

2012 Hyundai Veloster

2012-13 ENGINE General Information - Veloster Non-Turbo

2012-13 ENGINE**General Information - Veloster Non-Turbo****SPECIFICATIONS**

Description		Specifications	Limit
General			
Type		In-line, DOHC	
Number of cylinders		4	
Bore		77mm (3.0315in)	
Stroke		85.44mm (3.3638in)	
Total displacement		1, 591 cc (97.09 cu.in)	
Compression ratio		11.0: 1	
Firing order		1-3-4-2	
Valve timing			
Intake valve	Opens	ATDC 8°/BTDC 42°	
	Closes	ABDC 69°/ABDC 19°	
Exhaust valve	Opens	BBDC 50°/BBDC 10°	
	Closes	ATDC 5°/ATDC 45°	
Cylinder head			
Flatness of gasket surface		Less than 0.05mm (0.0020in) for total area Less than 0.02mm (0.0008in) for a section of 100mm (3.9370in) X 100mm (3.9370in)	
Camshaft			
Cam height	Intake	44.15mm (1.7382in)	
	Exhaust	43.55mm (1.7146in)	
Journal outer diameter (Intake, Exhaust)		22.964 ~ 22.980mm (0.9041 ~ 0.9047in)	
Camshaft cap oil clearance		0.027 ~ 0.058mm (0.0011 ~ 0.0023in)	0.1mm (0.0039in)
End play		0.10 ~ 0.20mm (0.0039 ~ 0.0079in)	
Valve			
Valve length	Intake	93.15mm (3.6673in)	
	Exhaust	92.60mm (3.6457in)	
Stem outer diameter	Intake	5.465 ~ 5.480mm (0.2152 ~ 0.2157in)	
	Exhaust	5.458 ~ 5.470mm (0.2149 ~ 0.2154in)	

2012 Hyundai Veloster

2012-13 ENGINE General Information - Veloster Non-Turbo

Face angle		45.25° ~ 45.75°	
Thickness of valve head (margin)	Intake	1.10mm (0.0433in)	0.8mm (0.0315in)
	Exhaust	1.26mm (0.0496in)	1.0mm (0.0394in)
Valve stem to valve guide clearance	Intake	0.020 ~ 0.047mm (0.0008 ~ 0.0019in)	0.10mm (0.0039in)
	Exhaust	0.030 ~ 0.054mm (0.0012 ~ 0.0021in)	0.15mm (0.0059in)
Valve guide			
Length	Intake	40.3 ~ 40.7mm (1.5866 ~ 1.6024in)	
	Exhaust	40.3 ~ 40.7mm (1.5866 ~ 1.6024in)	
Valve spring			
Free length		45.1mm (1.7756in)	
Out of squareness		Less than 1.5°	
Cylinder block			
Cylinder bore		77.00 ~ 77.03mm (3.0315 ~ 3.0327in)	
Flatness of gasket surface		Less than 0.05mm (0.0020in) for total area Less than 0.02mm (0.0008in) for a section of 100mm (3.9370in) X 100mm (3.9370in)	
Piston			
Piston outer diameter		76.97 ~ 77.00mm (3.0303 ~ 3.0315in)	
Piston to cylinder clearance		0.020 ~ 0.040mm (0.0008 ~ 0.0016in)	
Ring groove width	No. 1 ring groove	1.23 ~ 1.25mm (0.0484 ~ 0.0492in)	1.26mm (0.0496in)
	No. 2 ring groove	1.23 ~ 1.25mm (0.0484 ~ 0.0492in)	1.26mm (0.0496in)
	Oil ring groove	2.01 ~ 2.03mm (0.0791 ~ 0.0799in)	2.05mm (0.0807in)
Piston ring			
Side clearance	No. 1 ring	0.04 ~ 0.08mm (0.0016 ~ 0.0031in)	0.1 mm (0.0039in)
	No. 2 ring	0.04 ~ 0.08mm (0.0016 ~ 0.0031in)	0.1 mm (0.0039in)
	Oil ring	0.02 ~ 0.06mm (0.0008 ~ 0.0024in)	0.2 mm (0.0079in)
	No. 1 ring	0.14 ~ 0.28mm (0.0055 ~ 0.0110in)	0.30mm (0.0118in)

2012 Hyundai Veloster

2012-13 ENGINE General Information - Veloster Non-Turbo

End gap	No. 2 ring	0.30 ~ 0.45mm (0.0118 ~ 0.0177in)	0.50mm (0.0197in)
	Oil ring	0.20 ~ 0.40mm (0.0079 ~ 0.0157in)	0.80mm (0.0315in)
Piston pin			
Piston pin outer diameter		18.001 ~ 18.006mm (0.7087 ~ 0.7089in)	
Piston pin hole inner diameter		18.016 ~ 18.021mm (0.7093 ~ 0.7095in)	
Piston pin hole clearance		0.010 ~ 0.020mm (0.0004 ~ 0.0008in)	
Connecting rod small end hole inner diameter		17.974 ~ 17.985mm (0.7076 ~ 0.7081in)	
Piston pin press-in load		500~1, 500 kg (1, 102 ~ 3, 306 lb)	
Connecting rod			
Connecting rod big end inner diameter		45.000 ~ 45.018mm (1.7717 ~ 1.7724in)	
Connecting rod bearing oil clearance		0.032 ~ 0.052mm (0.0013 ~ 0.0020in)	0.060mm (0.0024in)
Side clearance		0.10 ~ 0.25mm (0.0039 ~ 0.0098in)	0.35m (0.0138in)
Crankshaft			
Main bearing oil clearance	No. 1, 2, 3, 4, 5	0.021 ~ 0.042mm (0.0008 ~ 0.0017in)	0.05mm (0.0020in)
End play		0.05 ~ 0.25mm (0.0020 ~ 0.0098in)	0.3mm (0.0118in)
Engine oil			
Oil quantity	Total	4.0L (4.22US qt, 3.51imp qt)	When replacing a short engine or a block assembly
	Oil pan	3.3L (3.48US qt, 2.90imp qt)	
	Drain and refill	3.6L (3.80US qt, 3.16imp qt)	Including oil filter
Oil grade	Recommendation	5W-20/GF4&SM	If not available, refer to the recommended API or ILSAC classification and SAE viscosity number.
	Classification	API SL, SM or above ILSAC GF3, GF4 or above	Satisfy the requirement of the API or ILSAC classification.
	SAE viscosity grade	Recommended SAE viscosity number	Refer to the "Lubrication System"

2012 Hyundai Veloster

2012-13 ENGINE General Information - Veloster Non-Turbo

Oil pressure (at 1000rpm)		100kPa (1.0kg/cm ² , 14.5psi) or above	Oil temperature in oil pan: 110±2°C (230± 36° F)
Cooling system			
Cooling method		Forced circulation with cooling fan	
Coolant quantity		MT: 5.0L (1.32 U.S.gal., 5.28 U, S, qt., 4.40 Imp.qt) AT: 5.2L (1.37 U.S.gal., 5.49 U, S, qt., 4.57 Imp.qt)	
Thermostat	Type	Wax pellet type	
	Opening temperature	82 ± 1.5°C (179.6 ± 2.7° F)	
	Full opening temperature	95°C (203°F)	
Radiator cap	Main valve opening pressure	93.16 ~ 122.58kpa (0.95 ~ 1.25kgf/cm ² , 13.51 ~ 17.78psi)	
	Vacuum valve opening pressure	MAX. 6.86 kpa (0.07kgf/cm ² , 1.00 psi)	
Water temperature sensor			
Type		Thermister type	
Resistance	20°C (68°F)	2.45±0.14 kohms	
	80°C (176°F)	0.3222 kohms	

TIGHTENING TORQUES

TIGHTENING TORQUES

Item	Quantity	N.m	kgf.m	lb-ft
Engine mounting				
Engine mounting bracket to body fixing bolt	2	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Engine mounting bracket to body fixing nut	1	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Engine mounting support bracket to engine mounting insulator fixing nut	1	63.7 ~ 83.4	6.5 ~ 8.5	47.0 ~ 61.5
Engine mounting support bracket to engine support bracket fixing bolt	1	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Engine mounting	2	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0

2012 Hyundai Veloster

2012-13 ENGINE General Information - Veloster Non-Turbo

support bracket to engine support bracket fixing nut				
Transaxle mounting bracket to body fixing bolt	2	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Transaxle mounting bracket to body fixing nut	1	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Transaxle mounting insulator to transaxle mounting support bracket fixing bolt	2	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Roll rod bracket to sub frame fixing bolt	2	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0
Roll rod insulator to roll rod mounting support bracket fixing nut	1	107.9 ~ 127.5	11.0 ~ 13.0	79.6 ~ 94.0
Timing system				
Timing chain and oil pump assembly cover bolt (M6x20)	10	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain and oil pump assembly cover bolt (M6x38)	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain and oil pump assembly cover bolt (M6x70)	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain and oil pump assembly cover bolt (M8x22)	3	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Idle pulley assembly bolt	1	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Timing chain tensioner arm bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain guide bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Crankshaft pulley bolt	1	127.5 ~ 137.3	13.0 ~ 14.0	94.0 ~ 101.3
NOTE: For additional crankshaft pulley bolt torque information, refer to				

2012 Hyundai Veloster

2012-13 ENGINE General Information - Veloster Non-Turbo

<u>GAMMA ENGINE CRANKSHAFT PULLEY BOLT INFORMATION .</u>				
Timing chain tensioner bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Cylinder head				
Ignition coil bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
High pressure fuel pipe nut	2	25.5 ~ 31.4	2.6 ~ 3.2	18.8 ~ 23.1
High pressure fuel pump bolt	2	12.7 ~ 14.7	1.3 ~ 1.5	9.4 ~ 10.8
Cylinder head cover bolt	19	[3.9~5.9] + [7.8~9.8]	[0.4~0.6] + [0.8~1.0]	[2.9~4.3] + [5.8~7.2]
Camshaft bearing cap bolt (M6)	18	[5.9] + [11.8~13.7]	[0.6] + [1.2~1.4]	[4.3] + [8.7~10.1]
Camshaft bearing cap bolt (M8)	4	[9.8] + [18.6~22.6]	[1.0] + [1.9~2.3]	[7.2] + [13.7~16.6]
Cylinder head bolt	10	[29.4] + [90°] + [90°]	[3.0] + [90°] + [90°]	[21.7] + [90°] + [90°]
Cylinder block				
Engine support bracket bolt	4	29.4 ~ 41.2	3.0 ~ 4.2	21.7 ~ 30.4
Ladder frame bolt	13	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Connecting rod cap bolt	8	[17.7~21.6] + [88~92°]	[1.8~2.2] + [88~92°]	[13.0~15.9] + [88~92°]
Crankshaft main bearing cap bolt	10	[19.6] + [90°]	[2.0] + [90°]	[14.5] + [90°]
Flywheel bolts (M/T)	6	71.6 ~ 75.5	7.3 ~ 7.7	52.8 ~ 55.7
Drive plate bolts (A/T)	6	71.6 ~ 75.5	7.3 ~ 7.7	52.8 ~ 55.7
Lubrication system				
Oil filter	1	11.8 ~ 15.7	1.2 ~ 1.6	8.7 ~ 11.6
Oil pan bolt	11	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pan drain plug	1	34.3 ~ 44.1	3.5 ~ 4.5	25.3 ~ 32.5
Oil screen bolt	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Oil pressure switch	1	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Oil level gauge assembly mounting bolt	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Cooling system				
Water pump pulley bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water pump bolt	5	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7

2012 Hyundai Veloster**2012-13 ENGINE General Information - Veloster Non-Turbo**

Water temperature control assembly mounting bolt	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Water inlet fitting nut	2	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Heater pipe mounting bolt (M6)	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Heater pipe mounting nut	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Heater pipe mounting bolt (M8)	1	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Engine coolant temperature sensor (ECTS)	1	29.4 ~ 39.2	3.0 ~ 4.0	21.7 ~ 28.9
Intake and exhaust system				
Air intake hose clamp bolt	2	2.9 ~ 4.9	0.3 ~ 0.5	2.2 ~ 3.6
Air cleaner assembly bolt	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Electronic throttle control (ETC) module bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Intake manifold nut	2	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Intake manifold bolt	3	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Exhaust manifold heat protector bolt	3	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Exhaust manifold stay bolt	3	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Exhaust manifold nut	9	29.4 ~ 41.2	3.0 ~ 4.2	21.7 ~ 30.4
Oxygen sensor (Front/Rear)	2	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Catalytic converter/muffler nut	6	39.2 ~ 58.8	4.0 ~ 6.0	28.9 ~ 43.4

REPAIR PROCEDURES**COMPRESSION PRESSURE INSPECTION**

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

1. Make sure the oil in the crankcase is of the correct viscosity and at the correct level and that the battery is correctly charged. Operate the vehicle until the engine is at normal operating temperature. Turn the ignition switch to the OFF position.
2. Remove the engine cover.

3. Disconnect the injector extension connector (A) and the ignition coil connectors (B).

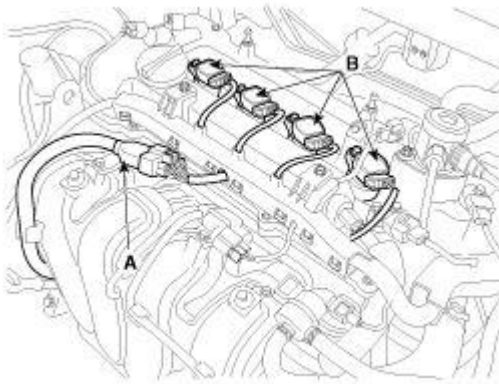


Fig. 1: Identifying Injector Extension Connector And Ignition Coil Connectors
Courtesy of HYUNDAI MOTOR AMERICA

4. Remove the ignition coils (A).

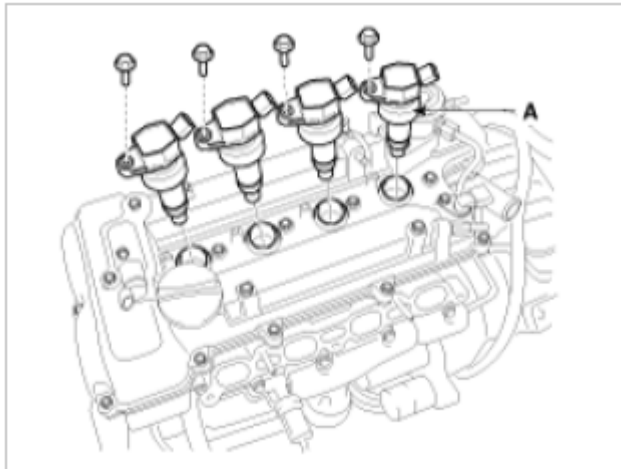


Fig. 2: Identifying Ignition Coils
Courtesy of HYUNDAI MOTOR AMERICA

5. Remove the spark plugs.

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

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

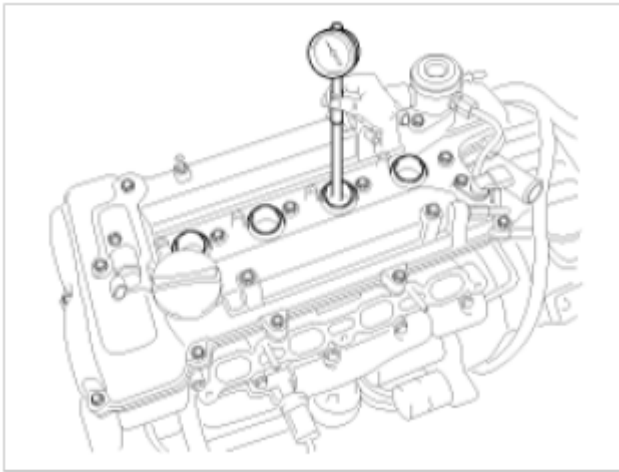


Fig. 3: Checking Cylinder Compression Pressure Using Compression Gauge
Courtesy of HYUNDAI MOTOR AMERICA

2. Set the throttle plate in the wide-open position.
3. While cranking the engine, measure the compression pressure.

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

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

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

Compression pressure

Standard: 1225.83kPa (12.5kg/cm² , 177.79psi) (200~250 rpm)

Minimum: 1078.73kPa (11.0kg/cm² , 156.46psi)

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

5. If the cylinder compression in one 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.
7. Install the spark plugs.

Tightening torque:

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

8. Install the ignition coil (A).

Tightening torque:

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

9. Connect the injector extension connector and the ignition coil connectors.
10. Install the engine cover.

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 cylinder head cover. (Refer to **TIMING SYSTEM**)
2. Set No. 1 cylinder to TDC/compression.
 1. Turn the crankshaft pulley and align its groove with the timing mark of the timing chain cover.

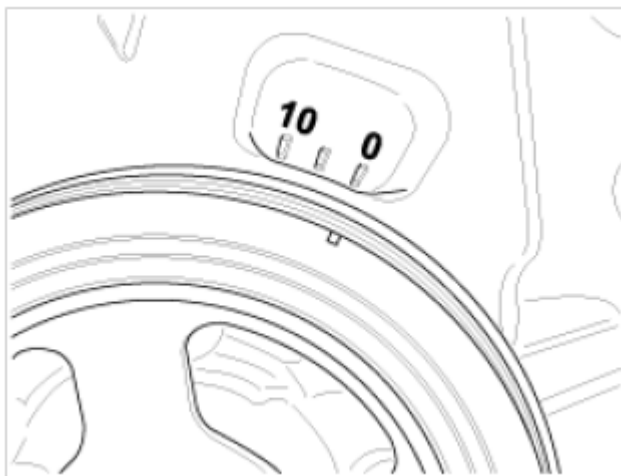


Fig. 4: Aligning Crankshaft Groove With Timing Mark Of Timing Chain Cover
Courtesy of HYUNDAI MOTOR AMERICA

2. Check that the marks of the intake and exhaust CVVT sprockets are in straight line on the cylinder head surface as shown in the illustration. If not, turn the crankshaft one revolution (360°).

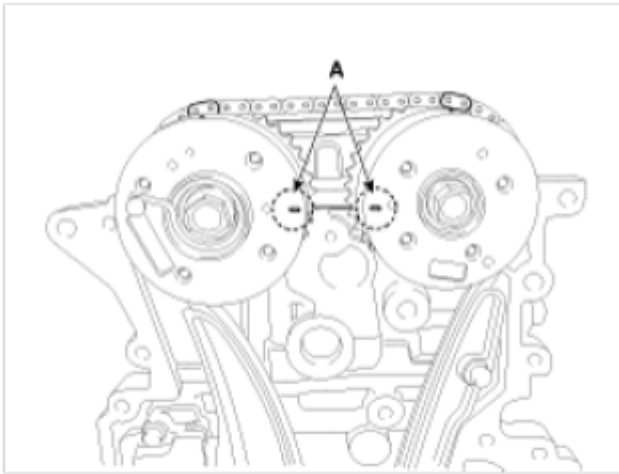


Fig. 5: Identifying Intake And Exhaust CVVT Sprockets Marks
Courtesy of HYUNDAI MOTOR AMERICA

3. Inspect the valve clearance.
 1. Check only the intake valves of the 1st and 2nd cylinders and exhaust valves of the 1st and 3rd cylinders for their clearance.
 - A. Using a thickness gauge, measure the clearance between the tappet and the base circle of camshaft.

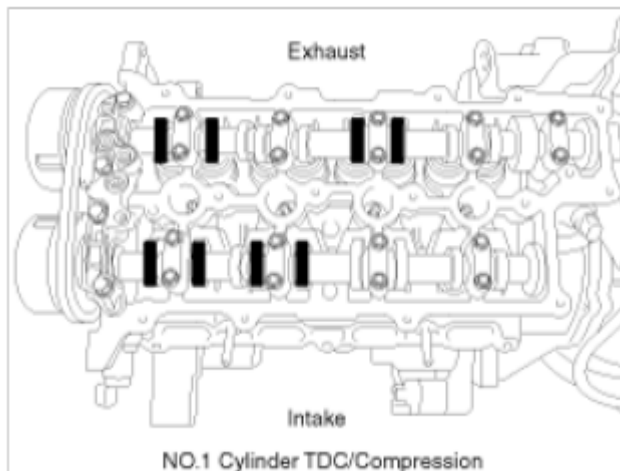


Fig. 6: Identifying Intake And Exhaust Valves Clearance (No. 1 Cylinder TDC/Compression)
Courtesy of HYUNDAI MOTOR AMERICA

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

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

Limit

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

Exhaust: 0.22 ~ 0.28mm (0.0087 ~ 0.0110in.)

2. Turn the crankshaft pulley one revolution (clockwise 360°) and align its groove with timing mark of the timing chain cover.
3. Check the intake valves of the 3rd and 4th cylinders and exhaust valves of the 2nd and 4th cylinders for their clearance.

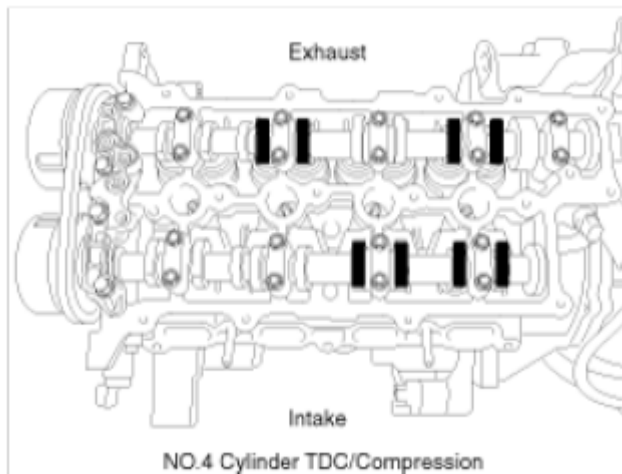


Fig. 7: Identifying Intake And Exhaust Valves Clearance (No. 4 Cylinder TDC/Compression)
Courtesy of HYUNDAI MOTOR AMERICA

4. Adjust the intake and exhaust valve clearance.
 1. Set the No. 1 cylinder to the TDC/compression position.
 2. Remove the timing chain. (Refer to **TIMING SYSTEM**)

CAUTION: Put paint marks on the timing chain links (2 places) that meet with the timing marks of the intake and exhaust CVVT sprockets.

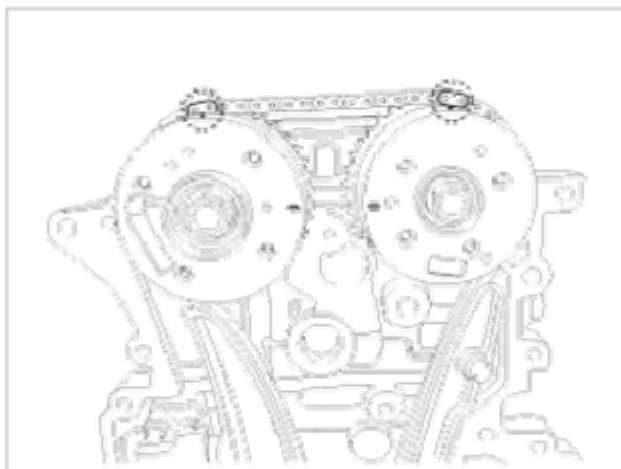


Fig. 8: Identifying Paint Marks On Timing Chain Links
Courtesy of HYUNDAI MOTOR AMERICA

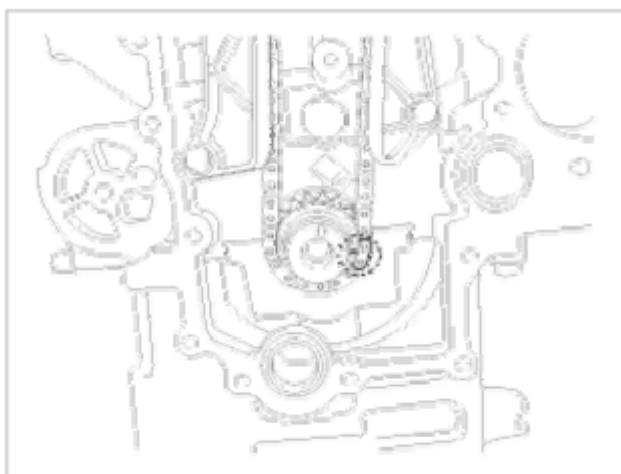


Fig. 9: Identifying Timing Marks On Intake And Exhaust CVVT Sprockets
Courtesy of HYUNDAI MOTOR AMERICA

3. Remove the camshaft bearing caps (A) with the order below.

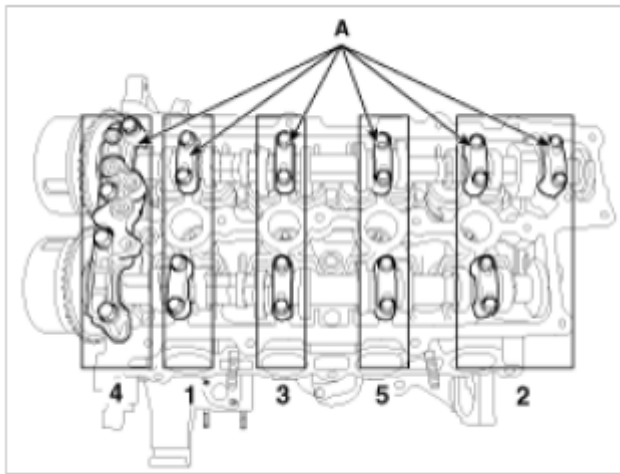


Fig. 10: Identifying Camshaft Bearing Caps Removal Sequence
Courtesy of HYUNDAI MOTOR AMERICA

4. Remove the intake camshaft assembly.
5. Remove the exhaust camshaft assembly.
6. Measure the thickness of the removed tappet using a micrometer.

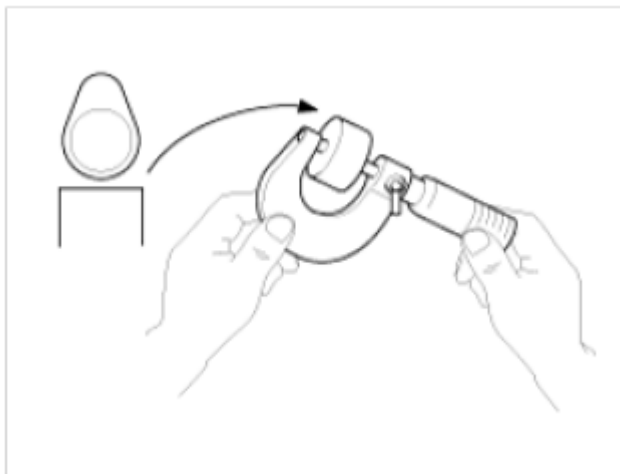


Fig. 11: Measuring Thickness Of Removed Tappet Using Micrometer
Courtesy of HYUNDAI MOTOR AMERICA

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)

T: Thickness of removed tappet

A: Measured valve clearance

N: Thickness of new tappet

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

Exhaust: $N = T + [A - 0.25\text{mm (0.0098in.)}]$

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 0.015mm (0.0006in.) from 3.00mm (0.118in.) to 3.690mm (0.1417in.)

9. Place a new tappet on the cylinder head.
10. Install the exhaust camshaft assembly.
11. Install the intake camshaft assembly.
12. Install the camshaft bearing caps with the order below.

Tightening torque:

1st step

M6 bolt:

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

M8 bolt:

9.8 N.m (1.0 kgf.m, 7.2 lb-ft)

2nd step

M6 bolts:

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

M8 bolts:

18.6 ~ 22.6N.m (1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)

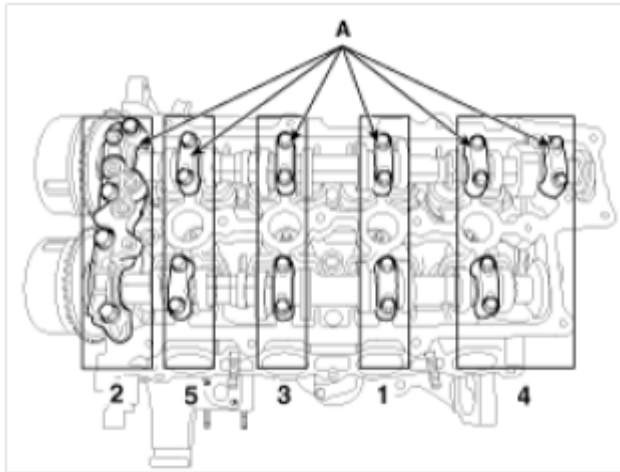


Fig. 12: Identifying Camshaft Bearing Caps Installation Sequence
Courtesy of HYUNDAI MOTOR AMERICA

13. Install the timing chain. (Refer to **TIMING SYSTEM**)
14. Turn the crankshaft two turns in the operating direction (clockwise) and check that the marks of the intake and exhaust CVVT sprockets are in straight line on the cylinder head surface.

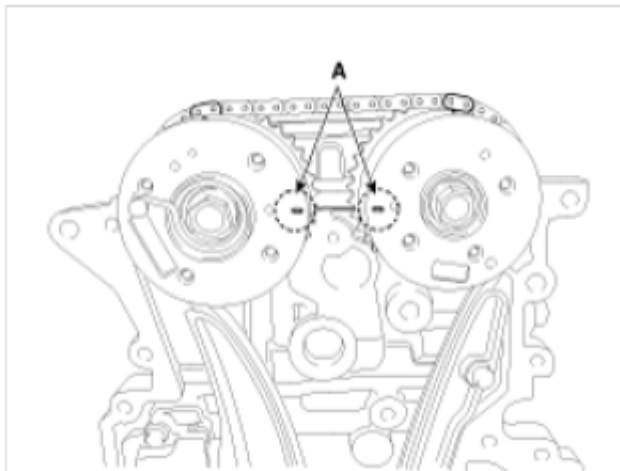


Fig. 13: Identifying Marks On Intake And Exhaust CVVT Sprockets
Courtesy of HYUNDAI MOTOR AMERICA

15. Recheck the valve clearance.

Valve clearance (Engine coolant temperature: 20°C)

[Specification]

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

Exhaust: 0.22 ~ 0.28mm (0.0087 ~ 0.0110in.)

TROUBLESHOOTING

Symptom	Suspect area	Remedy
Engine misfire with abnormal internal lower engine noises.	Loose or improperly installed engine flywheel.	Repair or replace the flywheel as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire.)	Inspect the cylinder for a loss of compression. Repair or replace as required.
	Worn crankshaft thrust bearings.	Replace the crankshaft and bearings as required.
Engine misfire with abnormal valve train noise.	Stuck valves. (Carbon buildup on the valve stem can cause the valve not to close properly.)	Repair or replace as required.
	Excessive worn or mis-aligned timing chain.	Replace the timing chain and sprocket as required.
	Worn camshaft lobes.	Replace the camshaft and MLA.
Engine misfire with coolant consumption.	<ul style="list-style-type: none"> Faulty cylinder head gasket and/or cracking or other damage to the cylinder head and engine block cooling system. Coolant consumption may or may not cause the engine to overheat. 	<ul style="list-style-type: none"> Inspect the cylinder head and engine block for damage to the coolant passages and/or a faulty head gasket. Repair or replace as required.
Engine misfire with excessive oil consumption.	Worn valves, valve guides and/or valve stem oil seals.	Repair or replace as required.
	Worn piston rings. (Oil consumption may or may not cause the engine to misfire)	Inspect the cylinder for a loss of compression. Repair or replace as required.
Engine noise on startup, but only lasting a few seconds.	Incorrect oil viscosity.	Drain the oil. Install the correct viscosity oil.
	Worn crankshaft thrust bearing.	Inspect the thrust bearing and crankshaft. Repair or replace as required.
Upper engine noise, regardless of engine speed.	Low oil pressure.	Repair or replace as required.
	Broken valve spring.	Replace the valve spring.
	Worn or dirty valve lifters.	Replace the valve lifters.
	Stretched or broken timing chain and/or damaged sprocket teeth.	Replace the timing chain and sprockets.
	Worn timing chain tensioner, if applicable.	Replace the timing chain tensioner as required.
	Worn camshaft lobes.	Inspect the camshaft lobes. Replace the camshaft and valve

2012 Hyundai Veloster

2012-13 ENGINE General Information - Veloster Non-Turbo

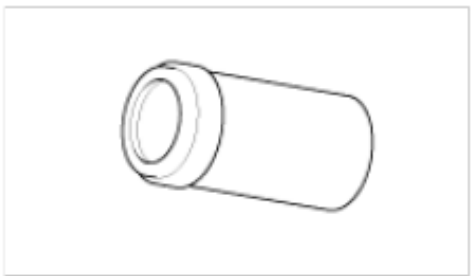
		lifters as required.
	Worn valve guides or valve stems.	Inspect the valves and valve guides, then repair as required.
	Stuck valves. (Carbon on the valve stem or valve seat may cause the valve to stay open.)	Inspect the valves and valve guides, then repair as required.
Lower engine noise, regardless of engine speed.	Low oil pressure.	Repair or replace damaged components as required.
	Loose or damaged flywheel.	Repair or replace the flywheel.
	Damaged oil pan, contacting the oil pump screen.	Inspect the oil pan. Inspect the oil pump screen. Repair or replace as required.
	Oil pump screen loose, damaged or restricted.	Inspect the oil pump screen. Repair or replace as required.
	Excessive piston-to-cylinder bore clearance.	Inspect the piston and cylinder bore. Repair as required.
	Excessive piston pin-to-bore clearance.	Inspect the piston, piston pin and the connecting rod. Repair or replace as required.
	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required. <ul style="list-style-type: none"> • The connecting rod bearings. • The connecting rods. • The crankshaft. • The crankshaft journal.
	Excessive crankshaft bearing clearance.	Inspect the following components and repair as required. <ul style="list-style-type: none"> • The crankshaft bearings. • The crankshaft journals.
	Incorrect piston, piston pin and connecting rod installation.	Verify the piston pins and connecting rods are installed correctly. Repair as required.
Engine noise under load.	Low oil pressure.	Repair or replace as required.
	Excessive connecting rod bearing clearance.	Inspect the following components and repair as required. <ul style="list-style-type: none"> • The connecting rod bearings. • The connecting rods.

2012 Hyundai Veloster

2012-13 ENGINE General Information - Veloster Non-Turbo

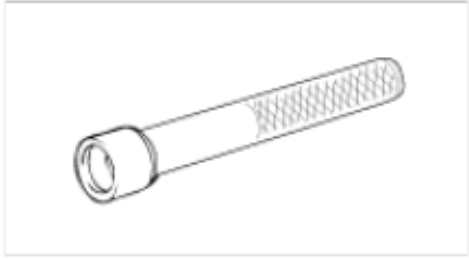
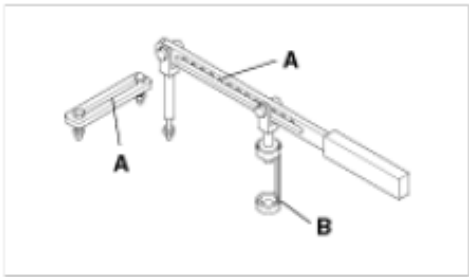
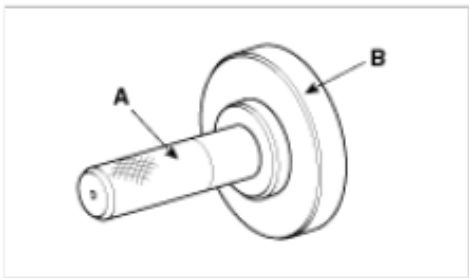
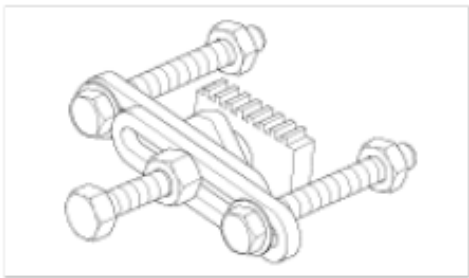
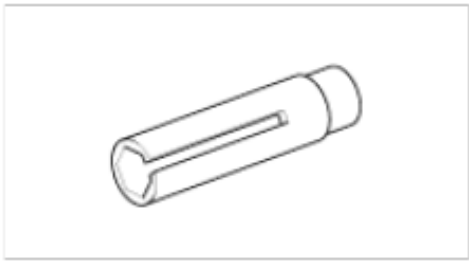
		<ul style="list-style-type: none"> • The crankshaft.
	Excessive crankshaft bearing clearance.	Inspect the following components and repair as required. <ul style="list-style-type: none"> • The crankshaft bearings. • The crankshaft journals. • The cylinder block crankshaft bearing bore.
Engine will not crank. (crankshaft will not rotate)	Hydraulically locked cylinder. <ul style="list-style-type: none"> • Coolant/antifreeze in cylinder. • Oil in cylinder. • Fuel in cylinder. 	Remove spark plugs and check for fluid. Inspect for broken head gasket. Inspect for cracked engine block or cylinder head. Inspect for a sticking fuel injector and/or leaking fuel regulator.
	Broken timing chain and/or timing chain gears.	Inspect timing chain and gears. Repair as required.
	Foreign material in cylinder. <ul style="list-style-type: none"> • Broken valve. • Piston material. • Foreign material. 	Inspect cylinder for damaged components and/or foreign materials. Repair or replace as required.
	Seized crankshaft or connecting rod bearings.	Inspect crankshaft and connecting rod bearing. Repair or replace as required.
	Bent or broken connecting rod.	Inspect connecting rods. Repair or replace as required.
	Broken crankshaft.	Inspect crankshaft. Repair or replace as required.

SPECIAL SERVICE TOOLS

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09455-21200)		Installation of the front oil seal
Valve stem oil seal installer (09222-2B100)		Installation of the valve stem oil seal



2012 Hyundai Veloster

2012-13 ENGINE General Information - Veloster Non-Turbo

		
Valve spring compressor and holder A. (09222-3K000) B. (09222-3K100)		Removal and installation of the intake or exhaust valve
Crankshaft rear oil seal installer A. (09231-H1100) B. (09231-2B200)		Installation of the crankshaft rear oil seal
Ring gear stopper (09231-2B100)		Installation of crankshaft pulley bolt
Engine coolant temperature sensor socket wrench (09221-25100)		Removal and installation of engine coolant sensor
Oil pan remover (09215-3C000)		Removal of oil pan

2012 Hyundai Veloster

2012-13 ENGINE General Information - Veloster Non-Turbo

		
Torque angle adapter (09221-4A000)		Installation of bolts & nuts needing an angular method

2012 ENGINE

Cylinder Block - Veloster

CYLINDER BLOCK

COMPONENTS AND COMPONENTS LOCATION

Components

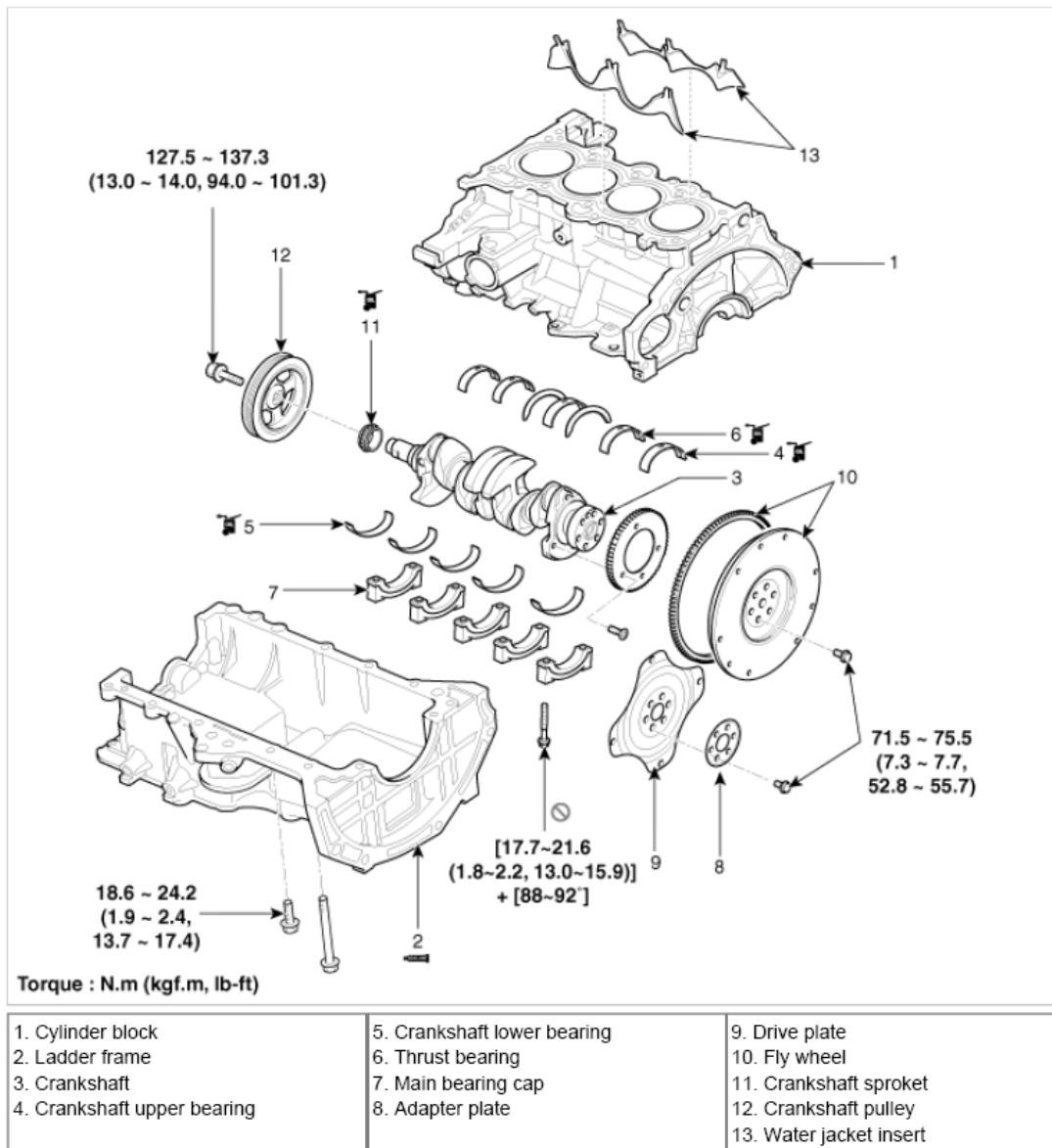


Fig. 1: Identifying Cylinder Block Components With Torque Specifications
Courtesy of HYUNDAI MOTOR AMERICA

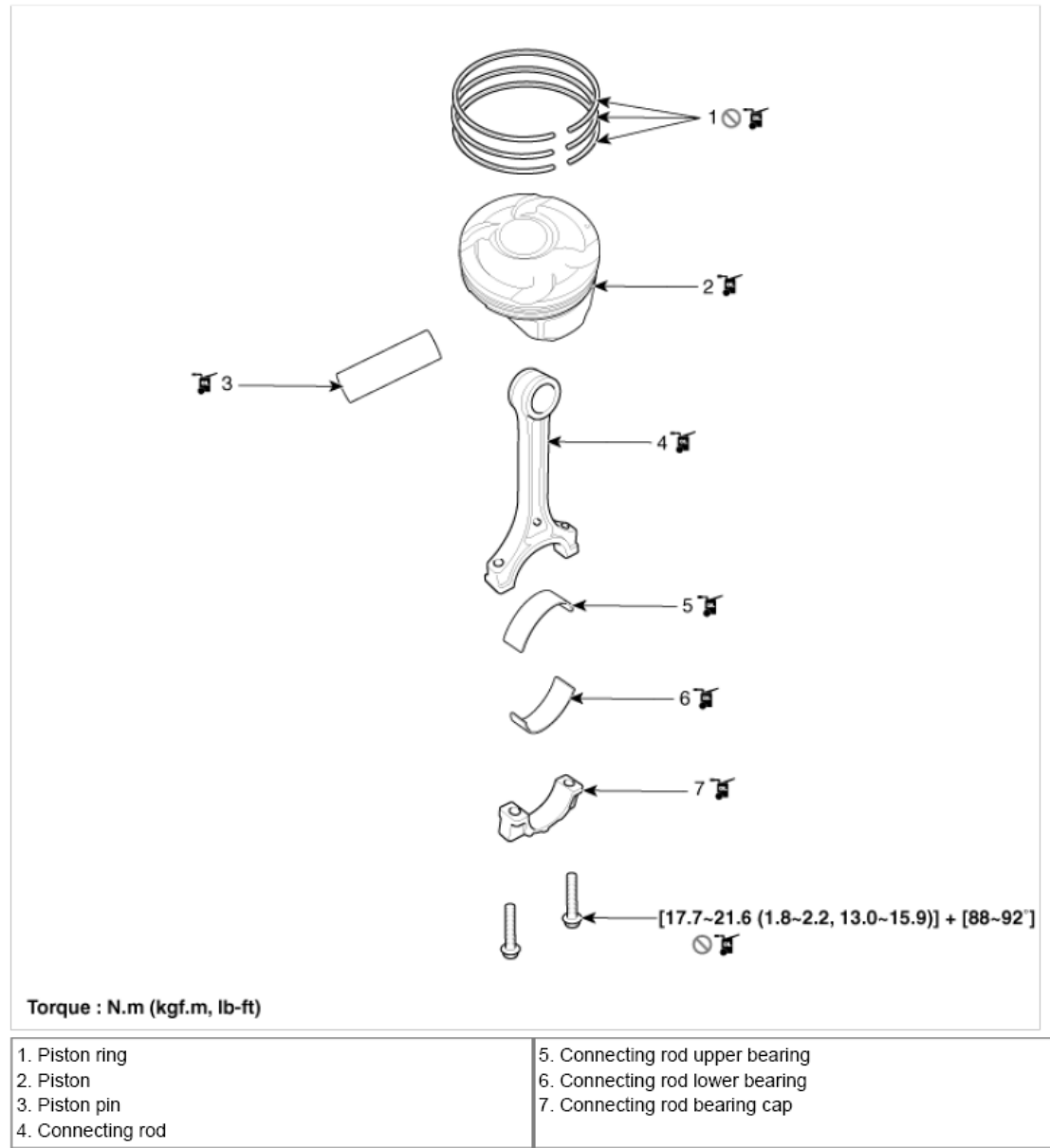


Fig. 2: Identifying Piston And Connecting Rod Assembly Components With Torque Specifications
 Courtesy of HYUNDAI MOTOR AMERICA

REPAIR PROCEDURES

Disassembly

Engine removal is required for this procedure. (Refer to ENGINE AND TRANSAXLE ASSEMBLY removal in this group)

1. M/T: Remove the fly wheel.
2. A/T: Remove the drive plate.
3. Install the engine to engine stand for disassembly.

4. Remove the timing chain. (Refer to **TIMING CHAIN** in this group)
5. Remove the cylinder head. (Refer to **CYLINDER HEAD** in this group)
6. Remove the water jacket insert (A).

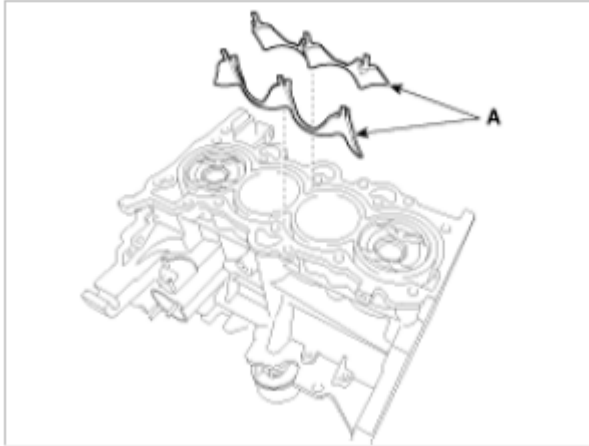


Fig. 3: Identifying Water Jacket Insert
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION: Be careful not to deform or damage it when removing.

7. Remove the oil level gauge tube.
8. Remove the knock sensor (A) and the oil filter (B).

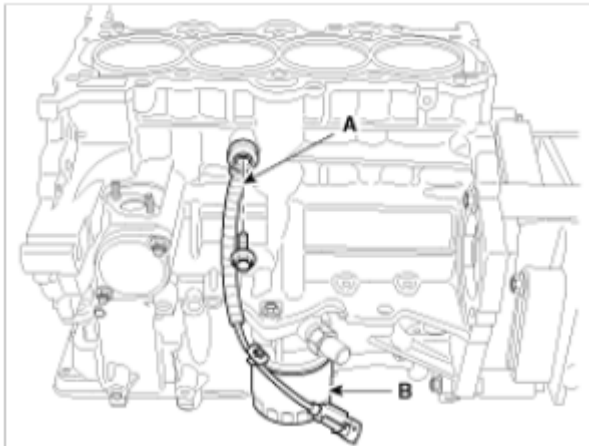


Fig. 4: Identifying Knock Sensor And Oil Filter
Courtesy of HYUNDAI MOTOR AMERICA

9. Remove the oil pressure switch (A).

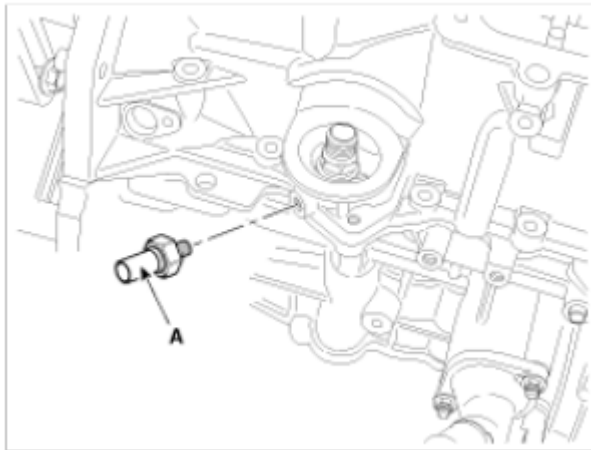


Fig. 5: Identifying Oil Pressure Switch

Courtesy of HYUNDAI MOTOR AMERICA

10. Using the SST (09215-3C000), remove the oil pan (A).

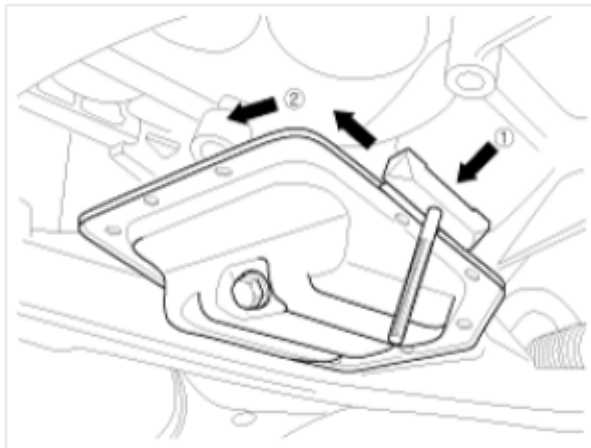


Fig. 6: Removing Oil Pan Using SST (09215-3C000)

Courtesy of HYUNDAI MOTOR AMERICA

CAUTION:

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

11. Remove the oil screen (A).

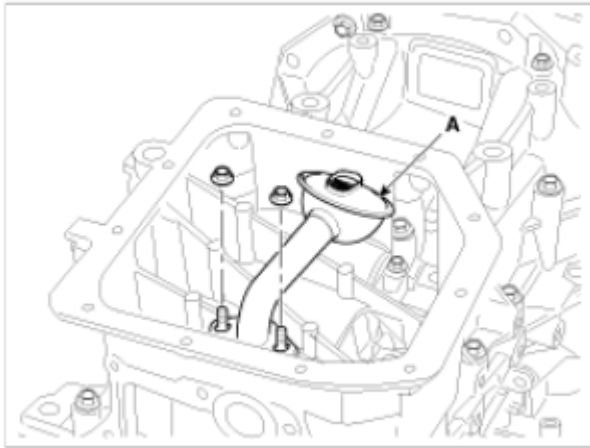


Fig. 7: Identifying Oil Screen

Courtesy of HYUNDAI MOTOR AMERICA

12. Remove the rear oil seal (A).

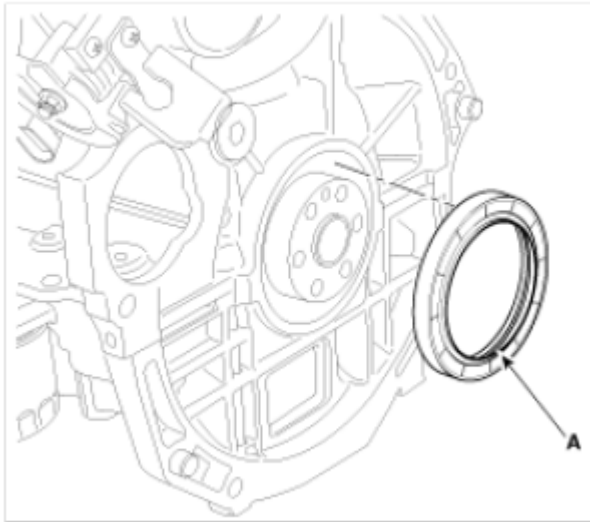
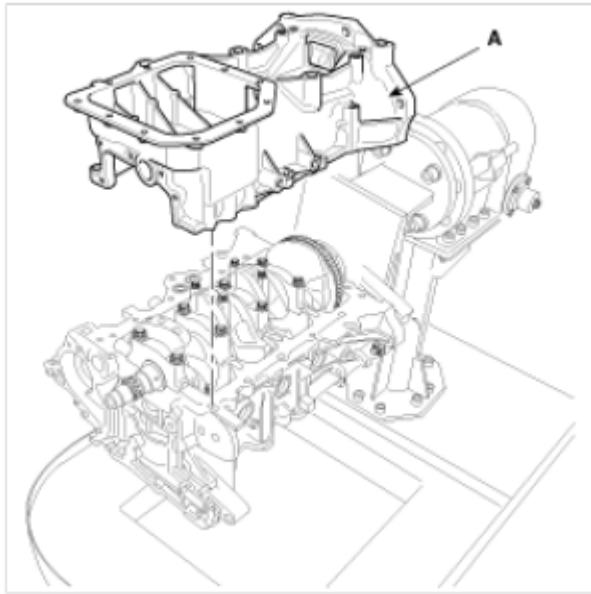


Fig. 8: Identifying Rear Oil Seal

Courtesy of HYUNDAI MOTOR AMERICA

13. Remove the ladder frame (A).

**Fig. 9: Identifying Ladder Frame****Courtesy of HYUNDAI MOTOR AMERICA**

14. Check the connecting rod end play.
15. Remove the connecting rod caps and check oil clearance.
16. 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.**

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

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

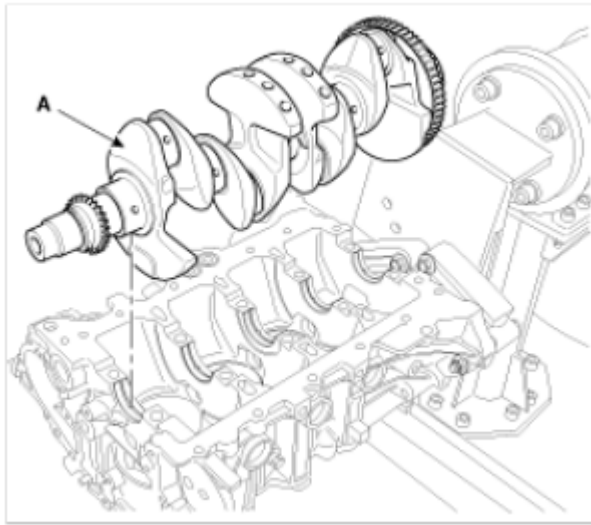


Fig. 10: Identifying Crankshaft
Courtesy of HYUNDAI MOTOR AMERICA

20. Check fit between piston and piston pin.

Try to move the piston back and forth on the piston pin.

If any movement is felt, replace the piston and pin as a set.

21. Remove the piston rings.
1. Using a piston ring expander, remove the 2 compression rings.
 2. Remove the 2 side rails and coil spring.

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

22. Remove the connecting rod from the piston.

Using a press, remove the piston pin from piston.

(Press-in load: 500 ~ 1,500kg (1,102 ~ 3,306lb))

Inspection

Connecting Rod And Crankshaft

1. Check the connecting rod end play.

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

End play

Standard: 0.10 ~ 0.25mm (0.0039 ~ 0.0098in)

Maximum: 0.35mm (0.0138in)

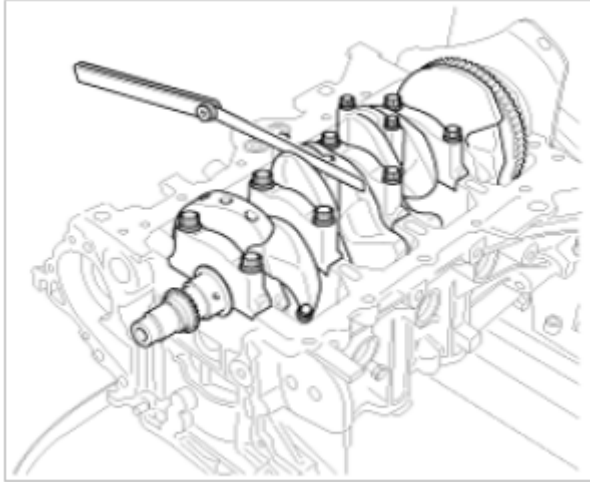


Fig. 11: Measuring Connecting Rod End Play Using Feeler Gauge
Courtesy of HYUNDAI MOTOR AMERICA

- 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 match marks on the connecting rod and cap are aligned to ensure correct reassembly.
 2. Remove the 2 connecting rod cap bolts.
 3. Remove the connecting rod cap and lower bearing.
 4. Clean the crankshaft pin journal and bearing.
 5. Place a plastigage across the crankshaft pin journal.
 6. Reinstall the lower bearing and cap, and tighten the bolts. Do not reuse the bolts.

Tightening torque:

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

NOTE: Do not turn the crankshaft.

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

Standard oil clearance

0.032 ~ 0.052mm (0.0013 ~ 0.0020in)

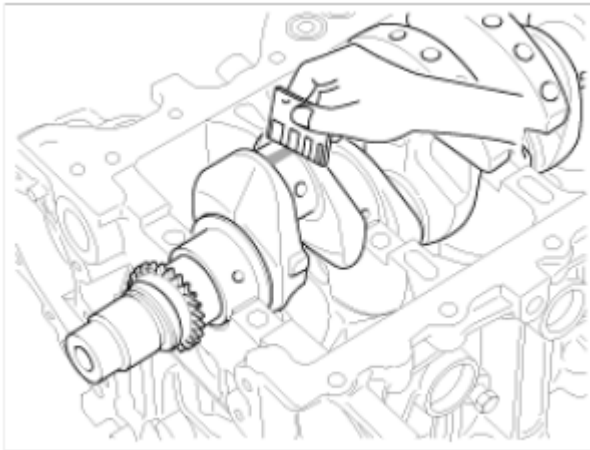


Fig. 12: Measuring Oil Clearance
Courtesy of HYUNDAI MOTOR AMERICA

9. If the measurement from the plastigage is too wide or too narrow, remove the upper and lower bearing and then install a new bearings with the same color mark.

Recheck the oil clearance.

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

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

Recheck the oil clearance.

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

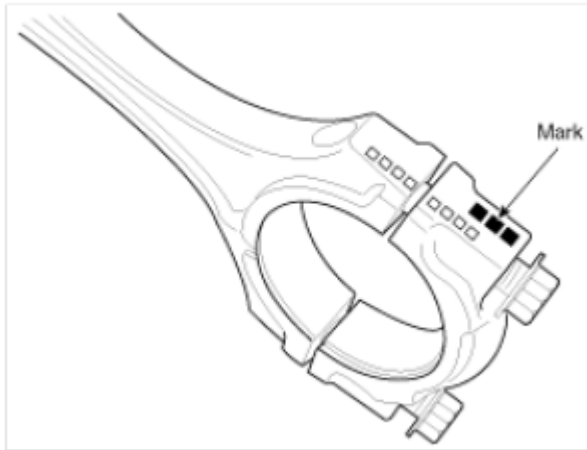


Fig. 13: Connecting Rod Mark Location
Courtesy of HYUNDAI MOTOR AMERICA

DISCRIMINATION OF CONNECTING ROD

Mark	Connecting rod big-end inner diameter
A, 0	45.000 ~ 45.006mm (1.7717 ~ 1.7719in)
B, 00	45.006 ~ 45.012mm (1.7719 ~ 1.7721in)
C, 000	45.012 ~ 45.018mm (1.7721 ~ 1.7724in)

Crankshaft Pin Diameter Mark Location

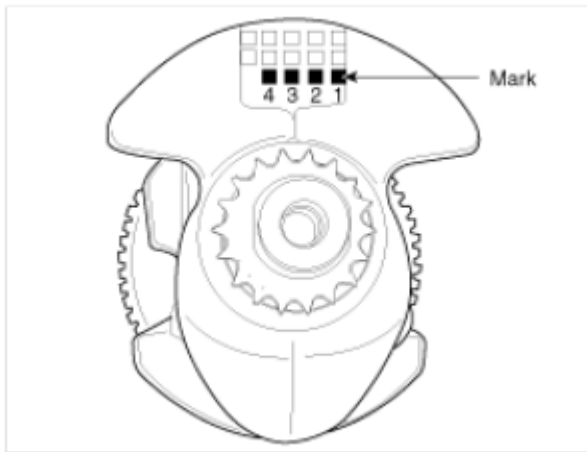


Fig. 14: Crankshaft Pin Diameter Mark Location
Courtesy of HYUNDAI MOTOR AMERICA

DISCRIMINATION OF CRANKSHAFT PIN DIAMETER

Mark	Crankshaft pin outer diameter
1	41.972 ~ 41.966mm (1.6524 ~ 1.6522in)
2	41.966 ~ 41.960mm (1.6522 ~ 1.6520in)
3	41.960 ~ 41.954mm (1.6520 ~ 1.6517in)

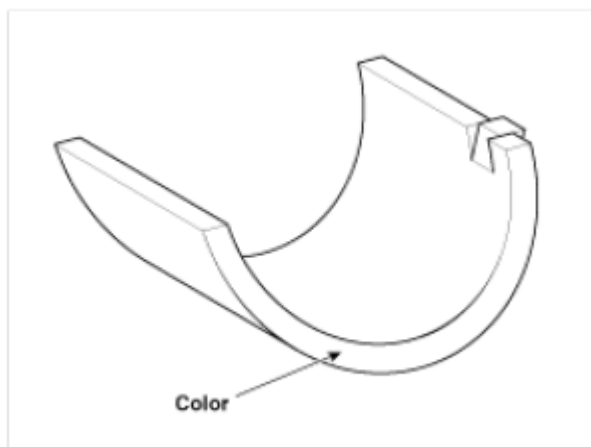
Connecting Rod Bearing Color Location

Fig. 15: Connecting Rod Bearing Color Location
 Courtesy of HYUNDAI MOTOR AMERICA

DISCRIMINATION OF CONNECTING ROD BEARING

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

11. Select the bearing by using selection table.

CONNECTING ROD BEARING SELECTION

	Connecting rod mark		
	A, 0	B, 00	C, 000
Crank shaft pin journal mark	1 E (Red)	D (Green)	C (None)
	2 D (Green)	C (None)	B (Black)
	3 C (None)	B (Black)	A (Blue)

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

or distorted should be replaced.

Allowable bend of connecting rod:

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

Allowable twist of connecting rod:

0.10mm/100mm (0.0039in/3.94in) or less

NOTE: When the connecting rods installed without bearings, there should be no difference on side surface.

4. Check the crankshaft bearing oil clearance.

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

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

Standard oil clearance:

No. 1, 2, 3, 4, 5: 0.021 ~ 0.042mm (0.0008 ~ 0.0017in)

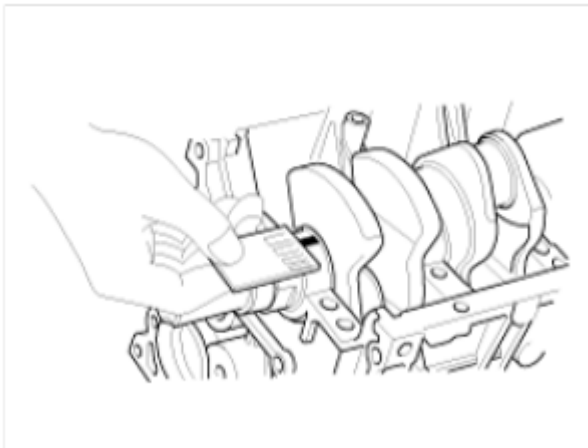


Fig. 16: Measuring Crankshaft Bearing Oil Clearance

Courtesy of HYUNDAI MOTOR AMERICA

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

Recheck the oil clearance.

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

7. If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing. (Refer to **crankshaft main bearing selection table** in this Group).

Recheck the oil clearance.

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

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

Cylinder block crankshaft journal bore mark location

Letters have been stamped on the side surface of the block as a mark for the size of each of the 5 main journal bores. Use them, and the numbers or letters stamped on the crank (marks for main journal size), to choose the correct bearings.

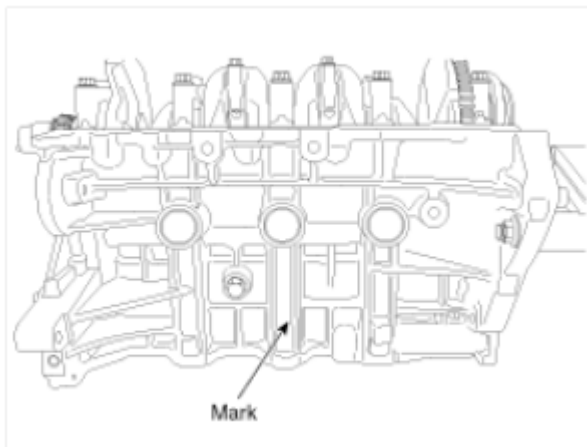


Fig. 17: Cylinder Block Crankshaft Journal Bore Mark Location
Courtesy of HYUNDAI MOTOR AMERICA

DISCRIMINATION OF CYLINDER BLOCK CRANKSHAFT JOURNAL BORE

Mark	Cylinder block crankshaft journal bore inner diameter
A	52.000 ~ 52.006mm (2.0472 ~ 2.0475in)
B	52.006 ~ 52.012mm (2.0475 ~ 2.0477in)
C	52.012 ~ 52.018mm (2.0477 ~ 2.0479in)

Crankshaft Main Journal Mark Location

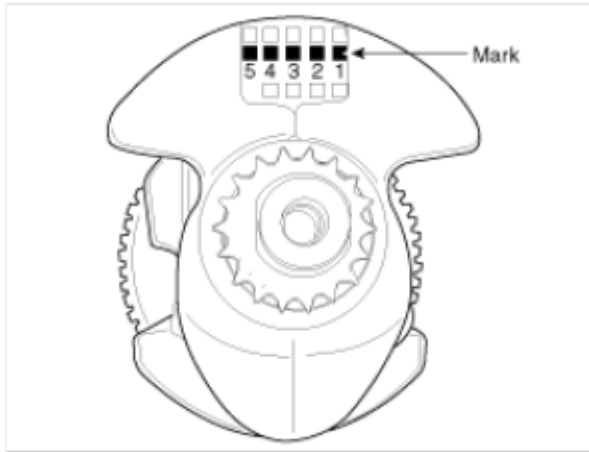


Fig. 18: Crankshaft Main Journal Mark Location
Courtesy of HYUNDAI MOTOR AMERICA

DISCRIMINATION OF CRANKSHAFT MAIN JOURNAL

Mark	Crankshaft main journal outer diameter
1	47.960 ~ 47.954mm (1.8882 ~ 1.8879in)
2	47.954 ~ 47.948mm (1.8879 ~ 1.8877in)
3	47.948 ~ 47.942mm (1.8877 ~ 1.8875in)

Crankshaft Main Bearing Color Location

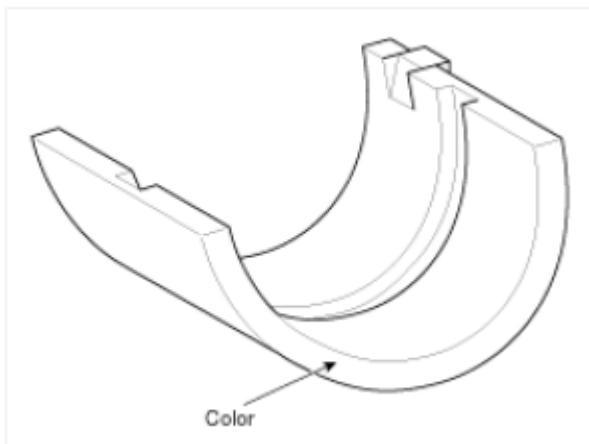


Fig. 19: Crankshaft Main Bearing Color Location
 Courtesy of HYUNDAI MOTOR AMERICA

DISCRIMINATION OF CRANKSHAFT MAIN BEARING

Mark	Color	Crankshaft main bearing thickness
		No. 1, 2, 3, 4, 5
A	Blue	2.026 ~ 2.029mm (0.0798 ~ 0.0799in)
B	Black	2.023 ~ 2.026mm (0.0796 ~ 0.0798in)
C	None	2.020 ~ 2.023mm (0.0795 ~ 0.0796in)
D	Green	2.017 ~ 2.020mm (0.0794 ~ 0.0795in)
E	Red	2.014 ~ 2.017mm (0.0793 ~ 0.0794in)

8. Select the bearing by using selection table.

CRANKSHAFT MAIN BEARING SELECTION

		Cylinder block crankshaft journal bore mark		
		A	B	C
Crank shaft main journal mark	1	E (Red)	D (Green)	C (None)
	2	D (Green)	C (None)	B (Black)
	3	C (None)	B (Black)	A (Blue)

5. Check the crankshaft end play.

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

End play

Standard: 0.05 ~ 0.25mm (0.0020 ~ 0.0098in)

Limit: 0.30mm (0.0118in)

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

Cylinder Block

1. Remove the gasket material.

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

2. Clean the cylinder block

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

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

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

Flatness of cylinder block gasket surface

Standard:

Less than 0.05mm (0.0020in) for total area

Less than 0.02mm (0.0008in) for a section of 100mm (3.9370in) X 100mm (3.9370in)

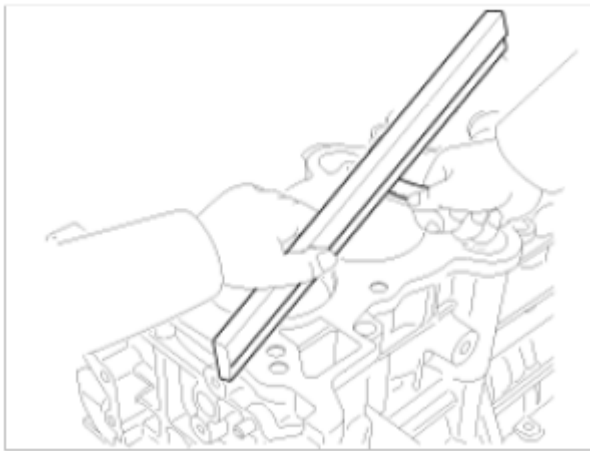


Fig. 20: Measuring Flatness Of Cylinder Block Gasket Surface Using Straight Edge And Feeler Gauge

Courtesy of HYUNDAI MOTOR AMERICA

4. Inspect the cylinder bore.

Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder block.

5. Inspect the cylinder bore diameter.

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

Standard diameter:

77.00 ~ 77.03mm (3.0315 ~ 3.0327in)

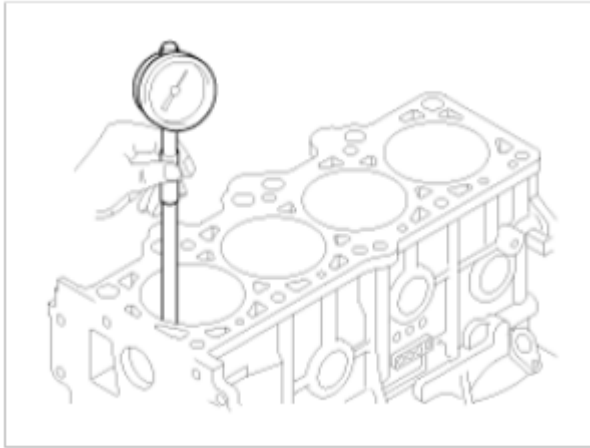


Fig. 21: Measuring Cylinder Bore Diameter Using Cylinder Bore Gauge
Courtesy of HYUNDAI MOTOR AMERICA

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

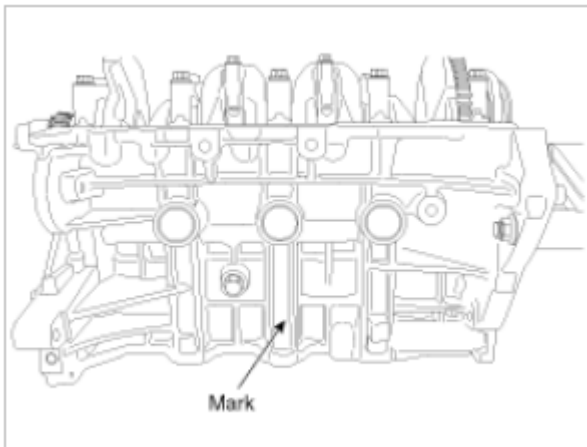
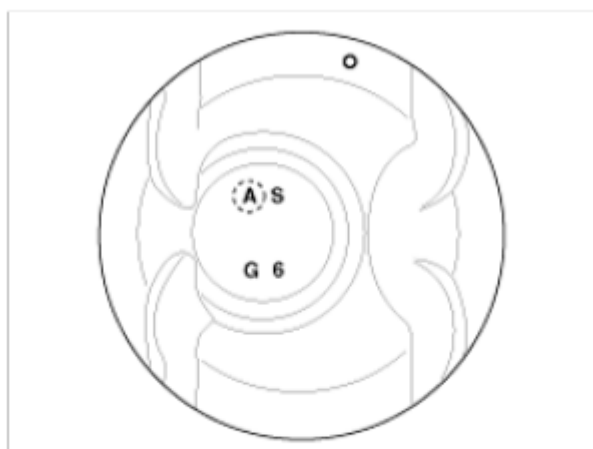


Fig. 22: Cylinder Block Crankshaft Journal Bore Mark Location
Courtesy of HYUNDAI MOTOR AMERICA

DISCRIMINATION OF CYLINDER BORE SIZE

Mark	Cylinder bore inner diameter
A	77.00 ~ 77.01mm (3.0315 ~ 3.0319in)
B	77.01 ~ 77.02mm (3.0319 ~ 3.0323in)
C	77.02 ~ 77.03mm (3.0323 ~ 3.0327in)

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



A : Grade
 S : ISG type
 G : Gasoline engine
 6 : 1.6L

Fig. 23: Identifying Piston Size Mark
 Courtesy of HYUNDAI MOTOR AMERICA

DISCRIMINATION OF PISTON OUTER DIAMETER

Mark	Piston outer diameter
A	76.97 ~ 76.98mm (3.0303 ~ 3.0307in)
B	76.98 ~ 76.99mm (3.0307 ~ 3.0311in)
C	76.99 ~ 77.00mm (3.0311 ~ 3.0315in)

8. Select the piston related to cylinder bore class.

Piston-to-cylinder clearance:

0.02 ~ 0.04mm (0.0008 ~ 0.0016in)

Piston And Piston Rings

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

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

2. The standard measurement of the piston outside diameter is taken 12mm (0.4724in) from bottom land of the piston.

Standard diameter:

76.97 ~ 77.00mm (3.0303 ~ 3.0315in)

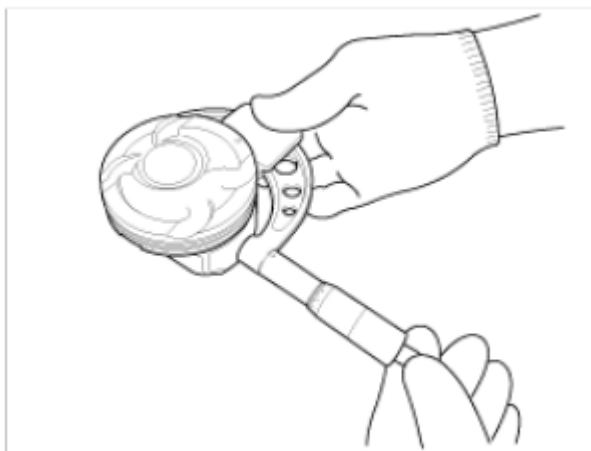


Fig. 24: Measuring Piston Outside Diameter Using Tool
Courtesy of HYUNDAI MOTOR AMERICA

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

Piston-to-cylinder clearance:

0.02 ~ 0.04mm (0.0008 ~ 0.0016in)

4. Inspect the piston ring side clearance.

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

Piston ring side clearance

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

No. 2 ring: 0.04 ~ 0.08mm (0.0016 ~ 0.0031in)

Oil ring: 0.02 ~ 0.06mm (0.0008 ~ 0.0024in)

Limit

No. 1 ring: 0.1mm (0.0039in)

No. 2 ring: 0.1mm (0.0039in)

Oil ring: 0.2mm (0.0079in)



Fig. 25: Measuring Piston Ring Side Clearance Using Feeler Gauge
Courtesy of HYUNDAI MOTOR AMERICA

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

5. Inspect the piston ring end gap.

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

Piston ring end gap

Standard

No. 1 ring: 0.14 ~ 0.28mm (0.0079 ~ 0.0138in)

No. 2 ring: 0.30 ~ 0.45mm (0.0118 ~ 0.0177in)

Oil ring: 0.20 ~ 0.40mm (0.0079 ~ 0.0157in)

Limit

No. 1 ring: 0.3mm (0.0118in)

No. 2 ring: 0.5mm (0.0197in)

Oil ring: 0.8mm (0.0315in)

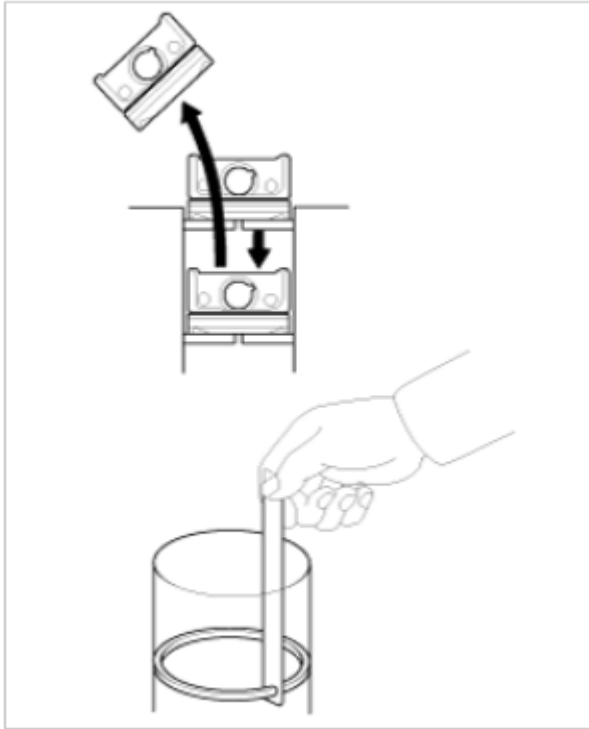


Fig. 26: Measuring Piston Ring End Gap Using Feeler Gauge
Courtesy of HYUNDAI MOTOR AMERICA

Piston Pins

1. Measure the outer diameter of piston pin

Piston pin diameter:

18.001 ~ 18.006mm (0.7087 ~ 0.7089in)



Fig. 27: Measuring Piston Pin Outer Diameter Using Micrometer
Courtesy of HYUNDAI MOTOR AMERICA

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

Piston pin-to-piston clearance:

0.010 ~ 0.020mm (0.0004 ~ 0.0008in)

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

Piston pin-to-connecting rod interference:

-0.032 ~ -0.016mm (-0.0013 ~ -0.0006in)

Reassembly

NOTE:

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

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

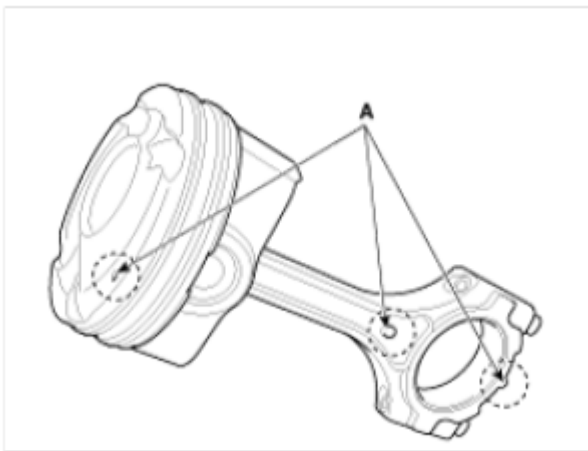


Fig. 28: Identifying Front Mark On Piston And Connecting Rod
 Courtesy of HYUNDAI MOTOR AMERICA

2. Install the piston rings.
 1. Install the oil ring coil spring 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.

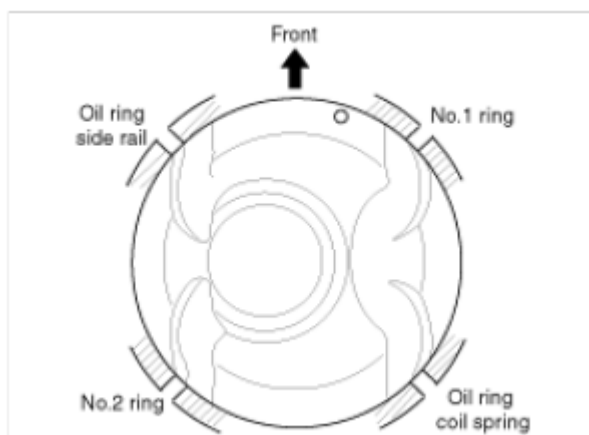


Fig. 29: Identifying Piston Rings Installation Position
Courtesy of HYUNDAI MOTOR AMERICA

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

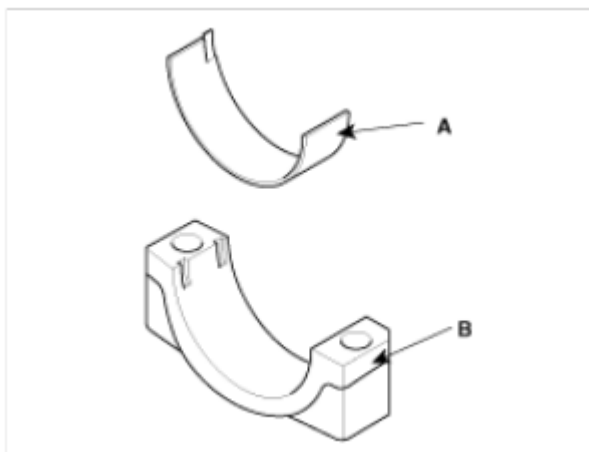


Fig. 30: Identifying Connecting Rod Bearing And Cap
Courtesy of HYUNDAI MOTOR AMERICA

4. Install the crankshaft main bearings.

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

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

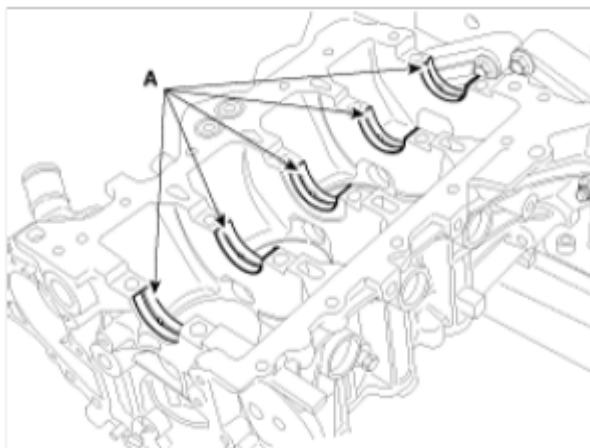


Fig. 31: Identifying Upper Bearings
Courtesy of HYUNDAI MOTOR AMERICA

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

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



Fig. 32: Identifying Thrust Bearing
Courtesy of HYUNDAI MOTOR AMERICA

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

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

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

Tightening torque:

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

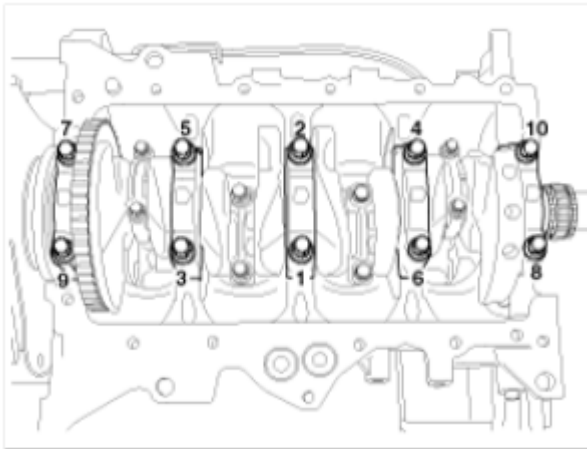


Fig. 33: Identifying Bearing Cap Bolts Tightening Sequence
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION: Do not reuse the main bearing cap bolts.

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

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

1. Install the ring compressor, check that the rings are securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.
2. Stop after the ring compressor pops free, and check the connecting rod-to-crank journal alignment before pushing the piston into place.
3. Install the rod caps with bearings, and tighten the bolts.

Tightening torque:

17.7~21.8Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 88~92°

CAUTION: Do not reuse the connecting rod cap bolts.

11. Apply the sealant on the ladder frame.

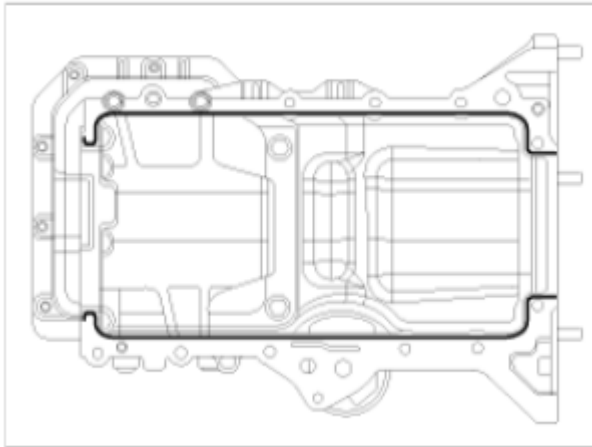


Fig. 34: Identifying Sealant Applying Areas On Ladder Frame
Courtesy of HYUNDAI MOTOR AMERICA

NOTE:

- Apply the sealant, Hyundai Gray RTV or TB 1217H or LOCTITE 5900H on the ladder frame rail portion and install it with in five minutes.

If when sealant is applied to cylinder block bottom position, sealant position to be same with position that is applied to ladder frame rail position.

- Apply sealant along the inner line of the bolt holes.

12. Install the ladder frame (A).

Tightening torque:

18.6 ~ 24.2N.m (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)

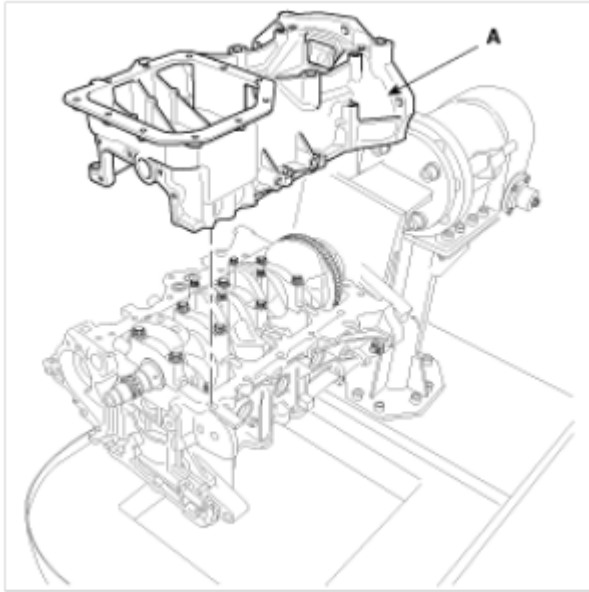


Fig. 35: Identifying Ladder Frame
Courtesy of HYUNDAI MOTOR AMERICA

13. Install the rear oil seal.
 1. Apply engine oil to a new oil seal lip.
 2. Using the SST (09231-H1100, 09231-2B200) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

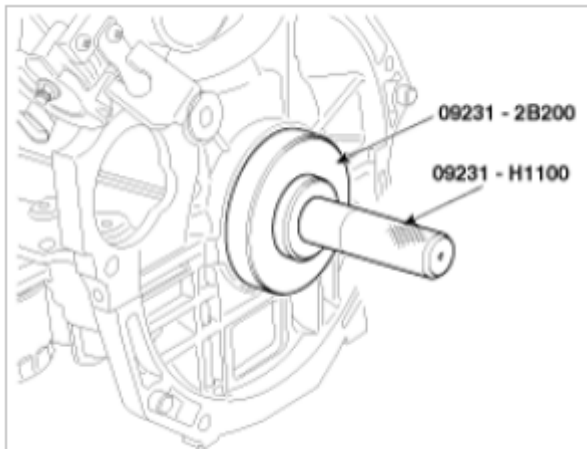


Fig. 36: Tapping Rear Oil Seal Using SST (09231-H1100 And 09231-2B200)
Courtesy of HYUNDAI MOTOR AMERICA

14. Install the oil screen (A).

Install a new gasket and oil screen with 2 bolts.

Tightening torque:

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

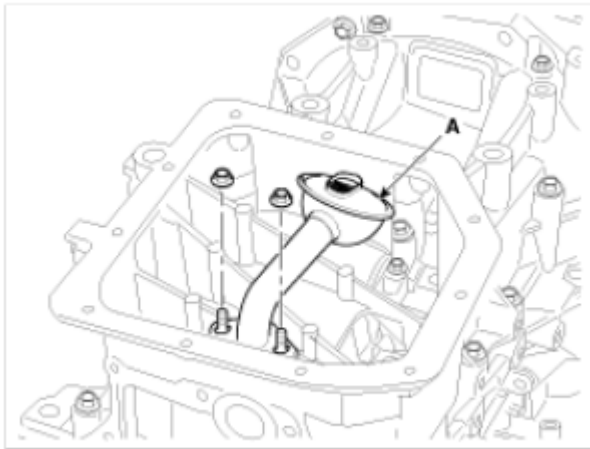


Fig. 37: Identifying Oil Screen
Courtesy of HYUNDAI MOTOR AMERICA

15. Install the oil pan.

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

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

2. Apply liquid gasket with the width of ø3mm, starting 1mm-away position from the inner rounding of the oil pan rail.

Liquid gasket: Hyundai Gray RTV or TB 1217H or LOCTITE 5900H

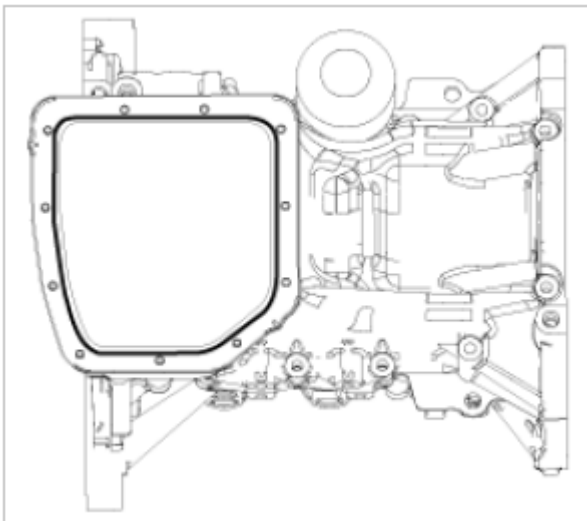


Fig. 38: Identifying Liquid Gasket Applying Areas On Oil Pan Rail

Courtesy of HYUNDAI MOTOR AMERICA

NOTE:

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

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

Uniformly tighten the bolts in several passes.

Tightening torque:

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

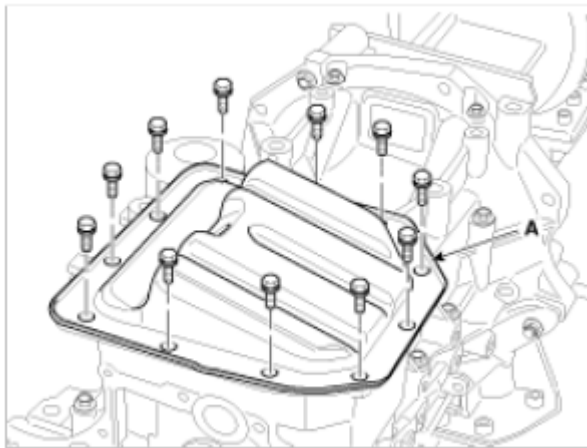


Fig. 39: Identifying Oil Pan And Mounting Bolts
Courtesy of HYUNDAI MOTOR AMERICA

16. Install the oil pressure switch.
 1. Apply adhesive to 2 or 3 threads.
 2. Install the oil pressure switch (A).

Tightening torque:

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

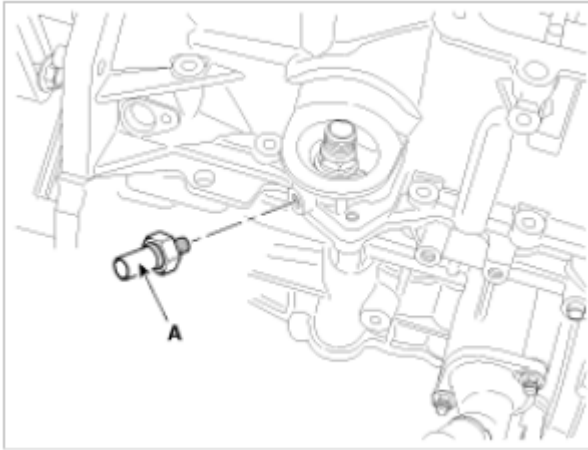


Fig. 40: Identifying Oil Pressure Switch
Courtesy of HYUNDAI MOTOR AMERICA

17. Install the knock sensor (A) and the oil filter (B).

Tightening torque:

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

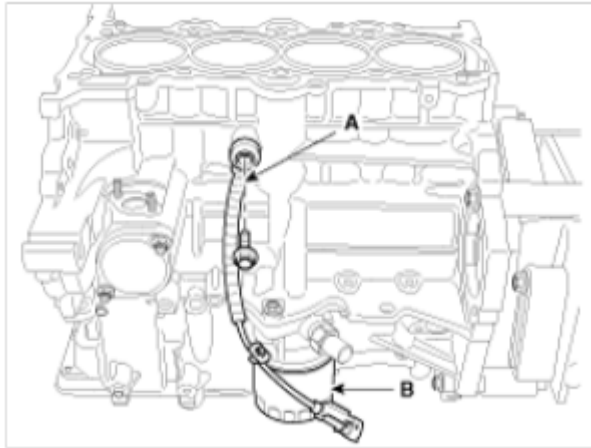


Fig. 41: Identifying Knock Sensor And Oil Filter
Courtesy of HYUNDAI MOTOR AMERICA

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

Tightening torque:

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

4. Install the water jacket insert (A).

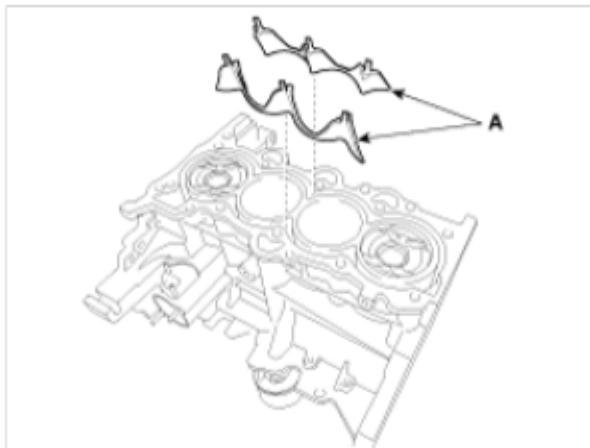


Fig. 42: Identifying Water Jacket Insert
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION: Maximum height of installed water jacket insert must be below top surface of cylinder block.

19. Install the cylinder head. (Refer to **CYLINDER HEAD** in this group)
20. Install the timing chain. (Refer to **TIMING CHAIN** in this group)
21. Remove the engine stand.
22. A/T: install the drive plate.

Tightening torque:

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

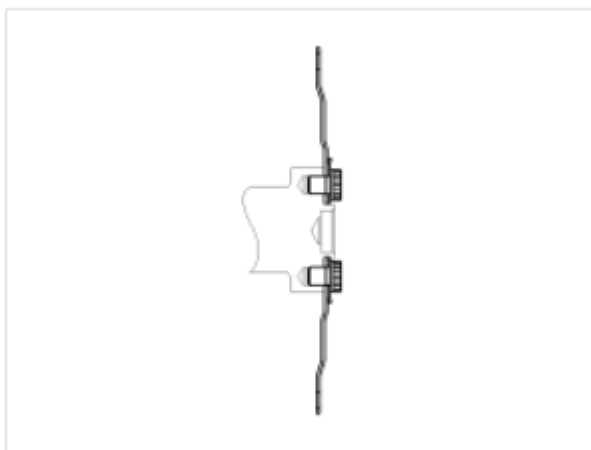


Fig. 43: Identifying Drive Plate Mounting Bolts
Courtesy of HYUNDAI MOTOR AMERICA

23. M/T: install the fly wheel.

Tightening torque:

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

24. Install the engine. (Refer to **ENGINE AND TRANSAXLE ASSEMBLY** in this group)

2012 ENGINE

Cylinder Head Assembly - Veloster

CYLINDER HEAD

COMPONENTS AND COMPONENTS LOCATION

Components

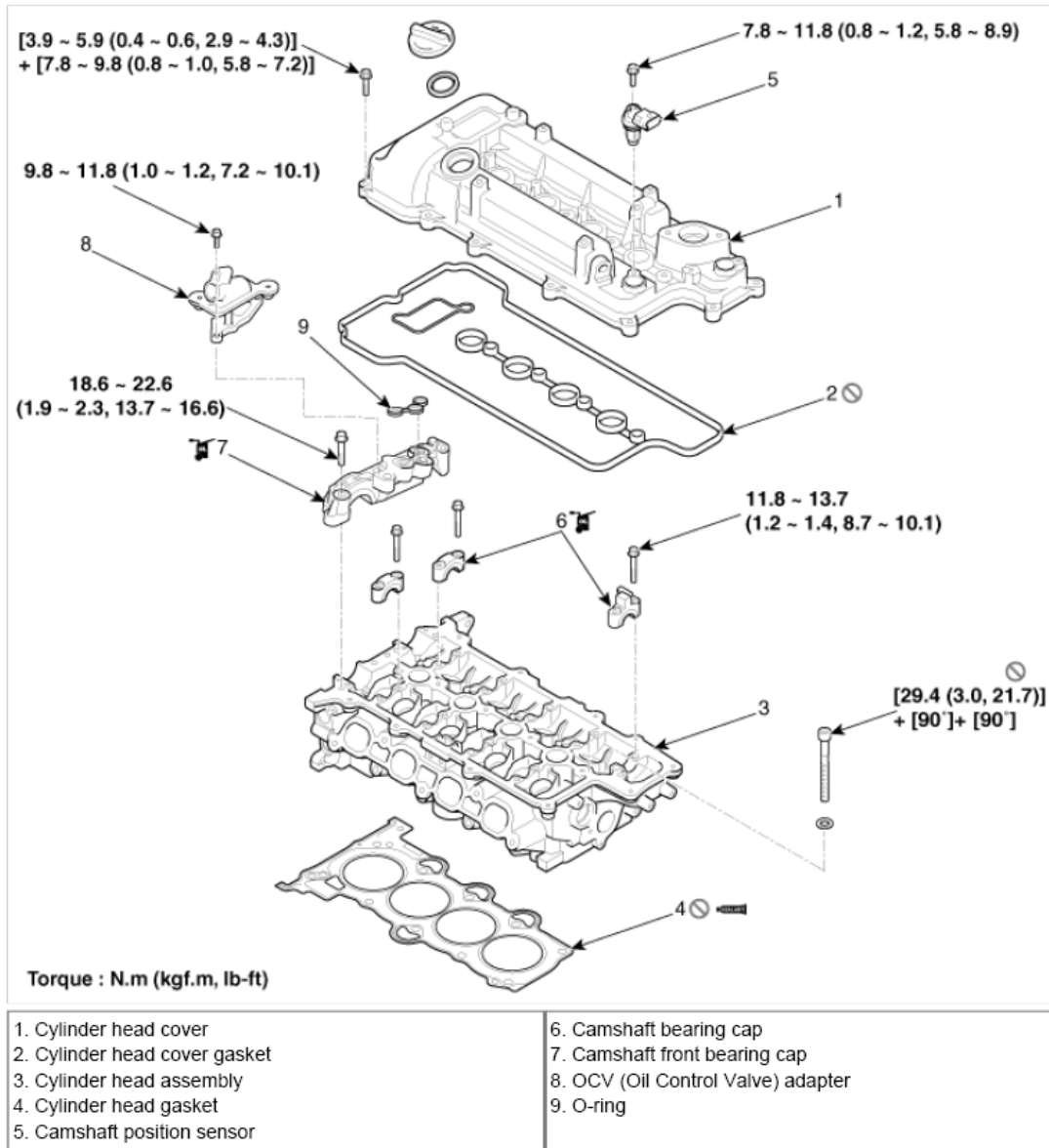


Fig. 1: Identifying Cylinder Head Components With Torque Specifications (1 Of 2)
 Courtesy of HYUNDAI MOTOR AMERICA

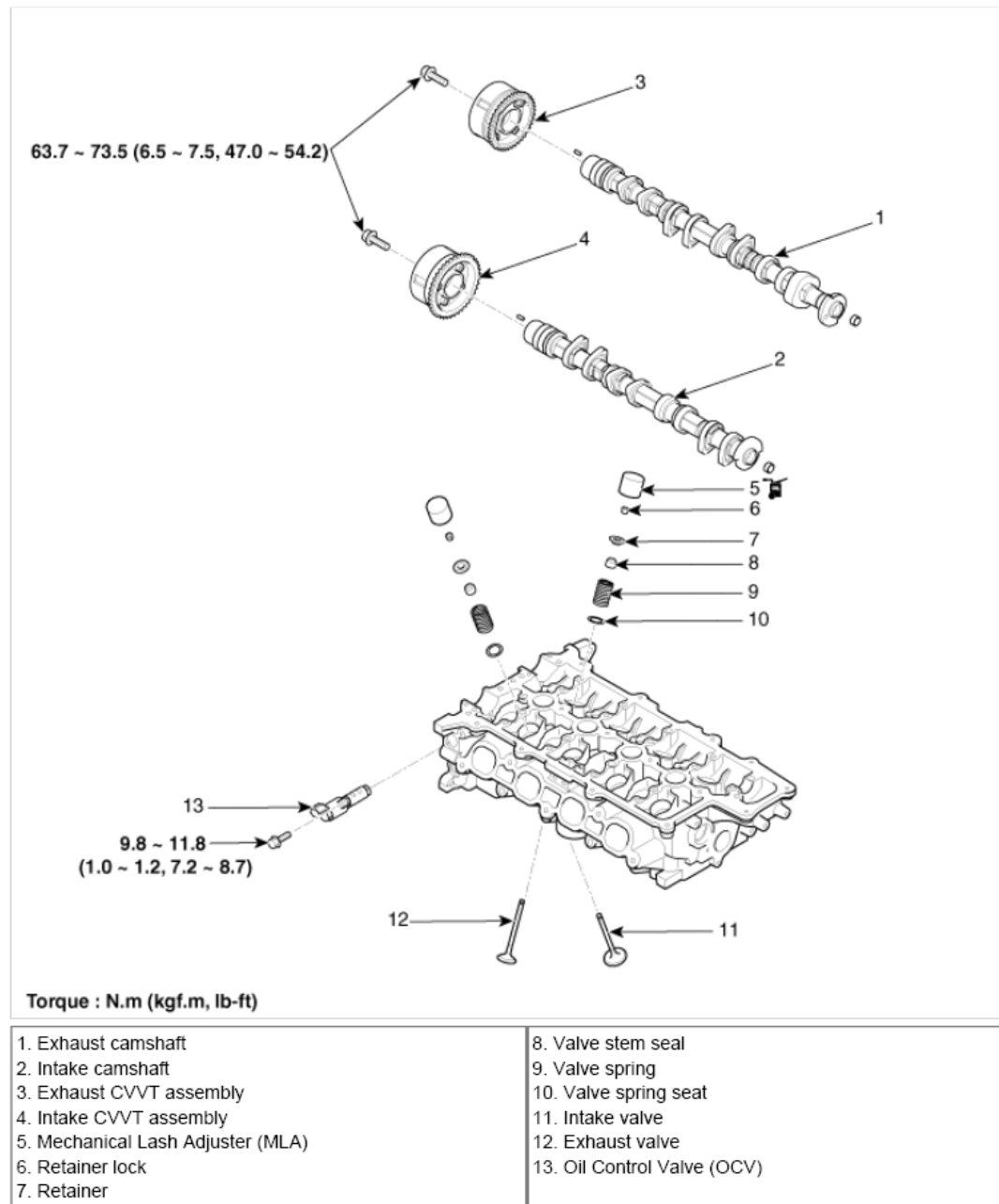


Fig. 2: Identifying Cylinder Head Components With Torque Specifications (2 Of 2)
 Courtesy of HYUNDAI MOTOR AMERICA

REPAIR PROCEDURES

Removal

Engine removal is not required for this procedure.

CAUTION: • Use fender covers to avoid damaging painted surfaces.

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

NOTE: Mark all wiring and hoses to avoid misconnection.

WARNING: In case of removing the high pressure fuel pump, high pressure fuel pipe, delivery pipe, and injector, there may be injury caused by leakage of the high pressure fuel. So don't do any repair work right after engine stops.

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

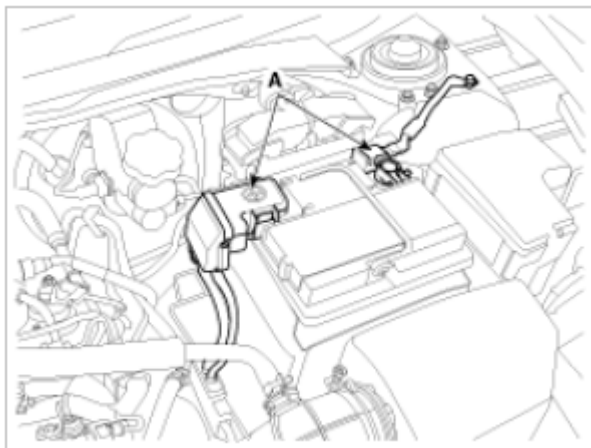


Fig. 3: Identifying Battery Terminals
Courtesy of HYUNDAI MOTOR AMERICA

3. Remove the air cleaner assembly.
 1. Remove the air duct (A)
 2. Disconnect the breather hose (B) and the air intake hose (C)
 3. Remove the air cleaner assembly (D)

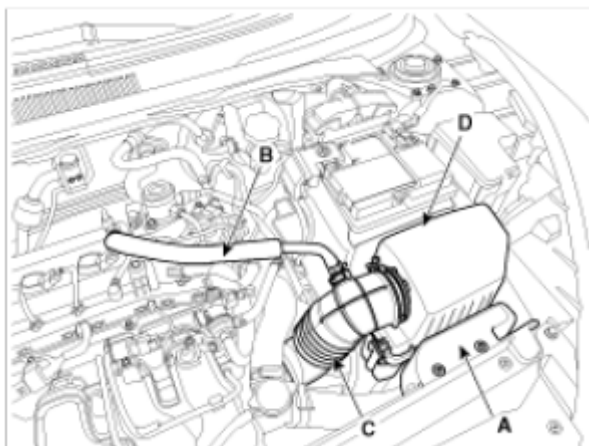


Fig. 4: Identifying Air Duct, Breather Hose, Air Intake Hose And Air Cleaner Assembly
Courtesy of HYUNDAI MOTOR AMERICA

4. Remove the battery (A) after removing the mounting bracket.

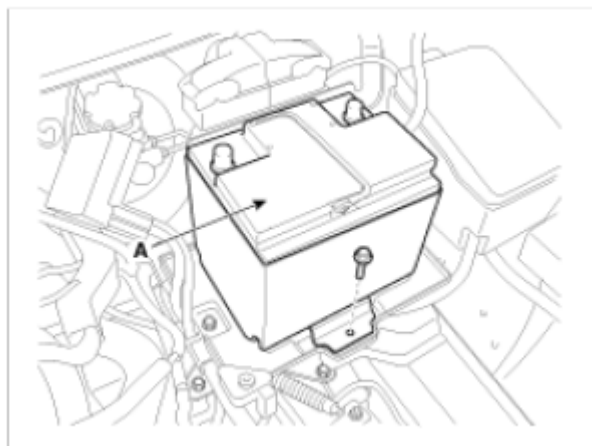


Fig. 5: Identifying Battery
Courtesy of HYUNDAI MOTOR AMERICA

5. Disconnect the ECM connectors (A) and then remove the ECM (B) and battery tray (C).

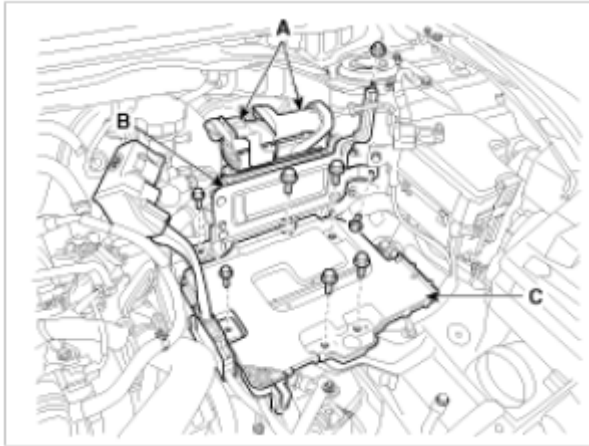


Fig. 6: Identifying ECM, Connectors And Battery Tray
Courtesy of HYUNDAI MOTOR AMERICA

6. Remove the RH front wheel.
7. Remove the under covers (A).

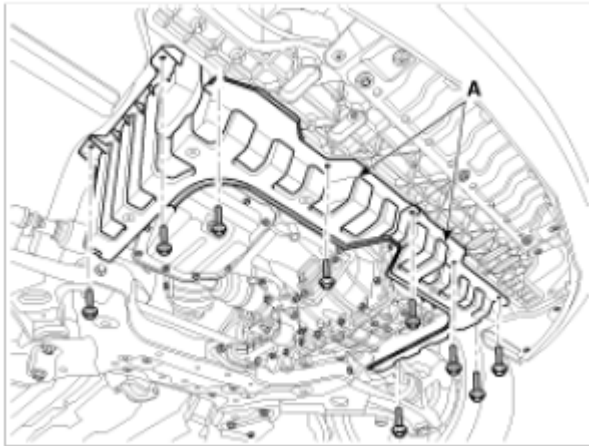


Fig. 7: Identifying Under Cover
Courtesy of HYUNDAI MOTOR AMERICA

8. Loosen the drain plug, and drain the engine coolant. Remove the radiator cap to help drain the coolant faster. (Refer to Cooling system)
9. Disconnect the radiator upper hose (A) and lower hose (B).

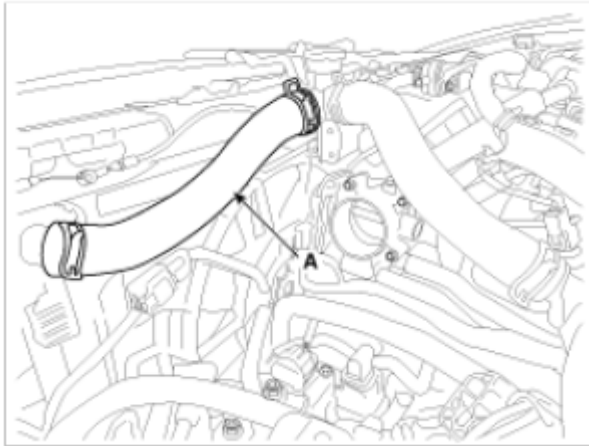


Fig. 8: Identifying Radiator Upper Hose
Courtesy of HYUNDAI MOTOR AMERICA

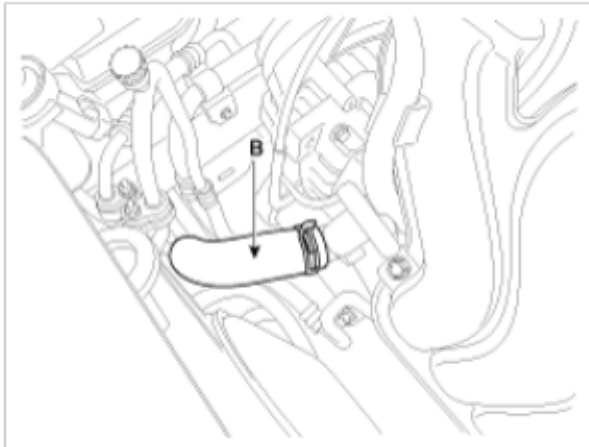


Fig. 9: Identifying Radiator Lower Hose
Courtesy of HYUNDAI MOTOR AMERICA

10. Disconnect the wiring connectors and harness clamps, and remove the wiring and protectors from the cylinder head and intake manifold.
 1. The A/C compressor switch connector (A), the alternator connector (B) and the cable from the alternator "B" terminal (C)

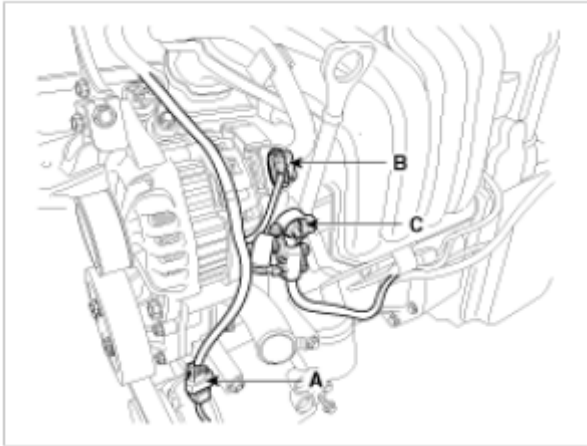


Fig. 10: Identifying A/C Compressor Switch Connector, Alternator Connector And Alternator "B" Terminal

Courtesy of HYUNDAI MOTOR AMERICA

2. The intake OCV (Oil control valve) connector (A) and the exhaust OCV (Oil control valve) connector (B)

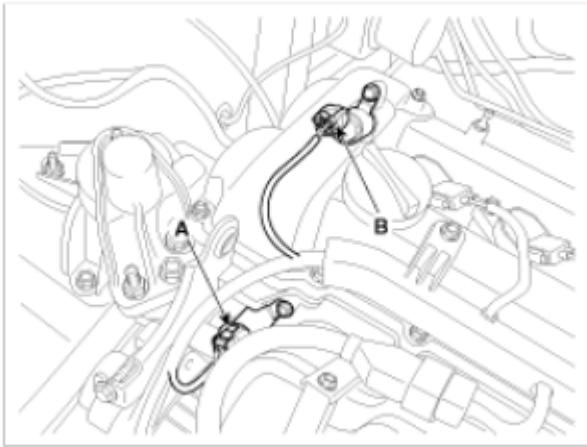


Fig. 11: Identifying Intake And Exhaust Oil Control Valve Connectors

Courtesy of HYUNDAI MOTOR AMERICA

3. The ignition coil connectors (A), the injector extension connector (B), the VIS (Variable intake system) connector (C) and the PCSV (Purge control solenoid valve) connector (D)

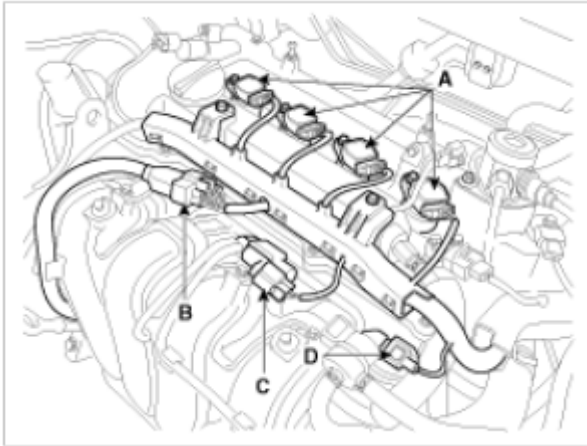


Fig. 12: Identifying Ignition Coil, Injector Extension, Variable Intake System And Purge Control Solenoid Valve Connectors
Courtesy of HYUNDAI MOTOR AMERICA

4. The FPCV (Fuel pressure control valve) connector (A), the intake CMPS (Camshaft position sensor) connector (B) and the exhaust CMPS (Camshaft position sensor) connector (C)

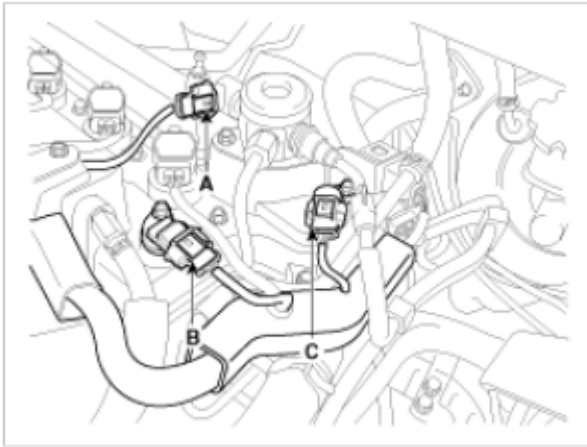


Fig. 13: Identifying Fuel Pressure Control Valve, Intake And Exhaust Camshaft Position Sensor Connectors
Courtesy of HYUNDAI MOTOR AMERICA

5. Disconnect the oxygen sensor connectors (A) and the condenser connector (B)

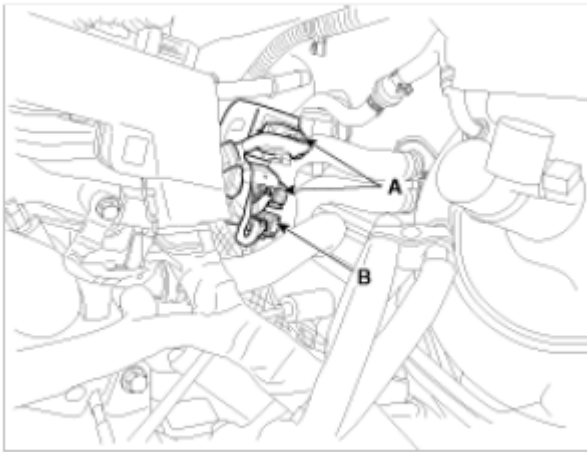


Fig. 14: Identifying Oxygen Sensor Connectors And Condenser Connector
Courtesy of HYUNDAI MOTOR AMERICA

6. The ECTS (Engine coolant temperature sensor) connector (A) and the ground line (B)

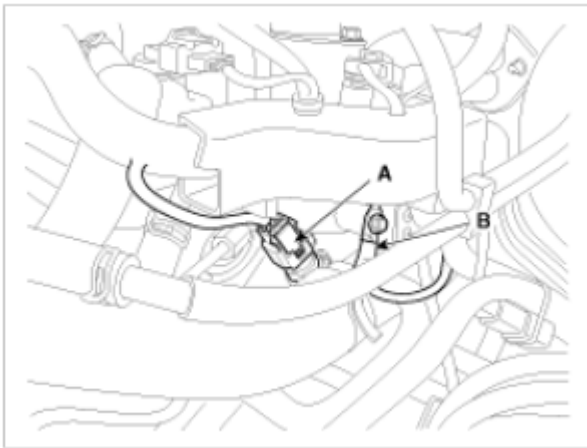


Fig. 15: Identifying Engine Coolant Temperature Sensor Connector And Ground Line
Courtesy of HYUNDAI MOTOR AMERICA

7. The ETC (Electronic throttle control) connector (A) and the MAPS (Manifold absolute pressure sensor) & IATS (Intake air temperature sensor) connector (B)

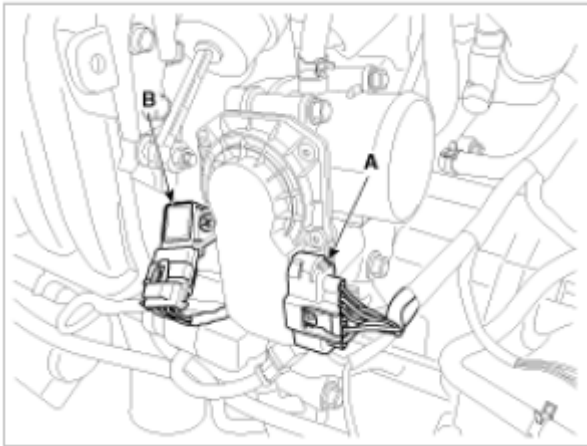


Fig. 16: Identifying Electronic Throttle Control And Manifold Absolute Pressure Sensor & Intake Air Temperature Sensor Connectors
Courtesy of HYUNDAI MOTOR AMERICA

11. Disconnect the brake booster vacuum hose (A) and heater hose (B).

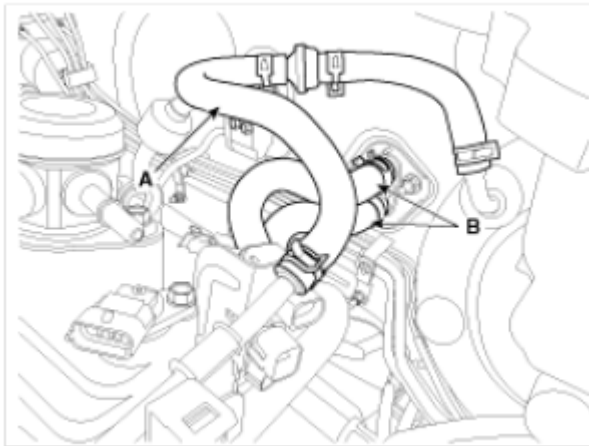


Fig. 17: Identifying Brake Booster Vacuum Hose And Heater Hose
Courtesy of HYUNDAI MOTOR AMERICA

12. Disconnect the fuel hose (A), the PCV (Positive crankcase ventilation) hose (B) and the PCSV (Purge control solenoid valve) hose (C).

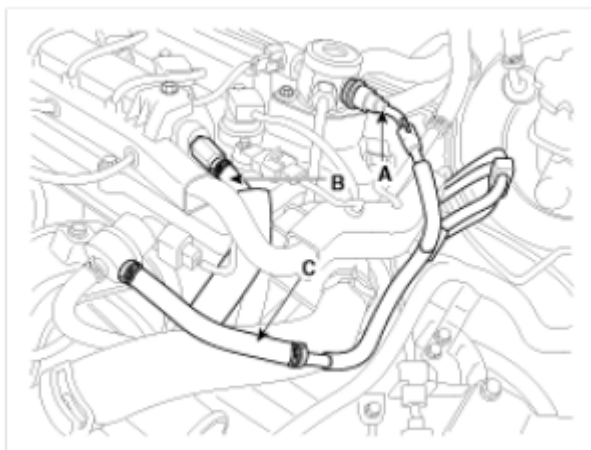


Fig. 18: Identifying Fuel Hose, Positive Crankcase Ventilation Hose And Purge Control Solenoid Valve Hose

Courtesy of HYUNDAI MOTOR AMERICA

13. Remove the vacuum pipe assembly (A).

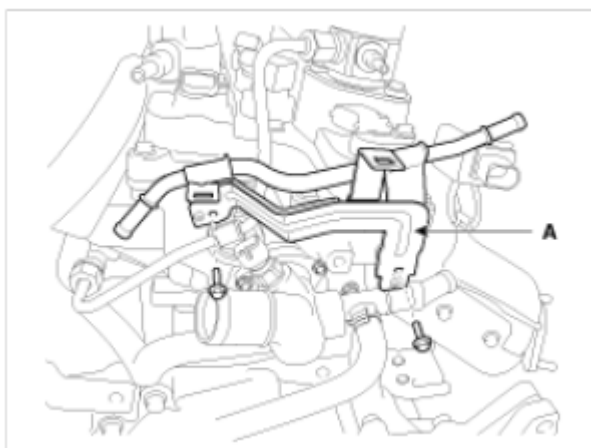


Fig. 19: Identifying Vacuum Pipe Assembly

Courtesy of HYUNDAI MOTOR AMERICA

14. Remove the high pressure pipe (A).

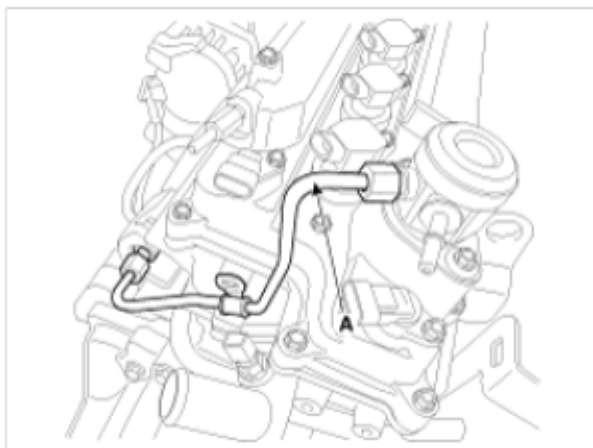


Fig. 20: Identifying High Pressure Pipe
Courtesy of HYUNDAI MOTOR AMERICA

15. Remove the high pressure fuel pump (A) and the roller tappet (B).

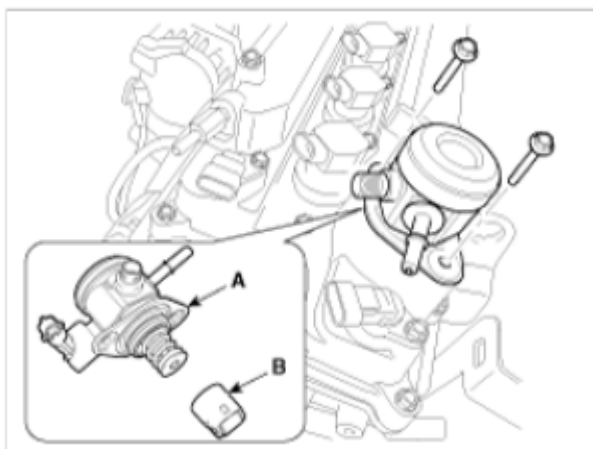


Fig. 21: Identifying High Pressure Fuel Pump And Roller Tappet
Courtesy of HYUNDAI MOTOR AMERICA

16. Remove the ignition coils (A).

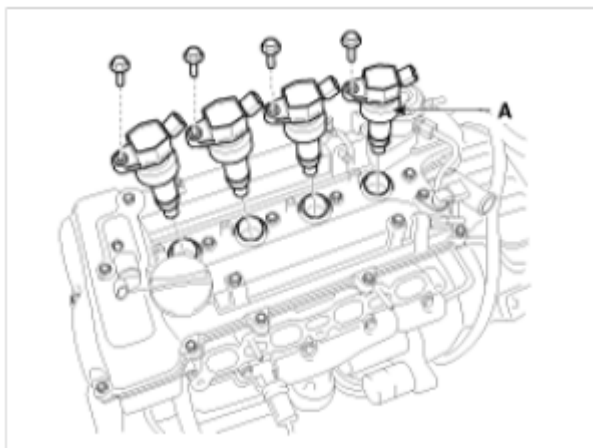


Fig. 22: Identifying Ignition Coils
Courtesy of HYUNDAI MOTOR AMERICA

17. Remove the exhaust OCV (Oil control valve) (B).

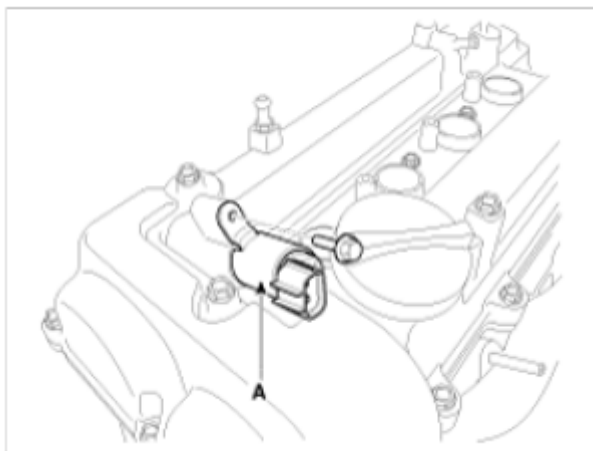


Fig. 23: Identifying Exhaust Oil Control Valve
Courtesy of HYUNDAI MOTOR AMERICA

18. Remove the cylinder head cover (A) with gaskets (B).

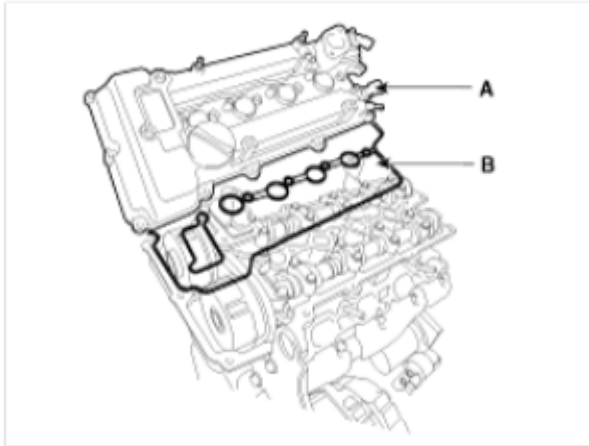


Fig. 24: Identifying Cylinder Head Cover And Gaskets
Courtesy of HYUNDAI MOTOR AMERICA

19. Remove the exhaust OCV (Oil control valve) adapter (A).

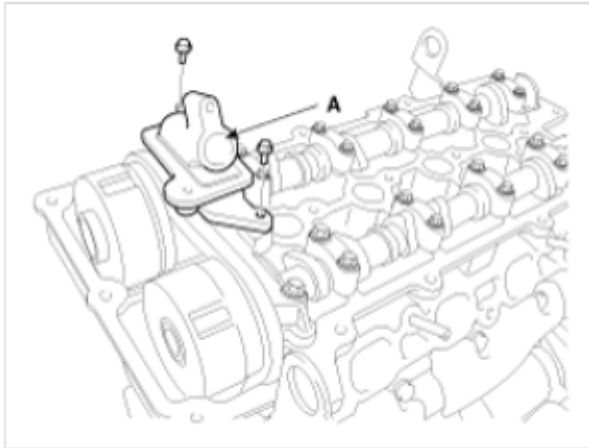


Fig. 25: Identifying Exhaust Oil Control Valve Adapter
Courtesy of HYUNDAI MOTOR AMERICA

20. Remove the timing chain.

(Refer to **Timing system**)

21. Remove the exhaust manifold assembly. (Refer to **Intake and exhaust system**)
22. Remove the intake manifold module assembly. (Refer to **Intake and exhaust system**)
23. Remove the intake CVVT assembly (A) and exhaust CVVT assembly (B).

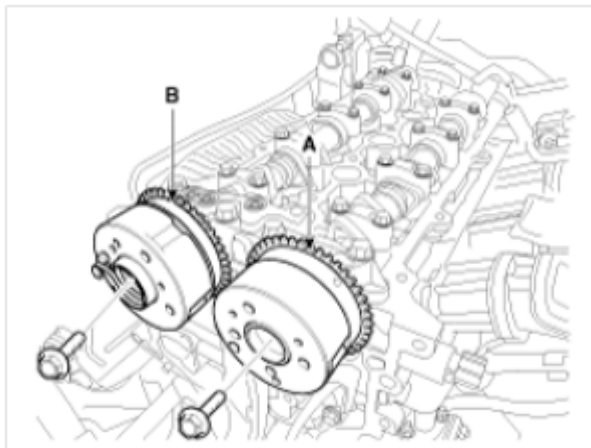


Fig. 26: Identifying Intake And Exhaust CVVT Assembly
Courtesy of HYUNDAI MOTOR AMERICA

NOTE: When removing the CVVT assembly bolt, prevent the camshaft from rotating by using a wrench at position (A).

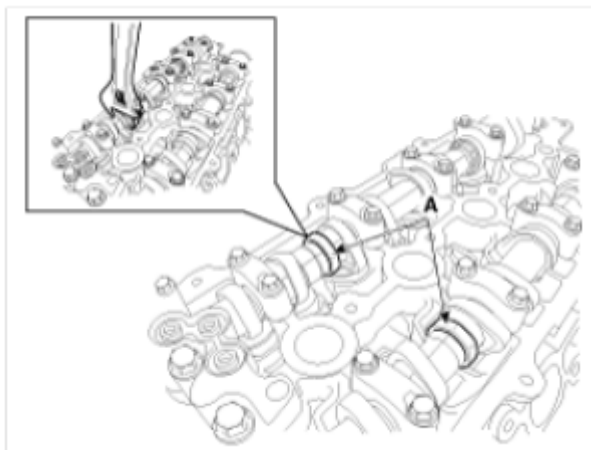


Fig. 27: Preventing Camshaft Rotation Using Wrench
Courtesy of HYUNDAI MOTOR AMERICA

24. Remove the camshaft bearing caps (A) with the order below.

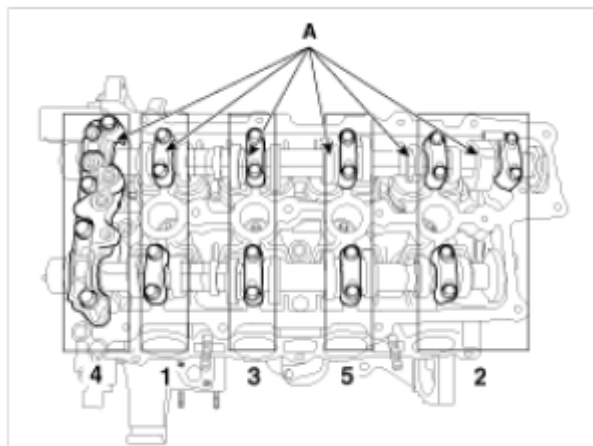


Fig. 28: Identifying Camshaft Bearing Caps Removal Sequence
Courtesy of HYUNDAI MOTOR AMERICA

25. Remove the camshafts (A).

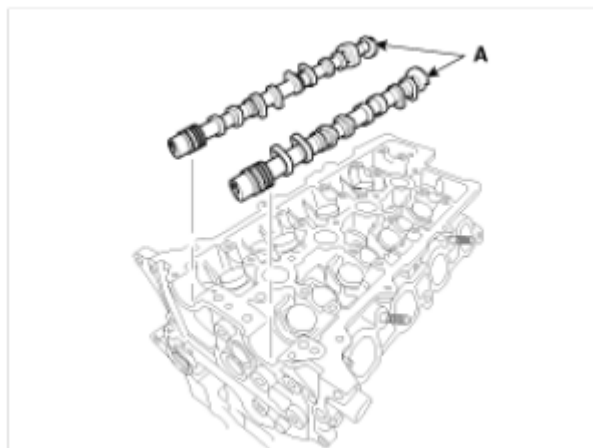


Fig. 29: Identifying Camshafts
Courtesy of HYUNDAI MOTOR AMERICA

26. Remove the injector & rail assembly (A).

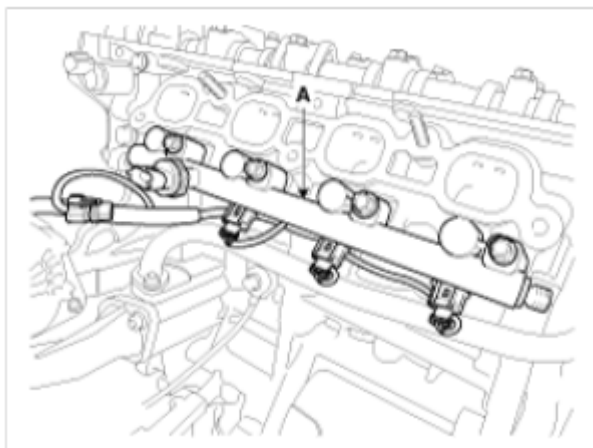


Fig. 30: Identifying Injector & Rail Assembly
Courtesy of HYUNDAI MOTOR AMERICA

27. Remove the water temperature control assembly (B) after disconnecting the throttle body cooling hose (A).

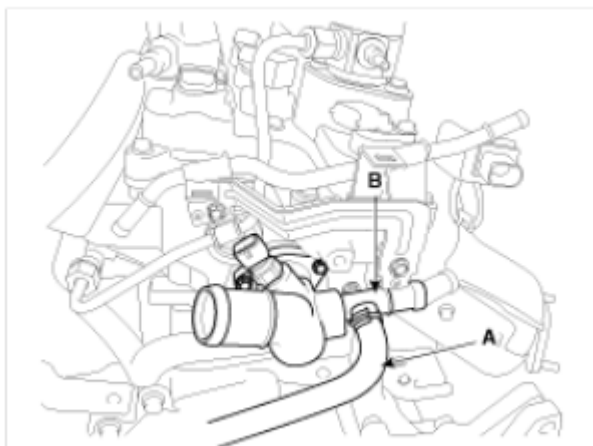
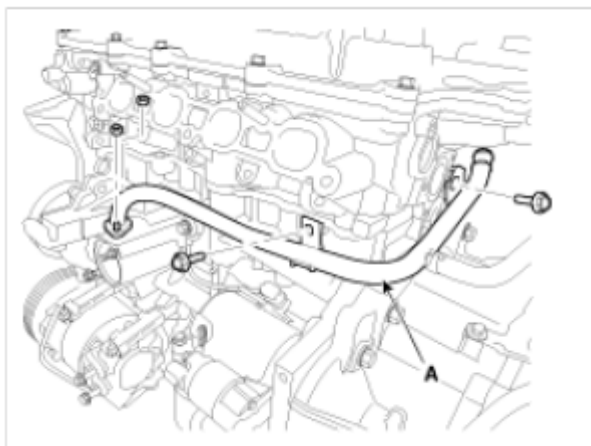
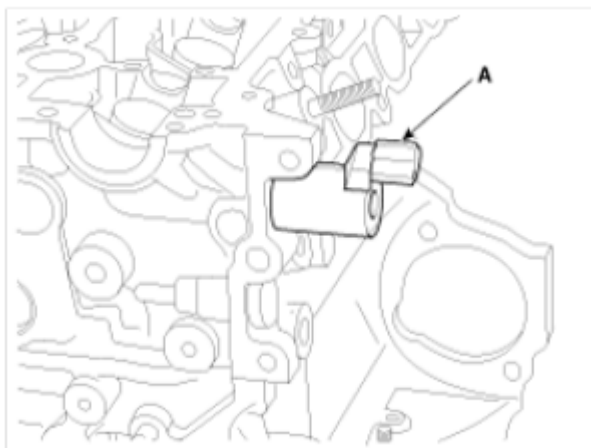


Fig. 31: Identifying Throttle Body Cooling Hose And Water Temperature Control Assembly
Courtesy of HYUNDAI MOTOR AMERICA

28. Remove the heater pipe (A).

**Fig. 32: Identifying Heater Pipe****Courtesy of HYUNDAI MOTOR AMERICA**

29. Remove the intake OCV (Oil Control Valve) (A).

**Fig. 33: Identifying Intake Oil Control Valve****Courtesy of HYUNDAI MOTOR AMERICA**

30. Remove the cylinder head bolts, then remove the cylinder head.
1. Uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown.



Fig. 34: Identifying Cylinder Head Bolts Loosening Sequence
Courtesy of HYUNDAI MOTOR AMERICA

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

2. Lift the cylinder head from the cylinder block and put the cylinder head on wooden blocks.

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

Disassembly

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

1. Remove the MLAs (A).

CAUTION: When removing MLAs, mark all the MLAs for their rearrangement.

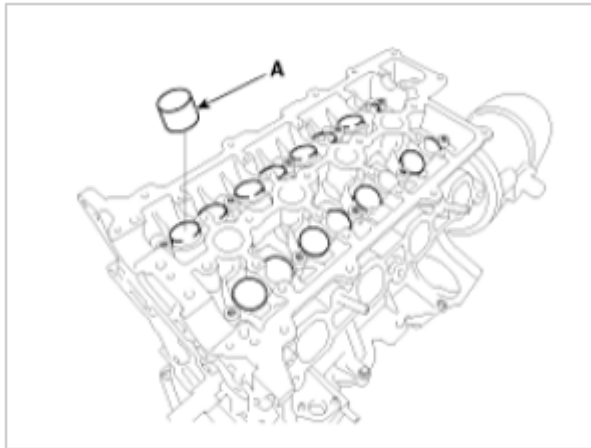


Fig. 35: Identifying Mechanical Lash Adjuster
Courtesy of HYUNDAI MOTOR AMERICA

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

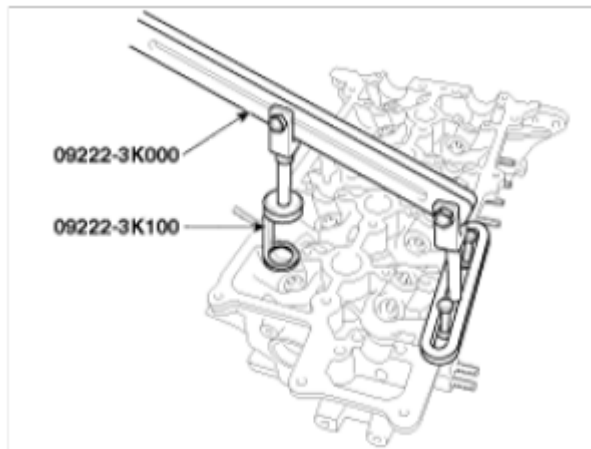


Fig. 36: Compressing Valve Spring Using SST (09222-3K000 And 09222-3K100)
Courtesy of HYUNDAI MOTOR AMERICA

2. Remove the spring retainer.
3. Remove the valve spring.
4. Remove the valve.
5. Remove the valve stem seal.
6. Using a magnetic pickup tool, remove the spring seat.

CAUTION: Do not reuse the valve stem seals.

Inspection**Cylinder Head**

1. Inspect for flatness.

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

Flatness of cylinder head gasket surface

Standard:

Less than 0.05mm (0.0020in) for total area

Less than 0.02mm (0.0008in) for a section of 100mm (3.9370in) X 100mm (3.9370in)

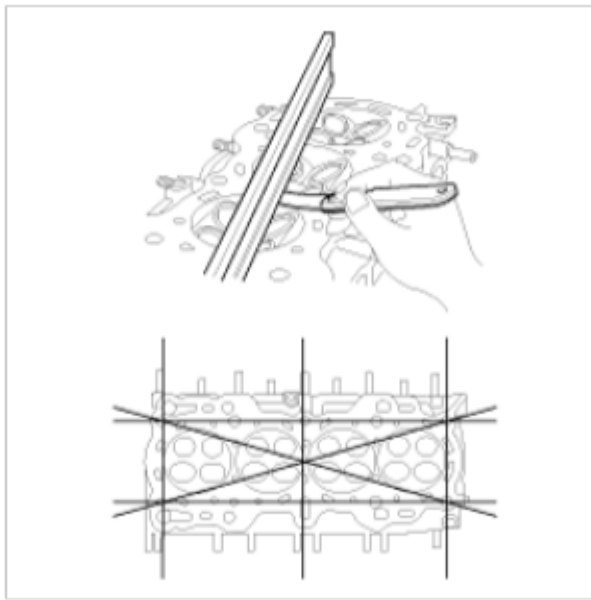


Fig. 37: Measuring Flatness Of Cylinder Head Gasket Surface Using Straight Edge And Feeler Gauge

Courtesy of HYUNDAI MOTOR AMERICA

2. Inspect for cracks.

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

Valve And Valve Spring

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

Valve guide inner diameter:

5.500 ~ 5.512mm (0.2165 ~ 0.2170in)

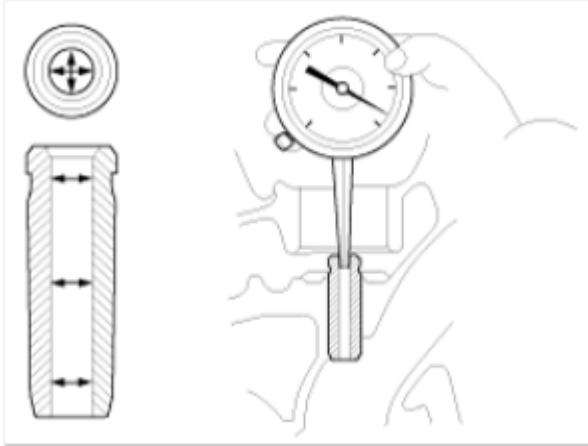


Fig. 38: Measuring Valve Guide Inner Diameter Using Caliper Gauge
 Courtesy of HYUNDAI MOTOR AMERICA

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

Valve stem outer diameter

Intake: 5.465 ~ 5.480mm (0.2152 ~ 0.2157in)

Exhaust: 5.458 ~ 5.470mm (0.2149 ~ 0.2154in)

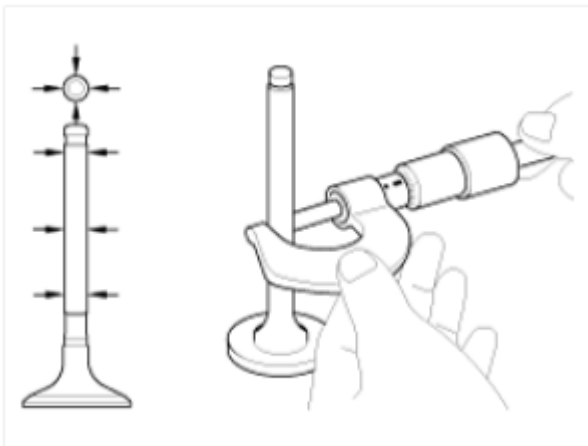


Fig. 39: Measuring Valve Stem Outer Diameter Using Micrometer
 Courtesy of HYUNDAI MOTOR AMERICA

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

Valve stem- to-guide clearance

Intake: 0.020 ~ 0.047mm (0.0008 ~ 0.0019in)

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

If the clearance is greater than specification, replace the valve or the cylinder head.

2. Inspect the valves.

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

If the valve face is worn, replace the valve.

3. Check the valve head margin thickness.

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

Margin**Standard**

Intake: 1.10mm (0.0433in)

Exhaust: 1.26mm (0.0496in)

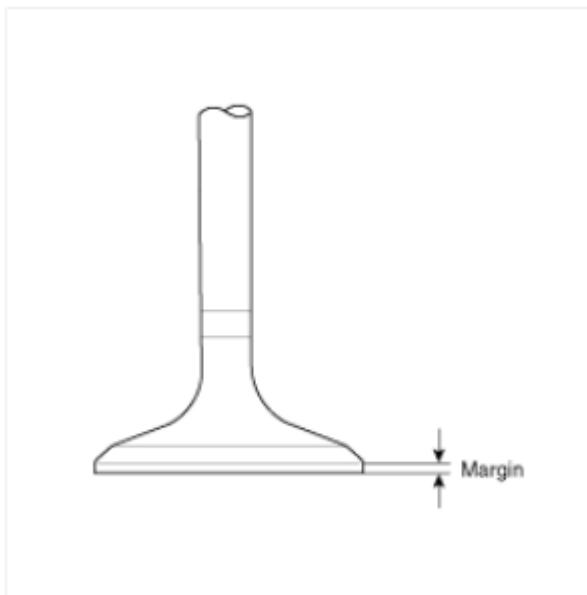


Fig. 40: Identifying Valve Head Margin Thickness
Courtesy of HYUNDAI MOTOR AMERICA

4. Check the length of valve.

Valve length

Standard

Intake: 93.15mm (3.6673 in)

Exhaust: 92.60mm (3.6457 in)

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

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

3. Inspect the valve seats.

1. Check the valve seat for evidence of overheating and improper contact with the valve face. If the valve seat is worn, replace the cylinder head.
2. Check the valve guide for wear. If the valve guide is worn, replace the cylinder head.

4. Inspect the valve springs.

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

Valve spring**Standard**

Free height: 45.1mm (1.7756in)

Out of square: Less than 1.5°

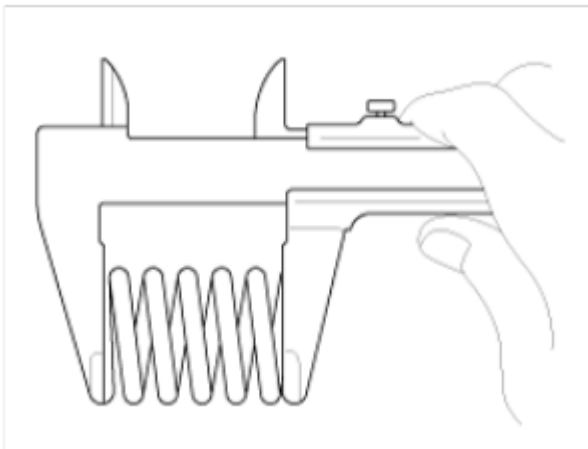


Fig. 41: Measuring Valve Spring Free Length Using Vernier Calipers
Courtesy of HYUNDAI MOTOR AMERICA

Camshaft

1. Inspect the cam height.

Using a micrometer, measure the cam height.

Cam height

Intake: 44.15mm (1.7382in)

Exhaust: 43.55mm (1.7146in)

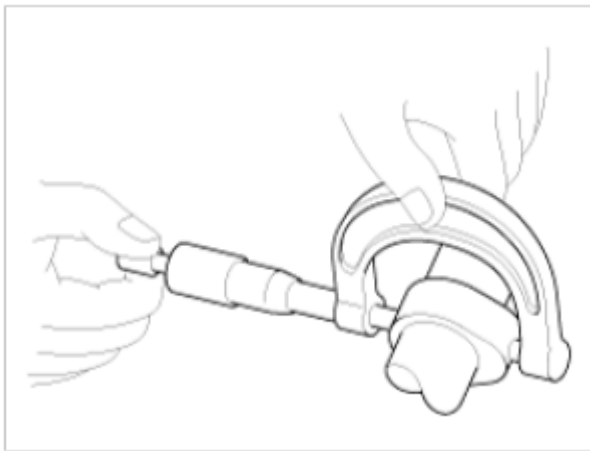


Fig. 42: Measuring Cam Height Using Micrometer
Courtesy of HYUNDAI MOTOR AMERICA

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

2. Check the cranshaft journal for wear.

If the journal is worn excessively, replace the camshaft.

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

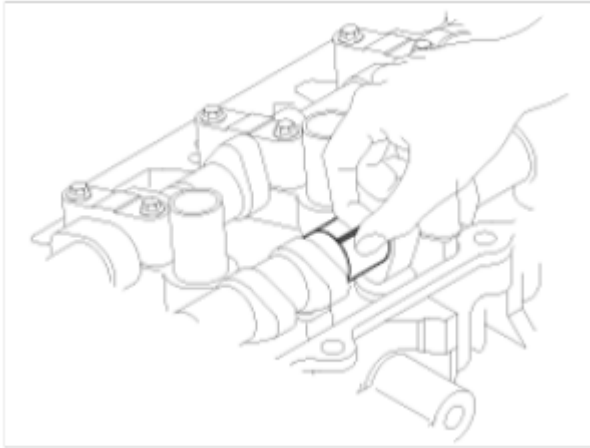


Fig. 43: Inspecting Camshaft Journal Clearance
Courtesy of HYUNDAI MOTOR AMERICA

4. Install the bearing caps and tighten the bolts with specified torque.

Tightening torque:

1st step

M6 bolt:

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

M8 bolt:

9.8 N.m (1.0 kgf.m, 7.2 lb-ft)

2nd step

M6 bolts:

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

M8 bolts:

18.6 ~ 22.6N.m (1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)

CAUTION: Do not turn the camshaft.

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

Bearing oil clearance

Standard: 0.027 ~ 0.058mm (0.0011 ~ 0.0023in)

Limit: 0.1mm (0.0039in)

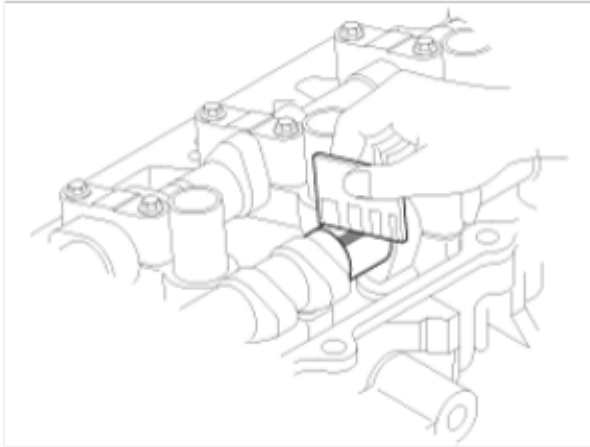


Fig. 44: Measuring Bearing Oil Clearance
Courtesy of HYUNDAI MOTOR AMERICA

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

4. 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: 0.1 ~ 0.2mm (0.0039 ~ 0.0079in)

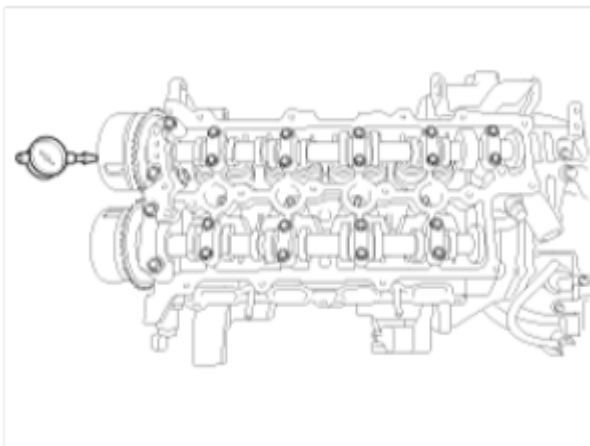


Fig. 45: Measuring Camshaft End Play Using Dial Indicator
Courtesy of HYUNDAI MOTOR AMERICA

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

3. Remove the camshafts.

Continuous Variable Valve Timing (CVVT) Assembly

1. Inspect the Continuous variable valve timing (CVVT) assembly.
 1. Fix the Continuous variable valve timing (CVVT) with its camshaft in a vice.
 2. Check that the CVVT assembly will not turn. If it is not turned, it is in normal condition.
 3. Apply vinyl tape to all the parts except the one hole.
 4. Using an air gun, apply the pressure, 147.10kpa (1.5kg/cm² , 21.33psi) in the hole. This makes the lock pin in maximum retarded state released.

NOTE:

- **Wrap around it with a shop rag, because the oil can splash out.**
- **After releasing the pin, you can turn the CVVT assembly for advance by hand.**
- **If there was too much air leakage, the pin can not be released.**

5. Under the condition of 3), turn the CVVT assembly to the advance angle side with your hand.

Depending on the air pressure, the CVVT assembly will turn to the advance side.

Also, if the air pressure that was applied was insufficient because of the air leakage from the port, the lock pin may not release properly.

6. 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 25°

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

Reassembly

NOTE:

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

1. Install the valves.
 1. Install the spring seats.
 2. Using the SST (09222 - 2B100), push in a new oil seal.

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

CAUTION: Intake valve stem seals are different from exhaust ones in type.
Do not reassembly ones in the other's places.

3. Install the valve, valve spring and spring retainer, after applying engine oil at the end of each valve.

NOTE: When installing valve springs, the enamel coated side should face the valve spring retainer.

2. 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.

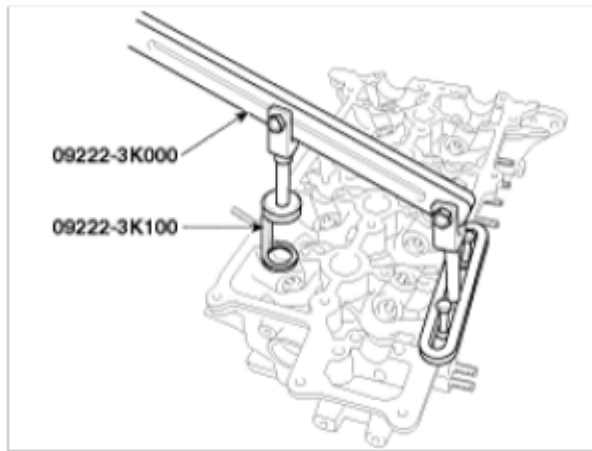


Fig. 46: Compressing Valve Spring Using SST (09222-3K000 And 09222-3K100)
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION: When installing the SST, use the torque, 1.2kgf.m or less.

3. 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.
4. Install the MLA (Mechanical lash adjusters).

Check that the MLA (A) rotates smoothly by hand.

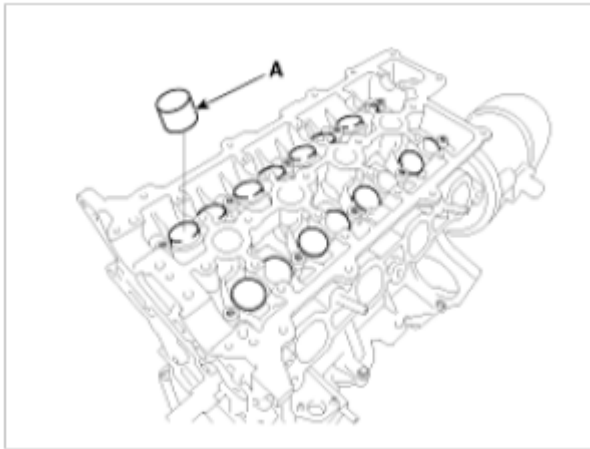


Fig. 47: Identifying Mechanical Lash Adjuster
Courtesy of HYUNDAI MOTOR AMERICA

NOTE: All the MLAs must be installed in its original position.

Installation

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

1. Install the cylinder head assembly.
 1. Before installing, remove the hardened sealant from the cylinder block and cylinder head surface.
 2. Before installing the cylinder head gasket, apply sealant on the upper surface of the cylinder block and reassemble the gasket within five minutes.

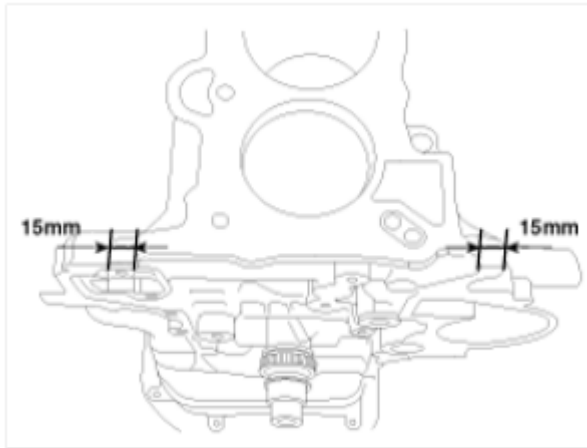


Fig. 48: Identifying Sealant Applying Areas On Upper Surface Of Cylinder Block
Courtesy of HYUNDAI MOTOR AMERICA

NOTE: Refer to the graphic below for applying sealant.

Width: 2.0 ~ 3.0mm (0.0787~0.1181in.)

Position: 1.0 ~ 1.5mm (0.0394~0.0591in.)

Specification: Hyundai Gray RTV or TB 1217H or LOCTITE 5900H

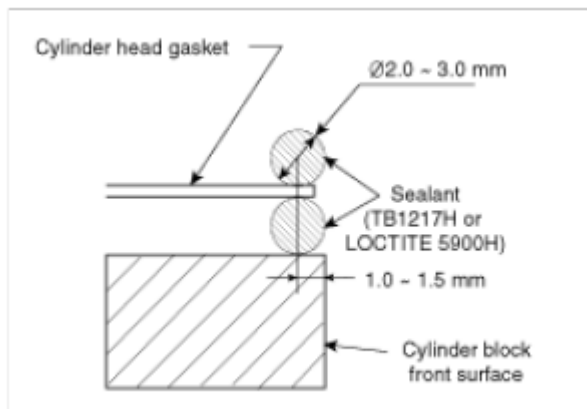


Fig. 49: Identifying Sealant Applying Areas On Cylinder Block Front Surface
Courtesy of HYUNDAI MOTOR AMERICA

3. After installing the cylinder head gasket on the cylinder block, apply sealant on the upper surface of the cylinder head gasket and reassemble in five minutes.
2. Place the cylinder head carefully not to damage the gasket.
3. Install the cylinder head bolts with washers.
 1. Tighten the 10 cylinder head bolts, in several passes, in the sequence shown.

Tightening torque:

29.4Nm (3.0kgf.m, 21.7lb-ft) + 90° + 90°

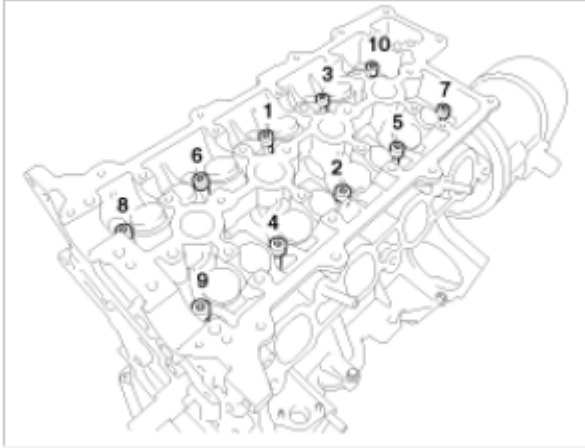


Fig. 50: Identifying Cylinder Head Bolts Tightening Sequence
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION: Always use new cylinder head bolts.

4. Install the oil control valve (OCV) (A).

Tightening torque:

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

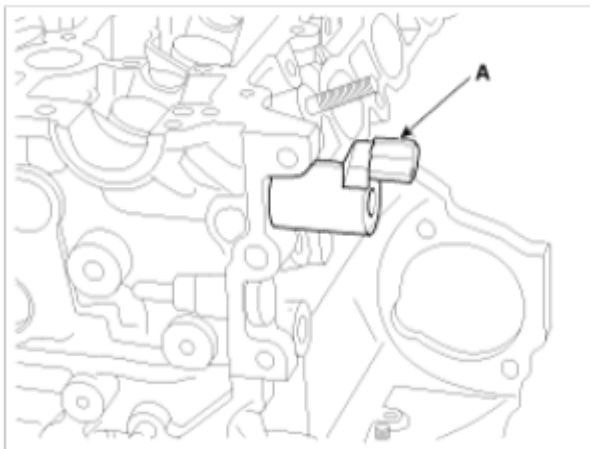


Fig. 51: Identifying Oil Control Valve
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION:

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

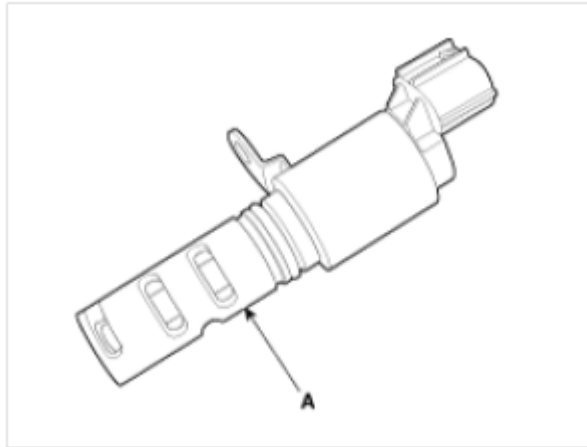


Fig. 52: Identifying Oil Control Valve Sleeve
Courtesy of HYUNDAI MOTOR AMERICA

5. Install the heater pipe (A).

Tightening torque

M6 bolt and nuts:

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

M8 bolts:

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

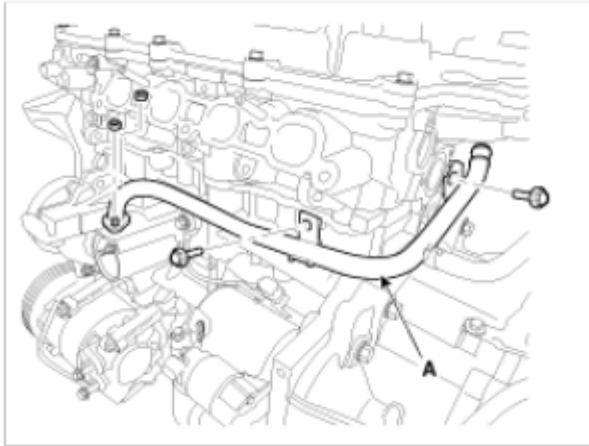


Fig. 53: Identifying Heater Pipe

Courtesy of HYUNDAI MOTOR AMERICA

6. Install the water temperature control assembly (A) after connecting the throttle body cooling hose (A).

Tightening torque:

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

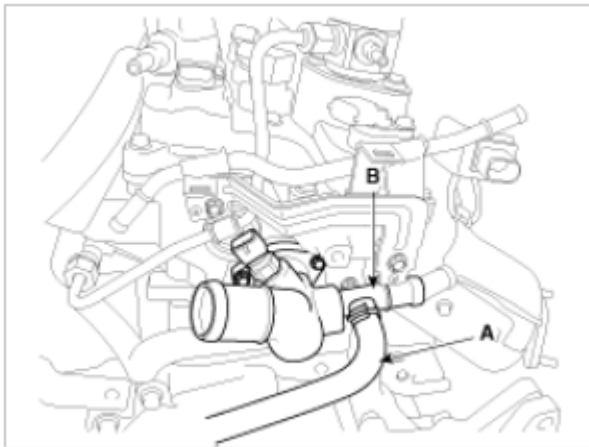


Fig. 54: Identifying Water Temperature Control Assembly And Throttle Body Cooling Hose

Courtesy of HYUNDAI MOTOR AMERICA

7. Install the injector & rail assembly (A).

Tightening torque:

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

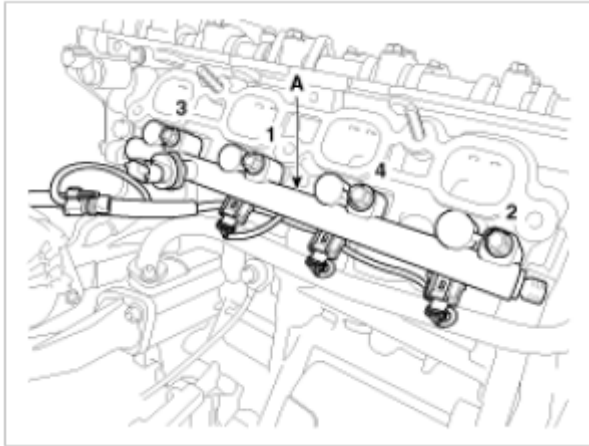


Fig. 55: Identifying Injector & Rail Assembly
Courtesy of HYUNDAI MOTOR AMERICA

8. Install the intake and exhaust manifold.

(Refer to **Intake and Exhaust system**)

9. Install the camshafts (A).
 1. Before installing, apply engine oil on journals.

CAUTION: Do not make oil flow down to the front side of the cylinder head.

2. After installing, check the valve clearance.

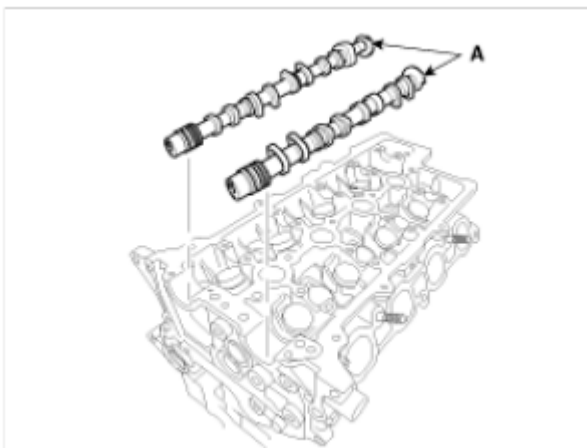


Fig. 56: Identifying Camshafts
Courtesy of HYUNDAI MOTOR AMERICA

10. Install the camshaft bearing caps with the order below.

Tightening torque:

1st step

M6 bolt:

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

M8 bolt:

9.8 N.m (1.0 kgf.m, 7.2 lb-ft)

2nd step

M6 bolts:

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

M8 bolts:

18.6 ~ 22.6N.m (1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)

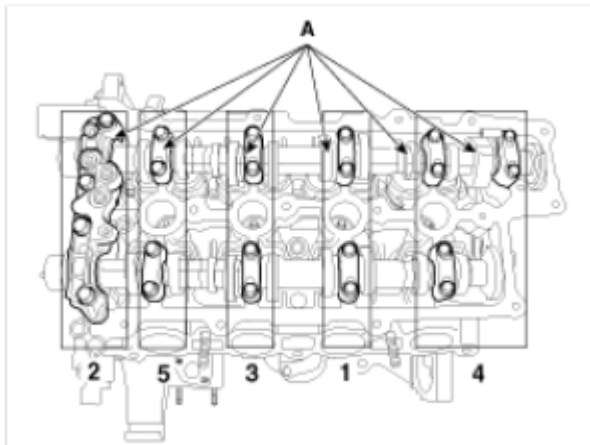


Fig. 57: Identifying Camshaft Bearing Caps Installation Sequence
Courtesy of HYUNDAI MOTOR AMERICA

11. Install the intake CVVT assembly (A) and exhaust CVVT assembly (B).

Tightening torque:

63.7 ~ 73.5N.m (6.5 ~ 7.5kgf.m, 47.0 ~ 54.2lb-ft)

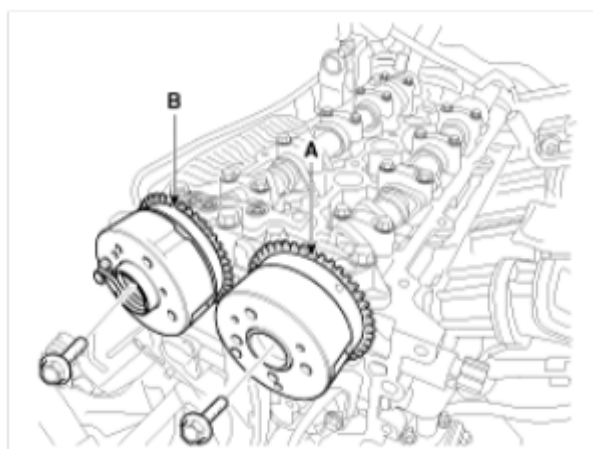


Fig. 58: Identifying Intake And Exhaust CVVT Assembly

Courtesy of HYUNDAI MOTOR AMERICA

NOTE: When installing the CVVT assembly bolt, prevent the camshaft from rotating by using a wrench at position (A).

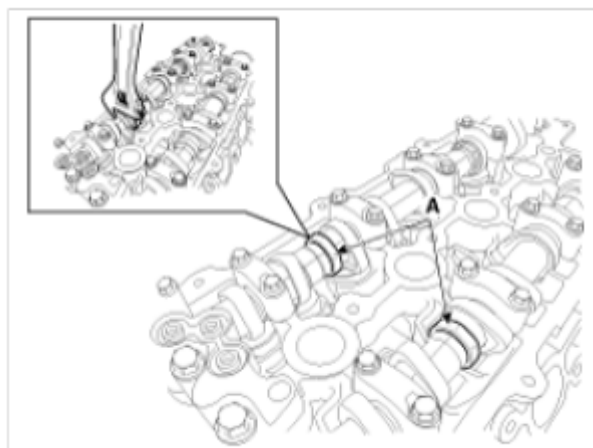


Fig. 59: Preventing Camshaft Rotation Using Wrench

Courtesy of HYUNDAI MOTOR AMERICA

12. Install the timing chain.

(Refer to **Timing system**)

13. Before installing the cylinder head cover, remove oil, dust or hardened sealant from the timing chain cover and the cylinder head upper surface.
14. After applying the liquid gasket, Hyundai Gray RTV or THREE BOND 1217H or LOCTITE 5900H on the cylinder head cover, reassemble the cover within five minutes.

Width: 2.0 ~ 2.5mm (0.0787~0.0984in.)

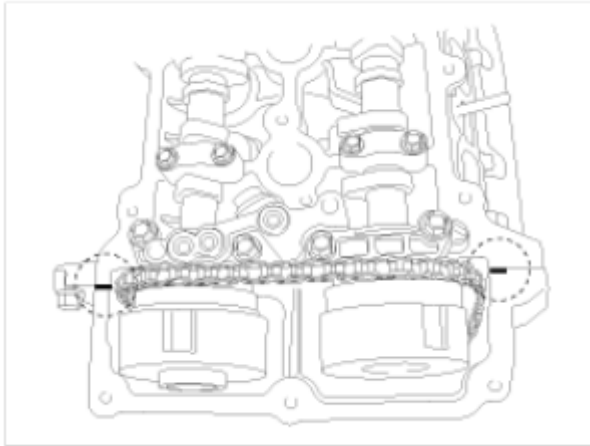


Fig. 60: Identifying Liquid Gasket Applying Areas On Cylinder Head Cover
Courtesy of HYUNDAI MOTOR AMERICA

15. Install the OCV (Oil Control Valve) adapter (A).

Tightening torque:

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

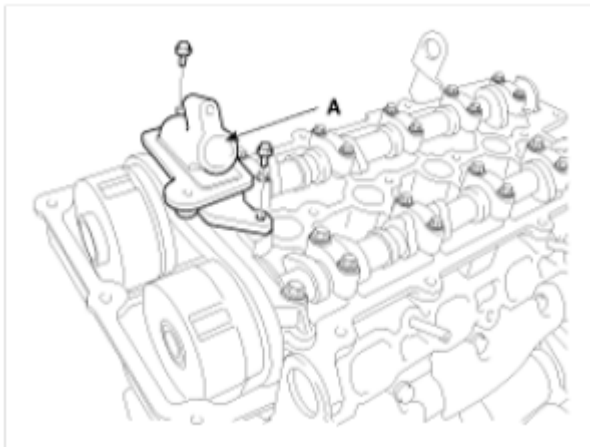


Fig. 61: Identifying Oil Control Valve Adapter
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION:

- Keep the OCV adapter clean.
- Make sure the O-rings on the front bearing cap are installed.

16. Install the cylinder head cover (A) with a new gasket (B).

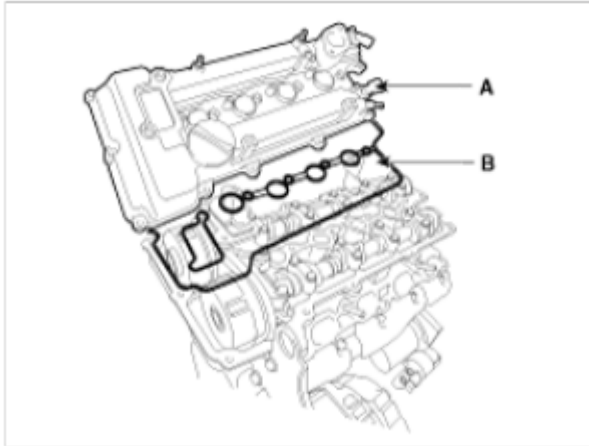


Fig. 62: Identifying Cylinder Head Cover And Gasket
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION: Do not reuse the disassembled gasket.

17. Tighten the cylinder head cover bolts (A) with the order and steps.

Tightening torque:

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

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

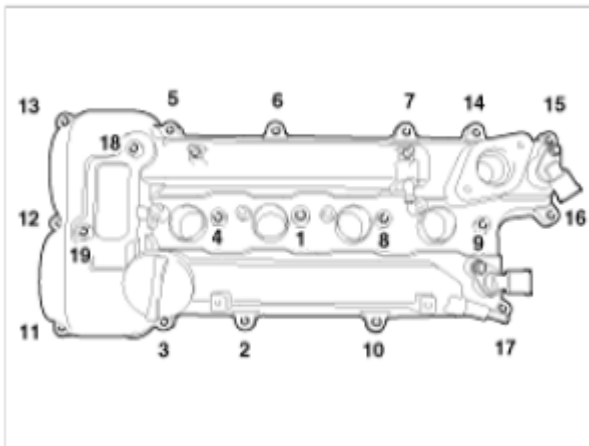


Fig. 63: Identifying Cylinder Head Cover Bolts Tightening Sequence
Courtesy of HYUNDAI MOTOR AMERICA

18. Install the exhaust OCV (Oil control valve) (A).

Tightening torque:

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

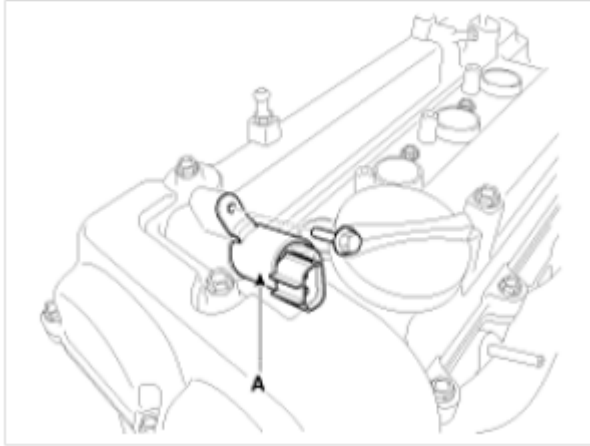


Fig. 64: Identifying Exhaust Oil Control Valve
 Courtesy of HYUNDAI MOTOR AMERICA

CAUTION:

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

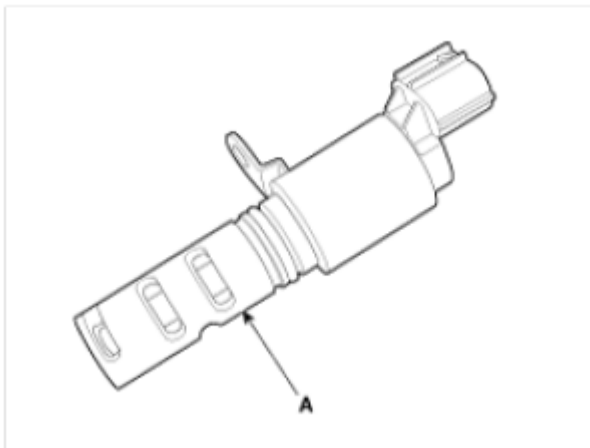


Fig. 65: Identifying Oil Control Valve Sleeve
 Courtesy of HYUNDAI MOTOR AMERICA

19. Install the ignition coils (A).

Tightening torque:

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

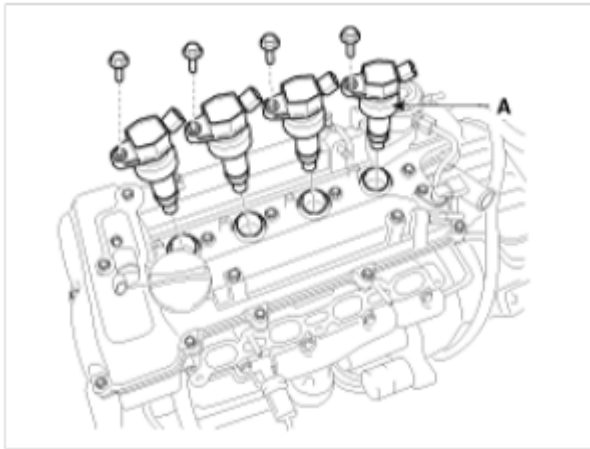


Fig. 66: Identifying Ignition Coils
Courtesy of HYUNDAI MOTOR AMERICA

20. Install the high pressure fuel pump (A) and the roller tappet (B).

Tightening torque:

12.7 ~ 14.7N.m (1.3 ~ 1.5kgf.m, 9.4 ~ 10.8lb-ft)

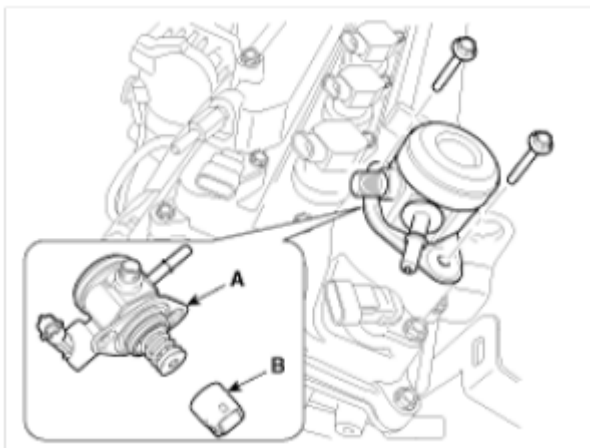


Fig. 67: Identifying High Pressure Fuel Pump And Roller Tappet
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION: Before installing the high pressure fuel pump, position the roller tappet in the lowest position (BDC) by rotating the crankshaft. Otherwise the installation bolts may be broken because of tension of the pump spring.

NOTE: Do not use already used bolt again.

NOTE: When tightening the installation bolts of the high pressure fuel pump, tighten in turn the bolts in small step (0.5 turns) after tightening them with hand-screwed torque.

CAUTION: Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

CAUTION: Apply engine oil to the O-ring (A) of the high pressure fuel pump, the roller tappet (B), and the protrusion (C). Also apply engine oil to the groove where the protrusion is installed.

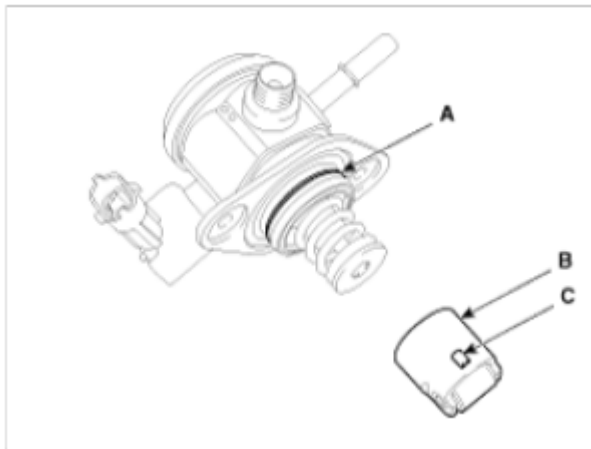


Fig. 68: Identifying High Pressure Fuel Pump O-Ring, Roller Tappet And Protrusion
Courtesy of HYUNDAI MOTOR AMERICA

21. Install the high pressure pipe (A).

Tightening torque:

25.5 ~ 31.4N.m (2.6 ~ 3.2kgf.m, 18.8 ~ 23.1lb-ft)

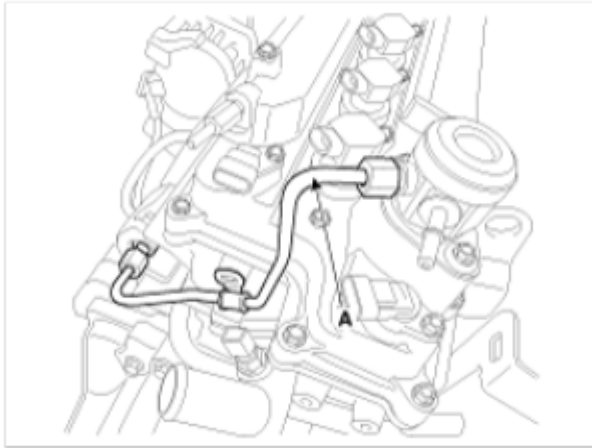


Fig. 69: Identifying High Pressure Pipe
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION: Do not reuse the high pressure pipe.

22. Install the vacuum pipe assembly (A).

Tightening torque:

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

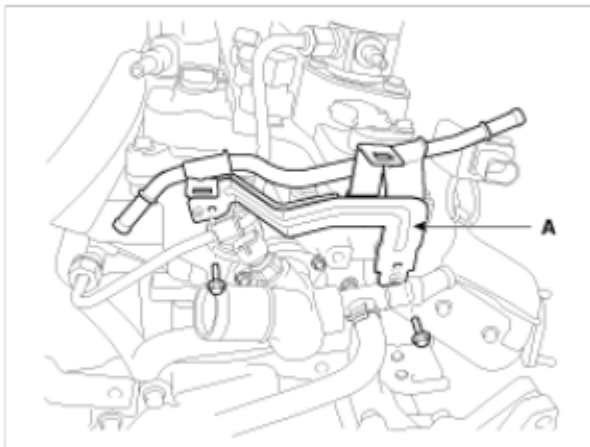


Fig. 70: Identifying Vacuum Pipe Assembly
Courtesy of HYUNDAI MOTOR AMERICA

23. Connect the fuel hose (A), the PCV (Positive crankcase ventilation) hose (B) and the PCSV (Purge control solenoid valve) hose (C).

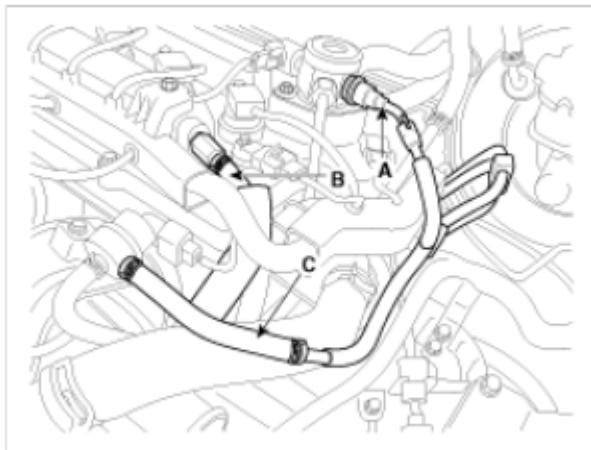


Fig. 71: Identifying Fuel Hose, Positive Crankcase Ventilation Hose And Purge Control Solenoid Valve Hose

Courtesy of HYUNDAI MOTOR AMERICA

24. Connect the brake booster vacuum hose (A) and heater hose (B).

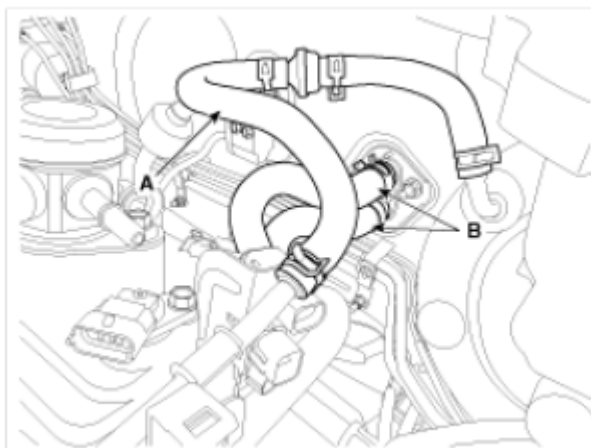


Fig. 72: Identifying Brake Booster Vacuum Hose And Heater Hose

Courtesy of HYUNDAI MOTOR AMERICA

NOTE: Install the heater hoses as shown illustrations.

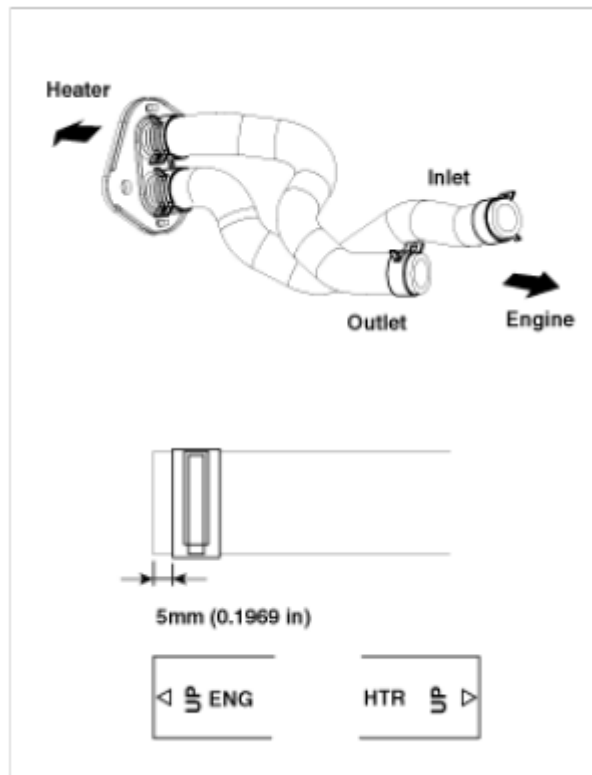


Fig. 73: Identifying Heater Hoses Installation Position

Courtesy of HYUNDAI MOTOR AMERICA

25. Connect the wiring connectors and harness clamps, and remove the wiring and protectors from the cylinder head and intake manifold.
 1. The A/C compressor switch connector (A), the alternator connector (B) and the cable from the alternator "B" terminal (C)

Tightening torque:

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

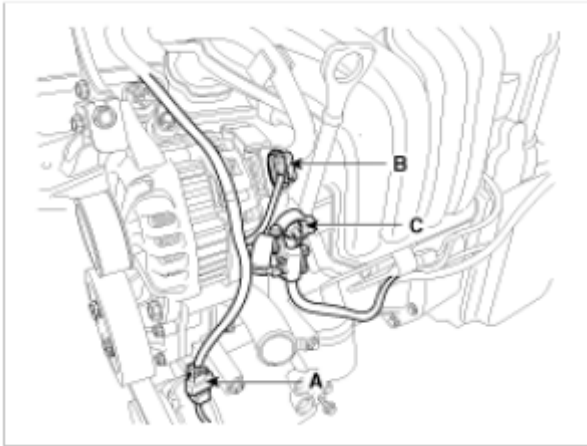


Fig. 74: Identifying A/C Compressor Switch Connector, Alternator Connector And Alternator "B" Terminal

Courtesy of HYUNDAI MOTOR AMERICA

2. The intake OCV (Oil control valve) connector (A) and the exhaust OCV (Oil control valve) connector (B)

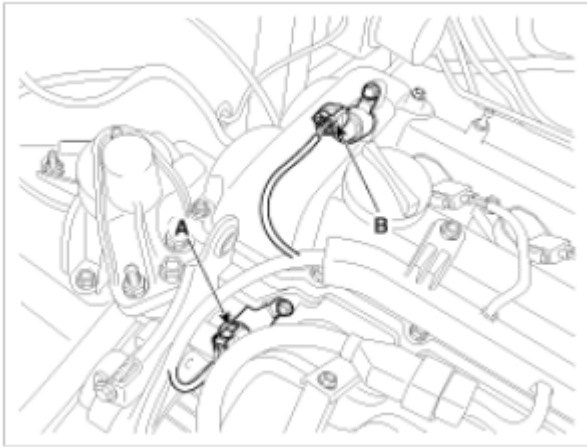


Fig. 75: Identifying Intake And Exhaust Oil Control Valve Connectors

Courtesy of HYUNDAI MOTOR AMERICA

3. The ignition coil connectors (A), the injector extension connector (B), the VIS (Variable intake system) connector (C) and the PCSV (Purge control solenoid valve) connector (D)

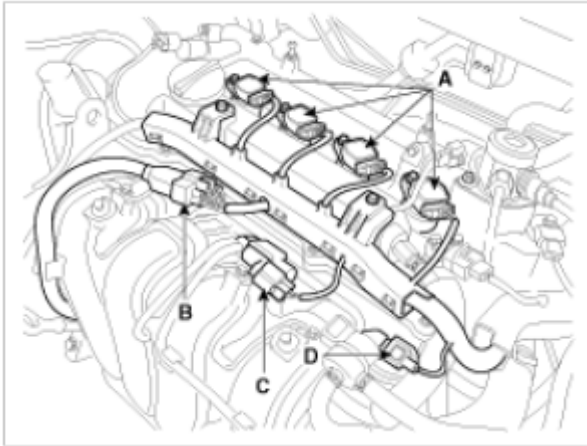


Fig. 76: Identifying Ignition Coil, Injector Extension, Variable Intake System And Purge Control Solenoid Valve Connectors
Courtesy of HYUNDAI MOTOR AMERICA

4. The FPCV (Fuel pressure control valve) connector (A), the intake CMPS (Camshaft position sensor) connector (B) and the exhaust CMPS (Camshaft position sensor) connector (C)

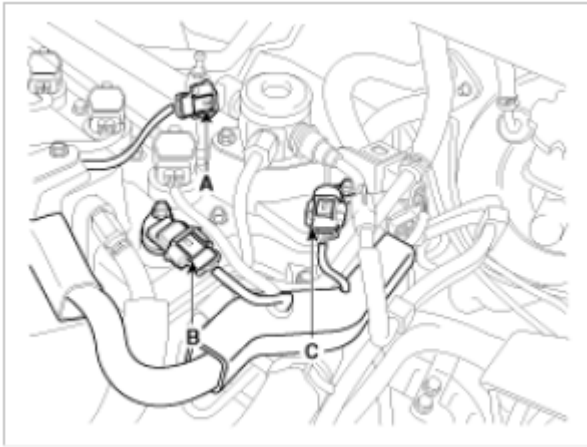


Fig. 77: Identifying Fuel Pressure Control Valve, Intake And Exhaust Camshaft Position Sensor Connectors
Courtesy of HYUNDAI MOTOR AMERICA

5. The oxygen sensor connectors (A) and the condenser connector (B).

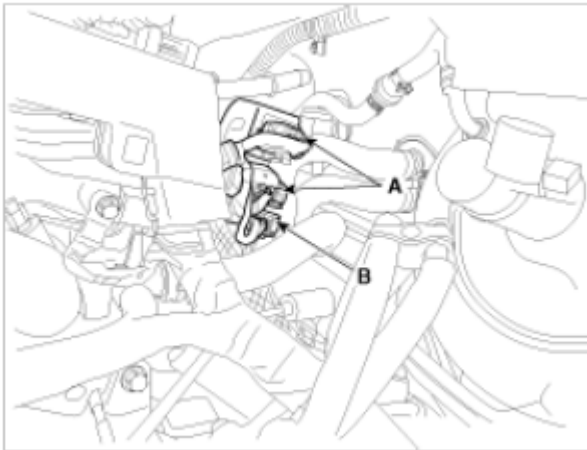


Fig. 78: Identifying Oxygen Sensor Connectors And Condenser Connector
Courtesy of HYUNDAI MOTOR AMERICA

6. The ECTS (Engine coolant temperature sensor) connector (A) and the ground line

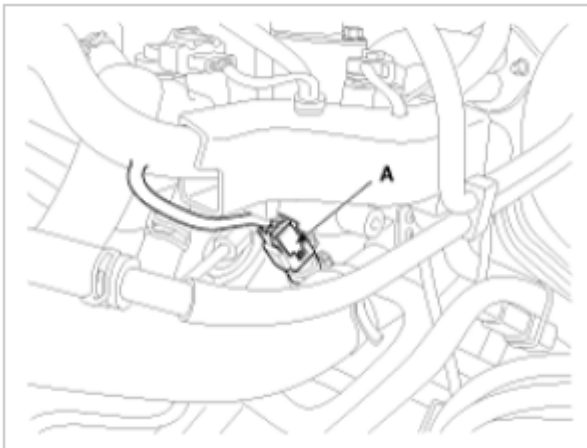


Fig. 79: Identifying Engine Coolant Temperature Sensor Connector And Ground Line
Courtesy of HYUNDAI MOTOR AMERICA

7. The ETC (Electronic throttle control) connector (A) and the MAPS (Manifold absolute pressure sensor) & IATS (Intake air temperature sensor) connector (B)

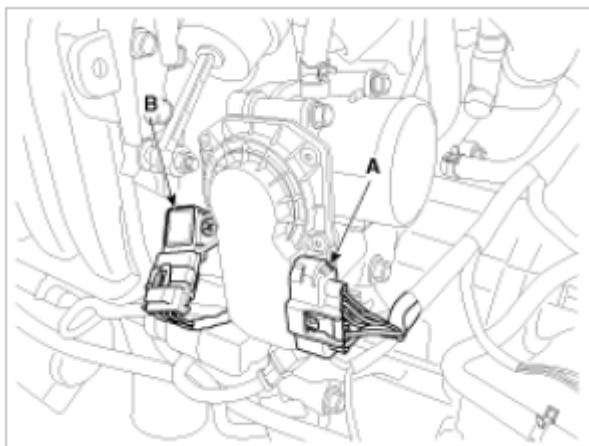


Fig. 80: Identifying Electronic Throttle Control And Manifold Absolute Pressure Sensor & Intake Air Temperature Sensor Connectors
Courtesy of HYUNDAI MOTOR AMERICA

26. Connect the radiator upper hose (A) and lower hose (B).

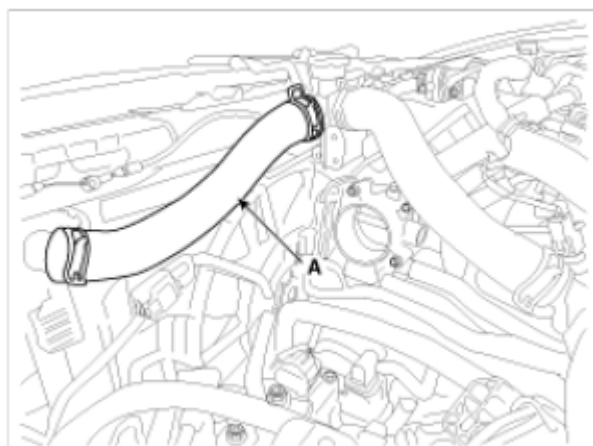


Fig. 81: Identifying Radiator Upper Hose
Courtesy of HYUNDAI MOTOR AMERICA

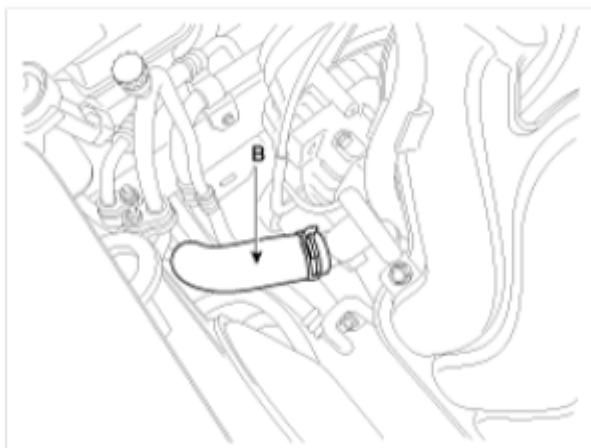


Fig. 82: Identifying Radiator Lower Hose
Courtesy of HYUNDAI MOTOR AMERICA

NOTE: Install the radiator hoses as shown illustrations.



Fig. 83: Identifying Radiator Hose Installation Position
Courtesy of HYUNDAI MOTOR AMERICA

27. Install the under covers (A).

Tightening torque:

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

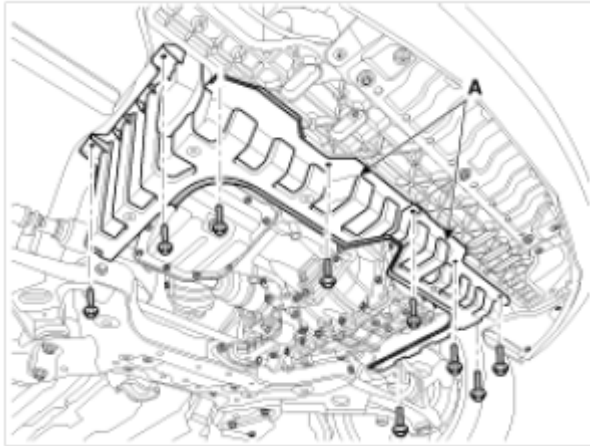


Fig. 84: Identifying Under Cover
Courtesy of HYUNDAI MOTOR AMERICA

28. Install the battery tray (C).

Tightening torque:

8.8 ~ 13.7 N.m (0.9 ~ 1.4 kgf.m, 6.5 ~ 10.1 lb-ft)

29. Install the ECM (B) and then connect the ECM connectors (A).

Tightening torque:

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

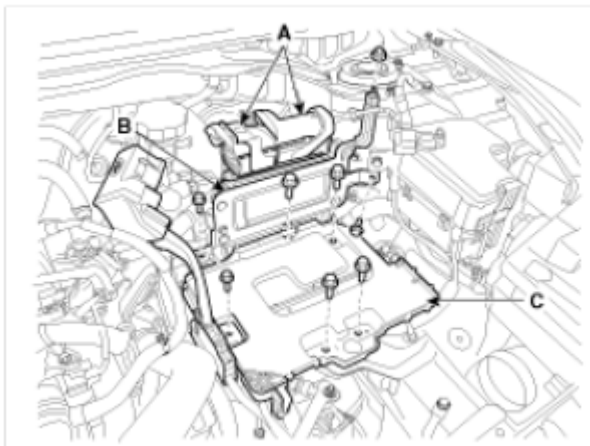


Fig. 85: Identifying ECM, Connectors And Battery Tray
Courtesy of HYUNDAI MOTOR AMERICA

30. Install the battery (A) after removing the mounting bracket.

Tightening torque:

8.8 ~ 13.7 N.m (0.9 ~ 1.4 kgf.m, 6.5 ~ 10.1 lb-ft)

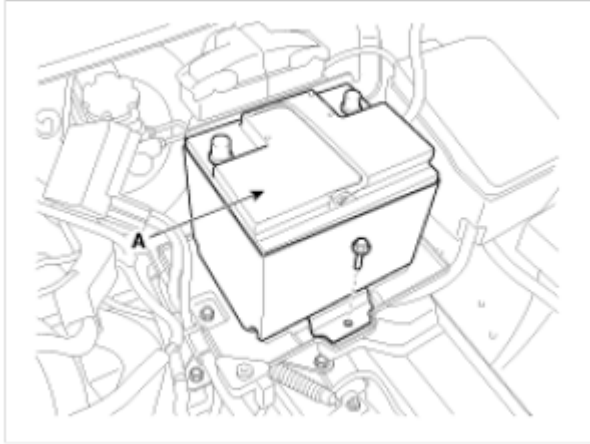


Fig. 86: Identifying Battery

Courtesy of HYUNDAI MOTOR AMERICA

31. Install the RH front wheel.
32. Install the air cleaner assembly.
 1. Install the air cleaner assembly (D) and the air intake hose (C).

Tightening torque

Hose clamp bolt:

2.9 ~ 4.9N.m (0.3 ~ 0.5kgf.m, 2.2 ~ 3.6lb-ft)

Air cleaner assembly bolts:

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

2. Connect the breather hose (B).
3. Install the air duct (A).

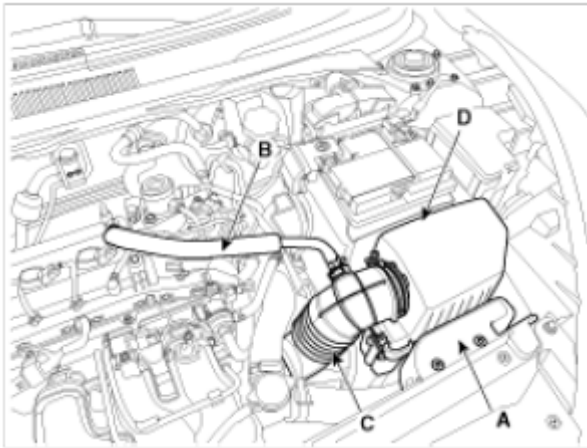


Fig. 87: Identifying Air Duct, Breather Hose, Air Intake Hose And Air Cleaner Assembly
 Courtesy of HYUNDAI MOTOR AMERICA

NOTE:

- Install the air intake hose while the plate of the hose clamp must be in line with the stopper of the hose.
- Install the air intake hose while the groove of hose must be matched to the protrusion of the throttle body.

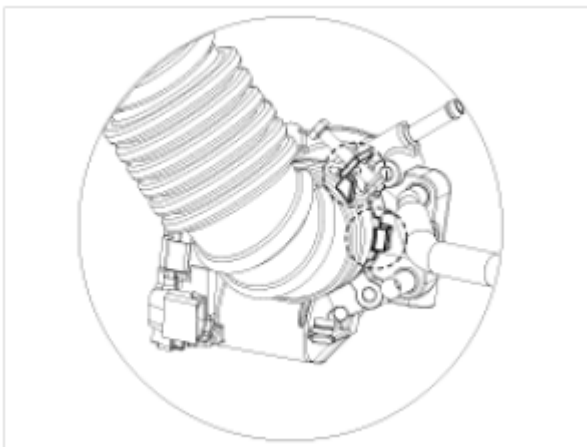


Fig. 88: Identifying Air Intake Hose Installation Position
 Courtesy of HYUNDAI MOTOR AMERICA

33. Connect the battery negative terminals (A).

Tightening torque

(+) terminal:

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

(-) terminal (without battery sensor):

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

(-) terminal (with battery sensor):

4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)

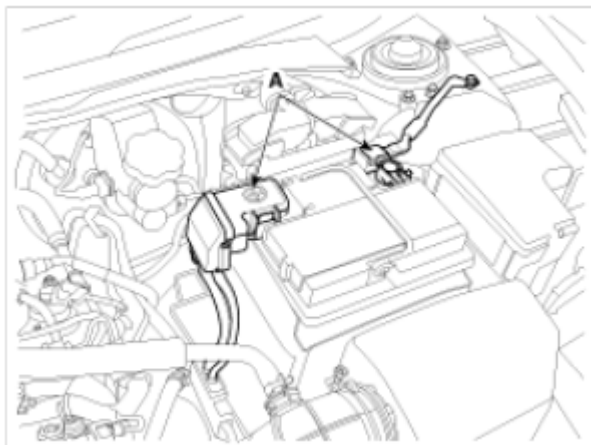


Fig. 89: Identifying Battery Negative Terminals
Courtesy of HYUNDAI MOTOR AMERICA

34. Install the engine cover.

CAUTION: Install the engine cover.

NOTE: Perform the following:

- Adjust a shift cable.
- Refill engine with engine oil.
- Refill a transaxle with fluid.
- Refill a radiator and a reservoir tank with engine coolant.
- Clean battery posts and cable terminals and assemble.
- Inspect for fuel leakage.
 - After assemble the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.
 - Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line.
- 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.**

2012 ENGINE

Timing System - Veloster

TIMING CHAIN

COMPONENTS AND COMPONENTS LOCATION

Components

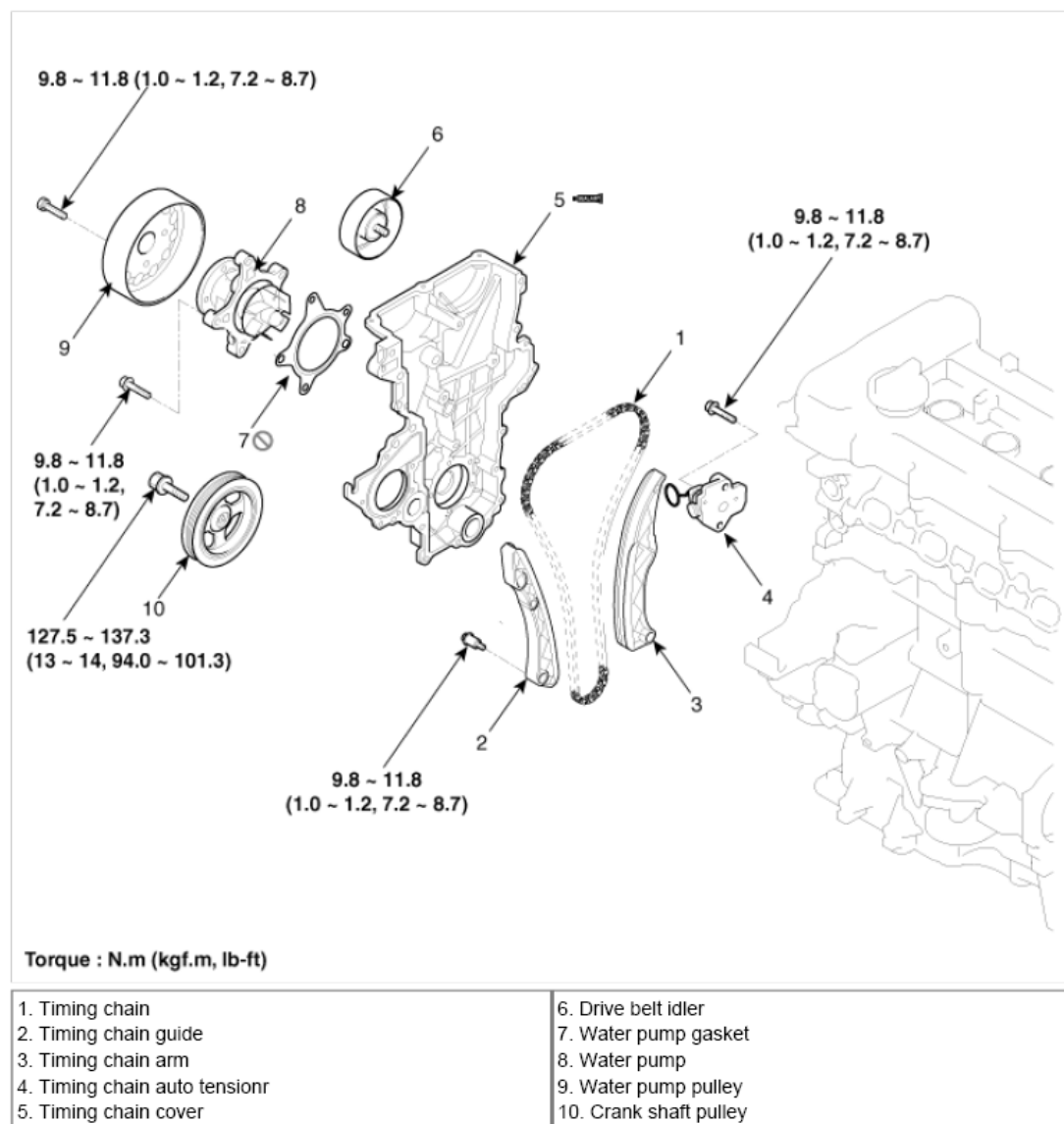


Fig. 1: Identifying Timing Chain Components With Torque Specifications
Courtesy of HYUNDAI MOTOR AMERICA

REPAIR PROCEDURES

Removal

Engine removal is not required for this procedure.

- 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.

WARNING: In case of removing the high pressure fuel pump, high pressure fuel pipe, delivery pipe, and injector, there may be injury caused by leakage of the high pressure fuel. So don't do any repair work right after engine stops.

1. Remove the engine cover.
2. Disconnect the battery negative terminal (A).

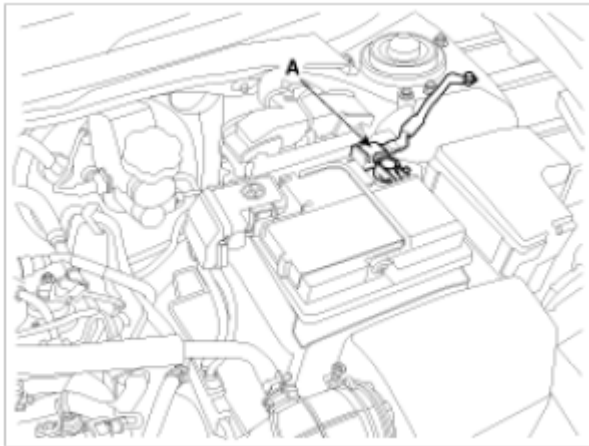


Fig. 2: Identifying Battery Negative Terminal
Courtesy of HYUNDAI MOTOR AMERICA

3. Remove the air cleaner assembly.
 1. Remove the air duct (A).
 2. Disconnect the breather hose (B).
 3. Disconnect the air intake hose (C) and then remove the air cleaner assembly (D).

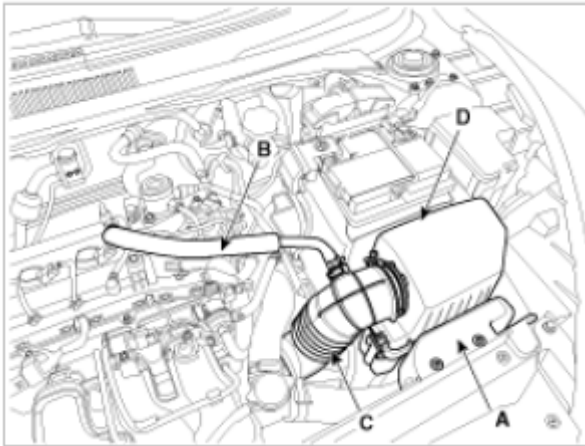


Fig. 3: Identifying Air Duct, Breather Hose, Air Intake Hose And Air Cleaner Assembly
Courtesy of HYUNDAI MOTOR AMERICA

4. Remove the RH front wheel.
5. Remove the under covers (A).

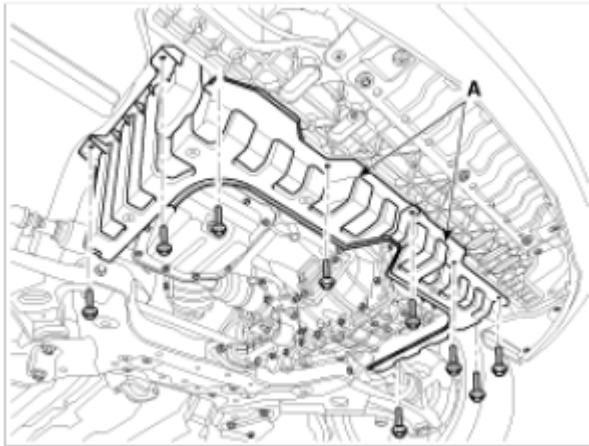


Fig. 4: Identifying Under Cover
Courtesy of HYUNDAI MOTOR AMERICA

6. Disconnect the A/C compressor switch connector (A), the alternator connector (B) and the cable from the alternator "B" terminal (C).

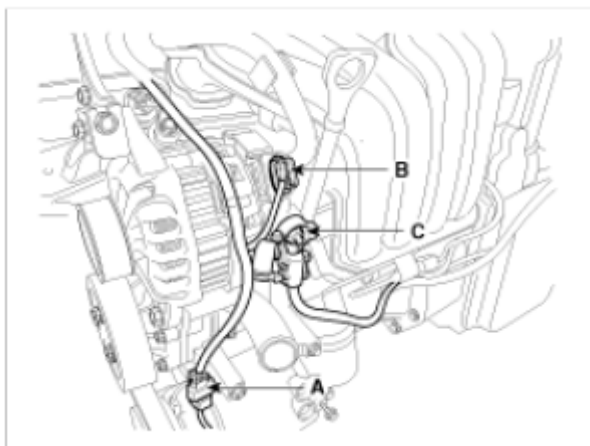


Fig. 5: Identifying A/C Compressor Switch Connector, Alternator Connector And Alternator "B" Terminal

Courtesy of HYUNDAI MOTOR AMERICA

7. Disconnect the intake OCV (Oil control valve) connector (A) and the exhaust OCV (Oil control valve) connector (B).

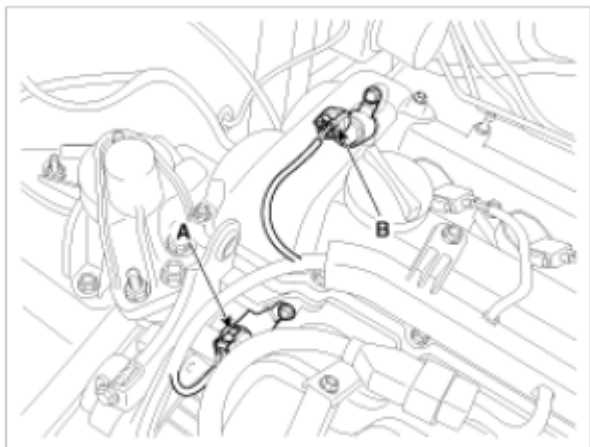


Fig. 6: Identifying Intake And Exhaust Oil Control Valve Connectors

Courtesy of HYUNDAI MOTOR AMERICA

8. Disconnect the ignition coil connectors (A), the injector extension connector (B), the VIS (Variable intake system) connector (C) and the PCSV (Purge control solenoid valve) connector (D).

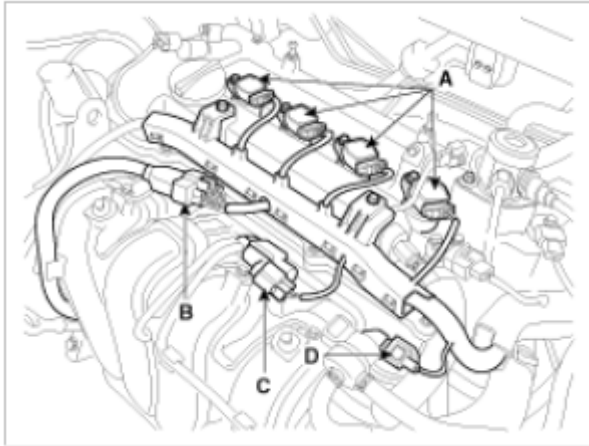


Fig. 7: Identifying Ignition Coil, Injector Extension, Variable Intake System And Purge Control Solenoid Valve Connectors

Courtesy of HYUNDAI MOTOR AMERICA

9. Disconnect the FPCV (Fuel pressure control valve) connector (A), the intake CMPS (Camshaft position sensor) connector (B) and the exhaust CMPS (Camshaft position sensor) connector (C).



Fig. 8: Identifying Fuel Pressure Control Valve, Intake And Exhaust Camshaft Position Sensor Connectors

Courtesy of HYUNDAI MOTOR AMERICA

10. Disconnect the oxygen sensor connectors (A) and the condenser connector (B).

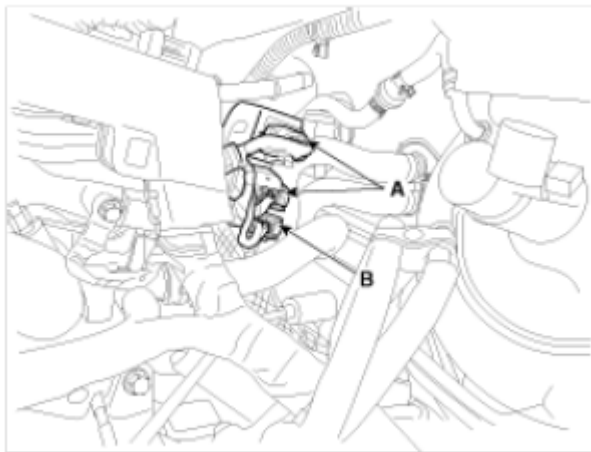


Fig. 9: Identifying Oxygen Sensor Connectors And Condenser Connector
Courtesy of HYUNDAI MOTOR AMERICA

11. Disconnect the fuel hose (A) and the PCV (Positive crankcase ventilation) hose (B).

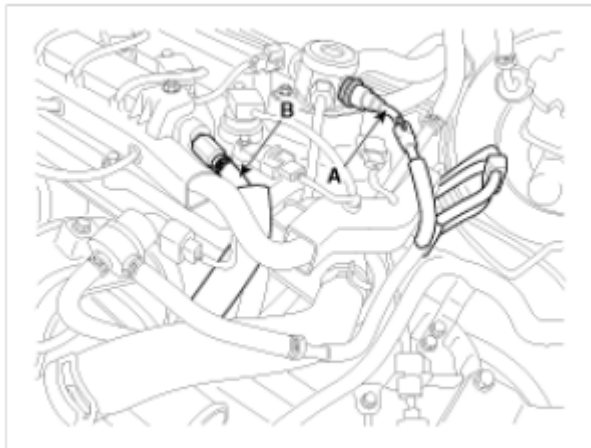


Fig. 10: Identifying Fuel Hose And Positive Crankcase Ventilation Hose
Courtesy of HYUNDAI MOTOR AMERICA

12. Remove the vacuum pipe assembly (A).

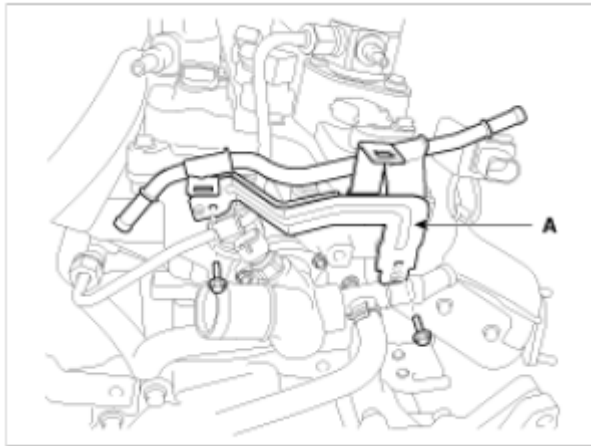


Fig. 11: Identifying Vacuum Pipe Assembly
Courtesy of HYUNDAI MOTOR AMERICA

13. Remove the high pressure pipe (A)

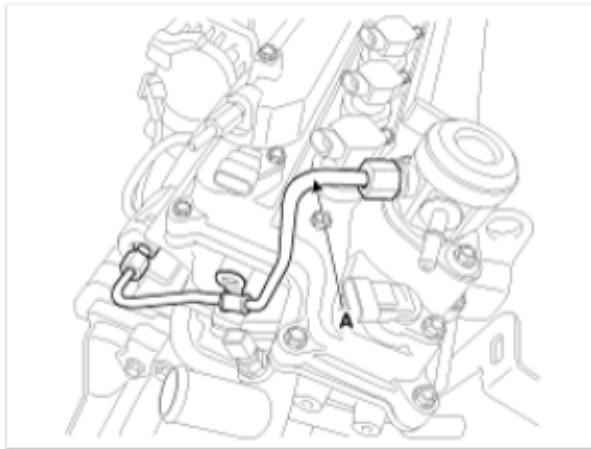


Fig. 12: Identifying High Pressure Pipe
Courtesy of HYUNDAI MOTOR AMERICA

14. Remove the high pressure fuel pump (A) and the roller tappet (B).

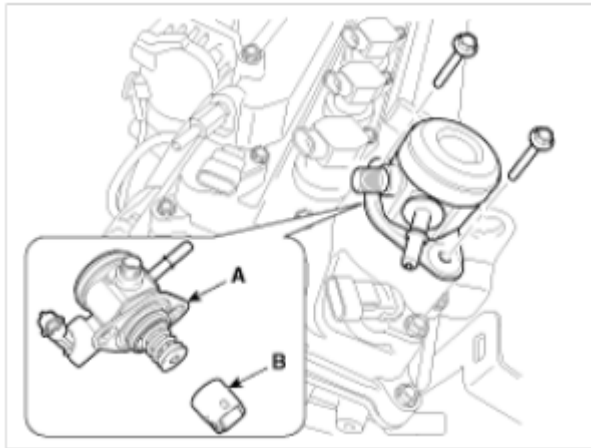


Fig. 13: Identifying High Pressure Fuel Pump And Roller Tappet
Courtesy of HYUNDAI MOTOR AMERICA

15. Remove the ignition coils (A).

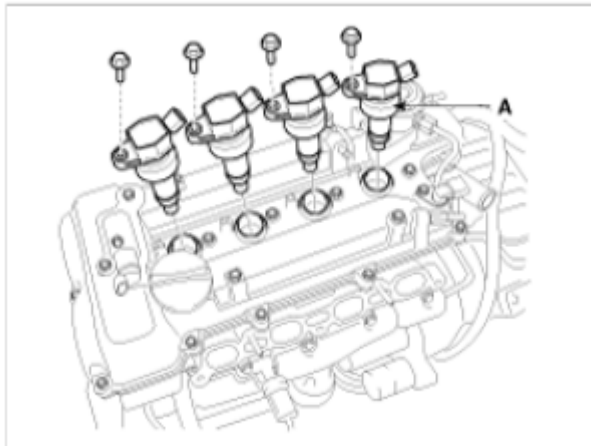


Fig. 14: Identifying Ignition Coils
Courtesy of HYUNDAI MOTOR AMERICA

16. Remove the exhaust OCV (Oil control valve) (B).

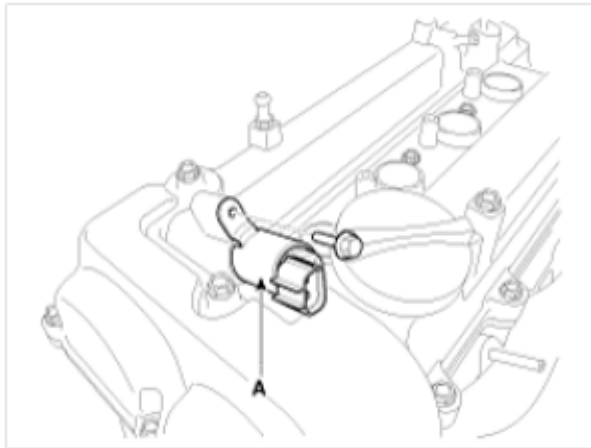


Fig. 15: Identifying Exhaust Oil Control Valve
Courtesy of HYUNDAI MOTOR AMERICA

17. Remove the cylinder head cover (A) with gaskets (B).

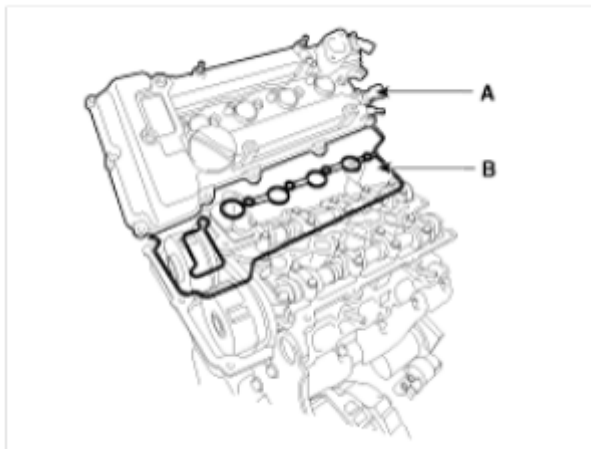


Fig. 16: Identifying Cylinder Head Cover And Gaskets
Courtesy of HYUNDAI MOTOR AMERICA

18. Remove the exhaust OCV (Oil control valve) adapter (A).

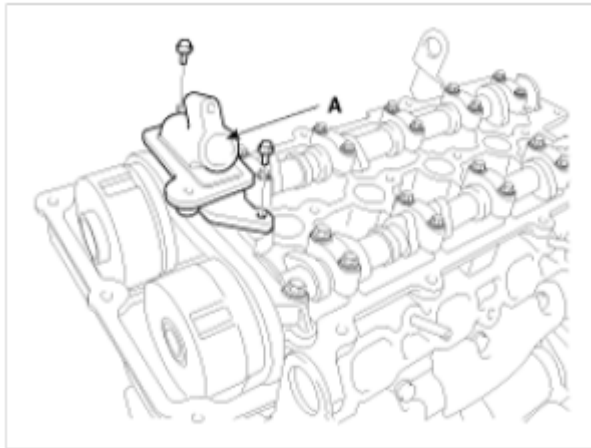


Fig. 17: Identifying Exhaust Oil Control Valve Adapter
Courtesy of HYUNDAI MOTOR AMERICA

19. Loosen the water pump pulley bolt and the drive idler mounting bolt.
20. Loosen the alternator tension adjusting bolt (A) to loosen tension.

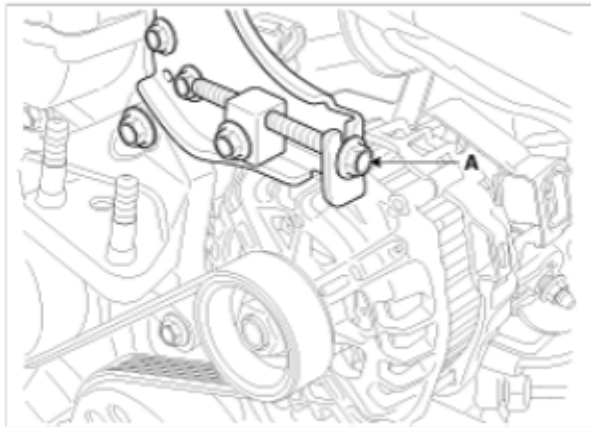


Fig. 18: Identifying Alternator Tension Adjusting Bolt
Courtesy of HYUNDAI MOTOR AMERICA

21. Remove the alternator drive belt (A).

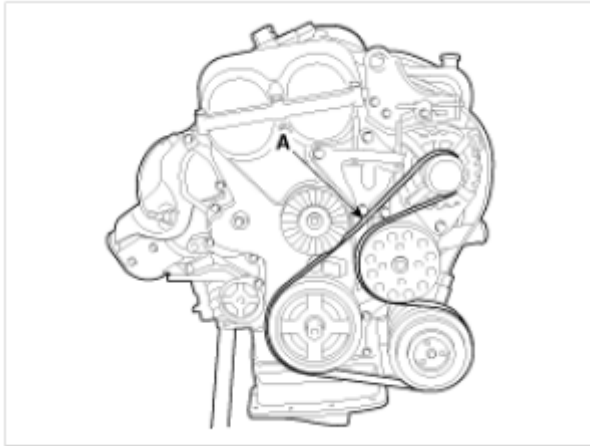


Fig. 19: Identifying Alternator Drive Belt
Courtesy of HYUNDAI MOTOR AMERICA

22. Remove the alternator (A).

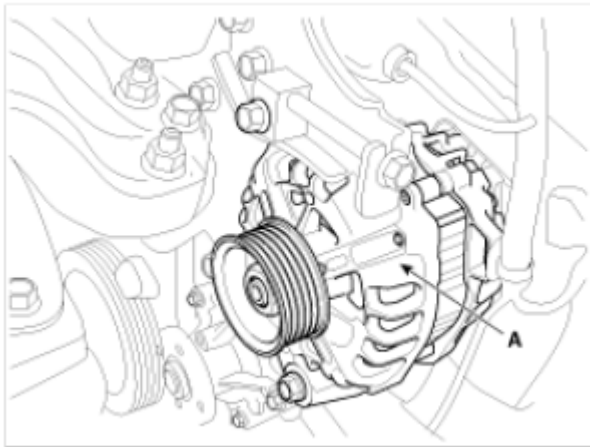


Fig. 20: Identifying Alternator
Courtesy of HYUNDAI MOTOR AMERICA

23. Disconnect the ground line (A) and then remove the engine mounting support bracket (A).

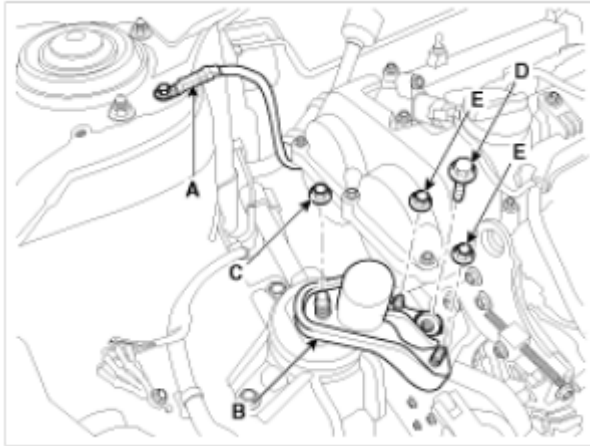


Fig. 21: Identifying Engine Mounting Support Bracket And Ground Line
Courtesy of HYUNDAI MOTOR AMERICA

NOTE: Support the engine with a jack not to be tilted.

24. Remove the alternator bracket (B).
25. Remove the engine support bracket (A).

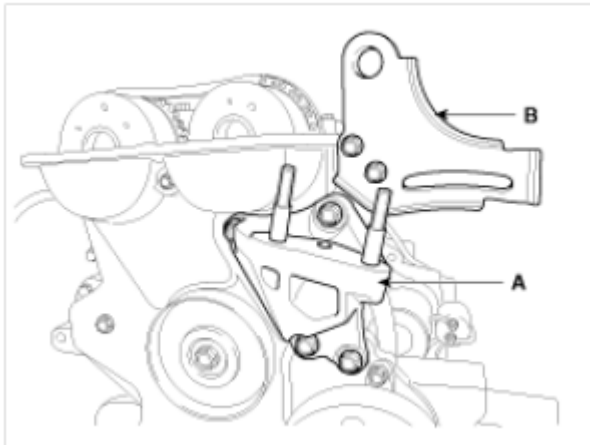


Fig. 22: Identifying Engine Support Bracket And Alternator Bracket
Courtesy of HYUNDAI MOTOR AMERICA

26. Remove the water pump pulley (A) and the drive belt idler (B).

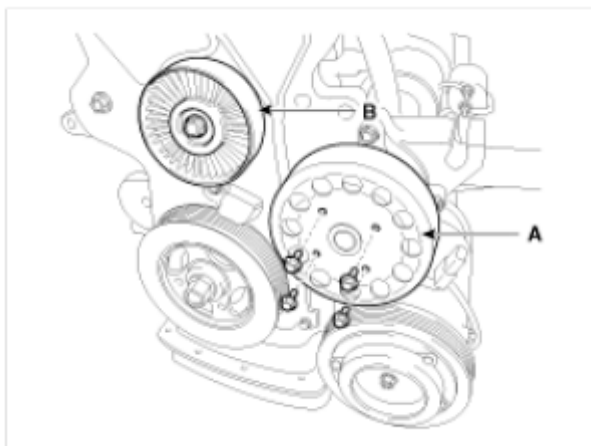


Fig. 23: Identifying Water Pump Pulley And Drive Belt Idler
Courtesy of HYUNDAI MOTOR AMERICA

27. Remove the water pump (A).

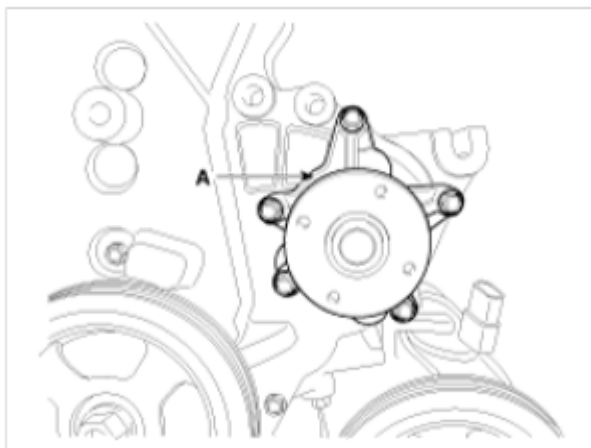


Fig. 24: Identifying Water Pump
Courtesy of HYUNDAI MOTOR AMERICA

28. Turn the crankshaft pulley clockwise, and align its groove with the timing mark of the timing chain cover.

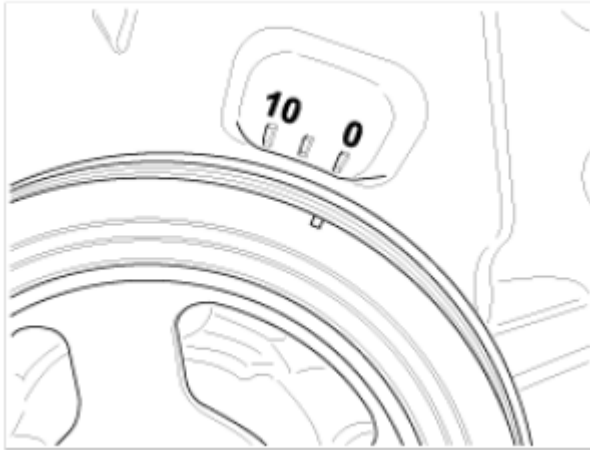


Fig. 25: Aligning Crankshaft Pulley Groove With Timing Mark Of Timing Chain Cover
Courtesy of HYUNDAI MOTOR AMERICA

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

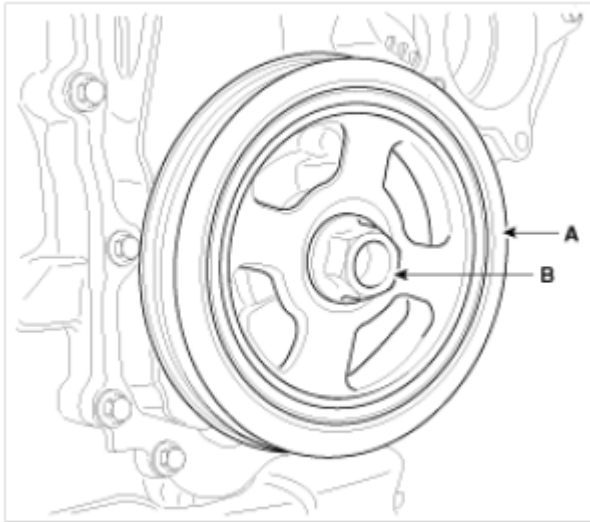


Fig. 26: Identifying Crankshaft Pulley And Bolt
Courtesy of HYUNDAI MOTOR AMERICA

NOTE: There are two methods to hold the ring gear when installing or removing the crankshaft damper pulley.

- Install the SST (09231-2B100) to hold the ring gear after removing the starter.

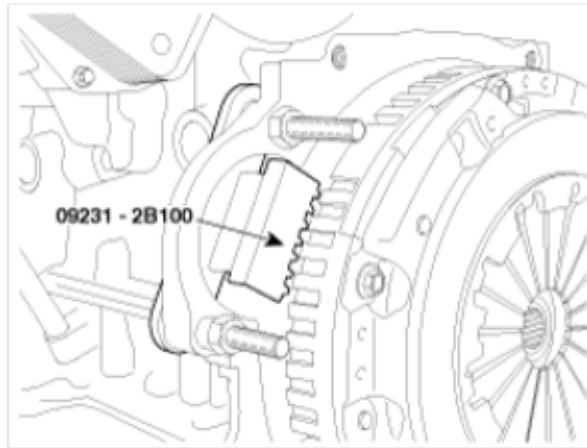


Fig. 27: Holding Ring Gear Using SST (09231-2B100)
Courtesy of HYUNDAI MOTOR AMERICA

- Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.

1. Remove the bracket (A).

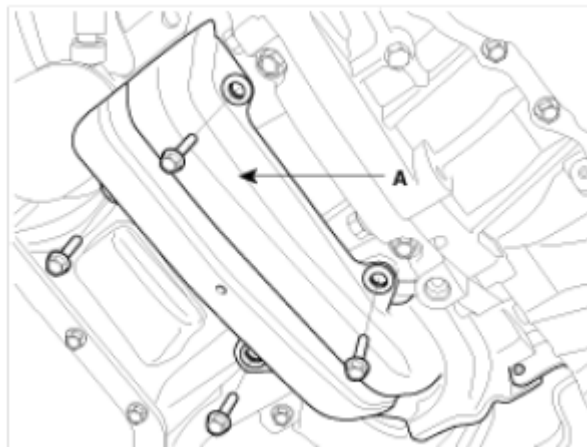


Fig. 28: Identifying Bracket
Courtesy of HYUNDAI MOTOR AMERICA

2. Remove the dust cover (A) and unfasten the transaxle mounting bolt (B).

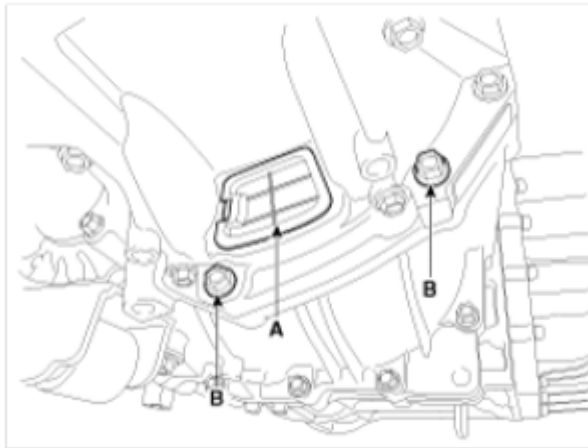


Fig. 29: Identifying Dust Cover And Transaxle Mounting Bolts
Courtesy of HYUNDAI MOTOR AMERICA

3. Adjust the length of the holder nuts (A) so that the front plate of the holder (B) puts in the ring gear (C) teeth.
4. Adjust the angle of the links (D), and fasten the bolt 70mm (2.7559in) in the original mounted hole.

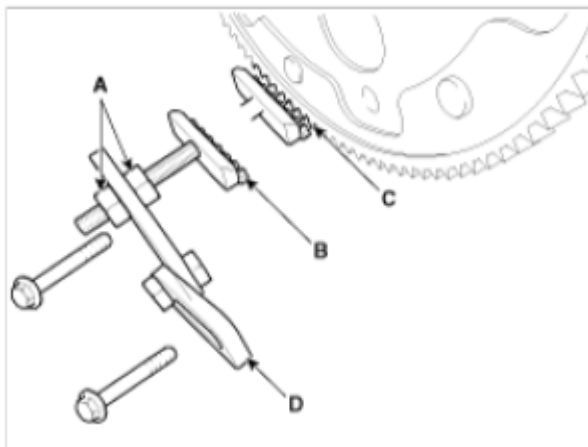


Fig. 30: Identifying Ring Gear, Holder, Nuts And Links
Courtesy of HYUNDAI MOTOR AMERICA

5. Tighten the bolts and nuts of the holder and links securely.

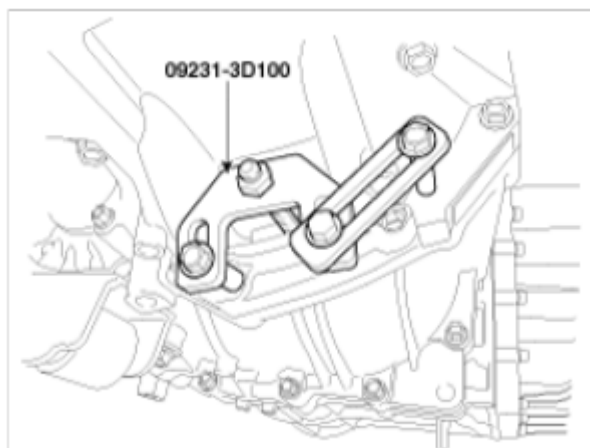


Fig. 31: Tightening Holder And Links Securely Bolts And Nuts Using SST (09231-3D100)

Courtesy of HYUNDAI MOTOR AMERICA

30. Remove the timing chain cover (A).

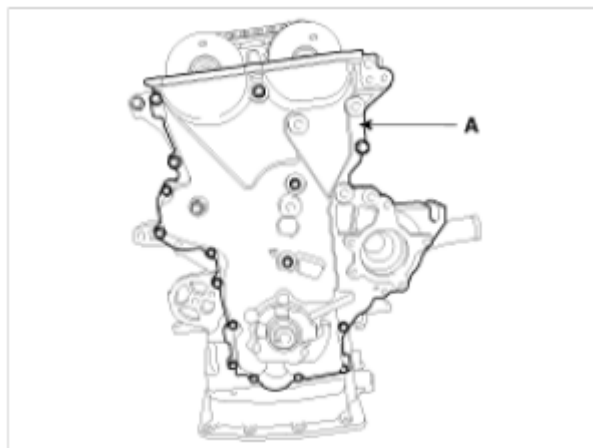


Fig. 32: Identifying Timing Chain Cover

Courtesy of HYUNDAI MOTOR AMERICA

31. Align the timing marks of the CVVT sprockets with the upper surface of the cylinder head to make No. 1 cylinder be positioned at TDC.
1. Check the dowel pin of the crankshaft for facing upside of the engine at this moment.

CAUTION: Put paint marks on the timing chain links (3 places) that meet with the timing marks of the CVVT sprockets (In, Ex: 2) and the CVVT sprocket.

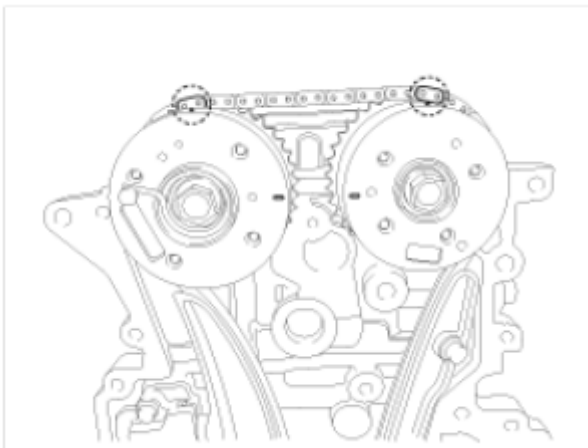


Fig. 33: Identifying Paint Marks On Timing Chain Links
Courtesy of HYUNDAI MOTOR AMERICA

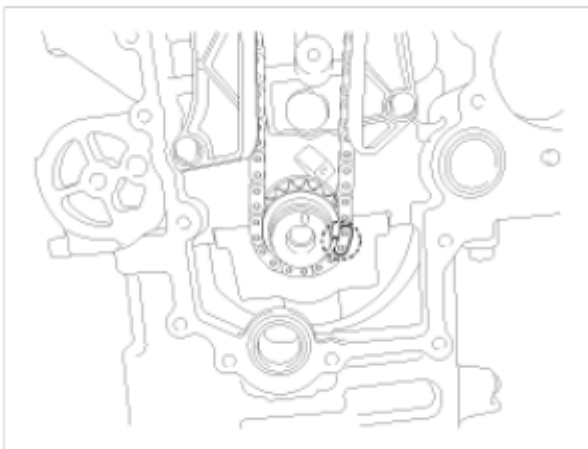


Fig. 34: Identifying Timing Marks On CVVT Sprockets
Courtesy of HYUNDAI MOTOR AMERICA

32. Remove the hydraulic tensioner (A).

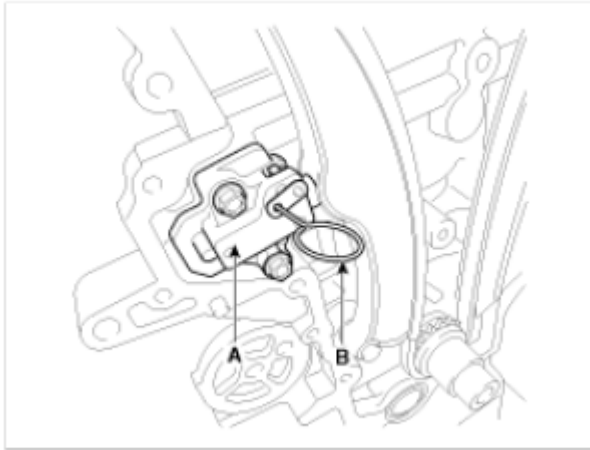


Fig. 35: Identifying Hydraulic Tensioner And Dowel Pin
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION: Before removing the tensioner, fix the piston of the tensioner with a pin through the hole (B) at compressed position.

33. Remove the timing chain tensioner arm (A) and guide (B).

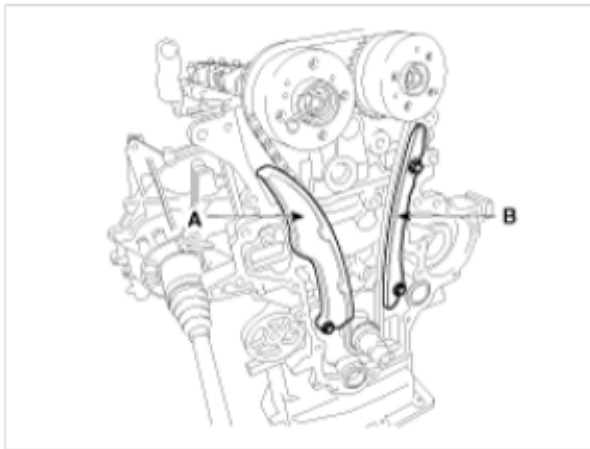


Fig. 36: Identifying Timing Chain Tensioner Arm And Guide
Courtesy of HYUNDAI MOTOR AMERICA

34. Remove the timing chain (A).

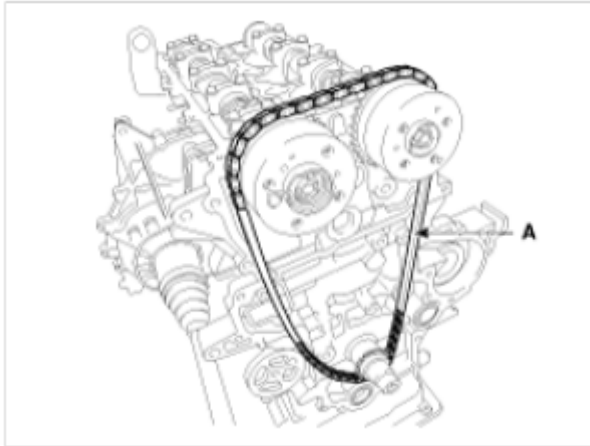


Fig. 37: Identifying Timing Chain
Courtesy of HYUNDAI MOTOR AMERICA

Inspection

Sprockets, Hydraulic Tensioner, Chain Guide, Tensioner Arm, Timing Chain

1. Check the CVVT sprocket, crankshaft sprocket teeth for abnormal wear, cracks or damage. Replace if necessary.
2. Check a contact surface of the chain tensioner arm and guide for abnormal wear, cracks or damage. Replace if necessary.
3. Check the hydraulic tensioner for its piston stroke and ratchet operation. Replace if necessary.
4. Check the timing chain for its elongation, abnormal wear or damage. Replace if necessary.

Belt, Idler, Pulley

1. Check the idler for excessive oil leakage, abnormal rotation or vibration. Replace if necessary.
2. Check belt for maintenance and abnormal wear of V-ribbed part. Replace if necessary.
3. Check the pulleys for vibration in rotation, oil or dust deposit of V-ribbed part. Replace if necessary.

NOTE:

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

Installation

1. Dowel pin of crankshaft should be positioned at 3° in relation to vertical center line.

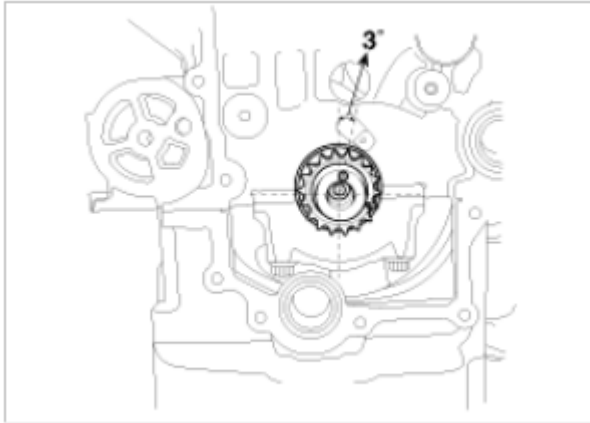


Fig. 38: Identifying Crankshaft Dowel Pin Position

Courtesy of HYUNDAI MOTOR AMERICA

2. Align the TDC marks (A) of the CVVT sprockets with the upper surface of the cylinder head to make No. 1 cylinder be positioned at TDC.

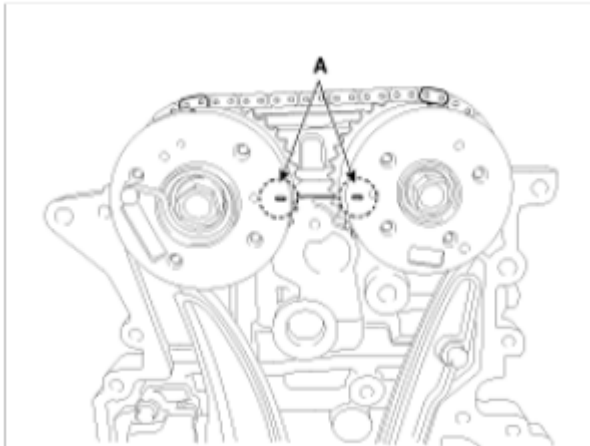


Fig. 39: Identifying TDC Marks On CVVT Sprockets

Courtesy of HYUNDAI MOTOR AMERICA

3. Install the new O-rings (A).

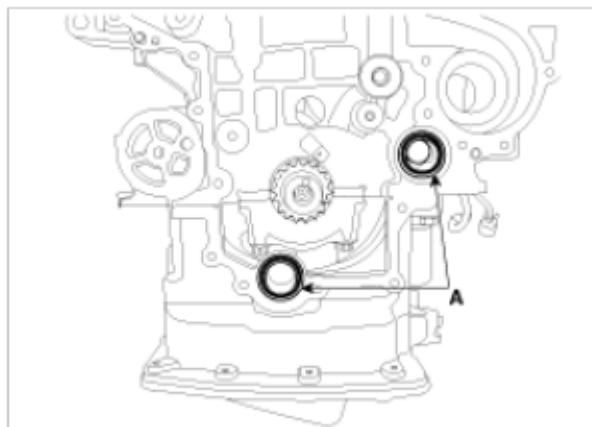


Fig. 40: Identifying O-Rings

Courtesy of HYUNDAI MOTOR AMERICA

4. Install the timing chain guide (A) and the timing chain (B).

Tightening torque:

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

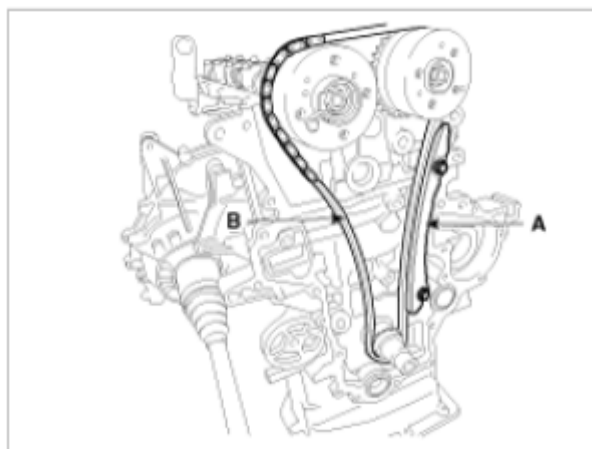


Fig. 41: Identifying Timing Chain And Guide

Courtesy of HYUNDAI MOTOR AMERICA

NOTE: When installing a timing chain, align the timing marks on the sprockets with paint marks of the chain.
Order: Crankshaft sprocket --> Timing chain guide --> Intake CVVT sprocket --> Exhaust CVVT sprocket.

5. Install the chain tensioner arm (A).

Tightening torque:

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

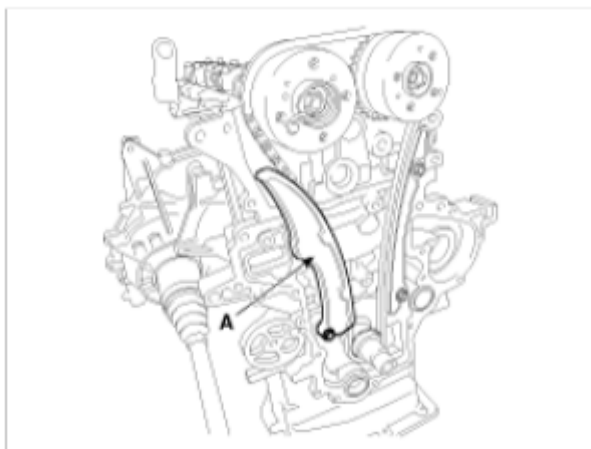


Fig. 42: Identifying Chain Tensioner Arm
Courtesy of HYUNDAI MOTOR AMERICA

6. Install the hydraulic tensioner (A) and remove the pin (B).

Tightening torque:

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

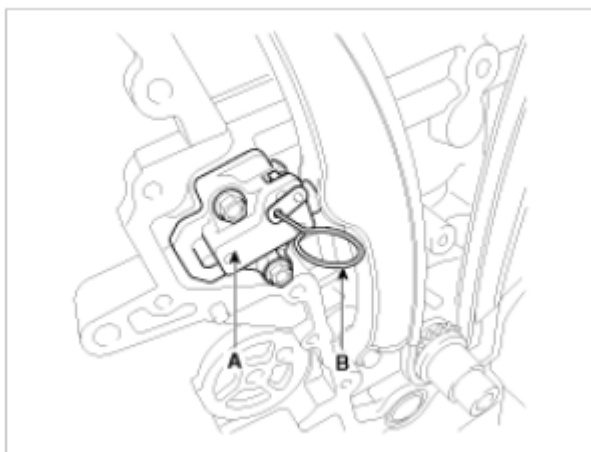


Fig. 43: Identifying Hydraulic Tensioner And Pin
Courtesy of HYUNDAI MOTOR AMERICA

NOTE: Recheck the top dead center (TDC) marks on the crankshaft and camshaft.

7. Install the timing chain cover.
 1. Before installing, remove the hardened sealant from the cylinder block and ladder frame surface.
 2. Apply the liquid gasket (TB 1217H or LOCTITE 5900H) on the surface between the cylinder head

and the cylinder block.

Width: 3 ~ 5mm (0.1181~0.1969in.)

3. Apply the liquid gasket, THREE BOND 1282B or THREE BOND 1216E on the water pump contact parts (A) of the timing chain cover and Hyundai Gray RTV or THREE BOND 1217H or LOCTITE 5900H on the rest parts (B). Reassemble the cover within 5 minutes.

Width: 3.5 ~ 4.5 mm (0.1378 ~ 0.1772 in.)

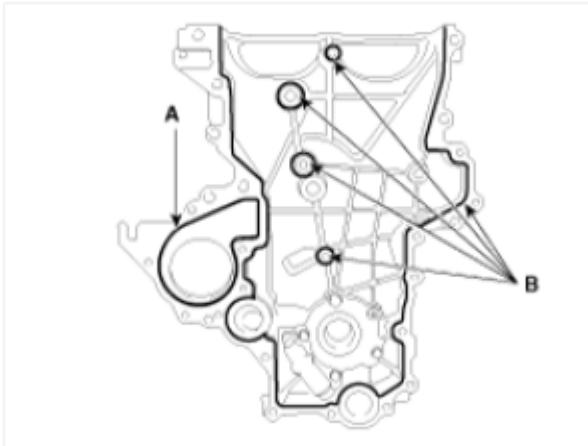


Fig. 44: Identifying Liquid Gasket Applying Areas On Water Pump Components
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION: Remove oil or dust on the surface surely.

4. Align the dowel pin of the cylinder block and the holes of the oil pump.
5. Tighten the bolts to install the timing chain cover (A).

Tightening torque:

M8 bolts:

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

M6 bolts:

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

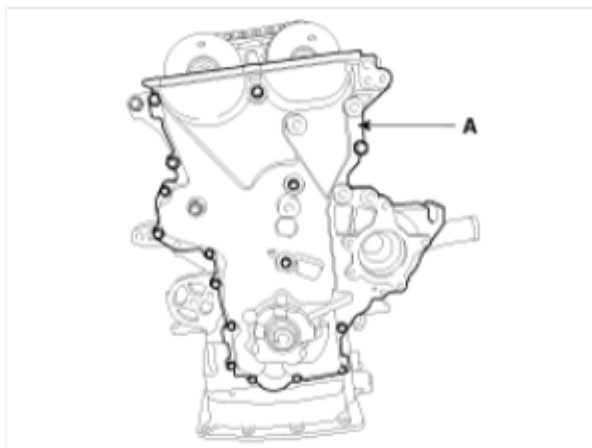


Fig. 45: Identifying Timing Chain Cover
 Courtesy of HYUNDAI MOTOR AMERICA

CAUTION: After the installation, do not crank engine or apply pressure on the cover for half an hour.

8. Using the SST (09455-21200), reassemble the timing chain cover oil seal.

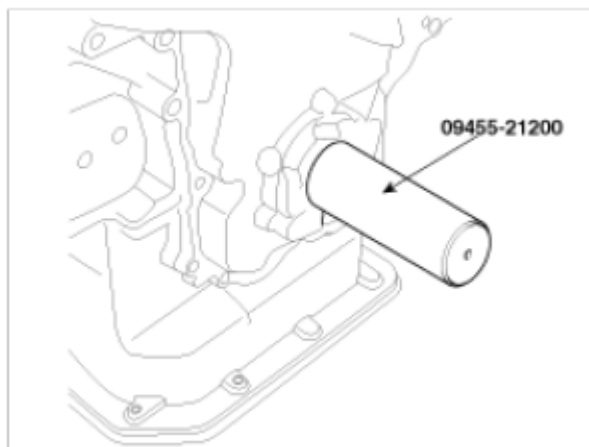


Fig. 46: Assembling Timing Chain Cover Oil Seal Using SST (09455-21200)
 Courtesy of HYUNDAI MOTOR AMERICA

9. Install the crankshaft pulley (A).

Tightening torque:

NOTE: For additional crankshaft pulley bolt torque information, refer to GAMMA ENGINE CRANKSHAFT PULLEY BOLT INFORMATION .

127.5 ~ 137.3 N.m (13.0 ~ 14.0 kgf.m, 94.0 ~ 101.3 lb-ft)

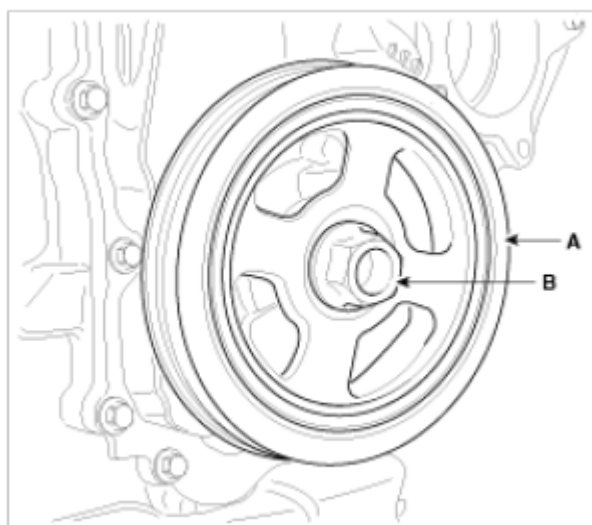


Fig. 47: Identifying Crankshaft Pulley And Bolt
Courtesy of HYUNDAI MOTOR AMERICA

NOTE: There are two methods to hold the ring gear when installing or removing the crankshaft damper pulley.

- Install the SST (09231-2B100) to hold the ring gear after removing the starter.

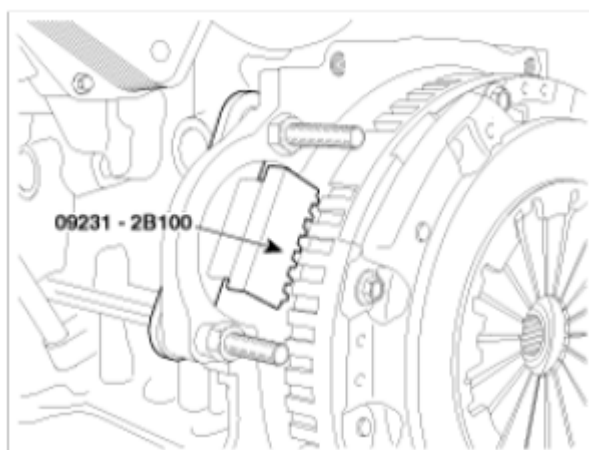


Fig. 48: Holding Ring Gear Using SST (09231-2B100)
Courtesy of HYUNDAI MOTOR AMERICA

- Install the SST (09231-3D100) to hold the ring gear after removing the dust cover.
1. Remove the bracket (A).

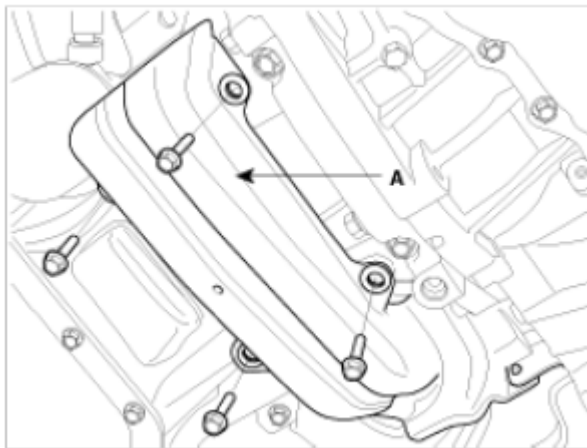


Fig. 49: Identifying Bracket
Courtesy of HYUNDAI MOTOR AMERICA

2. Remove the dust cover (A) and unfasten the transaxle mounting bolt (B).

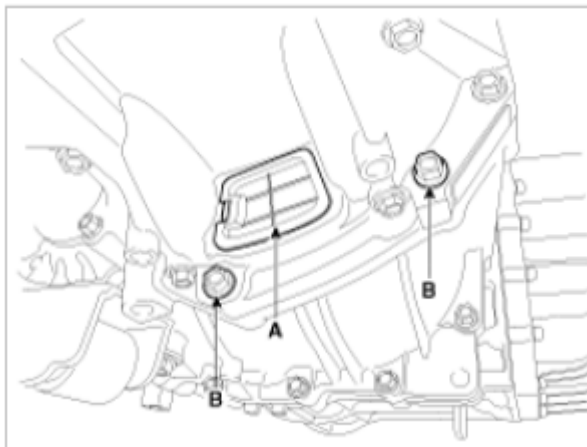


Fig. 50: Identifying Dust Cover And Transaxle Mounting Bolts
Courtesy of HYUNDAI MOTOR AMERICA

3. Adjust the length of the holder nuts (A) so that the front plate of the holder (B) puts in the ring gear (C) teeth.
4. Adjust the angle of the links (D), and fasten the bolt 70mm (2.7559in) in the original mounted hole.

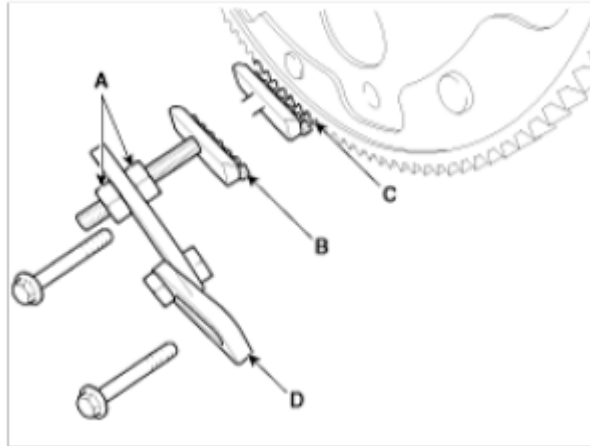


Fig. 51: Identifying Ring Gear, Holder, Nuts And Links
Courtesy of HYUNDAI MOTOR AMERICA

5. Tighten the bolts and nuts of the holder and links securely.

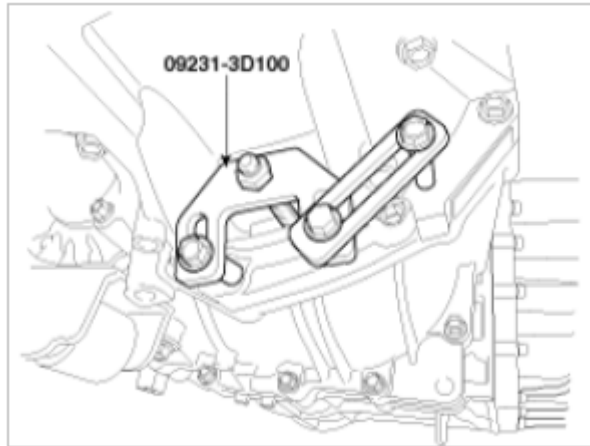


Fig. 52: Tightening Bolts And Nuts Of Holder And Links Securely Using Tool (09231-3D100)
Courtesy of HYUNDAI MOTOR AMERICA

NOTE: When installing the pulley, the groove on the pulley should be positioned outside.

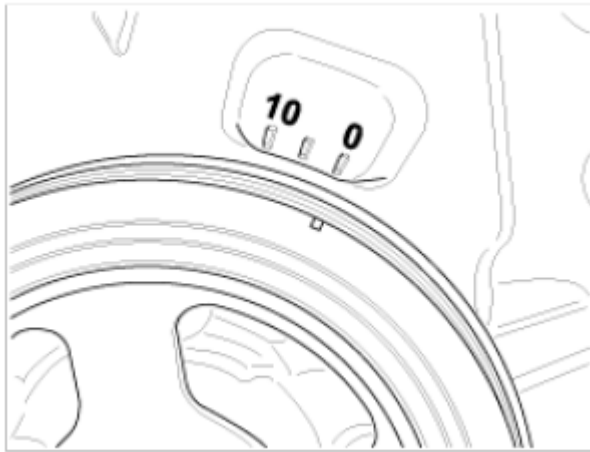


Fig. 53: Identifying Crankshaft Pulley Installation Position
Courtesy of HYUNDAI MOTOR AMERICA

10. Install the water pump (A) with a gasket.

Tightening torque:

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

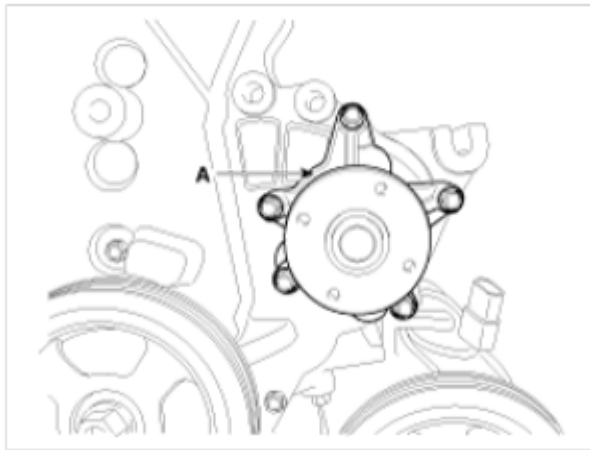


Fig. 54: Identifying Water Pump
Courtesy of HYUNDAI MOTOR AMERICA

11. Install the water pump pulley (A) and the drive belt idler (B).

Tightening torque:

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

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

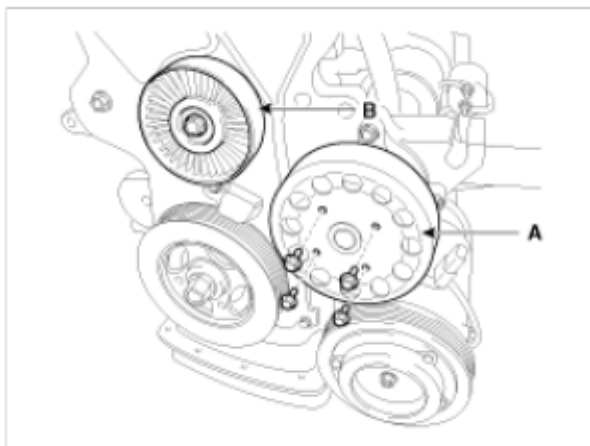


Fig. 55: Identifying Water Pump Pulley And Drive Belt Idler
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION: Tighten the bolts diagonally.

12. Install the engine support bracket (A).

Tightening torque:

29.4 ~ 41.2 N.m (3.0 ~ 4.2 kgf.m, 21.7 ~ 30.4 lb-ft)

13. Install the alternator bracket (B).

Tightening torque:

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

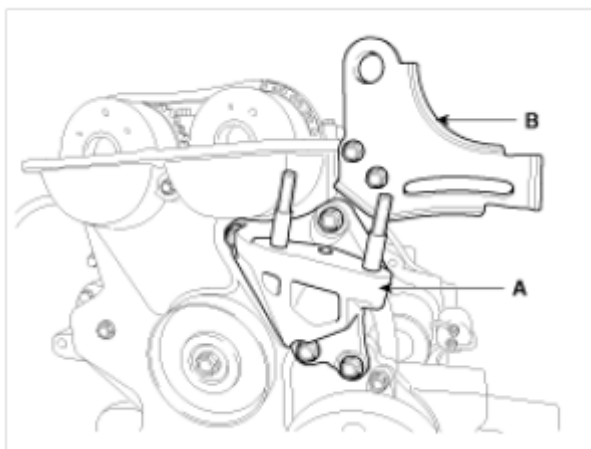


Fig. 56: Identifying Engine Support Bracket And Alternator Bracket
Courtesy of HYUNDAI MOTOR AMERICA

14. Install the engine mounting support bracket (B) and then connect the ground line (A).

Tightening torque

Ground line bolt:

10.8 ~ 13.7 N.m (1.1 ~ 1.4 kgf.m, 8.0 ~ 10.1 lb-ft)

Nut (C):

63.7 ~ 83.4 N.m (6.5 ~ 8.5 kgf.m, 47.0 ~ 61.5 lb-ft)

Bolt (D) and nuts (E):

49.0 ~ 63.7 N.m (5.0 ~ 6.5 kgf.m, 36.2 ~ 47.0 lb-ft)

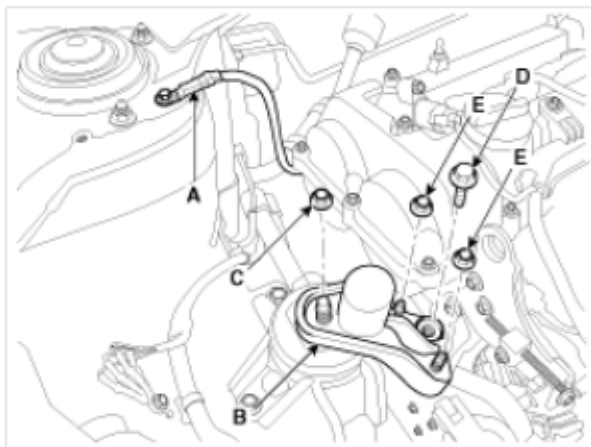


Fig. 57: Identifying Engine Mounting Support Bracket, Ground Line, Mounting Bolts And Nuts
Courtesy of HYUNDAI MOTOR AMERICA

15. Install the alternator (A).

Tightening torque:

M8 bolt:

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

M10 bolt:

29.4 ~ 41.2 N.m (3.0 ~ 4.2 kgf.m, 21.7 ~ 30.4 lb-ft)

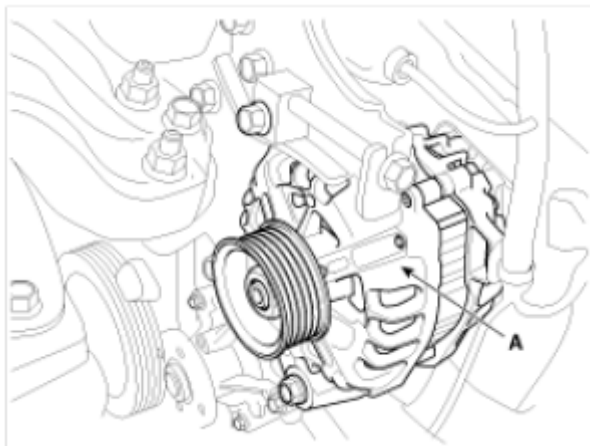


Fig. 58: Identifying Alternator
Courtesy of HYUNDAI MOTOR AMERICA

16. Install the drive belt (A).

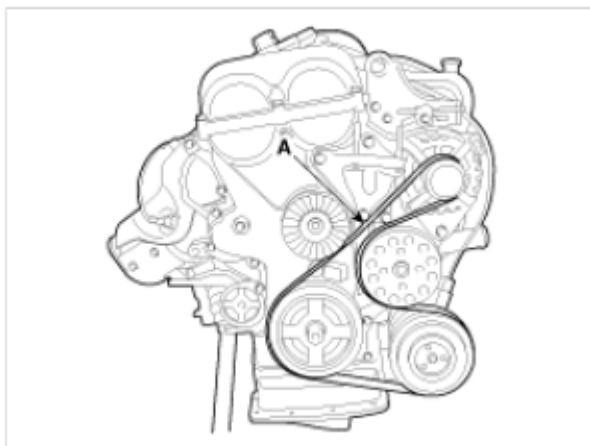


Fig. 59: Identifying Drive Belt
Courtesy of HYUNDAI MOTOR AMERICA

17. Adjust tension by tightening the alternator tension adjust bolt (A).

Tension

New belt: 882.6 ~ 980.7N (90 ~ 100kg, 198.4 ~ 220.5lb)

Used belt: 637.4 ~ 735.5N (65 ~ 75kg, 143.3 ~ 165.3lb)

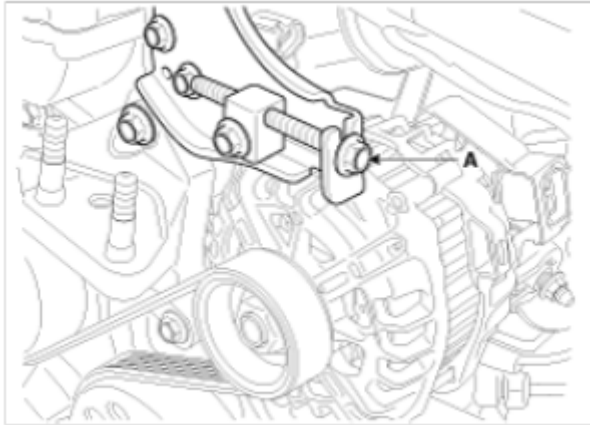


Fig. 60: Identifying Alternator Tension Adjust Bolt
Courtesy of HYUNDAI MOTOR AMERICA

18. Before installing the cylinder head cover, remove oil, dust or hardened sealant from the timing chain cover and the cylinder head upper surface.
19. After applying the liquid gasket, Hyundai Gray RTV or THREE BOND 1217H or LOCTITE 5900H on the cylinder head cover, reassemble the cover within five minutes.

Width: 2.0 ~ 2.5mm (0.0787~0.0984in.)

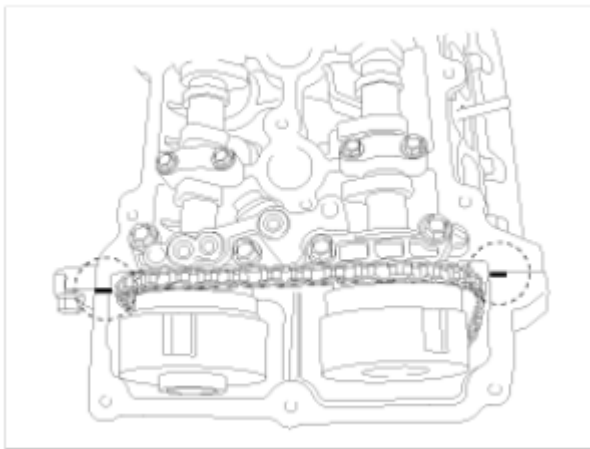


Fig. 61: Identifying Liquid Gasket Applying Areas On Cylinder Head Cover
Courtesy of HYUNDAI MOTOR AMERICA

20. Install the OCV (Oil Control Valve) adapter (A).

Tightening torque:

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

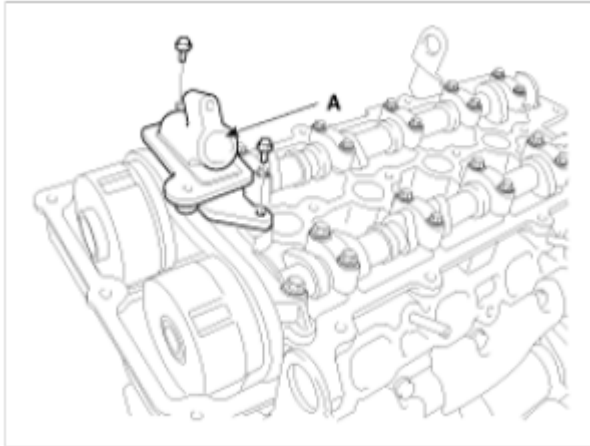


Fig. 62: Identifying Oil Control Valve Adapter
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION:

- Keep the OCV adapter clean.
- Make sure the O-rings on the front bearing cap are installed.

21. Install the cylinder head cover (A) with a new gasket (B).

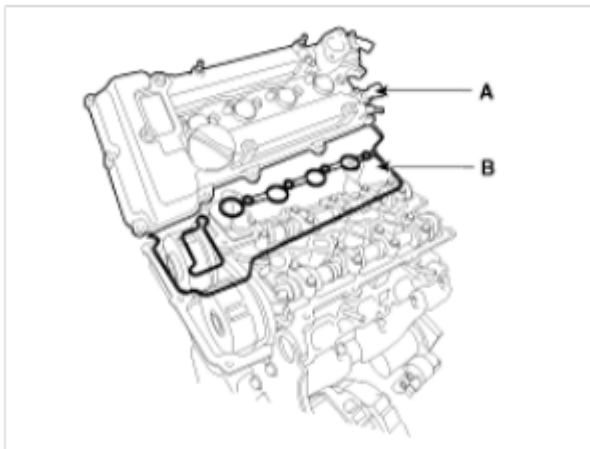


Fig. 63: Identifying Cylinder Head Cover And Gasket
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION: Do not reuse the disassembled gasket.

22. Tighten the cylinder head cover bolts with the order and steps.

Tightening torque:

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

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

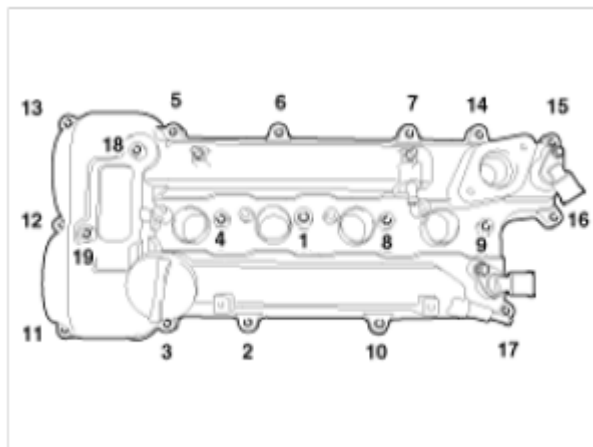


Fig. 64: Identifying Cylinder Head Cover Bolts Tightening Sequence
 Courtesy of HYUNDAI MOTOR AMERICA

23. Install the exhaust OCV (Oil Control Valve) (A).

Tightening torque:

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

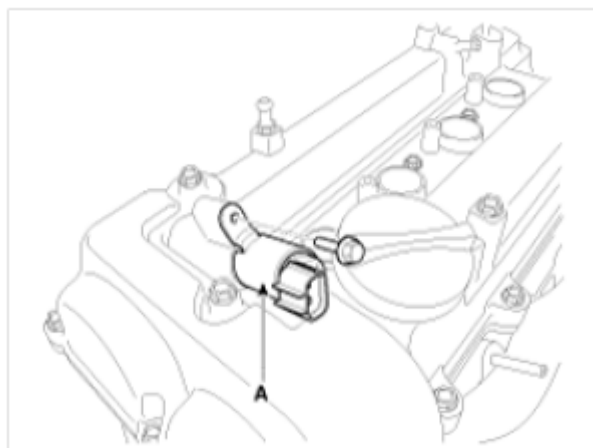


Fig. 65: Identifying Exhaust Oil Control Valve
 Courtesy of HYUNDAI MOTOR AMERICA

24. Install the ignition coils (A).

Tightening torque:

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

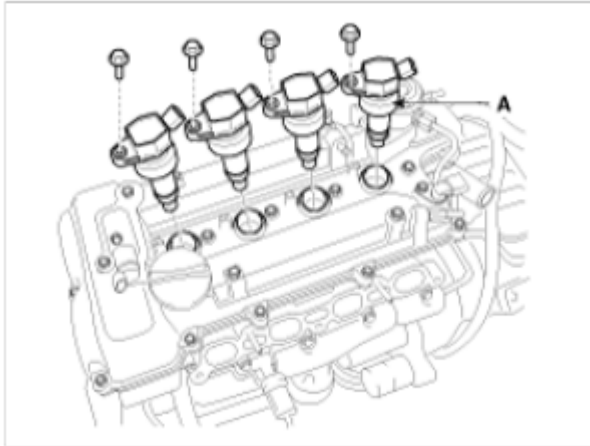


Fig. 66: Identifying Ignition Coils
Courtesy of HYUNDAI MOTOR AMERICA

25. Install the high pressure fuel pump (A) and the roller tappet (B).

Tightening torque:

12.7 ~ 14.7N.m (1.3 ~ 1.5kgf.m, 9.4 ~ 10.8lb-ft)

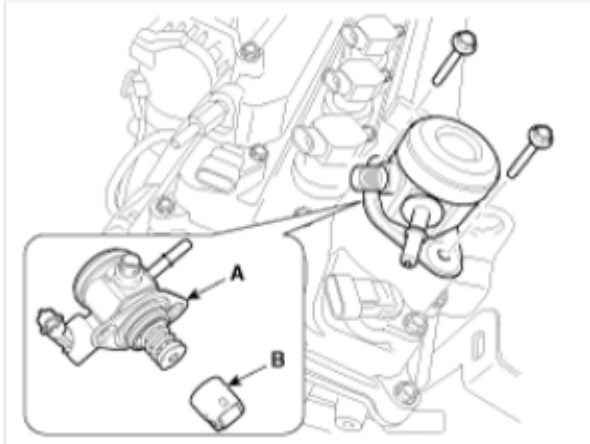


Fig. 67: Identifying High Pressure Fuel Pump And Roller Tappet
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION: Before installing the high pressure fuel pump, position the roller tappet in the lowest position (BDC) by rotating the crankshaft. Otherwise the installation bolts may be broken because of tension of the pump spring.

NOTE: Do not use already used bolt again.

NOTE: When tightening the installation bolts of the high pressure fuel pump, tighten in turn the bolts in small step (0.5 turns) after tightening them with hand-screwed torque.

CAUTION: Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

CAUTION: Apply engine oil to the O-ring (A) of the high pressure fuel pump, the roller tappet (B), and the protrusion (C). Also apply engine oil to the groove where the protrusion is installed.

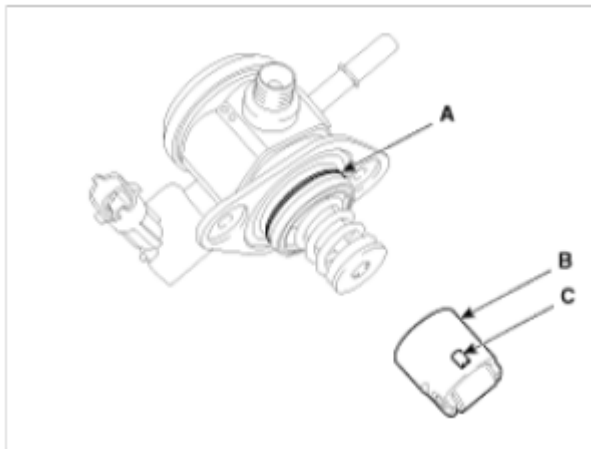


Fig. 68: Identifying High Pressure Fuel Pump O-Ring, Roller Tappet And Protrusion
Courtesy of HYUNDAI MOTOR AMERICA

26. Install the high pressure pipe (A).

Tightening torque:

25.5 ~ 31.4N.m (2.6 ~ 3.2kgf.m, 18.8 ~ 23.1lb-ft)

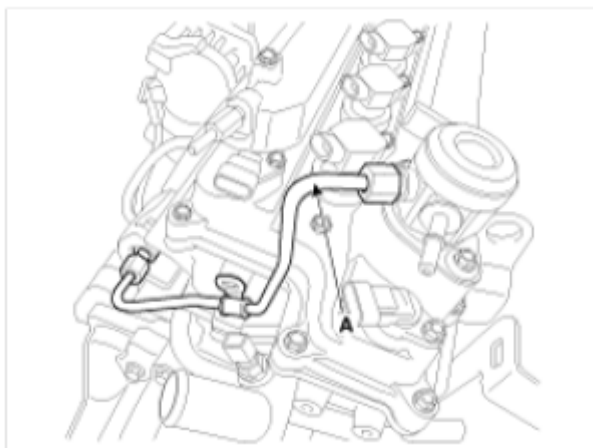


Fig. 69: Identifying High Pressure Pipe
Courtesy of HYUNDAI MOTOR AMERICA

CAUTION: Do not reuse the high pressure pipe.

27. Install the vacuum pipe assembly (A).

Tightening torque:

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

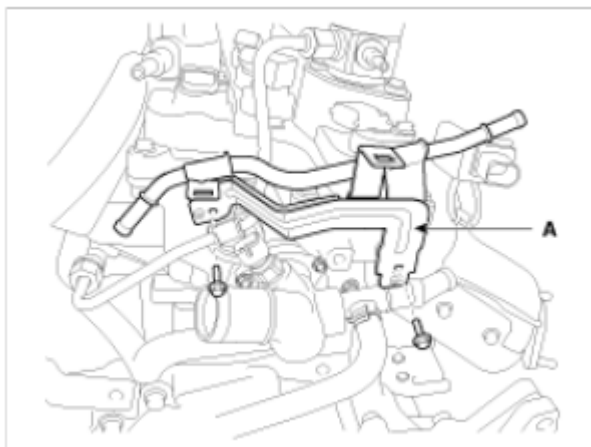


Fig. 70: Identifying Vacuum Pipe Assembly
Courtesy of HYUNDAI MOTOR AMERICA

28. Connect the fuel hose (A) and the PCSV (Purge control solenoid valve) hose (B).

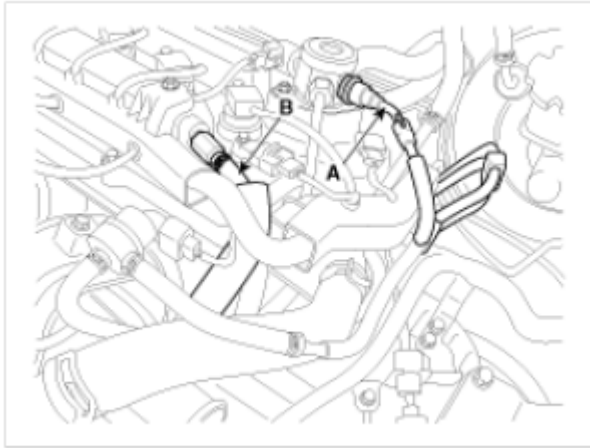


Fig. 71: Identifying Fuel Hose And Purge Control Solenoid Valve Hose
Courtesy of HYUNDAI MOTOR AMERICA

29. Connect the oxygen sensor connectors (A) and the condenser connector (B).

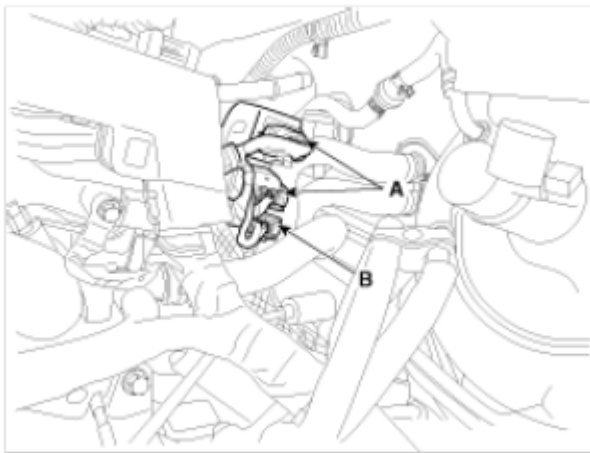


Fig. 72: Identifying Oxygen Sensor Connector And Condenser Connector
Courtesy of HYUNDAI MOTOR AMERICA

30. Connect the FPCV (Fuel pressure control valve) connector (A), the intake CMPS (Camshaft position sensor) connector (B) and the exhaust CMPS (Camshaft position sensor) connector (C).

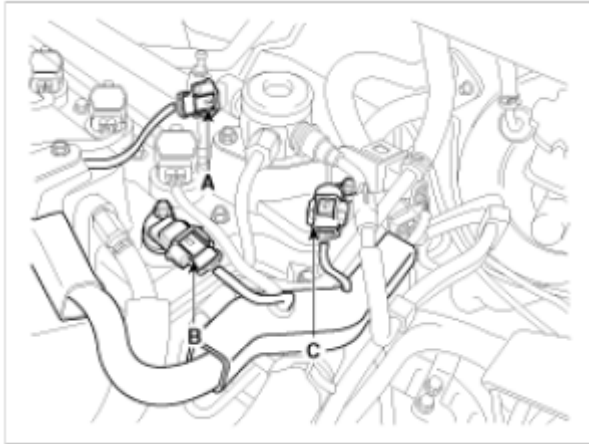


Fig. 73: Identifying Fuel Pressure Control Valve, Intake And Exhaust Camshaft Position Sensor Connectors

Courtesy of HYUNDAI MOTOR AMERICA

31. Connect the ignition coil connectors (A), the injector extension connector (B), the VIS (Variable intake system) connector (C) and the PCSV (Purge control solenoid valve) connector (D).

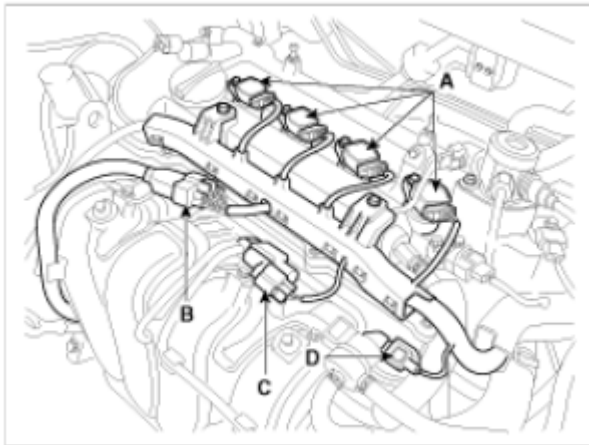


Fig. 74: Identifying Ignition Coil, Injector Extension, Variable Intake System And Purge Control Solenoid Valve Connectors

Courtesy of HYUNDAI MOTOR AMERICA

32. Connect the intake OCV (Oil control valve) connector (A) and the exhaust OCV (Oil control valve) connector (B).

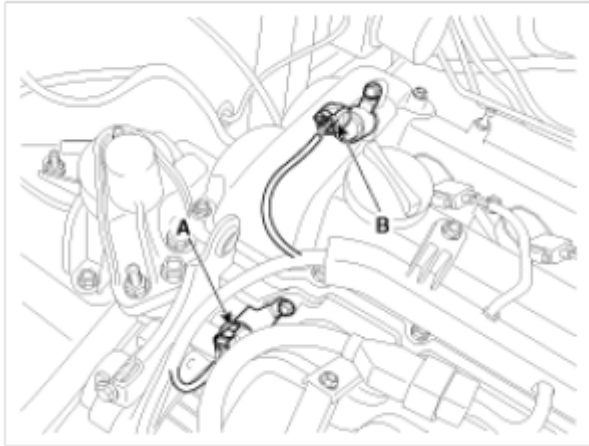


Fig. 75: Identifying Intake And Exhaust Oil Control Valve Connectors
Courtesy of HYUNDAI MOTOR AMERICA

33. Connect the A/C compressor switch connector (A), the alternator connector (B) and the cable from the alternator "B" terminal (C).

Tightening torque:

9.8 ~ 14.7N.m (1.0 ~ 1.5kgf.m, 7.2 ~ 10.8lb-ft)

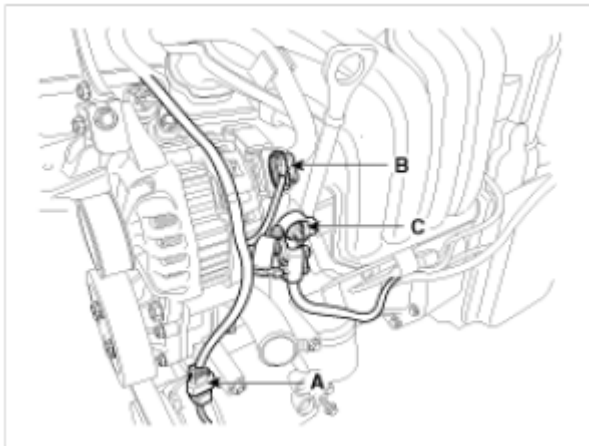


Fig. 76: Identifying A/C Compressor Switch Connector, Alternator Connector And Alternator "B" Terminal
Courtesy of HYUNDAI MOTOR AMERICA

34. Install the under covers (A).

Tightening torque:

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

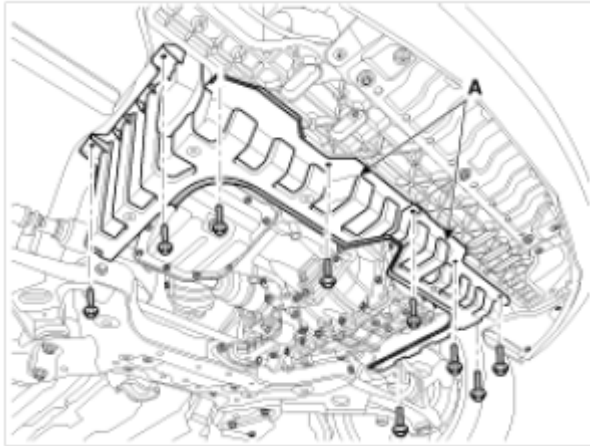


Fig. 77: Identifying Under Cover
Courtesy of HYUNDAI MOTOR AMERICA

35. Install the RH front wheel.
36. Install the air cleaner assembly.
 1. Install the air cleaner assembly (D) and then connect the air intake hose (C).

Tightening torque:

Hose clamp bolt:

2.9 ~ 4.9N.m (0.3 ~ 0.5kgf.m, 2.2 ~ 3.6lb-ft)

Air cleaner assembly bolts:

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

2. Connect the breather hose (B).
3. Install the air duct (A).

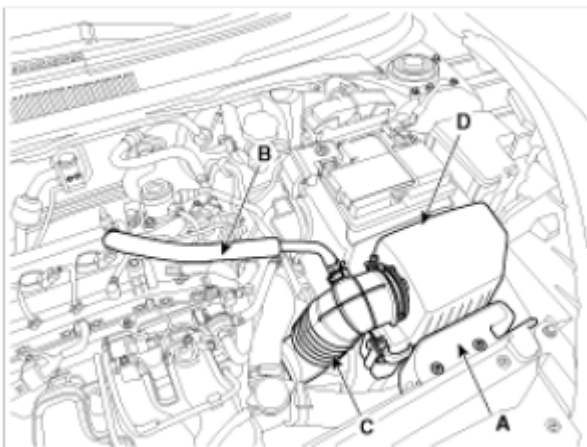


Fig. 78: Identifying Air Duct, Breather Hose, Air Intake Hose And Air Cleaner Assembly
Courtesy of HYUNDAI MOTOR AMERICA

NOTE:

- Install the air intake hose while the plate of the hose clamp must be in line with the stopper of the hose.
- Install the air intake hose while the groove of hose must be matched to the protrusion of the throttle body.

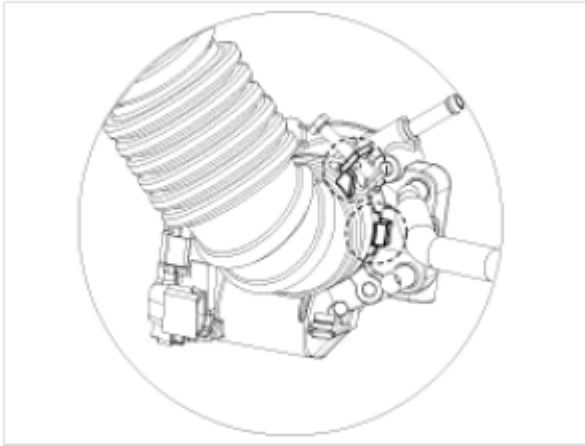


Fig. 79: Identifying Air Intake Hose Installation Position
Courtesy of HYUNDAI MOTOR AMERICA

37. Connect the battery negative terminal (A).

Tightening torque:

Without battery sensor:

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

With battery sensor:

4.0 ~ 6.0N.m (0.4 ~ 0.6kgf.m, 3.0 ~ 4.4lb-ft)

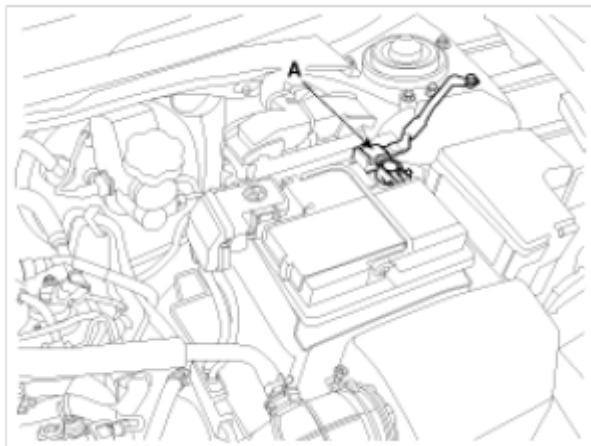


Fig. 80: Identifying Battery Negative Terminal
Courtesy of HYUNDAI MOTOR AMERICA

38. Install the engine cover.

CAUTION: Make sure the engine cover is installed before driving.