

2010 Hyundai Sonata GLS

2010 ENGINE General Information (Engine (G4KE - GSL 2.4)) - Sonata

2010 ENGINE**General Information (Engine (G4KE - GSL 2.4)) - Sonata****SPECIFICATIONS****DESCRIPTION CHART**

Description	Specifications	Limit
General		
Type	In-line, Double Overhead Camshaft	
Number of cylinder	4	
Bore	88mm (3.464in.)	
Stroke	97mm (3.819in.)	
Total displacement	2359cc (143.90cu.in.)	
Compression ratio	10.5	
Firing order	1-3-4-2	
Valve timing		
Intake valve		
Opens (ATDC/BTDC)	ATDC 7° ~ BTDC 38°	
Closes (ABDC)	ABDC 67° ~ 22°	
Exhaust		
Opens (BBDC)	BBDC 44° ~ 4°	
Closes (ATDC)	ATDC 0° ~ 40°	
Valve		
Valve length		
Intake	113.18mm (4.4559in.)	112.93mm (4.4460in.)
Exhaust	105.84mm (4.1669in.)	105.59mm (4.1570in.)
Stem O.D.		
Intake	5.465 ~ 5.480mm (0.2151 ~ 0.2157in.)	
Exhaust	5.458 ~ 5.470mm (0.2149 ~ 0.2153in.)	
Face angle	45.25° ~ 45.75°	
Margin		
Intake	1.02mm (0.0401in.)	
Exhaust	1.09mm (0.0429in.)	
Valve stem to valve guide clearance		
Intake	0.020 ~ 0.047mm (0.00078 ~ 0.00185in.)	0.07mm (0.00275in.)
Exhaust	0.030 ~ 0.054mm	0.09mm

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	(0.00118 ~ 0.00212in.)	(0.00354in.)
Valve guide		
Length		
Intake	43.8 ~ 44.2mm (1.7244 ~ 1.7401 in.)	
Exhaust	43.8 ~ 44.2mm (1.7244 ~ 1.7401 in.)	
Valve seat		
Width of seat contact		
Intake	1.16 ~ 1.46mm (0.0457 ~ 0.0575in.)	
Exhaust	1.35 ~ 1.65mm (0.0531 ~ 0.0649in.)	
Seat angle	44.75° ~ 45.10°	
Valve spring		
Free length	47.44mm (1.8677in.)	
Load	19.0 ± 0.6kg/35.0mm (41.88 ± 1.32lb/1.3779in.)	
Square	39.8 ± 1.2kg/26.0mm (87.74 ± 2.64lb/1.0236in.)	
1.5° MAX.		
Valve clearance		
Cold (20°C[68°F])		
Intake	0.17 ~ 0.23mm (0.0067 ~ 0.0090in.)	0.10 ~ 0.30mm (0.0039 ~ 0.0118in.)
Exhaust	0.27 ~ 0.33mm (0.0106 ~ 0.0129in.)	0.20 ~ 0.40mm (0.0078 ~ 0.0157in.)
Cylinder head		
Flatness of gasket surface	Max. 0.05mm (0.0019in.)	
Flatness of manifold mounting surface	Max. 0.10mm (0.0039in.)	
Cylinder block		
Cylinder bore	88.00 ~ 88.03mm (3.4645 ~ 3.4657in.)	
Out-of-round and taper of cylinder bore	Less than 0.05mm (0.0019in.)	
Clearance with piston (To set limits to new parts)	0.015 ~ 0.035mm (0.0005 ~ 0.0013in.)	
Piston		

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O.D (To set limits to new parts)			87.975 ~ 88.005mm (3.4635 ~ 3.4647in.)	
Ring groove width				
No. 1			1.235 ~ 1.250mm (0.0486 ~ 0.0492in.)	1.26mm (0.0496in.)
No. 2			1.230 ~ 1.250mm (0.0484 ~ 0.0492in.)	1.26mm (0.0496in.)
Oil ring			2.01 ~ 2.03mm (0.0791 ~ 0.0799in.)	2.05mm (0.0807in.)
Piston ring				
Side clearance				
No. 1			0.05 ~ 0.08mm (0.0019 ~ 0.0031in.)	0.1mm (0.004in.)
No. 2			0.04 ~ 0.08mm (0.0015 ~ 0.0031in.)	0.1mm (0.004in.)
Oil ring			0.06 ~ 0.13mm (0.0023 ~ 0.0051 in.)	0.2mm (0.008in.)
End gap				
No. 1			0.15 ~ 0.30mm (0.0059 ~ 0.0118in.)	0.6mm (0.0236in.)
No. 2			0.30 ~ 0.52mm (0.0118 ~ 0.0204in.)	0.7mm (0.0275in.)
Oil ring side rail			0.20 ~ 0.70mm (0.0078 ~ 0.0275in.)	0.8mm (0.0315in.)
Connecting rod				
Bend			0.05mm (0.0020in.) or less	
Twist			0.1mm (0.004in.) or less	
Connecting rod big end to crankshaft side clearance			0.100 ~ 0.250mm (0.0039 ~ 0.010in.)	0.35mm (0.0138in.)
Connecting rod bearing				
Oil clearance (To seat limits to new parts)			0.025 ~ 0.043mm (0.0009 ~ 0.0016in.)	0.05mm (0.0078in.)
Camshaft				
Cam height	Intake		44.20mm (1.7401 in.)	
	Exhaust		45.00mm (1.7716in.)	
Journal O.D	Intake	No. 1	0 30mm(1.1811 in.)	
		No. 2, 3, 4, 5	0 24mm (0.9449in.)	
	Exhaust	No. 1	0 36mm (1.4173in.)	
		No. 2, 3, 4, 5	0 24mm (0.9449in.)	
Bearing oil clearance	Intake	No. 1	0.022 ~ 0.057mm (0.0008 ~ 0.0022in.)	0.09mm (0.0035in.)

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		No. 2, 3, 4, 5	0.045 ~ 0.082mm (0.0017 ~ 0.0032in.)	0.12mm (0.0047in.)
	Exhaust	No. 1	0 ~ 0.032mm (0 ~ 0.0012in.)	
		No. 2, 3, 4, 5	0.045 ~ 0.082mm (0.0017 ~ 0.0032in.)	0.12mm (0.0047in.)
End play			0.04 ~ 0.16mm (0.0015 ~ 0.0062in.)	0.20mm (0.0047in.)
Crankshaft				
Pin O.D.			47.954 ~ 47.972mm (1.8879 ~ 1.8886in.)	
Journal O.D.			51.942 ~ 51.960mm (2.0449 ~ 2.0456in.)	
End play			0.07 ~ 0.25mm (0.0027 ~ 0.0098in.)	
Crankshaft bearing				
Oil clearance			0.020 ~ 0.038mm (0.0007 ~ 0.0014in.)	
Cooling method			Water-cooled, pressurized. Forced circulation with water pump	
Engine oil				
Oil quantity	Total	5.4 L (5.70 US qt, 4.75 lmp qt)	When replacing a short engine or a block assembly	
	Oil pan	4.2 L (4.43 US qt, 3.69 lmp qt)		
	Drain and refill	4.5 L (4.75 US qt, 3.95 lmp qt)	Including oil filter	
Oil grade	Recommendation	5W-20/GF4 & SM	If not available, refer to the recommended API or ILSAC classification and SAE viscosity number.	
	Classification	API SL, SM or above ILSAC GF3, GF4 or above	Satisfy the requirement of the API or ILSAC classification.	
	SAE viscosity grade	Recommended SAE viscosity number	Refer to the "Lubrication System"	
	147kPa (1.5kg/cm, 21.34psi) or above			Oil temperature in

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Oil pressure (at 1000rpm)		oil pan : 110±2°C (230± 36°F)
Radiator		
Type	Pressurized corrugated fin type	
Radiator cap		
Main valve opening pressure	83 ~ 110kpa (12 ~ 16psi, 0.83 ~ 1.1kg/cm ²)	
Vacuum valve opening pressure	-7kpa (-100psi, - 0.07kg/cm ²) or less	
Thermostat		
Type	Wax pellet type with jiggle valve	
Valve opening temperature	82°C (177°F)	
Full-opening temperature	95°C (201°F)	
Coolant pump	Centrifugal type impeller	
Drive belt		
Type	V-ribbed belt	
Engine coolant temperature sensor		
Type	Heat-sensitive thermistor type	
Resistance	2.31 ~ 2.59Kohms at 20°C (68°F)	
Air cleaner		
Type	Dry type	
Element	Paper type	
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension system	Rubber hangers	

SERVICE STANDARDS**SERVICE STANDARDS CHART**

Standard value	
Antifreeze	Mixture ratio of anti-freeze in coolant
ETHYLENE GLYCOL BASE FOR ALUMINUM	50%

TIGHTENING TORQUE**TIGHTENING TORQUE**

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Item	N.m	kgf.m	lb-ft
Ladder frame bolt (M8 x 55)	23.5 ~ 27.4	2.4 ~ 2.8	17.4 ~ 20.2
Ladder frame bolt (M8 x 103)	23.5 ~ 27.4	2.4 ~ 2.8 ~	17.4 ~ 20.2
Oil pump & Balance shaft module bolt (BSM)	16.7+ 60° + 60°	1.7 + 60°+ 60°	12.3 + 60° + 60°
Timing chain cover bolt (M8)	18.6 ~ 22.5	1.9 ~ 2.3	13.7 ~ 16.6
Timing chain cover bolt (M6)	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Oil pan bolt (M6x 10)	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan bolt (M8x 103)	26.5 ~ 30.4	2.7 ~ 3.1	19.5 ~ 22.4
Engine support bracket bolt (M8 x 30)	19.6 ~ 24.5	2.0 ~ 2.5	14.5 ~ 18.1
Engine support bracket bolt (M10 x 40)	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~ 32.5
Engine support bracket bolt (M12 x 45)	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~ 32.5
Camshaft bearing cap bolt (M6)	10.8 ~ 12.7	1.1 ~ 1.3	7.9 ~ 9.4
Camshaft bearing cap bolt (M8)	27.4 ~ 31.4	2.8 ~ 3.2	20.3 ~ 23.1
Cylinder head bolt	(32.4~36.3) + (90~95°) + (90~95°)	(3.3~3.7) + (90~95°) + (90~95°)	(23.9~26.8) + (90~95°) + (90~95°)
Engine hanger bolt	27.5 ~ 31.4	2.8 ~ 3.2	20.3 ~ 23.1
Cylinder head cover bolt	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Crankshaft pulley bolt	166.6 ~ 176.4	17.0 ~ 18.0	122.9 ~ 130.1
Connecting rod bearing cap bolt	(17.7~21.6) + (88~92°)	(1.8~2.2) + (88~92°)	(13.0~15.9) + (88~92°)
Main bearing cap bolt	14.7 + (27.5~31.4) + (120~125°)	1.5 + (2.8~3.2) + (120~125°)	10.8 + (20.3~23.1) + (120~125°)
Flywheel bolt	117.6 ~ 127.4	12.0 ~ 13.0	86.8 ~ 93.9
Drive plate bolt	117.6 ~ 127.4	12.0 ~ 13.0	86.8 ~ 93.9
Timing chain tensioner bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain tensioner arm bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain guide bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
OCV bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
CVVT bolt	53.9 ~ 63.7	5.5 ~ 6.5	39.7 ~ 47.0
BSM chain tensioner arm bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7

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BSM chain guide bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
BSM chain tensioner bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water pump bolt	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
A/C compressor bracket bolt	19.6 ~ 23.5	2.0 ~ 2.4	14.5 ~ 17.4
P/S pump bracket bolt	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Tensioner ASSY integrated bracket bolt	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~ 32.5
Water temp, control bolt & nut	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Water inlet pipe nut	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Oil level gauge assembly bolt	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Ignition coil bolt	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Intake manifold bolt	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Intake manifold nut	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Intake manifold stay bolt	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Exhaust manifold heat protector bolt	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Exhaust manifold nut	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~ 32.5
Exhaust manifold stay bolt	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Muffler bolt	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
Engine cover mounting bracket bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Crankshaft position sensor bolt	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Oxygen sensor	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.1
Knock sensor	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Camshaft position sensor	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Oil pressure switch	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Oil filter	11.8 ~ 15.7	1.2 ~ 1.6	8.7 ~ 11.6

SPECIFICATIONS

DESCRIPTION CHART

Description	Specifications	Limit
General		
Type	In-line, Double Overhead Camshaft	
Number of cylinder	4	
Bore	88mm (3.46in)	
Stroke	97mm (3.819in)	

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Total displacement		2359cc (143.90 cu. in.)
Compression ratio		10.5
Firing order		1-3-4-2
Valve timing		
Intake valve		
Opens (ATDC / BTDC)		ATDC 7° ~ BTDC 38°
Closes (ABDC)		ABDC 67° ~ 22°
Exhaust		
Opens (BBDC)		BBDC 44° ~ 4°
Closes (ATDC)		ATDC 0° ~ 40°
Valve		
Valve length		
Intake	113.18mm (4.4559in.)	112.93mm (4.4460in.)
Exhaust	105.84mm (4.1669in.)	105.59mm (4.1570in.)
Stem O.D.		
Intake	5.465 ~ 5.480mm (0.2151 ~ 0.2157in.)	
Exhaust	5.458 ~ 5.470mm (0.2149 ~ 0.2153in.)	
Face angle		45.25° ~ 45.75°
Margin		
Intake	1.02mm (0.0401in.)	
Exhaust	1.09mm (0.0429in.)	
Valve stem to valve guide clearance		
Intake	0.020 ~ 0.047mm (0.00078 ~ 0.00185in.)	0.07mm (0.00275in.)
Exhaust	0.030 ~ 0.054mm (0.00118 ~ 0.00212in.)	0.09mm (0.00354in.)
Valve guide		
Length		
Intake	43.8 ~ 44.2mm (1.7244 ~ 1.7401in.)	
Exhaust	43.8 ~ 44.2mm (1.7244 ~ 1.7401in.)	
Valve seat		
Width of seat contact		
Intake	1.16 ~ 1.46mm (0.0457 ~ 0.0575in.)	
Exhaust	1.35 ~ 1.65mm (0.0531 ~	

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		0.0649in.)
Seat angle		44.75° ~ 45.10°
Valve spring		
Free length		47.44mm (1.8677in.)
Load		19.0 ± 0.6kg/35.0mm (41.88 ± 1.32lb/1.3779in.)
Square		39.8 ± 1.2kg/26.0mm (87.74 ± 2.64lb/1.0236in.)
1.5° MAX.		
Valve clearance		
Cold (20°C[68°F])		
Intake	0.17 ~ 0.23mm (0.0067 ~ 0.0090in.)	0.10 ~ 0.30mm (0.0039 ~ 0.0118in.)
Exhaust	0.27 ~ 0.33mm (0.0106 ~ 0.0129in.)	0.20 ~ 0.40mm (0.0078 ~ 0.0157in.)
Cylinder head		
Flatness of gasket surface		Max. 0.05mm (0.0019in.)
Flatness of manifold mounting surface		Max. 0.10mm (0.0039in.)
Cylinder block		
Cylinder bore		88.00 ~ 88.03mm (3.4645 ~ 3.4657in.)
Out-of-round and taper of cylinder bore		Less than 0.05mm (0.0019in.)
Clearance with piston (To set limits to new parts)		0.015 ~ 0.035mm (0.0005 ~ 0.0013in.)
Piston		
O.D (To set limits to new parts)		87.975 ~ 88.005mm (3.4635 ~ 3.4647in.)
Ring groove width		
No. 1	1.235 ~ 1.250mm (0.0486 ~ 0.0492in.)	1.26mm (0.0496in.)
No. 2	1.230 ~ 1.250mm (0.0484 ~ 0.0492in.)	1.26mm (0.0496in.)
Oil ring	2.01 ~ 2.03mm (0.0791 ~ 0.0799in.)	2.05mm (0.0807in.)
Piston ring		
Side clearance		
No. 1	0.05 ~ 0.08mm (0.0019 ~ 0.0031in.)	0.1mm (0.004in.)
No. 2	0.04 ~ 0.08mm (0.0015 ~ 0.0031in.)	0.1mm (0.004in.)

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Oil ring				0.06 ~ 0.13mm (0.0023 ~ 0.0051in.)	0.2mm (0.008in.)
End gap					
No. 1				0.15 ~ 0.30mm (0.0059 ~ 0.0118in.)	0.6mm (0.0236in.)
No. 2				0.30 ~ 0.52mm (0.0118 ~ 0.0204in.)	0.7mm (0.0275in.)
Oil ring side rail				0.20 ~ 0.70mm (0.0078 ~ 0.0275in.)	0.8mm (0.0315in.)
Connecting rod					
Bend					0.05mm (0.0020in.) or less
Twist					0.1mm (0.004in.) or less
Connecting rod big end to crankshaft side clearance				0.100 ~ 0.250mm (0.0039 ~ 0.010in.)	0.35mm (0.0138in.)
Connecting rod bearing					
Oil clearance (To seat limits to new parts)				0.025 ~ 0.043mm (0.0009 ~ 0.0016in.)	0.05mm (0.0078in.)
Camshaft					
Cam height			Intake		44.20mm (1.7401in.)
			Exhaust		45.00mm (1.7716in.)
Journal O.D	Intake	No. 1	c 30mm (1.1811in.)		
		No. 2, 3, 4, 5	c 24mm (0.9449in.)		
	Exhaust	No. 1	c 36mm (1.4173in.)		
		No. 2, 3, 4, 5	c 24mm (0.9449in.)		
Bearing oil clearance	Intake	No. 1	0.022 ~ 0.057mm (0.0008 ~ 0.0022in.)	0.09mm (0.0035in.)	
		No. 2, 3, 4, 5	0.030 ~ 0.067mm (0.0012 ~ 0.0026in.)	0.10mm (0.0039in.)	
	Exhaust	No. 1	0 ~ 0.032mm (0 ~ 0.0012in.)	0.10mm (0.0039in.)	
		No. 2, 3, 4, 5	0.030 ~ 0.067mm (0.0012 ~ 0.0026in.)		
End play				0.04 ~ 0.16mm (0.0015 ~ 0.0062in.)	0.20mm (0.0047in.)
Crankshaft					
Pin O.D.				47.954 ~ 47.972mm (1.8879 ~ 1.8886in.)	
Journal O.D.				51.942 ~ 51.960mm (2.0449 ~ 2.0456in.)	
End play				0.07 ~ 0.25mm (0.0027 ~ 0.0098in.)	
Crankshaft bearing					

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Oil clearance	0.020 ~ 0.038mm (0.0007 ~ 0.0014in.)	
Cooling method	Water-cooled, pressurized. Forced circulation with water pump	
Radiator		
Type	Pressurized corrugated fin type	
Radiator cap		
Main valve opening pressure	83 ~ 110kpa (12 ~ 16psi, 0.83 ~ 1.1kg/cm)	
Vacuum valve opening pressure	-7kpa (-100psi, - 0.07kg/cm) or less	
Thermostat		
Type	Wax pellet type with jiggle valve	
Valve opening temperature	82°C (177°F)	
Full-opening temperature	95°C (201°F)	
Coolant pump	Centrifugal type impeller	
Drive belt		
Type	V-ribbed belt	
Engine coolant temperature sensor		
Type	Heat-sensitive thermistor type	
Resistance	2.31 ~ 2.59K Ω at 20° C (68°F)	
Air cleaner		
Type	Dry type	
Element	Paper type	
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension system	Rubber hangers	

SERVICE STANDARDS**SERVICE STANDARDS CHART**

Standard value	
Antifreeze	Mixture ratio of anti-freeze in coolant
ETHYLENE GLYCOL BASE FOR ALUMINUM	50%

TIGHTENING TORQUE

TIGHTENING TORQUE

Item	N.m	kgf.m	lb-ft
Ladder frame bolt (M8 x 55)	23.5 ~ 27.4	2.4 ~ 2.8	17.4 ~ 20.2
Ladder frame bolt (M8 x 103)	23.5 ~ 27.4	2.4 ~ 2.8	17.4 ~ 20.2
Oil pump & Balance shaft module bolt (BSM)	16.7+ 60° + 60°	1.7 + 60° + 60°	12.3 + 60° + 60°
Timing chain cover bolt (M8)	18.6 ~ 22.5	1.9 ~ 2.3	13.7 ~ 16.6
Timing chain cover bolt (M6)	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Oil pan bolt (M6 x 10)	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan bolt (M8 x 103)	26.5 ~ 30.4	2.7 ~ 3.1	19.5 ~ 22.4
Engine support bracket bolt (M8 x 30)	19.6 ~ 24.5	2.0 ~ 2.5	14.5 ~ 18.1
Engine support bracket bolt (M10 x 40)	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~ 32.5
Engine support bracket bolt (M12 x 45)	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~ 32.5
Camshaft bearing cap bolt (M6)	10.8 ~ 12.7	1.1 ~ 1.3	7.9 ~ 9.4
Camshaft bearing cap bolt (M8)	27.4 ~ 31.4	2.8 ~ 3.2	20.3 ~ 23.1
Cylinder head bolt	(32.4~36.3) + (90~95°) + (90~95°)	(3.3~3.7) + (90~95°) + (90~95°)	(23.9~26.8) + (90~95°) + (90~95°)
Engine hanger bolt	27.5 ~ 31.4	2.8 ~ 3.2	20.3 ~ 23.1
Cylinder head cover bolt	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Crankshaft pulley bolt	166.6 ~ 176.4	17.0 ~ 18.0	122.9 ~ 130.1
Connecting rod bearing cap bolt	(17.7~21.6) + (88~92°)	(1.8~2.2) + (88~92°)	(13.0~15.9) + (88~92°)
Main bearing cap bolt	14.7 + (27.5~31.4) + (120~125°)	1.5 + (2.8~3.2) + (120~125°)	10.8 + (20.3~23.1) + (120~125°)
Flywheel bolt	117.6 ~ 127.4	12.0 ~ 13.0	86.8 ~ 93.9
Drive plate bolt	117.6 ~ 127.4	12.0 ~ 13.0	86.8 ~ 93.9
Timing chain tensioner bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain tensioner arm bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain guide bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
OCV bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7

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CVVT bolt	53.9 ~ 63.7	5.5 ~ 6.5	39.7 ~ 47.0
BSM chain tensioner arm bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
BSM chain guide bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
BSM chain tensioner bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water pump bolt	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
A/C compressor bracket bolt	19.6 ~ 23.5	2.0 ~ 2.4	14.5 ~ 17.4
P/S pump bracket bolt	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Tensioner ASSY integrated bracket bolt	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~ 32.5
Water temp. control bolt & nut	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Water inlet pipe nut	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Oil level gauge assembly bolt	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Ignition coil bolt	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Intake manifold bolt	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Intake manifold nut	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Intake manifold stay bolt	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Exhaust manifold heat protector bolt	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Exhaust manifold nut	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~ 32.5
Exhaust manifold stay bolt	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Muffler bolt	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
Engine cover mounting bracket bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Crankshaft position sensor bolt	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Oxygen sensor	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.1
Knock sensor	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Camshaft position sensor	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Oil pressure switch	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Oil filter	11.8 ~ 15.7	1.2 ~ 1.6	8.7 ~ 11.6

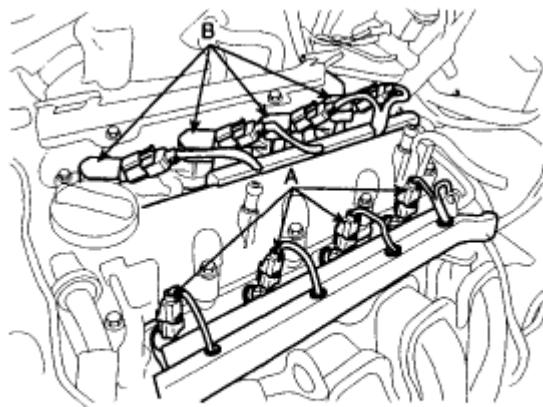
COMPRESSION PRESSURE INSPECTION

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

1. Warm up and stop engine.

Allow the engine to warm up to normal operating temperature.

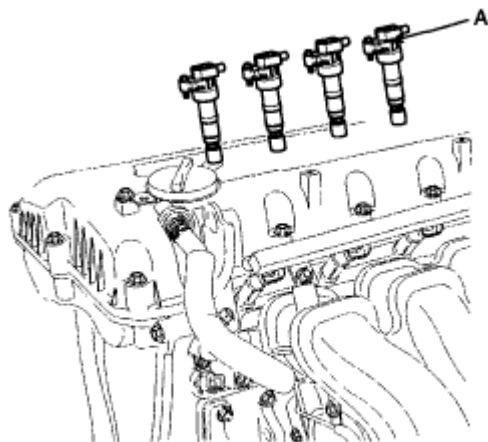
2. Disconnect the injector connectors (A) and ignition coil connectors (B).



SNFEM8005D

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

3. Remove ignition coils (A).



SNFEM8084L

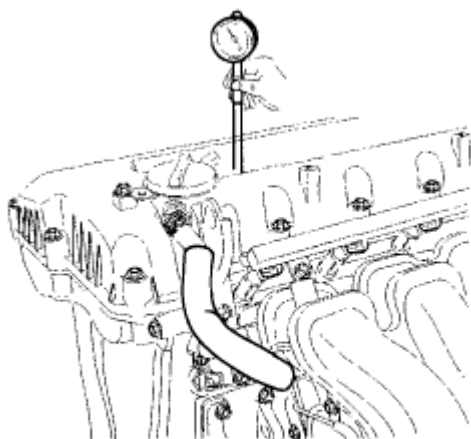
Fig. 2: Identifying Ignition Coils
Courtesy of HYUNDAI MOTOR CO.

4. Remove spark plugs.

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

5. Check cylinder compression pressure.

- a. Insert a compression gauge into the spark plug hole.



SNFEM8078D

Fig. 3: Checking Cylinder Compression Pressure
Courtesy of HYUNDAI MOTOR CO.

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

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

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

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

Compression pressure:

1,283kPa (13.0kgf/cm² , 185psi)

Minimum pressure:

1,135kPa (11.5kgf/cm² , 164psi)

Difference between each cylinder :

100kPa (1.0kgf/cm² , 15psi) or less

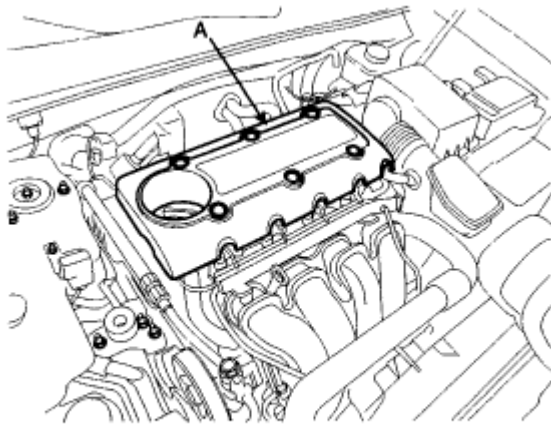
- e. If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for cylinders with low compression.

- If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
 - If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.
6. Reinstall spark plugs.
 7. Install ignition coils.
 8. Connect the injector connectors and ignition coil connectors.

VALVE CLEARANCE INSPECTION AND ADJUSTMENT

NOTE: **Inspect and adjust the valve clearance when the engine is cold (Engine coolant temperature : 20°C (68°F)) and cylinder head is installed on the cylinder block.**

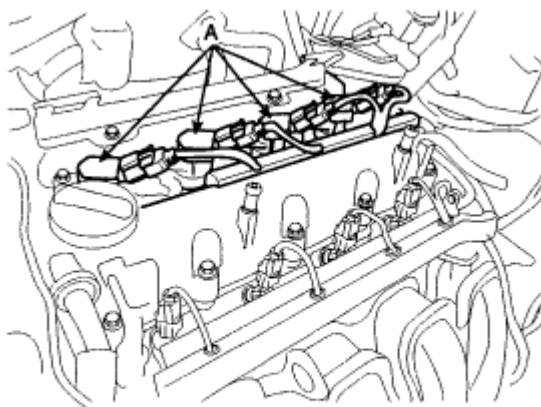
1. Remove the engine cover (A).



SNFEM8001D

Fig. 4: Identifying Engine Cover
Courtesy of HYUNDAI MOTOR CO.

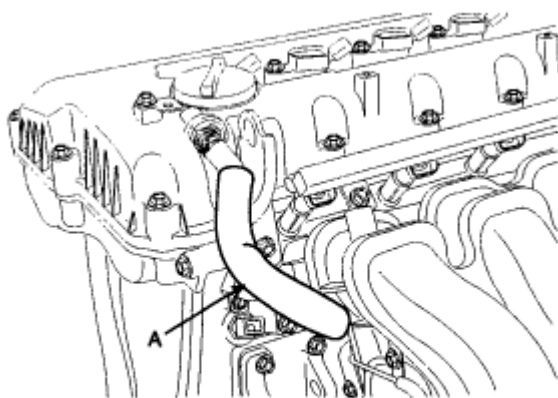
2. Remove the cylinder head cover.
 - a. Disconnect the ignition coil connectors (A) and remove the ignition coils.



SNFEM8067D

Fig. 5: Identifying Ignition Coil Connectors
Courtesy of HYUNDAI MOTOR CO.

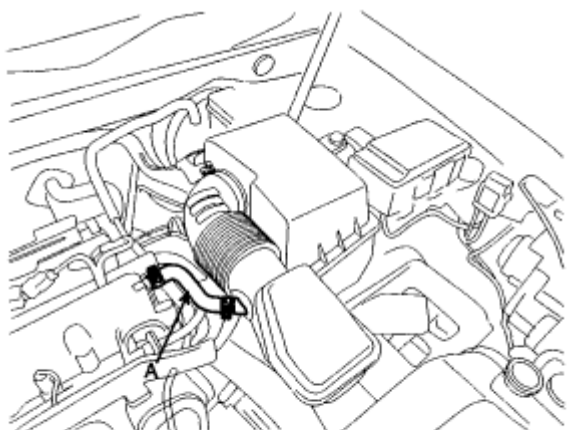
- b. Disconnect the P.C.V hose (A).



SMGEM8008D

Fig. 6: Identifying P.C.V Hose
Courtesy of HYUNDAI MOTOR CO.

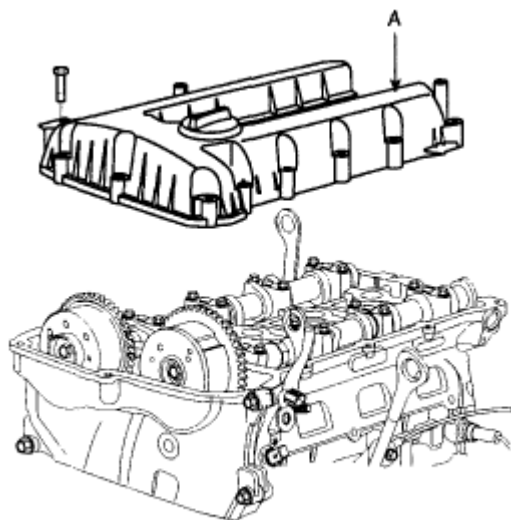
- c. Disconnect the breather hose (A).



SNFEM8066D

Fig. 7: Identifying Breather Hose
Courtesy of HYUNDAI MOTOR CO.

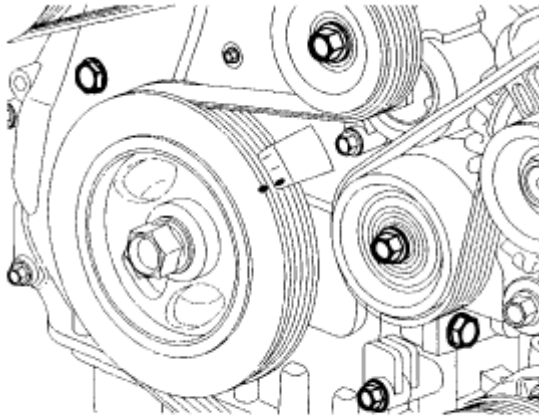
- d. Loosen the cylinder head cover bolts and then remove the cover (A) and gasket.



SNFEM8019D

Fig. 8: Identifying Cylinder Head Cover
Courtesy of HYUNDAI MOTOR CO.

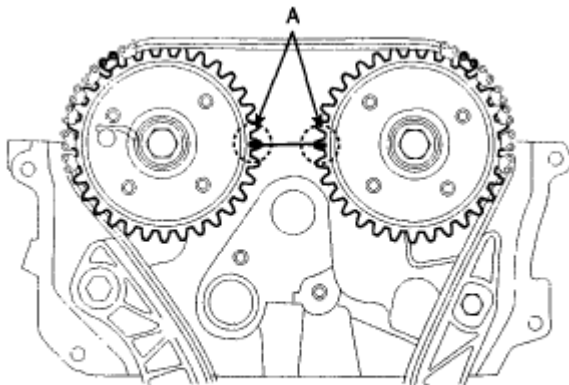
3. Set No. 1 cylinder to TDC/compression.
 - a. Turn the crankshaft pulley and align its groove with the timing mark "T" of the lower timing chain cover.



SNFEM8077D

Fig. 9: Identifying Timing Marks
Courtesy of HYUNDAI MOTOR CO.

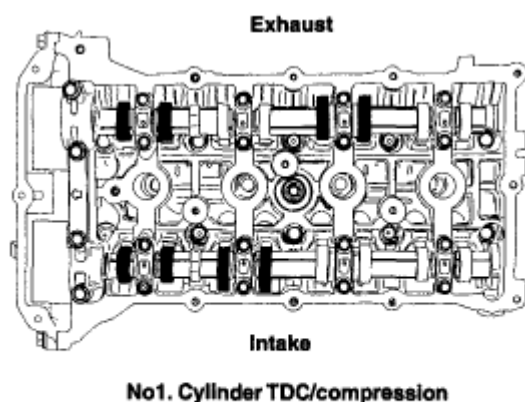
- b. Check that the mark (A) of the camshaft timing sprockets are in straight line on the cylinder head surface as shown in the illustration. If not, turn the crankshaft one revolution (360°)



SNFEM8017D

Fig. 10: Identifying Mark Of Camshaft Timing Sprockets
Courtesy of HYUNDAI MOTOR CO.

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



SNFEM8079L

Fig. 11: Identifying No. 1 Cylinder TDC/Compression Position
 Courtesy of HYUNDAI MOTOR CO.

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

Valve clearance

Specification

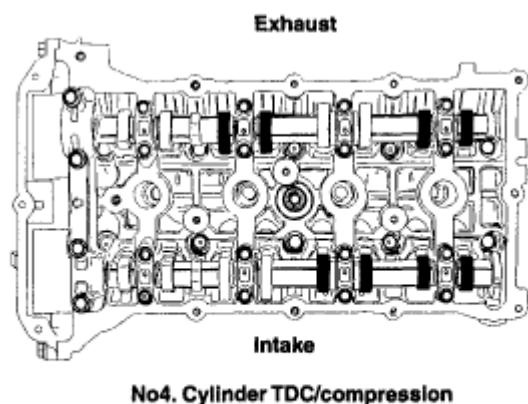
Engine coolant temperature : 20°C [68°F]

Limit

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

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

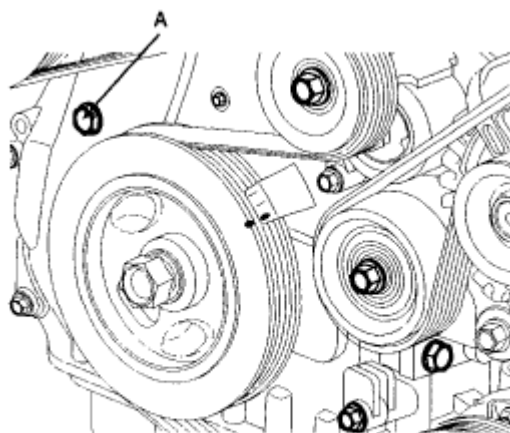
- Turn the crankshaft pulley one revolution (360°) and align the groove with timing mark "T" of the lower timing chain cover.
- Check only valves indicated as shown. [NO. 4 cylinder : TDC/compression]. Measure the valve clearance.



SNFEM8080L

Fig. 12: Identifying No. 4 Cylinder TDC/Compression Position
Courtesy of HYUNDAI MOTOR CO.

5. Adjust the intake and exhaust valve clearance.
 - a. Set the No. 1 cylinder to the TDC/compression.
 - b. Marks on the timing chain and camshaft timing sprockets.
 - c. Remove the service hole bolt (A) of the timing chain cover.

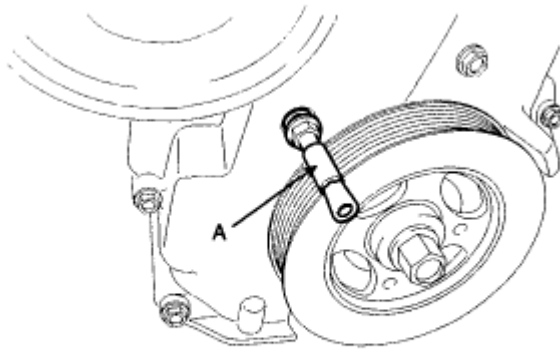


SNFEM8078D

Fig. 13: Identifying Service Hole Bolt
Courtesy of HYUNDAI MOTOR CO.

CAUTION: The bolt must not be reused once it has been assembled.

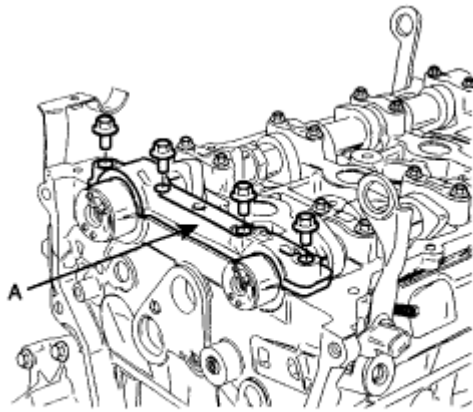
- d. Insert the SST (A) (09240-2G000) in the service hole of the timing chain cover and release the ratchet.



SMGEM8006D

Fig. 14: Inserting SST In Service Hole
Courtesy of HYUNDAI MOTOR CO.

- e. Remove the front camshaft bearing cap (A).



SNFEM8054D

Fig. 15: Identifying Front Camshaft Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

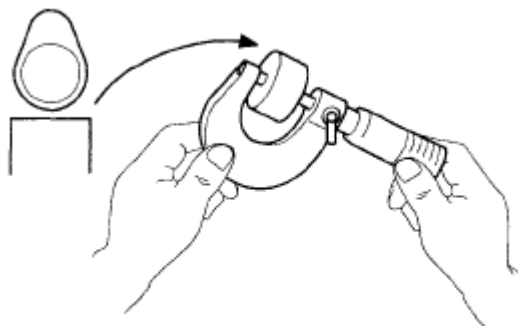
- f. Remove the exhaust camshaft bearing cap and exhaust camshaft.
- g. Remove the intake camshaft bearing cap and intake camshaft.

CAUTION: When disconnect the timing chain from the camshaft timing sprocket, hold the timing chain.

- h. Tie down timing chain so that it doesn't move.

CAUTION: Be careful not to drop anything inside timing chain cover.

- i. Measure the thickness of the removed tappet using a micrometer.



EDKE889D

Fig. 16: Measuring Thickness Of Tappet
Courtesy of HYUNDAI MOTOR CO.

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

Valve clearance (Engine coolant temperature : 20°C)

T : Thickness of removed tappet

A : Measured valve clearance

N : Thickness of new tappet

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

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

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

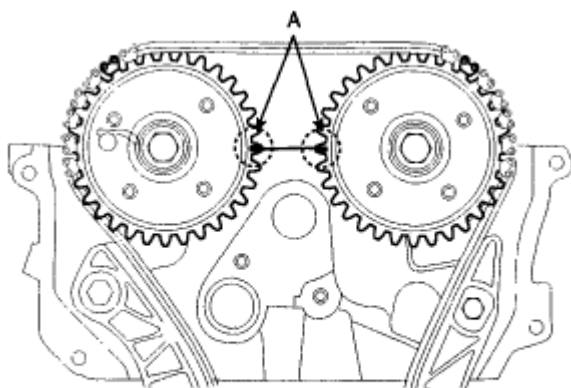
NOTE: Shims are available in 47size increments of 0.01 5mm (0.0006in.) from 3.00mm (0.118in.) to 3.690 mm (0.1452in.)

- l. Place a new tappet on the cylinder head.
- m. Hold the timing chain, and install the intake camshaft and timing sprocket assembly.
- n. Align the matchmarks on the timing chain and camshaft timing sprocket.
- o. Install the intake and exhaust camshaft.
- p. Install the front bearing cap.
- q. Install the service hole bolt.

Tightening torque:

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

- r. Turn the crankshaft two turns in the operating direction (clockwise) and realign crankshaft sprocket and camshaft sprocket timing marks (A).



SNFEM8017D

Fig. 17: Identifying Mark Of Camshaft Timing Sprockets
Courtesy of HYUNDAI MOTOR CO.

- s. Recheck the valve clearance.

Valve clearance (Engine coolant temperature : 20°C)

[Specification]

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

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

TROUBLESHOOTING**SYMPTOM CHART**

Symptom	Suspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Worn crankshaft bearings Loose or improperly engine flywheel	Replace the crankshaft and bearings as required. 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

2010 Hyundai Sonata GLS

2010 ENGINE General Information (Engine (G4KE - GSL 2.4)) - Sonata

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

2010 Hyundai Sonata GLS

2010 ENGINE General Information (Engine (G4KE - GSL 2.4)) - Sonata

	to stay open.	required.
	Worn drive belt, idler, tensioner and bearing.	Replace as required
Lower engine noise, regardless of engine speed	Low oil pressure	Repair or required.
	Loose or damaged flywheel.	Repair or replace the flywheel.
	Damaged oil pan, contacting the oil pump screen.	• Inspect the oil pan. • Inspect the oil pump screen. • Repair or replace as required.
	Oil pump screen loose, damaged or restricted.	• Inspect the oil pump screen. • Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	• Inspect the piston, piston pin and cylinder bore. • Repair or replace as required.
	Excessive piston pin-to-piston clearance	• Inspect the piston, piston pin and the connecting rod. • Repair or replace as required.
	Excessive connecting rod bearing clearance	Inspect the following components and repair or replace as required. • The connecting rod bearings. • The connecting rods. • The crankshaft pin journals.
	Excessive crankshaft bearing clearance	Inspect the following components, and repair or replace as required. • The crankshaft bearings. • The crankshaft main journals. • The cylinder block
	Incorrect piston, piston pin and connecting rod installation	• Verify the piston pins and connecting rods are

2010 Hyundai Sonata GLS

2010 ENGINE General Information (Engine (G4KE - GSL 2.4)) - Sonata

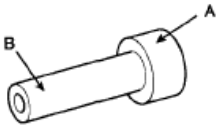
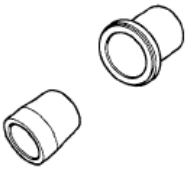
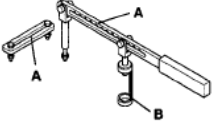
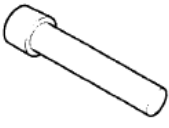
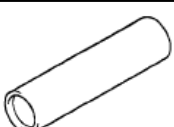
		installed correctly. • Repair as required.
Engine noise under load	Low oil pressure	Repair or replace as required.
	Excessive connecting rod bearing clearance	Inspect the following components and repair or replace as required: • The connecting rod bearings. • The connecting rods. • The crankshaft
	Excessive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

Broken crankshaft

1. Inspect crankshaft.
2. Repair as required.

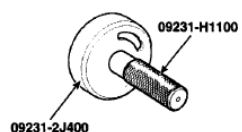
SPECIAL SERVICE TOOLS

SPECIAL SERVICE TOOLS CHART

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-3K000) (09231-H1100)	 ACRF002A	Installation of the front oil seal A:09214-3K000 B : 09231-H1100
Flywheel stopper (09231-3K000)	 KDRF233A	Holds flywheel so that engine doesn't turn/move.
Torque angle adapter (09221-4A000)	 ACJF125A	Installation of bolts & nuts needing an angular method of adjustment.
Valve stem oil seal installer (09222-4A000)	 ECRF003A	Installation of the valve stem oil seal
Valve spring compressor & holder (09222-3K000) (09222-3K100)	 SHMM19368N	Removal and installation of the intake or exhaust valve 09222-3K100 (holder)
Crankshaft rear oil seal installer (09214-3K100) (09231-H1100)	 LCAC030D	Installation of the crankshaft rear oil seal A:09214-3K100 B : 09231-H1100
Timing chain tensioner ratchet holder (09240-2G000)		Timing chain tension release. In vehicle inspection and adjustment of valve clearance.

2010 Hyundai Sonata GLS

2010 ENGINE General Information (Engine (G4KE - GSL 2.4)) - Sonata



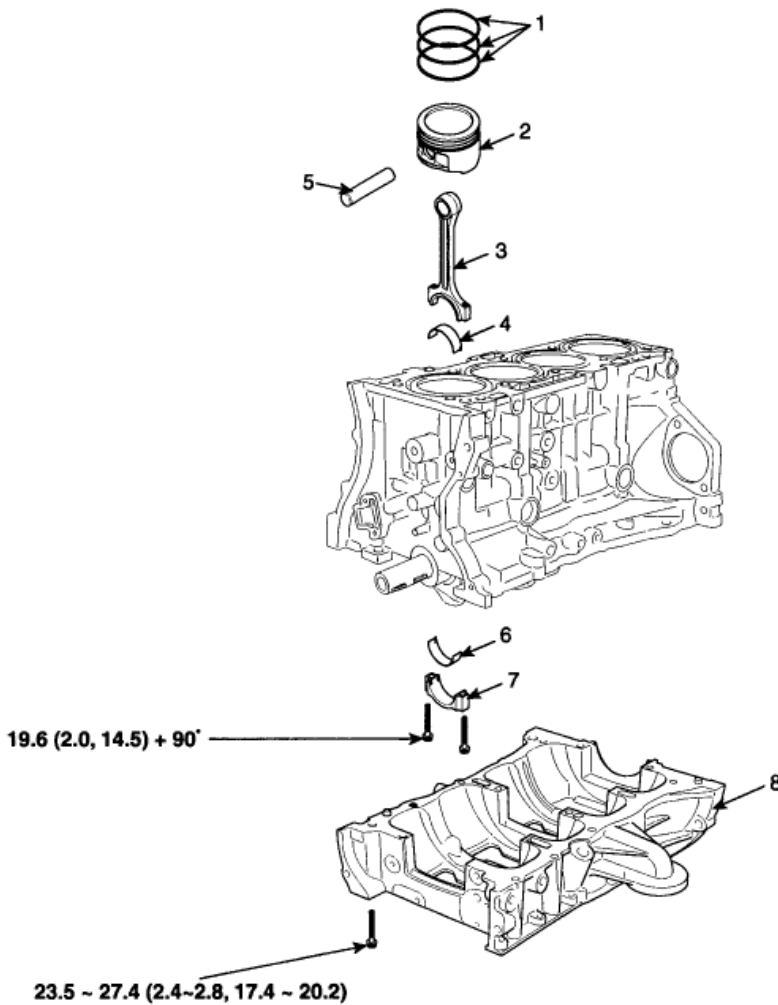
SHMM19369N

2010 ENGINE

Cylinder Block (Engine (G4KE - GSL 2.4)) - Sonata

CYLINDER BLOCK

COMPONENTS

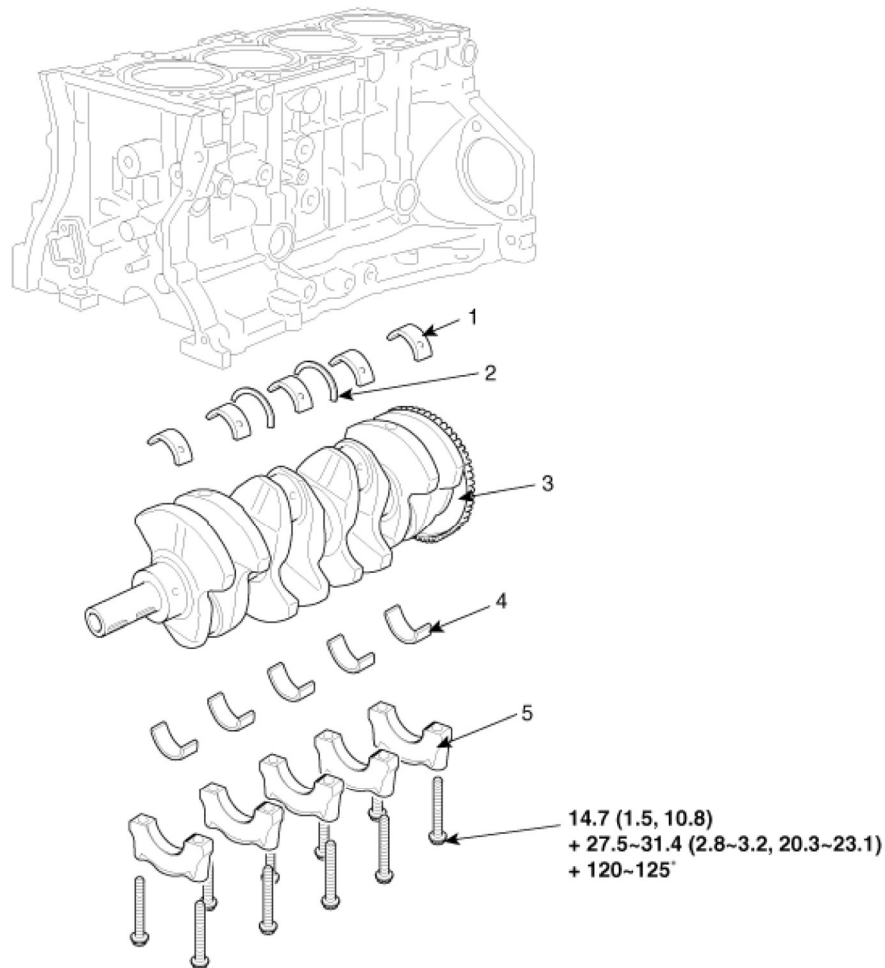


Torque : N.m (kgf.m, lb-ft)

SNFEM8063L

- | | |
|---------------------------------|---------------------------------|
| 1. Piston ring | 5. Piston pin |
| 2. Piston | 6. Connecting rod lower bearing |
| 3. Connecting rod | 7. Connecting rod bearing cap |
| 4. Connecting rod upper bearing | 8. Ladder frame |

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



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

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

DISASSEMBLY

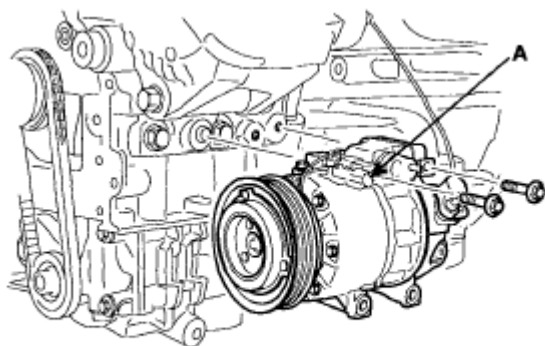
1. M/T : remove flywheel.
2. A/T : remove drive plate.
3. Install engine to engine stand for disassembly.
4. Remove timing chain.

(Refer to **TIMING SYSTEM (ENGINE (G4KE - GSL 2.4))**)

5. Remove cylinder head.

(Refer to **CYLINDER BLOCK**)

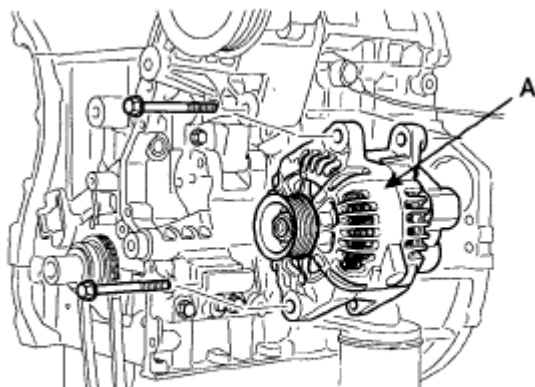
6. Remove A/C compressor (A) from engine.



KCRF158A

Fig. 3: Identifying A/C Compressor
Courtesy of HYUNDAI MOTOR CO.

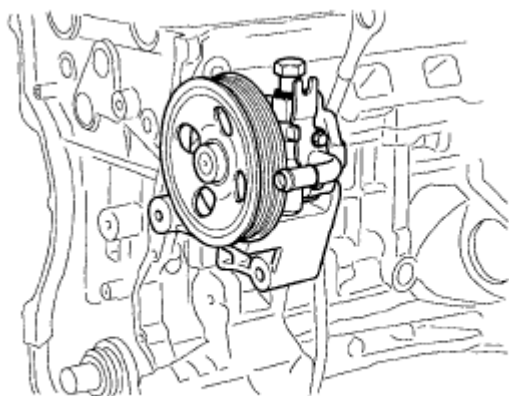
7. Remove alternator (A) from engine.



KCRF158A

Fig. 4: Identifying Alternator
Courtesy of HYUNDAI MOTOR CO.

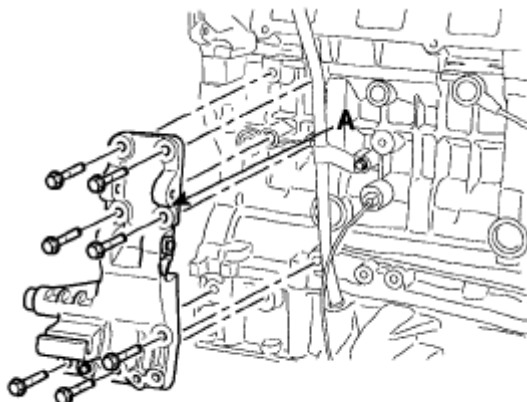
8. Remove power steering pump and bracket.



KCRF150A

Fig. 5: Identifying Power Steering Pump And Bracket
Courtesy of HYUNDAI MOTOR CO.

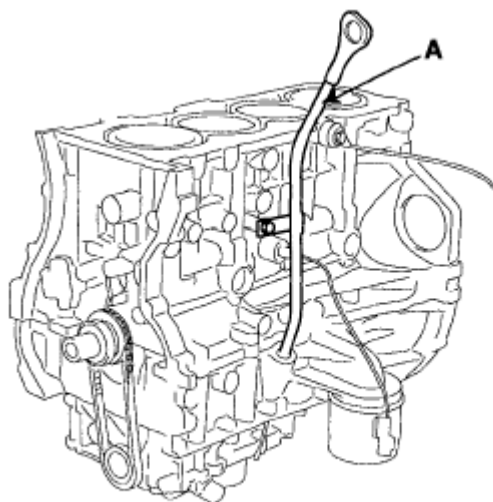
9. Remove tensioner assembly integrated bracket (A).



KCRF161A

Fig. 6: Identifying Tensioner Assembly Integrated Bracket
Courtesy of HYUNDAI MOTOR CO.

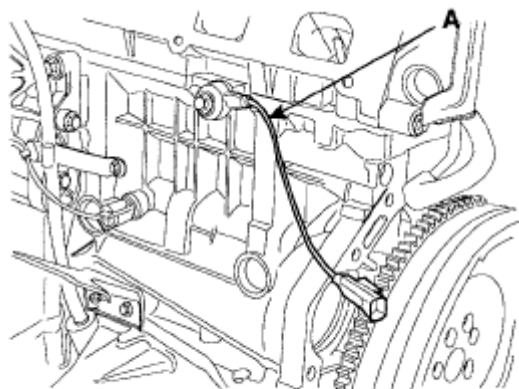
10. Remove oil level gauge assembly (A).



KCRF163B

Fig. 7: Identifying Oil Level Gauge Assembly
Courtesy of HYUNDAI MOTOR CO.

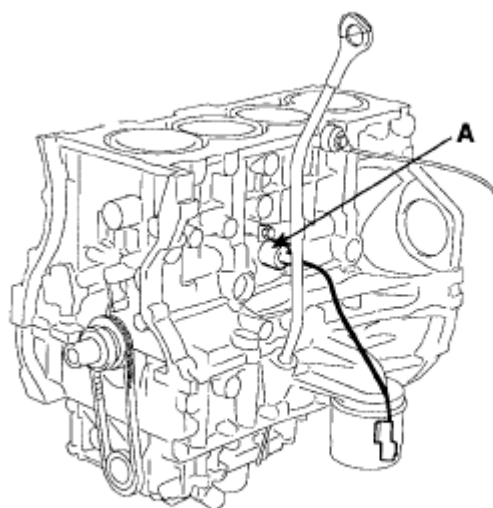
11. Remove knock sensor (A).



KCRF143A

Fig. 8: Identifying Knock Sensor
Courtesy of HYUNDAI MOTOR CO.

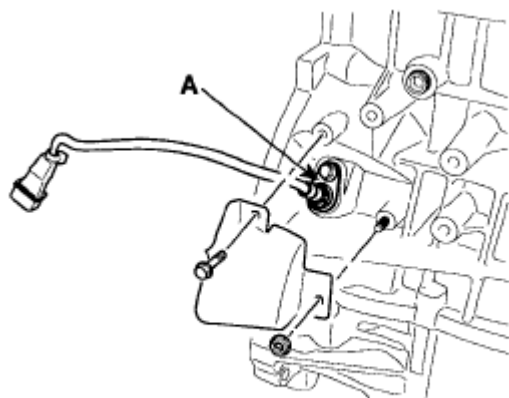
12. Remove oil pressure sensor (A).



KCRF163C

Fig. 9: Identifying Oil Pressure Sensor
Courtesy of HYUNDAI MOTOR CO.

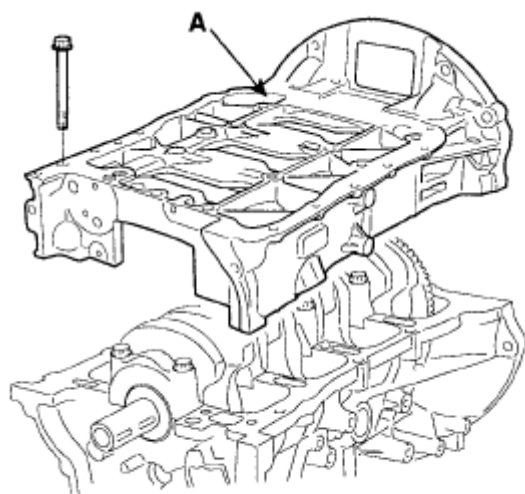
13. Remove CKP sensor (A).



KCRF164A

Fig. 10: Identifying CKP Sensor
Courtesy of HYUNDAI MOTOR CO.

14. Remove water pump.
15. Remove balance shaft module.
16. Remove ladder frame (A).



KCRF167A

Fig. 11: Identifying Ladder Frame
Courtesy of HYUNDAI MOTOR CO.

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

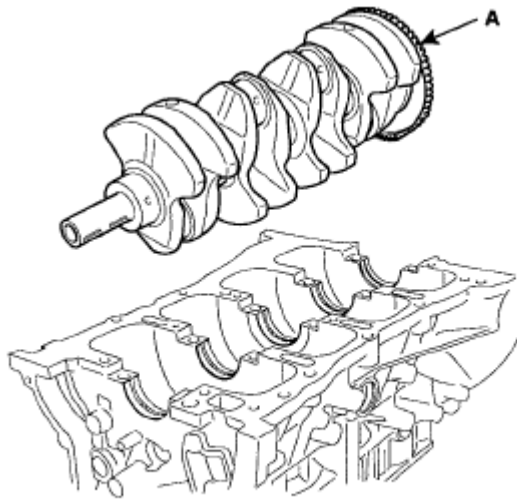
NOTE:

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

20. Remove crankshaft bearing cap and check oil clearance.
21. Check the crankshaft end play.
22. 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.



KCRF172A

Fig. 12: Identifying Crankshaft
Courtesy of HYUNDAI MOTOR CO.

23. 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.

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

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

25. Disconnect connecting rod from piston.

INSPECTION

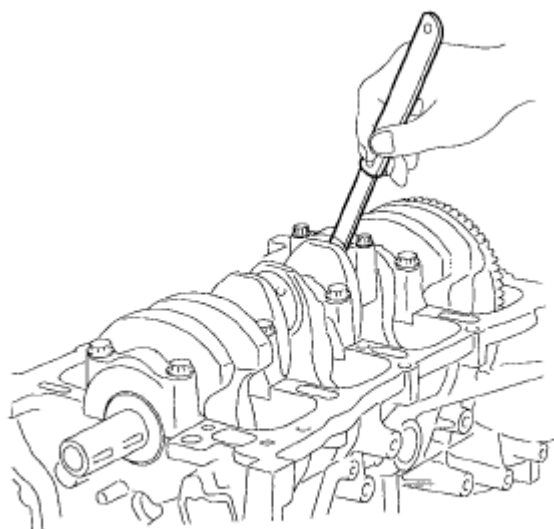
Connecting Rod And Crankshaft

1. Check the connecting rod end play.

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

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

Maximum end play : 0.35mm (0.0138in.)



KCRF109B

Fig. 13: Checking Connecting Rod End Play
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

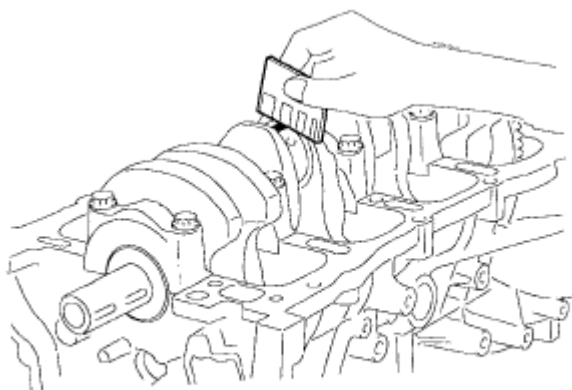
19.6N.m (2.0kgf.m, 14.46lb-ft) + 90°

NOTE: Do not turn the crankshaft.

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

Standard oil clearance

0.025 ~ 0.043mm (0.0009 ~ 0.0016in.)



KCRF169A

Fig. 14: Measuring Plastigage At Widest Point
Courtesy of HYUNDAI MOTOR CO.

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

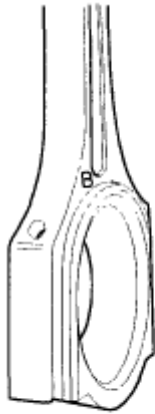
CAUTION: Do not file, shim, or scrape the bearings or the caps to adjust clearance.

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

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

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

Connecting Rod Mark Location



SNFEM8089L

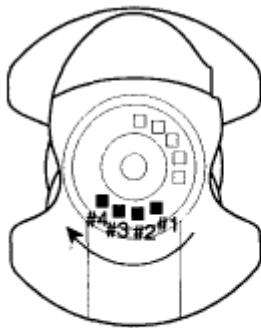
Fig. 15: Identifying Connecting Rod Mark Location
 Courtesy of HYUNDAI MOTOR CO.

Discrimination Of Connecting Rod

DISCRIMINATION OF CONNECTING ROD

Class	Mark	Inside Diameter
a	A	51.000 ~ 51.006mm (2.0079 ~ 2.0081in.)
b	B	51.006 ~ 51.012mm (2.0081 ~ 2.0083in.)
c	C	51.012 ~ 51.018mm (2.0083 ~ 2.0085in.)

Crankshaft Pin Mark Location Discrimination Of Crankshaft



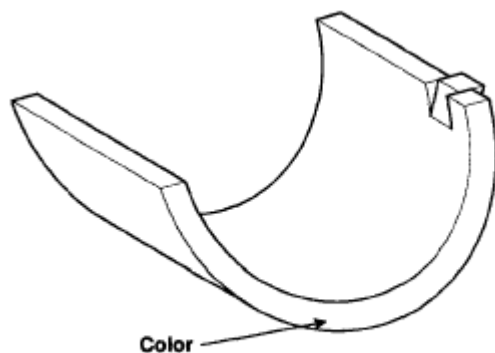
SNFEM8090L

Fig. 16: Identifying Crankshaft Pin Mark Location
 Courtesy of HYUNDAI MOTOR CO.

NOTE: Conform to read stamping order as shown arrow direction from #1.

Discrimination Of Crankshaft**DISCRIMINATION OF CRANKSHAFT**

Class	Mark	Outside Diameter Of Pin
I	1	47.966 ~ 47.972mm (1.8884 ~ 1.8886in.)
II	2	47.960 ~ 47.966mm (1.8881 ~ 1.8884in.)
III	3	47.954 ~ 47.960mm (1.8879 ~ 1.8881in.)

Place Of Identification Mark (Connecting Rod Bearing) Discrimination Of Connecting Rod Bearing

ECRF021A

Fig. 17: Identifying Connecting Rod Bearing Identification Mark
 Courtesy of HYUNDAI MOTOR CO.

Discrimination Of Connecting Rod Bearing**DISCRIMINATION OF CONNECTING ROD BEARING**

Class	Mark	Thickness Of Bearing
AA	BLUE	1.517 ~ 1.520mm (0.0597 ~ 0.0598in.)
A	BLACK	1.514 ~ 1.517mm (0.0596 ~ 0.0597in.)
B	NONE	1.511 ~ 1.514mm (0.0595 ~ 0.0596in.)
C	GREEN	1.508 ~ 1.511mm (0.0594 ~ 0.0595in.)
D	YELLOW	1.505 ~ 1.508mm (0.0593 ~ 0.0594in.)

11. Selection

BEARING SPECIFICATIONS

Crankshaft Identification Mark	Connecting Rod Identification Mark	Assembling Classification Of Bearing
1 (1)	a (A)	D (YELLOW)
	b (B)	C (GREEN)
	c (C)	B (NONE)

II (2)	a (A)	C (GREEN)
	b (B)	B (NONE)
	c (C)	A (BLACK)
III (3)	a (A)	B (NONE)
	b (B)	A (BLACK)
	c (C)	AA (BLUE)

3. Check the crankshaft bearing oil clearance.

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

Tightening torque

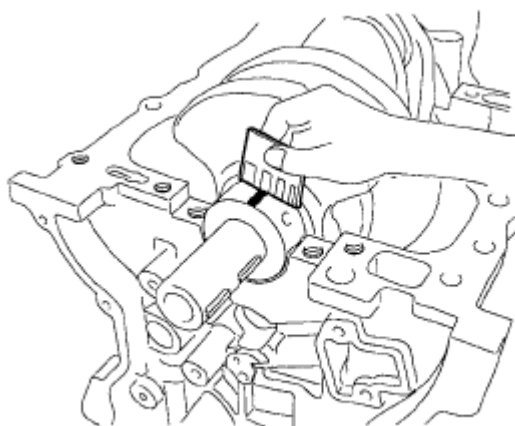
29.4N.m (3.0kgf.m, 21.7lb-ft) + 120°

NOTE: Do not turn the crankshaft.

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

Standard oil clearance

0.020 ~ 0.038mm (0.0008 ~ 0.0015in.)



KCRF170A

Fig. 18: Measuring Widest Part Of Plastigage
Courtesy of HYUNDAI MOTOR CO.

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

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

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

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

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

Connecting Rods

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

Allowable bend of connecting rod :

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

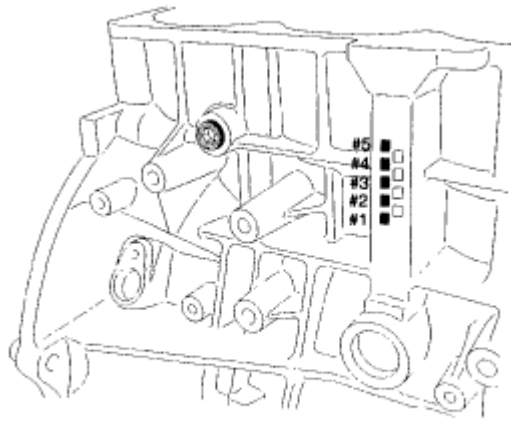
Allowable twist of connecting rod :

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

Crankshaft bore mark location

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

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



SNFEM8091L

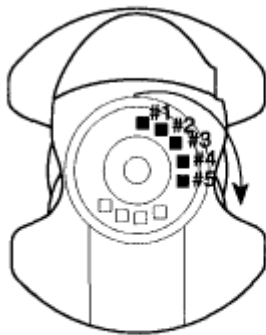
Fig. 19: Identifying Stamped On Block
Courtesy of HYUNDAI MOTOR CO.

Discrimination Of Cylinder Block

DISCRIMINATION OF CYLINDER BLOCK

Class	Mark	Inside Diameter
a	A	56.000 ~ 56.006mm (2.2047 ~ 2.2049in.)
b	B	56.006 ~ 56.012mm (2.2049 ~ 2.2052in.)
c	C	56.012 ~ 56.018mm (2.2052 ~ 2.2054in.)

Crankshaft Journal Mark Location Discrimination Of Crankshaft



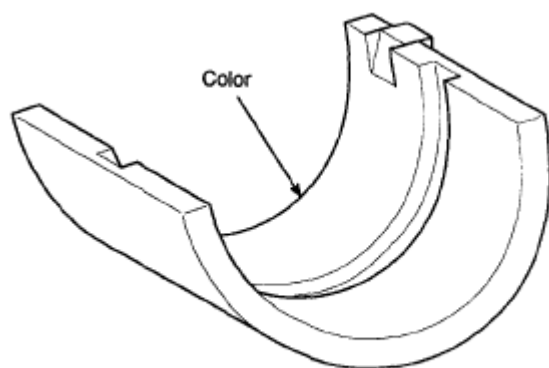
SNFEM8092L

Fig. 20: Identifying Crankshaft Journal Mark Location
Courtesy of HYUNDAI MOTOR CO.

NOTE: Conform to read stamping order as shown arrow direction from #1.

Discrimination Of Crankshaft**DISCRIMINATION OF CRANKSHAFT**

Class	Mark	Outside Diameter Of Journal
I	1	51.954 ~ 51.960mm (2.0454 ~ 2.0456in.)
II	2	51.948 ~ 51.954mm (2.0452 ~ 2.0454.)
III	3	51.942 ~ 51.948mm (2.0449 ~ 2.0452in.)

Place Of Identification Mark (Crankshaft Bearing) Discrimination Of Crankshaft Bearing

ECRF022A

Fig. 21: Identifying Crankshaft Bearing Identification Mark
 Courtesy of HYUNDAI MOTOR CO.

Discrimination Of Crankshaft Bearing**DISCRIMINATION OF CRANKSHAFT BEARING**

Class	Mark	Thickness Of Bearing
AA	Blue	2.026 ~ 2.029mm (0.0797 ~ 0.0798in.)
A	Black	2.023 ~ 2.026mm (0.0796 ~ 0.0797in.)
B	None	2.020 ~ 2.023mm (0.0795 ~ 0.0796in.)
C	Green	2.017 ~ 2.020mm (0.0794 ~ 0.795in.)
D	Yellow	2.014 ~ 2.017mm (0.0793 ~ 0.0794in.)

Selection**BEARING SPECIFICATIONS**

Crankshaft Identification Mark	Crankshaft Bore Identification Mark	Assembling Classification Of Bearing
1 (1)	a (A)	D (Yellow)
	b (B)	C (Green)
	c (C)	B (None)
	a (A)	C (Green)

II (2)	b (B)	B (None)
	c (C)	A (Black)
III (3)	a (A)	B (None)
	b (B)	A (Black)
	c (C)	AA (Blue)

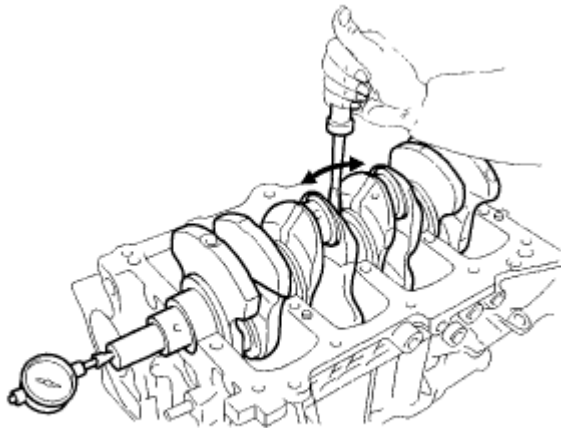
4. Check crankshaft end play.

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

Standard end play

0.07 ~ 0.25mm (0.0027 ~ 0.0098in.)

Limit: 0.30mm (0.0118in.)



KCRF211A

Fig. 22: Checking Crankshaft End Play
Courtesy of HYUNDAI MOTOR CO.

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

Thrust bearing thickness

1.925 ~ 1.965mm (0.0758 ~ 0.07736in.)

5. Inspect main journals and crank pins

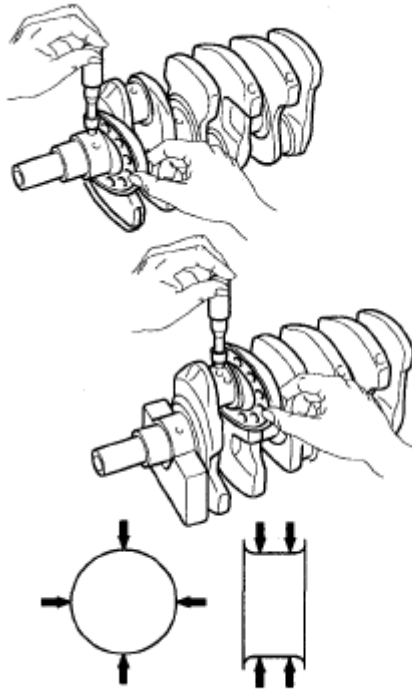
Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter:

51.942 ~ 51.960mm (2.0449 ~ 2.0456in.)

Crank pin diameter:

47.954 ~ 47.972mm (1.8879 ~ 1.8886in.)



KCRF212A

Fig. 23: Measuring Diameter Of Main Journal And Crank Pin
Courtesy of HYUNDAI MOTOR CO.

Cylinder Block

1. Remove gasket material.

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

2. Clean cylinder block

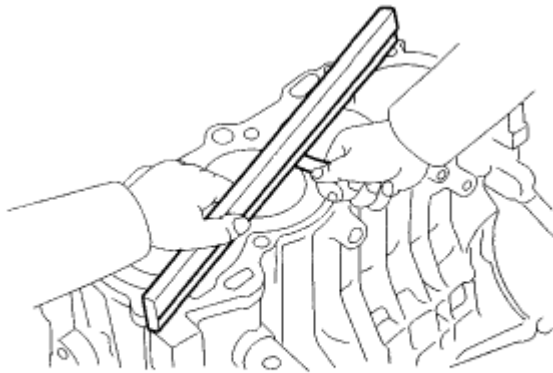
Using a soft brush and solvent, thoroughly clean the cylinder block.

3. Inspect top surface of cylinder block for flatness.

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

Flatness of cylinder block gasket surface

Standard : Less than 0.05mm (0.0020 in.)



KCRF213A

Fig. 24: Checking Flatness Of Cylinder Block Gasket Surface
Courtesy of HYUNDAI MOTOR CO.

4. Inspect cylinder bore diameter

Visually check the cylinder for vertical scratch.

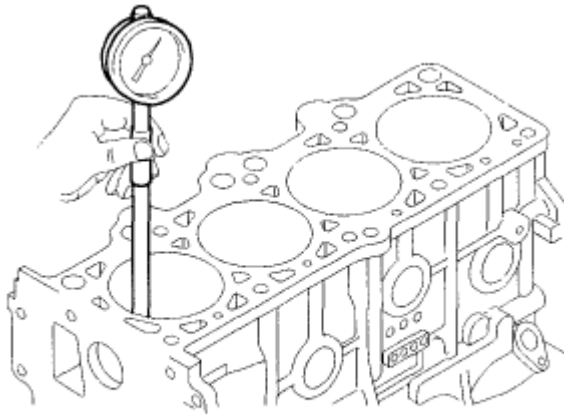
If deep scratches are present, replace the cylinder block.

5. Inspect cylinder bore diameter

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

Standard diameter

88.00 ~ 88.03mm (3.4645 ~ 3.4657in.)

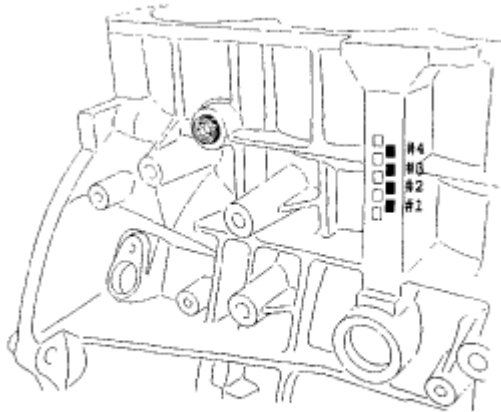


KCRF214A

Fig. 25: Measuring Cylinder Bore Diameter
Courtesy of HYUNDAI MOTOR CO.

NOTE: Measure position (from the bottom of the cylinder block)
: 110.7mm (4.3582in.)/160mm (6.2992in.) /210mm (8.2677in.)

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



SNFEM8093L

Fig. 26: Identifying Cylinder Bore Size Code On Cylinder Block
Courtesy of HYUNDAI MOTOR CO.

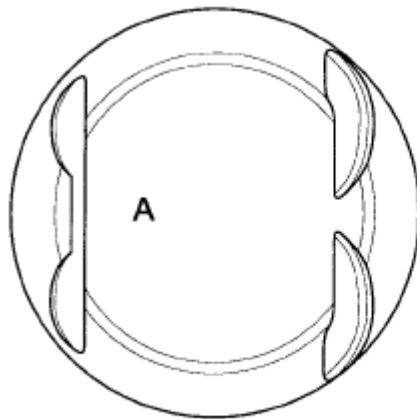
Cylinder Bore Inner Diameter

CYLINDER BORE INNER DIAMETER

Size Code	2.4
A	88.00 ~ 88.01 mm (3.4645 ~ 3.4649in.)
B	88.01 ~ 88.02mm (3.4649 ~ 3.4653in.)

C	88.02 ~ 88.03mm (3.4653 ~ 3.4657in.)
---	--------------------------------------

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



ECKE320B

Fig. 27: Identifying Piston Size Code On Piston Top Face
 Courtesy of HYUNDAI MOTOR CO.

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

Piston Outer Diameter

PISTON OUTER DIAMETER CHART

Size Code	2.4
A	87.975 ~ 87.985mm (3.4635 ~ 3.4639in.)
B	87.985 ~ 87.995mm (3.4639 ~ 3.4643in.)
C	87.995 ~ 88.005mm (3.4643 ~ 3.4647in.)

8. Select the piston related to cylinder bore class.

Clearance : 0.015 ~ 0.035mm (0.00059 ~ 0.00137in.)

Piston And Rings

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

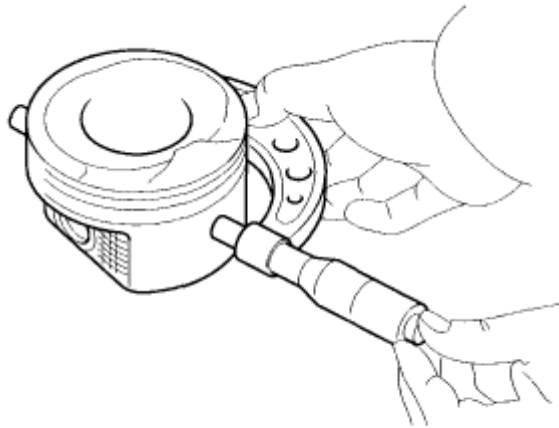
NOTE: Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 14 mm (0.55 in.) from the top land of

the piston.

Standard diameter

87.975 ~ 88.005mm (3.4635 ~ 3.4647in.)



KCRF215A

Fig. 28: Measuring Piston Outside Diameter

Courtesy of HYUNDAI MOTOR CO.

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

Piston-to-cylinder clearance

0.015 ~ 0.035mm (0.00059 ~ 0.00137in.)

4. Inspect the piston ring side clearance.

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

Piston ring side clearance

Standard

No. 1 : 0.05 ~ 0.08mm (0.0019 ~ 0.0031in.)

No. 2 : 0.04 ~ 0.08mm (0.0015 ~ 0.0031 in.)

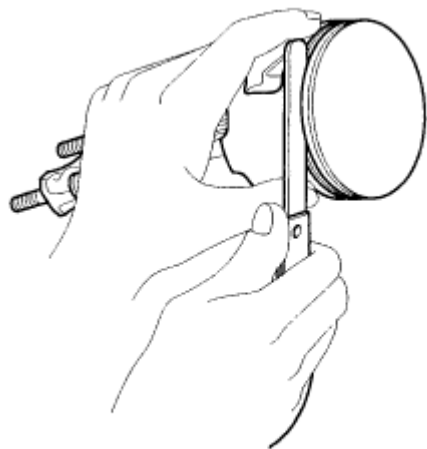
Oil ring : 0.06 ~ 0.15mm (0.0023 ~ 0.0059in.)

Limit

No. 1 : 0.1mm (0.004in.)

No. 2 : 0.1mm (0.004in.)

Oil ring : 0.2mm (0.008in.)



KCRF216A

Fig. 29: Measuring Clearance Between Piston Ring And Wall Of Ring Groove
Courtesy of HYUNDAI MOTOR CO.

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

5. Inspect piston ring end gap.

To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles to the cylinder wall by gently pressing it down with a piston. Measure the gap with a feeler gauge. If the gap exceeds the service limit, replace the piston ring. If the gap is too large, recheck the cylinder bore diameter against the wear limits, If the bore is over the service limit, the cylinder block must be rebored.

Piston ring end gap

Standard

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

No. 2 : 0.37 ~ 0.52m (0.0145 ~ 0.0204in.)

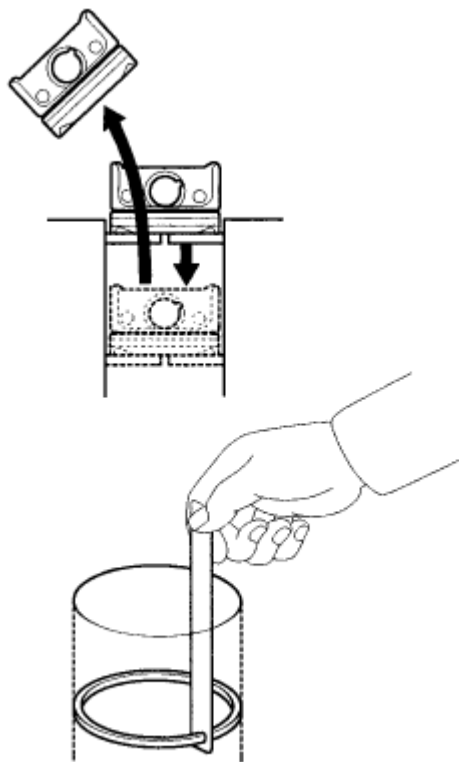
Oil ring : 0.20 ~ 0.70mm (0.0079 ~ 0.0275in.)

Limit

No. 1 : 0.6mm (0.0236in.)

No. 2 : 0.7mm (0.0275in.)

Oil ring : 0.8mm (0.0315in.)



KCRF217A

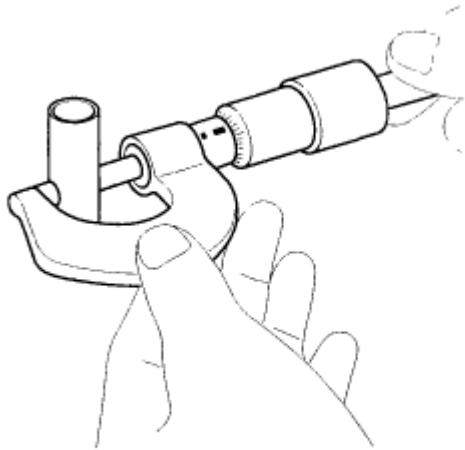
Fig. 30: Checking Piston Ring End Gap
Courtesy of HYUNDAI MOTOR CO.

Piston Pins

1. Measure the diameter of the piston pin.

Piston pin diameter

21.001 ~ 21.006mm (0.8268 ~ 0.8270in.)



KCRF218A

Fig. 31: Measuring Diameter Of Piston Pin
Courtesy of HYUNDAI MOTOR CO.

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

Piston pin-to-piston clearance

0.01 ~ 0.02mm (0.0004 ~ 0.0008in.)

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

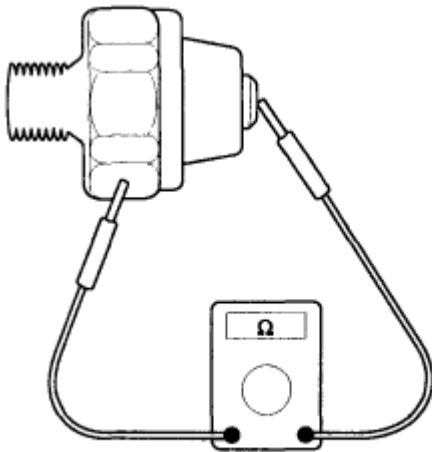
Piston pin-to-connecting rod interference

0.016 ~ 0.032mm (0.00063 ~ 0.00126in.)

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.

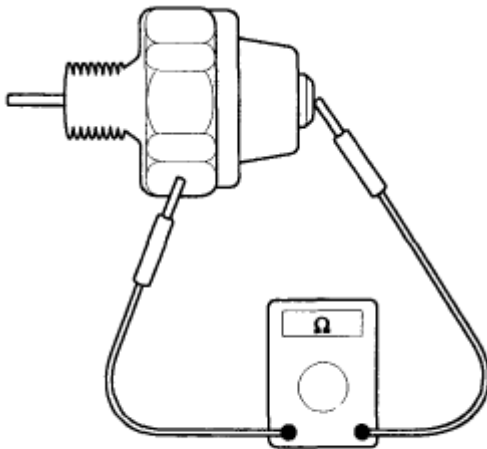


KCRF219A

Fig. 32: Checking Continuity Between Terminal And Body
Courtesy of HYUNDAI MOTOR CO.

2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.
3. If there is no continuity when a 50kpa (7psi) vacuum is applied through the oil hole, the switch is operating properly.

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



KCRF220A

Fig. 33: Checking Continuity Between Terminal And Body
Courtesy of HYUNDAI MOTOR CO.

REASSEMBLY

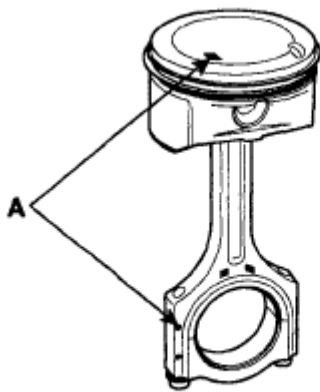
NOTE:

- Thoroughly clean all parts to assembled.

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

1. Assemble piston and connecting rod.

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

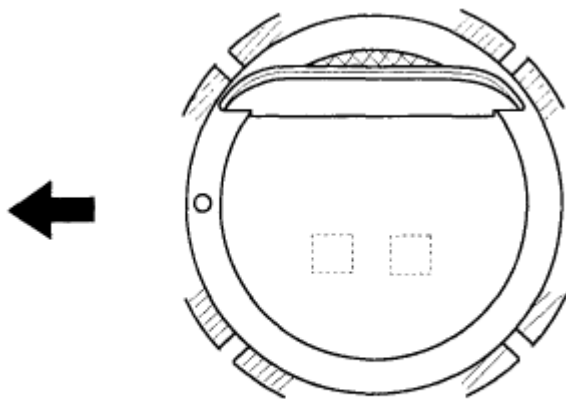


KCRF168A

Fig. 34: Identifying Piston Front Mark And Connecting Rod Front Mark
Courtesy of HYUNDAI MOTOR CO.

2. Install piston rings.

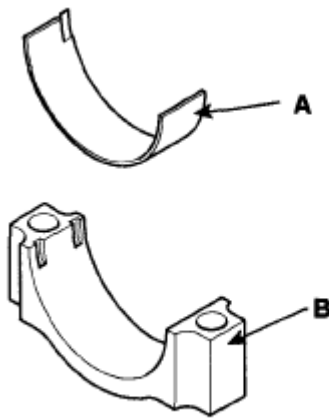
1. Install the oil ring spacer and 2 side rails by hand.
2. Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
3. Position the piston rings so that the ring ends are as shown.



KCRF221A

Fig. 35: Identifying Piston Rings Gap Direction
Courtesy of HYUNDAI MOTOR CO.

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



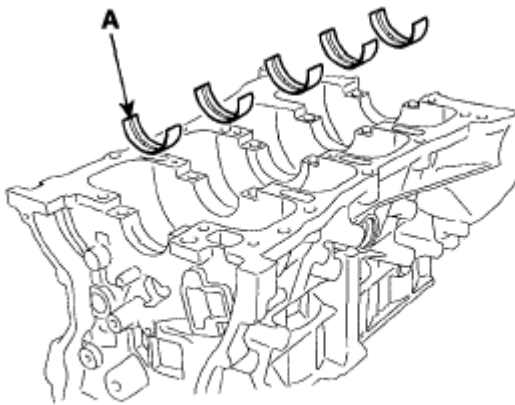
KCRF116B

Fig. 36: Identifying Bearings And Connecting Rod Cap
Courtesy of HYUNDAI MOTOR CO.

4. Install 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 5 upper bearings (A).



KCRF173A

Fig. 37: Identifying Upper Bearings
Courtesy of HYUNDAI MOTOR CO.

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

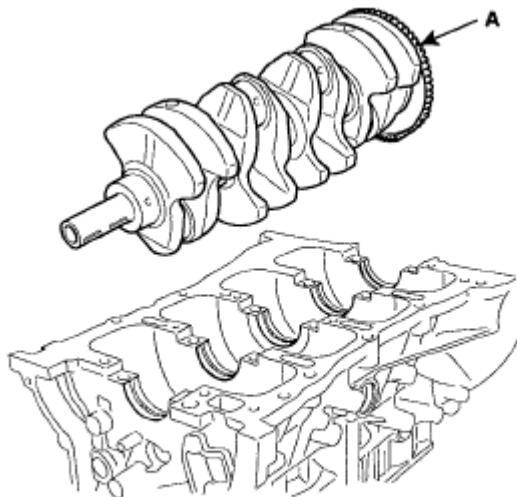
Install the 2 thrust bearings (A) under the No. 3 journal position of the cylinder block with the oil grooves facing outward.



KCRF222A

Fig. 38: Identifying Thrust Bearings
Courtesy of HYUNDAI MOTOR CO.

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



KCRF172A

Fig. 39: Identifying Crankshaft
Courtesy of HYUNDAI MOTOR CO.

7. Place main bearing caps on cylinder block.

8. Install main bearing cap bolts.

Tightening torque

29.4N.m (3.0kgf.m, 21.7lb-ft) + 120°

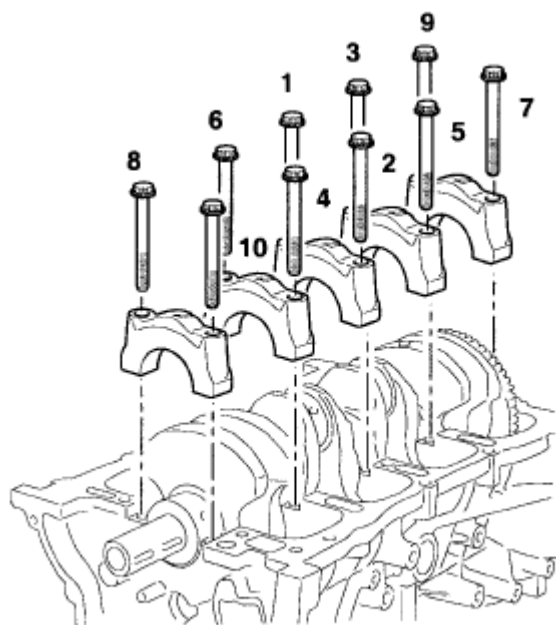
NOTE:

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

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

Tightening torque:

29.4N.m (3.0kgf.m, 21.7lb-ft)



KGRF171A

Fig. 40: Identifying Bearing Cap Bolts In Sequence
Courtesy of HYUNDAI MOTOR CO.

3. Retighten the bearing cap bolts by 120° in the numerical order shown.
4. Check that the crankshaft turns smoothly.
9. Check crankshaft end play.
10. Install piston and connecting rod assemblies.

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

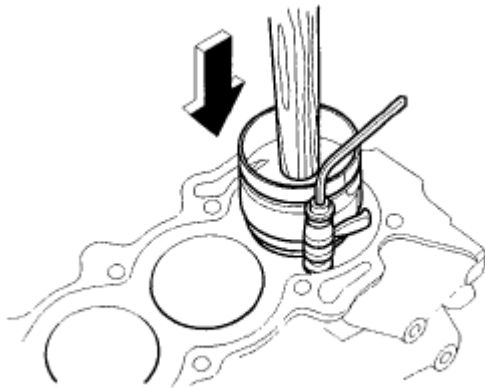
and cylinder bores.

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

Tightening torque

19.6N.m (2.0kgf.m, 14.46lb-ft) + 90°

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



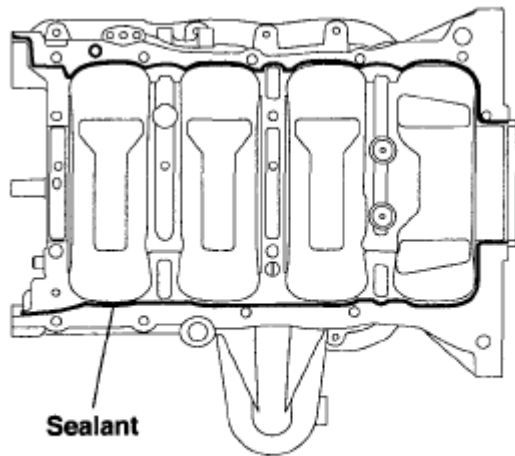
KCRF223A

Fig. 41: Pushing Piston Into Cylinder Block
Courtesy of HYUNDAI MOTOR CO.

11. Apply liquid gasket to the mating surface of cylinder block and ladder frame.

NOTE:

- Be assembling ladder frame, the liquid sealant Loctite 5900 or THREEBOND 1217H should be applied ladder frame.
- The part must be assembled within 5 minutes after sealant was applied.
- Apply sealant to the inner threads of the bolt holes.



ECRF023A

Fig. 42: Applying Liquid Gasket To Mating Surface Of Cylinder Block And Ladder Frame
 Courtesy of HYUNDAI MOTOR CO.

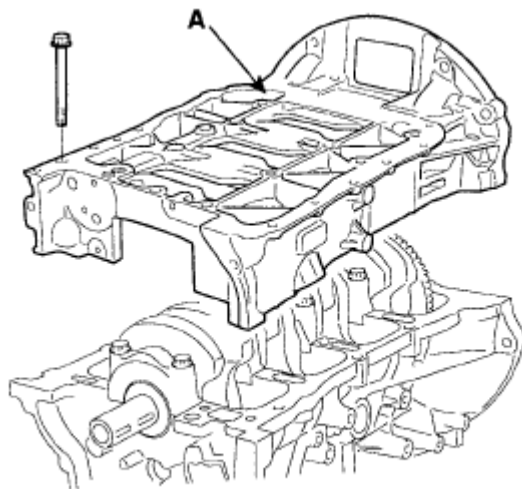
12. Install ladder frame (A) with 10 bolts in several passes in sequence shown.

Tightening torque

Step 1 :7.8 ~ 8.8N.m (0.8 ~ 0.9kgf.m, 5.8 ~ 6.5lb-ft)

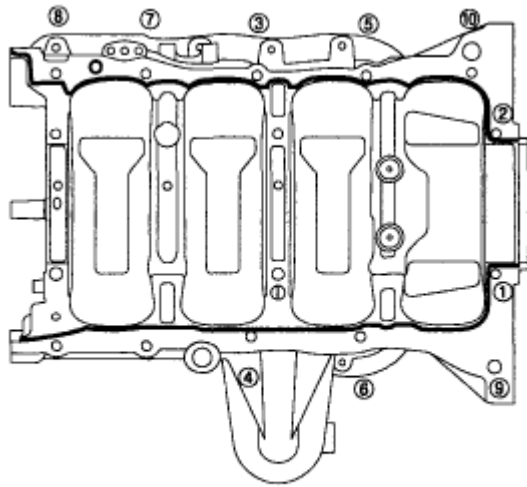
Step 2 :15.7 ~ 18.6N.m (1.6 ~ 1.9kgf.m, 11.6 ~ 13.7lb-ft)

Step 3 :23.5 ~ 27.5N.m (2.4 ~ 2.8kgf.m, 17.4 ~ 20.3lb-ft)



KCRF167A

Fig. 43: Identifying Ladder Frame
 Courtesy of HYUNDAI MOTOR CO.



SNFEM8084L

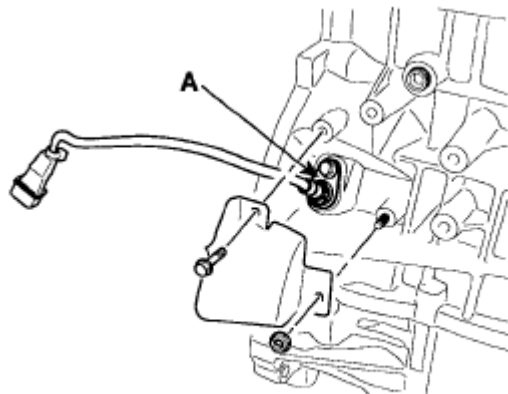
Fig. 44: Identifying Gasket

Courtesy of HYUNDAI MOTOR CO.

13. Install rear oil seal.
 1. Apply engine oil to a new oil seal lip.
 2. Using SST (09231-H1100, 09214 ~ 3K100) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
14. Install balance shaft module.
15. Install water pump.
16. Install CKP sensor (A) and sensor cover.

Tightening torque

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



KCRF164A

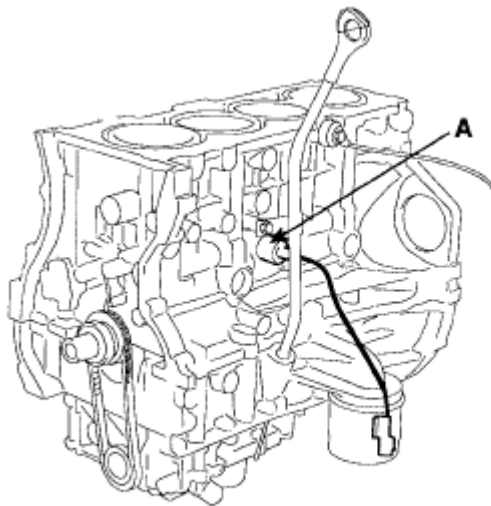
Fig. 45: Identifying CKP Sensor

Courtesy of HYUNDAI MOTOR CO.

17. Install oil pressure sensor.
 1. Apply adhesive to 2 or 3 threads. Adhesive : MS 721-39 (B) or equivalent.
 2. Install the oil pressure sensor (A).

Tightening torque

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



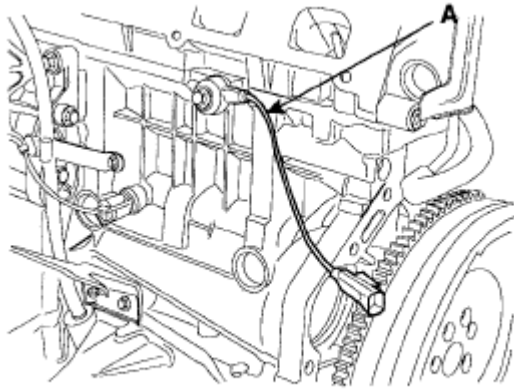
KCRF163C

Fig. 46: Identifying Oil Pressure Sensor
Courtesy of HYUNDAI MOTOR CO.

18. Install knock sensor (A).

Tightening torque

16.7 ~ 25.5N.m (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)



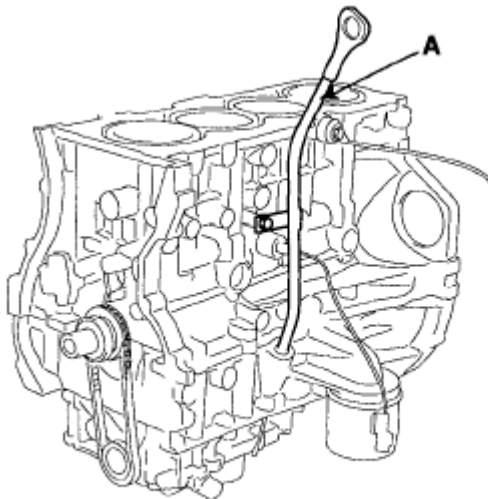
KCRF143A

Fig. 47: Identifying Knock Sensor
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

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



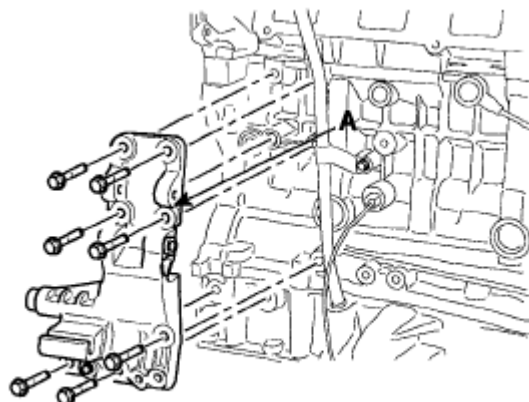
KCRF163B

Fig. 48: Identifying Oil Level Gauge Assembly
Courtesy of HYUNDAI MOTOR CO.

20. Install tensioner assembly integrated bracket (A).

Tightening torque

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



KCRF161A

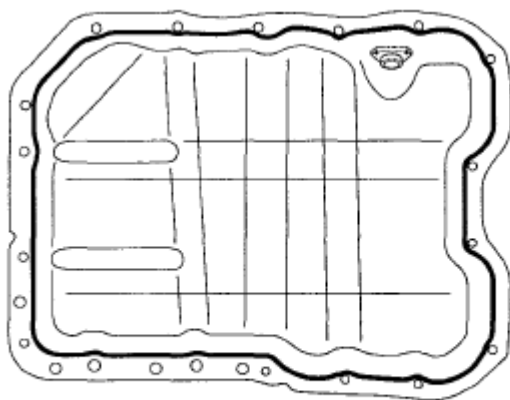
Fig. 49: Identifying Tensioner Assembly Integrated Bracket
Courtesy of HYUNDAI MOTOR CO.

21. Install the power steering pump bracket and power steering pump.
22. Install the alternator.
23. Install the A/C compressor.
24. Install the cylinder head.
25. Install the timing chain.
26. Install the oil pan.
 1. Using a razor blade and gasket scraper, remove all the old gasket material from the gasket surfaces.

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

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

Use liquid gasket LOCTITE5900H or THREEBOND 1217H equivalent (MS721-40).



KCRF179A

Fig. 50: Identifying Liquid Gasket
Courtesy of HYUNDAI MOTOR CO.

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.

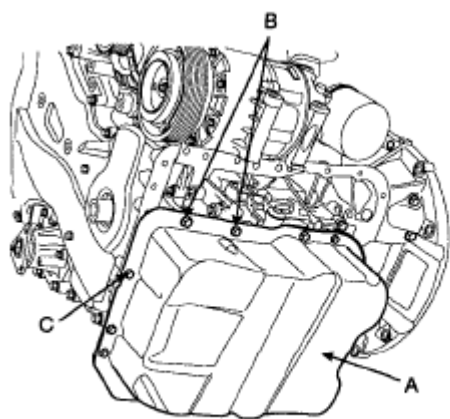
3. Install the oil pan (A).

Uniformly tighten the bolts in several passes.

Tightening torque

M8 (B):26.5 ~ 30.4N.m (2.7 ~ 3.1kgf.m, 19.5 ~ 22.4lb-ft)

M6 (C):9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



KCRF114B

Fig. 51: Identifying Oil Pan**Courtesy of HYUNDAI MOTOR CO.**

- 27. Remove engine stand.
- 28. A/T : Install drive plate (A).

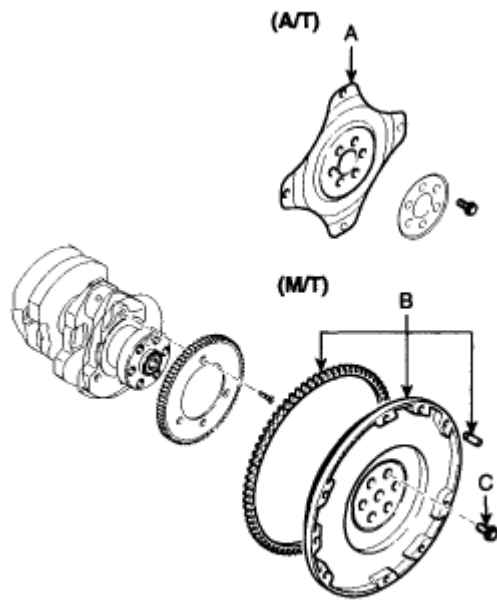
Tightening torque

117.7 ~ 127.5N.m (12 ~ 13kgf.m, 86.8 ~ 94.0lb-ft)

M/T: Install flywheel (B).

Tightening torque

117.7 ~ 127.5N.m (12 ~ 13kgf.m, 86.8 ~ 94.0lb-ft)



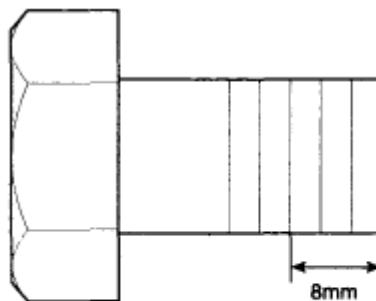
SNFEM7901L

Fig. 52: Identifying Drive Plate And Flywheel
Courtesy of HYUNDAI MOTOR CO.

NOTE:

- Always use new flywheel (drive plate) bolts (C).
- Apply sealant to the screw part (8mm from the end of the bolt) when using new flywheel bolts.

Sealant: Three bond 2403, Loctite 200 or 204



SNFEM7902L

Fig. 53: Identifying Flywheel Bolts Dimension
Courtesy of HYUNDAI MOTOR CO.

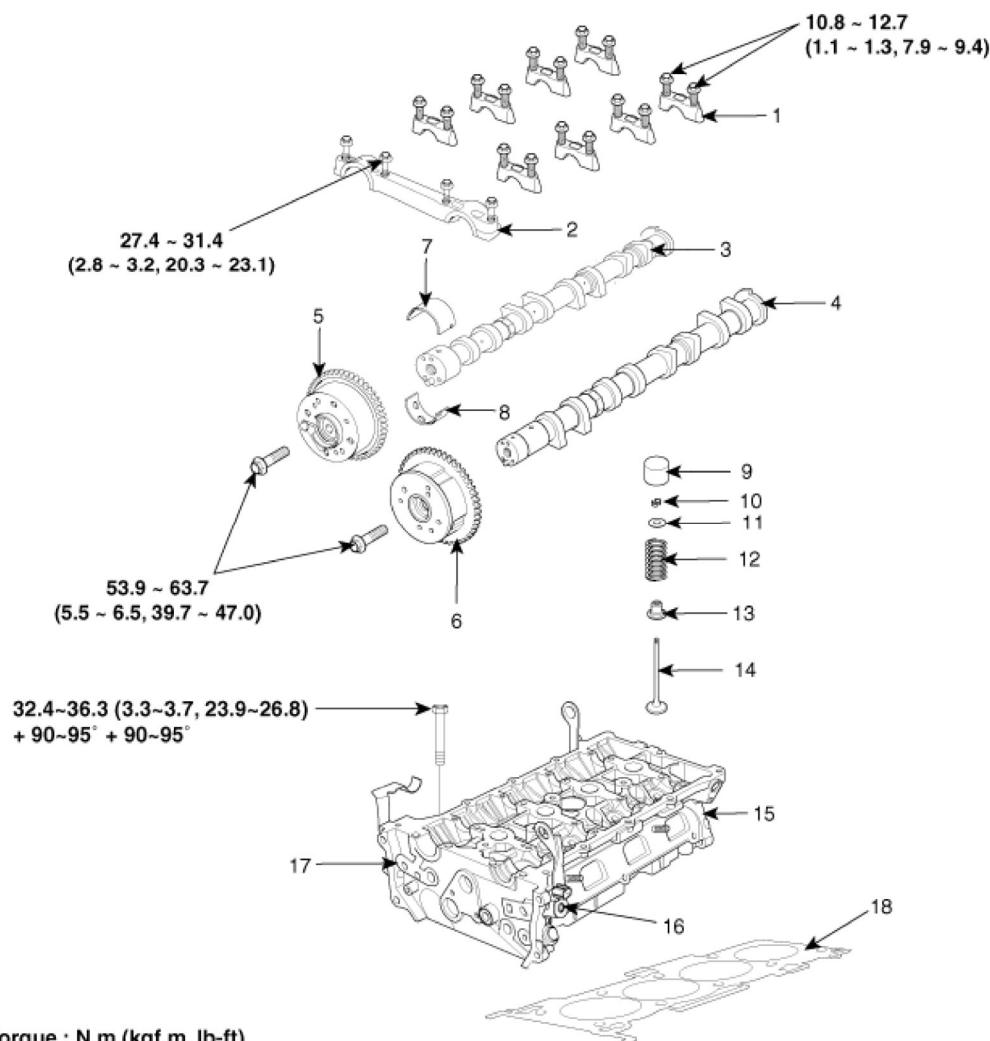
- Install and uniformly tighten the 7 bolts, in several passes.

2010 ENGINE

Cylinder Head Assembly (Engine (G4KE - GSL 2.4)) - Sonata

CYLINDER HEAD

COMPONENTS



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

Fig. 1: Identifying Cylinder Head Components And Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

REMOVAL

Engine removal is not required for this procedure.

CAUTION:

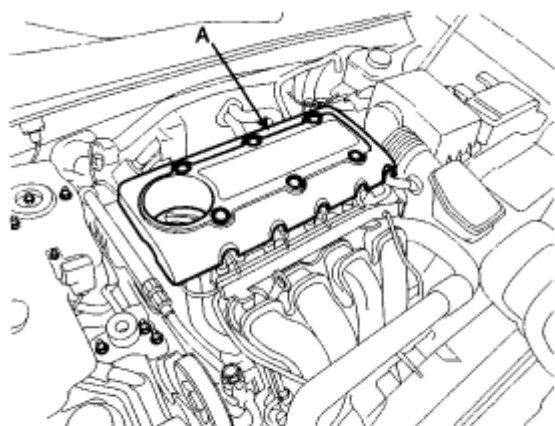
- Use fender covers to avoid damaging painted surfaces.
- To avoid damaging the cylinder head, wait until the engine coolant

temperature drops below normal temperature before removing it.

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

NOTE: Mark all wiring and hoses to avoid misconnection.

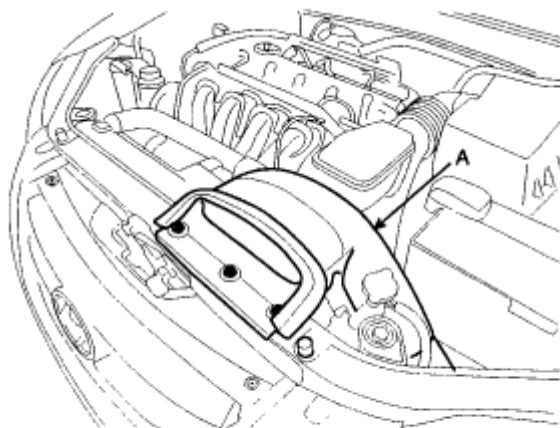
1. Disconnect the battery terminals and remove the battery.
2. Remove the engine cover (A).



SNFEM8001D

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

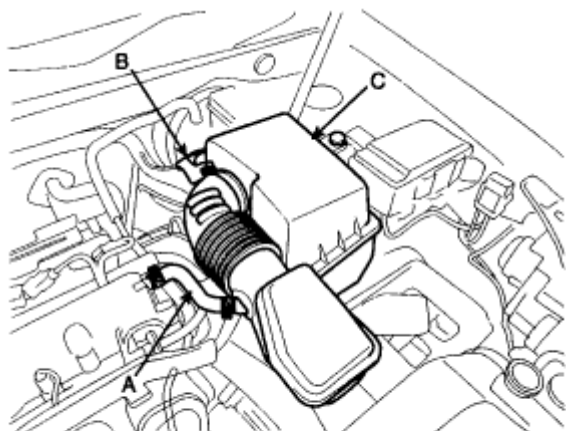
3. Remove the air duct (A).



SNFEM8002D

Fig. 3: Identifying Air Duct**Courtesy of HYUNDAI MOTOR CO.**

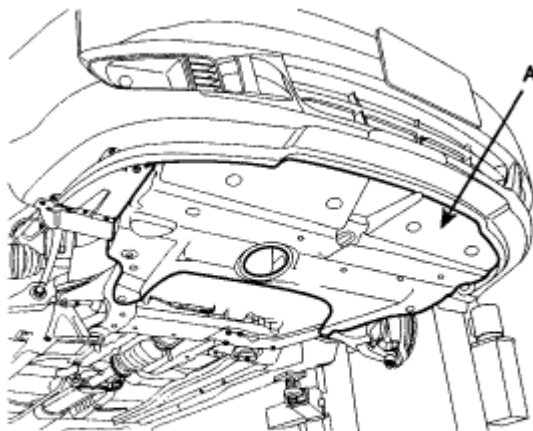
4. Disconnect the breather hose (A), ECM connector (B) and remove the air cleaner assembly (C).



SNFEM8003D

Fig. 4: Identifying Breather Hose, ECM Connector And Air Cleaner Assembly**Courtesy of HYUNDAI MOTOR CO.**

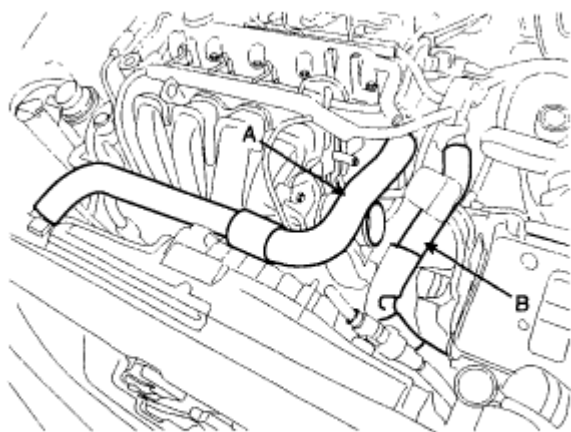
5. Remove the under cover (A).



SNFEM8031D

Fig. 5: Identifying Under Cover**Courtesy of HYUNDAI MOTOR CO.**

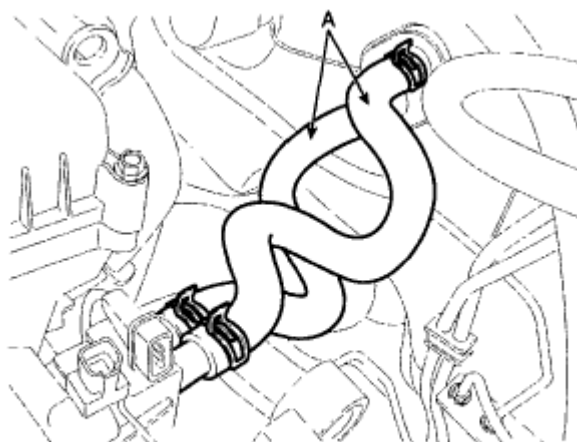
6. Remove the drain plug and drain the engine coolant.
7. Remove the radiator upper hose (A) and lower hose (B).



SNFEM8004D

Fig. 6: Identifying Radiator Upper Hose And Lower Hose
Courtesy of HYUNDAI MOTOR CO.

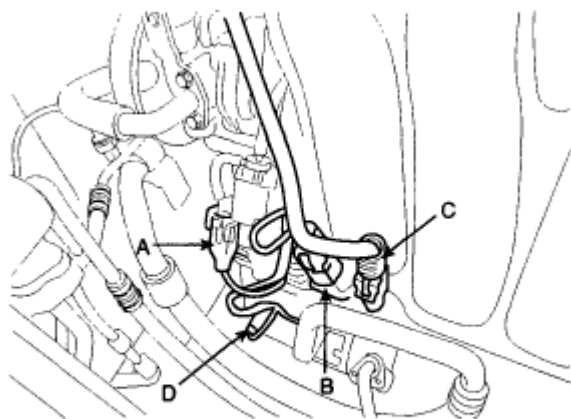
8. Remove the heater hoses (A).



ACLG003A

Fig. 7: Identifying Heater Hoses
Courtesy of HYUNDAI MOTOR CO.

9. Disconnect the VIS connector (A), OPS connector (B), knock sensor connector (C) and A/C switch connector (D).



SNFEM8006D

Fig. 8: Identifying VIS Connector, OPS Connector, Knock Sensor Connector And A/C Switch Connector

Courtesy of HYUNDAI MOTOR CO.

10. Disconnect the intake OCV connector (A).

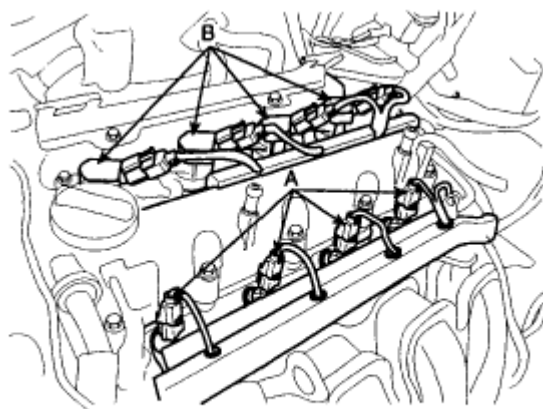


SNFEM8032D

Fig. 9: Identifying Intake OCV Connector

Courtesy of HYUNDAI MOTOR CO.

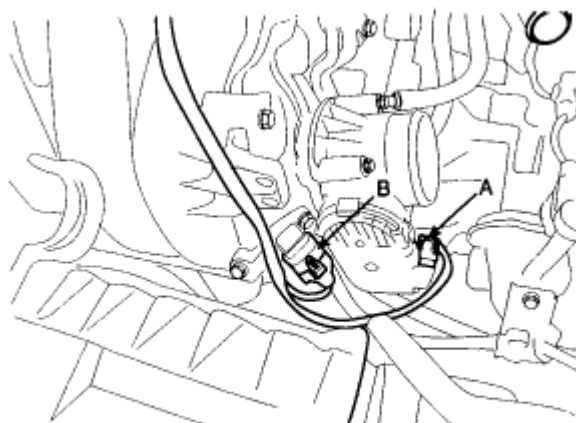
11. Disconnect the injector connectors (A) and ignition coil connectors (B).



SNFEM8005D

Fig. 10: Identifying Injector Connectors And Ignition Coil Connectors
Courtesy of HYUNDAI MOTOR CO.

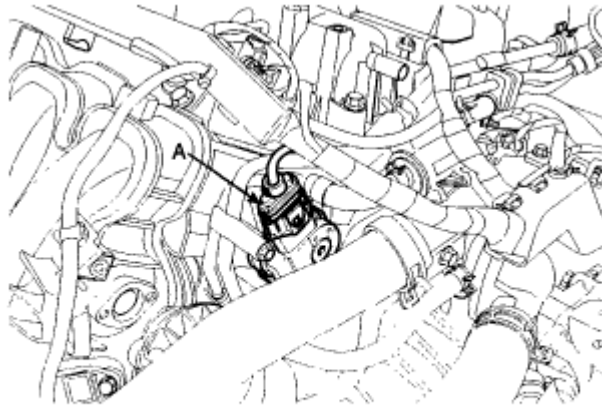
12. Disconnect the ETC connector (A) and MAP sensor connector (B).



SNFEM8007D

Fig. 11: Identifying ETC Connector And MAP Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

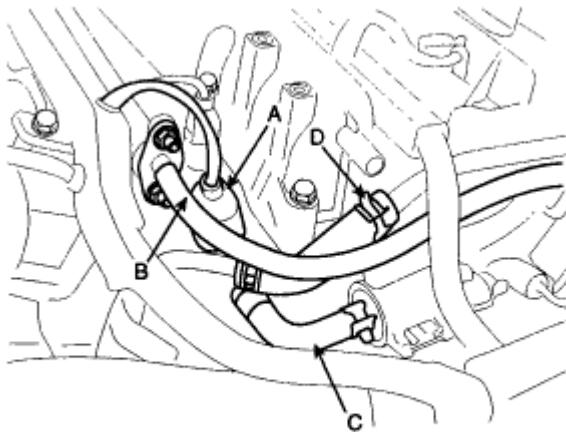
13. Disconnect the VCM connector (A).



SNFEM8090N

Fig. 12: Identifying VCM Connector
 Courtesy of HYUNDAI MOTOR CO.

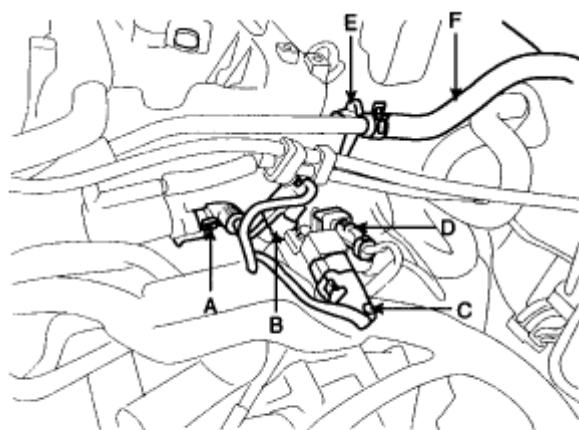
14. Disconnect the CMP sensor connector (A), fuel hose (B), brake booster vacuum hose (C) and PCSV hose (D).



SNFEM8088D

Fig. 13: Identifying CMP Sensor Connector, Fuel Hose, Brake Booster Vacuum Hose And PCSV Hose
 Courtesy of HYUNDAI MOTOR CO.

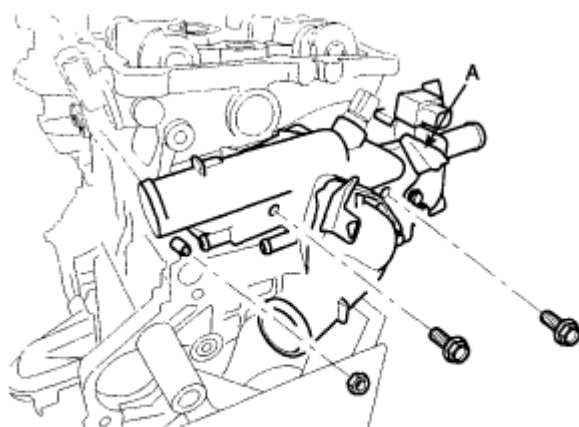
15. Disconnect the PCSV connector (A), ECT connector (B), condenser connector (C), CKP sensor connector (D), CMP sensor connector (E) and brake booster vacuum hose (F).



SNFEM8008D

Fig. 14: Identifying PCSV Connector, ECT Connector, Condenser Connector, CKP Sensor Connector, CMP Sensor Connector And Brake Booster Vacuum Hose
 Courtesy of HYUNDAI MOTOR CO.

16. Disconnect the front O2 sensor connector and rear O2 sensor connector.
17. Remove the water temp control assembly (A).

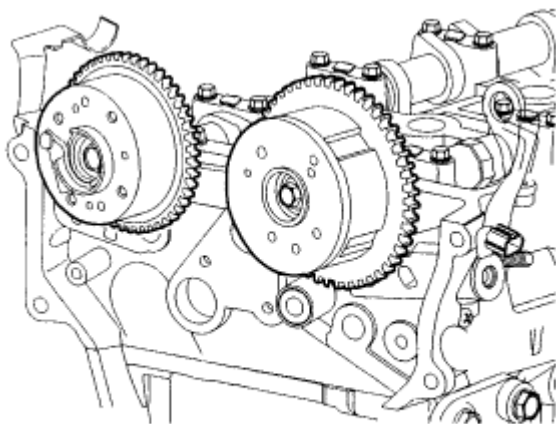


SNFEM8010D

Fig. 15: Identifying Water Temp Control Assembly
 Courtesy of HYUNDAI MOTOR CO.

18. Remove the timing chain.
 (Refer to **TIMING SYSTEM (ENGINE (G4KE - GSL 2.4))**)
19. Remove the intake & exhaust manifold.
 (Refer to **INTAKE AND EXHAUST SYSTEM (ENGINE (G4KE - GSL 2.4))**)

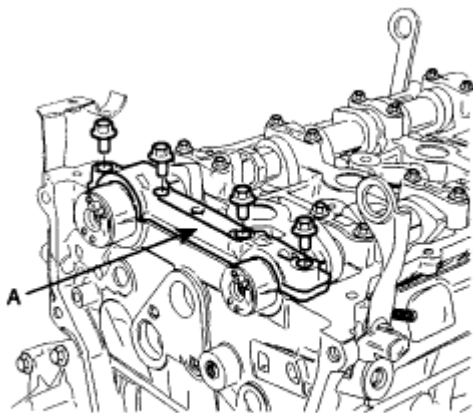
20. Remove the intake & exhaust CVVT assembly.



SNFEM8069D

Fig. 16: Identifying Intake & Exhaust CVVT Assembly
Courtesy of HYUNDAI MOTOR CO.

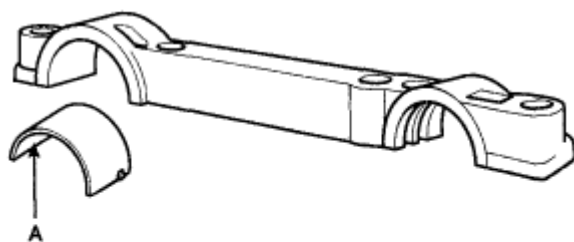
21. Remove the cam shaft.
- Remove the front cam shaft bearing cap (A).



SNFEM8054D

Fig. 17: Identifying Front Cam Shaft Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

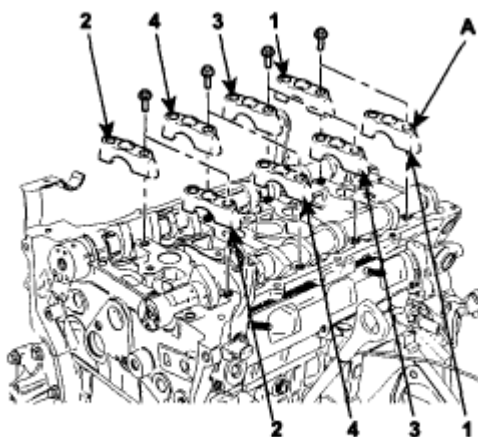
- Remove the exhaust cam shaft upper bearing (A).



SNFEM8016D

Fig. 18: Identifying Exhaust Cam Shaft Upper Bearing
Courtesy of HYUNDAI MOTOR CO.

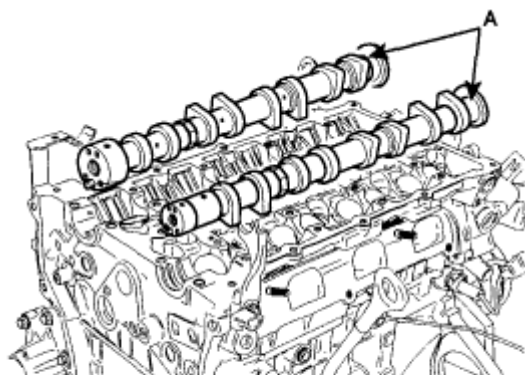
- c. Remove camshaft bearing cap (A), in the sequence shown.



SNFEM8085L

Fig. 19: Identifying Camshaft Bearing Cap In Sequence
Courtesy of HYUNDAI MOTOR CO.

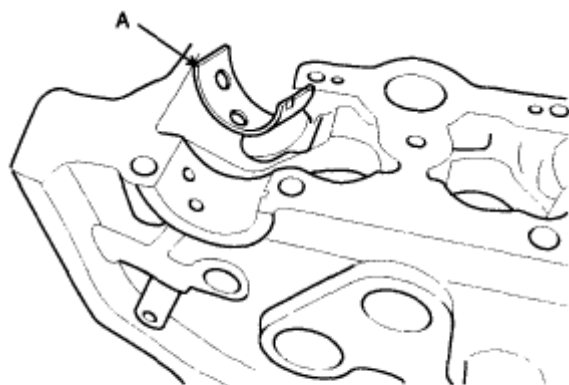
- d. Remove the cam shaft (A).



SNFEM8056D

Fig. 20: Identifying Camshaft
Courtesy of HYUNDAI MOTOR CO.

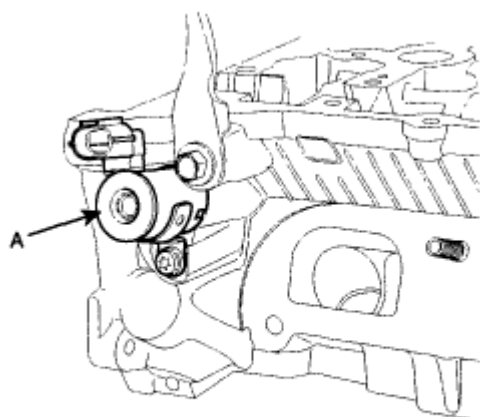
- e. Remove the exhaust cam shaft lower bearing (A).



SNFEM8057D

Fig. 21: Identifying Exhaust Cam Shaft Lower Bearing
Courtesy of HYUNDAI MOTOR CO.

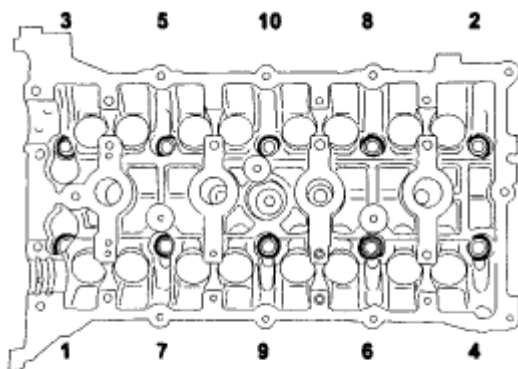
- 22. Use a Torx wrench, remove the intake OCV (A).



SNFEM8058D

Fig. 22: Identifying Intake OCV
Courtesy of HYUNDAI MOTOR CO.

23. Remove the exhaust OCV.
24. Remove the cylinder head bolts, then remove the cylinder head.
 - a. Using triple square wrench, uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown.



SNFEM8086L

Fig. 23: Identifying Cylinder Head Bolts In Sequence
Courtesy of HYUNDAI MOTOR CO.

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

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

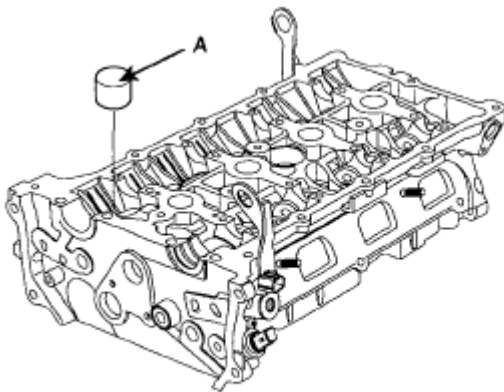
CAUTION: Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

25. Remove the cylinder head gasket.

DISASSEMBLY

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

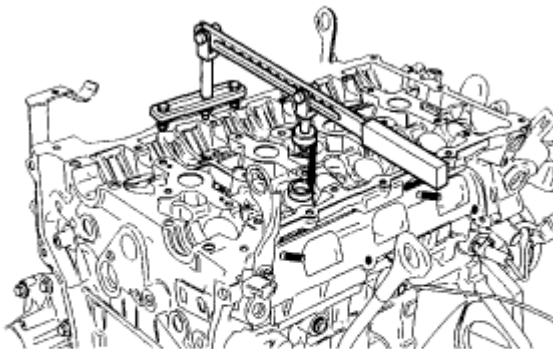
1. Remove MLAs (A).



KCRF125A

Fig. 24: Identifying MLAs
Courtesy of HYUNDAI MOTOR CO.

2. Remove valves.
 1. Using SST (09222-3K000, 09222-3K100), compress the valve spring and remove retainer lock.



SNFEM8087L

Fig. 25: Compressing Valve Spring

Courtesy of HYUNDAI MOTOR CO.

2. Remove the spring retainer.
3. Remove the valve spring.
4. Remove the valve.
5. Using needle-nose pliers, remove the valve stem seal.

INSPECTION (EXCEPT REVISED)

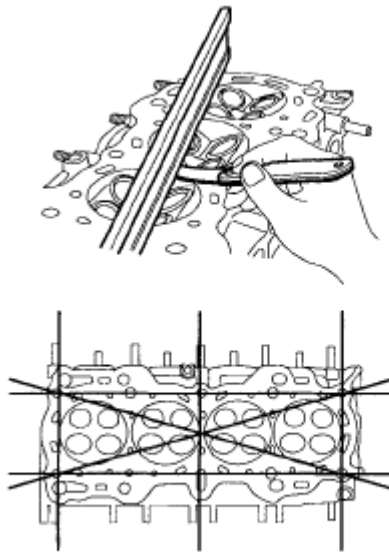
Cylinder Head

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 0.05mm (0.002in.)



ECKD001H

Fig. 26: Checking Flatness Of Cylinder Head Gasket 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.

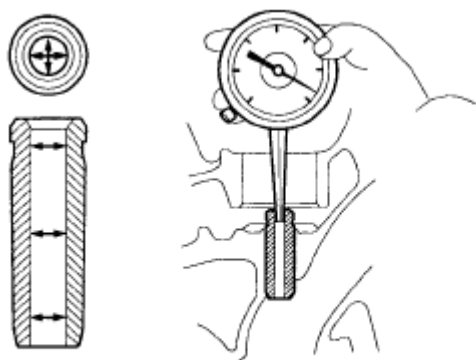
Valve And Valve Spring

1. Inspect valve stems and valve guides.

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

Valve guide I.D.

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



ECKD219A

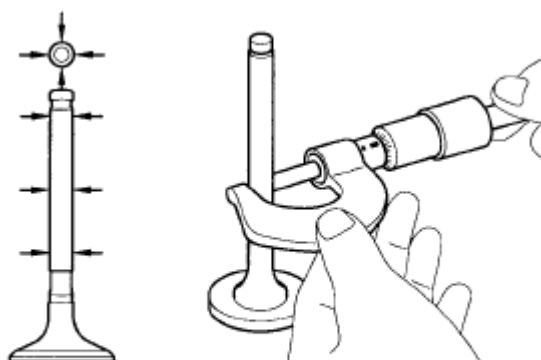
Fig. 27: Measuring Inside Diameter Of Valve Guide
Courtesy of HYUNDAI MOTOR CO.

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

Valve stem O.D.

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

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



ECKD220A

Fig. 28: Measuring Diameter Of Valve Stem
Courtesy of HYUNDAI MOTOR CO.

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

Valve stem-to-guide clearance**[Standard]**

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

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

[Limit]

Intake: 0.07mm (0.0027in.)

Exhaust: 0.09mm (0.0035in.)

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

2. Inspect valves.

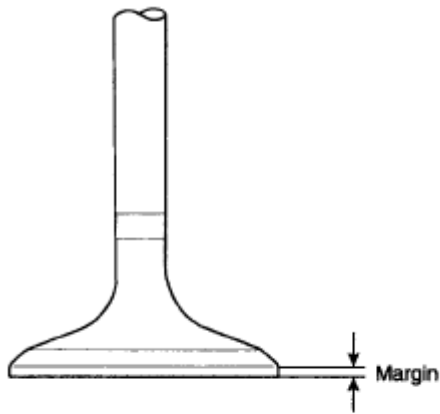
1. Check the valve is ground to the correct valve face angle.
2. Check that the surface of the valve for wear. If the valve face is worn, replace the valve.
3. Check the valve head margin thickness.

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

Margin**[Standard]**

Intake: 1.02mm (0.0401in.)

Exhaust: 1.09mm (0.0429in.)



ECKD221A

Fig. 29: Identifying Valve Head Margin Thickness
 Courtesy of HYUNDAI MOTOR CO.

4. Check the valve length.

Valve length

[Standard]

Intake: 113.18mm (4.456in.)

Exhaust: 105.84mm (4.167in.)

[Limit]

Intake: 112.93mm (4.446in.)

Exhaust: 105.59mm (4.157in.)

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

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

3. Inspect valve seats

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

Replace the seat if necessary.

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

4. Inspect valve springs.

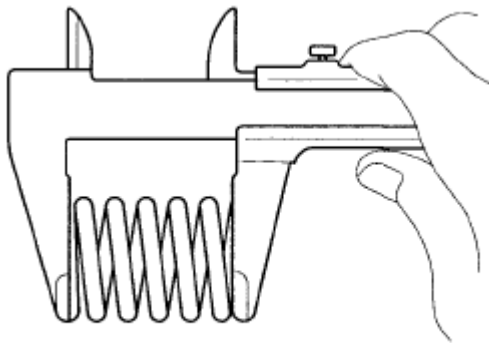
1. Using a steel square, measure the out-of-square of the valve spring.
2. Using a vernier calipers, measure the free length of the valve spring.

Valve spring

[Standard]

Free height: 47.44mm (1.8677in.)

Out-of-square: 1.5°



ECKD222A

Fig. 30: Measuring Free Length Of Valve Spring
Courtesy of HYUNDAI MOTOR CO.

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

MLA**1. Inspect MLA.**

Using a micrometer, measure the MLA outside diameter.

MLA O.D.

Intake/Exhaust:

31.964~31.980mm (1.2584 ~ 1.2590in.)

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

Intake/Exhaust:

32.000~32.025mm (1.2598 ~ 1.2608in.)

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

MLA to tappet bore clearance

[Standard]

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

[Limit]

Intake/Exhaust: 0.07mm (0.0027in.)

Camshaft

1. Inspect cam lobes.

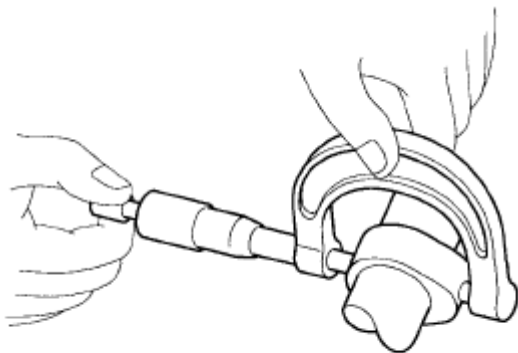
Using a micrometer, measure the cam lobe height.

Cam height

[Standard value]

Intake : 44.10 ~ 44.30mm (1.7362 ~ 1.7440in.)

Exhaust: 44.90 ~ 45.10mm (1.7677 ~ 1.7756in.)



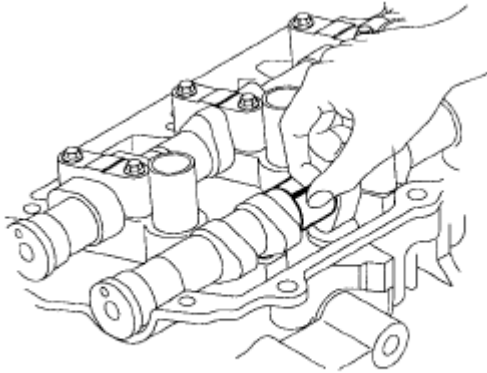
ECKD223A

Fig. 31: Measuring Cam Lobe Height
Courtesy of HYUNDAI MOTOR CO.

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

2. Inspect camshaft journal clearance.

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



ECKD224A

Fig. 32: Laying Strip Of Plastigage Across Of Camshaft Journal
Courtesy of HYUNDAI MOTOR CO.

4. Install the bearing caps.

CAUTION: Do not turn the camshaft.

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

Bearing oil clearance

[Standard value]

Intake

No. 1 journal: 0.022 ~ 0.057mm (0.0008 ~ 0.0022in.)

No. 2,3,4,5, journal: 0.045 ~ 0.082mm (0.0018 ~ 0.0032 in.)

Exhaust

No. 1 journal: 0 ~ 0.032mm (0 ~ 0.0012in.)

No. 2,3,4,5, journal: 0.045 ~ 0.082mm (0.0017 ~ 0.0032 in.)

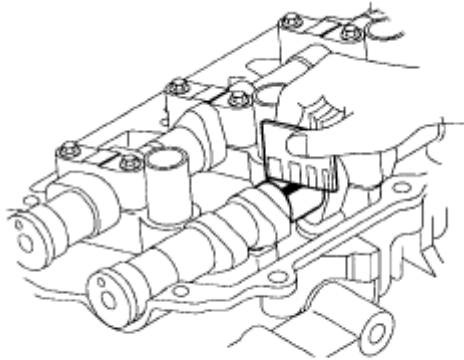
[Limit]:

Intake

No. 1 journal: 0.09mm (0.0035in.)

No. 2,3,4,5 journal: 0.12mm (0.0047in.)

Exhaust: 0.12mm (0.0047in.)



ECKD225A

Fig. 33: Measuring Plastigage At Widest Point
Courtesy of HYUNDAI MOTOR CO.

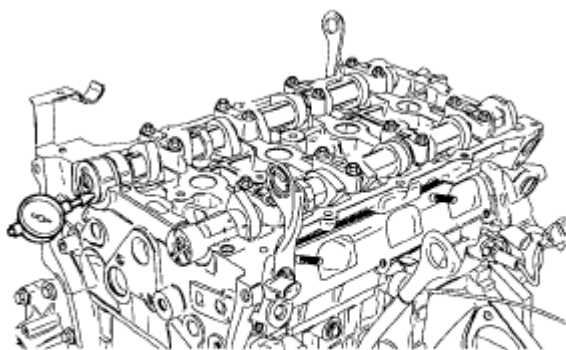
If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

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

Camshaft end play

[Standard value]: 0.04 ~ 0.16mm (0.0015 ~ 0.0062in.)

[Limit]: 0.24mm (0.0094in.)



KCRF151B

Fig. 34: Inspecting Camshaft End Play
Courtesy of HYUNDAI MOTOR CO.

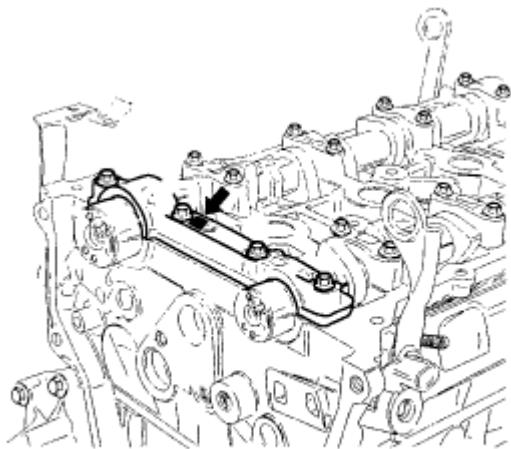
If the end play is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

3. Remove the camshafts.

Exhaust Cam Shaft Bearing

1. Check the cylinder head bore mark.

Location Of Cylinder Head Bore Mark



SNFEM8060D

Fig. 35: Locating Cylinder Head Bore Mark
Courtesy of HYUNDAI MOTOR CO.

Discrimination Of Cylinder Head

DISCRIMINATION OF CYLINDER HEAD

2010 Hyundai Sonata GLS

2010 ENGINE Cylinder Head Assembly (Engine (G4KE - GSL 2.4)) - Sonata

Class	Mark	Exhaust No. 1 Inside Diameter Of Cylinder Head Bore
a	A	40.000 ~ 40.008 mm (1.5748 ~ 1.5751 in.)
b	B	40.008 ~ 40.016 mm (1.5751 ~ 1.5754 in.)
c	C	40.016 ~ 40.024 mm (1.5754 ~ 1.5757 in.)

2. Select class of camshaft bearing same as class of cylinder head as shown on the table below.

Place Of Exhaust Cam Shaft Bearing Identification Mark

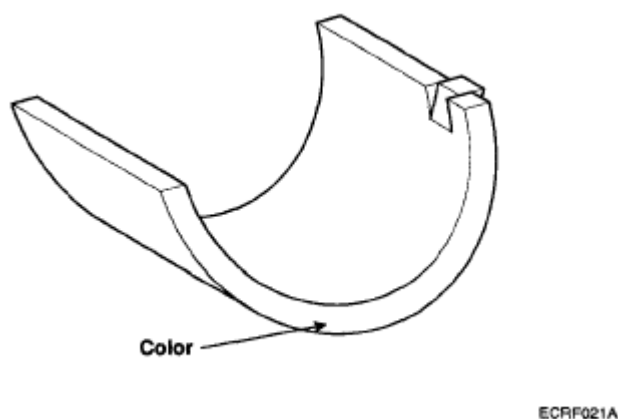


Fig. 36: Identifying Exhaust Cam Shaft Bearing Identification Mark
Courtesy of HYUNDAI MOTOR CO.

Discrimination Of Exhaust Camshaft Bearing

DISCRIMINATION OF EXHAUST CAMSHAFT BEARING

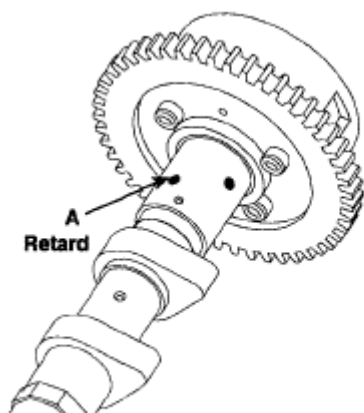
Cylinder Head Bore Class	Bearing Class For Installing (Color)	Thickness Of Bearing
a (A)	C (Green)	1.996~2.000mm (0.0785~0.0787in.)
b (B)	B (None color)	2.000~2.004mm (0.0787~0.0788in.)
c (C)	A (Black)	2.004~2.008mm (0.0788~0.0790in.)

Oil clearance : 0 ~ 0.032mm (0 ~ 0.0012in.)

CVVT Assembly

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

Verify the hold to tape and the hole to put air in.



ECRF015A

Fig. 37: Identifying Retard Hole
Courtesy of HYUNDAI MOTOR CO.

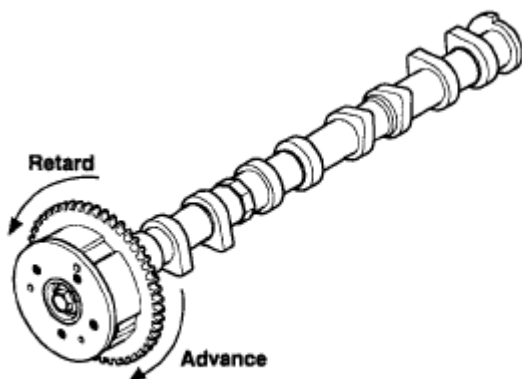
3. Wind tape around the tip of the air gun and apply air of approx. 150kpa (1.5kgf/cm² , 21psi) to the port of the camshaft.

(Perform this in order to release the lock pin.)

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

4. With air applied, as in step (3), turn the CVVT assembly to the advance angle side (the arrow marked direction in the illustration) with your hand.

Depending on the air pressure, the CVVT assembly will turn to the advance side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.



ECRF016A

Fig. 38: Identifying Retard And Advance Direction
Courtesy of HYUNDAI MOTOR CO.

5. Turn the CVVT assembly back and forth and check the movable range and that there is no disturbance.

Standard:

Should move smoothly in a range from about

22.5° (Intake)/20.0° (Exhaust)

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

INSPECTION (REVISED)**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 0.05mm(0.002in.)

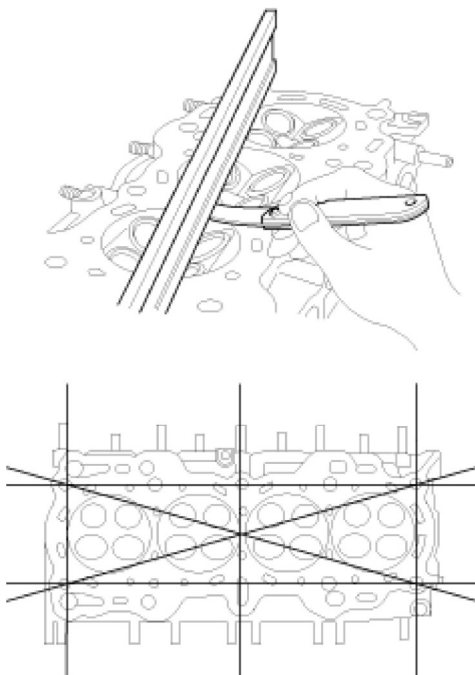


Fig. 39: Checking Flatness Of Cylinder Head Gasket Surface
Courtesy of HYUNDAI MOTOR CO.

2. Inspect for cracks.

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

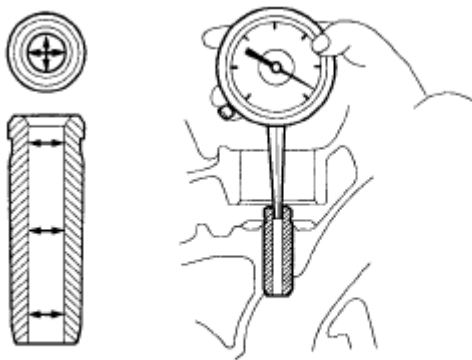
Valve And Valve Spring

1. Inspect valve stems and valve guides.

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

Valve guide I.D.

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



ECKD219A

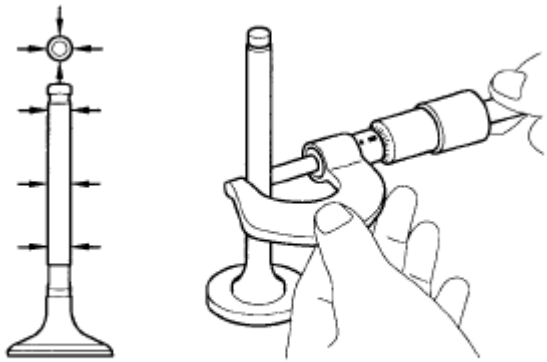
Fig. 40: Measuring Inside Diameter Of Valve Guide
Courtesy of HYUNDAI MOTOR CO.

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

Valve stem O.D.

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

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



ECKD220A

Fig. 41: Measuring Diameter Of Valve Stem
Courtesy of HYUNDAI MOTOR CO.

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

Valve stem-to-guide clearance

[Standard]

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

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

[Limit]

Intake : 0.07mm (0.0027in.)

Exhaust : 0.09mm (0.0035in.)

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

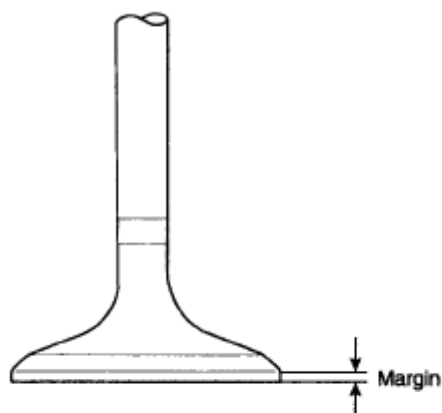
2. Inspect valves.
 1. Check the valve is ground to the correct valve face angle.
 2. Check that the surface of the valve for wear.
 3. If the valve face is worn, replace the valve.

Margin

[Standard]

Intake : 1.02mm(0.0401in.)

Exhaust : 1.09mm(0.0429in.)



ECKD221A

Fig. 42: Identifying Valve Head Margin Thickness
Courtesy of HYUNDAI MOTOR CO.

4. Check the valve length.

Valve length

[Standard]

Intake : 113.18mm (4.456in.)

Exhaust : 105.84mm (4.167in.)

[Limit]

Intake : 112.93mm (4.446in.)

Exhaust : 105.59mm (4.157in.)

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

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

3. Inspect valve seats

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

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

4. Inspect valve springs.

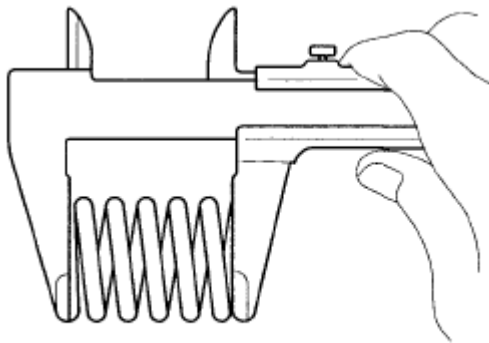
1. Using a steel square, measure the out-of-square of the valve spring.
2. Using a vernier calipers, measure the free length of the valve spring.

Valve spring

[Standard]

Free height : 47.44mm (1.8677in.)

Out-of-square : 1.5°



ECKD222A

Fig. 43: Measuring Free Length Of Valve Spring
Courtesy of HYUNDAI MOTOR CO.

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

MLA**1. Inspect MLA.**

Using a micrometer, measure the MLA outside diameter.

MLA O.D.

Intake/Exhaust :

31.964~31.980mm(1.2584 ~ 1.2590in.)

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

Intake/Exhaust :

32.000~32.025mm(1.2598 ~ 1.2608in.)

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

MLA to tappet bore clearance

[Standard]

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

[Limit]

Intake/Exhaust : 0.07mm(0.0027in.)

Camshaft

1. Inspect cam lobes.

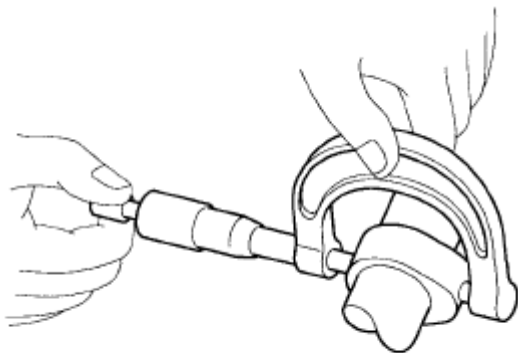
Using a micrometer, measure the cam lobe height.

Cam height

[Standard value]

Intake : 44.10 ~ 44.30mm (1.7362 ~ 1.7440in.)

Exhaust : 44.90 ~ 45.10mm (1.7677 ~ 1.7756in.)



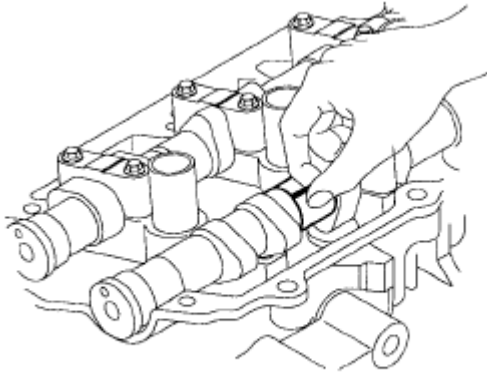
ECKD223A

Fig. 44: Measuring Cam Lobe Height
Courtesy of HYUNDAI MOTOR CO.

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

2. Inspect camshaft journal clearance.

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



ECKD224A

Fig. 45: Laying Strip Of Plastigage Across Of Camshaft Journal
Courtesy of HYUNDAI MOTOR CO.

4. Install the bearing caps.

CAUTION: Do not turn the camshaft.

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

Bearing oil clearance

[Standard value]

Intake

No. 1 journal : 0.022 ~ 0.057mm (0.0008 ~ 0.0022in.)

No. 2,3,4,5, journal :

0.030 ~ 0.067mm (0.0012 ~ 0.0026in.)

Exhaust

No. 1 journal : 0 ~ 0.032mm (0 ~ 0.0012in.)

No. 2,3,4,5, journal :

0.030 ~ 0.067mm (0.0012 ~ 0.0026in.)

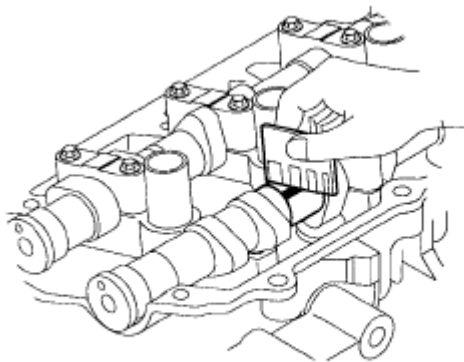
[Limit] :

Intake

No. 1 journal : 0.09mm (0.0035in.)

No. 2,3,4,5 journal : 0.10m (0.0039in.)

Exhaust : 0.10m (0.0039in.)



ECKD225A

Fig. 46: Measuring Plastigage At Widest Point
Courtesy of HYUNDAI MOTOR CO.

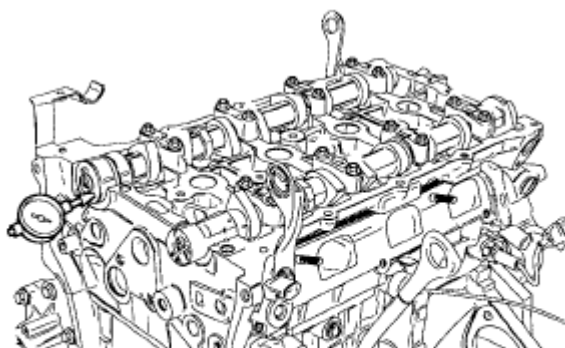
If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

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

Camshaft end play

[Standard value] : 0.04 ~ 0.16mm(0.0015 ~ 0.0062in.)

[Limit] : 0.24mm (0.0094in.)



KCRF151B

Fig. 47: Inspecting Camshaft End Play
Courtesy of HYUNDAI MOTOR CO.

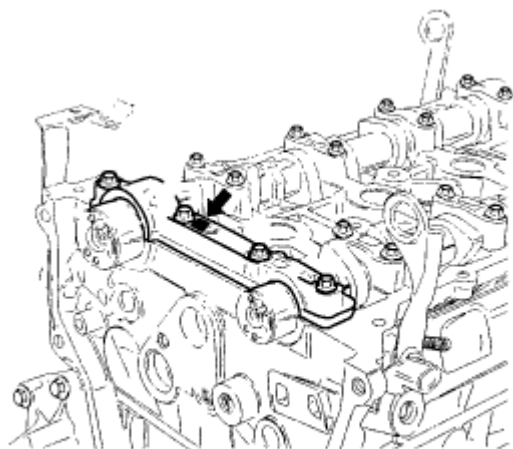
If the end play is greater than maximum, replace the camshaft. If necessary, replace cylinder head.

3. Remove the camshafts.

Exhaust Cam Shaft Bearing

1. Check the cylinder head bore mark.

Location Of Cylinder Head Bore Mark



SNFEM8060D

Fig. 48: Locating Cylinder Head Bore Mark
Courtesy of HYUNDAI MOTOR CO.

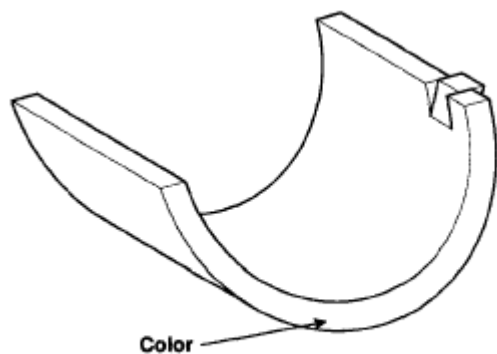
Discrimination Of Cylinder Head

Class	Mark	Exhaust No. 1 Inside Diameter Of
-------	------	-------------------------------------

		Cylinder Head Bore
a	A	40.000 ~ 40.008 mm (1.5748 ~ 1.5751 in.)
b	B	40.008 ~ 40.016 mm (1.5751 ~ 1.5754 in.)
c	C	40.016 ~ 40.024 mm (1.5754 ~ 1.5757 in.)

2. Select class of camshaft bearing same as class of cylinder head as shown on the table below.

Place Of Exhaust Cam Shaft Bearing Identification Mark



ECRF021A

Fig. 49: Identifying Exhaust Cam Shaft Bearing Identification Mark
Courtesy of HYUNDAI MOTOR CO.

Discrimination Of Exhaust Camshaft Bearing

Cylinder Head Bore Class	Bearing Class For Installing (Color)	Thickness Of Bearing
a (A)	C (Green)	1.996~2.000mm (0.0785~0.0787in.)
b (B)	B (None color)	2.000~2.004mm (0.0787~0.0788in.)
c (C)	A (Black)	2.004~2.008mm (0.0788~0.0790in.)

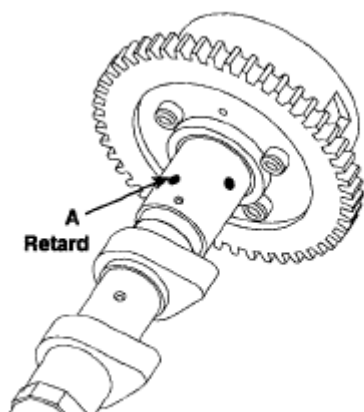
Oil clearance : 0 ~ 0.032mm (0 ~ 0.0012in.)

CVVT Assembly

1. Inspect CVVT assembly.

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

Verify the hold to tape and the hole to put air in.



ECRF015A

Fig. 50: Identifying Retard Hole
Courtesy of HYUNDAI MOTOR CO.

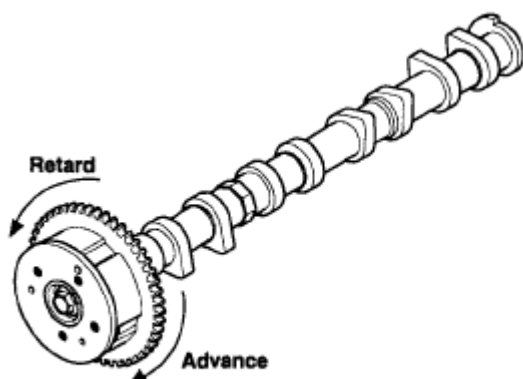
3. Wind tape around the tip of the air gun and apply air of approx. 150kpa(1.5kgf/cm, 21psi) to the port of the camshaft.

(Perform this in order to release the lock pin.)

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

4. With air applied, as in step(3), turn the CVVT assembly to the advance angle side (the arrow marked direction in the illustration) with your hand.

Depending on the air pressure, the CVVT assembly will turn to the advance side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.



ECRF016A

Fig. 51: Identifying Retard And Advance Direction
 Courtesy of HYUNDAI MOTOR CO.

5. Turn the CVVT assembly back and forth and check the movable range and that there is no disturbance.

Standard:

Should move smoothly in a range from about 22.5° (Intake) / 20.0° (Exhaust)

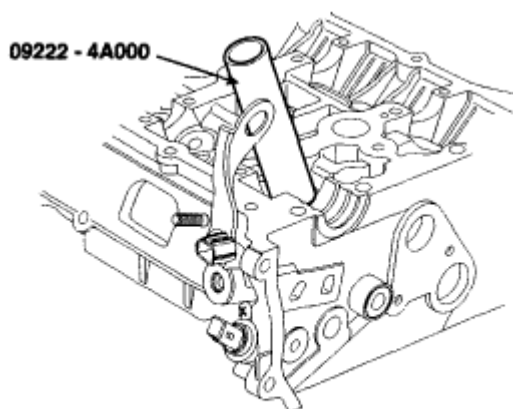
6. Turn the CVVT assembly with your hand and lock it at the maximum delay angle position (counter clockwise).

REASSEMBLY

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

1. Install valves.
 1. Using SST (09222-4A000), push in a new oil seal.

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



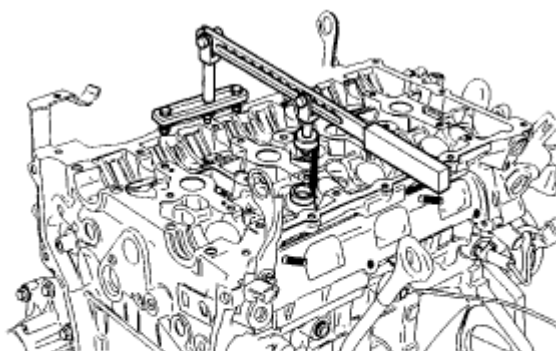
ACLG015A

Fig. 52: Pushing Oil Seal
Courtesy of HYUNDAI MOTOR CO.

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

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

3. Using the SST (09222-3K000, 09222-3K100), 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.



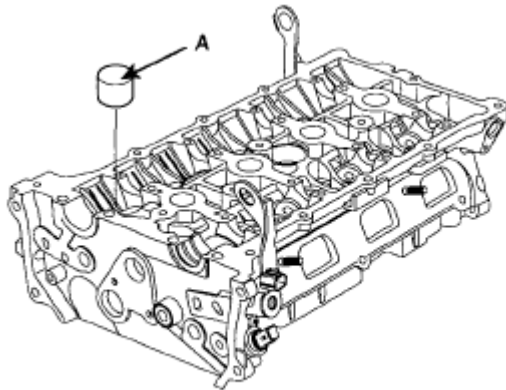
SNFEM8087L

Fig. 53: Compressing Spring
Courtesy of HYUNDAI MOTOR CO.

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

2. Install MLAs.

Check that the MLA rotates smoothly by hand.



KCRF125A

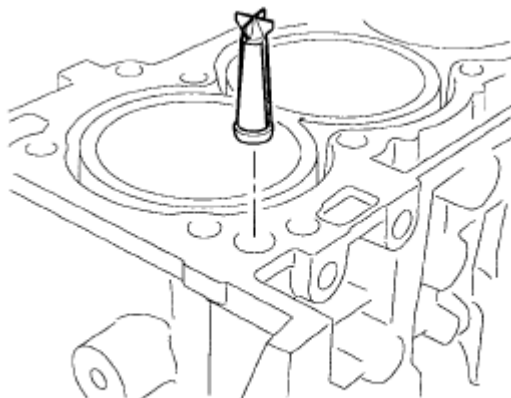
Fig. 54: Identifying MLAs
Courtesy of HYUNDAI MOTOR CO.

NOTE: MLA can be reinstalled in its original position.

INSTALLATION

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

1. Install OCV filter.



KCRF176A

Fig. 55: Identifying OCV Filter
Courtesy of HYUNDAI MOTOR CO.

CAUTION: Keep the OCV filter clean.

2. Install the cylinder head gasket (A) on the cylinder block.

NOTE:

- Be careful of the installation direction.
- Apply liquid gasket (Loctite 5900H) on the mark (B).
- After applying sealant, assemble the cylinder head in five minutes.

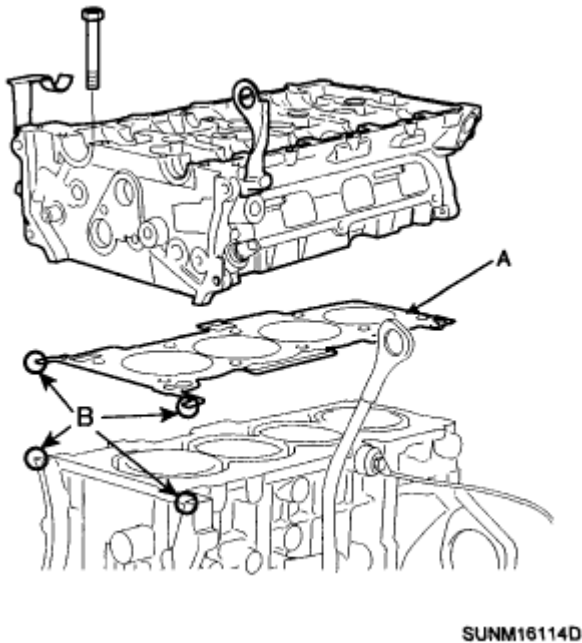
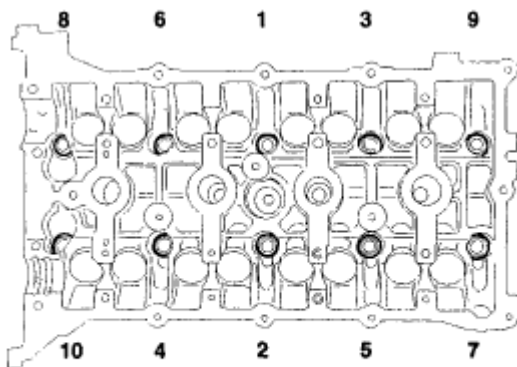


Fig. 56: Identifying Cylinder Head Gasket
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque:

34.3N.m (3.5kgf.m, 25.3lb-ft) + 90° + 90°



SNFEM8086L

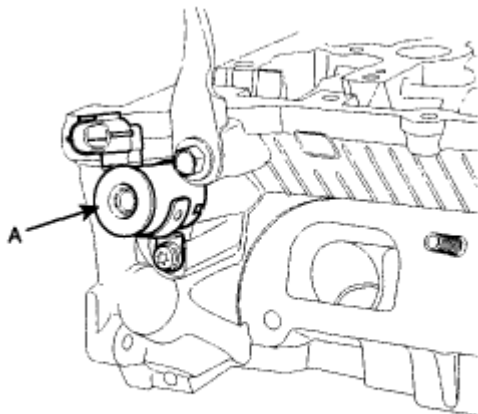
Fig. 57: Identifying Cylinder Head Bolts In Sequence
Courtesy of HYUNDAI MOTOR CO.

NOTE: Always use new cylinder head bolt.

5. Install the OCV (A).

Tightening torque:

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



SNFEM8058D

Fig. 58: Identifying OCV
Courtesy of HYUNDAI MOTOR CO.

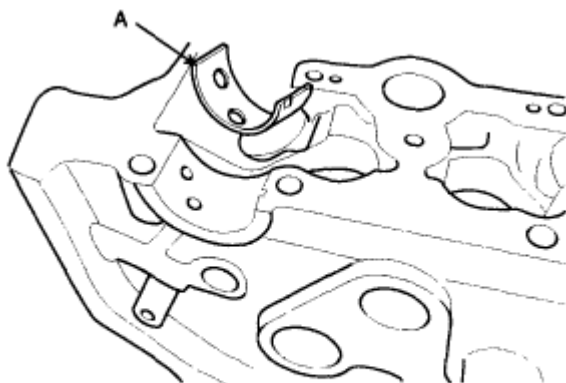
- CAUTION:**
- Do not reuse the OCV when dropped.
 - Keep the OCV filter clean.
 - Do not hold the OCV sleeve during servicing.

- When the OCV is installed on the engine, do not move the engine with holding the OCV yoke.

6. Install the camshafts.

NOTE: Apply a light coat of engine oil on camshaft journals.

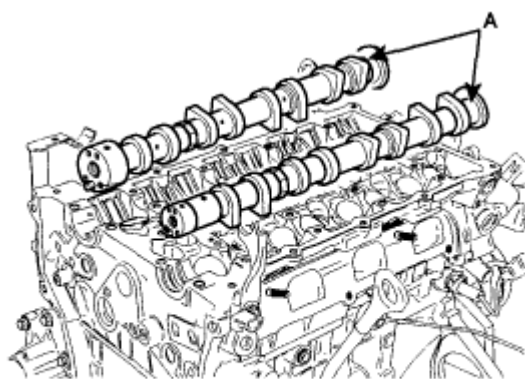
- a. Install the exhaust camshaft lower bearing (A).



SNFEM8057D

Fig. 59: Identifying Exhaust Camshaft Lower Bearing
Courtesy of HYUNDAI MOTOR CO.

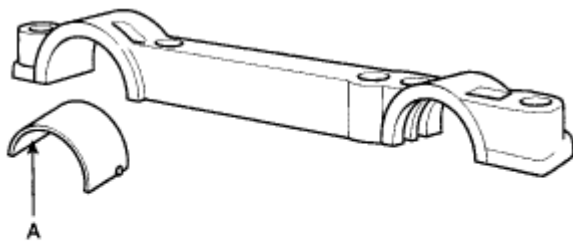
- b. Install the camshafts (A).



SNFEM8056D

Fig. 60: Identifying Camshafts
Courtesy of HYUNDAI MOTOR CO.

- c. Install the exhaust camshaft upper bearing (A).



SNFEM8016D

Fig. 61: Identifying Exhaust Camshaft Upper Bearing
Courtesy of HYUNDAI MOTOR CO.

- d. Install camshaft bearing caps in their proper locations.

Tightening order.

Group A --> Group B --> Group C.

Tightening torque

Step 1

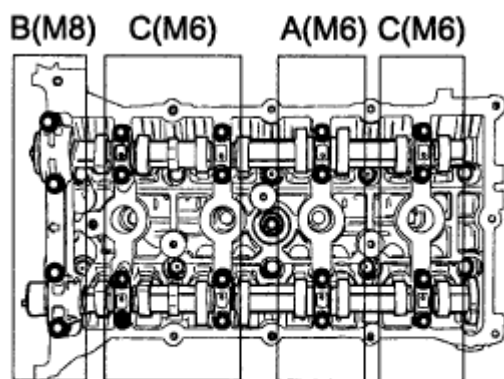
M6 : 5.9N.m (0.6kgf.m, 4.3lb-ft)

M8 : 14.7N.m (1.5kgf.m, 10.8lb-ft)

Step 2

M6 : 10.8 ~ 12.7N.m (1.1 ~ 1.3kgf.m, 7.9 ~ 9.4lb-ft)

M8 : 27.5 ~ 31.4N.m (2.8 ~ 3.2kgf.m, 20.3 ~ 23.1lb-ft)



SUNM16115D

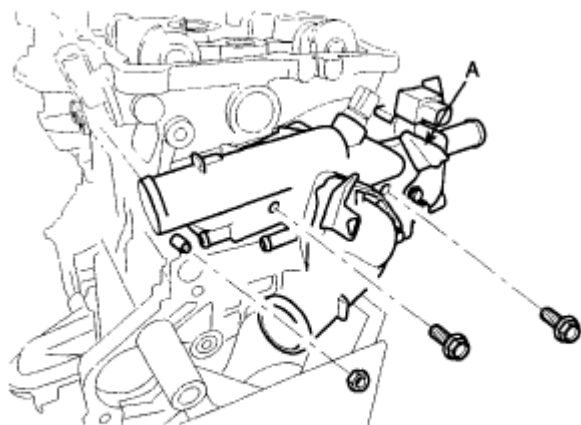
Fig. 62: Identifying Camshaft Bearing Caps
Courtesy of HYUNDAI MOTOR CO.

7. Install the water temp control assembly (A).

Tightening torque:

Bolts & Nut:

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



SNFEM8010D

Fig. 63: Identifying Water Temp Control Assembly
Courtesy of HYUNDAI MOTOR CO.

CAUTION:

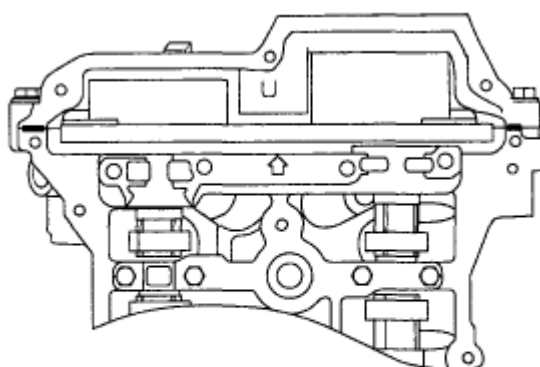
- Assemble water temp control assembly and water inlet pipe to water pump assembly before nuts for assembling of water inlet pipe to be tightened.

- **Always use a new O-ring.**

8. Install the timing chain.
9. Check and adjust valve clearance.
10. Install the cylinder head cover.
 - a. The hardening sealant located on the upper area between timing chain cover and cylinder head should be removed before assembling cylinder head cover.
 - b. After applying sealant, it should be assembled within 5 minutes.

Bead width : 2.5mm (0.1in.)

Sealant : LOCTITE 5900H



SNFEM8045D

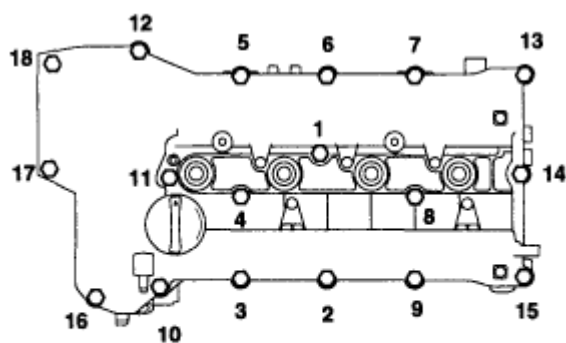
Fig. 64: Identifying Sealant Location
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque:

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

Step 2 : 7.8 ~ 9.8N.m (0.8 ~ 1.0kgf.m, 5.8 ~ 7.2lb-ft)

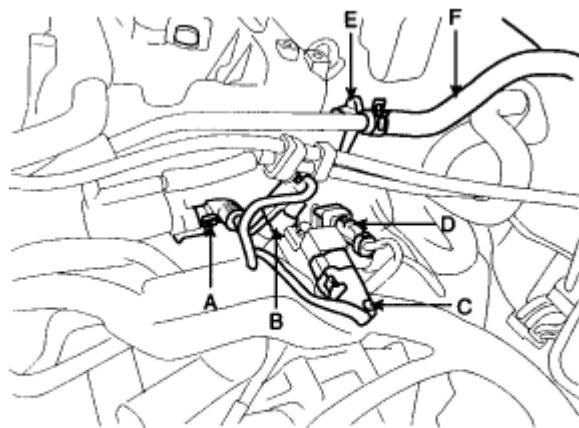


SNFEM8046D

Fig. 65: Identifying Cylinder Head Cover Bolts In Sequence
Courtesy of HYUNDAI MOTOR CO.

CAUTION: Do not reuse cylinder head cover gasket.

11. Install the intake & exhaust manifold. (Refer to **INTAKE AND EXHAUST SYSTEM (ENGINE (G4KE - GSL 2.4))**)
12. Connect the PCSV connector (A), ECT connector (B), condenser connector (C), CKP sensor connector (D), CMP sensor connector (E) and brake booster vacuum hose (F).

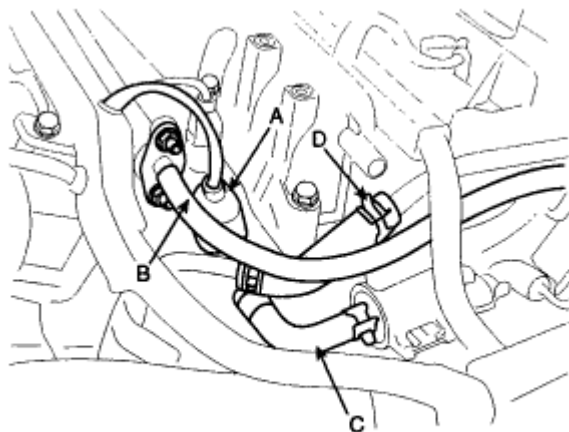


SNFEM8008D

Fig. 66: Identifying PCSV Connector, ECT Connector, Condenser Connector, CKP Sensor Connector, CMP Sensor Connector And Brake Booster Vacuum Hose
Courtesy of HYUNDAI MOTOR CO.

13. Connect the front O2 sensor connector and rear O2 sensor connector.
14. Connect the brake booster vacuum hose (D), PCSV hose (C) fuel hose (B) and CMP sensor connector

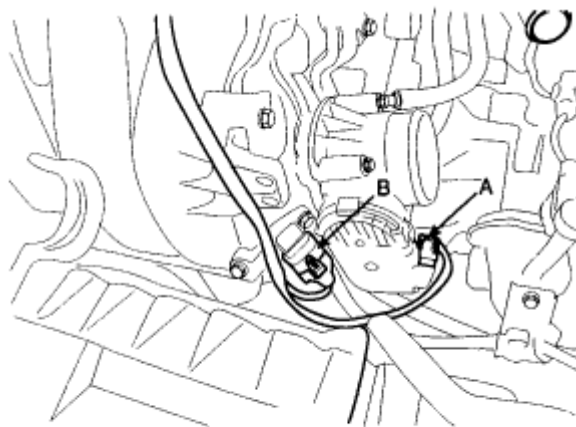
(A).



SNFEM8068D

Fig. 67: Identifying Brake Booster Vacuum Hose, PCSV Hose, Fuel Hose And CMP Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

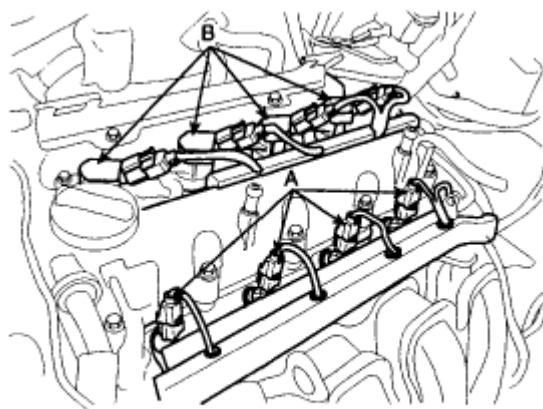
15. Connect the ETC connector (A) and MAP sensor connector (B).



SNFEM8007D

Fig. 68: Identifying ETC Connector And MAP Sensor Connector
Courtesy of HYUNDAI MOTOR CO.

16. Connect the injector connectors (A) and ignition coil connectors (B).



SNFEM8005D

Fig. 69: Identifying Injector Connectors And Ignition Coil Connectors
Courtesy of HYUNDAI MOTOR CO.

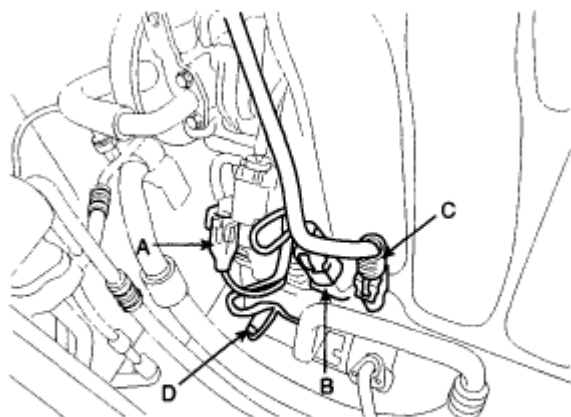
17. Connect the OCV connector (A).



SNFEM8032D

Fig. 70: Identifying OCV Connector
Courtesy of HYUNDAI MOTOR CO.

18. Connect the VIS connector (A), OPS connector (B), knock sensor connector (C) and A/C switch connector (D).

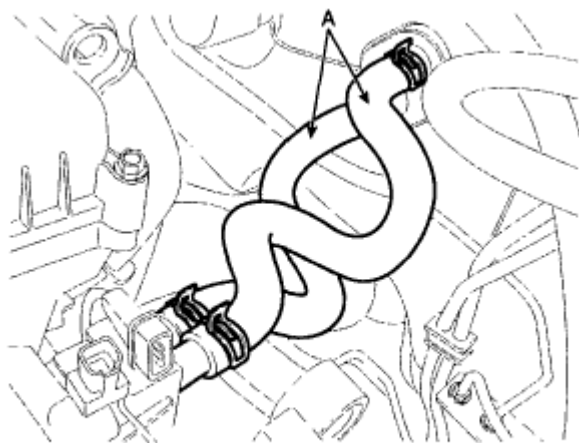


SNFEM8006D

Fig. 71: Identifying VIS Connector, OPS Connector, Knock Sensor Connector And A/C Switch Connector

Courtesy of HYUNDAI MOTOR CO.

19. Install the heater hoses (A).



ACLG003A

Fig. 72: Identifying Heater Hoses

Courtesy of HYUNDAI MOTOR CO.