

2010 ENGINE

General Information - Engine Mechanical - G3.5 DOHC - Santa Fe

SPECIFICATIONS

ENGINE MECHANICAL SYSTEM SPECIFICATIONS

Description		Specifications	Limit
General			
Type		V-type, DOHC	
Number of cylinders		6	
Bore		92mm (3.6220in.)	
Stroke		87.0mm (3.4252in.)	
Total displacement		3,470cc (211.75cu.in.)	
Compression ratio		10.6	
Firing order		1-2-3-4-5-6	
Valve timing			
Intake	Opens (ATDC)	10°	
	Closes (ABDC)	74°	
Exhaust	Opens (BBDC)	52°	
	Closes (ATDC)	0°	
Cylinder head			
Flatness of gasket surface		Less than 0.05mm (0.0019in.) [Less than 0.02mm (0.0008in.)/150x150]	
Flatness of manifold mounting	Intake	Less than 0.1mm (0.0039in.) [Less than 0.03mm (0.001in.)/110x110]	
	Exhaust	Less than 0.1mm (0.0039in.) [Less than 0.03mm (0.001in.)/110x110]	
Camshaft			
Cam height	LH Camshaft	Intake	47.2mm (1.8582in.)
		Exhaust	45.8mm (1.8031in.)
	RH Camshaft	Intake	47.2mm (1.8582in.)
		Exhaust	45.8mm (1.8031in.)
Journal outer diameter	LH, RHcamshaft	Intake	No. 1: 27.964 ~ 27.978mm (1.1009 ~ 1.1015in.) No. 2,3,4: 23.954 ~ 23.970mm (0.9430 ~ 0.9437in.)
			No. 1: 27.964 ~ 27.978mm

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		Exhaust	(1.1009 ~ 1.1015in.) No. 2,3,4: 23.954 ~ 23.970mm (0.9430 ~ 0.9437in.)	
Bearing oil clearance	LH, RHCamshaft	Intake	No. 1: 0.027 ~ 0.057mm (0.0011 ~ 0.0022in.) No. 2,3,4: 0.030 ~ 0.067mm (0.0012 ~ 0.0026in.)	
		Exhaust	No. 1: 0.027 ~ 0.057mm (0.0011 ~ 0.0022in.) No. 2,3,4: 0.030 ~ 0.067mm (0.0012 ~ 0.0026in.)	
End play			0.02 ~ 0.18mm (0.0008 ~ 0.0071in.)	
Valve				
Valve length	Intake		105.27mm (4.1445in.)	
	Exhaust		105.50mm (4.1535in.)	
Stem outer diameter	Intake		5.465 ~ 5.480mm (0.2151 ~ 0.2157in.)	
	Exhaust		5.458 ~ 5.470mm (0.2149 ~ 0.2153in.)	
Face angle			45.25° ~ 45.75°	
Thickness of valve head (margin)	Intake		1.56 ~ 1.86mm (0.06142 ~ 0.07323in.)	
	Exhaust		1.73 ~ 2.03mm (0.06811 ~ 0.07992in.)	
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				
Inner diameter	Intake		5.500 ~ 5.512mm (0.2165 ~ 0.2170in.)	
	Exhaust		5.500 ~ 5.512mm (0.2165 ~ 0.2170in.)	
Length	Intake		41.8 ~ 42.2mm (1.6457 ~ 1.6614in.)	
	Exhaust		41.8 ~ 42.2mm (1.6457 ~ 1.6614in.)	
Valve seat				
Width of seat contact	Intake		1.15 ~ 1.45mm (0.05118 ~ 0.05709in.)	
	Exhaust		1.35 ~ 1.65mm (0.05315 ~ 0.06496in.)	

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Seat angle	Intake	44.75° ~ 45.20°	
	Exhaust	44.75° ~ 45.20°	
Valve spring			
Free length		45.5mm (1.7913in.)	
Load		19.3±0.8kg/34.0mm (42.7±1.8 lb/1.3386in.)	
		42.3±1.3kg/23.8mm (93.3±2.9 lb/0.9370in.)	
Out of squareness		Less than 1.5°	
MLA			
MLA outer diameter	Intake	34.964 ~ 34.980mm (1.3765 ~ 1.3772in.)	
	Exhaust	34.964 ~ 34.980mm (1.3765 ~ 1.3772in.)	
Cylinder head tappet bore inner diameter	Intake	35.000 ~ 35.025mm (1.3779 ~ 1.3789in.)	
	Exhaust	35.000 ~ 35.025mm (1.3779 ~ 1.3789in.)	
MLA to tappet bore clearance	Intake	0.020 ~ 0.061mm (0.0008 ~ 0.0024in.)	0.07mm (0.0027in.)
	Exhaust	0.020 ~ 0.061mm (0.0008 ~ 0.0024in.)	0.07mm (0.0027in.)
Valve clearance (At 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 block			
Cylinder bore		92.00 ~ 92.03mm (3.6220 ~ 3.6232in.)	
Flatness of gasket surface		Less than 0.05mm (0.0019in.) [Less than 0.02mm (0.0008in.)/150x150]	
Piston			
Piston outer diameter		91.96 ~ 91.99mm (3.6204 ~ 3.6216in.)	
Piston to cylinder clearance		0.03 ~ 0.05mm (0.0012 ~ 0.0020in.)	
Ring groove width	No. 1 ring groove	1.23 ~ 1.25mm (0.0484 ~ 0.0492in.)	
	No. 2 ring groove	1.23 ~ 1.25mm (0.0484 ~ 0.0492in.)	
		2.01 ~ 2.03mm (0.0791 ~	

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	Oil ring groove	0.0799in.)	
Piston ring			
Side clearance	No. 1 ring	0.04 ~ 0.08mm (0.0015 ~ 0.0031in.)	0.1mm (0.004in.)
	No. 2 ring	0.04 ~ 0.08mm (0.0015 ~ 0.0031in.)	0.1mm (0.004in.)
	Oil ring	0.06 ~ 0.15mm (0.0024 ~ 0.0059in.)	0.2mm (0.008in.)
End gap	No. 1 ring	0.17 ~ 0.32mm (0.0067 ~ 0.0126in.)	0.6mm (0.0236in.)
	No. 2 ring	0.37 ~ 0.52mm (0.0145 ~ 0.0204in.)	0.7mm (0.0275in.)
	Oil ring	0.20 ~ 0.50mm (0.0078 ~ 0.0196in.)	0.8mm (0.0315in.)
Piston pin			
Piston pin outer diameter		21.097 ~ 22.000mm (0.8305 ~ 0.8661in.)	
Piston pin hole inner diameter		22.004 ~ 22.010mm (0.8662 ~ 0.8665in.)	
Piston pin hole clearance		0.004 ~ 0.013mm (0.00015 ~ 0.00051in.)	
Connecting rod small end inner diameter		22.005 ~ 22.016mm (0.8663 ~ 0.8667in.)	
Connecting rod small end hole clearance		0.005 ~ 0.019mm (0.00019 ~ 0.00074in.)	
Connecting rod			
Connecting rod big end inner diameter		58.000 ~ 58.018mm (2.2834 ~ 2.2842in.)	
Connecting rod bearing oil clearance		0.038 ~ 0.056mm (0.0014 ~ 0.0022in.)	
Side clearance		0.1 ~ 0.25mm (0.0039 ~ 0.0098in.)	
Crankshaft			
Main journal outer diameter		68.942 ~ 68.960mm (2.7142 ~ 2.7149in.)	
Pin journal outer diameter		54.954 ~ 54.972mm (2.1635 ~ 2.1642in.)	
Main bearing oil clearance		0.022 ~ 0.040mm (0.0008 ~ 0.0016in.)	
End play		0.10 ~ 0.28mm (0.0039 ~ 0.0110in.)	
Oil pump			
Regulating pressure		400 ~ 450kPa (4.08 ~ 4.59kgf/cm ² , 58.01 ~	

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		65.27psi)	
Engine oil			
Oil quantity	Total	6.0 L (6.34 US qt, 5.28 imp.qt)	
	Oil pan	5.5 L (5.81 US qt, 4.84 imp.qt)	
	Drain and refill	5.2 L (5.49 US qt, 4.58 imp.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 <u>LUBRICATION SYSTEM</u> .
Oil pressure (at 1000rpm)		130kPa (1.32kgf/cm ² , 18.77psi) [at 1000rpm, 110°C (230°F)]	Oil temperature (oil pan): 110±2° C (230±35.6°F)
Cooling system			
Cooling method		Forced circulation with water pump	
Coolant quantity		8.3 L (8.8 us.qts, 7.3 imp.qts)	
Thermostat	Type	Wax pellet type	
	Opening temperature	82±2°C (179.6±35.6°F)	
	Fully opened temperature	95°C (203°F)	
	Full lift	10mm (0.3937in.) MIN	
Radiator cap	Main valve opening pressure	93.16 ~ 122.58kpa (0.95 ~ 1.25kg/cm ² , 13.51 ~ 17.78psi)	
	Vacuum valve opening pressure	0 ~ 6.86 kpa (0 ~ 0.07kg/cm ² , 0 ~ 0.99psi)	
Water temperature sensor			
Type		Thermister type	
Resistance	20°C (68°F)	2.31 ~ 2.59Kohms	
	80°C (176°F)	0.3222 Kohms	

TIGHTENING TORQUES

TIGHTENING TORQUE SPECIFICATIONS

Item	Quantity	Nm	kgf.m	lb-ft
Crankshaft pulley bolt	1	284.4 ~ 304.0	29.0 ~ 31.0	209.8 ~ 224.2

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Timing chain cover bolt B	17	18.6 ~ 21.6	1.9 ~ 2.2	13.7 ~ 15.9
Timing chain cover bolt C	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain cover bolt D	2	58.8 ~ 68.6	6.0 ~ 7.0	43.4 ~ 50.6
Timing chain cover bolt F	2	24.5 ~ 26.5	2.5 ~ 2.7	18.1 ~ 19.5
Timing chain cover bolt G	4	21.6 ~ 23.5	2.2 ~ 2.4	15.9 ~ 17.4
Timing chain cover bolt H	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain cover bolt I	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain cover bolt J	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain cover bolt K	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain cover bolt L	1	21.6 ~ 26.5	2.2 ~ 2.7	15.9 ~ 19.5
Timing chain auto tensioner bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain auto tensioner nut	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain auto tensioner arm bolt	2	18.6 ~ 21.6	1.9 ~ 2.2	13.7 ~ 15.9
Timing chain guide bolt	4	19.6 ~ 24.5	2.0 ~ 2.5	14.5 ~ 18.1
Oil pump chain cover bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pump chain tensioner bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pump chain guide bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pump chain sprocket bolt	1	18.6 ~ 21.6	1.9 ~ 2.2	13.7 ~ 15.9
Lower oil pan bolt	13	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Drive belt auto tensioner bolt (M12)	1	81.4 ~ 85.3	8.3 ~ 8.7	60.0 ~ 62.9
Drive belt auto tensioner bolt (M8)	1	17.7 ~ 21.6	1.8 ~ 2.2	13.0 ~ 15.9
Drive belt idler bolt	1	53.9 ~ 57.9	5.5 ~ 5.9	39.8 ~ 42.7
OCV (oil control valve) bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Cylinder head bolt	16	(37.3~41.2) + (118~122°) + (88~92°)	(3.8~4.2) + (118~122°) + (88~92°)	(27.5~30.4) + (118~122°) + (88~92°)
Cylinder head bolt	1	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
CVVT bolt	4	64.7 ~ 76.5	6.6 ~ 7.8	47.7 ~ 56.4
Camshaft bearing cap bolt	32	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Cylinder head cover bolt	38	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Connecting rod bolt	12	(17.7~21.6) +	(1.8~2.2) + (88~92°)	(13.0~15.9) +

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		(88~92°)		(88~92°)
Main bearing cap inner bolt (M11)	8	49.0 + 90°	5.0 + 90°	36.2 + 90°
Main bearing cap outer bolt (M8)	8	19.6 + 120°	2.0 + 120°	14.5 + 120°
Main bearing cap side bolt (M8)	8	29.4 ~ 31.4	3.0 ~ 3.2	21.7 ~ 23.1
Oil drain cover bolt	6	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil jet bolt	3	27.5 ~ 31.3	2.8 ~ 3.2	20.2 ~ 23.1
Rear oil seal case bolt	6	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Baffle plate bolt	6	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Upper oil pan bolt	16	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Knock sensor bolt	2	15.7 ~ 23.5	1.6 ~ 2.4	11.6 ~ 17.4
Drive plate bolt	8	71.54 ~ 75.46	7.3 ~ 7.7	52.80 ~ 55.69
Oil filter cap		24.5	2.5	18.1
Oil drain bolt	1	34.3 ~ 44.1	3.5 ~ 4.5	25.3 ~ 32.5
Oil pump bolt	3	20.6 ~ 22.6	2.1 ~ 2.3	15.2 ~ 16.6
Oil filter body bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil cover bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water pump bolt (Timing chain cover bolt L)	1	21.6 ~ 26.5	2.2 ~ 2.7	15.9 ~ 19.5
Water pump bolt (Timing chain cover bolt K)	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water pump bolt (Timing chain cover bolt G)	4	21.6 ~ 23.5	2.2 ~ 2.4	15.9 ~ 17.4
Water pump pulley bolt	4	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Water temp. control nut	4	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Water temp. control bolt	2	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Water inlet pipe bolt	3	16.7 ~ 19.6	1.7 ~ 2.0	12.3 ~ 14.5
Intake manifold bolt	6	26.5 ~ 31.4	2.7 ~ 3.2	19.5 ~ 23.1
Intake manifold nut	2	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Surge tank bolt (M6 x 36)	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Surge tank bolt (M6 x 128)	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Surge tank nut	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Surge tank stay bolt (M10 x 20)	2	27.5 ~ 31.4	2.8 ~ 3.2	20.3 ~ 23.1
Exhaust manifold nut	16	39.2 ~ 44.1	4.0 ~ 4.5	28.9 ~ 32.6
Exhaust manifold stay bolt	4	24.5 ~ 35.3	2.5 ~ 3.6	18.1 ~ 26.0
Heat protector bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Front muffler bolt	2	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8

Front muffler nut	4	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
Center muffler nut	2	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
Main muffler nut	2	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4
Air cleaner assembly bolt	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Intake air hose clamp bolt	1	2.9 ~ 4.9	0.3 ~ 0.5	2.2 ~ 3.6

REPAIR PROCEDURES

INSPECTION

Compression Pressure

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

1. Warm up engine until the normal operating temperature (80~95°C (176-203°F)).
2. Remove the surge tank. (Refer to **INTAKE AND EXHAUST SYSTEM**.)
3. Remove the ignition coil connectors (A) and ignition coils (B).

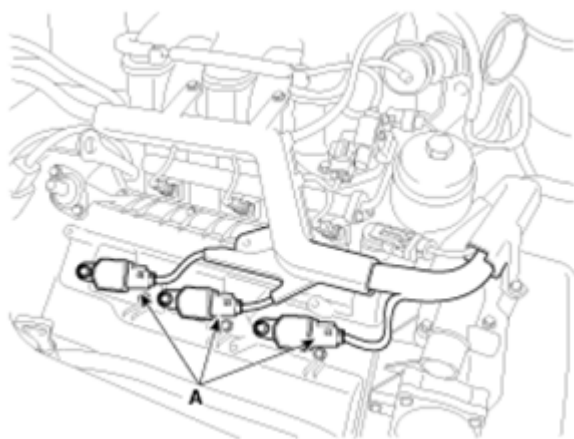


Fig. 1: Identifying Ignition Coil Connectors
Courtesy of HYUNDAI MOTOR CO.

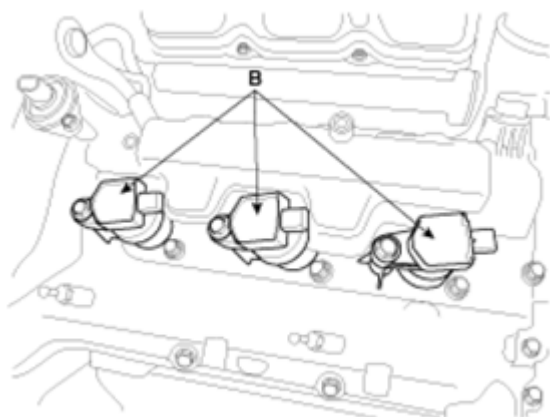


Fig. 2: Identifying Ignition Coils
Courtesy of HYUNDAI MOTOR CO.

4. Remove the spark plugs.

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

5. Check cylinder compression pressure.
 1. Insert a compression gauge into the spark plug hole.
 2. Fully open the throttle.
 3. Crank the engine over 7 times to measure compression pressure.

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

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

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

Compression pressure :

1,029kPa (10.5kgf/cm² , 149psi) (250~400 rpm)

Minimum pressure :

882kPa (9.0kgf/cm² , 128psi)

5. If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat step 1) through 3) for cylinders with low compression.
 - A. If adding oil helps the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.

- B. If pressure stays low, a valve may be sticking or seating is improper, or there may be leakage past the gasket.
6. Reinstall the spark plugs.
 7. Install the ignition coils and ignition connectors.
 8. Install the surge tank. (Refer to **INTAKE AND EXHAUST SYSTEM** .)

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.
2. Remove the engine side cover.
3. Remove air cleaner assembly.
4. Remove the surge tank. (Refer to **INTAKE AND EXHAUST SYSTEM** .)
5. Remove the cylinder head cover. (Refer to **TIMING SYSTEM** .)
6. Set No. 1 cylinder to TDC/compression.
 1. Turn the crankshaft pulley clockwise and align its groove with the timing mark "T" of the lower timing chain cover.

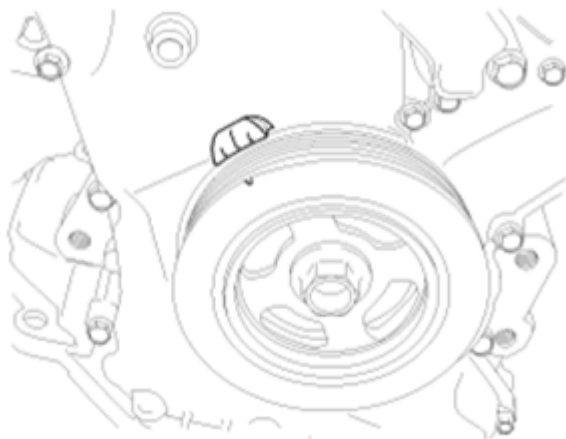


Fig. 3: Identifying Crankshaft Pulley Groove
Courtesy of HYUNDAI MOTOR CO.

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

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

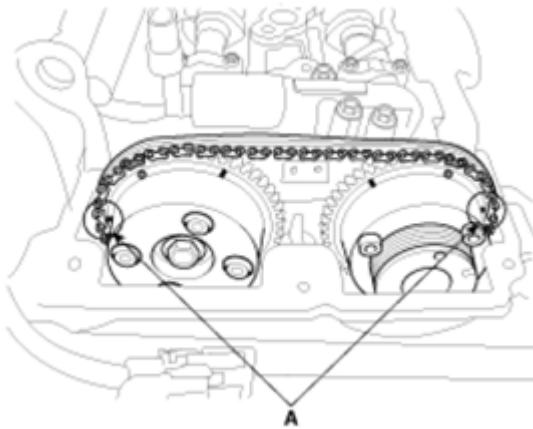


Fig. 4: Identifying Timing Mark On Camshaft Timing Sprockets
Courtesy of HYUNDAI MOTOR CO.

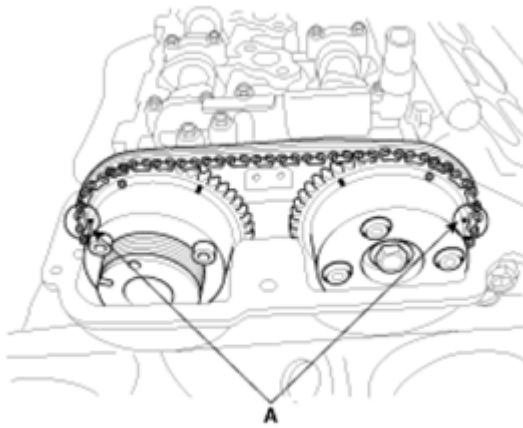


Fig. 5: Identifying Timing Mark On Camshaft Timing Sprocket
Courtesy of HYUNDAI MOTOR CO.

NOTE: Do not rotate engine counterclockwise.

7. Inspect the valve clearance.
 1. With No. 1 cylinder at TDC inspect clearances only on the valves shown in diagram below.

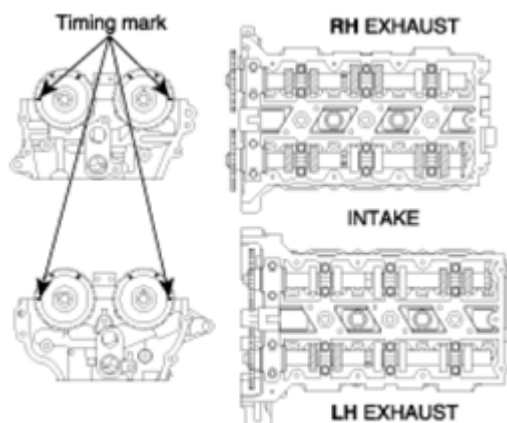


Fig. 6: Identifying Timing Marks And Valve Clearances (No. 1 Cylinder At TDC)
Courtesy of HYUNDAI MOTOR CO.

Measurement method.

- A. Using a thickness gauge, measure the clearance between the tappet and the base circle of camshaft.
- B. 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 (0.0078 ~ 0.0157in.)

2. Turn the crankshaft pulley clockwise one revolution (360°) and align the groove with timing mark "T" of the lower timing chain cover.
3. With No. 4 cylinder at TDC inspect clearances only the valves shown in diagram below. (Refer to procedure step 1.)

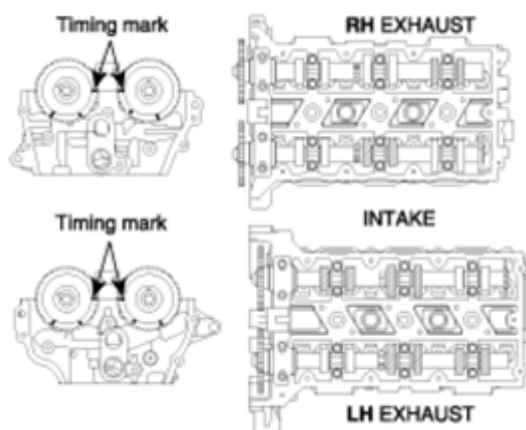


Fig. 7: Identifying Timing Marks And Valve Clearances (No. 4 Cylinder At TDC)
Courtesy of HYUNDAI MOTOR CO.

8. Adjust the intake and exhaust valve clearance.
 1. Set the No. 1 cylinder to the TDC/compression.
 2. Remove the timing chain.

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

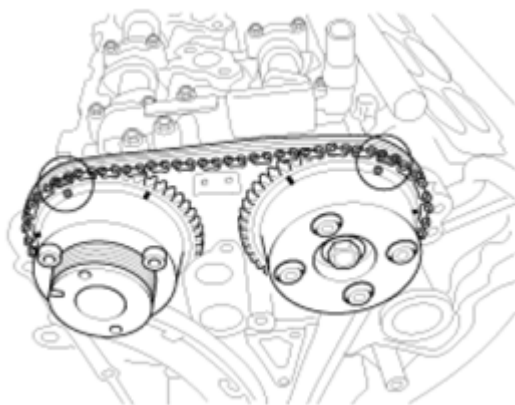


Fig. 8: Timing Chain And Sprocket Identification Mark (RH1)
Courtesy of HYUNDAI MOTOR CO.



Fig. 9: Timing Chain And Sprocket Identification Mark (RH2)
Courtesy of HYUNDAI MOTOR CO.



Fig. 10: Timing Chain And Sprocket Identification Mark (LH1)
Courtesy of HYUNDAI MOTOR CO.

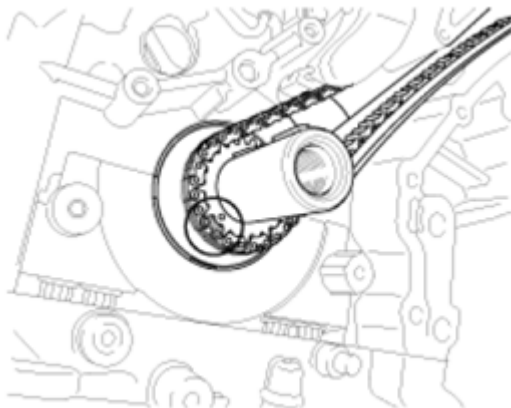


Fig. 11: Timing Chain And Sprocket Identification Mark (LH1)
Courtesy of HYUNDAI MOTOR CO.

3. Remove the LH/RH exhaust camshaft OCV (A).

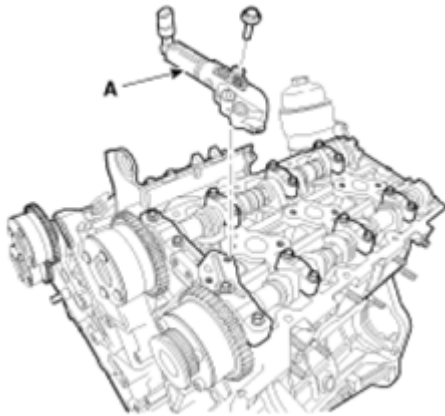


Fig. 12: Identifying LH Exhaust Camshaft OCV
Courtesy of HYUNDAI MOTOR CO.

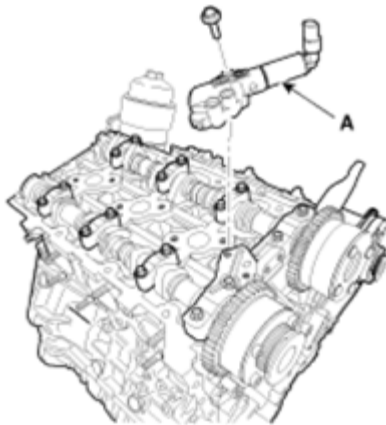


Fig. 13: Identifying RH Exhaust Camshaft OCV
Courtesy of HYUNDAI MOTOR CO.

4. Remove the LH/RH camshaft bearing cap (A) and thrust bearing cap (B).

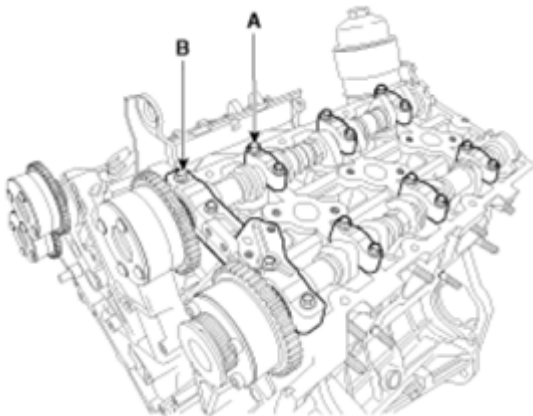


Fig. 14: Identifying LH Camshaft Bearing Cap And Thrust Bearing Cap

Courtesy of HYUNDAI MOTOR CO.

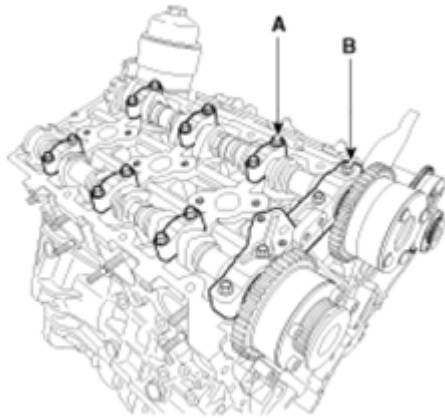


Fig. 15: Identifying RH Camshaft Bearing Cap And Thrust Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

5. Remove the LH/RH camshaft assembly (A).

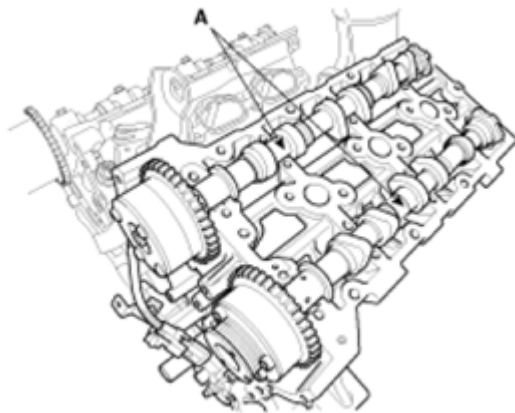


Fig. 16: Identifying LH Camshaft Assembly
Courtesy of HYUNDAI MOTOR CO.

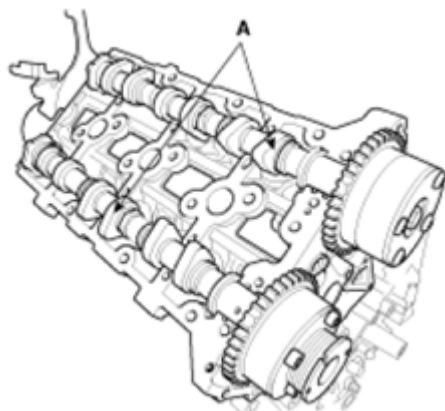


Fig. 17: Identifying RH Camshaft Assembly
Courtesy of HYUNDAI MOTOR CO.

6. Remove the MLA.
7. Measure the thickness of the removed tappet using a micrometer.

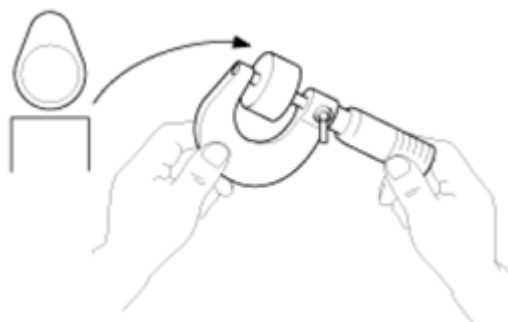


Fig. 18: Calculating New Tappet Thickness Using Screw Gauge
Courtesy of HYUNDAI MOTOR CO.

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

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

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

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

10. Place a new tappet on the cylinder head.

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

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

and camshaft sprocket timing marks (A).

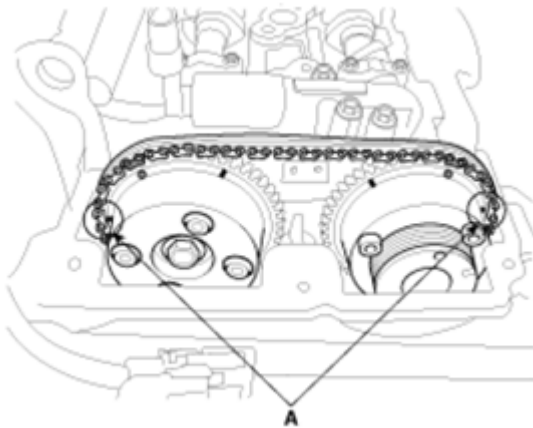


Fig. 19: Identifying Crankshaft Sprocket And Camshaft Sprocket Timing Marks
Courtesy of HYUNDAI MOTOR CO.

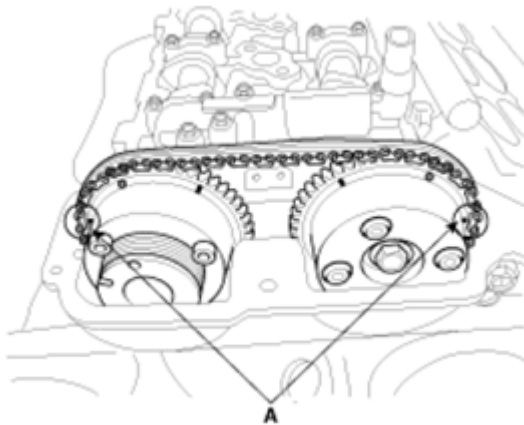


Fig. 20: Identifying Crankshaft Sprocket And Camshaft Sprocket Timing Marks
Courtesy of HYUNDAI MOTOR CO.

15. Recheck the valve clearance.

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

[Specification]

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

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

TROUBLESHOOTING

ENGINE MECHANICAL SYSTEM TROUBLESHOOTING

2010 Hyundai Santa Fe GLS

2010 ENGINE General Information - Engine Mechanical - G3.5 DOHC - Santa Fe

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

2010 Hyundai Santa Fe GLS

2010 ENGINE General Information - Engine Mechanical - G3.5 DOHC - Santa Fe

	Worn valve guides or valve stems.	Inspect the valves and valve guides, then repair as required.
	Stuck valves. Carbon on the valve stem or valve seat may cause the valve to stay open.	Inspect the valves and valve guides, then repair as required.
	Worn drive belt, idler, tensioner and bearing.	Replace as required.
Lower engine noise, regardless of engine speed.	Low oil pressure.	Repair as required.
	Loose or damaged drive plate.	Repair or replace the drive plate.
	Damaged oil pan, contacting the oil pump screen.	• Inspect the oil pan. • Inspect the oil pump screen. • Repair or replace as required.
	Oil pump screen loose, damaged or restricted.	• Inspect the oil pump screen. • Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	• Inspect the piston, piston pin and cylinder bore. • Repair as required.
	Excessive piston pin-to-piston clearance.	• Inspect the piston, piston pin and the connecting rod. • Repair or replace as required.
	Excessive connecting rod bearing clearance	Inspect the following components and repair as required. • The connecting rod bearings. • The connecting rods. • The crankshaft pin journals.
	Excessive crankshaft bearing clearance.	Inspect the following components, and repair as required. • The crankshaft bearings. • The crankshaft main journals. • The cylinder block.
	Incorrect piston, piston pin and connecting rod installation	• Verify the piston pins and connecting rods are installed correctly. • Repair as required.
	Low oil pressure	Repair or replace as required.
	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required: • The connecting rod bearings.

Engine noise under load.		• The connecting rods. • The crankshaft.
	Excessive crankshaft bearing clearance.	Inspect the following components, and repair as required. • The crankshaft bearings. • The crankshaft main journals. • The cylinder block.
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 bearing. 2. Repair as required.
	Bent or broken connecting rod.	1. Inspect connecting rods. 2. Repair as required.
	Broken crankshaft.	1. Inspect crankshaft. 2. Repair as required.

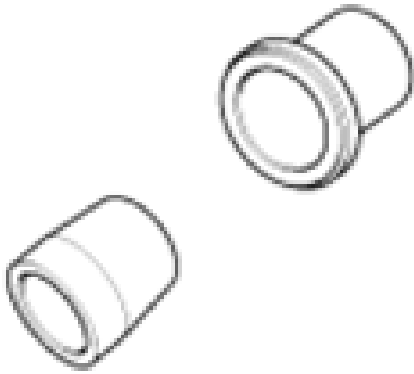
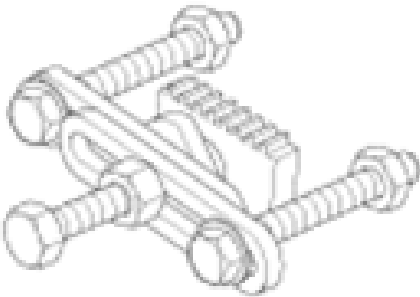
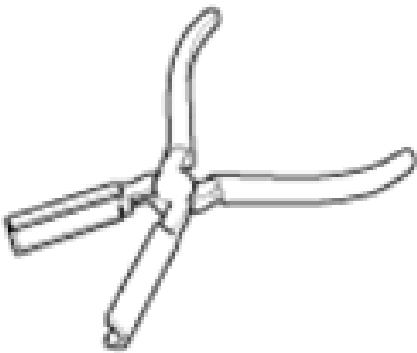
SPECIAL SERVICE TOOLS

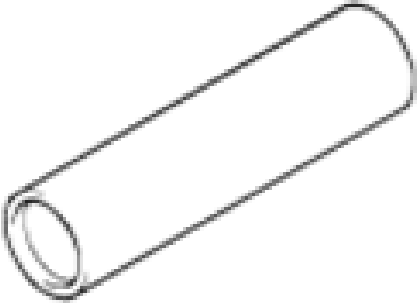
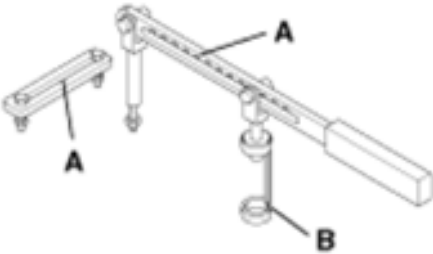
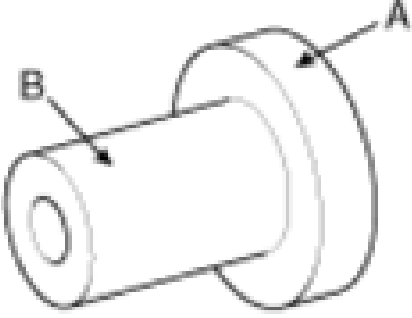
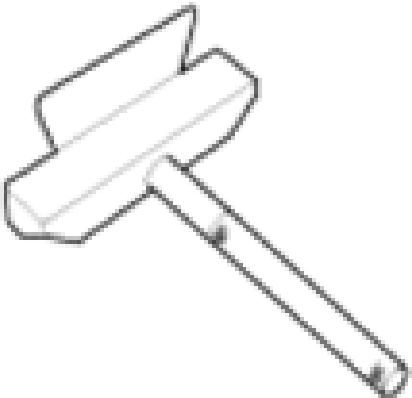
SPECIAL SERVICE TOOLS

Tool (Number and name)	Illustration	Use

2010 Hyundai Santa Fe GLS

2010 ENGINE General Information - Engine Mechanical - G3.5 DOHC - Santa Fe

Crankshaft front oil seal installer (09231-3C100)	 A technical drawing of a crankshaft front oil seal installer, which is a cylindrical tool with a flange at one end and a central hole.	Installation of the front oil seal
Flywheel stopper (09231-2B100)	 A technical drawing of a flywheel stopper, which is a T-shaped tool with a central body and two long, threaded rods extending from the ends.	Removal and installation of the flywheel and crankshaft pulley
Torque angle adapter (09221-4A000)	 A technical drawing of a torque angle adapter, which is a circular tool with a central hole and a series of small, evenly spaced holes around the perimeter.	Installation of bolts & nuts needing an angular method
Valve stem seal remover (09222-29000)	 A technical drawing of a valve stem seal remover, which is a tool with a central handle and four long, curved arms extending from the ends.	Removal of the valve stem seal

Valve stem seal installer (09222-3C100)		Installation of the valve stem seal
Valve spring compressor & holder (09222-3K000) (09222-3K100)		Removal and installation of the intake or exhaust valves A. 09222-3K000 B. 09222-3K100 (holder)
Crankshaft rear oil seal installer (09231-3C200) (09231-H1100)		Installation of the crankshaft rear oil seal A. 09231-3C200 B. 09231-H1100
Oil pan remover (09215-3C000)		Removal of oil pan

2010 ENGINE

Cylinder Block - G3.5 DOHC - Santa Fe

COMPONENTS AND COMPONENTS LOCATION

COMPONENTS

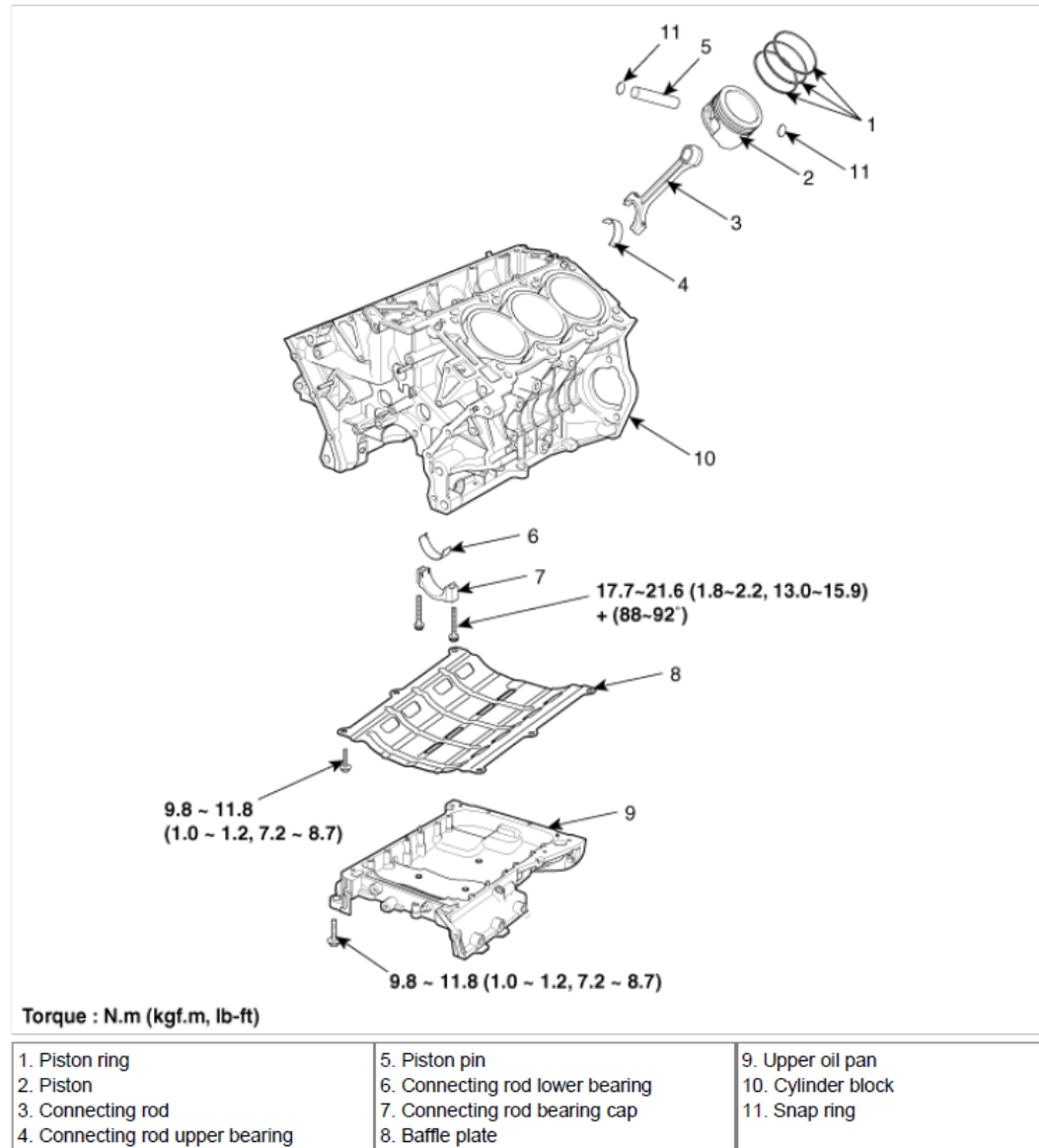


Fig. 1: Identifying Cylinder Block Components With Torque Specifications (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.

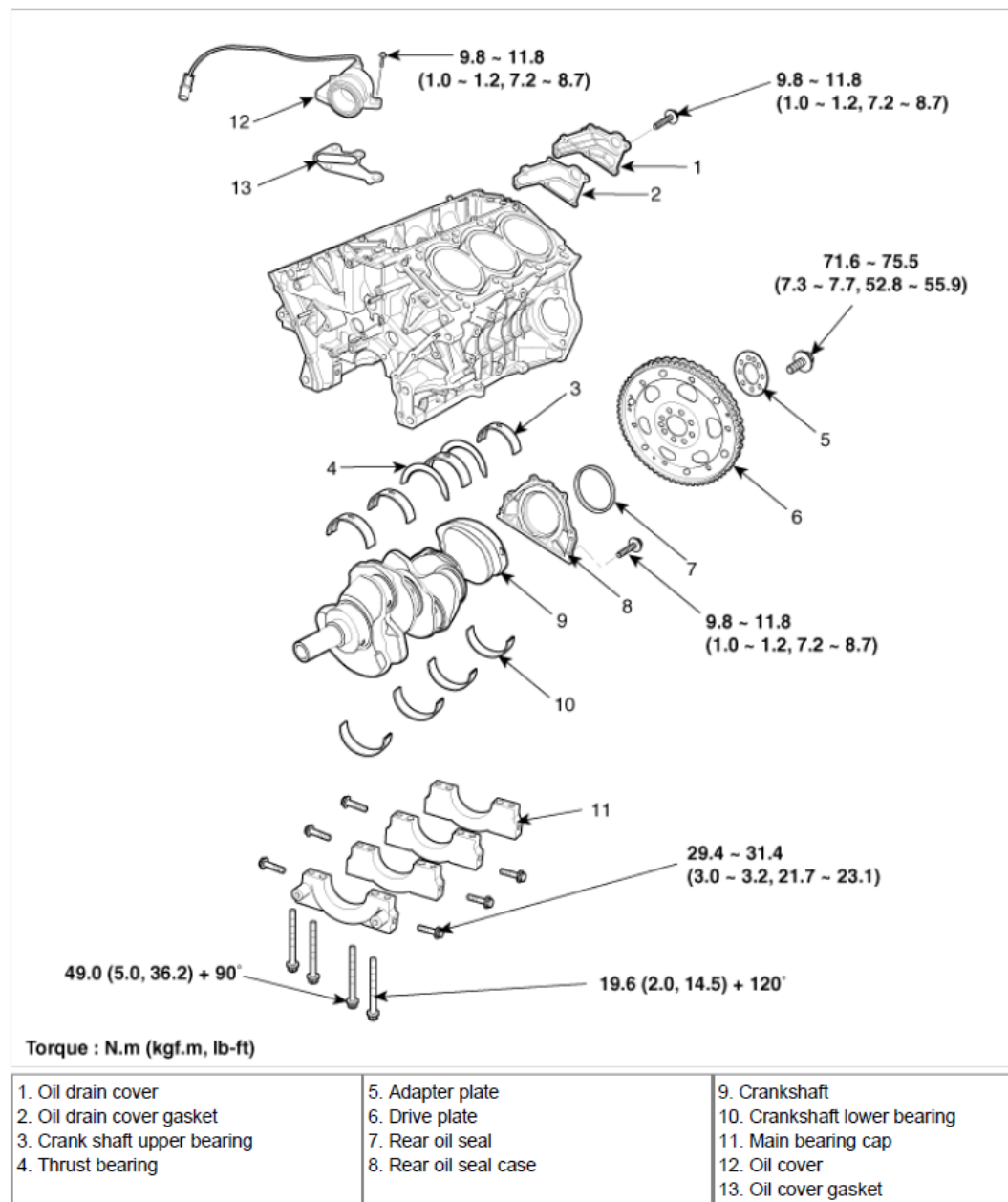


Fig. 2: Identifying Cylinder Block Components With Torque Specifications (2 Of 2)
 Courtesy of HYUNDAI MOTOR CO.

REPAIR PROCEDURES

DISASSEMBLY

CAUTION:

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

NOTE:

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

1. Remove the engine assembly from the vehicle. (Refer to ENGINE AND TRANSAXLE ASSEMBLY .)
2. Install the engine to engine stand for disassembly.
3. Remove the intake manifold and exhaust manifold. (Refer to INTAKE AND EXHAUST SYSTEM .)
4. Remove the timing chain. (Refer to TIMING SYSTEM .)
5. Remove the water temperature control assembly. (Refer to COOLING SYSTEM .)
6. Remove the cylinder head. (Refer to CYLINDER HEAD .)
7. Remove the oil pump. (Refer to LUBRICATION SYSTEM .)
8. Remove the oil filter assembly. (Refer to LUBRICATION SYSTEM .)
9. Remove the drive plate (A) and adapter plate (B).

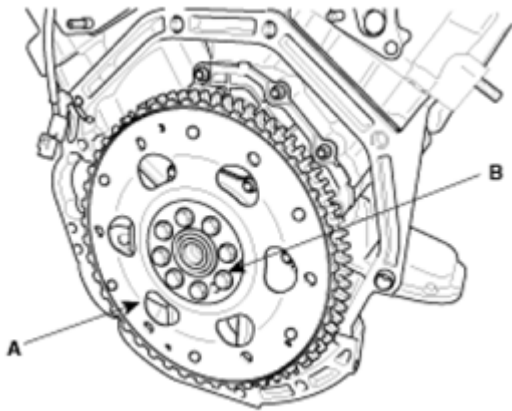


Fig. 3: Identifying Drive Plate And Adapter Plate
Courtesy of HYUNDAI MOTOR CO.

10. Remove the oil cover (A) and gasket (B).

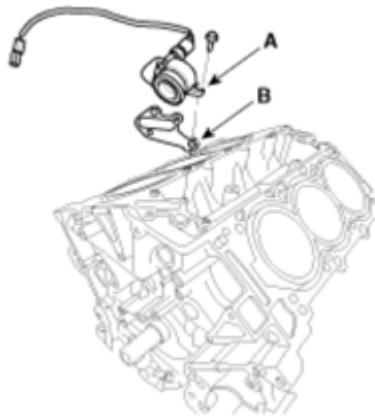


Fig. 4: Identifying Oil Cover And Gasket
Courtesy of HYUNDAI MOTOR CO.

11. Remove the knock sensor (A).

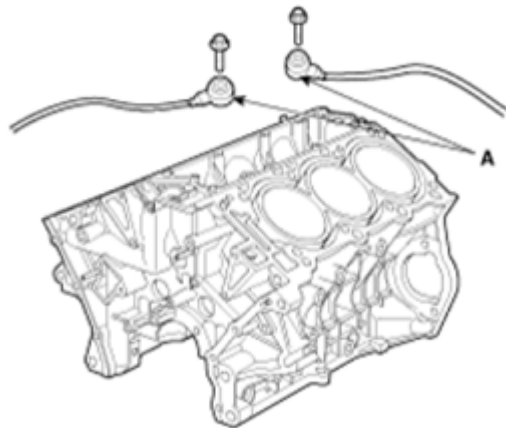


Fig. 5: Identifying Knock Sensor
Courtesy of HYUNDAI MOTOR CO.

12. Remove the upper oil pan (A).

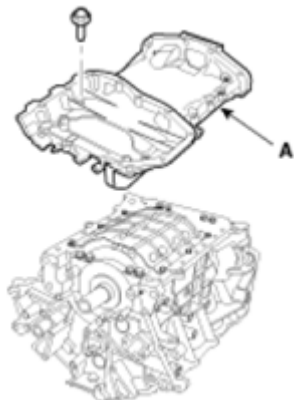


Fig. 6: Identifying Upper Oil Pan
Courtesy of HYUNDAI MOTOR CO.

13. Remove the baffle plate (A).

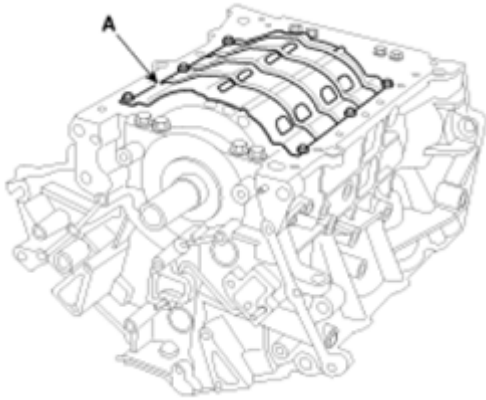


Fig. 7: Identifying Baffle Plate
Courtesy of HYUNDAI MOTOR CO.

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

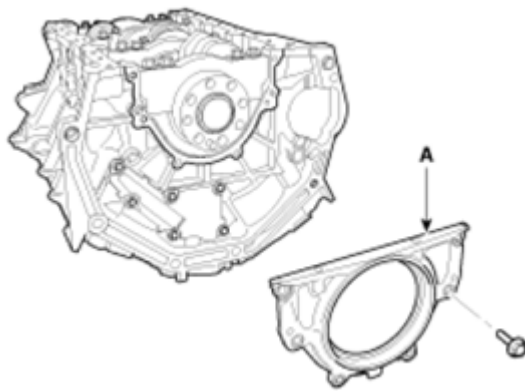


Fig. 8: Identifying Rear Oil Seal Case
Courtesy of HYUNDAI MOTOR CO.

15. Remove the oil drain cover (A) and gasket (B).

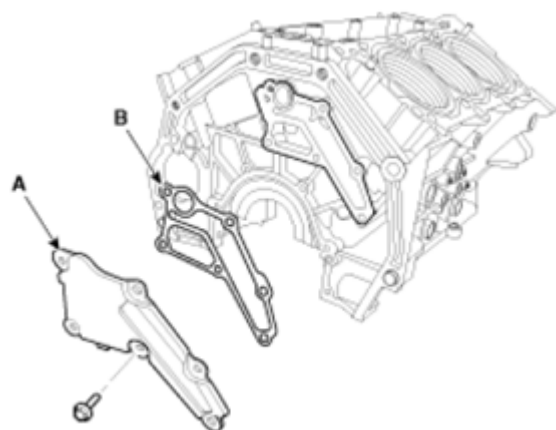


Fig. 9: Identifying Oil Drain Cover And Gasket
Courtesy of HYUNDAI MOTOR CO.

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

NOTE:

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

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

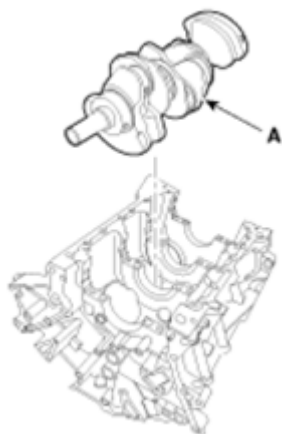


Fig. 10: Identifying Crankshaft
Courtesy of HYUNDAI MOTOR CO.

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

22. Remove the oil jets (A).



Fig. 11: Identifying Oil Jets
Courtesy of HYUNDAI MOTOR CO.

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

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

24. Disconnect the connecting rod from the piston.

Remove the snap ring at both ends of piston pin. And push the piston pin to separate and connecting rod.

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.)

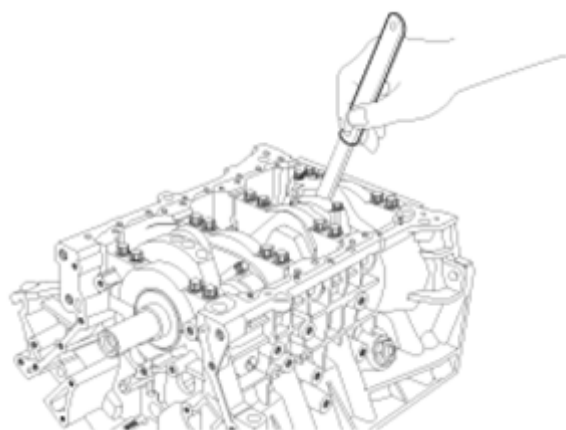


Fig. 12: Measuring End Play Using Feeler Gauge
 Courtesy of HYUNDAI MOTOR CO.

- 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

17.7~21.6N.m (1.8~2.2kgf.m, 13.0~15.9lb-ft) + (88~92°)

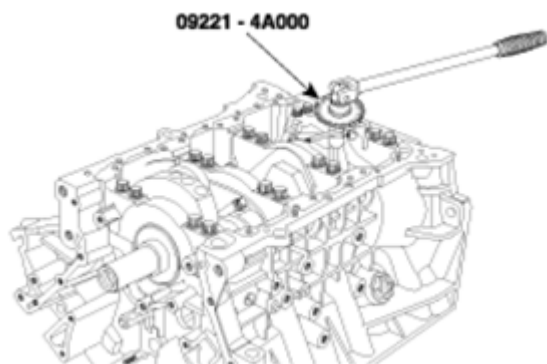


Fig. 13: Removing 2 Bolts, Connecting Rod Cap And Bearing Half
 Courtesy of HYUNDAI MOTOR CO.

NOTE: Do not turn the crankshaft.

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

Standard oil clearance

0.038 ~ 0.056mm (0.0015 ~ 0.0022in.)

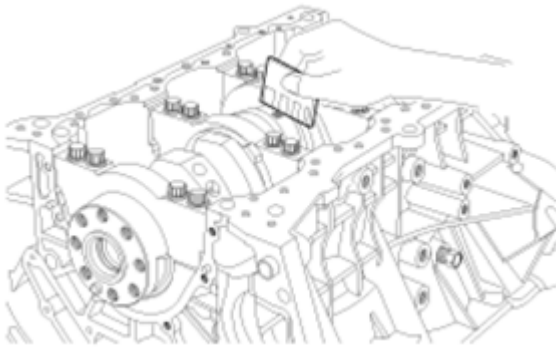


Fig. 14: Measuring Plastigage At Widest Point
Courtesy of HYUNDAI MOTOR CO.

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



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

Identification Of Connecting Rod

CONNECTING ROD IDENTIFICATION

Class	Mark	Inside Diameter
0	a	58.000 ~ 58.006mm (2.2834 ~ 2.2837in.)
1	b	58.006 ~ 58.012mm (2.2837 ~ 2.2839in.)
2	c	58.012 ~ 58.018mm (2.2839 ~ 2.2842in.)

Crankshaft Pin Mark Location

Identification Of Crankshaft

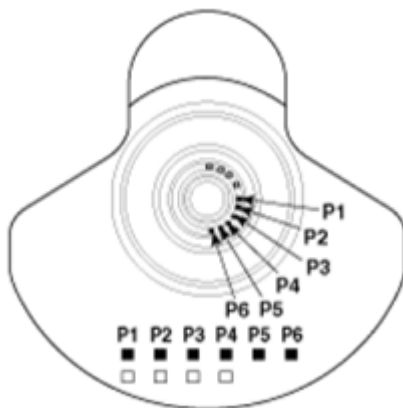


Fig. 16: Identifying Crankshaft Pins
Courtesy of HYUNDAI MOTOR CO.

Discrimination Of Crankshaft

CRANKSHAFT IDENTIFICATION

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2010 Hyundai Santa Fe GLS

2010 ENGINE Cylinder Block - G3.5 DOHC - Santa Fe

Class	Mark	Outside Diameter Of Pin
I	1 or A	54.966 ~ 54.972mm (2.1640 ~ 2.1642in.)
II	2 or B	54.960 ~ 54.966mm (2.1638 ~ 2.1640in.)
III	3 or C	54.954 ~ 54.960mm (2.1635 ~ 2.1638in.)

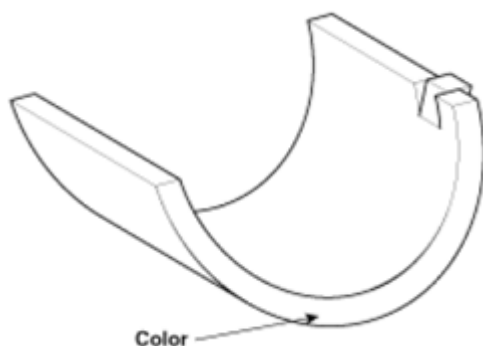
Place Of Identification Mark (Connecting Rod Bearing)

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

Identification Of Connecting Rod Bearing**CONNECTING ROD BEARING IDENTIFICATION**

Class	Mark	Thickness Of Bearing
E	Blue	1.514 ~ 1.517mm (0.0596 ~ 0.0597in.)
D	Black	1.511 ~ 1.514mm (0.0595 ~ 0.0596in.)
C	Brown	1.508 ~ 1.511mm (0.0594 ~ 0.0595in.)
B	Green	1.505 ~ 1.508mm (0.0593 ~ 0.0594in.)
A	Yellow	1.502 ~ 1.505mm (0.0591 ~ 0.0593in.)

(11) Selection

CONNECTING ROD COLOR IDENTIFICATION

		Connecting Rod Identification Mark		
		0 (a)	1 (b)	2 (c)
Crankshaft Identification Mark	1 or A	A (Yellow)	B (Green)	C (Brown)
	2 or B	B (Green)	C (Brown)	D (Black)
	3 or C	C (Brown)	D (Black)	E (Blue)

3. Check the connecting rod.

- When reinstalling, check the cylinder numbers on the connecting rods and the caps. When installing a new connecting rod, the notches for bearing fixing on the connecting rods and caps should face the same direction.
- If one or both edge of the connecting rod thrust surface is damaged, replace the rod. If the inner

surface of the rod is damaged or rough, also replace it.

3. Using a connecting rod aligner, measure the bent or torsion of the rod. If the measurement is near the specification, adjust the rod with a press. If the rod is bent or twisted excessively, replace it.

Allowable bend of connecting rod

0.05mm/100mm (0.0020in./3.9370in.)

Allowable twist of connecting rod

0.1mm/100mm (0.0039in./3.9370in.)

NOTE: When assembling the rod without a bearing, there should be no difference.

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

Tightening torque

49.0Nm (5.0 kgf.m, 36.2lb-ft) + 90°

19.6Nm (2.0 kgf.m, 14.5lb-ft)+ 120°

29.4 ~ 31.4Nm (3.0 ~ 3.2 kgf.m, 21.7 ~ 23.1lb-ft)

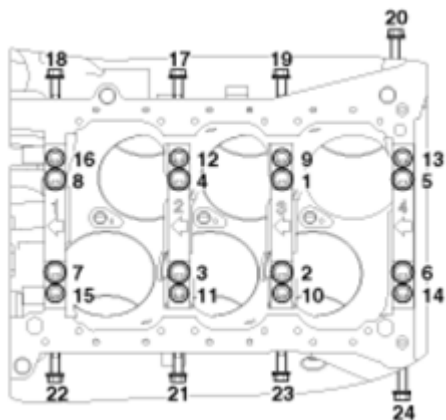


Fig. 18: Identifying Bearing Caps And Bolts
Courtesy of HYUNDAI MOTOR CO.

NOTE: Do not turn the crankshaft.

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

Standard oil clearance

0.022 ~ 0.040mm (0.0009 ~ 0.0016in.)

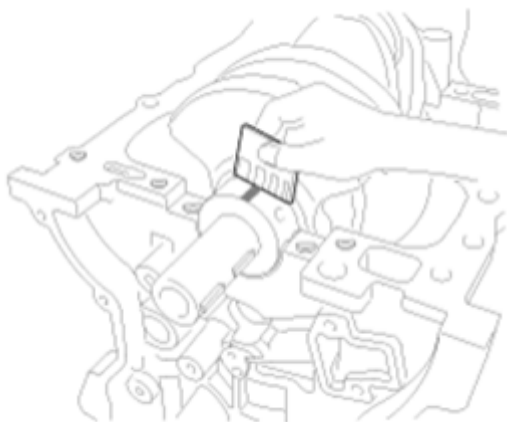


Fig. 19: Removing Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

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

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

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

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

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

Crankshaft bore mark location

Letters have been stamped on the block as a mark for the size of each of the 4 main journal bores.

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

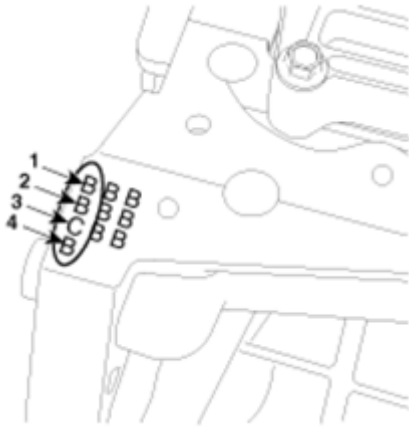


Fig. 20: Identifying Crankshaft Bore Mark Location
Courtesy of HYUNDAI MOTOR CO.

Discrimination Of Cylinder Block

CYLINDER BLOCK IDENTIFICATION

Class	Mark	Inside Diameter
a	A	73.500 ~ 73.506mm (2.8937 ~ 2.8939in.)
b	B	73.506 ~ 73.512mm (2.8939 ~ 2.8942in.)
c	C	73.512 ~ 73.518mm (2.8942 ~ 2.8944in.)

Crankshaft Journal Mark Location

Discrimination Of Crankshaft

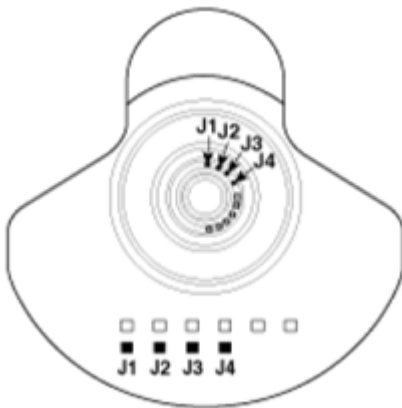


Fig. 21: Identifying Crankshaft Journal Mark Location
Courtesy of HYUNDAI MOTOR CO.

Discrimination Of Crankshaft

CRANKSHAFT IDENTIFICATION

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2010 Hyundai Santa Fe GLS

2010 ENGINE Cylinder Block - G3.5 DOHC - Santa Fe

Class	Mark	Outside Diameter Of Journal
I	1 or A	68.954 ~ 68.960mm (2.7147 ~ 2.7150in.)
II	2 or B	68.948 ~ 68.954mm (2.7145 ~ 2.7147in.)
III	3 or C	68.942 ~ 68.948mm (2.7142 ~ 2.7145in.)

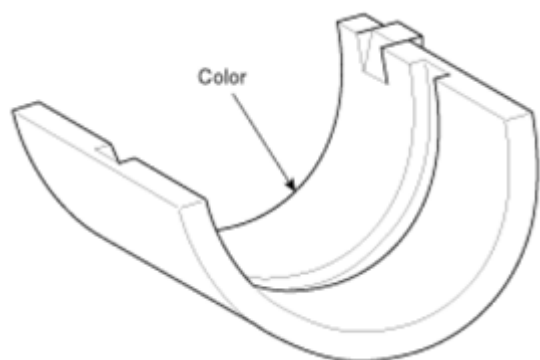
Place Of Identification Mark (Crankshaft Bearing)

Fig. 22: Identifying Crankshaft Bearing Mark
 Courtesy of HYUNDAI MOTOR CO.

Discrimination Of Crankshaft Bearing**CRANKSHAFT BEARING IDENTIFICATION**

Class	Mark	Thickness Of Bearing
E	Blue	2.277 ~ 2.280mm (0.0896 ~ 0.0897in.)
D	Black	2.274 ~ 2.277mm (0.0895 ~ 0.0896in.)
C	Brown	2.271 ~ 2.274mm (0.0894 ~ 0.0895in.)
B	Green	2.268 ~ 2.271mm (0.0893 ~ 0.0894in.)
A	Yellow	2.265 ~ 2.268mm (0.0892 ~ 0.0893in.)

Selection**CRANKSHAFT BORE IDENTIFICATION**

		Crankshaft Bore Identification Mark		
		a (A)	b (B)	c (C)
Crankshaft Identification Mark	1 or A	A (Yellow)	B (Green)	C (Brown)
	2 or B	B (Green)	C (Brown)	D (Black)
	3 or C	C (Brown)	D (Black)	E (Blue)

5. Check crankshaft end play.

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

Standard end play

0.10 ~ 0.28mm (0.0039 ~ 0.0110in.)

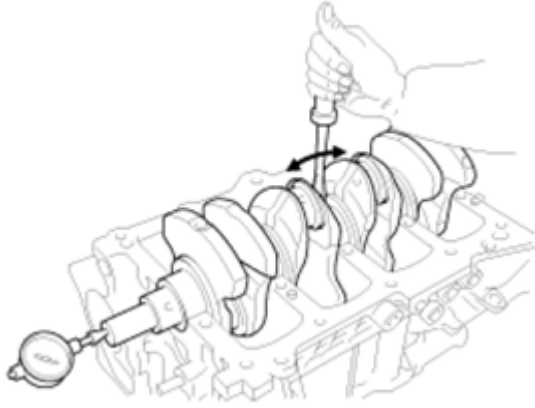


Fig. 23: Measuring Thrust Clearance Using Dial Indicator
Courtesy of HYUNDAI MOTOR CO.

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

Thrust bearing thickness

2.41 ~ 2.45mm (0.0949 ~ 0.0964in.)

6. Inspect main journals and crank pins

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

Main journal diameter :

68.942 ~ 68.960mm (2.7142 ~ 2.7149in.)

Crank pin diameter :

54.954 ~ 54.972mm (2.1635 ~ 2.1642in.)

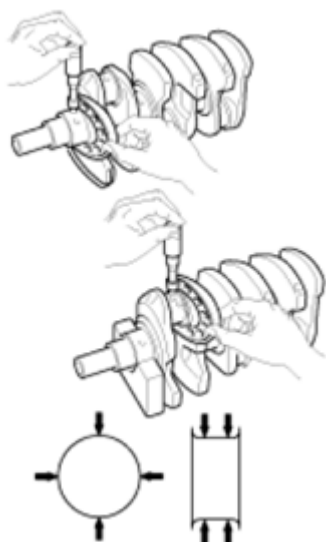


Fig. 24: Measuring Diameter Of Main Journal And Crank Pin Using Micrometer
Courtesy of HYUNDAI MOTOR CO.

Cylinder Block

1. Remove the gasket material.

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

2. Clean the cylinder block

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

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

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

Flatness of cylinder block gasket surface

Standard : Less than 0.05mm (0.0020 in.),

Less than 0.02mm (0.0008in.)/150 x 150

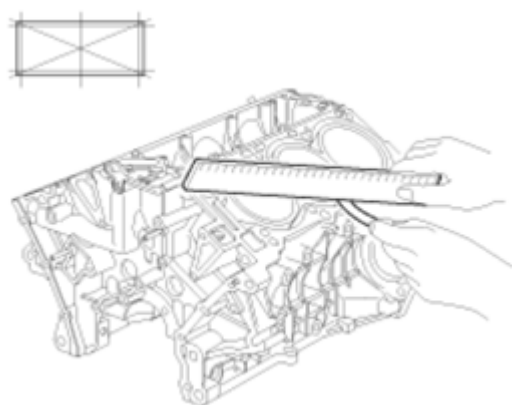


Fig. 25: Measuring Cylinder Head Gasket Surface Using Precision Straight Edge And Feeler Gauge
Courtesy of HYUNDAI MOTOR CO.

4. Inspect cylinder bore diameter

Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder block.

5. Inspect cylinder bore diameter

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

Standard diameter

92.00 ~ 92.03mm (3.6220 ~ 3.6232in.)

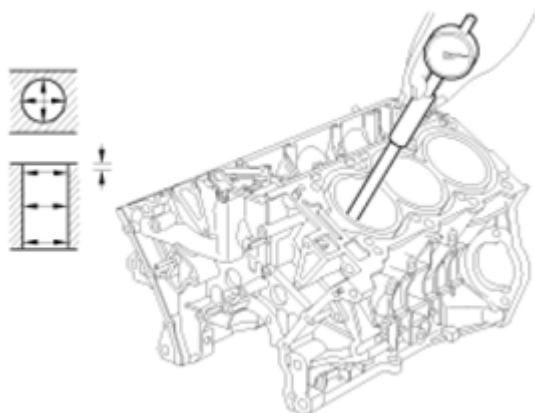


Fig. 26: Measuring Cylinder Bore Diameter Using Cylinder Bore Gauge
Courtesy of HYUNDAI MOTOR CO.

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

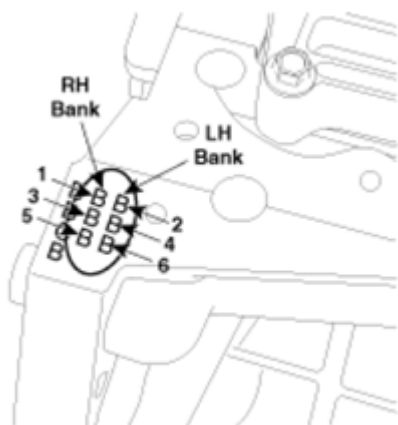


Fig. 27: Identifying Cylinder Bore Size Code
Courtesy of HYUNDAI MOTOR CO.

CYLINDER BORE SIZE CODES

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

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

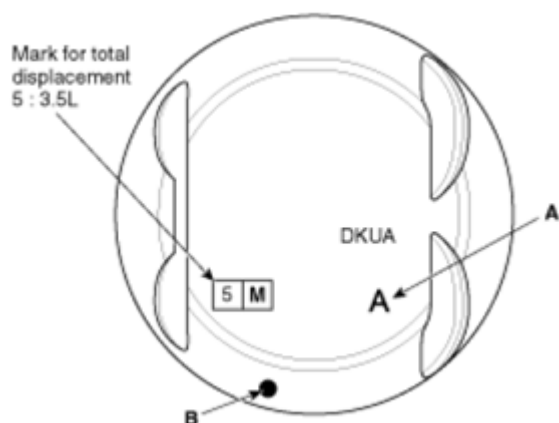


Fig. 28: Identifying Piston Size Code And Piston Top Face Mark
Courtesy of HYUNDAI MOTOR CO.

PISTON SIZE CODES

Class	Size code	Piston outer diameter
A	A	91.96 ~ 91.97mm (3.6204 ~ 3.6208in.)
B	B	91.97 ~ 91.98mm (3.6208 ~ 3.6212in.)
C	C	91.98 ~ 91.99mm (3.6212 ~ 3.6216in.)

8. Select the piston related to cylinder bore class.

Clearance : 0.03 ~ 0.05mm (0.0012 ~ 0.0020in.)

Boring Cylinder

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

BORING CYLINDER SIZE IDENTIFICATION

Identification Mark	Size
0.1	0.1 mm (0.004 in)
0.25	0.25 mm (0.010 in)

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

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

New bore size = piston O.D + 0.03 to 0.05mm (0.0012 to 0.0020in) (clearance between piston and cylinder) - 0.01mm (0.0004in) (honing margin.)

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

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

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

Standard : 0.03 ~ 0.05mm (0.0012 ~ 0.0020in)

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

Piston And Rings

1. Clean piston
 1. Using a gasket scraper, remove the carbon from the piston top.
 2. Using a groove cleaning tool, 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 12 mm (0.4724 in.) from the bottom of

the piston.

Standard diameter

91.96 ~ 91.99mm (3.6204 ~ 3.6216in.)

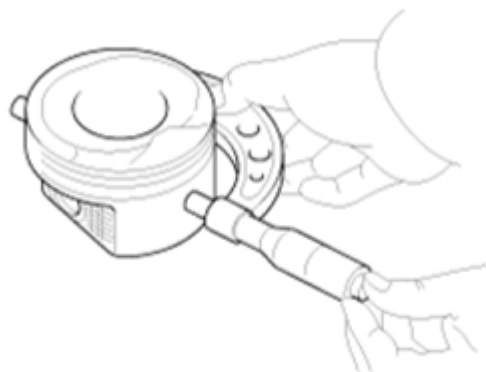


Fig. 29: Measuring Piston Outside Diameter And Cylinder Bore Diameter
Courtesy of HYUNDAI MOTOR CO.

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

Piston-to-cylinder clearance

0.03 ~ 0.05mm (0.0012 ~ 0.0020in.)

4. Inspect the piston ring side clearance.

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

Piston ring side clearance

Standard

No. 1 : 0.04 ~ 0.08mm (0.0015 ~ 0.0031in.)

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

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

Limit

No. 1 : 0.1mm (0.004in.)

No. 2 : 0.1mm (0.004in.)

Oil ring : 0.2mm (0.008in.)



Fig. 30: Inspecting Piston Ring Side Clearance Using Feeler Gauge
Courtesy of HYUNDAI MOTOR CO.

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

5. Inspect piston ring end gap.

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

Piston ring end gap

Standard

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

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

Oil ring : 0.20 ~ 0.50mm (0.0078 ~ 0.0196in.)

Limit

No. 1 : 0.6mm (0.0236in.)

No. 2 : 0.7mm (0.0275in.)

Oil ring : 0.8mm (0.0315in.)

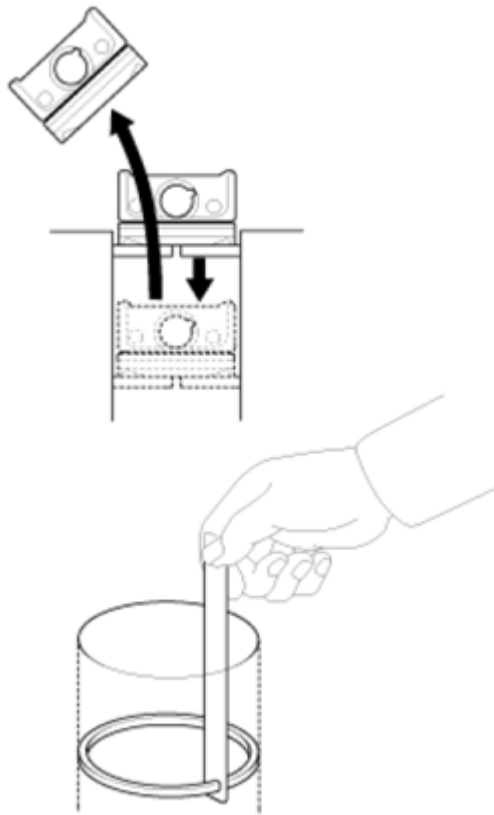


Fig. 31: Inspecting Piston Ring End Gap
Courtesy of HYUNDAI MOTOR CO.

Piston Pins

1. Measure the diameter of the piston pin.

Piston pin diameter

21.097 ~ 22.000mm (0.8305 ~ 0.8661in.)

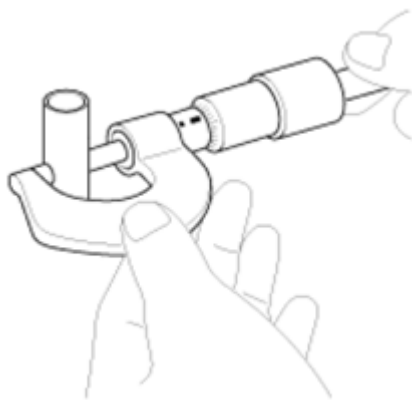


Fig. 32: Measuring Diameter Of Piston Pin

Courtesy of HYUNDAI MOTOR CO.

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

Piston pin-to-connecting rod clearance

0.004 ~ 0.013mm (0.00015 ~ 0.00051in.)

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

Piston pin-to-connecting rod interference

0.005 ~ 0.019mm (0.00019 ~ 0.00074in.)

Boring Cylinder

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

BORING CYLINDER SIZE IDENTIFICATION

Identification Mark	Size
0.1	0.1 mm (0.004 in)
0.25	0.25 mm (0.010 in)

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

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

New bore size = piston O.D + 0.03 to 0.05mm (0.0012 to 0.0020in) (clearance between piston and cylinder) - 0.01mm (0.0004in) (honing margin.)

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

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

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

Standard : 0.03 ~ 0.05mm (0.0012 ~ 0.0020in)

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

Reassembly

NOTE:

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

1. Assemble the piston and the connecting rod.

1. Install the piston pin with snap ring 2EA and check the snap ring assembly thoroughly.
2. The piston front mark and the connecting rod front mark must face the timing belt side of the engine.

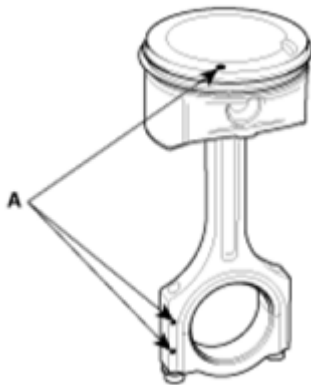


Fig. 33: Identifying Piston And Connecting Rod Front Mark
Courtesy of HYUNDAI MOTOR CO.

2. Install the piston rings.

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

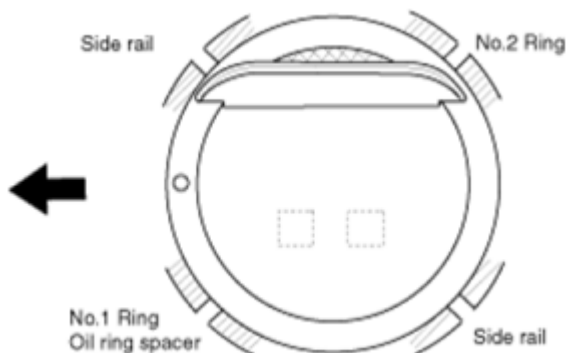


Fig. 34: Identifying Piston Rings And Oil Ring Spacer
Courtesy of HYUNDAI MOTOR CO.

3. Install the connecting rod bearings.

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

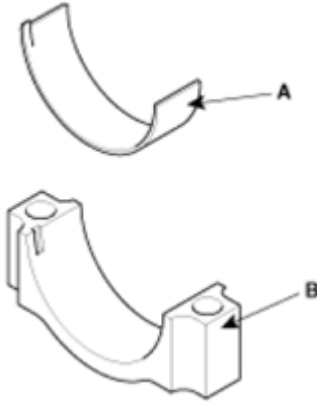


Fig. 35: Identifying Bearings And Connecting Rod Cap
Courtesy of HYUNDAI MOTOR CO.

CAUTION: When reassembling the connecting rods and the caps, ensure the front marks on them and the number of cylinder.

4. Install the oil jets (A).

Tightening torque

27.5 ~ 31.3 N.m (2.8 ~ 3.2kgf.m, 20.2 ~ 23.1lb-ft)



Fig. 36: Identifying Oil Jets
Courtesy of HYUNDAI MOTOR CO.

5. Install the main bearings.

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

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

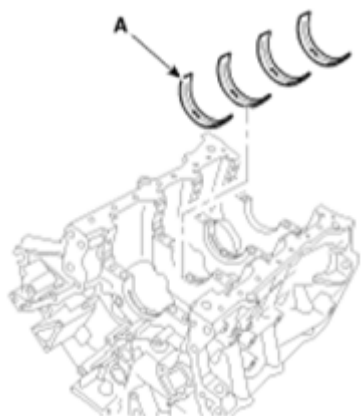


Fig. 37: Identifying Main Bearings
Courtesy of HYUNDAI MOTOR CO.

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

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



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

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

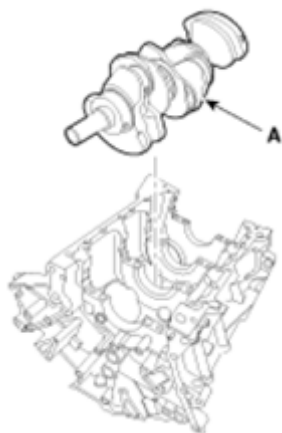


Fig. 39: Identifying Crankshaft
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

Main bearing cap bolt

49.0N.m (5.0 kgf.m, 36.2lb-ft) + 90° (1 ~ 8)

19.6N.m (2.0 kgf.m, 14.5lb-ft) + 120° (9 ~ 16)

29.4 ~ 31.4N.m (3.0 ~ 3.2 kgf.m, 21.7 ~ 23.1lb-ft) (17 ~ 24)

NOTE:

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

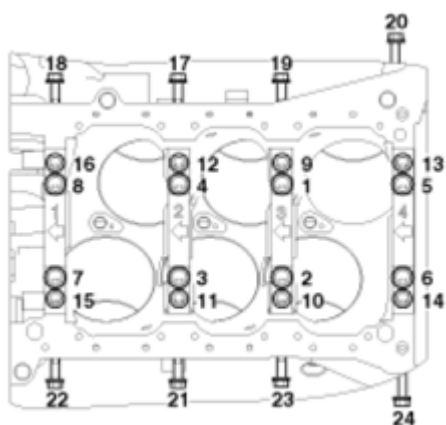


Fig. 40: Identifying Bearing Cap Bolts
Courtesy of HYUNDAI MOTOR CO.

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

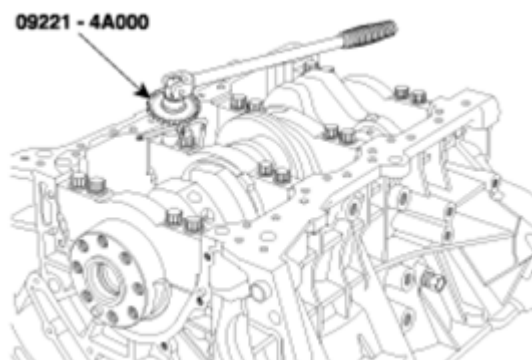


Fig. 41: Installing Main Bearing Cap Bolts Using SST (09221-4A000)
Courtesy of HYUNDAI MOTOR CO.

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

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

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

Tightening torque

17.7~21.6N.m (1.8~2.2kgf.m, 13.0~15.9lb-ft) + (88~92°)

NOTE:

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

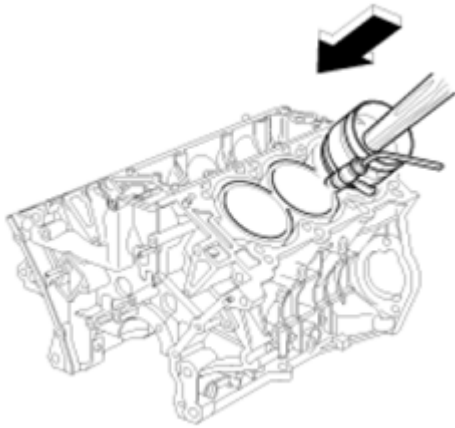


Fig. 42: Tapping Piston Cylinder Using Wooden Handle Hammer
Courtesy of HYUNDAI MOTOR CO.

NOTE:

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

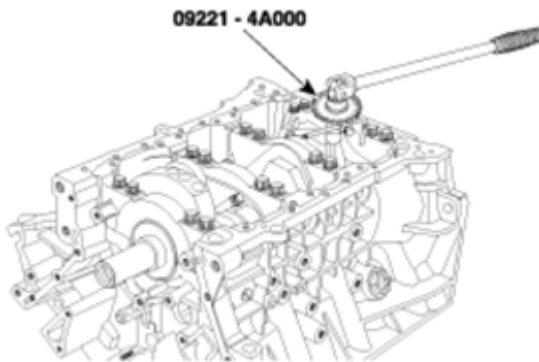


Fig. 43: Installing Connecting Rod Bearing Cap Bolts Using SST (09221-4A000)
Courtesy of HYUNDAI MOTOR CO.

12. Check the connecting rod end play.
13. Install the oil drain cover (A) with a new gasket (B).

Tightening torque

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

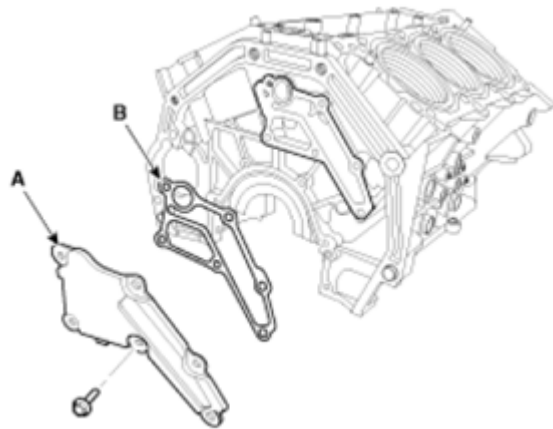


Fig. 44: Identifying Oil Drain Cover And Gasket
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

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

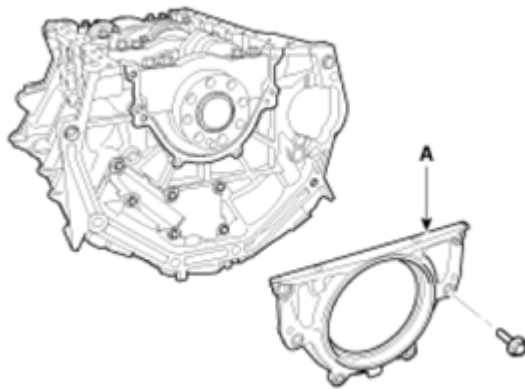


Fig. 45: Identifying Rear Oil Seal Case
Courtesy of HYUNDAI MOTOR CO.

NOTE:

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

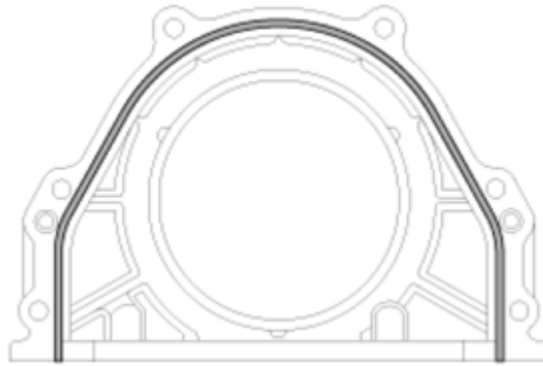


Fig. 46: Identifying Sealant And Rear Oil Seal Case
Courtesy of HYUNDAI MOTOR CO.

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

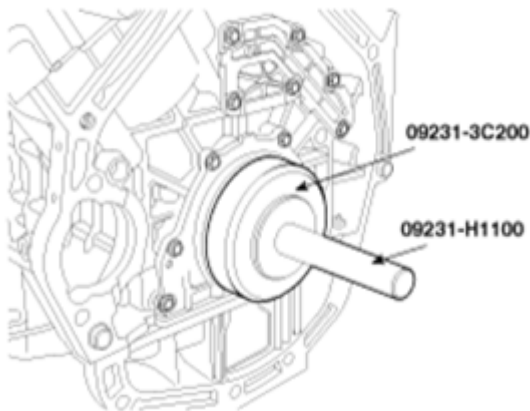


Fig. 47: Installing Rear Oil Seal Using SST (09231-3C200, 09231-H1100)
Courtesy of HYUNDAI MOTOR CO.

16. Install the baffle plate.

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

Tightening torque

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

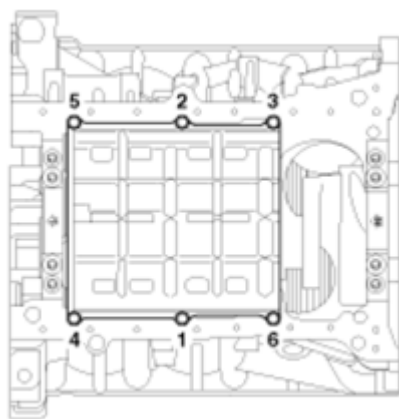


Fig. 48: Identifying Baffle Plate Bolts
Courtesy of HYUNDAI MOTOR CO.

17. Install the upper oil pan.
 - A. Using a gasket scraper, remove all the old packing material from the gasket surfaces.
 - B. Before assembling the oil pan, the liquid sealant TB1217H should be applied on upper oil pan.

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

Bead width : 2.5mm (0.1in.)

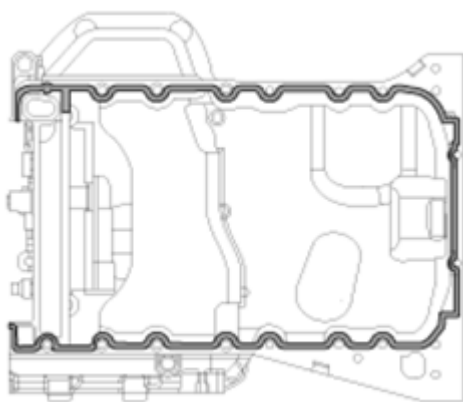


Fig. 49: Identifying Liquid Sealant (TB1217H) On Upper Oil Pan
Courtesy of HYUNDAI MOTOR CO.

NOTE:

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

- C. Install the upper oil pan.

Uniformly tighten the bolts in several passes.

Tightening torque

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



Fig. 50: Identifying Upper Oil Pan Bolts
Courtesy of HYUNDAI MOTOR CO.

18. Install the oil cover (A) and gasket (B).

Tightening torque

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

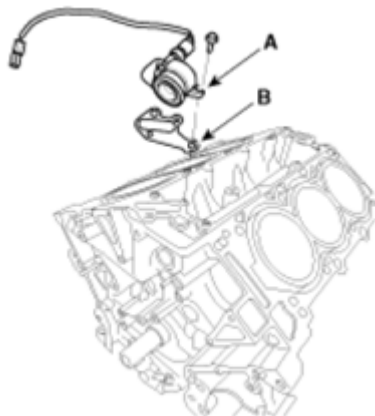


Fig. 51: Identifying Oil Cover And Gasket
Courtesy of HYUNDAI MOTOR CO.

19. Install the knock sensor (A).

Tightening torque

15.7 ~ 23.5Nm (1.6 ~ 2.4kgf.m, 11.6 ~ 17.3lb-ft)

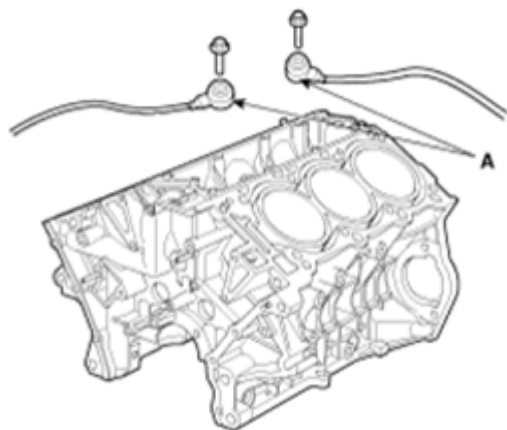


Fig. 52: Identifying Knock Sensor
Courtesy of HYUNDAI MOTOR CO.

20. Install the drive plate (A) and adapter plate (B).

Tightening torque :

71.6 ~ 75.5N.m (7.3 ~ 7.7kgf.m, 52.8 ~ 55.7lb-ft)

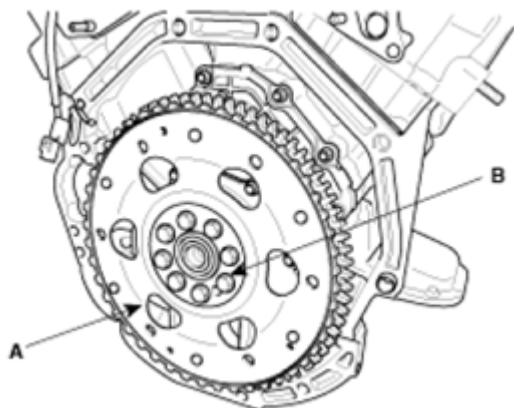


Fig. 53: Identifying Drive And Adapter Plate
Courtesy of HYUNDAI MOTOR CO.

21. Install the oil filter assembly. (Refer to **LUBRICATION SYSTEM** .)
22. Install the oil pump. (Refer to **LUBRICATION SYSTEM** .)
23. Install the cylinder head. (Refer to **CYLINDER HEAD** .)
24. Install the water temperature control assembly. (Refer to **COOLING SYSTEM** .)
25. Install the timing chain. (Refer to **TIMING SYSTEM** .)

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26. Install the intake manifold and exhaust manifold. (Refer to **INTAKE AND EXHAUST SYSTEM** .)
27. Install the engine assembly to the vehicle. (Refer to **ENGINE AND TRANSAXLE ASSEMBLY** .)

2010 ENGINE

Cylinder Head Assembly - G3.5 DOHC - Santa Fe

CYLINDER HEAD

COMPONENTS AND COMPONENTS LOCATION

Components

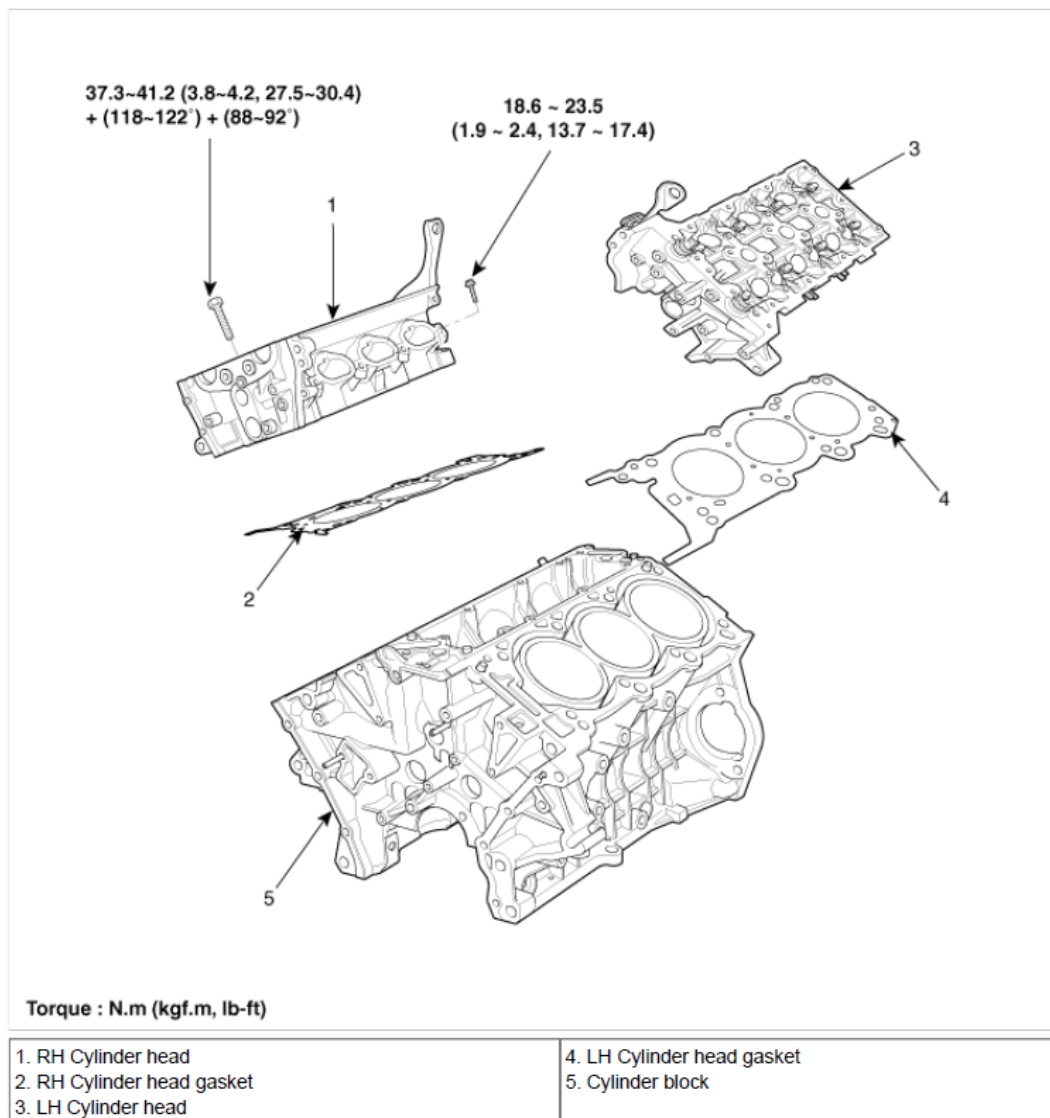


Fig. 1: Identifying Cylinder Block, Cylinder Head And Gasket With Torque Specifications (Right And Left)

Courtesy of HYUNDAI MOTOR CO.

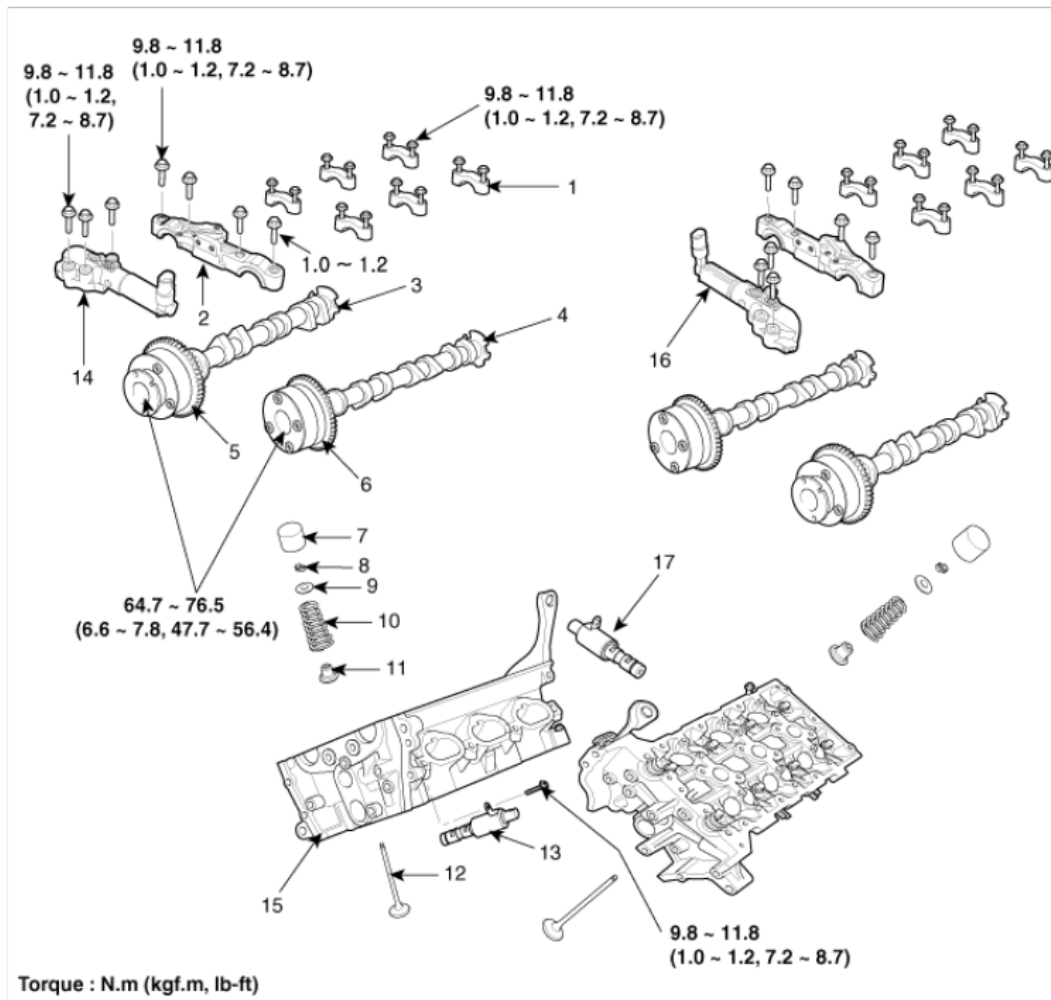


Fig. 2: Disassemble View Of Cylinder Head Assembly With Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

REPAIR PROCEDURES

Removal

CAUTION:

- Use fender covers to avoid damaging painted surfaces.
- To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal temperature (20°C [68°F]) before removing it.
- When handling a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.

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

NOTE:

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

1. Remove the intake manifold and exhaust manifolds. (Refer to **INTAKE AND EXHAUST SYSTEM** .)
2. Remove the timing chain. (Refer to **TIMING SYSTEM** .)
3. Disconnect the oil cooler hoses (A).
4. Remove the water temperature control assembly (B).

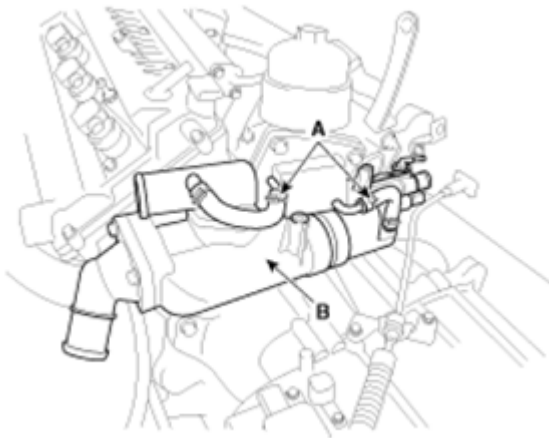


Fig. 3: Identifying Water Temperature Control Assembly With Oil Cooler Hoses
Courtesy of HYUNDAI MOTOR CO.

5. Remove the LH/RH exhaust camshaft OCV (A).

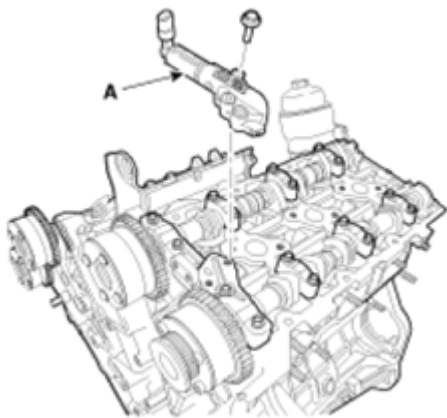


Fig. 4: Identifying LH/RH Exhaust Camshaft OCV
Courtesy of HYUNDAI MOTOR CO.

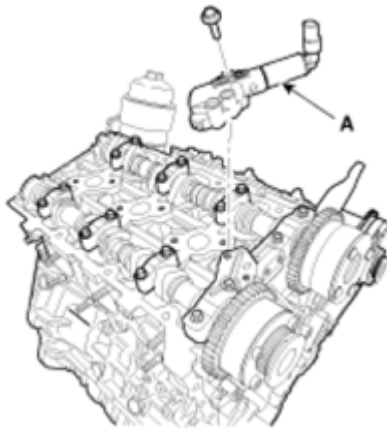


Fig. 5: Identifying LH/RH Exhaust Camshaft OCV
Courtesy of HYUNDAI MOTOR CO.

6. Remove the LH/RH camshaft bearing cap (A) and thrust bearing cap (B).

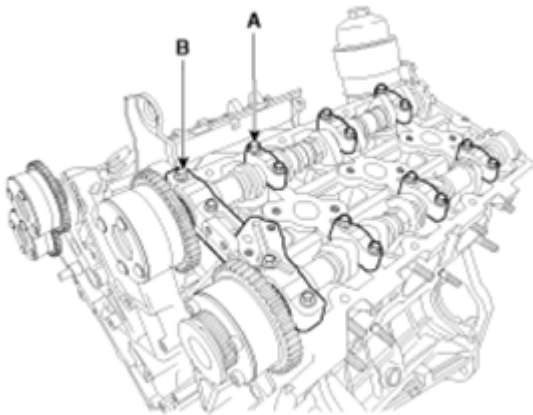


Fig. 6: Identifying LH/RH Camshaft Bearing Cap And Thrust Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

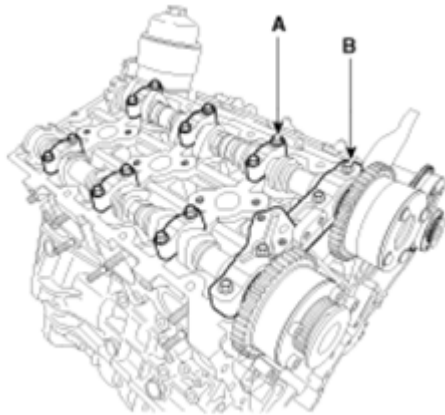


Fig. 7: Identifying LH/RH Camshaft Bearing Cap And Thrust Bearing Cap

Courtesy of HYUNDAI MOTOR CO.

7. Remove the LH/RH camshaft assembly (A).

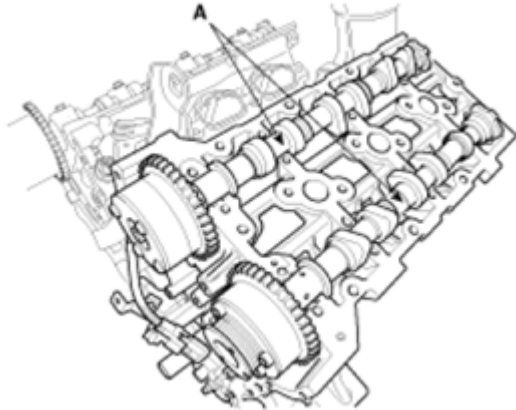


Fig. 8: Identifying LH/RH Camshaft Assembly
Courtesy of HYUNDAI MOTOR CO.

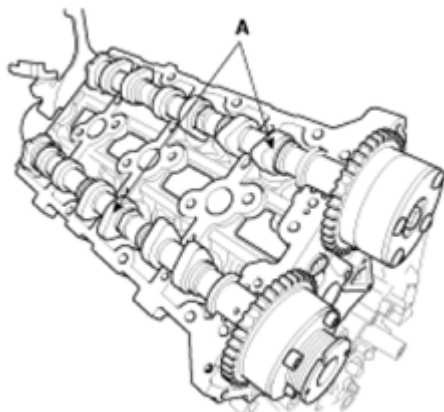


Fig. 9: Identifying LH/RH Camshaft Assembly
Courtesy of HYUNDAI MOTOR CO.

8. Remove the LH/RH cylinder heads.
 1. Remove the RH cylinder head rear bolt (A).



Fig. 10: Identifying RH Cylinder Head Rear Bolt
Courtesy of HYUNDAI MOTOR CO.

2. Uniformly loosen and remove the cylinder head bolts, in several passes, in the sequence shown.

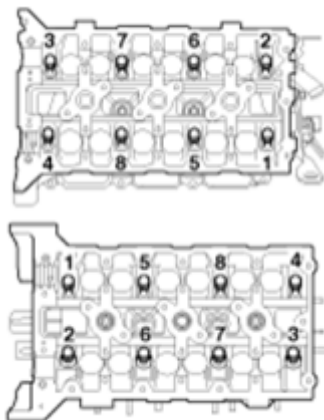


Fig. 11: Identifying Cylinder Head Bolts Removing Sequence
Courtesy of HYUNDAI MOTOR CO.

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

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

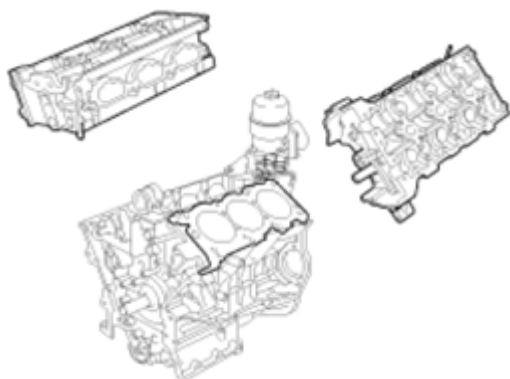


Fig. 12: Identifying Cylinder Head
Courtesy of HYUNDAI MOTOR CO.

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

4. Remove the cylinder head gaskets.

Disassembly

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

1. Remove the MLAs (A).

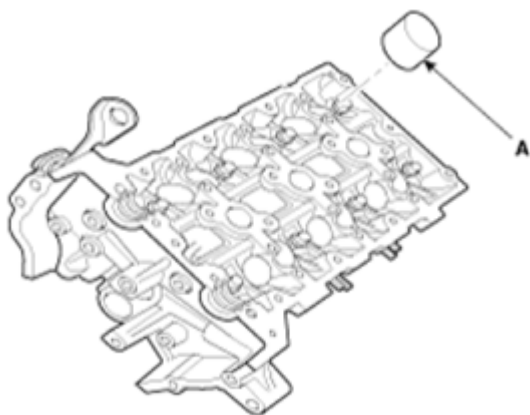


Fig. 13: Identifying MLA
Courtesy of HYUNDAI MOTOR CO.

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

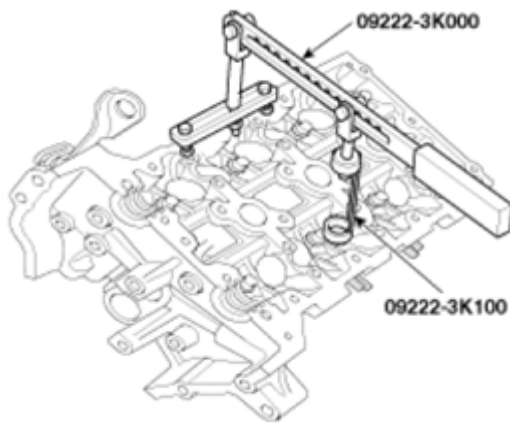


Fig. 14: Removing Retainer Lock Using SST (09222-3K000, 09222-3K100)
Courtesy of HYUNDAI MOTOR CO.

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

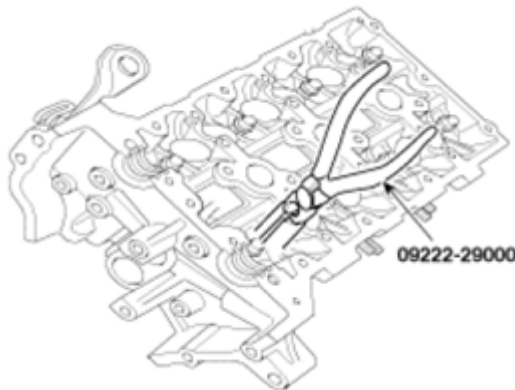


Fig. 15: Removing Valve Stem Seal Using SST (09222-29000)
Courtesy of HYUNDAI MOTOR CO.

NOTE: Do not reuse old valve stem seals.

3. Remove the intake camshaft OCV (A).

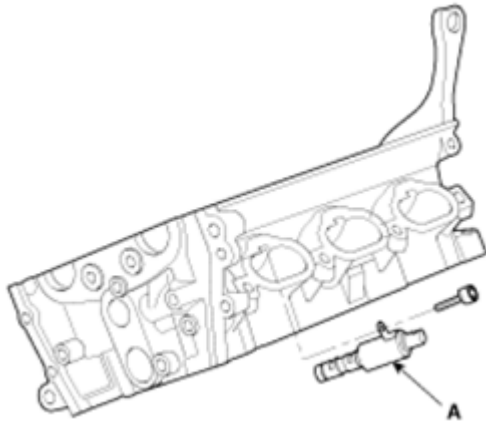


Fig. 16: Identifying Intake Camshaft OCV
Courtesy of HYUNDAI MOTOR CO.

Inspection

Cylinder Head

1. Inspect for flatness.

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

Flatness of cylinder head gasket surface

Standard : Less than 0.05mm (0.002in.)

[Less than 0.02mm (0.0008in.)/150x150]

Flatness of manifold gasket surface

Standard : Less than 0.03mm (0.001in)/110x110

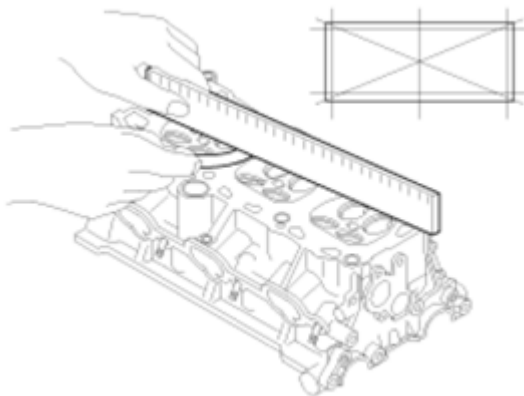


Fig. 17: Measuring Cylinder Block Contacting Surface Using Straight Edge And Feeler Gauge

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.)

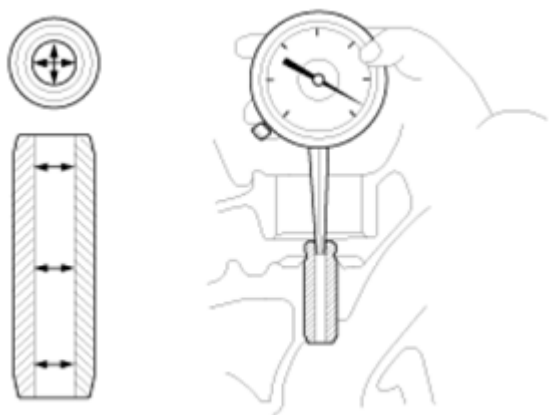


Fig. 18: Measuring Valve Guide Inside Diameter Using Caliper Gauge
Courtesy of HYUNDAI MOTOR CO.

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.)

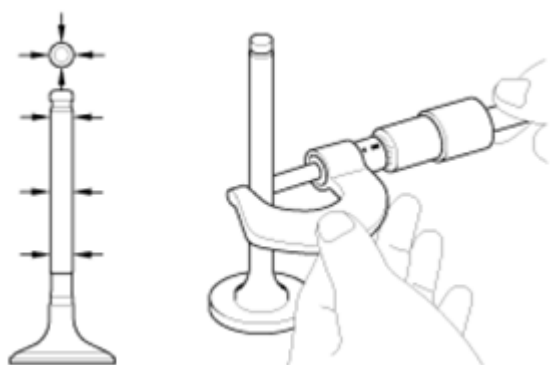


Fig. 19: Measuring Valve Stem Diameter Using Micrometer
Courtesy of HYUNDAI MOTOR CO.

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.)

2. Inspect valves.
 1. Check the valve is ground to the correct valve face angle.
 2. Check that the surface of the valve for wear.

If the valve face is worn, replace the valve.

3. Check the valve head margin thickness.

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

Margin

[Standard]

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

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

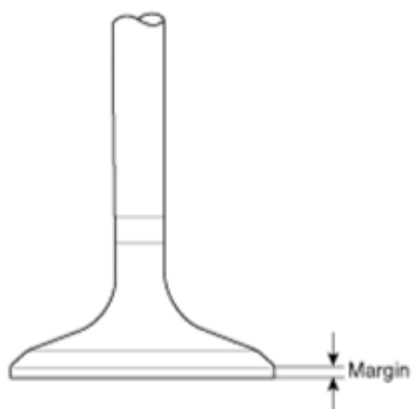


Fig. 20: Identifying Valve Head Margin Thickness
Courtesy of HYUNDAI MOTOR CO.

4. Check the valve length.

Length

Intake : 105.27mm (4.1445in)

Exhaust : 105.50mm (4.1535in)

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

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

3. Inspect valve seats

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

If the valve seat is worn, replace cylinder head.

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

4. Inspect valve springs.

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

Valve spring

[Standard]

Free height : 45.5mm (1.7913in.)

Out-of-square : 1.5°

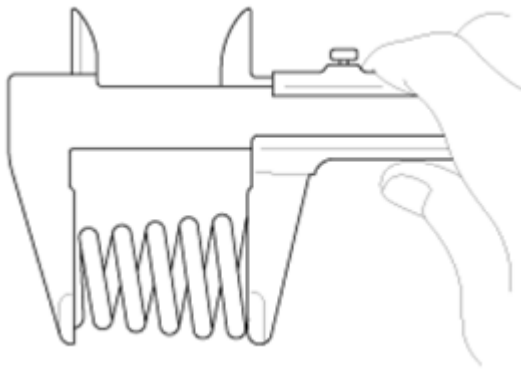


Fig. 21: Measuring Valve Spring Free Length Using Vernier Caliper
Courtesy of HYUNDAI MOTOR CO.

MLA

1. Inspect MLAs.

Using a micrometer, measure the MLA outside diameter.

MLA O.D.

Intake/Exhaust:

34.964 ~ 34.980mm (1.3765 ~ 1.3771in.)

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

Tappet bore I.D.

Intake/Exhaust:

35.000 ~ 35.025mm (1.3779 ~ 1.3789in.)

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 : 47.2mm (1.8582in.)

Exhaust : 45.8mm (1.8031in.)



Fig. 22: Measuring Cam Lobe Height Using Micrometer
Courtesy of HYUNDAI MOTOR CO.

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

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

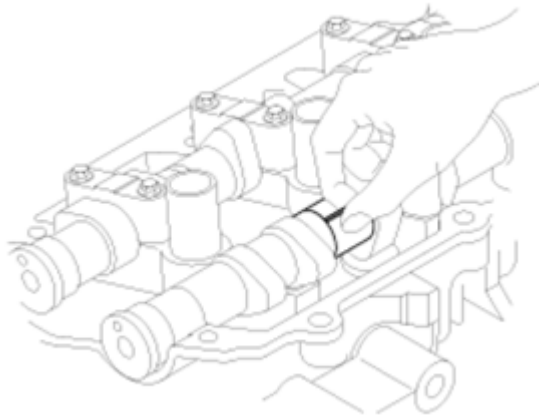


Fig. 23: Inspecting Camshaft Journal Clearance
Courtesy of HYUNDAI MOTOR CO.

4. Install the bearing cap (A) and thrust bearing cap (B) with specified torque. (Refer to **CYLINDER HEAD.**)

Tightening torque :

1st step : 5.8N.m (0.6kgf.m, 4.3lb-ft)

2nd step : 9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

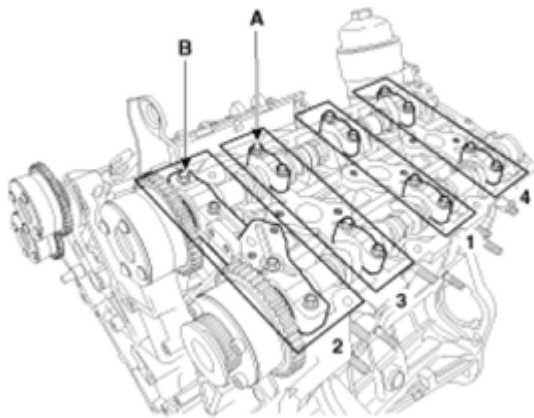


Fig. 24: Identifying Camshaft Bearing Cap And Thrust Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

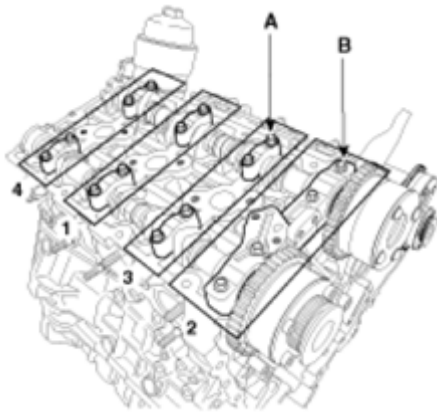


Fig. 25: Identifying Camshaft Bearing Cap And Thrust Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

CAUTION: Do not turn the camshaft.

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

Bearing oil clearance

[Standard value]

Intake

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

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

Exhaust

No. 1 journal : 0.027 ~ 0.057mm (0.0010 ~ 0.0022in.)

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

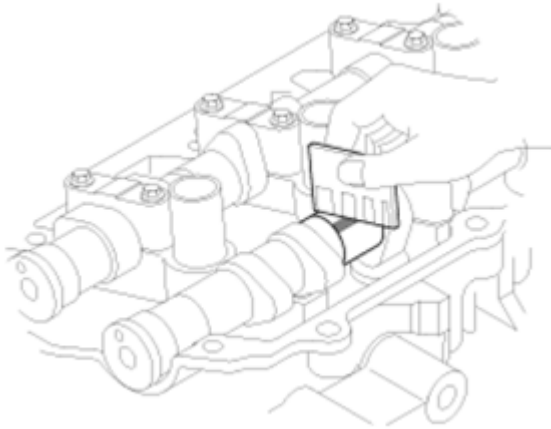


Fig. 26: Measuring Plastigage At Widest Point
Courtesy of HYUNDAI MOTOR CO.

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 the camshaft end play.
 1. Install the camshafts.
 2. Install the bearing cap (A) and thrust bearing cap (B) with specified torque.

Tightening torque :

1st step : 5.8N.m (0.6kgf.m, 4.31lb-ft)

2nd step : 9.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

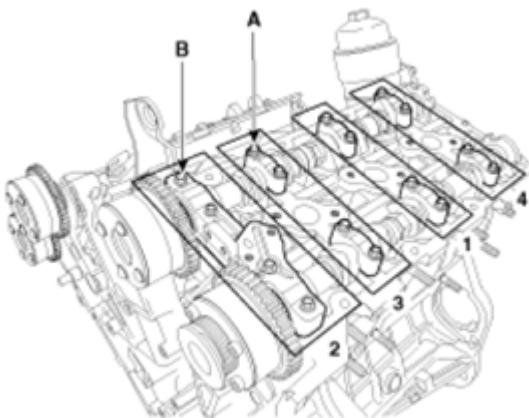


Fig. 27: Identifying Camshaft Bearing Cap And Thrust Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

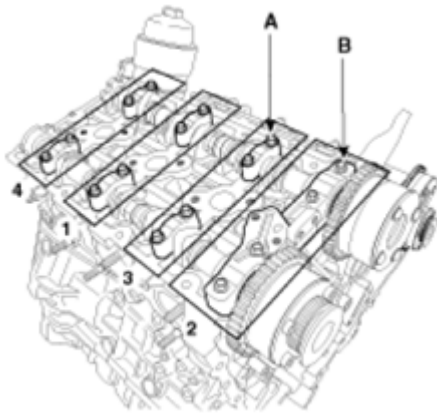


Fig. 28: Identifying Camshaft Bearing Cap And Thrust Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

3. Using a dial indicator, measure the end play while moving the camshaft back and forth.

Camshaft end play

[Standard value] : 0.02 ~ 0.18mm (0.0008 ~ 0.0071in.)

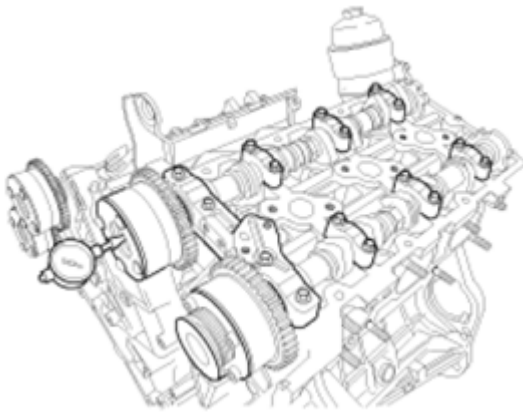


Fig. 29: Measuring Camshaft End Play Using Dial Indicator
Courtesy of HYUNDAI MOTOR CO.

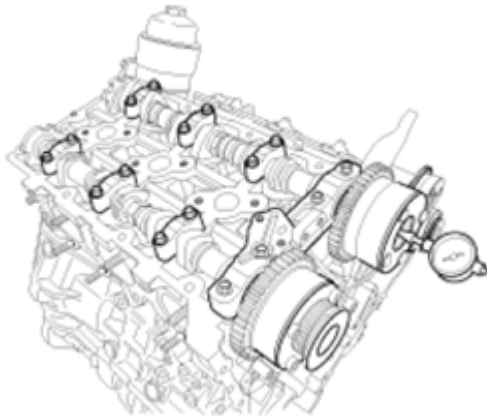


Fig. 30: Measuring Camshaft End Play Using Dial Indicator
Courtesy of HYUNDAI MOTOR CO.

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

4. Remove the camshafts.

CVVT Assembly

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

[Intake CVVT]

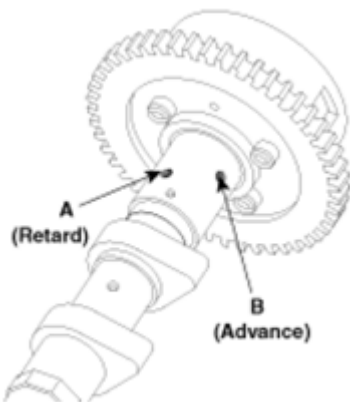


Fig. 31: Identifying CCVT Retard And Advance Hole (Intake)
Courtesy of HYUNDAI MOTOR CO.

[Exhaust CVVT]

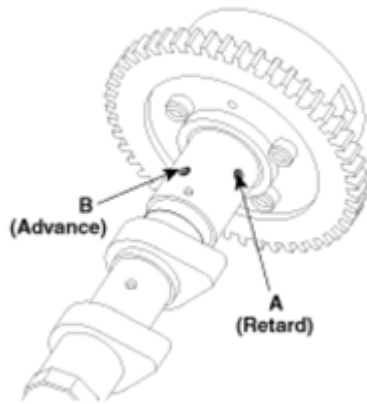


Fig. 32: Identifying CCVT Retard And Advance Hole (Exhaust)
 Courtesy of HYUNDAI MOTOR CO.

3. Wrap 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 for the maximum delay angle locking.)

NOTE: To reduce oil splashing during pressurizing with air gun, shield the nozzle tip with a shop rag. Wipe off any splashed oil after checking.

4. Under the condition of (3), turn the CVVT assembly to the advance angle side (the arrow marked direction in the illustration) with your hand.

Depending on the air pressure, the CVVT assembly will turn to the advance side without applying force by hand.

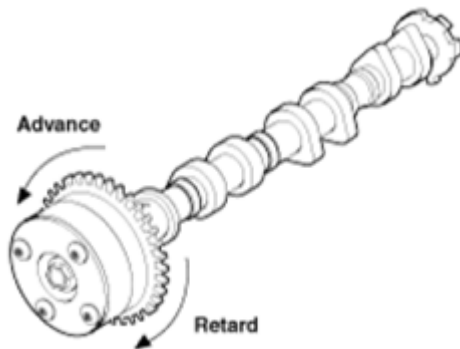


Fig. 33: Identifying CCVT Assembly Turning Direction
 Courtesy of HYUNDAI MOTOR CO.

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

Standard: The normal movable range is approximately 30° before the lock pin.

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

Reassembly

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

1. Install the valves.
 1. Using the SST (09222-3C100), push in a new oil seal.

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

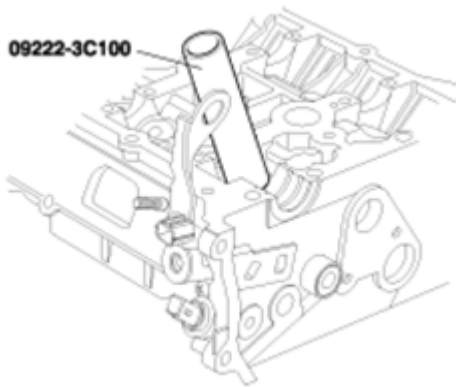


Fig. 34: Pushing New Oil Seal Using SST (09222-3C100)
Courtesy of HYUNDAI MOTOR CO.

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

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

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

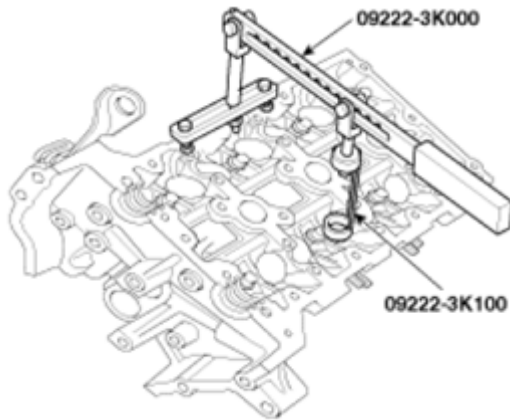


Fig. 35: Removing Retainer Lock Using SST (09222-3K000, 09222-3K100)
 Courtesy of HYUNDAI MOTOR CO.

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

Check that the MLA rotates smoothly by hand.

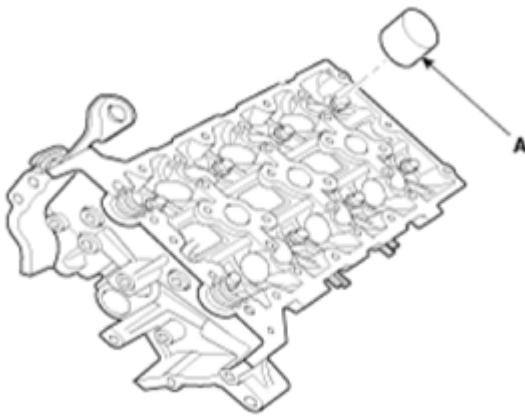


Fig. 36: Identifying MLA
 Courtesy of HYUNDAI MOTOR CO.

NOTE: MLA can be reinstalled in its original position. However, the valve lash clearances must be rechecked and adjusted accordingly before the cylinder head is installed onto the cylinder block. Refer to GENERAL INFORMATION - ENGINE MECHANICAL - 3.5L for Valve Clearance checking and adjustment procedure.

3. Install the OCV (A).

Tightening torque

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

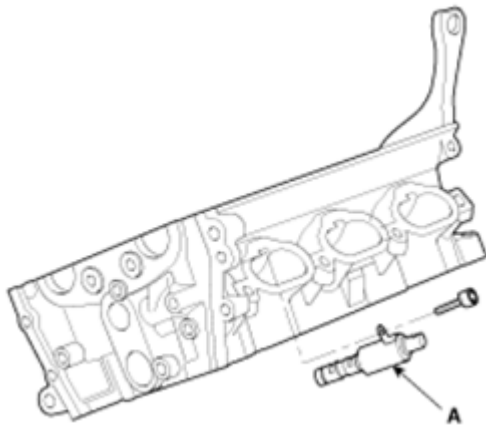


Fig. 37: Identifying OCV

Courtesy of HYUNDAI MOTOR CO.

NOTE:

- Install OCV with gray colored connector into RH bank.
- Install OCV with black colored connector into LH bank.

CAUTION:

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

Installation

NOTE:

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

1. Install the cylinder head.

- A. The sealant locations on cylinder head and cylinder block must be free of engine oil and ETC.
- B. Apply sealant on cylinder block top face before assembling cylinder head gaskets.

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

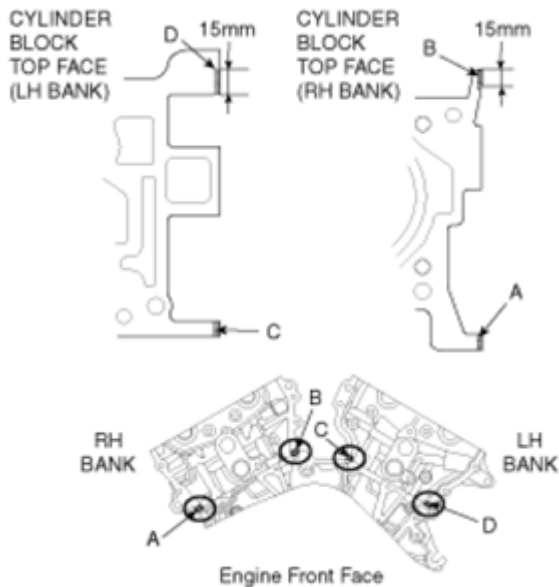


Fig. 38: Identifying Cylinder Block Top Face Sealant Applying Portion (Right And Left)
Courtesy of HYUNDAI MOTOR CO.

NOTE: Refer to below illustration to apply the sealant.

Bead width :

2.0~3.0 mm (0.078 ~ 0.118 in.)

Sealant locations :

1.0~1.5mm (0.039 ~ 0.059 in.) from block surface

Recommended sealant : Liquid sealant TB1217H

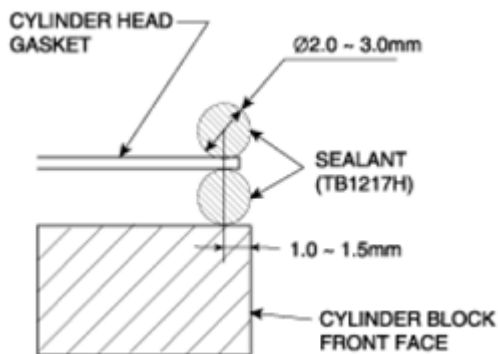


Fig. 39: Sealant Application On Block Surface
Courtesy of HYUNDAI MOTOR CO.

C. Apply sealant on cylinder head gaskets after assembling cylinder head gaskets on cylinder block.

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

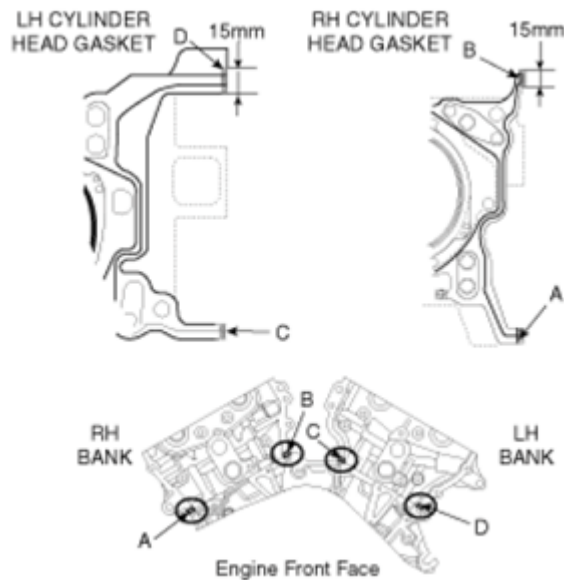


Fig. 40: Identifying Cylinder Head Gasket Sealant Applying Portion (Right And Left)
Courtesy of HYUNDAI MOTOR CO.

NOTE: Be careful of the installation direction.

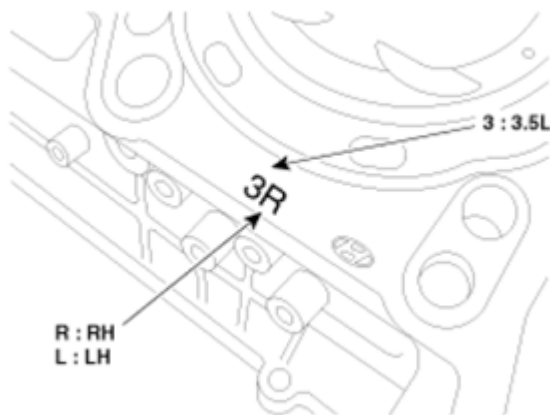


Fig. 41: Identifying Cylinder Head Mark
Courtesy of HYUNDAI MOTOR CO.

D. Install the cylinder head.

NOTE: Remove the extruded sealant after assembling cylinder heads.

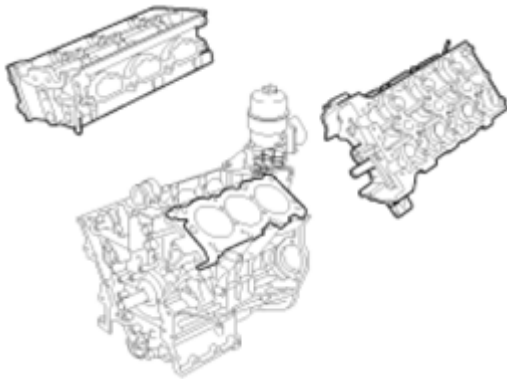


Fig. 42: Identifying Cylinder Head
Courtesy of HYUNDAI MOTOR CO.

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

CAUTION: Always use a new cylinder head bolts.

Tightening torque

Head bolt: 37.3~41.2N.m (3.8~4.2kgf.m, 27.5~30.4lb-ft) + (118~122°) + (88~92°)

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

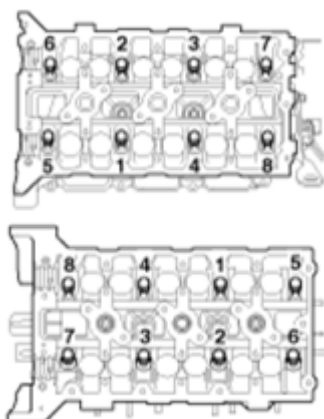


Fig. 43: Identifying Cylinder Head Bolts Installing Sequence
Courtesy of HYUNDAI MOTOR CO.



Fig. 44: Identifying Cylinder Head Bolt
Courtesy of HYUNDAI MOTOR CO.

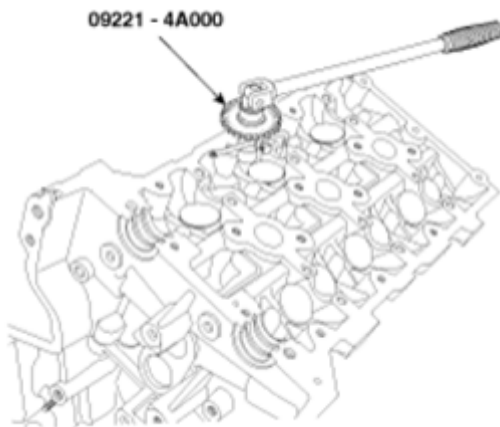


Fig. 45: Tightening Cylinder Head Bolt Using SST (09221-4A000)
Courtesy of HYUNDAI MOTOR CO.

3. Install the CVVT assembly.

Tightening torque :

64.7 ~ 76.5N.m (6.6 ~ 7.8kgf.m, 47.7 ~ 56.4lb-ft)

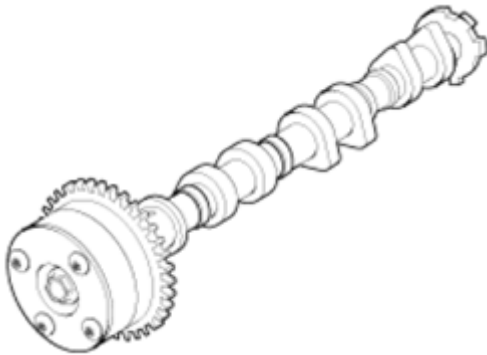


Fig. 46: Identifying CVVT Assembly
Courtesy of HYUNDAI MOTOR CO.

CAUTION:

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

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

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

4. Install the LH/RH camshaft assembly (A).

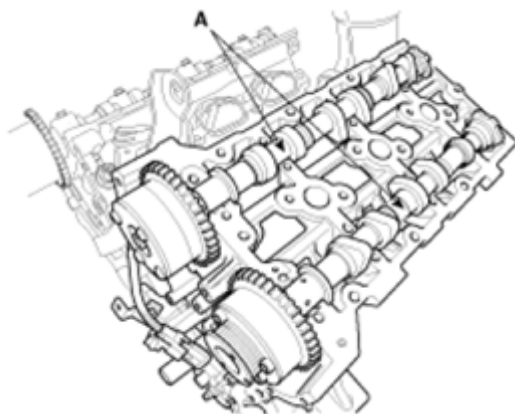


Fig. 47: Identifying LH/RH Camshaft Assembly
Courtesy of HYUNDAI MOTOR CO.

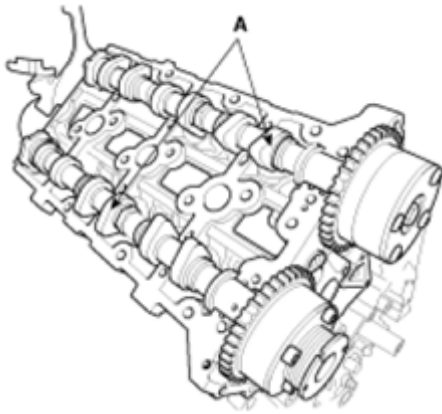


Fig. 48: Identifying LH/RH Camshaft Assembly
Courtesy of HYUNDAI MOTOR CO.

CAUTION:

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

Intake Camshaft

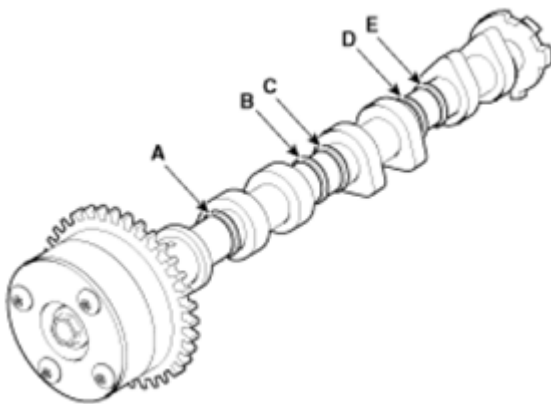


Fig. 49: Identifying Intake Camshafts
Courtesy of HYUNDAI MOTOR CO.

As for camshaft identification, refer to the table below.

CAMSHAFT OUTER DIAMETER

Displacement	Outer diameter	
	LH	RH
	A : 27mm (1.0630in.)	A : 27mm (1.0630in.)
	B : 27mm (1.0630in.)	B : 27mm (1.0630in.)

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2010 ENGINE Cylinder Head Assembly - G3.5 DOHC - Santa Fe

Intake camshaft	C : 30mm (1.1811in.)	C : 30mm (1.1811in.)
	D : 30mm (1.1811in.)	D : 27mm (1.0630in.)
	E : 27mm (1.0630in.)	E : 30mm (1.1811in.)

Exhaust Camshaft

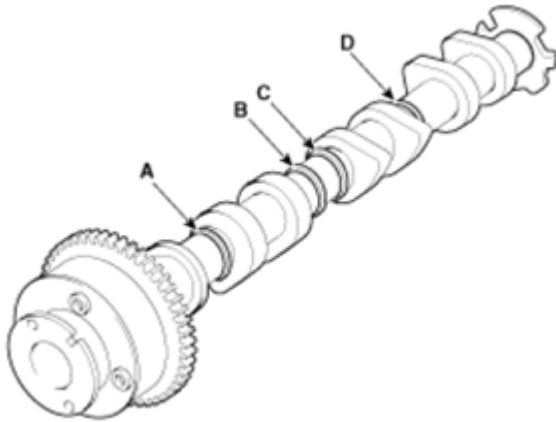


Fig. 50: Identifying Exhaust Camshafts
Courtesy of HYUNDAI MOTOR CO.

As for camshaft identification, refer to the table below.

CAMSHAFT OUTER DIAMETER

Displacement	Outer diameter	
	LH	RH
Exhaust camshaft	A : 27mm (1.0630in.)	A : 27mm (1.0630in.)
	B : 27mm (1.0630in.)	B : 27mm (1.0630in.)
	C : 30mm (1.1811in.)	C : 30mm (1.1811in.)
	D : 27mm (1.0630in.)	D : 30mm (1.1811in.)

5. Install the LH/RH camshaft bearing cap (A) and thrust bearing cap (B).

Tightening torque

1st step : 5.8N.m (0.6kgf.m, 4.3lb-ft)

2nd step : 9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

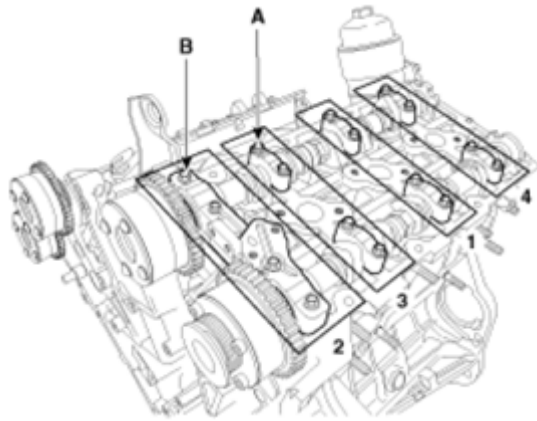


Fig. 51: Identifying LH/RH Camshaft Bearing Cap And Thrust Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

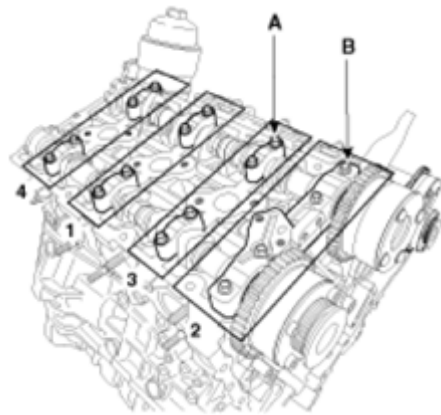
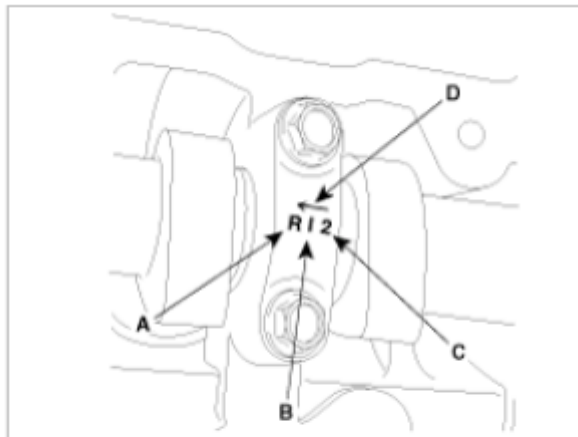


Fig. 52: Identifying LH/RH Camshaft Bearing Cap And Thrust Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

CAUTION: Be sure to install the thrust bearing cap bolts and the bearing cap bolts in the correct place.

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



A : L(LH),R(RH)

B : I(Intake), E(Exhaust)

C : Journal number

D : Front mark

Fig. 53: Bearing Cap Bolt Identification Mark

Courtesy of HYUNDAI MOTOR CO.

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

6. Install the LH/RH exhaust camshaft OCV (A).

Tightening torque :

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

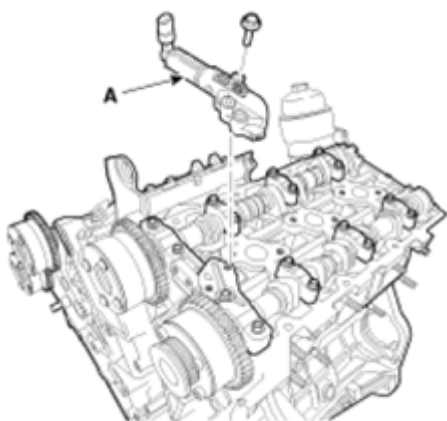


Fig. 54: Identifying LH/RH Exhaust Camshaft OCV

Courtesy of HYUNDAI MOTOR CO.

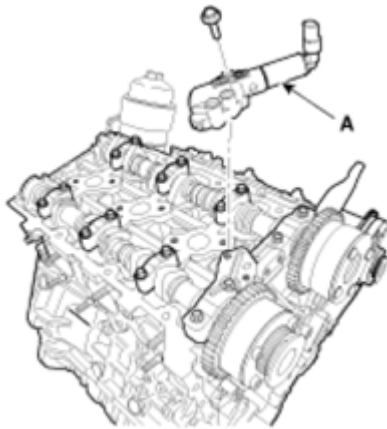


Fig. 55: Identifying LH/RH Exhaust Camshaft OCV
 Courtesy of HYUNDAI MOTOR CO.

7. Install the water temperature control assembly (B).

Tightening torque :

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

8. Connect the oil cooler hoses (A).

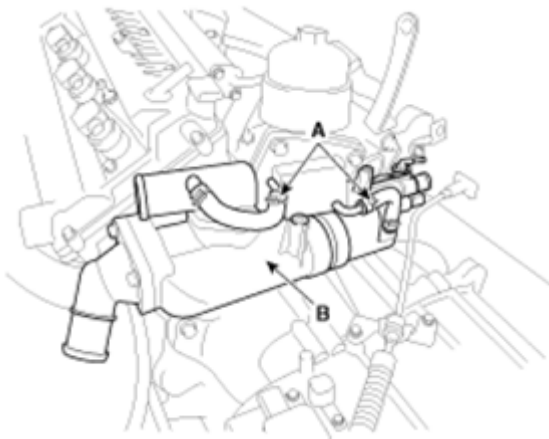


Fig. 56: Identifying Water Temperature Control Assembly With Oil Cooler Hoses
 Courtesy of HYUNDAI MOTOR CO.

9. Install the timing chain. (Refer to **TIMING SYSTEM** .)

10. Install the intake manifold and exhaust manifolds. (Refer to **INTAKE AND EXHAUST SYSTEM** .)

NOTE:

- Refill engine oil.
- Clean the battery posts and cable terminals with sandpaper. Assemble and then apply grease to prevent corrosion.

- **Inspect for fuel leakage.**
 - **After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.**
 - **Repeat this operation two or three times, then check for fuel leakage at any point in the fuel lines.**
- **Refill radiator and reservoir tank with engine coolant.**
- **Bleed air from the cooling system.**
 - **Start engine and let it run until it warms up. (Until the radiator fan operates 3 or 4 times.)**
 - **Turn Off the engine. Check the level in the radiator, add coolant if needed. This will allow trapped air to be removed from the cooling system.**
 - **Put radiator cap on tightly, then run the engine again and check for leaks.**