

2008 Hyundai Accent SE

2008 ENGINE Engine Mechanical System (G4ED-GSL 1.6) - Accent

2008 ENGINE**Engine Mechanical System (G4ED-GSL 1.6) - Accent****GENERAL****SPECIFICATION****ENGINE GENERAL SPECIFICATIONS**

Description		Specifications	Limit
		1.6 CVVT	
General			
Type		In-line, DOHC	
Number of cylinders		4	
Bore		76.5 mm (3.0118 in.)	
Stroke		87 mm (3.4252 in.)	
Total displacement		1,599 cc (97.57 cu. in.)	
Compression ratio		10.0: 1	
Firing order		1-3-4-2	
Valve timing			
Intake valve	Opens (BTDC)	-8°	
	Closes (ABDC)	60°	
Exhaust valve	Opens (BBDC)	46°	
	Closes (ATDC)	10°	
Cylinder head			
Flatness of gasket surface		Less than 0.03 mm (0.0012 in.)	
Flatness of manifold mounting surface	Intake	Less than 0.15 mm (0.0059 in.)	
	Exhaust	Less than 0.15 mm (0.0059 in.)	
Valve guide hole diameter (Intake, Exhaust)	STD	11.000 ~ 11.018 mm (0.4331 ~ 0.4338 in.)	
	0.05 OS	11.050 ~ 11.068 mm (0.4350 ~ 0.4357 in.)	
	0.25 OS	11.250 ~ 11.268 mm (0.4429 ~ 0.4436 in.)	
	0.50 OS	11.500 ~ 11.518 mm (0.4528 ~ 0.4535 in.)	
Intake valve seat ring hole diameter	STD	30.400 ~ 30.421 mm (1.1968 ~ 1.1977 in.)	
	0.3 OS	30.700 ~ 30.721 mm (1.2087 ~ 1.2095 in.)	

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	0.6 OS	31.000 ~ 31.021 mm (1.2205 ~ 1.2213 in.)	
Exhaust valve seat ring hole diameter	STD	27.000 ~ 27.021 mm (1.0630 ~ 1.0638 in.)	
	0.3 OS	27.300 ~ 27.321 mm (1.0748 ~ 1.0756 in.)	
	0.6 OS	27.600 ~ 27.621 mm (1.0866 ~ 1.0874 in.)	
Camshaft			
Cam height	Intake	43.7492 ~ 43.9492 mm (1.72241 ~ 1.73028 in.)	
	Exhaust	44.1494 ~ 44.3494 mm (1.73816 ~ 1.74604 in.)	
Journal outer diameter (Intake, Exhaust)		26.964 ~ 26.980 mm (1.0616 ~ 1.0622 in.)	
Camshaft cap oil clearance		0.02 ~ 0.061 mm (0.0008 ~ 0.0024 in.)	
End play		0.10 ~ 0.20 mm (0.0039 ~ 0.0079 in.)	
Valve			
Valve length	Intake	91.8 mm (3.6142 in.)	
	Exhaust	92.4 mm (3.6378 in.)	
Stem outer diameter	Intake	5.965 ~ 5.980 mm (0.2348 ~ 0.2354 in.)	
	Exhaust	5.950 ~ 5.965 mm (0.2343 ~ 0.2348 in.)	
Face angle		45° ~ 45°30'	
Thickness of valve head (margin)	Intake	1.1 mm (0.0433 in.)	0.8 mm (0.0315 in.)
	Exhaust 1.3 mm	(0.0512 in.)	1.0 mm (0.0394 in.)
Valve stem to valve guide clearance	Intake	0.02 ~ 0.05 mm (0.0008 ~ 0.0020 in.)	0.10 mm (0.0039 in.)
	Exhaust	0.035 ~ 0.065 mm (0.0014 ~ 0.0026 in.)	0.15 mm (0.0059 in.)
Valve guide			
Length	Intake	36.3 ~ 36.7 mm (1.4291 ~ 1.4449 in.)	
	Exhaust	39.3 ~ 39.7 mm (1.5472 ~ 1.5630 in.)	
Valve seat			
Width of seat contact	Intake	0.8 ~ 1.2 mm (0.0315 ~ 0.0472 in.)	
	Exhaust	1.3 ~ 1.7 mm (0.0512 ~ 0.0669 in.)	
	Intake	45° ~ 45°30'	

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Seat angle	Exhaust	45° ~ 45°30'	
Valve spring			
Free length		44.0 mm (1.7323 in.)	
Load		21.6±1.1kg/35 mm (47.6±2.4 lb/1.3780 in.)	
		45.1±2.2kg/27.2 mm (99.4±4.9 lb/1.0709 in.)	
Out of squareness		Less than 1.5°	3°
Cylinder block			
Cylinder bore		76.50 ~ 76.53 mm (3.0118 ~ 3.0130 in.)	
Flatness of gasket surface		Less than 0.05 mm (0.0020 in.)	
Piston			
Piston outer diameter		76.47 ~ 76.50 mm (3.0106 ~ 3.0118 in.)	
Piston to cylinder clearance		0.020 ~ 0.040 mm (0.0008 ~ 0.0016 in.)	
Ring groove width	No. 1 ring groove	1.230 ~ 1.255 mm (0.0484 ~ 0.0494 in.)	
	No. 2 ring groove	1.230 ~ 1.255 mm (0.0484 ~ 0.0494 in.)	
	Oil ring groove	2.030 ~ 2.055 mm (0.0799 ~ 0.0809 in.)	
Piston ring			
Side clearance	No.1 ring	0.04 ~ 0.085 mm (0.0016 ~ 0.0033 in.)	0.1 mm (0.0039 in.)
	No.2 ring	0.04 ~ 0.085 mm (0.0016 ~ 0.0033 in.)	0.1 mm (0.0039 in.)
	Oil ring	0.08 ~ 0.175 mm (0.0031 ~ 0.0069 in.)	
End gap	No. 1 ring	0.15 ~ 0.30 mm (0.0059 ~ 0.0118 in.)	1.0 mm (0.0394 in.)
	No. 2 ring	0.35 ~ 0.50 mm (0.0138 ~ 0.0197 in.)	1.0 mm (0.0394 in.)
	Oil ring	0.20 ~ 0.70 mm (0.0079 ~ 0.0276 in.)	1.0 mm (0.0394 in.)
Piston pin			
Piston pin outer diameter		18.001 ~ 18.007 mm (0.7087 ~ 0.7089 in.)	
Piston pin hole inner diameter		18.016 ~ 18.021 mm (0.7093 ~ 0.7095 in.)	
Piston pin hole clearance		0.011 ~ 0.018 mm (0.0004 ~ 0.0007 in.)	

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Connecting rod small end hole inner diameter		17.974 ~ 17.985 mm (0.7076 ~ 0.7081 in.)	
Connecting rod small end hole clearance		-0.032 ~ -0.016 mm (- 0.0013 ~ -0.0006 in.)	
Piston pin press-in load		500 ~ 1,500 kg (1,102 ~ 3,306 lb)	
Connecting rod			
Connecting rod big end inner diameter		48.000 ~ 48.018 mm (1.8898 ~ 1.8905 in.)	
Connecting rod bearing oil clearance		0.018 ~ 0.036 mm (0.0007 ~ 0.0014 in.)	
Side clearance		0.10 ~ 0.25 mm (0.0039 ~ 0.0098 in.)	0.4 mm (0.0157 in.)
Crankshaft			
Main journal outer diameter		49.950 ~ 49.968 mm (1.9665 ~ 1.9672 in.)	
Pin journal outer diameter		44.954 ~ 44.972 mm (1.7698 ~ 1.7705 in.)	
Main bearing oil clearance	No. 1, 2, 4, 5	0.022 ~ 0.040 mm (0.0009 ~ 0.0016 in.)	0.1 mm (0.0039 in.)
	No. 3	0.028 ~ 0.046 mm (0.0011 ~ 0.0018 in.)	0.1 mm (0.0039 in.)
End play		0.05 ~ 0.175 mm (0.0020 ~ 0.0069 in.)	0.2 mm (0.0079 in.)
Flywheel			
Runout		0.1 mm (0.0039 in.)	0.13 mm (0.0051 in.)
Oil pump			
Side clearance	Inner rotor	0.040 ~ 0.085 mm (0.0016 ~ 0.0033 in.)	
	Outer rotor	0.040 ~ 0.090 mm (0.0016 ~ 0.0035 in.)	
Body clearance		0.060 ~ 0.090 mm (0.0024 ~ 0.0035 in.)	
Relief valve opening pressure		500±49.0 kpa (5.1±0.5kg/cm ² , 72.5±7.1psi)	
Relief spring	Free length	46.6 mm (1.8346 in.)	
	Load	6.1± 0.4kg/40.1 mm (13.4±0.9 lb/1.5787 in.)	
Engine oil			
Oil quantity (Total)		3.8 L (4.01 US qt, 3.34 Imp qt)	
Oil quantity (Oil Pan)		3.0 L(3.17 US qt, 2.63 Imp qt)	

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Oil quantity (Drain and refill including oil filter)		3.3 L (3.48 US qt, 2.90 Imp qt)	
Oil quality		Above API SJ/SL or SAE 5W-20	
Oil pressure (Idle)		107.8 kpa (1.1kg/cm ² , 15.6 psi)	
Cooling system			
Cooling method		Forced circulation with cooling fan	
Coolant quantity		5.5 ~ 5.8 L (5.81 ~ 6.13 US qt, 4.84 ~ 5.10 Imp qt)	
Thermostat	Type	Wax pellet type	
	Opening temperature	82±1.5°C (179.6±2.7°F)	
	Pull opening temperature	95°C (203°F)	
Radiator cap	Main valve opening pressure	93.16 ~ 122.58 kpa (0.95 ~ 1.25kg/cm ² , 13.51 ~ 17.78psi)	
	Vacuum valve opening pressure	0.98 ~ 4.90 kpa (0.01 ~ 0.05kg/cm ² , 0.14 ~ 0.71 psi)	
Water temperature sensor			
Type		Thermistor type	
Resistance	20°C (68°F)	2.45±0.14 kohms	
	80°C (176°F)	0.3222 kohms	

TIGHTENING TORQUE

TORQUE SPECIFICATIONS

Item	Quantity	Tightening torque		
		N.m	kgf.m	lb-ft
Cylinder block				
Engine support bracket bolt	2	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Engine support bracket nut	1	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Engine support bracket stay bolt	2	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Rear plate bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Engine mounting				
Engine mounting bracket and body fixing bolt	3	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Engine mounting	1	68.6 ~ 93.2	7.0 ~ 9.5	50.6 ~ 68.7

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insulator and engine mounting support bracket fixing nut				
Engine mounting support bracket and engine support bracket fixing bolt	2	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Engine mounting support bracket and engine support bracket fixing nut	1	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Transaxle mounting bracket and body fixing bolt	3	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Transaxle mounting insulator and transaxle support bracket fixing bolt	2	68.6 ~ 93.2	7.0 ~ 9.5	50.6 ~ 68.7
Front roll stopper bracket and sub frame fixing bolt	3	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Front roll stopper insulator and front roll stopper support bracket fixing bolt, nut	1	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Rear roll stopper bracket and sub frame fixing bolt	3	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Rear roll stopper insulator and rear roll stopper support bracket fixing bolt, nut	1	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Main moving system				
Connecting rod cap nut	8	31.4 ~ 34.3	3.2 ~ 3.5	23.1 ~ 25.3
Crankshaft main bearing cap bolt	10	53.9 ~ 58.8	5.5 ~ 6.0	39.8 ~ 43.4
Flywheel bolt (M/T)	5	117.7 ~ 127.5	12.0 ~ 13.0	86.8 ~ 94.0
Drive plate bolt (A/T)	5	117.7 ~ 127.5	12.0 ~ 13.0	86.8 ~ 94.0
Timing belt				
Timing belt front upper cover bolt	4	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2

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Timing belt front lower cover bolt	5	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Timing belt rear lower LH cover bolt	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing belt rear upper LH cover bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing belt rear upper RH cover bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Crankshaft pulley bolt	1	137.3 ~ 147.1	14.0 ~ 15.0	101.3 ~ 108.5
Camshaft sprocket bolt	1	78.5 ~ 98.1	8.0 ~ 10.0	57.9 ~ 72.3
Timing belt tensioner bolt	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing belt idler bolt	1	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Cylinder head				
Engine cover bolt	4	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Cylinder head cover bolt	12	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Camshaft bearing cap bolt	24	11.8 ~ 13.7	1.2 ~ 1.4	8.7 ~ 10.1
Intake camshaft and CMP sensor target wheel fixing bolt	1	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Exhaust camshaft and CVVT assembly fixing bolt	1	64.7 ~ 76.5	6.6 ~ 7.8	47.7 ~ 56.4
Timing chain auto tensioner bolt	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
OCV(oil control valve) bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
OCV(oil control valve) filter	1	40.2 ~ 50.0	4.1 ~ 5.1	29.7 ~ 36.9
Cylinder head bolt	10	29.4+90° --> Release all bolts --> 29.4+90°	3.0+90° --> Release all bolts --> 3.0+90°	21.7+90° --> Release all bolts --> 21.7+90°
Cooling system				
Water pump pulley bolt	4	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Water pump bolt (8 X 28)	3	11.8 ~ 14.7	1.2 ~ 1.5	8.7 ~ 10.8
Water pump and alternator brace	1	19.6 ~ 23.5	2.0 ~ 2.4	14.5 ~ 17.4

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fixing bolt (8 X 45)				
Water pump and alternator brace fixing bolt (8 X 65)	1	19.6 ~ 23.5	2.0 ~ 2.4	14.5 ~ 17.4
Thermostat housing nut	2	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Water outlet fitting nut	2	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Water inlet fitting bolt	3	16.7 ~ 19.6	1.7 ~ 2.0	12.3 ~ 14.5
Water temperature sensor	1	19.6 ~ 39.2	2.0 ~ 4.0	14.5 ~ 28.9
Water pipe fixing bolt	1	9.8 ~ 14.7	1.0 ~ 1.5	7.2 ~ 10.8
Lubrication system				
Oil filter	1	11.8 ~ 15.7	1.2 ~ 1.6	8.7 ~ 11.6
Front case bolt (8 X 22)	1	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Front case bolt (8 X 30)	3	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Front case bolt (8 X 45)	1	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Front case bolt (8 X 60)	1	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Oil pan bolt	18	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan drain plug	1	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~ 32.5
Oil screen bolt	2	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Oil pressure switch	1	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Rear oil seal case	5	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Intake and exhaust system				
Intake manifold and cylinder head fixing nut	6	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Intake manifold and cylinder head fixing bolt (8X45)	2	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Intake manifold and cylinder head fixing bolt (8X22)	1	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Intake manifold stay bolt	4	17.7 ~ 24.5	1.8 ~ 2.5	13.0 ~ 18.1
Exhaust manifold and cylinder head fixing nut	9	29.4 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3

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O2 sensor to exhaust manifold	1	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
Exhaust manifold heat cover and exhaust manifold fixing bolt	3	16.7 ~ 21.6	1.7 ~ 2.2	12.3 ~ 15.9
Air cleaner lower cover fixing bolt	3	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Throttle body and surge tank fixing bolt and nut	4	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Exhaust manifold and front muffler fixing nut	2	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Front muffler and center muffler fixing nut	2	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Center muffler and main muffler fixing nut	2	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9

COMPRESSION PRESSURE INSPECTION

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. Disconnect the ignition coil connectors and the spark plug cables. (Refer to **IGNITION SYSTEM (ENGINE ELECTRICAL SYSTEM G4ED-GSL 1.6)**).

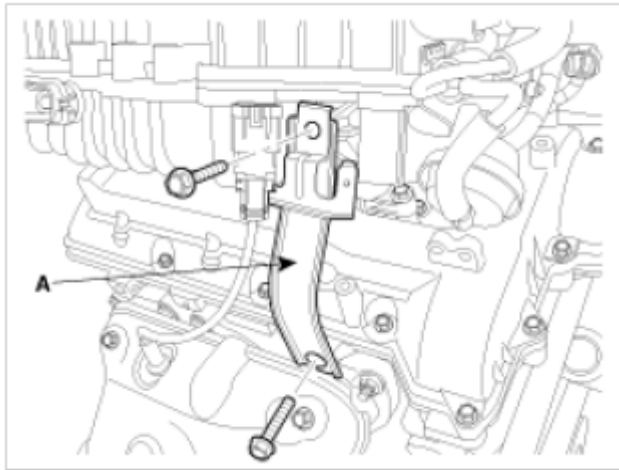


Fig. 1: Identifying Spark Plug Cables
Courtesy of HYUNDAI MOTOR CO.

3. Remove the spark plugs.

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

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

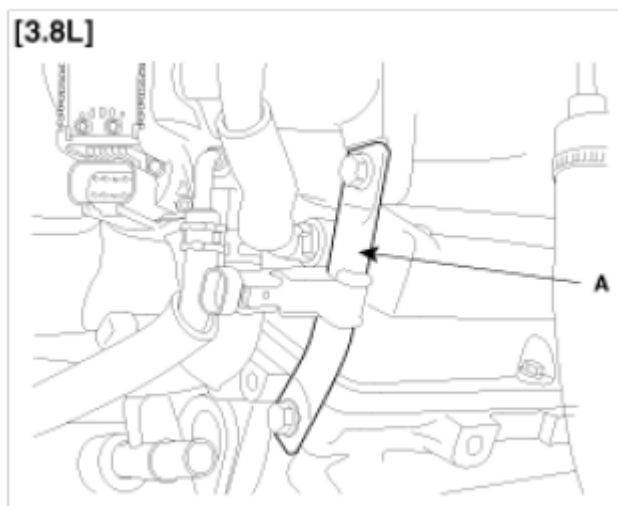


Fig. 2: Inserting Compression Gauge Into Spark Plug Hole
Courtesy of HYUNDAI MOTOR CO.

2. Fully open the throttle.
3. While cranking the engine, measure the compression pressure.

NOTE: Always use a fully charged battery to obtain engine speed of 250

RPM or more.

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

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

Compression pressure (1.6 CVVT)

Standard: 1,422kPa (14.5 kg/cm² , 206psi) (250 ~ 400 RPM)

Minimum: 1,275kPa (13.0 kg/cm² , 185psi)

Difference between each cylinder: 98kPa (1.0 kg/cm² , 14psi) or less

5. If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat step 1) through 3) for cylinders with low compression.
 - If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
 - If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.
5. Reinstall the spark plugs.
6. Connect the ignition coil connectors and the spark plug cables. (Refer to **IGNITION SYSTEM (ENGINE ELECTRICAL SYSTEM G4ED-GSL 1.6)**).

TIMING BELT TENSION ADJUSTMENT

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

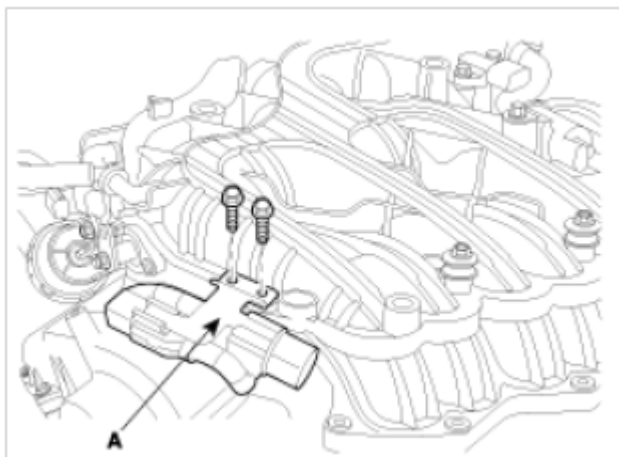


Fig. 3: Identifying RH Side Cover
Courtesy of HYUNDAI MOTOR CO.

4. Loosen the water pump pulley bolts.

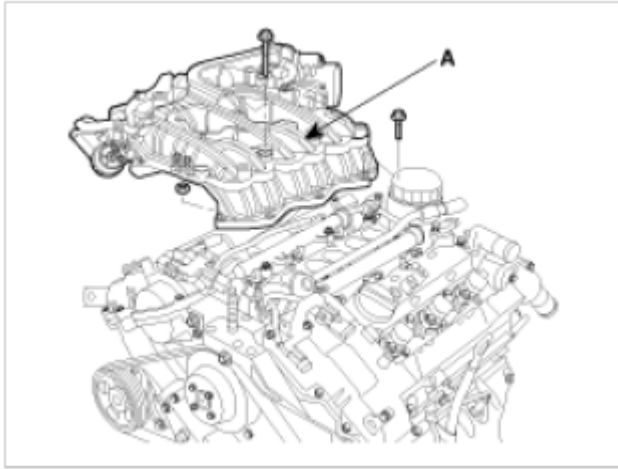


Fig. 4: Identifying Water Pump Pulley Bolts
Courtesy of HYUNDAI MOTOR CO.

5. Remove the alternator drive belt (A). (Refer to **REPLACEMENT**).

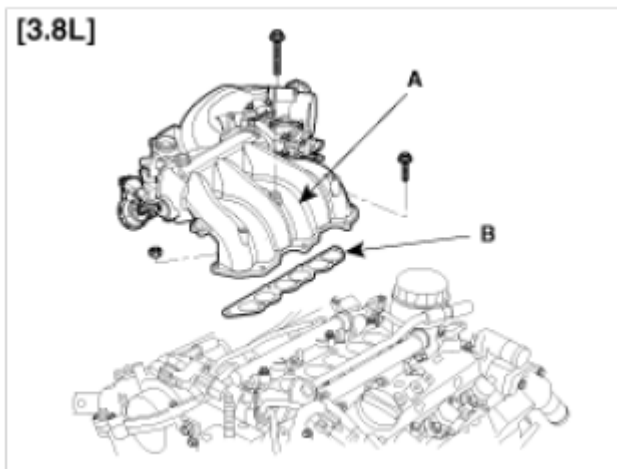


Fig. 5: Identifying Alternator Drive Belt
Courtesy of HYUNDAI MOTOR CO.

6. Remove the air conditioner compressor drive belt (B). (Refer to **DRIVE BELT** - air conditioner compressor).
7. Remove the power steering pump drive belt (C). (Refer to **REMOVAL** - power steering pump).
8. Remove the water pump pulley.
9. Remove the 4 bolts (B) and timing belt upper cover (A).

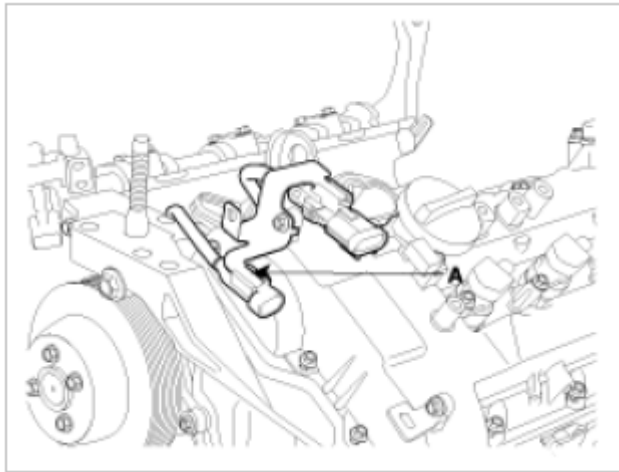


Fig. 6: Identifying Timing Belt Upper Cover
Courtesy of HYUNDAI MOTOR CO.

10. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover. Check that the timing mark of camshaft sprocket (A) is aligned with the timing mark of cylinder head cover. (No. 1 cylinder compression TDC position).

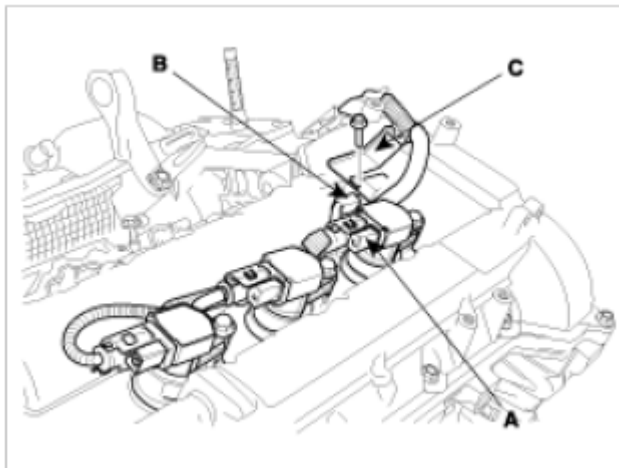


Fig. 7: Identifying Timing Marks On Crankshaft Pulley
Courtesy of HYUNDAI MOTOR CO.

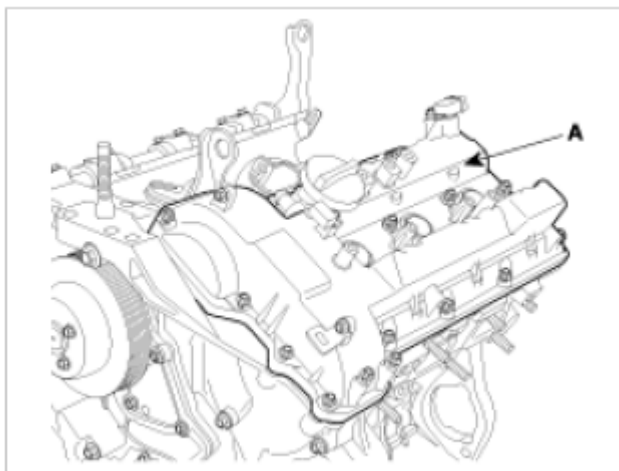


Fig. 8: Align Groove With Timing Mark "T" Of Timing Belt Cover
Courtesy of HYUNDAI MOTOR CO.

11. Remove the crankshaft pulley (A).

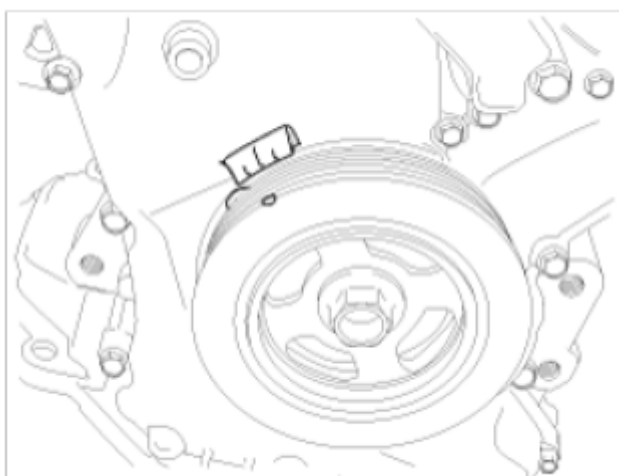


Fig. 9: Identifying Crankshaft Pulley
Courtesy of HYUNDAI MOTOR CO.

12. Remove the 4 bolts (B) and timing belt lower cover (A).

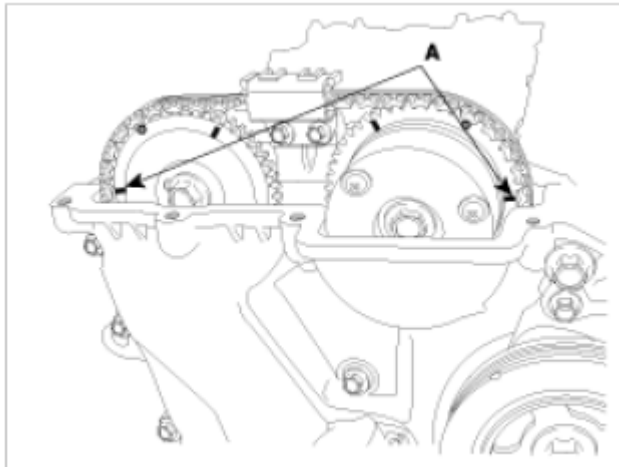


Fig. 10: Identifying Timing Belt Lower Cover
Courtesy of HYUNDAI MOTOR CO.

13. Move the tensioner pulley (C) in the direction of the arrow shown after loosen the mounting bolt (A, B). And temporarily tighten mounting bolt (A, B).

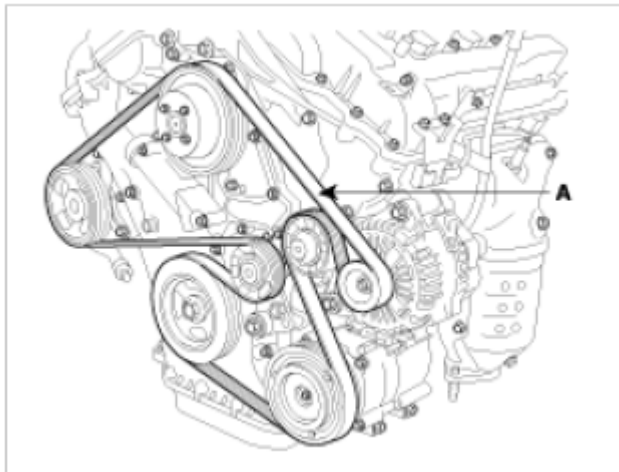


Fig. 11: Moving Tensioner Pulley
Courtesy of HYUNDAI MOTOR CO.

14. Adjust the timing belt tension.
 1. After inspecting the timing belt, replace it if necessary.
 2. Loosen the tensioner pulley mounting bolt and apply tension to the timing belt.

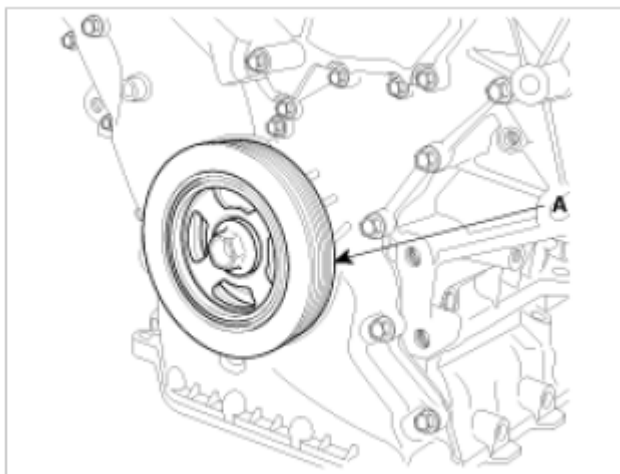


Fig. 12: Adjust Timing Belt Tensioner With Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

3. After checking the alignment between each sprocket and each timing belt tooth, tighten the mounting bolt (A) and (B) one by one.

Tightening torque:

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

4. Then recheck the belt tension.

Verify that when the tensioner and the tension side of the timing belt are pushed in horizontally with a moderate force [approx. 49N (11lb)], the timing belt cog end is approx. 1/2 of the tensioner mounting bolt head radius (across flats) away from the bolt head center.

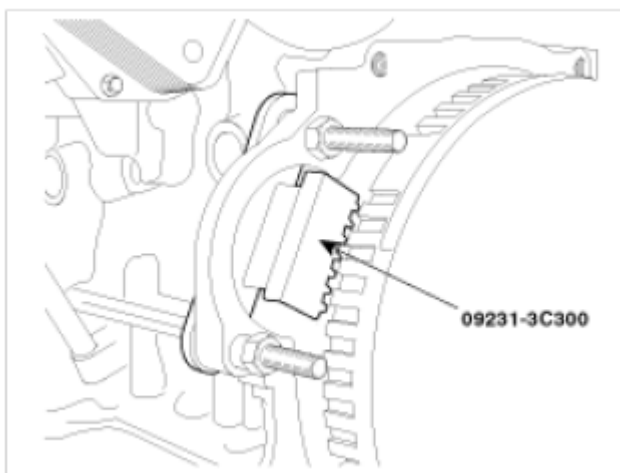


Fig. 13: Identifying Timing Belt
Courtesy of HYUNDAI MOTOR CO.

5. Timing belt tension measuring procedure (by a sonic tension gauge)

Rotate crankshaft in clockwise direction to set 1st piston on top dead center (TDC) and rotate crankshaft in counterclockwise to 90° then measure the belt tension in the middle of tension side span (in arrow direction of above illustration) by free vibration method.

CAUTION: Avoid rotating the crankshaft in a counter clock wise direction.

Engine damage could occur.

Conversion equation of frequency into tension:

$$T = (4 / 9.8) \times S^2 \times M \times W \times f^2 / 1000000000$$

S: Measured belt span (mm)

M: Unit weight of belt (gf/cm²)

W: Belt width (mm)

f: Transverse natural frequency of belt (Hz)

TIMING BELT SPECIFICATIONS

TIMING BELT SPECIFICATIONS

Item	Specifications
S (mm)	249.6
M (gf/cm ²)	0.4543
W (mm)	22
f (Hz)	70.4 ~ 87.9
T (kgf)	16 ± 3.5

15. Turn the crankshaft two turns in the operating direction (clockwise) and realign the crankshaft sprocket and camshaft sprocket timing mark.
16. Install the timing belt lower cover (A) with bolts (B).

Tightening torque:

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

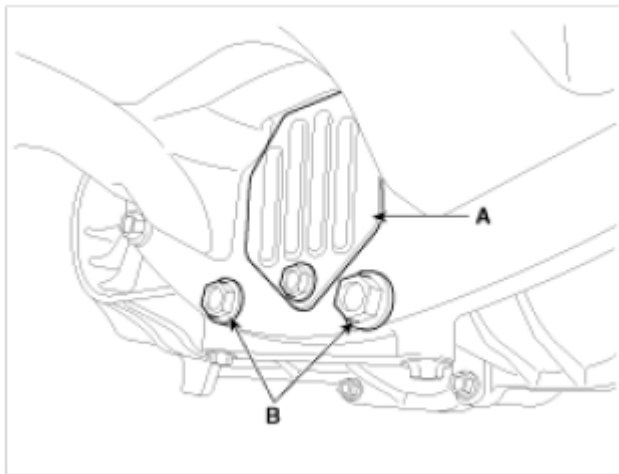


Fig. 14: Identifying Timing Belt Lower Cover
Courtesy of HYUNDAI MOTOR CO.

17. Install the crankshaft pulley (A).

Tightening torque:

137.3 ~ 147.1 N.m (14.0 ~ 15.0 kgf.m, 101.3 ~ 108.5 lb-ft)

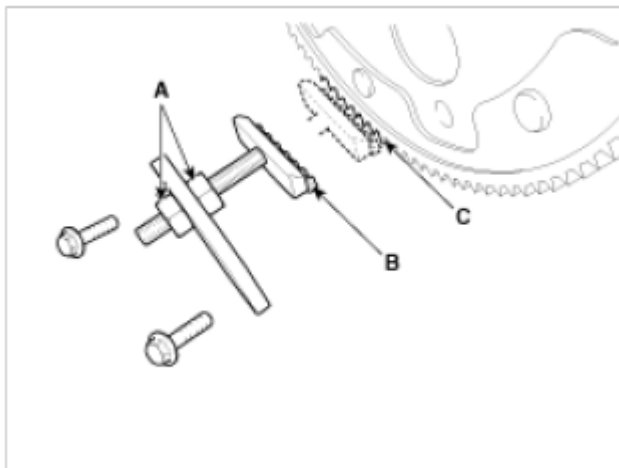


Fig. 15: Identifying Crankshaft Pulley
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque:

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

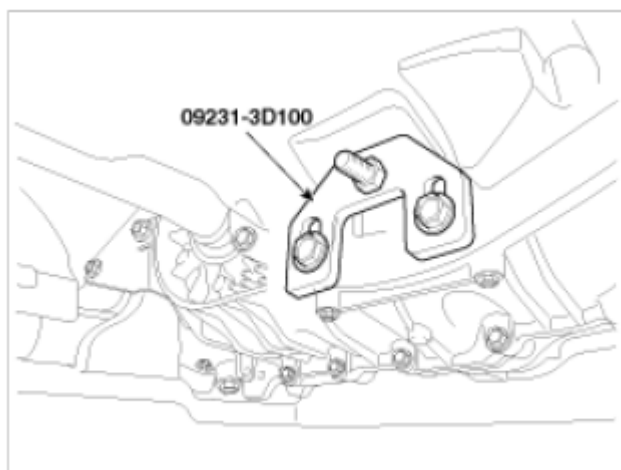


Fig. 16: Identifying Timing Belt Upper Cover
Courtesy of HYUNDAI MOTOR CO.

19. Install the water pump pulley.
20. Install the power steering pump drive belt (C). (Refer to **CHECKING POWER STEERING BELT TENSION** - power steering pump).

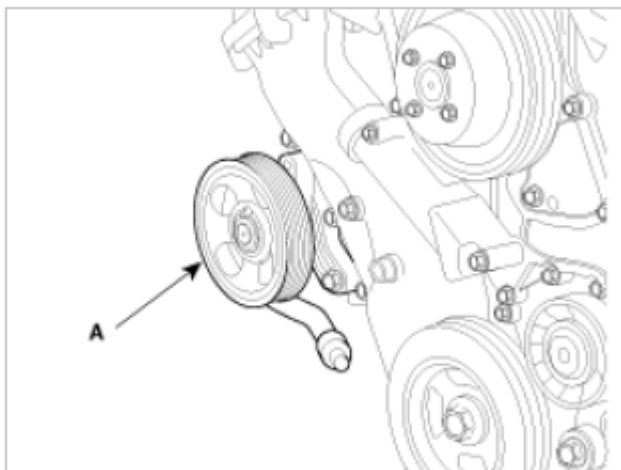


Fig. 17: Identifying Alternator Drive Belt
Courtesy of HYUNDAI MOTOR CO.

21. Install the air conditioner compressor drive belt (B). (Refer to **HEATING, VENTILATION & AIR CONDITIONING** - air conditioner compressor)
22. Install the alternator drive belt (A). (Refer to **REPLACEMENT**).
23. Install the RH side cover (A) with bolts (B)

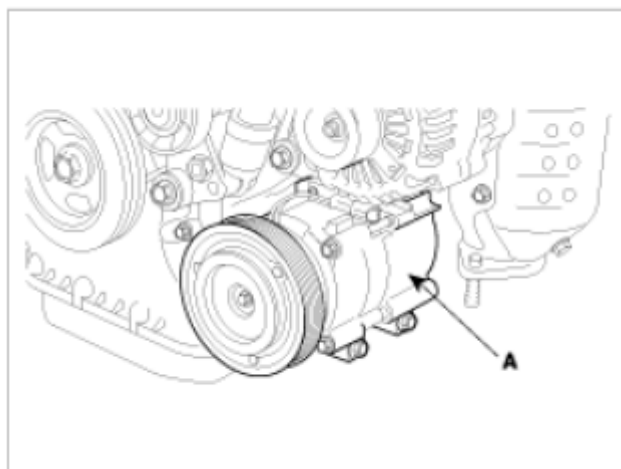


Fig. 18: Identifying RH Side Cover
Courtesy of HYUNDAI MOTOR CO.

24. Install the RH front wheel.

Tightening torque:

88.3 ~ 107.9 N.m (9 ~ 11 kgf.m, 65.1 ~ 79.6 lb-ft)

25. Install the engine cover with bolts.

Tightening torque:

7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

TROUBLESHOOTING

TROUBLESHOOTING CHART

Symptom	Suspect area	Remedy
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 can cause the valve not to close properly.)	Repair or replace as required.
	Excessive worn or mis-aligned timing chain.	Replace the timing chain and sprocket as required.

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

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	clearance.	bore. Repair as required.
	Excessive piston pin-to-bore clearance.	Inspect the piston, piston pin and the connecting rod. Repair or replace as required.
	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft. • The crankshaft journal.
	Excessive crankshaft bearing clearance.	Inspect the following components and repair as required. • The crankshaft bearings. • The crankshaft journals.
	Incorrect piston, piston pin and connecting rod installation.	Verify the piston pins and connecting rods are installed correctly. Repair as required.
Engine noise under load.	Low oil pressure.	Repair or replace as required.
	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft.
	Excessive crankshaft bearing clearance.	Inspect the following components and repair as required. • The crankshaft bearings. • The crankshaft journals. • The cylinder block crankshaft bearing bore.
Engine will not crank. (crankshaft will not rotate)	Hydraulically locked cylinder. • Coolant/antifreeze in cylinder. • Oil in cylinder. • Fuel in cylinder.	Remove spark plugs and check for fluid. Inspect for broken head gasket. Inspect for cracked engine block or cylinder head. Inspect for a sticking fuel injector and/or leaking fuel regulator.

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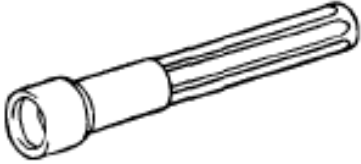
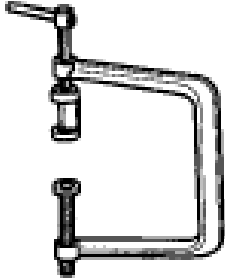
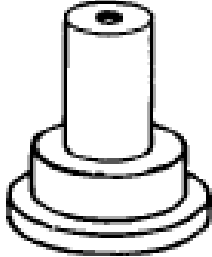
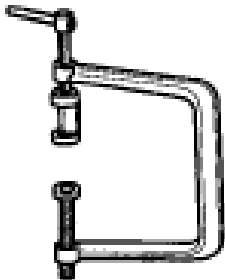
Broken timing chain and/or timing chain gears.	Inspect timing chain and gears. Repair as required.
Foreign material in cylinder. • Broken valve. • Piston material. • Foreign material.	Inspect cylinder for damaged components and/or foreign materials. Repair or replace as required.
Seized crankshaft or connecting rod bearings.	Inspect crankshaft and connecting rod bearing. Repair or replace as required.
Bent or broken connecting rod.	Inspect connecting rods. Repair or replace as required.
Broken crankshaft.	Inspect crankshaft. Repair or replace as required.

SPECIAL SERVICE TOOLS**SPECIAL SERVICE TOOLS REFERENCE 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)	 EDDA005B	Installation of the front oil seal
Camshaft oil seal installer (09221-21000)		Installation of the camshaft oil seal

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	 ECKA010A	
Valve guide remover (09209221-3F100 (A)) Valve guide installer (09221-26000)	 EDDA006C	Removal and installation of the valve guide
Valve stem oil seal installer (09222-22001)	 EDDA005F	Installation of the valve stem oil seal
Valve spring compressor (09222-28000) Valve spring compressor adaptor (09222-28100)	 EDDA006C	Removal and installation of the intake or exhaust valve
Crankshaft rear oil seal installer (09231-21000)		Installation of the crankshaft rear oil seal

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	 LCAC030A	
Water temperature sensor socket wrench (09221-25100)	 LCAC030A	Removal and installation of water temperature sensor
Oil pan remover (09215-3C000)	 ACJF125A	Removal of oil pan
Torque angle adapter (09221-4A000)	 LCAC030A	Installation of bolts & nuts needing an angular method

TIMING SYSTEM

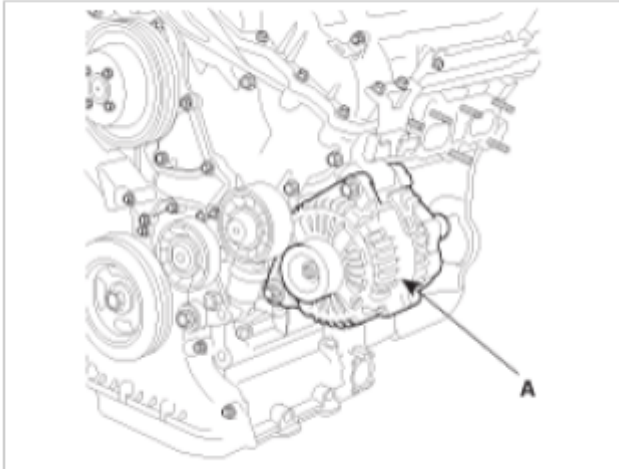
TIMING BELT**COMPONENT**

Fig. 19: Identifying Timing Belt Component - Torque Specification
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

Engine removal is not required for this procedure.

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

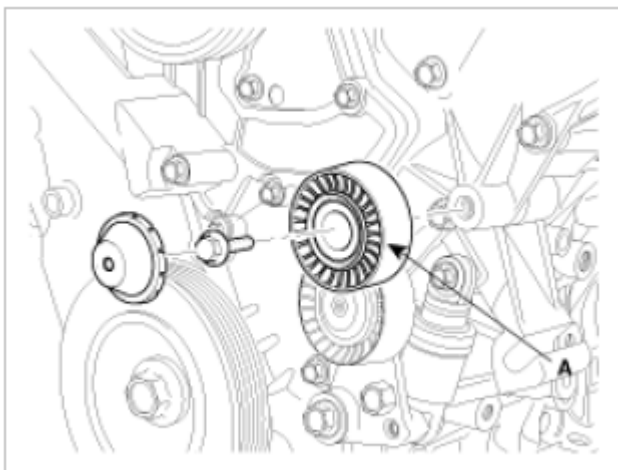


Fig. 20: Identifying RH Side Cover
Courtesy of HYUNDAI MOTOR CO.

4. Temporarily loosen the water pump pulley bolts.

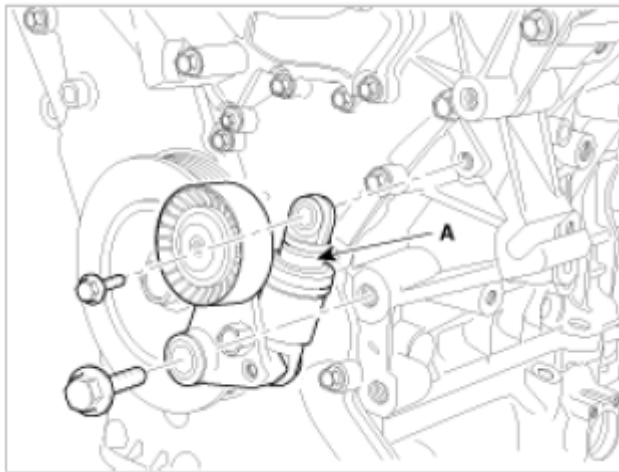


Fig. 21: Identifying Water Pump Pulley Bolts
Courtesy of HYUNDAI MOTOR CO.

5. Remove the alternator drive belt (A). (Refer to **REPLACEMENT** - alternator).

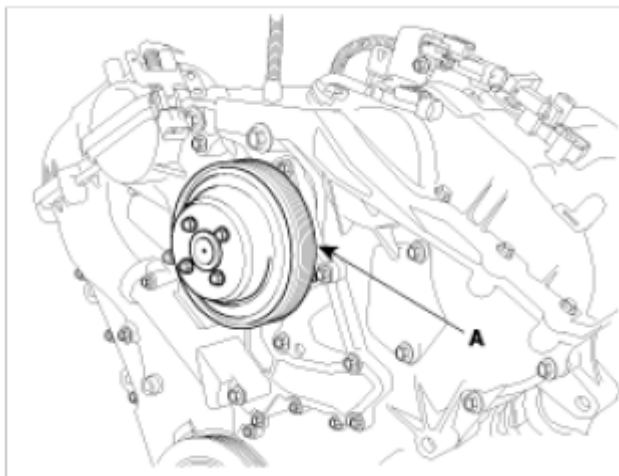


Fig. 22: Identifying Alternator Drive Belt
Courtesy of HYUNDAI MOTOR CO.

6. Remove the air conditioner compressor drive belt (B). (Refer to **DRIVE BELT** - air conditioner compressor).
7. Remove the power steering pump drive belt (C). (Refer to **REMOVAL** - power steering pump).
8. Remove the 4 bolts and water pump pulley.
9. Remove the 4 bolts (B) and timing belt upper cover (A).

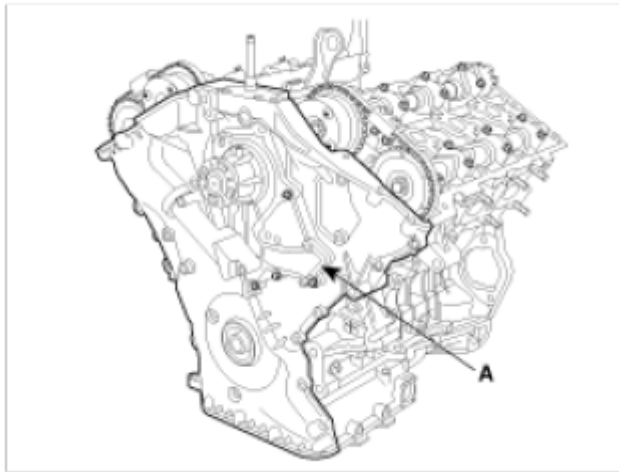


Fig. 23: Identifying Timing Belt Upper Cover
Courtesy of HYUNDAI MOTOR CO.

10. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover. Check that the timing mark of camshaft sprocket is aligned with the timing mark of cylinder head cover. (No. 1 cylinder compression TDC position).

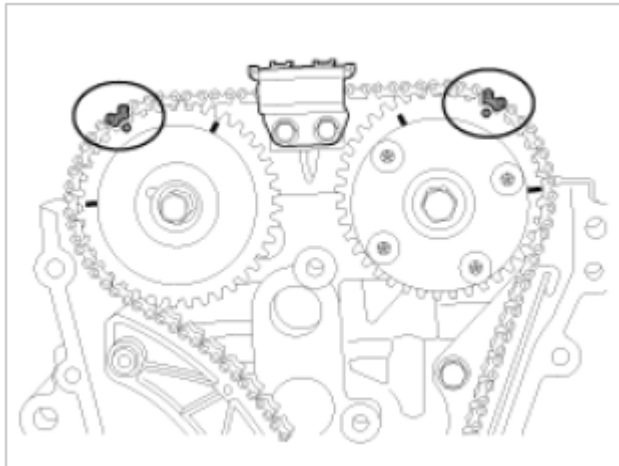


Fig. 24: Identifying Timing Marks On Crankshaft Pulley
Courtesy of HYUNDAI MOTOR CO.



Fig. 25: Align Groove With Timing Mark "T" Of Timing Belt Cover
Courtesy of HYUNDAI MOTOR CO.

11. Remove the crankshaft pulley bolt and crankshaft pulley (A).

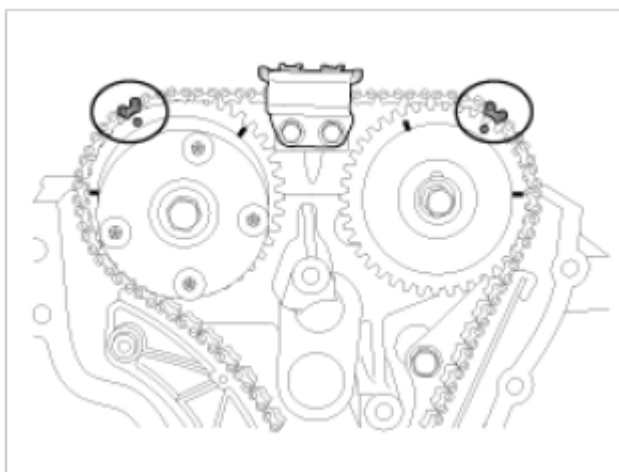


Fig. 26: Identifying Crankshaft Pulley
Courtesy of HYUNDAI MOTOR CO.

12. Remove the crankshaft flange (A).

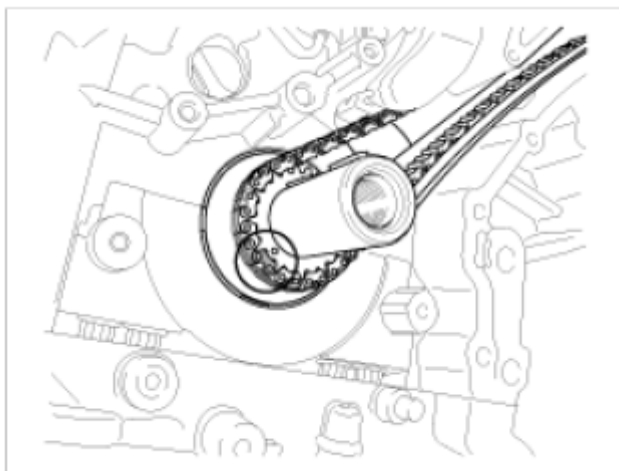


Fig. 27: Identifying Crankshaft Flange
Courtesy of HYUNDAI MOTOR CO.

13. Remove the 4 bolts (B) and timing belt lower cover (A).

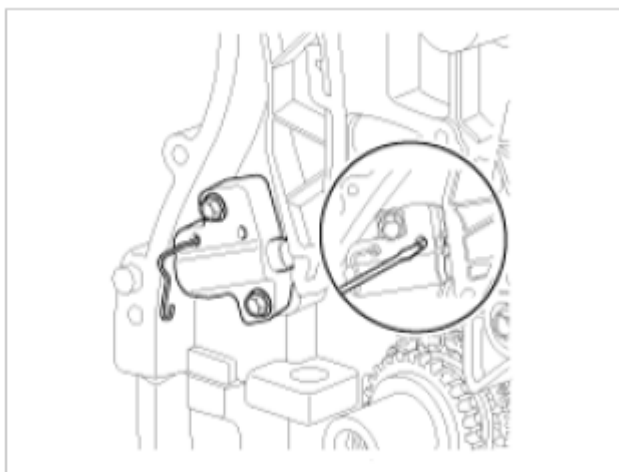


Fig. 28: Identifying Timing Belt Lower Cover
Courtesy of HYUNDAI MOTOR CO.

14. Remove the timing belt tensioner (A) and timing belt.

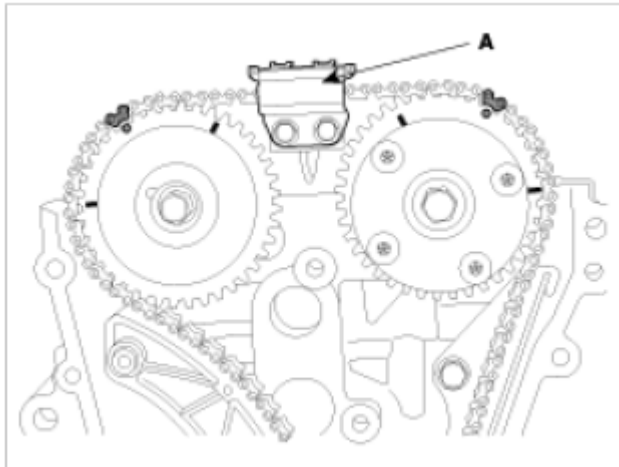


Fig. 29: Identifying Timing Belt Tensioner
Courtesy of HYUNDAI MOTOR CO.

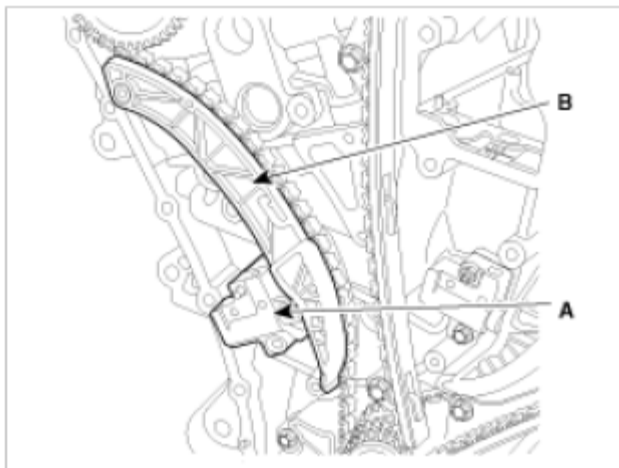


Fig. 30: Identifying Timing Belt
Courtesy of HYUNDAI MOTOR CO.

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

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

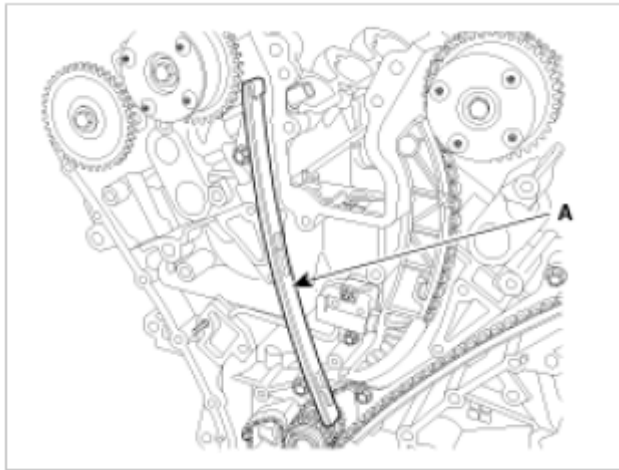


Fig. 31: Identifying Timing Belt Idler And Bolt
Courtesy of HYUNDAI MOTOR CO.

16. Remove the crankshaft sprocket (A).

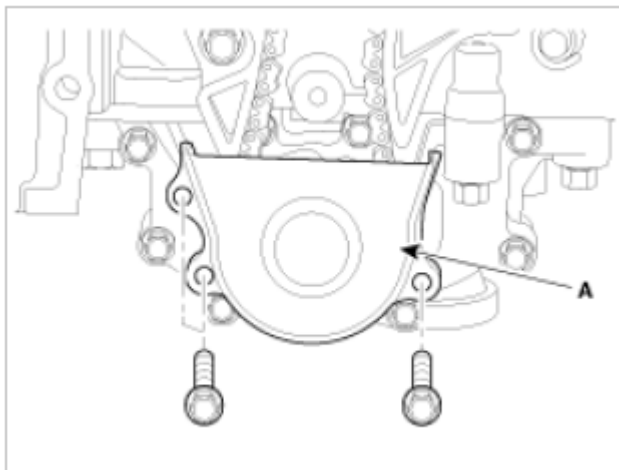


Fig. 32: Identifying Crankshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

17. Remove the cylinder head cover.
 1. Remove the wire harness bracket (A).

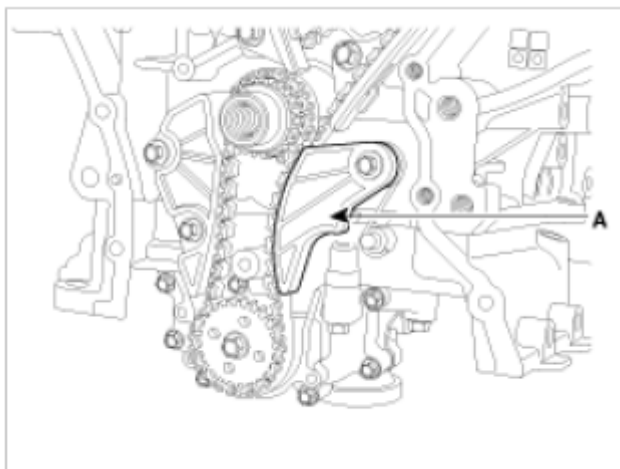


Fig. 33: Identifying Wire Harness Bracket
Courtesy of HYUNDAI MOTOR CO.

2. Remove the ignition coil.

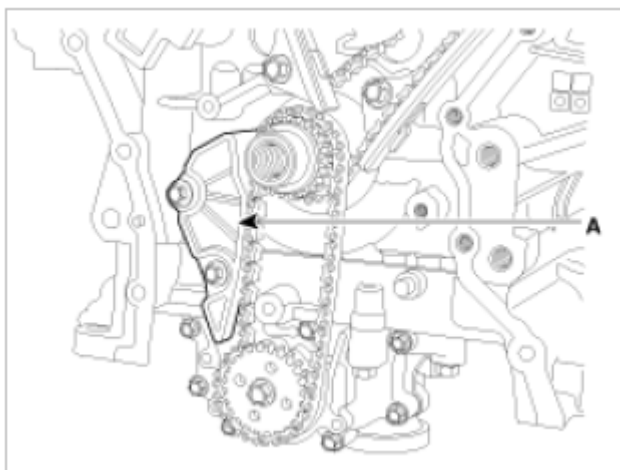
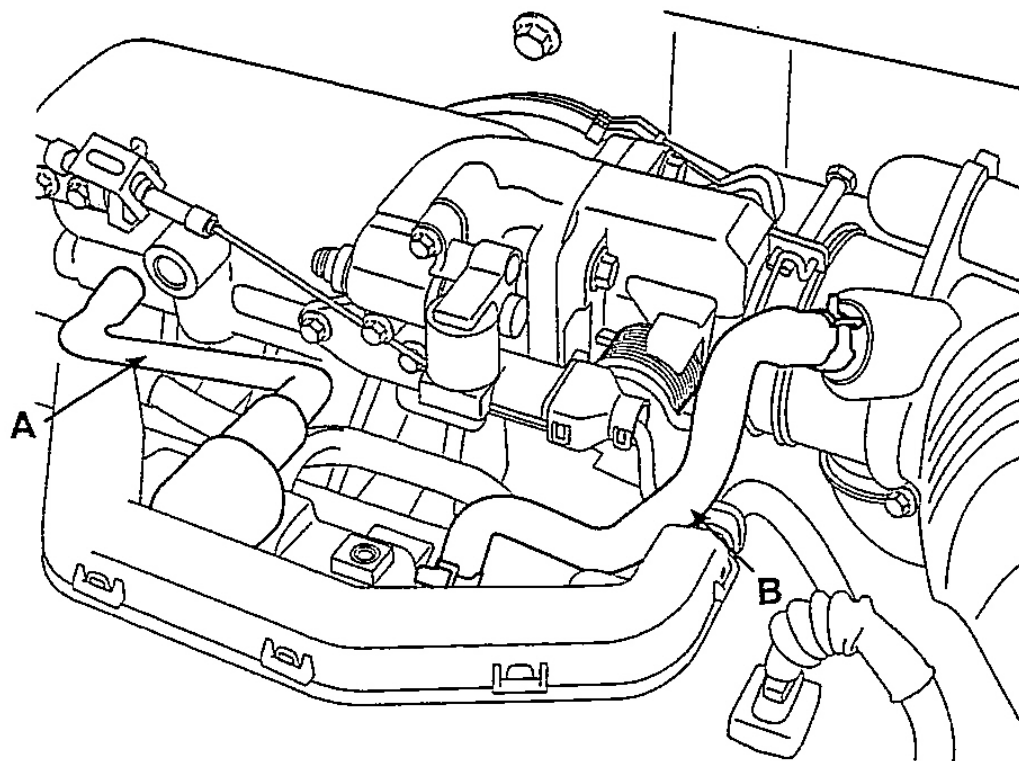


Fig. 34: Identifying Ignition Harness And Coils
Courtesy of HYUNDAI MOTOR CO.

3. Remove the PCV (Positive Crankcase Ventilation) hose (A) and the breather hose (B) from the cylinder head cover.



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Fig. 35: Identifying (Positive Crankcase Ventilation) Hose & Breather Hose
Courtesy of HYUNDAI MOTOR CO.

4. Remove the engine cover bracket (A).

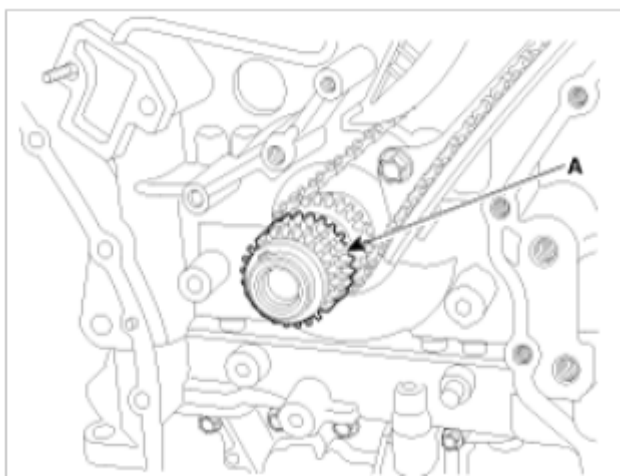


Fig. 36: Identifying Engine Cover Bracket

Courtesy of HYUNDAI MOTOR CO.

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

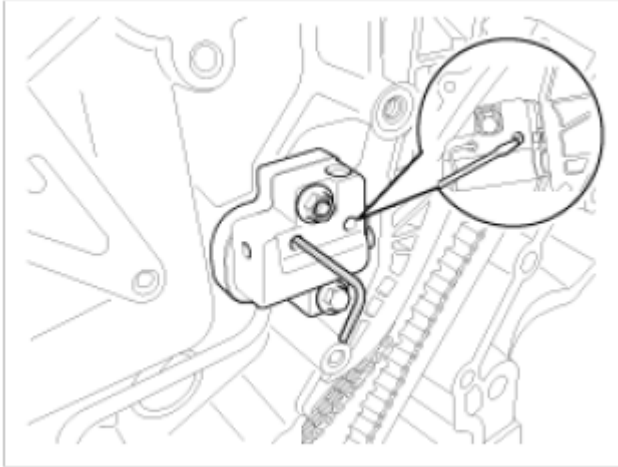


Fig. 37: Identifying Cylinder Head Cover & Bolts
Courtesy of HYUNDAI MOTOR CO.

18. Remove the camshaft sprocket.
 1. Hold the portion (A) of the camshaft with a hexagonal wrench, and remove the bolt (C) with a wrench (B) and remove the camshaft sprocket.

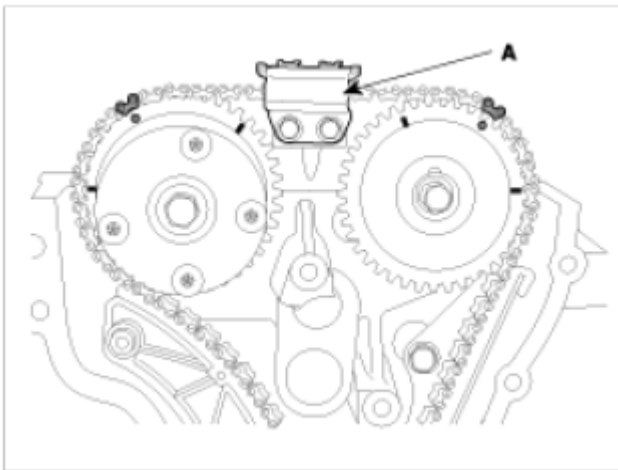


Fig. 38: Removing Camshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

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

INSPECTION

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 timing belt to come into contact with oil, water and steam.**

3. Inspect the belt closely. If the following problems are evident, replace the belt with a new one.

1. Hardened back surface of rubber.

Back surface is glossn, non-elastic and so hard that when the nail of your finger is pressed into it, no mark is produced.

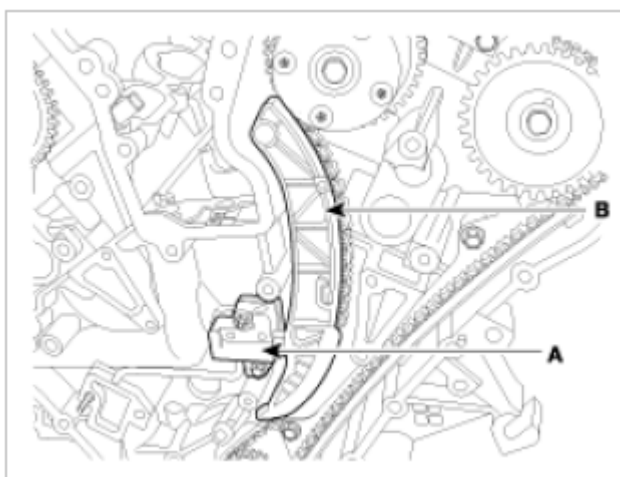


Fig. 39: Inspecting Belt

Courtesy of HYUNDAI MOTOR CO.

2. Cracked back surface of rubber.

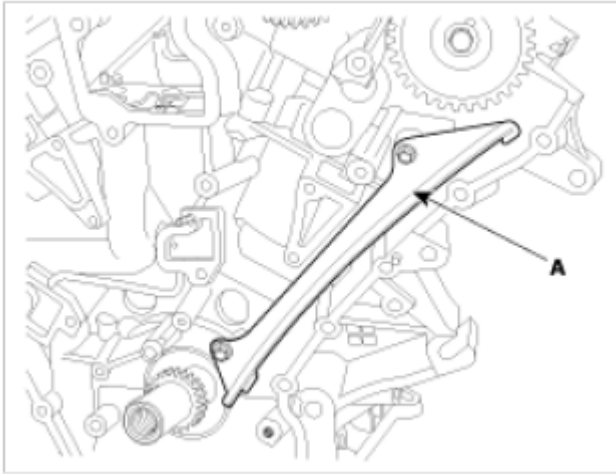


Fig. 40: Identifying Cracked Back Surface Of Rubber
Courtesy of HYUNDAI MOTOR CO.

3. Side of belt is badly worn.

NOTE: A belt in good condition should have clear-cut sides as if it were cut with a sharp knife.

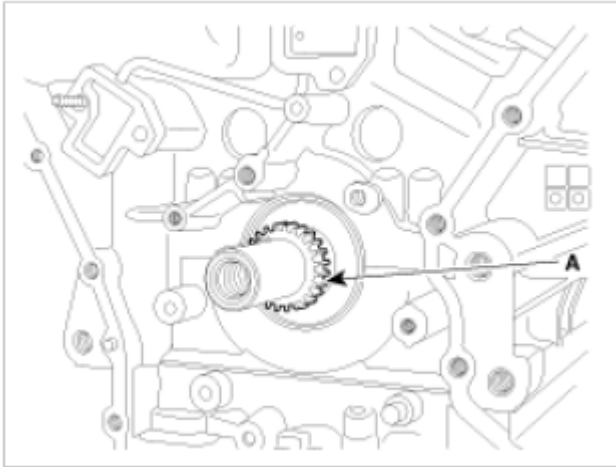


Fig. 41: Identifying Belt Is Badly Worn
Courtesy of HYUNDAI MOTOR CO.

4. Teeth are badly worn out.

Initial stage: Canvas on load side of the tooth flank worn (fluffy canvas fibers, rubber gone, color changed to white, and unclear canvas texture)

Last stage: Canvas on the load side of the tooth flank worn down and rubber exposed (tooth width reduced).

5. Missing tooth.

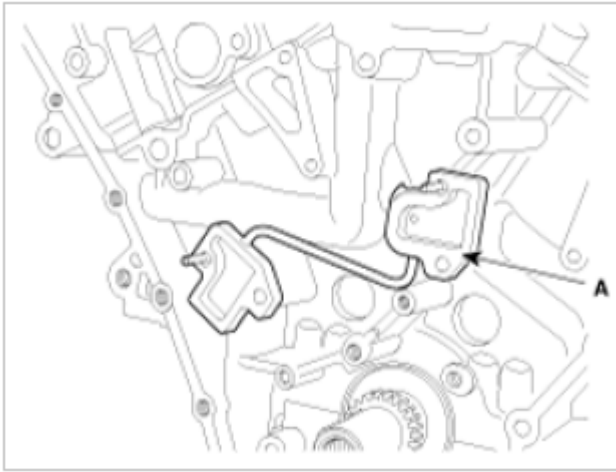


Fig. 42: Missing Tooth
Courtesy of HYUNDAI MOTOR CO.

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.



Fig. 43: Identifying Sprockets, Tensioner, Idler
Courtesy of HYUNDAI MOTOR CO.

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

INSTALLATION

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

Tightening torque:

78.5 ~ 98.1 N.m (8.0 ~ 10.0 kgf.m, 57.9 ~ 72.3 lb-ft)

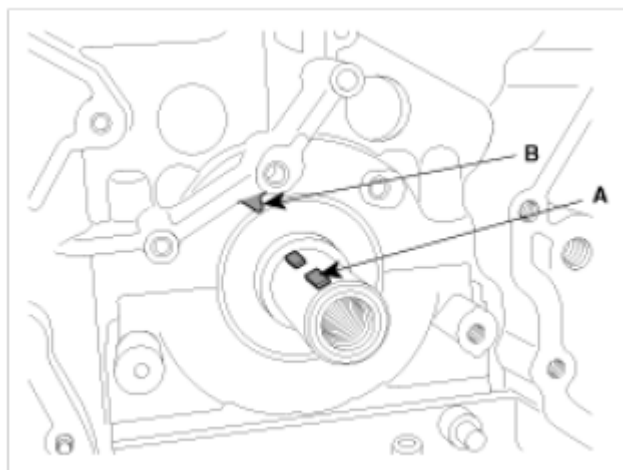


Fig. 44: Tightening Camshaft Sprocket Bolt
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque:

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

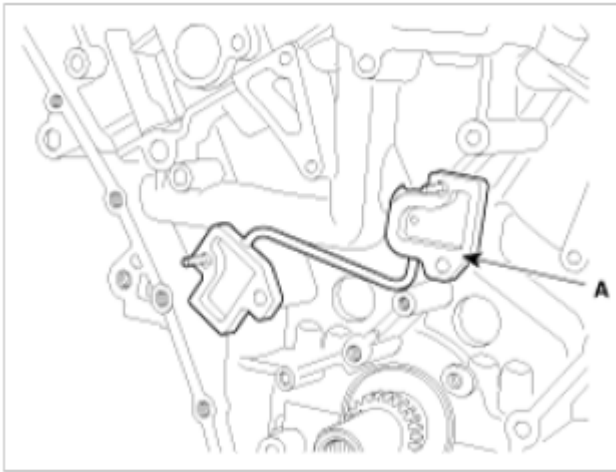


Fig. 45: Identifying Cylinder Head Cover Bolts (A) & (B) Specs (Sequence)
Courtesy of HYUNDAI MOTOR CO.

2. Install the engine cover bracket (A).

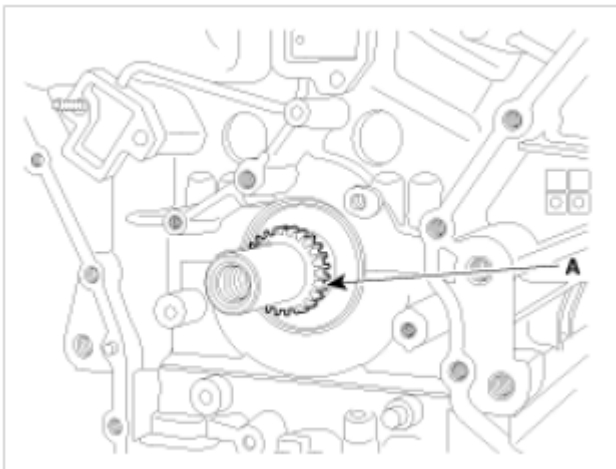


Fig. 46: Identifying Engine Cover Bracket
Courtesy of HYUNDAI MOTOR CO.

3. Install the PCV(Positive Crankcase Ventilation) hose (A) and breather hose (B) to the cylinder head cover.

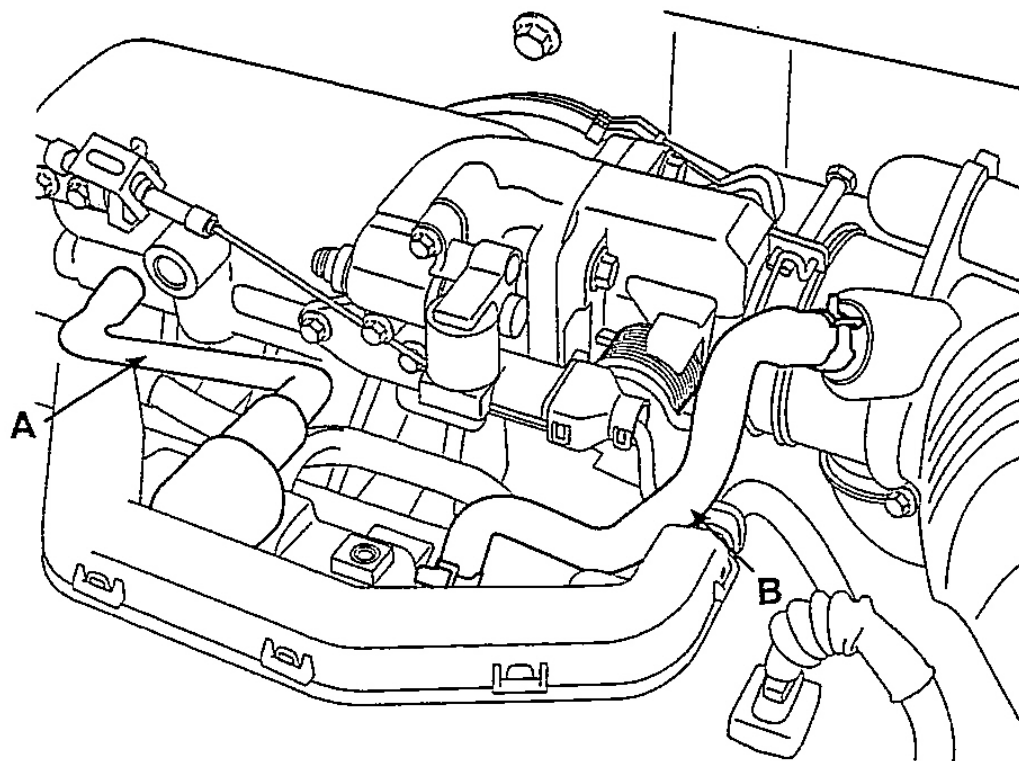


Fig. 47: Identifying (Positive Crankcase Ventilation) Hose & Breather Hose
Courtesy of HYUNDAI MOTOR CO.

4. Install the ignition coil.



Fig. 48: Identifying Ignition Coil

Courtesy of HYUNDAI MOTOR CO.

3. Install the crankshaft sprocket (A).

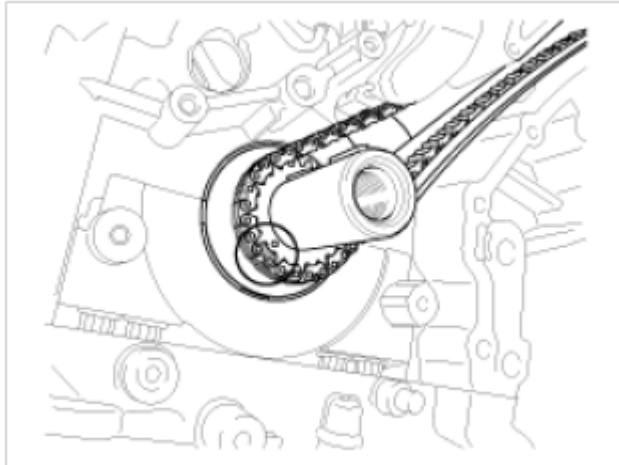


Fig. 49: Identifying Crankshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

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.

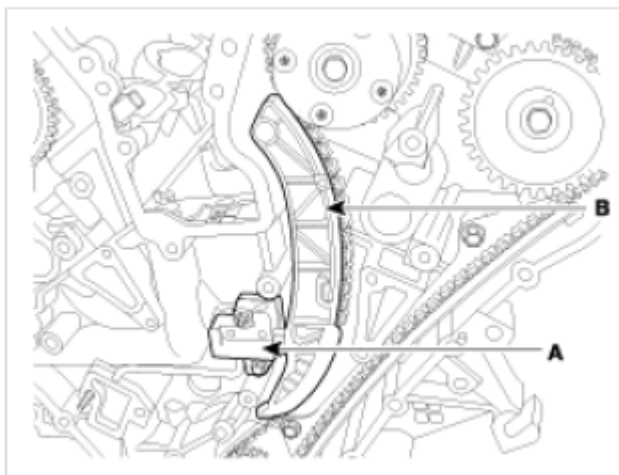


Fig. 50: Align Groove With Timing Mark "T" Of Timing Belt Cover
Courtesy of HYUNDAI MOTOR CO.

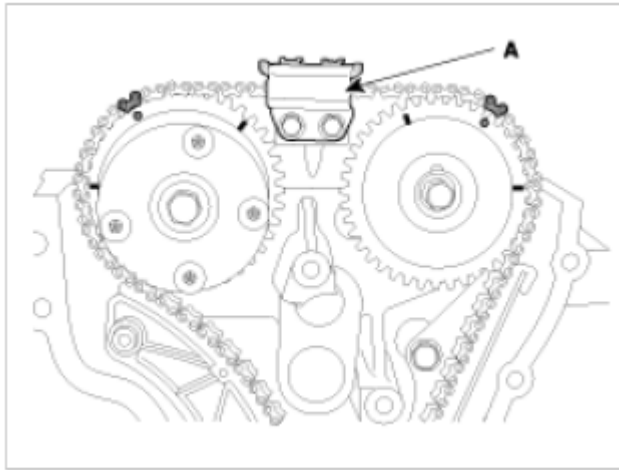


Fig. 51: Identifying Timing Marks Of Crankshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque:

42.2 ~ 53.9 N.m (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)

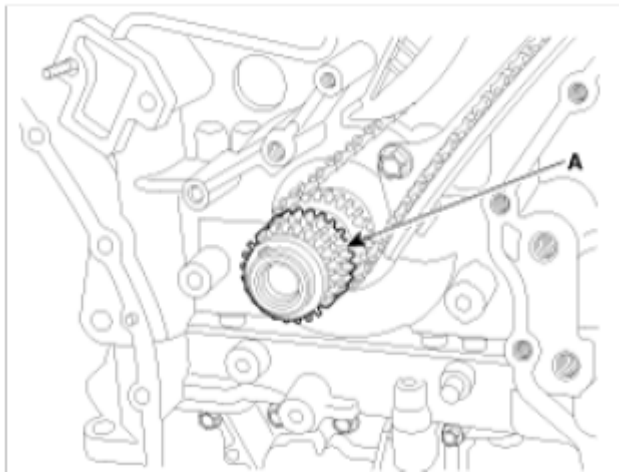


Fig. 52: Identifying Timing Belt Idler & Bolt
Courtesy of HYUNDAI MOTOR CO.

6. Temporarily install the timing belt tensioner (A).

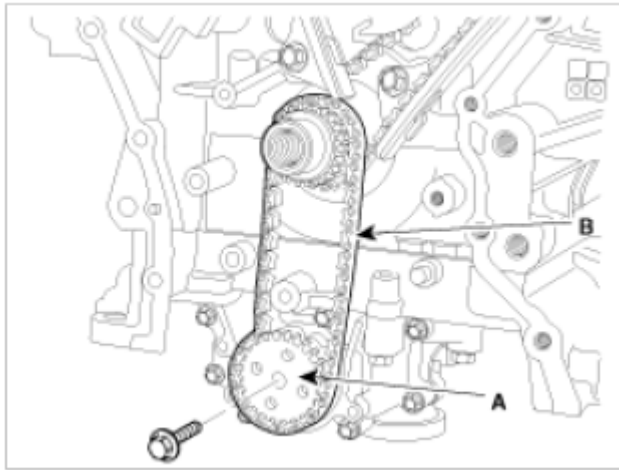


Fig. 53: Identifying Timing Belt Tensioner
Courtesy of HYUNDAI MOTOR CO.

7. Install the belt so as not give slack at each center of shaft. Use the following order when installing timing belt.

Crankshaft sprocket (A) --> idler pulley (B) --> camshaft sprocket (C) --> timing belt tensioner (D).

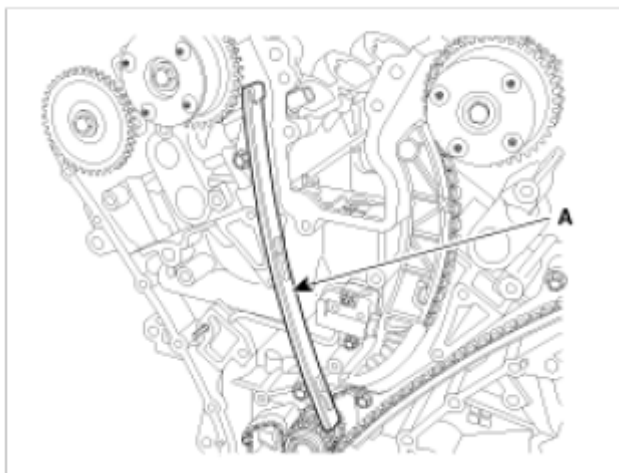


Fig. 54: Identifying Timing Belt Components With Timing Marks
Courtesy of HYUNDAI MOTOR CO.

8. Adjust the timing belt tension.
 1. Loosen the tensioner pulley mounting bolt and apply tension to the timing belt.

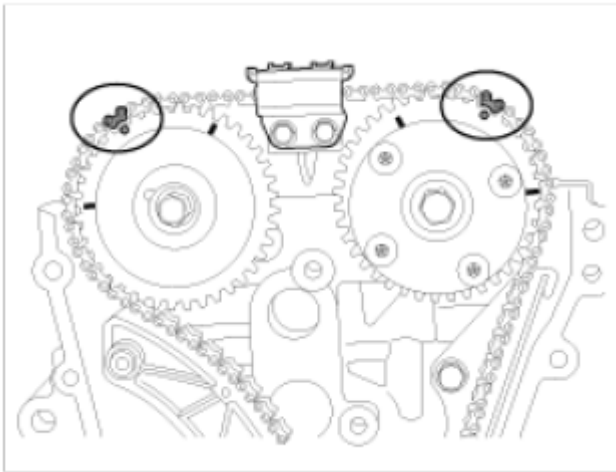


Fig. 55: Adjust Timing Belt Tensioner With Mounting Bolts
Courtesy of HYUNDAI MOTOR CO.

2. After checking the alignment between each sprocket and each timing belt tooth, tighten the mounting bolt (A) and (B) one by one.

Tightening torque:

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

3. Then recheck the belt tension.

Verify that when the tensioner and the tension side of the timing belt are pushed in horizontally with a moderate force [approx. 49 N (11 lb)], the timing belt cog end is approx. 1/2 of the tensioner mounting bolt head radius (across flats) away from the bolt head center.



Fig. 56: Identifying Timing Belt
Courtesy of HYUNDAI MOTOR CO.

4. Timing belt tension measuring procedure (by a sonic tension gauge)

Rotate crankshaft in clockwise direction to set 1st piston on top dead center (TDC) and rotate crankshaft in counterclockwise to 90° then measure the belt tension in the middle of tension side span (in arrow direction of above illustration) by free vibration method.

CAUTION: Avoid rotating the crankshaft in a counter clockwise direction.

Engine damage could occur.

Conversion equation of frequency into tension:

$$T = (4 / 9.8) \times S^2 \times M \times W \times f^2 / 100000000$$

S: Measured belt span (mm)

M: Unit weight of belt (gf/cm²)

W: Belt width (mm)

f: Transverse natural frequency of belt (Hz)

TIMING BELT SPECIFICATIONS

TIMING BELT SPECIFICATIONS

Item	Specifications
S (mm)	249.6
M (gf/cm ²)	0.4543
W (mm)	22
f (Hz)	70.4 ~ 87.9
T (kgf)	16 ± 3.5

9. Turn the crankshaft two turns in the operating direction (clockwise) and realign crankshaft sprocket and camshaft sprocket timing mark.
10. Install the timing belt lower cover (A) with 5 bolts (B).

Tightening torque:

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

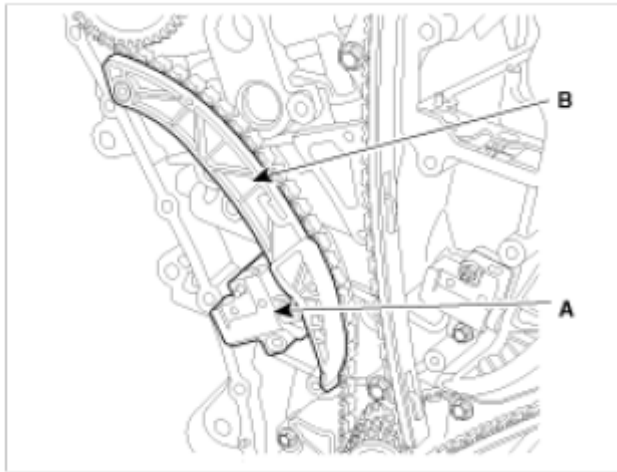


Fig. 57: Identifying Timing Belt Lower Cover
Courtesy of HYUNDAI MOTOR CO.

11. Install the flange and crankshaft pulley (A), and then tighten crankshaft pulley bolt.

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

Tightening torque:

137.3 ~ 147.1 N.m (14.0 ~ 15.0 kgf.m, 101.3 ~ 108.5 lb-ft)

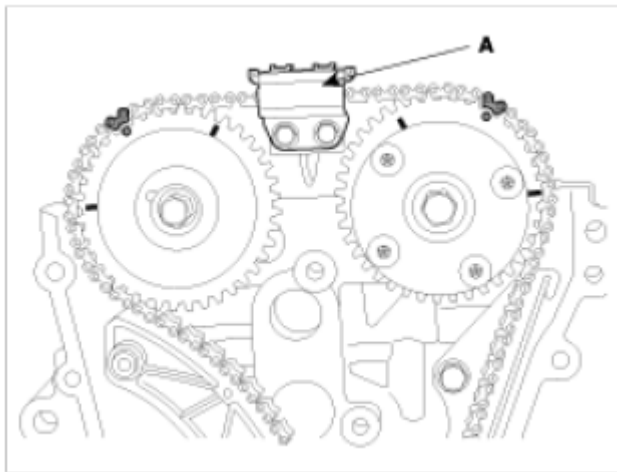


Fig. 58: Identifying Crankshaft Pulley
Courtesy of HYUNDAI MOTOR CO.

12. Install the timing belt upper cover (A) with 4 bolts (B).

Tightening torque:

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

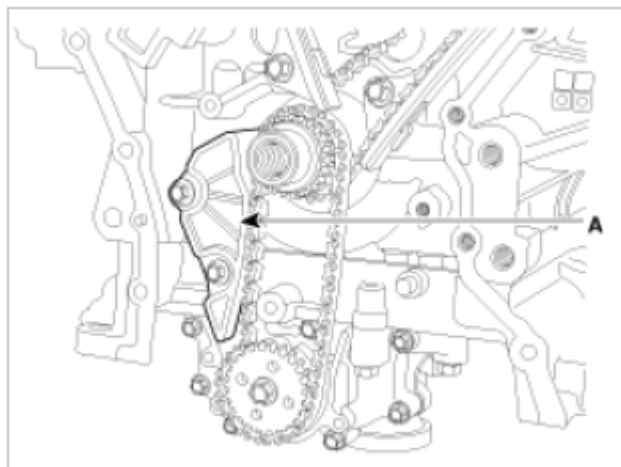


Fig. 59: Identifying Timing Belt Upper Cover
Courtesy of HYUNDAI MOTOR CO.

13. Install the water pump pulley and 4 bolts.
14. Install the power steering pump drive belt (C). (Refer to **CHECKING POWER STEERING BELT TENSION** - power steering pump).

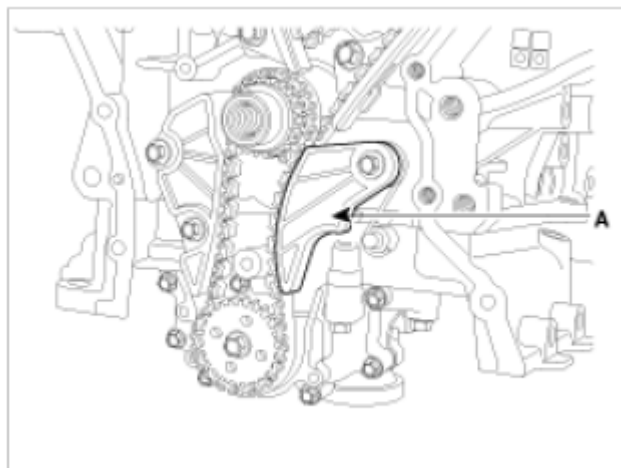


Fig. 60: Identifying Alternator Drive Belt
Courtesy of HYUNDAI MOTOR CO.

15. Install the air conditioner compressor drive belt (B). (Refer to **DRIVE BELT** - air conditioner compressor).
16. Install the alternator drive belt (A). (Refer to **REPLACEMENT** - alternator).
17. Install the RH side cover (A) with 2 bolts (B).

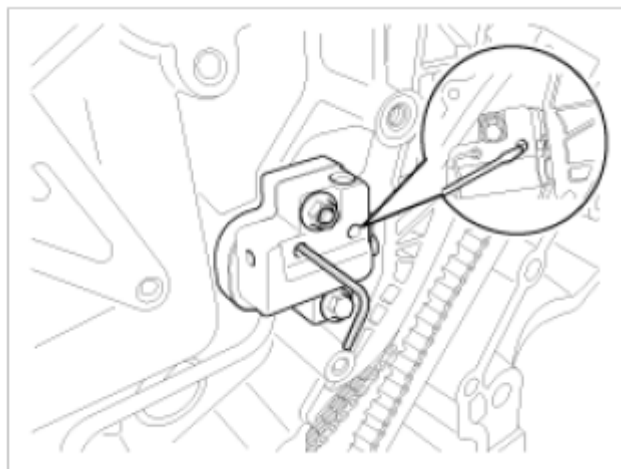


Fig. 61: Identifying RH Side Cover
Courtesy of HYUNDAI MOTOR CO.

18. Install the RH front wheel.

Tightening torque:

88.3 ~ 98.1 N.m (9.0 ~ 10.0 kgf.m, 65.1 ~ 72.3 lb-ft)

19. Install the engine cover with bolts.

Tightening torque:

7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

CYLINDER HEAD ASSEMBLY

COMPONENT

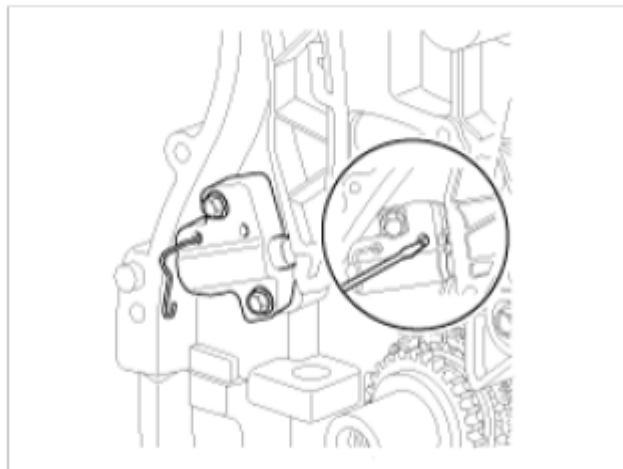


Fig. 62: Identifying Cylinder Head Assembly Component - Torque Specifications (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

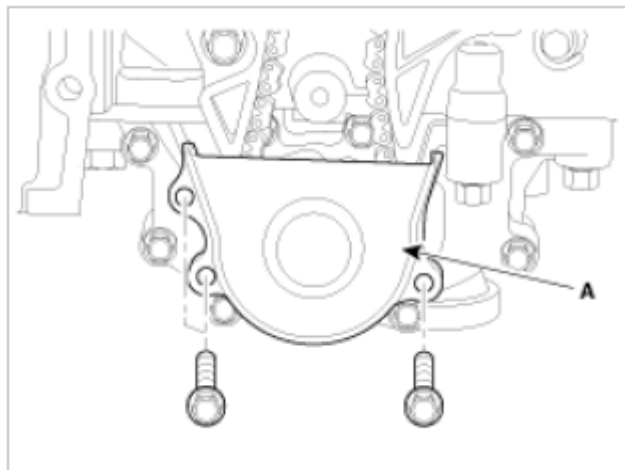


Fig. 63: Identifying Cylinder Head Assembly Component - Torque Specifications (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

Engine removal is not required for this procedure.

CAUTION:

- Use Fender cover 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 mis-connection.
- Inspect the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center. (Refer to **REMOVAL**).

1. Disconnect the terminals (A) from battery and remove the battery.

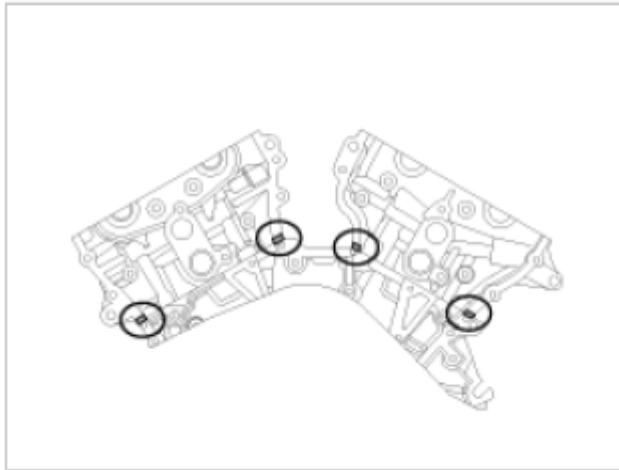


Fig. 64: Identifying Battery Terminals
Courtesy of HYUNDAI MOTOR CO.

2. Remove the engine cover.
3. Remove the under cover (A).

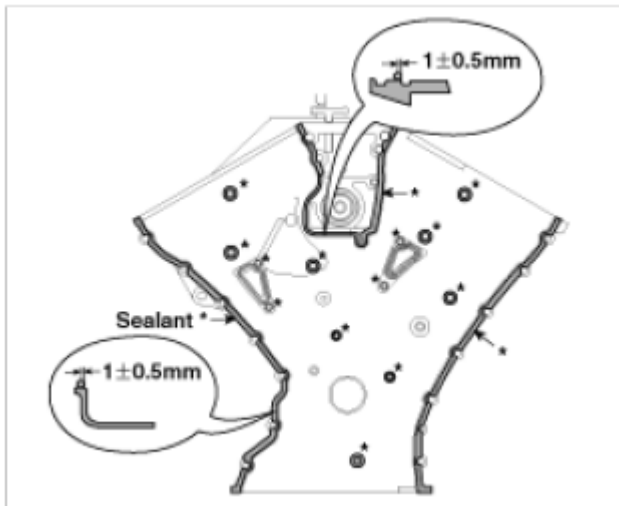


Fig. 65: Identifying Under Cover
Courtesy of HYUNDAI MOTOR CO.

4. Drain the engine coolant. (Refer to **ENGINE COOLANT REFILLING AND BLEEDING**). Remove the radiator cap to speed draining.
5. Remove the intake air hose and air cleaner assembly.
 1. Disconnect the breather hose (B) from intake air hose (D).
 2. Remove the intake air hose (D) and air cleaner upper cover (C).

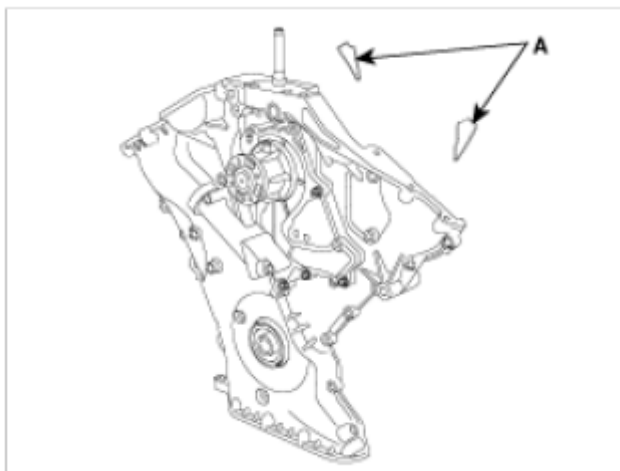


Fig. 66: Identifying Intake Air Hose & Air Cleaner Upper Cover
 Courtesy of HYUNDAI MOTOR CO.

3. Disconnect the ECM connector (A) and ECM connector (B) (A/T only).
4. Remove the air cleaner element and air cleaner lower cover (C).

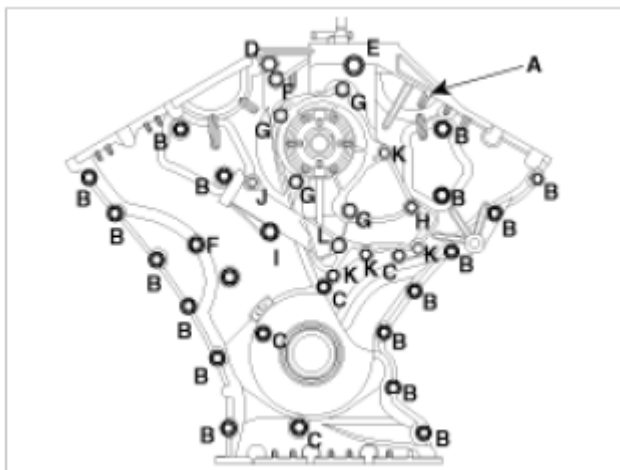


Fig. 67: Identifying Air Cleaner Element & Air Cleaner Lower Cover
 Courtesy of HYUNDAI MOTOR CO.

6. Remove the battery tray (A).

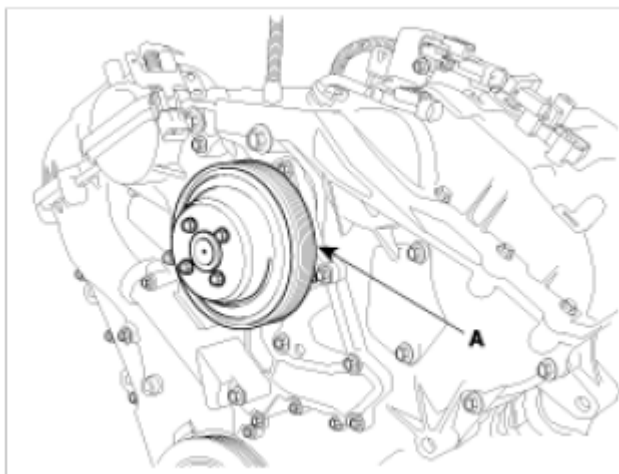


Fig. 68: Identifying Battery Tray
Courtesy of HYUNDAI MOTOR CO.

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

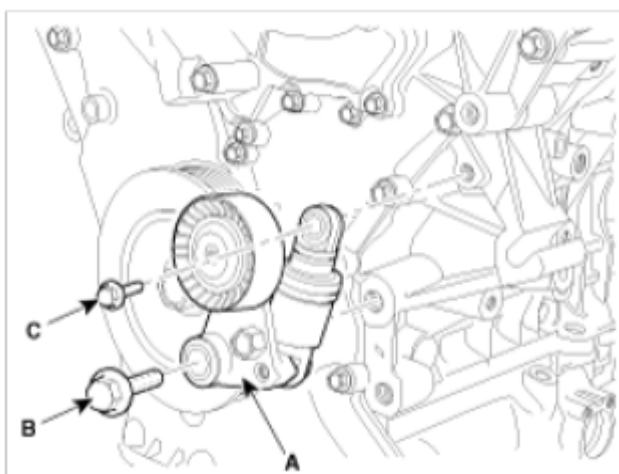


Fig. 69: Identifying Upper Radiator Hose & Lower Radiator Hose
Courtesy of HYUNDAI MOTOR CO.

8. Remove the heater hoses (A).
9. Remove the fuel hose (B).

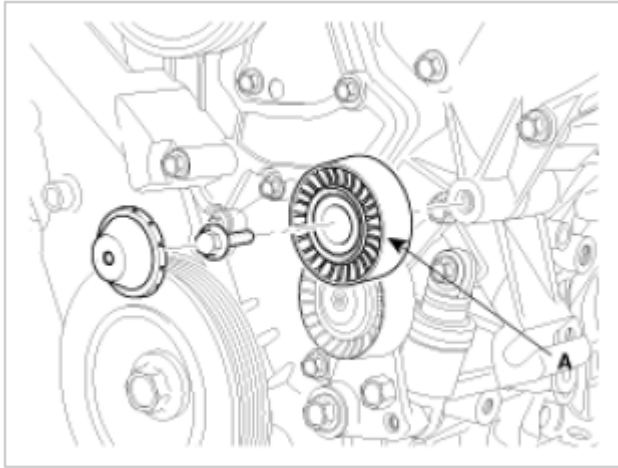


Fig. 70: Identifying Heater Hoses & Fuel Hose
Courtesy of HYUNDAI MOTOR CO.

10. Remove the accelerator cable (A) by loosening the lock-nut, then slip the cable end out of the throttle linkage.
11. Disconnect the TPS (Throttle Position Sensor) connector (B).

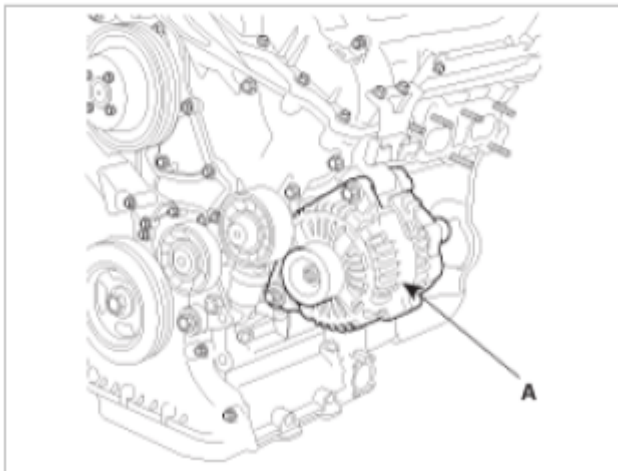


Fig. 71: Identifying Throttle Position Sensor Connector And Accelerator Cable
Courtesy of HYUNDAI MOTOR CO.

12. Remove the engine wire harness connectors and wire harness clamps from cylinder head and the intake manifold.
 1. Disconnect the rear oxygen sensor connector (A).
 2. Disconnect the air conditioner compressor switch connector (B).
 3. Disconnect the knock sensor connector (C).
 4. Disconnect the injector connectors (No. 3,4) (D).
 5. Disconnect the injector connectors (No. 1,2) (E)

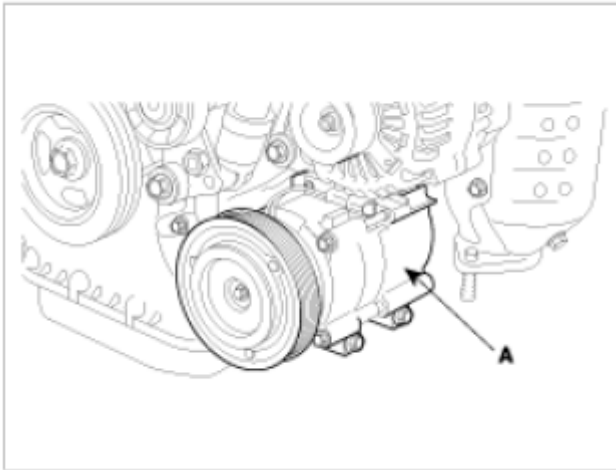


Fig. 72: Identifying Rear Oxygen Sensor Connector & Air Conditioner Compressor Switch Connector

Courtesy of HYUNDAI MOTOR CO.

6. Remove the wire harness bracket (A).
7. Disconnect the ISA (Idle Speed Actuator) connector (B).

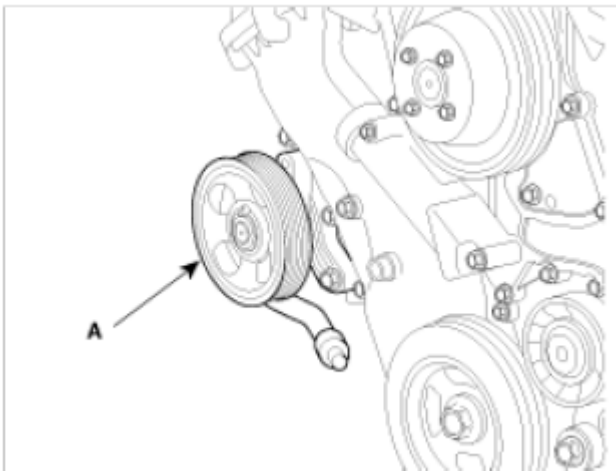


Fig. 73: Identifying Idle Speed Actuator Connector & Wire Harness Bracket

Courtesy of HYUNDAI MOTOR CO.

8. Disconnect the front oxygen sensor connector (A).
9. Disconnect the CKP(Crankshaft Position Sensor) connector (B).
10. Disconnect the OCV(Oil Control Valve) connector (C).

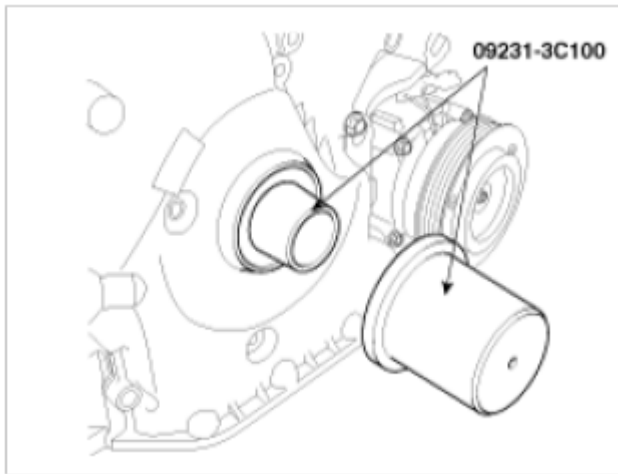


Fig. 74: Identifying Oxygen Sensor Connector , Crankshaft Position Sensor Connector & Oil Control Valve Connector

Courtesy of HYUNDAI MOTOR CO.

11. Disconnect the ignition coil connector (A).
12. Disconnect the ignition coil condenser connector (B).
13. Disconnect the CMP(Camshaft Position Sensor) connector (C).
14. Disconnect the ground cable (D).
15. Remove the wire harness bracket (E).

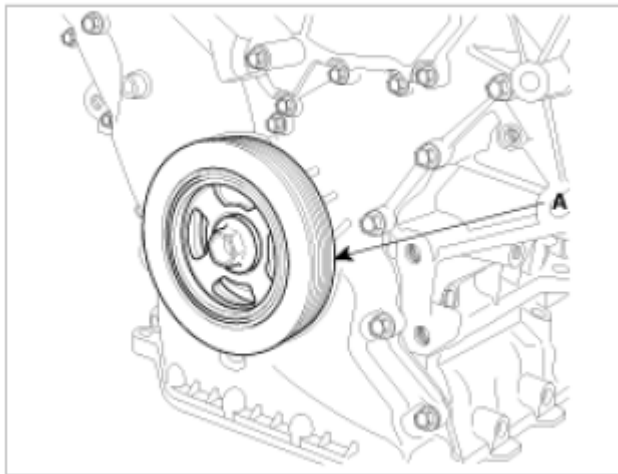


Fig. 75: Identifying Ignition Coil Connector

Courtesy of HYUNDAI MOTOR CO.

13. Disconnect the hose (A) of the PCSV (Purge Control Solenoid Valve) side.
14. Remove the brake booster vacuum hose (B).

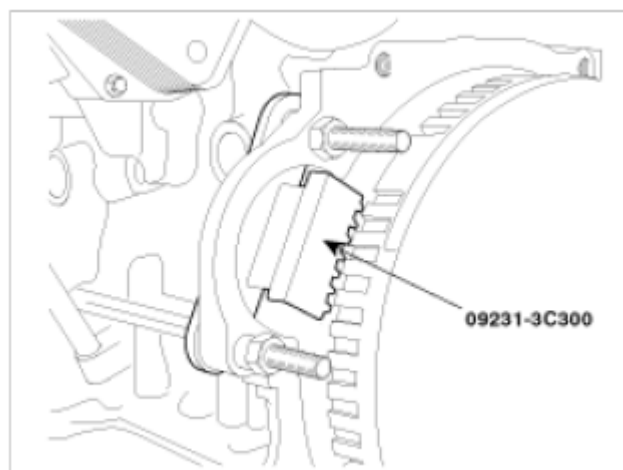


Fig. 76: Identifying Brake Booster Vacuum Hose
 Courtesy of HYUNDAI MOTOR CO.

15. Remove the power steering pump and fix the pump to vehicle with a wire. (Refer to **REMOVAL** - power steering pump).
16. Remove the ignition coil. (Refer to **REPLACEMENT** - ignition system)
17. Remove the exhaust manifold. (Refer to **REMOVAL**)
18. Remove the intake manifold. (Refer to **REMOVAL**)
19. Remove the timing belt. (Refer to **REMOVAL**)
20. Remove the cylinder head cover. (Refer to **REMOVAL**)
21. Remove the camshaft sprocket. (Refer to **REMOVAL**)
22. Remove the timing chain auto tensioner (A).

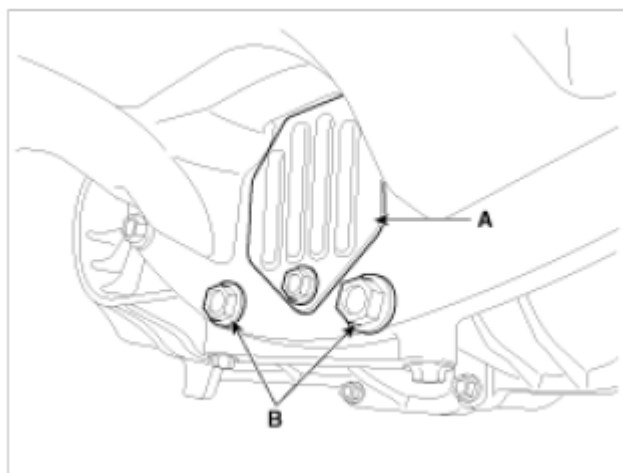


Fig. 77: Identifying Timing Chain Auto Tensioner
 Courtesy of HYUNDAI MOTOR CO.

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

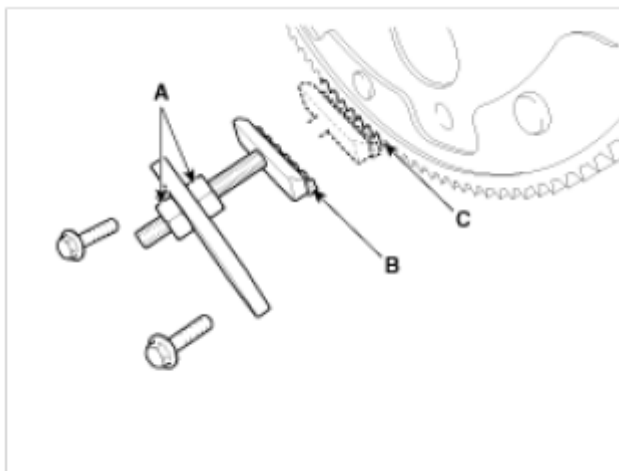


Fig. 78: Identifying Camshaft Bearing Caps & Camshafts
Courtesy of HYUNDAI MOTOR CO.

24. Remove the OCV(Oil Control Valve) (A).

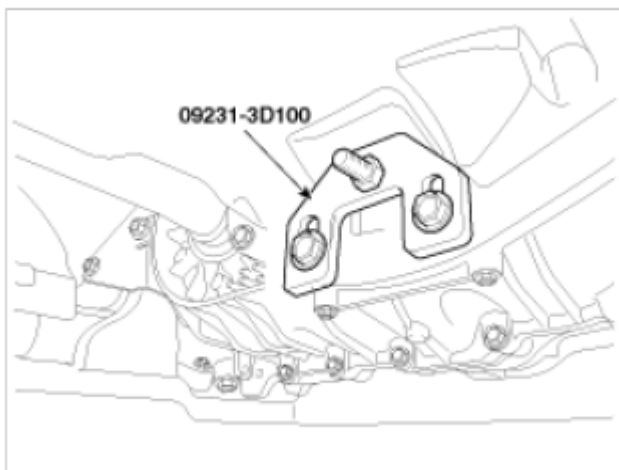


Fig. 79: Identifying Oil Control Valve
Courtesy of HYUNDAI MOTOR CO.

25. Remove the OCV(Oil Control Valve) filter (A).

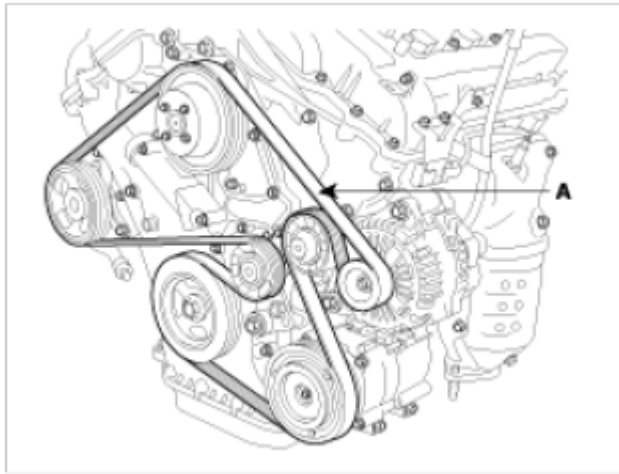


Fig. 80: Identifying Oil Control Valve
Courtesy of HYUNDAI MOTOR CO.

26. Remove the engine mounting support bracket fixing bolts (A).

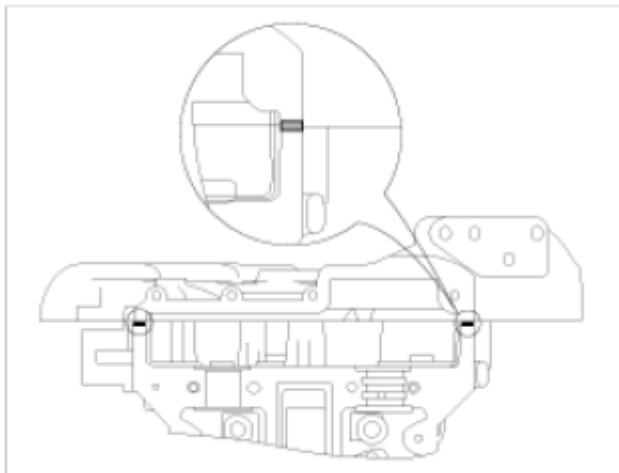


Fig. 81: Identifying Engine Mounting Support Bracket Bolts
Courtesy of HYUNDAI MOTOR CO.

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

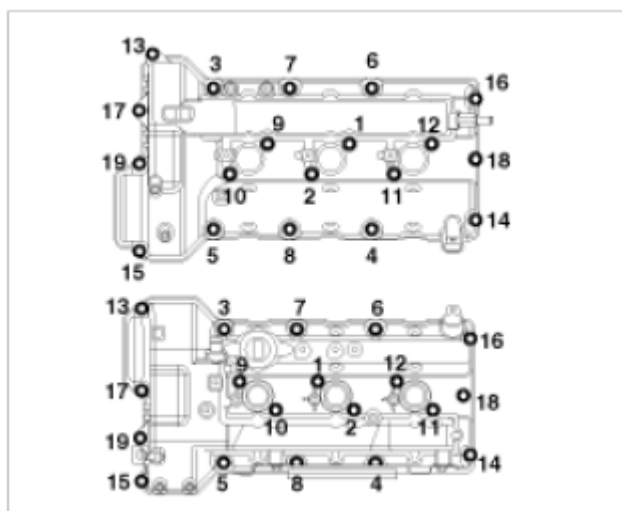


Fig. 82: Identifying Loosening Sequence For Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.

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

2. Lift the cylinder head from the dowels on the cylinder block and 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 HLA(Hydraulic Lash Adjuster), valves, valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove the HLAs (A).

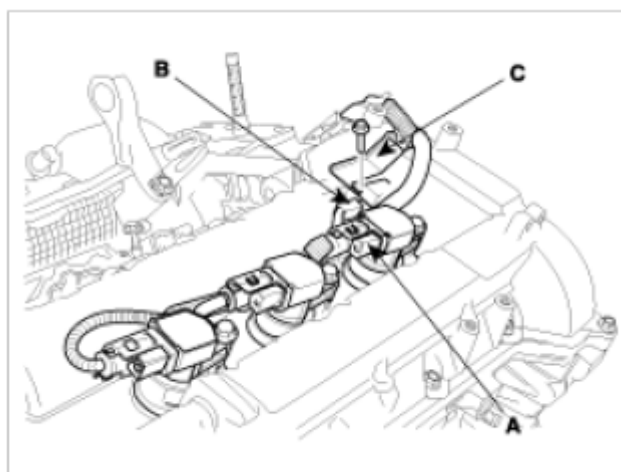


Fig. 83: Identifying Hydraulic Lash Adjuster
Courtesy of HYUNDAI MOTOR CO.

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

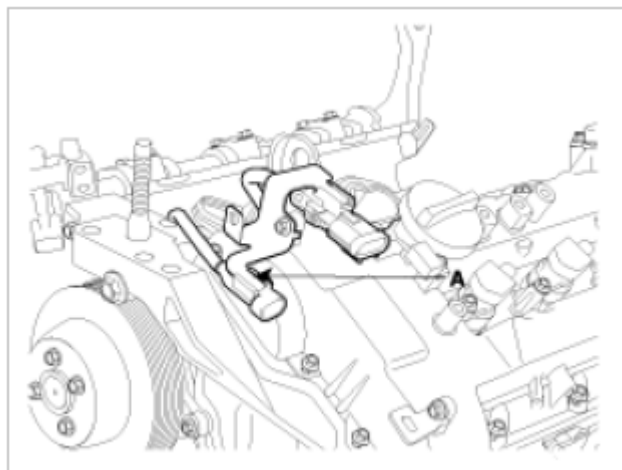


Fig. 84: Identifying SST (09222 - 28000, 09222 - 28100) On Valves
Courtesy of HYUNDAI MOTOR CO.

2. Remove the spring retainer.
3. Remove the valve spring.
4. Remove the valve.
5. Using a 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 0.03 mm (0.0012 in.)

Limit: 0.05 mm (0.0020 in.)

Flatness of manifold mating surface:

Standard: Less than 0.15 mm (0.0059 in.)

Limit: 0.20 mm (0.0079 in.)

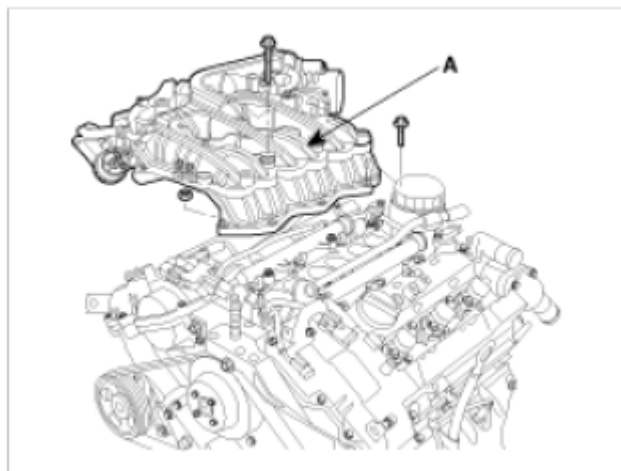


Fig. 85: Checking Cylinder Head Surface
Courtesy of HYUNDAI MOTOR CO.

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

Valve guide inner diameter:

6.000 ~ 6.015 mm (0.2362 ~ 0.2368 in.)

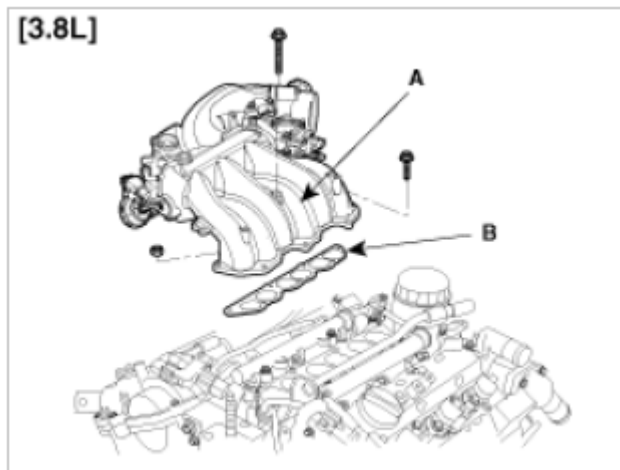


Fig. 86: Measuring Inner Diameter Of Valve Guide
Courtesy of HYUNDAI MOTOR CO.

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

Valve stem outer diameter:

Intake: 5.965 ~ 5.980 mm (0.2348 ~ 0.2354 in.)

Exhaust: 5.950 ~ 5.965 mm (0.2343 ~ 0.2348 in.)

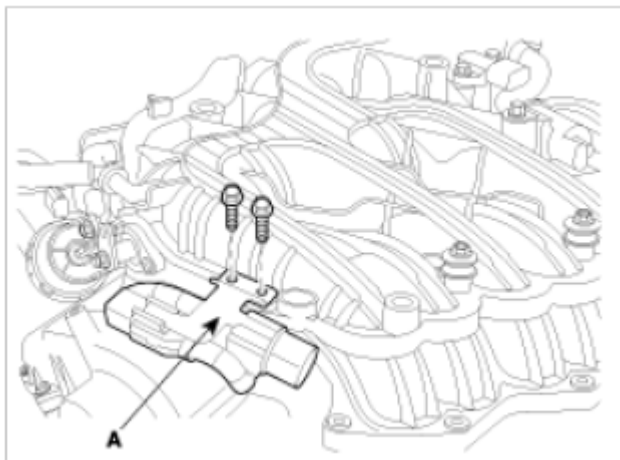


Fig. 87: Measuring Outer Diameter Of Valve Stem
Courtesy of HYUNDAI MOTOR CO.

3. Subtract the valve stem outer diameter measurement from the valve guide inner diameter measurement.

Valve stem-to-guide clearance Standard:

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

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

Limit

Intake: 0.10 mm (0.0039 in.)

Exhaust: 0.15 mm (0.0059 in.)

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

2. Inspect the valves.
 1. Check the valve is ground to the correct valve face angle.
 2. Check the surface of 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: 1.1 mm (0.0433 in.)

Exhaust: 1.3 mm (0.0512 in.)

Limit

Intake: 0.8 mm (0.0315 in.)

Exhaust: 1.0 mm (0.0394 in.)

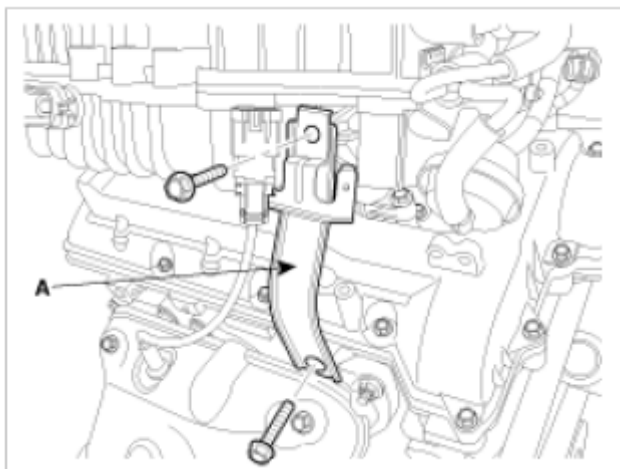


Fig. 88: Identifying Valve Head Margin Thickness
Courtesy of HYUNDAI MOTOR CO.

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

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

3. Inspect the valve seats.

1. Check the valve seat for evidence of overheating and improper contact with the valve face. Replace the seat if necessary.
2. Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it, then recondition the seat.
3. 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.

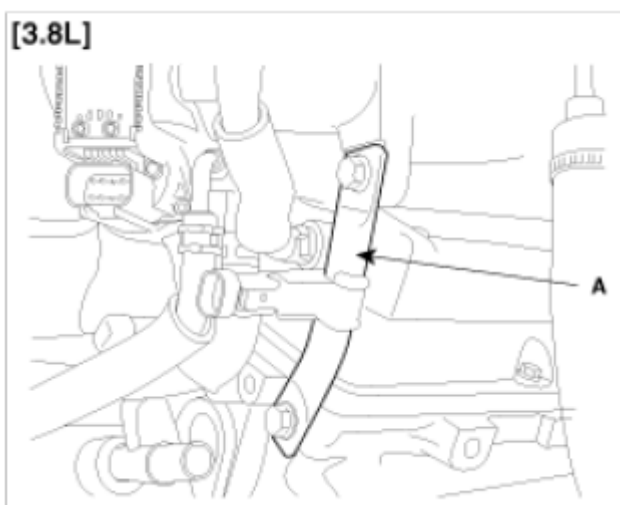


Fig. 89: Grinding Of Valve Seat
Courtesy of HYUNDAI MOTOR CO.

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

Valve spring Standard:

Free height: 44 mm (1.7323 in.)

Load: 21.6 ± 1.1 kg/35.0 mm (47.6 ± 2.4 lb/1.3780 in.) 45.1 ± 2.2 kg/27.2 mm (99.4 ± 4.9 lb/1.0709 in.)

Out of square: Less than 1.5°

Limit:

Out of square: 3°

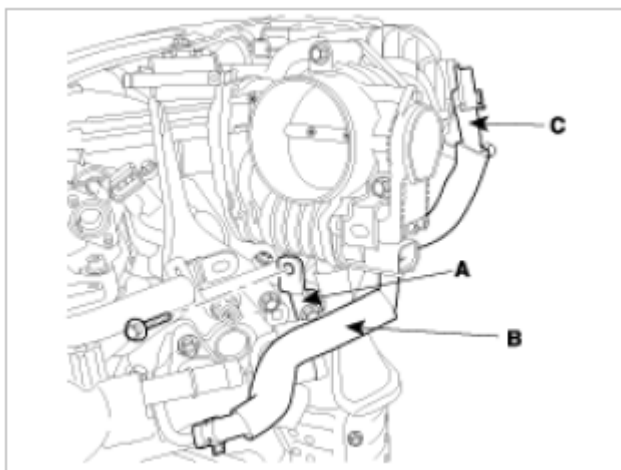


Fig. 90: Measuring Free Length Of Valve Spring
Courtesy of HYUNDAI MOTOR CO.

If the loads is not as specified, replace the valve spring.

CAMSHAFT

1. Inspect the cam lobes.

Using a micrometer, measure the cam lobe height.

Cam height

Intake: 43.7492 ~ 43.9492 mm (1.72241 ~ 1.73028 in.)

Exhaust: 44.1494 ~ 44.3494 mm (1.73816 ~ 1.74604 in.)

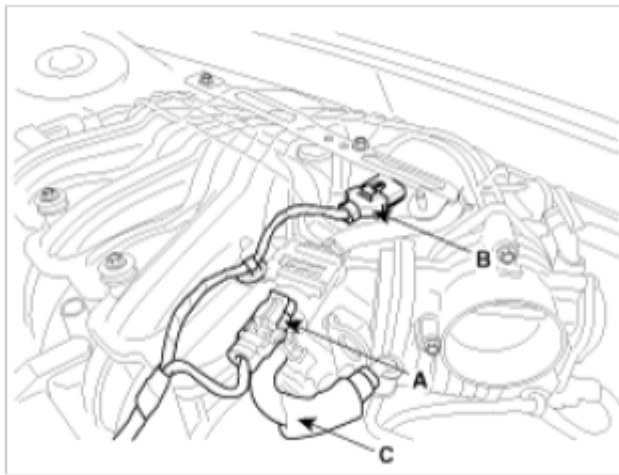


Fig. 91: Measuring Cam Lobe Height
Courtesy of HYUNDAI MOTOR CO.

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

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

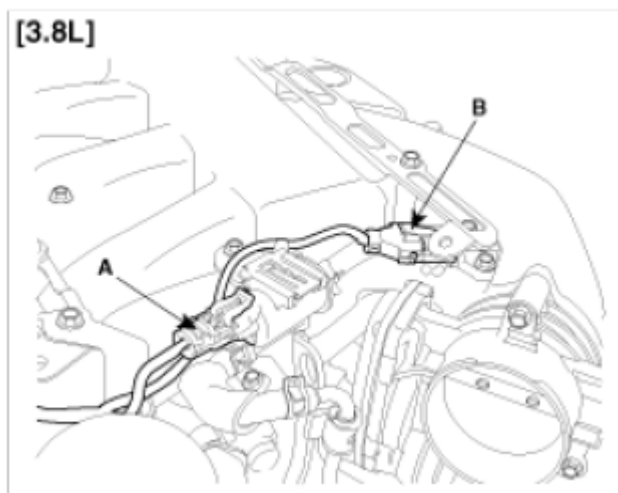


Fig. 92: Laying Strip Of Plastigage Of Camshaft Journal
Courtesy of HYUNDAI MOTOR CO.

4. Install the bearing caps and tighten the bolts with specified torque. (Refer to **INSTALLATION**).

CAUTION: Do not turn the camshaft.

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

Bearing oil clearance

Standard: 0.020 ~ 0.061 mm (0.0008 ~ 0.0024 in.)

Limit: 0.1 mm (0.0039 in.)

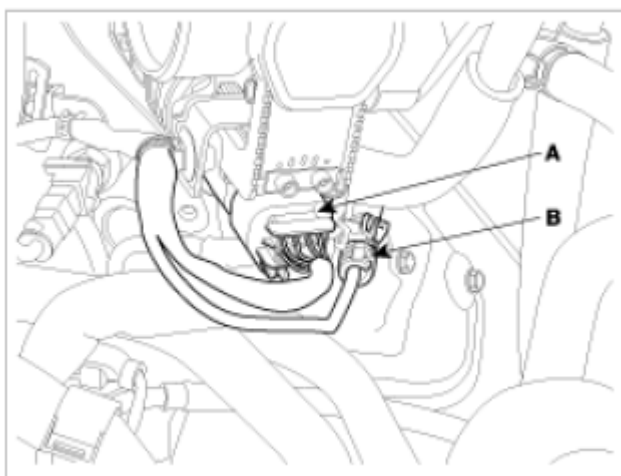


Fig. 93: Identifying Plastigage Widest Point
Courtesy of HYUNDAI MOTOR CO.

If the oil clearance is greater than specified, 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 the camshaft end play.
1. Install the camshafts. (Refer to **INSTALLATION**).
 2. Using a dial indicator, measure the end play while moving the camshaft back and forth.

Camshaft end play

Standard: 0.1 ~ 0.2 mm (0.0039 ~ 0.0079 in.)

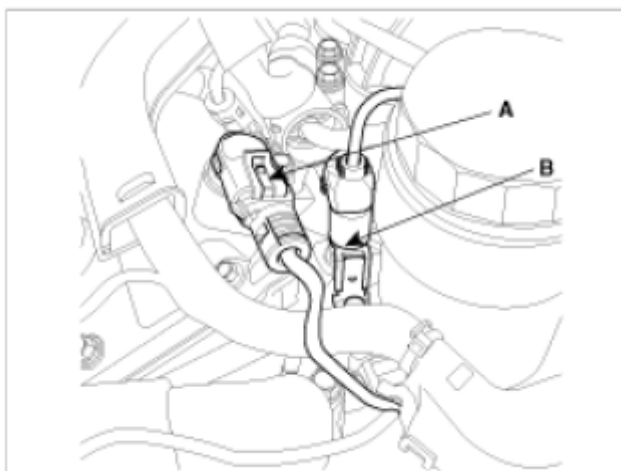


Fig. 94: Measuring Camshaft End Play
Courtesy of HYUNDAI MOTOR CO.

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

3. Remove the camshafts.

CVVT(CONTINUOUS VARIABLE VALVE TIMING) ASSEMBLY

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

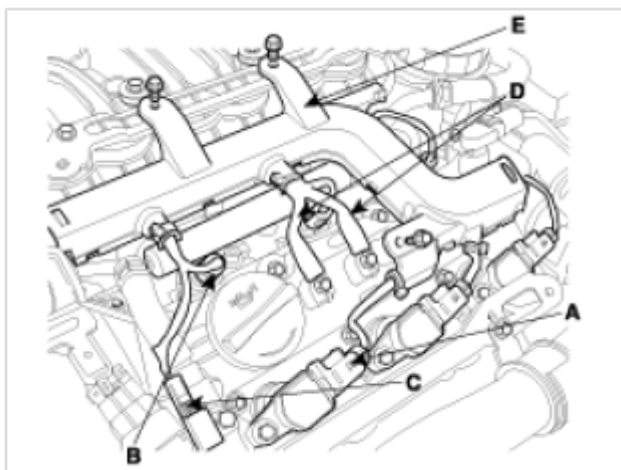


Fig. 95: Identifying Variable Valve Timing Port
Courtesy of HYUNDAI MOTOR CO.

3. Wrap tape around the tip of the air gun and apply air of approx. 98 kpa (1 kg/cm² , 14psi) to the

port of the camshaft.

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

NOTE: **Wrap around it with a shop rag and the likes, because the oil splashes.**

4. Under the condition of 3), turn the CVVT assembly to the advance angle side with your hand.
 - Depending on the air pressure, the CVVT assembly will turn to the advance side.
 - If air is leaking from the port and air pressure cannot be maintained, the locking pin will not release.

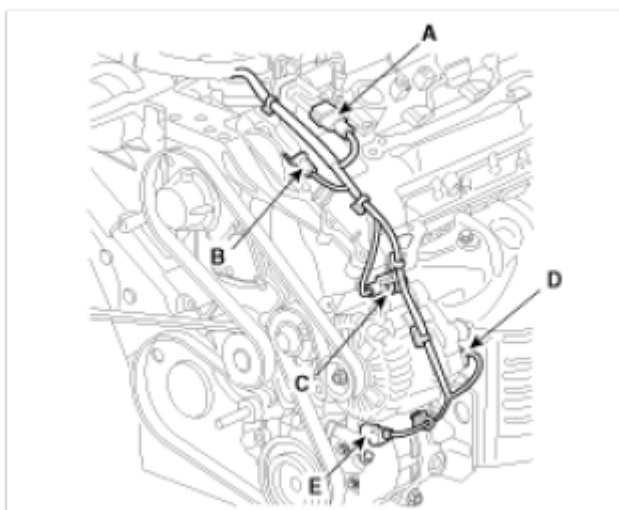


Fig. 96: Identifying CVVT Assembly
Courtesy of HYUNDAI MOTOR CO.

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

Standard: Movable smoothly in the range about 20°

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

HLA (HYDRAULIC LASH ADJUSTER)

With the HLA filled with engine oil, hold A and press B by hand. If B moves, replace the HLA.

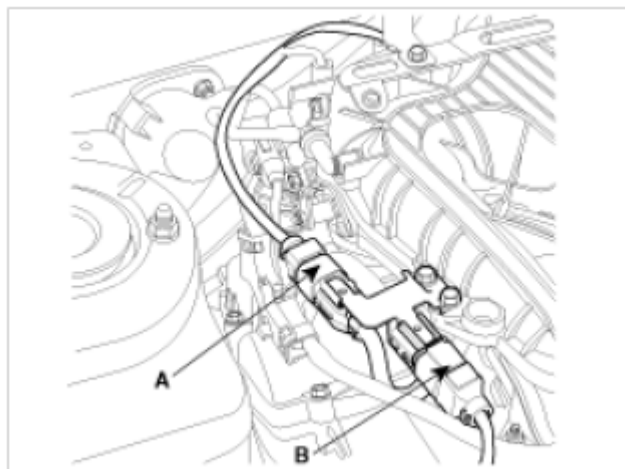


Fig. 97: Identifying Hydraulic Lash Adjuster
Courtesy of HYUNDAI MOTOR CO.

TROUBLESHOOTING CHART

No.	Problem	Possible cause	Action
1	Temporary noise when starting a cold engine	Normal	This noise will disappear after the oil in the engine reaches the normal pressure.
2	Continuous noise when the engine is started after parking more than 48 hours.	Oil leakage of the high pressure chamber on the HLA, allowing air to get in.	Noise will disappear within 15 minutes when engine runs at 2,000 ~ 3,000 RPM. If it doesn't disappear, refer to step 7 below.
3	Continuous noise when the engine is first started after rebuilding cylinder head.	Insufficient oil in cylinder head oil gallery.	CAUTION: Do not run engine at a speed higher than 3,000 RPM, as this may damage the HLA.
4	Continuous noise when the engine is started after excessively cranking the engine by the starter motor.	Oil leakage of the high-pressure chamber in the HLA, allowing air to get in.	
5	Continuous noise when the engine is running after changing the HLA.	Insufficient oil in the HLA.	
6	Continuous noise during idle after high engine speed.	Engine oil level too high or too low.	Check oil level. Drain or add oil as necessary.
		Excessive amount of air in the oil at high engine speed.	Check oil supply system
		Deteriorated oil.	Check oil quality.

			If deteriorated, replace with specified type.
7	Noise continues for more than 15 minutes.	Low oil pressure	Check oil pressure and oil supply system of each part of engine.
		Faulty HLA.	Remove the cylinder head cover and press HLA down by hand. If it moves, replace the HLA. WARNING: Be careful with the hot HLAs.

REPLACEMENT

VALVE GUIDE

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

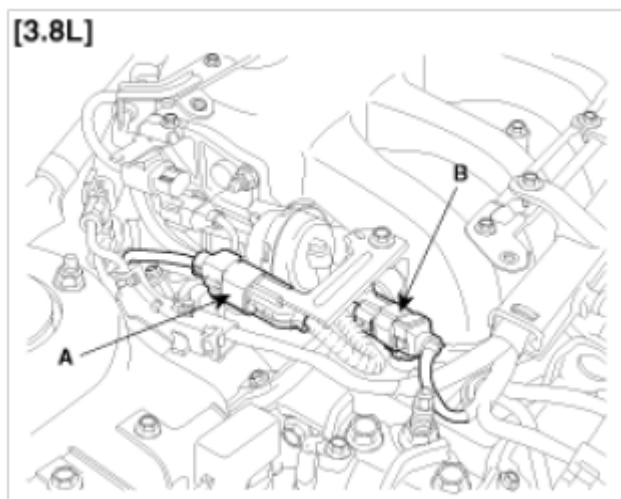


Fig. 98: Identifying SST (09221 - 3F100A) On Cylinder Head
Courtesy of HYUNDAI MOTOR CO.

2. Recondition the valve guide hole of cylinder head so that it can match the newly press-fitted oversize valve guide.
3. Using the SST (09221-3F100A, 09221-26000), press-fit the valve guide. The valve guide must be press-fitted from the upper side of the cylinder head. Keep in mind that the intake and exhaust valve guides are different in length.

Valve guide length

Intake: 36.3 ~ 36.7 mm (1.4291 ~ 1.4449 in.)

Exhaust: 40.8 ~ 41.2 mm (1.6063 ~ 1.6220 in.)

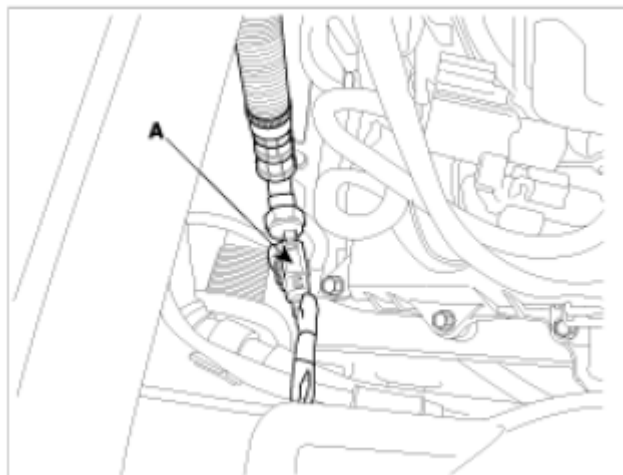


Fig. 99: Identifying Valve Guide Length
Courtesy of HYUNDAI MOTOR CO.

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

VALVE GUIDE OVERSIZE

VALVE GUIDE OVERSIZE SPECIFICATIONS

Item	Oversize [mm (in.)]	Size mark	Valve guide hole inner diameter [mm (in.)]	Valve guide outer diameter [mm (in.)]	Valve guide protrusion height [mm (in.)]
Valve guide	STD	-	11.000 ~ 11.018 (0.4331 ~ 0.4338)	11.050 ~ 11.060 (0.4350 ~ 0.4354)	12.8 (0.5039)
	0.05 (0.002) OS	5	11.050 ~ 11.068 (0.4350 ~ 0.4357)	11.100 ~ 11.110 (0.4370 ~ 0.4374)	
	0.25 (0.010) OS	25	11.250 ~ 11.268 (0.4429 ~ 0.4436)	11.300 ~ 11.310 (0.4449 ~ 0.4453)	
	0.50 (0.020) OS	50	11.500 ~ 11.518 (0.4528 ~ 0.4535)	11.550 ~ 11.560 (0.4547 ~ 0.4551)	

VALVE SEAT RING

1. Cut away the inner face of the valve seat to reduce the wall thickness.

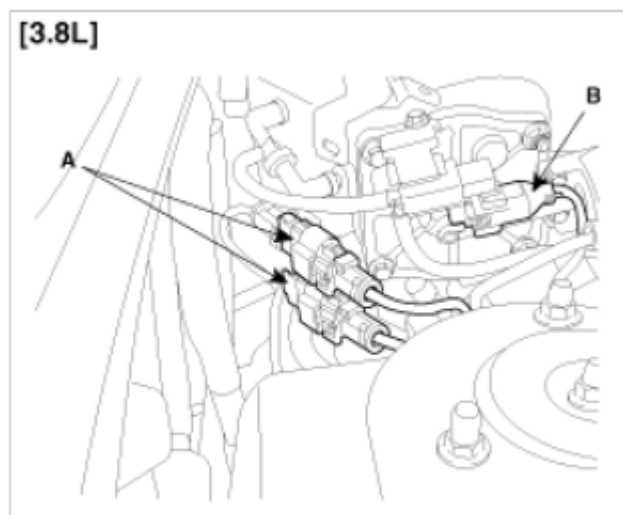


Fig. 100: Identifying Inner Face Of Valve Seat Thickness

Courtesy of HYUNDAI MOTOR CO.

2. Enlarge the seat ring hole of cylinder head so that matches the specified cylinder head hole inner diameter of new valve seat ring.
3. Heat the cylinder head to about 250°C(480°F) and press-fit an oversize seat ring for the cylinder head hole size.
4. Using lapping compound, lap the valve to the new seat.

VALVE SEAT RING OVERSIZE

VALVE GUIDE OVERSIZE SPECIFICATIONS

Item	Over size mm (in.)	Size mark	Seat ring hole inner diameter [mm (in.)]	Seat ring outer diameter [mm (in.)]	Seat ring height [mm (in.)]
Intake valve seat ring	STD	-	30.400 ~ 30.421 (1.1968 ~ 1.1977)	30.490 ~ 30.505 (1.2004 ~ 1.2010)	4.800 ~ 5.000 (0.1890 ~ 0.1969)
	0.3(0.012)OS	30	30.700 ~ 30.721 (1.2087 ~ 1.2095)	30.790 ~ 30.805 (1.2122 ~ 1.2128)	5.100 ~ 5.300 (0.2008 ~ 0.2087)
	0.6(0.024)OS	60	31.000 ~ 31.021 (1.2205 ~ 1.2213)	31.090 ~ 31.105 (1.2240 ~ 1.2246)	5.400 ~ 5.600 (0.2126 ~ 0.2205)
Exhaust valve seat ring	STD	-	27.000 ~ 27.021 (1.0630 ~ 1.0638)	27.095 ~ 27.115 (1.0667 ~ 1.0675)	5.900 ~ 6.100 (0.2323 ~ 0.2402)
	0.3(0.012)	30	27.300 ~ 27.321 (1.0748 ~ 1.0756)	27.395 ~ 27.415 (1.0785 ~ 1.0793)	6.200 ~ 6.400 (0.2441 ~ 0.2520)
	0.6(0.024)	60	27.600 ~ 27.621	27.695 ~ 27.715	6.500 ~ 6.700

(1.0866 ~
1.0874)(1.0904 ~
1.0911)(0.2559 ~
0.2638)**REASSEMBLY****NOTE:**

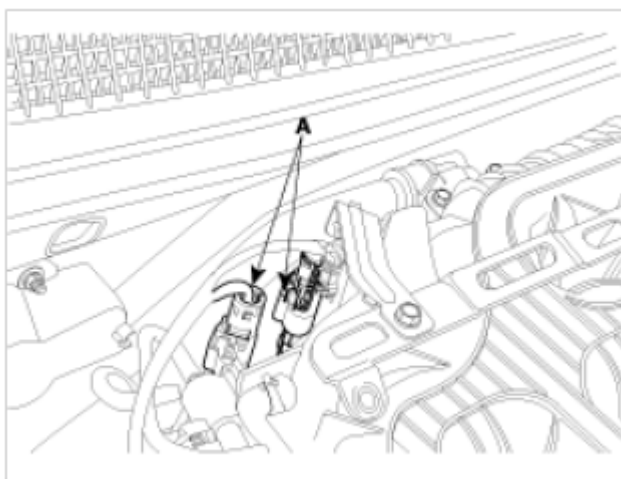
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surface.
- Replace oil seals with new ones.

1. Install the valves.

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

NOTE:

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

**Fig. 101: Taping Oil Seal****Courtesy of HYUNDAI MOTOR CO.**

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

NOTE:

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

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



Fig. 102: Compressing Spring & Retainer Locks
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.

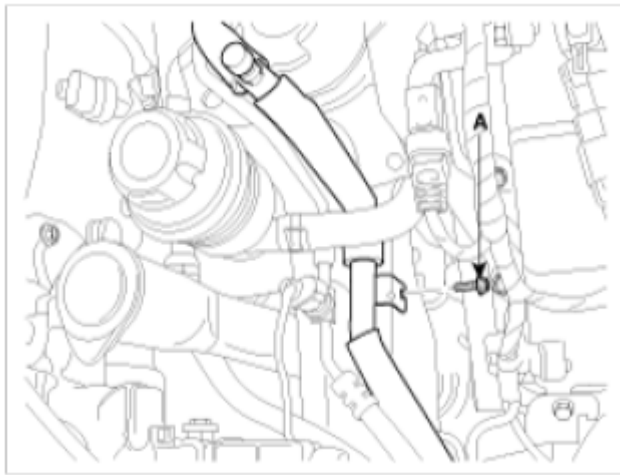


Fig. 103: Taping Valve Stem
Courtesy of HYUNDAI MOTOR CO.

2. Install the HLA(Hydraulic Lash Adjuster)s. Check that the HLA rotates smoothly by hand.

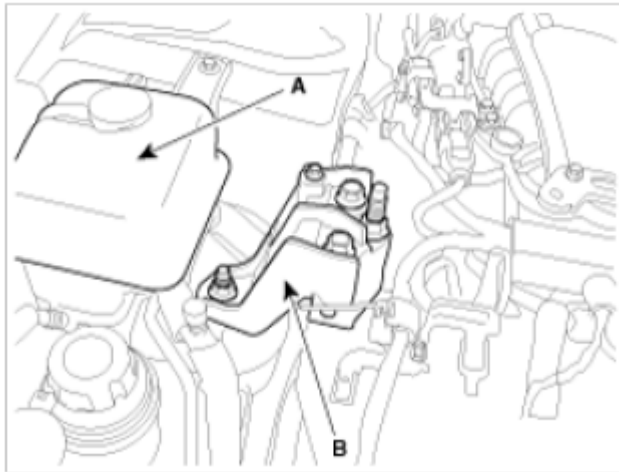


Fig. 104: Identifying Hydraulic Lash Adjuster
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION

NOTE:

- Thoroughly clean all parts to be assembled.
- Always use a new cylinder head and manifold gasket.
- Always use a new cylinder head bolt.
- 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.

NOTE:

Be careful of the installation direction.

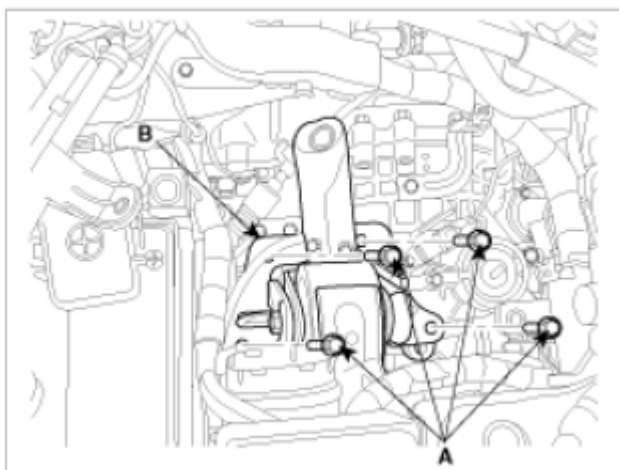


Fig. 105: Identifying Cylinder Head Gasket On Cylinder Block
Courtesy of HYUNDAI MOTOR CO.

2. Place the cylinder head quietly in order not to damage the gasket with the bottom part of the end.
3. Install the 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 8 mm and 10 mm hexagon wrench, install and tighten the 10 cylinder head bolts and plate washers, in several passes, in the sequence shown.

Tightening torque:

29.4 N.m (3.0 kgf.m, 21.7 lb-ft) + 90° --> Release all bolts --> 29.4 N.m (3.0 kgf.m, 21.7 lb-ft) + 90°



Fig. 106: Identifying Tightening Sequence For Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.

4. Install the engine mounting support bracket fixing bolts (A).

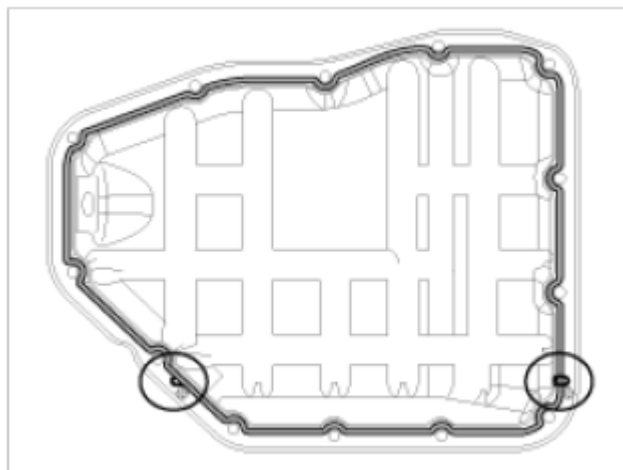


Fig. 107: Identifying Engine Mounting Support Bracket Bolts
Courtesy of HYUNDAI MOTOR CO.

5. Install the OCV(Oil Control Valve) filter (A).

Tightening torque:

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

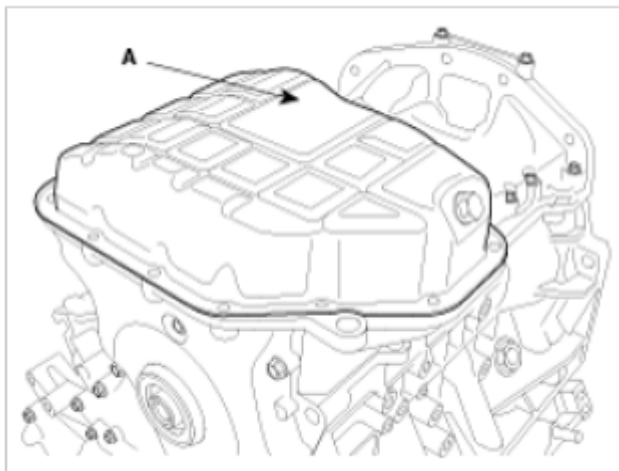


Fig. 108: Identifying Filter (Oil Control Valve)
Courtesy of HYUNDAI MOTOR CO.

NOTE:

- Always use a new OCV(Oil Control Valve) filter gasket.
- Keep clean the OCV(Oil Control Valve) filter.

6. Install the OCV(Oil Control Valve) (A).

Tightening torque:

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

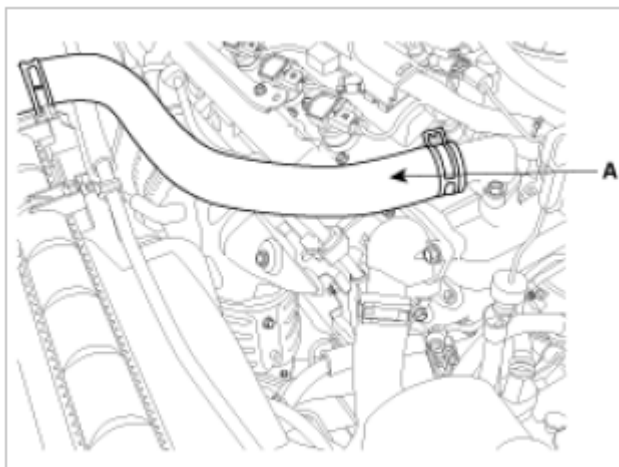


Fig. 109: Identifying Oil Control Valve
Courtesy of HYUNDAI MOTOR CO.

CAUTION:

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

7. Install the camshafts.

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

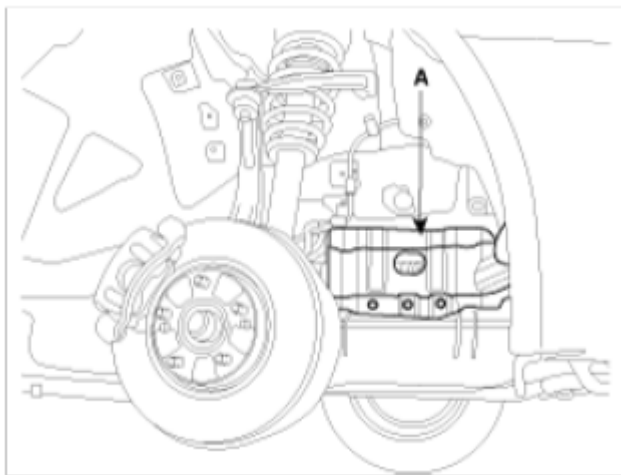


Fig. 110: Identifying Timing Chain Installation Positions
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque:

11.8 ~ 13.7 N.m (1.2 ~ 1.4 kgf.m, 8.7 ~ 10.1 lb-ft)

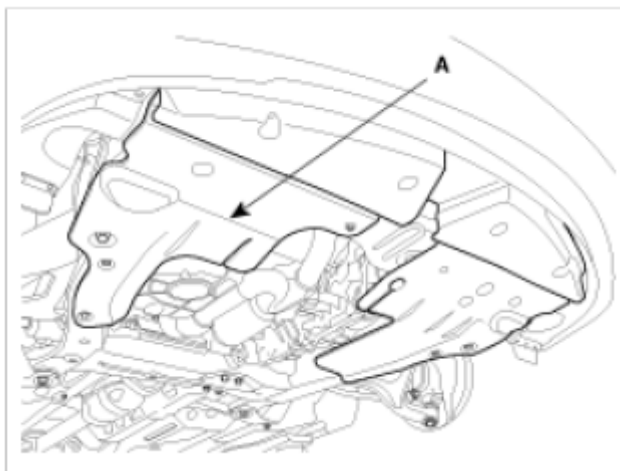


Fig. 111: Identifying Camshaft & Bearing Caps
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque:

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

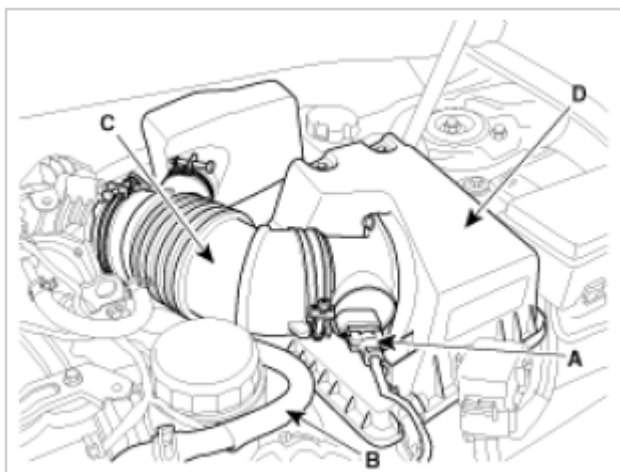


Fig. 112: Identifying Timing Chain Auto Tensioner
Courtesy of HYUNDAI MOTOR CO.

8. Using the SST (09221 - 21000), install the camshaft bearing oil seal.

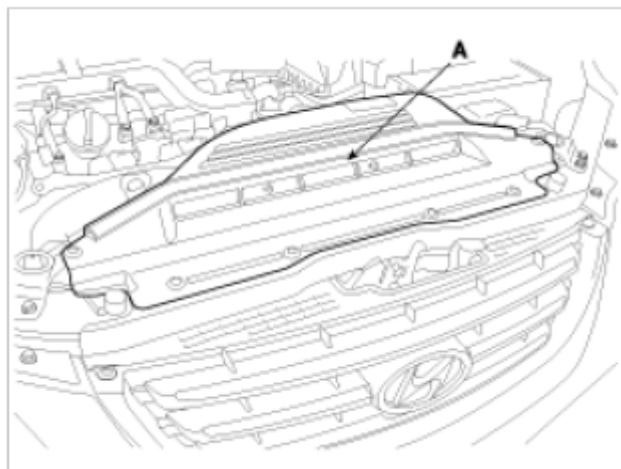


Fig. 113: Identifying SST (09221 - 21000) On Camshaft Bearing Oil Seal
Courtesy of HYUNDAI MOTOR CO.

9. Install the camshaft sprocket. (Refer to **INSTALLATION**).
10. Install the cylinder head cover.
 1. Install the cylinder head cover gasket (A) in the groove of the cylinder head cover (B).

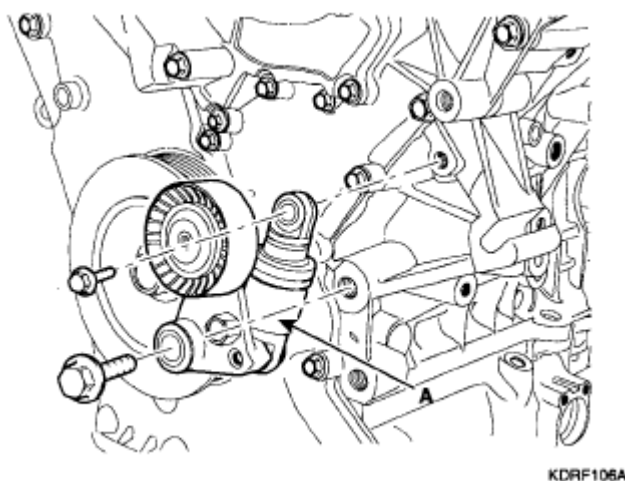


Fig. 114: Identifying Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

NOTE:

- Before installing the cylinder head cover gasket, thoroughly clean the cylinder head cover and the groove.
- When installing, make sure the cylinder 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.

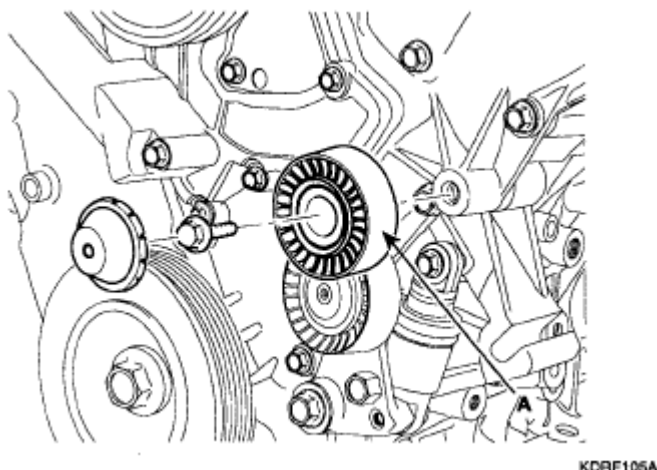


Fig. 115: Identifying Cylinder Head Cover Gasket
Courtesy of HYUNDAI MOTOR CO.

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 bolts (B). Uniformly tighten the bolts in several passes. Pre-tighten all bolts by 3.9 ~ 4.9 N.m (0.4 ~ 0.5 kgf.m, 2.9 ~ 3.6 lb-ft) and then tighten by the specified torque.

Tightening torque:

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

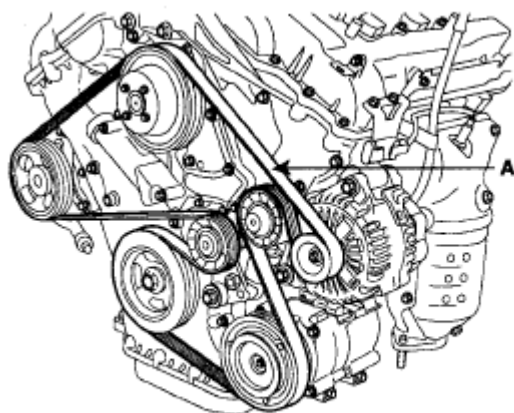
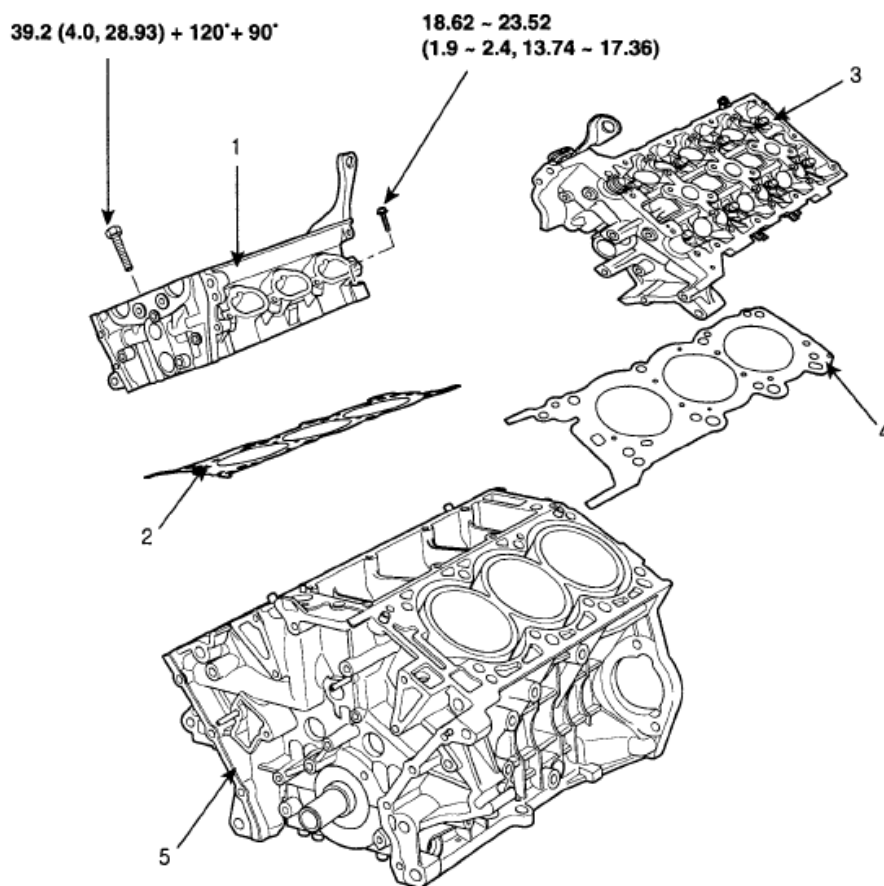


Fig. 116: Identifying Cylinder Head Cover Installation Positions

Courtesy of HYUNDAI MOTOR CO.

11. Install the timing belt. (Refer to **INSTALLATION**)
12. Install the intake manifold. (Refer to **REMOVAL**)
13. Install the exhaust manifold. (Refer to **REMOVAL**).
14. Install the ignition coil. (Refer to **REPLACEMENT** - ignition system).
15. Install the power steering pump. (Refer to **POWER STEERING OIL PUMP**).
16. Install the brake booster hose (B).
17. Connect the hose (A) of the PCSV (Purge Control Solenoid Valve) side.



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

1. RH cylinder head
2. RH cylinder head gasket
3. LH cylinder head

4. LH cylinder head gasket
5. Cylinder block

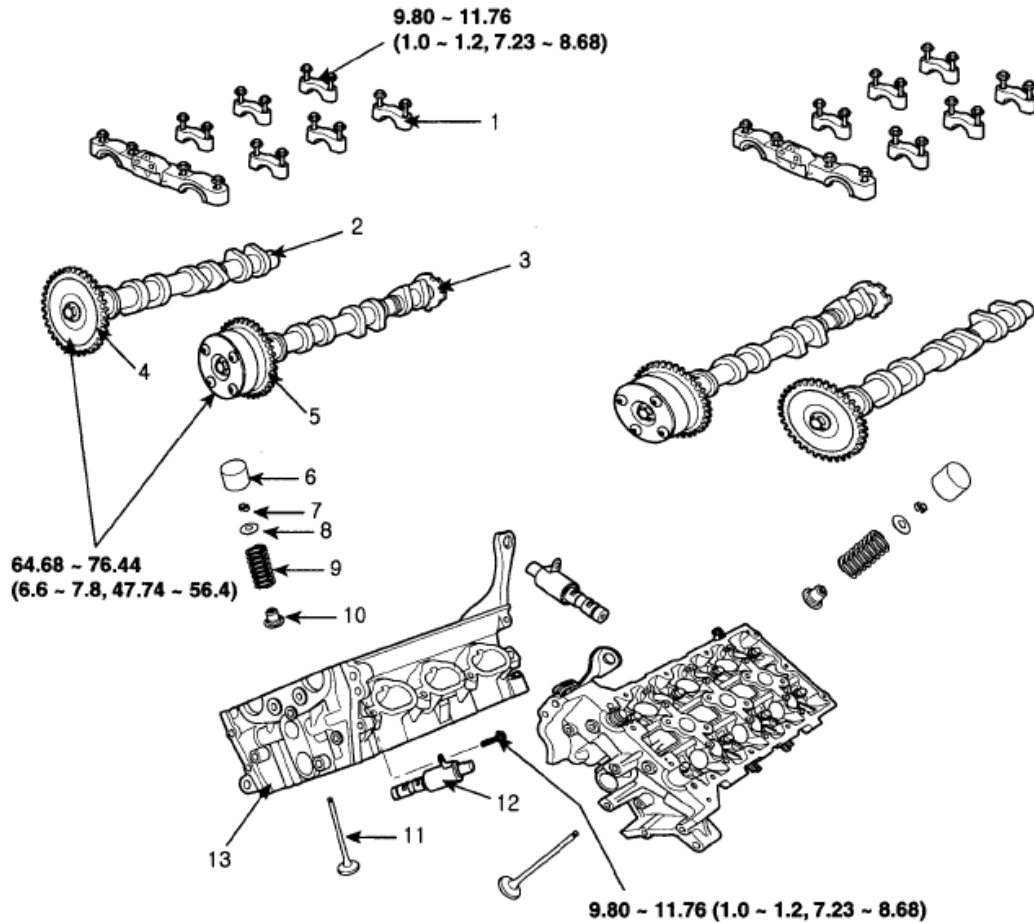
ECBF010A

Fig. 117: Identifying Brake Booster Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

18. Install the engine wire harness connectors and wire harness clamps to the cylinder head and the intake

manifold.

1. Install the wire harness bracket (E).
2. Connect the ground cable (D).
3. Connect the CMP(Camshaft position sensor) connector (C).
4. Connect the ignition coil condenser connector (B).
5. Connect the ignition coil connector (A).



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

1. Camshaft bearing cap
2. Exhaust camshaft
3. Intake camshaft
4. Exhaust camshaft sprocket
5. CVVT assembly

6. MLA
7. Retainer lock
8. Retainer
9. Valve spring
10. Valve stem seal

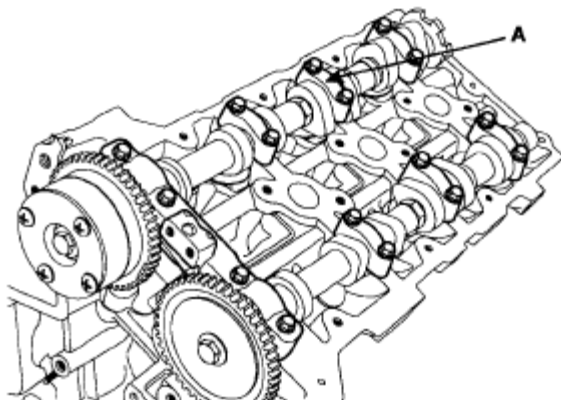
11. Valve
12. OCV
13. Cylinder head

ECBF011A

Fig. 118: Identifying Ignition Coil Connector
Courtesy of HYUNDAI MOTOR CO.

6. Connect the OCV(Oil Control Valve) connector (C).

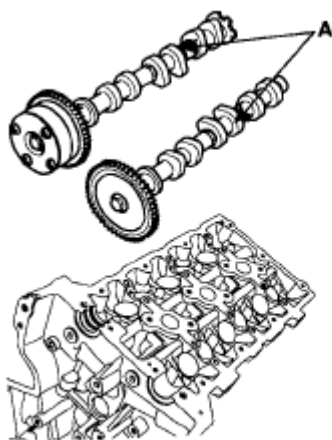
7. Connect the CKP(Crankshaft Position Sensor) connector (B).
8. Connect the front oxygen sensor connector (A).



KDRF196A

Fig. 119: Identifying Oxygen Sensor Connector , Crankshaft Position Sensor Connector & Oil Control Valve Connector
Courtesy of HYUNDAI MOTOR CO.

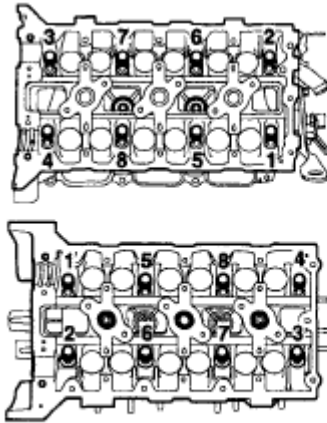
9. Connect the ISA(Idle Speed Actuator) connector (B).
10. Install the wire harness bracket (A).



KDRF197A

Fig. 120: Identifying Idle Speed Actuator Connector & Wire Harness Bracket
Courtesy of HYUNDAI MOTOR CO.

11. Connect the injector connectors (No. 1,2) (E).
12. Connect the injector connectors (No. 3,4) (D).
13. Connect the knock sensor connector (C).
14. Connect the air conditioner compressor switch connector (B).
15. Connect the rear oxygen sensor connector (A).

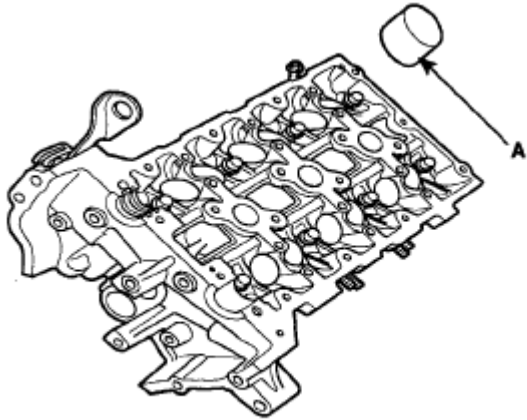


KDRF199A

Fig. 121: Identifying Rear Oxygen Sensor Connector & Air Conditioner Compressor Switch Connector

Courtesy of HYUNDAI MOTOR CO.

19. Connect the TPS (Throttle Position Sensor) connector (B).
20. Install the accelerator cable (A).

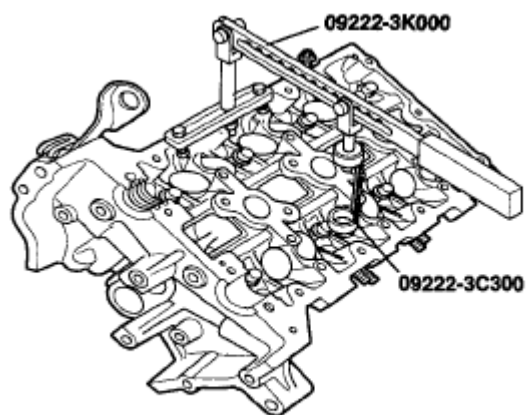


KDRF200A

Fig. 122: Identifying Throttle Position Sensor Connector & Accelerator Cable

Courtesy of HYUNDAI MOTOR CO.

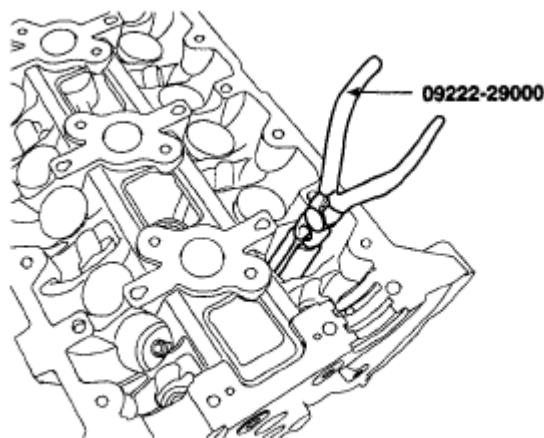
21. Install the fuel hose (B).
22. Install the heater hoses (A).



KDRF201A

Fig. 123: Identifying Heater Hoses & Fuel Hose
Courtesy of HYUNDAI MOTOR CO.

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



KDRF234A

Fig. 124: Identifying Upper Radiator Hose & Lower Radiator Hose
Courtesy of HYUNDAI MOTOR CO.

24. Install the battery tray (A).

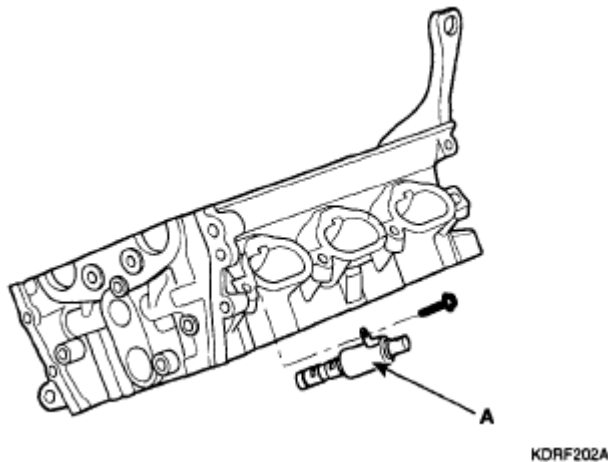


Fig. 125: Identifying Battery Tray
 Courtesy of HYUNDAI MOTOR CO.

25. Install the intake air hose and air cleaner assembly.
 1. Install the air cleaner element and air cleaner lower cover (C).

Tightening torque:

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

2. Connect the ECM connector (A) and ECM connector (B) (A/T only).

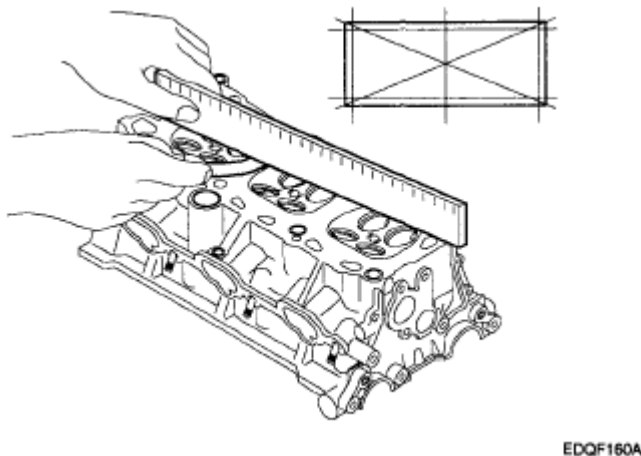
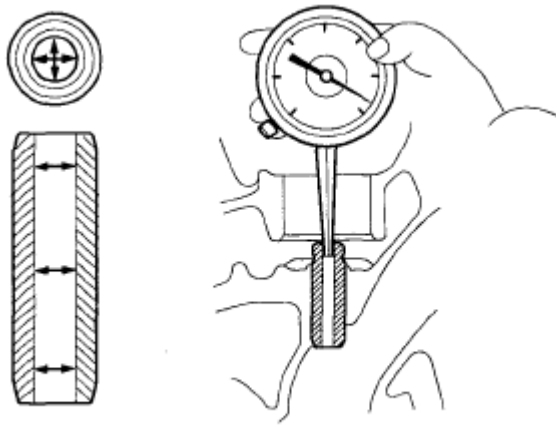


Fig. 126: Identifying Air Cleaner Element & Air Cleaner Lower Cover
 Courtesy of HYUNDAI MOTOR CO.

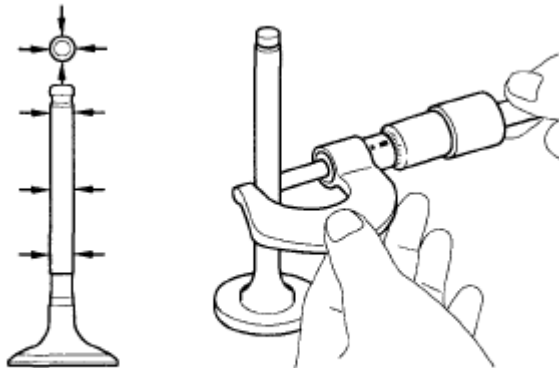
3. Install the intake air hose (D) and air cleaner upper cover (C).
4. Connect the breather hose (B) to intake air hose (D).



ECBF034A

Fig. 127: Identifying Intake Air Hose & Air Cleaner Upper Cover
Courtesy of HYUNDAI MOTOR CO.

26. Install the under cover (A).



KCRF227A

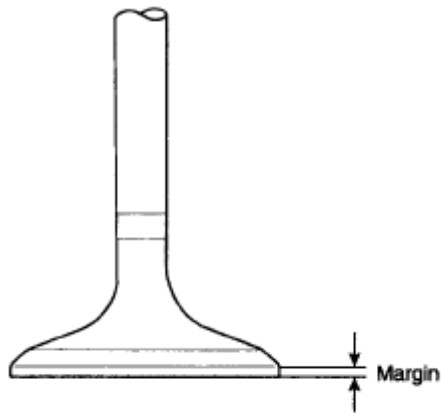
Fig. 128: Identifying Under Cover
Courtesy of HYUNDAI MOTOR CO.

27. Install the engine cover.

Tightening torque:

3.9 ~ 5.9 N.m (0.4 ~ 0.6 kgf.m, 2.9 ~ 4.3 lb-ft)

28. Install the battery and connect the battery terminals (A).



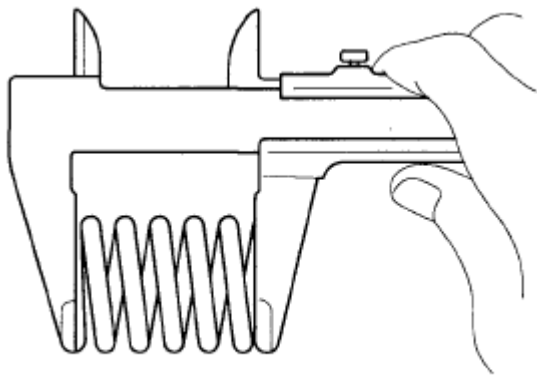
ECKD221A

Fig. 129: Identifying Battery Terminals
Courtesy of HYUNDAI MOTOR CO.

29. Fill with engine coolant. (Refer to **ENGINE COOLANT REFILLING AND BLEEDING**).
30. Start the engine and check for leaks.
31. Recheck engine coolant level and oil level.

ENGINE AND TRANSAXLE ASSEMBLY

COMPONENT



KCRF205A

Fig. 130: Identifying Engine & Transaxle Assembly Components - Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

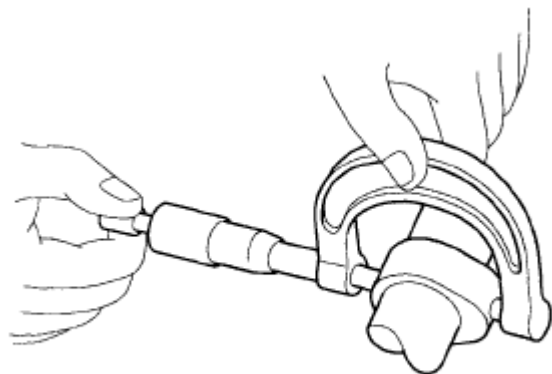
- CAUTION:**
- Use fender covers to avoid damaging painted surfaces.

- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

NOTE:

- Mark all wiring and hoses to avoid misconnection.

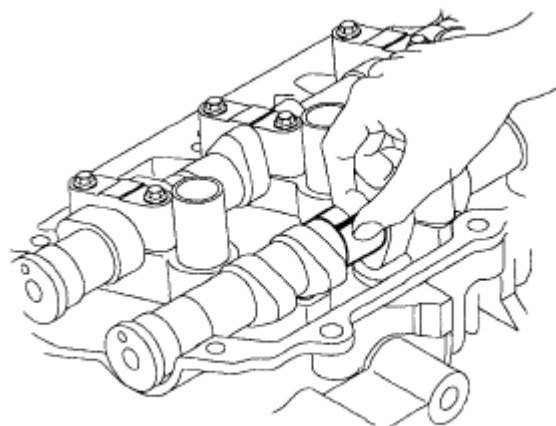
1. Disconnect the terminals (A) from battery and remove the battery.



KCRF206A

Fig. 131: Identifying Battery Terminals
Courtesy of HYUNDAI MOTOR CO.

2. Remove the engine cover.
3. Remove the under cover (A).

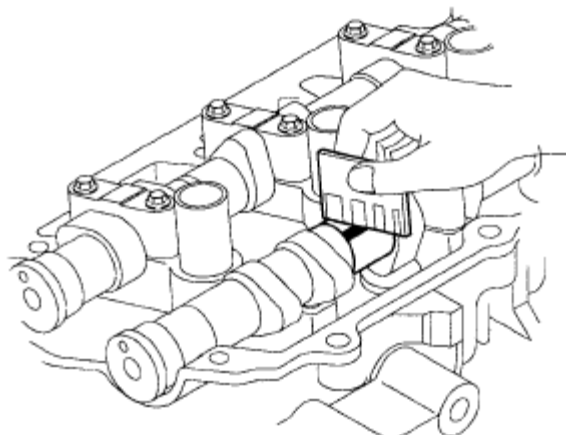


KCRF207A

Fig. 132: Identifying Under Cover
Courtesy of HYUNDAI MOTOR CO.

4. Drain the engine coolant. (Refer to **ENGINE COOLANT REFILLING AND BLEEDING**). Remove the radiator cap to speed draining.
5. Remove the intake air hose and air cleaner assembly.

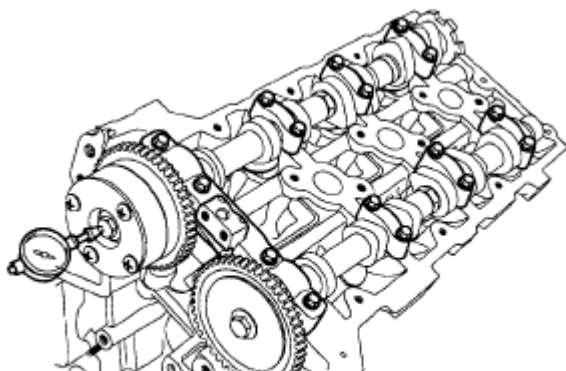
1. Disconnect the breather hose (B) from intake air hose (D).
2. Remove the intake air hose (D) and air cleaner upper cover (C).



KCRF208A

Fig. 133: Identifying Intake Air Hose & Air Cleaner Upper Cover
Courtesy of HYUNDAI MOTOR CO.

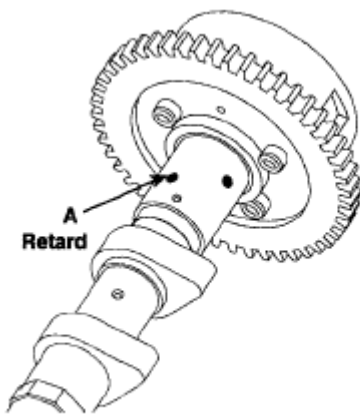
3. Disconnect the ECM connector (A) and ECM connector (B) (A/T only).
4. Remove the air cleaner element and air cleaner lower cover (C).



KDRF196B

Fig. 134: Identifying Air Cleaner Element & Air Cleaner Lower Cover
Courtesy of HYUNDAI MOTOR CO.

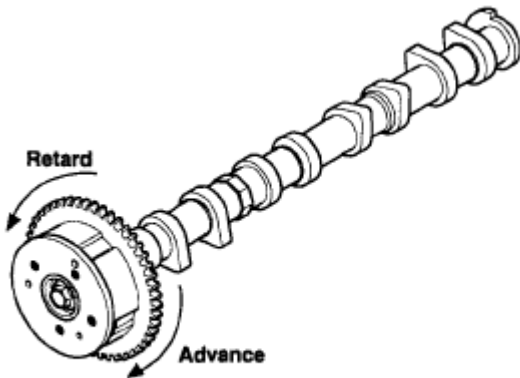
6. Remove the battery tray (A).



ECRF015A

Fig. 135: Identifying Battery Tray
Courtesy of HYUNDAI MOTOR CO.

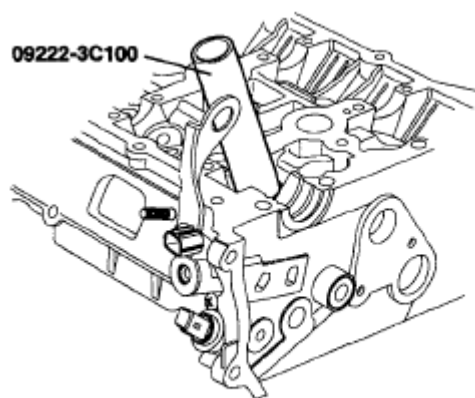
7. Disconnect the upper radiator hose (A) and lower radiator hose (B).
8. Disconnect the ATF oil cooler hoses (C).



ECRF016A

Fig. 136: Identifying Upper Radiator Hose & Lower Radiator Hose With ATF Oil Cooler Hoses
Courtesy of HYUNDAI MOTOR CO.

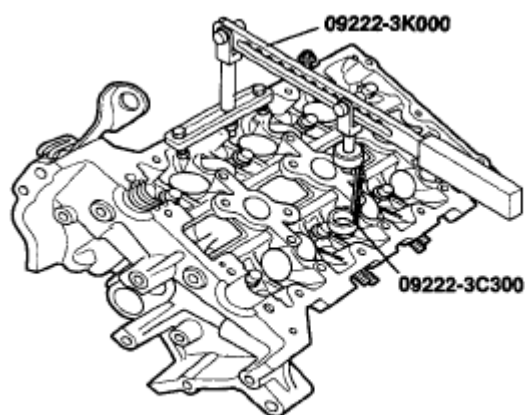
9. Disconnect the heater hoses (A).
10. Disconnect the fuel hose (B).



KCRF120B

Fig. 137: Identifying Heater Hoses & Fuel Hose
Courtesy of HYUNDAI MOTOR CO.

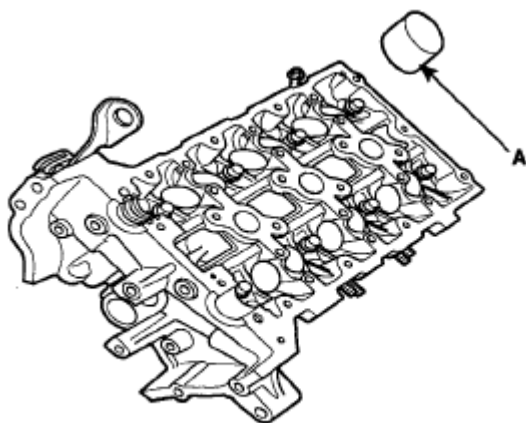
11. Remove the accelerator cable (A) by loosening the lock-nut, then slip the cable end out of the throttle linkage.
12. Disconnect the TPS (Throttle Position Sensor) connector (B) and the MAP sensor connector (C).



KDRF201A

Fig. 138: Identifying Throttle Position Sensor Connector & Accelerator Cable
Courtesy of HYUNDAI MOTOR CO.

13. Remove the engine wire harness connectors and wire harness clamps from cylinder head and the intake manifold.
 1. Disconnect the rear oxygen sensor connector (A).
 2. Disconnect the air conditioner compressor switch connector (B).
 3. Disconnect the knock sensor connector (C).
 4. Disconnect the injector connectors(No. 3,4) (D).
 5. Disconnect the injector connectors(No. 1,2) (E)

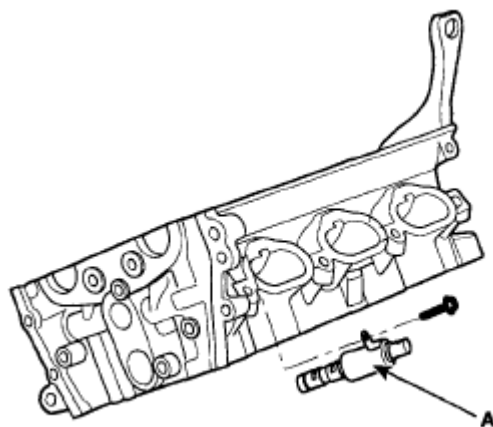


KDRF200A

Fig. 139: Identifying Rear Oxygen Sensor Connector & Air Conditioner Compressor Switch Connector

Courtesy of HYUNDAI MOTOR CO.

6. Remove the wire harness bracket (A).
7. Disconnect the ISA (Idle Speed Actuator) connector (B).



KDRF202A

Fig. 140: Identifying Idle Speed Actuator Connector & Wire Harness Bracket

Courtesy of HYUNDAI MOTOR CO.

8. Disconnect the front oxygen sensor connector (A).
9. Disconnect the CKP(Crankshaft Position Sensor) connector (B).
10. Disconnect the OCV(Oil Control Valve) connector (C).

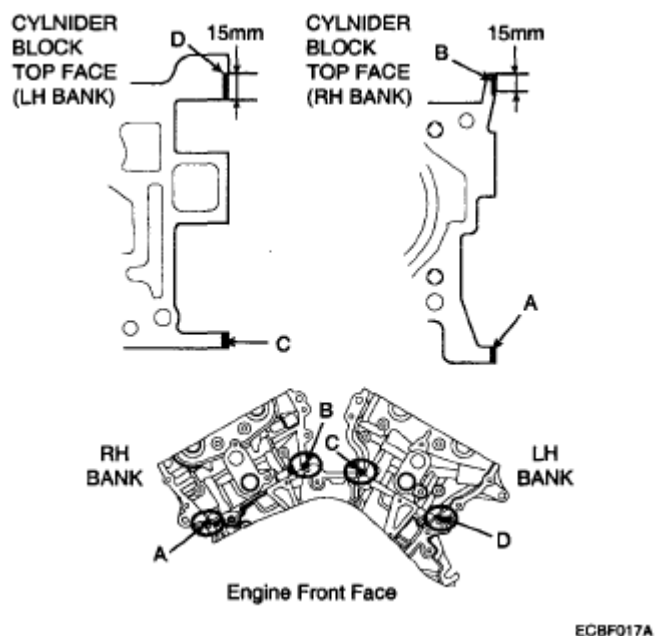


Fig. 141: Identifying Oxygen Sensor Connector , Crankshaft Position Sensor Connector & Oil Control Valve Connector

Courtesy of HYUNDAI MOTOR CO.

11. Disconnect the ignition coil connector (A).
12. Disconnect the ignition coil condenser connector (B).
13. Disconnect the CMP(Camshaft Position Sensor) connector (C).
14. Disconnect the ground cable (D).
15. Remove the wire harness bracket (E).

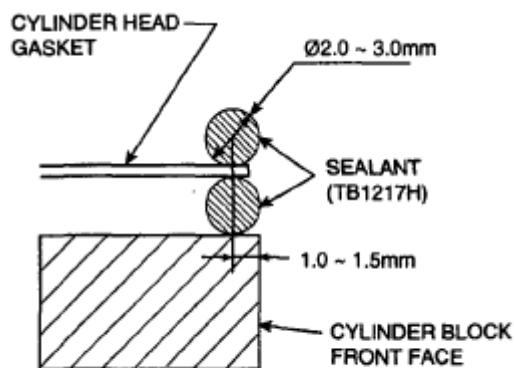


Fig. 142: Identifying Ignition Coil Connector

Courtesy of HYUNDAI MOTOR CO.

16. Remove the ground cable (A) between engine mounting and vehicle body.

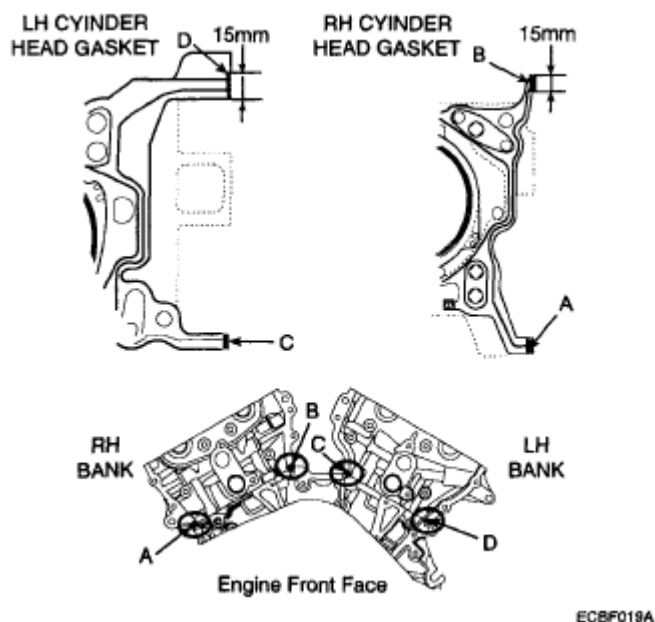


Fig. 143: Identifying Engine Mounting & Ground Cable
Courtesy of HYUNDAI MOTOR CO.

17. Remove the ground cable (A) between transaxle housing and vehicle body.

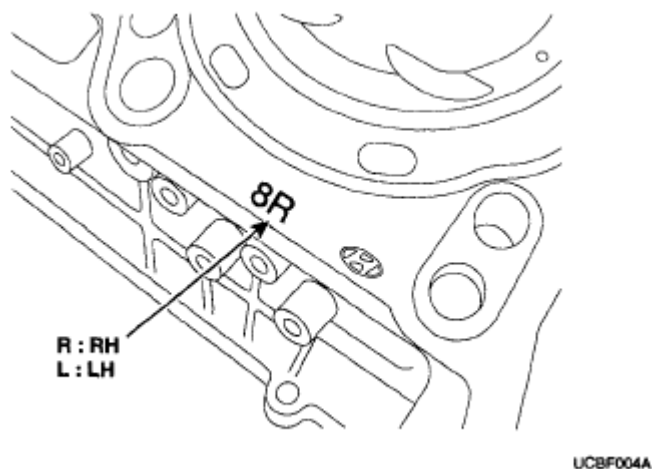
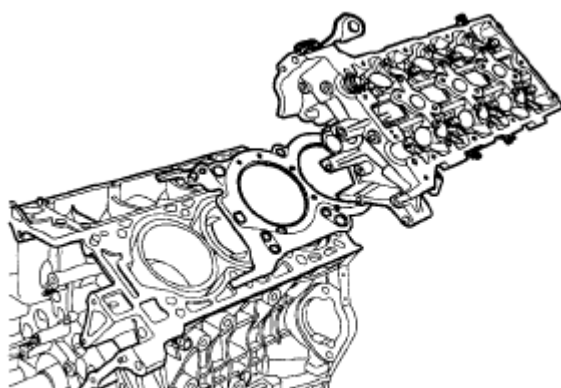


Fig. 144: Identifying Ground Cable Between Transaxle Housing
Courtesy of HYUNDAI MOTOR CO.

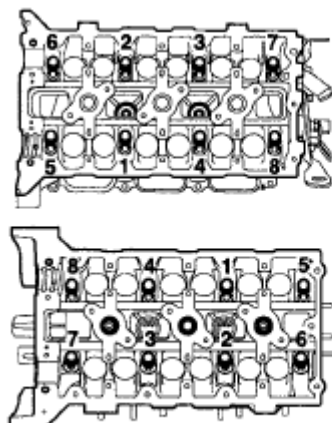
14. Remove the transaxle wire harness connectors and control cable from transaxle (A/T).
 1. Disconnect the transaxle range switch connector (A).
 2. Disconnect the solenoid valve connector (B).
 3. Disconnect the ATF oil temperature sensor connector (C).



KDRF198A

Fig. 145: Identifying Transaxle Range Switch & Solenoid Valve With Oil Temperature Sensor Connector
 Courtesy of HYUNDAI MOTOR CO.

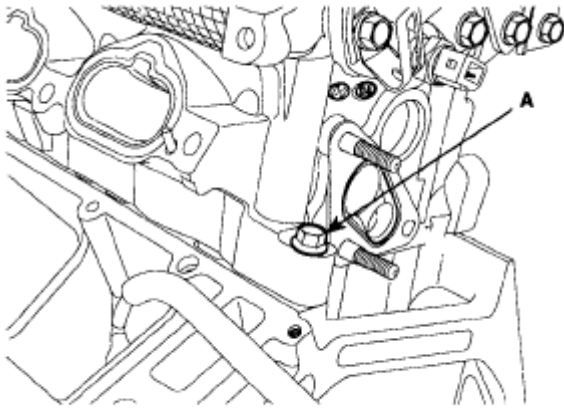
4. Disconnect the vehicle speed sensor connector (A).
5. Disconnect the band server switch connector (B).
6. Disconnect the pulse generator (A) connector (C).
7. Disconnect the pulse generator (B) connector (D).



KDRF199B

Fig. 146: Identifying Vehicle Speed Sensor Connector
 Courtesy of HYUNDAI MOTOR CO.

8. Remove the control cable nut (A) from transaxle range switch.
9. Remove the control cable (B).

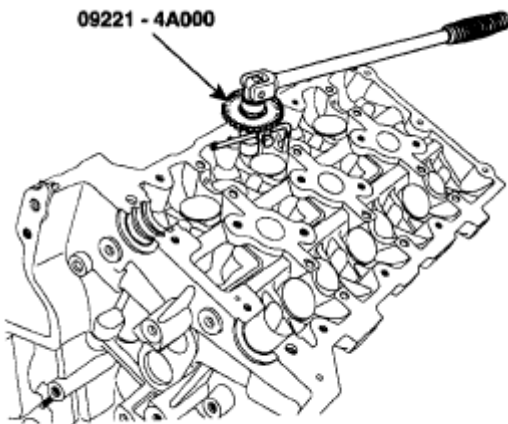


ECBF035A

Fig. 147: Identifying Control Cable Nut From Transaxle Range Switch
Courtesy of HYUNDAI MOTOR CO.

15. Remove the transaxle wire harness connectors and control cable from transaxle (M/T).

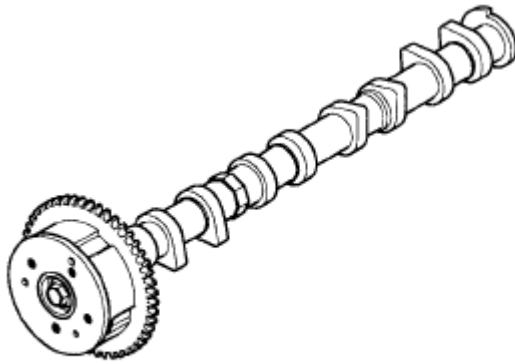
1. Disconnect the vehicle speed sensor connector (A).
2. Disconnect the neutral switch connector (B).
3. Disconnect the back-up lamp switch connector (C).



KDRF223A

Fig. 148: Identifying Vehicle Speed Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

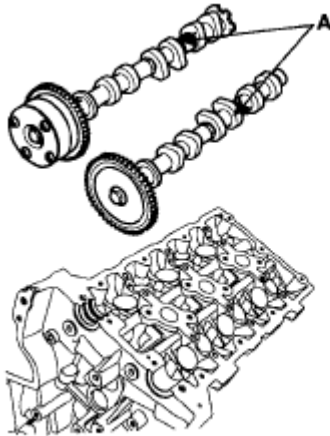
4. Remove the control cable (A).



KCRF122A

Fig. 149: Identifying Control Cable
Courtesy of HYUNDAI MOTOR CO.

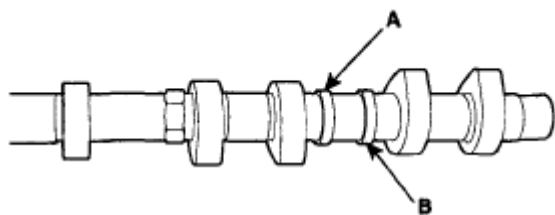
16. Move the disconnected wire harnesses to the fuse box side so as to prevent interfering with other parts.
17. Disconnect the hose (A) of the PCSV (Purge Control Solenoid Valve) side.
18. Remove the brake booster vacuum hose (B).



KDRF197A

Fig. 150: Identifying Brake Booster Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

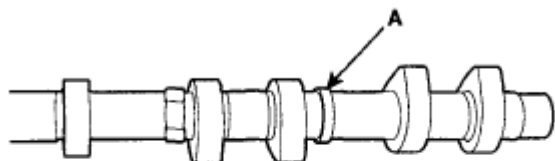
19. Remove the power steering oil hose (A) and drain the power steering oil.



KDRF226A

Fig. 151: Identifying Power Steering Oil Hose
Courtesy of HYUNDAI MOTOR CO.

20. Remove the power steering return hose (A).



KDRF227A

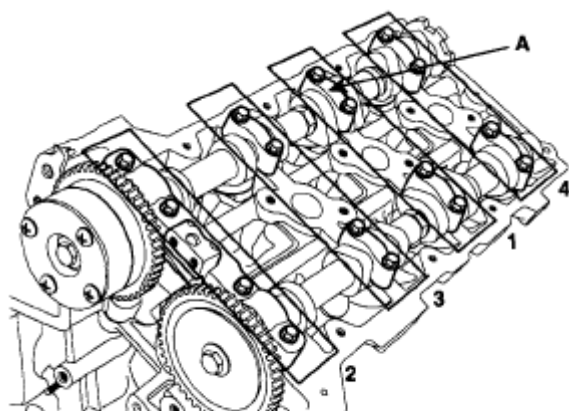
Fig. 152: Identifying Power Steering Return Hose
Courtesy of HYUNDAI MOTOR CO.

21. Recovering refrigerant and remove the high & low pressure pipe. (Refer to **HEATING, VENTILATION & AIR CONDITIONING** - air conditioner compressor).
22. Remove the nuts (B, D), bolt (C) and engine mounting support bracket (A).

Tightening torque:

Nut (B): 68.6 ~ 93.2 N.m (7.0 ~ 9.5 kgf.m, 50.6 ~ 68.7 lb-ft)

Bolt (C), Nut (D): 49.0 ~ 63.7 N.m (5.0 ~ 6.5 kgf.m, 36.2 ~ 47.0 lb-ft)



UCBF014A

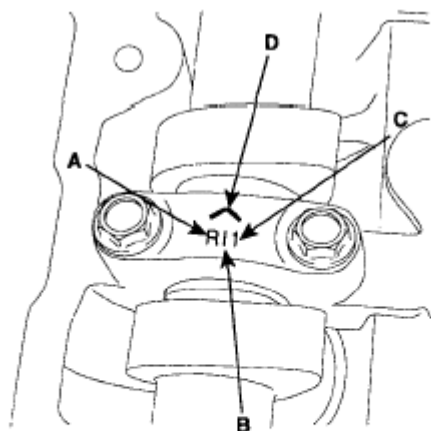
Fig. 153: Identifying Engine Mounting Support Bracket
Courtesy of HYUNDAI MOTOR CO.

23. Remove the transaxle mounting bracket (A).

Tightening torque:

Bolt, Nut (B):

68.6 ~ 93.2 N.m (7.0 ~ 9.5 kgf.m, 50.6 ~ 68.7 lb-ft)

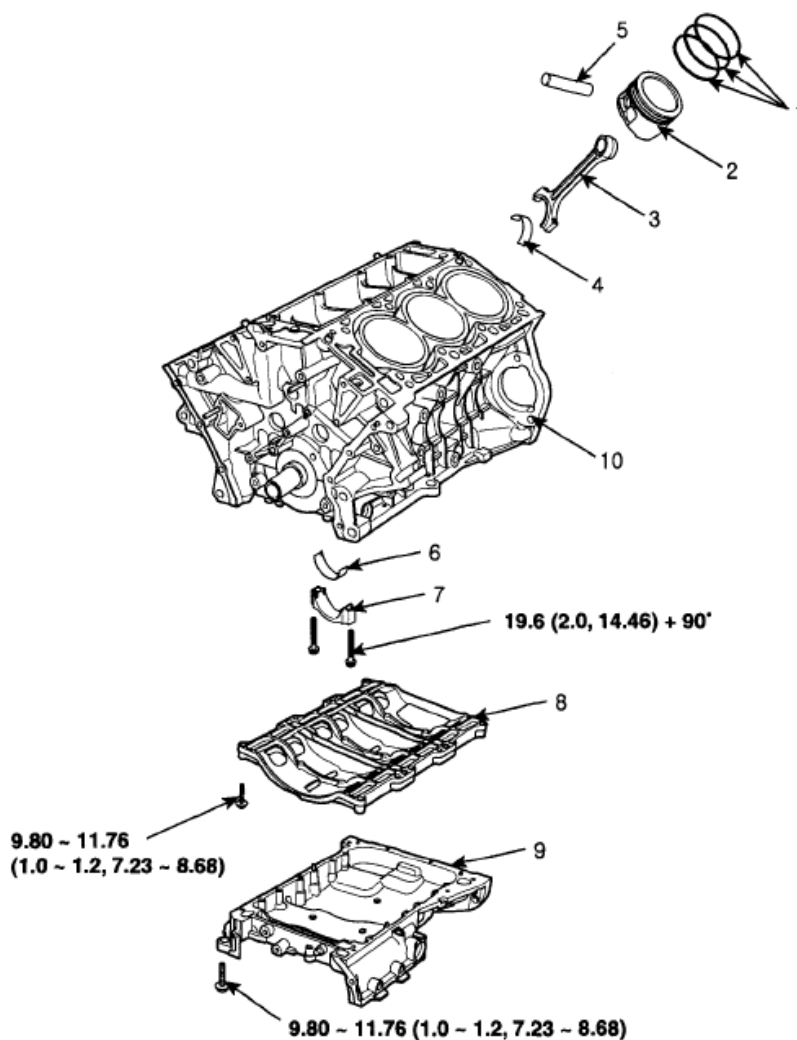


ECBF036A

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

Fig. 154: Identifying Wire Harness Protector On Transaxle Mounting Support Bracket
Courtesy of HYUNDAI MOTOR CO.

* A/T: Remove the wire harness protector (B) on the transaxle mounting support bracket.



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

- 1. Piston ring
- 2. Piston
- 3. Connecting rod
- 4. Connecting rod upper bearing
- 5. Piston pin

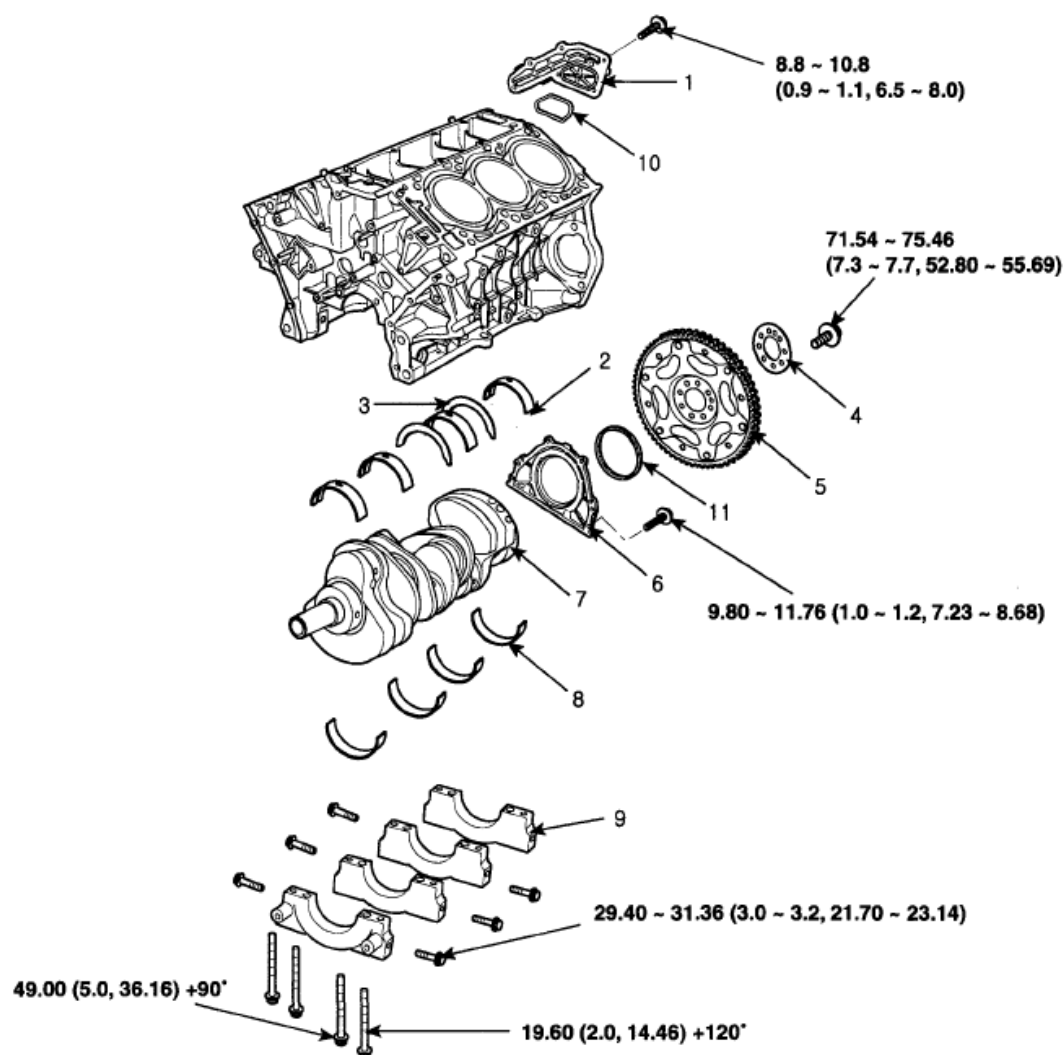
- 6. Connecting rod lower bearing
- 7. Connecting rod bearing cap
- 8. Baffle plate
- 9. Upper oil pan
- 10. Cylinder block

ECBF012A

Fig. 155: Identifying Cylinder Oil Hose On Transaxle Mounting Support Bracket
 Courtesy of HYUNDAI MOTOR CO.

* M/T: Remove the clutch release cylinder oil hose (B) on the transaxle mounting support bracket.

24. Disconnect the alternator connector (A) and "B" terminal (B).



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

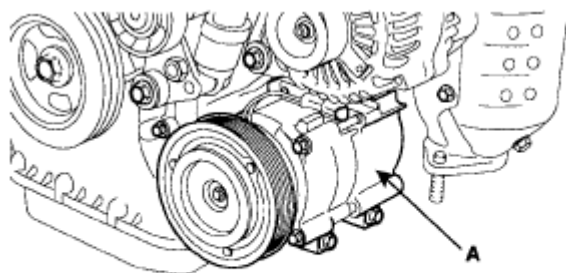
1. Oil drain cover
2. Crankshaft upper bearing
3. Thrust bearing
4. Plate adapter
5. Drive plate

6. Rear oil seal case
7. Crankshaft
8. Crankshaft lower bearing
9. Main bearing cap
10. Oil drain cover gasket
11. Rear oil seal

UCBF015A

Fig. 156: Identifying Alternator Connector Terminal
Courtesy of HYUNDAI MOTOR CO.

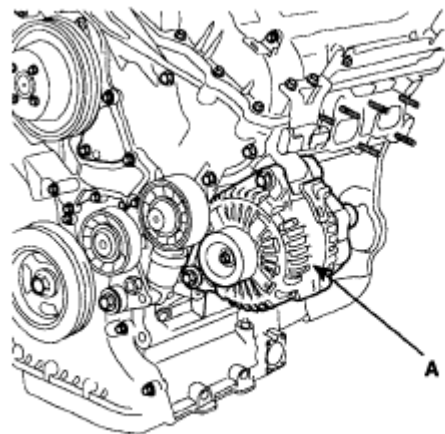
25. Remove the front tires.
26. Remove the ABS wheel speed sensor (A).



KDRF103A

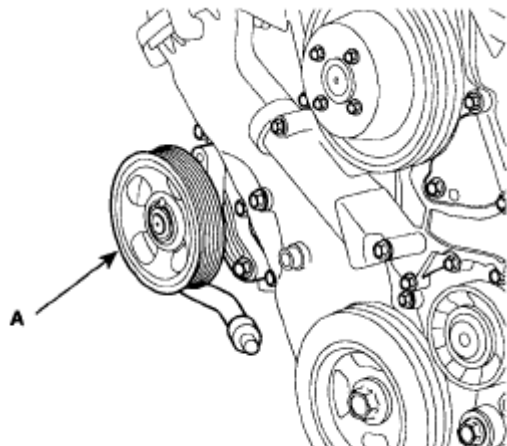
Fig. 157: Identifying ABS Wheel Speed Sensor
Courtesy of HYUNDAI MOTOR CO.

27. Remove the caliper and hang assembly (A).



KDRF104A

Fig. 158: Identifying Caliper & Hang Assembly
Courtesy of HYUNDAI MOTOR CO.

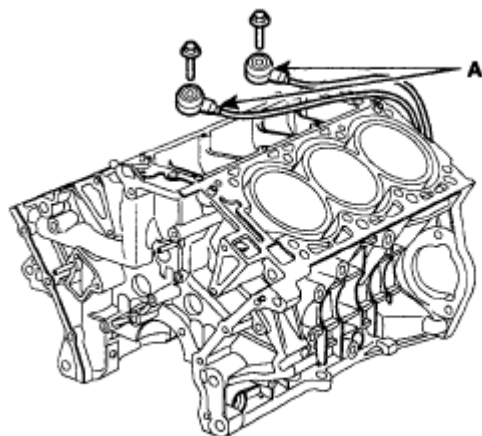


KDRF102A

Fig. 159: Identifying Caliper

Courtesy of HYUNDAI MOTOR CO.

28. Remove the knuckle mounting bolts (A).

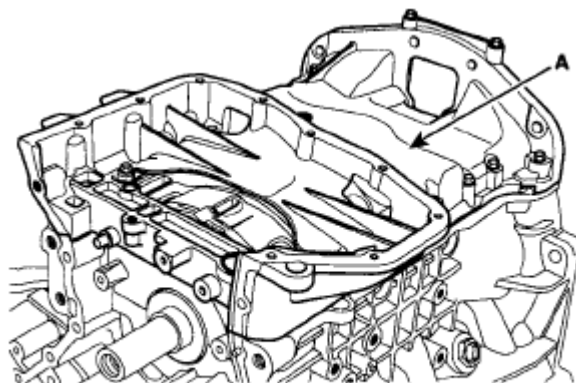


KDRF205A

Fig. 160: Identifying Knuckle Mounting Bolts

Courtesy of HYUNDAI MOTOR CO.

29. Remove the steering u-joint mounting bolt (A).



KDRF206A

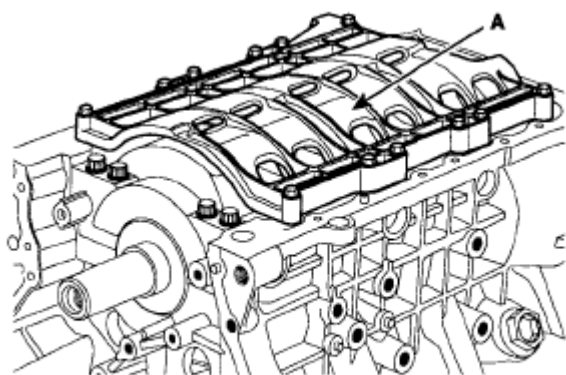
Fig. 161: Identifying Steering U-Joint Mounting Bolt

Courtesy of HYUNDAI MOTOR CO.

30. Remove the front muffler heat protector (A).
31. Remove the front muffler (B).

Tightening torque:

29.4 ~ 39.2 N.m (3.0 ~ 4.0 kgf.m, 21.7 ~ 28.9 lb-ft)

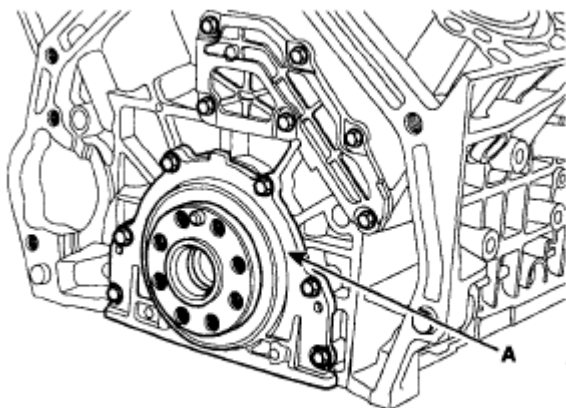


KDRF207A

Fig. 162: Identifying Front Muffler Heat Protector
 Courtesy of HYUNDAI MOTOR CO.

32. Using a floor jack, support the engine and transaxle assembly.

NOTE: After removing the sub frame mounting bolt, the engine and transaxle assembly may fall downward, and so support them securely with floor jack.
 Verify that the hoses and connectors are disconnected before removing the engine and transaxle assembly.



KDRF208A

Fig. 163: Identifying Support Engine & Transaxle Assembly
 Courtesy of HYUNDAI MOTOR CO.

33. Remove the sub frame bolts and nuts.

Tightening torque:

Bolt (A), Nut (B):

93.2 ~ 117.7 N.m (9.5 ~ 12.0 kgf.m, 68.7 ~ 86.8 lbf.ft)

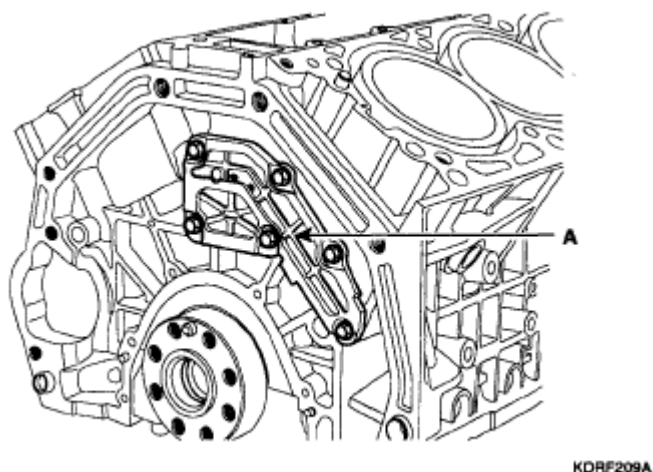


Fig. 164: Identifying Sub Frame Bolts & Nuts
Courtesy of HYUNDAI MOTOR CO.

34. Remove the engine and transaxle assembly by lifting vehicle.

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

INSTALLATION

Installation is in the reverse order of removal.

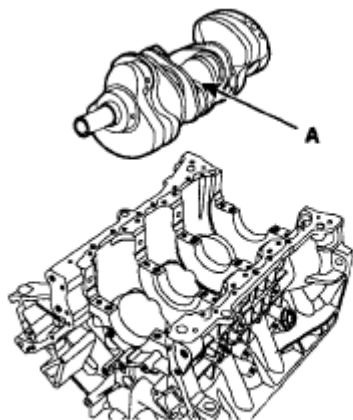
Perform the following:

- Adjust the shift cable.
- Adjust the throttle cable.
- Refill the engine with engine oil.
- Refill the transaxle with fluid.
- Refill the radiator and reservoir tank with engine coolant.
- Place the heater control knob on "HOT" position.
- Bleed air from the cooling system
 - Start engine and let it run until it warms up. (until the radiator fan operates 3 or 4 times.)
 - Turn Off the engine. Check the level in the radiator, add coolant if needed. This will allow trapped air to be removed from the cooling system.
 - Put the radiator cap on tightly, then run the engine again and check for leaks.
- Clean the battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
- Inspect for fuel leakage.
 - After assemble 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.

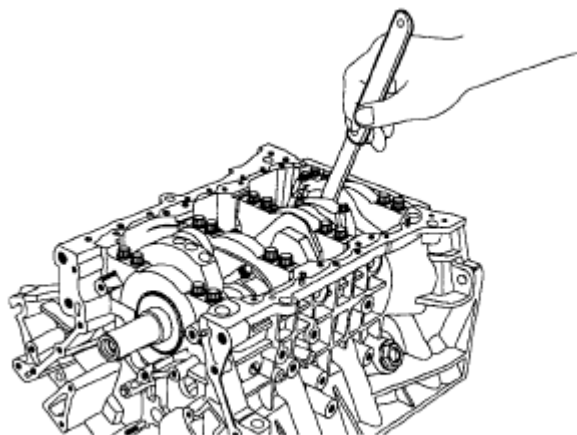
ENGINE BLOCK

COMPONENT



KDRF210A

Fig. 165: Identifying Engine Block Components - Torque Specifications (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



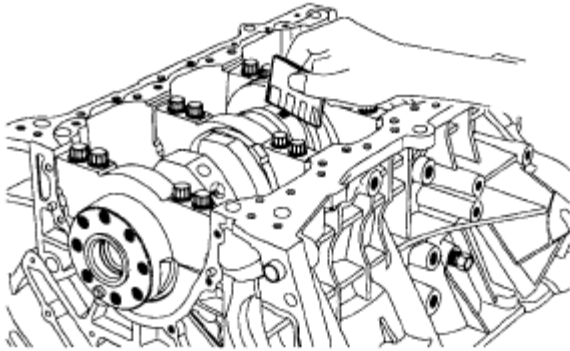
KDRF211A

Fig. 166: Identifying Engine Block Components - Torque Specifications (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

1. M/T: Remove the fly wheel.
2. A/T: Remove the drive plate.
3. Install the engine to engine stand for disassembly.
4. Remove the timing belt. (Refer to **REMOVAL**)

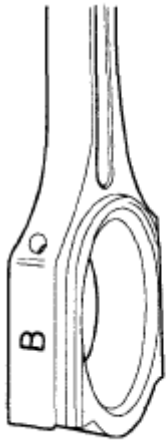
5. Remove the cylinder head. (Refer to **REMOVAL**)
6. Remove the oil level gauge tube (A).



KDRF212A

Fig. 167: Identifying Oil Level Gauge Tube
Courtesy of HYUNDAI MOTOR CO.

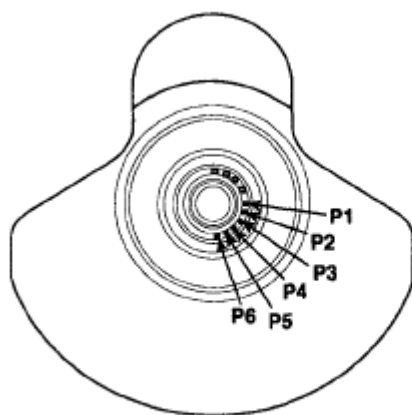
7. Remove the knock sensor (A).



EDQF196A

Fig. 168: Identifying Knock Sensor
Courtesy of HYUNDAI MOTOR CO.

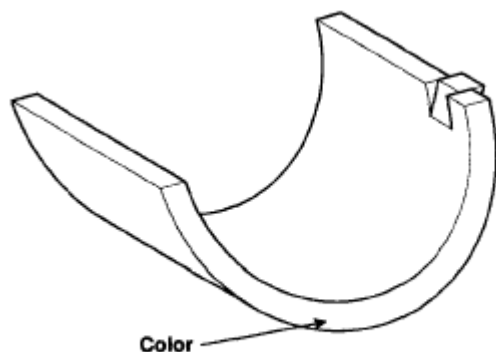
8. Remove the oil pressure switch (A).



ECBF037A

Fig. 169: Identifying Oil Pressure Switch
Courtesy of HYUNDAI MOTOR CO.

9. Remove the water pump. (Refer to **REMOVAL**).
10. Remove the oil pan (A).

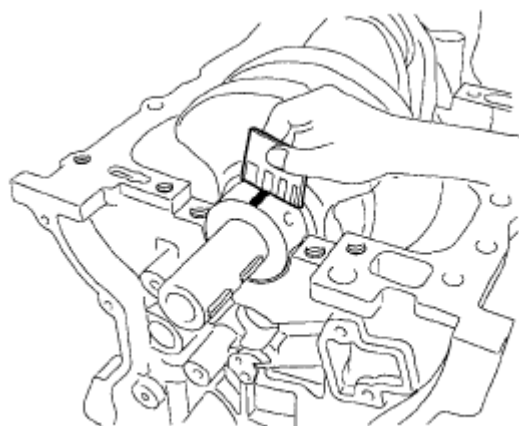


ECRF021A

Fig. 170: Identifying Oil Pan
Courtesy of HYUNDAI MOTOR CO.

11. Remove the oil screen.

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



KCRF170A

Fig. 171: Identifying Oil Screen & Gasket
Courtesy of HYUNDAI MOTOR CO.

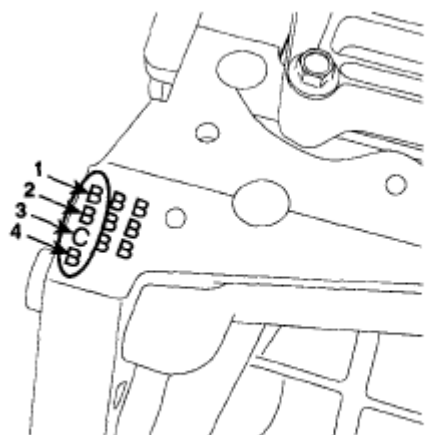
12. Check the connecting rod end play. (Refer to **INSPECTION**).
13. Remove the connecting rod caps and check oil clearance. (Refer to **INSPECTION**).
14. Remove the piston and connecting rod assemblies.
 1. Using a ridge reamer, remove all the carbon from the top of the cylinder.
 2. Push the piston,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

NOTE:

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

15. Remove the front case. (Refer to **OIL PUMP**).
16. Remove the rear oil seal case.

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

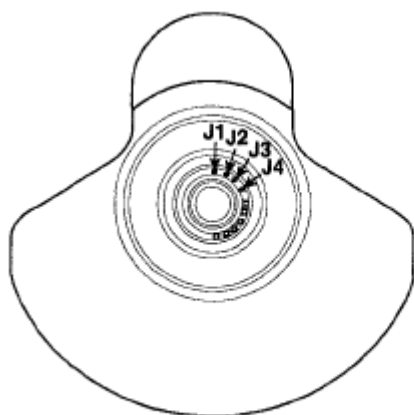


ECBF038A

Fig. 172: Identifying Rear Oil Seal Case With Bolts
 Courtesy of HYUNDAI MOTOR CO.

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

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



ECBF039A

Fig. 173: Identifying 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 the piston rings.
 1. Using a piston ring expander, remove the 2 compression rings.
 2. Remove the 2 side rails and oil ring by hand.

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

22. Remove the connecting rod from the piston.

Using a press, remove the piston pin from piston. (Press-in load: 500 ~ 1,500 kg (1,102 ~ 3,306 lb))

INSPECTION

CONNECTING ROD AND CRANKSHAFT

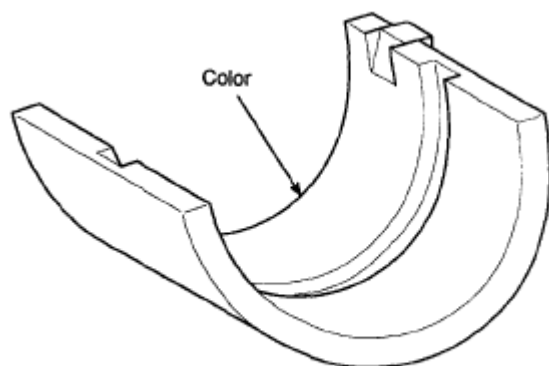
1. Check the connecting rod end play.

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

End play

Standard: 0.1 ~ 0.25 mm (0.0039 ~ 0.0098 in.)

Maximum: 0.4 mm (0.0157 in.)



ECRF022A

Fig. 174: 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 rod bearing oil clearance.
1. Check the match marks 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 lower bearing.
 4. Clean the crankshaft pin journal and bearing.
 5. Place a plastigage across the crankshaft pin journal.
 6. Reinstall the lower bearing and cap, and tighten the nuts.

Tightening torque:

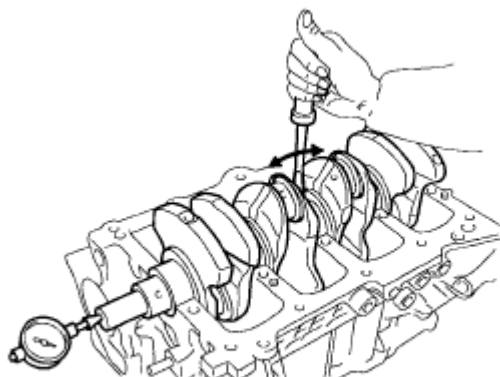
31.4 ~ 34.3 N.m (3.2 ~ 3.5 kgf.m, 23.1 ~ 25.3 lb-ft)

NOTE: Do not turn the crankshaft.

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

Standard oil clearance

0.018 ~ 0.036 mm (0.0007 ~ 0.0014 in.)



ECKD001B

Fig. 175: Measuring Plastigage Widest Point
Courtesy of HYUNDAI MOTOR CO.

9. If the plastigage measures too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark. (Refer to **CONNECTING ROD AND CRANKSHAFT** , connecting rod bearing selection table)

Recheck the oil clearance.

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

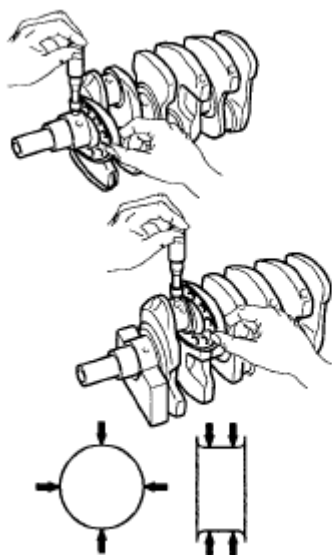
10. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing. (Refer to **CONNECTING ROD AND CRANKSHAFT** , connecting rod bearing selection table)

Recheck the oil clearance.

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



ECKD001E

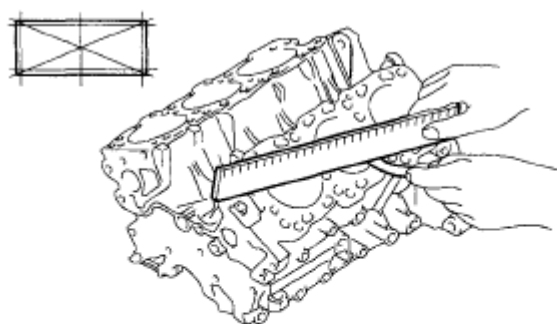
Fig. 176: Identifying Connecting Rod Mark Location
 Courtesy of HYUNDAI MOTOR CO.

IDENTIFICATION OF CONNECTING ROD

CONNECTING ROD BIG-END INNER DIAMETER SPECIFICATIONS

Mark	Connecting rod big-end inner diameter
^	48.000 ~ 48.006 mm (1.8898 ~ 1.8900 in.)
b	48.006 ~ 48.012 mm (1.8900 ~ 1.8902 in.)
c	48.012 ~ 48.018 mm (1.8902 ~ 1.8905 in.)

CRANKSHAFT PIN JOURNAL MARK LOCATION



EDQF154A

Fig. 177: Identifying Crankshaft Pin Journal Mark Location

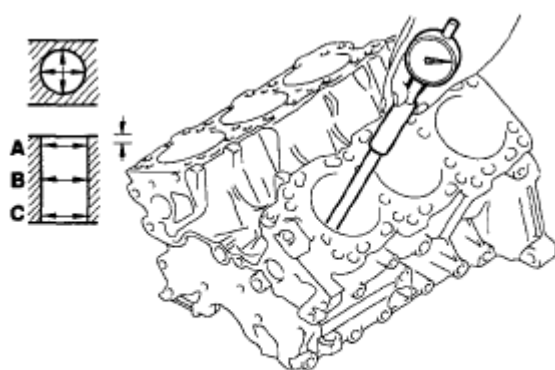
Courtesy of HYUNDAI MOTOR CO.

IDENTIFICATION OF CRANKSHAFT PIN JOURNAL

CRANKSHAFT PIN JOURNAL OUTER DIAMETER SPECIFICATIONS

Mark	Crankshaft pin journal outer diameter
^	44.966 ~ 44.972 mm (1.7703 ~ 1.7705 in.)
b	44.960 ~ 44.966 mm (1.7701 ~ 1.7703 in.)
c	44.954 ~ 44.960 mm (1.7698 ~ 1.7701 in.)

CONNECTING ROD BEARING MARK LOCATION



EDQF153A

Fig. 178: Identifying Connecting Rod Bearing Mark Location
Courtesy of HYUNDAI MOTOR CO.

IDENTIFICATION OF CONNECTING ROD BEARING

CONNECTING ROD BEARING THICKNESS SPECIFICATIONS

Mark	Color	Connecting rod bearing thickness
AA	Blue	1.514 ~ 1.517 mm (0.0596 ~ 0.0597 in.)
A	Black	1.511 ~ 1.514 mm (0.0595 ~ 0.0596 in.)
B	None	1.508 ~ 1.511 mm (0.0594 ~ 0.0595 in.)
C	Green	1.505 ~ 1.508 mm (0.0593 ~ 0.0594 in.)
D	Yellow	1.502 ~ 1.505 mm (0.0591 ~ 0.0593 in.)

11. Select the bearing by using selection table.

CONNECTING ROD BEARING SELECTION TABLE

CONNECTING ROD BEARING SELECTION TABLE

		Connecting rod mark		
		^	b	c
Crank shaft pin journal mark	^	D (Yellow)	C (Green)	B (None)
	b	C (Green)	B (None)	A (Black)
	c	B (None)	A (Black)	AA (Blue)

3. Check the connecting rods.

- 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.
- 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.
- Using a connecting rod aligning tool, check the rod for bend and twist. If the measured value is close to the repair limit, correct the rod by a press. Any connecting rod that has been severely bent or distorted should be replaced.

Allowable bend of connecting rod:

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

Allowable twist of connecting rod:

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

4. Check the crankshaft bearing oil clearance.

- To check main bearing-to-journal oil clearance, remove the main bearing caps and lower bearings.
- Clean each main journal and lower bearing with a clean shop towel.
- Place one strip of plastigage across each main journal.
- Reinstall the lower bearings and caps, then tighten the bolts.

Tightening torque:

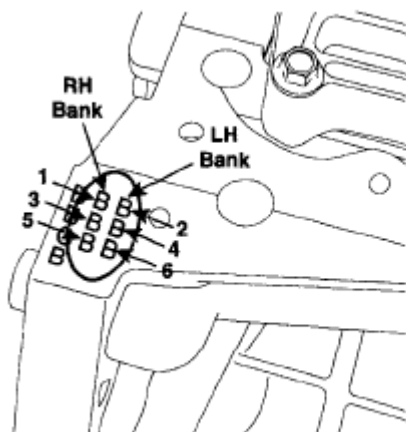
53.9 ~ 58.8 N.m (5.5 ~ 6.0 kgf.m, 39.8 ~ 43.4 lb-ft)

NOTE: Do not turn the crankshaft.

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

Standard oil clearance:

No. 1, 2, 4, 5: 0.022 ~ 0.040 mm (0.0009 ~ 0.0016 in.)



ECBF002A

Fig. 179: Measuring Widest Part Of Plastigage
Courtesy of HYUNDAI MOTOR CO.

6. If the plastigage measures too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark. (Refer to CONNECTING ROD AND CRANKSHAFT , crankshaft main bearing selection table)

Recheck the oil clearance.

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

7. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing. (Refer to CONNECTING ROD AND CRANKSHAFT , crankshaft main bearing selection table)

Recheck the oil clearance.

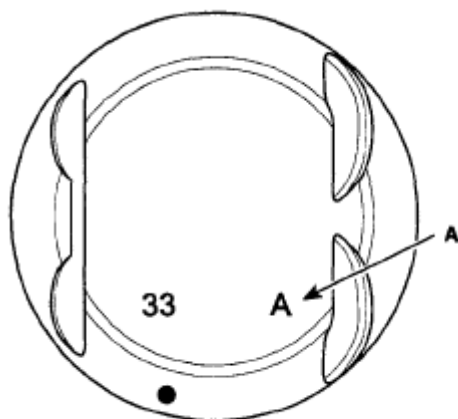
NOTE: If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

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.

Cylinder block crankshaft journal 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 letters stamped on the crank (marks for main journal size), to choose the correct bearings.



KDRF215A

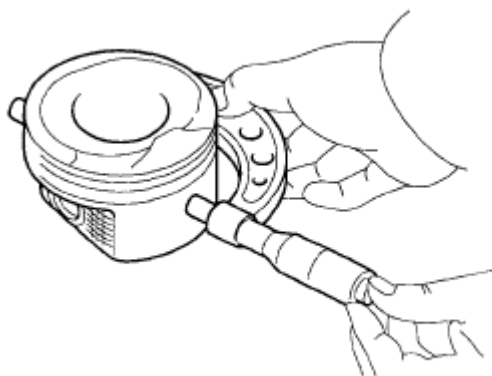
Fig. 180: Identifying Cylinder Block Crankshaft Journal Bore Mark Location
Courtesy of HYUNDAI MOTOR CO.

IDENTIFICATION OF CYLINDER BLOCK CRANKSHAFT JOURNAL BORE

CYLINDER BLOCK CRANKSHAFT JOURNAL BORE INNER DIAMETER SPECIFICATIONS

Mark	Cylinder block crankshaft journal bore inner diameter
^	54.000 ~ 54.006 mm (2.1260 ~ 2.1262 in.)
b	54.006 ~ 54.012 mm (2.1262 ~ 2.1265 in.)
c	54.012 ~ 54.018 mm (2.1265 ~ 2.1267 in.)

CRANKSHAFT MAIN JOURNAL MARK LOCATION

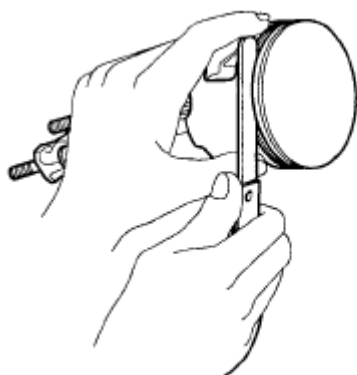


ECKD001D

Fig. 181: Identifying Crankshaft Main Journal Mark Location
Courtesy of HYUNDAI MOTOR CO.

IDENTIFICATION OF CRANKSHAFT MAIN JOURNAL**CRANKSHAFT MAIN JOURNAL OUTER DIAMETER SPECIFICATIONS**

Mark	Crankshaft main journal outer diameter
^	49.962 ~ 49.968 mm (1.9670 ~ 1.9672 in.)
b	49.956 ~ 49.962 mm (1.9668 ~ 1.9670 in.)
c	49.950 ~ 49.956 mm (1.9665 ~ 1.9668 in.)

CRANKSHAFT MAIN BEARING MARK LOCATION

ECKD001G

Fig. 182: Identifying Crankshaft Main Bearing Mark Location
 Courtesy of HYUNDAI MOTOR CO.

IDENTIFICATION OF CRANKSHAFT MAIN BEARING**CRANKSHAFT MAIN BEARING THICKNESS SPECIFICATIONS**

Mark	Color	Crankshaft main bearing thickness	
		No.1, 2, 4, 5	No. 3
AA	Blue	2.014 ~ 2.017 (0.0793 ~ 0.0794)	2.011 ~ 2.014 (0.0792 ~ 0.0793)
A	Black	2.011 ~ 2.014 (0.0792 ~ 0.0793)	2.008 ~ 2.011 (0.0791 ~ 0.0792)
B	None	2.008 ~ 2.011 (0.0791 ~ 0.0792)	2.005 ~ 2.008 (0.0789 ~ 0.0791)
C	Green	2.005 ~ 2.008 (0.0789 ~ 0.0791)	2.002 ~ 2.005 (0.0788 ~ 0.0789)
D	Yellow	2.002 ~ 2.005 (0.0788 ~ 0.0789)	1.999 ~ 2.002 (0.0787 ~ 0.0788)

8. Select the bearing by using selection table.

CRANKSHAFT MAIN BEARING SELECTION TABLE

CRANKSHAFT MAIN BEARING SELECTION CHART

		Cylinder block crankshaft journal bore mark		
		^	b	c
Crank shaft main journal mark	^	D (Yellow)	C (Green)	B (None)
	b	C (Green)	B (None)	A (Black)
	c	B (None)	A (Black)	AA (Blue)

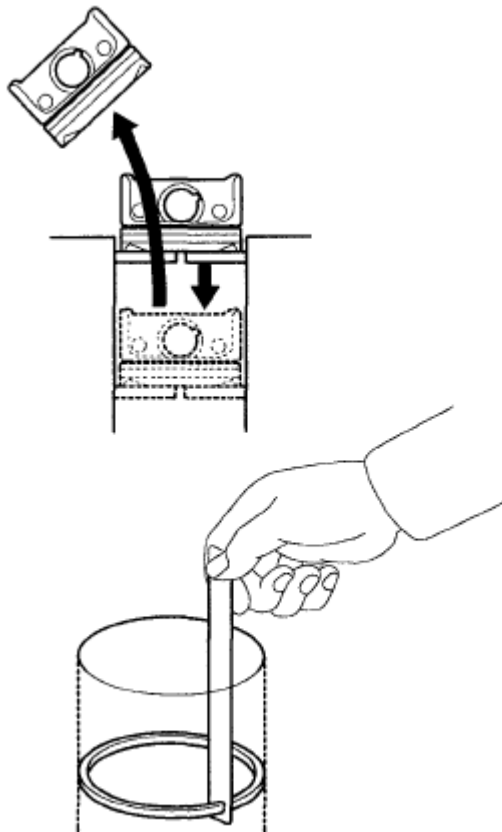
5. Check the crankshaft end play.

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

End play

Standard: 0.05 ~ 0.175 mm (0.0020 ~ 0.0069 in.)

Limit: 0.20 mm (0.0079 in.)



ECKD001K

Fig. 183: Measuring Crankshaft Thrust Clearance
Courtesy of HYUNDAI MOTOR CO.

If the end play is greater than maximum, replace the center bearing.

6. Inspect the crankshaft main journals and pin journals.

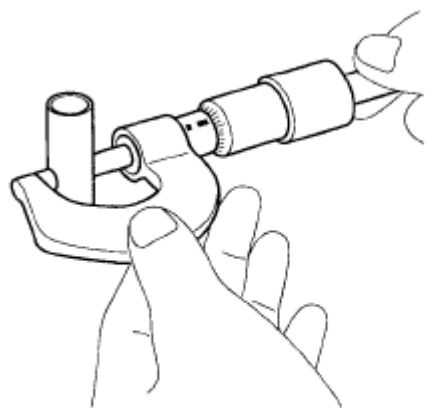
Using a micrometer, measure the diameter of each main journal and pin journal.

Main journal diameter:

49.950 ~ 49.968 mm (1.9665 ~ 1.9672 in.)

Pin journal diameter:

44.954 ~ 44.972 mm (1.7698 ~ 1.7705 in.)



ECKD001Z

Fig. 184: Measuring Diameter Of Each Main Journal & Pin Journal
Courtesy of HYUNDAI MOTOR CO.

CYLINDER BLOCK

1. Remove the gasket material.

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

2. Clean the cylinder block

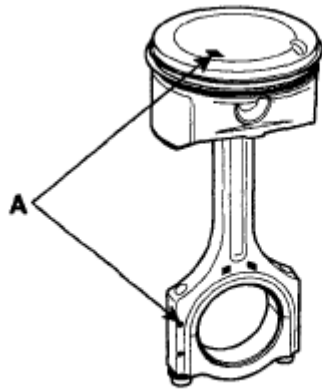
Using a soft brush and solvent, thoroughly clean the cylinder block.

3. Inspect the top surface of 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.)



KCRF168A

Fig. 185: Measuring Cylinder Head Surface
Courtesy of HYUNDAI MOTOR CO.

4. Inspect the cylinder bore.

Visually check the cylinder for vertical scratches.

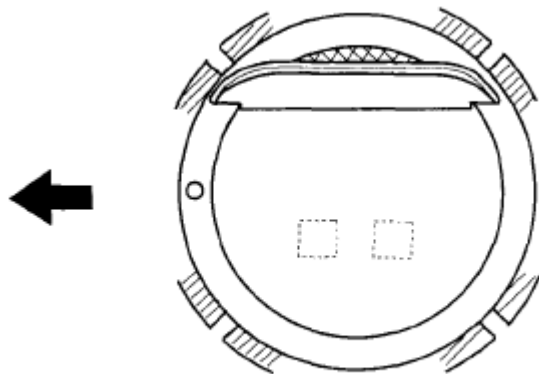
If deep scratch are present, replace the cylinder block.

5. Inspect the cylinder bore diameter.

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

Standard diameter:

1.6 CVVT: 76.50 ~ 76.53 mm (3.0118 ~ 3.0130 in.)

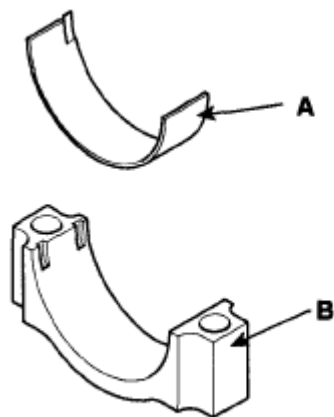


ECKD321A

Fig. 186: Measuring Cylinder Bore Diameter

Courtesy of HYUNDAI MOTOR CO.

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



KCRF116B

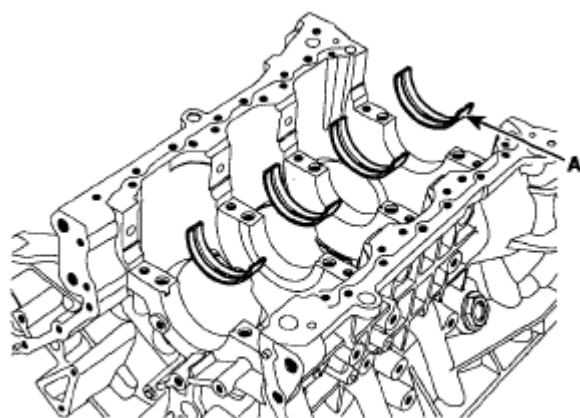
Fig. 187: Identifying Cylinder Bore Size Code On Cylinder Block Bottom Face
Courtesy of HYUNDAI MOTOR CO.

IDENTIFICATION OF CYLINDER BORE SIZE

CYLINDER BORE INNER DIAMETER SPECIFICATIONS

Mark	Cylinder bore inner diameter
A	76.50 ~ 76.51 mm (3.0118 ~ 3.0122 in.)
B	76.51 ~ 76.52 mm (3.0122 ~ 3.0126 in.)
C	76.52 ~ 76.53 mm (3.0126 ~ 3.0130 in.)

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



KDRF216A

Fig. 188: Identifying Piston Size Mark On Piston Top Face
Courtesy of HYUNDAI MOTOR CO.

DISCRIMINATION OF PISTON OUTER DIAMETER**PISTON OUTER DIAMETER SPECIFICATIONS**

Mark	Piston outer diameter
A	76.47 ~ 76.48 mm (3.0106 ~ 3.0110 in.)
B	76.48 ~ 76.49 mm (3.0110 ~ 3.0114 in.)
C	76.49 ~ 76.50 mm (3.0114 ~ 3.0118 in.)

- Select the piston related to cylinder bore class.

Piston-to-cylinder clearance:

0.02 ~ 0.04 mm (0.0008 ~ 0.0016 in.)

BORING CYLINDER

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

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

- Measure the outside diameter of the piston to be used.
- According to the measured O.D (Outer Diameter), 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) - 0.01 mm (0.0004 in.) (honing margin.)

- Bore each of the cylinders to the calculated size.

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

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

Standard: 0.02 ~ 0.04 mm (0.0008 ~ 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.

(1.6 CVT: Don't use over size)

PISTON AND PISTON RINGS

- Clean the 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 39.15 mm (1.5413 in.) from top land of the piston.

Standard diameter:

76.47 ~ 76.50 mm (3.0106 ~ 3.0118 in.)



ECKD324A

Fig. 189: Identifying Piston Outside Diameter Is From Top Land Of Piston
Courtesy of HYUNDAI MOTOR CO.

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

Piston-to-cylinder clearance:

0.02 ~ 0.04 mm (0.0008 ~ 0.0016 in.)

4. Inspect the piston ring side clearance.

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

Piston ring side clearance

No. 1 ring: 0.04 ~ 0.085 mm (0.0016 ~ 0.0033 in.)

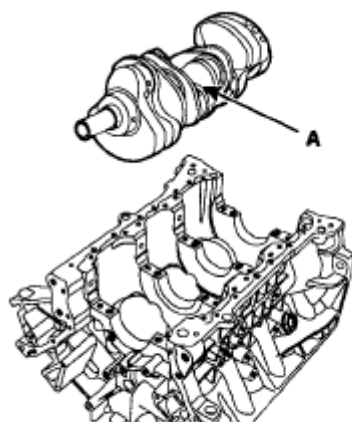
No. 2 ring: 0.04 ~ 0.085 mm (0.0016 ~ 0.0033 in.)

Oil ring: 0.08 ~ 0.175 mm (0.0031 ~ 0.0069 in.)

Limit

No. 1 ring: 0.1 mm (0.0039 in.)

No. 2 ring: 0.1 mm (0.0039 in.)



KDRF210A

Fig. 190: Measuring Clearance Between Piston Ring & Ring Groove
Courtesy of HYUNDAI MOTOR CO.

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

5. Inspect the 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 rings. If the gap is too large, recheck the cylinder bore inner diameter. If the bore is over the service limit, the cylinder block must be rebored. (Refer to **BORING CYLINDER**).

Piston ring end gap Standard

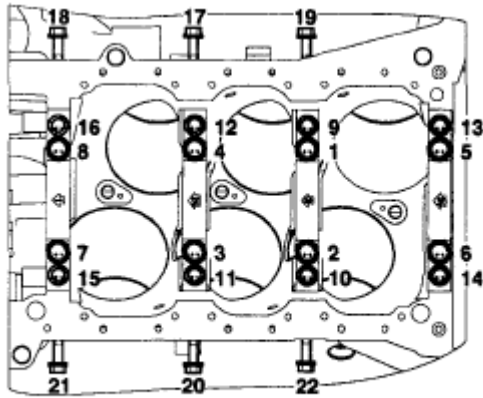
No. 1 ring: 0.15 ~ 0.30 mm (0.0059 ~ 0.0118 in.)

No. 2 ring: 0.35 ~ 0.50 mm (0.0138 ~ 0.0197 in.)

Oil ring: 0.20 ~ 0.70 mm (0.0079 ~ 0.0276 in.)

Limit

No. 1, 2, oil ring: 1.0 mm (0.0394 in.)



KDRF140A

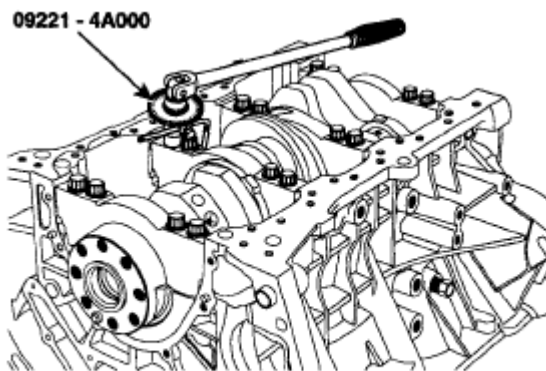
Fig. 191: Inserting Piston Ring Into Cylinder Bore
Courtesy of HYUNDAI MOTOR CO.

PISTON PINS

1. Measure the outer diameter of piston pin

Piston pin diameter:

18.001 ~ 18.007 mm (0.7087 ~ 0.7089 in.)



KDRF224A

Fig. 192: Measuring Outer Diameter Of Piston Pin
Courtesy of HYUNDAI MOTOR CO.

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

Piston pin-to-piston clearance:

0.011 ~ 0.018 mm (0.0004 ~ 0.0007 in.)

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

diameter.

Piston pin-to-connecting rod interference:

-0.033 ~ -0.016 mm (-0.0013 ~ -0.0006 in.)

OIL PRESSURE SWITCH

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

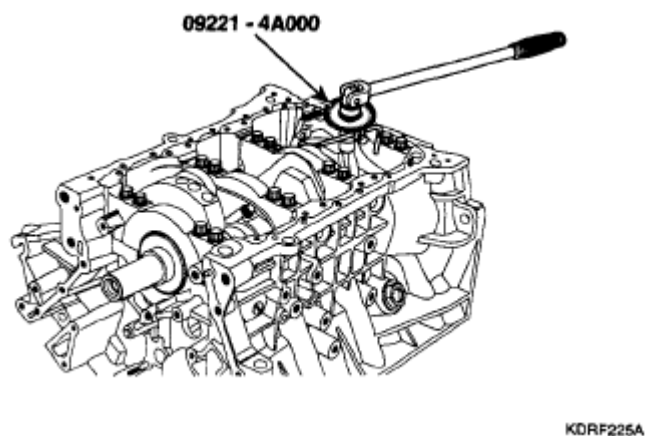


Fig. 193: Checking Continuity Between Terminal & Body With Ohmmeter
Courtesy of HYUNDAI MOTOR CO.

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.

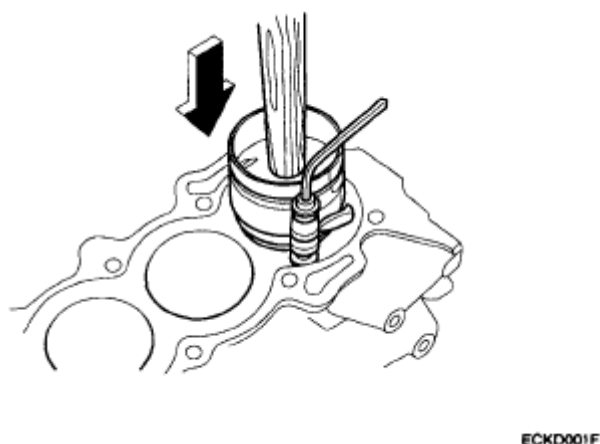


Fig. 194: Checking Continuity Between Terminal & Body
Courtesy of HYUNDAI MOTOR CO.

3. If there is no continuity when a 49.0 kpa (0.5 kg/cm² , 7.1psi) vacuum is applied through the oil hole, the

switch is operating properly.

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

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 the piston and connecting rod.

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

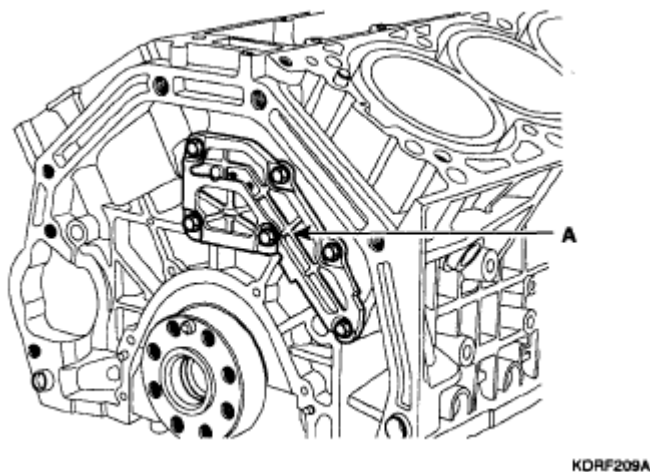
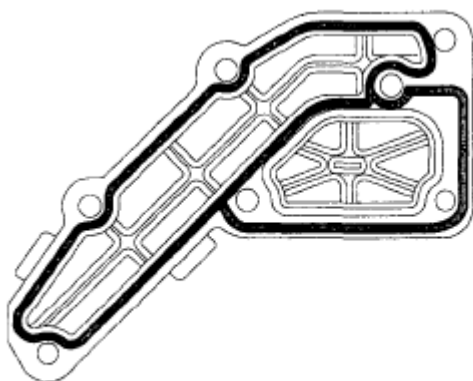


Fig. 195: Identifying Connecting Rod & Piston Mark Location
Courtesy of HYUNDAI MOTOR CO.

2. Install the piston rings.

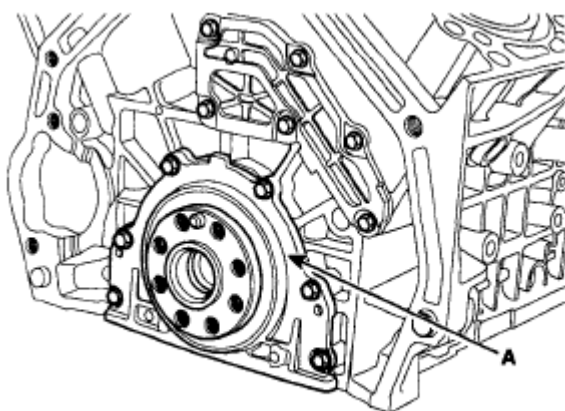
1. Install the oil ring expander and 2 side rails by hand.
2. Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
3. Position the piston rings so that the ring ends are as shown.



ECBF003A

Fig. 196: Identifying Piston Rings Positions
Courtesy of HYUNDAI MOTOR CO.

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



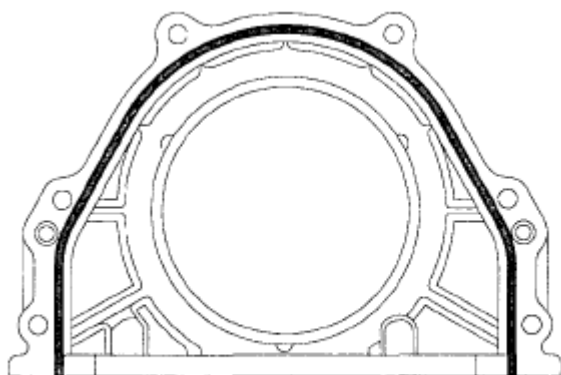
KDRF208A

Fig. 197: Identifying Bearing & Connecting Rod Cap
Courtesy of HYUNDAI MOTOR CO.

4. Install the crankshaft main bearings.

NOTE: **Upper bearings have an oil groove of oil holes; Lower bearings do not.**

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

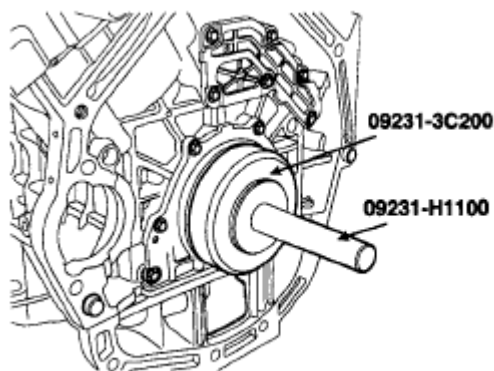


KDRF218A

Fig. 198: Identifying Bearing Claw
Courtesy of HYUNDAI MOTOR CO.

2. Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.
5. Install the center bearing.

Install the center bearing (A) under the No. 3 journal position of the cylinder block with the oil grooves facing outward.



KDRF237A

Fig. 199: Identifying Center Bearing
Courtesy of HYUNDAI MOTOR CO.

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

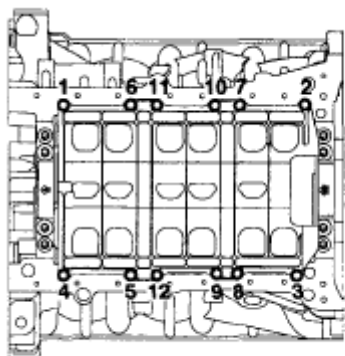
NOTE: The main bearing cap bolts are tightened in 2 progressive steps.
If any of the bearing cap bolt is broken or deformed, replace it.

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:

53.9 ~ 58.8 N.m (5.5 ~ 6.0 kgf.m, 39.8 ~ 43.4 lb-ft)



KDRF135A

Fig. 200: Identifying Bearing Cap Installation Positions
Courtesy of HYUNDAI MOTOR CO.

3. Check that the crankshaft turns smoothly.
9. Check the crankshaft end play. (Refer to CONNECTING ROD AND CRANKSHAFT).
10. Install the piston and connecting rod assemblies.

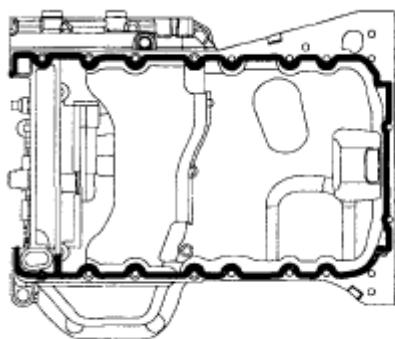
NOTE: Before installing the piston, apply a coat of engine oil to the ring grooves and cylinder bores.

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 rings are 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-crank journal alignment before pushing the piston into place.
4. Apply engine oil to the bolt threads. install the rod caps with bearings, and tighten the nuts.

Tightening torque:

31.4 ~ 34.3 N.m (3.2 ~ 3.5 kgf.m, 23.1 ~ 25.3 lb-ft)

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



KDRF130A

Fig. 201: Identifying Piston Installation Positions To Cylinder Bores
Courtesy of HYUNDAI MOTOR CO.

11. Install the rear oil seal case.

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.

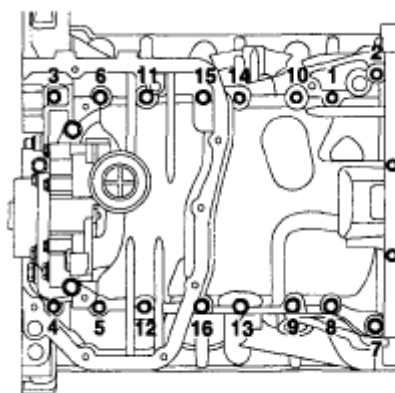
2. Apply liquid gasket as an even bead, centered between the edges of the mating surface.

Liquid gasket: LOCTITE 5900 or equivalent

3. Install the rear oil seal case (A) with 5 bolts (B).

Tightening torque:

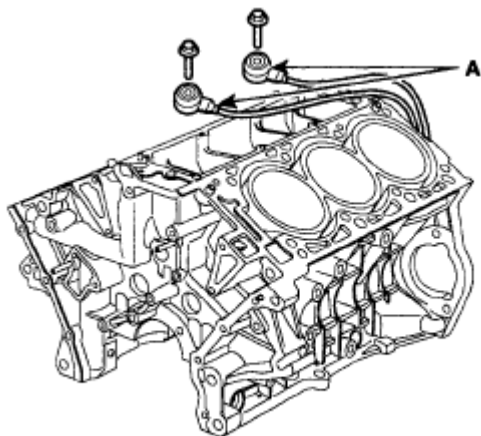
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



KDRF131A

Fig. 202: Identifying Rear Oil Seal Case With Bolts
Courtesy of HYUNDAI MOTOR CO.

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



KDRF205A

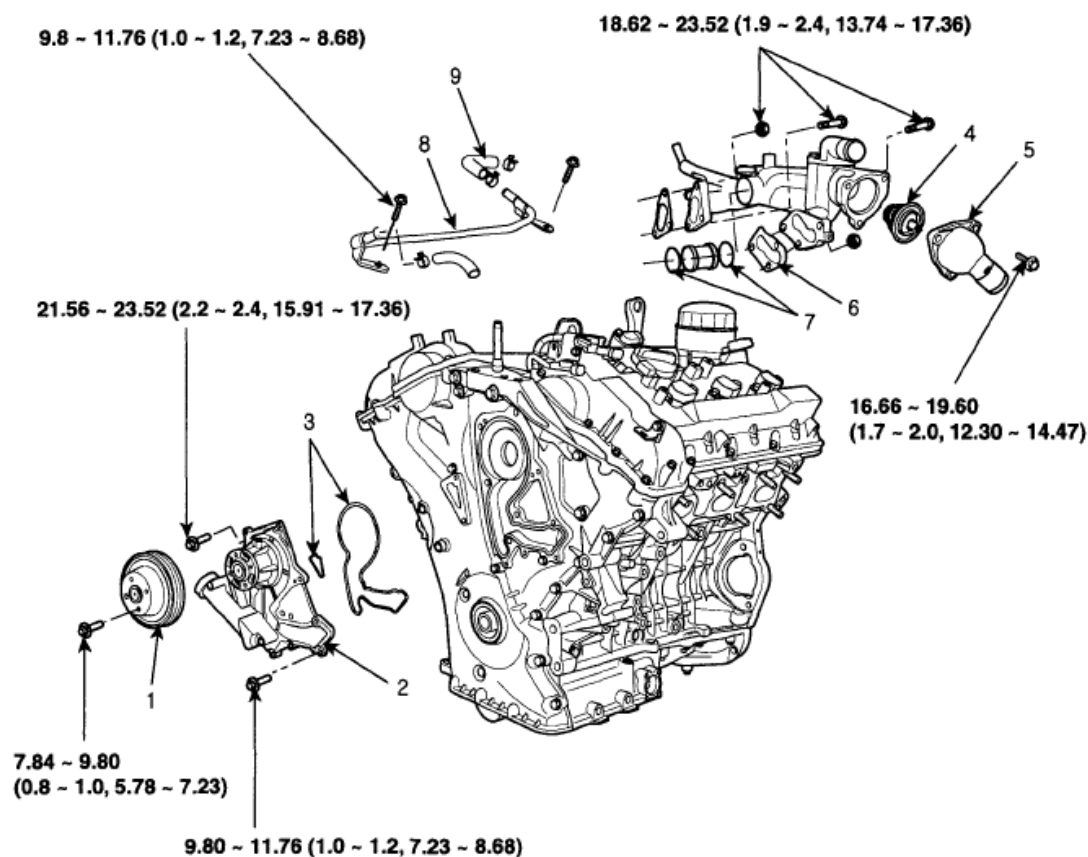
Fig. 203: Taping Oil Seal
Courtesy of HYUNDAI MOTOR CO.

13. Install the front case. (Refer to **INSTALLATION**).
14. Install the oil screen.

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

Tightening torque:

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



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

1. Water pump pulley
2. Water pump
3. Water pump gasket
4. Thermostat

5. Water inlet pipe
6. Gasket
7. O - ring
8. Air vent pipe
9. Hose

UCBF016A

Fig. 204: Identifying Oil Screen & Gasket
Courtesy of HYUNDAI MOTOR CO.

15. Install the 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.

Liquid gasket: TB1217H or equivalent

NOTE:

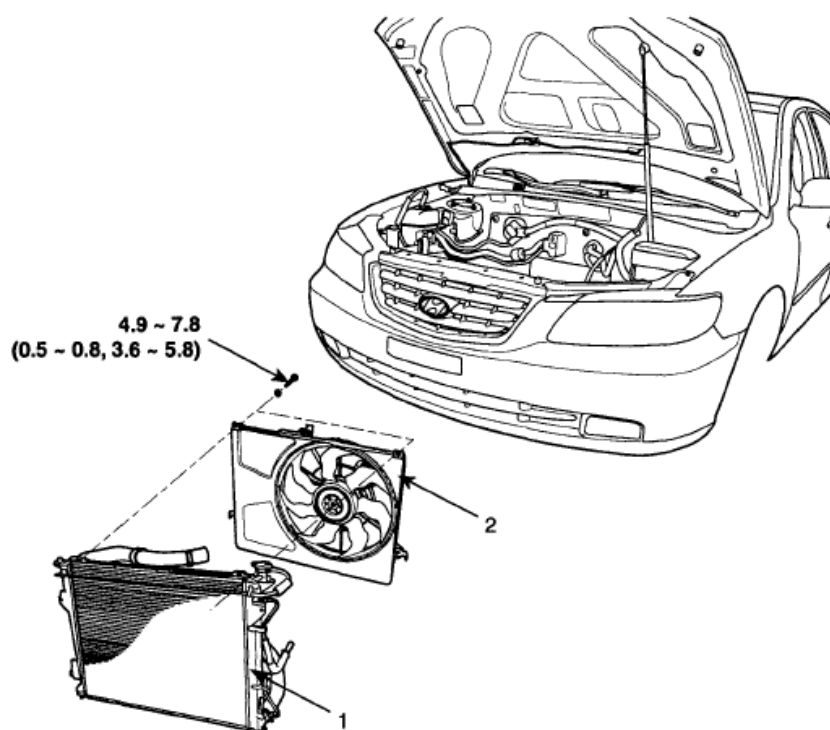
- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
- Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.
- After assembly, wait at least 30 minutes before filling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

3. Install the oil pan (A) with the bolts.

Uniformly tighten the bolts in several passes.

Tightening torque:

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



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

1. Radiator
2. Radiator fan

ECBF004A

Fig. 205: Identifying Oil Pan
Courtesy of HYUNDAI MOTOR CO.

16. Install the water pump. (Refer to **INSTALLATION**)

17. Install the oil pressure switch.

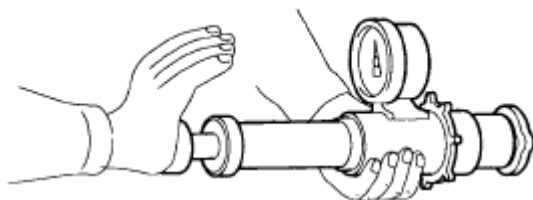
1. Apply adhesive to 2 or 3 threads.

Adhesive: TB 2310/2350 or equivalent.

2. Install the oil pressure switch (A).

Tightening torque:

4.7 ~ 21.6 N.m (1.5 ~ 2.2 kgf.m, 10.8 ~ 15.9 lb-ft)



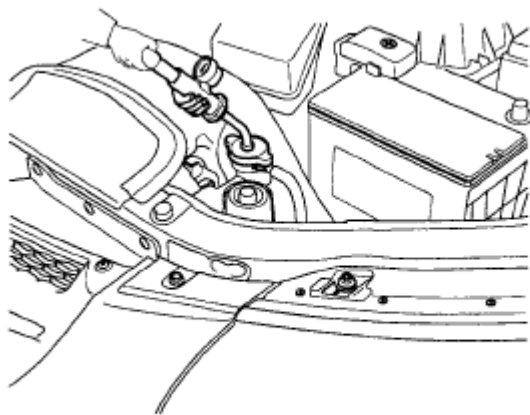
ECKD501X

Fig. 206: Identifying Oil Pressure Switch
Courtesy of HYUNDAI MOTOR CO.

18. Install the knock sensor (A).

Tightening torque:

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



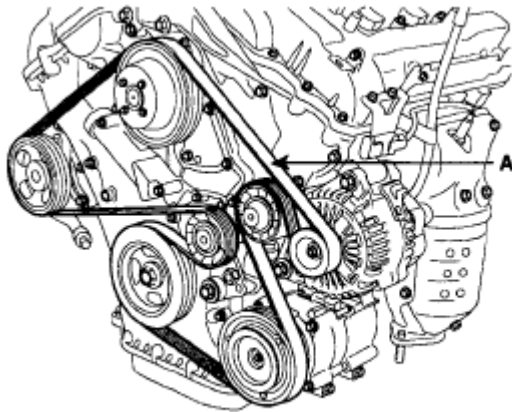
KCRF184A

Fig. 207: Identifying Knock Sensor
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque:

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



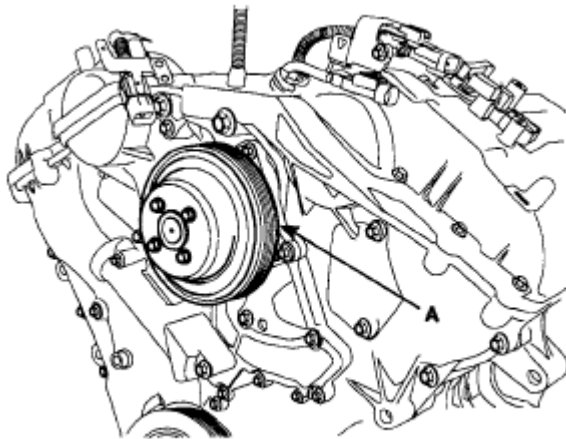
UCBF009A

Fig. 208: Identifying Oil Level Gauge Tube
Courtesy of HYUNDAI MOTOR CO.

20. Install the cylinder head. (Refer to **INSTALLATION**).
21. Install the timing belt. (Refer to **INSTALLATION**).
22. Remove the engine stand.
23. A/T: install the drive plate.

Tightening torque:

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



KDRF107A

Fig. 209: Identifying Drive Plate
Courtesy of HYUNDAI MOTOR CO.

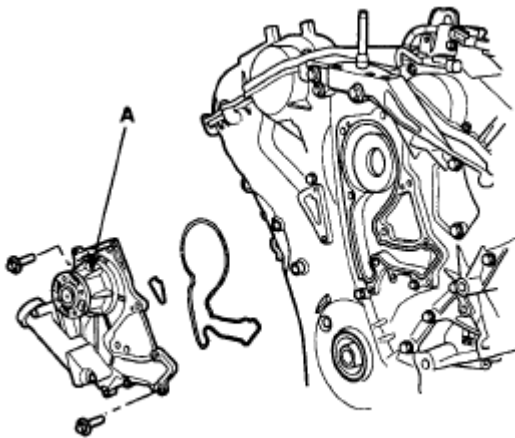
24. M/T: install the fly wheel.

Tightening torque:

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

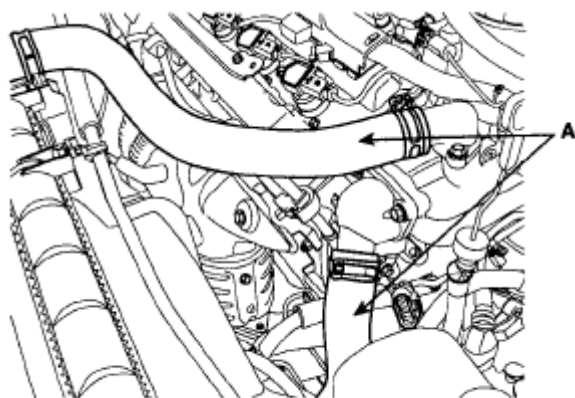
COOLING SYSTEM

COMPONENT



KDRF221A

Fig. 210: Identifying Cooling System Components Location
Courtesy of HYUNDAI MOTOR CO.



KDRF148A

Fig. 211: Identifying Cooling System Components - Torque Specifications
 Courtesy of HYUNDAI MOTOR CO.

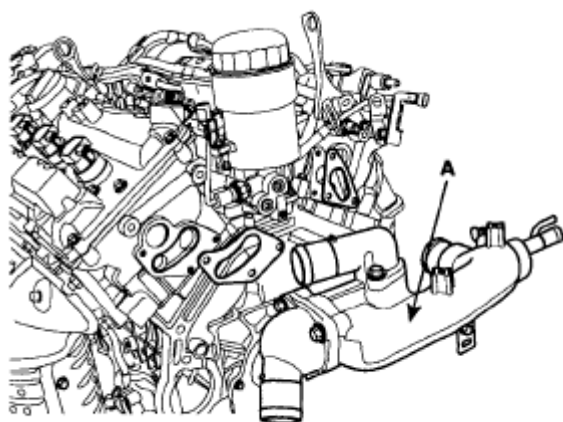
ENGINE COOLANT REFILLING AND BLEEDING

WARNING: Never remove the radiator cap when the engine is hot.

Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

CAUTION: When pouring engine coolant, be sure to shut the relay box lid and not to let coolant spill on the electrical parts of 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 the radiator cap (A).



KDRF194A

Fig. 212: Identifying Radiator Cap
 Courtesy of HYUNDAI MOTOR CO.

3. Loosen the drain plug (A), and drain the coolant.

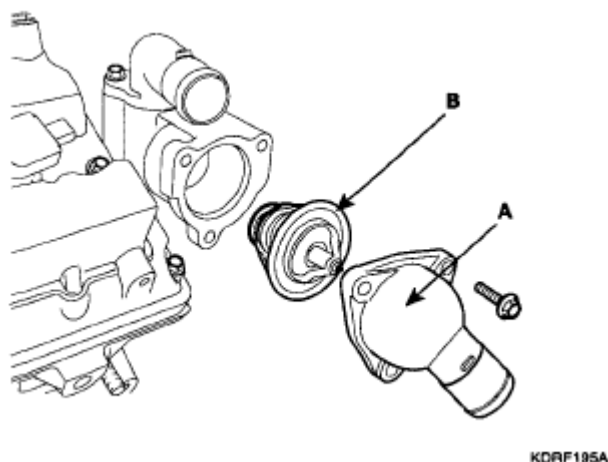


Fig. 213: Identifying Drain Plug
Courtesy of HYUNDAI MOTOR CO.

4. Tighten the radiator drain plug (A) securely.
5. Remove the coolant reservoir tank. Drain the coolant and reinstall the coolant reservoir tank. Fill the coolant reservoir tank to the MAX mark with the coolant.

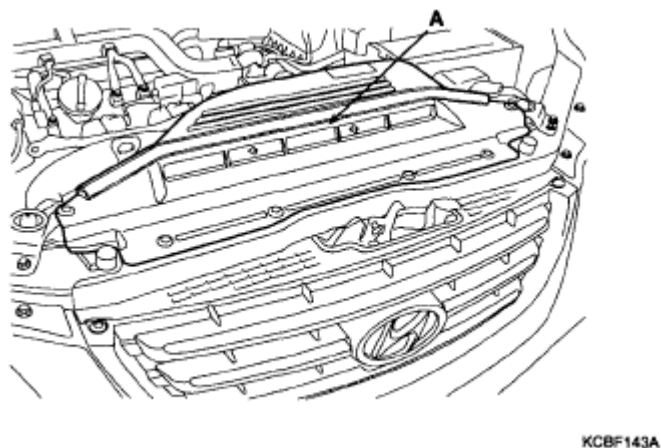


Fig. 214: Identifying Coolant Reservoir Tank
Courtesy of HYUNDAI MOTOR CO.

6. Fill the coolant into the radiator to the base of filler neck. Gently squeeze the upper/lower hoses of radiator so as to bleed air easily.

NOTE:

- Mix the Recommended antifreeze with an equal amount of water in a clean container.
- 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 of freezing.

- Coolant concentrations greater than 60% will impair cooling efficiency and are not Recommended.

CAUTION:

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

7. Start the engine and allow coolant to circulates.

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

8. Repeat step 7 until the cooling fan cycles on and off three to five times to sufficiently bleed air out of the cooling system.
9. Install the radiator cap and fill the reservoir tank to the "MAX" line with coolant.
10. Run the vehicle under idle until the cooling fan operates 2 ~ 3 times.
11. Stop the engine and allow coolant to cool.
12. Repeat steps 6 to 11 until the coolant level stays constant and all air is bleed out of the cooling system.

NOTE:

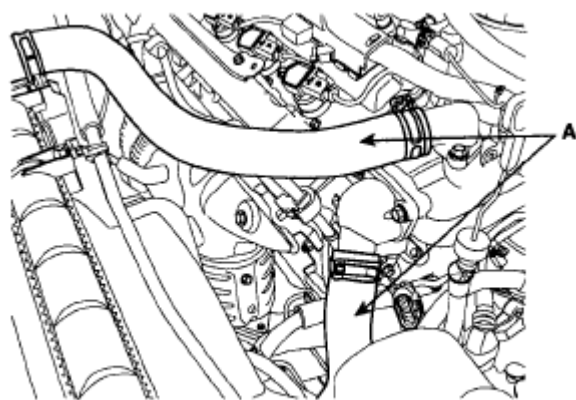
Recheck the coolant level in the reservoir tank for 2 ~ 3 days after replacing coolant.

Coolant capacity:

5.5 ~ 5.8 liters (5.8 ~ 6.1 US qt, 4.8 ~ 5.1 Imp qt)

RADIATOR CAP TESTING

1. Remove the radiator cap, wet the seal with coolant, then install it onto pressure tester.



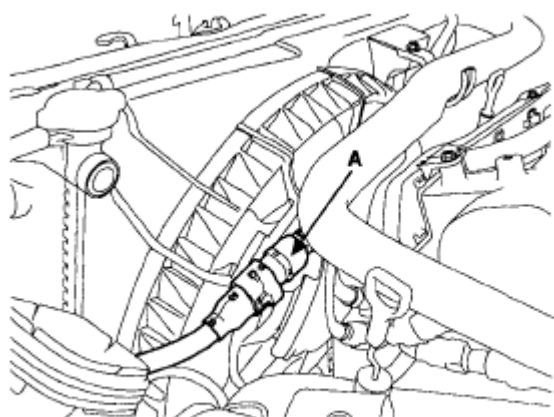
KDRF148A

Fig. 215: Identifying Radiator Cap Onto Pressure Tester
Courtesy of HYUNDAI MOTOR CO.

2. Apply a pressure of 93.16 ~ 122.58 kpa (0.95 ~ 1.25 kg/cm² , 13.51 ~ 17.78psi)
3. Check for a drop in pressure.
4. If the pressure drops, replace the cap.

RADIATOR LEAKAGE TEST

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 ~ 122.58 kpa (0.95 ~ 1.25 kg/cm² , 13.51 ~ 17.78 psi).



KCBF159A

Fig. 216: 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.

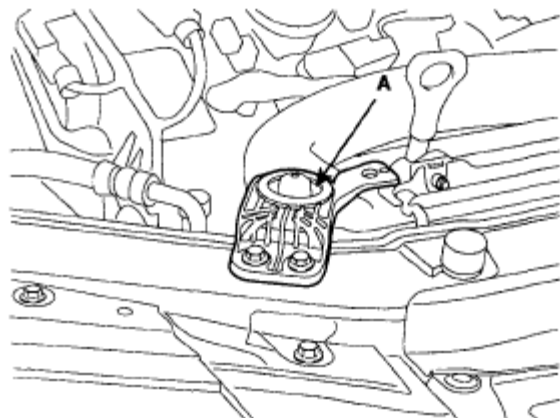
REMOVAL

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.

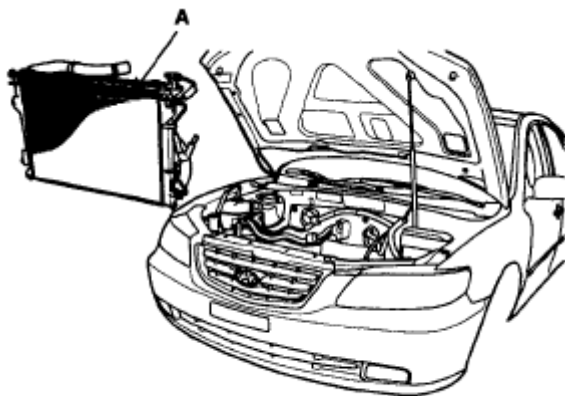
2. Loosen the water pump pulley bolts.
3. Remove the drive belts.



KCBF142A

Fig. 217: Identifying Alternator Drive Belt
Courtesy of HYUNDAI MOTOR CO.

4. Remove the water pump pulley.
5. Remove the timing belt. (Refer to **REMOVAL**).
6. Remove the timing belt idler.
7. Remove the water pump.
 1. Remove the 2 bolts and alternator brace (A).
 2. Remove the 3 bolts and remove the water pump (B) and gasket.



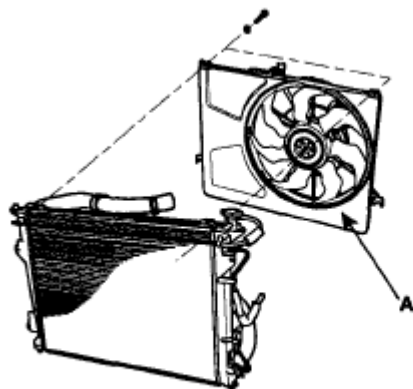
KCBF142B

Fig. 218: Identifying Water Pump
Courtesy of HYUNDAI MOTOR CO.

THERMOSTAT

NOTE: Disassembly of the thermostat would have an adverse effect, causing a lowering of cooling efficiency.

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



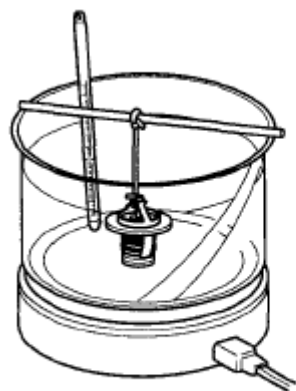
KCBF142C

Fig. 219: Identifying Water Inlet Fitting, Gasket & Thermostat
Courtesy of HYUNDAI MOTOR CO.

RADIATOR

1. Drain the engine coolant.

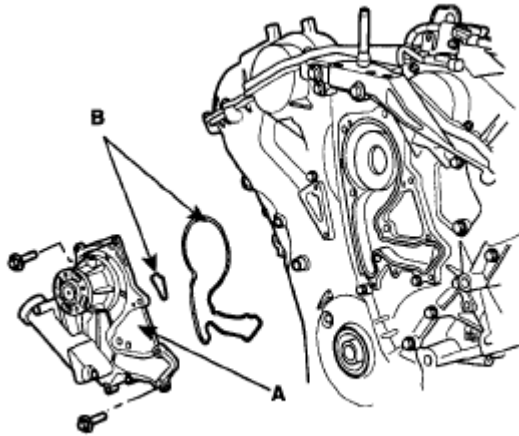
Remove the radiator cap to speed draining.
2. Remove the upper radiator hose (A) and lower radiator hose (B).
3. Remove the ATF (Automatic Transaxle Fluid) oil cooler hoses (C). (A/T)



ECKD503B

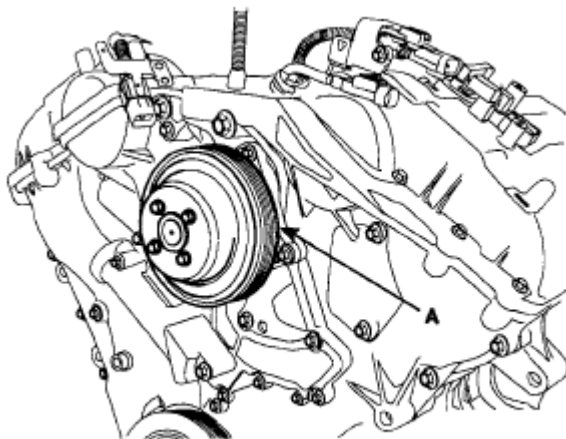
Fig. 220: Identifying Upper Radiator Hose & Lower Radiator Hose With ATF Oil Cooler Hoses
Courtesy of HYUNDAI MOTOR CO.

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



KDRF221B

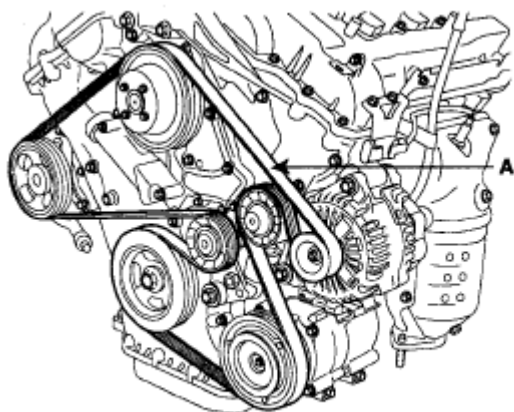
Fig. 221: Identifying Fan Motor Connector (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



KDRF107A

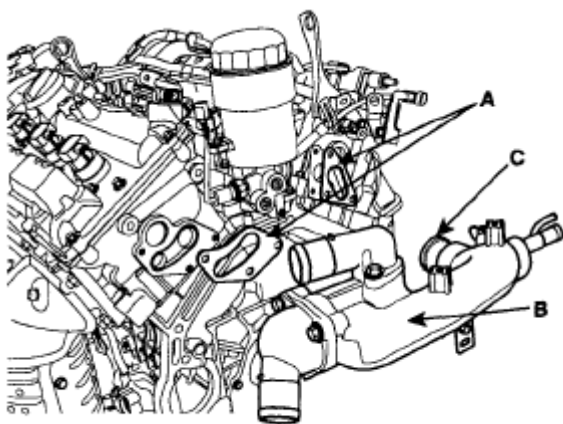
Fig. 222: Identifying Fan Motor Connector (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

5. Remove the cooling fan mounting bolt (A, B) and remove cooling fan.



KDRF101A

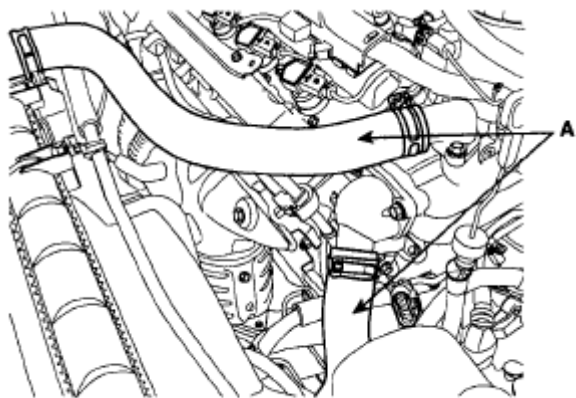
Fig. 223: Identifying Cooling Fan Mounting Bolt (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



KDRF194B

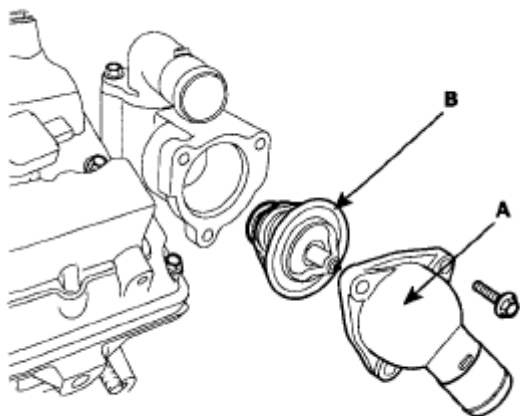
Fig. 224: Identifying Cooling Fan Mounting Bolt (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

6. Remove the radiator upper bracket (A, B), then pull up the radiator.



KDRF148A

Fig. 225: Identifying Radiator Upper Bracket
Courtesy of HYUNDAI MOTOR CO.



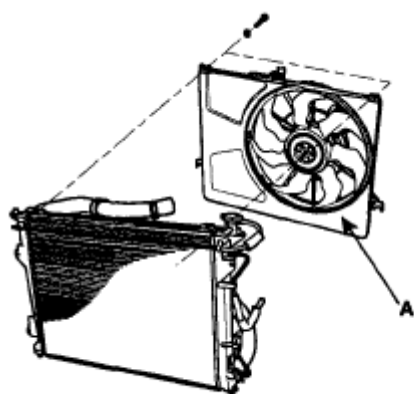
KDRF195A

Fig. 226: Identifying 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.



KCBF142C

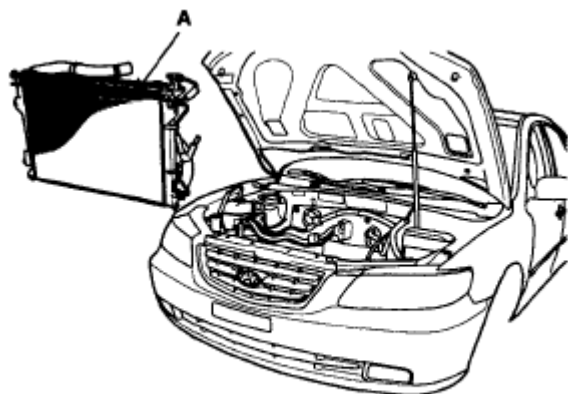
Fig. 227: Identifying Water Pump
Courtesy of HYUNDAI MOTOR CO.

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.



KCBF142B

Fig. 228: Checking Valve Opening Temperature
Courtesy of HYUNDAI MOTOR CO.

2. Check the valve opening temperature.

Valve opening temperature: $82 \pm 1.5^{\circ}\text{C}$ ($179.6 \pm 2.7^{\circ}\text{F}$)

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

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

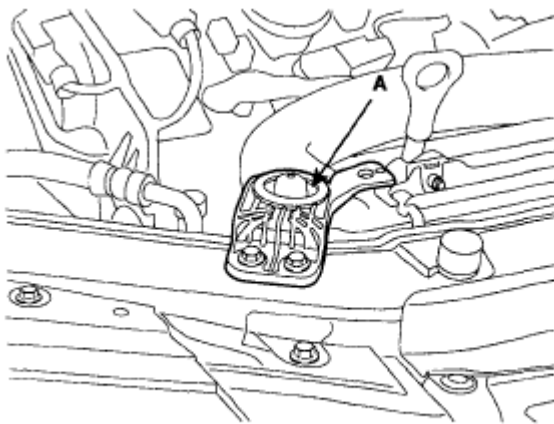
3. Check the valve lift.

Valve lift: 8 mm (0.3 in.) or more at 95°C (203°F)

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

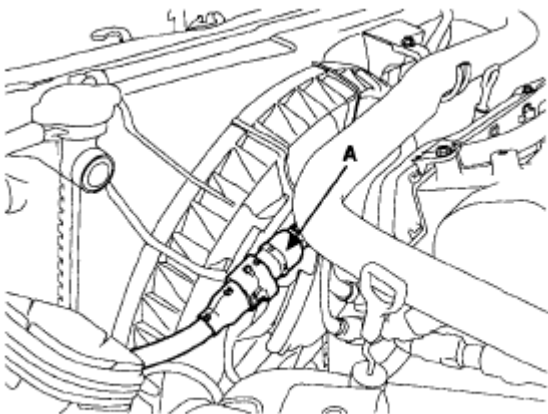
COOLING FAN

1. Disconnect the cooling fan motor connector.



KCBF142A

Fig. 229: Identifying Fan Motor Connector (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



KCBF159A

Fig. 230: Identifying Fan Motor Connector (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

2. Check that the radiator fan rotates when battery voltage is applied between (+) and (-) terminals.

INSTALLATION

WATER PUMP

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

Tightening torque:

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

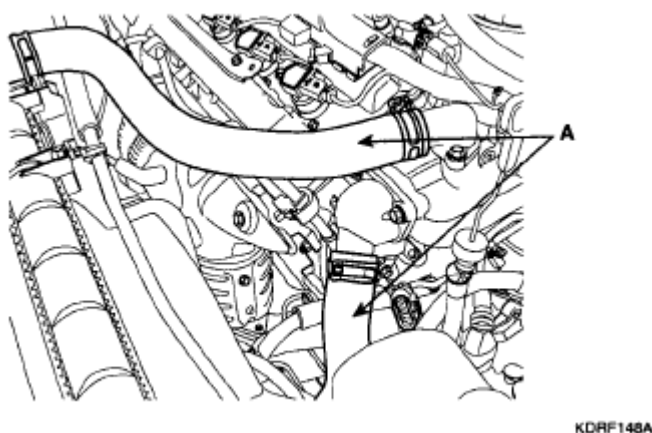


Fig. 231: Identifying Water Pump & Gasket With Bolts
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque:

19.6 ~ 23.5 N.m (2.0 ~ 2.4 kgf.m, 14.5 ~ 17.4 lb-ft)

2. Install the timing belt idler.
3. Install the timing belt. (Refer to **INSTALLATION**).
4. Install the water pump pulley.
5. Install the drive belts.
6. Tighten the water pump pulley bolts.

Tightening torque:

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

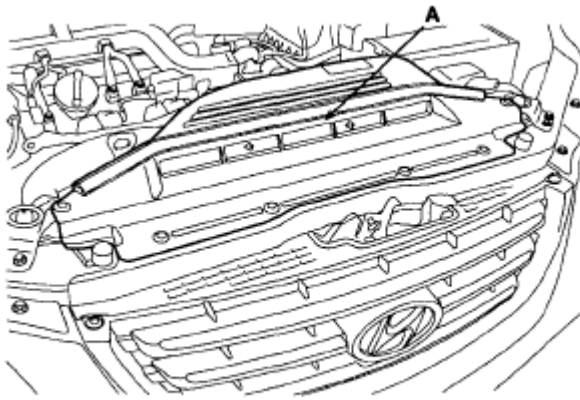
7. Fill with engine coolant.
8. Start engine and check for leaks.
9. Recheck engine coolant level.

THERMOSTAT

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

Tightening torque:

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



KCBF143A

Fig. 232: Identifying Water Inlet Fitting, Gasket & Thermostat
Courtesy of HYUNDAI MOTOR CO.

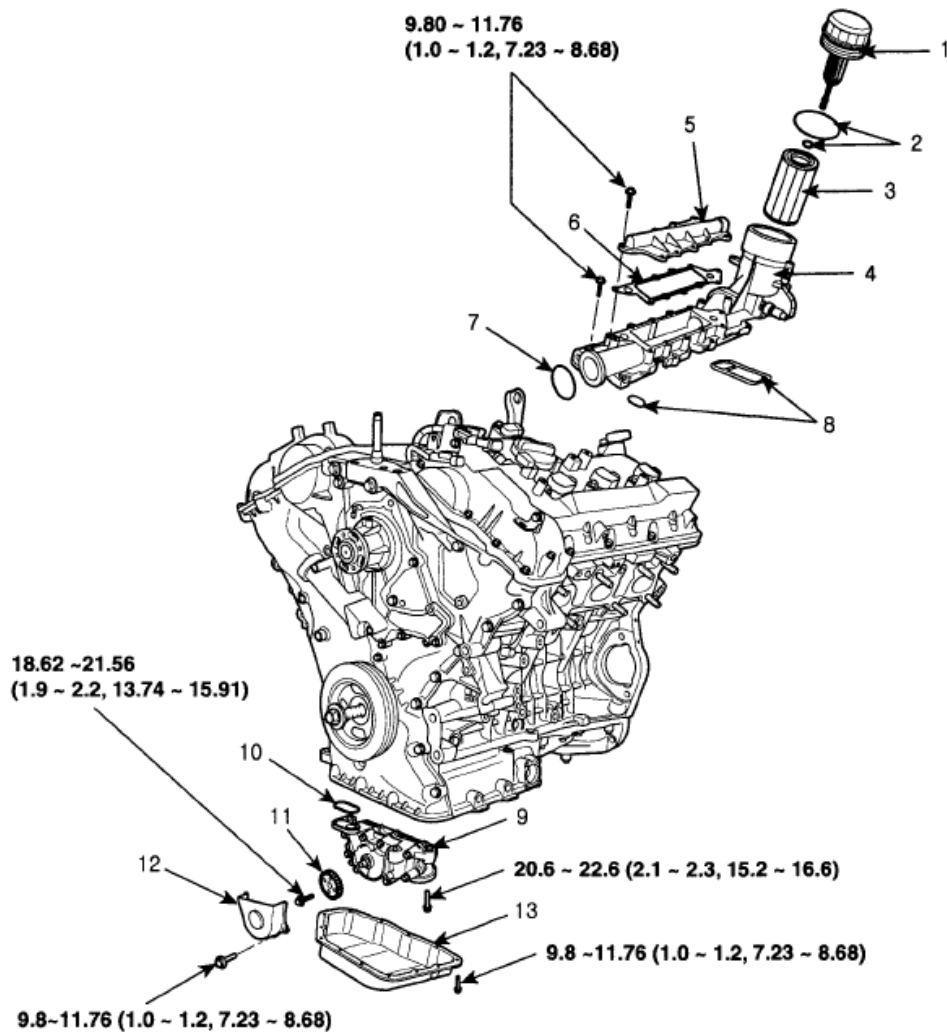
3. Fill with engine coolant.
4. Start engine and check for leaks.

RADIATOR

1. Install the radiator.
2. Install the radiator upper bracket (A, B).

Tightening torque:

6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)



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

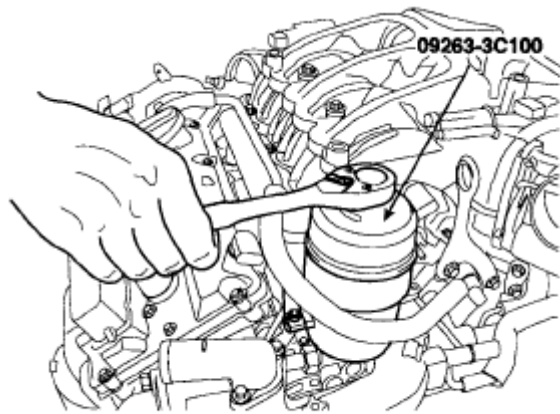
1. Oil filter cap
2. O - ring
3. Oil filter element
4. Oil filter body
5. Oil filter body cover

6. Gasket
7. O - ring
8. Gasket
9. Oil pump
10. Gasket

11. Oil pump sprocket
12. Oil pump chain cover
13. Lower oil pan

ECBF005A

Fig. 233: Identifying Radiator Upper Bracket (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



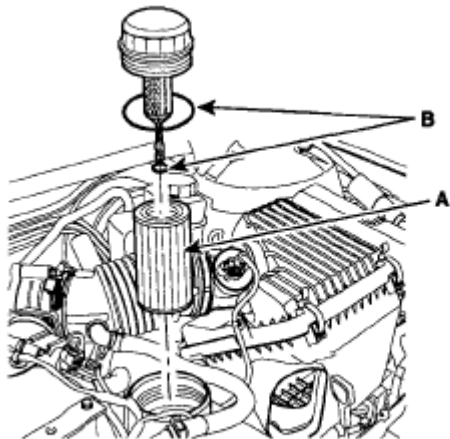
ECRF051A

Fig. 234: Identifying Radiator Upper Bracket (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

3. Install the cooling fan mounting bolts (A, B).

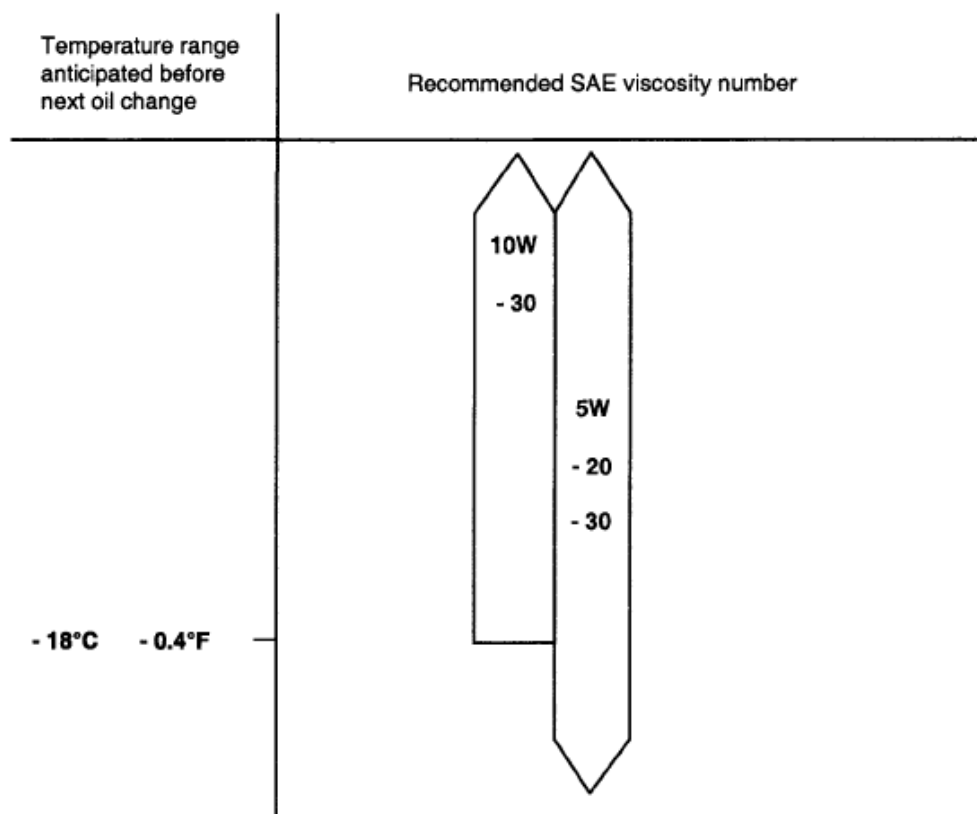
Tightening torque:

6.9 ~ 10.8 N.m (0.7 ~ 1.1 kgf.m, 5.1 ~ 8.0 lb-ft)



KDRF188A

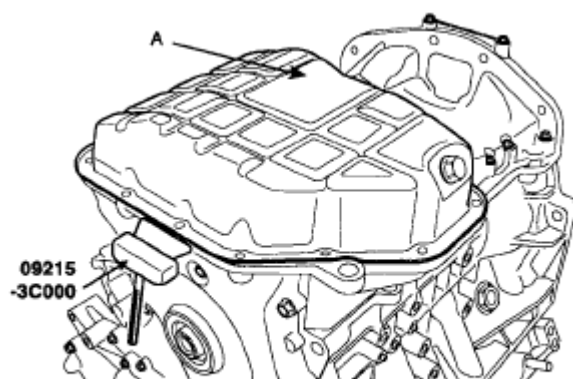
Fig. 235: Identifying Cooling Fan Mounting Bolt (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



EDRF020A

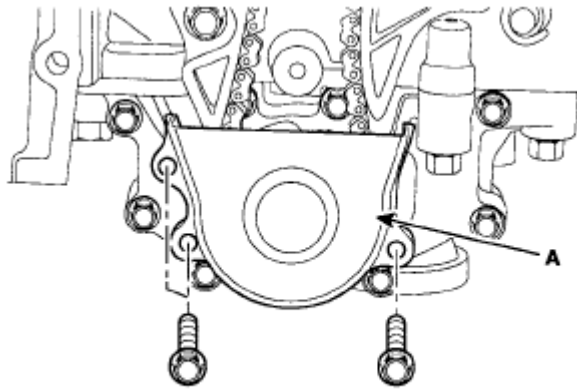
Fig. 236: Identifying Cooling Fan Mounting Bolt (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

4. Connect the fan motor connector (A, B).



ECRF060A

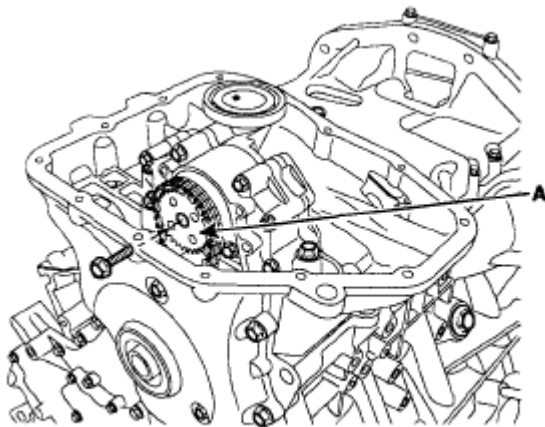
Fig. 237: Identifying Fan Motor Connector (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



KDRF185A

Fig. 238: Identifying Fan Motor Connector (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

5. Install the upper radiator hose (A) and lower radiator hose (B).
6. Install the ATF (Automatic Transaxle Fluid) oil cooler hoses (C).



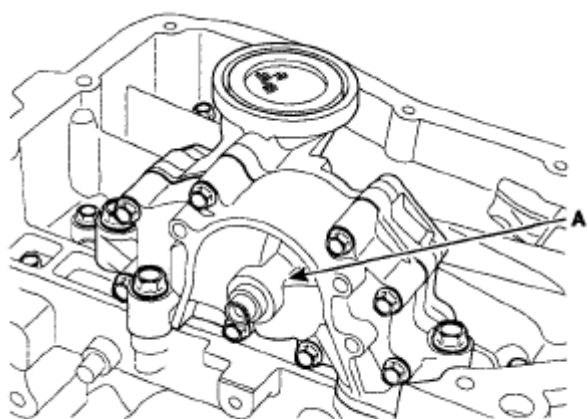
KDRF189A

Fig. 239: Identifying Upper Radiator Hose And Lower Radiator Hose With ATF Oil Cooler Hoses
Courtesy of HYUNDAI MOTOR CO.

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

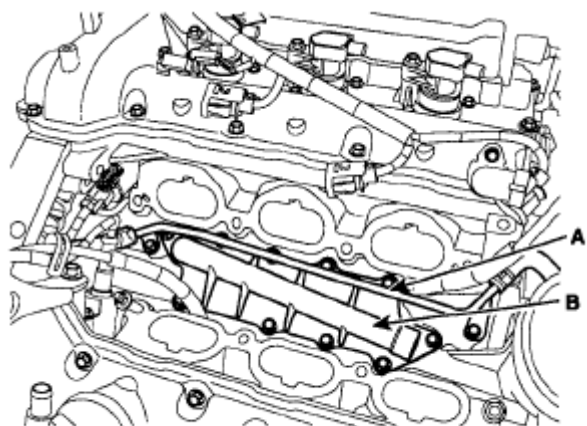
LUBRICATION SYSTEM

COMPONENT



KDRF190A

Fig. 240: Identifying Lubrication System Components - Torque Specifications (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



KDRF191A

Fig. 241: Identifying Lubrication System Components - Torque Specifications (2 Of 2)
Courtesy of HYUNDAI MOTOR CO.

OIL AND FILTER REPLACEMENT

CAUTION:

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

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

Tightening torque:

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

2. Fill with fresh engine oil.

Oil Capacity

Total: 3.3L (3.49 US qt, 2.90 Imp qt)

Oil pan: 3.0 L (3.17 US qt, 2.64 Imp qt)

Oil filter: 0.3 L (0.32 US qt, 0.26 Imp qt)

3. Install the oil filler cap.
4. Start engine and check for oil leaks.
5. Recheck the engine oil level.

INSPECTION

1. Check the engine oil quality.

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

If the quality is visibly poor, replace the oil.

2. Check the 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 in 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 ILSAC classification: GF3 OR ABOVE

Recommended API classification: SJ / SL OR ABOVE

Recommended SAE viscosity grades:

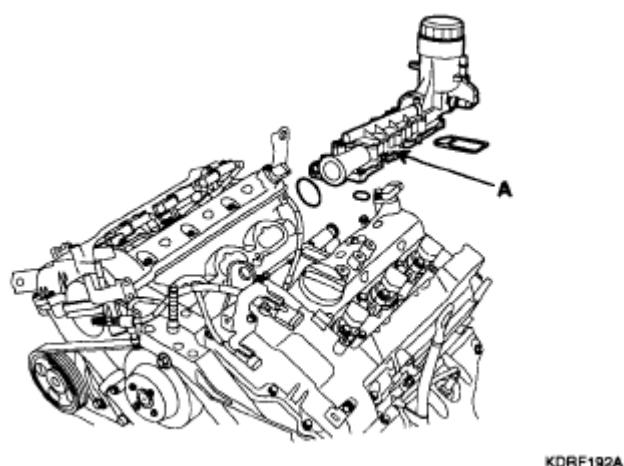


Fig. 242: Engine Oil Viscosity Chart
Courtesy of HYUNDAI MOTOR CO.

*1 :Recommended regardless of environment.

If not available, refer to the recommended SAE viscosity numbers.

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

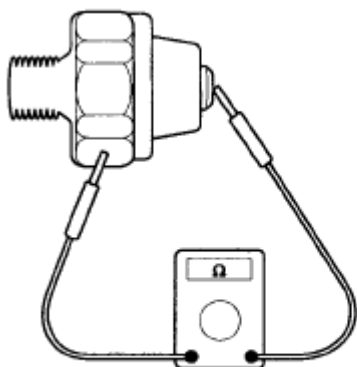
1. Satisfy the requirement of the API classification.
2. Have proper SAE grade number for expected ambient temperature range.
3. Lubricants that do not have both an SAE grade number and API service classification on the container should not be used.

REMOVAL

OIL PAN

1. Drain the engine oil.

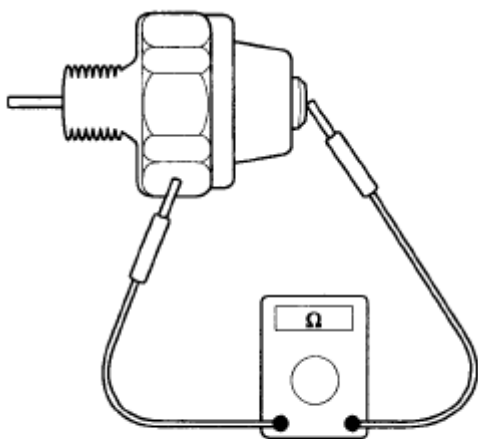
2. Disconnect the rear oxygen sensor connector (A).



ECKD001W

Fig. 243: Identifying Rear Oxygen Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

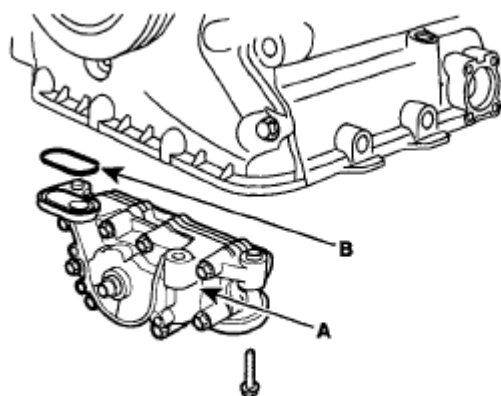
3. Remove the front muffler heat protector (A)
4. Remove the front muffler (B).



ECKD001Y

Fig. 244: Identifying Front Muffler Heat Protector
Courtesy of HYUNDAI MOTOR CO.

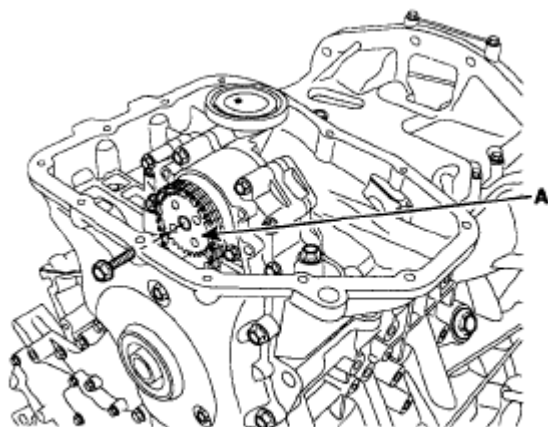
5. Remove the exhaust manifold and catalytic converter assembly (A). (Refer to **REMOVAL**).



KDRF222A

Fig. 245: Identifying Exhaust Manifold & Catalytic Converter Assembly
Courtesy of HYUNDAI MOTOR CO.

6. Using the SST(09215-3C000) and remove the oil pan.



KDRF189A

Fig. 246: Identifying SST(09215-3C000) On Oil Pan
Courtesy of HYUNDAI MOTOR CO.

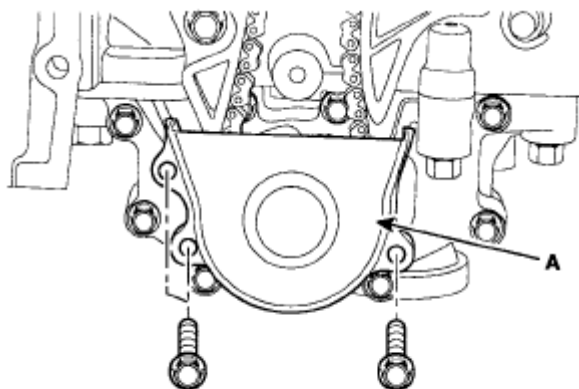
CAUTION:

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

OIL PUMP

1. Drain the engine oil.

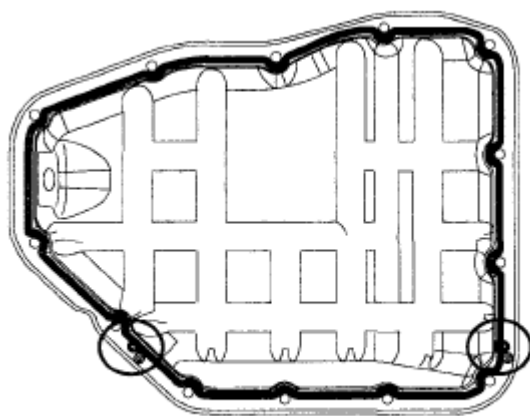
2. Remove the drive belts.
3. Turn the crankshaft pulley, and align its groove with timing mark "T" of the timing belt cover.
4. Remove the timing belt. (Refer to **REMOVAL**).
5. Remove the timing belt tensioner (A).



KDRF185A

Fig. 247: Identifying Timing Belt Tensioner
Courtesy of HYUNDAI MOTOR CO.

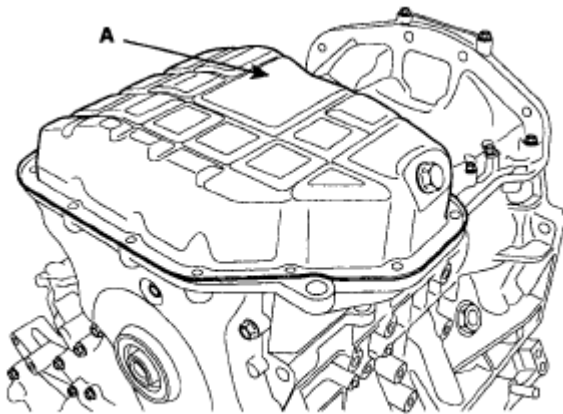
6. Remove the oil pan and oil screen.
7. Remove the alternator. (Refer to **GENERATOR** - alternator).
8. Remove the air conditioner compressor tensioner bracket (A).



KDRF136A

Fig. 248: Identifying Timing Belt Tensioner Bracket
Courtesy of HYUNDAI MOTOR CO.

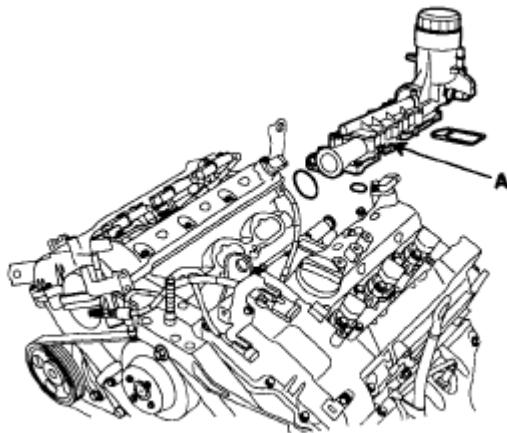
9. Remove the front case.
 1. Remove the screw from the pump housing, then separate the housing and cover (A).



KDRF114A

Fig. 249: Identifying Pump Housing Cover
Courtesy of HYUNDAI MOTOR CO.

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



KDRF192A

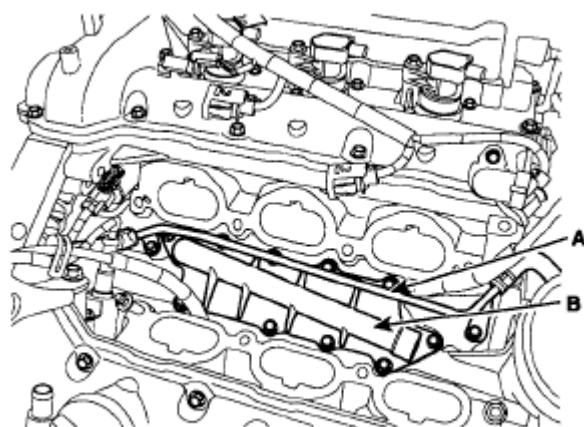
Fig. 250: Identifying Inner Rotor & Outer Rotor
Courtesy of HYUNDAI MOTOR CO.

DISASSEMBLY

RELIEF PLUNGER

1. Remove the relief plunger.

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



KDRF191A

Fig. 251: Identifying Plug, Spring & Relief Plunger
 Courtesy of HYUNDAI MOTOR CO.

INSPECTION

1. Inspect the relief plunger.

Coat the plunger 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 the relief valve spring.

Inspect for distorted or broken relief valve spring.

Standard value

Free height: 46.6 mm (1.8346 in.)

Load: 6.1 ± 0.4 kg/40.1 mm (13.4 ± 0.9 lb/1.5787 in.)

3. Inspect the rotor side clearance.

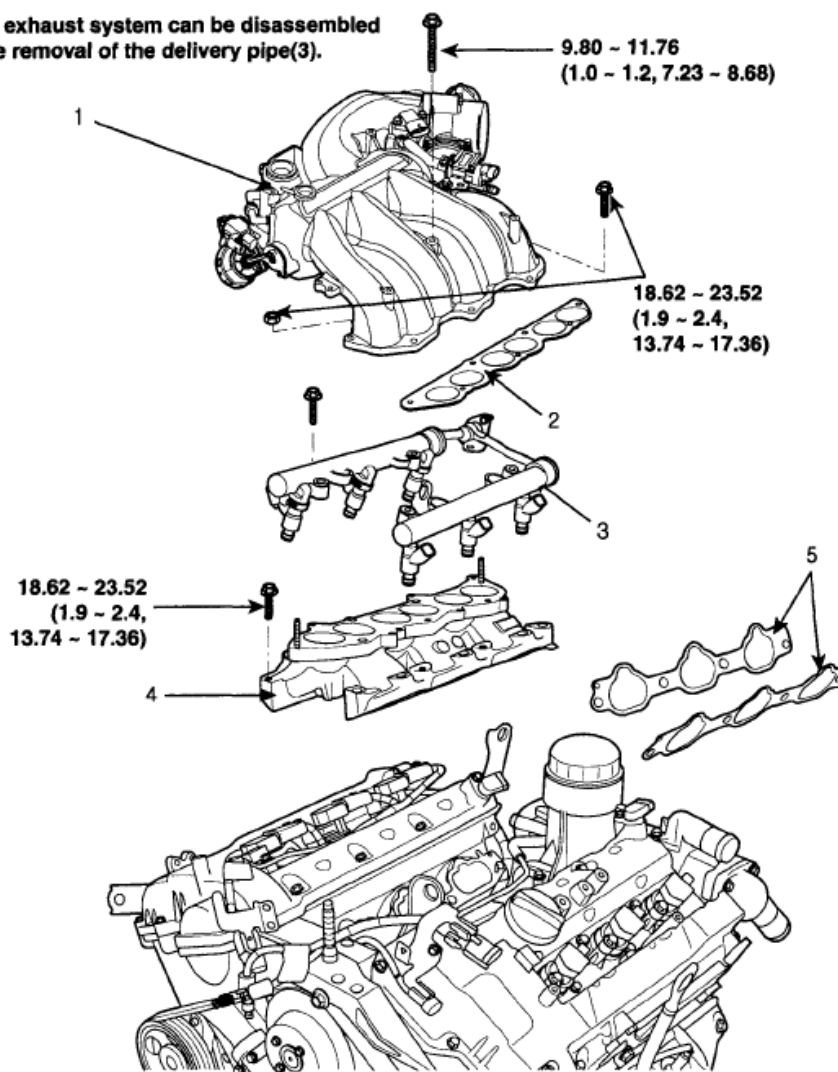
Using a feeler gauge and precision straight edge, measure the clearance between the rotors and precision straight edge.

INNER ROTOR CLEARANCE SPECIFICATIONS

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

<NOTE>

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. Surge tank gasket
- 3. Delivery pipe

- 4. Intake manifold
- 5. Intake manifold gasket

UCBF017A

Fig. 252: Measuring Clearance Between Rotors & Precision Straight
Courtesy of HYUNDAI MOTOR CO.

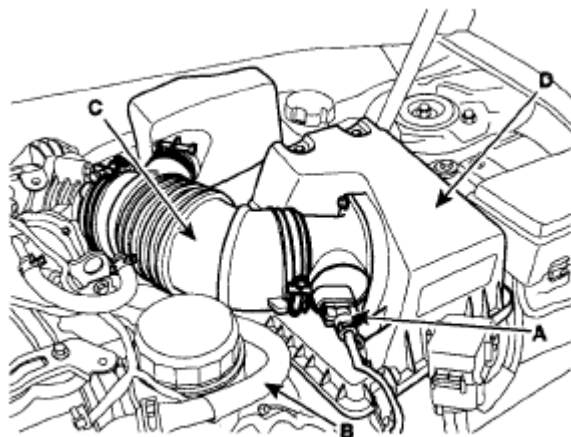
If the side clearance is greater than maximum, replace the rotors as a set. If necessary, replace the front case.

- 4. Inspect the 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.)



KDRF173A

Fig. 253: Measuring Tip Clearance Between Inner & Outer Rotor Tips
Courtesy of HYUNDAI MOTOR CO.

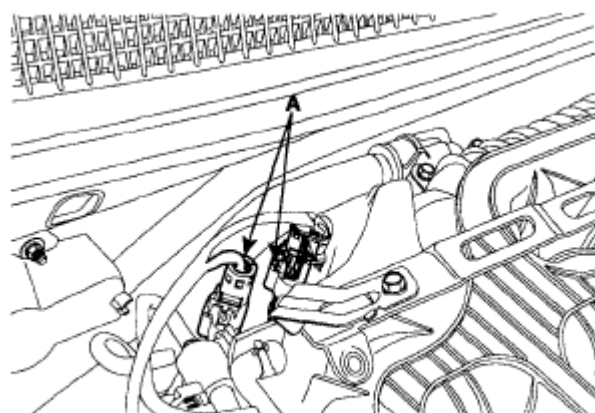
If the tip clearance is greater than specified, replace the rotors as a set.

5. Inspect the rotor body clearance.

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

Body clearance:

0.060 ~ 0.090 mm (0.0024 ~ 0.0035 in.)



UCBF018A

Fig. 254: Measuring Clearance Between Outer Rotor & Body
Courtesy of HYUNDAI MOTOR CO.

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

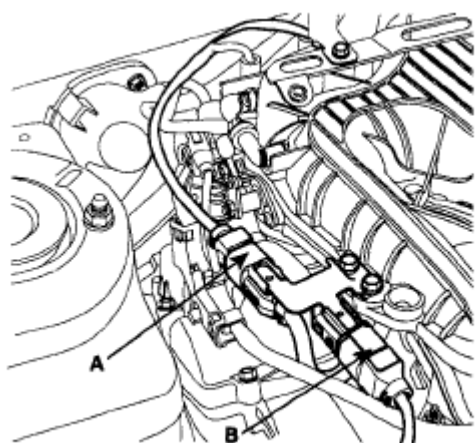
REASSEMBLY**RELIEF PLUNGER**

1. Install the relief plunger.

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

Tightening torque:

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



KDRF153A

Fig. 255: Identifying Plug, Spring & Relief Plunger
Courtesy of HYUNDAI MOTOR CO.

INSTALLATION**OIL PUMP**

1. Install the 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.

Tightening torque:

5.9 ~ 6.9 N.m (0.6 ~ 0.7 kgf.m, 4.3 ~ 5.1 lb-ft)

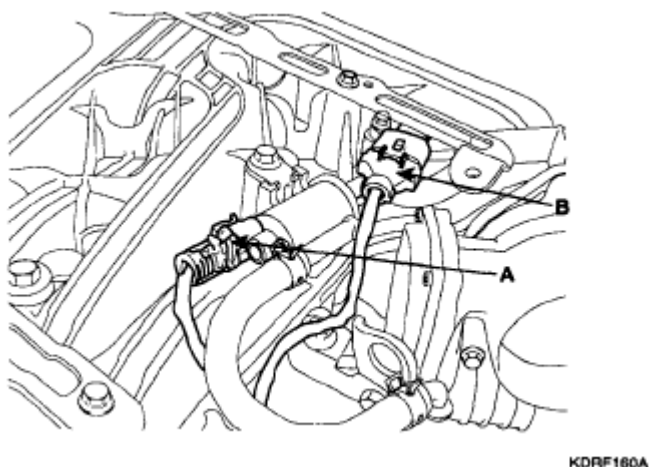


Fig. 256: Identifying Pump Housing Cover
Courtesy of HYUNDAI MOTOR CO.

2. Check that the oil pump turns freely.
3. Install the oil pump on the cylinder block.
 1. Place a new front case gasket on the cylinder block.
 2. Apply engine oil to the lip of the oil pump seal.

Then, install the oil pump onto the crankshaft.

3. When the pump is in place, clean any excess grease off the crankshaft and check that the oil seal lip is not distorted.

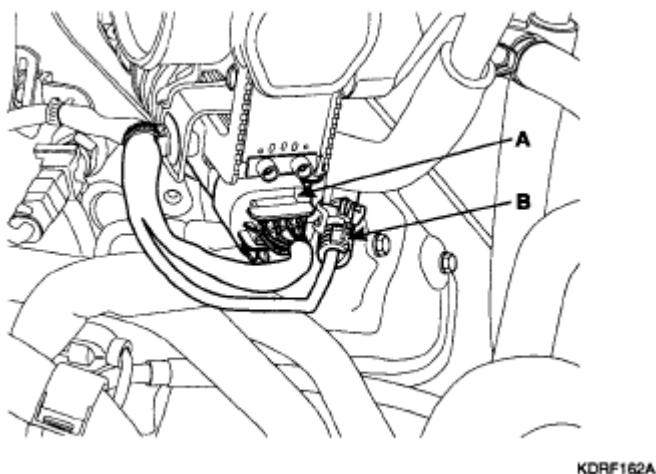


Fig. 257: Identifying Oil Pump Housing Onto Crankshaft
Courtesy of HYUNDAI MOTOR CO.

Bolt length

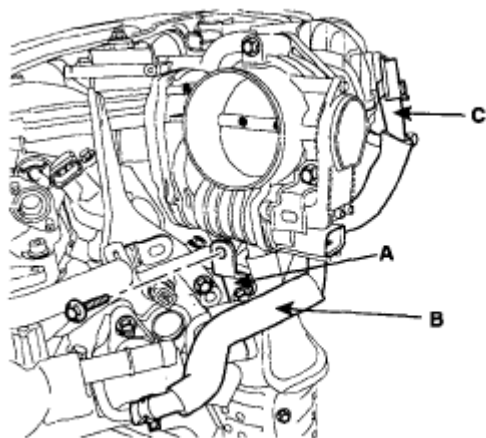
(A): 30 mm (1.181 in.), (B): 22 mm (0.866 in.),

(C): 45 mm (1.772 in.), (D): 60 mm (2.362 in.)

Tightening torque:

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

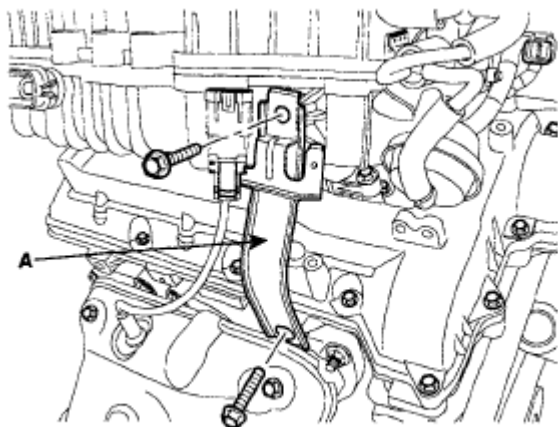
4. Apply a light coat of oil to the front case oil seal lip.
5. Using the SST(09214-32000), install the front case oil seal.



KDRF176A

Fig. 258: Identifying SST (09214-32000) On Front Case Oil Seal
Courtesy of HYUNDAI MOTOR CO.

6. Install the air conditioner compressor tensioner bracket (A).



UCBF020A

Fig. 259: Identifying Timing Belt Tensioner Bracket
Courtesy of HYUNDAI MOTOR CO.

7. Install the alternator. (Refer to **REPLACEMENT** - alternator)
8. Install the oil screen.

Tightening torque:

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

9. Install the oil pan.

Tightening torque:

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

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

10. Install the timing belt tensioner.
11. Install the timing belt (Refer to INSTALLATION)
12. Install the drive belts.
13. Fill with engine oil.

OIL PAN

1. Install the 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.

Liquid gasket: TB1217H or equivalent

NOTE:

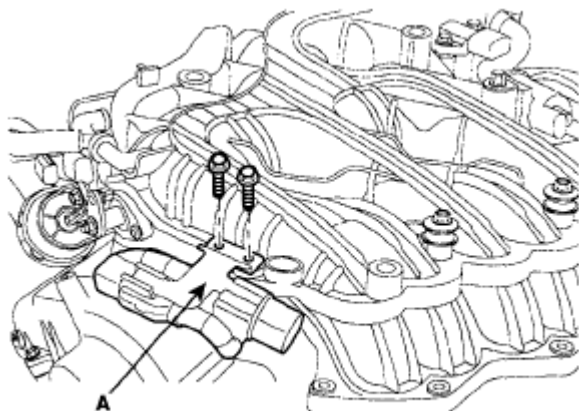
- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
- Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.
- After assembly, wait at least 30 minutes before filling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

3. Install the oil pan (A) with the bolts.

Uniformly tighten the bolts in several passes.

Tightening torque:

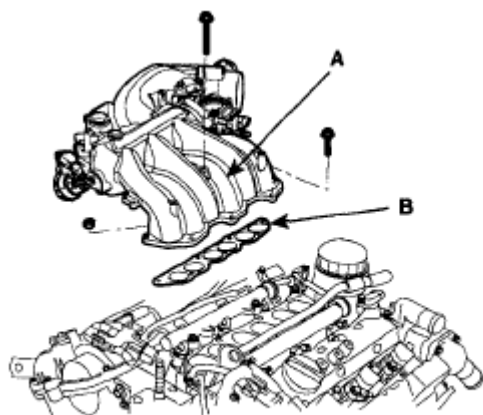
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



KDRF178A

Fig. 260: Applying Liquid Gasket To Inner Threads Of Oil Pan Bolt Holes
Courtesy of HYUNDAI MOTOR CO.

2. Install the exhaust manifold and catalytic converter assembly (A). (Refer to **REMOVAL**).



UCBF007A

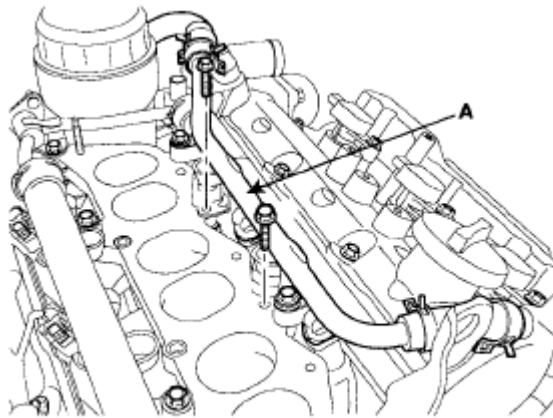
Fig. 261: Identifying Exhaust Manifold & Catalytic Converter Assembly
Courtesy of HYUNDAI MOTOR CO.

3. Install the front muffler (B).

Tightening torque:

29.4 ~ 39.2 N.m (3.0 ~ 4.0 kgf.m, 21.7 ~ 28.9 lb-ft)

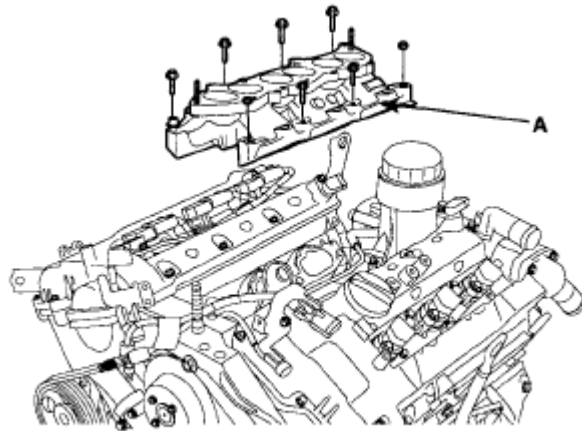
4. Install the front muffler heat protector (A).



ECBF031A

Fig. 262: Identifying Front Muffler Heat Protector
Courtesy of HYUNDAI MOTOR CO.

5. Connect the rear oxygen sensor connector (A).



KDRF182A

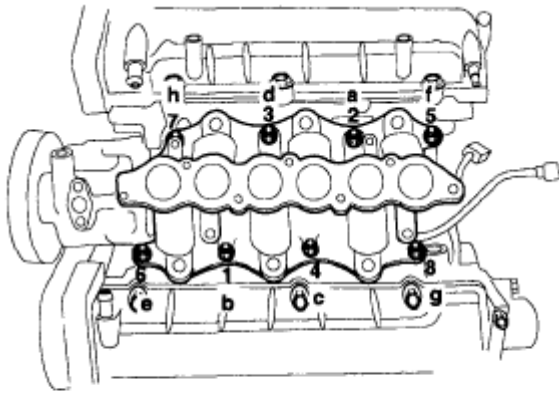
Fig. 263: Identifying Rear Oxygen Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

6. Fill with engine oil

INTAKE AND EXHAUST SYSTEM

INTAKE MANIFOLD

COMPONENT

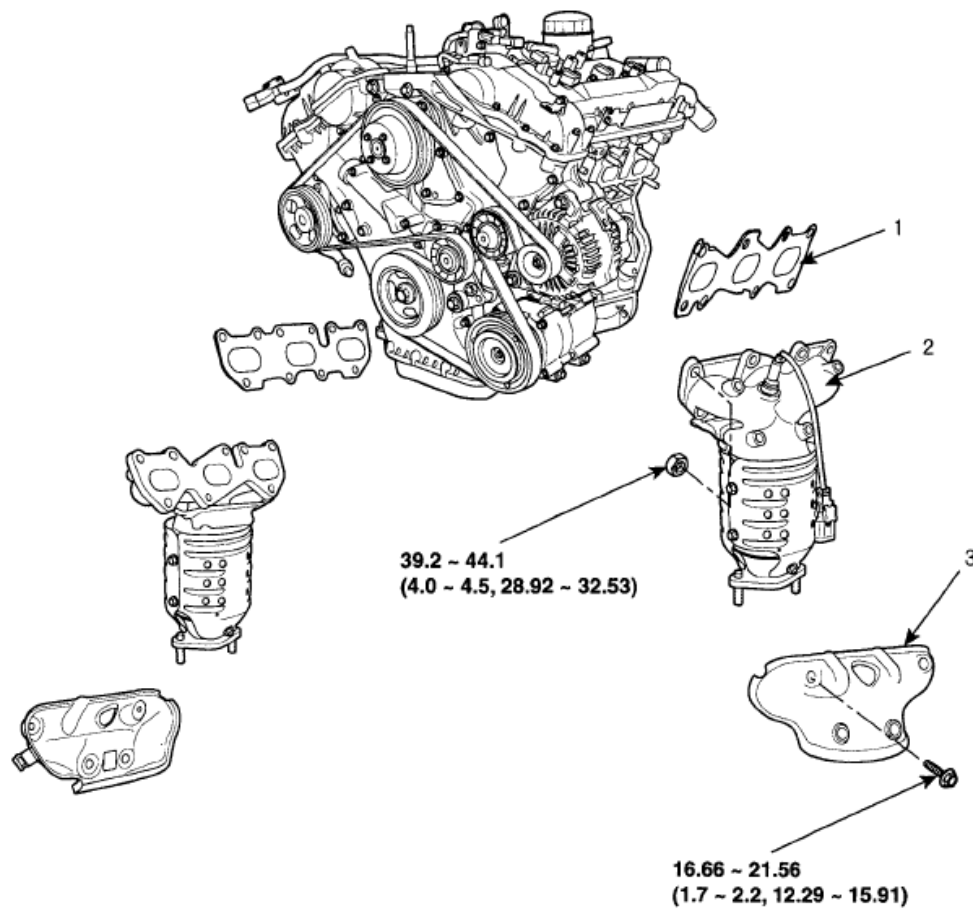


UCBF019A

Fig. 264: Intake & Exhaust Manifold Components - Torque Specification
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

1. Remove the engine cover.
2. Remove the accelerator cable (A).
3. Disconnect the TPS (Throttle Position Sensor) connector (B).
4. Disconnect the ISA (Idle Speed Actuator) connector (B).
5. Disconnect the PCV (Positive Crankcase Ventilation) hose (D) and breather hose (E).



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

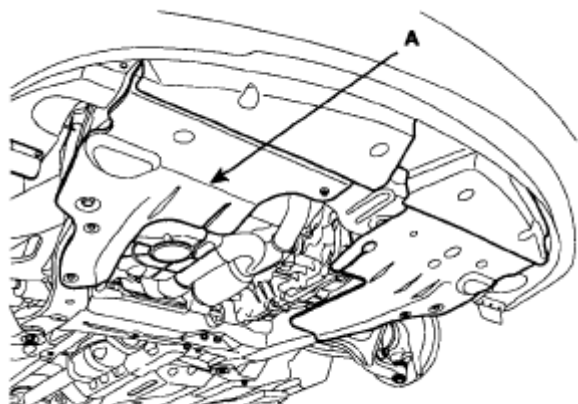
- 1. Gasket
- 2. Exhaust manifold

- 3. Heat protector

ECBF014A

Fig. 265: Identifying (Positive Crankcase Ventilation) Hose & Breather Hose
 Courtesy of HYUNDAI MOTOR CO.

- 6. Disconnect the injector connector (No. 3, 4) (A).
- 7. Disconnect the injector connector (No. 1, 2) (B).

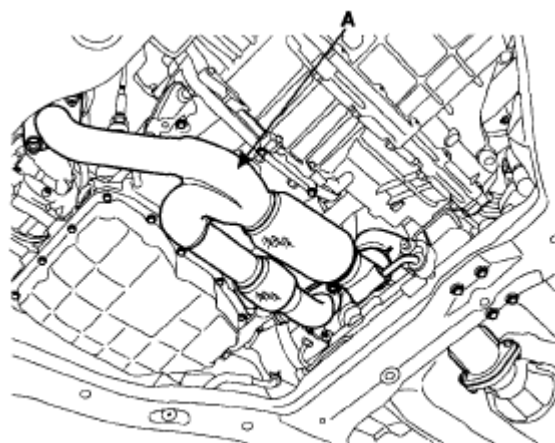


KCBF101A

Fig. 266: Identifying Rear Oxygen Sensor Connector & Air Conditioner Compressor Switch Connector

Courtesy of HYUNDAI MOTOR CO.

8. Remove the heater hose (A), PCSV(Purge Control Solenoid Valve) (B) and the brake vacuum hose (C) from throttle body and intake manifold.
9. Disconnect the PCSV(Purge Control Solenoid Valve) (D) and water temperature sensor connector (E).



KCBF102A

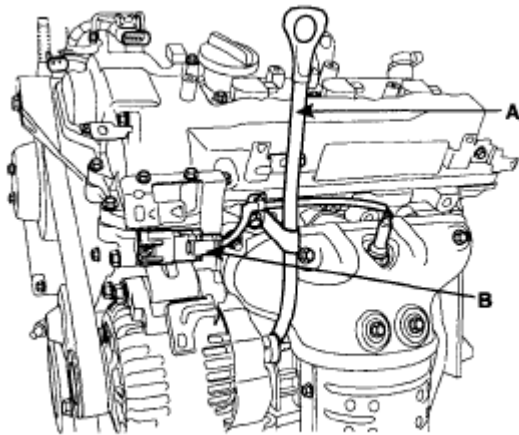
Fig. 267: Identifying Purge Control Solenoid Valve & Brake Vacuum Hose

Courtesy of HYUNDAI MOTOR CO.

10. Remove the delivery pipe (A).

Tightening torque:

18.6 ~ 27.5 N.m (1.9 ~ 2.8 kgf.m, 13.7 ~ 20.3 lb-ft)



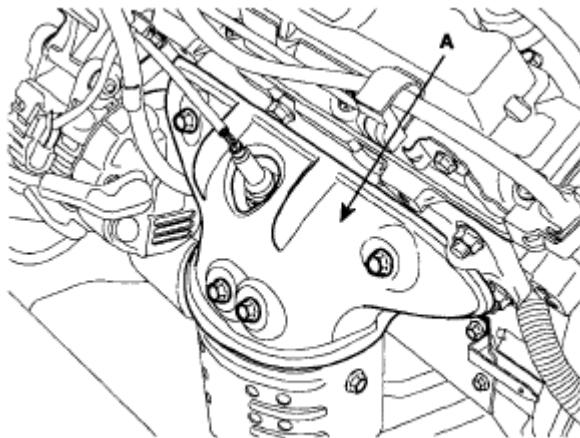
UCBF010A

Fig. 268: Identifying Delivery Pipe
Courtesy of HYUNDAI MOTOR CO.

11. Remove the intake manifold stay (A).

Tightening torque:

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



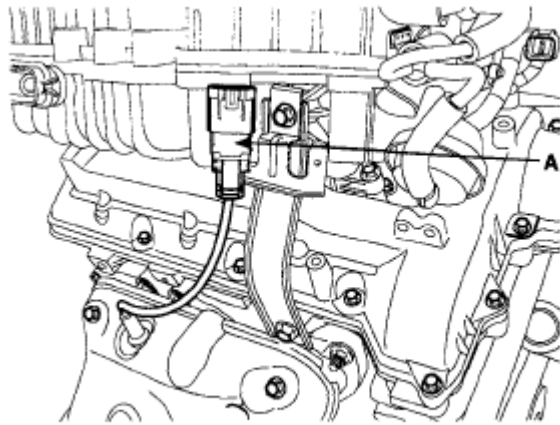
UCBF011A

Fig. 269: Identifying Intake Manifold Stay
Courtesy of HYUNDAI MOTOR CO.

12. Remove the intake manifold.

Tightening torque:

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



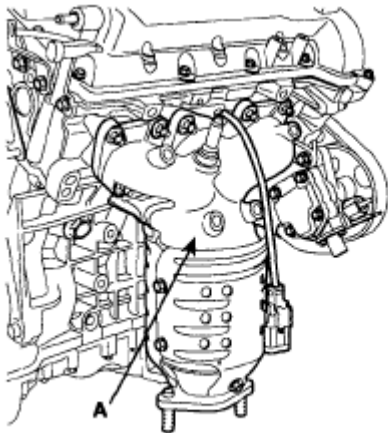
KDRF177B

Fig. 270: Identifying Intake Manifold
Courtesy of HYUNDAI MOTOR CO.

13. Installation is in the reverse order of removal with new gasket.

EXHAUST MANIFOLD

COMPONENT



UCBF012A

Fig. 271: Identifying Exhaust Manifold Components - 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 heat protector (A).

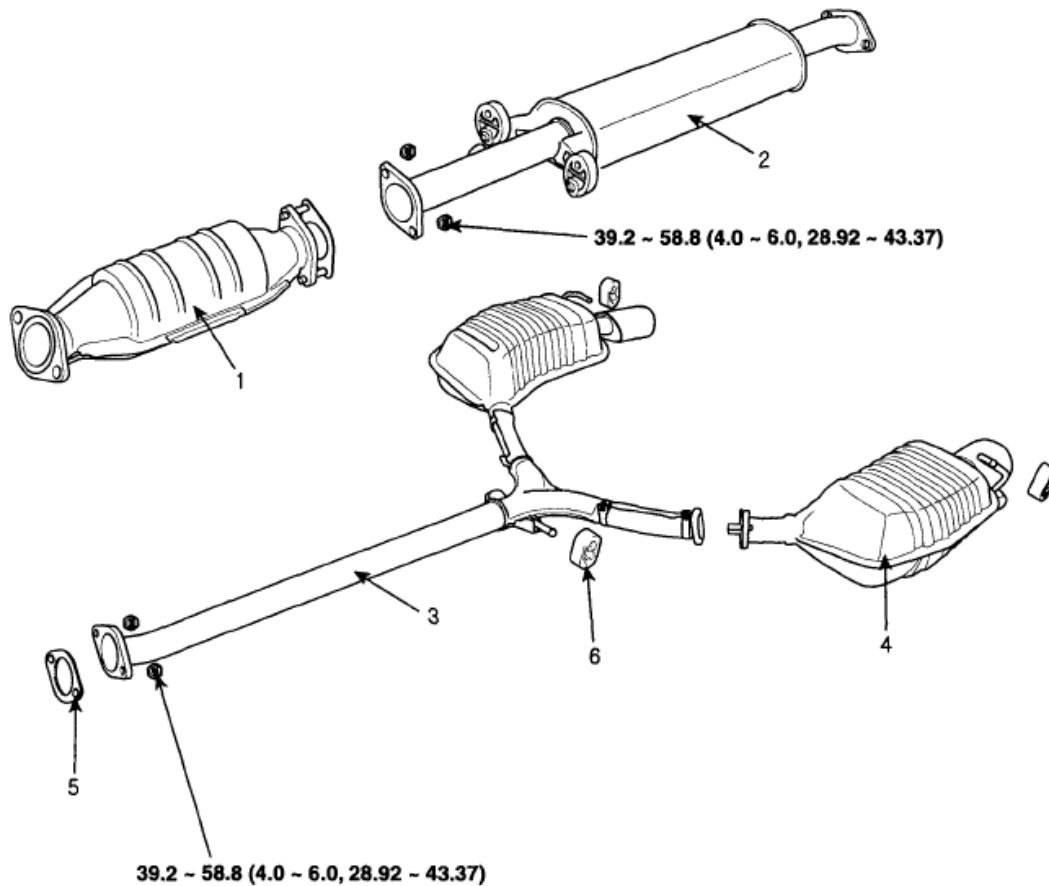
Tightening torque:

7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

4. Remove the front muffler (B).

Tightening torque:

29.4 ~ 39.2 N.m (3.0 ~ 4.0 kgf.m, 21.7 ~ 28.9 lb-ft)



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

- | | |
|------------------------|------------------|
| 1. Catalytic converter | 4. LH muffler |
| 2. Center muffler | 5. Gasket |
| 3. Main muffler | 6. Rubber hanger |

ECBF015A

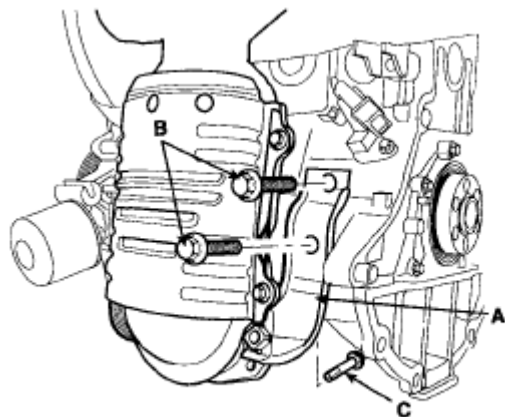
Fig. 272: Identifying Front Muffler Heat Protector
 Courtesy of HYUNDAI MOTOR CO.

5. Remove the stay (A) of the exhaust manifold and catalytic converter assembly.

Tightening torque:

Bolts (B): 34.3 ~ 39.2 N.m (3.5 ~ 5.5 kgf.m, 25.3 ~ 28.9 lb-ft)

Bolts (C): 29.4 ~ 39.2 N.m (3.0 ~ 5.5 kgf.m, 21.7 ~ 28.9 lb-ft)



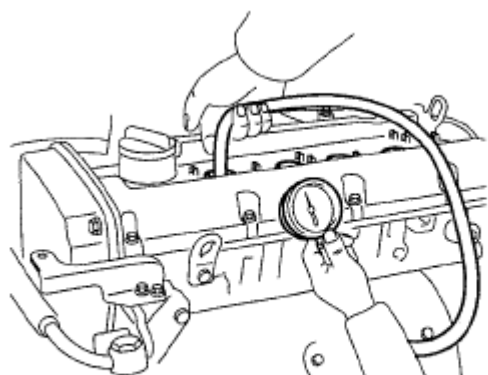
ACJF123A

Fig. 273: Identifying Exhaust Manifold & Catalytic Converter Assembly
Courtesy of HYUNDAI MOTOR CO.

6. Remove the heat protector (A).

Tightening torque:

16.7 ~ 21.6 N.m (1.7 ~ 2.2 kgf.m, 12.3 ~ 15.9 lb-ft)



SHDM16314L

Fig. 274: Identifying Heat Protector
Courtesy of HYUNDAI MOTOR CO.

7. Remove the exhaust manifold and catalytic converter assembly (A).

Tightening torque:

29.4 ~ 34.3 N.m (3.0 ~ 3.5 kgf.m, 21.7 ~ 25.3 lb-ft)

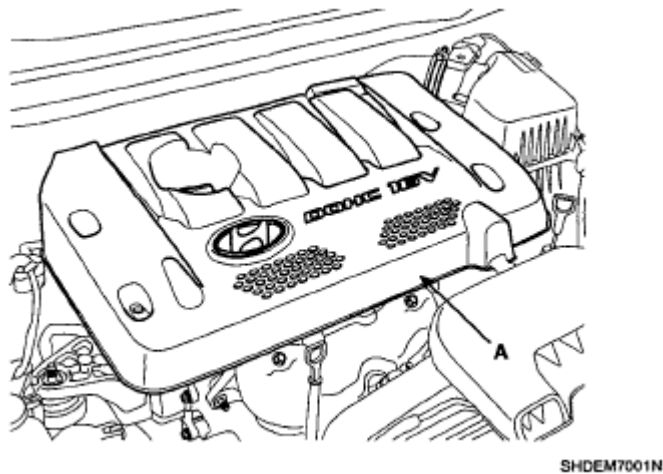


Fig. 275: Identifying Exhaust Manifold & Catalytic Converter Assembly
Courtesy of HYUNDAI MOTOR CO.

8. Installation is in the reverse order of removal

EXHAUST PIPE

COMPONENT

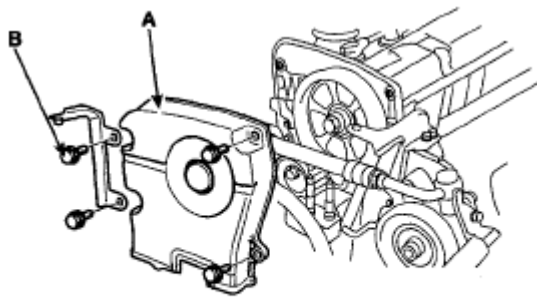


Fig. 276: Identifying Exhaust Pipe Components - Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

1. Remove the front muffler heat protector (A).

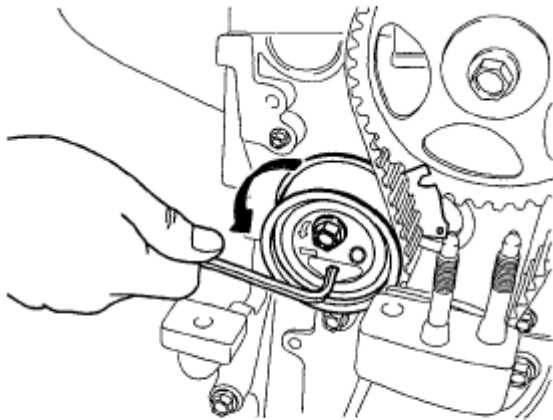
Tightening torque:

7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

2. Remove the front muffler (B).

Tightening torque:

29.4 ~ 39.2 N.m (3.0 ~ 4.0 kgf.m, 21.7 ~ 28.9 lb-ft)



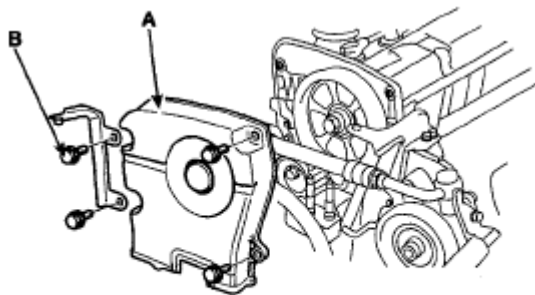
SHDEM7002N

Fig. 277: Identifying Front Muffler Heat Protector
Courtesy of HYUNDAI MOTOR CO.

3. Remove the center muffler (A).

Tightening torque:

29.4 ~ 39.2 N.m (3.0 ~ 4.0 kgf.m, 21.7 ~ 28.9 lb-ft)



ECKD105A

Fig. 278: Identifying Center Muffler
Courtesy of HYUNDAI MOTOR CO.

4. Remove the main muffler (A).

Tightening torque:

29.4 ~ 39.2 N.m (3.0 ~ 4.0 kgf.m, 21.7 ~ 28.9 lb-ft)

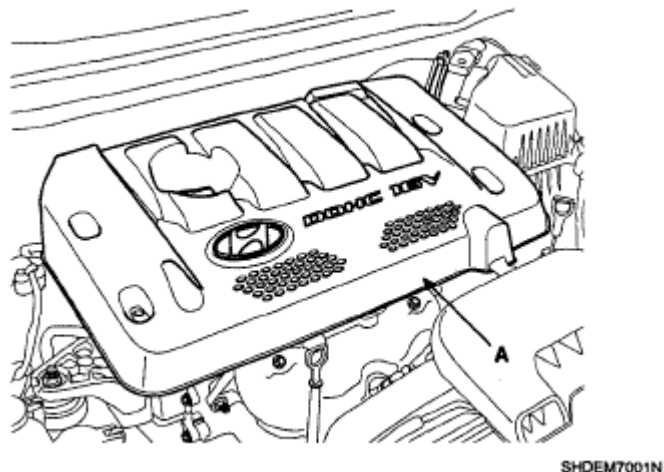


Fig. 279: Identifying Main Muffler
Courtesy of HYUNDAI MOTOR CO.