

2010 Hyundai Veracruz GLS

2010 ENGINE General Information (Engine Mechanical) - Veracruz

2010 ENGINE**General Information (Engine Mechanical) - Veracruz****SPECIFICATIONS****ENGINE SPECIFICATION**

Description			Specifications	Limit
General				
Type		V-type, DOHC		-
Number of cylinders		6		-
Bore		96 mm (3.7795 in)		-
Stroke		87.0 mm (3.4252 in)		-
Total displacement		3,778 cc (230.55 cu.in.)		-
Compression ratio		10.4		-
Firing order		1-2-3-4-5-6		-
Idle RPM		710 RPM		-
Valve timing				
Intake	Opens (ATDC)		10°	-
	Closes (ABDC)		62°	-
Exhaust	Opens (BBDC)		42°	-
	Closes (ATDC)		6°	-
Cylinder head				
Flatness of gasket surface			Less than 0.05 mm (0.0019 in.) [Less than 0.02 mm (0.0008 in.)/150x150]	-
Flatness of manifold mounting	Intake		Less than 0.1 mm (0.0039 in.) [Less than 0.03 mm (0.001 in)/110x110]	-
	Exhaust		Less than 0.1 mm (0.0039 in.) [Less than 0.03 mm (0.001 in)/110x110]	-
Camshaft				
Cam height	LH Camshaft	Intake	46.8 mm (1.8425 in.)	-
		Exhaust	45.8 mm (1.8031 in.)	-
	RH Camshaft	Intake	46.8 mm (1.8425 in.)	-
		Exhaust	45.8 mm (1.8031 in.)	-
Journal outer diameter	LH, RH camshaft	Intake	No. 1: 27.964 ~ 27.978 mm (1.1009 ~	-

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			1.1015 in.) No. 2, 3, 4: 23.954 ~ 23.970 mm (0.9430 ~ 0.9437 in.)	
		Exhaust	No. 1: 27.964 ~ 27.978 mm (1.1009 ~ 1.1015 in.) No. 2, 3, 4: 23.954 ~ 23.970 mm (0.9430 ~ 0.9437 in.)	-
Bearing oil clearance	LH, RH camshaft	Intake	No. 1: 0.027 ~ 0.057 mm (0.0011 ~ 0.0022 in.) No. 2, 3, 4: 0.030 ~ 0.067 mm (0.0012 ~ 0.0026 in.)	-
		Exhaust	No. 1: 0.027 ~ 0.057 mm (0.0011 ~ 0.0022 in.) No. 2, 3, 4: 0.030 ~ 0.067 mm (0.0012 ~ 0.0026 in.)	-
End play			0.02 ~ 0.18 mm (0.0008 ~ 0.0071 in.)	-
Valve				
Valve length	Intake		105.27 mm (4.1445 in.)	-
	Exhaust		105.50 mm (4.1535 in.)	-
Stem outer diameter	Intake		5.465 ~ 5.480 mm (0.2151 ~ 0.2157 in.)	-
	Exhaust		5.458 ~ 5.470 mm (0.2149 ~ 0.2153 in.)	-
Face angle			45.25° ~ 45.75°	-
Thickness of valve head (margin)	Intake		1.56 ~ 1.86 mm (0.06142 ~ 0.07323 in.)	-
	Exhaust		1.73 ~ 2.03 mm (0.06811 ~ 0.07992 in.)	-
Valve stem to valve guide clearance	Intake		0.020 ~ 0.047 mm (0.00078 ~ 0.00185 in.)	0.07 mm (0.00275 in.)
	Exhaust		0.030 ~ 0.054 mm (0.00118 ~ 0.00212 in.)	0.09 mm (0.00354 in.)

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Valve guide

Inner diameter	Intake	5.500 ~ 5.512 mm (0.2165 ~ 0.2170 in.)	-
	Exhaust	5.500 ~ 5.512 mm (0.2165 ~ 0.2170 in.)	-
Length	Intake	41.8 ~ 42.2 mm (1.6457 ~ 1.6614 in.)	-
	Exhaust	41.8 ~ 42.2 mm (1.6457 ~ 1.6614 in.)	-

Valve seat

Width of seat contact	Intake	1.15 ~ 1.45 mm (0.05118 ~ 0.05709 in.)	-
	Exhaust	1.35 ~ 1.65 mm (0.05315 ~ 0.06496 in.)	-
Seat angle	Intake	44.75° ~ 45.20°	-
	Exhaust	44.75° ~ 45.20°	-

Valve spring

Free length	43.86 mm (1.7267 in.)	-
Load	19.3 ± 0.8 kg/34.0 mm (42.7 ± 1.8 lb/1.3386 in.) 42.3 ± 1.3 kg/24.2 mm (93.3 ± 2.9 lb/0.9527 in.)	-
Out of squareness	Less than 1.5°	-

MLA

MLA outer diameter	Intake	34.964 ~ 34.980 mm (1.3765 ~ 1.3772 in.)	-
	Exhaust	34.964 ~ 34.980 mm (1.3765 ~ 1.3772 in.)	-
Cylinder head tappet bore inner diameter	Intake	35.000 ~ 35.025 mm (1.3779 ~ 1.3789 in.)	-
	Exhaust	35.000 ~ 35.025 mm (1.3779 ~ 1.3789 in.)	-
MLA to tappet bore clearance	Intake	0.020 ~ 0.061 mm (0.0008 ~ 0.0024 in.)	0.07 mm (0.0027 in.)
	Exhaust	0.020 ~ 0.061 mm (0.0008 ~ 0.0024 in.)	0.07 mm (0.0027 in.)

Valve clearance

Intake	0.17 ~ 0.23 mm (0.0067 ~ 0.0090 in.)	0.10 ~ 0.30 mm (0.0039 ~ 0.0118 in.)
Exhaust	0.27 ~ 0.33 mm	0.20 ~ 0.40 mm (0.0078 ~ 0.0157 in.)

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		(0.0106 ~ 0.0129 in.)	0.0157 in.)
Cylinder block			
Cylinder bore		96.00 ~ 96.03 mm (3.7795 ~ 3.7807 in.)	-
Flatness of gasket surface		Less than 0.05 mm (0.0019 in.) [Less than 0.02 mm (0.0008 in.)/150x150]	-
Piston			
Piston outer diameter		95.96 ~ 95.99 mm (3.7779 ~ 3.7791 in.)	-
Piston to cylinder clearance		0.03 ~ 0.05 mm (0.0012 ~ 0.0020 in.)	-
Ring groove width	No. 1 ring groove	1.22 ~ 1.24 mm (0.0480 ~ 0.0488 in.)	1.26 mm (0.0496 in.)
	No. 2 ring groove	1.22 ~ 1.24 mm (0.0480 ~ 0.0488 in.)	1.26 mm (0.0496 in.)
	Oil ring groove	2.01 ~ 2.03 mm (0.0791 ~ 0.0799 in.)	2.05 mm (0.0807 in.)
Piston ring			
Side clearance	No. 1 ring	0.03 ~ 0.07 mm (0.0012 ~ 0.0027 in.)	0.1 mm (0.004 in.)
	No. 2 ring	0.03 ~ 0.07 mm (0.0012 ~ 0.0027 in.)	0.1 mm (0.004 in.)
	Oil ring	0.06 ~ 0.15 mm (0.0024 ~ 0.0059 in.)	0.2 mm (0.008 in.)
End gap	No. 1 ring	0.17 ~ 0.32 mm (0.0067 ~ 0.0126 in.)	0.6 mm (0.0236 in.)
	No. 2 ring	0.32 ~ 0.47 mm (0.0126 ~ 0.0185 in.)	0.7 mm (0.0275 in.)
	Oil ring	0.20 ~ 0.70 mm (0.0078 ~ 0.0275 in.)	0.8 mm (0.0315 in.)
Piston pin			
Piston pin outer diameter		23.001 ~ 23.006 mm (0.9055 ~ 0.9057 in.)	-
Piston pin hole inner diameter		23.016 ~ 23.021 mm (0.9061 ~ 0.9063 in.)	-
Piston pin hole clearance		0.01 ~ 0.02 mm (0.0004 ~ 0.0008 in.)	-
Connecting rod small end inner diameter		22.974 ~ 22.985 mm (0.9045 ~ 0.9049 in.)	-
Connecting rod small end hole clearance		-0.032 ~ -0.016 mm (- 0.0012 ~ 0.0006 in.)	-
Connecting rod			

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Connecting rod big end inner diameter		58.000 ~ 58.018 mm (2.2834 ~ 2.2842 in.)	-
Connecting rod bearing oil clearance		0.038 ~ 0.056 mm (0.0015 ~ 0.0022 in.)	-
Side clearance		0.1 ~ 0.25 mm (0.0039 ~ 0.0098 in.)	-
Crankshaft			
Main journal outer diameter		68.942 ~ 68.960 mm (2.7142 ~ 2.7149 in.)	-
Pin journal outer diameter		54.954 ~ 54.972 mm (2.1635 ~ 2.1642 in.)	-
Main bearing oil clearance		0.022 ~ 0.040 mm (0.0008 ~ 0.0016 in.)	-
End play		0.10 ~ 0.28 mm (0.0039 ~ 0.0110 in.)	-
Oil pump			
Relief valve opening pressure		450 ~ 550 kPa (4.59 ~ 5.61 kgf/cm ² , 65.28 ~ 79.79 psi)	-
Engine oil			
Oil quantity	Total	6.0L (6.34 US qt, 5.28 lmp qt)	When replacing a short engine or a block assembly
	Oil pan	5.5L (5.81 US qt, 4.84 lmp qt)	-
	Drain and refill	5.2L (5.49 US qt, 4.58 lmp qt)	Including oil filter
Oil grade	Recommendation	5W-20/GF4&SM	If not available, refer to the recommended API or ILSAC classification and SAE viscosity number.
	Classification	API SL, SM or above ILSAC GF3, GF4 or above	Satisfy the requirement of the API or ILSAC classification.
	SAE viscosity grade	Recommended SAE viscosity number	Refer to the <u>LUBRICATION SYSTEM</u>
Oil pressure (at 1000 rpm)		130 kPa (1.32 kg/cm ² , 18.77 psi) or above Oil temperature in oil pan: 110 ± 2°C (230 ± 36°F)	-
Cooling system			
Cooling method		Forced circulation	-

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		with electrical fan	
Coolant quantity		8.5 ~ 10.5 L (8.98 ~ 11.10 U.S. qts, 7.48 ~ 9.24 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	10 mm (0.3937 in.) MIN	-
Radiator cap	Main valve opening pressure	93.16 ~ 122.58 kpa (0.95 ~ 1.25 kg/cm ² , 13.51 ~ 17.78 psi)	-
	Vacuum valve opening pressure	0.98 ~ 4.90 kpa (0.01 ~ 0.05 kg/cm ² , 0.14 ~ 0.71 psi)	-
Water temperature sensor			
Type		Thermistor type	-
Resistance	20°C (68°F)	2.31 ~ 2.59 Kohms	-
	80°C (176°F)	0.3222 Kohms	-

TIGHTENING TORQUES

TIGHTENING TORQUES SPECIFICATION

Item	Quantity	N.m	kgf.m	lb-ft
Crankshaft pulley bolt	1	284.2 ~ 303.8	29.0 ~ 31.0	209.76 ~ 224.22
Timing chain cover bolt B	17	18.62 ~ 21.56	1.9 ~ 2.2	13.74 ~ 15.91
Timing chain cover bolt C	4	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain cover bolt D	1	58.80 ~ 68.80	6.0 ~ 7.0	43.40 ~ 50.63
Timing chain cover bolt E	1	58.80 ~ 68.80	6.0 ~ 7.0	43.40 ~ 50.63
Timing chain cover bolt F	2	24.50 ~ 26.46	2.5 ~ 2.7	18.08 ~ 19.53
Timing chain cover bolt G	4	21.56 ~ 23.52	2.2 ~ 2.4	15.91 ~ 17.36
Timing chain cover bolt H	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain cover bolt I	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain cover	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68

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bolt J				
Cam to cam guide bolt	4	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain auto tensioner bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain auto tensioner nut	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Timing chain guide bolt	4	19.60 ~ 24.50	2.0 ~ 2.5	14.17 ~ 18.08
Oil pump chain cover bolt	3	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil pump chain tensioner bolt	1	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil pump chain guide bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil pump chain sprocket bolt	1	18.62 ~ 21.56	1.9 ~ 2.2	13.74 ~ 15.91
Lower oil pan bolt	13	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Drive belt auto tensioner bolt (M12)	1	81.4 ~ 85.3	8.3 ~ 8.7	60.0 ~ 62.9
Drive belt auto tensioner bolt (M8)	1	17.64 ~ 21.56	1.8 ~ 2.2	13.02 ~ 15.91
Drive belt idler bolt	1	53.90 ~ 57.82	5.5 ~ 5.9	39.78 ~ 42.67
OCV (oil control valve) bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Cylinder head bolt	16	(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	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
CVVT & exhaust cam sprocket bolt	4	64.68 ~ 76.44	6.6 ~ 7.8	47.74 ~ 56.42
Camshaft bearing cap bolt	32	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Cylinder head cover bolt	38	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Connecting rod bearing bolt	12	(17.7 ~ 21.6) + (88~92°)	(1.8 ~ 2.2) + (88 ~ 92°)	(13.0 ~ 15.9) + (88~92°)
Main bearing cap inner bolt (M11)	8	49.00 + 90°	5.0 + 90°	36.16 + 90°
Main bearing cap outer bolt (M8)	8	19.60 + 120°	2.0 + 120°	14.46 + 120°
Main bearing cap side bolt (M8)	6	29.40 ~ 31.36	3.0 ~ 3.2	21.70 ~ 23.14
Oil drain cover bolt	6	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Rear oil seal case	6	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68

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bolt				
Baffle plate bolt	12	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Upper oil pan bolt	16	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Knock sensor bolt	2	15.68 ~ 23.52	1.6 ~ 2.4	11.57 ~ 17.36
Drive plate bolt cap	8	71.54 ~ 75.46	7.3 ~ 7.7	52.80 ~ 55.69
Oil filter cap	-	24.50	2.5	18.08
Oil drain bolt cap	1	34.30 ~ 44.10	3.5 ~ 4.5	25.31 ~ 32.55
Oil pump bolt	3	20.6 ~ 22.6	2.1 ~ 2.3	15.2 ~ 16.6
Oil filter body bolt	10	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Oil filter body cover bolt	11	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Water vent hose bolt (Timing chain cover bolt L)	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Water pump bolt (Timing chain cover bolt K)	1	21.56 ~ 26.46	2.2 ~ 2.7	15.91 ~ 19.53
Water pump bolt	4	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Water pump pulley bolt	4	7.84 ~ 9.80	0.8 ~ 1.0	5.78 ~ 7.23
Water temp. control nut	4	19.6 ~ 23.52	2.0 ~ 2.4	14.5 ~ 17.36
Water temp. control bolt	2	19.6 ~ 23.52	2.0 ~ 2.4	14.5 ~ 17.36
Water inlet pipe bolt	3	16.66 ~ 19.60	1.7 ~ 2.0	12.30 ~ 14.47
Air vent pipe bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Intake manifold bolt	6	26.5 ~ 31.4	2.7 ~ 3.2	19.5 ~ 23.1
Intake manifold nut	2	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
Surge tank bolt (M8 x 25)	3	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
Surge tank bolt (M6 x 106)	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Surge tank nut	1	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
Breather pipe bolt	2	9.80 ~ 11.76	1.0 ~ 1.2	7.23 ~ 8.68
Surge tank bracket bolt rear (M10 x 18)	2	27.44 ~ 31.36	2.8 ~ 3.2	20.25 ~ 23.14
Surge tank bracket bolt front (M8 x 16)	2	18.62 ~ 23.52	1.9 ~ 2.4	13.74 ~ 17.36
ETC bracket bolt	2	15.68 ~ 25.48	1.6 ~ 2.6	11.57 ~ 18.80
Exhaust manifold nut	16	39.20 ~ 44.10	4.0 ~ 4.5	28.93 ~ 32.55
Heat proctor bolt	8	16.66 ~ 21.56	1.7 ~ 2.2	12.30 ~ 15.91
Front muffler	2	39.20 ~ 58.80	4.0 ~ 6.0	28.93 ~ 43.40

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 and stop engine.

Allow the engine to warm up to normal operating temperature.

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

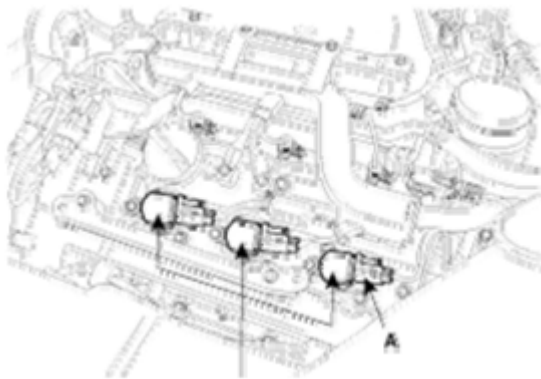


Fig. 1: Identifying Ignition Coil Connectors
Courtesy of HYUNDAI MOTOR CO.

4. Remove the spark plugs.

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

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

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

4. Repeat steps 1 through 3 for each cylinder.

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

Compression pressure:

1,225 kPa (12.5 kgf/cm² , 177 psi)

Minimum pressure:

1,078 kPa (11.0 kgf/cm² , 156 psi)

5. If the cylinder compression in 1 or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps 1 through 3 for cylinders with low compression.
 - 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 coil and ignition coil connectors.
8. Install the surge tank.

Valve Clearance Inspection and Adjustment

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

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

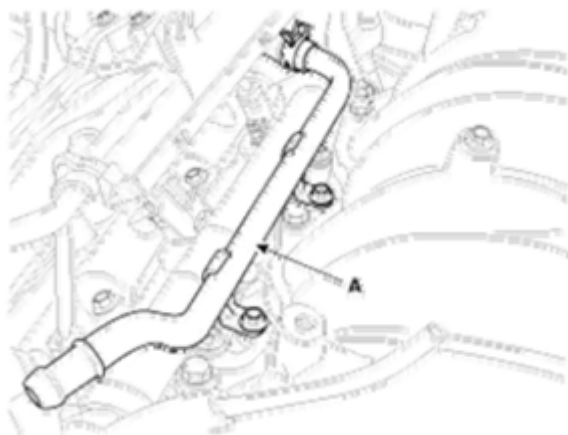


Fig. 2: Identifying Breather Pipe Assembly
Courtesy of HYUNDAI MOTOR CO.

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

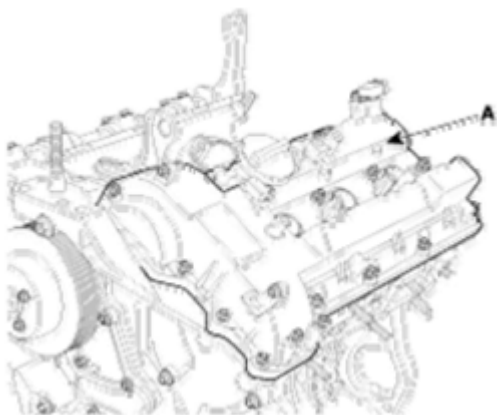


Fig. 3: Identifying Cover
Courtesy of HYUNDAI MOTOR CO.

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



Fig. 4: Identifying Mark On Crankshaft Pulley
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 below.

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

NOTE: Do not rotate engine counterclockwise

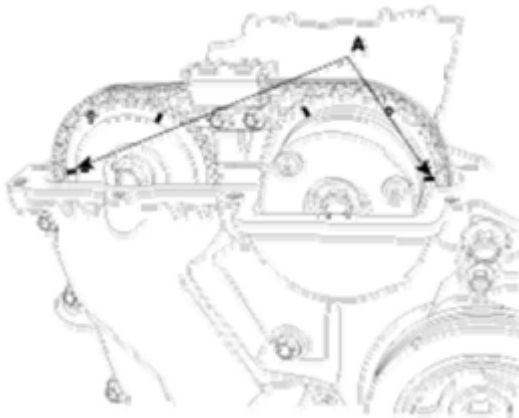


Fig. 5: Identifying Mark On Camshaft Timing Sprockets
Courtesy of HYUNDAI MOTOR CO.

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

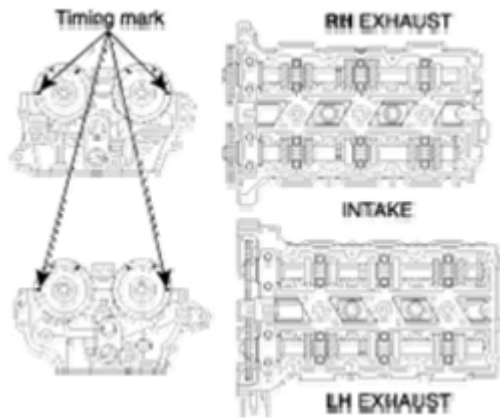


Fig. 6: Identifying Timing Mark
Courtesy of HYUNDAI MOTOR CO.

Measurement method.

- A. Using a thickness gauge, measure the clearance between the tappet and the base circle of camshaft.

Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting tappet.

Valve clearance

Specification

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

Limit

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

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

2. Turn the crankshaft pulley one revolution (360°) and align the groove with timing mark "T" of the lower timing chain cover.

NOTE: Do not rotate engine counterclockwise

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

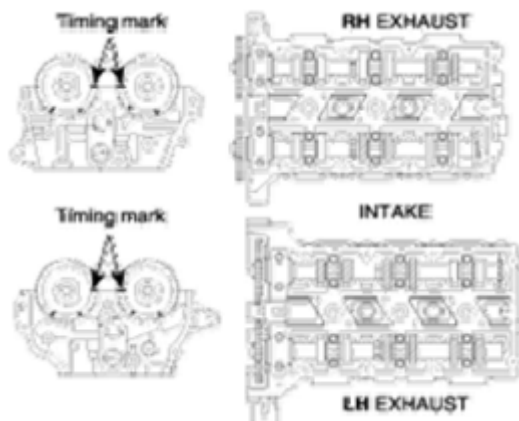


Fig. 7: Identifying Timing Mark
Courtesy of HYUNDAI MOTOR CO.

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

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

3. Remove the camshaft bearing caps (A).

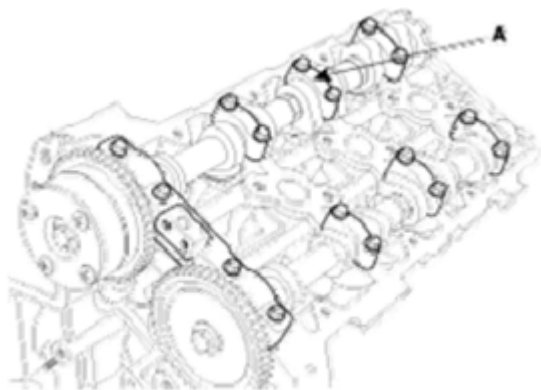


Fig. 8: Identifying Camshaft Bearing Caps
Courtesy of HYUNDAI MOTOR CO.

4. Remove the camshaft assembly (A).

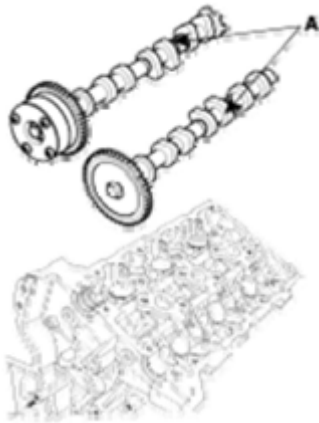


Fig. 9: Identifying Camshaft Assembly
Courtesy of HYUNDAI MOTOR CO.

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

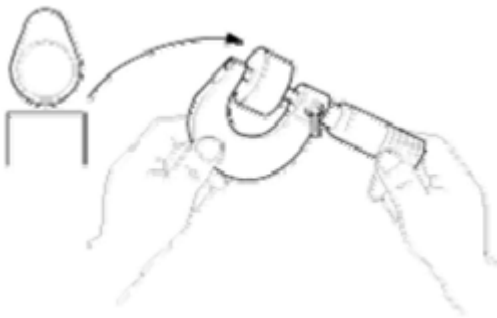


Fig. 10: Measuring Thickness Of Removed Tappet Using Micrometer
Courtesy of HYUNDAI MOTOR CO.

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

Valve clearance

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

T: Thickness of removed tappet

A: Measured valve clearance

N: Thickness of new tappet

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

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

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

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

9. Place a new tappet on the cylinder head.

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

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

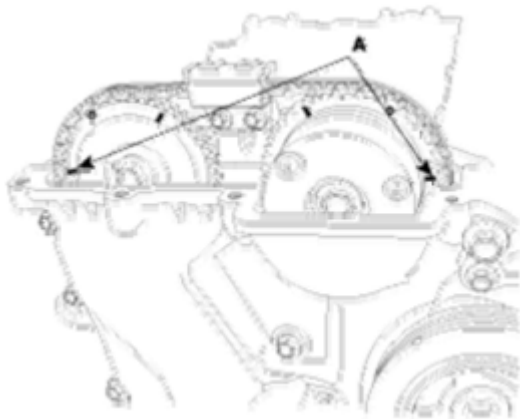


Fig. 11: Identifying Camshaft Sprocket Timing Marks
Courtesy of HYUNDAI MOTOR CO.

14. Recheck the valve clearance.

Valve clearance

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

[Specification]

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

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

TROUBLESHOOTING

PROBLEM SYMPTOMS

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	Replace the timing chain and

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Lower engine noise, regardless of engine speed.	and/or damaged sprocket teeth.	sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	- Inspect the camshaft lobes. - Replace the timing camshaft and valve lifters as required.
	Worn valve guides or valve stems.	Inspect the valves and valve guides, then repair as required.
	Stuck valves. Carbon on the valve stem or valve seat may cause the valve to stay open.	Inspect the valves and valve guides, then repair as required.
	Worn drive belt, idler, tensioner and bearing.	Replace as required.
	Low oil pressure.	Repair as required.
	Loose or damaged drive plate.	Repair or replace the drive plate.
	Damaged oil pan, contacting the oil pump screen.	- Inspect the oil pan. - Inspect the oil pump screen. - Repair or replace as required.
	Oil pump screen loose, damaged or restricted.	- Inspect the oil pump screen. - Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	- Inspect the piston, piston pin and cylinder bore. - 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

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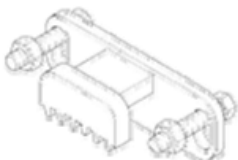
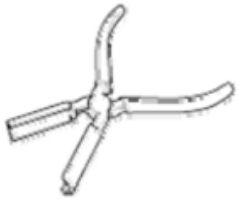
2010 ENGINE General Information (Engine Mechanical) - Veracruz

	Excessive crankshaft bearing clearance.	journals. Inspect the following components, and repair as required. • The crankshaft bearings. • The crankshaft main journals. • The cylinder block.
	Incorrect piston, piston pin and connecting rod installation	• Verify the piston pins and connecting rods are installed correctly. • Repair as required.
Engine noise under load.	Low oil pressure	Repair or replace as required.
	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required : • The connecting rod bearings. • The connecting rods. • The crankshaft.
	Excessive crankshaft bearing clearance.	Inspect the following components, and repair as required. • The crankshaft bearings. • The crankshaft main journals. • The cylinder block.
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.	1. Inspect cylinder for damaged components and/or foreign materials. 2. Repair or replace as required.
	• Broken valve • Piston material • Foreign material	
	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.

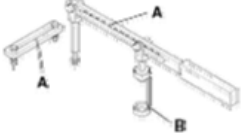
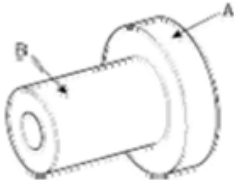
SPECIAL SERVICE TOOLS

SPECIAL SERVICE TOOLS DESCRIPTION

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

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3C100)		
Valve spring compressor & holder (09222-3K000) (09222-3C300)		Removal and installation of the intake or exhaust valves 1. 09222-3K000 2. 09222-3C300 (holder)
Crankshaft rear oil seal installer (09231-3C200) (09231-H1100)		Installation of the crankshaft rear oil seal 1. 09231-3C200 2. 09231-H1100
Oil pan remover (09215-3C000)		Removal of oil pan
Oil filter wrench (09263-3C100)		Removal and installation of the oil filter

2010 ENGINE

Cylinder Block - Veracruz

COMPONENTS AND COMPONENTS LOCATION

COMPONENTS

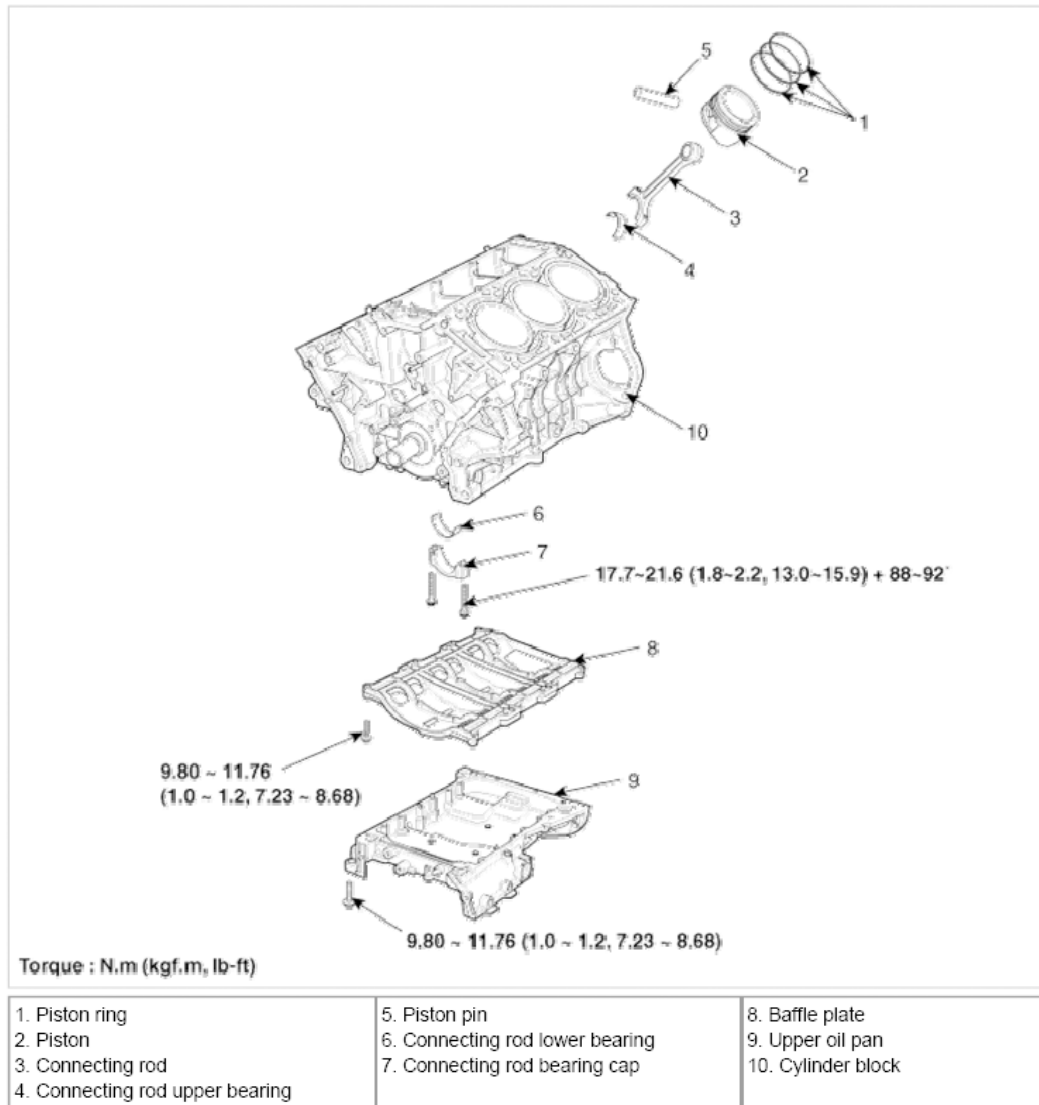


Fig. 1: Identifying Cylinder Block Components With Torque Specifications
Courtesy of HYUNDAI MOTOR CO.

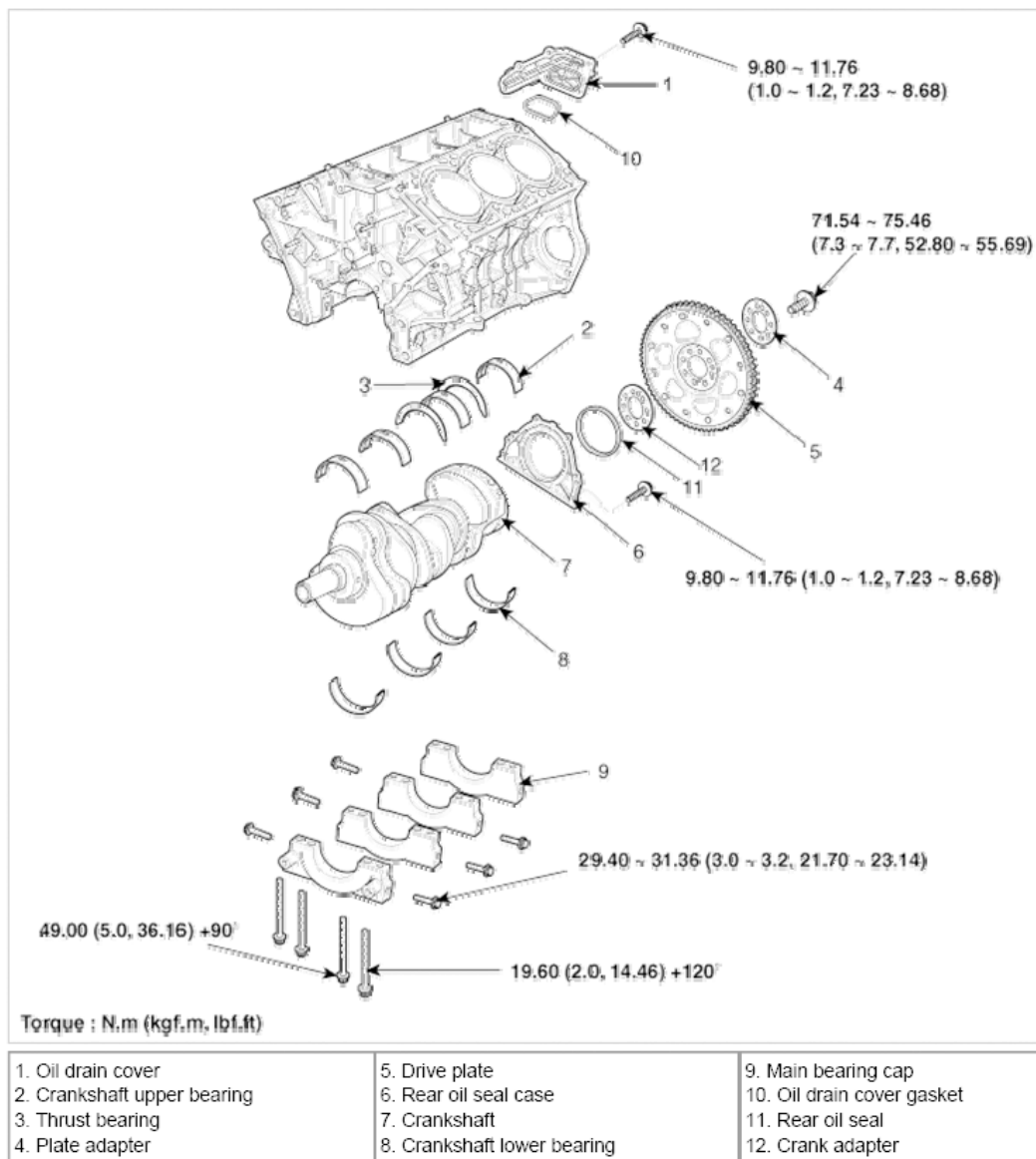


Fig. 2: Identifying Cylinder Block Components With Torque Specifications
 Courtesy of HYUNDAI MOTOR CO.

REPAIR PROCEDURES

REMOVAL

CAUTION:

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

NOTE:

- Mark all wiring and hoses to avoid misconnection.

- **Inspect the timing belt before removing the cylinder head.**
- **Turn the crankshaft pulley so that the No. 1 piston is at top dead center.**
- **Engine removal is required for this procedure.**

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

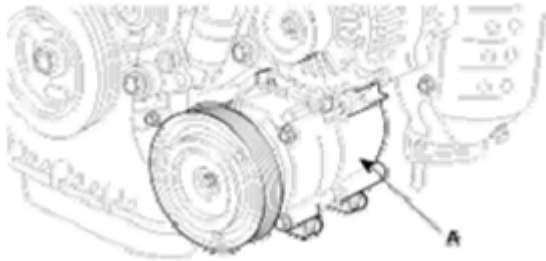


Fig. 3: Identifying A/C Compressor
Courtesy of HYUNDAI MOTOR CO.

9. Remove the alternator (A) from engine.

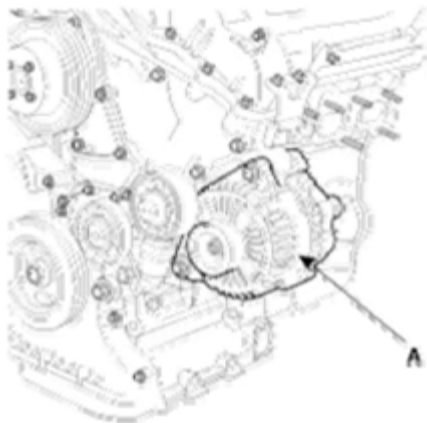


Fig. 4: Identifying Generator
Courtesy of HYUNDAI MOTOR CO.

10. Remove the power steering pump from engine.

(Refer to **POWER STEERING OIL PUMP**).

DISASSEMBLY

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

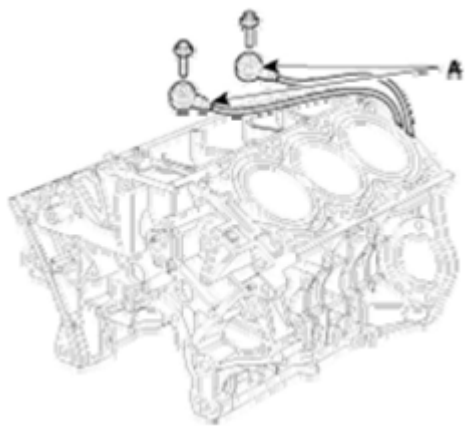


Fig. 5: Identifying Knock Sensor
Courtesy of HYUNDAI MOTOR CO.

3. Remove the upper oil pan (A).

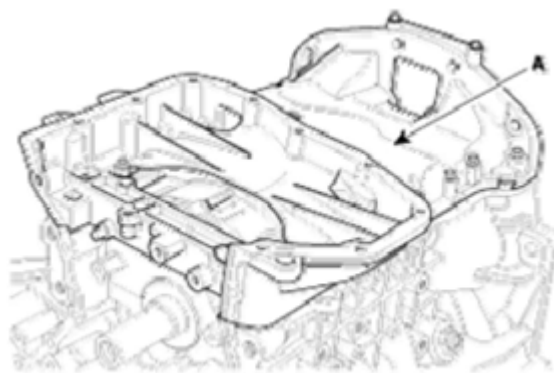


Fig. 6: Identifying Upper Oil Pan
Courtesy of HYUNDAI MOTOR CO.

4. Remove the baffle plate (A).

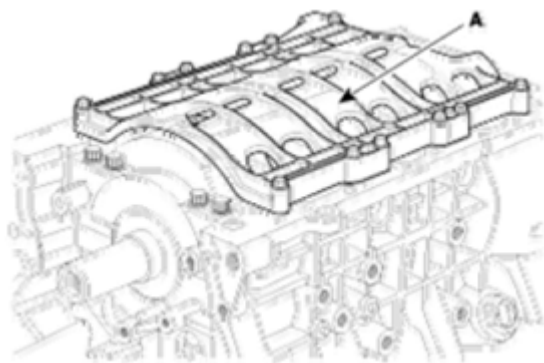


Fig. 7: Identifying Baffle Plate
Courtesy of HYUNDAI MOTOR CO.

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

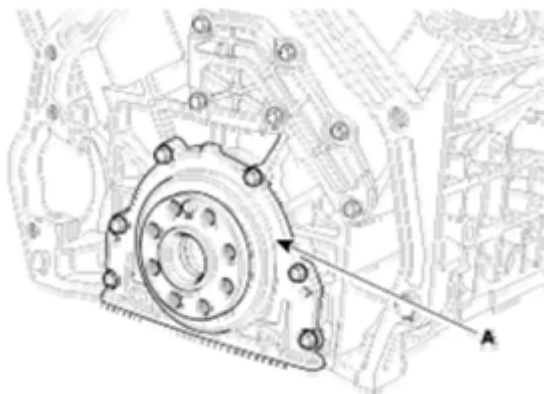


Fig. 8: Identifying Rear Oil Seal Case
Courtesy of HYUNDAI MOTOR CO.

6. Remove the oil drain cover (A).

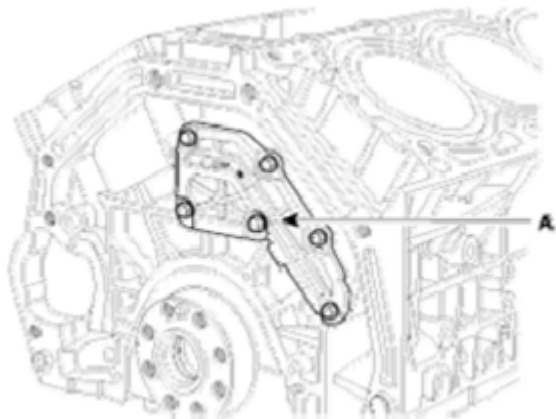


Fig. 9: Identifying Oil Drain Cover
Courtesy of HYUNDAI MOTOR CO.

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

NOTE:

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

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

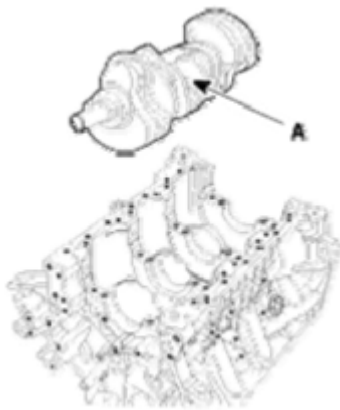


Fig. 10: Identifying Crankshaft
Courtesy of HYUNDAI MOTOR CO.

NOTE:

- **Arrange the main bearings and thrust bearings in the correct order.**

13. Check fit between piston and piston pin.

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

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

NOTE:

- **Arrange the piston rings in the correct order only.**

15. Disconnect connecting rod from piston.

Using a press, remove the piston pin from the piston.

(Press-in load : 800 ~ 1400kg (1764 ~ 3086lb))

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.)

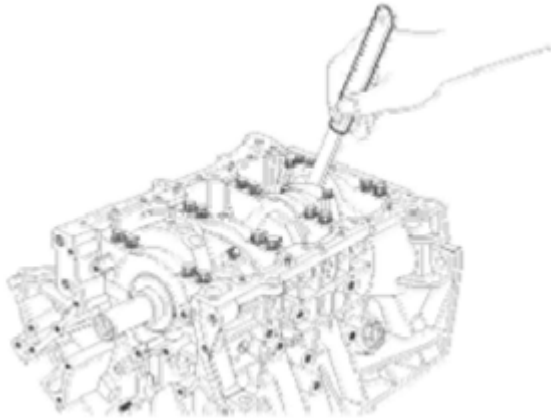


Fig. 11: Measuring End Play

Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

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

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.)

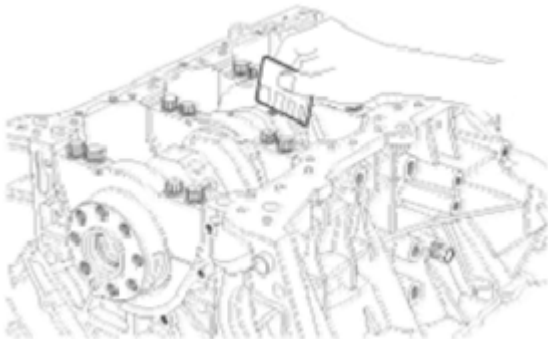


Fig. 12: Measuring Plastigage
Courtesy of HYUNDAI MOTOR CO.

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. 13: Identifying Connecting Rod Mark
 Courtesy of HYUNDAI MOTOR CO.

Identification Of Connecting Rod

CONNECTING ROD SPECIFICATION

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

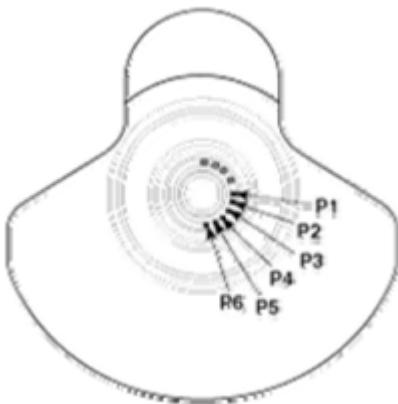


Fig. 14: Identifying Crankshaft Pin Mark Location
 Courtesy of HYUNDAI MOTOR CO.

Discrimination of Crankshaft

CRANKSHAFT DISCRIMINATION

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)

Upper

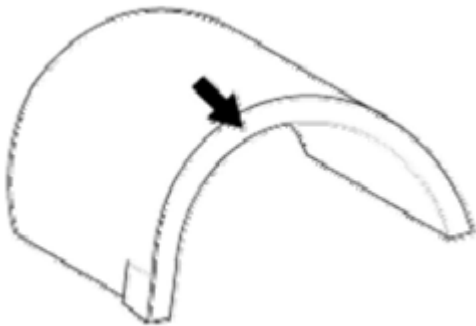


Fig. 15: Identifying Connecting Rod (Upper) Bearing Mark
Courtesy of HYUNDAI MOTOR CO.

Lower

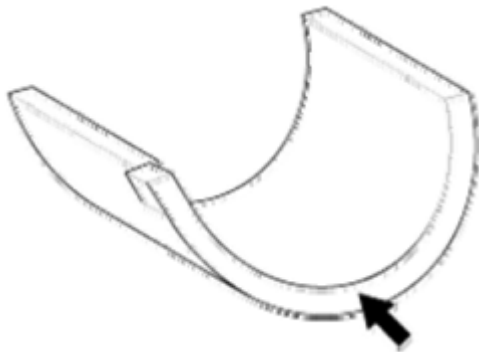


Fig. 16: Identifying Connecting Rod (Lower) Bearing Mark
Courtesy of HYUNDAI MOTOR CO.

Identification of Connecting Rod Bearing

CONNECTING ROD BEARING SPECIFICATION

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.)

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2010 ENGINE Cylinder Block - Veracruz

B	Green	1.505 ~ 1.508mm (0.0593 ~ 0.0594in.)
A	Yellow	1.502 ~ 1.505mm (0.0591 ~ 0.0593in.)

*(11) Selection

CONNECTING ROD IDENTIFICATION MARK

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

3. Check the crankshaft bearing oil clearance.

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

Tightening torque

49.00Nm (5.0 kgf.m, 36.16lb-ft) + 90°

19.60 Nm (2.0 kgf.m, 14.46lb-ft) + 120°

29.40 ~ 31.36Nm (3.0 ~ 3.2 kgf.m, 21.70 ~ 23.14lb-ft)

NOTE: Do not turn the crankshaft.

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

Standard oil clearance

0.022 ~ 0.040mm (0.0009 ~ 0.0016in.)



Fig. 17: Measuring Plastigage
Courtesy of HYUNDAI MOTOR CO.

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

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

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

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

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

Crankshaft bore mark location

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

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



Fig. 18: Identifying Crankshaft Bore Mark Location
Courtesy of HYUNDAI MOTOR CO.

Discrimination of Cylinder Block

CYLINDER BLOCK DISCRIMINATION

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

Discrimination of Crankshaft

CRANKSHAFT DISCRIMINATION

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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)

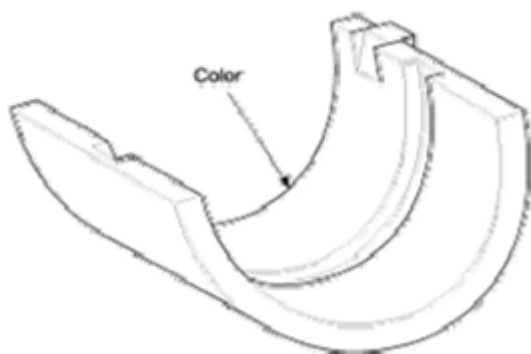


Fig. 20: Identifying Crankshaft Bearing Mark
Courtesy of HYUNDAI MOTOR CO.

Discrimination of Crankshaft Bearing

CRANKSHAFT BEARING DISCRIMINATION

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 MARK

		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)

4. Check crankshaft end play.

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

Standard end play

0.10 ~ 0.28mm (0.0039 ~ 0.0110in.)

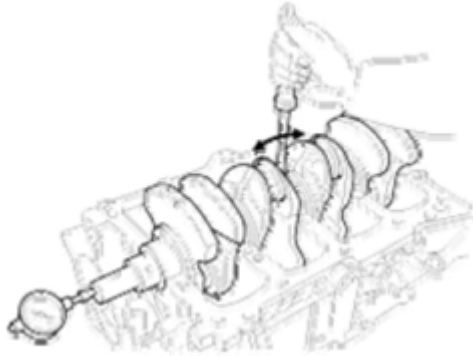


Fig. 21: Checking Crankshaft End Play
Courtesy of HYUNDAI MOTOR CO.

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

Thrust bearing thickness

2.41 ~ 2.45mm (0.0949 ~ 0.0964in.)

5. Inspect main journals and crank pins

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

Main journal diameter :

68.942 ~ 68.960mm (2.7142 ~ 2.7149in.)

Crank pin diameter :

54.954 ~ 54.972mm (2.1635 ~ 2.1642in.)

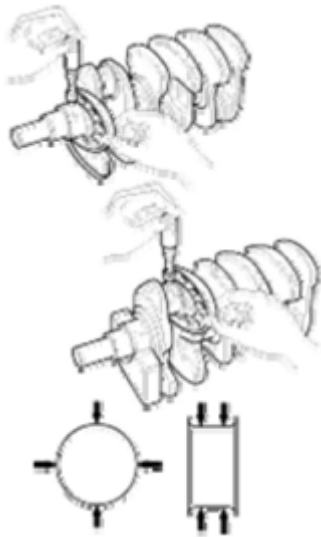


Fig. 22: Measuring Diameter Of Main Journal And Crank Pin
Courtesy of HYUNDAI MOTOR CO.

Connecting Rods

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

Allowable bend of connecting rod :

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

Allowable twist of connecting rod :

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

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

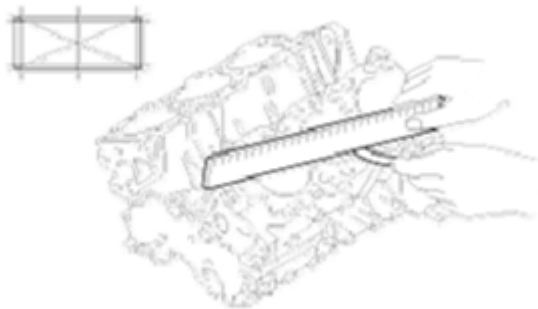


Fig. 23: Inspecting Surface Of Cylinder Block For Flatness
Courtesy of HYUNDAI MOTOR CO.

4. Inspect cylinder bore diameter

Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder block.

5. Inspect cylinder bore diameter

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

Standard diameter

96.00 ~ 96.03mm (3.7795 ~ 3.7807in.)

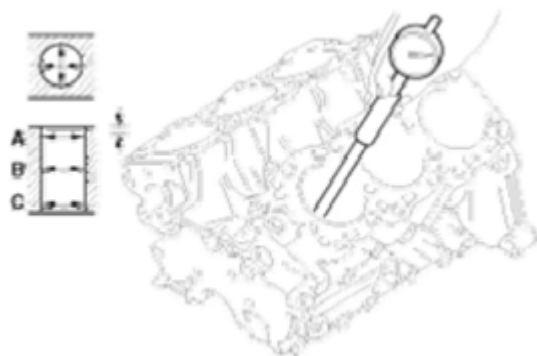


Fig. 24: Inspecting Cylinder Bore Diameter
Courtesy of HYUNDAI MOTOR CO.

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

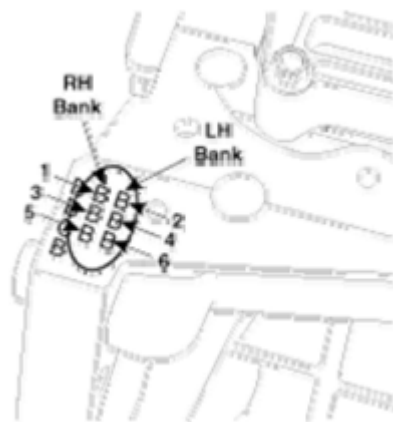


Fig. 25: Identifying Cylinder Bore Size Code On Cylinder Block
Courtesy of HYUNDAI MOTOR CO.

CYLINDER BORE SIZE CODE

Class	Size Code	Cylinder Bore Inner Diameter
A	A	96.00~96.01mm (3.7795 ~ 3.7799in.)
B	B	96.01~96.02mm (3.7799 ~ 3.7803in.)
C	C	96.02~96.03mm (3.7803 ~ 3.7807in.)

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

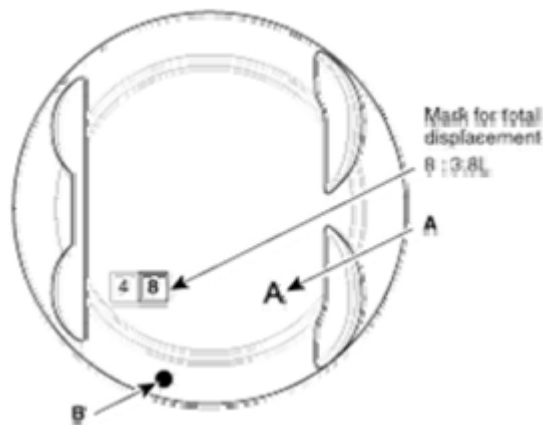


Fig. 26: Identifying Piston Size Code On Piston
 Courtesy of HYUNDAI MOTOR CO.

PISTON SIZE CODE

Class	Size Code	Piston Outer Diameter
A	A	95.96 ~ 95.97mm (3.7779 ~ 3.7783in.)
B	B	95.97 ~ 95.98mm (3.7783 ~ 3.7787in.)
C	C	95.98 ~ 95.99mm (3.7787 ~ 3.7791in.)

8. Select the piston related to cylinder bore class.

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

Piston And Rings

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

NOTE: Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 14 mm (0.5512 in.) from the bottom of the piston.

Standard diameter

95.96 ~ 95.99mm (3.7779~ 3.7791in.)

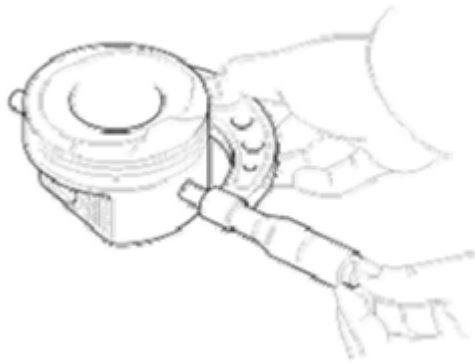


Fig. 27: Measuring Of Piston Outside Diameter
Courtesy of HYUNDAI MOTOR CO.

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

Piston-to-cylinder clearance

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

No. 2 : 0.03 ~ 0.07mm (0.0012 ~ 0.0027in.)

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. 28: Measuring Clearance Between Piston Ring And Wall
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 : 0.32 ~ 0.47m (0.0126 ~ 0.0185in.)

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

Limit

No. 1 : 0.6mm (0.0236in.)

No. 2 : 0.7mm (0.0275in.)

Oil ring : 0.8mm (0.0315in.)

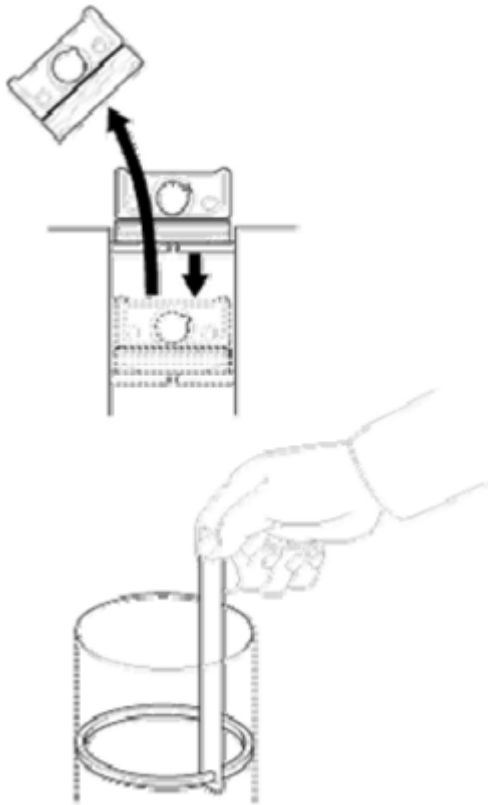


Fig. 29: Checking Piston Ring End Gap
Courtesy of HYUNDAI MOTOR CO.

Piston Pins

1. Measure the diameter of the piston pin.

Piston pin diameter

23.001 ~ 23.006mm (0.9056 ~ 0.9057in.)

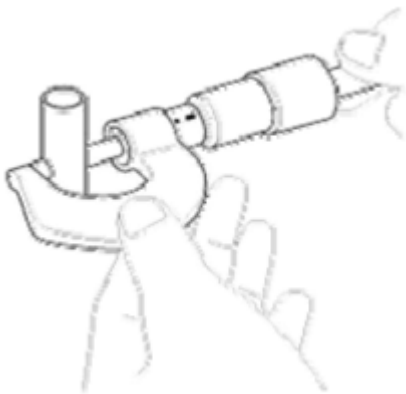


Fig. 30: Measuring Diameter Of Piston Pin

Courtesy of HYUNDAI MOTOR CO.

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

Piston pin-to-piston clearance

0.009 ~ 0.017mm (0.0004 ~ 0.0007in.)

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

Piston pin-to-connecting rod interference

-0.032 ~ -0.017mm (-0.0012 ~ -0.0007in.)

REASSEMBLY

NOTE:

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

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

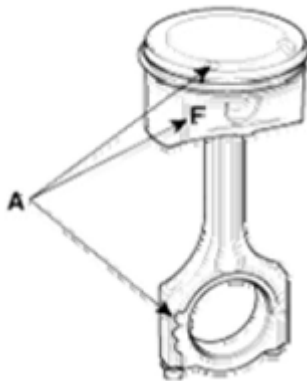


Fig. 31: Checking Difference Between Piston Pin Diameter And Connecting Rod Small End Diameter

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.

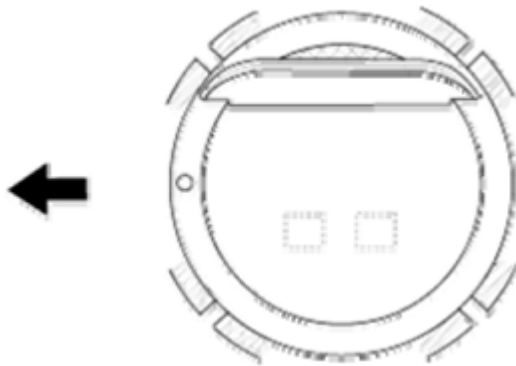


Fig. 32: Identifying Piston Rings
Courtesy of HYUNDAI MOTOR CO.

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).

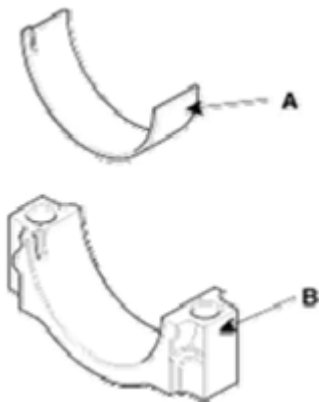


Fig. 33: Identifying Bearings
Courtesy of HYUNDAI MOTOR CO.

4. Install the main bearings.

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

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

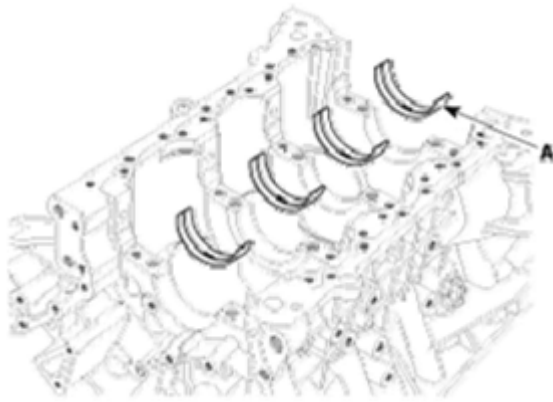


Fig. 34: Identifying Lower Bearings
Courtesy of HYUNDAI MOTOR CO.

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

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



Fig. 35: Identifying Thrust Bearings
Courtesy of HYUNDAI MOTOR CO.

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

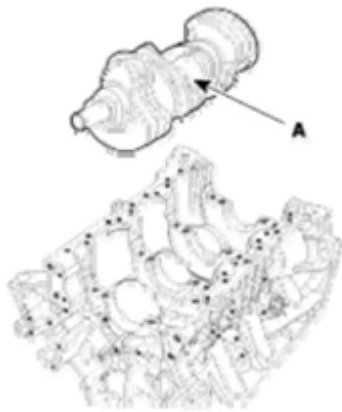


Fig. 36: Identifying Crankshaft
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

Main bearing cap bolt

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

19.60 Nm (2.0 kgf.m, 14.46lb-ft) + 120° (9 ~ 16)

29.40 ~ 31.36Nm (3.0 ~ 3.2 kgf.m, 21.70 ~ 23.14lb-ft) (17 ~ 22)

NOTE:

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

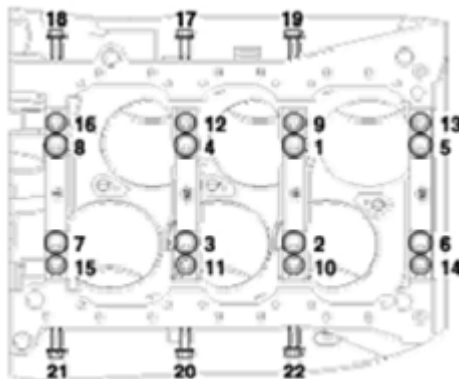


Fig. 37: Identifying Main Bearing Cap Bolt Tightening Sequence
Courtesy of HYUNDAI MOTOR CO.

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

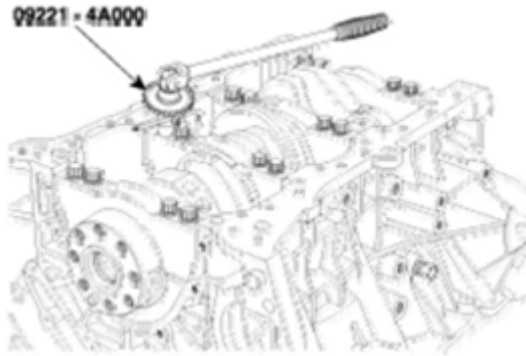


Fig. 38: Installing Main Bearing Cap Bolts
Courtesy of HYUNDAI MOTOR CO.

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

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

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

Tightening torque

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

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

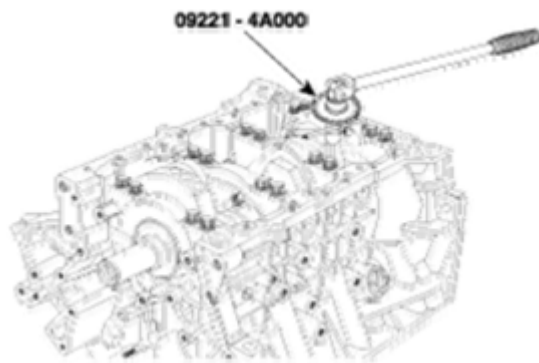


Fig. 39: Installing Connecting Rod Bearing Cap Bolts
Courtesy of HYUNDAI MOTOR CO.

NOTE:

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

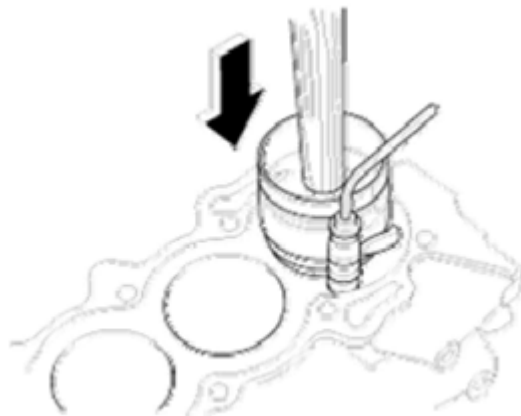


Fig. 40: Installing Piston
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

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

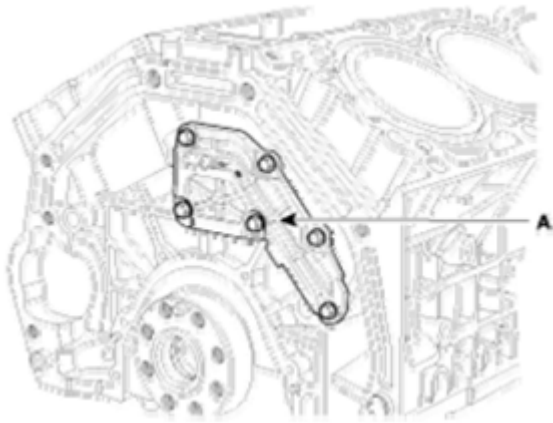


Fig. 41: Identifying Oil Drain Cover
Courtesy of HYUNDAI MOTOR CO.

NOTE:

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

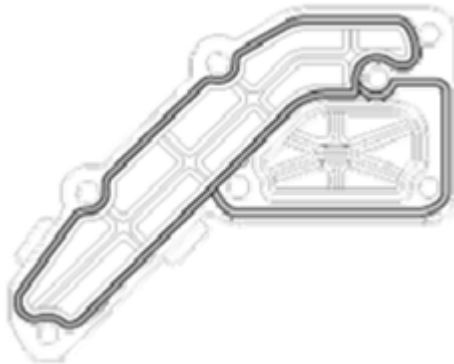


Fig. 42: Identifying Sealant Apply Area
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

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

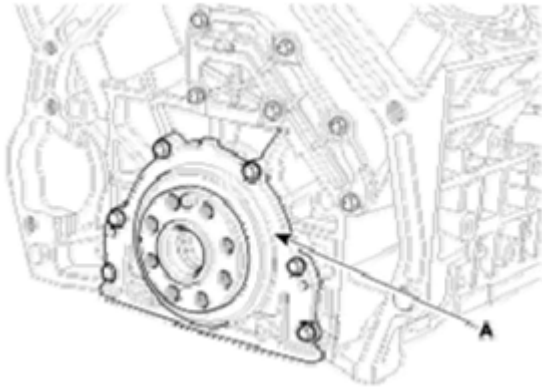


Fig. 43: Identifying Rear Oil Seal Case
Courtesy of HYUNDAI MOTOR CO.

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.

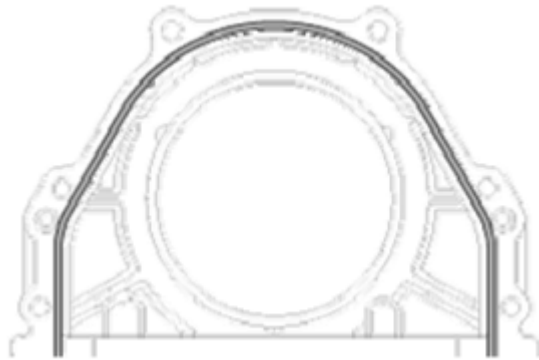


Fig. 44: Identifying Sealant Apply Area
Courtesy of HYUNDAI MOTOR CO.

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

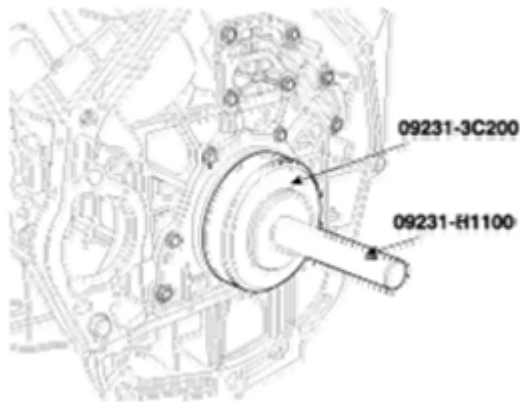


Fig. 45: Identifying Rear Oil Seal
Courtesy of HYUNDAI MOTOR CO.

15. Install the baffle plate.

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

Tightening torque

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



Fig. 46: Identifying Baffle Plate Bolts Tightening Sequence
Courtesy of HYUNDAI MOTOR CO.

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

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

Bead width : 2.5mm (0.1in.)

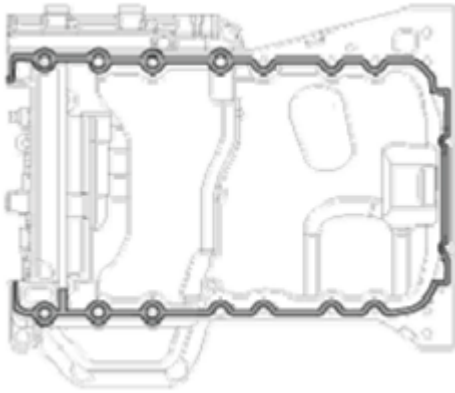


Fig. 47: Identifying Upper Oil Pan Liquid Sealant Apply Area
Courtesy of HYUNDAI MOTOR CO.

NOTE:

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

C. Install the upper oil pan.

Uniformly tighten the bolts in several passes.

Tightening torque

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



Fig. 48: Identifying Upper Oil Pan Bolts Tightening Sequence
Courtesy of HYUNDAI MOTOR CO.

17. Install the knock sensor (A).

Tightening torque

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



Fig. 49: Identifying Knock Sensor
Courtesy of HYUNDAI MOTOR CO.

18. Install the drive plate.

Tightening torque

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

INSTALLATION

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

2010 ENGINE

Cylinder Head Assembly - Veracruz

COMPONENTS AND COMPONENTS LOCATION

COMPONENTS

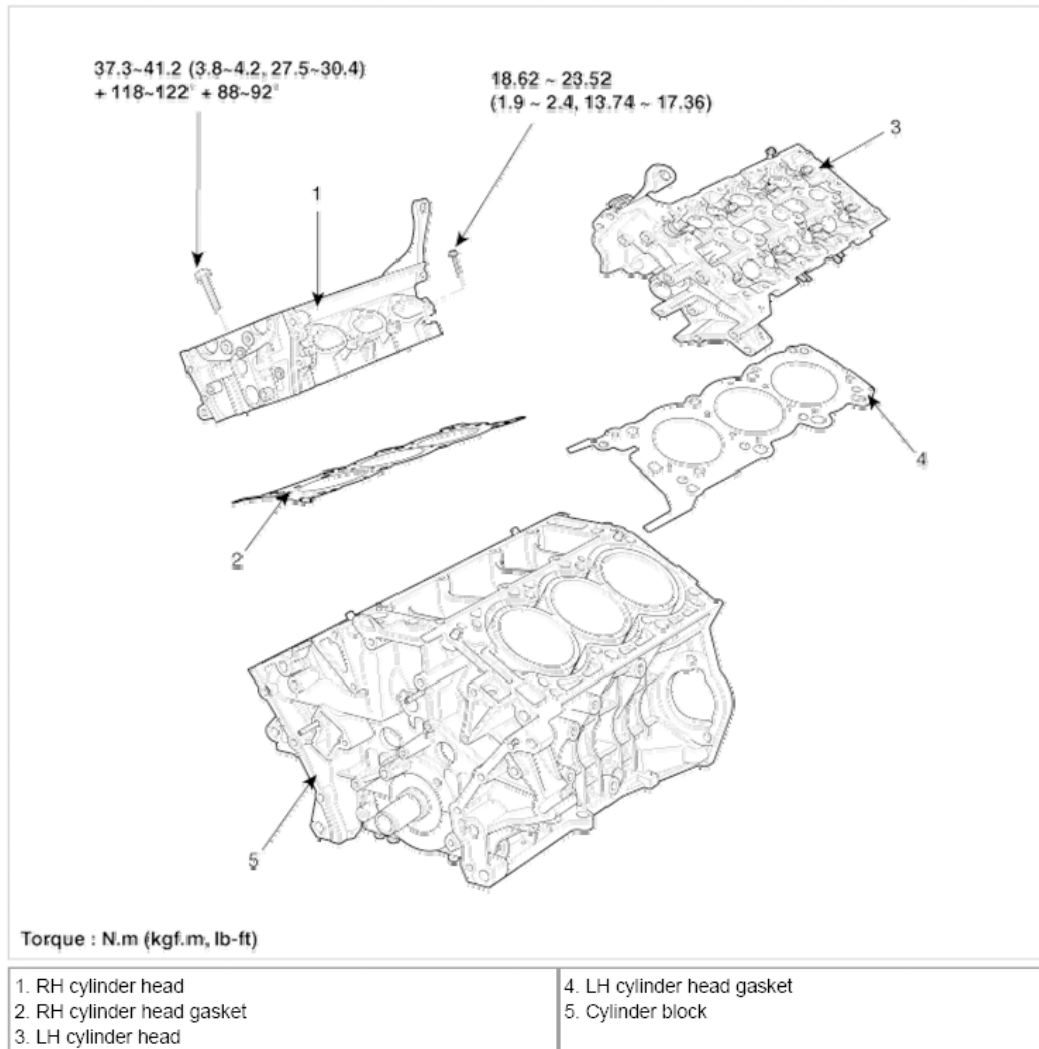
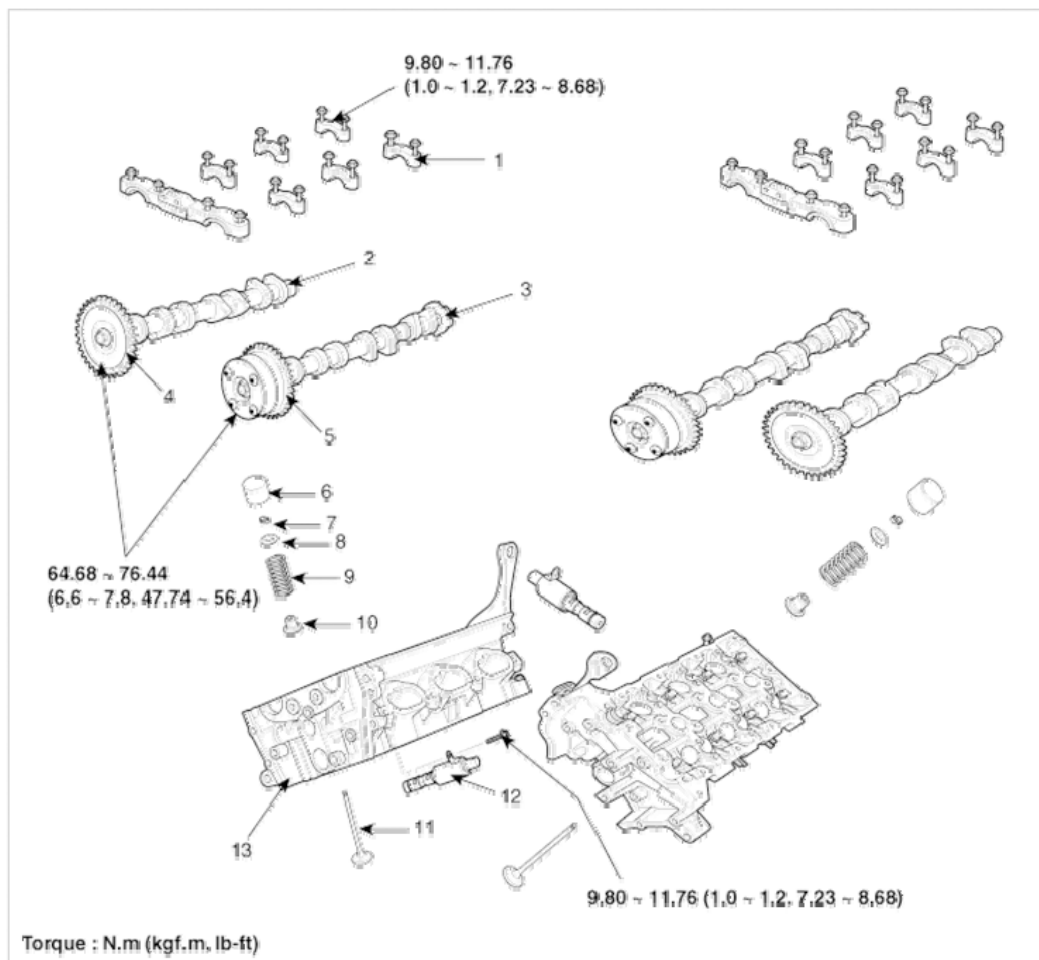


Fig. 1: Identifying Cylinder Head Assembly Components With Torque Specifications (1 Of 2)
Courtesy of HYUNDAI MOTOR CO.



1. Camshaft bearing cap	6. MLA	11. Valve
2. Exhaust camshaft	7. Retainer lock	12. OCV
3. Intake camshaft	8. Retainer	13. Cylinder head
4. Exhaust camshaft sprocket	9. Valve spring	
5. CVVT assembly	10. Valve stem seal	

Fig. 2: Identifying Cylinder Head Assembly Components With Torque Specifications (2 Of 2)
 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 operating temperature before removing it.
- When handling a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.
- To avoid damage, unplug the wiring connectors carefully while

holding the connector portion.

NOTE:

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

Engine removal is required for this procedure.

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

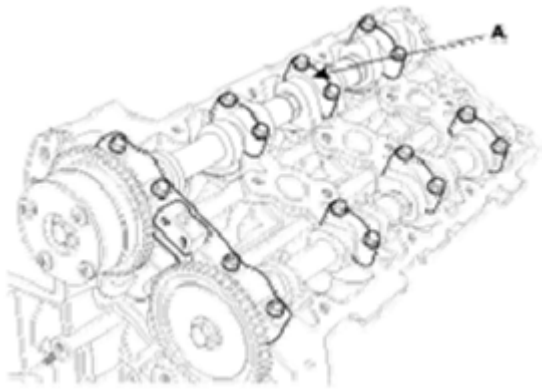


Fig. 3: Identifying Camshaft Bearing Cap
Courtesy of HYUNDAI MOTOR CO.

6. Remove the camshaft assembly (A).

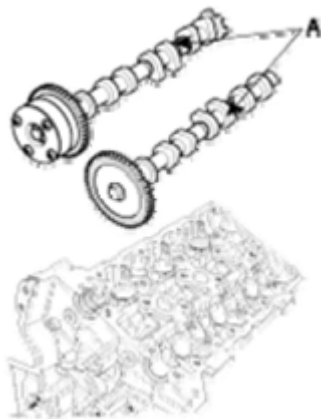


Fig. 4: Identifying Camshaft Assembly
Courtesy of HYUNDAI MOTOR CO.

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

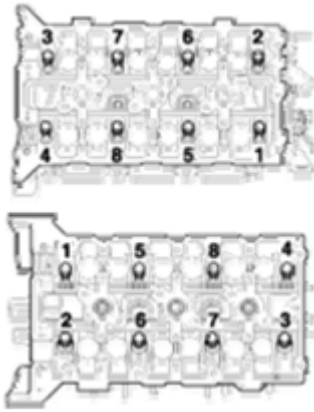


Fig. 5: Identifying Cylinder Head Bolt Loosening Sequence
 Courtesy of HYUNDAI MOTOR CO.

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

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

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

DISASSEMBLY

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

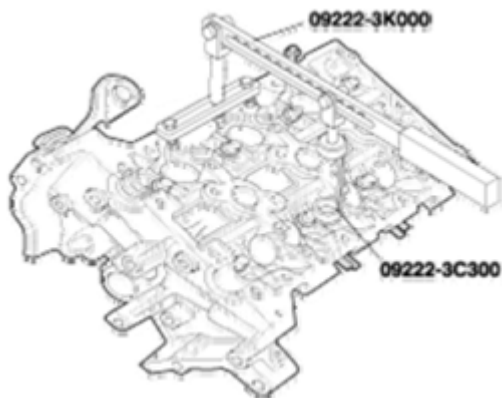
1. Remove the MLAs (A).

**Fig. 6: Identifying MLA**

Courtesy of HYUNDAI MOTOR CO.

2. Remove the valves.

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

**Fig. 7: Compressing Valve Spring**

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.

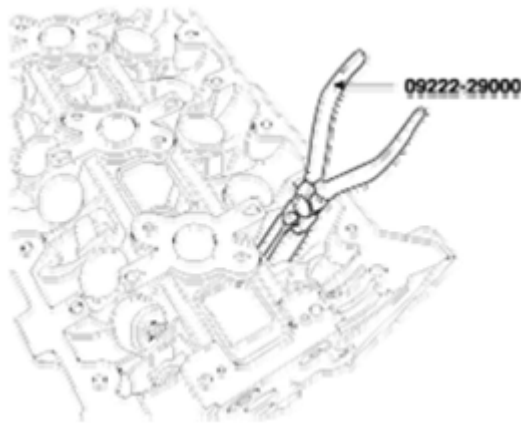


Fig. 8: Removing Valve Stem Seal
 Courtesy of HYUNDAI MOTOR CO.

NOTE: **Do not reuse old valve stem seals.**

3. Remove the OCV (A).

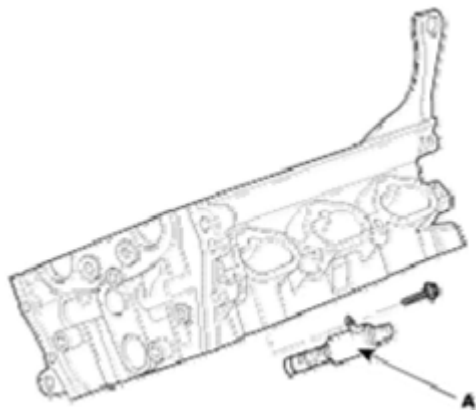


Fig. 9: Identifying OCV
 Courtesy of HYUNDAI MOTOR CO.

INSPECTION

Cylinder Head

1. Inspect for flatness.

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

Flatness of cylinder head gasket surface

Standard: Less than 0.05 mm (0.002 in.)

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

Flatness of manifold gasket surface

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

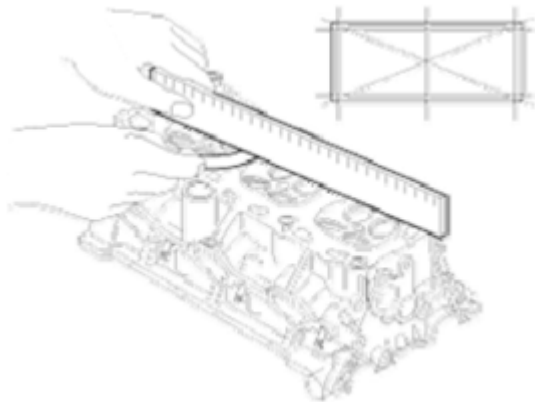


Fig. 10: Inspecting For Flatness
Courtesy of HYUNDAI MOTOR CO.

2. Inspect for cracks.

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

Valve And Valve Spring

1. Inspect valve stems and valve guides.

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

Valve guide I.D.

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

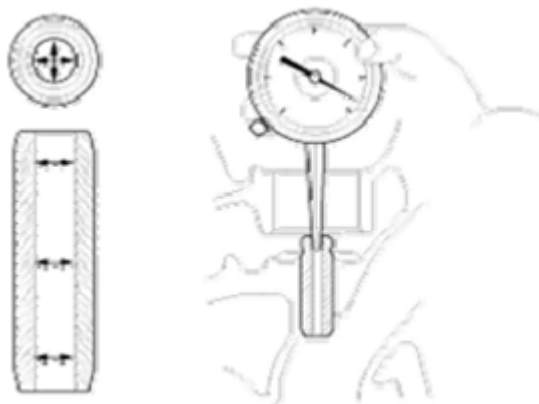


Fig. 11: Measuring Inside Diameter Of Valve Guide
Courtesy of HYUNDAI MOTOR CO.

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

Valve stem O.D.

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

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

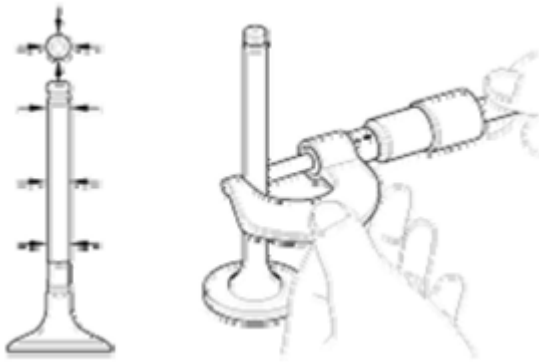


Fig. 12: Measuring Diameter Of Valve Stem
Courtesy of HYUNDAI MOTOR CO.

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

Valve stem-to-guide clearance

[Standard]

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

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

[Limit]

Intake: 0.07 mm (0.0027 in.)

Exhaust: 0.09 mm (0.0035 in.)

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

If the valve face is worn, replace the valve.

3. Check the valve head margin thickness.

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

Margin

[Standard]

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

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

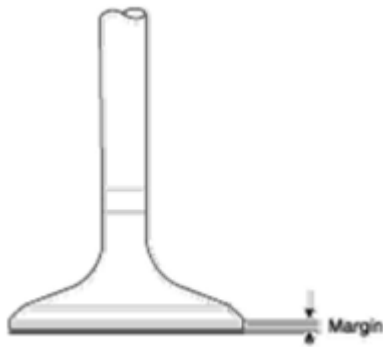


Fig. 13: Checking Valve Head Margin Thickness
Courtesy of HYUNDAI MOTOR CO.

4. Check the valve length.

Length

Intake: 105.27 mm (4.1445 in)

Exhaust: 105.50 mm (4.1535 in)

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

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

3. Inspect valve seats

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

If the valve seat is worn, replace cylinder head.

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

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

Valve spring

[Standard]

Free height: 43.86 mm (1.7267 in.)

Out-of-square: 1.5°

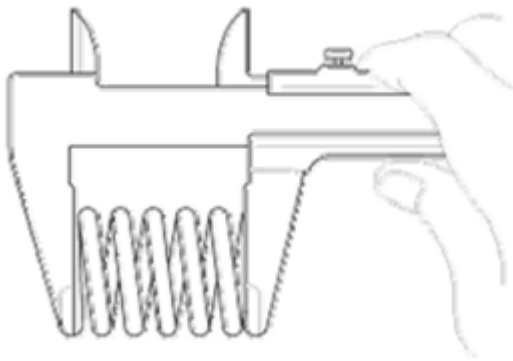


Fig. 14: Measuring Free Length Of Valve Spring
Courtesy of HYUNDAI MOTOR CO.

MLA

1. Inspect MLAs.

Using a micrometer, measure the MLA outside diameter.

MLA O.D.

Intake/Exhaust: 34.964 ~ 34.980 mm

(1.3765 ~ 1.3771 in.)

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

Tappet bore I.D.

Intake/Exhaust: 35.000 ~ 35.025 mm

(1.3779 ~ 1.3789 in.)

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

MLA to tappet bore clearance

[Standard]

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

[Limit]

Intake/Exhaust: 0.07 mm (0.0027 in.)

Camshaft

1. Inspect cam lobes.

Using a micrometer, measure the cam lobe height.

Cam height

[Standard value]

Intake: 46.8 mm (1.8425 in.)

Exhaust: 45.8 mm (1.8031 in.)

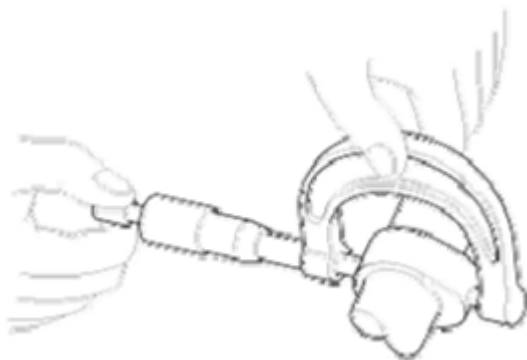


Fig. 15: Measuring Cam Lobe Height Using Micrometer
Courtesy of HYUNDAI MOTOR CO.

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.

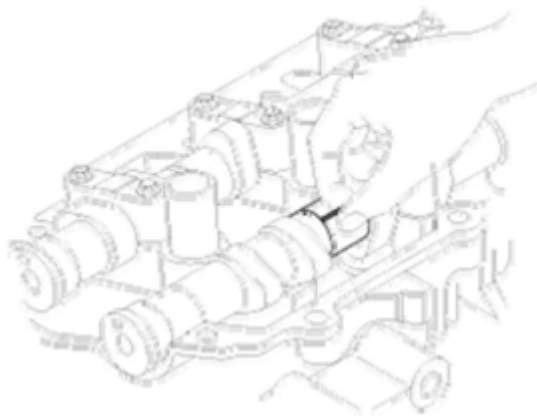


Fig. 16: Laying Strip Of Plastigage Across Of Camshaft Journal
Courtesy of HYUNDAI MOTOR CO.

4. Install the bearing caps.

CAUTION: Do not turn the camshaft.

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

Bearing oil clearance

[Standard value]

Intake

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

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

Exhaust

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

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

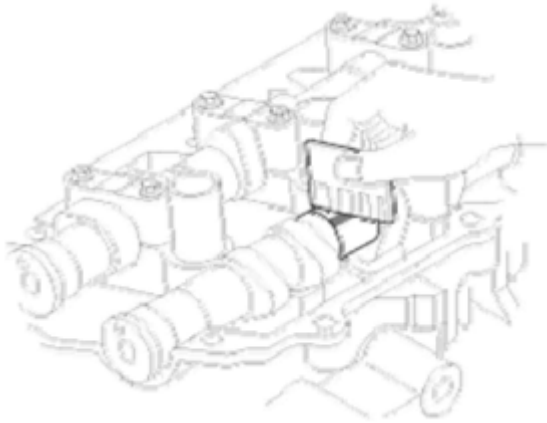


Fig. 17: Measuring Plastigage
Courtesy of HYUNDAI MOTOR CO.

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

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

Camshaft end play

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

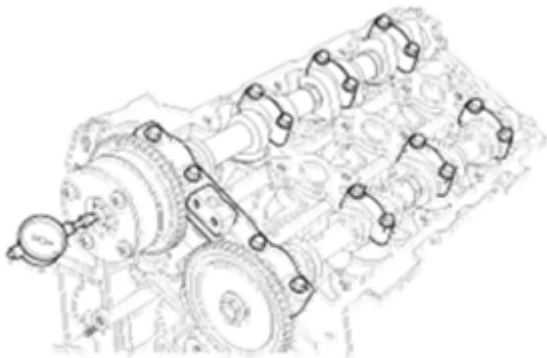


Fig. 18: Measuring End Play Using Dial Indicator
Courtesy of HYUNDAI MOTOR CO.

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

3. Remove the camshafts.

CVVT Assembly

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

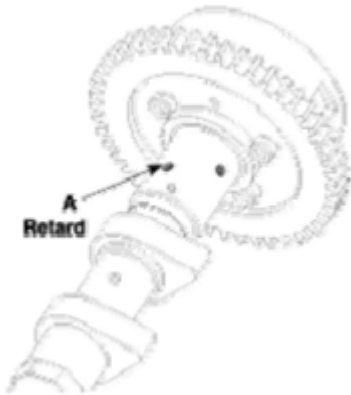


Fig. 19: Identifying Mark
Courtesy of HYUNDAI MOTOR CO.

3. Wind tape around the tip of the air gun and apply air of approx. 150 kpa (1.5 kgf/cm², 21 psi) to the port of the camshaft. (Perform this in order to release the lock pin for the maximum delay angle locking.)

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

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

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

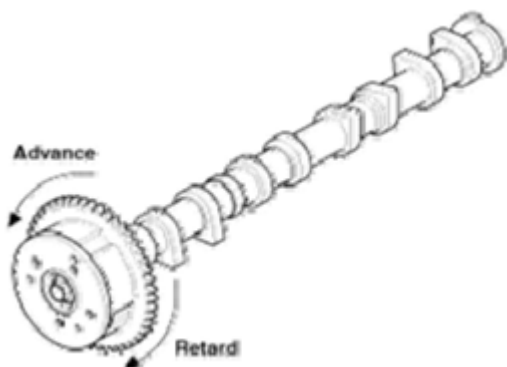


Fig. 20: Turning CVVT Assembly
Courtesy of HYUNDAI MOTOR CO.

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

Standard: Movable smoothly in the range about 22.5°

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

REASSEMBLY

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

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

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

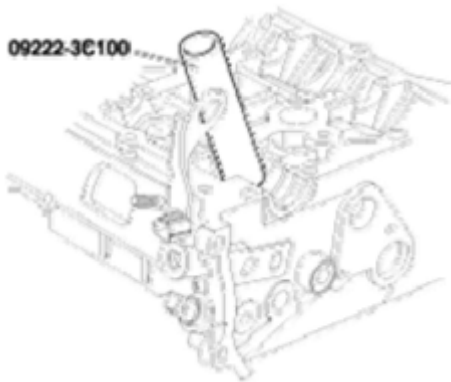


Fig. 21: Pushing Oil Seal
Courtesy of HYUNDAI MOTOR CO.

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

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

3. Using the SST (09222 - 3K000, 09222-3C300), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.

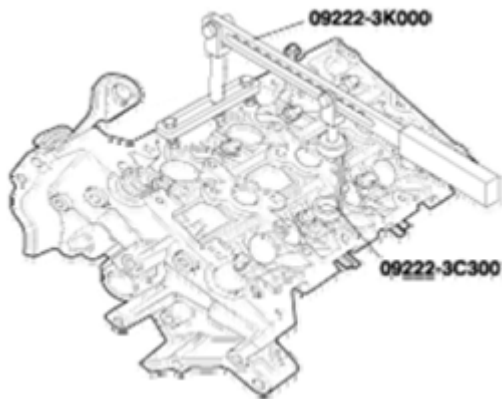


Fig. 22: Compressing Spring
Courtesy of HYUNDAI MOTOR CO.

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

Check that the MLA rotates smoothly by hand.



Fig. 23: Identifying MLA
Courtesy of HYUNDAI MOTOR CO.

NOTE: MLA can be reinstalled in its original position.

3. Install the OCV (A).

Tightening torque

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

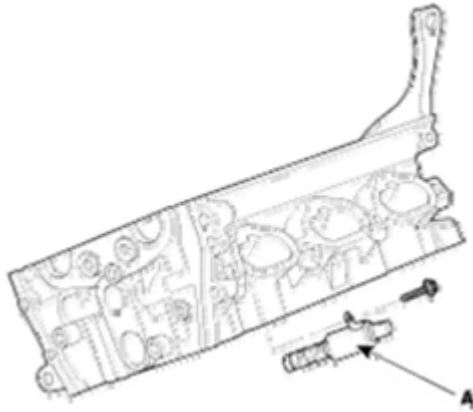


Fig. 24: Identifying OCV

Courtesy of HYUNDAI MOTOR CO.

NOTE:

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

CAUTION:

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

INSTALLATION

NOTE:

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

1. Install the cylinder head.

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

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

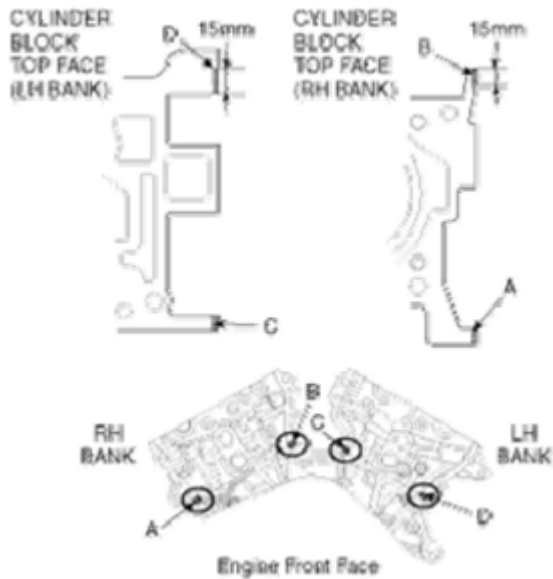


Fig. 25: Identifying Sealant Location
Courtesy of HYUNDAI MOTOR CO.

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

Bead width: 2.0 ~ 3.0 mm

Sealant locations: 1.0 ~ 1.5 mm from block surface

Recommended sealant: Liquid sealant TB1217H

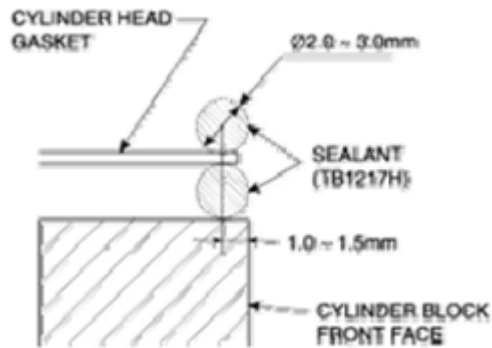


Fig. 26: Identifying Sealant Apply Area
Courtesy of HYUNDAI MOTOR CO.

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.

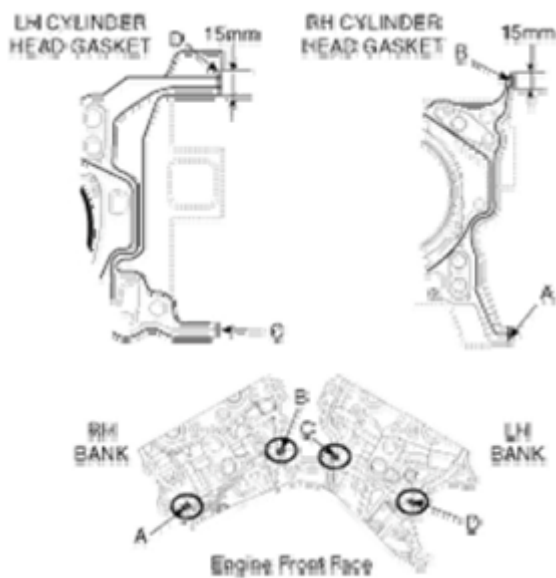


Fig. 27: Identifying Sealant On Cylinder Head Gaskets
Courtesy of HYUNDAI MOTOR CO.

NOTE: Be careful of the installation direction.

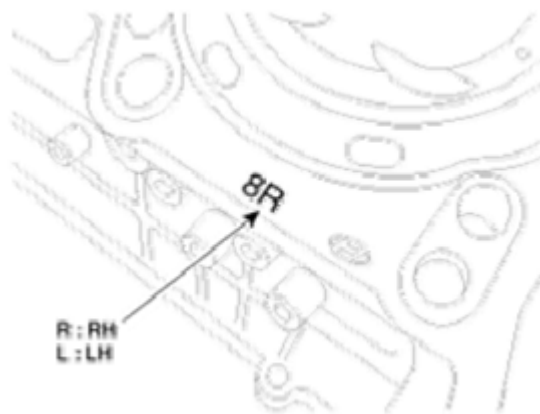


Fig. 28: Identifying Mark
Courtesy of HYUNDAI MOTOR CO.

D. Install the cylinder head.

NOTE: Remove the extruded sealant after assembling cylinder heads.

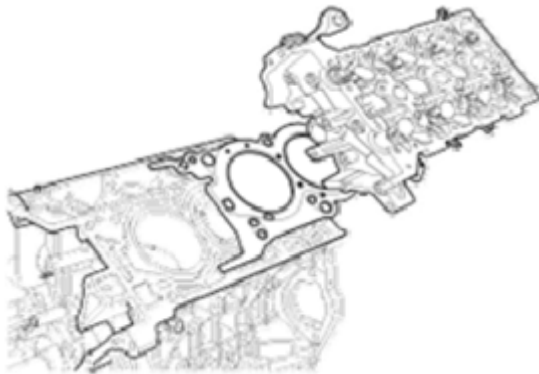


Fig. 29: Identifying Cylinder Head
Courtesy of HYUNDAI MOTOR CO.

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

Tightening torque

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

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

NOTE: Always use new cylinder head bolts.

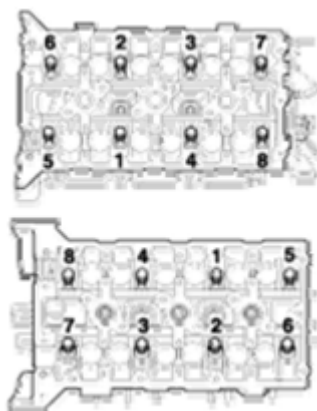


Fig. 30: Identifying Cylinder Head Bolt Tightening Sequence
Courtesy of HYUNDAI MOTOR CO.



Fig. 31: Identifying Bolt
Courtesy of HYUNDAI MOTOR CO.

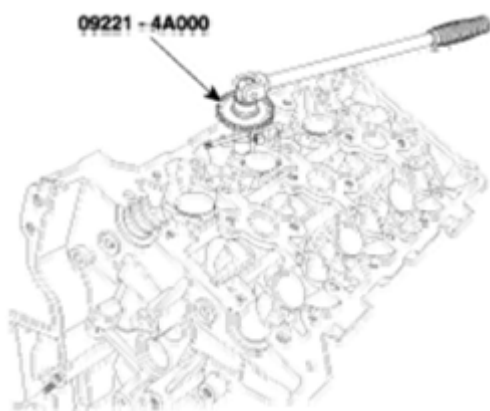


Fig. 32: Installing Cylinder Head Bolts
Courtesy of HYUNDAI MOTOR CO.

4. Install the CVVT and camshaft sprocket.

Tightening torque

64.68 ~ 76.44 N.m (6.6 ~ 7.8 kgf.m, 47.74 ~ 56.4 lb-ft)

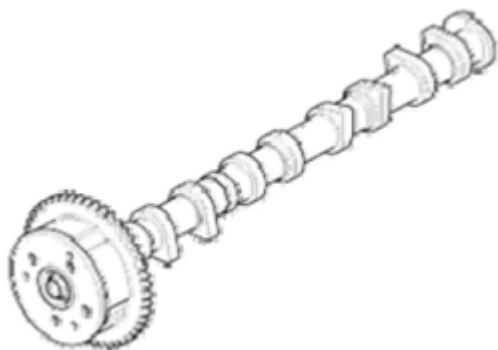


Fig. 33: Identifying CVVT & Camshaft Sprocket
Courtesy of HYUNDAI MOTOR CO.

NOTE:

- Install camshaft-inlet to dowel pin of CVVT assembly.
- At this time, do not install to oil hole of camshaft-inlet.
- Hold the hexagonal head wrench portion of the camshaft with a vise, and install the bolt and CVVT assembly.
 - Do not rotate CVVT assembly when camshaft is installed to dowel pin of CVVT assembly.

5. Install the camshafts (A).

NOTE:

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

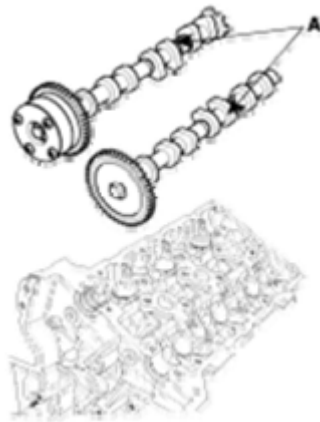


Fig. 34: Identifying Camshafts
Courtesy of HYUNDAI MOTOR CO.

Intake Camshaft

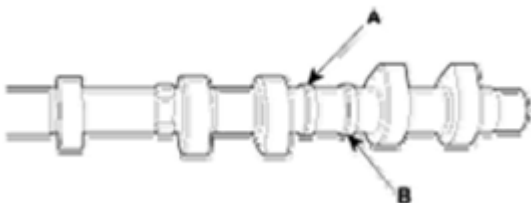


Fig. 35: Identifying Intake Camshaft

Courtesy of HYUNDAI MOTOR CO.

INTAKE CAMSHAFT SPECIFICATION

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

Exhaust Camshaft

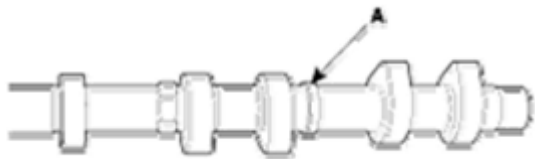


Fig. 36: Identifying Exhaust Camshaft
Courtesy of HYUNDAI MOTOR CO.

EXHAUST CAMSHAFT SPECIFICATION

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

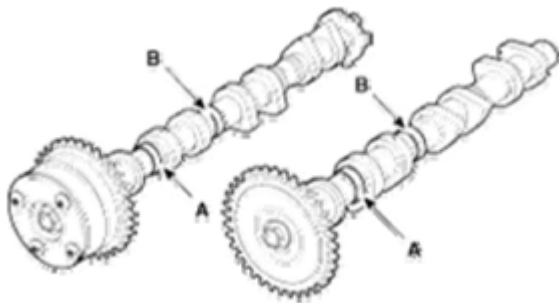


Fig. 37: Identifying Camshaft
Courtesy of HYUNDAI MOTOR CO.

CAMSHAFT SPECIFICATION

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

1. Install the camshaft bearing caps as following order.

Tightening torque

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

2nd step:

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

- 2nd step

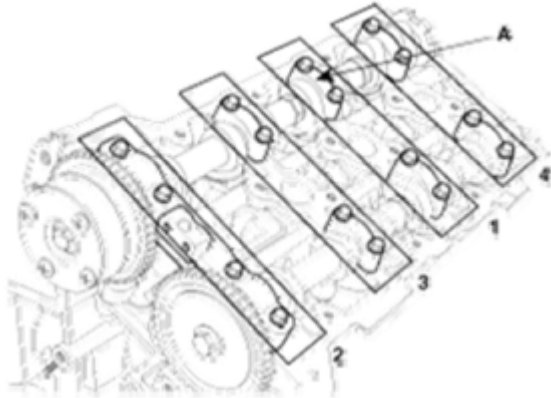


Fig. 38: Identifying Camshaft Bearing Caps
Courtesy of HYUNDAI MOTOR CO.

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

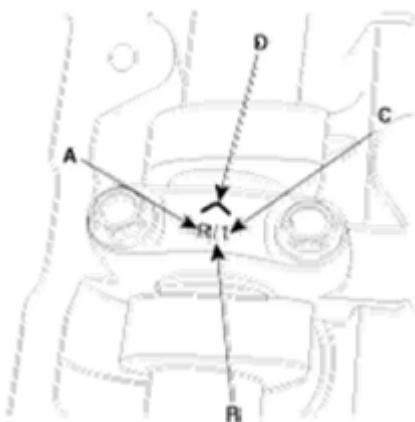


Fig. 39: Identifying Mark On Cap
Courtesy of HYUNDAI MOTOR CO.

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

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

2. Install the water temperature control assembly.
3. Install the timing chain.
4. Check and adjust valve clearance.
5. Install the exhaust manifold.
6. Install the intake manifold.