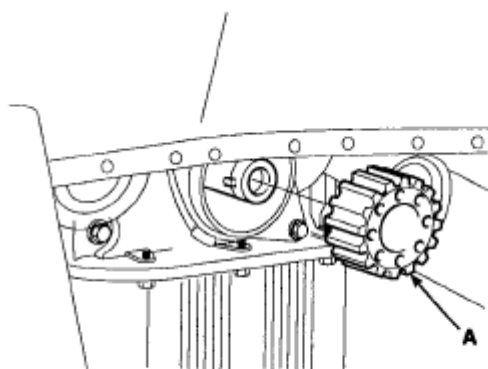
8. Select a new tappet with a thickness as close as possible to the calculated value.

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.)

9. Place a new tappet on the cylinder head.

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

10. Install the intake and exhaust camshaft.
11. Install the bearing caps. (Refer to **CYLINDER HEAD ASSEMBLY**)
12. Install the timing chain. (Refer to **TIMING SYSTEM**)
13. Turn the crankshaft two turns in the operating direction (clockwise) and realign crankshaft sprocket and camshaft sprocket timing marks (A).



ECKD110A

Fig. 11: Identifying Camshaft Timing Mark Location
Courtesy of HYUNDAI MOTOR CO.

14. 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.)

TROUBLESHOOTING

TROUBLESHOOTING CHART

Symptom	Suspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Worn crankshaft bearings. Loose or damaged 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 abnormal valve train noise.	Stuck valves. (Carbon buildup on the valve stem)	Repair or replace as required.
	Excessive worn or mis-aligned timing chain.	Replace the timing chain and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and valve lifters.
	Faulty cylinder head gasket and/or	Inspect the cylinder head and

2007 Hyundai Veracruz Limited

2007 ENGINE Engine (G6DA - GSL 3.8) - Veracruz

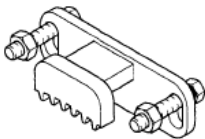
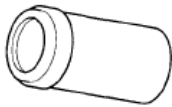
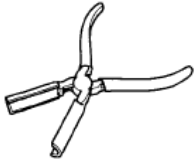
Engine misfire with coolant consumption.	cranking or other damage to the cylinder head and engine block cooling system. Coolant consumption may or may not cause the engine to overheat.	engine block for damage to the coolant passages and/or a faulty head gasket. Repair or replace as required.
Engine misfire 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, regard-less 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 as 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 restricted.	- Inspect the oil pump screen. - Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	Inspect the piston, piston pin and cylinder bore.

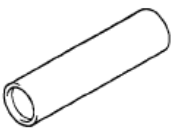
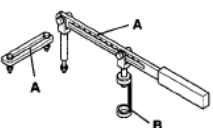
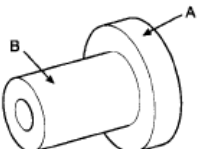
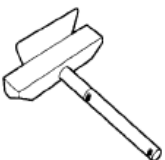
Lower engine noise, regardless of engine speed.		• Repair as required.
	Excessive piston pin-to-piston clearance.	• Inspect the piston, piston pin and the connecting rod. • Repair or replace as required.
	Excessive connecting rod bearing clearance	• Inspect the following components and repair as required. • 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. • Fuel in cylinder.	1. Remove spark plugs and check for fluid. 2. Inspect for broken head gasket. 3. Inspect for cracked engine block or cylinder head. 4. Inspect for a sticking fuel injector and/or leaking fuel regulator.

Engine will not crank- crankshaft will not rotate.	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 SERVICE TOOLS

SPECIAL SERVICE TOOLS REFERENCE CHART

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09231-3C100)	 KDRF233A	Installation of the front oil seal
Flywheel stopper (09231-3C300)	 KCRF0300	Removal and installation of the flywheel and crankshaft pulley.
Torque angle adapter (09221- 4A000)	 EDKA010A	Installation of bolts & nuts needing an angular method
Valve stem seal remover (09222- 29000)	 KDRF232A	Removal of the valve stem seal
Valve stem seal installer (09222- 29000)		Installation of the valve stem seal

3C100)	 LCAC030D	
Valve spring compressor & holder (09222-3K000) (09222-3C300)	 ECRF003A	Removal and installation of the intake or exhaust valves A: 09222-3K000 B: 09222-3C300 (holder)
Crankshaft rear oil seal installer (09231-3C200) (09231-H1100)	 ACRF003A	Installation of the crankshaft rear oil seal A: 09231-3C200 B: 09231-H1100
Oil pan remover (09215-3C000)	 KDRF219A	Removal of oil pan
Oil filter wrench (09263-3C100)	 B6327000	Removal and installation of the oil filter

ENGINE AND TRANSAXLE ASSEMBLY

REMOVAL

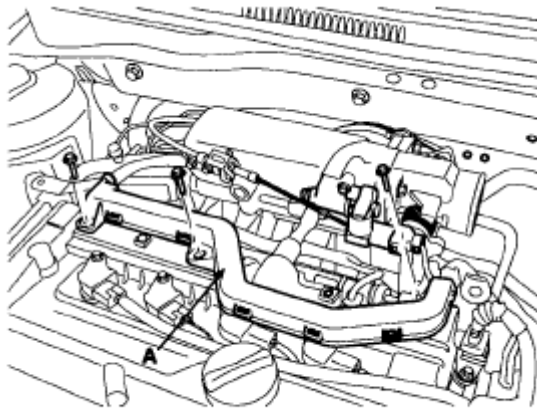
CAUTION:

- 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/Disconnection.

1. Remove the engine cover (A).

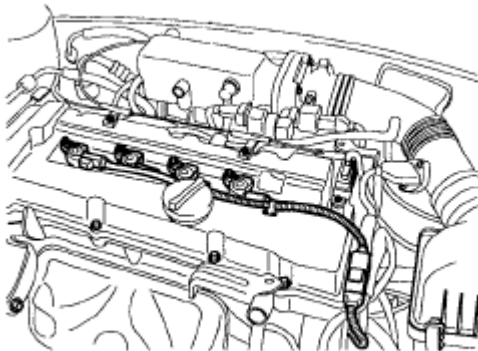


ACJF120A

Fig. 12: Identifying Engine Cover With Bolts
Courtesy of HYUNDAI MOTOR CO.

2. Remove the air duct (A).
3. Disconnect the negative terminal from the battery (B).

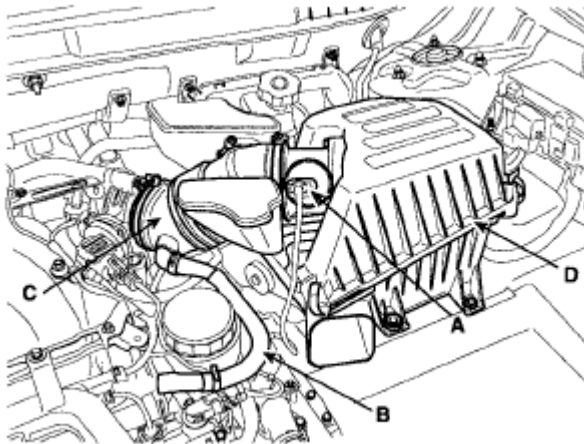
■ 1.6 CVVT



ACJF066A

Fig. 13: Identifying Air Duct And Battery
Courtesy of HYUNDAI MOTOR CO.

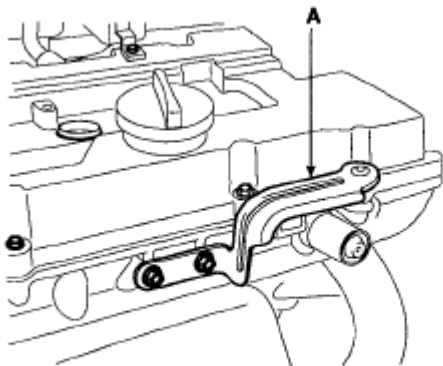
4. Recover refrigerant and remove the high & low pressure pipe. (Refer to HEATING, VENTILATION & AIR CONDITIONING)
5. Remove the intake air hose and air cleaner assembly.
 1. Disconnect the AFS connector (A).
 2. Disconnect the breather hose (B) from air cleaner hose.
 3. Remove the intake air hose (C) and air cleaner body (D).



SEN17004L

Fig. 14: Identifying AFS Connector, Breather Hose And Intake Air Hose With Air Cleaner Body
Courtesy of HYUNDAI MOTOR CO.

6. Remove the battery tray (A).



ADGE031A

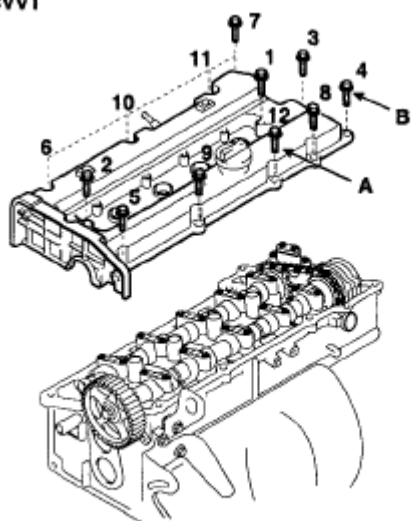
Fig. 15: Identifying Battery Tray With Bolts
Courtesy of HYUNDAI MOTOR CO.

7. Remove the front wheels.
8. Remove the under cover.
9. Drain the engine coolant.

Remove the radiator cap to speed draining.

10. Remove the upper radiator hose and lower radiator hose (A).

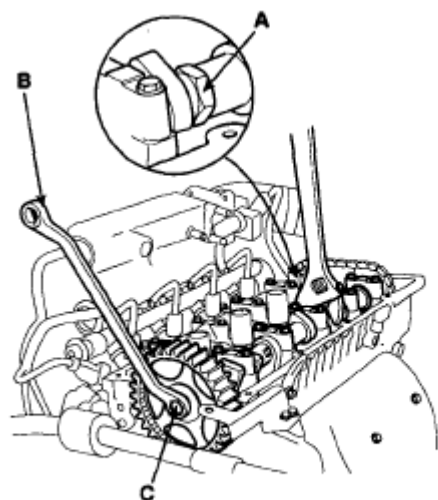
■ 1.6 CVVT



ACJF068A

Fig. 16: Identifying Upper Radiator Hose And Lower Radiator Hose
Courtesy of HYUNDAI MOTOR CO.

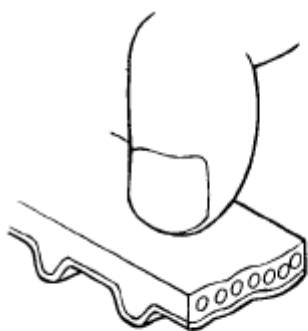
11. Remove the transaxle oil cooler hose.
12. Remove the fuel hose (A) and PCSV (B) hose.



ADGE002A

Fig. 17: Identifying Fuel Hose And PCSV Hose
Courtesy of HYUNDAI MOTOR CO.

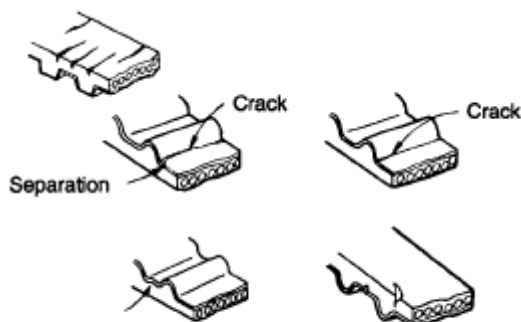
13. Remove the engine wiring.
 1. Disconnect the RH oxygen sensor connectors (B).
 2. Disconnect the power steering oil pressure sensor connector (A).



BCJF011A

Fig. 18: Identifying RH Oxygen Sensor And Power Steering Oil Pressure Sensor Connectors
 Courtesy of HYUNDAI MOTOR CO.

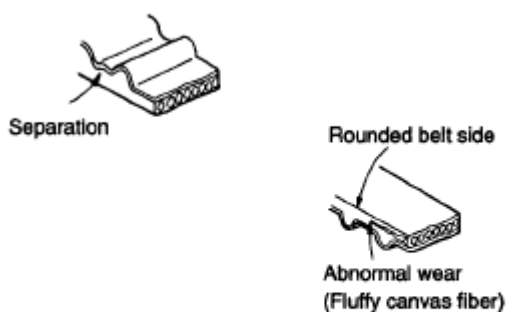
3. Disconnect the RH injector connector and the ignition coil connector.
4. Disconnect the OCV connector (A) and the knock sensor connector (B).
5. Disconnect the LH front oxygen sensor connector (C).
6. Disconnect the alternator connector (D) and the air compressor connector (E).



BCJF012A

Fig. 19: Identifying OCV, Knock Sensor, Alternator And Air Compressor Connectors
 Courtesy of HYUNDAI MOTOR CO.

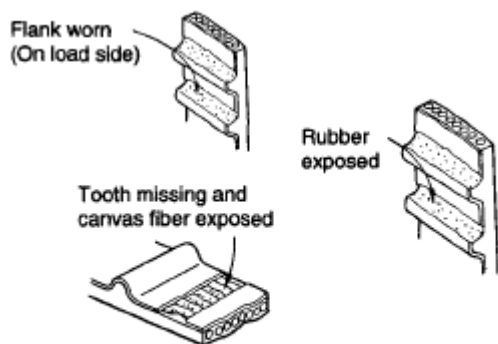
7. Disconnect the LH ignition coil connector (A), the injector connector (B), the condenser connector (C) and the ground (D), and remove the wiring harness protector (E).
8. Disconnect the LH CMPS (F) and the oil pressure switch connector (G).



BCJF013A

Fig. 20: Identifying LH Ignition Coil, Injector, Condenser, Wiring Harness Protector, LH CMPS And Oil Pressure Switch Connectors
Courtesy of HYUNDAI MOTOR CO.

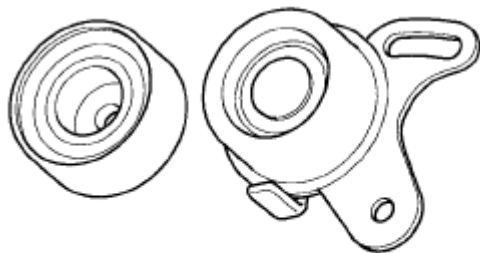
9. Disconnect the PCSV connector (A) and the MAP sensor connector (B).



BCJF014A

Fig. 21: Identifying PCSV And MAP Sensor Connectors
Courtesy of HYUNDAI MOTOR CO.

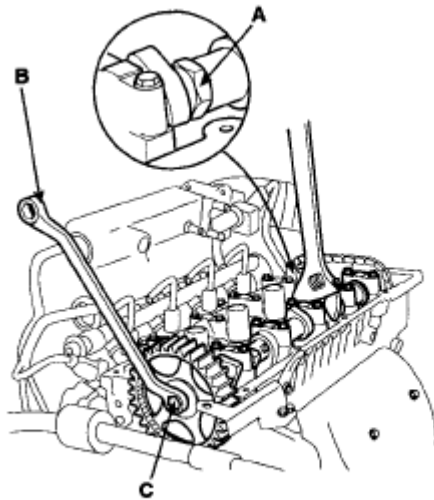
10. Disconnect the RH CMPS (A) and the OTS connector (B).



EDKD106A

Fig. 22: Identifying RH CMPS And OTS Connector
Courtesy of HYUNDAI MOTOR CO.

11. Disconnect the ETC connector (A) and the knock sensor connector (B).
12. Disconnect the ECT sensor connector (C).

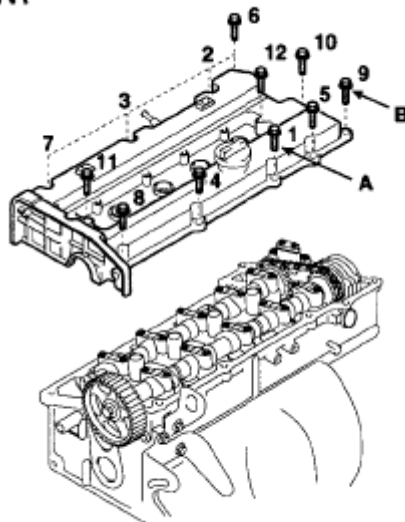


ADGE002A

Fig. 23: Identifying ETC Connector And Knock Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

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

■ 1.6 CVVT

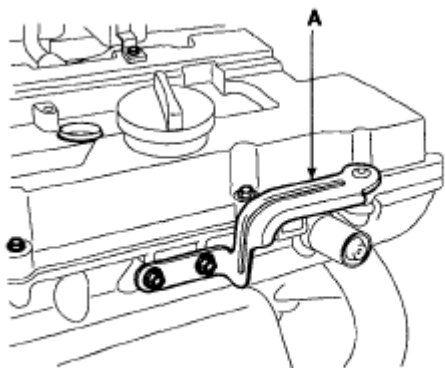


ACJF070A

Fig. 24: Identifying LH Rear Oxygen Sensor Connector And CPS Connector

Courtesy of HYUNDAI MOTOR CO.

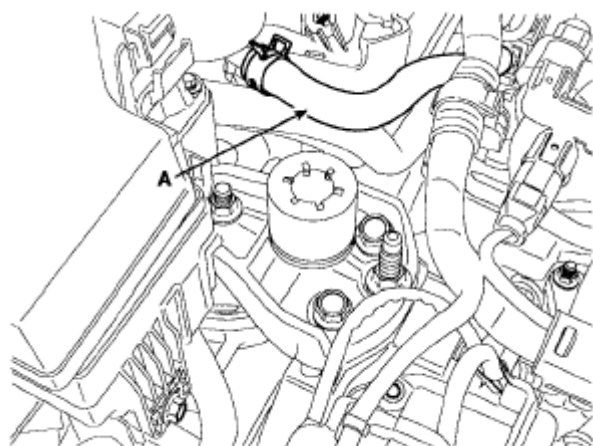
14. Disconnect the transaxle wire harness connector and remove the transaxle control cable.
15. Remove the heater hose (A).
16. Remove the brake vacuum hose (B).



ADGE031A

Fig. 25: Identifying Heater Hose And Brake Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

17. Remove the power steering pump hose (A).



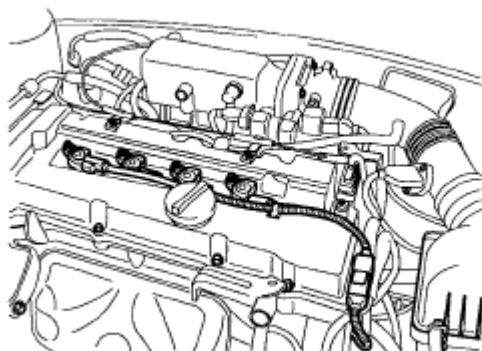
SENM17011L

Fig. 26: Identifying Power Steering Pump Hose
Courtesy of HYUNDAI MOTOR CO.

18. Remove the A/C compressor hose.
19. Drain transaxle oil.
20. Remove the lower arm ball joint.
21. Remove the tie rod end ball joint.
22. Remove the stabilizer link.

23. After removing a split pin and nut from the steering bar tie rod, disconnect it.
24. Remove the power steering return hose and drain power steering oil.
25. Remove the front roll stopper mounting bolt.
26. Remove the rear roll stopper mounting bolt.
27. Remove the steering u-joint mounting bolt.
28. Remove the front exhaust pipe (A).

■ 1.6 CVVT



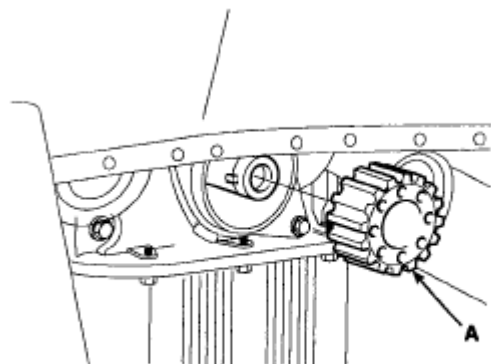
ACJF072A

Fig. 27: Identifying Front Exhaust Pipe
Courtesy of HYUNDAI MOTOR CO.

29. Supporting the cross member (A) with a jack, remove the stay with the mounting bolts.

Tightening torque :

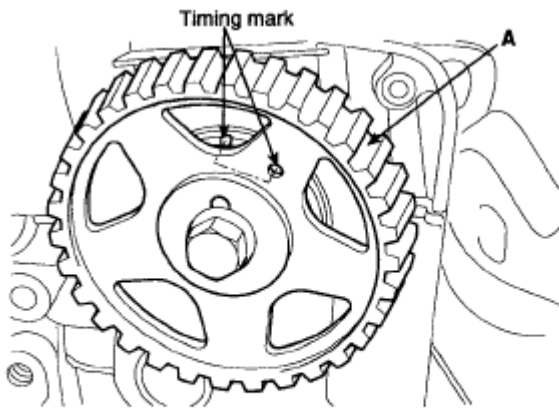
137.3~156.9 Nm (14.0~16.0 kgf.m, 101.3~115.7 lb-ft)



ECKD110A

Fig. 28: Identifying Cross Member
Courtesy of HYUNDAI MOTOR CO.

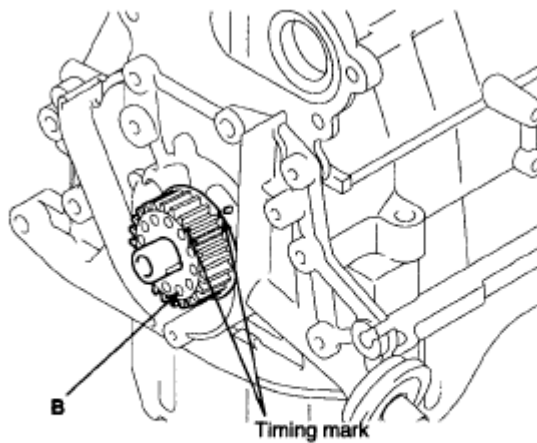
30. Remove the drive shafts from transaxle.
31. Install a jack for supporting the engine and transaxle assembly.
32. Disconnect the ground cable (A) from the engine mounting bracket.



ECDD008F

Fig. 29: Identifying Ground Cable From Engine Mounting Bracket
Courtesy of HYUNDAI MOTOR CO.

33. Remove the engine mounting bracket (A).



EDKD107A

Fig. 30: Identifying Engine Mounting Bracket
Courtesy of HYUNDAI MOTOR CO.

34. Remove the transaxle mounting bracket.
35. Remove the engine and transaxle assembly by lifting vehicle.

NOTE: When removing the engine and transaxle assembly, be careful not to damage any surrounding parts or body components.

INSTALLATION

Installation is in the reverse order of removal.

Perform the following:

- Adjust the shift cable.
- Refill an engine with engine oil.
- Refill a transaxle with fluid.
- Refill a 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.

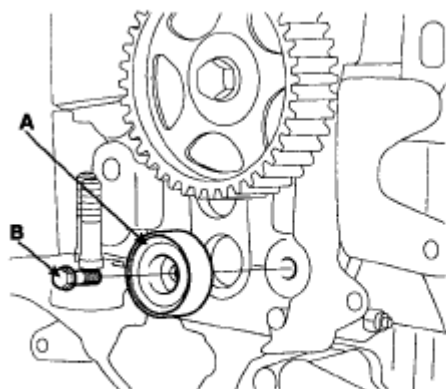
Repeat this operation two or three times, then check for fuel leakage at any point in the fuel lines.

TIMING SYSTEM

TIMING CHAIN

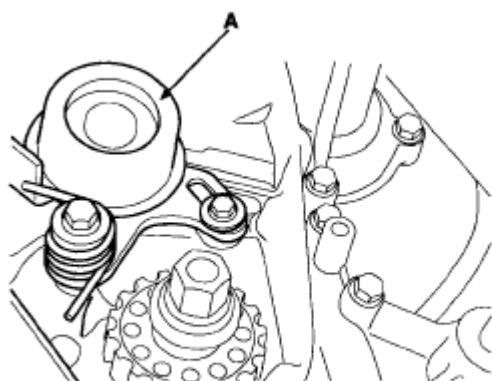
Components and Components Location

COMPONENTS



EDKD103A

Fig. 31: Exploded View Of Timing Chain System With Torque Specification (1 Of 2)



KDPC008E

Fig. 32: Exploded View Of Timing Chain System With Torque Specification (2 Of 2)

Repair procedures

Removal

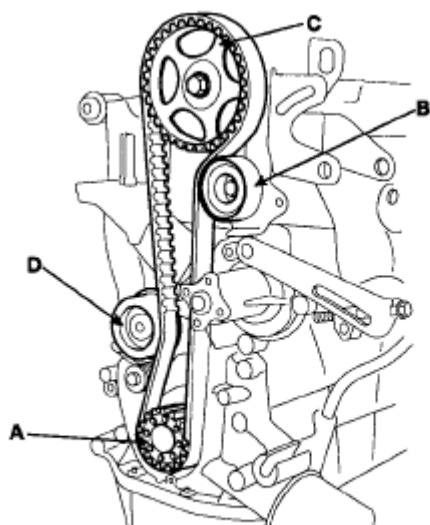
CAUTION:

- 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.

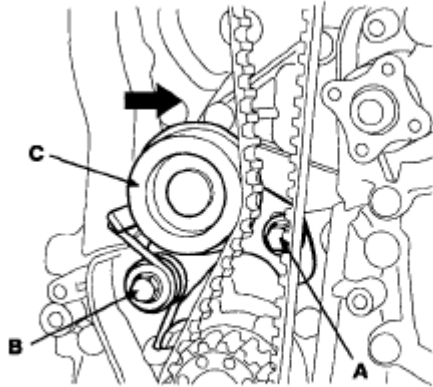
1. Disconnect the battery negative cable (A).



EDKD109A

Fig. 33: Identifying Battery Negative Cable

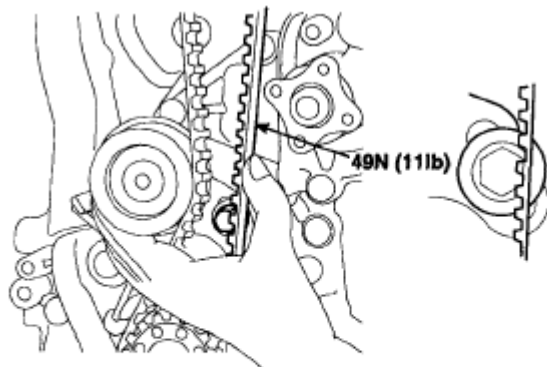
2. Remove the air duct (A).



ADGE026A

Fig. 34: Identifying Air Duct With Mounting Screws

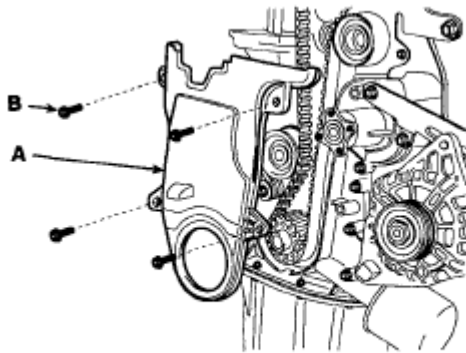
3. Remove the engine cover (A).



EDKD108A

Fig. 35: Identifying Engine Cover With Mounting Screws

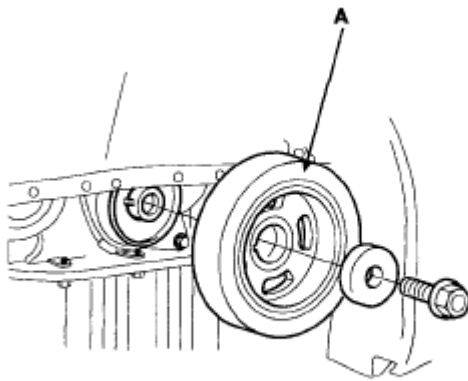
4. Remove the intake air hose and air cleaner assembly.
 1. Disconnect the AFS connector (A).
 2. Disconnect the breather hose (B) from air cleaner hose.
 3. Remove the intake air hose (C) and air cleaner body (D).



ADGE024A

Fig. 36: Identifying AFS Connector, Breather Hose, Intake Air Hose And Air Cleaner Body

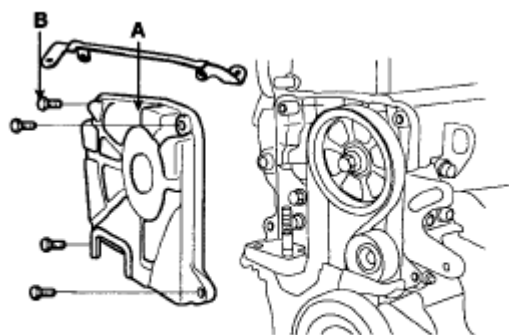
5. Remove the RH front wheel.
6. Remove the under cover (A).



ADGE074A

Fig. 37: Identifying Under Cover

7. Remove the side cover.
8. Loosen the drain plug and drain the engine coolant.
9. Drain the engine oil.
10. Disconnect the ground cable (A) and loosen the power steering hose mounting bolt (B).

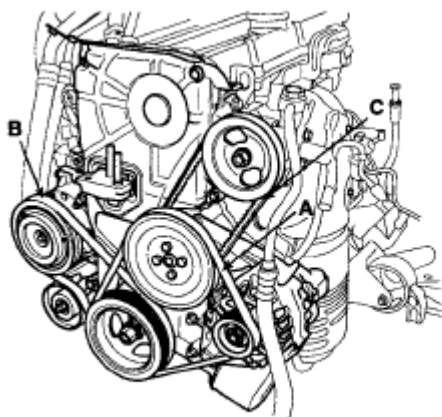


ADGE023A

Fig. 38: Identifying Ground Cable And Power Steering Hose Mounting Bolt

11. Remove the surge tank and engine wiring.

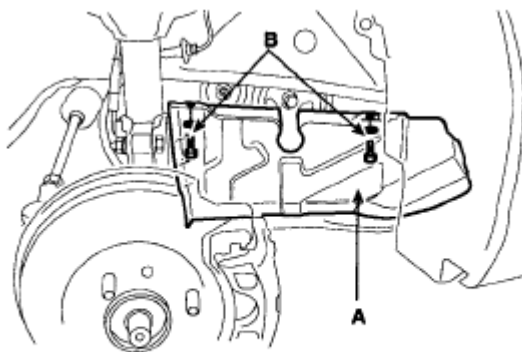
1. Disconnect the RH front and rear oxygen sensor connectors (A), the power steering sensor connector (B), the RH injector harness connector (C) and the VIS solenoid valve connector (D).



ACJF002A

Fig. 39: Identifying RH Oxygen Sensor Connectors, Power Steering Sensor Connector, RH Injector Harness Connector And VIS Solenoid Valve Connector

2. Disconnect the RH ignition coil connector.
3. Disconnect the OCV connector (A) and the knock sensor connector (B).
4. Disconnect the LH front oxygen sensor connector (C).
5. Disconnect the alternator connector (D) and the air compressor connector (E).

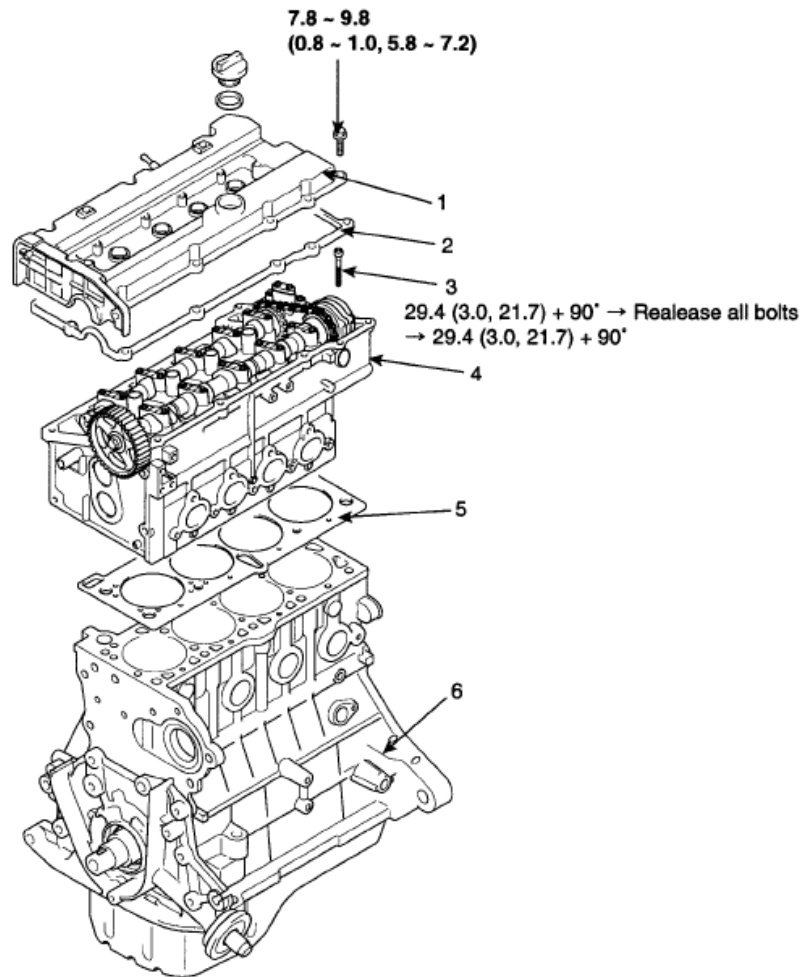


KXDSE16A

Fig. 40: Identifying OCV Connector, Knock Sensor Connector, LH Front Oxygen Sensor Connector, Alternator Connector And Air Compressor Connector

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

■ 1.6 CVVT



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

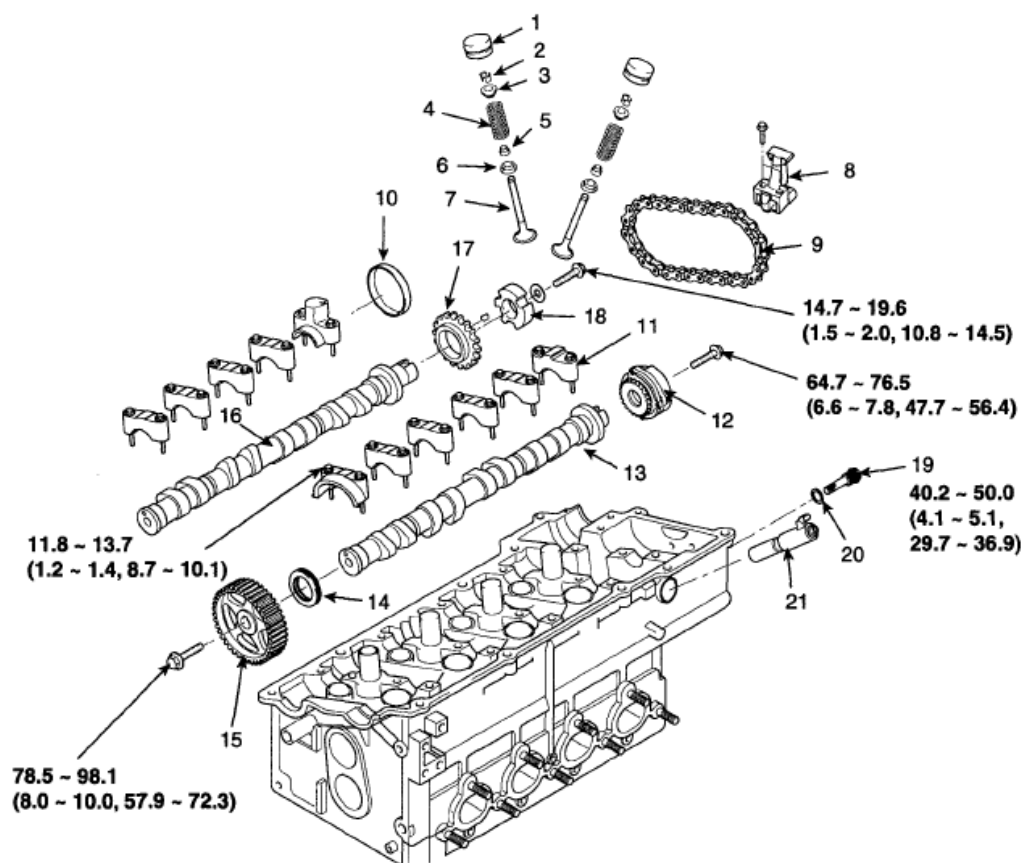
- | | |
|------------------------|-------------------------|
| 1. Cylinder head cover | 4. Cylinder head |
| 2. Gasket | 5. Cylinder head gasket |
| 3. Cylinder head bolt | 6. Cylinder block |

LCJF003A

Fig. 41: Identifying LH Ignition Coil Connector, Injector Connector, Condenser Connector, Ground And Wiring Harness Protector

7. Disconnect the RH CMPS (A) and the OTS connector (B).

■ 1.6 CVVT



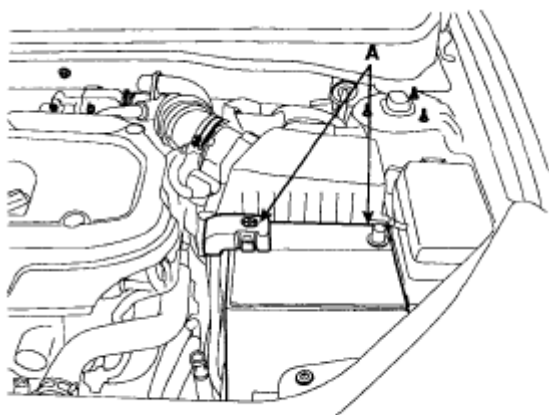
TORQUE : N.m (kgf.m, lb-ft)

- | | |
|-------------------------------------|--|
| 1. HLA
(Hydraulic Lash Adjuster) | 11. Camshaft bearing cap |
| 2. Retainer lock | 12. CVVT (Continuously Variable Valve Timing) assembly |
| 3. Retainer | 13. Exhaust camshaft |
| 4. Valve spring | 14. Oil seal |
| 5. Stem seal | 15. Camshaft sprocket |
| 6. Spring seat | 16. Intake camshaft |
| 7. Valve | 17. Chain sprocket |
| 8. Auto tensioner | 18. Camshaft position sensor target wheel |
| 9. Timing chain | 19. OCV (Oil Control Valve) Filter |
| 10. Oil seal cap | 20. Washer |
| | 21. OCV (Oil Control Valve) |

LCJF004A

Fig. 42: Identifying RH CMPS And OTS Connector

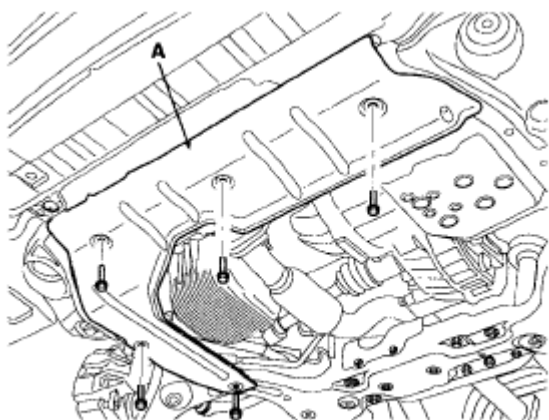
- Disconnect the PCSV connector (A), the MAP sensor connector (B) and the PCSV hose.



UCNG003A

Fig. 43: Identifying PCSV Connector And Map Sensor Connector

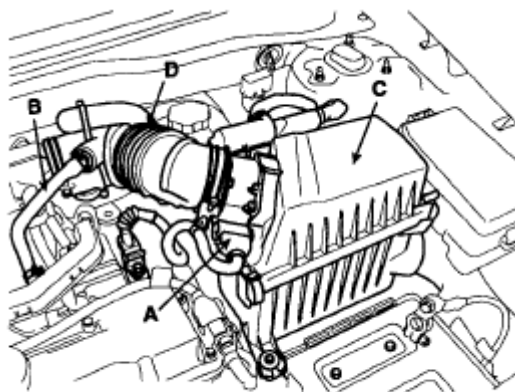
9. Disconnect the ETC connector (A) and the knock sensor connector (B).



ACJF006A

Fig. 44: Identifying ETC Connector And Knock Sensor Connector

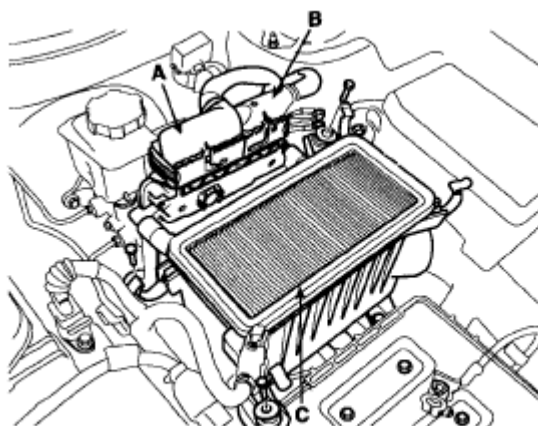
10. Disconnect the water hoses (B) from ETC and PCV(C) hose.



ACJF007A

Fig. 45: Identifying Water Hoses, ETC And PCV

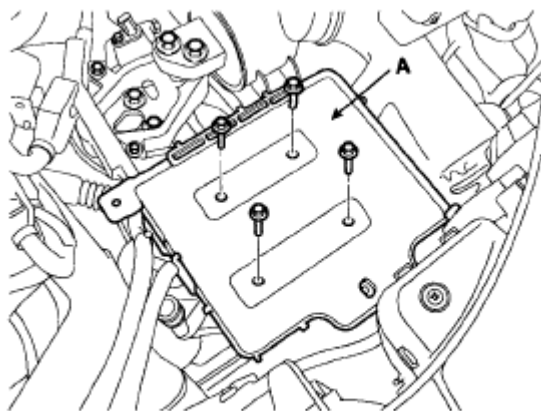
11. Disconnect the TCU connector (A) and CKP sensor connector (B).



ACJF008A

Fig. 46: Identifying TCU Connector And CKP Sensor Connector

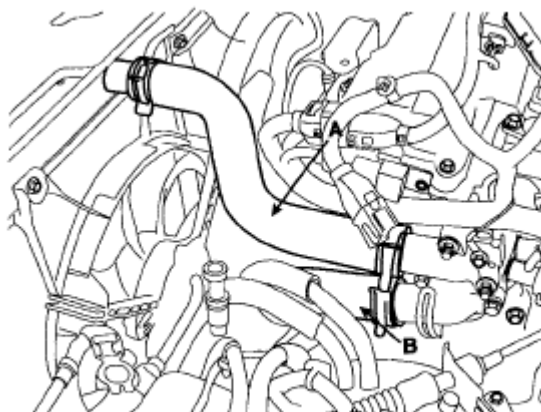
12. Disconnect the LH rear oxygen sensor connector (A).



ACJF008A

Fig. 47: Identifying LH Rear Oxygen Sensor Connector

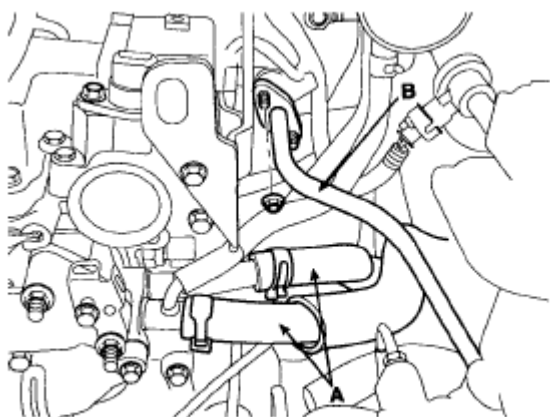
13. Disconnect brake vacuum hose.
14. Remove the breather pipe assembly (A).



ACJF126A

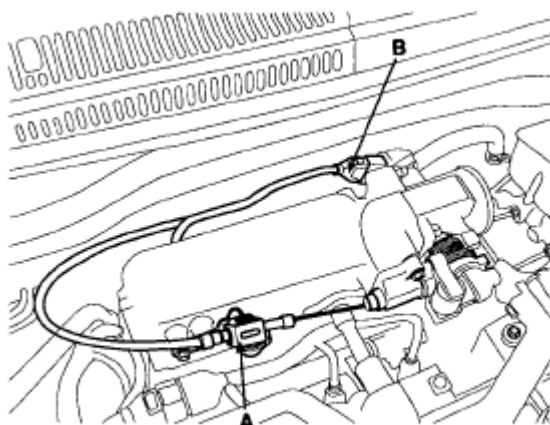
Fig. 48: Identifying Breather Pipe Assembly

15. Remove the surge tank stays (A).



ACJF011A

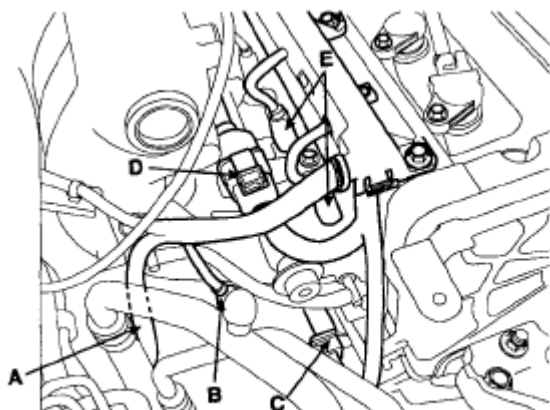
Fig. 49: Identifying Surge Tank Stays (1 Of 2)



BCJF001A

Fig. 50: Identifying Surge Tank Stays (2 Of 2)

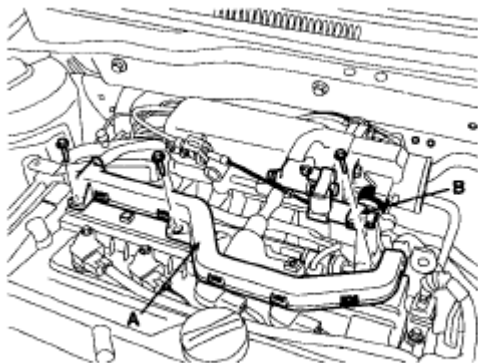
16. Remove the connector bracket (A) from the surge tank.



ACJF013A

Fig. 51: Identifying Surge Tank Connector Bracket

17. Remove the surge tank (A).

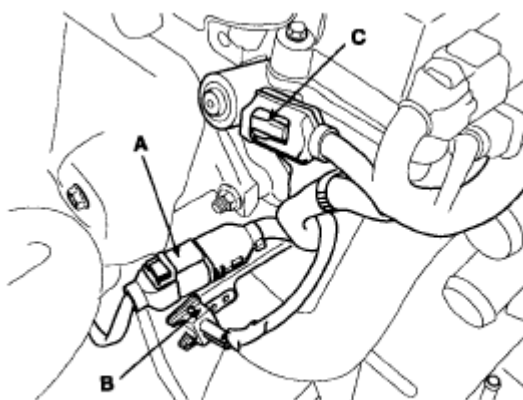


ACJF003A

Fig. 52: 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.

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



ACJF014A

Fig. 53: Identifying LH Cylinder Head Cover Connector Bracket

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

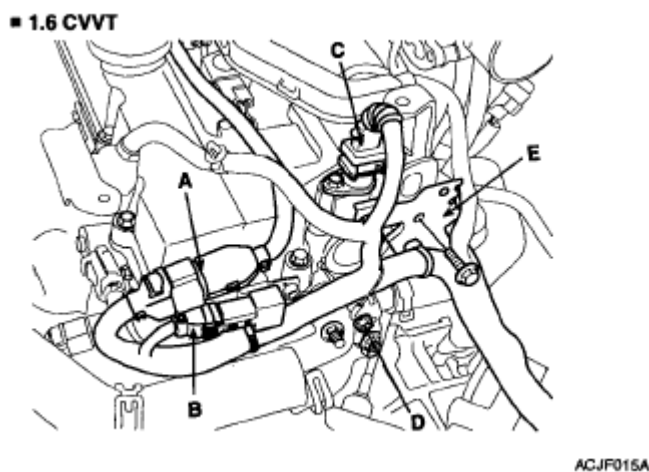


Fig. 54: Identifying RH Ignition Coil Connector, Condenser Connector And Wiring Bracket

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

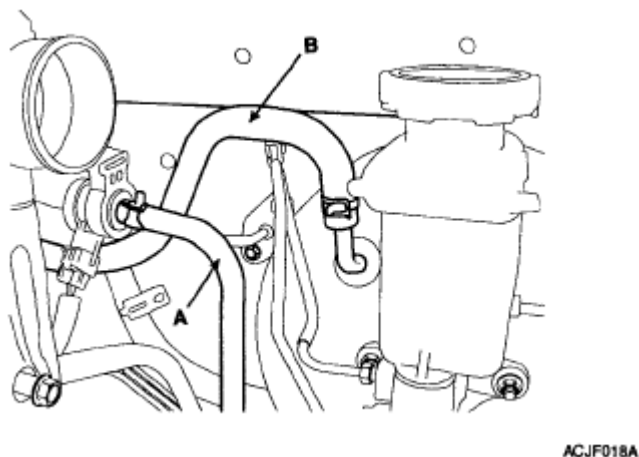
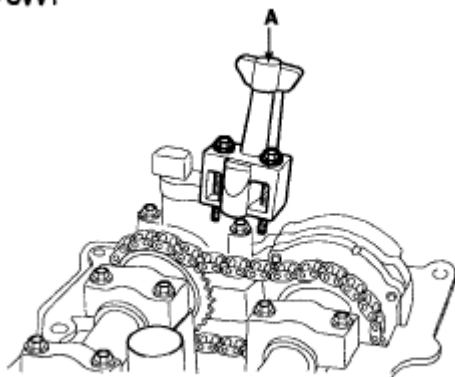


Fig. 55: Identifying LH And RH Cylinder Head Cover

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

■ 1.6 CVVT



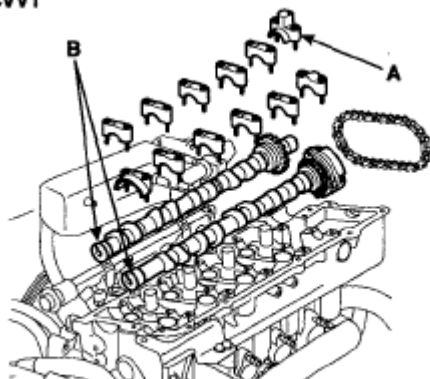
ACJF102A

Fig. 56: 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.

14. Set a jack to the upper oil pan.

■ 1.6 CVVT

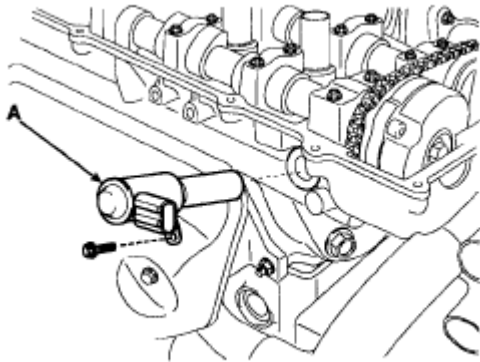


ACJF103A

Fig. 57: Locating Upper Oil Pan

15. Remove the PCM & relay box cover and loosen the relay box mounting bolts.

■ 1.6 CVVT

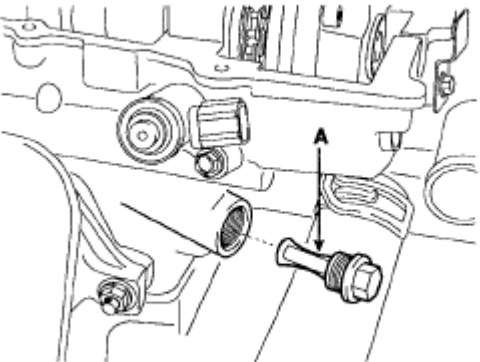


ACJF105A

Fig. 58: Identifying PCM & Relay Box Cover And Relay Box Mounting Bolts

16. Remove the engine mounting bracket (A).

■ 1.6 CVVT

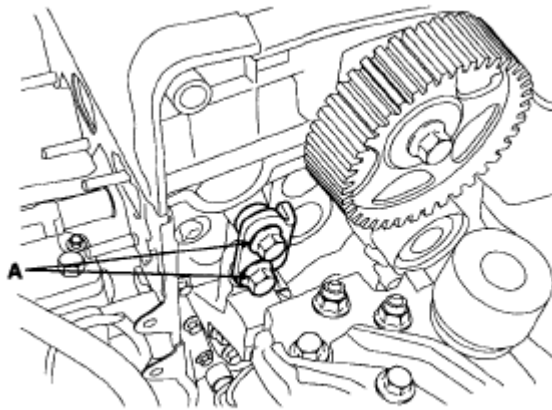


ACJF106A

Fig. 59: Identifying Engine Mounting Bracket

17. 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.



ACJF019A

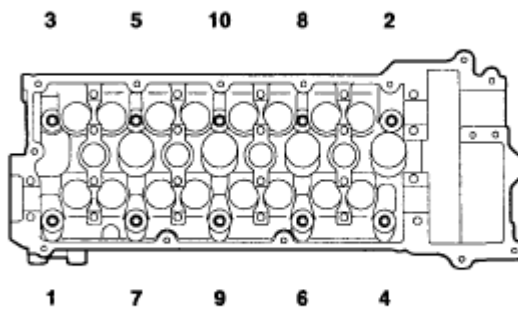
Fig. 60: Identifying Timing Mark On Lower Timing Chain Cover

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°).

NOTE: Do not rotate engine counterclockwise.

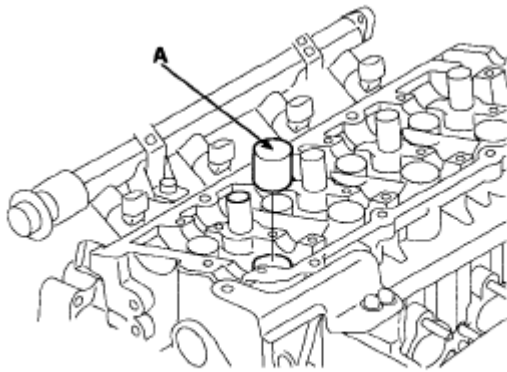
■ 1.6 CVVT



ACJF107A

Fig. 61: Identifying Mark On Camshaft Timing Sprockets

18. Remove the drive belt (A).

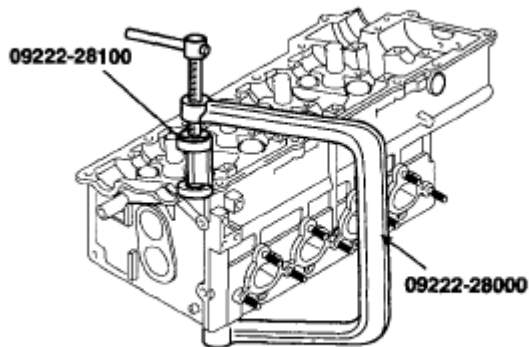


ECKD217A

Fig. 62: Identifying Drive Belt

19. Remove the crankshaft damper pulley (A).

■ 1.6 CVVT

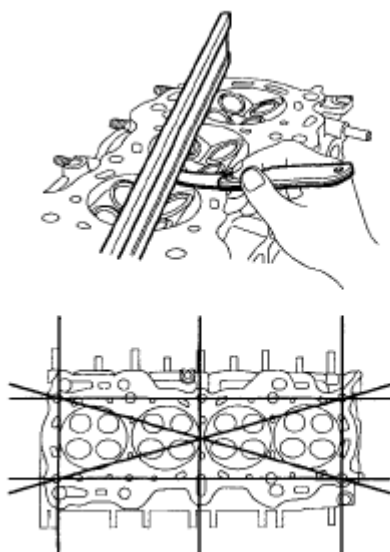


ACJF078A

Fig. 63: Identifying Crankshaft Damper Pulley

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

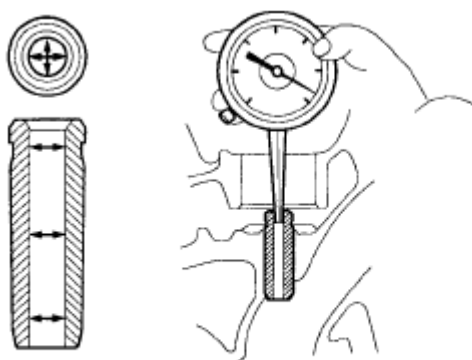
- Install the SST (09231-3C300) to hold the ring gear after removing the starter.



ECKD001H

Fig. 64: Installing Crankshaft Damper Pulley Using SST (09231-3C300)

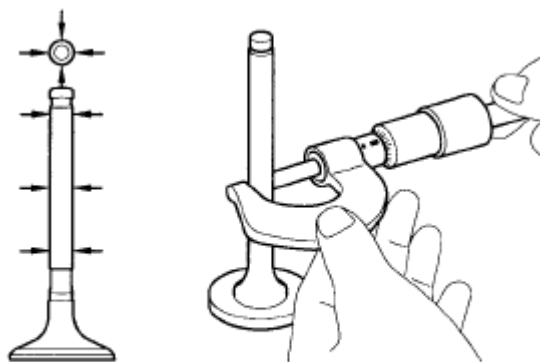
- Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.
 1. Remove the front muffler. (Refer to Intake And Exhaust system)
 2. Remove the dust cover (A) on the bottom of the upper oil pan and unfasten the two transaxle mounting bolts (B).



ECKD219A

Fig. 65: Identifying Dust Cover And Transaxle Mounting Bolts

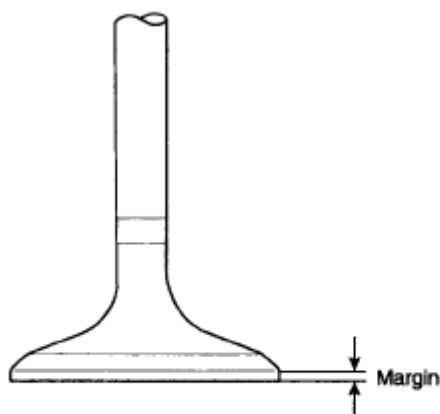
3. Adjust the length of the holder nuts (A) so that the front plate of the holder (B) puts in the ring gear (C) teeth.
4. Fasten the two transaxle mounting bolts in the original mounted holes.



ECKD220A

Fig. 66: Identifying Holder Nuts, Holder And Ring Gear With Mounting Bolts

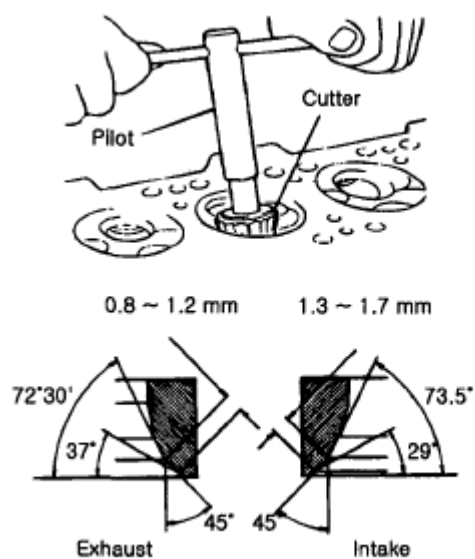
5. Install the SST (09231-3D100) using the two mounting bolts. Tighten the bolts and nuts of the holder securely.



ECKD221A

Fig. 67: Installing SST (09231-3D100) Using Mounting Bolts

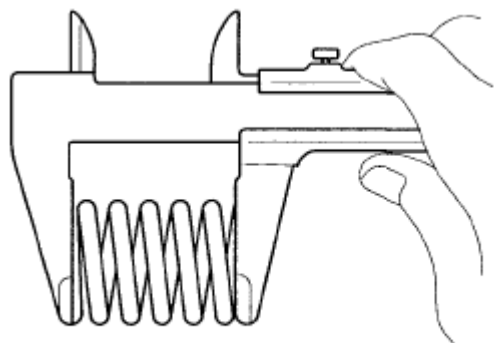
20. Lift up the engine assembly to using the jack.
21. Remove the drive belt idler (A).



LCGE005A

Fig. 68: Identifying Drive Belt Idler With Mounting Bolt

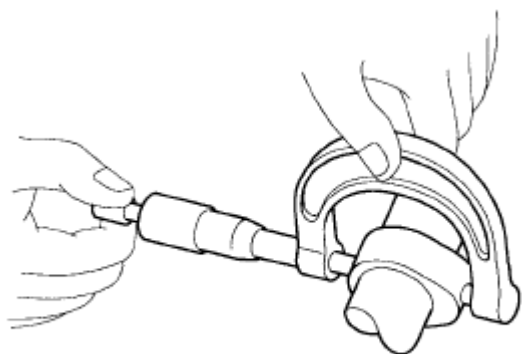
22. Remove the drive belt auto tensioner (A).



ECKD222A

Fig. 69: Identifying Drive Belt Auto Tensioner With Mounting Bolts

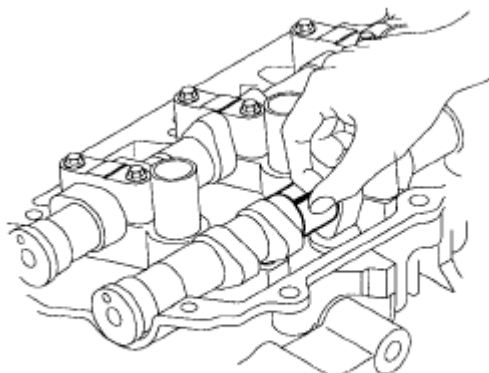
23. Remove the water pump pulley (A).



ECKD223A

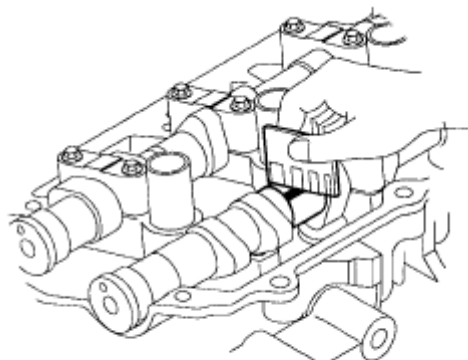
Fig. 70: Identifying Water Pump Pulley

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



ECKD224A

Fig. 71: Identifying Timing Chain Cover



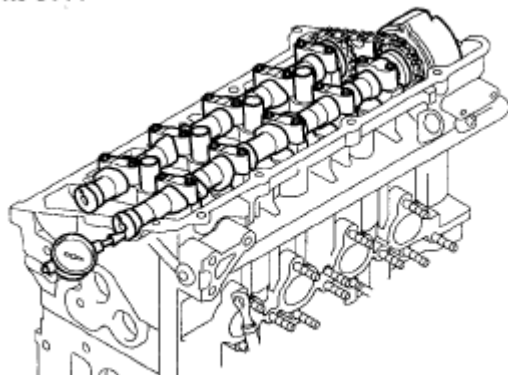
ECKD225A

Fig. 72: 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.

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

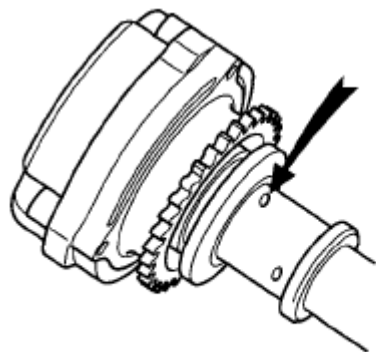
■ 1.6 CVVT



ACJF079A

Fig. 73: Installing Set Pin

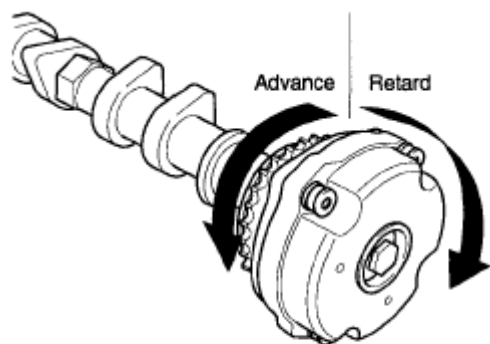
26. Remove the RH cam-to-cam guide (A).



EDKD270B

Fig. 74: Identifying RH Cam-To-Cam Guide

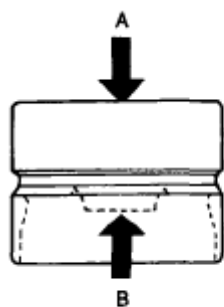
27. Remove the RH timing chain auto tensioner (A) and RH timing chain tensioner arm (B).



BCGE010A

Fig. 75: Identifying RH Timing Chain Auto Tensioner And RH Timing Chain Tensioner Arm

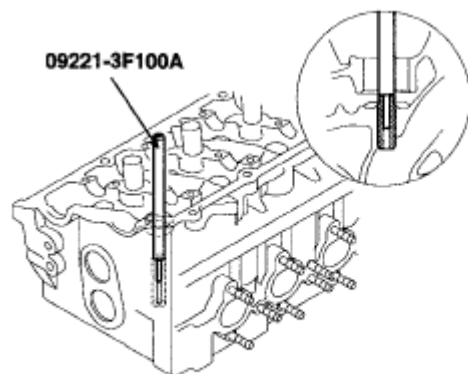
28. Remove the RH timing chain.
29. Remove the RH timing chain guide (A).



EDA9260B

Fig. 76: Identifying RH Timing Chain Guide

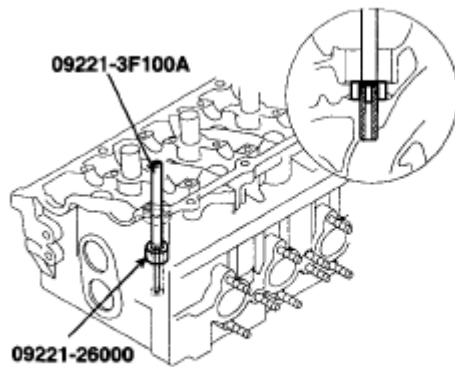
30. Remove the oil pump chain cover (A).



EDKD900A

Fig. 77: Identifying Oil Pump Chain Cover With Mounting Bolts

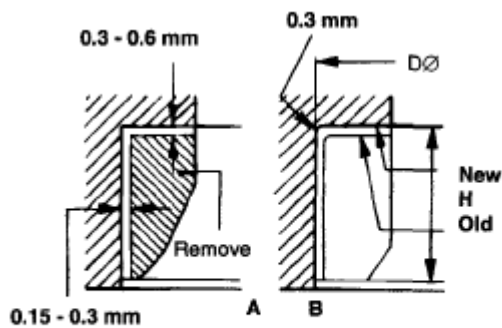
31. Remove the oil pump chain tensioner assembly (A).



ADGE006A

Fig. 78: Identifying Oil Pump Chain Tensioner Assembly

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

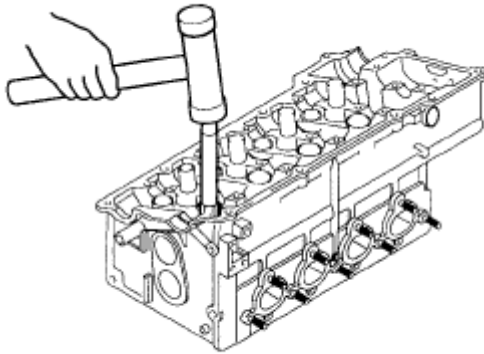


LCJF075A

Fig. 79: Identifying Oil Pump Chain Guide

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

■ 1.6 CVVT

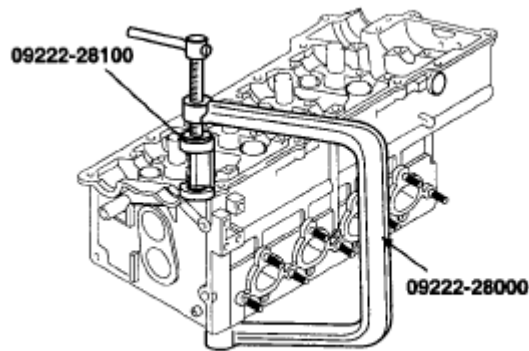


ACJF081A

Fig. 80: Identifying Oil Pump Chain Sprocket And Oil Pump Chain With Mounting Bolts

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

■ 1.6 CVVT

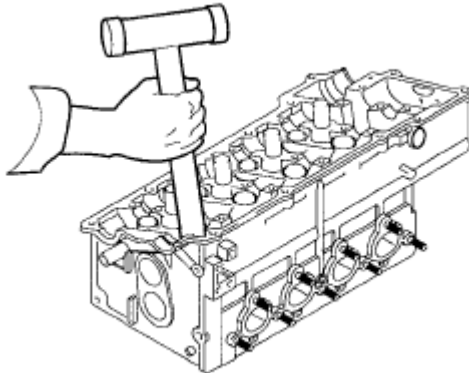


ACJF083A

Fig. 81: Identifying Crankshaft Sprocket (Oil Pump & RH Camshaft Drive)

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

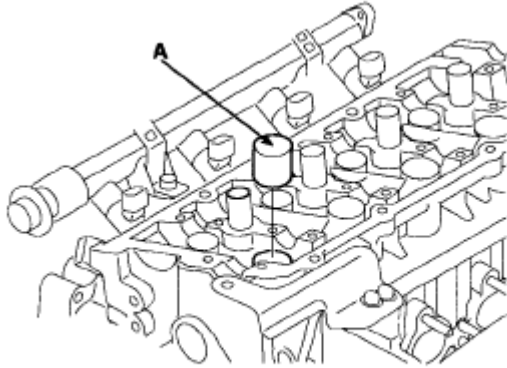
■ 1.6 CVVT



ACJF085A

Fig. 82: Installing Set Pin

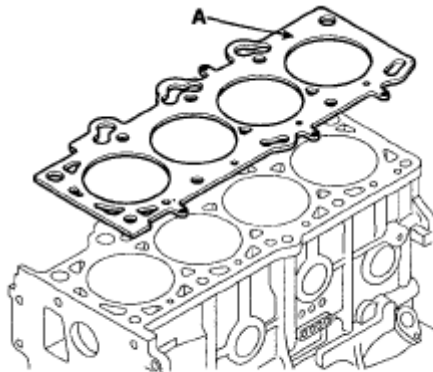
36. Remove the LH cam-to-cam guide (A).



ECKD217A

Fig. 83: Identifying LH Cam-To-Cam Guide

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

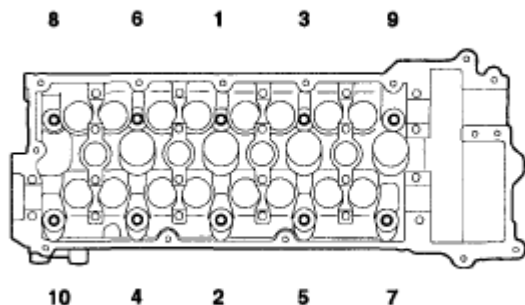


ECKD231A

Fig. 84: Identifying LH Timing Chain Auto Tensioner And LH Timing Chain Tensioner Arm

38. Remove the LH timing chain.
39. Remove the LH timing chain guide (A).

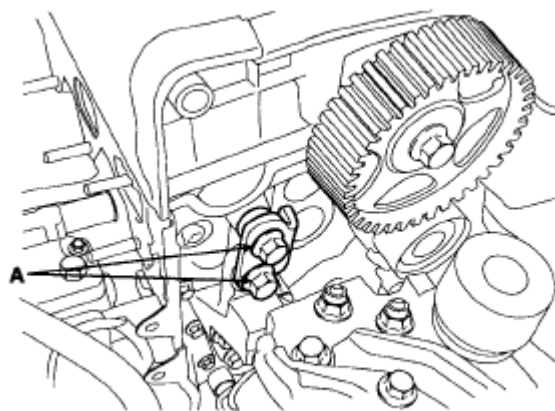
■ 1.6 CVVT



ACJF092A

Fig. 85: Identifying LH Timing Chain Guide

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

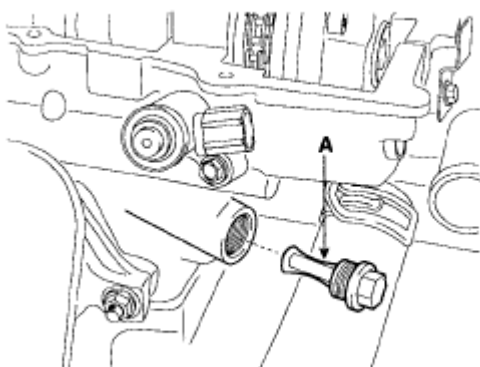


ACJF019A

Fig. 86: Identifying Crankshaft Sprocket (LH Camshaft Drive)

41. Remove the tensioner adapter assembly (A).

■ 1.6 CVVT



ACJF117A

Fig. 87: Identifying Tensioner Adapter Assembly

INSPECTION

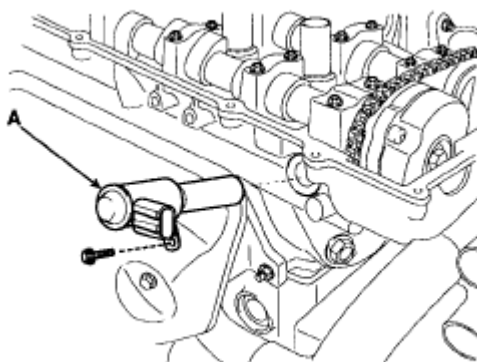
SPROCKETS, CHAIN TENSIONER, CHAIN GUIDE, CHAIN TENSIONER ARM

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.

■ 1.6 CVVT

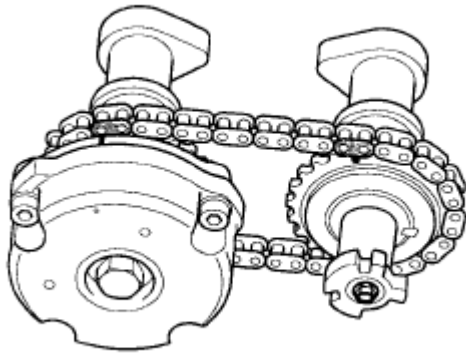


ACJF118A

Fig. 88: Locating Upper Oil Pan

2. The key (A) of crankshaft should be aligned with the timing mark (B) of timing chain cover. As a result of this, the piston of No. 1 cylinder is placed at the top dead center on compression stroke.

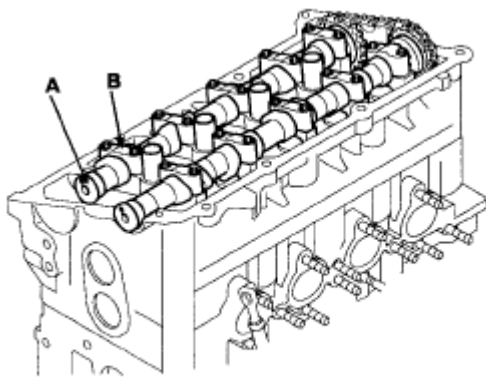
■ 1.6 CVVT



ACJF094A

Fig. 89: Identifying Key And Timing Mark On Timing Chain Cover

3. Install the tensioner adapter assembly (A).

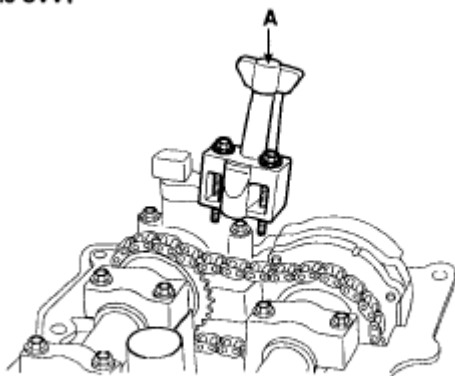


EDKD124A

Fig. 90: Identifying Tensioner Adapter Assembly

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

■ 1.6 CVVT



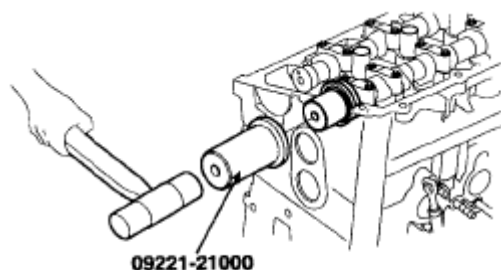
ACJF119A

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

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

Tightening torque

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



EDKD125A

Fig. 92: Identifying LH Timing Chain Guide

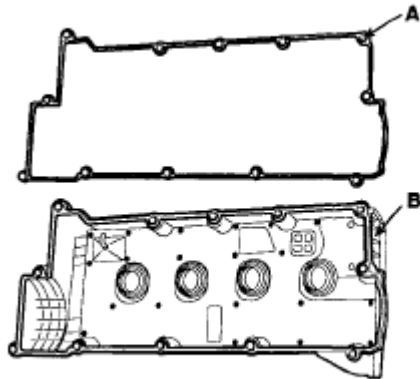
6. Install LH timing chain.

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.

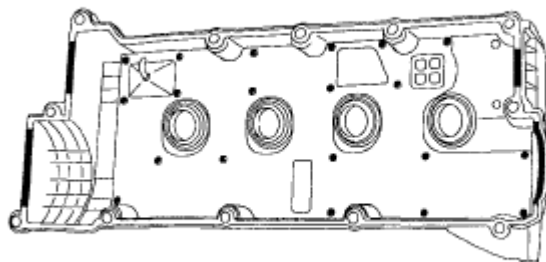
■ 1.6 CVVT



ACJF096A

Fig. 93: Identifying Timing Mark On Exhaust Camshaft Sprocket And Intake Camshaft Sprocket

■ 1.6 CVVT



ACJF096A

Fig. 94: Identifying LH Timing Chain

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

Tightening torque

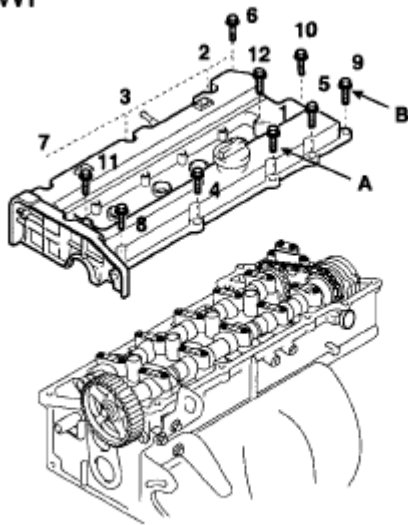
18.62 ~ 21.56 Nm (1.9 ~ 2.2 kgf.m, 13.74 ~ 15.91 lb-ft)

8. Install the LH chain tensioner (A).

Tightening torque

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

■ 1.6 CVVT



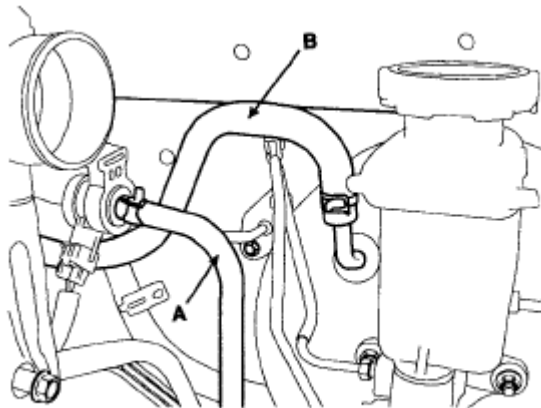
ACJF087A

Fig. 95: Identifying LH Timing Chain Tensioner Arm And LH Chain Tensioner

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

Tightening torque

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



ACJF018A

Fig. 96: Identifying LH Cam-To-Cam Guide

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

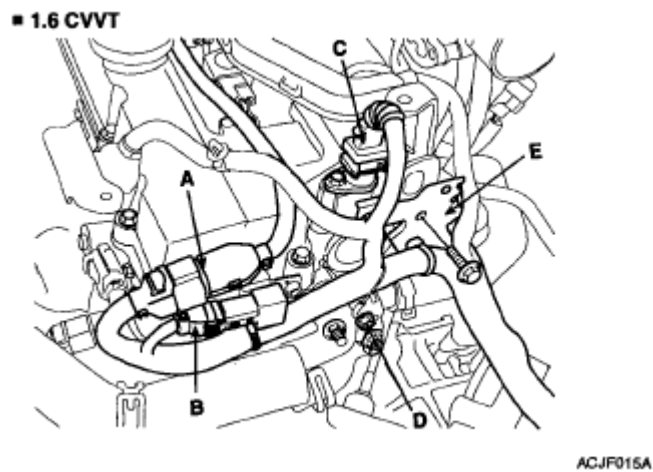


Fig. 97: Identifying Crankshaft Sprocket (Oil Pump & RH Camshaft Drive)

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

Tightening torque

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

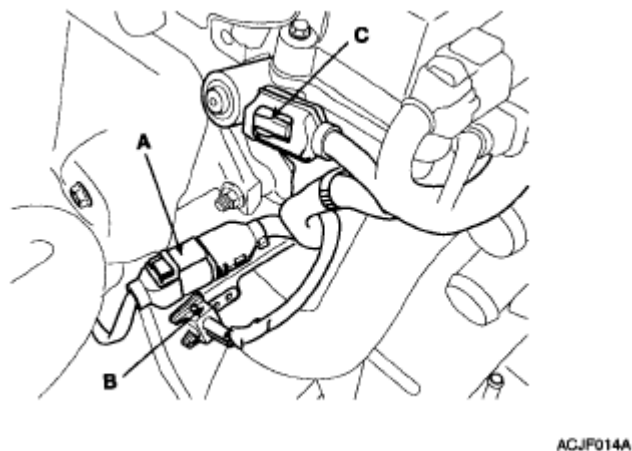
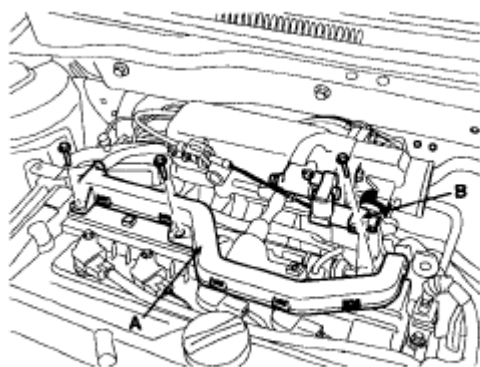


Fig. 98: Identifying Oil Pump Chain And Oil Pump Sprocket With Mounting Bolt

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

Tightening torque

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



ACJF003A

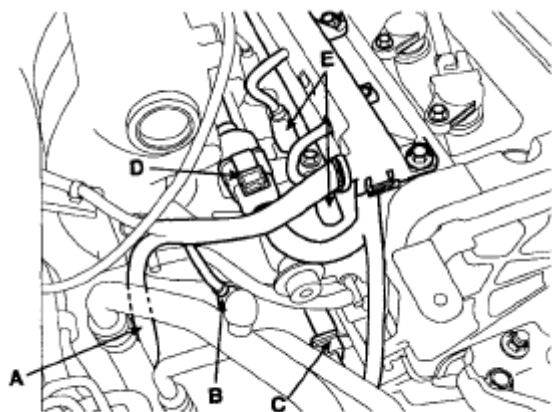
Fig. 99: Identifying RH Timing Chain Guide

13. Install the RH timing chain.

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

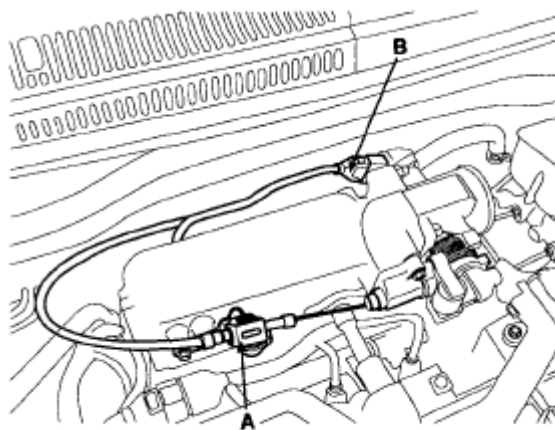
Crankshaft sprocket (A) --> Intake camshaft sprocket (B) --> Exhaust camshaft sprocket (C).

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



ACJF013A

Fig. 100: Identifying Timing Mark On Crankshaft Sprocket



BCJF001A

Fig. 101: Identifying Timing Mark On Intake Camshaft Sprocket And Exhaust Camshaft Sprocket

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

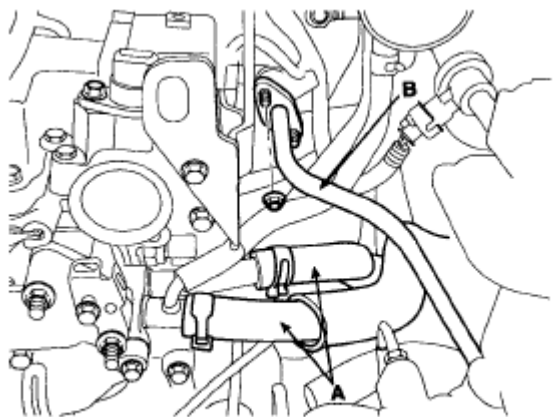
Tightening torque

18.62 ~ 21.56 Nm (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 Nm (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)



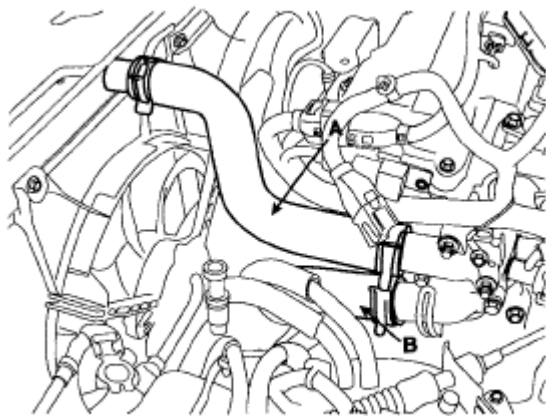
ACJF011A

Fig. 102: Identifying RH Timing Chain Auto Tensioner And RH Timing Chain Tensioner Arm

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

Tightening torque

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



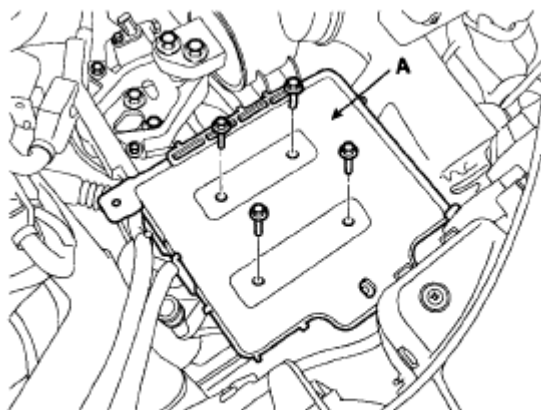
ACJF126A

Fig. 103: Identifying RH Cam-To-Cam Guide

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

Tightening torque

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



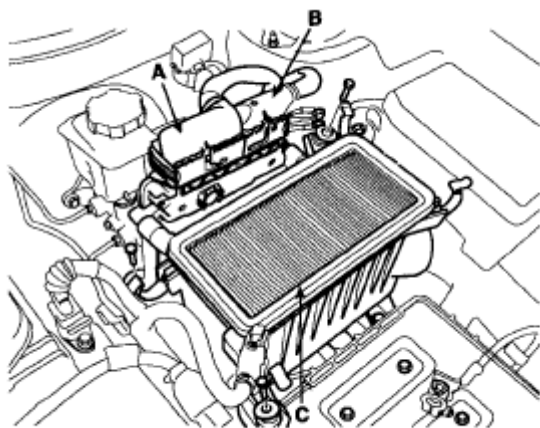
ACJF009A

Fig. 104: Identifying Oil Pump Chain Guide

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

Tightening torque

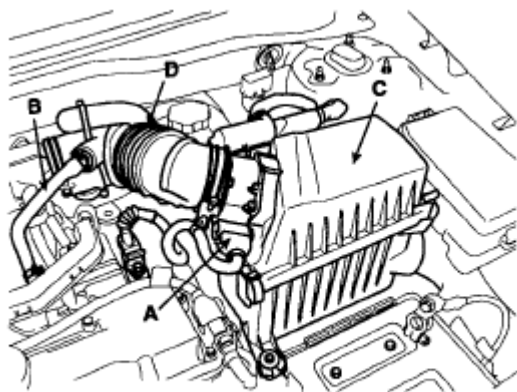
9.80 ~ 11.76 Nm (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)



ACJF008A

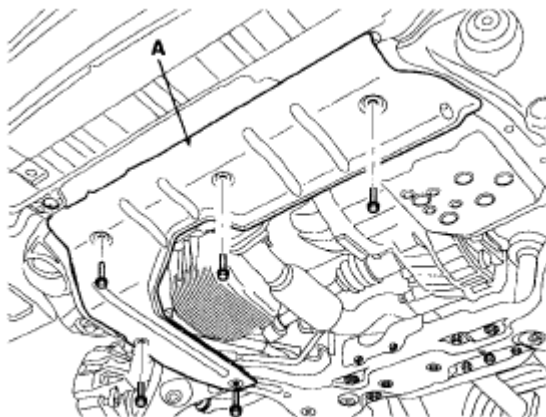
Fig. 105: Identifying Oil Pump Chain Tensioner Assembly

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



ACJF007A

Fig. 106: Pulling Out Pins Of Hydraulic Tensioners (LH)



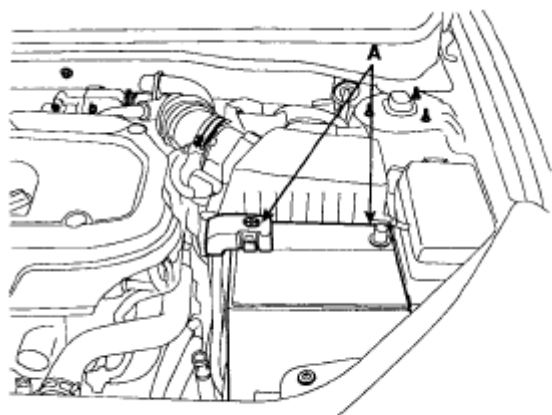
ACJF006A

Fig. 107: Pulling Out Pins Of Hydraulic Tensioners (RH)

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

Tightening torque

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



UCNG003A

Fig. 108: Identifying Oil Pump Chain Cover With Mounting Bolts

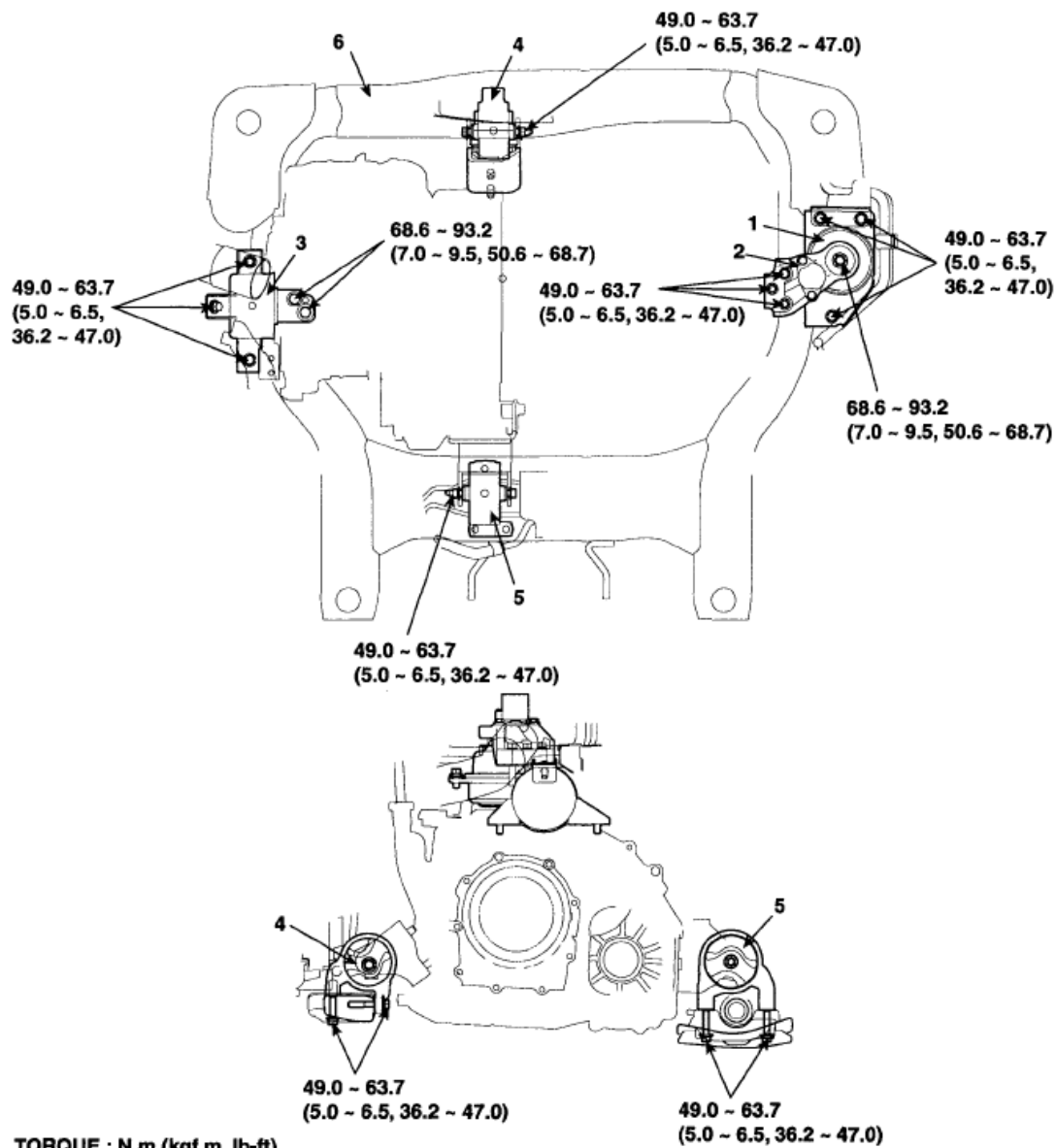
21. After rotating crankshaft 2 revolutions in regular direction (clockwise viewed from front), confirm the timing mark.

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.
 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 (0.1in.)



1. Engine mounting bracket
2. Engine mounting support bracket
3. Transaxle mounting bracket

4. Front roll stopper
5. Rear roll stopper
6. Sub-frame

LCJF007A

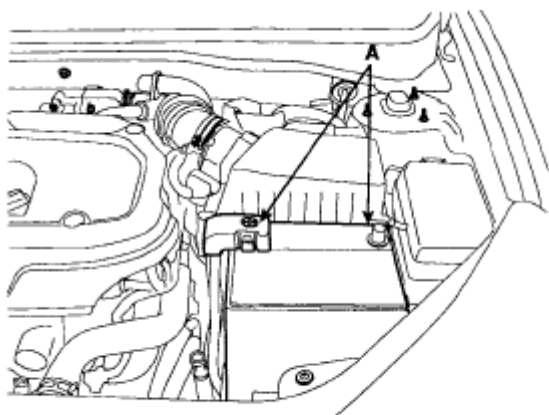
Fig. 109: Identifying Timing Chain Cover

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.

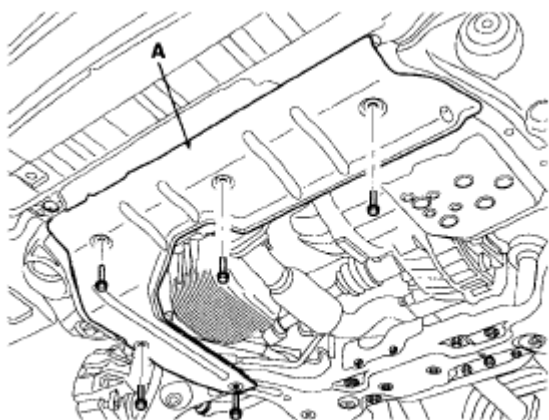
Bead width: 2.5 mm (0.1 in.)



UCNG003A

Fig. 110: Identifying Timing Chain Cover Liquid Sealant TB1217H Applying Dimensions

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



ACJF006A

Fig. 111: 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): 21.56 ~ 23.52 N.m (2.2 ~ 2.4 kgf.m, 15.91 ~ 17.36 lb-ft)

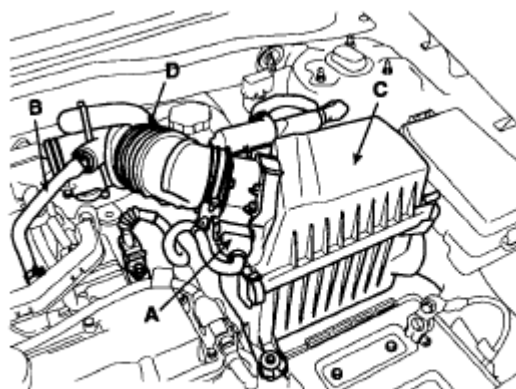
H(1): 9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)

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)

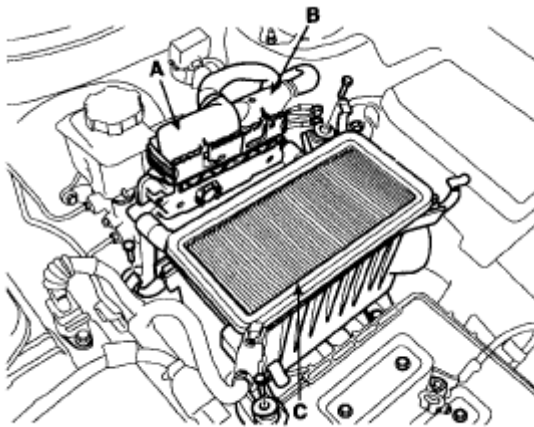
L(1): 21.56 ~ 26.46 N.m (2.2 ~ 2.7 kgf.m, 15.91 ~ 19.53 lb-ft) - New bolt



ACJF007A

Fig. 112: 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.



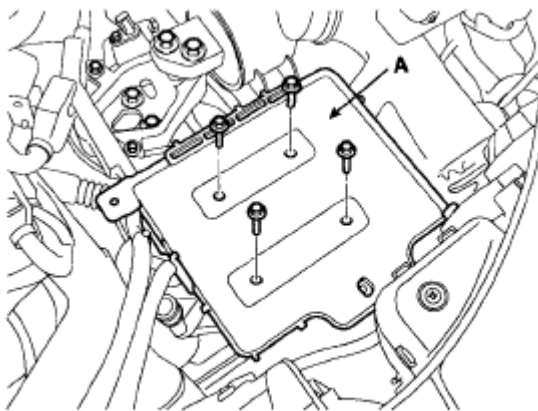
ACJF008A

Fig. 113: Identifying Water Pump Pulley

23. Install the water pump pulley (A).

Tightening torque

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



ACJF008A

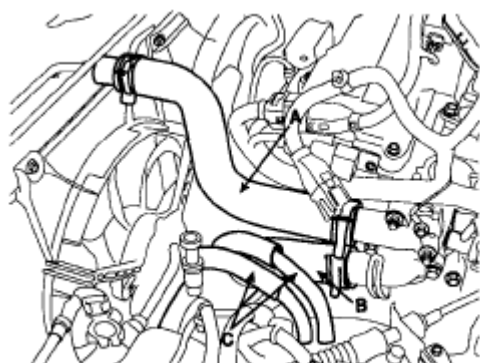
Fig. 114: Identifying Drive Belt Auto Tensioner With Mounting Bolts

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)



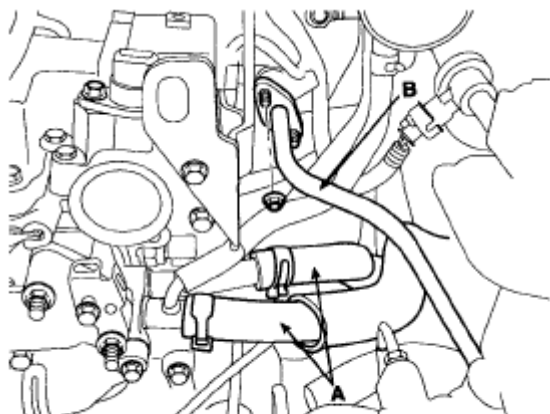
ACJF010A

Fig. 115: Identifying Drive Belt Idler With Mounting Bolt

25. Install the drive belt idler (A).

Tightening torque

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



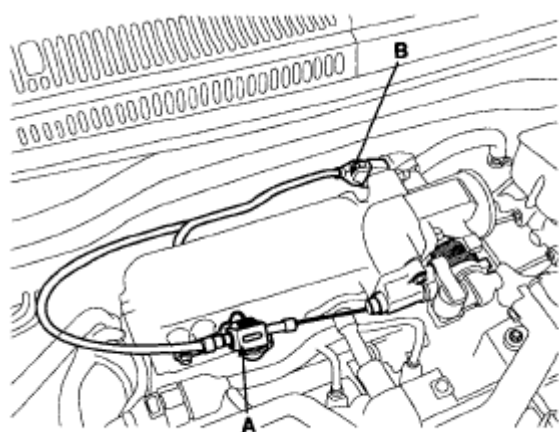
ACJF011A

Fig. 116: Installing Timing Chain Cover Oil Seal Using SST (09231-3C100)

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

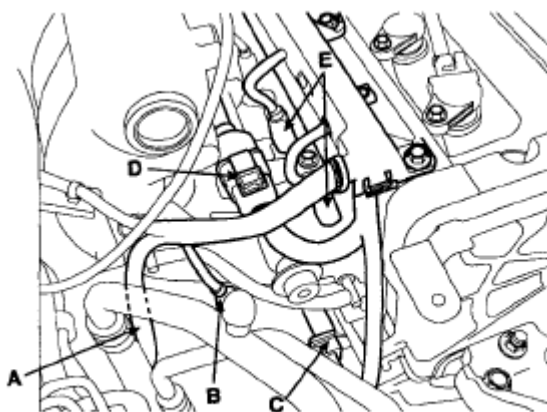


BCJF001A

Fig. 117: Identifying Crankshaft Damper Pulley

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

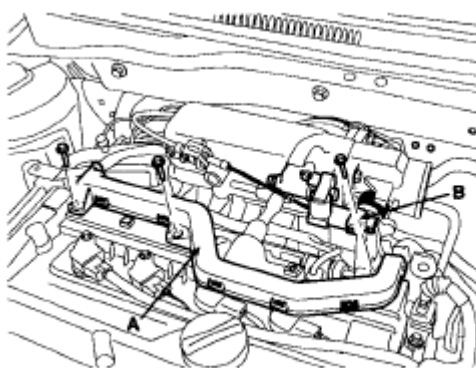
- Install the SST (09231-3C300) to hold the ring gear after removing the starter.



ACJF013A

Fig. 118: Installing Crankshaft Damper Pulley Using SST (09231-3C300)

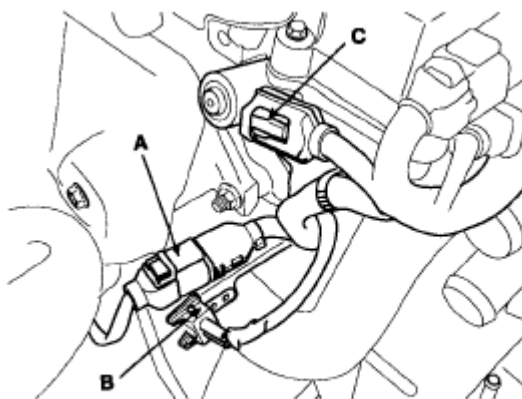
- Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.
 1. Remove the front muffler. (Refer to Intake And Exhaust system)
 2. Remove the dust cover (A) on the bottom of the upper oil pan and unfasten the two transaxle mounting bolts (B).



ACJF003A

Fig. 119: 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.



ACJF014A

Fig. 120: Identifying Holder Nuts, Holder And Ring Gear With Mounting Bolts

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

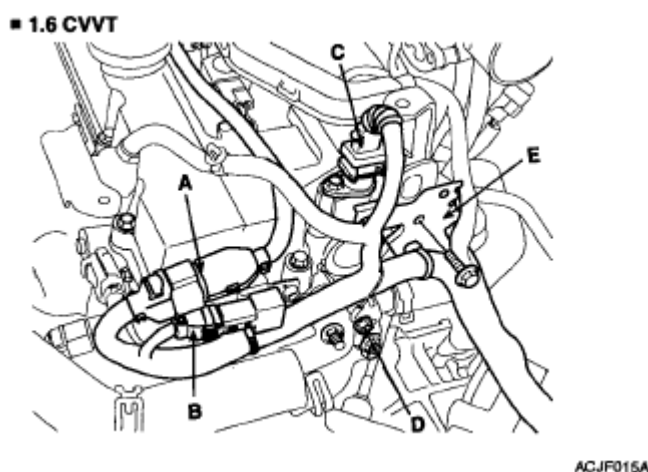


Fig. 121: Installing SST (09231-3D100) Using Mounting Bolts

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.

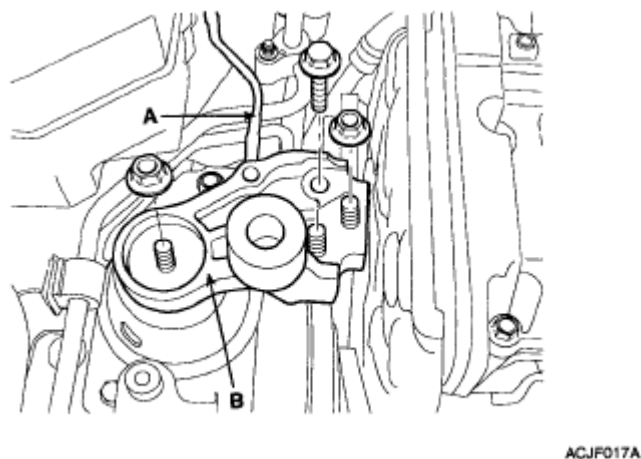
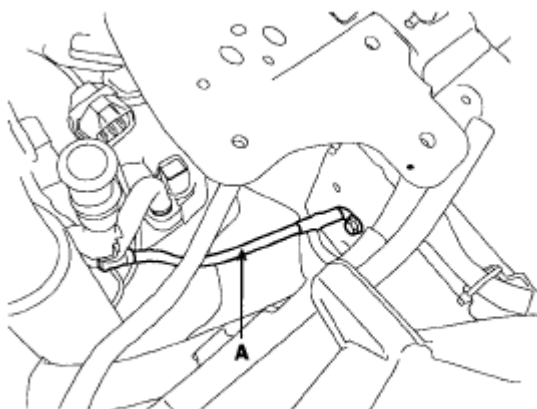


Fig. 122: Identifying Drive Belt

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.)



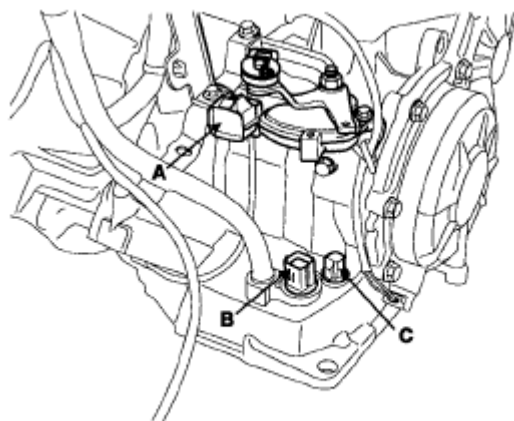
ACJF020A

Fig. 123: 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)

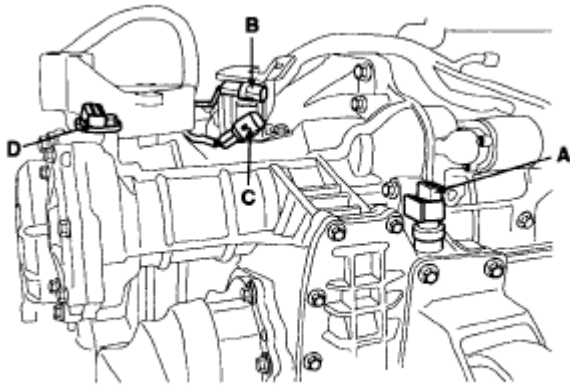


ACJF021A

Fig. 124: Identifying Cylinder Head Cover Bolts Tightening Sequence

CAUTION: Do not reuse cylinder head cover gasket.

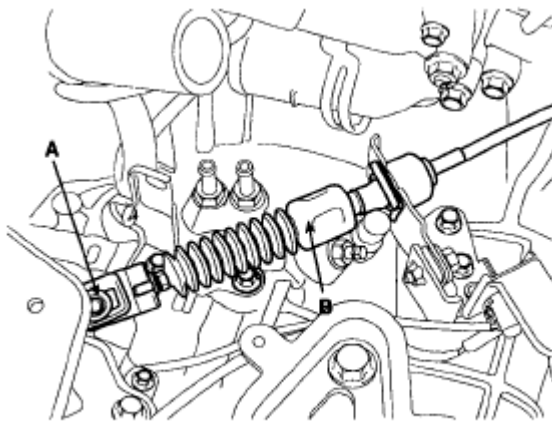
5. Install the ignition coil.
6. Connect the RH ignition coil connector (A), the condenser connector (B) and install the wiring bracket (C).



ACJF022A

Fig. 125: Identifying RH Ignition Coil Connector, Condenser Connector And Wiring Bracket

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



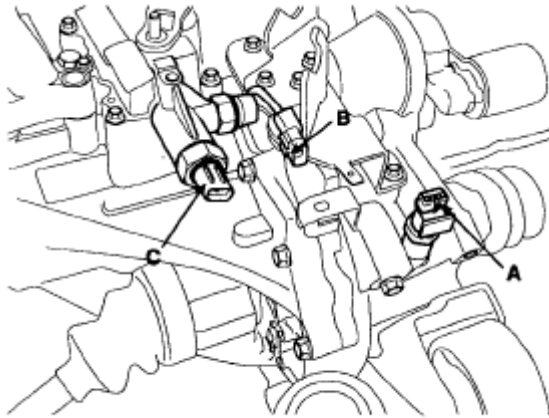
ACJF023A

Fig. 126: 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)



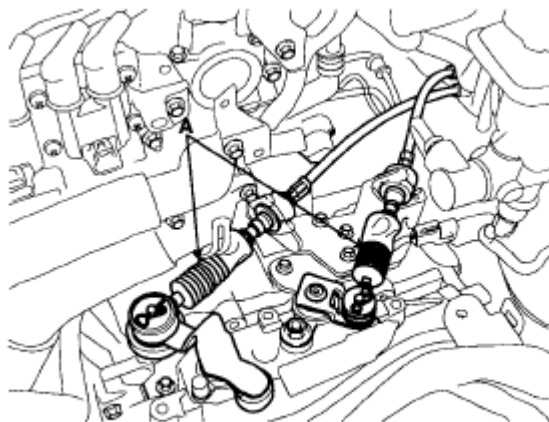
ACJF024A

Fig. 127: 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)



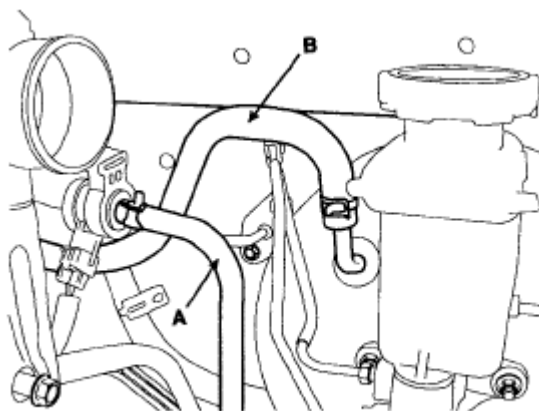
ACJF025A

Fig. 128: Identifying Surge Tank Connector Bracket

3. Install the surge tank stays (A).

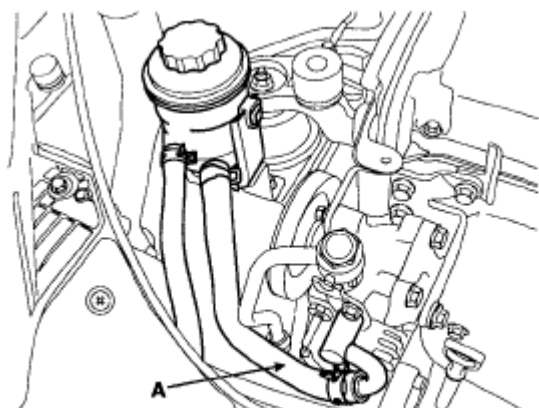
Tightening torque

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



ACJF018A

Fig. 129: Identifying Surge Tank Stays (1 Of 2)



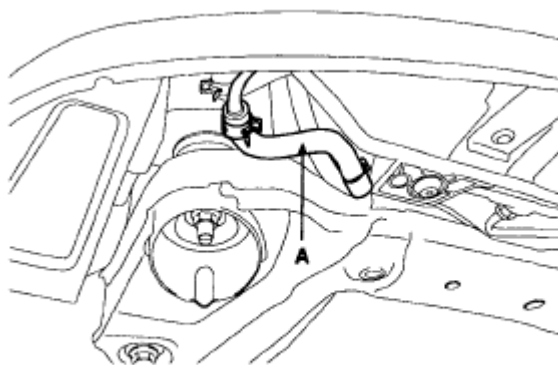
ACJF026A

Fig. 130: Identifying Surge Tank Stays (2 Of 2)

4. Install the breather pipe assembly (A).

Tightening torque

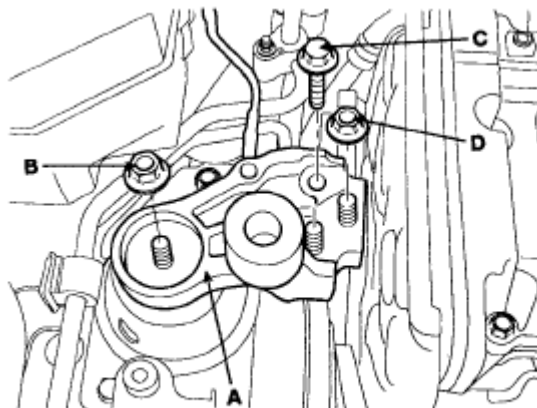
9.80 ~ 11.76 N.m (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft)



ACJF027A

Fig. 131: Identifying Breather Pipe Assembly

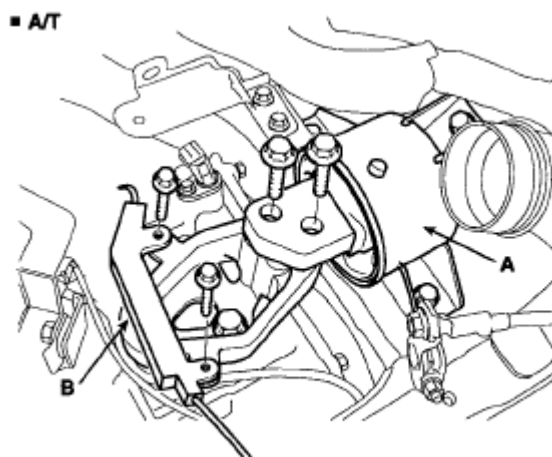
5. Connect the brake vacuum hose.
6. Connect the LH rear oxygen sensor connector (A).



ACJF130A

Fig. 132: Identifying LH Rear Oxygen Sensor Connector

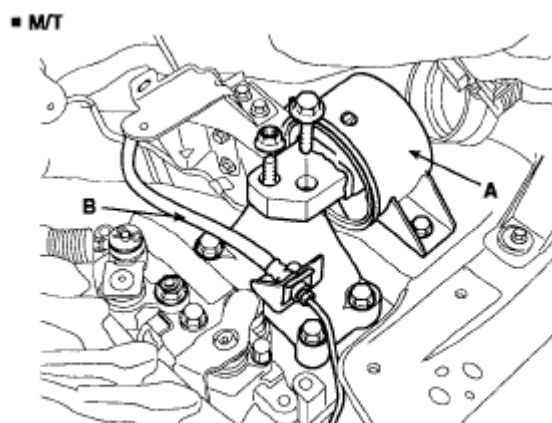
7. Connect the TCU connector (A) and CKP sensor connector (B).



BCJF002A

Fig. 133: Identifying TCU Connector And CKP Sensor Connector

8. Connect the water hoses (B) to the ETC and PCV (C) hose.



BCJF003A

Fig. 134: Identifying Water Hoses, ETC And PCV

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

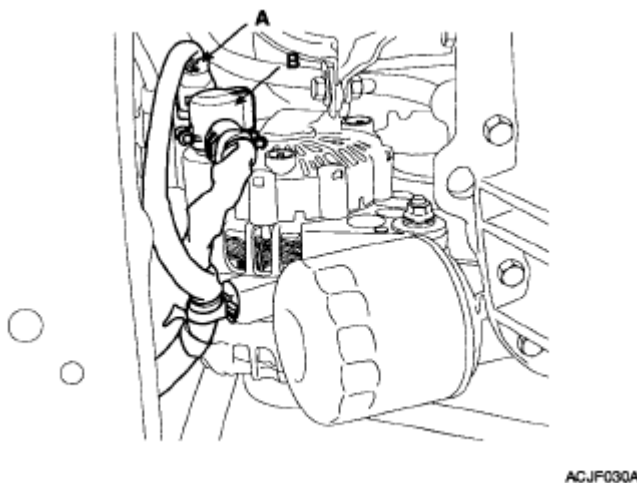


Fig. 135: Identifying ETC Connector And Knock Sensor Connector

10. Connect the PCSV connector (A), the MAP sensor connector (B) and the PCSV hose.

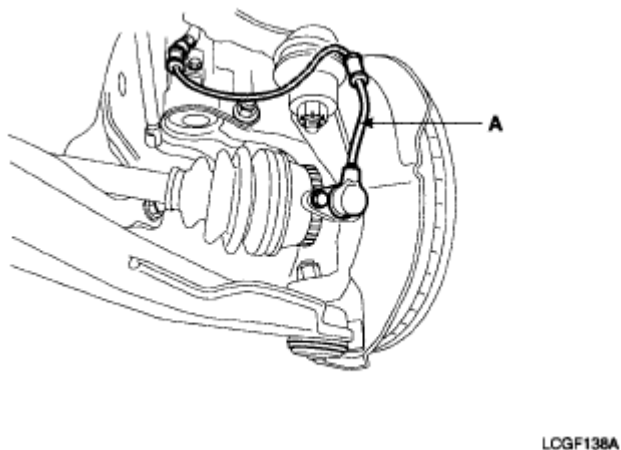
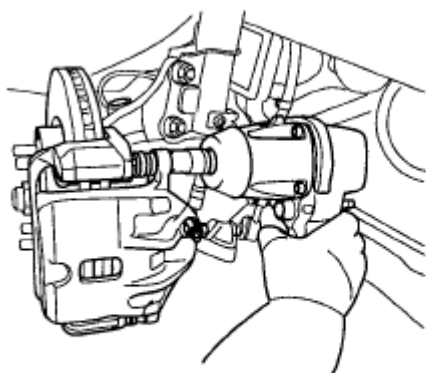


Fig. 136: Identifying PCSV Connector And Map Sensor Connector

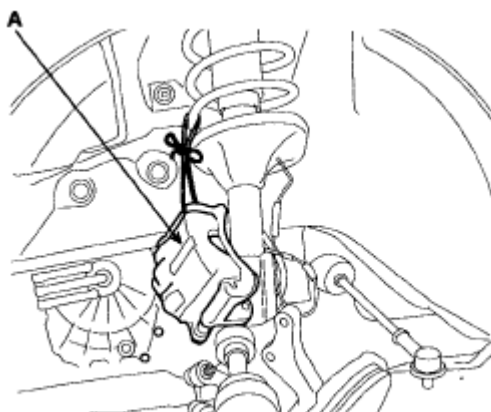
11. Disconnect the RH CMPS (A) and the OTS connector (B).



LCGF139A

Fig. 137: Identifying RH CMPS And OTS Connector

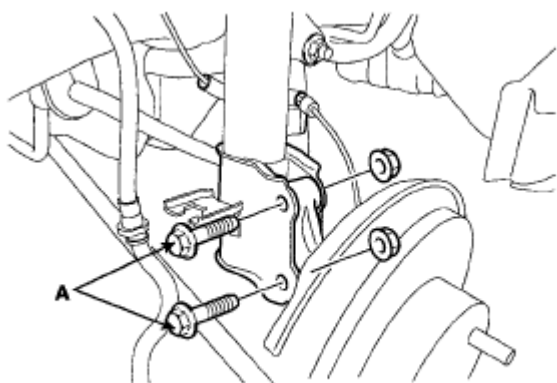
12. Install the wiring harness protector (E) and connect the LH ignition coil connector (A), the injector connector (B), the condenser connector (C) and the ground (D).



LCGF140A

Fig. 138: Identifying LH Ignition Coil Connector, Injector Connector, Condenser Connector, Ground And Wiring Harness Protector

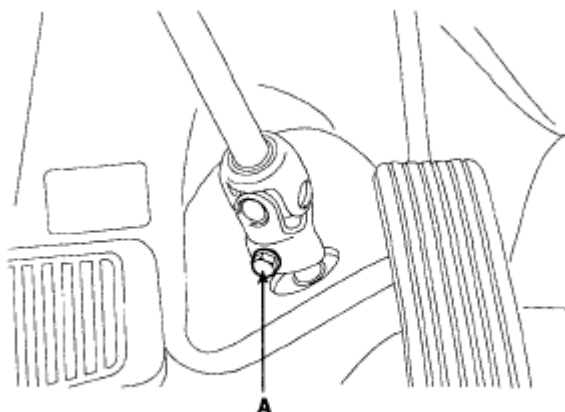
13. Connect the alternator connector (D) and the air compressor connector (E).
14. Connect the LH front oxygen sensor connector (C).
15. Connect the OCV connector (A) and the knock sensor connector (B).
16. Connect the RH ignition coil connector.



LCGF141A

Fig. 139: Identifying OCV Connector, Knock Sensor Connector, LH Front Oxygen Sensor Connector, Alternator Connector And Air Compressor Connector

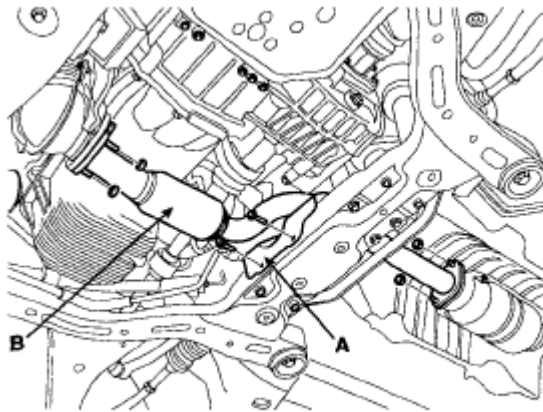
17. Disconnect the RH front and rear oxygen sensor connectors (A), the power steering sensor connector (B), the RH injector harness connector (C) and the VIS solenoid valve connector (D).



LCGF142A

Fig. 140: Identifying RH Oxygen Sensor Connectors, Power Steering Sensor Connector, RH Injector Harness Connector And VIS Solenoid Valve Connector

32. Connect the ground cable (A) and tighten the power steering hose mounting bolt (B).



ACJF031A

Fig. 141: Identifying Ground Cable And Power Steering Hose Mounting Bolt

33. 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)

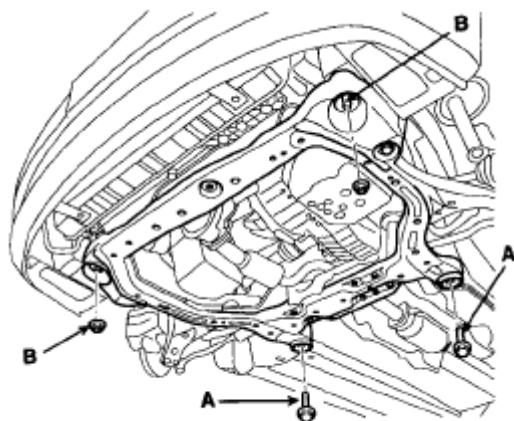
C: 63.7 ~ 83.4 N.m (6.5 ~ 8.5 kgf.m, 47.0 ~ 61.5 lb-ft)



KDNF001A

Fig. 142: Identifying Engine Mounting Bracket

34. Tighten the relay box mounting bolts and install the PCM & relay box cover.



ACJF033A

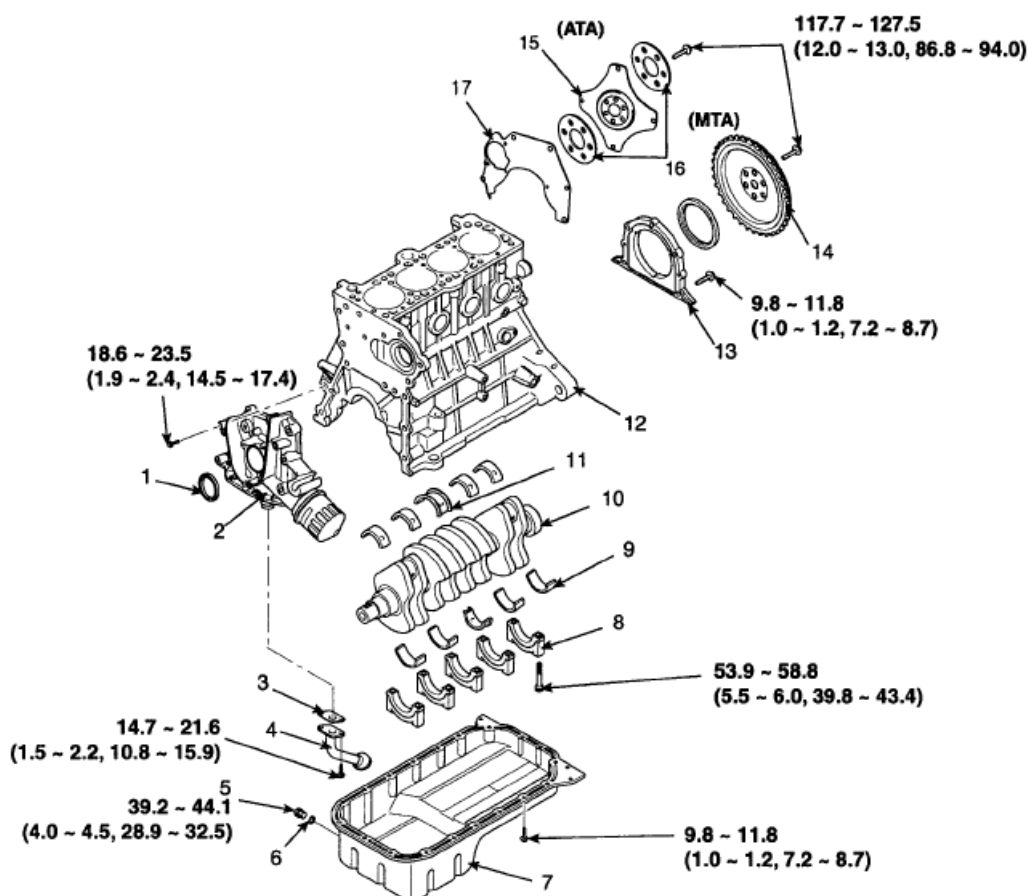
Fig. 143: Identifying PCM & Relay Box Cover And Relay Box Mounting Bolts

35. Remove the jack from the upper oil pan.
36. 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.)



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

- | | |
|---------------------|------------------------|
| 1. Oil seal | 10. Crankshaft |
| 2. Front case | 11. Center bearing |
| 3. Gasket | 12. Cylinder block |
| 4. Oil screen | 13. Rear oil seal case |
| 5. Drain plug | 14. Flywheel |
| 6. Gasket | 15. Drive plate |
| 7. Oil pan | 16. Washer |
| 8. Main bearing cap | 17. Rear plate |
| 9. Main bearing | |

UCNG001A

Fig. 144: Identifying Lower Oil Pan Sealant Applying Area

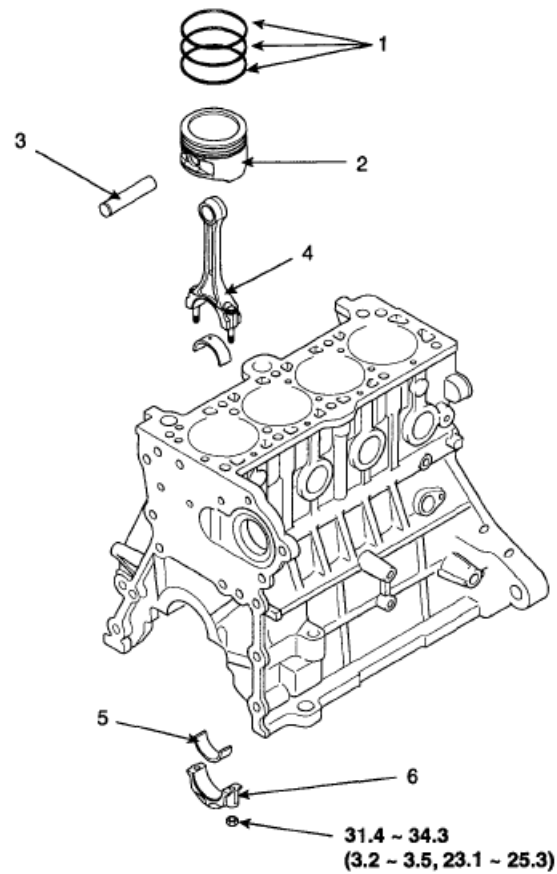
CAUTION:

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 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)



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

- 1. Piston ring
- 2. Piston
- 3. Piston pin

- 4. Connecting rod
- 5. Connecting rod bearing
- 6. Connecting rod bearing cap

LCJF009A

Fig. 145: Identifying Lower Oil Pan

- 37. Install the side cover.

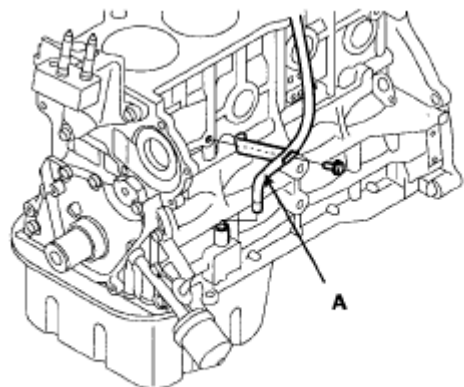
Tightening torque

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

- 38. 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)



ECKD301A

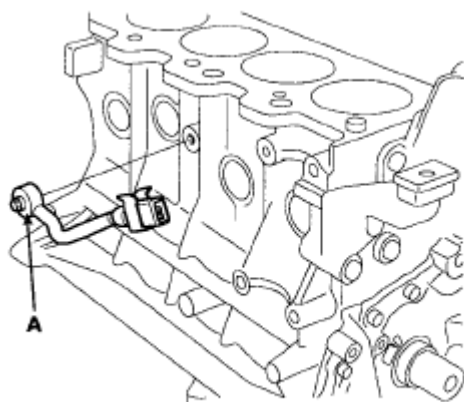
Fig. 146: Identifying Under Cover

39. 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)

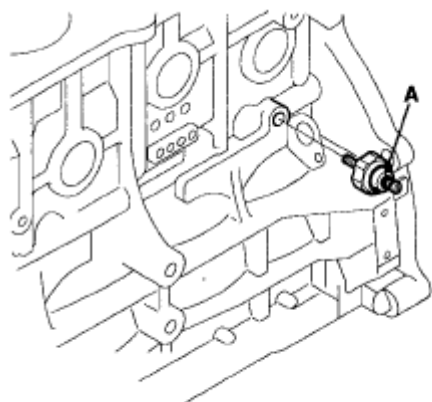
40. Install the intake air hose and air cleaner assembly.
1. Install the intake air hose (C) and air cleaner body (D).
 2. Connect the breather hose (B) to the air cleaner hose.
 3. Connect the AFS connector (A).



ECKD302A

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

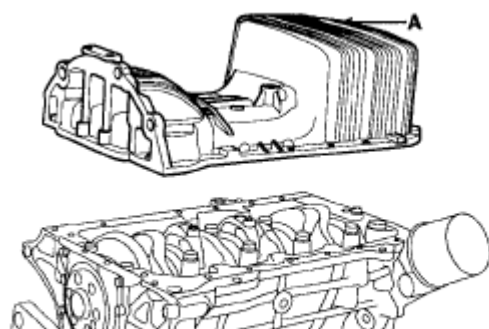
41. Install the engine cover (A).



ECKD303A

Fig. 148: Identifying Engine Cover With Mounting Screws

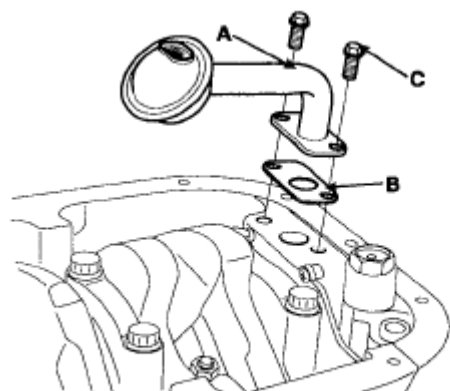
42. Install the air duct (A).



EDKD142A

Fig. 149: Identifying Air Duct With Mounting Screws

43. Connect the battery negative cable (A).



EDKD143A

Fig. 150: 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.

ACCESSORY DRIVE BELT

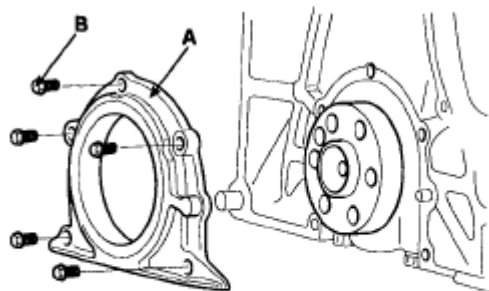
INSTALLATION

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

Tightening torque

81.4 ~ 85.3 Nm (8.3 ~ 8.7 kgf.m, 60.0 ~ 62.9 lb-ft)

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



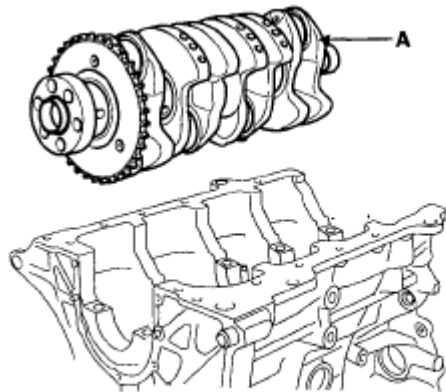
EDKD144A

Fig. 151: Identifying Drive Belt Auto Tensioner
Courtesy of HYUNDAI MOTOR CO.

2. Install the drive belt idler (A).

Tightening torque

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



ECKD307A

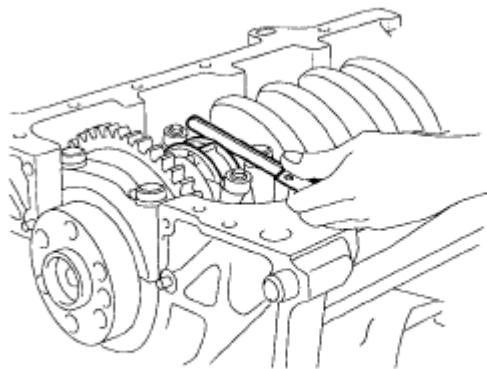
Fig. 152: Identifying Drive Belt Idler
Courtesy of HYUNDAI MOTOR CO.

3. Install the drive belt (A).

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

Rotate auto tensioner arm in the counter ~ clockwise direction while moving auto tensioner pulley bolt with wrench.

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

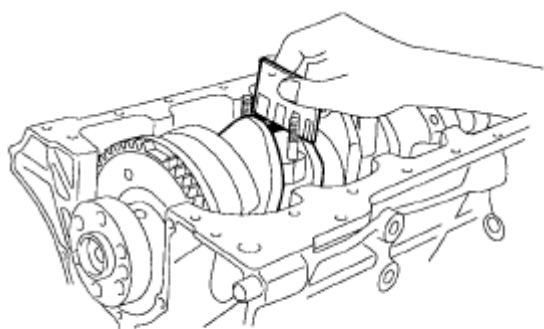


EDKD145A

Fig. 153: Identifying Drive Belt
Courtesy of HYUNDAI MOTOR CO.

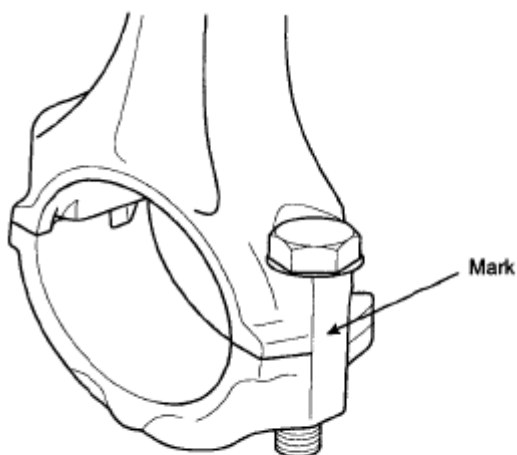
CYLINDER HEAD ASSEMBLY

COMPONENTS



ECKD309A

Fig. 154: Identifying Cylinder Head Assembly Components With Torque Specification (1 Of 2)
 Courtesy of HYUNDAI MOTOR CO.



EDKD146A

Fig. 155: Identifying Cylinder Head Assembly Components With Torque Specification (2 Of 2)
 Courtesy of HYUNDAI MOTOR CO.

REMOVAL

CAUTION:

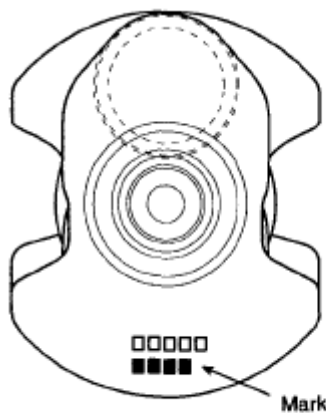
- Use fender covers to avoid damaging painted surfaces.
- To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal operating temperature before removing it.
- When handling a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.
- 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.

Engine removal is required for this procedure.

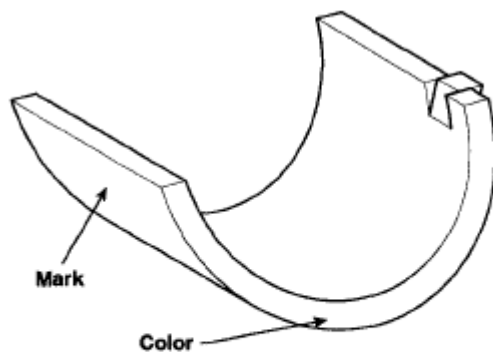
1. Remove the exhaust manifold.
2. Remove the intake manifold.
3. Remove the timing chain.
4. Remove the water temperature control assembly.
5. Remove the camshaft bearing cap (A).



LCGE007A

Fig. 156: Identifying Camshaft Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

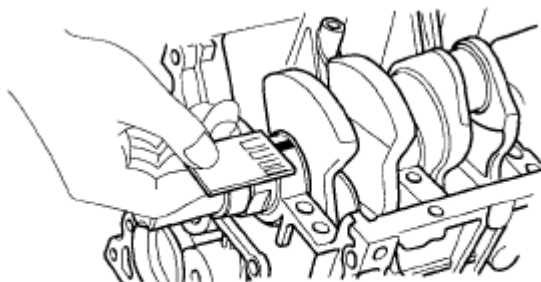
6. Remove the camshaft assembly (A).



ECKD313A

Fig. 157: Identifying Camshaft Assembly
Courtesy of HYUNDAI MOTOR CO.

7. Remove the cylinder head bolts, then remove cylinder head.
 1. Uniformly loosen and remove the 16 cylinder head bolts, in several passes, in the sequence shown. Remove the 16 cylinder head bolts and plate washers.



ECKD0011

Fig. 158: Identifying Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.

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

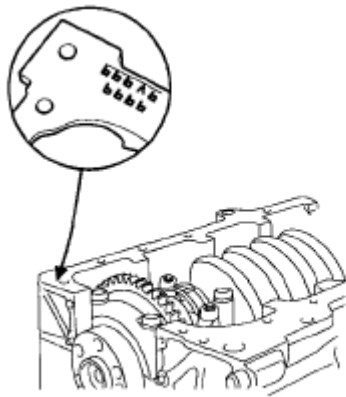
2. Lift the cylinder head from the dowels on the cylinder block and place the cylinder head on wooden blocks on a bench.

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.

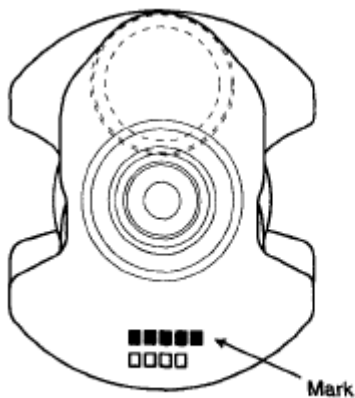
1. Remove the MLAs (A).



EDKD147A

Fig. 159: Identifying MLAs
Courtesy of HYUNDAI MOTOR CO.

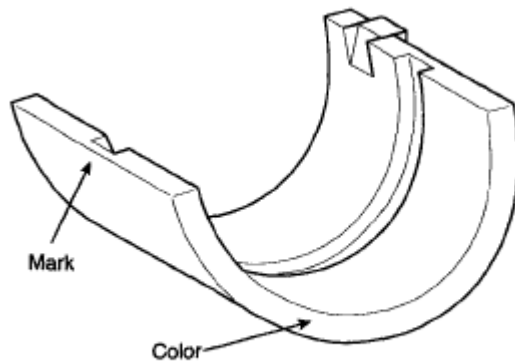
2. Remove the valves.
 1. Using the SST (09222-3K000, 09222-3C300), compress the valve spring and remove retainer lock.



LCGE009A

Fig. 160: Compressing Valve Spring Removing Retainer Lock
Courtesy of HYUNDAI MOTOR CO.

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

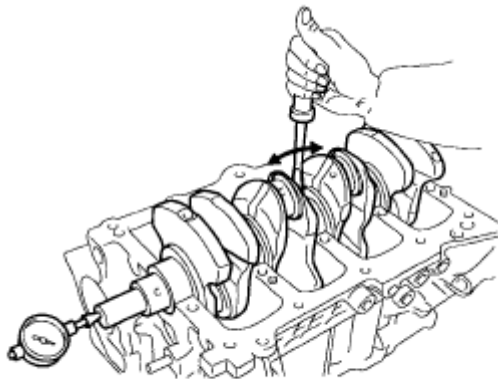


ECKD316A

Fig. 161: Identifying SST (09222-29000)
Courtesy of HYUNDAI MOTOR CO.

NOTE: Do not reuse old valve stem seals.

3. Remove the OCV (A).



ECKD001B

Fig. 162: Identifying OCV
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

CYLINDER HEAD

1. Inspect for flatness.

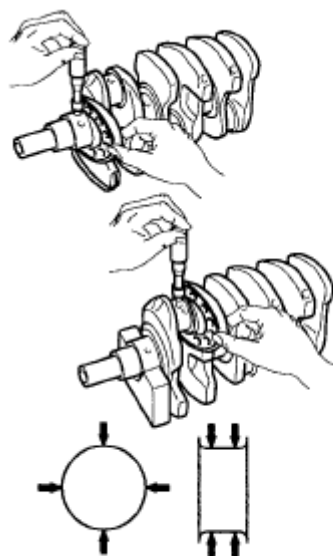
Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder block and the manifolds for warpage.

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



ECKD001E

Fig. 163: Measuring Surface Contacting Cylinder Block And Manifolds For Warpage
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.

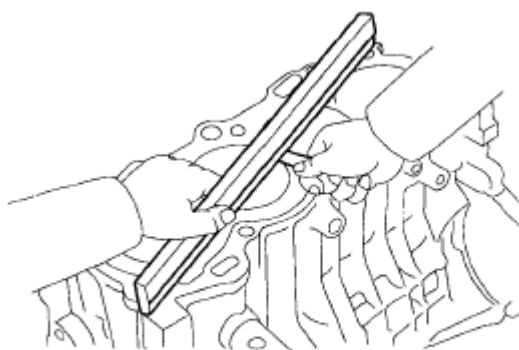
VALVE AND VALVE SPRING

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.)



ECKD001L

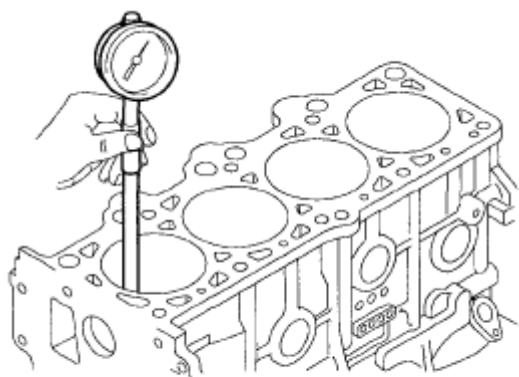
Fig. 164: Measuring Inside Diameter Of Valve Guide
Courtesy of HYUNDAI MOTOR CO.

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.)



ECKD318A

Fig. 165: 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]

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.

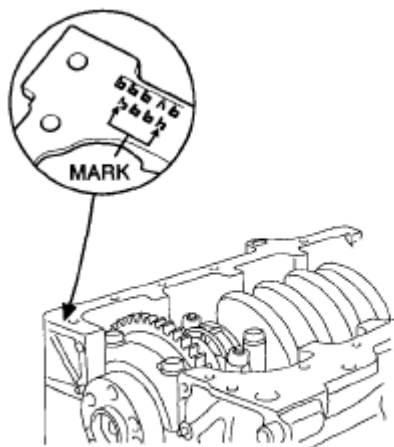
If the margin thickness is less than minimum, replace the valve.

Margin

[Standard]

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

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



LCGE010A

Fig. 166: Checking Valve Head Margin Thickness
Courtesy of HYUNDAI MOTOR CO.

4. Check the valve length.

Length

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.

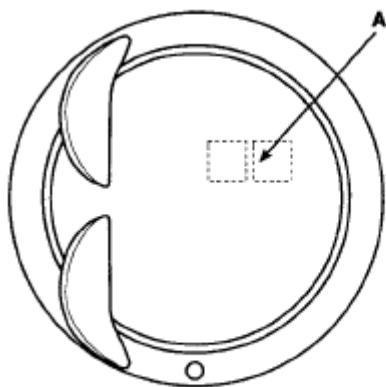
4. Inspect valve springs.
 1. Using a steel square, measure the out-of-square of the valve spring.
 2. Using vernier calipers, measure the free length of the valve spring.

Valve spring

[Standard]

Free height: 43.86 mm (1.7267 in.)

Out-of-square: 1.5°



BCJF004A

Fig. 167: Measuring Free Length Of Valve Spring
Courtesy of HYUNDAI MOTOR CO.

MLA

1. Inspect MLAs.

Using a micrometer, measure the MLA outside diameter.

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

1. Inspect cam lobes.

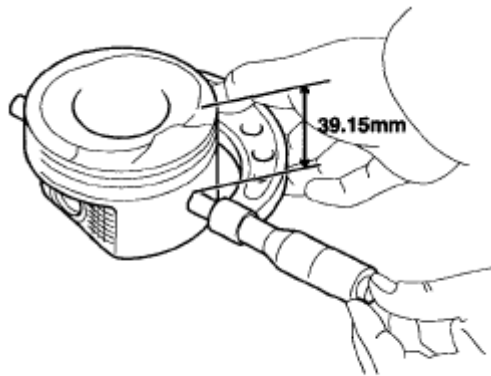
Using a micrometer, measure the cam lobe height.

Cam height

[Standard value]

Intake: 46.8 mm (1.8425 in.)

Exhaust: 45.8 mm (1.8031 in.)

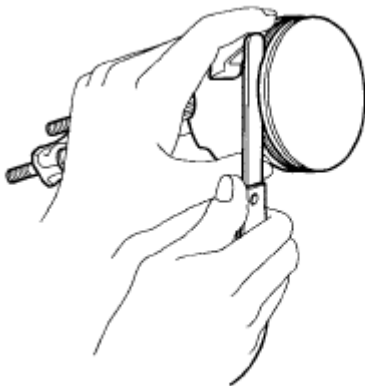


BCJF005A

Fig. 168: Measuring Cam Lobe Height
Courtesy of HYUNDAI MOTOR CO.

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

2. Inspect the 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 journals.



ECKD001G

Fig. 169: Inspecting Camshaft Journal Clearance
Courtesy of HYUNDAI MOTOR CO.

4. Install the bearing caps.

CAUTION: Do not turn the camshaft.

5. Remove the bearing caps.

6. Measure the plastigage at its widest point.

Bearing oil clearance

[Standard value]

Intake

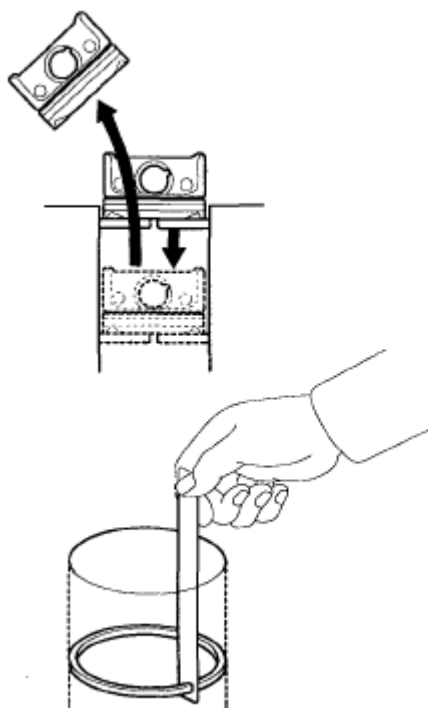
No. 1 journal: 0.020 ~ 0.057 mm (0.0008 ~ 0.0022 in.)

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.)



ACJF112A

Fig. 170: Measuring Plastigage Widest Point
Courtesy of HYUNDAI MOTOR CO.

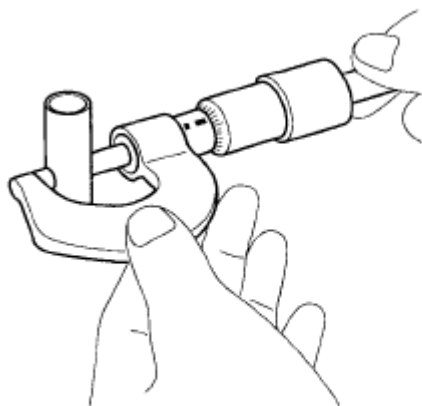
If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

7. Completely remove the plastigage.

8. Remove the camshafts.
3. Inspect the 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]: 0.02 ~ 0.18 mm (0.0008 ~ 0.0071 in.)



ECKD001Z

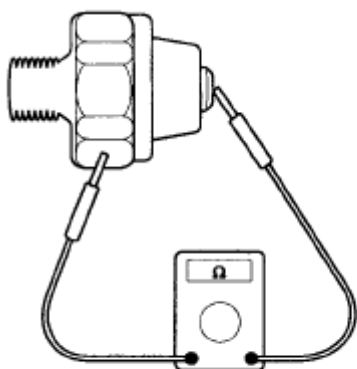
Fig. 171: Measuring End Play Camshaft Back And Forth
Courtesy of HYUNDAI MOTOR CO.

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

3. Remove the camshafts.

CVVT ASSEMBLY

1. Inspect the 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.



ECKD001W

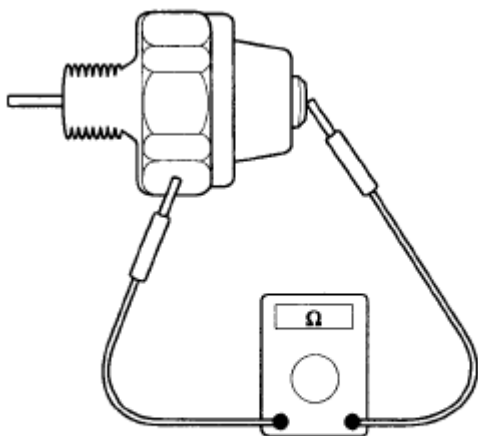
Fig. 172: Identifying Retard Hole
Courtesy of HYUNDAI MOTOR CO.

3. Wind tape around the tip of the air gun and apply air of approx. 150 kpa (1.5 kgf/cm² , 21 psi) to the port of the camshaft.

(Perform this in 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.



ECKD001Y

Fig. 173: Turning CVVT Assembly (Advance Angle)
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 interference.

Standard: Movable smoothly in the range about 22.5°

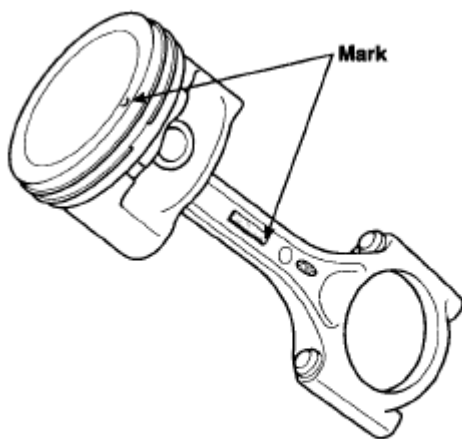
6. Turn the CVVT assembly with your hand and lock it at the maximum delay angle position (clockwise).

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 the valves.
 1. Using the 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.



ECKD320A

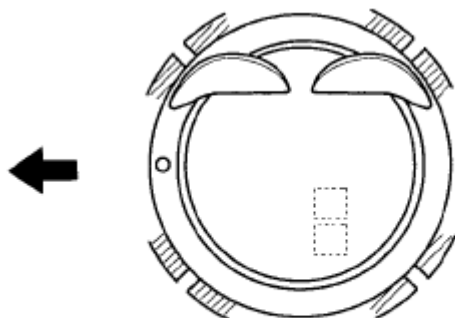
Fig. 174: Identifying SST (09222-3C100)
Courtesy of HYUNDAI MOTOR CO.

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

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

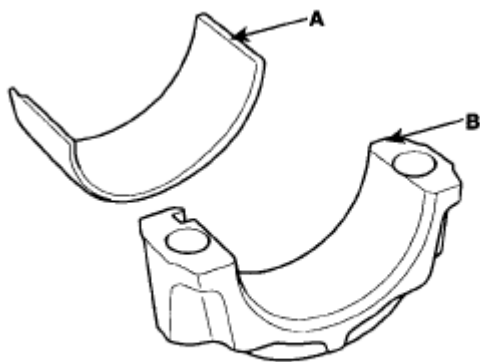


BCJF006A

Fig. 175: Identifying SST (09222 - 3K000, 09222-3C300)
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 the MLAs.

Check that the MLA rotates smoothly by hand.



ECKD322A

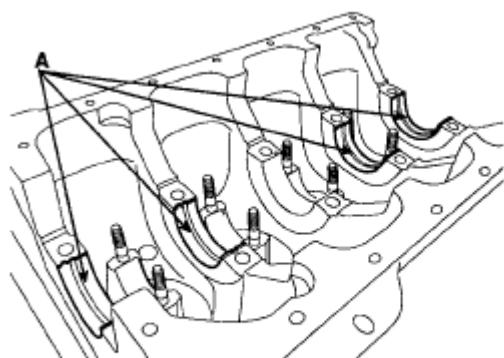
Fig. 176: Identifying MLA
Courtesy of HYUNDAI MOTOR CO.

NOTE: MLA can be reinstalled in its original position.

3. Install the OCV (A).

Tightening torque

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



EDKD149A

Fig. 177: Identifying 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 the OCV clean.
- Do not hold the OCV sleeve during servicing.
- When the OCV is installed on the engine, do not move the engine while 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.



EDKD150A

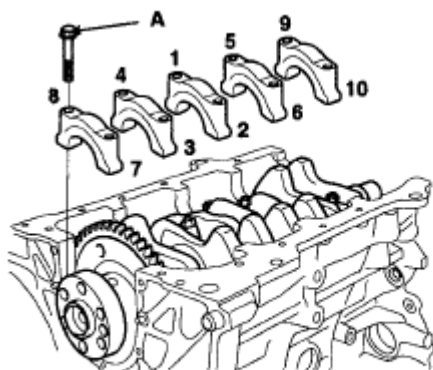
Fig. 178: Identifying Sealant Locations On Cylinder Head And Cylinder Block
Courtesy of HYUNDAI MOTOR CO.

NOTE: Refer to the illustration below to apply the sealant.

Bead width: 2.0~3.0 mm

Sealant locations: 1.0~1.5 mm from block surface

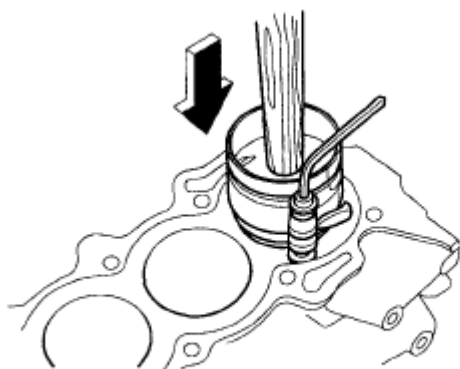
Recommended sealant: Liquid sealant TB1217H



ADGE063A

Fig. 179: Identifying Sealant Locations On Block Surface
Courtesy of HYUNDAI MOTOR CO.

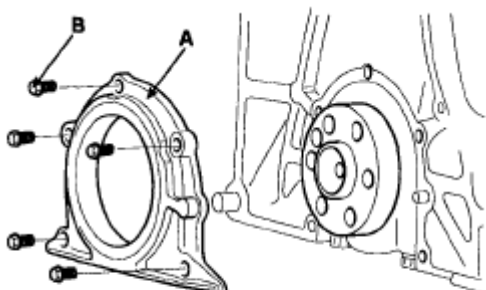
- c. Apply sealant on cylinder head gaskets after assembling cylinder head gaskets on cylinder block. The part must be assembled within 5 minutes after sealant was applied.



ECKD001F

Fig. 180: Identifying Sealant On Cylinder Head Gaskets
Courtesy of HYUNDAI MOTOR CO.

NOTE: Be careful of the installation direction.



EDKD144A

Fig. 181: Identifying Installation Label (8R)
Courtesy of HYUNDAI MOTOR CO.

- d. Install the cylinder head.

NOTE: Remove the extruded sealant after assembling cylinder heads.

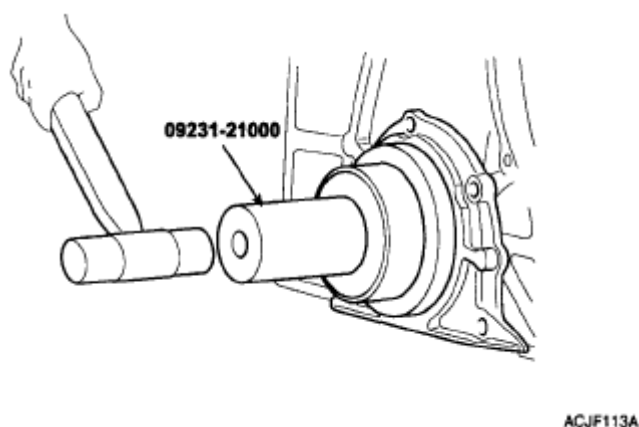


Fig. 182: Identifying Cylinder Head
Courtesy of HYUNDAI MOTOR CO.

2. Place the cylinder head carefully to avoid damaging the gasket.
3. Install the cylinder head bolts.
 1. Do not apply engine oil on the threads and under the heads of the cylinder head bolts.
 2. Using the SST (09221-4A000), install and tighten the cylinder head bolts and plate washers, in several passes, in the sequence shown.

Tightening torque

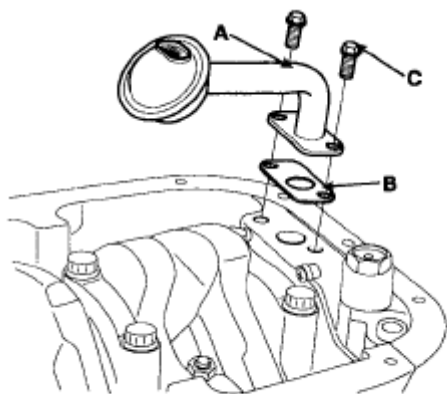
1st step: 37.3~41.2 Nm (3.8~4.2 kgf.m, 27.5~30.4 lb-ft)

2nd step: $120^\circ \pm 2^\circ$

3rd step: $90^\circ \pm 2^\circ$

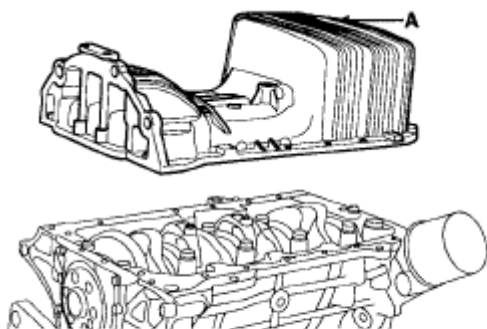
18.62 ~ 23.52 Nm (1.9 ~ 2.4 kgf.m, 13.74 ~ 17.36 lb-ft) (A)

NOTE: Always use new cylinder head bolts.



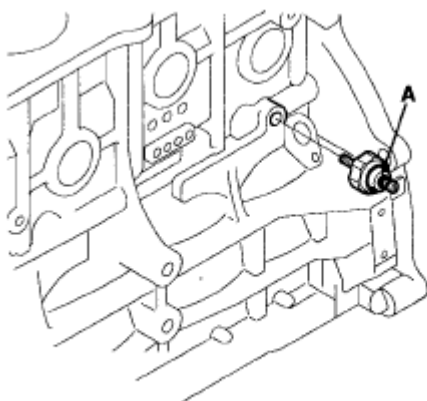
EDKD143A

Fig. 183: Identifying Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.



EDKD142A

Fig. 184: Identifying Bolt
Courtesy of HYUNDAI MOTOR CO.



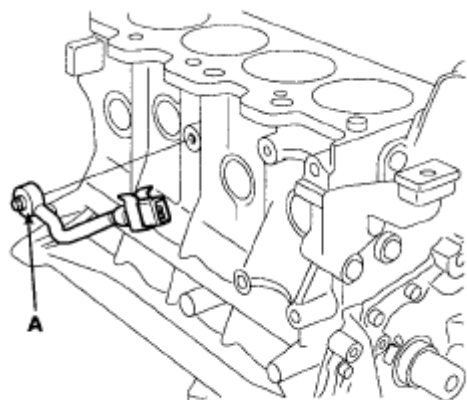
ECKD303A

Fig. 185: Identifying SST
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)



ECKD302A

Fig. 186: Identifying CVVT And Camshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

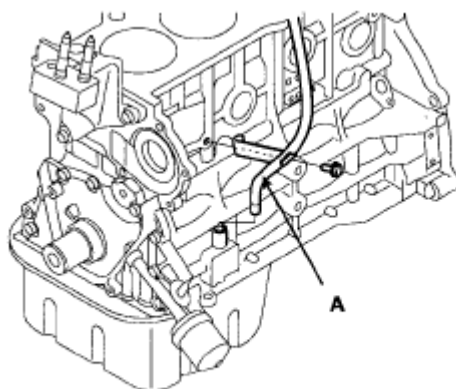
NOTE:

- Install camshaft-inlet to dowel pin of CVVT assembly.
- At this time, do not install 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 the camshafts (A).

NOTE:

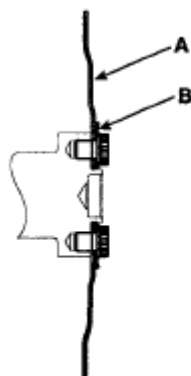
- Apply a light coat of engine oil on camshaft journals.
- Assemble the key groove of camshaft rear side to the same level of head top surface.
- Be careful the right, left bank, intake, exhaust side before assembling.



ECKD301A

Fig. 187: Identifying Camshafts
Courtesy of HYUNDAI MOTOR CO.

INTAKE CAMSHAFT



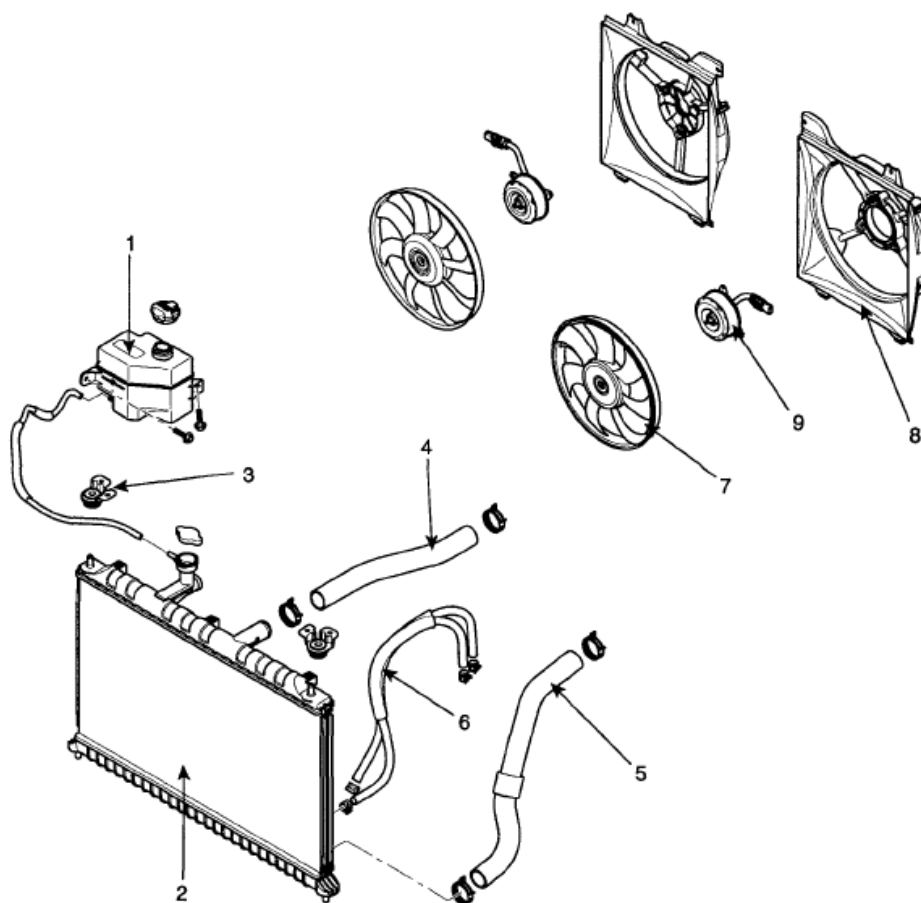
ACGE018A

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

INTAKE CAMSHAFT SPECIFICATIONS

	LH	RH
3.8L	A: 30 mm (1.1811 in.) B: 27 mm (1.0630 in.)	A: 27 mm (1.0630 in.) B: 30 mm (1.1811 in.)

EXHAUST CAMSHAFT



- 1. Coolant reservoir tank
- 2. Radiator
- 3. Radiator mounting bracket
- 4. Radiator upper hose
- 5. Radiator lower hose

- 6. ATF oil cooler hose
- 7. Cooling fan
- 8. Cooling fan shroud
- 9. Cooling fan motor

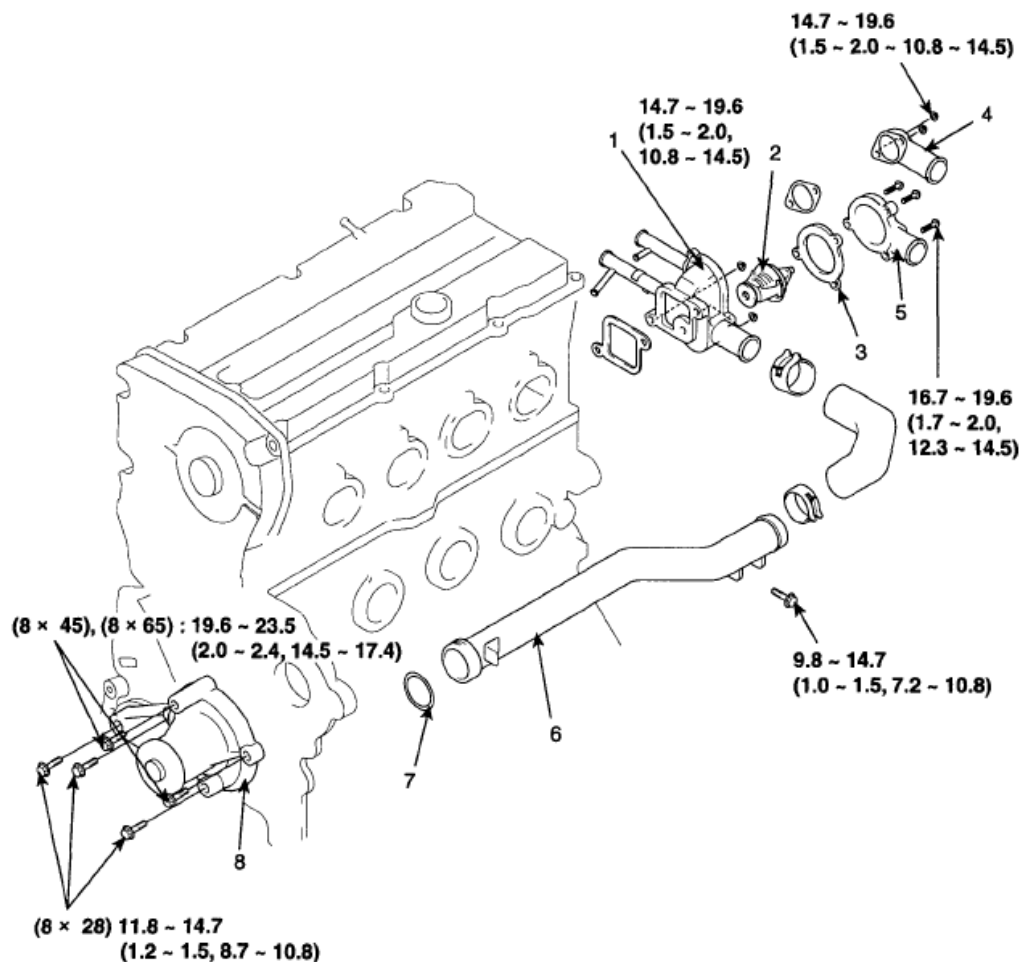
LCJF076A

Fig. 189: Identifying Exhaust Camshaft
Courtesy of HYUNDAI MOTOR CO.

EXHAUST CAMSHAFT SPECIFICATIONS

	LH	RH
3.8L	A: 27 mm (1.0630 in.)	A: 30 mm (1.1811 in.)

1.6 CVVT



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

- | | |
|------------------------|-------------------------|
| 1. Thermostat housing | 5. Water outlet fitting |
| 2. Thermostat | 6. Water inlet pipe |
| 3. Gasket | 7. O-ring |
| 4. Water inlet fitting | 8. Water pump |

UCNG002A

Fig. 190: Identifying Camshaft With Sprocket
Courtesy of HYUNDAI MOTOR CO.

EXHAUST CAMSHAFT SPECIFICATIONS

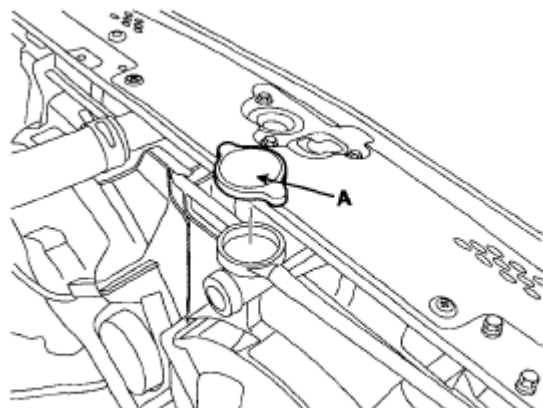
	LH	RH
3.8L	A: 30 mm (1.1811 in.) B: 30 mm (1.1811 in.)	A: 30 mm (1.1811 in.) B: 30 mm (1.1811 in.)

- Install the camshaft bearing caps as following order.

Tightening torque

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

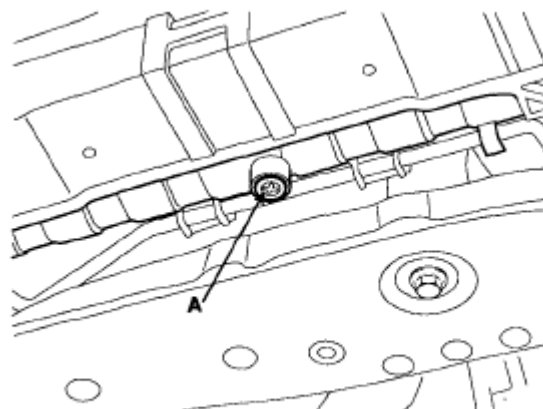
2nd step: 9.80 ~ 11.76 Nm (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft) ~ 2nd step



ACJF034A

Fig. 191: Identifying Camshaft Bearing Caps
Courtesy of HYUNDAI MOTOR CO.

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



ACJF036A

Fig. 192: Identifying Front Mark On Camshaft Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

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

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

ENGINE BLOCK

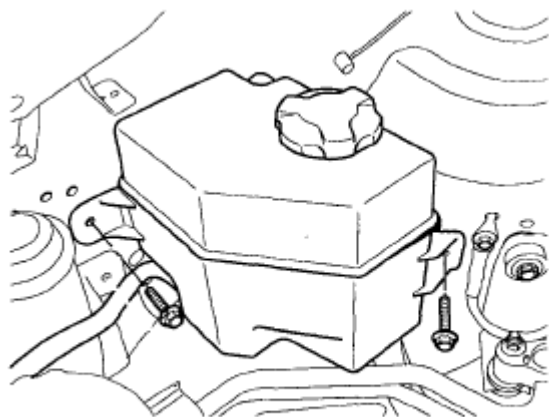
ENGINE MOUNTS

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.

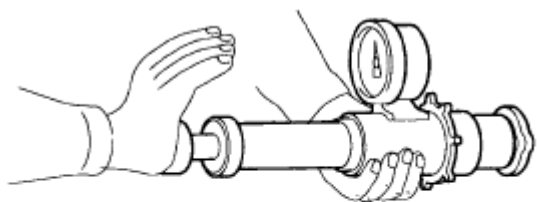
This system is composed of a control module, solenoid valve and a diaphragm for ON/OFF in it. At idle, the control module receives a RPM signal and give it to the solenoid valve. As the valve opens or closes, vacuum pressure in the intake system goes to the diaphragm for opening the orifice. By opening the orifice, the mounting has a low damping value and a low spring coefficient for reducing vibration.

OPERATION



ACJF037A

Fig. 193: Intake System Operation Diagram
Courtesy of HYUNDAI MOTOR CO.



ECKD501X

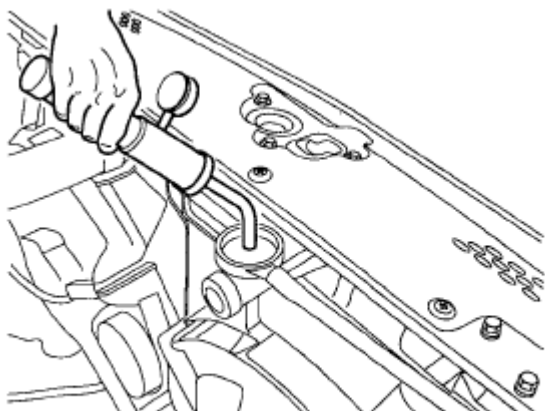
Fig. 194: Intake System Function Diagram
Courtesy of HYUNDAI MOTOR CO.

ECM: Electronic Controlled Mounting

OPERATION DESCRIPTION

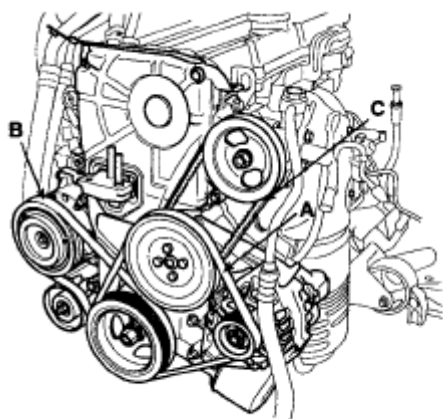
SYSTEM	CONDITION		SOLENOID VALVE RELAY	VOLTAGE
Semi-active engine mount or Electronic Controlled Mounting (ECM)	After ignition switch is ON	~ 880 RPM	ON (idle)	9V ~
		880~1040 RPM	Hold the previous state.	2~9V
		1040 PRM ~	OFF (driving)	~ 2V
	Ignition switch is OFF		OFF	

TROUBLESHOOTING



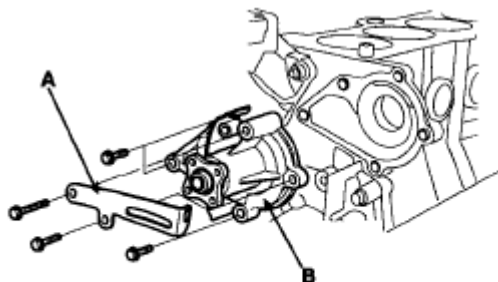
ACJF035A

Fig. 195: Troubleshooting Flow Chart (1 Of 3)
Courtesy of HYUNDAI MOTOR CO.



ACJF002A

Fig. 196: Troubleshooting Flow Chart (2 Of 3)
Courtesy of HYUNDAI MOTOR CO.

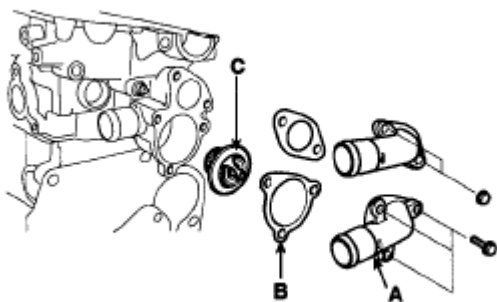


EDKD181A

Fig. 197: Troubleshooting Flow Chart (3 Of 3)
Courtesy of HYUNDAI MOTOR CO.

COMPONENT

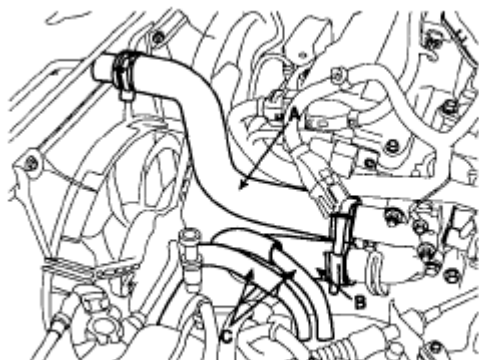
■ 1.6 CVVT



ACJF110A

Fig. 198: Identifying Engine System Components With Torque Specifications (1 Of 2)

Courtesy of HYUNDAI MOTOR CO.



ACJF010A

Fig. 199: Identifying Engine System Components With Torque Specifications (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

CAUTION:

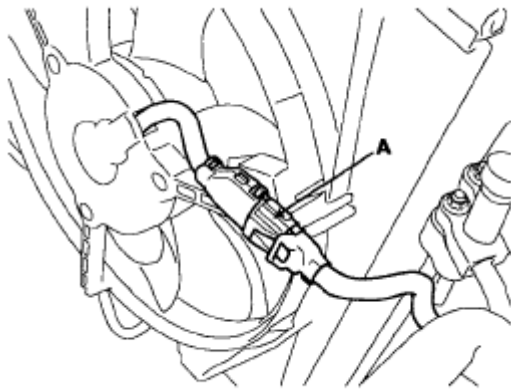
- Use fender covers to avoid damaging painted surfaces.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

NOTE:

- Mark all wiring and hoses to avoid misconnection.
- Inspect the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center.
- Engine removal is required for this procedure.

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

■ 2 Fan type

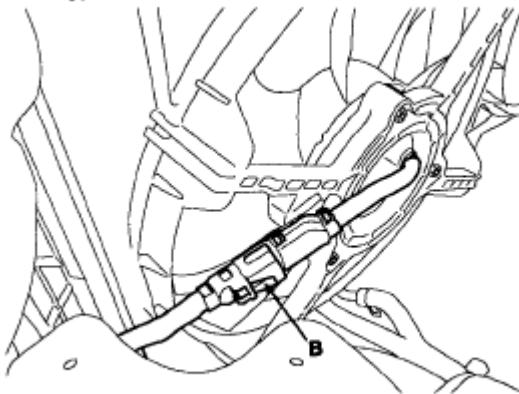


LCJF078A

Fig. 200: Identifying A/C Compressor On Engine
Courtesy of HYUNDAI MOTOR CO.

9. Remove the alternator (A) from engine.

■ 2 Fan type



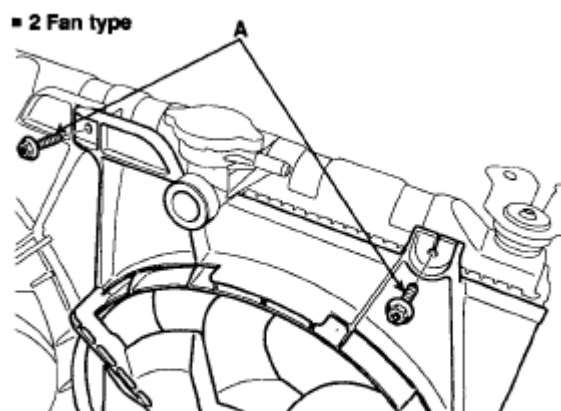
LCJF079A

Fig. 201: Identifying Alternator On Engine
Courtesy of HYUNDAI MOTOR CO.

10. Remove the power steering pump from engine. (Refer to **POWER STEERING OIL PUMP** .)

DISASSEMBLY

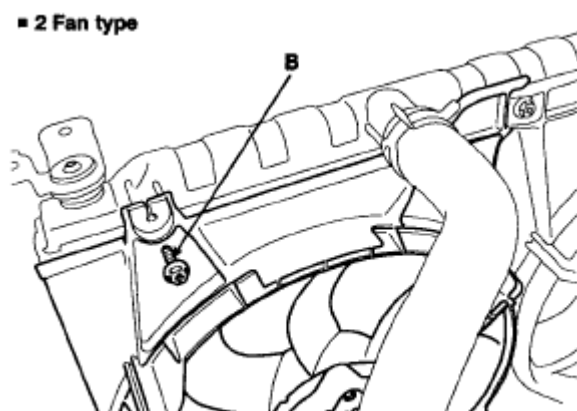
1. Remove the drive plate.
2. Remove the knock sensor (A).



LCJF082A

Fig. 202: Identifying Knock Sensor
Courtesy of HYUNDAI MOTOR CO.

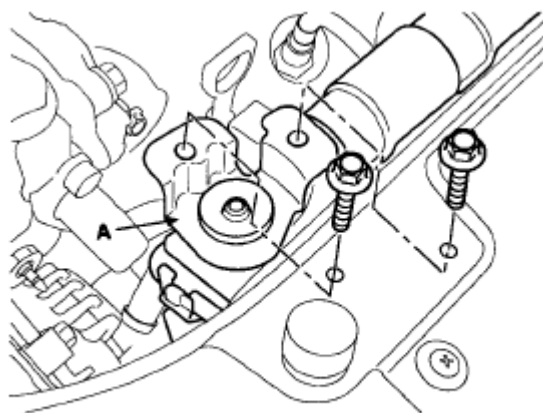
3. Remove the upper oil pan (A).



LCJF083A

Fig. 203: Identifying Upper Oil Pan
Courtesy of HYUNDAI MOTOR CO.

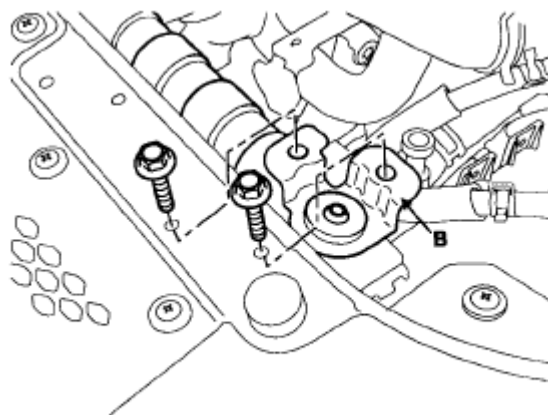
4. Remove the baffle plate (A).



ACJF045A

Fig. 204: Identifying Baffle Plate
Courtesy of HYUNDAI MOTOR CO.

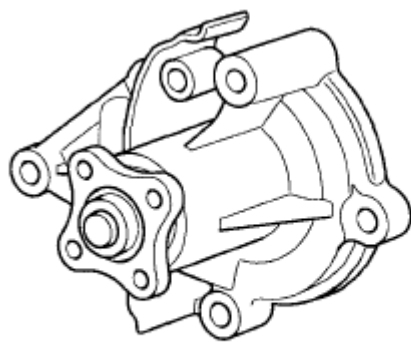
5. Remove the rear oil seal case (A).



ACJF046A

Fig. 205: Identifying Rear Oil Seal Case
Courtesy of HYUNDAI MOTOR CO.

6. Remove the oil drain cover (A).



EDKD183A

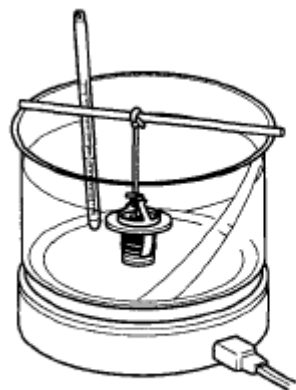
Fig. 206: Identifying Oil Drain Cover
Courtesy of HYUNDAI MOTOR CO.

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



ECKD503B

Fig. 207: Identifying 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 the piston rings.

1. Using a piston ring expander, 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.

Using a press, remove the piston pin from the piston. (Press-in load : 800 ~ 1400 kg (1764 ~ 3086 lb))

INSPECTION

CONNECTING ROD AND CRANKSHAFT

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.)

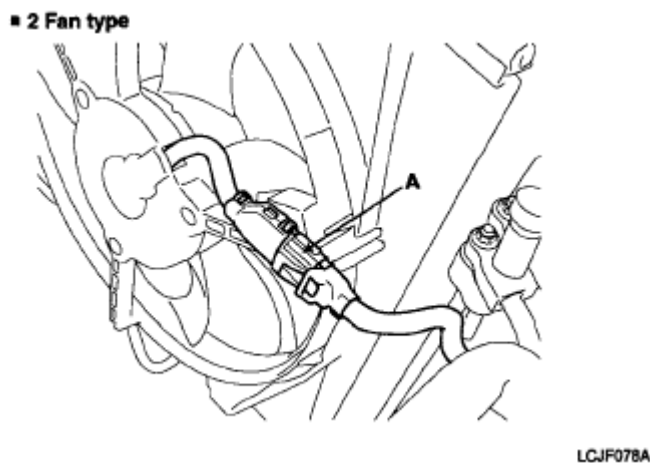


Fig. 208: Checking Connecting Rod End Play
Courtesy of HYUNDAI MOTOR CO.

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

0.038 ~ 0.056 mm (0.0015 ~ 0.0022 in.)

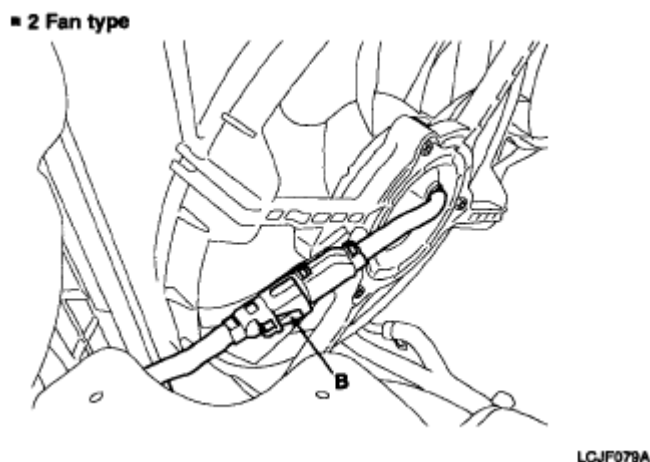


Fig. 209: Checking Oil Clearance
Courtesy of HYUNDAI MOTOR CO.

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 the next column), and recheck the clearance.

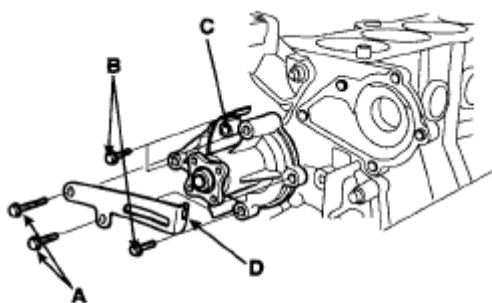
CAUTION: Do not file, shim, or scrape the bearings or the caps to adjust clearance.

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

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

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

CONNECTING ROD MARK LOCATION



EDKD181B

Fig. 210: Identifying Connecting Rod Mark Location
Courtesy of HYUNDAI MOTOR CO.

IDENTIFICATION OF CONNECTING ROD

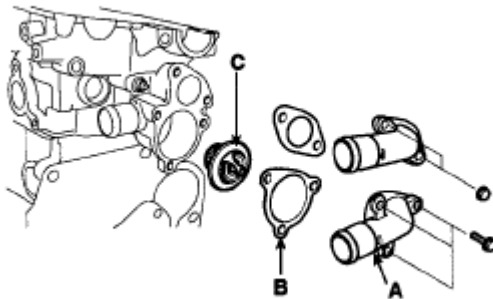
IDENTIFICATION OF CONNECTING ROD

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.)

CRANKSHAFT PIN MARK LOCATION

IDENTIFICATION OF CRANKSHAFT

■ 1.6 CVVT



ACJF110A

Fig. 211: Identifying Crankshaft Pin Marks
Courtesy of HYUNDAI MOTOR CO.

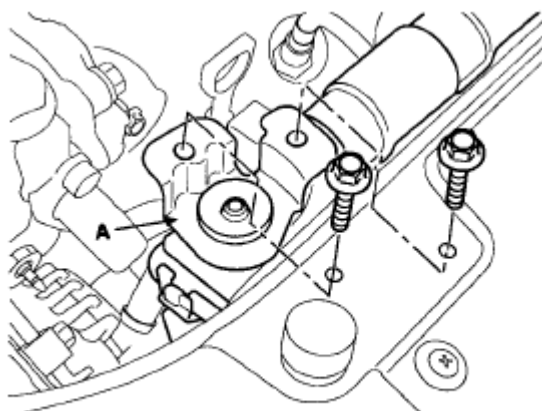
DISCRIMINATION OF CRANKSHAFT

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)

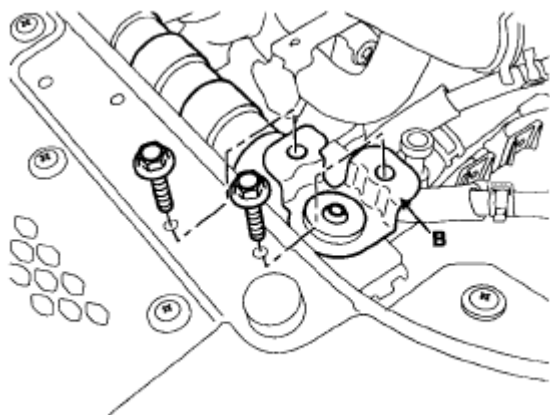
UPPER



ACJF045A

Fig. 212: Locating Identification Mark On Upper Connecting Rod Bearing
Courtesy of HYUNDAI MOTOR CO.

LOWER



ACJF046A

Fig. 213: Locating Identification Mark On Lower Connecting Rod Bearing
Courtesy of HYUNDAI MOTOR CO.

IDENTIFICATION OF CONNECTING ROD BEARING

IDENTIFICATION 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

CONNECTING ROD IDENTIFICATION MARK DESCRIPTION

		CONNECTING ROD IDENTIFICATION MARK		
		0 (a)	1 (b)	2 (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)

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 towel.
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, 14.46 lb-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.)

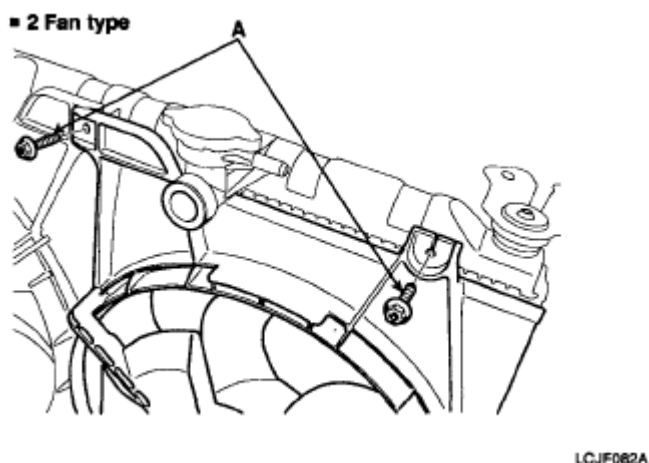


Fig. 214: Checking Oil Clearance
Courtesy of HYUNDAI MOTOR CO.

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 the next column), and recheck the clearance.

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

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

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

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

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.

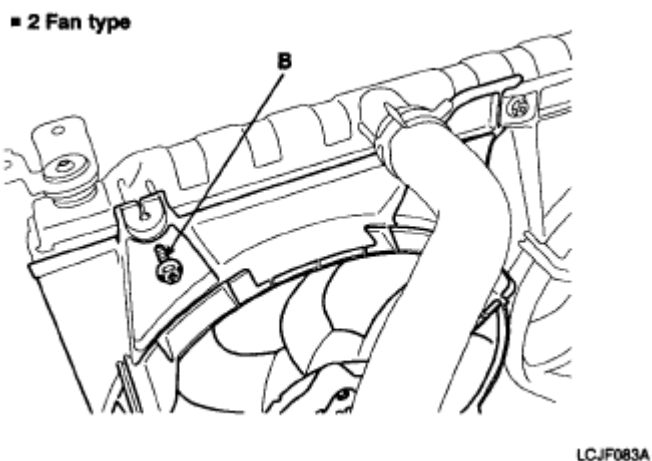


Fig. 215: Identifying Crankshaft Bore Mark Location
Courtesy of HYUNDAI MOTOR CO.

DISCRIMINATION OF CYLINDER BLOCK

DISCRIMINATION OF CYLINDER BLOCK

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

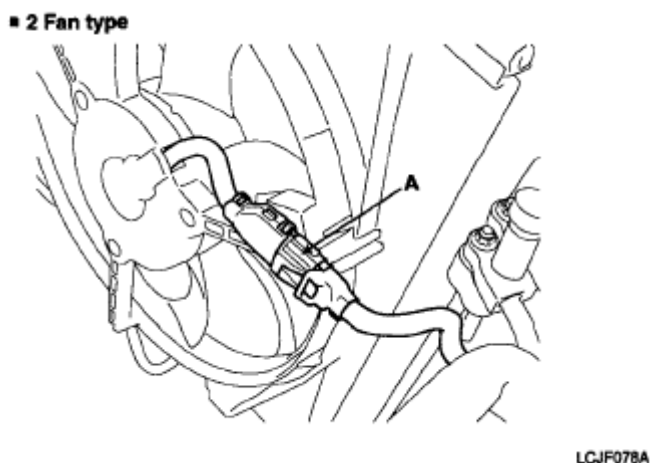


Fig. 216: Identifying Crankshaft Journal Marks
 Courtesy of HYUNDAI MOTOR CO.

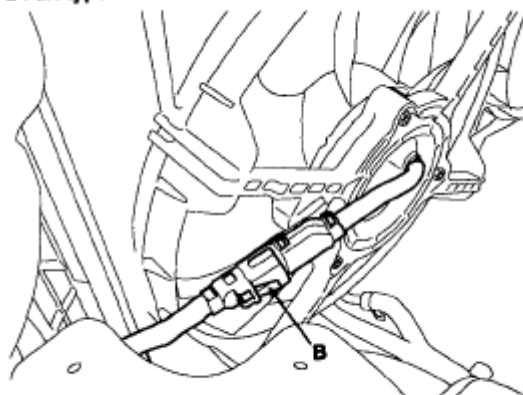
DISCRIMINATION OF CRANKSHAFT

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 mm (2.7142 ~ 2.7145 in.)

PLACE OF IDENTIFICATION MARK (CRANKSHAFT BEARING)

■ 2 Fan type



LGJF079A

Fig. 217: Locating Identification Mark On 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

CRANKSHAFT BORE IDENTIFICATION MARK

		CRANKSHAFT BORE IDENTIFICATION MARK		
		a (A)	b (B)	c (C)
	1 or A	A (YELLOW)	B (GREEN)	C (BROWN)

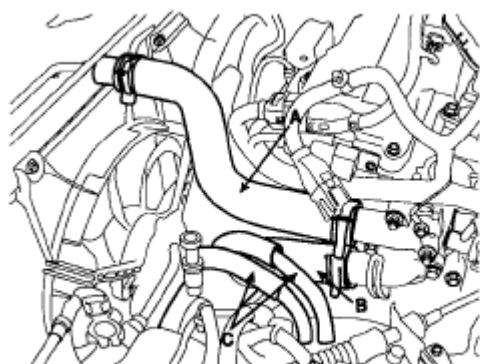
CRANKSHAFT IDENTIFICATION MARK	2 or B	B (GREEN)	C (BROWN)	D (BLACK)
	3 or C	C (BROWN)	D (BLACK)	E (BLUE)

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.)



ACJF010A

Fig. 218: 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

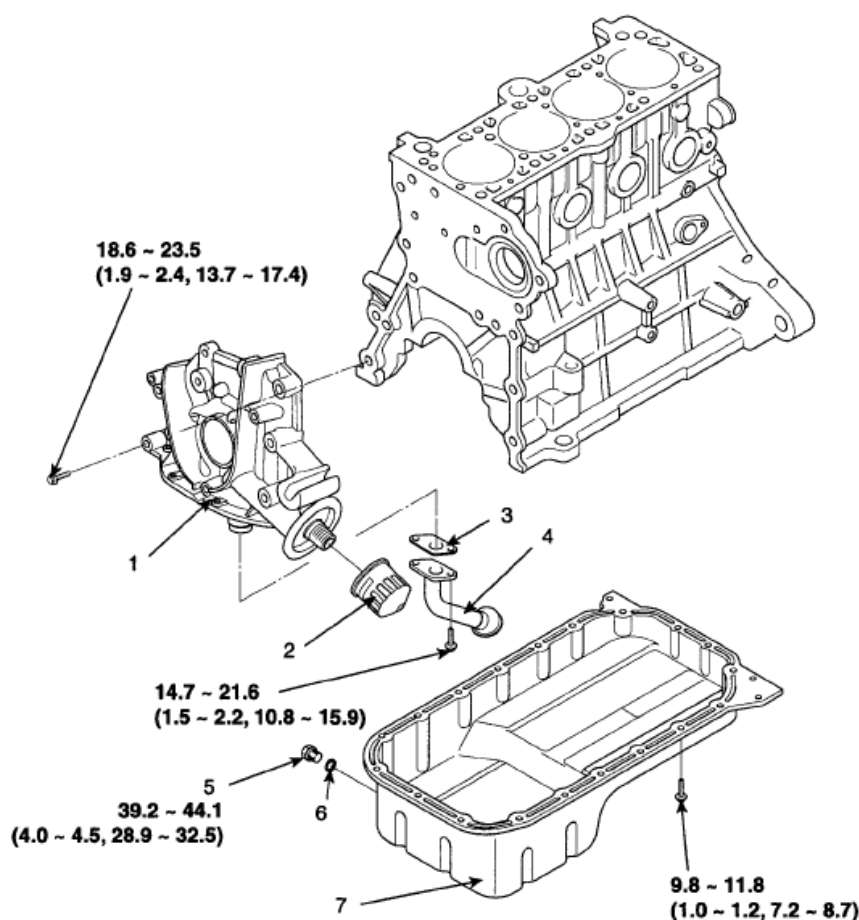
2.41 ~ 2.45 mm (0.0949 ~ 0.0964 in.)

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.)



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

- | | |
|---------------|---------------|
| 1. Front case | 5. Drain plug |
| 2. Filter | 6. Gasket |
| 3. Gasket | 7. Oil pan |
| 4. Oil screen | |

BCJF007A

Fig. 219: 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 the gasket material.

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

2. Clean the cylinder block

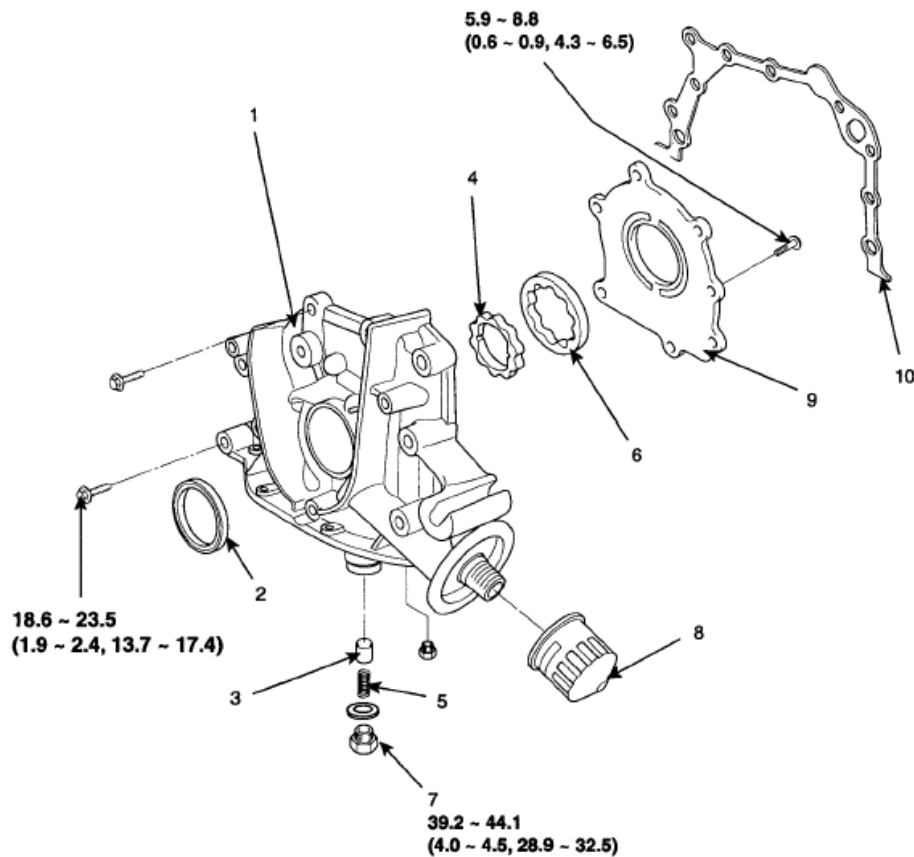
Using a soft brush and solvent, thoroughly clean the cylinder block.

3. Inspect the top surface of the cylinder block for flatness.

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

Flatness of cylinder block gasket surface

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



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

- 1. Front case
- 2. Oil seal
- 3. Relief plunger
- 4. Inner rotor
- 5. Relief spring

- 6. Outer rotor
- 7. Plug
- 8. Oil filter
- 9. Pump cover
- 10. Gasket

BCJF008A

Fig. 220: Measuring Surface Contacting Cylinder Head Gasket For Warpage
 Courtesy of HYUNDAI MOTOR CO.

4. Inspect cylinder bore diameter

Visually check the cylinder for vertical scratches.

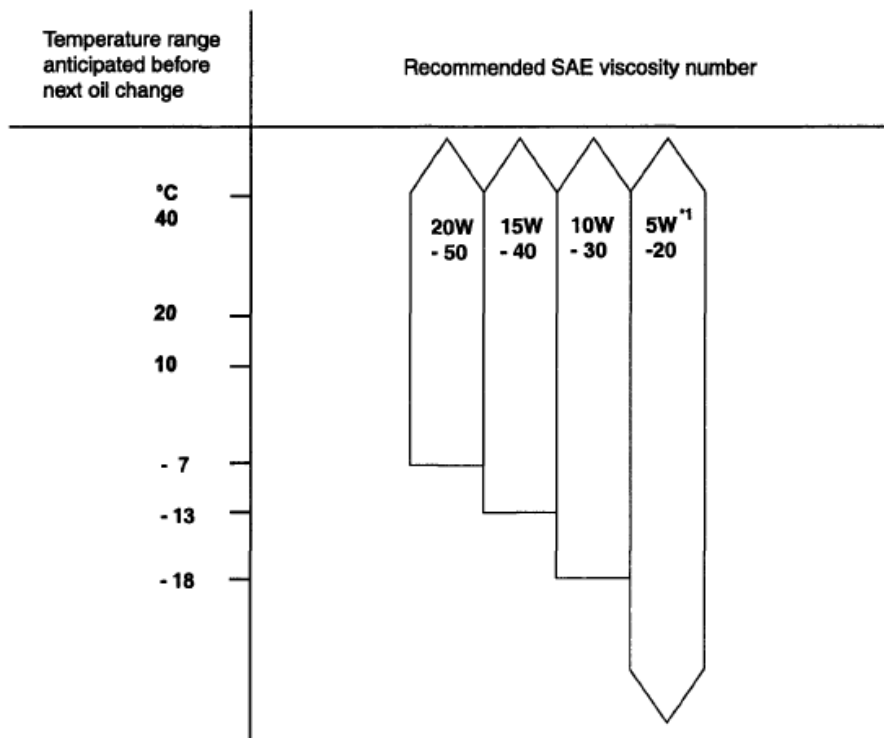
If deep scratches are present, replace the cylinder block.

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

96.00 ~ 96.03 mm (3.7795 ~ 3.7807 in.)

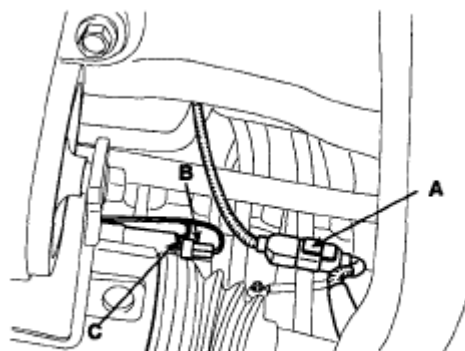


*1 : Recommended regardless of environment.
If not available, refer to the recommended SAE viscosity numbers.

LC8F002A

Fig. 221: Measuring Cylinder Bore Diameter
Courtesy of HYUNDAI MOTOR CO.

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



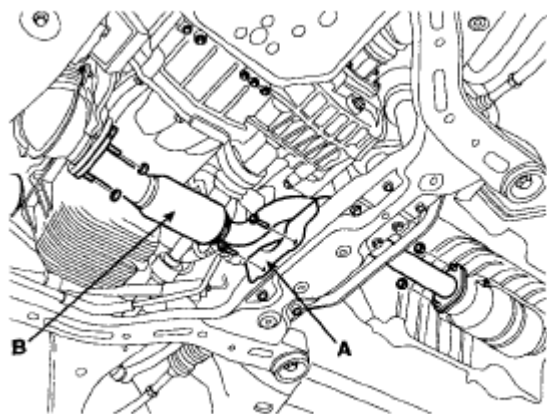
ACGE013A

Fig. 222: Identifying Cylinder Bore Size Code On Cylinder Block
Courtesy of HYUNDAI MOTOR CO.

CYLINDER BORE INNER DIAMETER

Class	Size code	Cylinder bore inner diameter
		3.8L
A	A	96.00 ~ 96.01 mm (3.7795 ~ 3.7799 in.)
B	B	96.01 ~ 96.02 mm (3.7799 ~ 3.7803 in.)
C	C	96.02 ~ 96.03 mm (3.7803 ~ 3.7807 in.)

7. Check the piston size code (A) and the front mark (B) on the piston top face.



ACJF031A

Fig. 223: Identifying Piston Size Code And Front Mark On Piston Top Face
 Courtesy of HYUNDAI MOTOR CO.

PISTON OUTER DIAMETER

Class	Size code	Piston outer diameter
		3.8L
A	A	95.96 ~ 95.97 mm (3.7779 ~ 3.7783 in.)
B	B	95.97 ~ 95.98 mm (3.7783 ~ 3.7787 in.)
C	C	95.98 ~ 95.99 mm (3.7787 ~ 3.7791 in.)

8. Select the piston related to cylinder bore class.

Clearance:

0.03 ~ 0.05mm (0.0012 ~ 0.0020in.)

PISTON AND RINGS

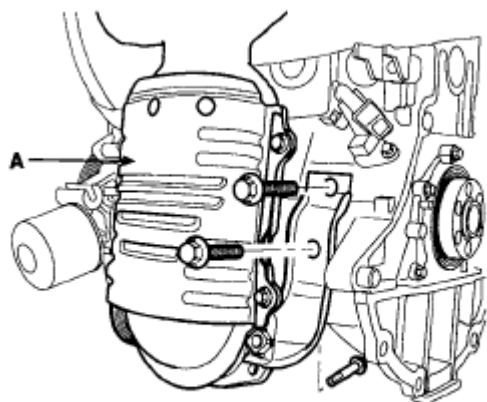
1. Clean piston
 1. Using a gasket scraper, remove the carbon from the piston top.
 2. Using a groove cleaning tool, clean the piston ring grooves.
 3. Using solvent and a brush, thoroughly clean the piston.

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.

Standard diameter

95.96 ~ 95.99 mm (3.7779 ~ 3.7791 in.)



ACJF005A

Fig. 224: 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

0.03 ~ 0.05 mm (0.0012 ~ 0.0020 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: 0.03 ~ 0.07 mm (0.0012 ~ 0.0027 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.)

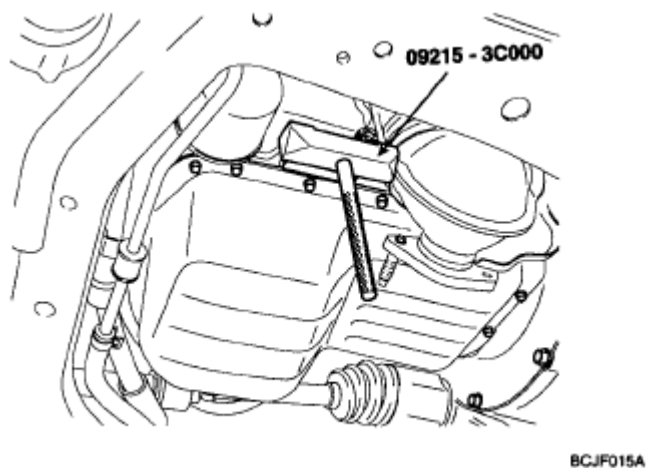


Fig. 225: Measuring Piston Ring Side Clearance
Courtesy of HYUNDAI MOTOR CO.

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.)

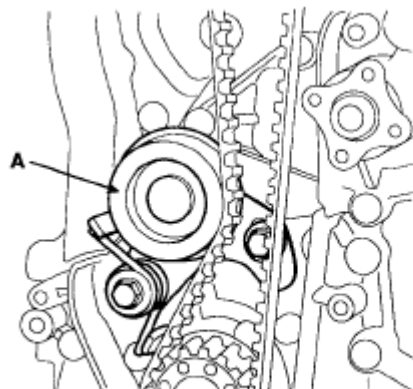
Oil ring: 0.20 ~ 0.70 mm (0.0079 ~ 0.0275 in.)

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.)



EDKD102B

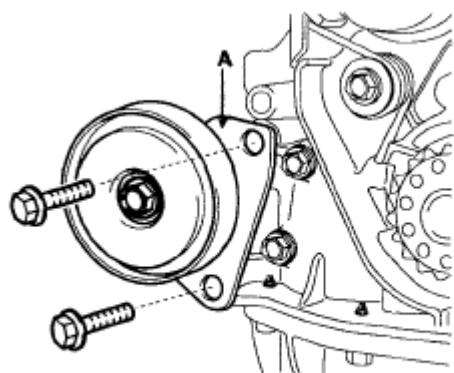
Fig. 226: Checking Piston Ring End Gap
Courtesy of HYUNDAI MOTOR CO.

PISTON PINS

1. Measure the diameter of the piston pin.

Piston pin diameter

23.001 ~ 23.006 mm (0.9056 ~ 0.9057 in.)



ADGE066A

Fig. 227: Measuring Piston Pin Diameter
Courtesy of HYUNDAI MOTOR CO.

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

Piston pin-to-piston clearance

0.01 ~ 0.02 mm (0.0004 ~ 0.0008 in.)

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

Piston pin-to-connecting rod interference

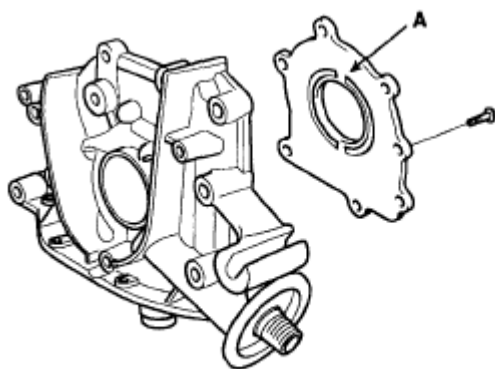
-0.032 ~ -0.016 mm (-0.00126 ~ -0.00063 in.)

REASSEMBLY

NOTE:

- Thoroughly clean all parts to be 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.

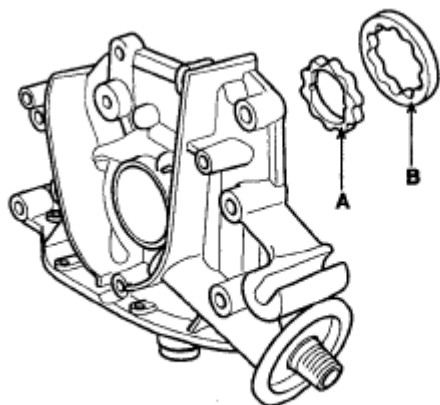
1. Assemble the piston and the connecting rod.
 1. Use a hydraulic press for installation.
 2. The piston front mark and the connecting rod front mark must face the timing belt side of the engine.



EDKD202A

Fig. 228: Identifying Piston Front Mark And Connecting Rod Front Mark
Courtesy of HYUNDAI MOTOR CO.

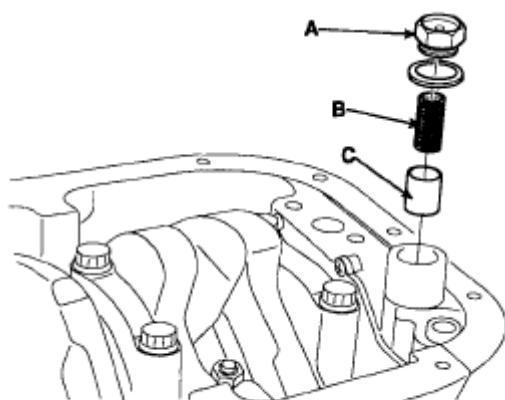
2. Install the piston rings.
 1. Install the oil ring spacer and 2 side rails by hand.
 2. Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
 3. Position the piston rings so that the ring ends are as shown.



EDKD203A

Fig. 229: Identifying Piston Rings Position
Courtesy of HYUNDAI MOTOR CO.

3. Install the 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).



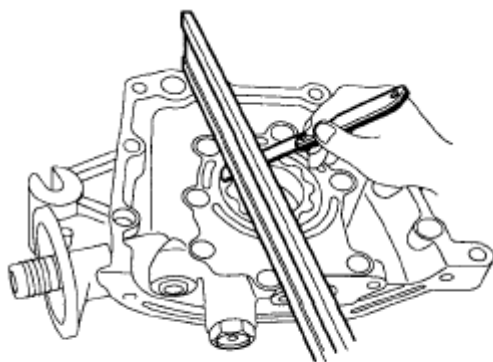
ACJF128A

Fig. 230: Identifying Bearings In Connecting Rod And Connecting Rod Cap
Courtesy of HYUNDAI MOTOR CO.

4. Install the main bearings.

NOTE: 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).

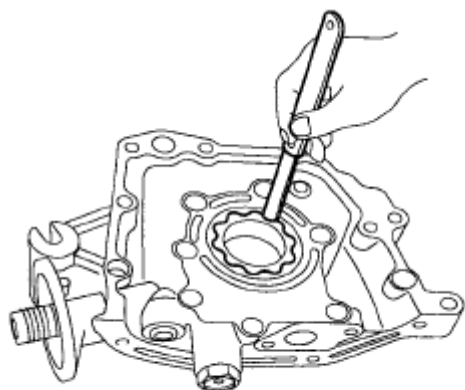


EDKD205A

Fig. 231: Identifying 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 the thrust bearings.

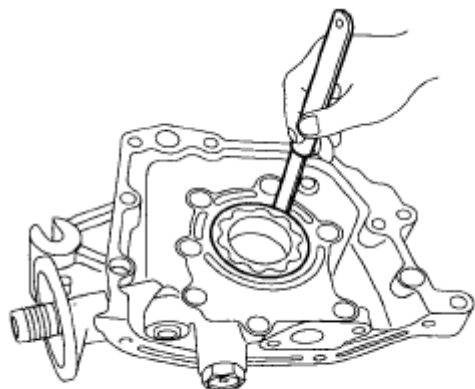
Install the 2 thrust bearings (A) under the No. 3 journal position of the cylinder block with the oil grooves facing outward.



EDKD206A

Fig. 232: Identifying Thrust Bearings
Courtesy of HYUNDAI MOTOR CO.

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



EDKD207A

Fig. 233: Identifying Crankshaft On Cylinder Block
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

Main bearing cap bolt

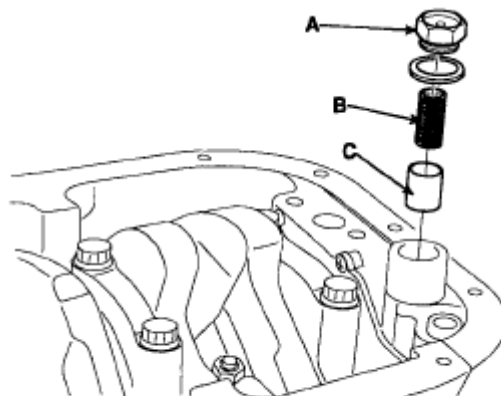
49.00 Nm (5.0 kgf.m, 36.16 lb-ft) + 90° (1 ~ 8)

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:

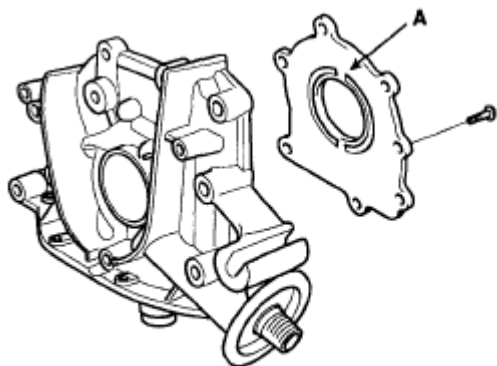
- Always use new main bearing cap bolts.
- If any of the bearing cap bolts are broken or deformed, replace it.



ACJF128A

Fig. 234: Identifying Main Bearing Cap Bolts
Courtesy of HYUNDAI MOTOR CO.

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



EDKD202A

Fig. 235: Identifying SST (09221-4A000)
Courtesy of HYUNDAI MOTOR CO.

2. Check that the crankshaft turns smoothly.
9. Check crankshaft end play.
10. Install the piston and connecting rod assemblies.

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

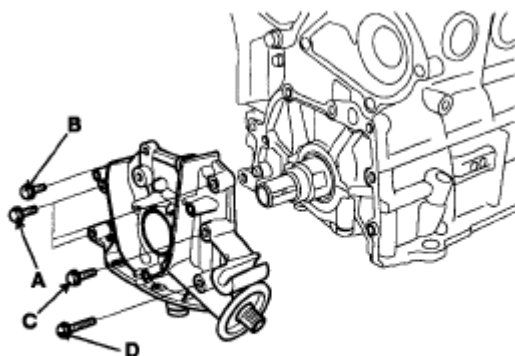
and cylinder bores.

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.

Tightening torque

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

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

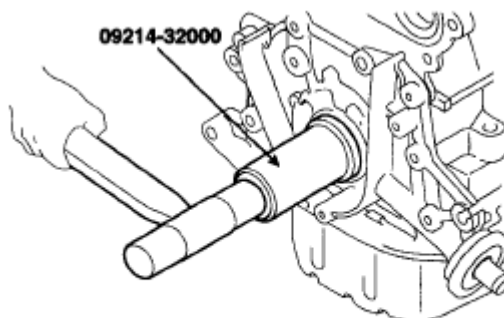


EDKD208A

Fig. 236: Identifying SST (09221-4A000)
Courtesy of HYUNDAI MOTOR CO.

NOTE:

- Always use new connecting rod bearing cap bolts.
- Maintain downward force on the ring compressor to prevent the rings from expanding before entering the cylinder bore.



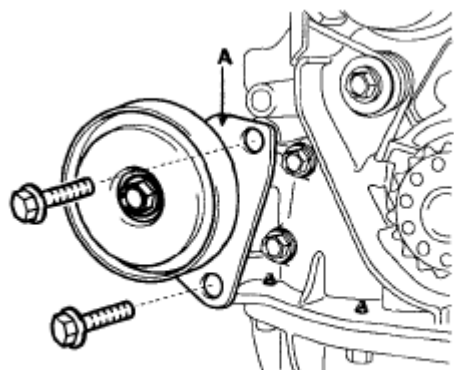
EDKD209A

Fig. 237: Applying Downward Force On Ring Compressor
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

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

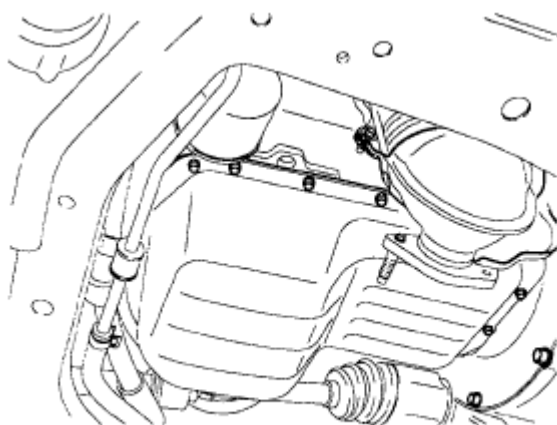


ADGE066A

Fig. 238: Identifying Oil Drain Cover
Courtesy of HYUNDAI MOTOR CO.

NOTE:

- Clean the sealing face before assembling two parts.
- Remove harmful foreign materials on the sealing face before applying sealant
- Before assembling oil drain cover, the liquid sealant TB1217H should be applied to the 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.



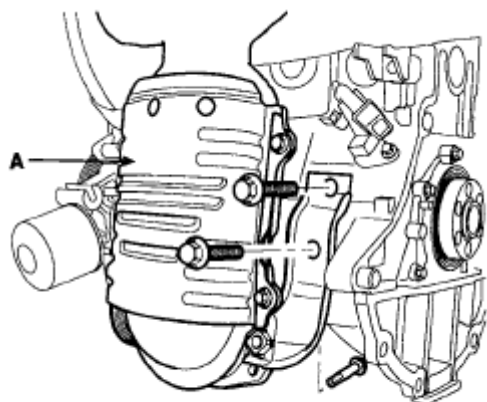
BCJF016A

Fig. 239: Identifying Liquid Sealant On Oil Drain Cover
 Courtesy of HYUNDAI MOTOR CO.

13. Install the rear oil seal case (A).

Tightening torque

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



ACJF005A

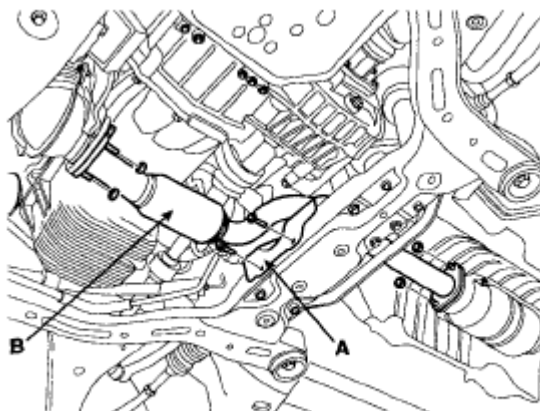
Fig. 240: Identifying Rear Oil Seal Case
 Courtesy of HYUNDAI MOTOR CO.

NOTE:

- Clean the sealing face before assembling two parts.
- Remove harmful foreign materials on the sealing face before applying sealant
- Before assembling rear oil seal case, the liquid sealant TB1217H should be applied to the rear oil seal case.
- The part must be assembled within 5 minutes after sealant was

applied.

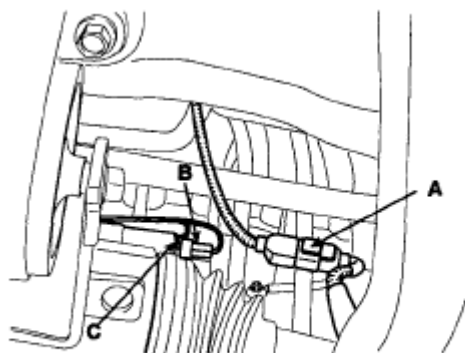
- Apply sealant to the inner threads of the bolt holes.



ACJF031A

Fig. 241: Identifying Liquid Sealant On Rear Oil Seal Case
Courtesy of HYUNDAI MOTOR CO.

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



ACGE013A

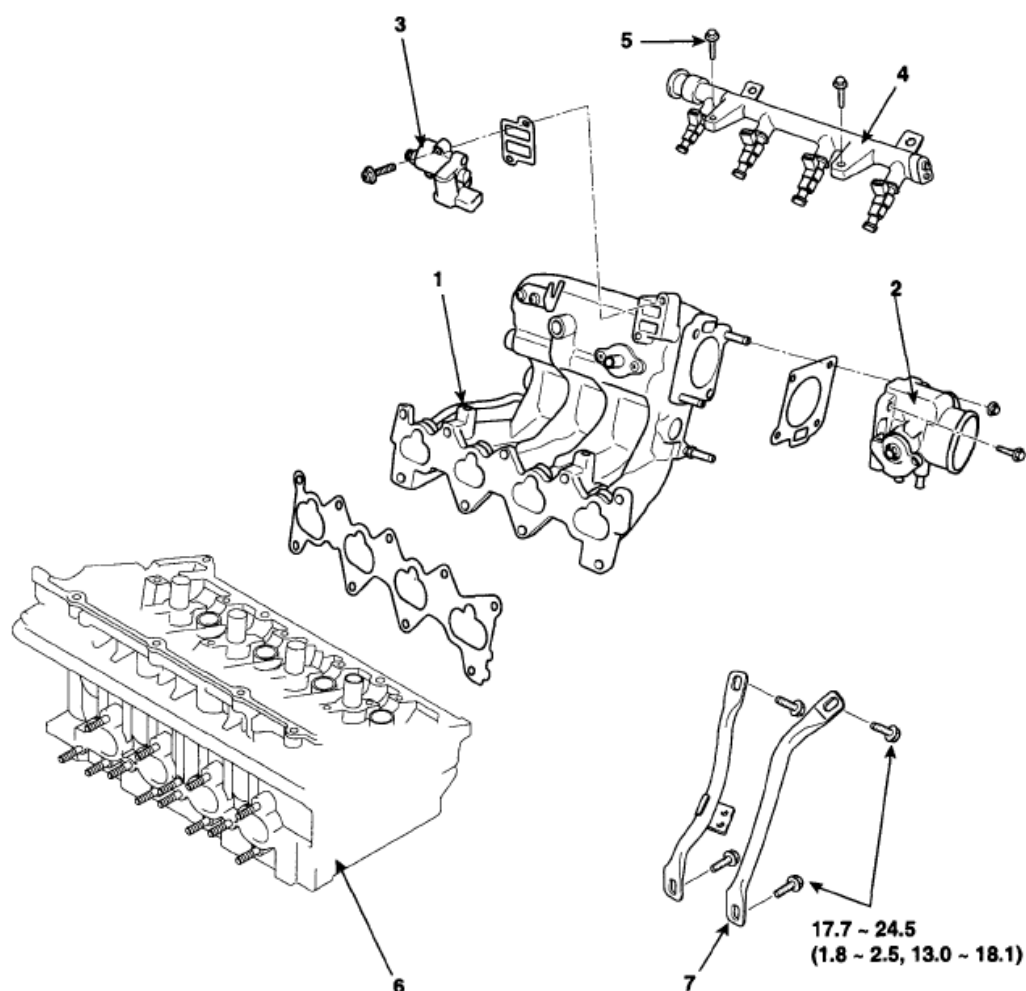
Fig. 242: Identifying SST (09231-3C200, 09231-H1100)
Courtesy of HYUNDAI MOTOR CO.

15. Install the baffle plate.

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

Tightening torque

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



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

1. Intake manifold
2. Throttle body
3. ISA (Idle Speed Actuator)
4. Delivery pipe

5. Gasket
6. Cylinder head
7. Intake manifold stay

LCJF015A

Fig. 243: Identifying Baffle Plate Bolts Sequence
Courtesy of HYUNDAI MOTOR CO.

16. Install the 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.

Bead width: 2.5 mm (0.1 in.)

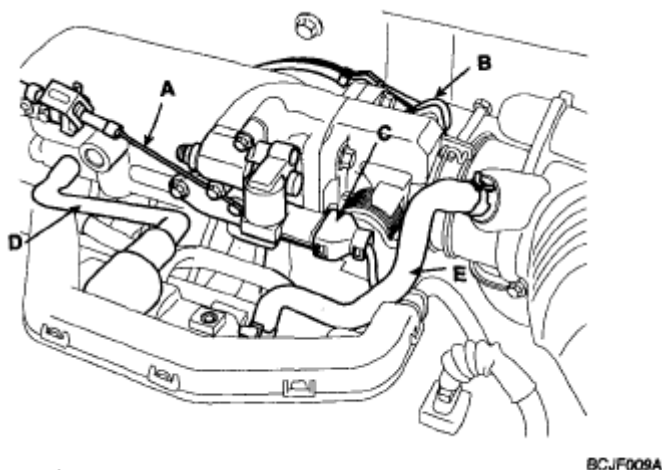


Fig. 244: Identifying Liquid Sealant On Upper Oil Pan
Courtesy of HYUNDAI MOTOR CO.

NOTE:

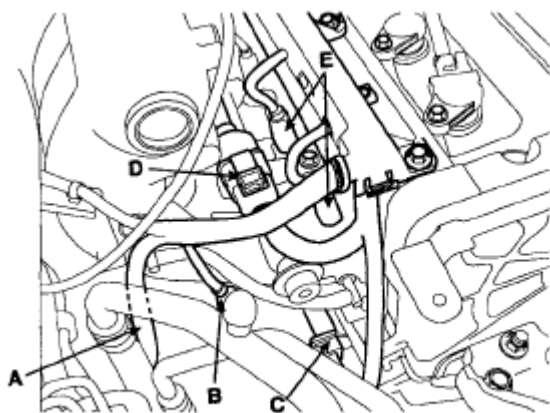
- Clean the sealing face before assembling two parts.
- Remove harmful foreign materials on the sealing face before applying sealant
- When applying sealant gasket, sealant must not protrude into the inside of oil pan.
- To prevent leakage of oil, apply sealant gasket to the inner threads of the bolt holes.

c. Install the 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)



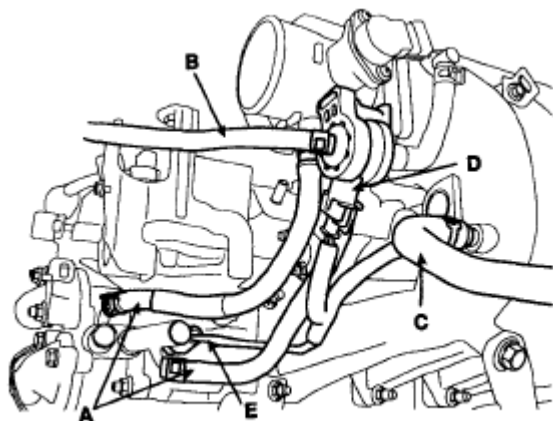
ACJF013A

Fig. 245: Identifying Upper Oil Pan Bolts Sequence
Courtesy of HYUNDAI MOTOR CO.

17. Install the knock sensor (A).

Tightening torque

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



ACJF047A

Fig. 246: Identifying Knock Sensor
Courtesy of HYUNDAI MOTOR CO.

18. Install the drive plate.

Tightening torque

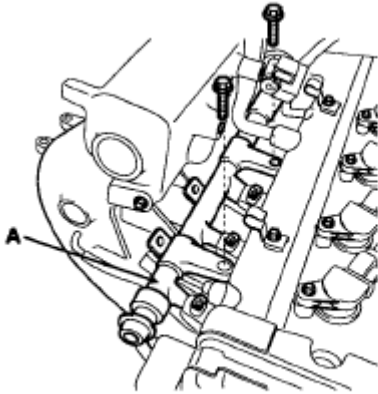
71.54 ~ 75.46 Nm (7.3 ~ 7.7 kgf.m, 52.80 ~ 55.69 lb-ft)

INSTALLATION

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

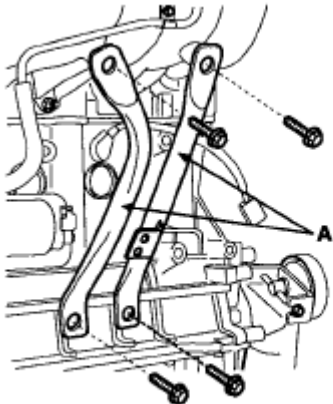
COOLING SYSTEM

COMPONENTS



ADGE067A

Fig. 247: Identifying Cooling System Components With Torque Specifications (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



ADGE070A

Fig. 248: Identifying Cooling System Components With Torque Specifications (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

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 the 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 to 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 than 60% will impair cooling 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.**

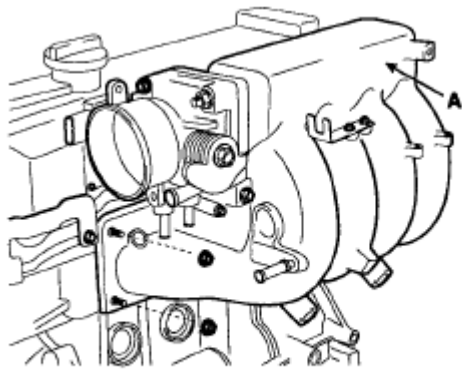
7. Start the engine and run so coolant circulates. When the cooling fan operates and coolant circulates, refill coolant through the radiator cap.
8. Repeat 7 until the cooling fan cycles 3-5 times and bleed air sufficiently out of the cooling system.
9. Install the radiator cap and fill the reservoir 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 until 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:

Bleed air out of the cooling system and refill coolant when coolant completely cools, 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 to pressure tester.



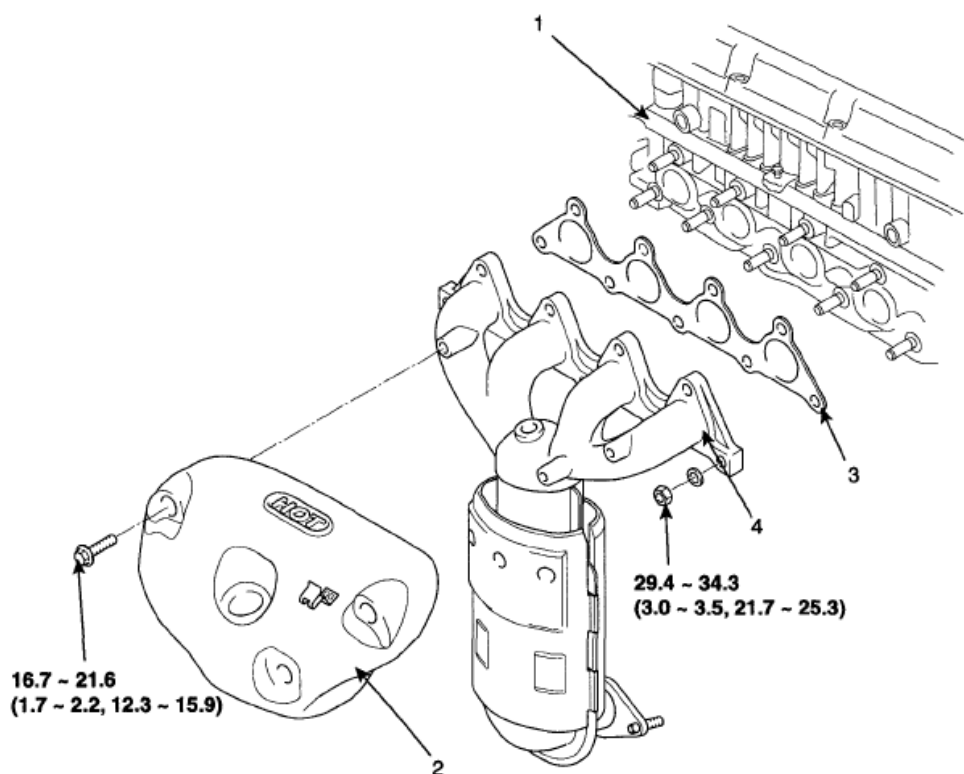
ADGE071A

Fig. 249: Installing Radiator Cap To Pressure Tester
Courtesy of HYUNDAI MOTOR CO.

2. Apply a pressure of 93 ~ 123 kPa (0.95 ~ 1.25 kgf/cm² , 14 ~ 19 psi)
3. Check for a drop in pressure.
4. If the pressure drops, replace the cap.

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.



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

- 1. Cylinder head
- 2. Heat protector

- 3. Gasket
- 4. Exhaust manifold

BCJF010A

Fig. 250: Checking Engine Coolant Leaks In Radiator
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/cm² 14 ~ 18psi).
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.

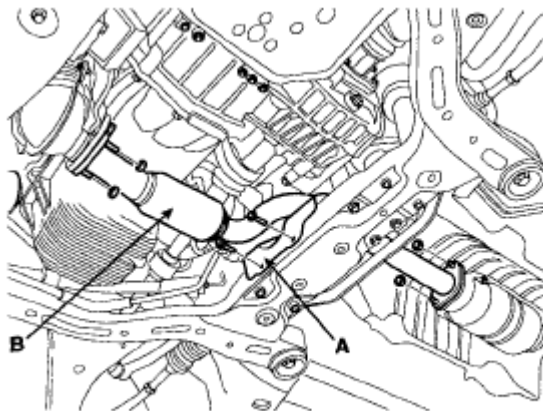
REMOVAL

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.

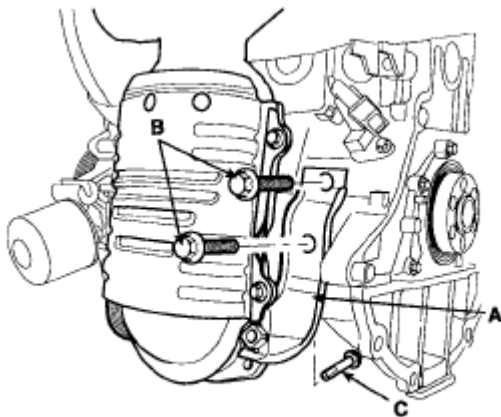
2. Remove the drive belt (A).



ACJF031A

Fig. 251: Identifying Drive Belt
Courtesy of HYUNDAI MOTOR CO.

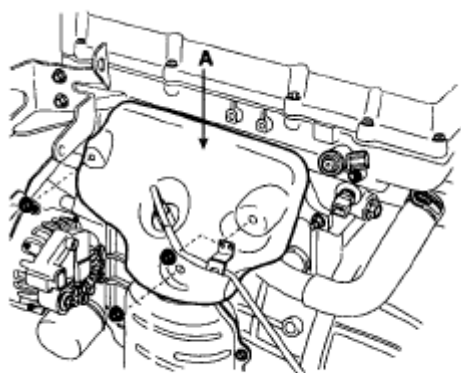
3. Remove the 4 bolts and the pump pulley (A).



ACJF123A

Fig. 252: Identifying Bolts And Pump Pulley
Courtesy of HYUNDAI MOTOR CO.

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

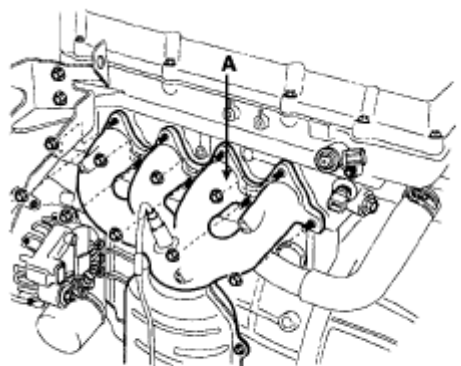


ADGE072A

Fig. 253: Identifying Water Pump And Gasket
Courtesy of HYUNDAI MOTOR CO.

WATER TEMPERATURE CONTROL ASSEMBLY

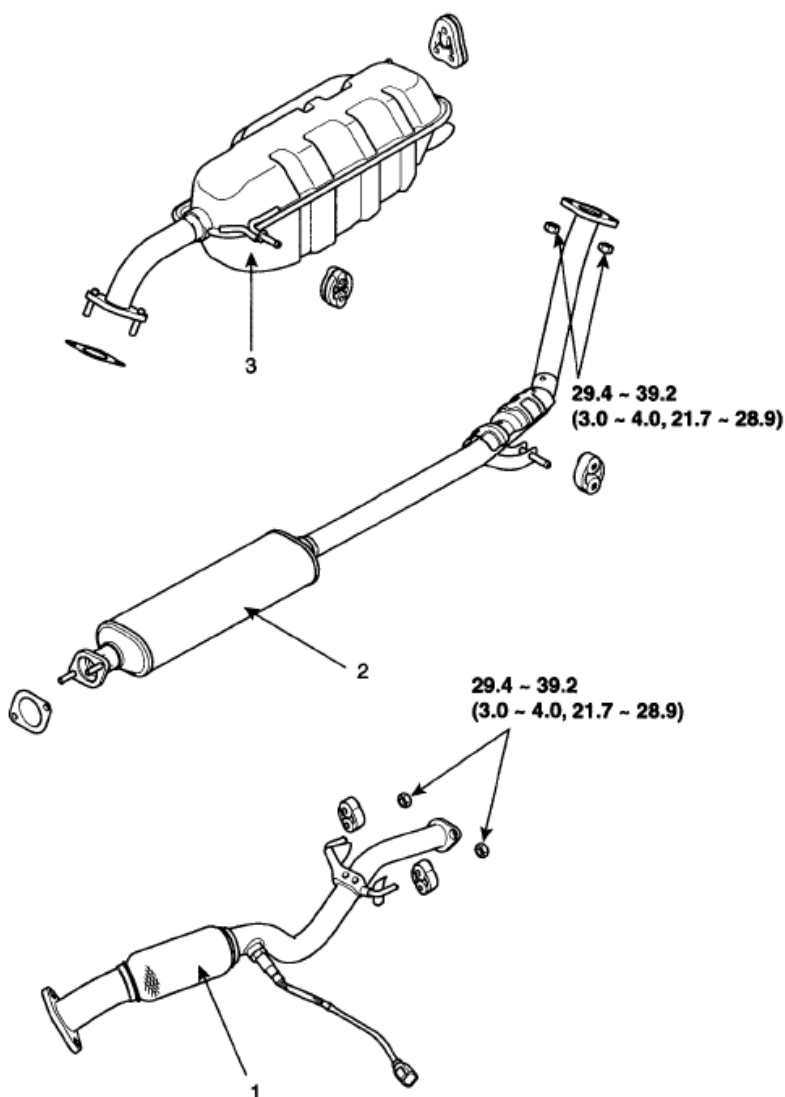
1. Drain the engine coolant.
2. Remove the air cleaner assembly.
3. Disconnect the radiator upper and lower hose (A).



ADGE073A

Fig. 254: Identifying Radiator Upper And Lower Hose
Courtesy of HYUNDAI MOTOR CO.

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



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

1. Front muffler
2. Center muffler

3. Main muffler

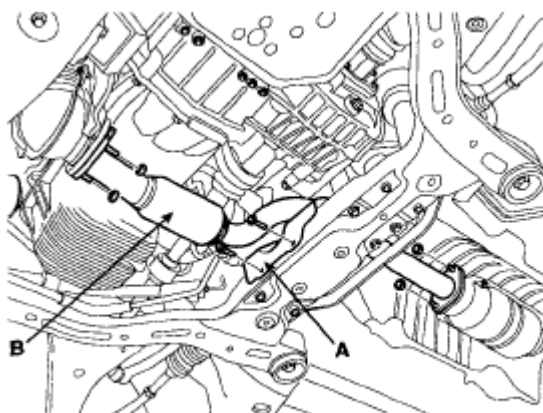
LCJF017A

Fig. 255: Identifying 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 the water inlet (A) and the thermostat (B).

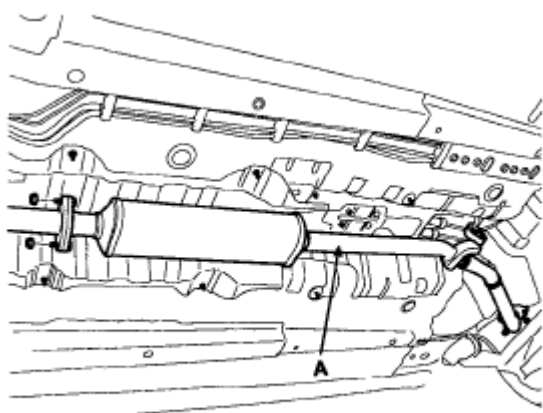


ACJF031A

Fig. 256: Identifying Water Inlet And Thermostat
Courtesy of HYUNDAI MOTOR CO.

RADIATOR

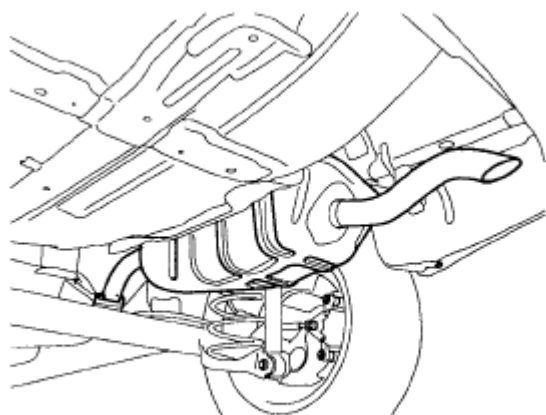
1. Drain the engine coolant.
2. Remove the air duct (A).



ACJF050A

Fig. 257: Identifying Air Duct
Courtesy of HYUNDAI MOTOR CO.

3. Disconnect the radiator upper and lower hoses (A).



ACJF054A

Fig. 258: Identifying Radiator Upper And Lower Hoses
Courtesy of HYUNDAI MOTOR CO.

4. Disconnect transaxle oil cooler hoses.
5. Disconnect the radiator fan connector.
6. Remove the radiator bracket.
7. Remove the radiator.

INSPECTION

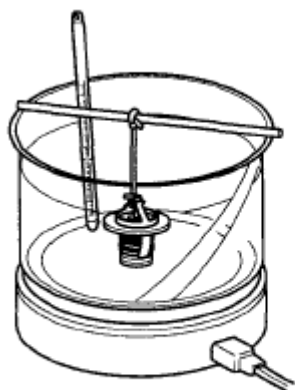
WATER PUMP

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.



ECKD503B

Fig. 259: Checking Thermostat Valve Lift
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

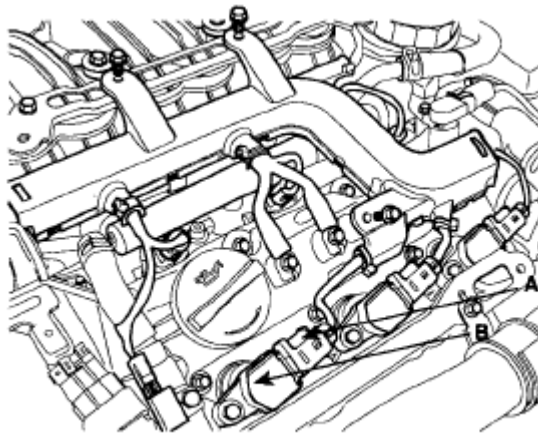
WATER PUMP

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

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)



KDRF158B

Fig. 260: Identifying Water Pump And Gasket
Courtesy of HYUNDAI MOTOR CO.

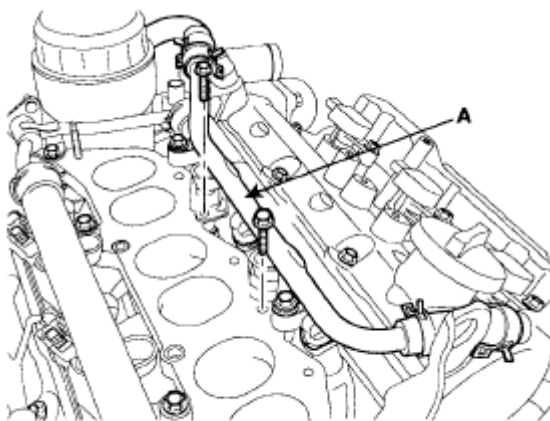
NOTE:

- Clean the contact face before assembly.
- Always use a new bolt (C) and gaskets (B).

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

Tightening torque

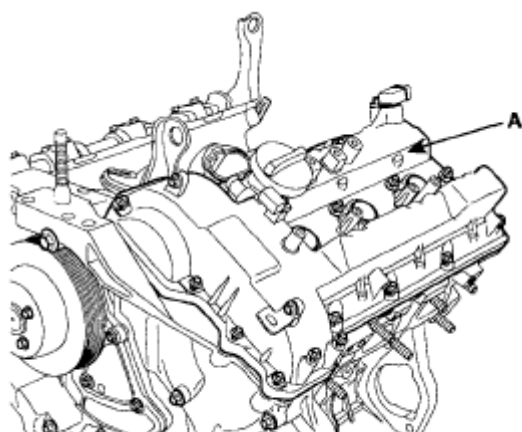
7.84 ~ 9.80 Nm (0.8 ~ 1.0 kgf.m, 5.78 ~ 7.23 lb-ft)



ECBF031A

Fig. 261: Identifying Pump Pulley
Courtesy of HYUNDAI MOTOR CO.

3. Install the drive belt (A).



KDRF112A

Fig. 262: Identifying Drive Belt
Courtesy of HYUNDAI MOTOR CO.

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

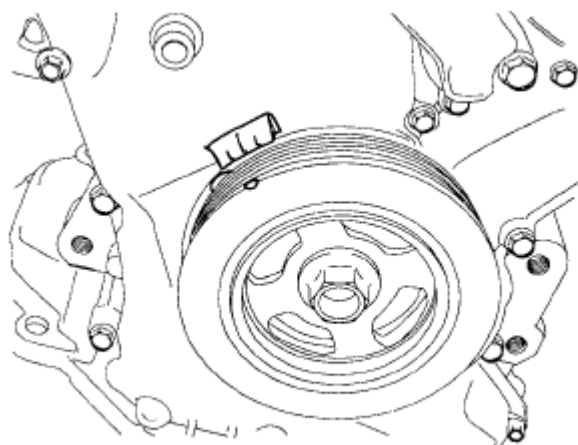
WATER TEMPERATURE CONTROL ASSEMBLY

NOTE: Clean the contact face before assembly.

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

Tightening torque

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

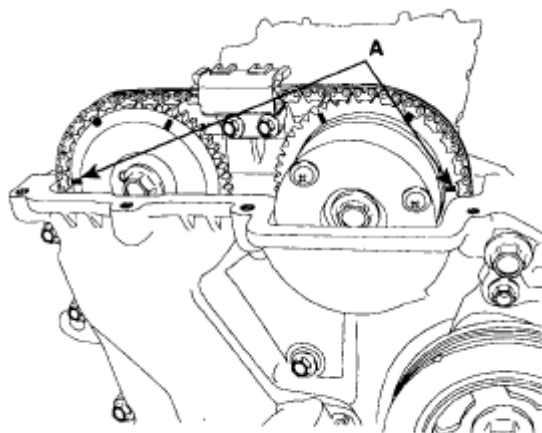


KDRF108A

Fig. 263: Identifying Water Temperature Control Assembly And Gasket
Courtesy of HYUNDAI MOTOR CO.

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

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



KDRF113A

Fig. 264: Identifying Radiator Upper And Lower Hose
Courtesy of HYUNDAI MOTOR CO.

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

THERMOSTAT

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

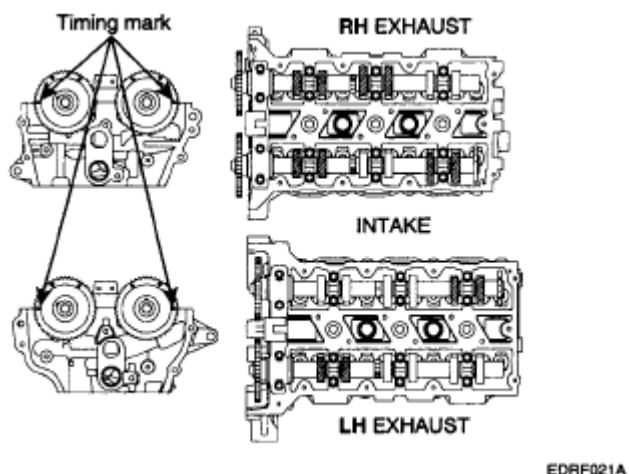


Fig. 265: Identifying Thermostat
Courtesy of HYUNDAI MOTOR CO.

2. Install the water inlet (A).

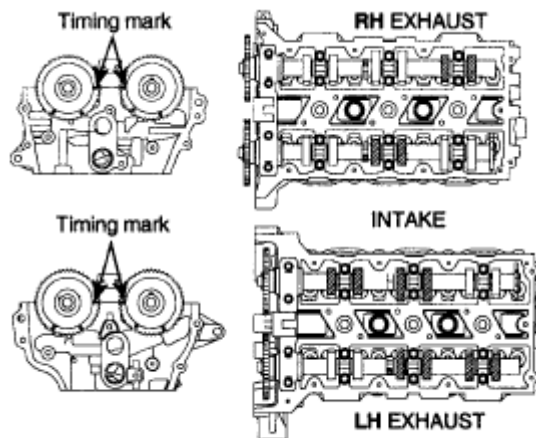
Tightening torque

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

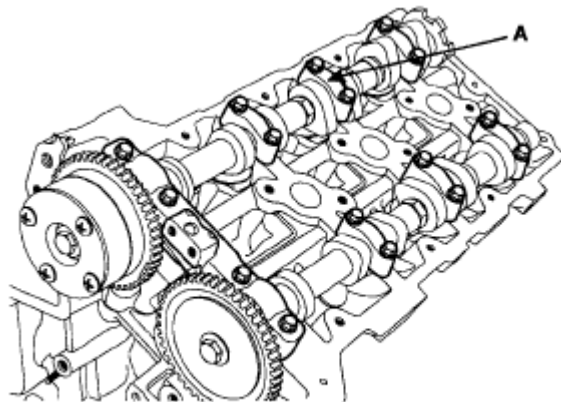
1. Install the radiator.
2. Install the radiator bracket.
3. Reconnect the radiator fan connector.
4. Connect the transaxle oil cooler hoses.
5. Connect the radiator upper and lower hoses (A).



EDRF022A

Fig. 266: Identifying Radiator Upper And Lower Hoses
Courtesy of HYUNDAI MOTOR CO.

6. Install the air duct (A).



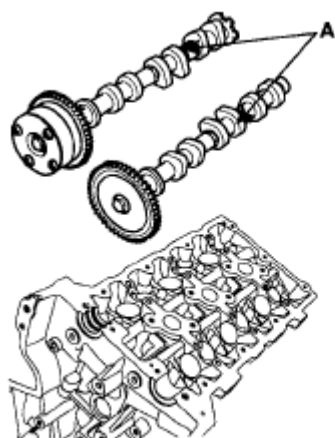
KDRF196A

Fig. 267: Identifying Air Duct
Courtesy of HYUNDAI MOTOR CO.

7. Fill with engine coolant.
8. Start engine and check for leaks.
9. Recheck engine coolant level.

LUBRICATION SYSTEM

COMPONENTS



KDRF197A

Fig. 268: Identifying Lubrication System Components With Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

INSPECTION

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.

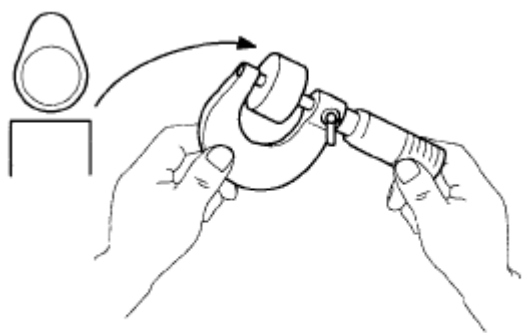
After warming up the engine and then 5 minutes after the engine stops, oil level should be between the "L" and "F" marks on the dipstick.

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.



EDKE889D

Fig. 269: SAE Viscosity Grades And Temperature Range Graph For Engine Oil
Courtesy of HYUNDAI MOTOR CO.

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

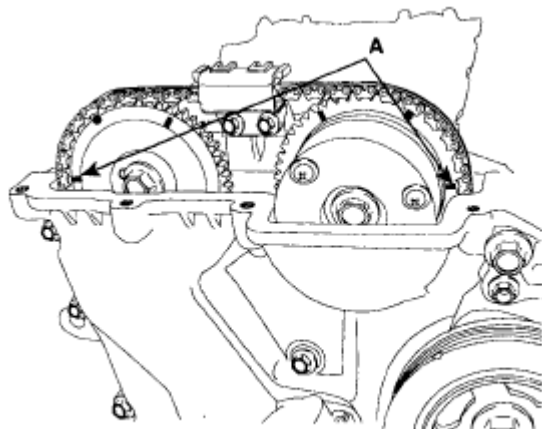
- Satisfy the requirement of the API classification.
- Have proper SAE grade number for expected ambient temperature range.

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

REMOVAL

OIL PUMP

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



KDRF113A

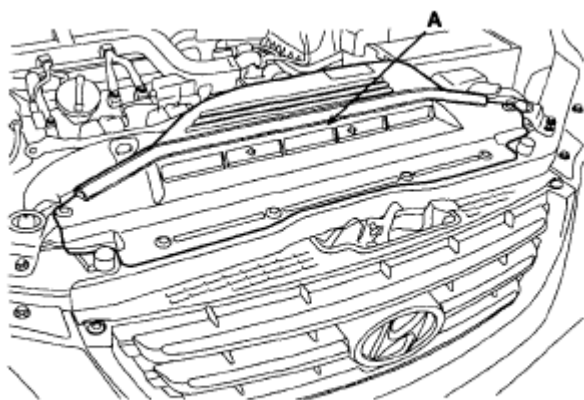
Fig. 270: Identifying Lower Oil Pan
Courtesy of HYUNDAI MOTOR CO.

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

- CAUTION:**
- Insert the SST between the oil pan and the ladder frame by tapping it with a plastic hammer in the direction of (1) arrow.
 - After tapping the SST with a plastic hammer along the direction of (2) arrow around more than 2/3 edge of the oil pan, remove it from the ladder frame.
 - Do not turn over the SST abruptly without tapping.

It can result in damage of the SST.

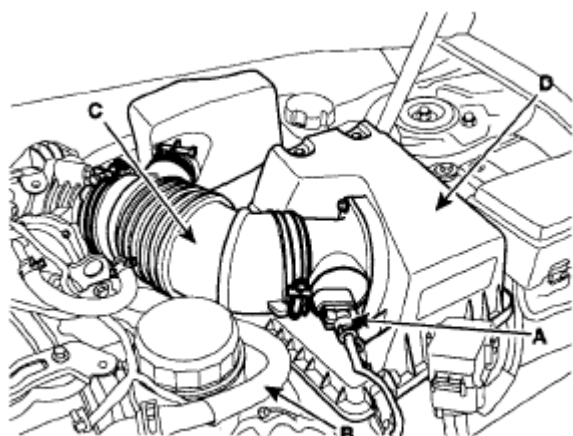
3. Remove the oil pump chain cover (A).



KCBF143A

Fig. 271: Identifying Oil Pump Chain Cover
Courtesy of HYUNDAI MOTOR CO.

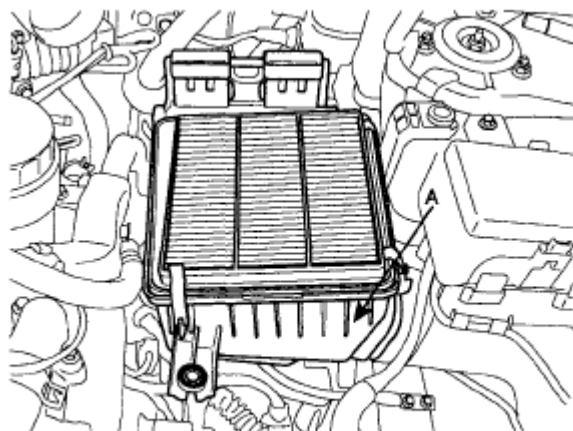
4. Remove the oil pump chain sprocket (A).



KDRF173A

Fig. 272: Identifying Oil Pump Chain Sprocket
Courtesy of HYUNDAI MOTOR CO.

5. Remove the oil pump (A).

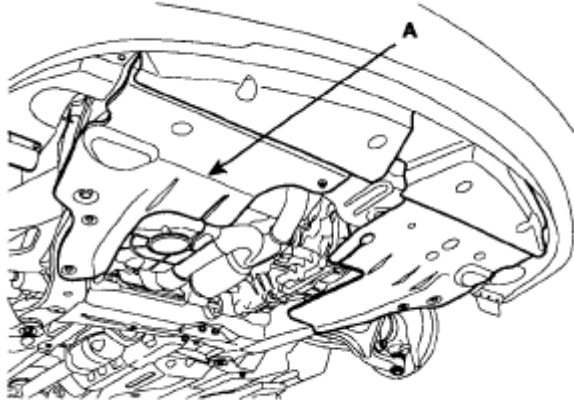


ECBF016A

Fig. 273: Identifying Oil Pump
Courtesy of HYUNDAI MOTOR CO.

OIL FILTER ASSEMBLY

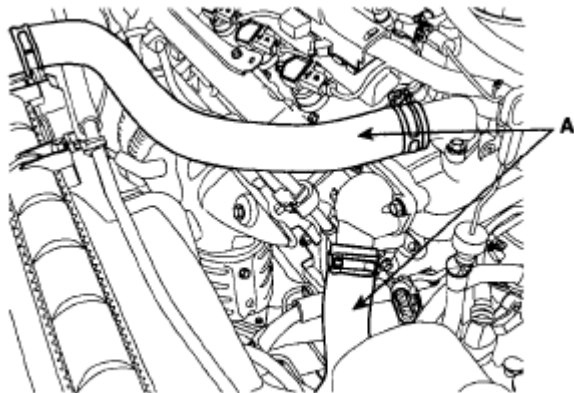
1. Loosen the oil filter cap by turning it counterclockwise to drain oil in the oil filter.
2. Drain the engine coolant.
3. Disconnect the oil pressure switch connector.
4. Remove the surge tank and the intake manifold (A) with the delivery pipe assembly.



KCBF101A

Fig. 274: Identifying Intake Manifold With Delivery Pipe Assembly
Courtesy of HYUNDAI MOTOR CO.

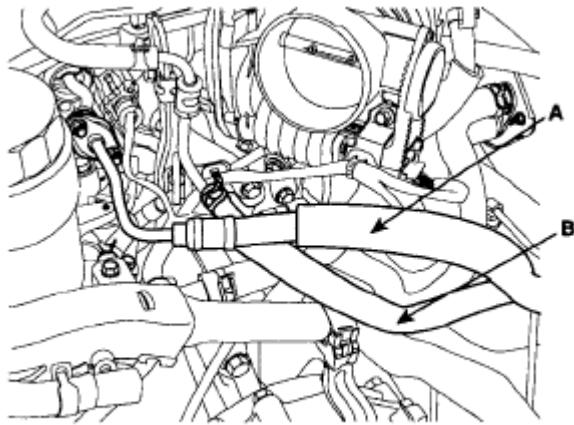
5. Disconnect the water hoses from ETC.
6. Remove the water temperature control assembly (A).



KDRF148A

Fig. 275: Identifying Water Temperature Control Assembly
Courtesy of HYUNDAI MOTOR CO.

7. Disconnect the water vent hose (A).
8. Remove the oil filter body cover (B).



KDRF149A

Fig. 276: Identifying Oil Filter Body Cover And Water Vent Hose
Courtesy of HYUNDAI MOTOR CO.

9. Remove the oil filter body.

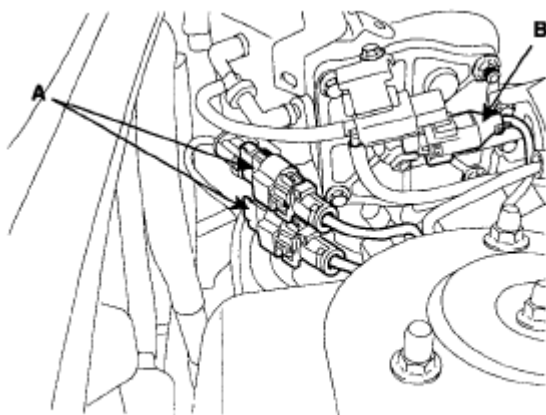
NOTE: Be careful of the knock sensor connector.

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.



UCBF001A

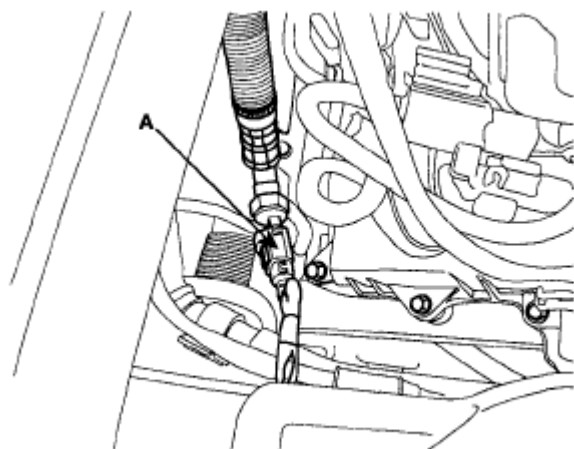
Fig. 277: Checking Oil Pressure Switch Continuity
Courtesy of HYUNDAI MOTOR CO.

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.



KDRF152A

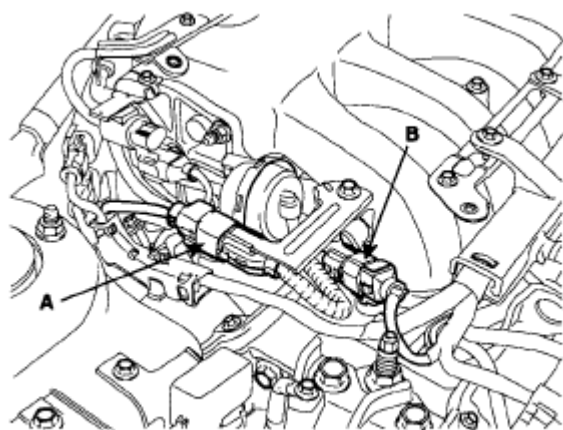
Fig. 278: Checking Continuity Between Terminal And Body When Fine Wire Pushed
Courtesy of HYUNDAI MOTOR CO.

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 waterless 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.

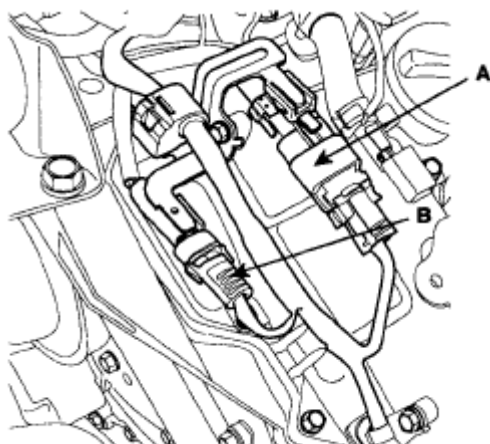
1. Park the car on level ground. Start the engine and let it warm up.
2. Turn the engine off and open the hood. Remove the engine cover.
3. Wait for 5 minutes after loosening the oil filter cap by turning it counterclockwise with the SST (09263-3C100) to drain well the oil in the oil filter.



UCBF002A

Fig. 279: Identifying SST (09263-3C100)
Courtesy of HYUNDAI MOTOR CO.

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



KDRF155A

Fig. 280: Identifying Oil Filter Element And New 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.

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 removing the engine oil level gauge.

Capacity

When replacing a short engine or a block assembly:

6.0L (6.34 U.S.qts, 5.28 imp.qts)

When replacing an oil pan only:

5.5L (5.81 U.S.qts, 4.84 imp.qts)

Drain and refill: 5.2L (5.49 U.S.qts, 4.58 imp.qts)

- 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.

8. Recheck engine oil level.

INSTALLATION**OIL PUMP**

1. Install the oil pump (A).

Tightening torque

20.6 ~ 22.6 Nm (2.1 ~ 2.3 kgf.m, 15.2 ~ 16.6 lb-ft)

NOTE: Always use a new O-ring (B).

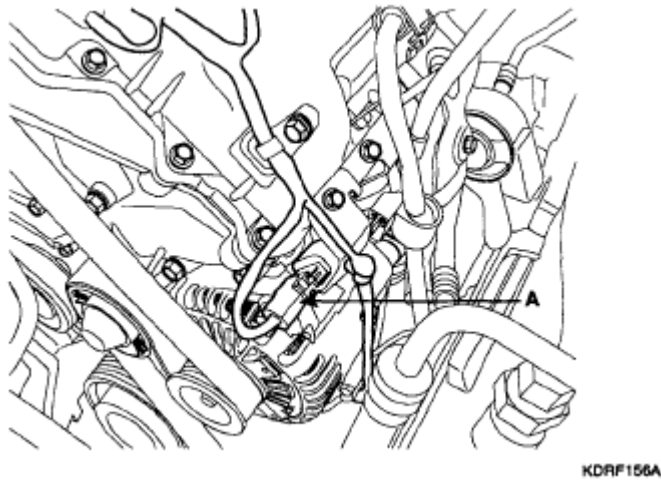


Fig. 281: Identifying Oil Pump
Courtesy of HYUNDAI MOTOR CO.

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

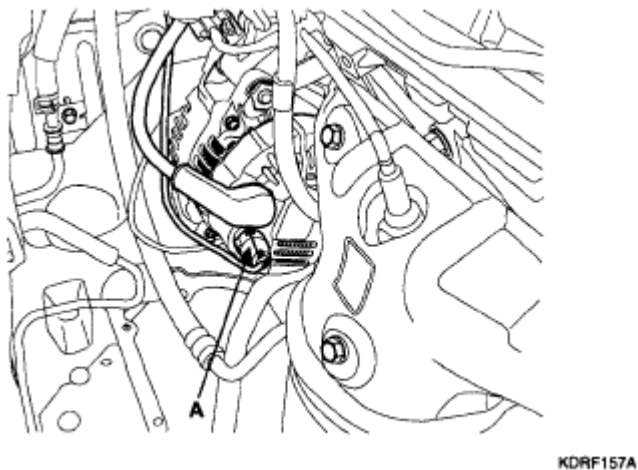
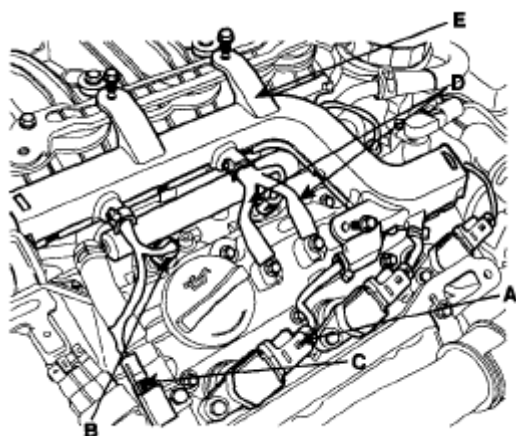


Fig. 282: Identifying Oil Pump Sprocket And Oil Pump Chain On Oil Pump
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

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



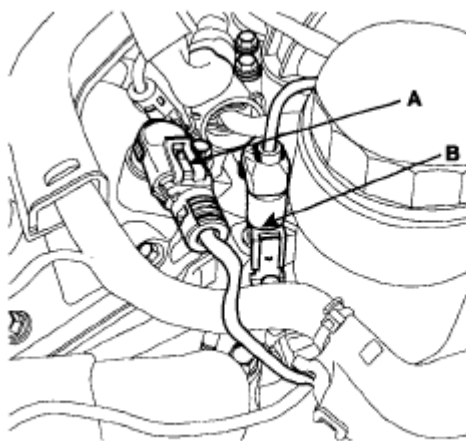
KDRF158A

Fig. 283: Identifying Oil Pump Chain Cover
 Courtesy of HYUNDAI MOTOR CO.

4. Install the lower 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.

Bead width: 2.5 mm (0.1 in.)

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



KDRF159A

Fig. 284: Identifying Liquid Sealant On Upper Oil Pan
 Courtesy of HYUNDAI MOTOR CO.

CAUTION:

- Clean the sealing face before assembling two parts.
- Remove harmful foreign materials on the sealing face before applying sealant

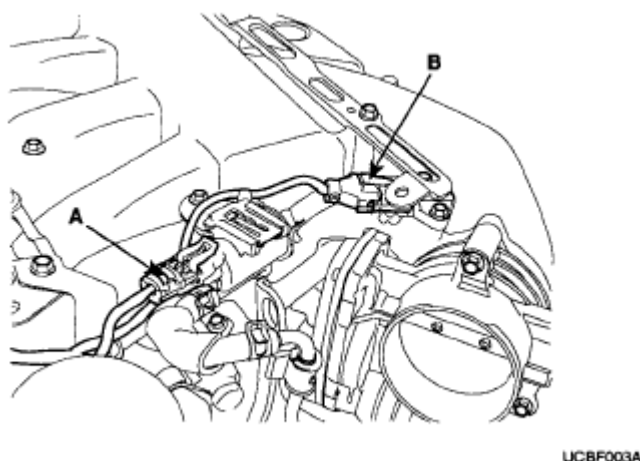
- When applying sealant gasket, sealant must not be protrude into the inside of oil pan.
- To prevent leakage of oil, apply sealant gasket to the inner threads of the bolt holes.

c. Install the lower oil pan (A).

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)



UCBF003A

Fig. 285: Identifying Lower Oil Pan
Courtesy of HYUNDAI MOTOR CO.

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

OIL FILTER ASSEMBLY

1. Install the 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 gaskets must not be damaged by assembling parts.
- Be careful of the knock sensor connector.
- Always use a new O-ring

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

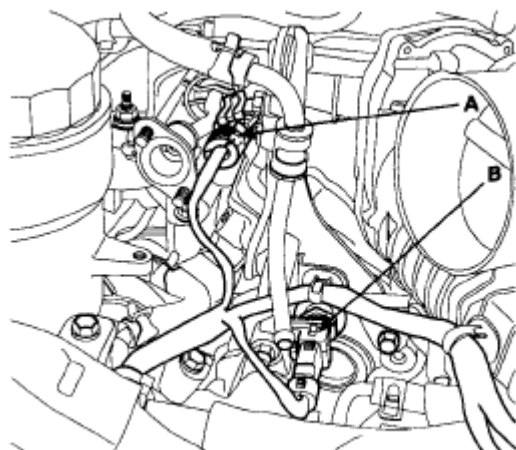
Tightening torque

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

3. Connect the water vent hose (A)

Tightening torque

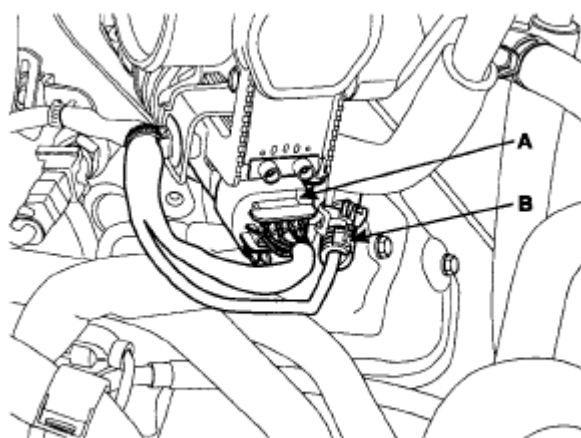
9.80 ~ 11.76 Nm (1.0-1.2 kgf.m, 7.23 ~ 8.68 lb-ft)



KDRF161A

Fig. 286: Identifying Water Vent Hose
Courtesy of HYUNDAI MOTOR CO.

4. Install the water temperature control assembly (A).

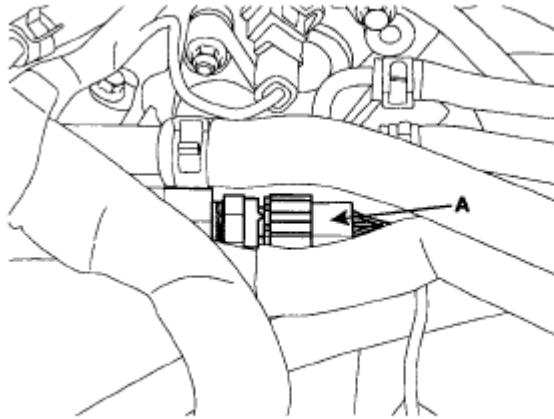


KDRF162A

Fig. 287: Identifying Water Temperature Control Assembly
Courtesy of HYUNDAI MOTOR CO.

5. Connect the water hoses on the ETC.

6. Connect the oil pressure switch connector.
7. Install the intake manifold (A) and the surge tank.



KDRF163A

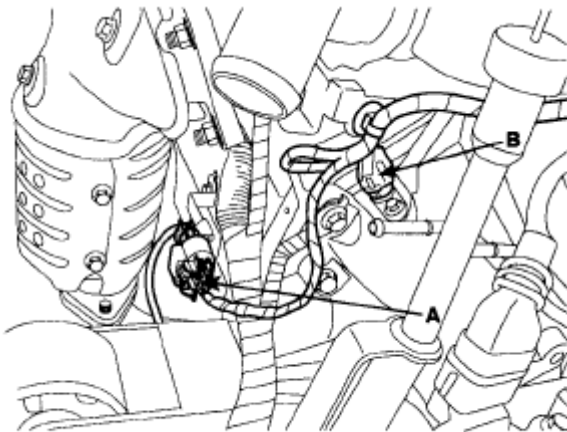
Fig. 288: Identifying Intake Manifold And Surge Tank
Courtesy of HYUNDAI MOTOR CO.

8. Fill with engine coolant.
9. Start engine and check for leaks.
10. Recheck engine coolant level.

INTAKE AND EXHAUST SYSTEM

INTAKE MANIFOLD

COMPONENTS

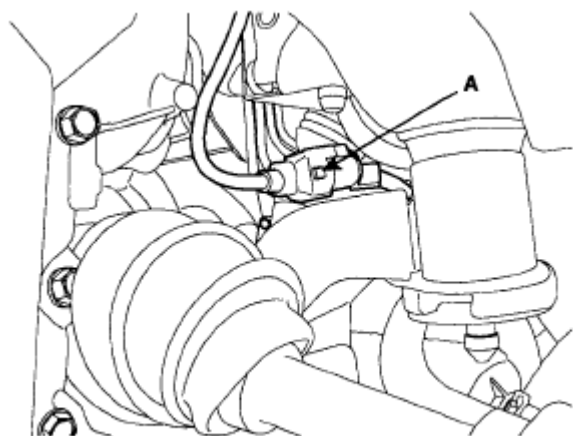


KDRF164A

Fig. 289: Identifying Intake Manifold Components With Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

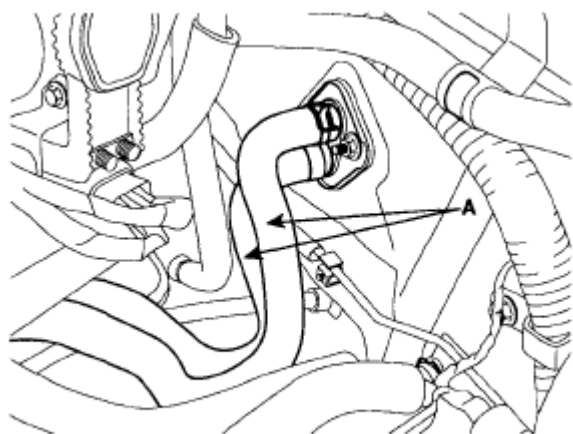
1. Disconnect the AFS connector (A) and the breather hose (B).
2. Remove the air cleaner body (D) and the intake hose (C).



KCBF103A

Fig. 290: Identifying Air Cleaner Body And Intake Hose
Courtesy of HYUNDAI MOTOR CO.

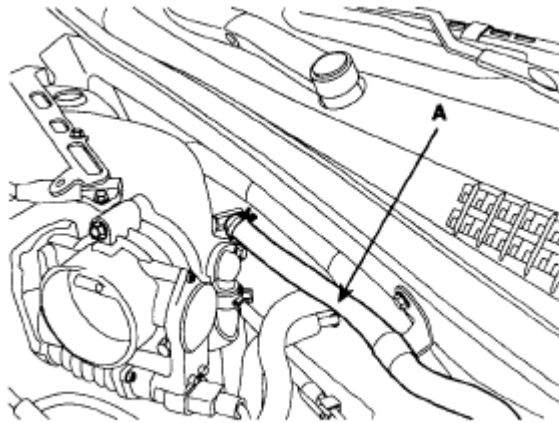
3. Disconnect the RH front and rear oxygen sensor connectors (A), the power steering sensor connector (B), the RH injector harness connector (C) and the VIS solenoid valve connector (D).



KDRF165A

Fig. 291: Identifying Rear Oxygen Sensor Connectors And Power Steering Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

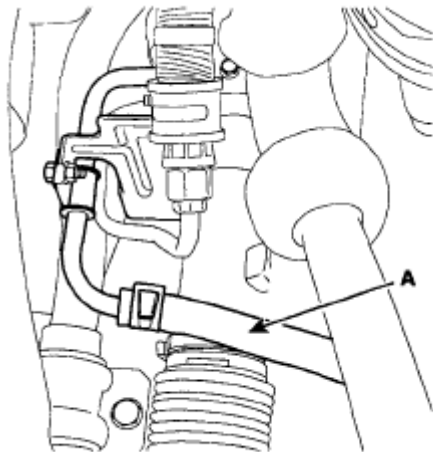
4. Disconnect the PCSV connector (A), the MAP sensor connector (B) and the PCSV hose.



KDBF101A

Fig. 292: Identifying PCSV Connector, MAP Sensor Connector And PCSV Hose
Courtesy of HYUNDAI MOTOR CO.

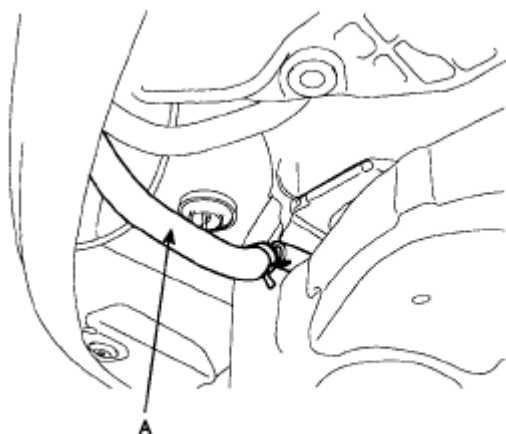
5. Disconnect the ETC connector (A) and the knock sensor connector (B).



KDRF175A

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

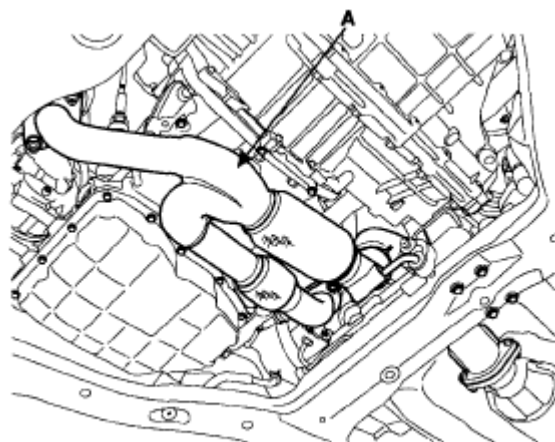
6. Disconnect the water hoses (B) from ETC.
7. Disconnect the PCV (C) hose.



ECBF007A

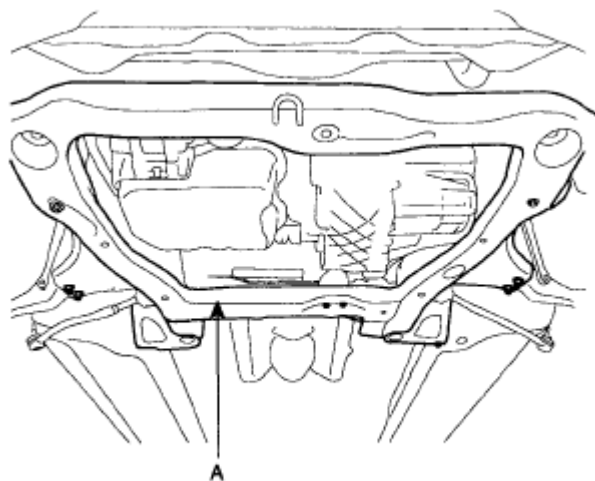
Fig. 294: Identifying Water Hoses And PCV Hose
Courtesy of HYUNDAI MOTOR CO.

8. Disconnect brake vacuum hose.
9. Remove the surge tank stays (A).



KCBF102A

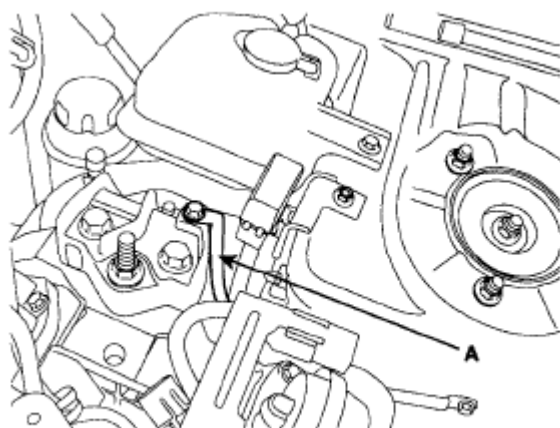
Fig. 295: Identifying Surge Tank Stays
Courtesy of HYUNDAI MOTOR CO.



KMRE009R

Fig. 296: Identifying Surge Tank Stays
Courtesy of HYUNDAI MOTOR CO.

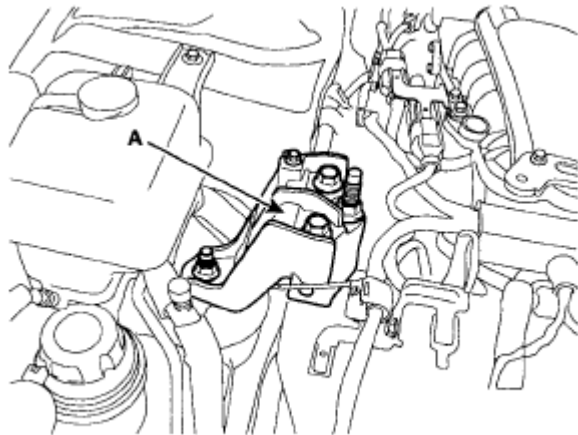
10. Remove the surge tank (A).



KDBF102A

Fig. 297: Identifying Surge Tank
Courtesy of HYUNDAI MOTOR CO.

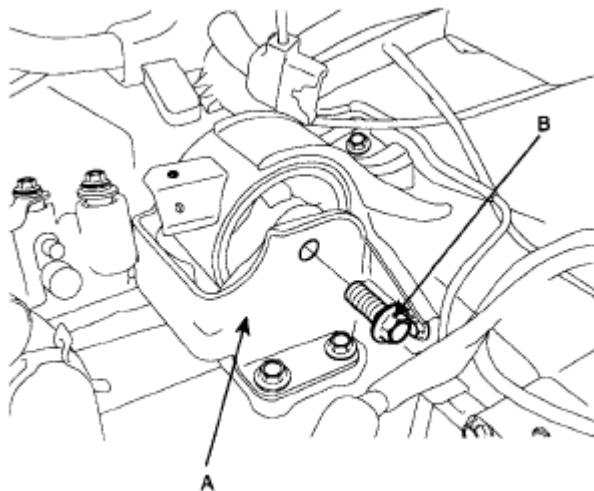
11. Disconnect the breather Pipe assembly (A).



KDRF172A

Fig. 298: Identifying Breather Pipe Assembly
Courtesy of HYUNDAI MOTOR CO.

12. Disconnect the LH injector harness connectors.
13. Remove the intake manifold (A) and gasket.



KMRE009T

Fig. 299: Identifying Intake Manifold And Gasket
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

1. Install the 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)

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

3nd: Repeat 2nd step twice or more.

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

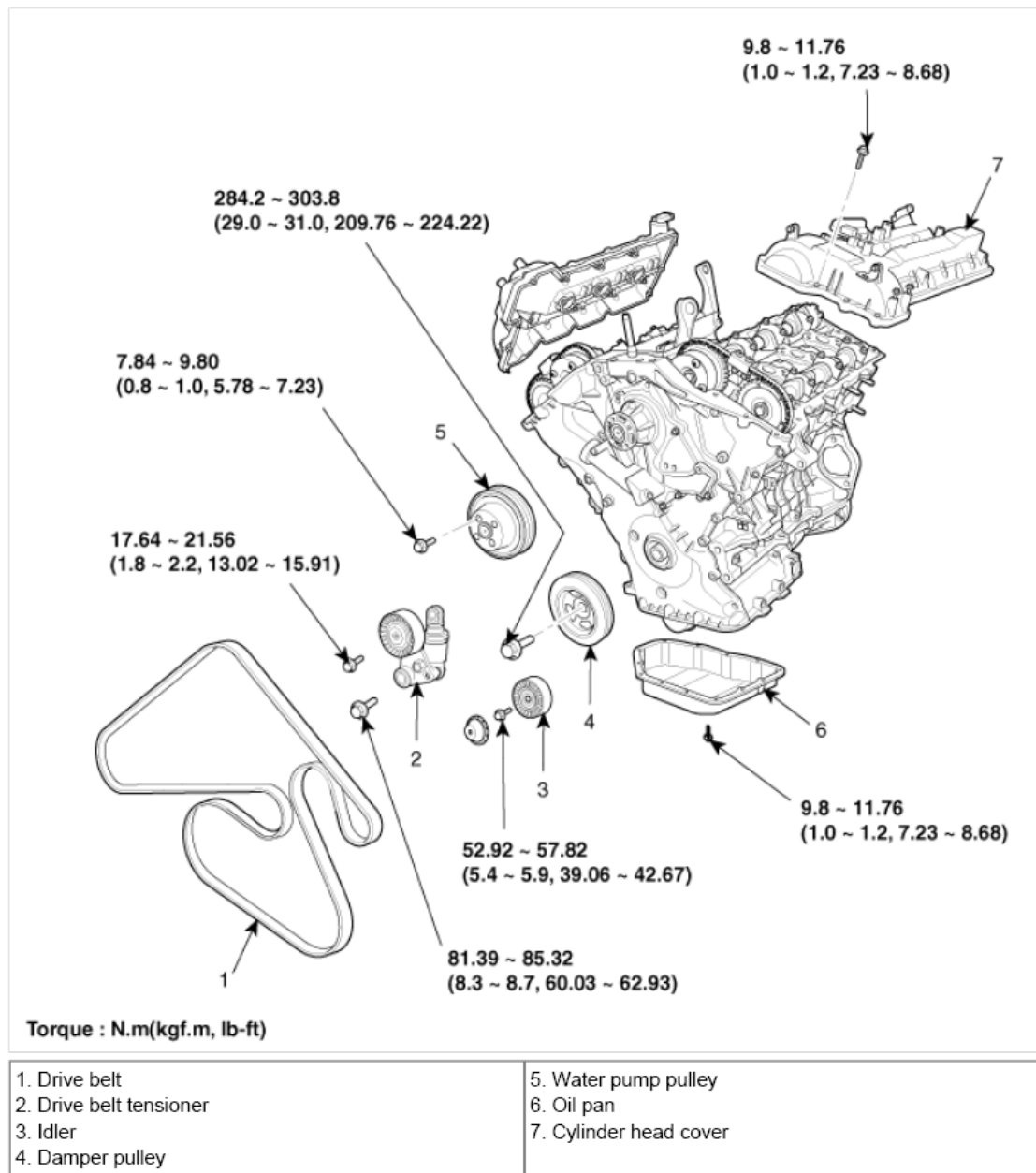


Fig. 300: Identifying Intake Manifold Bolts
Courtesy of HYUNDAI MOTOR CO.

2. Install the delivery pipe. (Refer to **FUEL SYSTEM (G6DA - GSL 3.8)**)

5. Install the surge tank.

Tightening torque

9.80 ~ 11.76 Nm (1.0 ~ 1.2 kgf.m, 7.23 ~ 8.68 lb-ft) - Long bolt 1EA

18.62 ~ 23.52 Nm (1.9 ~ 2.4 kgf.m, 13.74 ~ 17.36 lb-ft) - Short bolts 3EA/Nuts 2EA

6. Install the surge tank stays (A).

Tightening torque

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

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

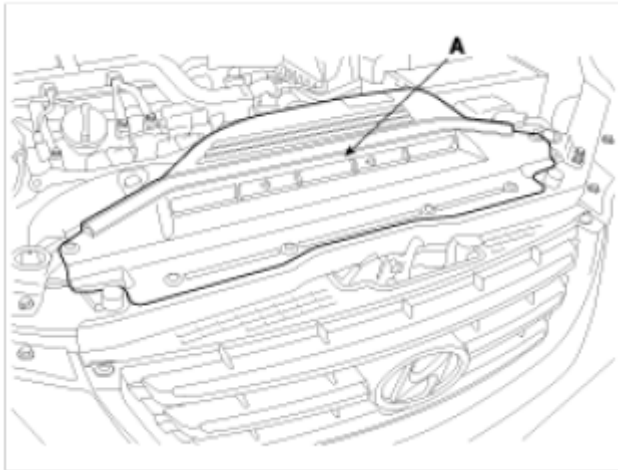


Fig. 302: Identifying Surge Tank Stays
Courtesy of HYUNDAI MOTOR CO.

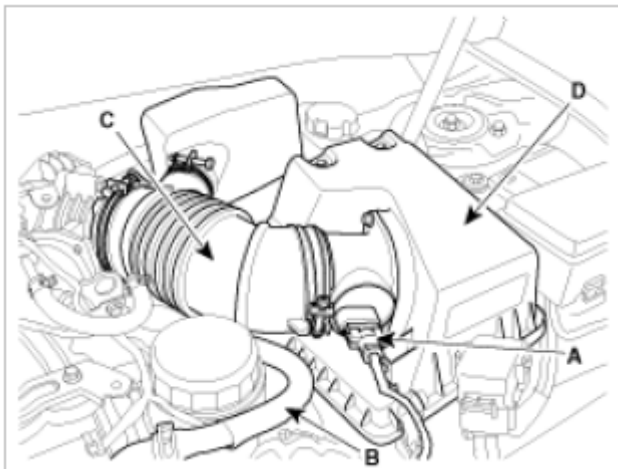


Fig. 303: Identifying Surge Tank Stays
Courtesy of HYUNDAI MOTOR CO.

7. Connect the brake vacuum hose (A).

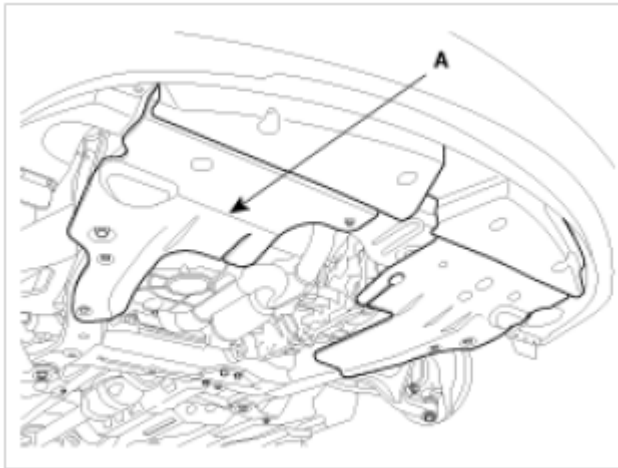


Fig. 304: Identifying Brake Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

8. Connect the PCV hose (C).
9. Connect the water hoses (B) to ETC.

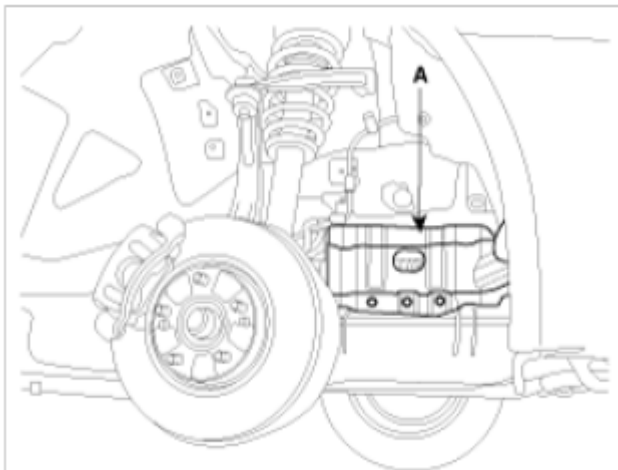


Fig. 305: Identifying Water Hoses And PCV Hose
Courtesy of HYUNDAI MOTOR CO.

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

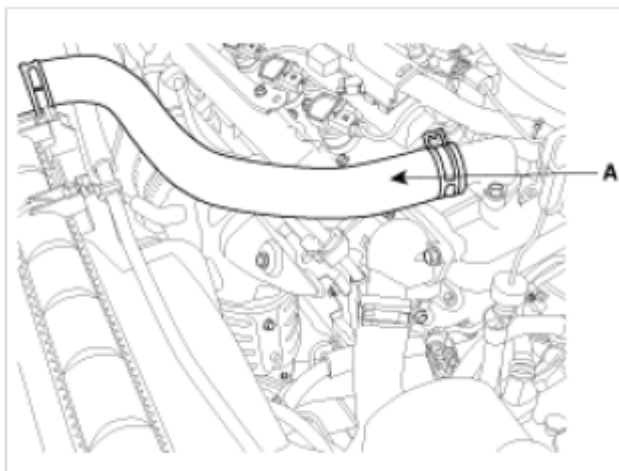


Fig. 306: Identifying ETC Connector And Knock Sensor Connector
 Courtesy of HYUNDAI MOTOR CO.

11. Connect the PCSV connector (A), the MAP sensor connector and the PCSV hose (B).

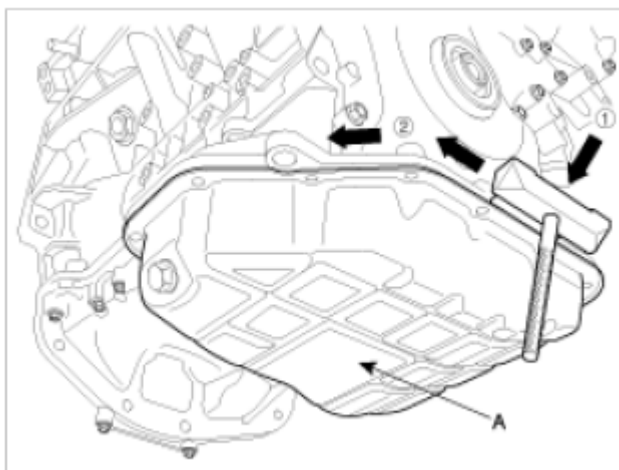


Fig. 307: Identifying PCSV Connector, MAP Sensor Connector And PCSV Hose
 Courtesy of HYUNDAI MOTOR CO.

12. Connect the RH injector harness connector (C) and the VIS solenoid valve connector (D).
13. Connect the RH front and rear oxygen sensor connectors (A) and the power steering sensor connector (B).

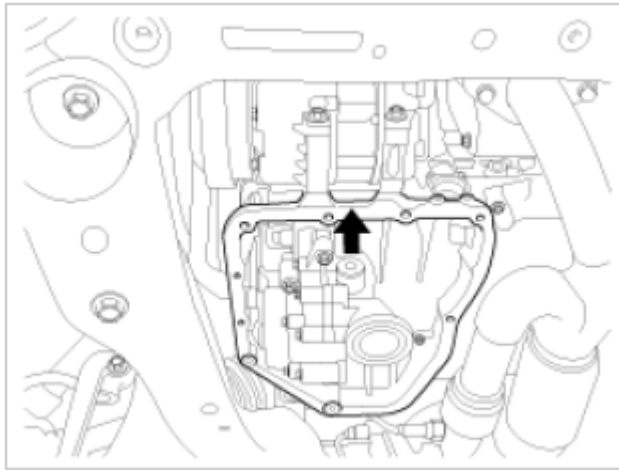


Fig. 308: Identifying RH Injector Harness Connector And VIS Solenoid Valve Connector
Courtesy of HYUNDAI MOTOR CO.

14. Install the air cleaner body (D) and the intake hose (C).
15. Connect the AFS (A) connector and the breather hose (B).

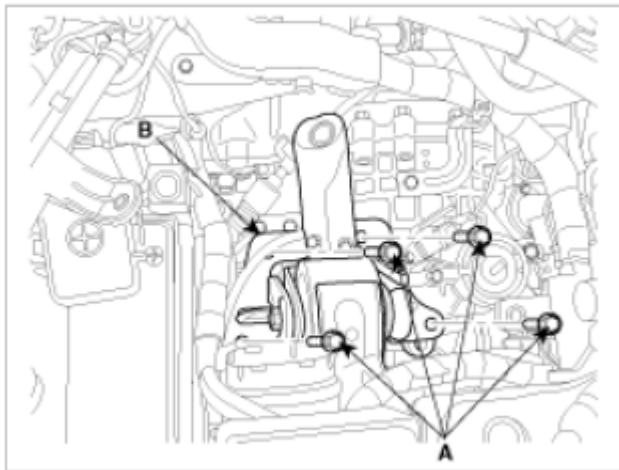


Fig. 309: Identifying AFS Connector And Breather Hose
Courtesy of HYUNDAI MOTOR CO.

EXHAUST MANIFOLD

COMPONENTS

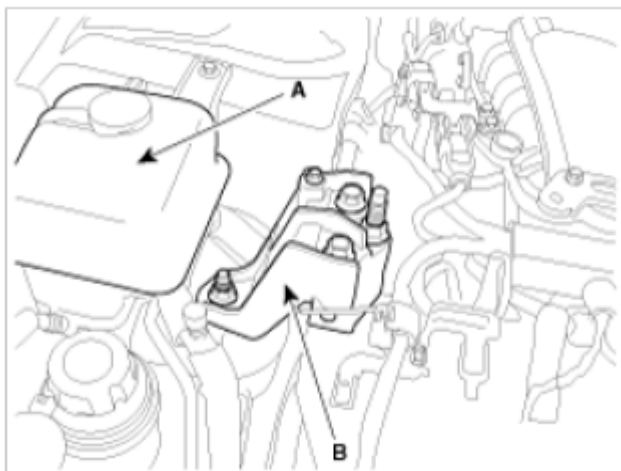


Fig. 310: Identifying Exhaust Manifold Components With Torque Specifications
 Courtesy of HYUNDAI MOTOR CO.

REMOVAL

1. Remove the under cover (A).

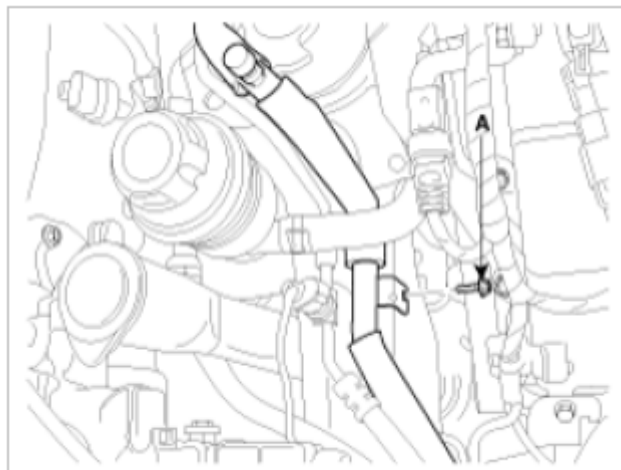


Fig. 311: Identifying Under Cover
 Courtesy of HYUNDAI MOTOR CO.

2. Remove the front muffler (A).



Fig. 312: Identifying Front Muffler
Courtesy of HYUNDAI MOTOR CO.

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

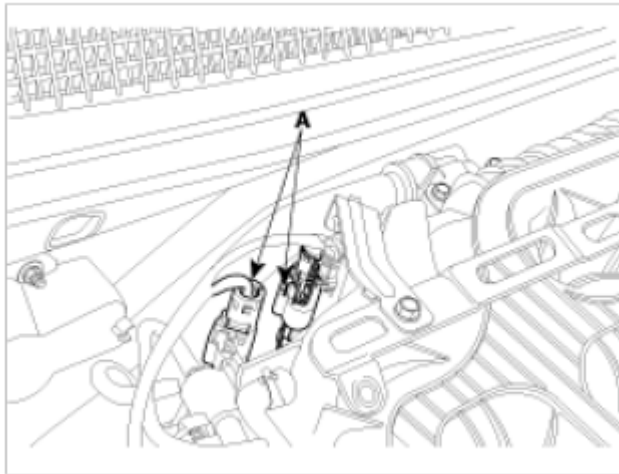


Fig. 313: Identifying Oil Level Gauge And Front Oxygen Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

5. Disconnect the LH rear oxygen sensor connector (A).

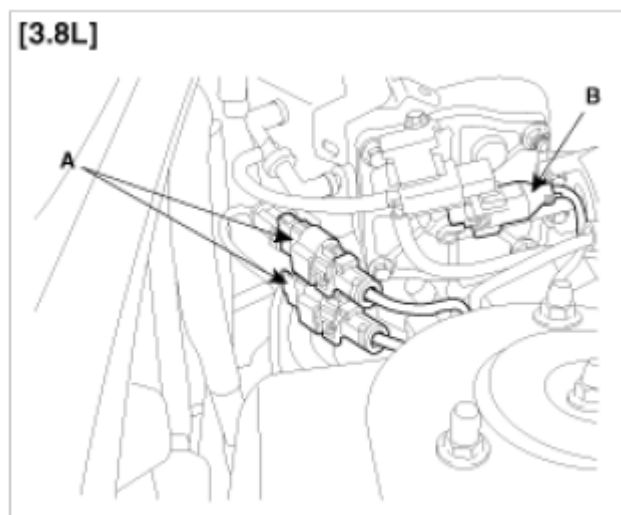


Fig. 314: Identifying Rear Oxygen Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

6. Remove the LH heat protector (A).
7. Remove the LH exhaust manifold (B).

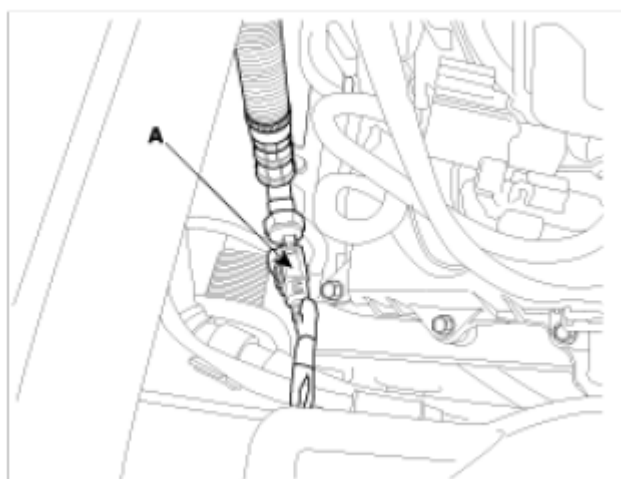


Fig. 315: Identifying Exhaust Manifold And Heat Protector
Courtesy of HYUNDAI MOTOR CO.

8. Disconnect the RH front and rear oxygen sensor connectors (A) from bracket.

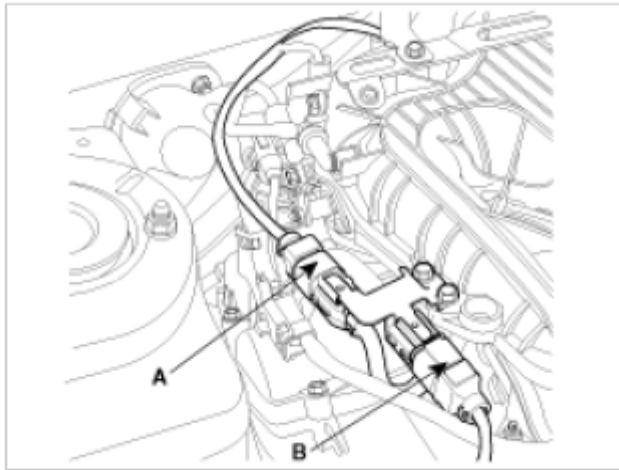


Fig. 316: Identifying RH Front And Rear Oxygen Sensor Connectors
Courtesy of HYUNDAI MOTOR CO.

9. Remove the RH heat protector.
10. Remove the RH exhaust manifold (A).

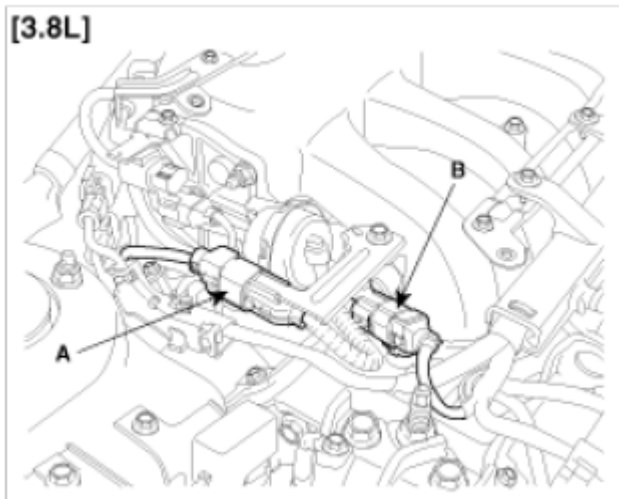


Fig. 317: Identifying Exhaust Manifold And Heat Protector
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

1. Install a new gasket (B) and the exhaust manifold (A).

Tightening torque

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

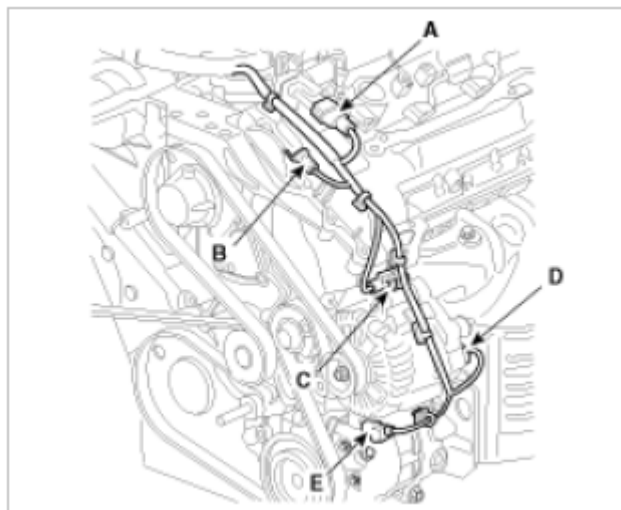


Fig. 318: Identifying Exhaust Manifold
 Courtesy of HYUNDAI MOTOR CO.

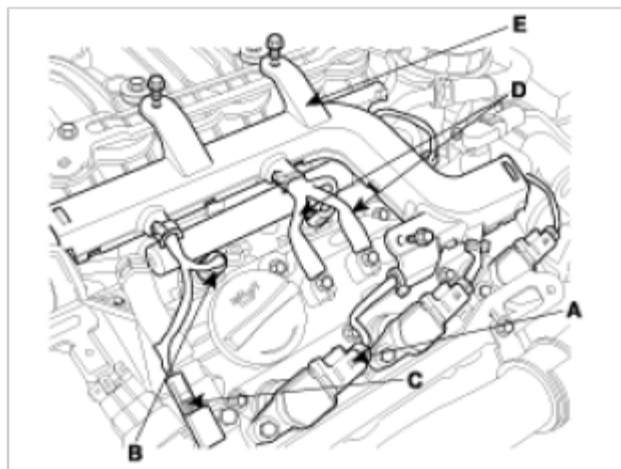


Fig. 319: Identifying Gasket
 Courtesy of HYUNDAI MOTOR CO.

2. Install the heat protector.

Tightening torque

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

3. Install the front muffler (A).

Tightening torque

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

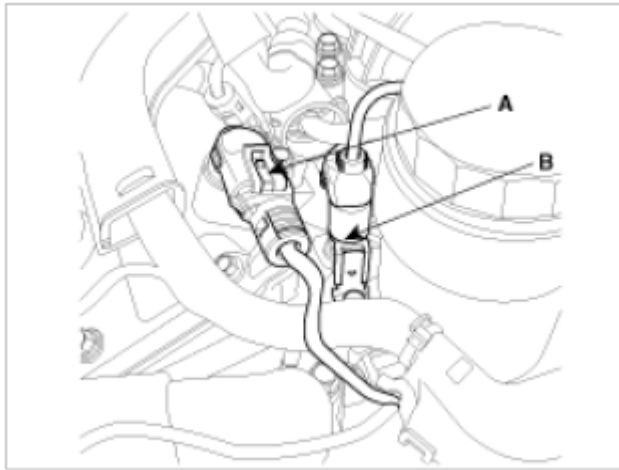


Fig. 320: Identifying Front Muffler
Courtesy of HYUNDAI MOTOR CO.

4. Connect the oxygen sensor connectors (A).

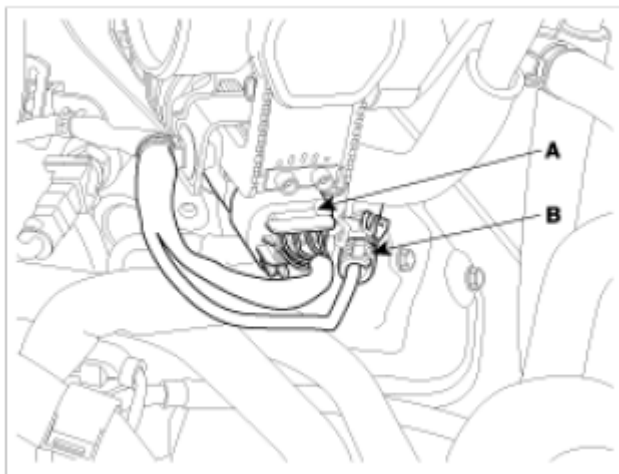


Fig. 321: Identifying Oxygen Sensor Connectors
Courtesy of HYUNDAI MOTOR CO.

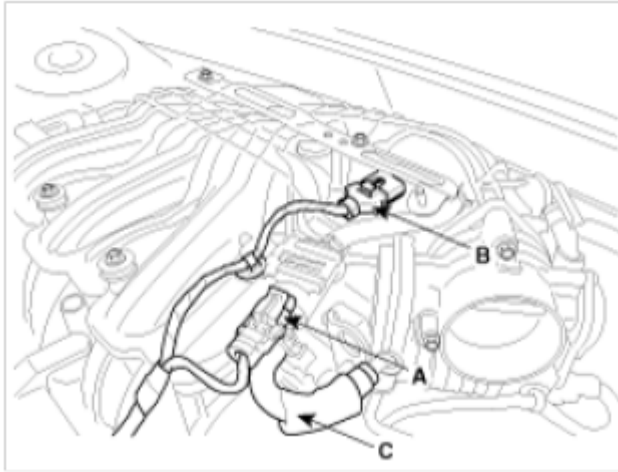


Fig. 322: Identifying Oxygen Sensor Connectors
Courtesy of HYUNDAI MOTOR CO.

5. Install the under cover (A).

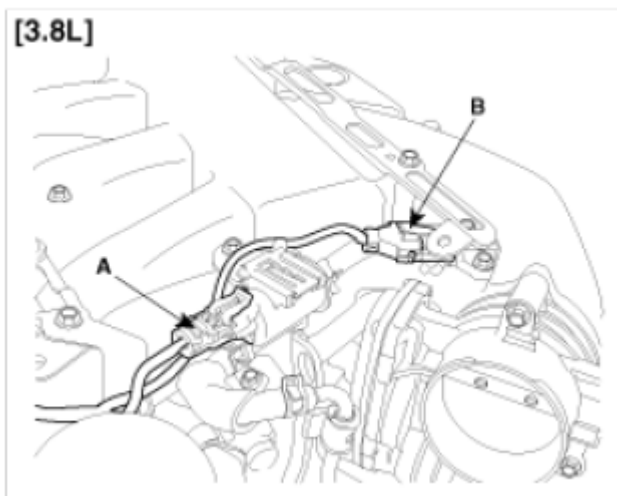


Fig. 323: Identifying Under Cover
Courtesy of HYUNDAI MOTOR CO.