

# 2008 Hyundai Elantra SE

## 2008 ENGINE Engine Mechanical System (G4GC-GSL 2.0) - Elantra

### 2008 ENGINE

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## GENERAL

## SPECIFICATIONS

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Description	Specifications	Limit
<b>General</b>		
Type	In-line, Double Overhead Camshaft	
Number of cylinder	4	
Bore	82mm (3.228in)	
Stroke	93.5mm (3.681 in)	
Total displacement	1975cc (120.52cu.in)	
Compression ratio	10.1 : 1	
Firing order	1-3-4-2	
<b>Valve timing</b>		
Intake valve	Opens (ATDC)	11°
	Closes (ABDC)	59°
Exhaust	Opens (BBDC)	42°
	Closes (ATDC)	6°
<b>Valve</b>		
Valve length	Intake	114.34mm (4.5016in)
	Exhaust	116.8mm (4.598in)
Stem outer diameter	Intake	5.965 ~ 5.98mm (0.2348 ~ 0.2354in)
	Exhaust	5.950 ~ 5.965mm (0.2343 ~ 0.2348in)
<b>Face angle thickness of valve head (Margin)</b>		
Intake	1.6±0.15mm (0.0630±0.0059in)	0.8mm (0.031 in)
	1.8±0.15mm (0.0709±0.0059in)	1.0mm (0.039in)
<b>Valve stem to valve guide clearance</b>		
Intake	0.02 ~ 0.05mm (0.0008 ~ 0.0019in)	0.10mm (0.0039in)
	0.035 ~ 0.065mm (0.0014 ~ 0.0026in)	0.13mm(0.0051in)
<b>Valve guide</b>		
Intake	45.8~46.2mm (1.8031 ~	

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Installed dimension outer diameter	Exhaust	1.8189in) 52.8~53.2mm (2.0787~2.0945in)	
	Service oversize	0.05, 0.25, 0.50mm (0.002, 0.010, 0.020in) oversize	
<b>Valve seat</b>			
Width of seat contact	Intake	1.1 ~ 1.5mm (0.043 ~ 0.059in)	
	Exhaust	1.3 ~ 1.7mm (0.051 ~ 0.066in)	
Oversize		0.3, 0.6mm (0.012, 0.024in) oversize	
<b>Valve spring</b>			
Free length		48.86mm (1.9236in)	
Load		18.8k±0.9kg/39.0mm (41.4±2.0lb/1.5354in) 41.0±1.5kg/30.5mm (90.4±3.3lb/1.2008in)	
Squarences		1.5° or less	
<b>Valve clearance</b>			
Cold (20°C[68°F])	Intake	0.20mm (0.0079in)	0.17~0.23mm (0.0067-0.0091 in)
	Exhaust	0.28mm (0.0110in)	0.25~0.31 mm (0.0098~0.0122in)
Hot(80°C[176°F]): only for reference	Intake	0.29mm (0.0114in)	
	Exhaust	0.34mm (0.0134in)	
<b>Cylinder head</b>			
Flatness of gasket surface		Max. 0.03mm (0.0012in)	0.06mm(0.0024in)
Flatness of manifold mounting surface		Max. 0.15mm (0.0059in)	0.03mm(0.0012in)
Oversize rework dimensions of valve seat hole			
Intake	0.3mm (0.012in) O.S.	33.300 ~ 33.325mm (1.3110 ~ 1.3120in)	
	0.6mm (0.024in) O.S.	33.600 ~ 33.625mm (1.3228 ~ 1.3238in)	
Exhaust	0.3mm (0.012in) O.S.	28.800 ~ 28.821mm (1.1338 ~ 1.1346in)	
	0.6mm (0.024in) O.S.	29.100 ~ 29.121mm (1.1456 ~ 1.1465in)	
Oversize rework dimensions of valve guide hole (both intake and exhaust)			
0.05mm (0.002in) O.S		11.05 ~ 11.068mm (0.435 ~ 0.4357in)	
0.25mm (0.010in) O.S		11.25 ~ 11.268mm (0.443 ~ 0.4436in)	

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0.50mm (0.020in) O.S	11.50 ~ 11.518mm (0.453 ~ 0.4535in)	
<b>Cylinder block</b>		
Cylinder bore	82.00 ~ 82.03mm (3.2283 ~ 3.2295in)	
Out-of-round and taper of cylinder bore	Less than 0.01mm (0.0004in)	
Clearance with piston (To set limits to new parts)	0.02 ~ 0.04mm (0.0008 ~ 0.0016in)	
<b>Piston</b>		
Outer diameter (To set limits to new parts)	81.97 ~ 82.00mm (3.2271 ~ 3.2283in)	
Service oversize	0.25, 0.50mm (0.010, 0.020in) oversize	
<b>Piston ring</b>		
Side clearance	No.1	0.04 ~ 0.08mm (0.0015 ~ 0.0031 in)
	No.2	0.03 ~ 0.07mm (0.0012 ~ 0.0027in)
End gap	No.1	0.20 ~ 0.35mm (0.0079 ~ 0.0138in)
	No.2	0.37 ~ 0.52mm (0.0146 ~ 0.0205in)
Oil ring side rail	0.20 ~ 0.60mm (0.0078 ~ 0.0236in)	1mm (0.039in)
Service oversize	0.25, 0.50mm (0.010, 0.020in.) oversize	
<b>Piston pin</b>		
Outer diameter	20.001 ~ 20.006mm (0.7874 ~ 0.7876in)	
Hole inner diameter	20.016 ~ 20.021mm (0.7880 ~ 0.7882in)	
Hole clearance	0.010 ~ 0.020mm (0.0004 ~ 0.0008in)	
Connecting rod small end inner diameter	19.974 ~ 19.985mm (0.7864 ~ 0.7868in)	
<b>Connecting rod</b>		
Bend	0.05mm (0.0020in) or less	
Twist	0.1mm (0.004in) or less	
Connecting rod big end to crankshaft side clearance	0.100 ~ 0.250mm (0.0039 ~ 0.010in)	0.4mm(0.0157in)
<b>Connecting rod bearing</b>		
Oil clearance (To seat limits to new parts)	0.024 ~ 0.042mm (0.0009 ~ 0.0017in)	

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Undersize	0.25mm (0.01in)	
<b>Camshaft</b>		
Cam height	Intake	44.618mm (1.7566in)
	Exhaust	44.518mm (1.7527in)
Journal outer diameter		28mm (1.1023in)
Bearing oil clearance		0.02 ~ 0.061mm (0.0008 ~ 0.0024in)
End play		0.1 ~ 0.2mm (0.0040 ~ 0.0079in)
<b>Crankshaft</b>		
Pin outer diameter		44.946 ~ 44.966mm (1.7695 ~ 1.7703in)
Journal outer diameter		56.942 ~ 56.962mm (2.2418 ~ 2.2426in)
Bend		0.03mm (0.0012in) or less
Out-of-round, taper of journal and pin		0.01mm (0.0004in) or less
End play		0.06 ~ 0.260mm (0.0023 ~ 0.010in)
Undersize rework dimension of pin	0.25mm (0.010in)	44.725 ~ 44.740mm (1.7608 ~ 1.7614in)
Undersize rework dimension of journal	0.25mm (0.010in)	56.727 ~ 56.742mm (2.2333 ~ 2.2339in)
<b>Crankshaft bearing</b>		
Oil clearance		0.028 ~ 0.046mm (0.0011 ~ 0.0018in)
<b>Flywheel</b>		
Runout	0.1mm (0.0039in)	
<b>Cooling method</b>		Water-cooled, pressurized. Forced circulation with electrical fan
<b>Coolant</b>		
Quantity	6.5~6.6liter (6.87~6.97U.S qts, 5.72~5.81Imp. qts)	
<b>Radiator</b>		
Type	Pressurized corrugated fin type	
<b>Radiator cap</b>		
Main valve opening pressure	93.16 ~ 122.58kpa(0.95 ~ 1.25kg/cm <sup>2</sup> , 13.51 ~ 17.78psi	
Vacuum valve opening pressure	MAX. 6.86 kpa (0.07kg/cm <sup>2</sup> , 1.00 psi)	
<b>Thermostat</b>		

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Type	Wax pellet type with jiggle valve
Valve opening temperature	82°C (177°F)
Valve closing temperature	77°C (170.6°F)
Full-opening temperature	95°C (201 °F)
<b>Coolant pump</b>	Centrifugal type impeller
<b>Drive belt</b>	
Type	V-ribbed belt
<b>Engine coolant temperature sensor</b>	
Type	Heat-sensitive thermistor type
Resistance	2.31 ~ 2.59kQ at 20°C (68°F) 0.3222kohms at 80°C (176°F)
<b>Oil pump</b>	
Clearance between outer circumference and front case.	0.120 ~ 0.185mm (0.0049 ~ 0.0073in)
Front case tip clearance	0.025 ~ 0.069mm (0.0009 ~ 0.0027in)
Side clearance	
Inner gear	0.04 ~ 0.085mm (0.0016 ~ 0.0033in)
Outer gear	0.04 ~ 0.09mm (0.0016 ~ 0.0035in)
Engine oil pressure at 1500 RPM [Oil temperature is 90 to 110°C (194 to 230°F)]	245KPa (2.5kg/cm <sup>2</sup> , 35.5psi)
<b>Engine oil</b>	
Oil Quantity (Total)	4.1L (4.33US qt, 3.60 lmp.qt)
Oil Quantity (Oil pan)	3.7L (3.91US qt, 3.26 lmp.qt)
Oil Quantity (Drain & refill including oil filter)	4.0L (4.23 US qt, 3.52 lmp.qt)
Grade	Above API SJ/SL or SAE 5W-20
<b>Relief spring</b>	
Free height	43.8mm (1.725in.)
Load	3.7±0.4kg at 40.1mm (3.15lb/1.578in)
<b>Air cleaner</b>	
Type	Dry type
Element	Unwoven cloth type

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## Exhaust pipe

Muffler	Expansion resonance type
Suspension system	Rubber hangers

## SERVICE STANDARDS

### SERVICE STANDARDS CHART

Standard value	
Antifreeze	Mixture ratio of anti-freeze in coolant
Ethylene glycol base for aluminum	50%

## TIGHTENING TORQUE

### TIGHTENING TORQUE

Item	Nm	kgf.m	lb·ft
<b>Cylinder Block</b>			
Front engine support bracket bolt and nut	34.3 ~ 49.0	3.5 ~ 5.0	25.3 ~ 36.2
Front roll stopper bracket bolt	68.6 ~ 88.3	7.0 ~ 9.0	50.6 ~ 65.1
Rear roll stopper bracket bolt	68.6 ~ 88.3	7.0 ~ 9.0	50.6 ~ 65.1
Rear engine stopper bracket bolt	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
<b>Engine Mounting</b>			
Right mounting insulator (large) nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Right mounting insulator (small) nut	44.1 ~ 58.8	4.5 ~ 6.0	32.5 ~ 43.4
Right mounting bracket to engine nuts and bolts	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Transmission mount insulator nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Transmission insulator bracket to side member bolt	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Rear roll stopper insulator nut	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Rear roll stopper bracket to center member bolts	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Front roll stopper insulator nut	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Front roll stopper bracket to center member bolts.	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
<b>Main Moving</b>			
Connecting rod cap nut	49.0 ~ 52.0	5.0 ~ 5.3	36.2 ~ 38.3
Crankshaft bearing cap bolt	27.5~31.4+(60°~64°)	2.8~3.2+(60°~64°)	20.3~23.1+(60°~64°)
Fly wheel M/T bolt	117.7~127.5	12.0 ~ 13.0	86.8 ~ 94.0
Drive plate A/T bolt	117.7~127.5	12.0 ~ 13.0	86.8 ~ 94.0
Engine cover	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3

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Heat protector	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Water pipe bracket bolts	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
<b>Cooling system</b>			
Alternator support bolt and nut	19.6 ~ 24.5	2.0 ~ 2.5	14.5 ~ 18.1
Alternator lock bolt	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Alternator brace mounting bolt	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Coolant pump pulley bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Coolant pump bolts	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Coolant temperature sensor	19.6 ~ 39.2	2.0 ~ 4.0	14.5 ~ 28.9
Coolant inlet fitting nuts	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Thermostat housing bolts and nuts	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
<b>Lubrication system</b>			
Oil filter	11.8 ~ 15.7	1.2 ~ 1.6	8.7 ~ 11.6
Oil pan bolts	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan drain plug	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~ 32.5
Oil screen bolts	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Oil pressure switch	12.7 ~ 14.7	1.3 ~ 1.5	9.4 ~ 10.8
<b>Intake and Exhaust system</b>			
Air cleaner body mounting bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Resonator mounting bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Intake manifold to cylinder head nuts and bolts	15.7 ~ 22.6	1.6 ~ 2.3	11.6 ~ 16.6
Intake manifold stay to cylinder block bolts	17.7 ~ 24.5	1.8 ~ 2.5	13.0 ~ 18.1
Throttle body to surge tank nuts	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Exhaust manifold to cylinder head nuts	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Exhaust manifold cover to exhaust manifold bolts	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Oxygen sensor to front muffler	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
Oxygen sensor to exhaust manifold	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
Front exhaust pipe to exhaust manifold nuts	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Front exhaust pipe bracket bolts	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Front exhaust pipe to catalytic converter bolts	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
Main muffler hanger support bracket bolts	9.8 ~ 14.7	1.0 ~ 1.5	7.2 ~ 10.8
<b>Cylinder head</b>			
Cylinder head bolts ~ M10	22.6 ~ 26.5 + (60° ~ 65°) + (60° ~ 65°)	2.3 ~ 2.7 + (60° ~ 65°) + (60° ~ 65°)	16.6 ~ 19.5 + (60° ~ 65°) + (60° ~ 65°)

Cylinder head bolts ~ M12	27.5~31.4+(60°~65°) + (60°~65°)	2.8~3.2+(60°~65°) + (60°~65°)	20.3~33.1+(60°~65°) + (60°~65°)
Intake manifold nuts	17.7 ~ 24.5	1.8 ~ 2.5	13.0 ~ 18.1
Exhaust manifold nuts	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Cylinder head cover bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Camshaft bearing cap bolts	13.7 ~ 14.7	1.4 ~ 1.5	10.1 ~ 10.8
Oil control valve bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
OCV Filter	40.2 ~ 50.0	4.1 ~ 5.1	29.7 ~ 36.9
CVVT unit to exhaust camshaft bolt	64.7 ~ 76.5	6.6 ~ 7.8	47.7 ~ 56.4
Rear plate bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
<b>Timing Belt</b>			
Crankshaft pulley bolt	156.9 ~ 166.7	16.0 ~ 17.0	115.7 ~ 123.0
Camshaft sprocket bolt	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Timing belt auto tensioner bolts	22.6 ~ 28.4	2.3 ~ 2.9	16.6 ~ 21.0
Timing belt cover bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Front case bolts	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Timing belt idler bolt	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8

M/T : Manual Transmission  
A/T : Automatic Transmission

## INSPECTION

### COMPRESSION PRESSURE

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

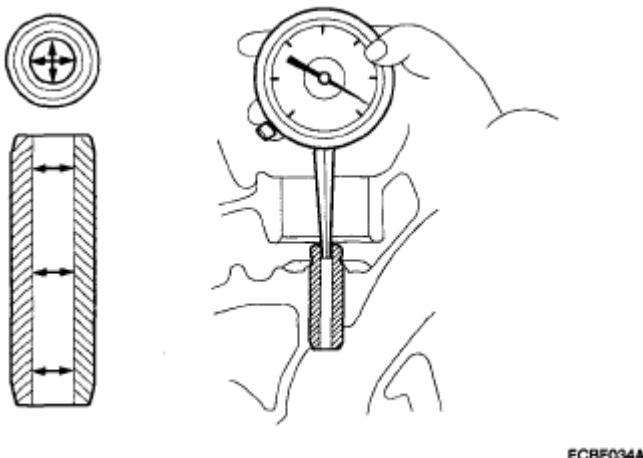
1. Warm up and stop engine.

Allow the engine to warm up to normal operating temperature.

2. Remove ignition coils.
3. Remove spark plugs.

Using a 16mm plug wrench, remove the 4 spark plugs.

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



ECBF034A

**Fig. 1: Measuring Compression Pressure**  
Courtesy of HYUNDAI MOTOR CO.

- b. Fully open the throttle.
- c. while cranking the engine, measure the compression pressure.

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

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

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

Compression pressure : 1421.96kPa (14.5kgf/cm<sup>2</sup> , 206.24psi)

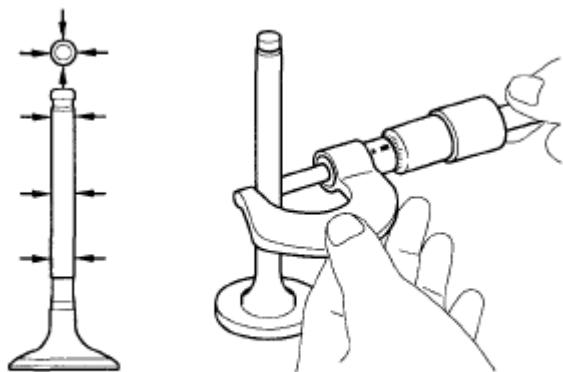
Minimum pressure : 1274.86kPa (13.0kgf/cm<sup>2</sup> , 184.90psi)

Difference between each cylinder: 98.07kPa (1.0kgf/cm<sup>2</sup> , 14.22psi) or less

- e. If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.
  - If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
  - If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.
5. Reinstall spark plugs.
6. Install ignition coils.

#### TIMING BELT TENSION ADJUSTMENT

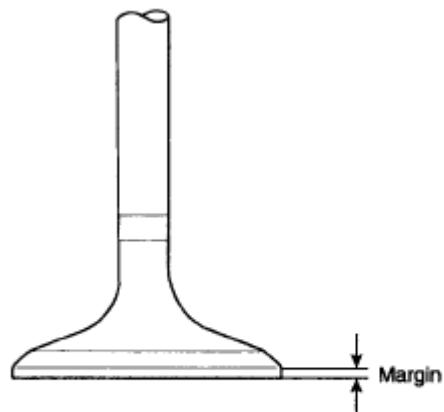
1. Remove the engine cover (A).



KCRF227A

**Fig. 2: Identifying Engine Cover**  
Courtesy of HYUNDAI MOTOR CO.

2. Remove RH front wheel.
3. Remove the 4bolts (B) and timing belt upper cover (A).



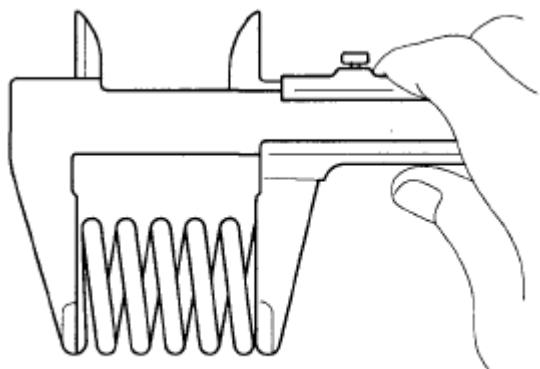
ECKD221A

**Fig. 3: Identifying Timing Belt Upper Cover With Bolts**  
Courtesy of HYUNDAI MOTOR CO.

4. Slacken the tensioner bolt.

**NOTE:** When check the timing belt tension or install the timing belt tensioner, must it the engine oil temperature is between 15°C(59°F) and 25°C(77°F).

5. Using a hex wrench, turn the adjuster counterclockwise to make the indicator of the arm located at the center of the base.



KCRF205A

**Fig. 4: Checking Timing Belt Tension**  
Courtesy of HYUNDAI MOTOR CO.

**CAUTION: Do not rotate the adjuster clockwise.  
It will result in auto tensioner's functional problem.**

6. Tightening tensioner bolt with fixing the indicator not to move.

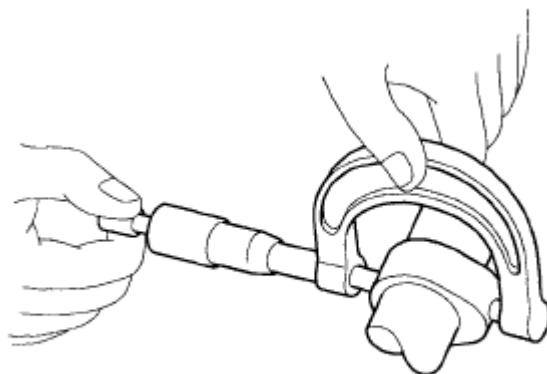
#### **Tightening torque**

Tensioner bolt : 22.6 ~ 28.4Nm (2.3 ~ 2.9kgf.m, 16.6 ~ 21.0lb-ft)

7. Turn the crankshaft two revolutions in the operating direction (clockwise) and check that the indicator is in the center of base.
8. If the indicator is not located at the center of base, slacken the bolt and repeat the above procedure.
9. Install the timing belt upper cover (A) with the four bolts (B).

#### **Tightening torque :**

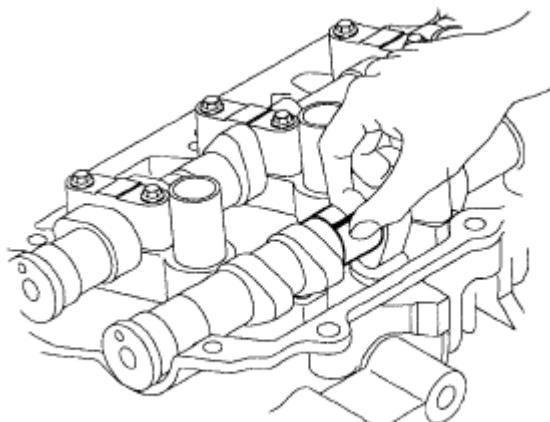
7.8 ~ 9.8Nm (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)



KCRF206A

**Fig. 5: Identifying Timing Belt Upper Cover With Bolts**  
Courtesy of HYUNDAI MOTOR CO.

10. Install RH front wheel.
11. Install engine cover (A) with the four bolts.



KCRF207A

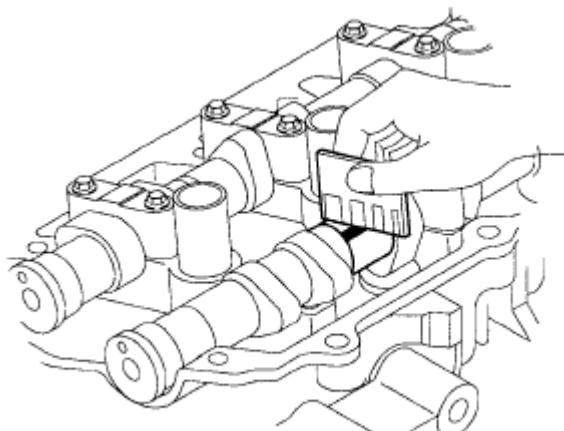
**Fig. 6: Identifying Engine Cover**  
Courtesy of HYUNDAI MOTOR CO.

#### VALVE CLEARANCE INSPECTION AND ADJUSTMENT

##### MLA (MECHANICAL LASH ADJUSTER)

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

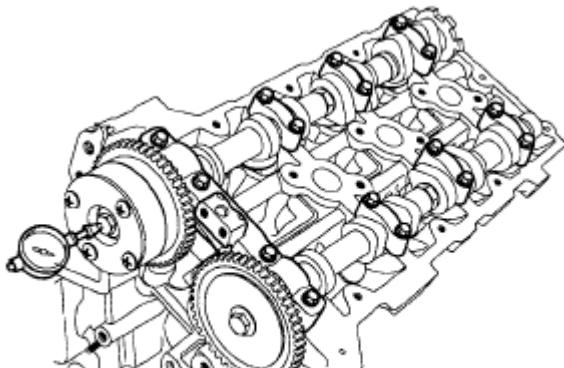
1. Remove the engine cover (A).



KDRF208A

**Fig. 7: Identifying Engine Cover**  
Courtesy of HYUNDAI MOTOR CO.

2. Remove the upper timing belt cover (A).



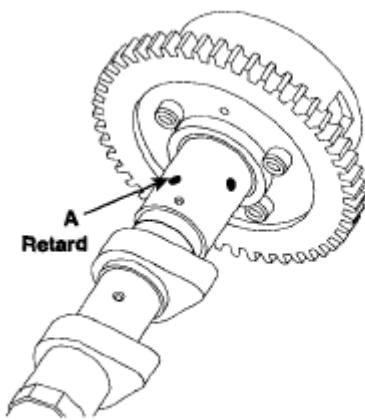
KDRF196B

**Fig. 8: Identifying Upper Timing Belt Cover With Bolts**  
Courtesy of HYUNDAI MOTOR CO.

- a. Loosen the upper timing cover bolts and then remove the cover.
3. Remove the cylinder head cover.
  - a. Disconnect the spark plug cables and do not pull on the spark plug by force.

**NOTE: Pulling on or bending the cables may damage the conductor inside.**

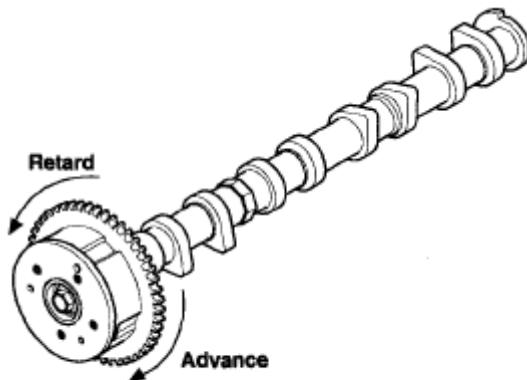
- b. Disconnect the P.C.V hose (A) and the breather hose (B) from the cylinder head cover.
- c. Disconnect the accelerator cable (C) and the auto-cruise cable (D) from the cylinder head cover.



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**Fig. 9: Identifying P.C.V Hose, Breather Hose, Accelerator Cable And Auto-Cruise Cable**  
Courtesy of HYUNDAI MOTOR CO.

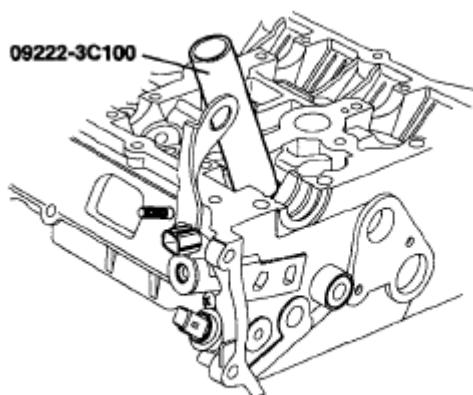
- d. Loosen the cylinder head cover bolts (B) and then remove the cover (A) and gasket.



ECRF016A

**Fig. 10: Identifying Cylinder Head Cover With Bolts**  
Courtesy of HYUNDAI MOTOR CO.

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

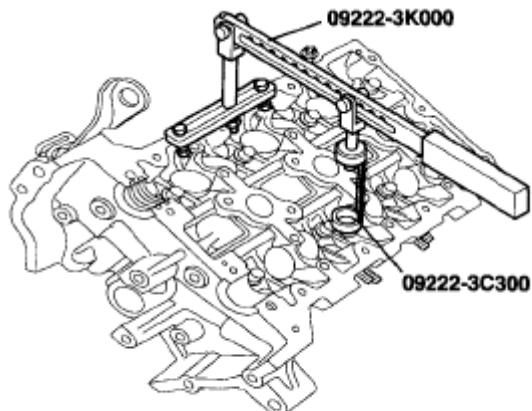


KCRF120B

**Fig. 11: Identifying Timing Marks On Crankshaft Pulley**  
Courtesy of HYUNDAI MOTOR CO.

- b. Check that the hole of the camshaft timing pulley (A) is aligned with the timing mark of the bearing cap.

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

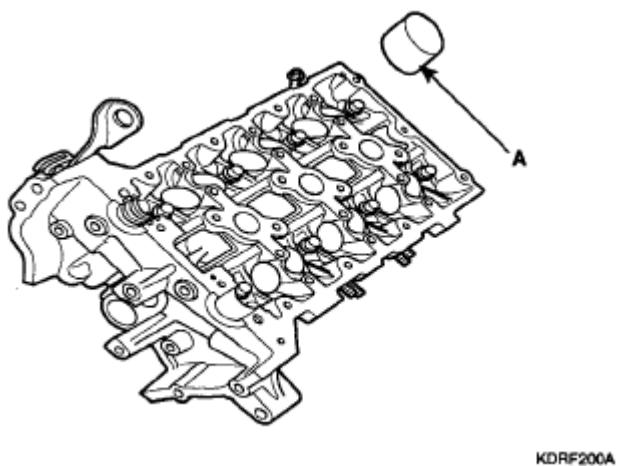


LDKG002A

**Fig. 12: Aligning Timing Mark Camshaft Timing Pulley And Bearing Cap**  
Courtesy of HYUNDAI MOTOR CO.

5. Inspect the valve clearance

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



**Fig. 13: Identifying Valve Clearance (No. 1 Cylinder)**  
Courtesy of HYUNDAI MOTOR CO.

- Using a thickness gauge, measure the clearance between the tappet shim 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 shim.

### Valve clearance

#### Specification

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

Intake : 0.20mm (0.0079in.)

Exhaust : 0.28mm (0.0110in.)

Engine coolant temperature : 80°C [176°F]

Intake : 0.29mm (0.0114in.)

Exhaust: 0.34mm (0.0134in.)

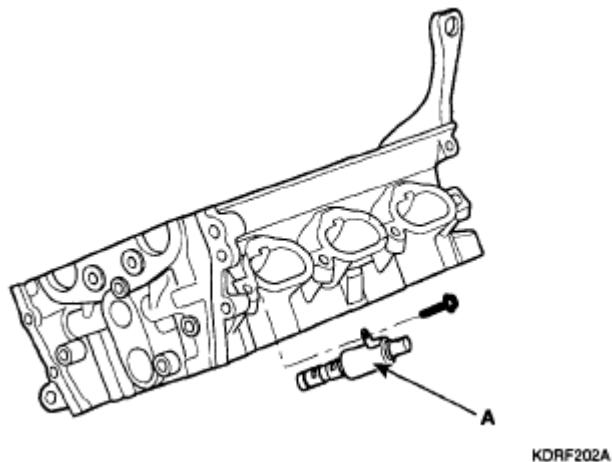
#### Limit

Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.091in.)

Exhaust: 0.25 ~ 0.31mm (0.0098 ~ 0.0122in.)

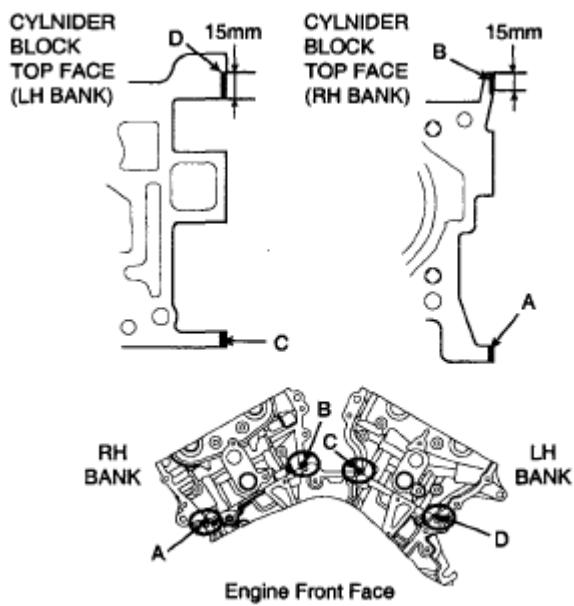
- Turn the crankshaft pulley one revolution (360°) and align the groove with timing mark T of the lower timing belt cover.
- Check only valves indicated as shown. [NO. 4 cylinder: TDC/compression]. Measure the valve

clearance. (See procedure in step (6))



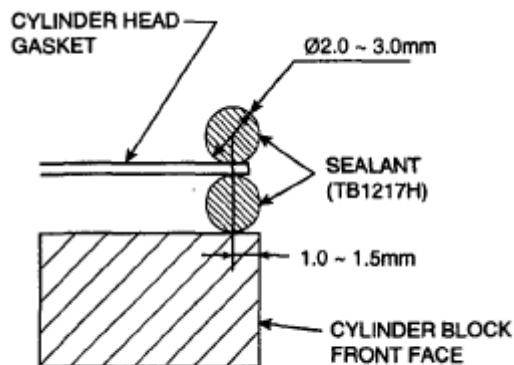
**Fig. 14: Identifying Valve Clearance (No. 4 Cylinder)**  
Courtesy of HYUNDAI MOTOR CO.

6. Adjust the intake and exhaust valve clearance.
  - a. Turn the crankshaft so that the cam lobe of the camshaft on the adjusting valve is upward.
  - b. Using the SST(09220 - 2D000), press down the valve lifter and place the stopper between the camshaft and valve lifter and remove the special tool.



**Fig. 15: Identifying SST(09220 - 2D000)**  
Courtesy of HYUNDAI MOTOR CO.

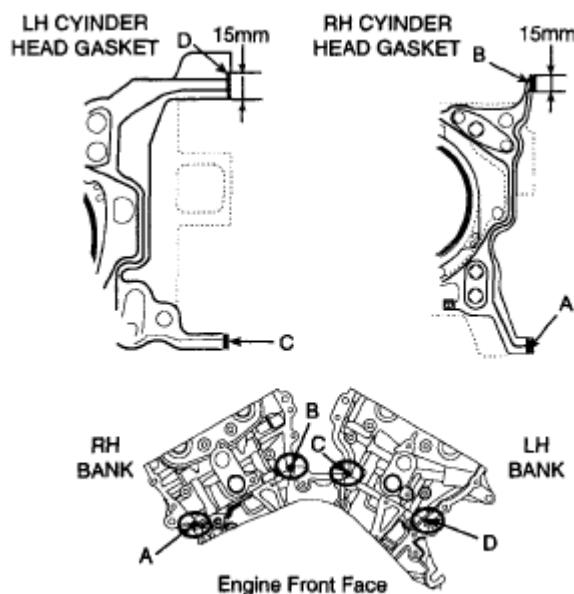
- c. Remove the adjusting shim with a small screw driver (A) and magnet (B).



ECBF018A

**Fig. 16: Identifying Small Screw Driver And Magnet**  
Courtesy of HYUNDAI MOTOR CO.

- Measure the thickness of the removed shim using a micrometer.



ECBF019A

**Fig. 17: Measuring Thickness Of Shim**  
Courtesy of HYUNDAI MOTOR CO.

- Calculate the thickness of a new shim so that the valve clearance comes within the specified value.

**Valve clearance (Engine coolant temperature : 20°C)**

T : Thickness of removed

A : shim Measured valve clearance

N : Thickness of new shim

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

Exhaust:  $N = T + [A - 0.28\text{mm} (0.011\text{ Pin.})]$

f. Select a new shim with a thickness as close as possible to the calculated value. [Refer to the illustration]

**NOTE: Shims are available in 20 size increments of 0.04mm (0.0016in.) from 2.00mm (0.079in.) to 2.76mm (0.1087in.)**

g. Place a new adjusting shim on the valve lifter.  
h. Using the SST(09220 - 2D000), press down the valve lifter and remove the stopper.  
i. Recheck the valve clearance.

#### Valve clearance (Engine coolant temperature : 20°C)

[Specification]

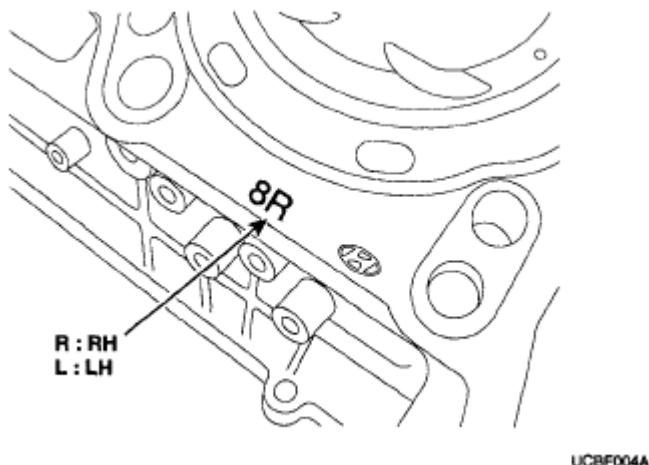
Intake : 0.20mm (0.0079in.)

Exhaust : 0.28mm (0.0110in.)

[Limit] (After adjusting valve clearance)

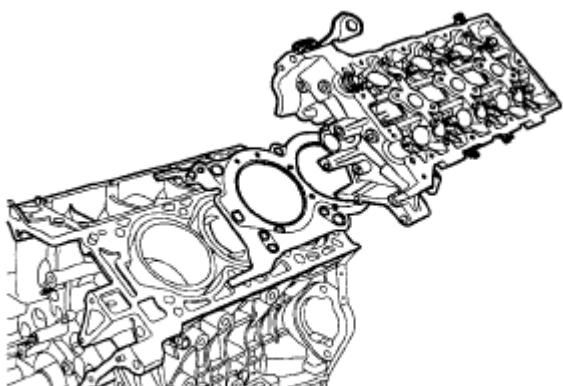
Intake : 0.17 ~ 0.23mm (0.0067 ~ 0.0091 in.)

Exhaust: 0.25 ~ 0.31mm (0.0098 ~ 0.0122in.)



**Fig. 18: Shim Selection Chart (Intake)**

Courtesy of HYUNDAI MOTOR CO.



KDRF198A

**Fig. 19: Shim Selection Chart (Exhaust)**

Courtesy of HYUNDAI MOTOR CO.

## TROUBLESHOOTING

### TROUBLESHOOTING CHART

Symptom	Suspect area	Remedy (See)
Engine misfire with abnormal internal lower engine noises.	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
	Worn piston rings (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression. Repair or replace as required.
	Worn crankshaft thrust bearings	Replace the crankshaft and bearings as required
Engine misfire with abnormal valve train noise.	Stuck valves. (Carbon buildup on the valve stem)	Repair or replace as required
	Excessive worn or mis-aligned timing chain	Replace the timing chain and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and valve lifters.
Engine misfire with coolant consumption.	<ul style="list-style-type: none"> <li>Faulty cylinder head gasket and/or cranking or other damage to the cylinder head and engine block cooling system.</li> <li>Coolant consumption may or may not cause the engine to overheat.</li> </ul>	<ul style="list-style-type: none"> <li>Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket.</li> <li>Repair or replace as required.</li> </ul>
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)	<ul style="list-style-type: none"> <li>Inspect the cylinder for a loss of compression.</li> <li>Repair or replace as required.</li> </ul>

Engine noise on start-up, but only lasting a few seconds.	Incorrect oil viscosity	<ul style="list-style-type: none"> <li>• Drain the oil.</li> <li>• Install the correct viscosity oil.</li> </ul>
	Worn crankshaft thrust bearing.	<ul style="list-style-type: none"> <li>• Inspect the thrust bearing and crankshaft.</li> <li>• Repair or replace as required.</li> </ul>
Upper engine noise, regardless of engine speed.	Low oil pressure	Repair or replace as required.
	Broken valve spring.	Replace the valve spring.
	Worn or dirty valve lifters.	Replace the valve lifters.
	Stretched or broken timing chain and/or damaged sprocket teeth.	Replace the timing chain and sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	<ul style="list-style-type: none"> <li>• Inspect the camshaft lobes.</li> <li>• Replace the timing camshaft and valve lifters as required.</li> </ul>
	Worn valve guides or valve stems.	Inspect the valves and valve guides, then repair as required.
	Stuck valves. (Carbon on the valve stem or valve seat may cause the valve to stay open.	Inspect the valves and valve guides, then repair as required.
Lower engine noise, regardless of engine speed	Low oil pressure.	Repair or required.
	Loose or damaged flywheel.	Repair or replace the flywheel.
	Damaged oil pan, contacting the oil pump screen.	<ul style="list-style-type: none"> <li>• Inspect the oil pan.</li> <li>• Inspect the oil pump screen.</li> <li>• Repair or replace as required.</li> </ul>
	Oil pump screen loose, damaged or restricted.	<ul style="list-style-type: none"> <li>• Inspect the oil pump screen.</li> <li>• Repair or replace as required.</li> </ul>
	Excessive piston-to-cylinder bore clearance.	<ul style="list-style-type: none"> <li>• Inspect the piston, piston pin and cylinder bore.</li> <li>• Repair as required.</li> </ul>
	Excessive piston pin-to-clearance	<ul style="list-style-type: none"> <li>• Inspect the piston, piston pin and the connecting rod.</li> <li>• Repair or replace as required.</li> </ul>
	Excessive connecting rod bearing rod clearance	<p>Inspect the following components and repair as required.</p> <ul style="list-style-type: none"> <li>• The connecting rod bearings.</li> <li>• The connecting rods.</li> <li>• The crankshaft.</li> <li>• The crankshaft journal.</li> </ul>
		Inspect the following components,

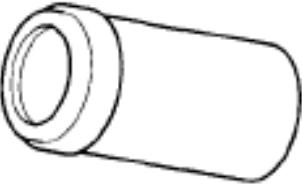
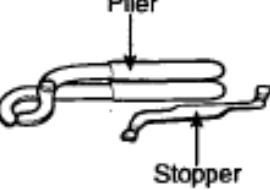
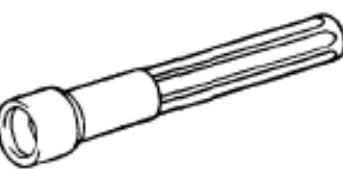
	Excessive crankshaft bearing clearance	and repair as required. <ul style="list-style-type: none"><li>• The crankshaft bearing.</li><li>• The crankshaft journals.</li></ul>
	Incorrect piston, piston pin and connecting rod installation	<ul style="list-style-type: none"><li>• Verify the piston pins and connecting rods are installed correctly.</li><li>• Repair as required.</li></ul>
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 : <ul style="list-style-type: none"><li>• The connecting rod bearings.</li><li>• The connecting rods.</li><li>• The crankshaft</li></ul>
	Excessive crankshaft bearing clearance	Inspect the following components, and repair as required. <ul style="list-style-type: none"><li>• The crankshaft bearings.</li><li>• The crankshaft journals.</li><li>• The cylinder block crankshaft</li></ul>
	Hydro-locked cylinder <ul style="list-style-type: none"><li>• Coolant/antifreeze in cylinder.</li><li>• Oil in cylinder.</li><li>• Fuel in cylinder</li></ul>	<ol style="list-style-type: none"><li>1. Remove spark plugs and check for fluid.</li><li>2. Inspect for broken head gasket.</li><li>3. Inspect for cracked engine block or cylinder head.</li><li>4. Inspect for a sticking fuel injector and/or leaking fuel regulator.</li></ol>
Engine will not crank shaft will not rotate	Broken timing chain and/or timing chain and/or timing chain gears.	<ol style="list-style-type: none"><li>1. Inspect timing chain and gears.</li><li>2. Repair as required.</li></ol>
	Material cylinder <ul style="list-style-type: none"><li>• Broken valve</li><li>• Piston material</li><li>• Foreign material</li></ul>	<ol style="list-style-type: none"><li>1. Inspect cylinder for damaged components and/or foreign materials.</li><li>2. Repair or replace as required.</li></ol>
	Seized crankshaft or connecting rod bearings.	<ol style="list-style-type: none"><li>1. Inspect crankshaft and connecting rod bearing.</li><li>2. Repair as required.</li></ol>
	Bent or broken connecting rod.	<ol style="list-style-type: none"><li>1. Inspect connecting rods.</li><li>2. Repair as required.</li></ol>

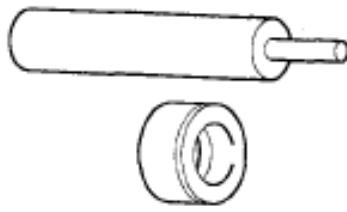
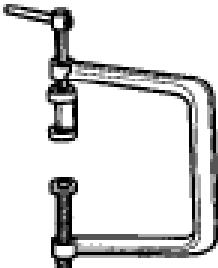
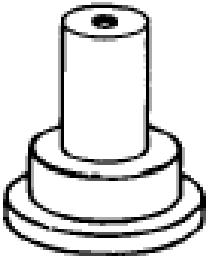
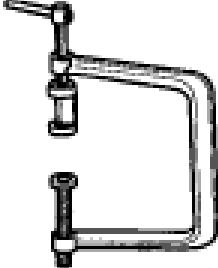
Broken crankshaft

1. Inspect crankshaft.
2. Repair as required.

## SPECIAL SERVICE TOOLS

### SPECIAL SERVICE TOOLS CHART

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-32000)	 EDKA010A	Installation of the front oil seal
Crankshaft front oil seal guide (09214-32100)	 EDDA006B	Installation of the front oil seal
Valve clearance adjust tool set (09220-2D000)	 EDKB001A	Removal and installation of the tappet shim
Camshaft oil seal installer (09221-21000)	 ECKA010A	Installation of the camshaft oil seal

Valve guide installer (09221-22000 A/B)	 ECKA010B	Remove and installation of the valve guide
Valve stem oil seal installer (09222-22001)	 EDDA006C	Installation of the valve stem oil seal
Valve spring compressor (09222-28000, 09222-28100)	 EDDA005F	Removal and installation of the intake or exhaust valve
Crankshaft rear oil seal installer (09231-21000)	 EDDA006C	<ol style="list-style-type: none"> <li>1. installation of the engine rear oil seal</li> <li>2. Installation of the crankshaft rear oil seal</li> </ol>

## ENGINE AND TRANSALE ASSEMBLY

### REMOVAL

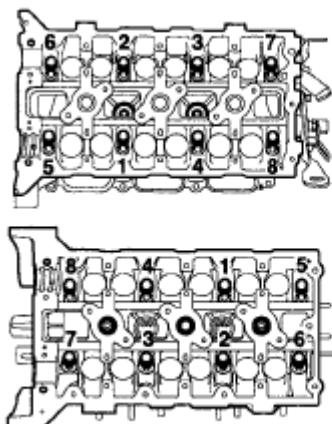
**CAUTION:**

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

**NOTE:**

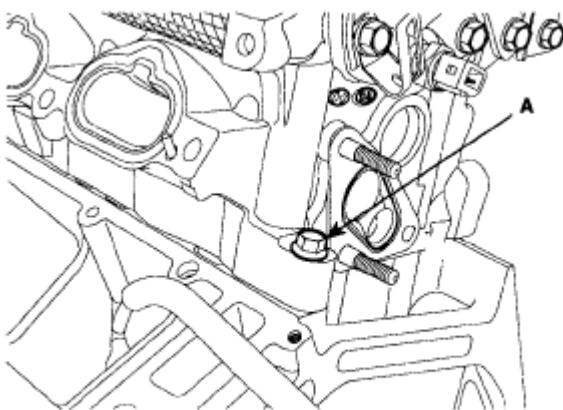
- Mark all wiring and hoses to avoid misconnection.
- Inspection the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center.

1. Disconnect the terminal (A) from the battery (B).



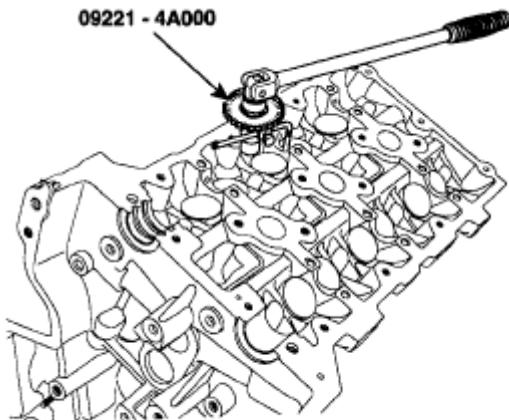
**Fig. 20: Identifying Terminal From Battery**  
Courtesy of HYUNDAI MOTOR CO.

2. Remove the engine cover (A).



**Fig. 21: Identifying Engine Cover**  
Courtesy of HYUNDAI MOTOR CO.

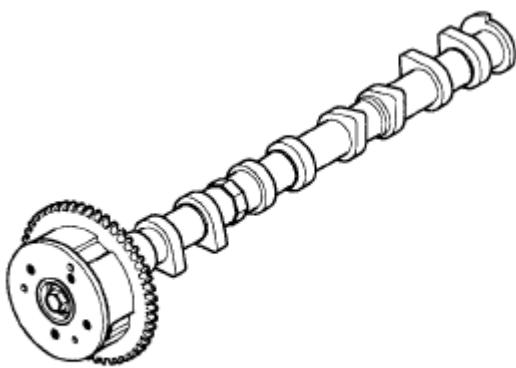
3. Drain the engine coolant.  
Remove the radiator cap to speed draining.
4. Remove the intake air hose and air cleaner assembly.



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**Fig. 22: Identifying PCM, MAF Connectors, Breather Hose, Air Cleaner Hose And Air Cleaner**  
Courtesy of HYUNDAI MOTOR CO.

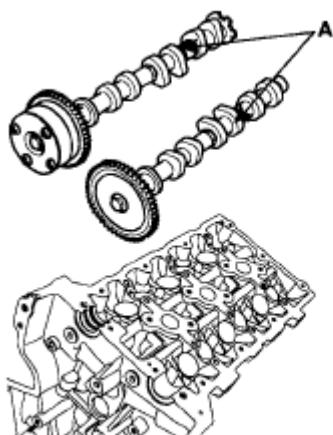
1. Disconnect the PCM connectors (A).
2. Disconnect the MAF connector (B).
3. Disconnect the breather hose (C) from air cleaner hose (D).
4. Remove the intake air hose and air cleaner (E).
5. Remove the upper radiator hose (A) and lower radiator hose (B),



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**Fig. 23: Identifying Upper Radiator Hose And Lower Radiator Hose**  
Courtesy of HYUNDAI MOTOR CO.

6. Remove the heater hoses (A).

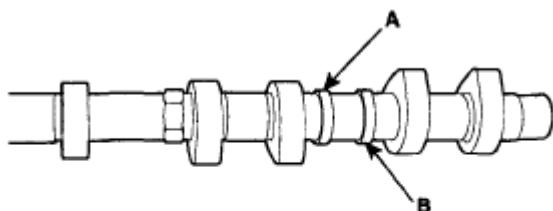


KDRF197A

**Fig. 24: Identifying Heater Hoses**

Courtesy of HYUNDAI MOTOR CO.

7. Remove the engine wire harness connectors (A) and wire harness clamps from the engine room fuse and relay junction box.

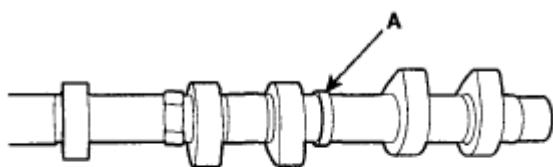


KDRF226A

**Fig. 25: Identifying Engine Wire Harness Connectors**

Courtesy of HYUNDAI MOTOR CO.

8. Remove the fuel inlet from delivery pipe (A).

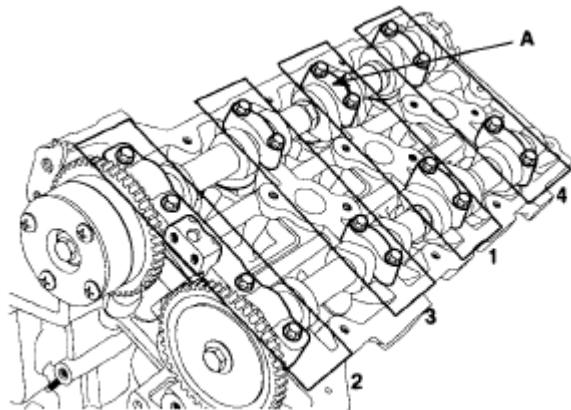


KDRF227A

**Fig. 26: Identifying Delivery Pipe**

Courtesy of HYUNDAI MOTOR CO.

9. Remove the PCSV hose.
10. Remove the brake booster vacuum hose.
11. Remove the accelerator cable and the auto-cruise cable by loosening the locknut, then slip the cable end out of the throttle linkage.
12. Remove the transaxle control cable.
13. Remove the clip of the control cable.
14. Remove the transaxle earth cable.
15. Install the SST (09200-38001, 09200-1C000), the engine support fixture and the adapter, on the engine and transaxle assembly.

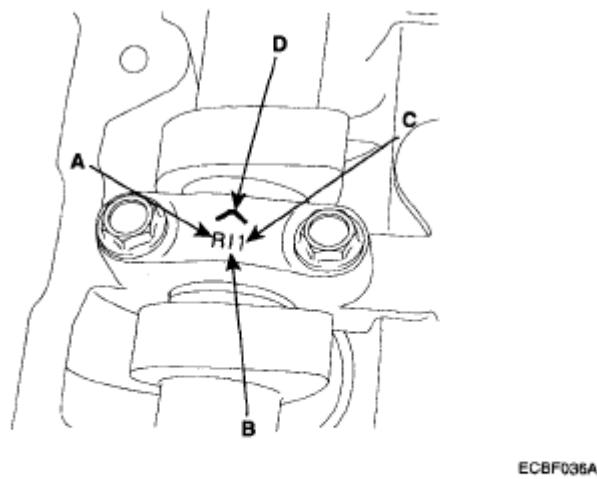


UCBF008A

**Fig. 27: Identifying SST (09200-38001, 09200-1C000)**

Courtesy of HYUNDAI MOTOR CO.

16. Remove the engine mounting bracket (A) by removing the bolt (B) and nuts (C, D).



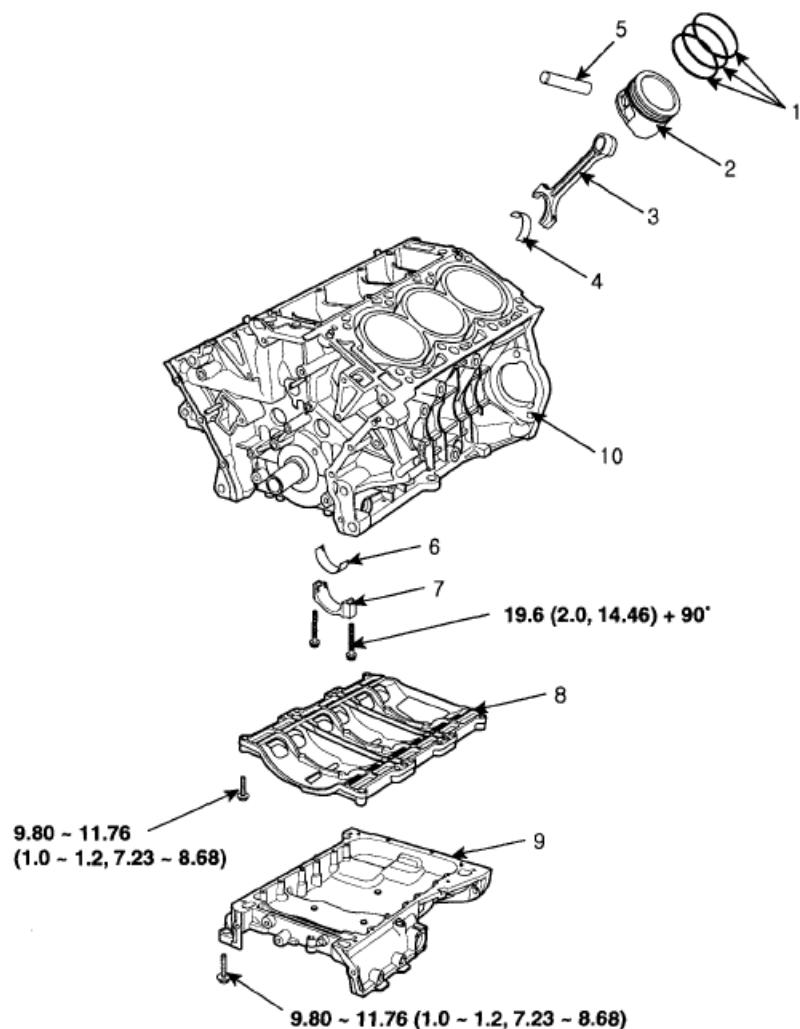
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A : L(LH),R(RH)  
B : l(Intake),None(Exhaust)  
C : Journal number  
D : Front mark

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**Fig. 28: Identifying Engine Mounting Bracket And Nuts With Bolt**  
Courtesy of HYUNDAI MOTOR CO.

17. Remove the transaxle mounting bracket.
18. Remove the front tires.
19. Remove the lower arm ball joint mounting bolts.
20. Disconnect the tie-vod from the knuckle.
21. Disconnect the stabilizer bar link from the strut.
22. Disconnect the rear oxygen sensor connector(A).

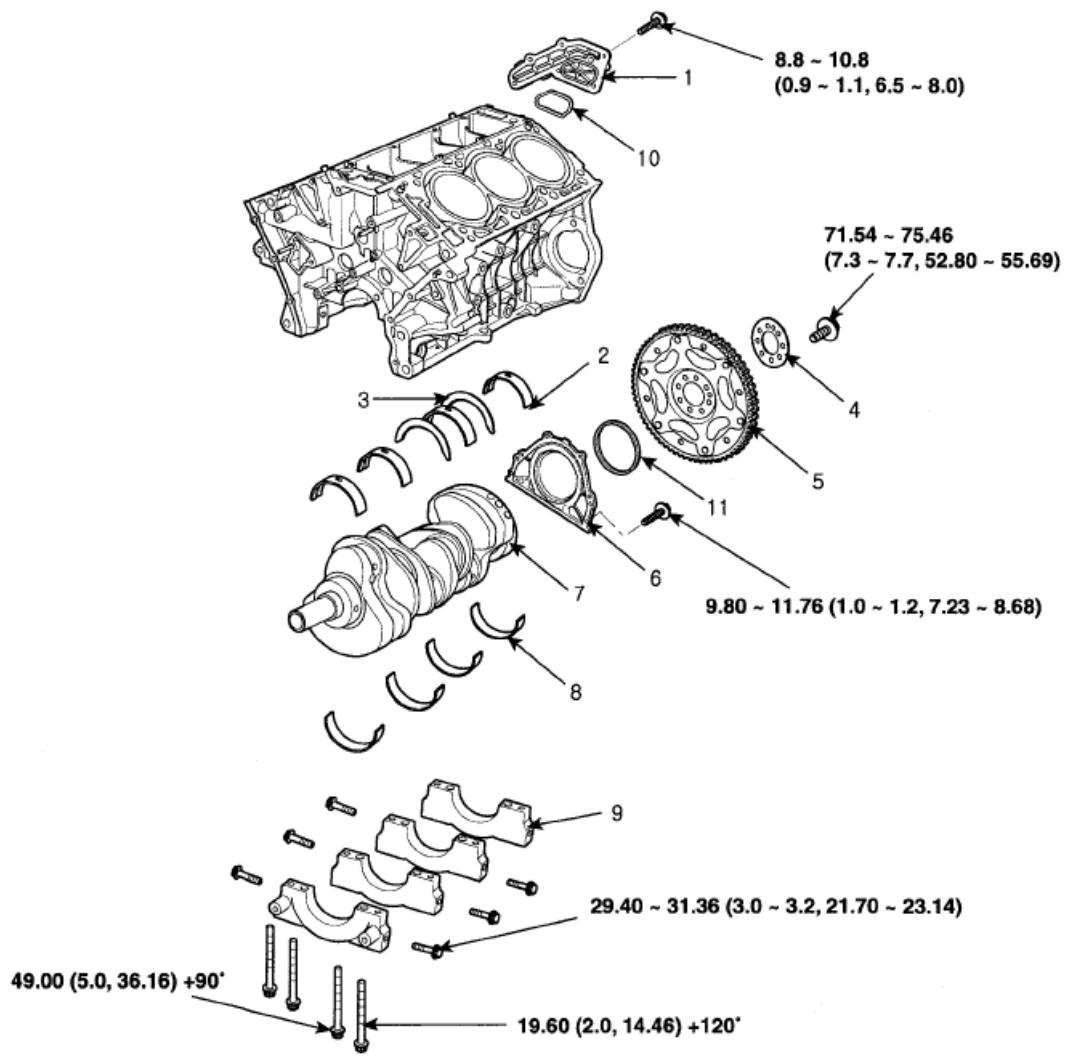
**TORQUE : N.m (kgf.m, lb·ft)**

1. Piston ring	6. Connecting rod lower bearing
2. Piston	7. Connecting rod bearing cap
3. Connecting rod	8. Baffle plate
4. Connecting rod upper bearing	9. Upper oil pan
5. Piston pin	10. Cylinder block

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**Fig. 29: Identifying Rear Oxygen Sensor Connector**  
 Courtesy of HYUNDAI MOTOR CO.

23. Remove the front muffler.
24. Remove the steering u-joint mounting bolt(A).

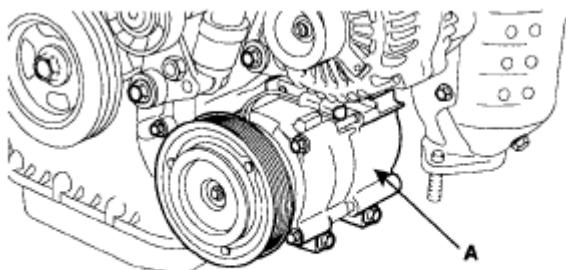
**TORQUE : N.m (kgf.m, lb·ft)**

1. Oil drain cover	6. Rear oil seal case
2. Crankshaft upper bearing	7. Crankshaft
3. Thrust bearing	8. Crankshaft lower bearing
4. Plate adapter	9. Main bearing cap
5. Drive plate	10. Oil drain cover gasket
	11. Rear oil seal

BCKG026A

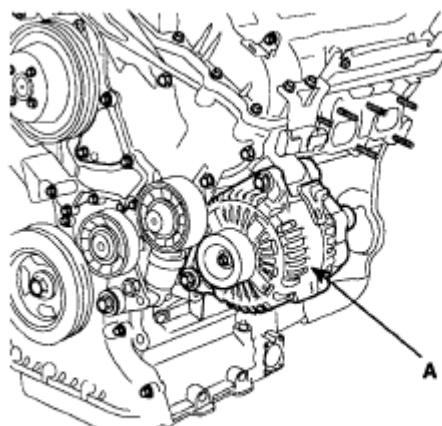
**Fig. 30: Identifying Steering U-Joint Mounting Bolt**  
 Courtesy of HYUNDAI MOTOR CO.

25. Remove the sub frame bolts (A).



KDRF103A

**Fig. 31: Identifying Sub Frame**  
Courtesy of HYUNDAI MOTOR CO.



KDRF104A

**Fig. 32: Identifying Bolt**  
Courtesy of HYUNDAI MOTOR CO.

26. Remove the engine support fixture and the adapter.
27. Jack up the vehicle.

## INSTALLATION

Installation is in the reverse order of removal.

Perform the following :

- Adjust shift cable.
- Adjust throttle cable.
- Refill engine with engine oil.
- Refill transaxle with fluid.
- Refill radiator with engine coolant.

- Bleed air from the cooling system with the heater valve open.
- Clean battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
- Inspect for fuel leakage.

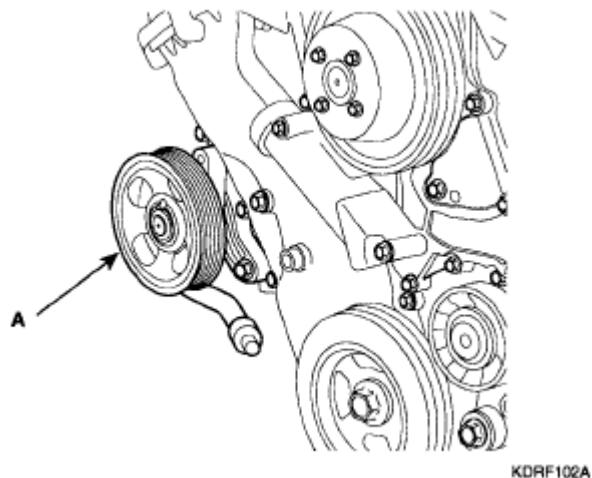
After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.

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

## TIMING SYSTEM

### TIMING BELT

#### COMPONENTS



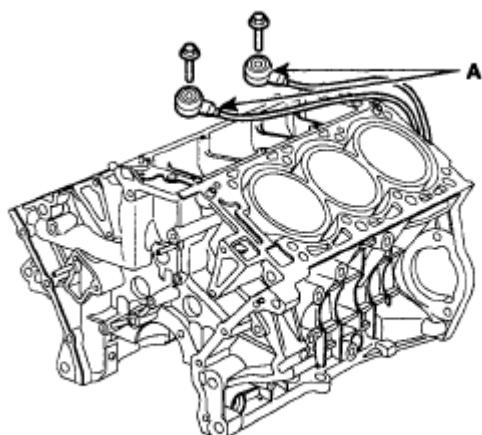
**Fig. 33: Identifying Timing Belt Components With Torque Specification**

Courtesy of HYUNDAI MOTOR CO.

#### REMOVAL

Engine removal is not required for this procedure.

1. Remove the engine cover (A).

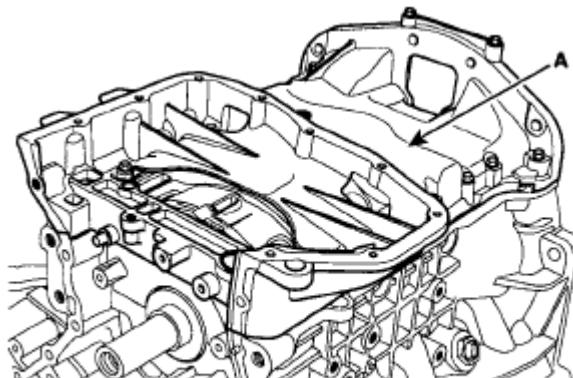


KDRF205A

**Fig. 34: Identifying Engine Cover**

Courtesy of HYUNDAI MOTOR CO.

2. Remove RH front wheel.
3. Remove 2bolts (B) and RH side cover (A).

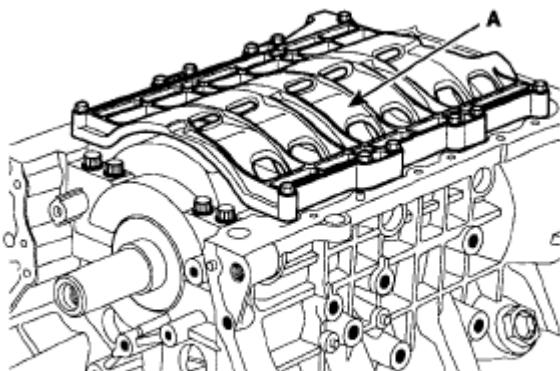


KDRF206A

**Fig. 35: Identifying RH Side Cover With Bolts**

Courtesy of HYUNDAI MOTOR CO.

4. Remove the engine mount bracket.
  1. Set the jack to the engine oil pan.

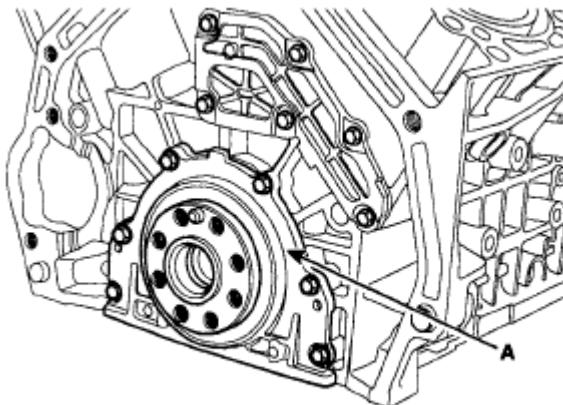


KDRF207A

**Fig. 36: Lifting Engine Oil Pan**  
Courtesy of HYUNDAI MOTOR CO.

**NOTE: Place wooden block between the jack and engine oil pan.**

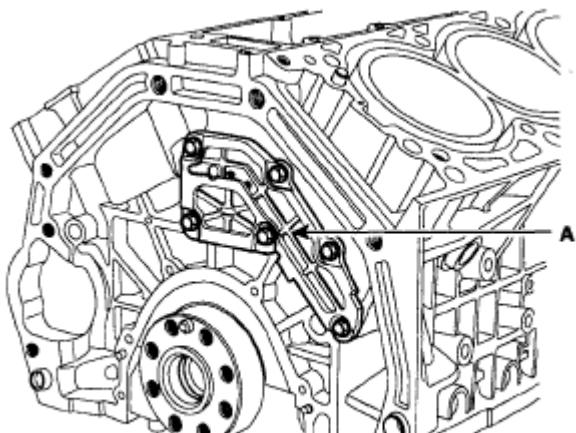
2. Remove the bolt (B), three nuts (C, D) and engine mount bracket (A).



KDRF208A

**Fig. 37: Identifying Engine Mount Bracket And Bolt With Nuts**  
Courtesy of HYUNDAI MOTOR CO.

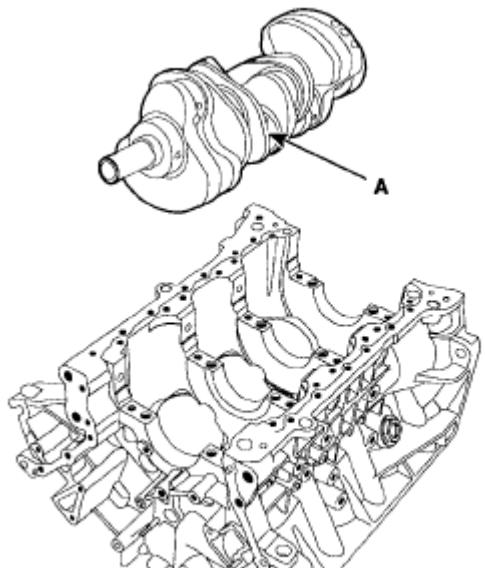
3. Remove the bolt (B) and stay plate (A).



KDRF209A

**Fig. 38: Locating Bolt And Stay Plate**  
Courtesy of HYUNDAI MOTOR CO.

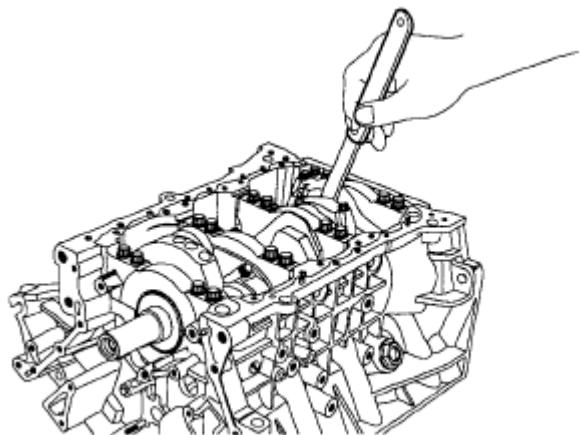
5. Temporarily loosen the water pump pulley bolts.



LDKG003A

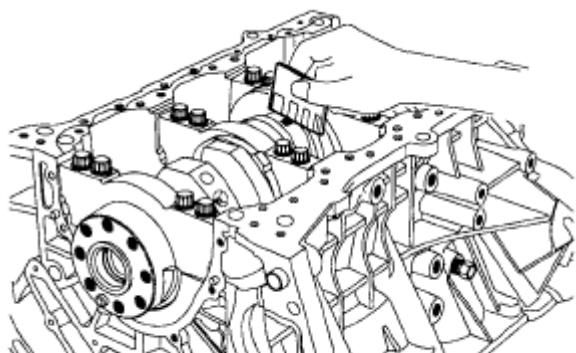
**Fig. 39: Loosening Water Pump Pulley Bolts**  
Courtesy of HYUNDAI MOTOR CO.

6. Remove alternator belt.
7. Remove air compressor belt.
8. Remove power steering belt.
9. Remove four bolts and water pump pulley.
10. Remove the four bolts (B) and timing belt upper cover (A).



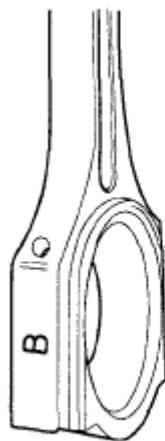
**Fig. 40: Locating Bolts And Timing Belt Upper Cover**  
Courtesy of HYUNDAI MOTOR CO.

11. Turn the crankshaft pulley, and align its groove with timing mark " T" of the timing belt cover.



**Fig. 41: Identifying Timing Marks On Crankshaft Pulley**  
Courtesy of HYUNDAI MOTOR CO.

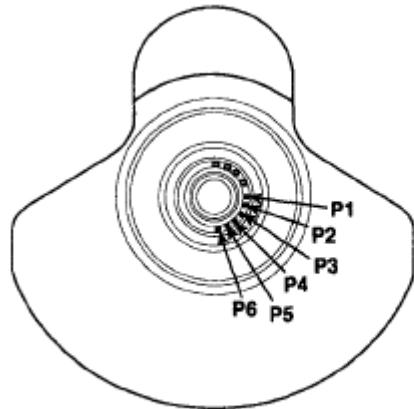
12. Remove the crankshaft pulley bolt (B) and crankshaft pulley (A).



EDQF196A

**Fig. 42: Locating Crankshaft Pulley Bolt And Crankshaft Pulley**  
Courtesy of HYUNDAI MOTOR CO.

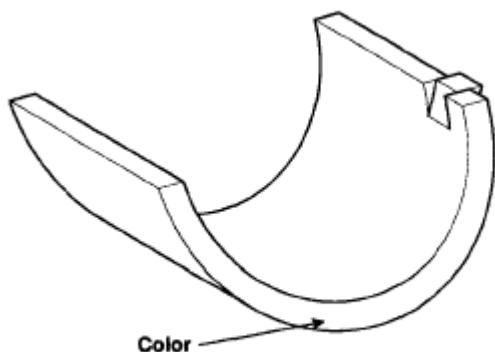
13. Remove the crankshaft flange (A).



ECBF037A

**Fig. 43: Locating Crankshaft Flange**  
Courtesy of HYUNDAI MOTOR CO.

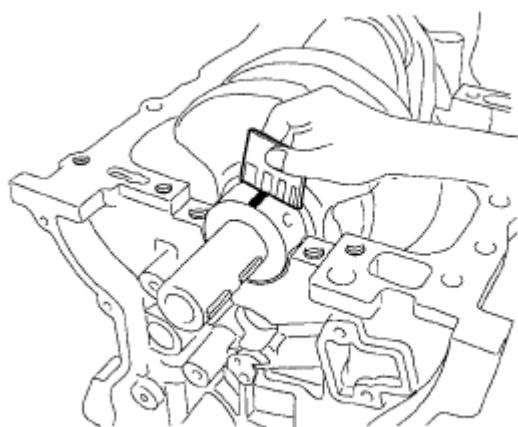
14. Remove the 5bolts (B) and timing belt lower cover (A).



KCRF021A

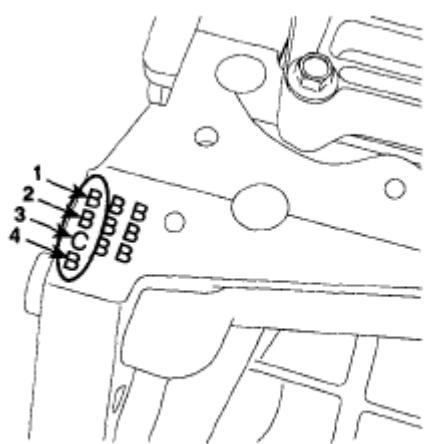
**Fig. 44: Locating Bolts And Timing Belt Lower Cover**  
Courtesy of HYUNDAI MOTOR CO.

15. Remove the timing belt tensioner (A) and timing belt (B).



KCRF170A

**Fig. 45: Locating Timing Belt Tensioner**  
Courtesy of HYUNDAI MOTOR CO.



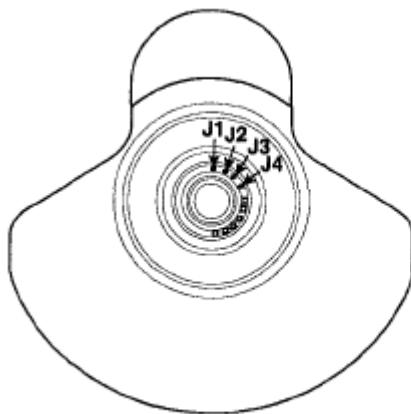
ECBF038A

**Fig. 46: Locating Timing Belt**

Courtesy of HYUNDAI MOTOR CO.

**NOTE:** If the timing belt is reused, make an arrow indicating the turning direction to make sure that the belt is reinstalled in the same direction as before.

16. Remove the bolt (B) and timing belt idler (A).

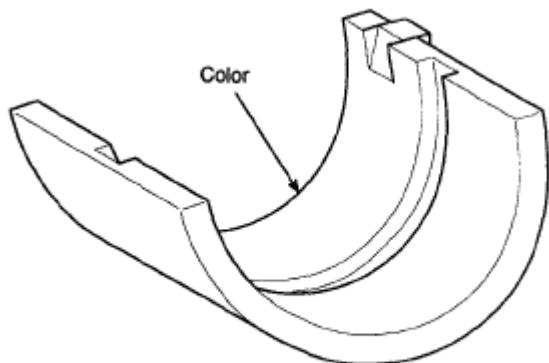


ECBF039A

**Fig. 47: Locating Bolt And Timing Belt Idler**

Courtesy of HYUNDAI MOTOR CO.

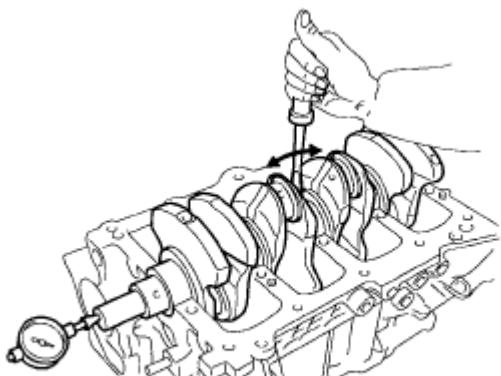
17. Remove the crankshaft sprocket (A).



ECRF022A

**Fig. 48: Locating Crankshaft Sprocket**  
Courtesy of HYUNDAI MOTOR CO.

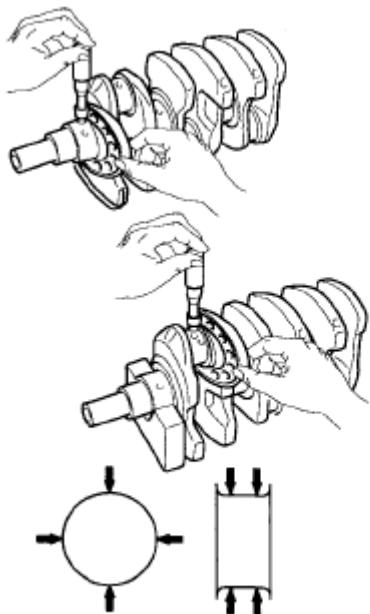
18. Remove the cylinder head cover.
  1. Remove the spark plug cable.
  2. Remove the accelerator cable (C) and the auto-cruise cable (D) from the cylinder head cover.
  3. Remove the PCV(Positive Crankcase ventilation) hose (A) and breather hose (6).



ECKD001B

**Fig. 49: Locating Accelerator Cable And Auto-Cruise Cable**  
Courtesy of HYUNDAI MOTOR CO.

4. Remove the bolts and cylinder head cover.
19. Remove camshaft sprocket.
  1. Hold the hexagonal head wrench (A) portion of the camshaft with a wrench (B), and remove the bolt and camshaft sprocket (C).



LDKG004A

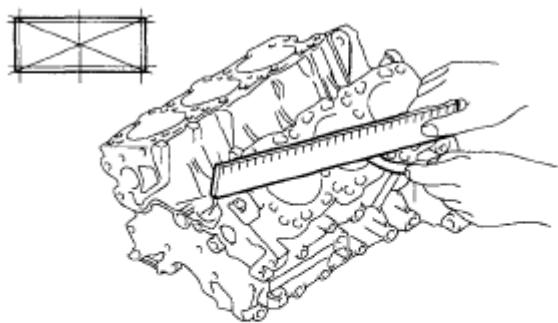
**Fig. 50: Locating Portion Of Camshaft With Wrench And Camshaft Sprocket**  
Courtesy of HYUNDAI MOTOR CO.

**CAUTION: Be careful not to damage the cylinder head and valve lifter with the wrench.**

## INSPECTION

### SPROCKETS, TENSIONER, IDLER

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



EDQF154A

**Fig. 51: Identifying Tensioner Pulley And Idler Pulley**  
Courtesy of HYUNDAI MOTOR CO.

3. Replace the pulley if there is a grease leak from its bearing.

#### TIMING BELT

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

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

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

#### NOTE:

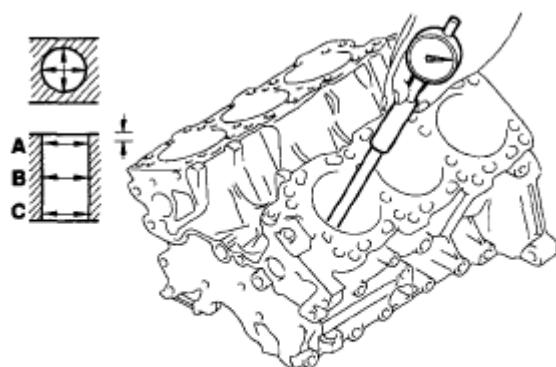
- **Do not bend, twist or turn the timing belt inside out.**
- **Do not allow the timing belt to come into contact with oil, water and stem.**

#### INSTALLATION

1. Install the camshaft sprocket and tighten the bolt to the specified torque.
  1. Temporarily install the camshaft sprocket bolt.
  2. Hold the hexagonal head wrench (A) portion of the camshaft with a wrench (B), and tighten the camshaft sprocket (C) bolt.

#### Tightening torque

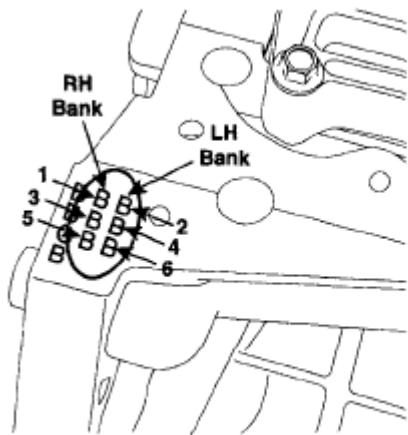
Camshaft sprocket bolt : 98.1 ~ 117.7Nm (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



EDQF153A

**Fig. 52: Locating Portion Of Camshaft With Wrench And Camshaft Sprocket**  
 Courtesy of HYUNDAI MOTOR CO.

2. Install cylinder head cover.
  1. Install cylinder head cover (A) and the twelve bolts (B).



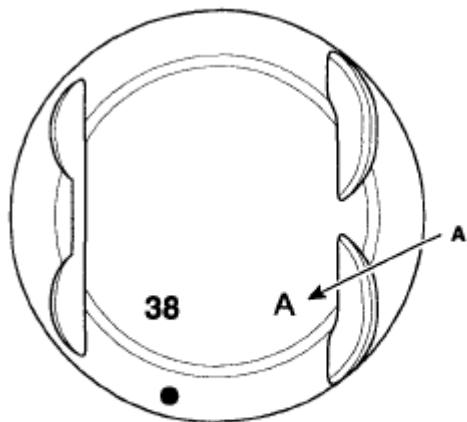
ECBF002A

**Fig. 53: Locating Cylinder Head Cover And Bolts**  
 Courtesy of HYUNDAI MOTOR CO.

**Tightening torque :**

7.8 ~ 9.8Nm (0.8 ~ 10kgf.m, 5.8 ~ 7.2lb-ft)

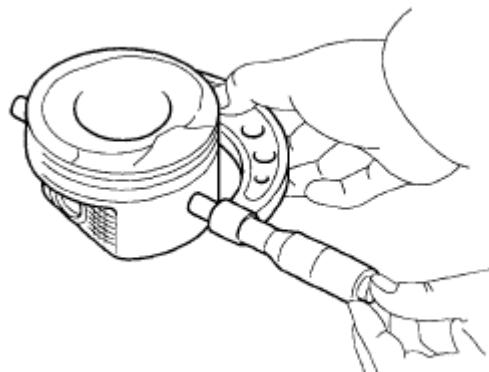
2. Install the PCV hose (A) and breather hose (B).
3. Install the accelerator cable (C) and the auto-cruise cable (D) from the cylinder head cover.



BCKG027A

**Fig. 54: Locating PCV Hose And Breather Hose**  
Courtesy of HYUNDAI MOTOR CO.

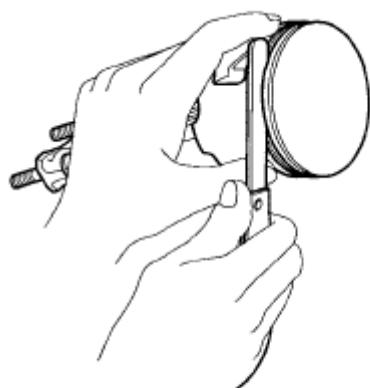
4. Install the spark plug cable.
3. Install the crankshaft sprocket (A).



ECKD001D

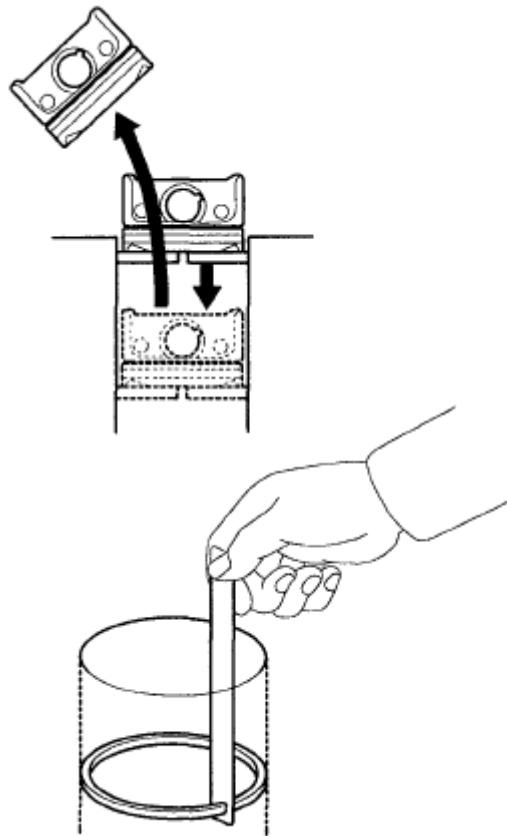
**Fig. 55: Locating Crankshaft Sprocket**  
Courtesy of HYUNDAI MOTOR CO.

4. Align the timing marks of the camshaft sprocket (A) and crankshaft sprocket (B) with the No. 1 piston placed at top dead center and its compression stroke.



ECKD001G

**Fig. 56: Locating Timing Marks Of Camshaft Sprocket**  
Courtesy of HYUNDAI MOTOR CO.



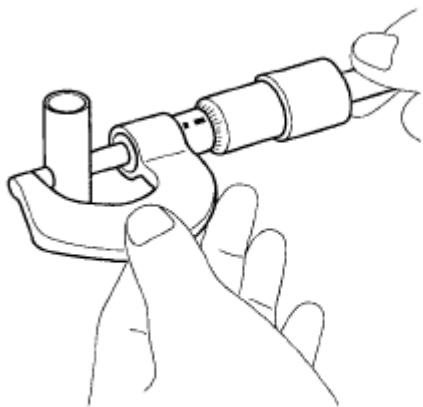
ECKD001K

**Fig. 57: Locating Timing Marks Of Crankshaft Sprocket**  
Courtesy of HYUNDAI MOTOR CO.

5. Install the idler pulley (A) and tighten the bolt (B) to the specified torque.

#### Tightening torque

Idler pulley bolt : 42.2 ~ 53.9Nm (4.3 ~ 5.5kgf.m, 31.1 ~ 39.8lb-ft)

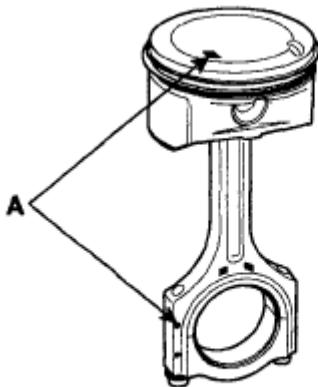


ECKD001Z

**Fig. 58: Locating Idler Pulley And Bolt**

Courtesy of HYUNDAI MOTOR CO.

6. Install the timing belt tensioner loosely enough for the adjuster to rotate. Make sure that the stopper of base is leaning against the lowering sealing cap on the cylinder head.
7. Belt so as not give slack at each center of shaft. Do as following procedures when installing timing belt. Crankshaft sprocket (A) --> Idler pulley (B) --> Camshaft sprocket (C) --> timing belt tensioner (D). (The tensioner can be installed after the timing belt.)

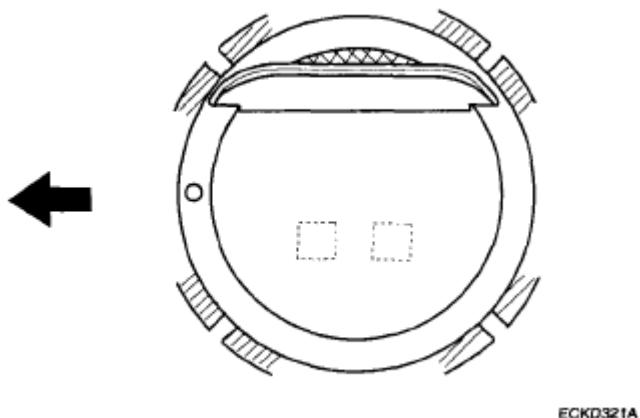


KCRF168A

**Fig. 59: Locating Crankshaft Sprocket, Idler Pulley, Camshaft Sprocket And Timing Belt Tensioner**

Courtesy of HYUNDAI MOTOR CO.

8. Check the alignment of the timing marks on each sprocket.
9. Remove the pin fixing the tensioner arm.
10. Using a hex wrench, turn the adjuster counterclockwise to make the indicator of the arm located at the center of the base.



**Fig. 60: Turning Adjuster Counterclockwise**  
Courtesy of HYUNDAI MOTOR CO.

**CAUTION: Do not rotate the adjuster clockwise. It will result in auto tensioner's functional problem.**

11. Tightening tensioner bolt with fixing the indicator not to move.

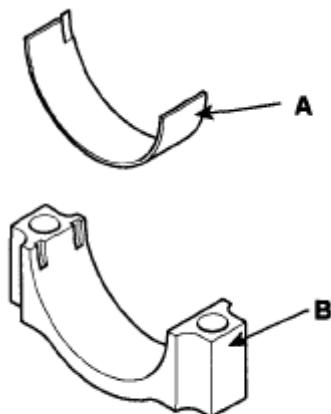
#### **Tightening torque**

Tensioner bolt : 22.6 ~ 28.4Nm (2.3 ~ 2.9kgf.m, 16.6 ~ 21.0lb-ft)

12. Turn the crankshaft two revolutions in the operating direction (clockwise) and check that the indicator is in the center of base.
13. If the indicator is not located at the center of base, slacken the bolt and repeat the above procedure.
14. Install the timing belt lower cover (A) with the fire bolts (B).

#### **Tightening torque**

Timing belt cover bolt : 7.8 ~ 9.8Nm (0.8 ~ 1.0kgf.m 5.8 ~ 7.2lb-ft)



KCRF116B

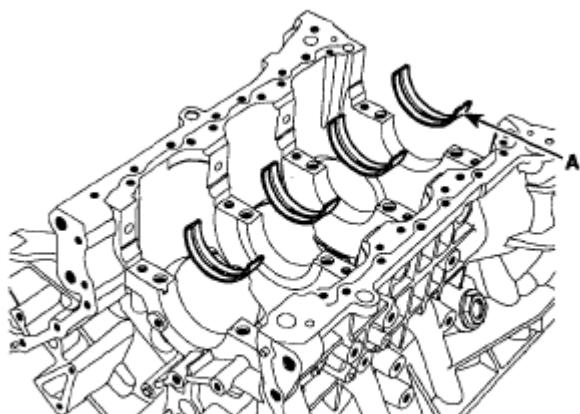
**Fig. 61: Locating Timing Belt Lower Cover And Bolts**  
Courtesy of HYUNDAI MOTOR CO.

15. Install the flange and crankshaft pulley (A).

Make sure that crankshaft sprocket pin fits the small hole in the pulley.

#### **Tightening torque**

Crankshaft pulley bolt : 156.9 ~ 166.7N.m (16.0 ~ 17.0kgf.m, 115.7 ~ 123.0lb-ft)



KDRF216A

**Fig. 62: Locating Flange And Crankshaft Pulley**  
Courtesy of HYUNDAI MOTOR CO.

16. Install the timing belt upper cover (A) with the four bolts (B).

#### **Tightening torque :**

7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)



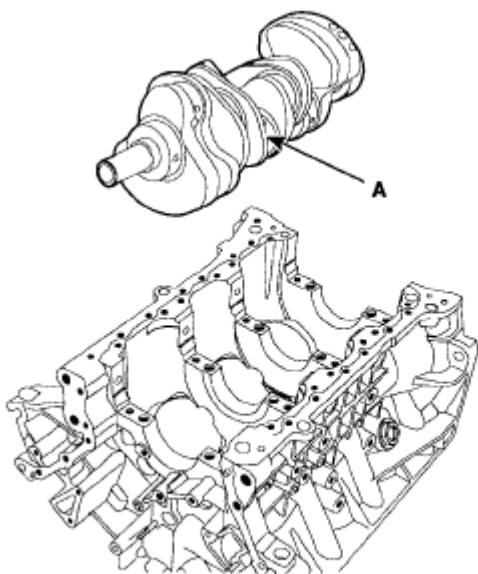
ECKD324A

**Fig. 63: Locating Bolts And Timing Belt Upper Cover**  
Courtesy of HYUNDAI MOTOR CO.

17. Install the coolant pump pulley with 4bolts.
18. Install power steering belt.
19. Install air compressor bolt.
20. Install alternator belt.
21. Install the engine mount bracket
  1. Install the stay plate (A) with bolt (B).

**Tightening torque**

Stay plate bolt : 42.2 ~ 53.9Nm (4.3 ~ 5.5kgf.m 31.1 ~ 39.8lb-ft)



LDKG003A

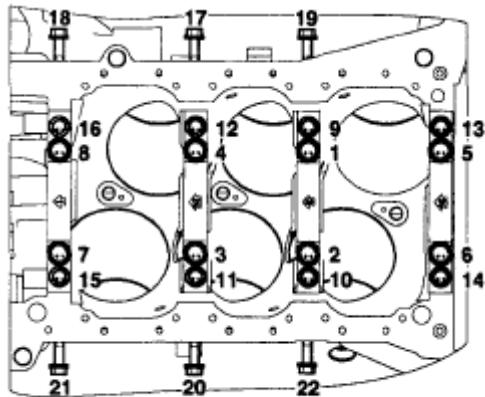
**Fig. 64: Locating Stay Plate And Bolt**  
Courtesy of HYUNDAI MOTOR CO.

2. Install engine mount bracket(A) with the three nuts (C, D) and bolt (B).

#### Tightening torque

17mm nut : 68.6 ~ 93.2Nm (7.0 ~ 9.5kgf.m 50.6 ~ 68.7lb-ft)

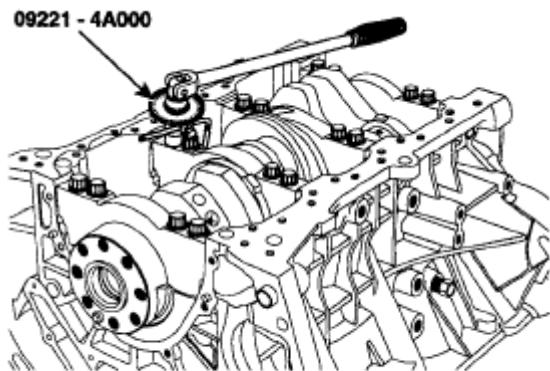
14mm nut : 49.0 ~ 63.7Nm (5.0 ~ 6.5kgf.m 36.2 ~ 47.0lb-ft)



KDRF140A

**Fig. 65: Locating Engine Mount Bracket And Nuts**  
Courtesy of HYUNDAI MOTOR CO.

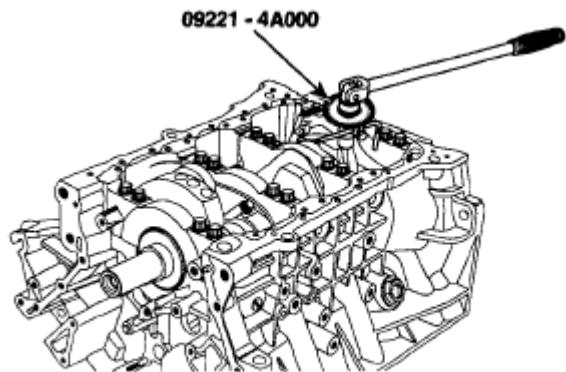
22. Install RH side cover (A) with 2bolts (B).



KDRF224A

**Fig. 66: Locating RH Side Cover And Bolts**  
Courtesy of HYUNDAI MOTOR CO.

23. Install RH front wheel.
24. Install engine cover (A) with the four bolts.

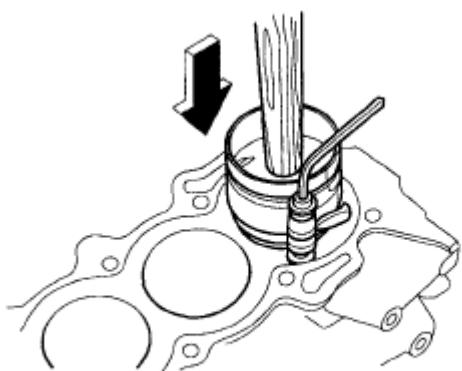


KDRF225A

**Fig. 67: Locating Engine Cover**  
Courtesy of HYUNDAI MOTOR CO.

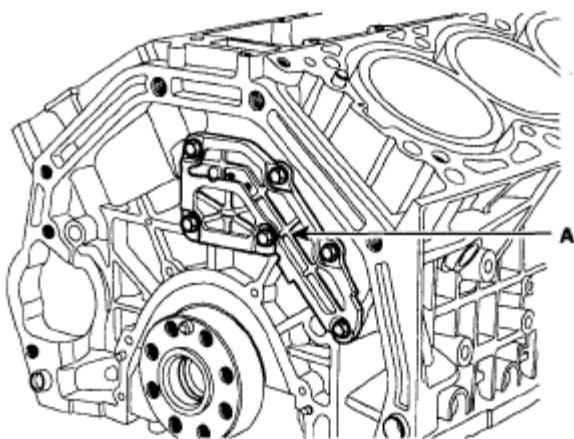
## CYLINDER HEAD ASSEMBLY

### COMPONENTS



ECKD001F

**Fig. 68: Identifying Cylinder Head Assembly Components And Torque Specifications (1 Of 2)**  
Courtesy of HYUNDAI MOTOR CO.



KDRF209A

**Fig. 69: Identifying Cylinder Head Assembly Components And Torque Specifications (2 Of 2)**  
Courtesy of HYUNDAI MOTOR CO.

## REMOVAL

Engine removal is not required for this procedure.

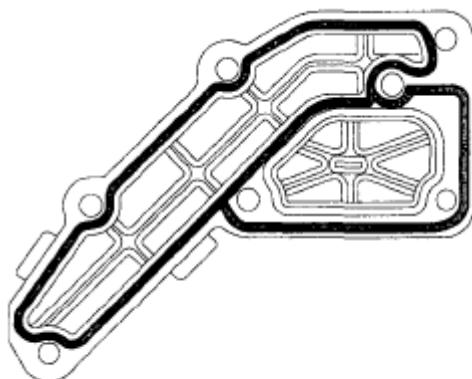
### CAUTION:

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

**NOTE:**

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

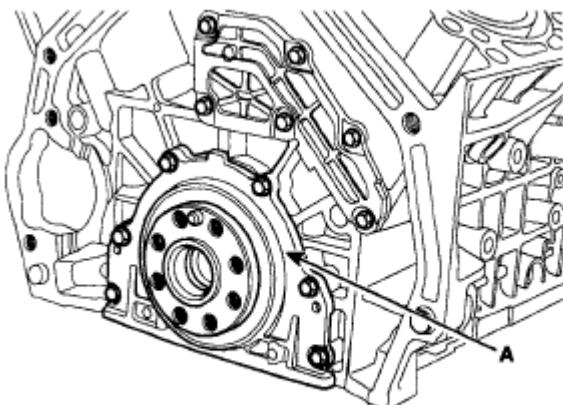
1. Disconnect the negative terminal (A) from the battery and remove the battery (B).



ECBF003A

**Fig. 70: Locating Negative Terminal And Battery**  
Courtesy of HYUNDAI MOTOR CO.

2. Remove the engine cover (A).



KDRF208A

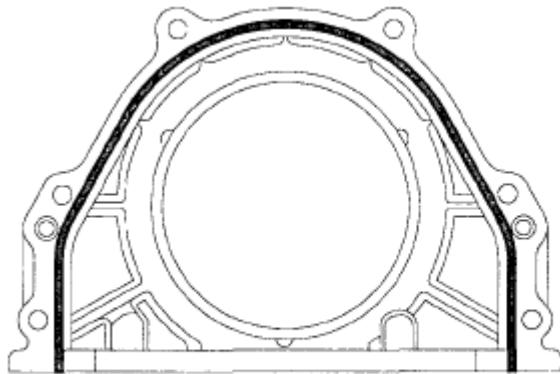
**Fig. 71: Locating Engine Cover**  
Courtesy of HYUNDAI MOTOR CO.

3. Drain the engine coolant.

Remove the radiator cap to speed draining.

4. Remove the intake air hose and air cleaner assembly.

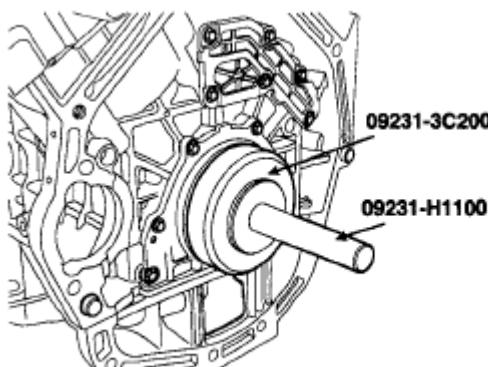
1. Disconnect the PCM connectors (A).
2. Disconnect the MAF connector (B).
3. Disconnect the breather hose (C) from air cleaner hose (D).
4. Remove the intake air hose and air cleaner assembly (E).



KDRF218A

**Fig. 72: Locating Breather Hose, Air Cleaner Hose And Air Cleaner Assembly**  
Courtesy of HYUNDAI MOTOR CO.

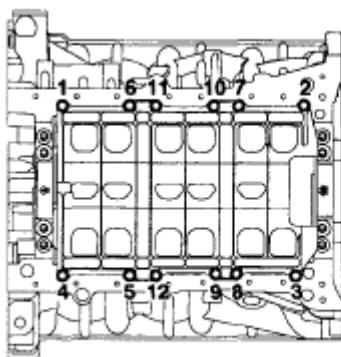
5. Remove the upper radiator hose(A) and lower radiator hose(B).



KDRF237A

**Fig. 73: Locating Upper Radiator Hose And Lower Radiator Hose**  
Courtesy of HYUNDAI MOTOR CO.

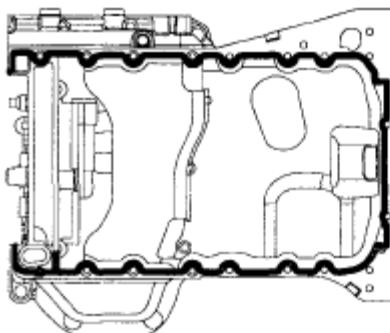
6. Remove the heater hoses (A).



KDRF135A

**Fig. 74: Locating Heater Hoses**  
Courtesy of HYUNDAI MOTOR CO.

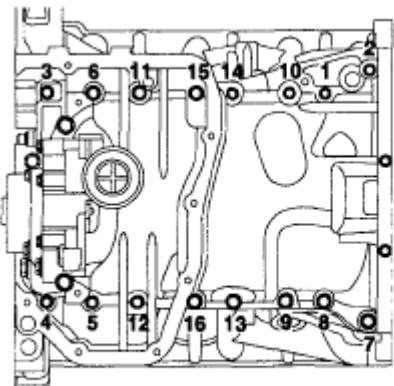
7. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.
  1. OCV(Oil control Valve) connector (A).
  2. Oil temperature sensor (OTS) connector (B).
  3. Engine coolant temperature (ECT) sensor connector (C).
  4. Ignition coil connector (D).



KDRF130A

**Fig. 75: Locating Engine Coolant Temperature (ECT) Sensor Connector And Ignition Coil Connector**  
Courtesy of HYUNDAI MOTOR CO.

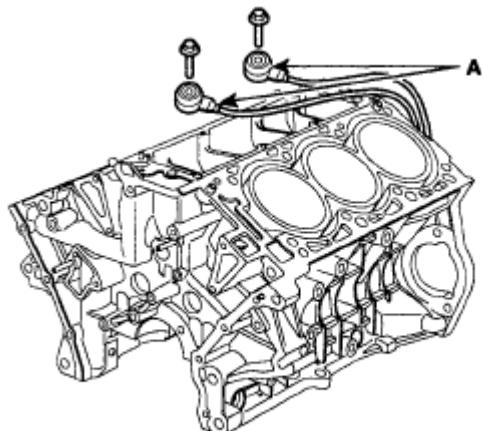
5. TPS(Throttle Position Sensor) connector (A).
6. ISA(Idle Speed Actuator) connector (B).
7. CMP(Camshaft Position Sensor) connector (C).
8. Four fuel injector connectors.
9. Knock sensor connector (D).
10. PCSV(Purge Control Solenoid Valve) connector (E).



KDRF131A

**Fig. 76: Locating Knock Sensor Connector, Four Fuel Injector Connectors And PCSV (Purge Control Solenoid Valve) Connector**  
Courtesy of HYUNDAI MOTOR CO.

11. Front heated oxygen sensor connector.
8. Remove the fuel inlet hose (A) from delivery pipe.

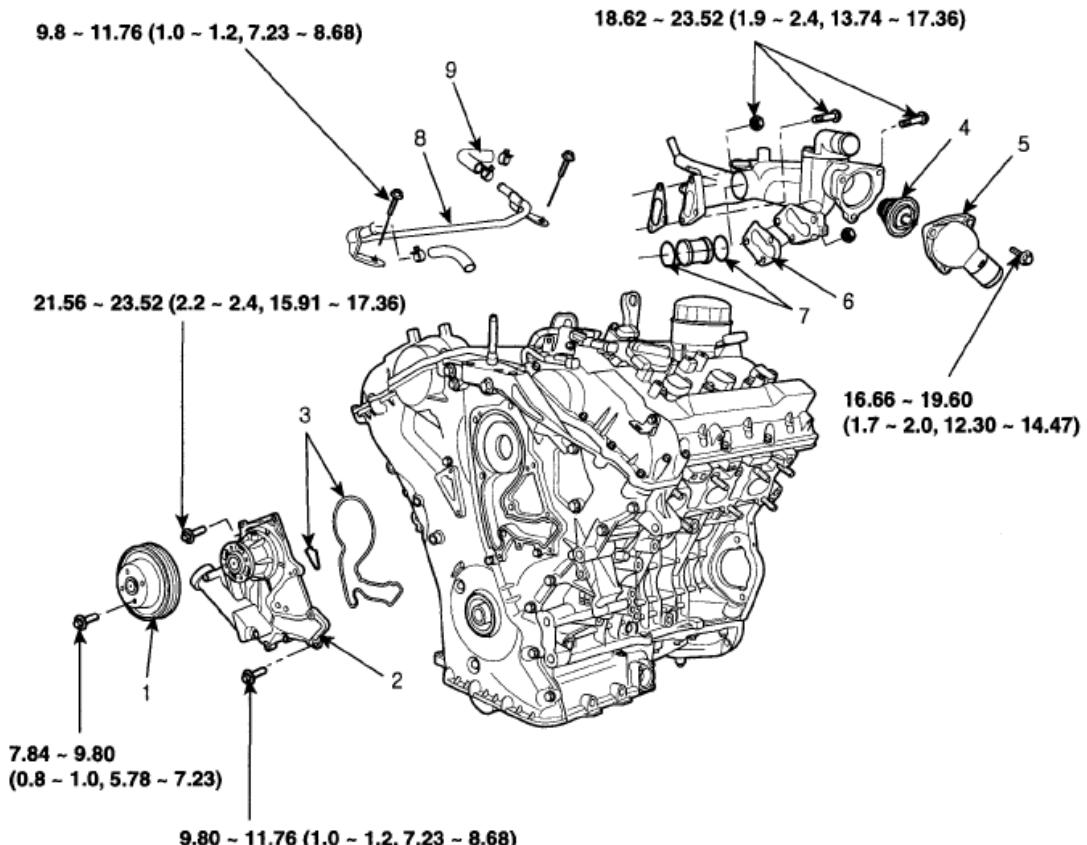


KDRF205A

**Fig. 77: Locating Fuel Inlet Hose**  
Courtesy of HYUNDAI MOTOR CO.

9. Remove the PCSV hose.
10. Remove the brake booster vacuum hose.
11. Remove the accelerator cable and the auto-cruise cable by loosening the locknut, then slip the cable end out of the throttle linkage.
12. Remove the spark plug cable.
13. Remove the PCV hose.
14. Remove the cylinder head cover.
15. Remove the timing belt.
16. Remove the exhaust manifold.

17. Remove the intake manifold.
18. Remove the camshaft sprocket.
19. Remove the timing chain auto tensioner (A)



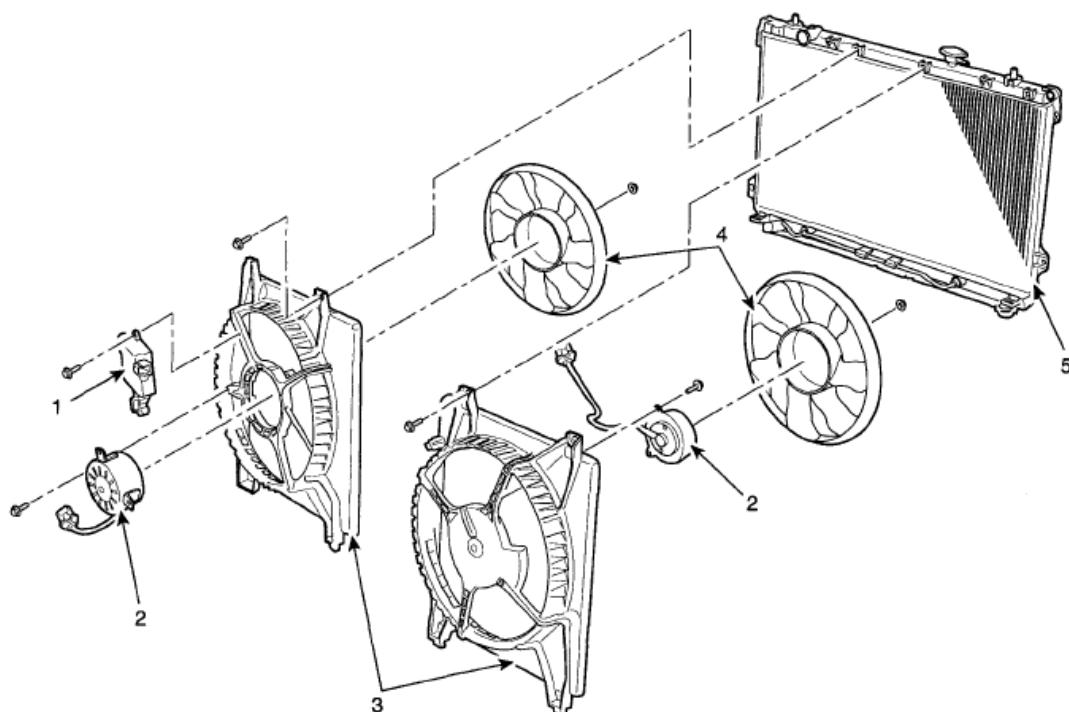
**TORQUE : N.m (kgf.m, lb-ft)**

1. Water pump pulley	5. Water inlet fitting
2. Water pump	6. Gasket
3. Water pump gasket	7. O - ring
4. Thermostat	8. Water vent pipe
	9. Hose

SEPEM6005N

**Fig. 78: Locating Timing Chain Auto Tensioner**  
Courtesy of HYUNDAI MOTOR CO.

20. Remove the camshaft bearing caps (A) and camshafts (B).

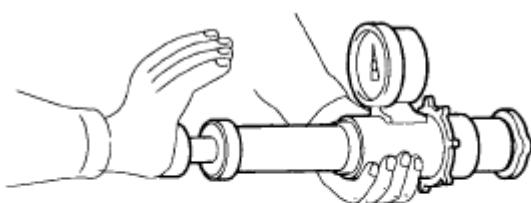


1. Cooling fan controller
2. Cooling fan motor
3. Cooling fan cover
4. Cooling fan
5. Radiator assembly

BCKG011A

**Fig. 79: Locating Camshaft Bearing Caps And Camshafts**  
Courtesy of HYUNDAI MOTOR CO.

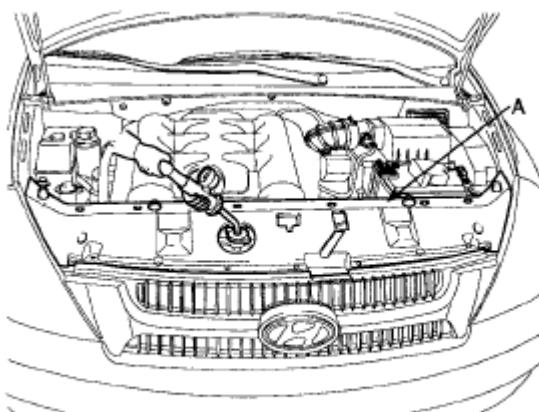
21. Remove the OCV(oil control valve) (A).



ECKD501X

**Fig. 80: Locating OCV (Oil Control Valve)**  
Courtesy of HYUNDAI MOTOR CO.

22. Remove the OCV(oil control valve) filter (A).

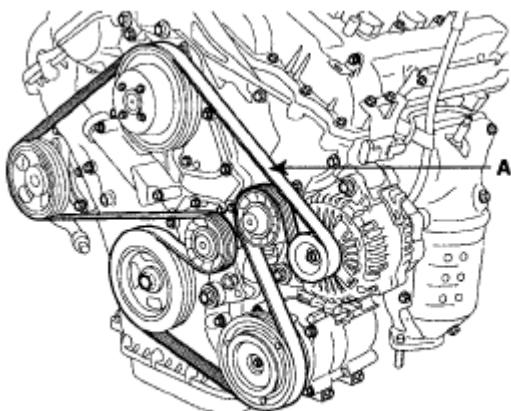


SEPEM6003N

**Fig. 81: Locating OCV (Oil Control Valve) Filter**  
Courtesy of HYUNDAI MOTOR CO.

23. Remove the cylinder head bolts, then remove the cylinder head.

1. Using 8mm and 10mm hexagon wrench, uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown. Remove the 10 cylinder head bolts and plate washers.



KDRF101A

**Fig. 82: Identifying Cylinder Head Bolts In Sequence**  
Courtesy of HYUNDAI MOTOR CO.

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

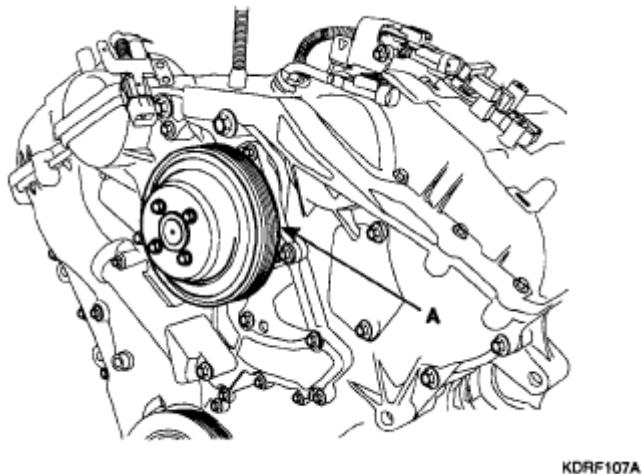
2. Lift the cylinder head from the dowels on the cylinder block and replace the cylinder head on wooden blocks on a bench.

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

## DISASSEMBLY

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

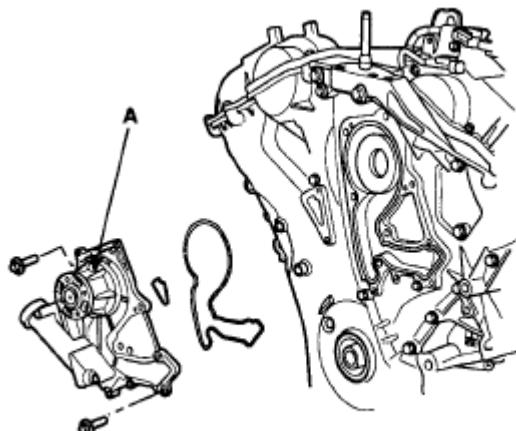
1. Remove MLAs (A).



**Fig. 83: Locating MLAs**  
Courtesy of HYUNDAI MOTOR CO.

2. Remove valves.

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



KDRF221A

**Fig. 84: Compressing Valve Spring**  
Courtesy of HYUNDAI MOTOR CO.

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

## INSPECTION

### CYLINDER HEAD

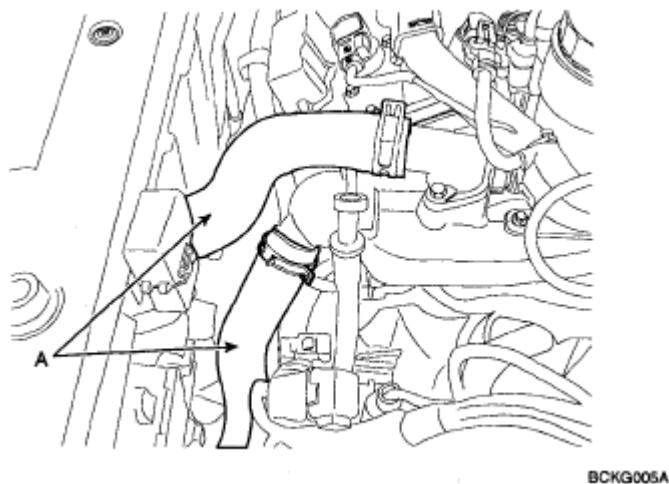
1. Inspect for flatness.

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

#### Flatness of cylinder head gasket surface

Standard : Less than 0.03mm(0.0012 in)

Limit : 0.06 mm ( 0.0024 in)



**Fig. 85: Measuring Surface Contacting Cylinder Block**  
Courtesy of HYUNDAI MOTOR CO.

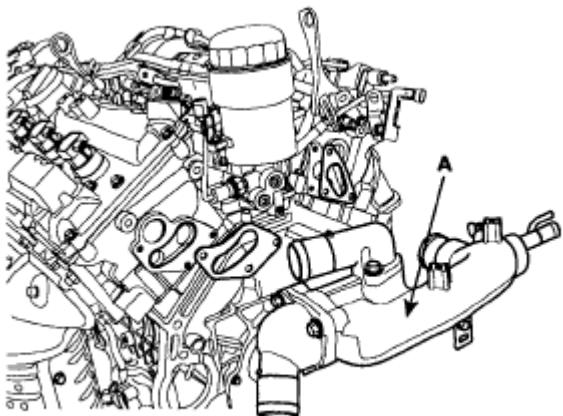
2. Inspect for cracks.

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.

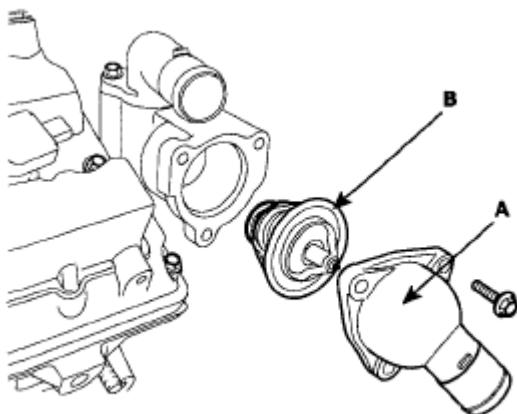
1. Using a caliper gauge, measure the inside diameter of the valve guide. Valve guide inside.



KDRF194A

**Fig. 86: Measuring Inside Diameter Or Valve Guide**  
Courtesy of HYUNDAI MOTOR CO.

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



KDRF195A

**Fig. 87: 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 : 0.02 ~ 0.05mm (0.0008 ~ 0.0020in)

Exhaust: 0.035 ~ 0.065mm (0.0014 ~ 0.0026in)

**[Limit]**

Intake : 0.1mm (0.0040in)

Exhaust : 0.13mm (0.0051 in)

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

**2. Inspect valves.**

1. Check the valve is ground to the correct valve face angle.
2. Check that the surface of the valve for wear. If the valve face is worn, replace the valve.
3. Check the valve head margin thickness.

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

**Margin**

**[Standard]**

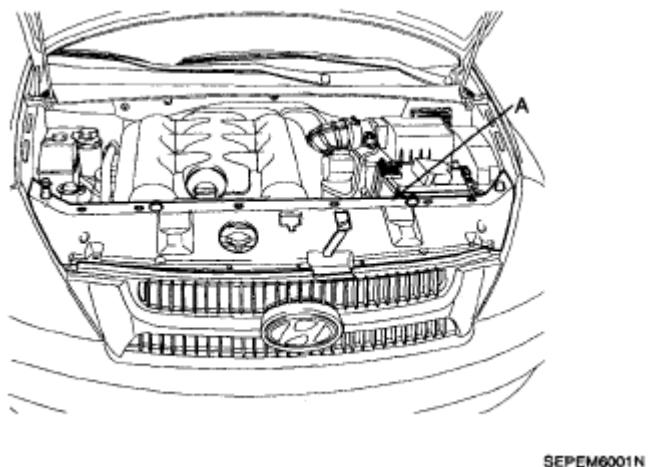
Intake : 1.6 mm(0.0630 in)

Exhaust: 1.8 mm(0.0709 in)

**[Limit]**

Intake : 1.45 mm(0.0571 in)

Exhaust : 1.65mm(0.0650 in)



**Fig. 88: Identifying Margin Thickness Of Valve**  
Courtesy of HYUNDAI MOTOR CO.

4. Check the surface of the valve stem tip for wear. If the valve stem tip is worn, replace the valve.

### 3. Inspect valve seats

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

Replace the seat if necessary.

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

### 4. Inspect valve springs.

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

Valve spring

[Standard]

Free height: 48.86mm (1.9236 in)

Load :

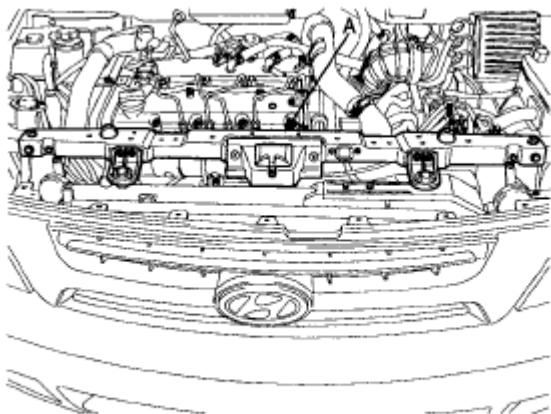
$18.8 \pm 0.9 \text{ kg} / 39.0 \text{ mm} (41.4 \pm 2.0 \text{ lb} / 1.5354 \text{ in})$

$41.0 \pm 1.5 \text{ kg} / 30.5 \text{ mm} (90.4 \pm 3.3 \text{ lb} / 1.2008 \text{ in})$

Out-of-square :  $1.5^\circ$

[Limit]

Out-of-square :  $3^\circ$



SEPEM6002N

**Fig. 89: Measuring Free Length Of Valve Spring**

**Courtesy of HYUNDAI MOTOR CO.**

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

## CAMSHAFT

1. Inspect cam lobes.

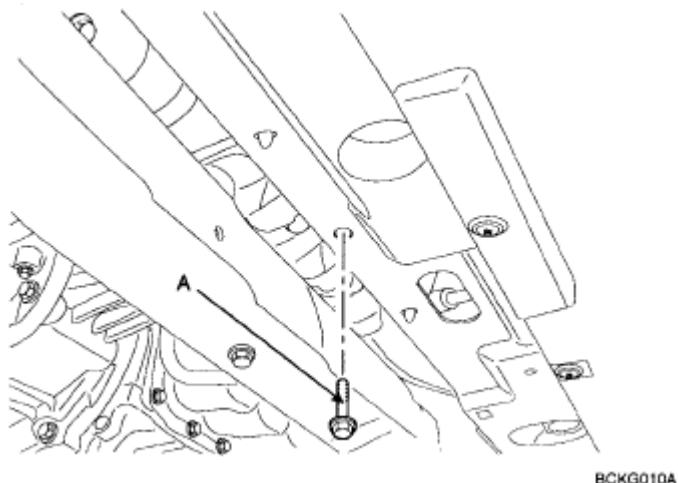
Using a micrometer, measure the cam lobe height.

### Cam height

[Standard value]

Intake : 44.518~44.718mm (1.7527~1.7605in)

Exhaust: 44.418~44.618mm (1.7487~1.7566in)

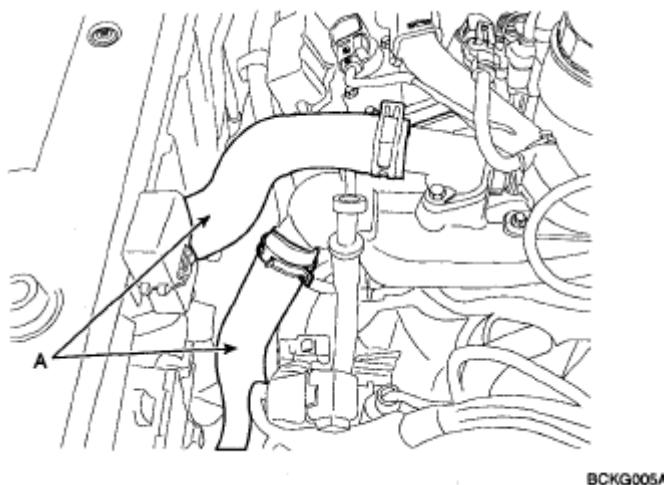


**Fig. 90: Measuring Cam Lobe Height**

**Courtesy of HYUNDAI MOTOR CO.**

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

2. Inspect camshaft journal clearance.
  1. Clean the bearing caps and camshaft journals.
  2. Place the camshafts on the cylinder head.
  3. Lay a strip of plastigage across each of the camshaft journal.



**Fig. 91: Laying Strip Of Plastigage Across Of Camshaft Journal**  
Courtesy of HYUNDAI MOTOR CO.

4. Install the bearing caps.

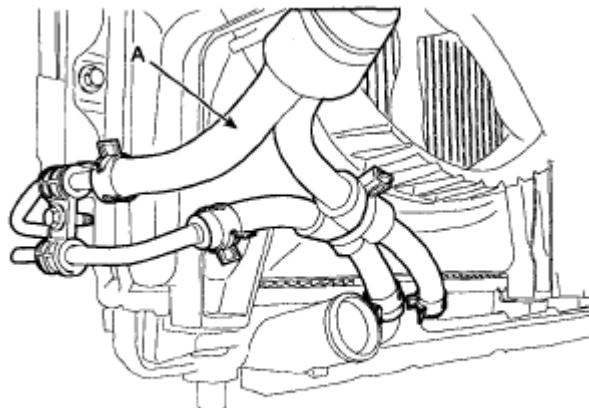
**CAUTION: Do not turn the camshaft.**

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

**Bearing oil clearance :**

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

[Limit] : 0.1mm(0.0039in)



BCKG015A

**Fig. 92: Measuring Plastigage**

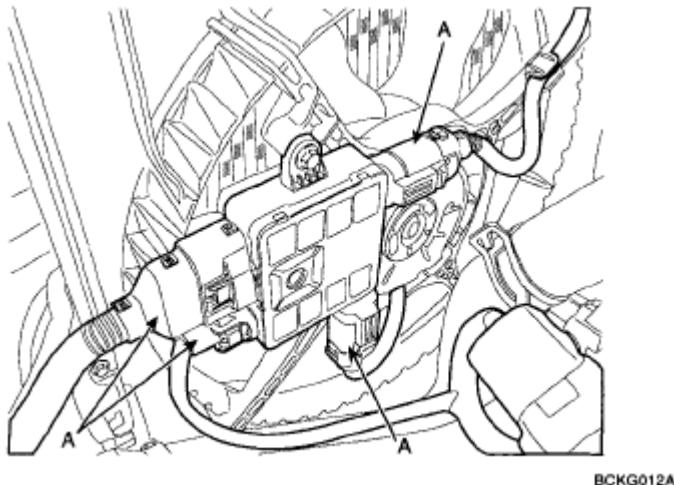
**Courtesy of HYUNDAI MOTOR CO.**

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

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

**Camshaft end play**

**[Standard value]: 0.1 ~ 0.15mm(0.0039 ~ 0.0059in)**



**Fig. 93: Inspecting Camshaft End Play**

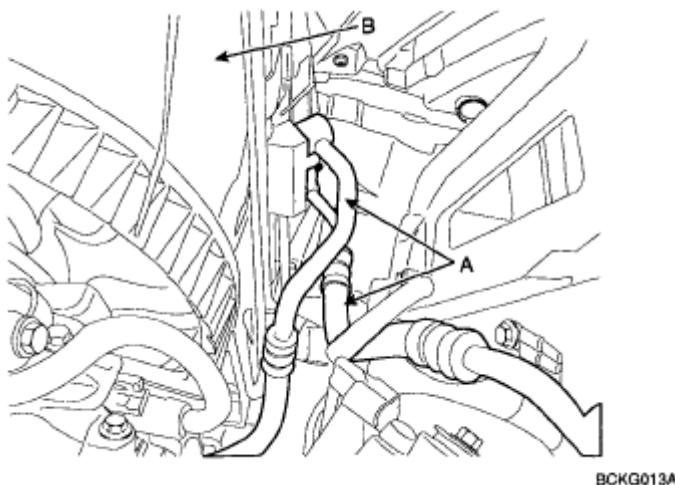
**Courtesy of HYUNDAI MOTOR CO.**

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

3. Remove the camshafts.

**CVVT ASSEMBLY**

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



**Fig. 94: Identifying CVVT Assembly**  
Courtesy of HYUNDAI MOTOR CO.

- Wind tape around the tip of the air gun and apply air of approx. 100kpa(1kgf/cm<sup>2</sup> , 14psi) to the port of the camshaft.

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

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

- Under the condition of (3), turn the CVVT assembly to the advance angle side (the arrow marked direction in the illustration) with your hand. Depending on the air pressure, the CVVT assembly will turn to the advance side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.
- Except the position where the lock pin meets at the maximum delay angle, let the CVVT assembly turn back and forth and check the movable range and that there is no disturbance.

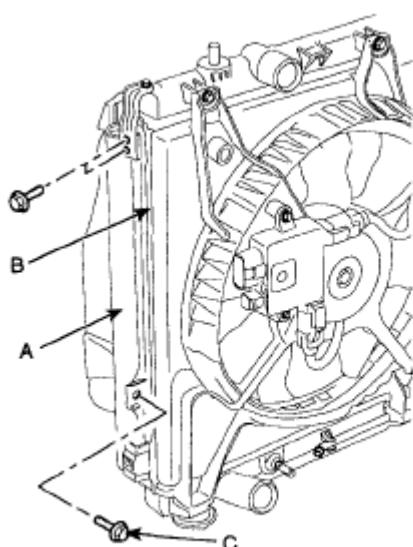
Standard: Movable smoothly in the range about 20°

- Turn the CVVT assembly with your hand and lock it at the maximum delay angle position.

## REPLACEMENT

### VALVE GUIDE

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



BCKG016A

**Fig. 95: Locating Valve Guide**

Courtesy of HYUNDAI MOTOR CO.

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

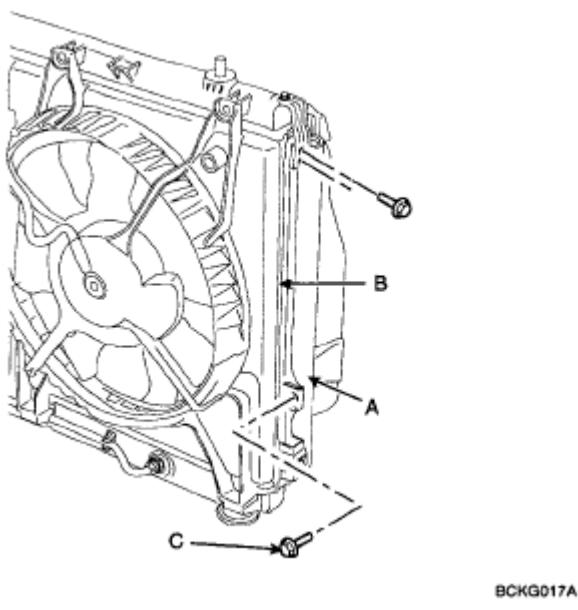
**VALVE GUIDE SPECIFICATIONS**

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

**Valve guide length**

Intake : 46mm (1.8in.)

Exhaust : 54.5mm (2.15in.)



BCKG017A

**Fig. 96: Locating SST**  
Courtesy of HYUNDAI MOTOR CO.

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

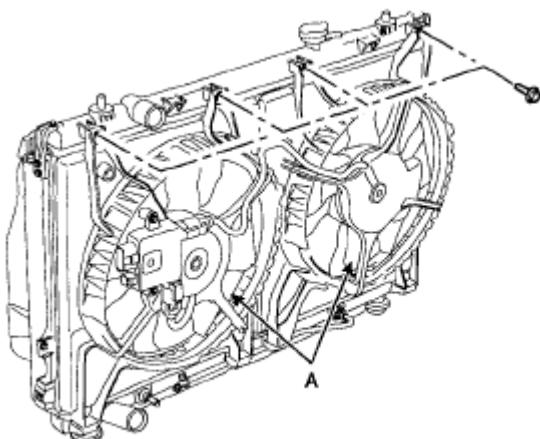
## REASSEMBLY

**NOTE:** Thoroughly clean all parts to be assembled. Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.

Replace oil seals with new ones.

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

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



BCKG018A

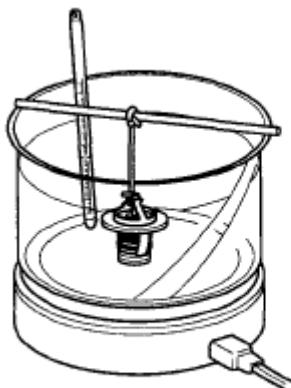
**Fig. 97: Installing Oil Seal**

Courtesy of HYUNDAI MOTOR CO.

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

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

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

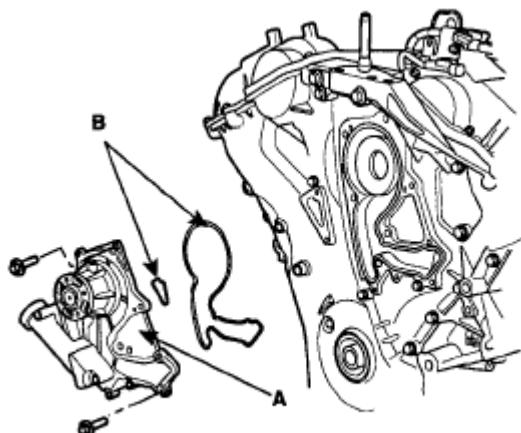


ECKD503B

**Fig. 98: Compressing Valve Spring**

Courtesy of HYUNDAI MOTOR CO.

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

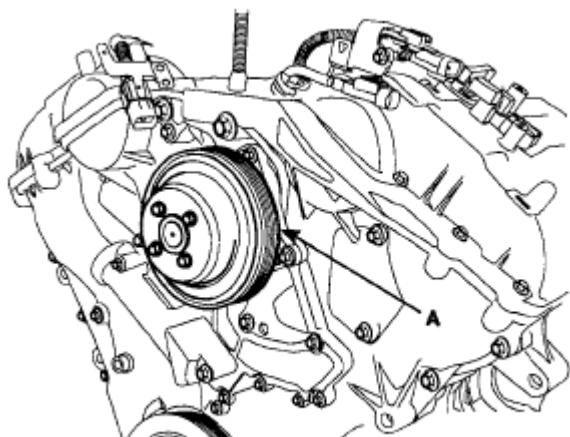


KDRF221B

**Fig. 99: Tapping End Of Each Valve Stem**  
Courtesy of HYUNDAI MOTOR CO.

2. Install MLAs.

Check that the MLA rotates smoothly by hand.



KDRF107A

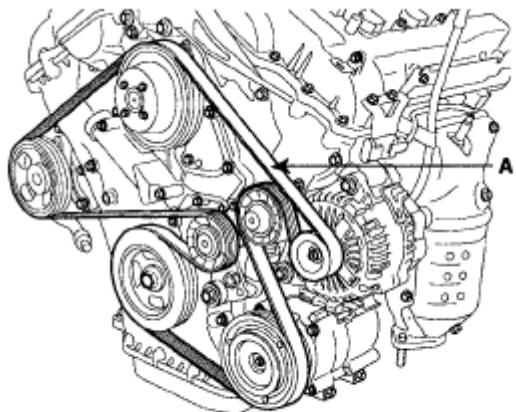
**Fig. 100: Locating MLAs**  
Courtesy of HYUNDAI MOTOR CO.

## 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 gasket (A) on the cylinder block.



KDRF101A

**Fig. 101: Locating Cylinder Head Gasket**

Courtesy of HYUNDAI MOTOR CO.

**NOTE: Be careful of the installation direction.**

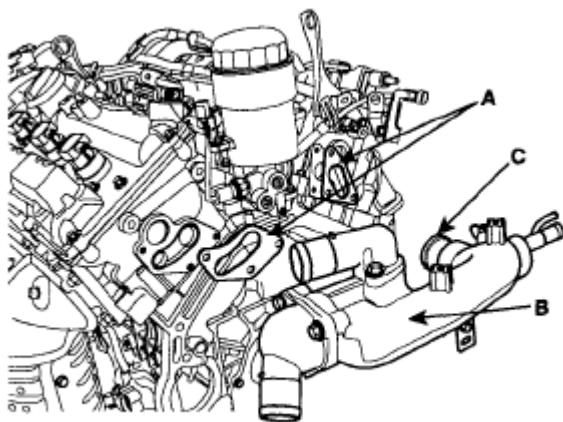
2. Place the cylinder head quietly in order not to damage the gasket with the bottom part of the end.
3. Install cylinder head bolts.
  1. Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
  2. Using 8mm and 10mm hexagon wrench, install and tighten the 10 cylinder head bolts and plate washers, in several passes, in the sequence shown.

**Tightening torque****M10 :**

22.6~26.5Nm (2.3~2.7kgf.m, 16.6~19.5lb-ft) + (60° ~ 65°) + (60° ~ 65°)

**M12 :**

27.5~31.4Nm (2.8~3.2kgf.m, 20.3~23.1 lb-ft) + (60° ~ 65°) + (60° ~ 65°)



KDRF194B

**Fig. 102: Identifying Cylinder Head Bolts In Sequence**  
Courtesy of HYUNDAI MOTOR CO.

4. Install OCV filter (A).

**Tightening torque**

40.2 ~ 50.0Nm (4.1 ~ 5.1kgf.m, 29.7 ~ 36.9lb-ft)



BCKG005A

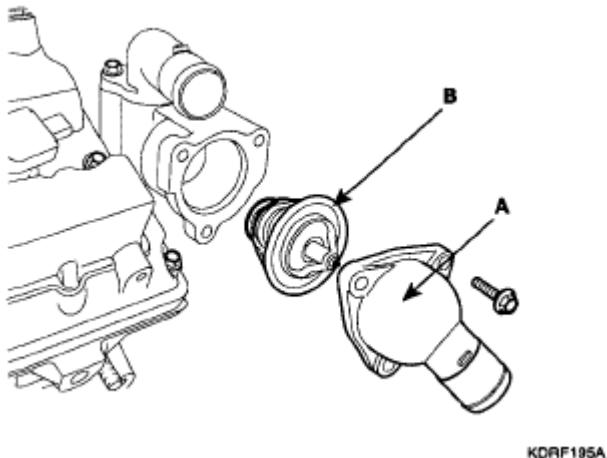
**Fig. 103: Locating OCV (Oil Control Valve) Filter**  
Courtesy of HYUNDAI MOTOR CO.

**NOTE:** **Always use a new OCV filter gasket.**  
**Keep clean the OCV filter.**

5. Install OCV (A).

**Tightening torque**

9.8 ~ 11.8Nm(1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb·ft)



**Fig. 104: Locating OCV (Oil Control Valve)**

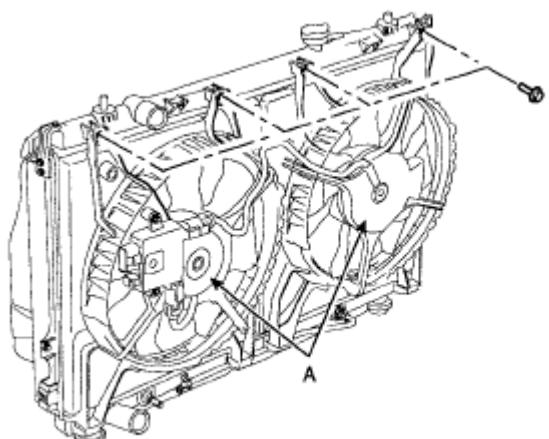
Courtesy of HYUNDAI MOTOR CO.

**CAUTION:**

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

6. Install the camshafts.

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



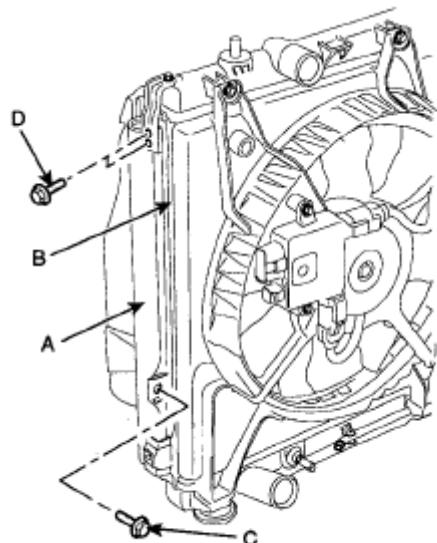
**Fig. 105: Aligning Camshaft Timing Chain With Intake Timing Chain Sprocket And Exhaust Timing Chain Sprocket**

Courtesy of HYUNDAI MOTOR CO.

2. Install the camshafts (A) and bearing caps (B).

**Tightening torque**

13.7 ~ 14.7Nm (1.4 ~ 1.5kgf.m, 10.1 ~ 10.8lb-ft)



BCKG032A

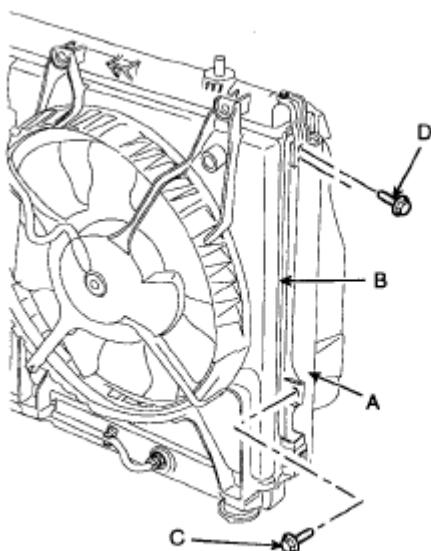
**Fig. 106: Locating Camshafts And Bearing Caps**

Courtesy of HYUNDAI MOTOR CO.

3. Install the timing chain auto tensioner (A).

**Tightening torque**

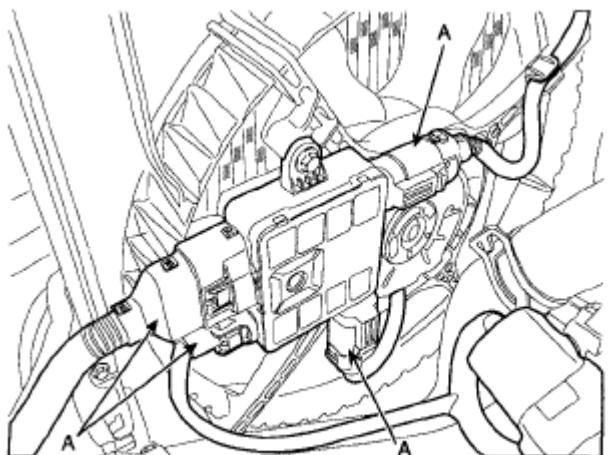
7.8 ~ 9.8Nm (0.8 ~ 10kgf.m, 5.8 ~ 7.2lb-ft)



BCKG034A

**Fig. 107: Locating Timing Chain Auto Tensioner**  
Courtesy of HYUNDAI MOTOR CO.

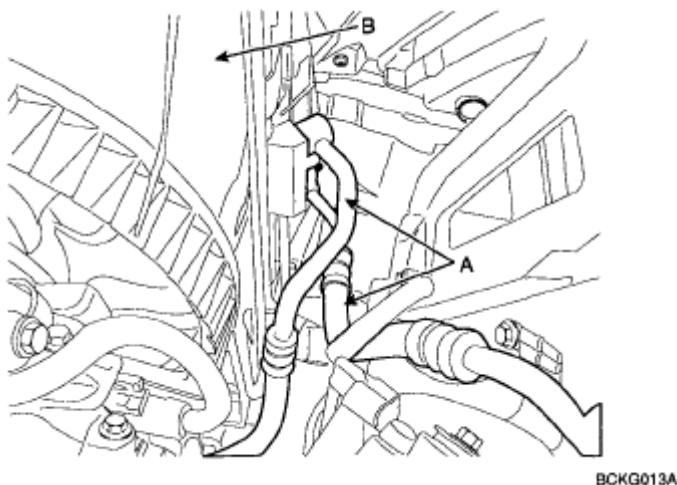
4. Remove the auto tensioner stopper pin (B).
7. Check and adjust valve clearance.
8. Using the SST (09221-21000), install the camshaft bearing oil seal.



BCKG012A

**Fig. 108: Installing Camshaft Bearing Oil Seal**  
Courtesy of HYUNDAI MOTOR CO.

9. Install the camshaft sprocket.
10. Install the timing belt.
11. Install the cylinder head cover.
  1. install the cylinder head cover gasket (A) in the groove of the cylinder head cover(B).

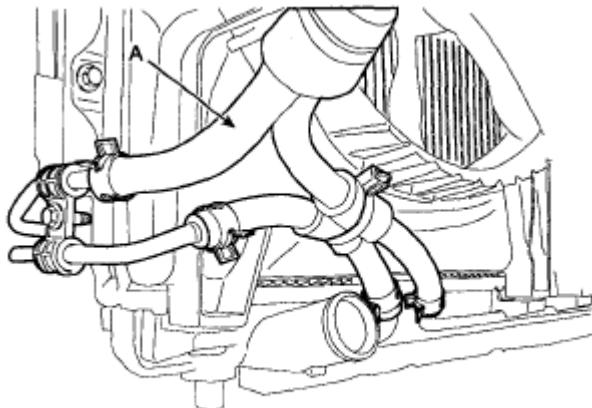


**Fig. 109: Locating Cylinder Head Cover Gasket And Cylinder Head Cover**  
Courtesy of HYUNDAI MOTOR CO.

**NOTE:**

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

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



BCKG015A

**Fig. 110: Applying Liquid Gasket To Head Cover Gasket**  
Courtesy of HYUNDAI MOTOR CO.

**NOTE:**

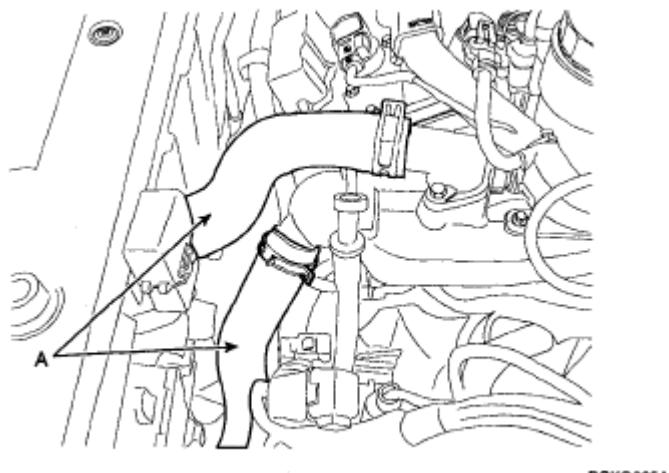
- Use liquid gasket, loctite No. 5999.
- Check that the mating surfaces are clean and dry before applying liquid gasket
- After assembly, wait at least 30 minutes before filling the engine

with oil.

3. Install the cylinder head cover (A) with the 12bolts(B). Uniformly tighten the bolts in several passes.

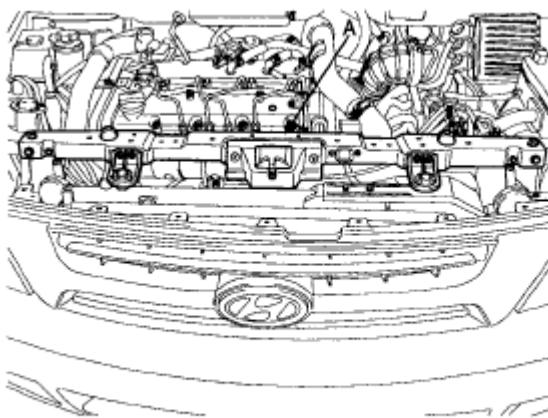
#### Tightening torque

7.8 ~ 9.8N.m (0.8 ~ 10kgf.m, 5.8 ~ 7.2 lb-ft)



**Fig. 111: Locating Cylinder Head Cover And Bolts**  
Courtesy of HYUNDAI MOTOR CO.

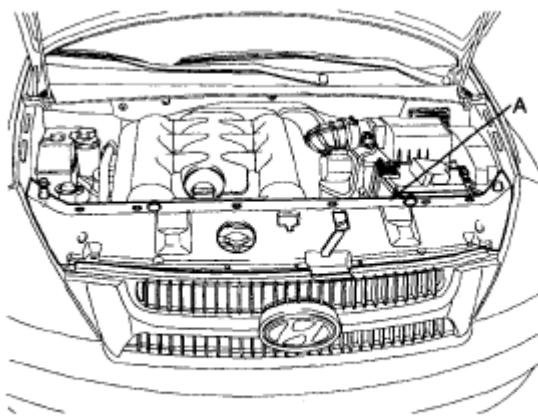
12. Install the intake manifold.
13. Install the exhaust manifold.
14. Install the PCV.
15. Install the spark plug cable. (Refer to [IGNITION SYSTEM -- ELANTRA](#) ).
16. Install the accelerator and the auto-cruise cables.
17. Install the bake booster hose.
18. Install the PCSV hose.
19. Install the fuel inlet hose (A).



SEPEM6002N

**Fig. 112: Locating Fuel Inlet Hose**  
Courtesy of HYUNDAI MOTOR CO.

20. Install the engine wire harness connectors and wire harness clamps to the cylinder head and the intake manifold.
  1. Front heated oxygen sensor connector.
  2. Knock sensor connector (D).
  3. Four fuel injector connectors.
  4. CMP connector (C).
  5. PCSV connector (E).
  6. ISA connector (B).
  7. TPS connector (A).

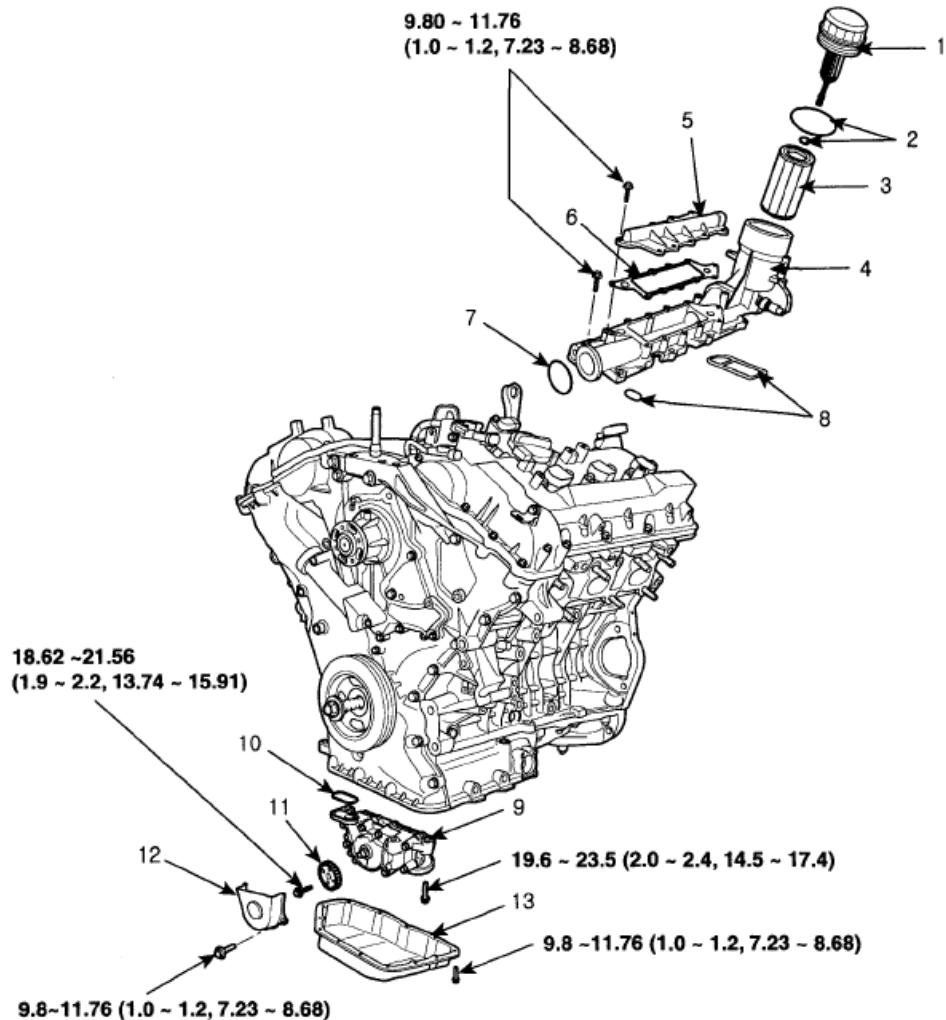


SEPEM6001N

**Fig. 113: Locating Knock Sensor Connector, Four Fuel Injector Connectors And PCSV (Purge Control Solenoid Valve) Connector**  
Courtesy of HYUNDAI MOTOR CO.

8. Ignition coil connector (D).

9. ECT sensor connector (C).
10. Oil temperature sensor connector (B).
11. OCV connector (A).



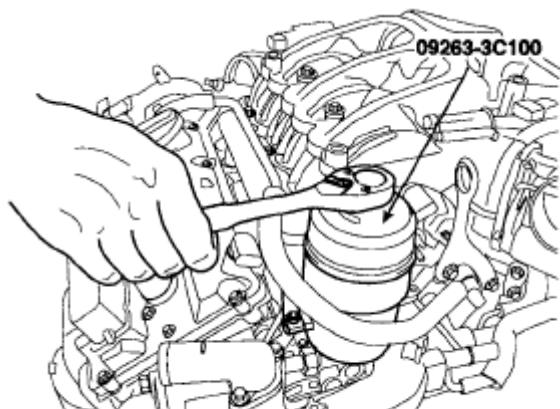
**TORQUE : N.m (kgf.m, lb-ft)**

1. Oil filter cap	6. Gasket	11. Oil pump sprocket
2. O - ring	7. O - ring	12. Oil pump chain cover
3. Oil filter element	8. Gasket	13. Lower oil pan
4. Oil filter body	9. Oil pump	
5. Oil filter body cover	10. Gasket	

BCKG029A

**Fig. 114: Locating Engine Coolant Temperature (ECT) Sensor Connector And Ignition Coil Connector**  
**Courtesy of HYUNDAI MOTOR CO.**

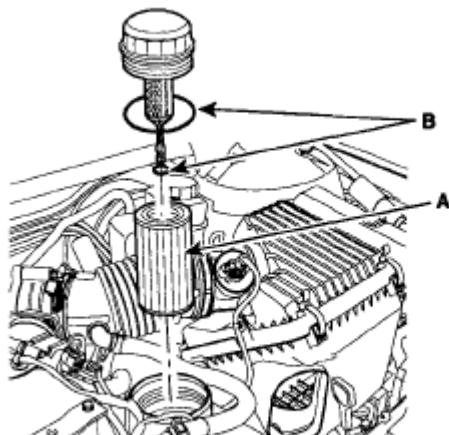
21. Install the heater hoses (A).



ECRF051A

**Fig. 115: Locating Heater Hoses**  
Courtesy of HYUNDAI MOTOR CO.

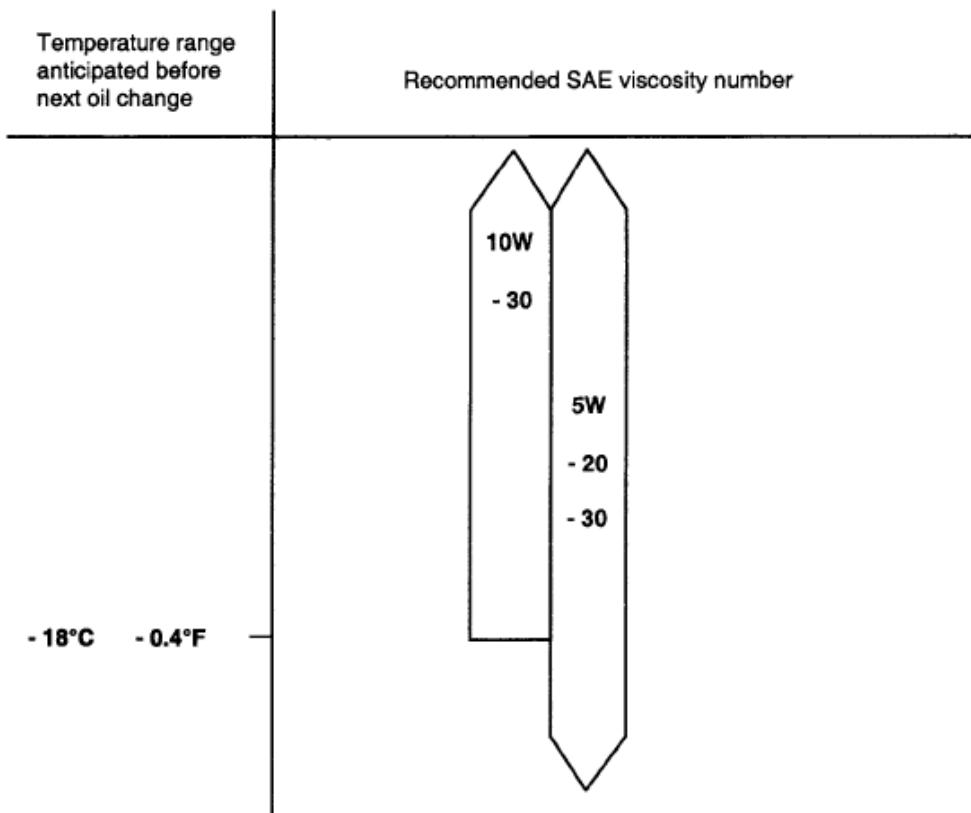
22. Install the upper radiator hose (A) and lower radiator hose (B).



KDRF188A

**Fig. 116: Locating Upper Radiator Hose And Lower Radiator Hose**  
Courtesy of HYUNDAI MOTOR CO.

23. Install the intake air hose and air cleaner assembly.
24. Install the engine cover (A).



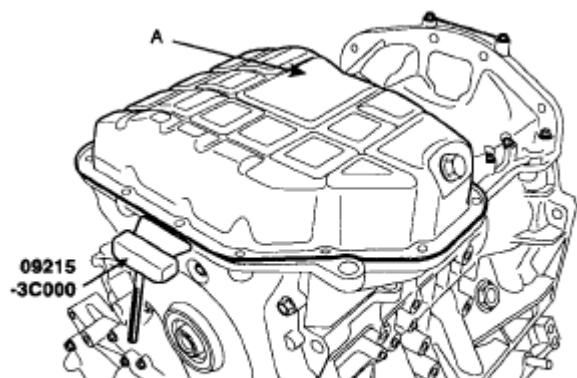
EDRF020A

**Fig. 117: Locating Engine Cover**  
Courtesy of HYUNDAI MOTOR CO.

25. Connect the negative terminal to the battery.
26. Fill with engine coolant.
27. Start the engine and check for leaks.
28. Recheck engine coolant level and oil level.

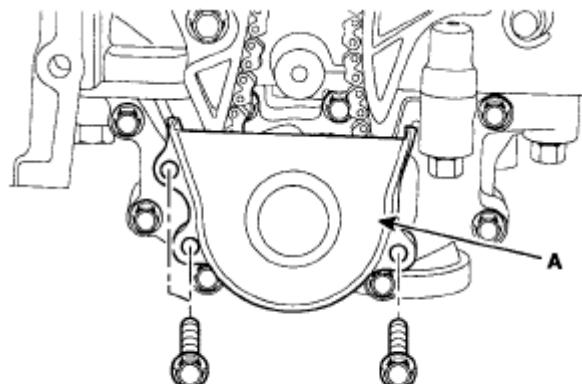
## ENGINE BLOCK

### COMPONENTS



ECRF060A

**Fig. 118: Identifying Engine Block Components And Torque Specifications (1 Of 2)**  
Courtesy of HYUNDAI MOTOR CO.

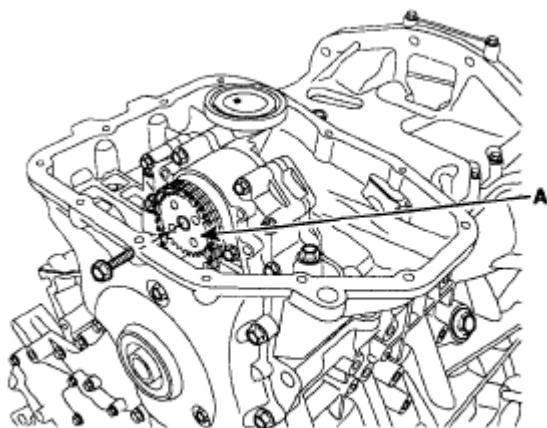


KDRF185A

**Fig. 119: Identifying Engine Block Components And Torque Specifications (2 Of 2)**  
Courtesy of HYUNDAI MOTOR CO.

## DISASSEMBLY

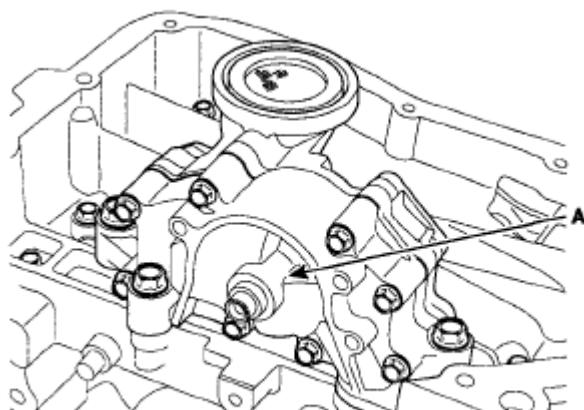
1. M/T : remove flywheel.
2. A/T : remove drive plate.
3. Install engine to engine stand for disassembly.
4. Remove timing belt.
5. Remove cylinder head.
6. Remove oil level gauge assembly (A).



KDRF189A

**Fig. 120: Locating Oil Level Gauge Assembly**  
Courtesy of HYUNDAI MOTOR CO.

7. Remove knock sensor.
8. Remove oil pressure sensor (A).

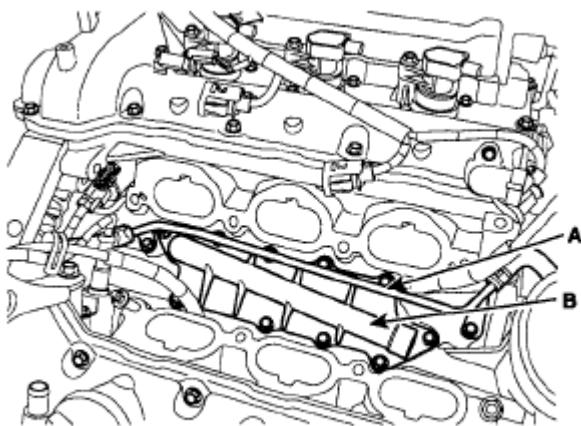


KDRF190A

**Fig. 121: Locating Oil Pressure Sensor**  
Courtesy of HYUNDAI MOTOR CO.

9. Remove water pump.
10. Remove oil pan.
11. Remove oil screen.

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



KDRF191A

**Fig. 122: Locating Bolts, Oil Screen And Gasket**  
Courtesy of HYUNDAI MOTOR CO.

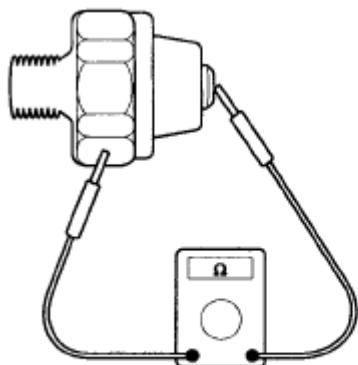
12. Check the connecting rod end play.
13. Remove the connecting rod caps and check oil clearance.
14. Remove piston and connecting rod assemblies.
  1. Using a ridge reamer, remove all the carbon from the top of the cylinder.
  2. Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

**NOTE:**

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

15. Remove front case.
16. Remove rear oil seal case.

Remove the 5 bolts(B) and rear oil seal case (A).

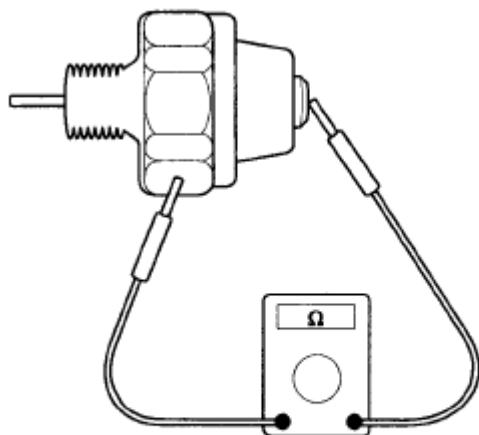


ECKD001W

**Fig. 123: Locating Bolts And Rear Oil Seal Case**  
Courtesy of HYUNDAI MOTOR CO.

17. Remove crankshaft bearing cap and check oil clearance.
18. Check the crankshaft end play.
19. Lift the crankshaft (A) out of the engine, being careful not to damage journals.

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



ECKD001Y

**Fig. 124: Locating Crankshaft**  
Courtesy of HYUNDAI MOTOR CO.

20. Check fit between piston and piston pin.

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

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

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

22. Disconnect connecting rod from piston.

## INSPECTION

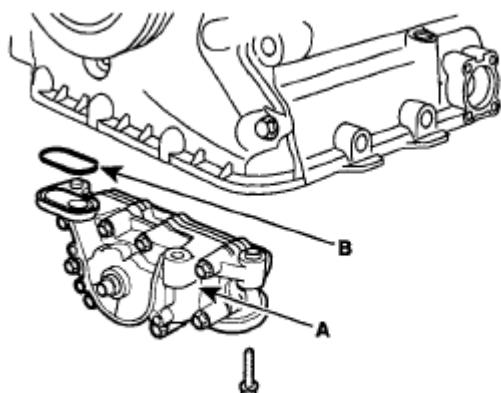
### CONNECTING ROD AND CRANKSHAFT

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 ~ 0.25mm(0.004 ~ 0.010in)

Maximum end play : 0.4mm(0.016in)



KDRF222A

**Fig. 125: Measuring 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 road bearing oil clearance.

1. Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
2. Remove the 2 connecting rod cap nuts.
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 nuts.

#### **Tightening torque**

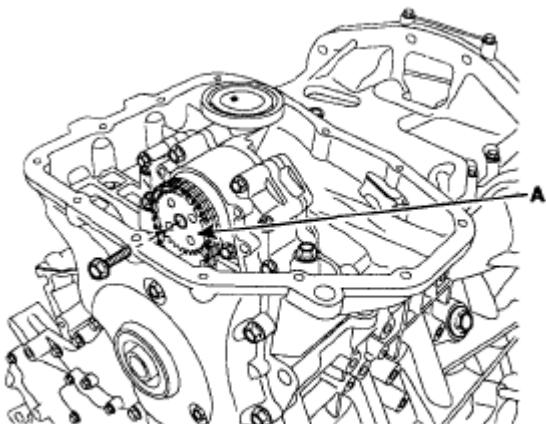
49.0 ~ 52.0 Nm (5.0 ~ 5.3kgf.m, 36.2 ~ 38.3lb-ft)

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

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

#### **Standard oil clearance**

0.024 ~ 0.042mm(0.0009 ~ 0.0017in)



KDRF189A

**Fig. 126: Measuring Plastigage At Its Widest Point**  
Courtesy of HYUNDAI MOTOR CO.

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

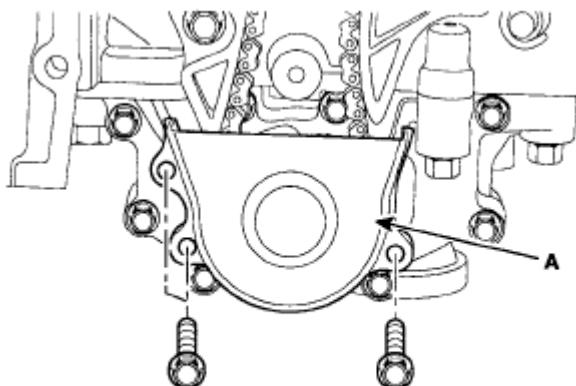
**CAUTION: Do not file, shim, or scrape the bearings or the caps to adjust clearance.**

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



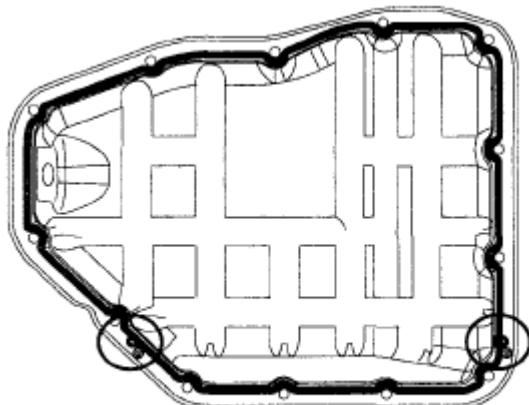
KDRF185A

**Fig. 127: Locating Connecting Rod Mark Location**  
Courtesy of HYUNDAI MOTOR CO.

#### DISCRIMINATION OF CONNECTING ROD

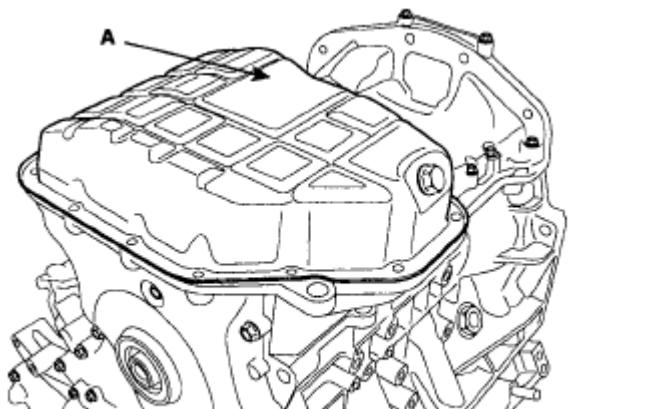
CLASS	MARK	INSIDE DIAMETER
A	WHITE	48.00 ~ 48.006mm (1.8896 ~ 1.8899in.)
B	NONE	48.006 ~ 48.012mm (1.8899 ~ 1.8902in.)
C	YELLOW	48.012 ~ 48.018mm (1.8902 ~ 1.8904in.)

#### CRANKSHAFT PIN MARK LOCATION



KDRF136A

**Fig. 128: Locating Crankshaft Pin Mark Location (1 Of 2)**  
Courtesy of HYUNDAI MOTOR CO.



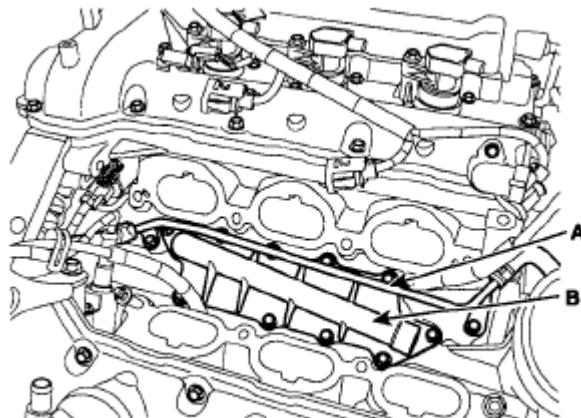
KDRF114A

**Fig. 129: Locating Crankshaft Pin Mark Location (2 Of 2)**  
Courtesy of HYUNDAI MOTOR CO.

#### DISCRIMINATION OF CRANKSHAFT

CLASS	MARK	OUTSIDE DIAMETER OF PIN
I	YELLOW	44.960 ~ 44.966mm (1.7700 ~ 1.7703in.)
II	NONE	44.954 ~ 44.960mm (1.7698 ~ 1.7700in.)
III	WHITE	44.948 ~ 44.954mm (1.7696 ~ 1.7698in.)

#### PLACE OF IDENTIFICATION MARK (CONNECTING ROD BEARING)



KDRF191A

**Fig. 130: Locating Identification Mark (Connecting Rod Bearing)**  
Courtesy of HYUNDAI MOTOR CO.

#### DISCRIMINATION OF CONNECTING ROD BEARING

#### DISCRIMINATION OF CONNECTING ROD BEARING

CLASS	MARK	THICKNESS OF BEARING
AA	BLUE	1.514 ~ 1.517mm (0.0596 ~ 0.0597in.)

A	BLACK	1.511 ~ 1.514mm (0.0595 ~ 0.0596in.)
B	NONE	1.508 ~ 1.511mm (0.0594 ~ 0.0595in.)
C	GREEN	1.505 ~ 1.508mm (0.0593 ~ 0.0594in.)
D	YELLOW	1.502 ~ 1.505mm (0.0591 ~ 0.0593in)

## 11. Selection

## CRANKSHAFT IDENTIFICATION MARK CHART

CRANKSHAFT IDENTIFICATION MARK	CONNECTING ROD IDENTIFICATION MARK	ASSEMBLING CLASSIFICATION OF BEARING
I (YELLOW)	A (WHITE)	D (YELLOW)
	B (NONE)	C (GREEN)
	C (YELLOW)	B (NONE)
II (NONE)	A (WHITE)	C (GREEN)
	B (NONE)	B (NONE)
	C (YELLOW)	A (BLACK)
III (WHITE)	A (WHITE)	B (NONE)
	B (NONE)	A (BLACK)
	C (YELLOW)	AA (BLUE)

## 3. Check the crankshaft bearing oil clearance.

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

**Tightening torque :**

27.5~31.4Nm (2.8~3.2kgf.m, 20.3~23.11 lb-ft) + 60° ~ 64°

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

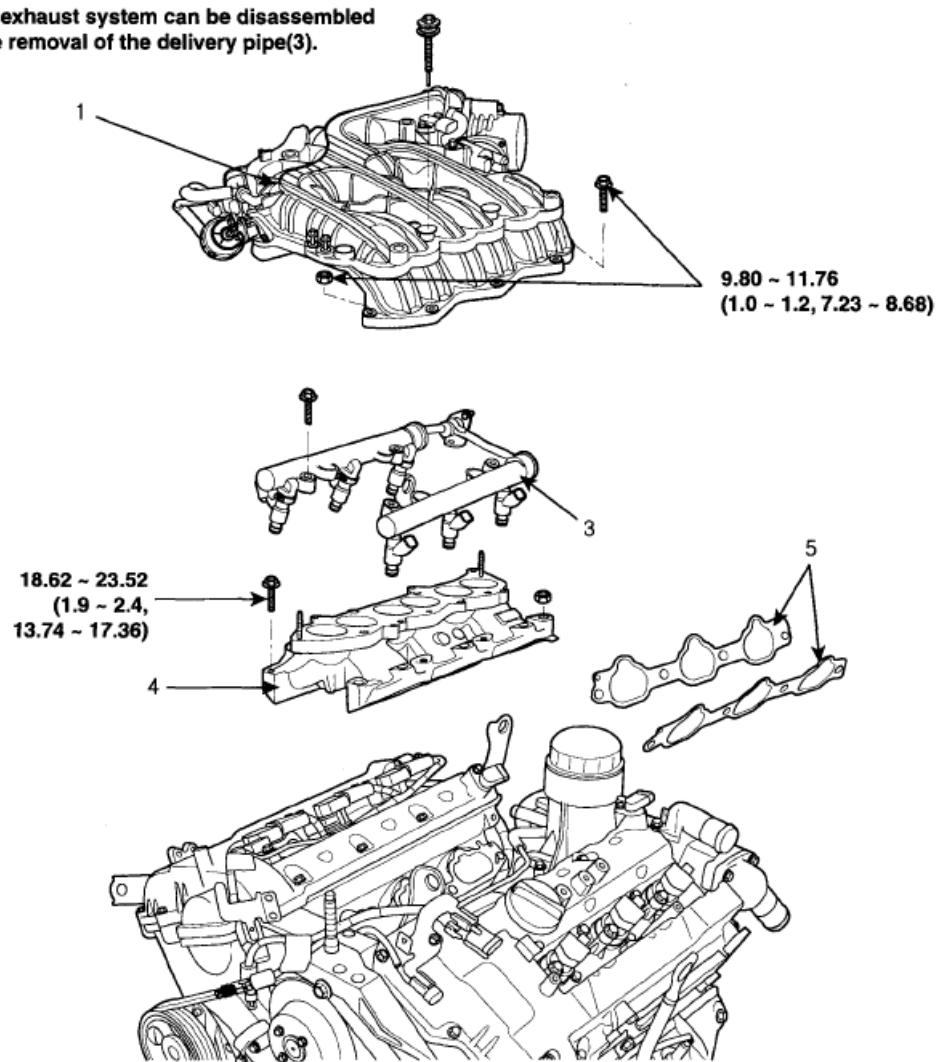
5. Remove the cap and bearing again, and measure the widest part of the plastigage.

**Standard oil clearance :**

0.028 ~ 0.046mm (0.0011 ~ 0.0018in)

## &lt;NOTE&gt;

Intake and exhaust system can be disassembled  
without the removal of the delivery pipe(3).



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

1. Surge tank  
2. Delivery pipe

3. Intake manifold  
4. Intake manifold gasket

SEPEM6006N

**Fig. 131: Measuring Widest Part Of Plastigage**  
Courtesy of HYUNDAI MOTOR CO.

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

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

7. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the

color listed above or below that one), and check clearance again.

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

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

## Connecting rods

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

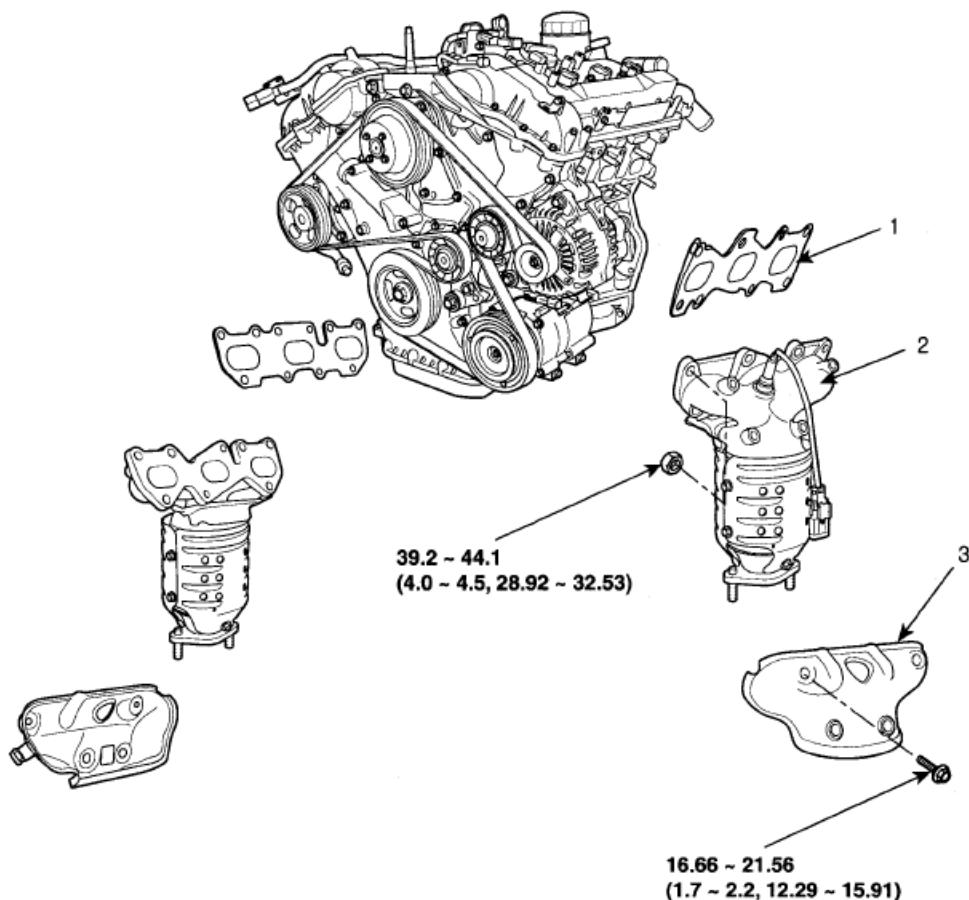
Allowable bend of connecting rod : 0.05mm / 100mm (0.0020 in./3.94 in) or less

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

## Crankshaft bore mark location

Letters have been stamped on the end of 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.



**TORQUE : N.m (kgf.m, lb·ft)**

1. Gasket  
 2. Exhaust manifold  
 3. Heat protector

ECBF014A

**Fig. 132: Locating Crankshaft Bore Mark Location**

Courtesy of HYUNDAI MOTOR CO.

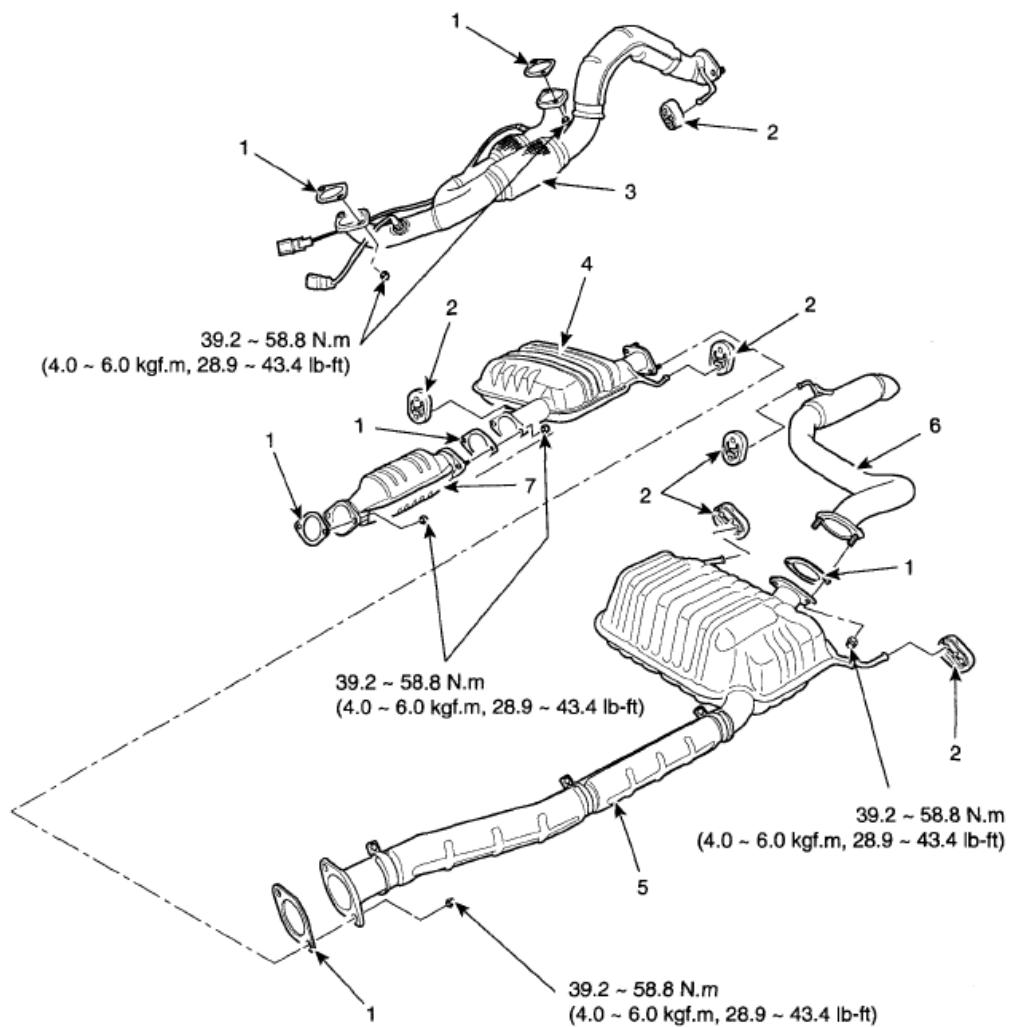
#### DISCRIMINATION OF CYLINDER BLOCK

CALSS	MARK	INSIDE DIAMETER
a	A	59.000 ~ 59.006mm (2.3228 ~ 2.3230in.)
b	B	59.006 ~ 59.012mm (2.3230 ~ 2.3233in.)
c	C	59.012 ~ 59.018mm (2.3233 ~ 2.3235in.)

#### CRANKSHAFT JOURNAL MARK LOCATION

## 2008 Hyundai Elantra SE

### 2008 ENGINE Engine Mechanical System (G4GC-GSL 2.0) - Elantra

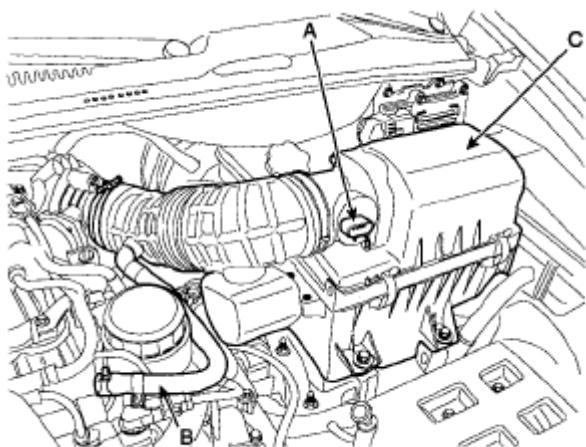


- 1. Gasket
- 2. Hanger
- 3. Front muffler assembly
- 4. Center muffler assembly

- 5. Main muffler assembly
- 6. Tail pipe muffler assembly
- 7. Catalytic converter assembly

BCKG019A

**Fig. 133: Locating Crankshaft Journal Mark Location (1 Of 2)**  
Courtesy of HYUNDAI MOTOR CO.



BCKG002A

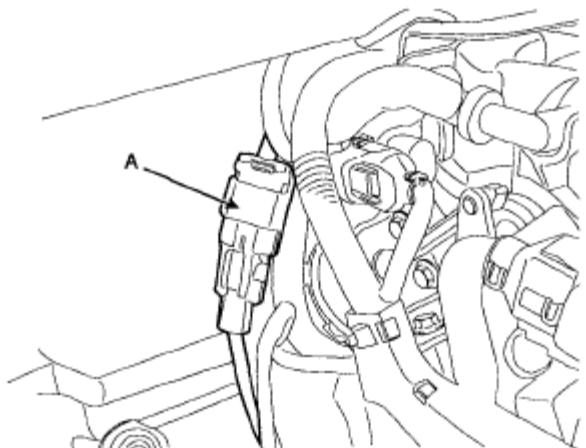
**Fig. 134: Locating Crankshaft Journal Mark Location (2 Of 2)**  
Courtesy of HYUNDAI MOTOR CO.

## DISCRIMINATION OF CRANKSHAFT

### DISCRIMINATION OF CRANKSHAFT

CLASS	MARK	OUTSIDE DIAMETER OF JOURNAL
I	YELLOW	54.956 ~ 54.962mm (2.1636 ~ 2.1638in.)
II	NONE	54.950 ~ 54.956mm (2.1633 ~ 2.1636in.)
III	WHITE	54.944 ~ 54.950mm (2.1631 ~ 2.1633in.)

## PLACE OF IDENTIFICATION MARK (CRANKSHAFT BEARING)



BCKG008A

**Fig. 135: Locating Identification Mark (Crankshaft Bearing)**  
Courtesy of HYUNDAI MOTOR CO.

## DISCRIMINATION OF CRANKSHAFT BEARING

## DISCRIMINATION OF CRANKSHAFT BEARING

CLASS	MARK	THICKNESS OF BEARING
AA	BLUE	2.014~2.017mm (0.0793 ~ 0.0794in.)
A	BLACK	2.011 ~ 2.014mm (0.0791 ~ 0.0793in.)
B	NONE	2.008 ~ 2.011mm (0.0790 ~ 0.0791 in.)
C	GREEN	2.005 ~ 2.008mm (0.0789 0.790in.)
D	YELLOW	2.002 ~ 2.005mm (0.0788 ~ 0.0789in.)

## SELECTION

## CRANKSHAFT IDENTIFICATION MARK CHART

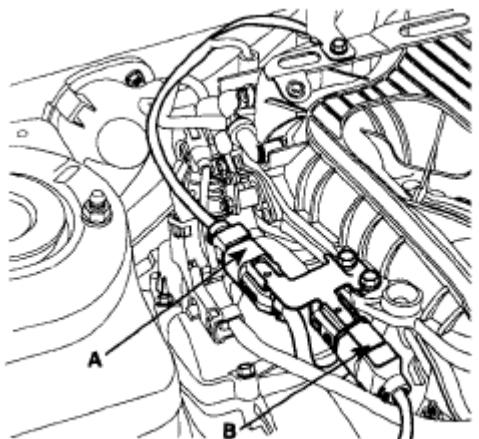
CRANKSHAFT IDENTIFICATION MARK	CRANKSHAFT BORE IDENTIFICATION MARK	ASSEMBLING CLASSIFICATION OF BEARING
I (YELLOW)	a (A)	D (YELLOW)
	b (B)	C (GREEN)
	c (C)	B (NONE)
II (NONE)	a (A)	C (GREEN)
	b (B)	B (NONE)
	c (C)	A (BLACK)
III (WHITE)	a (A)	B (NONE)
	b (B)	A (BLACK)
	c (C)	AA (BLUE)

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:** 0.06 ~ 0.26mm (0.0023 ~ 0.010in)

Limit : 0.30mm (0.0118in)



KDRF153A

**Fig. 136: 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 :**

2.44 ~ 2.47mm(0.096 ~ 0.097in)

5. Inspect main journals and crank pins

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

Main journal diameter : 56.942 ~ 56.962mm (2.2418 ~ 2.2426in)

Crank pin diameter : 44.946 ~ 44.966mm (1.7695 ~ 1.7703in)



KDRF160A

**Fig. 137: Measuring Diameter Of Main Journal And Crank Pin**  
Courtesy of HYUNDAI MOTOR CO.

## CYLINDER BLOCK

1. Remove gasket material.

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

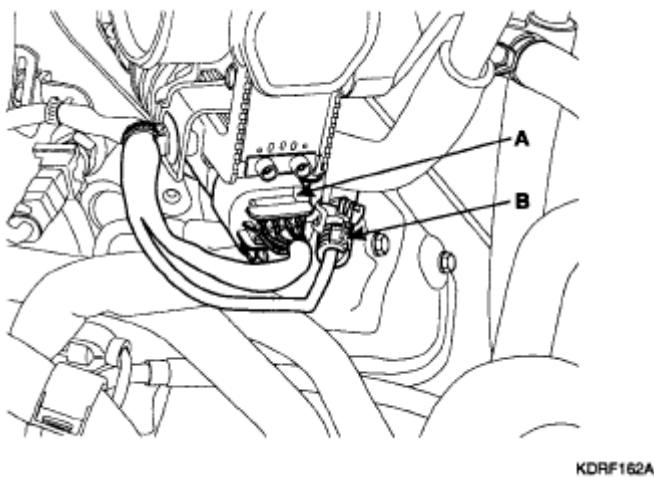
2. Clean cylinder block

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

3. Inspect top surface of cylinder block for flatness. Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

### Flatness of cylinder block gasket surface

Standard : Less than 0.05 mm (0.0020 in)



**Fig. 138: Checking Top Surface Of Cylinder Block For Flatness**

Courtesy of HYUNDAI MOTOR CO.

4. Inspect cylinder bore diameter

Visually check the cylinder for vertical scratches.

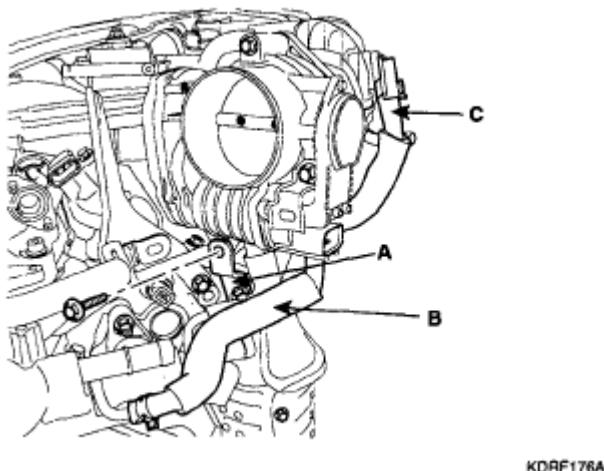
If deep scratches are present, replace the cylinder block.

5. Inspect cylinder bore diameter

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

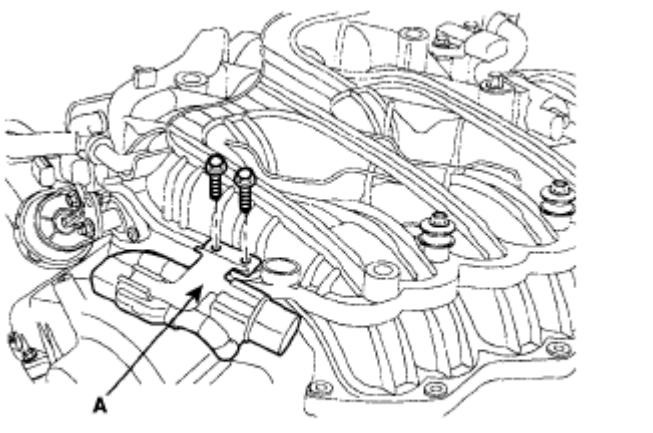
**Standard diameter :**

82.00 ~ 82.03mm (3.2283 ~ 3.2295in)



**Fig. 139: Measuring Cylinder Bore Diameter**  
Courtesy of HYUNDAI MOTOR CO.

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

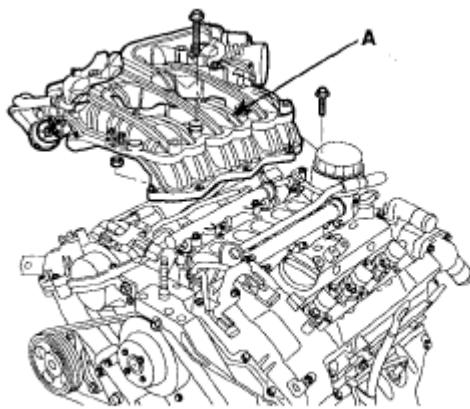


**Fig. 140: Locating Cylinder Bore Size Code On Cylinder Block Bottom Face**  
Courtesy of HYUNDAI MOTOR CO.

#### CYLINDER BORE INNER DIAMETER CHART

Class	Cylinder bore inner diameter	Size code
A	82.00 ~ 82.01mm (3.228 ~ 3.2287in)	A
B	82.01 ~ 82.02mm (3.2287 ~ 3.2291 in)	B
C	82.02 ~ 82.03mm (3.2291 ~ 3.2295in.)	C

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



KDRF179A

**Fig. 141: Locating Piston Size Code On Piston Top Face**  
Courtesy of HYUNDAI MOTOR CO.

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

#### PISTON OUTER DIAMETER CHART

Class	Piston outer diameter	Size code
A	81.97 ~ 81.98mm (3.2271 ~ 3.2275in)	A
-	81.98 ~ 81.99mm (3.2275 ~ 3.2279in)	-
C	81.99 ~ 82.00mm (3.2279 ~ 3.2283in)	C

8. Select the piston related to cylinder bore class.

#### Clearance

0.02 ~ 0.04mm (0.00078 ~ 0.00157in.)

#### Boring cylinder

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

#### IDENTIFICATION MARK CHART

Identification Mark	Size
0.25	0.25mm (0.010in)
0.50	0.50mm (0.020in)

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

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

New bore size = Piston O.D + 0.02 to 0.04 mm (0.0008 to 0.0016 in.) (clearance between piston and

cylinder)  $\sim 0.01$  mm (0.0004 in.) (honing margin.)

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

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

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

Standard :  $0.02 \sim 0.04$  mm (0.0008  $\sim 0.0016$  in.)

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

## PISTON AND RINGS

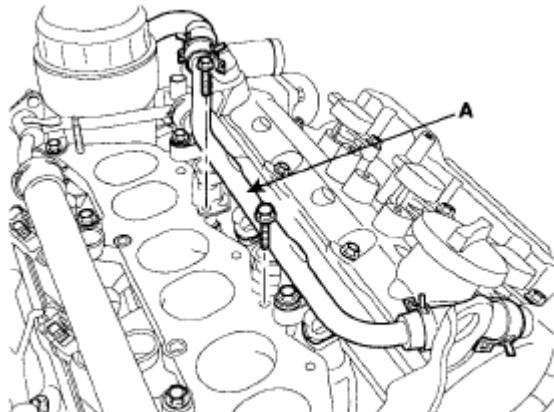
1. Clean piston
  1. Using a gasket scraper, remove the carbon from the piston top.
  2. Using a groove cleaning tool or broken ring, clean the piston ring grooves.
  3. Using solvent and a brush, thoroughly clean the piston.

**NOTE: Do not use a wire brush.**

2. The standard measurement of the piston outside diameter is taken 47 mm (1.85 in.) from the top land of the piston.

### Standard diameter

81.97  $\sim$  82.00mm (3.2272  $\sim$  3.2283in)



ECBF031A

**Fig. 142: Checking Piston Outside Diameter**  
Courtesy of HYUNDAI MOTOR CO.

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

**Piston-to-cylinder clearance**

0.02 ~ 0.04mm(0.0008 ~ 0.0016in)

4. Inspect the piston ring side clearance.

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

**Piston ring side clearance**

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

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

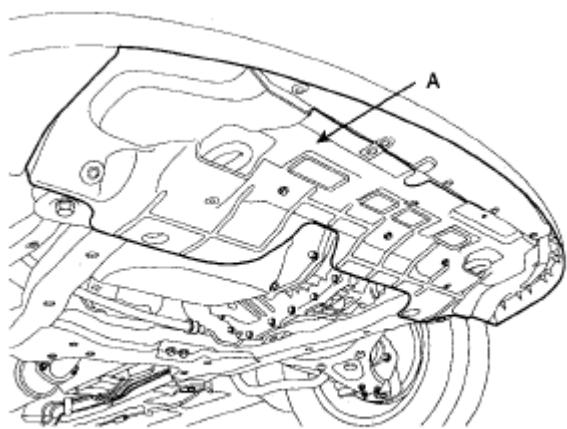
Oil ring : 0.06 ~ 0.15 mm (0.0024 ~ 0.0059 in)

Limit

No. 1 : 0.1mm (0.004in)

No. 2 : 0.1mm (0.004in)

Oil ring : 0.2 mm (0.0079 in)



ACKF064A

**Fig. 143: Measuring Clearance Between New Piston Ring And Wall Of Ring Groove**  
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 rebored.

### Piston ring end gap

#### Standard

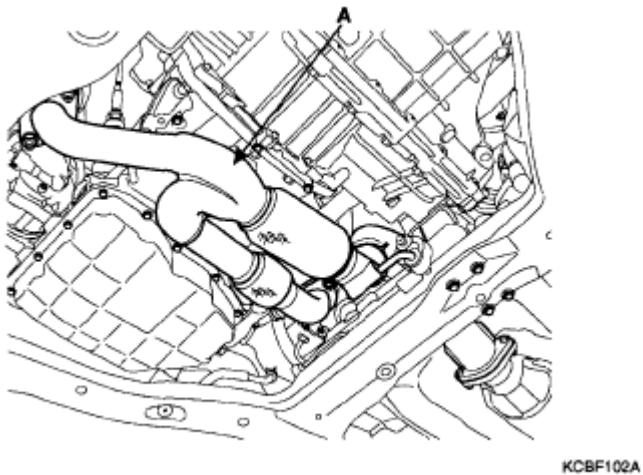
No. 1 : 0.20 ~ 0.35mm (0.0079 ~ 0.0138in)

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

Oil ring : 0.20 ~ 0.60 mm (0.0079 ~ 0.0236 in)

#### Limit

No. 1, 2, oil ring : 1.0mm (0.039in)



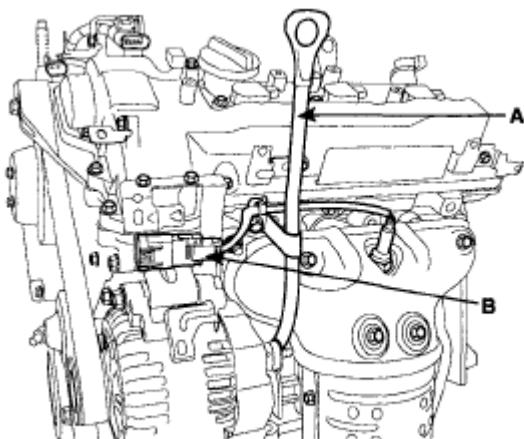
**Fig. 144: Checking Piston Ring End Gap**  
Courtesy of HYUNDAI MOTOR CO.

## PISTON PINS

### 1. Measure the diameter of the piston pin.

### Piston pin diameter

20.001 ~ 20.006mm (0.7874 ~ 0.7876in)



SEPEM6007N

**Fig. 145: Measuring Diameter Of Piston Pin**

Courtesy of HYUNDAI MOTOR CO.

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

#### **Piston pin-to-piston clearance**

0.01 ~ 0.02mm (0.0004 ~ 0.0008in)

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

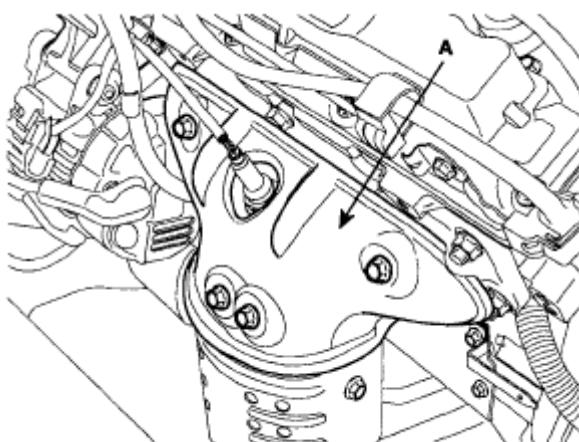
#### **Piston pin-to-connecting rod interference**

-0.032 ~ -0.016mm (-0.0013 ~ -0.00006in)

#### **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.

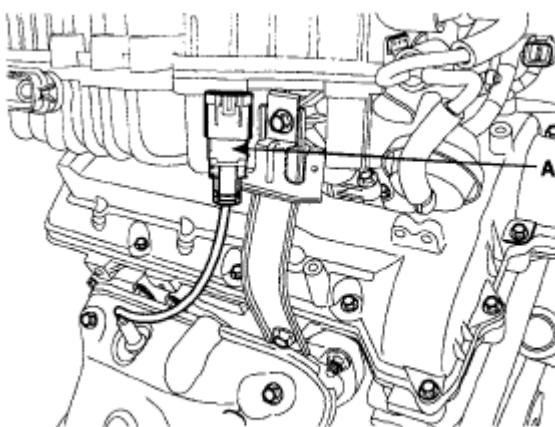


UCBF011A

**Fig. 146: Checking Continuity Between Terminal And Body**  
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 50kpa (7psi) vacuum is applied through the oil hole, the switch is operating properly.

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



KDRF177B

**Fig. 147: Checking Continuity Between Terminal And Body**  
Courtesy of HYUNDAI MOTOR CO.

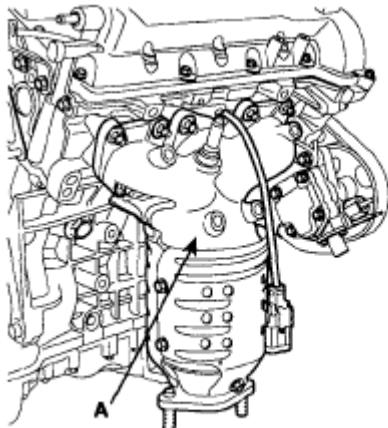
## REASSEMBLY

### NOTE:

- Thoroughly clean all parts to assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.

- Replace all gaskets, O-rings and oil seals with new parts.

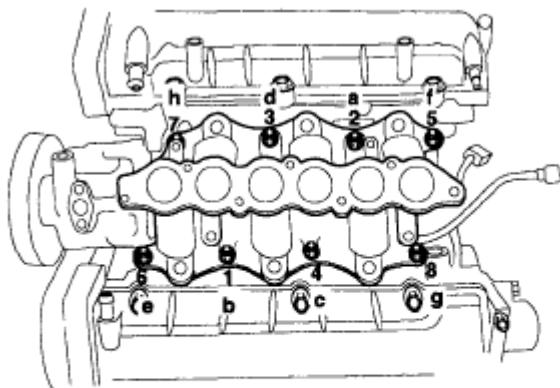
1. Assemble piston and connecting rod.
  1. Use a hydraulic press for installation.
  2. The piston front mark and the connecting rod front mark must face the timing belt side of the engine.



UCBF012A

**Fig. 148: Locating Piston Front Mark And Connecting Rod Front Mark**  
Courtesy of HYUNDAI MOTOR CO.

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

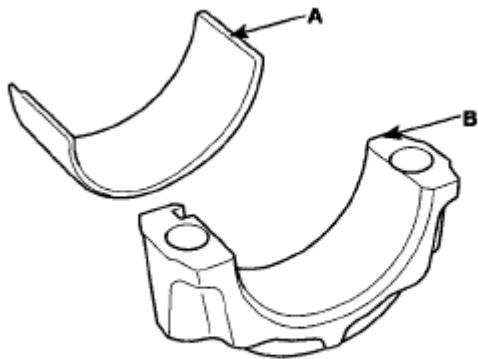


UCBF019A

**Fig. 149: Identifying Piston Rings Gap Direction**

**Courtesy of HYUNDAI MOTOR CO.**

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



ECKD322A

**Fig. 150: Locating Bearings And Connecting Rod Cap**

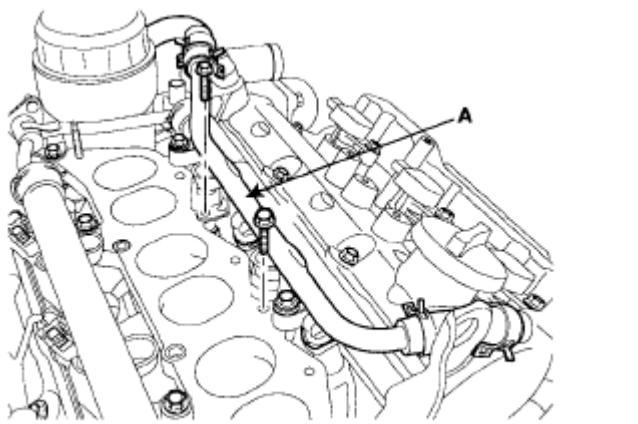
**Courtesy of HYUNDAI MOTOR CO.**

4. Install main bearings.

**NOTE:      Upper 1,2,4,5 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 5 upper bearings(A).
2. Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.
5. Install thrust bearings.

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



ECBF031A

**Fig. 151: Locating Thrust Bearings**  
Courtesy of HYUNDAI MOTOR CO.

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

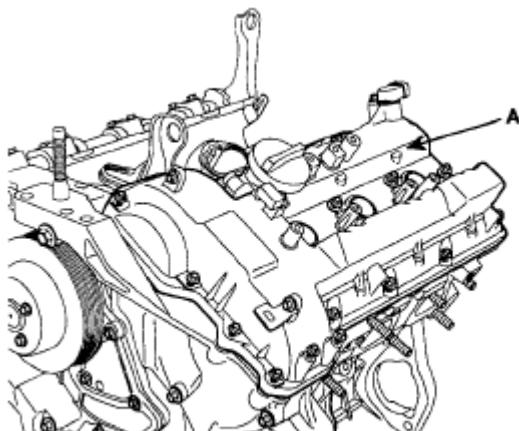
**NOTE:**

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

1. Apply a light coat of engine oil on the threads and under the bearing cap bolts.
2. Install and uniformly tighten the 10 bearing cap bolts(A), in several passes, in the sequence shown.

**Tightening torque**

27.5 ~ 31.4Nm (2.8 ~ 3.2kgf.m, 20.3 ~ 23.1lb-ft) + 60 ~ 64°



KDRF112A

**Fig. 152: Locating Bearing Cap Bolts**

**Courtesy of HYUNDAI MOTOR CO.**

3. Retighten the bearing cap bolts by  $60^\circ \sim 66^\circ$  in the numerical order shown.

#### **Tightening torque**

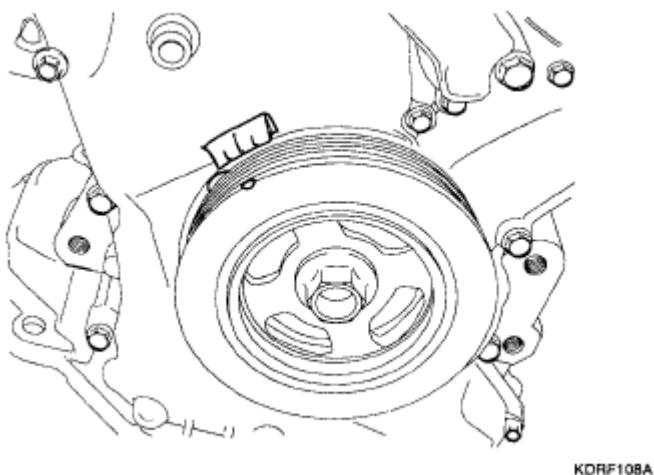
Main bearing cap bolt :  $27.5 \sim 31.4 \text{Nm}$  ( $2.8 \sim 3.2 \text{kgf.m}$ ,  $20.3 \sim 23.1 \text{lb} \sim \text{ft}$ ) +  $60 \sim 64^\circ$

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

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

1. Remove the connecting rod caps, and slip short sections of rubber hose over the threaded ends of the connecting rod bolts.
2. Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.
3. Stop after the ring compressor pops free, and check the connecting rod-to-check journal alignment before pushing the piston into place.
4. Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the nuts :  $50 \sim 53 \text{Nm}$  ( $5.0 \sim 5.3 \text{kgf.m}$ ,  $36.9 \sim 39 \text{lb-ft}$ )

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

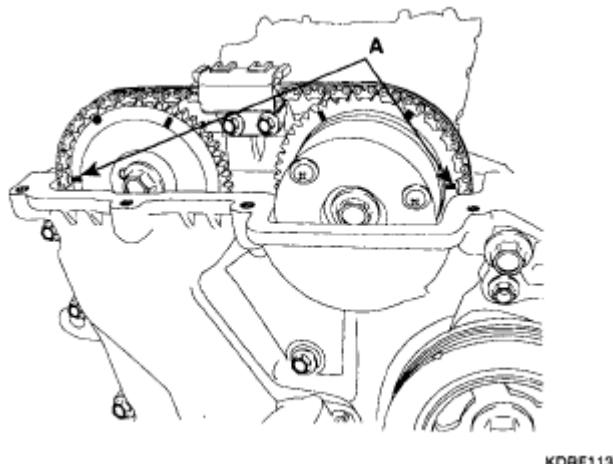


**Fig. 153: Installing Piston And Connecting Rod Assemblies**  
**Courtesy of HYUNDAI MOTOR CO.**

11. Install a new gasket and rear oil seal case (A) with 5 bolts (B).

**Tightening torque**

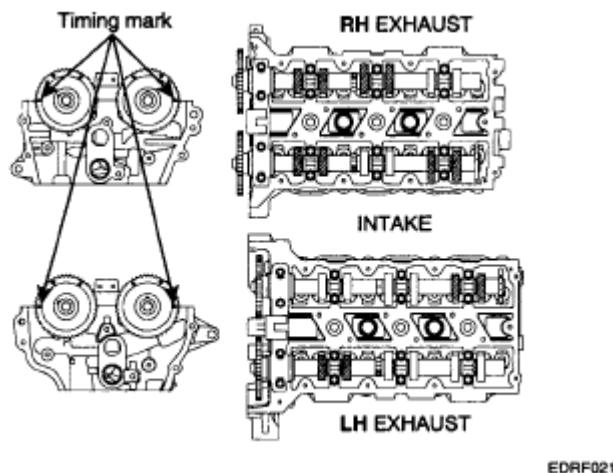
9.8 ~ 11.8Nm (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



**Fig. 154: Locating Bolts And Rear Oil Seal Case**  
Courtesy of HYUNDAI MOTOR CO.

**NOTE:** Check that the mating surfaces are clean and dry.

12. Install rear oil seal.
  1. Apply engine oil to a new oil seal lip.
  2. Using SST(09231~21000) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.



**Fig. 155: Installing Rear Oil Seal**  
Courtesy of HYUNDAI MOTOR CO.

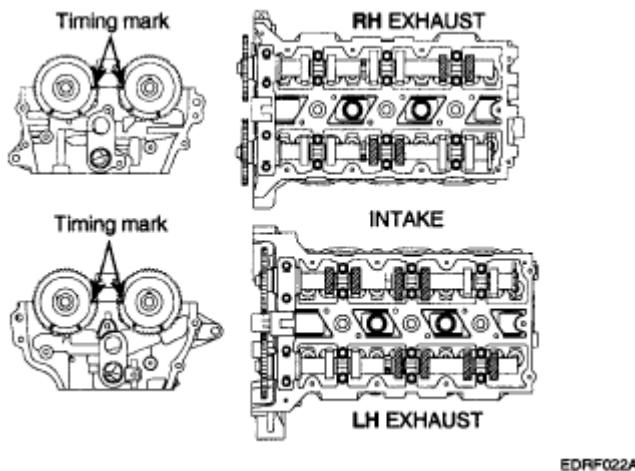
13. Install front case.

## 14. Install oil screen.

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

### Tightening torque

14.7 ~ 21.6Nm (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)



**Fig. 156: Locating Gasket, Oil Screen And Bolts**

Courtesy of HYUNDAI MOTOR CO.

## 15. Install oil pan.

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

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

2. Apply liquid gasket as an even bead, centered between the edges of the mating surface. Use liquid gasket TB 1217H' or equivalent.

**NOTE:**

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

3. Install the oil pan with the 19 bolts.

Uniformly tighten the bolts in several passes.

### Tightening torque

9.8 ~ 11.8Nm (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

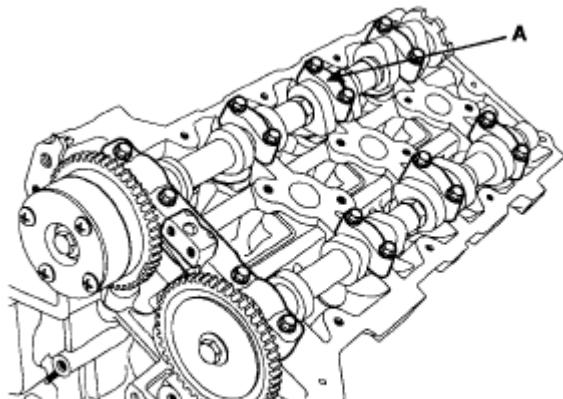
16. Install water pump.
17. Install oil pressure sensor.
  1. Apply adhesive to 2 or 3 threads.

Adhesive : Three bond 2310/2350 or equivalent.

2. Install the oil pressure sensor (A).

### Tightening torque

14.7 ~ 21.6Nm (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)



KDRF196A

**Fig. 157: Locating Oil Pressure Sensor**

Courtesy of HYUNDAI MOTOR CO.

18. Install knock sensor.

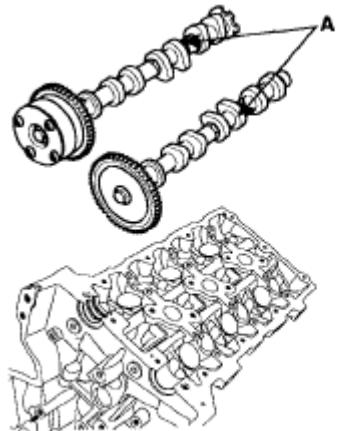
### Tightening torque

16.7 ~ 26.5Nm (1.7 ~ 2.7kgf.m, 12.3 ~ 19.5lb-ft)

19. Install oil level gauge assembly.
  1. Install a new O-ring on the oil level gauge.
  2. Apply engine oil on the O-ring.
  3. Install the oil level gauge assembly (A) with the bolt.

### Tightening torque

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



KDRF197A

**Fig. 158: Locating Oil Level Gauge Assembly**  
Courtesy of HYUNDAI MOTOR CO.

20. Install cylinder head.
21. Install timing belt.
22. Remove engine stand.
23. A/T : Install drive plate.

### Tightening torque

117.7 ~ 127.5Nm (12.0 ~ 13.0kgf.m, 86.8 ~ 94.0lb-ft)

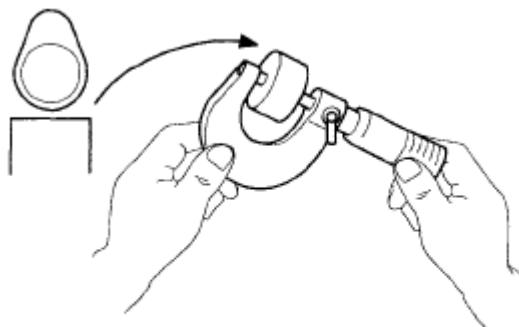
24. M/T : Install flywheel.

### Tightening torque

117.7 ~ 127.5Nm (12.0 ~ 13.0kgf.m, 86.8 ~ 94.0lb-ft)

## COOLING SYSTEM

### COMPONENTS



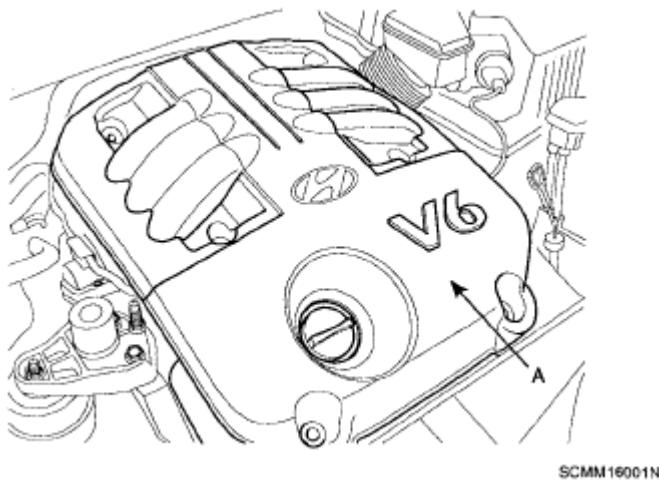
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**Fig. 159: Identifying Cooling System Components And Torque Specifications**  
Courtesy of HYUNDAI MOTOR CO.

## ENGINE COOLANT REFILLING AND BLEEDING

**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. Slide the heater temperature control lever to maximum heat. Make sure the engine and radiator are cool to the touch.
2. Remove radiator cap (A).



**Fig. 160: Locating Radiator Cap**  
Courtesy of HYUNDAI MOTOR CO.

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 "F" mark with water, then up to the

"F" mark with antifreeze.

6. Mix the recommended antifreeze with water at the ratio of four to six in a clean container.

**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.

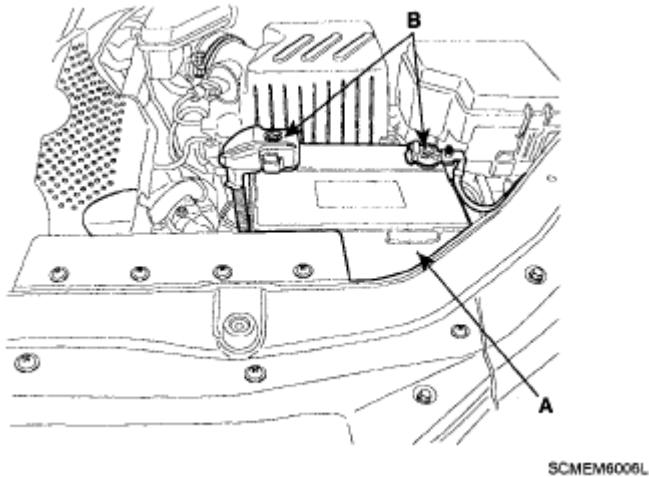
**CAUTION:**

- Do not mix different brands of antifreeze/coolants.
- Do not use additional anti-leak products, rust inhibitors or anti-rust products; they may not be compatible with the coolant.

7. Pour coolant into the radiator up to base of the filler neck, and install the radiator cap loosely.
8. Start the engine and let it run until it warms up (the radiator fan comes on at least twice).
9. Turn off the engine. Check the level in the radiator, add coolant if needed.
10. Put the radiator cap on tightly, then run the engine again and check for leaks.

**CAP TESTING**

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



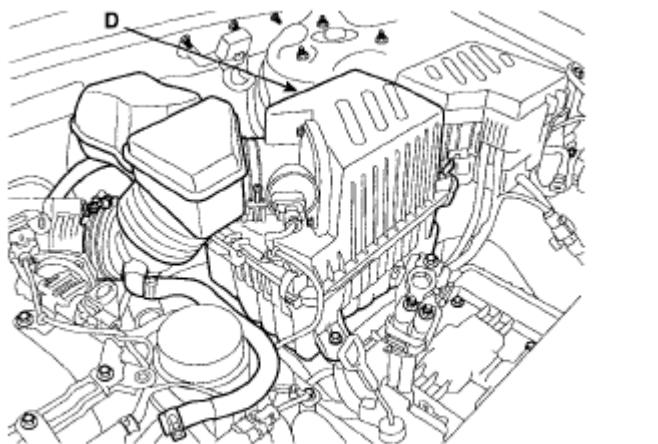
**Fig. 161: Checking Radiator Cap**  
Courtesy of HYUNDAI MOTOR CO.

2. Apply a pressure of 93.16 ~ 122.58kPa (0.95 ~ 1.25kgf/cm<sup>2</sup> , 13.51 ~ 17.78psi)
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.
2. Apply a pressure tester to the radiator and apply a pressure of 93.16 ~ 122.58kPa (0.95 ~ 1.25kgf/cm<sup>2</sup> 13.51 ~ 17.78psi).



**Fig. 162: Applying Pressure Tester To Radiator**  
Courtesy of HYUNDAI MOTOR CO.

3. Inspect for engine coolant leaks and a drop in pressure.
4. Remove the tester and reinstall the radiator cap.

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

## REMOVAL

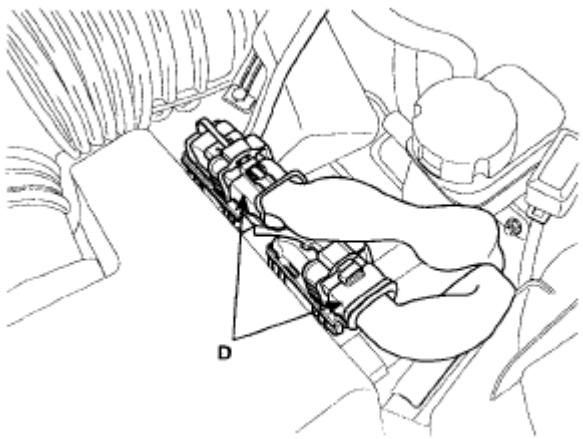
### WATER PUMP

1. Drain the engine coolant.

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

2. Remove drive belts.
3. Remove the timing belt.
4. Remove the timing belt idler.
5. Remove the water pump.

1. Remove the 4 bolts and pump pulley.
2. Remove the 2 bolts(C), then remove the alternator brace (A).
3. Remove the water pump (B) and gasket.

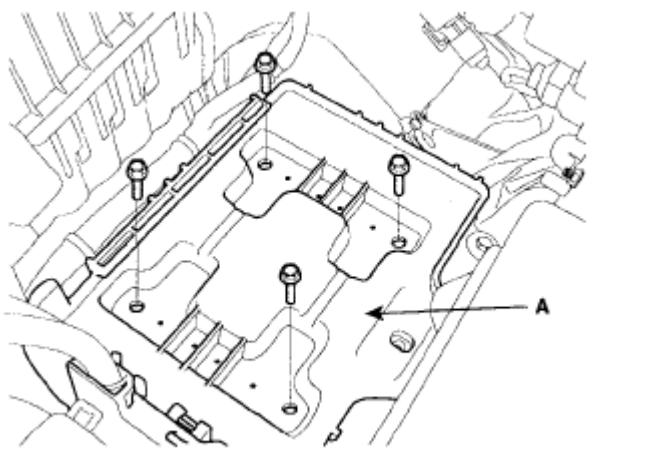


**Fig. 163: Locating Bolts, Alternator Brace And Water Pump**  
Courtesy of HYUNDAI MOTOR CO.

#### THERMOSTAT

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

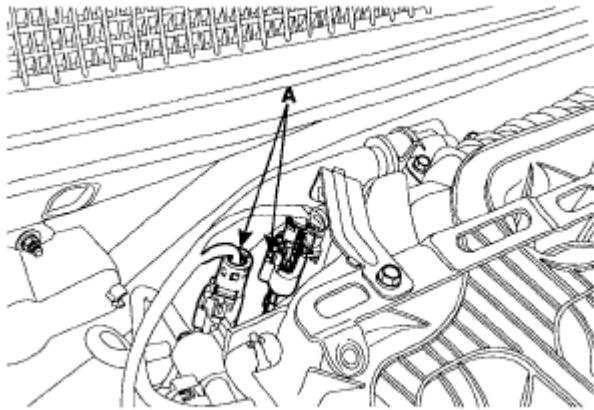
1. Drain engine coolant so its level is below thermostat.
2. Remove water inlet (A), gasket and thermostat.



**Fig. 164: Locating Water Inlet**  
Courtesy of HYUNDAI MOTOR CO.

## RADIATOR

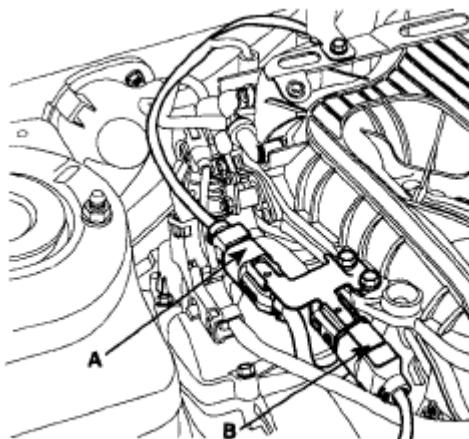
1. Drain the engine coolant.
2. Remove the upper and lower radiator hoses (A, B), and ATF cooler hoses.



KDRF151A

**Fig. 165: Locating Upper And Lower Radiator Hoses**  
Courtesy of HYUNDAI MOTOR CO.

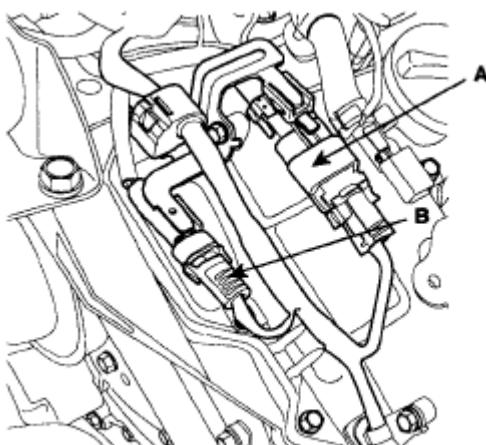
3. Disconnect the fan motor connector(A).



KDRF153A

**Fig. 166: Locating Fan Motor Connector**  
Courtesy of HYUNDAI MOTOR CO.

4. Separate the air conditioner condenser with radiator.
  1. Remove the battery and battery tray.
  2. Remove the air duct and make task space.
5. Remove the radiator upper bracket (A), then pull up the radiator.



KDRF155A

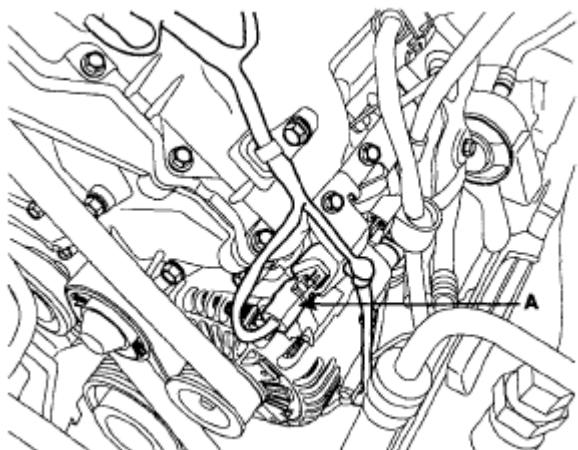
**Fig. 167: Locating Radiator Upper Bracket**

Courtesy of HYUNDAI MOTOR CO.

## 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.



KDRF156A

**Fig. 168: Identifying Water Pump**

Courtesy of HYUNDAI MOTOR CO.

3. Check for coolant leakage. If coolant leaks from hole, the seal is defective. Replace the coolant pump assembly

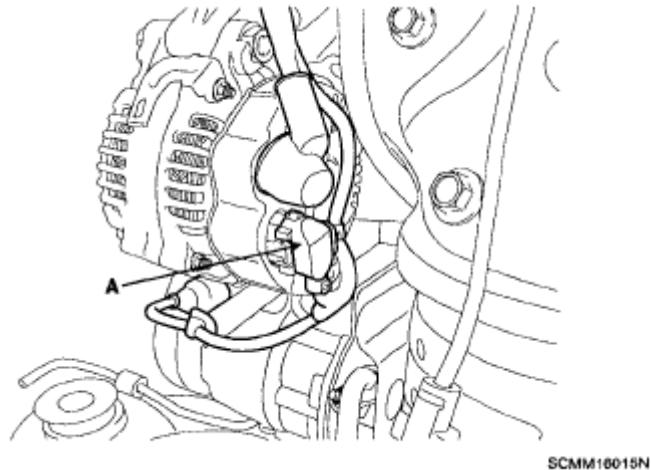
**NOTE: A small amount of "weeping" from the bleed hole is normal.**

## THERMOSTAT

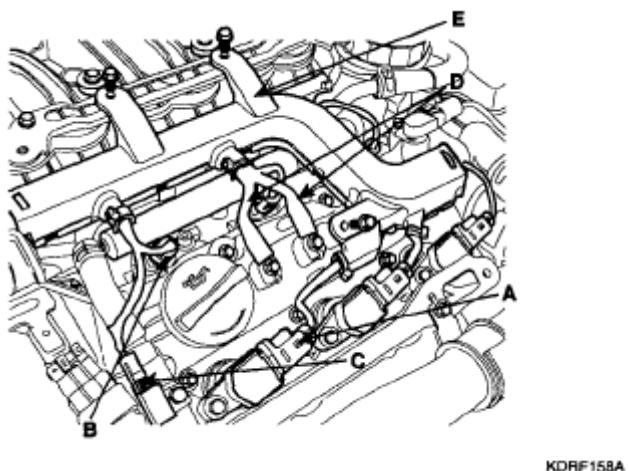
1. Immerse the thermostat in water and gradually heat the water.
2. Check the valve opening temperature.

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

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



**Fig. 169: Checking Valve Opening Temperature**  
Courtesy of HYUNDAI MOTOR CO.



**Fig. 170: Locating Water Inlet**  
Courtesy of HYUNDAI MOTOR CO.

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

3. Check the valve lift.

Valve lift: 8mm(0.3in.) or more at 95 °C(205 °F)

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

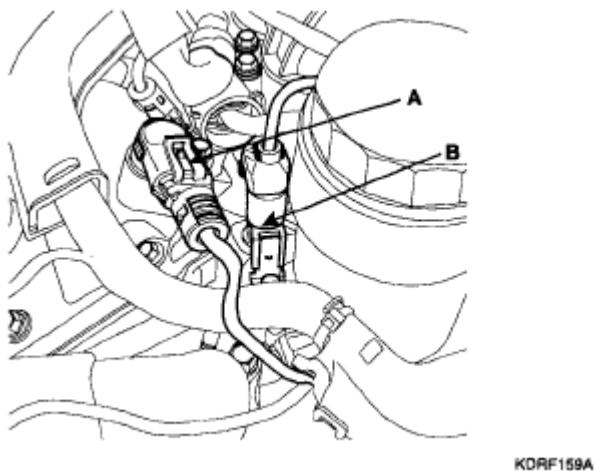
## INSTALLATION

### WATER PUMP

1. Install the water pump.
  1. Install the water pump (B) and a new gasket with the 3 bolts(C).

#### Tightening torque

11.8 ~ 14.7Nm (1.2 ~ 1.5kgf.m, 8.7 ~ 10.8lb-ft)



**Fig. 171: Locating Water Pump And Bolts**  
Courtesy of HYUNDAI MOTOR CO.

2. Install the alternator brace (A) with the 2 bolts (D).

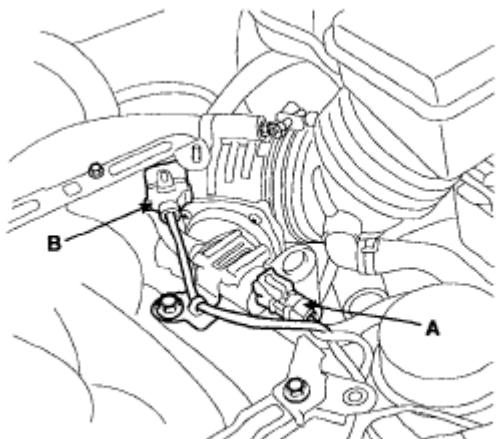
#### Tightening torque

19.6 ~ 26.5Nm (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)

3. Install the 4 bolts and pump pulley.
2. Install the timing belt idler.
3. Install the timing belt.
4. Install drive belts.
5. Fill with engine coolant.
6. Start engine and check for leaks.
7. Recheck engine coolant level.

**THERMOSTAT**

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



SCMM16019N

**Fig. 172: Locating Gasket And Thermostat**

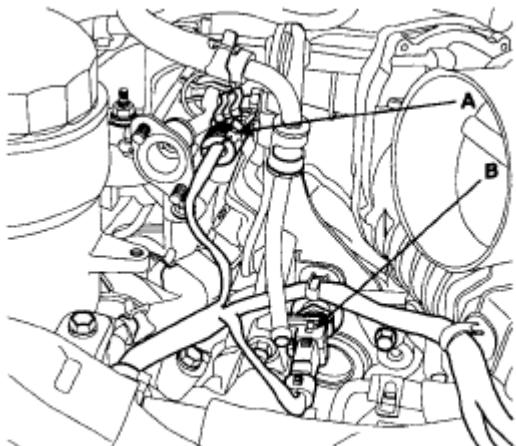
Courtesy of HYUNDAI MOTOR CO.

2. Install water inlet (A).

**Tightening torque**

14.7 ~ 19.6Nm (1.5 ~ 2.0kgf.m, 10.8 ~ 14.5lb-ft)

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

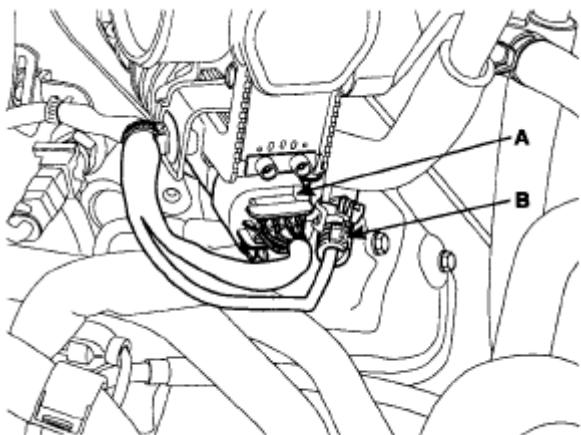


KDRF161A

**Fig. 173: Locating Water Inlet**  
Courtesy of HYUNDAI MOTOR CO.

**RADIATOR**

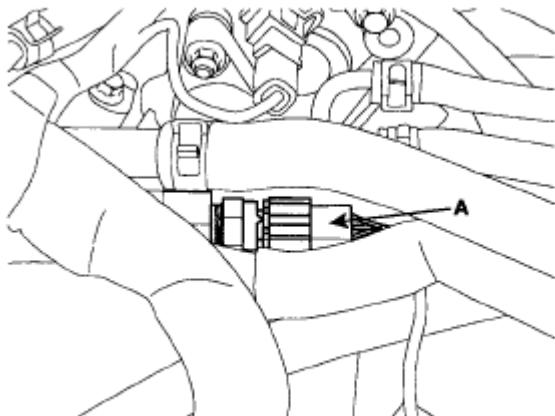
1. Install the cooling fan to the radiator.
2. Install the radiator at the air conditioner condenser. Installation is in the reverse order of removal.
3. Connect the fan motor connector(A).



KDRF162A

**Fig. 174: Locating Fan Motor Connector**  
Courtesy of HYUNDAI MOTOR CO.

4. Install the upper and lower radiator hoses(A, B), and ATF cooler hoses.



KDRF163A

**Fig. 175: Locating Upper And Lower Radiator Hoses**  
Courtesy of HYUNDAI MOTOR CO.

5. Fill with engine coolant.

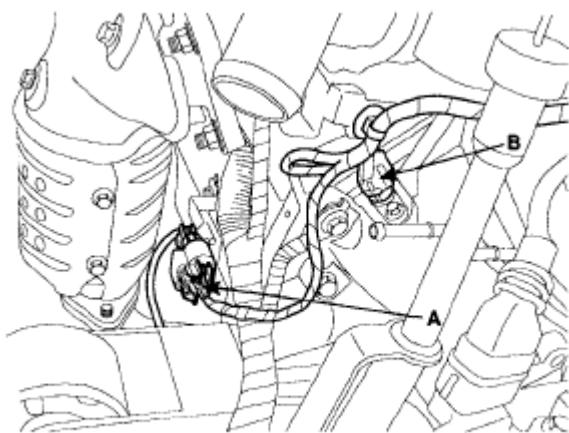
**Quantity :**

6.5 ~ 6.6L (6.87 ~ 6.97US qt, 5.72 ~ 5.81 lmp qt)

6. Start engine and check for leaks.

## LUBRICATION SYSTEM

### COMPONENTS



KDRF164A

**Fig. 176: Identifying Lubrication System Components And 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 stop, oil level should be between the "L" and "F" marks on the dipstick.

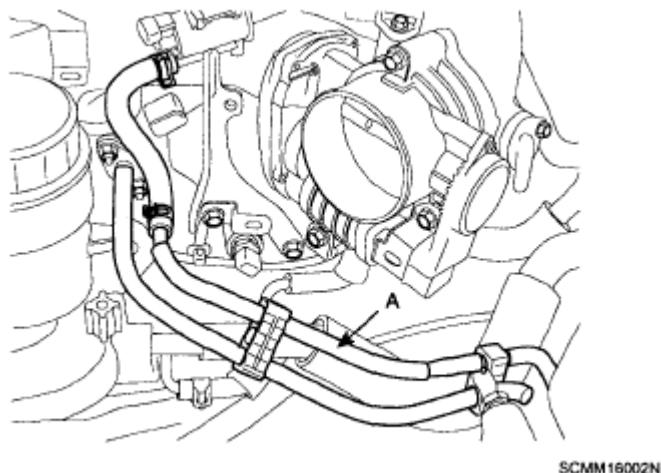
If low, check for leakage and add oil up to the "F" mark.

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

### SELECTION OF ENGINE OIL

Recommended API classification : Above SJ or SL

Recommended SAE viscosity grades :



**Fig. 177: SAE Viscosity Grades Chart**  
Courtesy of HYUNDAI MOTOR CO.

**\*1 If 5W-20 / GF3 engine oil is not available, 5W-30/GF3 or secondary recommended engine oil for corresponding temperature range can be used.**

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

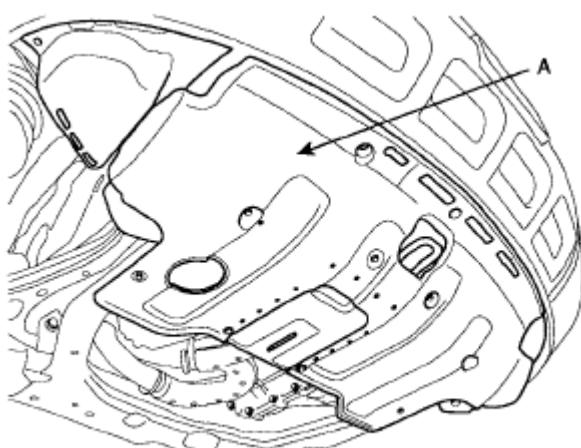
- 1. Satisfy the requirement of the API classification.**
- 2. Have proper SAE grade number for expected ambient temperature range.**

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

## REMOVAL

### ED6D811C

1. Drain engine oil.
2. Remove the drive belts.
3. Turn the crankshaft and align the white groove on the crankshaft pulley with the pointer on the lower cover.
4. Remove the timing belt.
5. Remove the oil pan and oil screen.
6. Remove the front case.

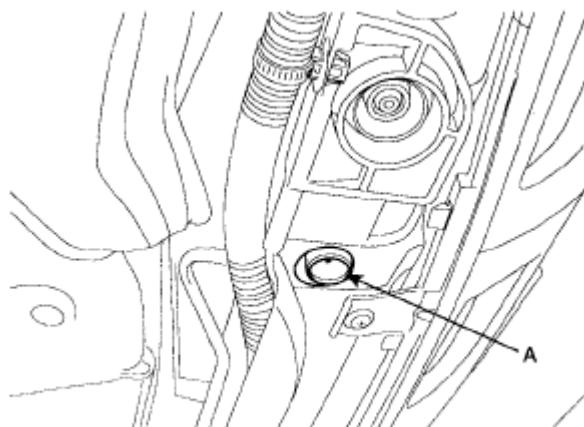


SCMM16006N

**Fig. 178: Locating Bolts**

Courtesy of HYUNDAI MOTOR CO.

1. Remove the screws (B) from the pump housing, then separate the housing and cover (A).

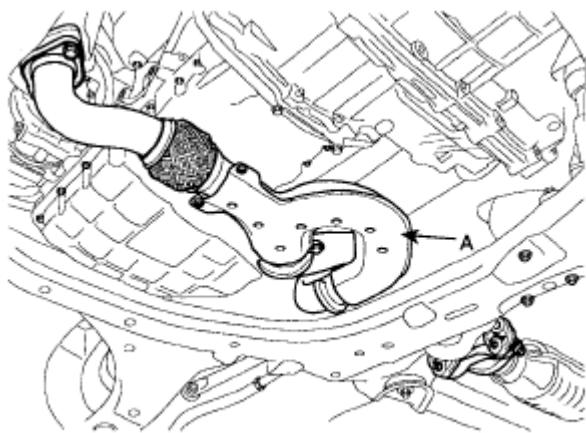


SCMM16007N

**Fig. 179: Locating Screws And Housing And Cover**

Courtesy of HYUNDAI MOTOR CO.

2. Remove the inner (A) and outer (B) rotors.



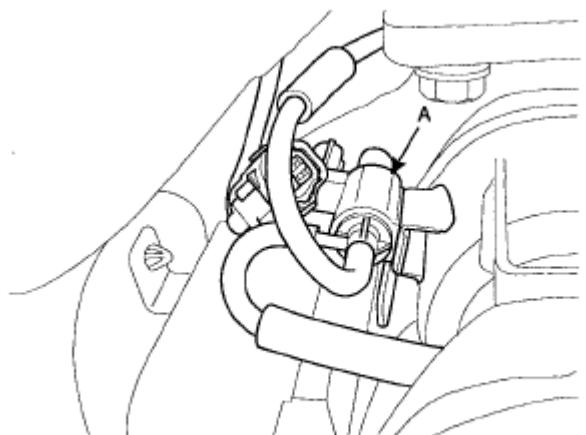
SCMM16008N

**Fig. 180: Locating Inner And Outer Rotors**  
Courtesy of HYUNDAI MOTOR CO.

## DISASSEMBLY

1. Remove the relief plunger.

Remove the plug(A), spring(B) and relief plunger(A).



SCMM16009N

**Fig. 181: Locating Plug, Spring And Relief Plunger**  
Courtesy of HYUNDAI MOTOR CO.

## INSPECTION

1. Inspect relief plunger.

Coat the valve with engine oil and check that it falls smoothly into the plunger hole by its own weight. If it does not, replace the relief plunger. If necessary, replace the front case.

**2. Inspect relief valve spring.**

Inspect for distorted or broken relief valve spring.

**Standard value**

Free height : 43.8mm (1.724 in.)

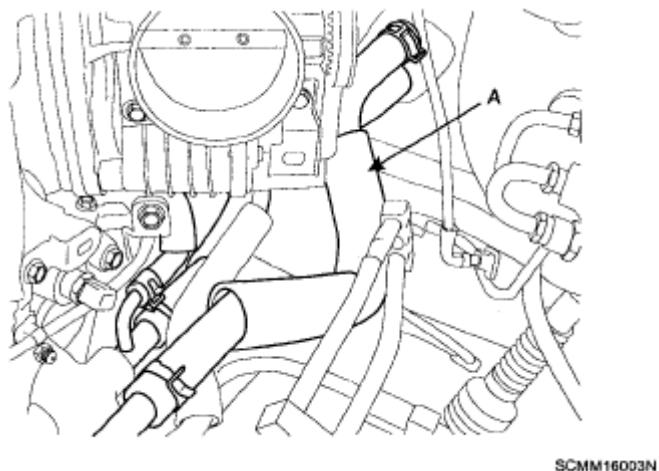
Load :  $3.7 \pm 0.4$ kg/40.1mm (8.14 lb/1.579 in.)

**3. Inspect rotor side clearance.**

Using a feeler gauge and precision straight edge, measure the clearance between the rotors and precision straight edge.

**SIDE CLEARANCE CHART**

Side clearance	Outer gear	0.04 ~ 0.09mm (0.0016 ~ 0.0035in.)
	Inner gear	0.04 ~ 0.085mm (0.0016 ~ 0.0033in.)



**Fig. 182: Inspecting Rotor Side Clearance**  
Courtesy of HYUNDAI MOTOR CO.

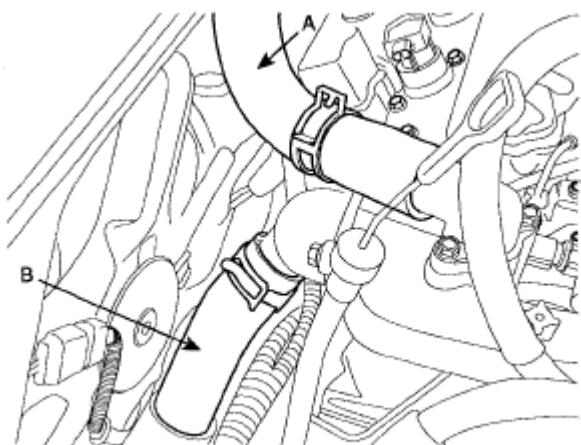
If the side clearance is greater than maximum, replace the rotors as a set. If necessary, replace the front case.

**4. Inspect rotor tip clearance.**

Using a feeler gauge, measure the tip clearance between the inner and outer rotor tips.

**Tip clearance**

0.025 ~ 0.069 mm(0.0010 ~ 0.0027 in.)



SCMM16004N

**Fig. 183: Inspecting Rotor Tip Clearance**

Courtesy of HYUNDAI MOTOR CO.

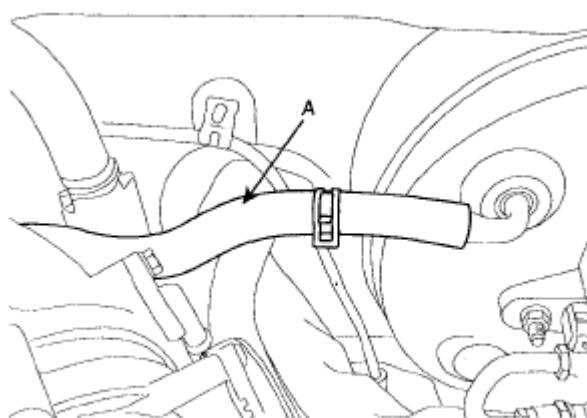
If the tip clearance is greater than maximum, replace the rotor as a set.

5. Inspect rotor body clearance.

Using a feeler gauge, measure the clearance between the outer rotor and body.

#### Body clearance

0.12 ~ 0.185 mm(0.0047 ~ 0.0073 in.)



SCMM16005N

**Fig. 184: Inspecting Rotor Body Clearance**

Courtesy of HYUNDAI MOTOR CO.

If the body clearance is greater than maximum, replace the rotors as a set. If necessary, replace the front case.

## 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. Drain engine oil.
  - a. Remove the oil filter cap.
  - b. Remove the oil drain plug, and drain the oil into a container.
2. Replace oil filter.
  - a. Remove the oil filter.
  - b. Check and clean the oil filter installation surface.
  - c. Check the part number of the new oil filter is as same as old one.
  - d. Apply clean engine oil to the gasket of a new oil filter.
  - e. Lightly screw the oil filter into place, and tighten it until the gasket contacts the seat.
  - f. Tighten it an additional 3/4 turn.
3. Refill with engine oil filter.
  - a. Clean and install the oil drain plug with a new gasket.

**Torque :**

39.2 ~ 44.1 N.m (4.0 ~ 4.5kgf.m, 28.9 ~ 32.5lb-ft)

- b. Fill with fresh engine oil

**Capacity**

Drain and refill : 4.1L (4.33 US qts, 3.60 Imp qts)

Oil pan: 3.7L (3.91 US qts, 3.26 Imp qts)

Drain & refill including oil filter: 4.0L (4.23 US qts, 3.25 Imp qts)

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

- c. Install the oil filter cap.
4. Start engine and check for oil leaks.
5. Recheck engine oil level.

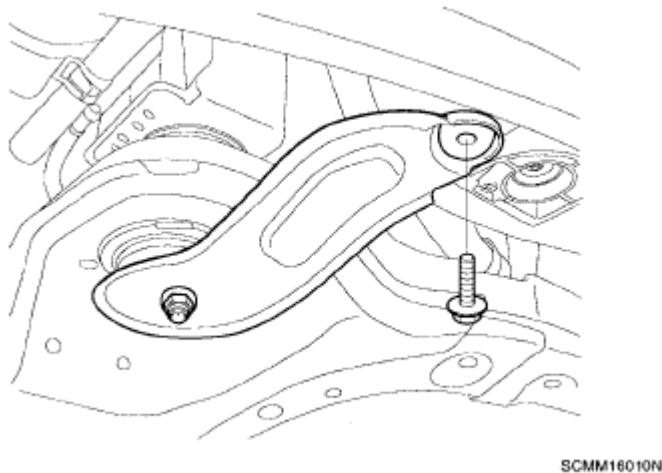
## REASSEMBLY

1. Install relief plunger.

Install relief plunger(A) and spring(B) into the front case hole, and install the plug(A).

### Tightening torque

39.2 ~ 49.0N.m (4.0 ~ 5.0kgf.m, 28.9 ~ 36.2lb-ft)



**Fig. 185: Locating Plug, Spring And Relief Plunger**  
Courtesy of HYUNDAI MOTOR CO.

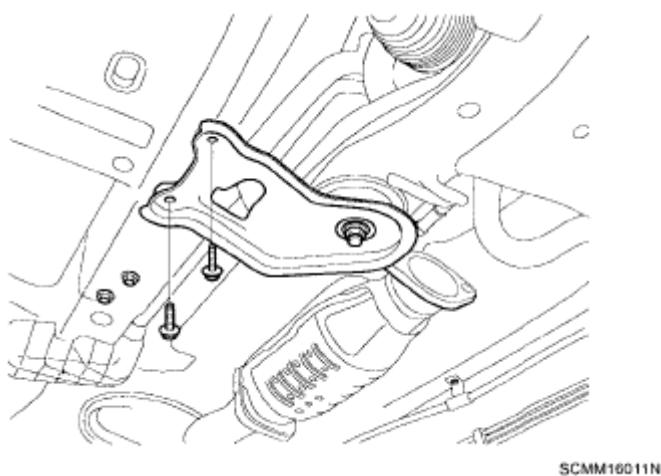
## INSTALLATION

1. Install oil pump.
  1. Place the inner and outer rotors into front case with the marks facing the oil pump cover side.
  2. Install the oil pump cover (A) to front case with the 7 screws(B).

### Tightening torque

5.9 ~ 8.8N.m (0.6 ~ 0.9kgf.m, 4.3 ~ 6.5lb-ft)

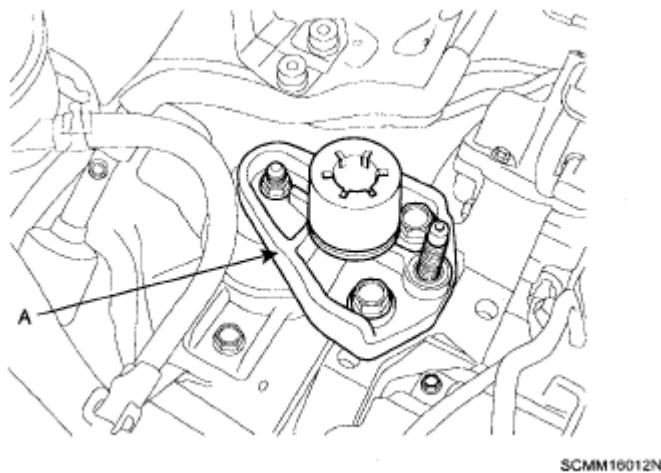
2. Check that the oil pump turns freely.



**Fig. 186: Locating Screws And Housing And Cover**  
Courtesy of HYUNDAI MOTOR CO.

3. Install the oil pump on the cylinder block.

Place a new front case gasket on the cylinder block. Apply engine oil to the lip of the oil pump seal. Then, install the oil pump onto the crankshaft. When the pump is in place, clean any excess grease off the crankshaft and check that the oil seal lip is not distorted.

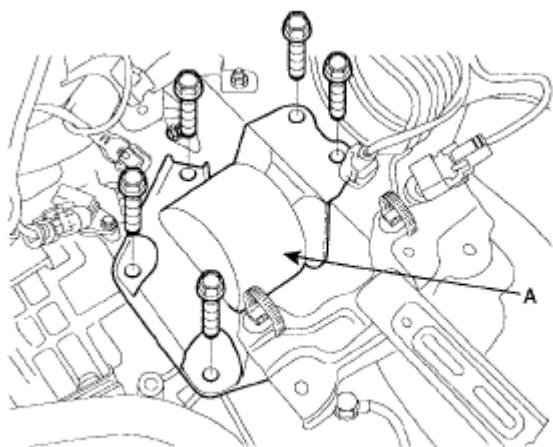


**Fig. 187: Locating Bolts**  
Courtesy of HYUNDAI MOTOR CO.

#### Tightening torque

18.6 ~ 23.5N.m (1.9 ~ 2.4kgf.m, 13.7 ~ 17.41 lb-ft)

4. Apply a light coat of oil to the seal lip.
5. Using the SST(09214~32000), install the oil seal.



SCMM16013N

**Fig. 188: Installing Oil Seal**

Courtesy of HYUNDAI MOTOR CO.

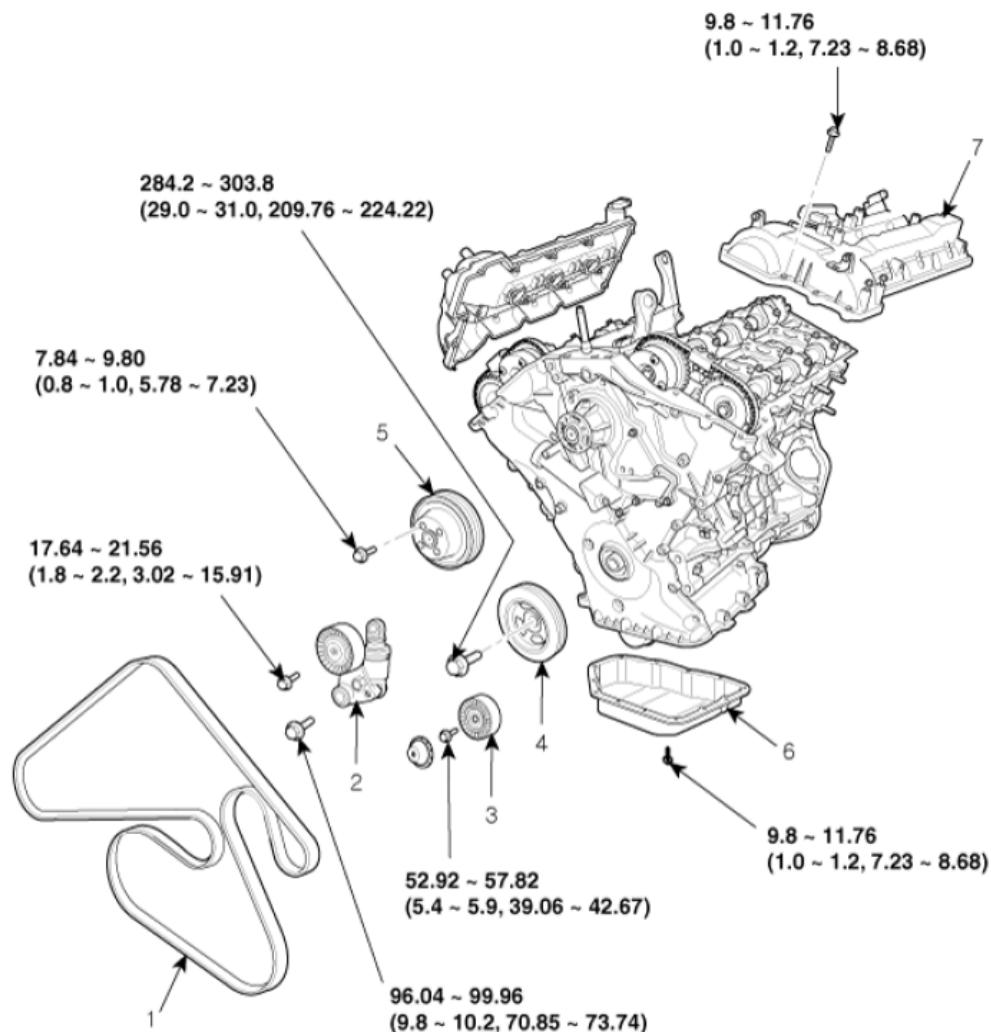
6. Install the oil screen.
7. Install the oil pan.

**NOTE: Clean the oil pan gasket mating surfaces.**

## INTAKE AND EXHAUST SYSTEM

### INTAKE MANIFOLD

#### COMPONENTS



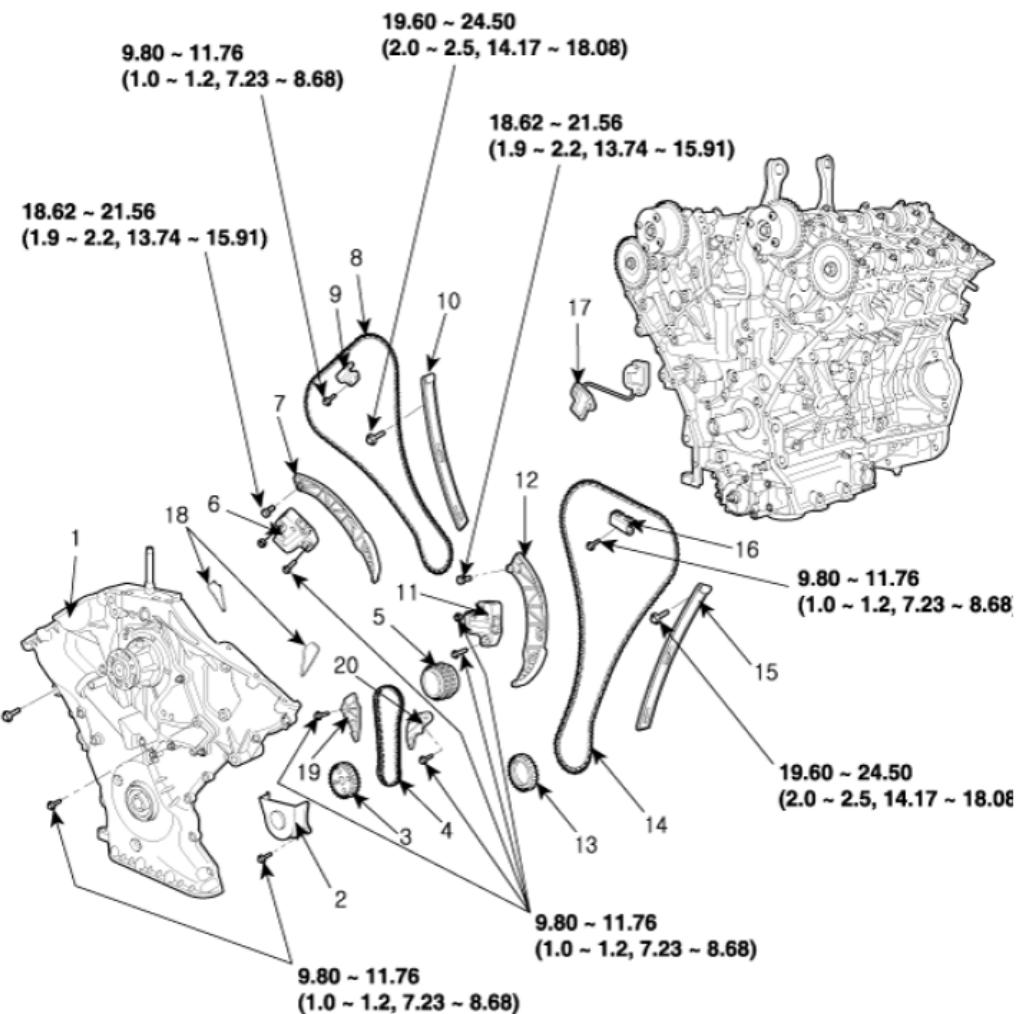
**TORQUE : N.m (kgf.m, lbf.ft)**

1. Drive belt	5. Water pump pulley
2. Drive belt tensioner	6. Oil pan
3. Idler	7. Cylinder head cover
4. Damper pulley	

**Fig. 189: Identifying Intake Manifold Components And Torque Specifications**  
Courtesy of HYUNDAI MOTOR CO.

#### REMOVAL

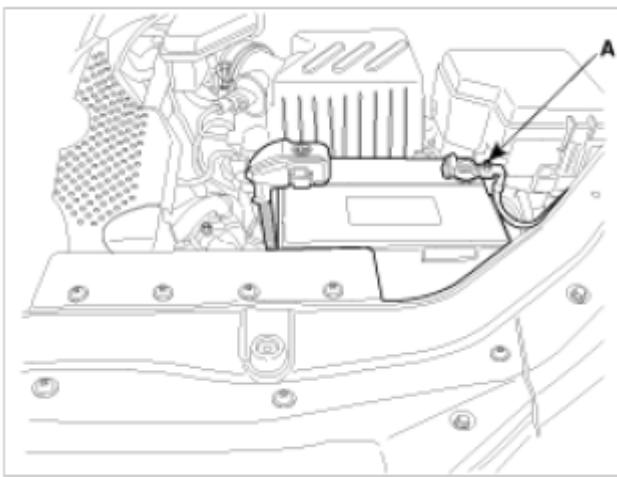
1. Removal the engine cover (A).

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

1. Timing chain cover	8. Timing chain	15. Timing chain guide
2. Oil pump chain cover	9. Cam to cam guide	16. Cam to cam guide
3. Oil pump sprocket	10. Timing chain guide	17. Tensioner adapter
4. Oil pump chain	11. Timing chain auto tensioner	18. Gasket
5. Crankshaft sprocket	12. Timing chain tensioner arm	19. Oil pump chain guide
6. Timing chain auto tensioner	13. Crankshaft sprocket	20. Oil pump tensioner assy
7. Timing chain tensioner arm	14. Timing chain	

**Fig. 190: Locating Engine Cover**  
Courtesy of HYUNDAI MOTOR CO.

2. Disconnect the throttle position sensor(TPS) and the idle speed actuator(ISA) connectors.
3. Disconnect the positive crankcase ventilation(PCV) hose and the breather hose.
4. Disconnect the accelerator cable.
5. Remove the delivery pipe(A).



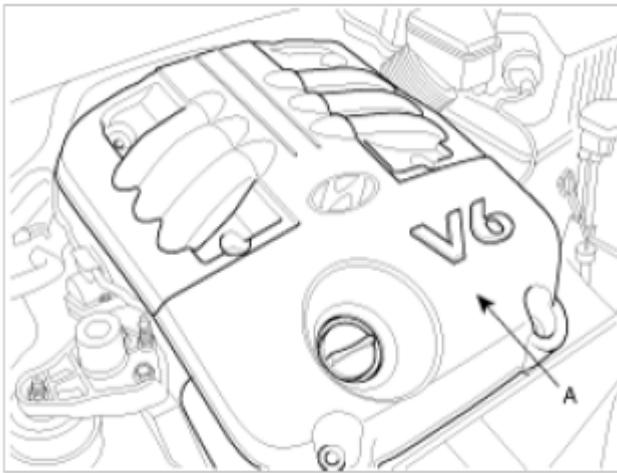
**Fig. 191: Locating Delivery Pipe**

Courtesy of HYUNDAI MOTOR CO.

6. Disconnect the pulge control solenoid valve(PCSv) hose and the brake booster hose from the intake manifold and throttle body assembly.
7. Remove the intake manifold stay(A).

#### **Tightening torque**

17.7 ~ 24.5Nm (1.8 ~ 2.5kgf.m, 13.0 ~ 18.1 lb-ft)



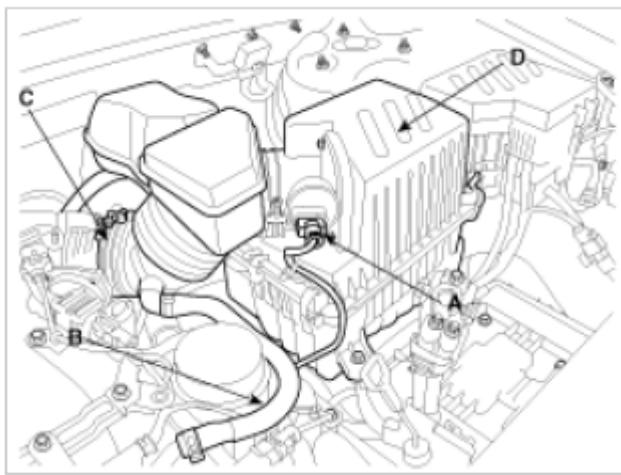
**Fig. 192: Locating Intake Manifold Stay**

Courtesy of HYUNDAI MOTOR CO.

8. Remove the intake manifold assembly(A).

#### **Tightening torque**

15.7 ~ 22.6Nm (1.6 ~ 2.3kgf.m, 11.6 ~ 16.6lb-ft)

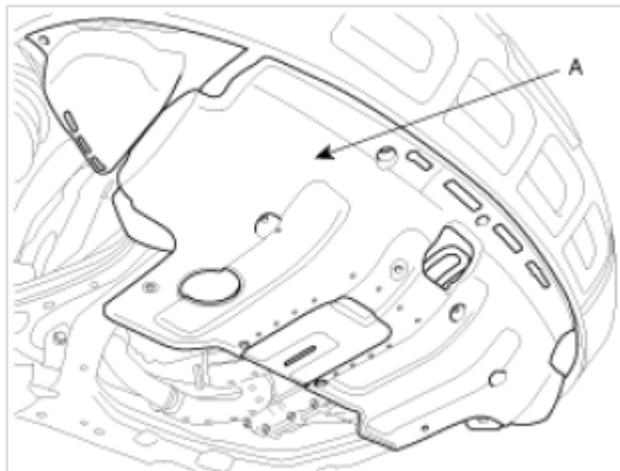


**Fig. 193: Locating Intake Manifold Assembly**  
Courtesy of HYUNDAI MOTOR CO.

9. To install, reverse the removal procedure with new gaskets.

## EXHAUST MANIFOLD

### COMPONENTS



**Fig. 194: Identifying Exhaust Manifold Components And Torque Specifications**  
Courtesy of HYUNDAI MOTOR CO.

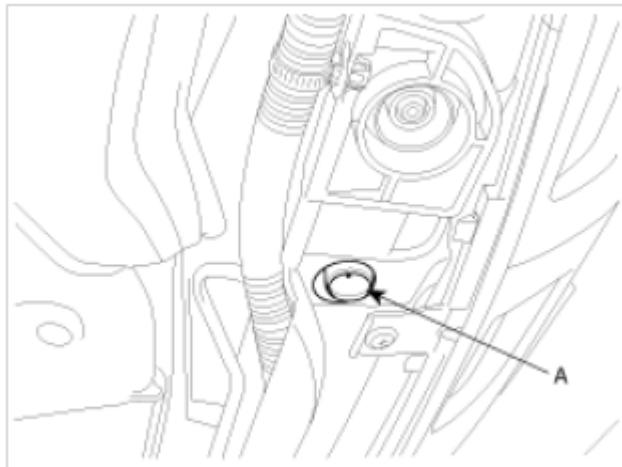
### REMOVAL

1. Remove the engine cover.
2. Disconnect the front oxygen sensor connector.
3. Remove the front muffler.

### Tightening torque

39.8 ~ 58.8Nm (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)

4. Remove the heat protector.
5. Remove the exhaust manifold and catalytic converter assembly(A).



**Fig. 195: Locating Exhaust Manifold And Catalytic Converter Assembly**

Courtesy of HYUNDAI MOTOR CO.